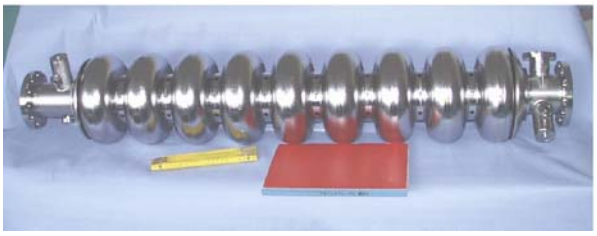
SRF



CARE/JRA1 Quarter report 2/2005

Research and Development on Superconducting Radio-Frequency Technology for Accelerator Application

Acronym: SRF

Co-Coordinators: D. Proch, DESY, T. Garvey, CNRS-Orsay

Participating Laboratories and Institutes:

Institute (Participating number)	Acronym	Country	Coordinator	SRF Scientific Contact	Associated to
DESY (6)	DESY	D	D. Proch	D. Proch	
CEA/DSM/DAPNIA (1)	CEA	F	R. Aleksan	O. Napoly	
CNRS-IN2P3-Orsay (3)	CNRS-Orsay	F	T. Garvey	T. Garvey	CNRS
INFN Legnaro (10)	INFN-LNL	I	S. Guiducci	E. Palmieri	INFN
INFN Milano (10)	INFN-Mi	I	S. Guiducci	C. Pagani	INFN
INFN Roma2 (10)	INFN-Ro2	I	S. Guiducci	S. Tazzari	INFN
INFN Frascati (10)	INFN-LNF	I	S. Guiducci	M. Castellano	INFN
Paul Scherrer Institute (19)	PSI	CH	V. Schlott	V. Schlott	
Technical University of Lodz (12)	TUL	PL	A. Napieralski	M. Grecki	
Warsaw University of Technology (14)	WUT-ISE	PL	R. Romaniuk	R. Romaniuk	
IPJ Swierk (13)	IPJ	PL	M. Sadowski	M. Sadowski	

Industrial Involvement:

Company Name	Country	Contact Person
ACCEL Instruments GmbH	D	M. Peiniger
WSK Mess- und Datentechnik GmbH	D	F. Schölz
E. ZANON SPA	I	G. Corniani
Henkel Lohnpoliertechnik GmbH	D	B. Henkel

Work supported by the European Community-Research Infrastructure Activity under the FP6 "Structuring the European Research Area" programme (CARE, contract number RII3-CT-2003-506395).

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DESY (6)	DESY	D	D. Proch	D. Proch	
CEA/DSM/DAPNIA (1)	CEA	F	R. Aleksan	O. Napoly	
CNRS-IN2P3-Orsay (3)	CNRS-Orsay	F	T.Garvey	T.Garvey	CNRS
INFN Legnaro (10)	INFN-LNL	I	S. Guiducci	E. Palmieri	INFN
INFN Milano (10)	INFN-Mi	I	S. Guiducci	C. Pagani	INFN
INFN Roma2 (10)	INFN-Ro2	I	S. Guiducci	S. Tazzari	INFN
INFN Frascati (10)	INFN-LNF	I	S. Guiducci	M. Castellano	INFN
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Technical University of Lodz (12)	TUL	PL	A.Napieralski	M. Grecki	
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IPJ Swierk (13)	IPJ	PL	M. Sadowski	M. Sadowski	

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Table of content:

Milestones and Deliverables of the reporting period

2nd 18 month and 2nd Quarterly report 2005

No.	Deliverable (D) / Milestone (M)		WP/Task	Contractor	Task leader	planned	fulfilled/expected
12	Installation finished	M	5.4.1.5	DESY	D. Reschke	11.04.2005	01.06.2005
14	Proposal for alternative electrolytes	M	5.3.4.2	INFN-Lnl	E. Palmieri	24.05.2005	31.12.2005
15	Summary report on quality of planar arc coating	M	4.2.2.4	INFN-Ro2	S. Tazzari	27.05.2005	ok
16	Start of Integrated Experiments	D	8.3.4	INFN-Mi	A. Bosland	01.06.2005	
17	First report on BCP/EP and DIC surface	M	6.3.1.7	DESY	D. Reschke	10.06.2005	15.12.2005
18	Present BPM installed in TTF module	M	11.1.1	INFN-Lnl	M.Castellano	30.06.2005	
19	Hydro forming machine ready	M	3.2.2.5	DESY	W. Singer	01.07.2005	ok
20	Seamless tubes ready	M	3.2.4.3	DESY	W. Singer	01.07.2005	ok
21	Integration tests in cryostat (1st test)	M	10.3	CEA	B. Visentin	14.07.2005	09.12.2005
22	Proof-of-Principle experiment hot water rinsing	M	5.2.1.1.3	DESY	A.Matheisen	18.07.2005	01.11.2005
23	Electrode design fixed	M	5.2.1.2.3	DESY	A.Matheisen	18.07.2005	01.12.2005
24	Process parameters fixed	D	5.2.1.3.5	DESY	A.Matheisen	29.07.2005	01.12.2005
25	Report UMI tuner	M	8.1.5	INFN-Mi	A. Bosotti	18.08.2005	

CARE publications, papers, conference contributions and talks

CARE-Pub	Title	Authors	Journal/Conf.
	High quality super-conducting niobium films produced by ultra-high vacuum cathodic arc	R. Russo, L. Catani, A. Cianchi, J. Langner, S. Tazzari	Supercond. Sci. Technol. **18** (2005) L41–44
	Modelling of magnetic channels for micro-droplets filtering and tests of their efficiency in UHV arc-discharges	P. Strzyżewski, J. Langner, R. Mirowski, M.J. Sadowski, S. Tazzari, J, Witkowski	Physica Scripta (2005), in print
	Research on deposition of thin superconducting films for RF accelerator cavities (in Polish)	J. Langner, R. Mirowski, M.J. Sadowski, P. Strzyzewski, J. Witkowski, S. Tazzari, L. Catani, A. Cianchi, J. Lorkiewicz, R. Russo,f. Tazzioli, D. Proch	Elektronika Vol. 50, Nos. 7 (2005) pp. 6 - 11
	Przegląd prac Politechniki Łódzkiej realizowanych w programie CARE - Research overview realized by Technical University of Lodz in CARE framework -	A. Napieralski, M. Grecki, P. Sekalski, D. Makowski, M. Wojtowski, W. Cichalewski, B. Koseda, B. Swiercz,	Elektronika 2/2005, ISSN 0033-2089
	Systemy elektromechaniczne do kompensacji odkształcenia wnęk rezonansowych stosowanych w technologii - TESLA Electromechanical systems for shape compensation of TESLA technology based cavities -	P. Sekalski	Elektronika 7/2005, ISSN 0033-2089
	Single Bunch Transient Detection for the Beam Phase Measurement in Superconducting Accelerators	P.Pawlik, M. Grecki, S. Simrock	DIPAC 2005, Lyon, France, 6th-8th June 2005
	Super–conducting niobium films produced by means of UHV arc	J. Langner, M. J. Sadowski, K. Czaus, R. Mirowski, J. Witkowski, L. Catani, A.Cianchi, R. Russo, S. Tazzari, F.Tazzioli, D. Proch, N.N. Koval, Y.H. Akhmadeev	CARE-Pub-04-004

CARE-Pub	Title	Authors	Journal/Conf.
	System for High Resolution Detection of Beam Induced Transients in RF Signals	P. Pawlik, M. Grecki, S. Simrock	MIXDES 2005, Kraków, Poland, 22-25 June 2005
	The application of SRAM chip as a novel neutron detector	D. Makowski, M. Grecki, B. Mukherjee, S.Simrock, B. Swiercz, A. Napieralski	2005 NSTI Nanotechnology Conference and Trade Show Nanotech 2005, May 2005
	Interpretation of the single event upset in static random access memory chips induced by low energy neutrons	B. Mukherjee, D. Makowski, D. Rybka, M. Grecki, S. Simrock	12th Mixed Design of Integrated Circuits and Systems, MIXDES 2005, June 2005
	SEE induced in SRAM operating in a superconducting electron linear accelerator environment	D.Makowski,B.Murkherjee, M. Grecki, S. Simrock	XIV IEEE-SPIE 2004, May 2004
	SRAM-based passive dosimeter for accelerator environments	D. Makowski, M. Grecki, B. Mukherjee, S.Simrock, B. Swiercz, A. Napieralski	7th European Workshop on Diagnostics and Instrumentation for Particle Accelerators, DIPAC2005, June 2005
	Dosimetry of high energy electron linac produced photoneutrons and the bremsstrahlung gamma rays using TLD-500 and TLD-700 dosimeter pairs	B. Mukherjee, D. Makowski, S. Simrock	Nuclear Instruments and Methods in Physics Research, 2005
	IaradSim - IA32 architecture under high radiation environment simulator	B. Swiercz, D. Makowski, A. Napieralski	2005 NSTI Nanotechnology Conference and Trade Show, Nanotech 2005, Smart Sensors and Systems, May, 2005
	The sCore - Operating System for Research of Fault-Tolerant Computing	B. Swiercz, D. Makowski, A. Napieralski	12th Mixed Design of Integrated Circuits and Systems, Mixdes 2005

CARE-Conf	**Title**	**Authors**	**Journal/Conf.**
	Cathodic Arc Grown Niobium Films for RF Superconducting Cavity Applications	A. Cianchi, L. Catani, J. Lorkiewicz, S. Tazzari, J. Langner, R. Mirowski, M.J. Sadowski, P. Strzyżewski, J. Witkowski, A.Andreone, G.Cifariello,E. Di Gennaro, G. Lamura, R. Russo	Proc. SRF2005 Intern. Workshop, Cornell, USA, July 2005 (in print)
	Thin superconducting niobium-coatings for RF accelerator cavities; Progress in CARE-JRA1-WP4	J. Langner, L. Catani, A. Cianchi, R. Mirowski, D. Proch, R. Russo, M.J. Sadowski, P. Strzyżewski, S. Tazzari, and J. Witkowski	Proc. SPIE Intern. Congress on Optics and Optoelectronics, Warsaw, Poland, Aug. 28 – Sept. 2, 2005 – *in print*.
	Improvement of the Blade Tuner Design for Superconducting RF Cavities	Carlo Pagani, Angelo Bosotti, Paolo Michelato, Nicola Panzeri, Paolo Pierini	PAC 05
	Quality Control of the Electro Polishing Process at DESY	N. Steinhau-Kühl	PAC 05
	Performance of Magnetostrictive Elements at LHe Environment	M. Grecki, P. Sekalski, DMCS-TUL, C.Albrecht, DESY	12th International Conference MIXDES 2005, pp. 799-802, ISBN 83-919289-9-3.
	The Fast Piezo-Blade Tuner for SCRF Resonators	Carlo Pagani, Angelo Bosotti, Paolo Michelato, Nicola Panzeri, Rocco Paparella, Paolo Pierini, INFN	SRF05
	Posters with partial components under CARE. Papers under Preparation.	N. Krupka, N. Steinhau-Kühl, K.Escherich	SRF2005 poster
	Electromechanical, Thermal Properties and Radiation Hardness Tests of Piezoelectric Actuators at Low Temperature	M. Fouaidy, G. Martinet, N. Hammoudi, F. Chatelet, A. Olivier, S. Blivet, H. Saugnac, IPN-Orsay	SRF2005 poster

CARE-Conf	Title	Authors	Journal/Conf.
	Cold tuning system for 700 MHz elliptical superconducting Cavity for proton accelerator	M. Fouaidy, N. Hammoudi, N. Gandolfo, S. Rousselot, M. Nicolas, P. Szott, S. Blivet, H. Saugnac, S. Bousson, IPN-Orsay	SRF2005 poster
	Progress on spun seamless cavities	V. Palmieri	Submitted for publication in the Proceedings of SRF2005
	Fluxgate magnetometry	C.Bonavolontà, V.Palmieri, V.Rampazzo, M. Valentino	Submitted for publication in the Proceedings of SRF2005
	Advancement in comprehension of the Q-slope for superconducting cavities	V. Palmieri	Submitted for publication in the Proceedings of SRF2005
	Further improvement with dry-ice cleaning on SRF cavities	Arne Brinkmann, Jens Iversen, Detlef Reschke, Jörg Ziegler	SRF 2005 poster
	Efficiency of Electropolishing Versus Bath Composition And Aging: First Results	F. Éozénou, C. Antoine, A. Aspart, S. Berry, JF. Denis, B. Malki	SRF2005, submitted to Physica C
	Aluminum and Sulfur Impurities in Electropolishing Baths	A. Aspart, F. Eozénou, C. Antoine	SRF2005, submitted to Physica C

CARE-Note	Title	Authors	CARE-Note
	Design of the Re-entrant Cold BPM	M. Luong, G. Congretel, M. Jablonka, C. Magne, C. Simon	CARE-Note-2005-002-SRF
	Improved standard cavity fabrication	P. Michelato, L. Monaco, R. Paulon	CARE-Note-2005-003-SRF
	Mechanical study of the “Saclay piezo tuner” PTS (Piezo Tuning System)	P. Bosland, Bo Wu, DAPNIA - CEA Saclay	CARE-Note-2005-004-SRF
	DC Field Emission Scanning Measurements on Electro polished Niobium Samples	Arti Dangwal DESY/Uni Wuppertal, Günter Müller Uni Wuppertal, Detlef Reschke DESY	

Talks

Subject	Speaker/Lab	Event	Date	Web site
Mechanical Vibration Measurements on TTF Cryomodules	A. Bosotti (INFN/LASA)	PAC 05	May 20	http://www.sns.gov/pac05/
Full Characterization at Low Temperature of Piezoelectric Actuators Used for SRF Cavities Active Tuning	M. Fouaidy IPN-Orsay	PAC 05	May 20	http://www.sns.gov/pac05/
Variety of electromechanical Lorentz force compensation systems dedicated for superconducting high field resonant cavities	P. Sekalski DMCS-TUL	Wilga Symposium	May 31	http://wilga.ise.pw.edu.pl/2005/eng/
Modelling of magnetic channels for micro-droplets filtering and tests of their efficiency in UHV arc-discharges.	P.Strzyzewski, IPJ, Swierk	The 5th International Workshop and Summer School "Towards Fusion Energy – Plasma Physics, Diagnostics, Spin-offs", Kudowa, Poland	June 6-10, 2005	None
Invited talk	W.Singer, DESY	ISOHIM 2005	14.06.05	http://www-conference.slu.se/ISOHIM/
Oral presentation	S. Anakhov, DESY	ISOHIM 2005	16.06.05	http://www-conference.slu.se/ISOHIM
The Cold Re-entrant Q-BPM Design		ILC Meeting, London	June 2005	http://www.pp.rhul.ac.uk/workshop/
Baking for ILC	B. Visentin / CEA	ILC Meeting, London	June 21st 2005	http://www.pp.rhul.ac.uk/workshop/

Talks

Subject	Speaker/Lab	Event	Date	Web site
Performance of Magnetostrictive Elements at LHe Environment	P. Sekalski DMCS-TUL	MIXDES	June 22	www.mixdes.org
Static and dynamic properties of piezoelectric actuators at low temperatures and integration in SRF cavities cold tuning systems	M. Fouaidy, IPN-Orsay	MIXDES	June 23	www.mixdes.org
Invited talk	W. Singer, DESY	SRF2005	11.07.05	http://www.lns.cornell.edu/
Piezoelectric stack based system for Lorentz force compensation	P. Sekalski, DMCS-TUL	SRF 2005	July 12	http://www.lns.cornell.edu/public/SRF2005/
High quality Niobium films produced by Ultra High Vacuum Cathodic Arc	R.Russo, INFN-RM2 & Napoli	TFSRF 2005	July 17, 2005	http://www.jlab.org/intralab/calendar/archive05/TFSRF/program.html
Coupler review	T. Garvey / LAL	SRF-2005	July 2005	http://www.lns.cornell.edu/public/SRF2005/
Q-Slope	V.Palmieri	SRF2005	July 12th	http://www.lns.cornell.edu/public/SRF2005/
Flux gate magnetometry	C. Bonavolontà	SRF2005	July 12th	http://www.lns.cornell.edu/public/SRF2005/
Cleanliness techniques	Detlef Reschke, DESY	SRF workshop 2005, Cornell	July, 10th	www.lns.cornell.edu/SRF2005/program.html

JRA-SRF Activities May – August 2005

Date	Title/Subject	Location	Number of attendees	Website address
May 11, 2005	EP Parameters and Experiences	Argonne USA		none
May 20-21, 2005	Problems of the current reduction and stabilization, design of new magnetic filters	Rome	6	none
May 16-20, 2005	PAC 2005	Knoxville, Tennessee, USA		http://www.sns.gov/pac05/
May 23-24, 2005	EP Parameter and Experiences	TJNF USA		none
May 30-June 5 2005	WILGA Symposium	Wilga, Poland	120	http://wilga.ise.pw.edu.pl/2005/eng/
June 7, 2005	Parameters of electro polishing	Saclay		none
June 22-25 2005	12th International Conference MIXDES	Cracow, Poland	150	www.mixdes.org
June	ILC European Meeting	London	134	http://www.pp.rhul.ac.uk/workshop/
July 10-15, 2005	SRF Workshop	Cornell, Ithaca. USA	251	http://www.lns.cornell.edu/public/SRF2005/
August 14-27, 2005	ILC Workshop	Snowmass, USA	650	http://www.linearcollider.org/cms/

Work package 1: Management & Communication

Status of money spending

	Spent money	Value of new orders/ contracts	Expected spending of new orders/contracts until end 2005	Sum of column 2 & 4
Travel	10300		5000	15300
Consumables	100		900	1000
Manpower	40000		20000	60000
Durable				
			Total sum	76300

Work package 2: Improved Standard Cavity Fabrication.

Task 2.2: improved component design

1.) Status of activities

The study of flange/gasket system has continued performing several compression tests at room temperature. Moreover, we have started the characterization of the system at liquid nitrogen temperature with some preliminary tests.
During the flange assembly, the torque of bolts and nuts produce the load on the sealing gasket. The force applied on the seal depends obviously on the friction coefficients between bolts, nuts and washers. In order to decouple the applied load from the friction coefficient, we load, in a controlled way, the seal with a material testing machine (Instron, maximum load 200 kN) measuring the leak rate and the mechanical properties of the gasket. The reference flange/gasket system used is the TESLA beam line connection.
Two different materials have been used for the gaskets: Al5754 (also called AlMg3) and Al6060. The aluminum alloys composition has been verified by ICP spectrophotometry. Some pictures and a sketch of the measurement set up are shown in Figure 1

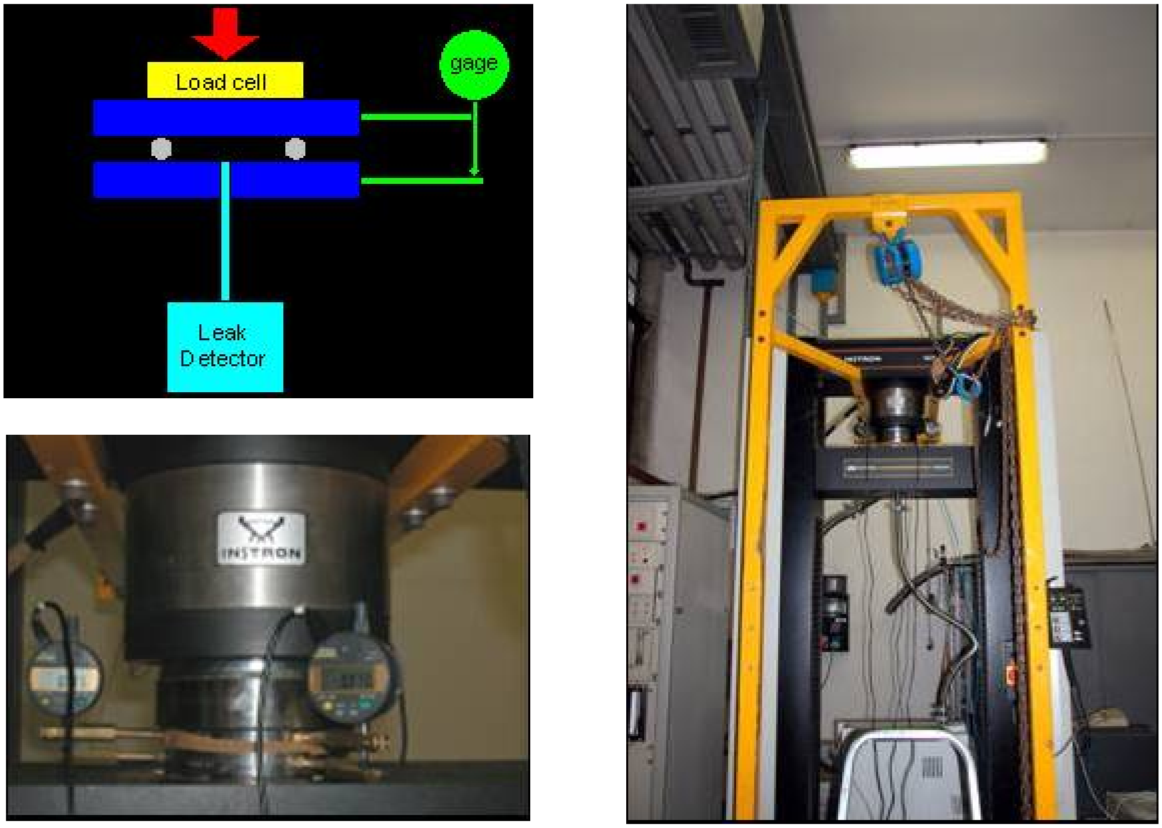


Figure 1: sketch and pictures of the apparatus used for compression and leak tests of TTF flange and gasket. Maximum load that can be applied is 200 kN. The leak detector is connected to the bottom flange.

The total displacement of the movable flange has been recorded by the transducer installed into the machine, while the gasket compression has been recorded by three electronic gages (Mitutoyo, 1 μm resolution) mechanically connected to the flanges. During the seal compression, leak tests have been also performed in order to check the seal efficiencies, using a calibrated leak detector (UL200, Leybold, sensitivity $1 \cdot 10^{-10}$ mbar l/s).
The mechanical properties of the gasket are summarized in the displacement vs. load graphs shown in Figure 2: the displacements are the mean values of the measurements of the three displacement gages positioned at 120° around the flange. Fig. 2 highlights a different mechanical behavior of the two gasket families. G18, G20 and G37 (Al5754) gaskets show, with the same load, larger compression. Also the plastic behavior of the two materials seems different. Further investigation and data analysis are underway. These studies will be included in the numerical model under development.

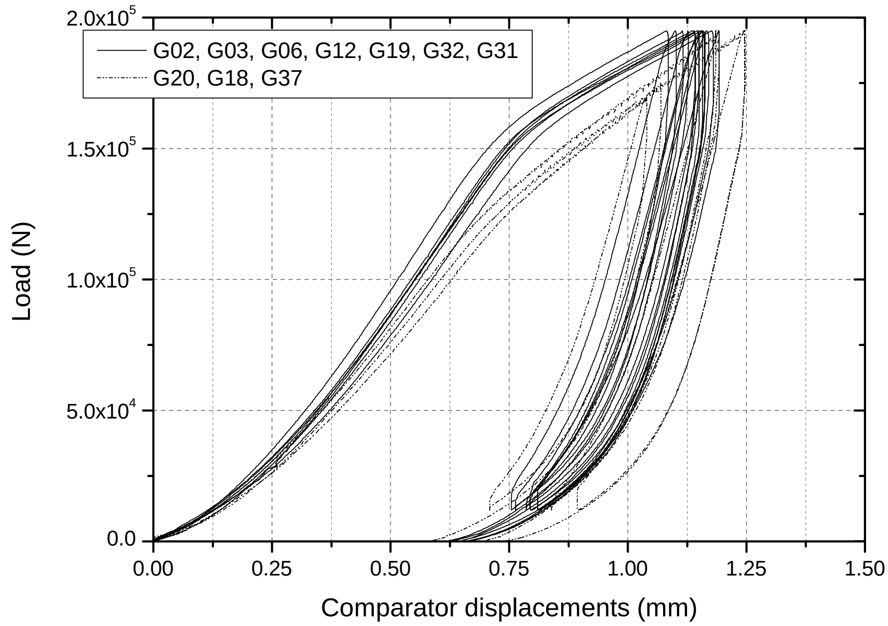


Figure 2: comparison of different seals during the load test

Usually the liner force and the pressure applied to the seal are the parameter that has to be carefully investigated to characterize the quality of a seal [1, 2]. For this purpose, we perform a series of tests to evaluate the gasket flattening (see Figure 3) as a function of the applied load from which we calculate the pressure applied on the gasket.

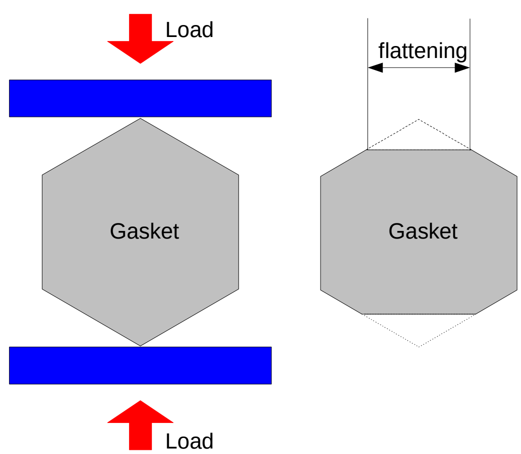


Figure 3: gasket flattening

Figure 4 shows the typical data for an Al6060 alloy gasket. The gasket flattening increases linearly with the load and hence the pressure stays constant (up to 90 kN). In the same figure, the behavior of the leak rate vs. load is also reported (red line). At about

30 kN, the tightness of the seal is generated (pressure on the seal about 340 MPa, linear load on the seal about 92 N/mm).

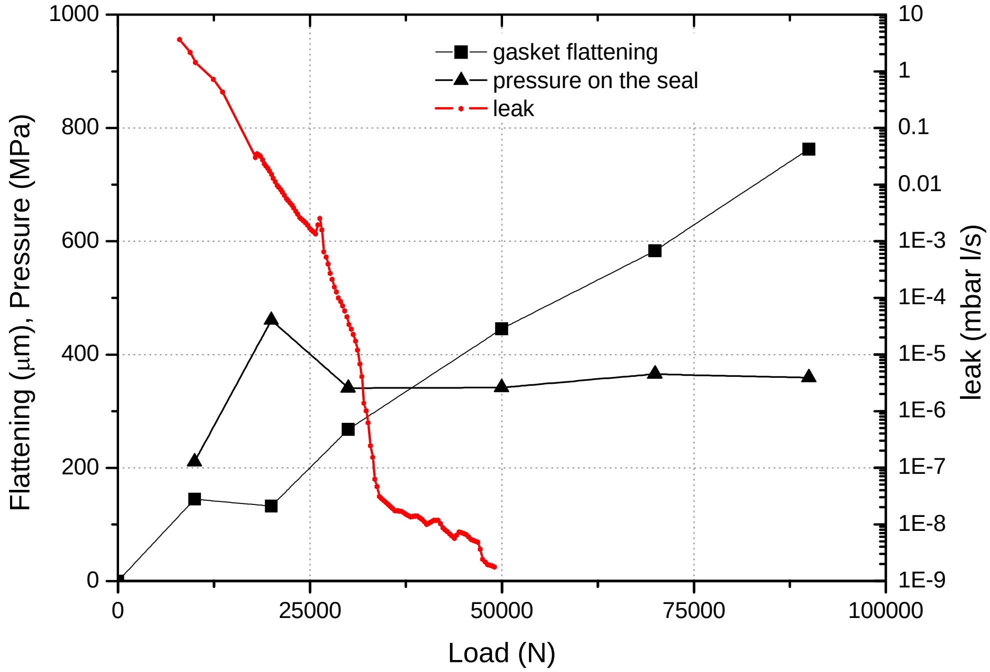


Figure 4: gasket flattening and pressure on the seal for an Al6060 gasket vs. load. The leak behavior vs. load is also reported.

The results so far obtained applying the mechanical test machine will used to predict the behavior of the flange/gasket system under standard operation where bolt and nuts are used. Tests are under way, by manually tightening with a torque meter, SS washers and bolts and CuNiSil nuts both at warm and at cold temperature (liquid nitrogen). Fig. 5 and 6 show the experimental setup for these measurements.

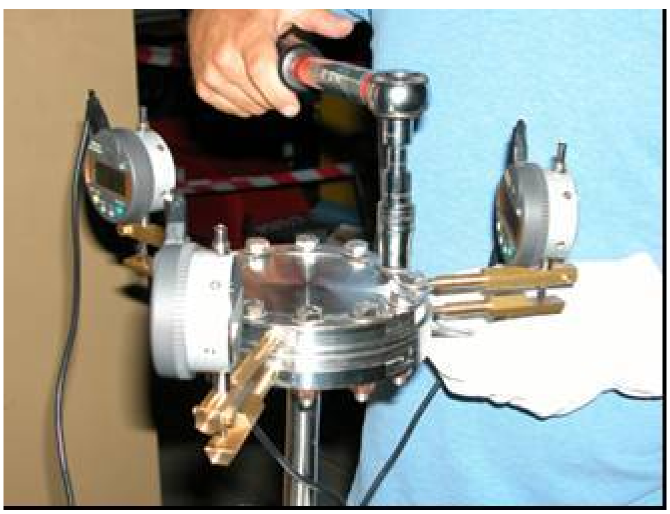


Figure 5: bolt tightening with torque meter. Displacement is measured by three gages.

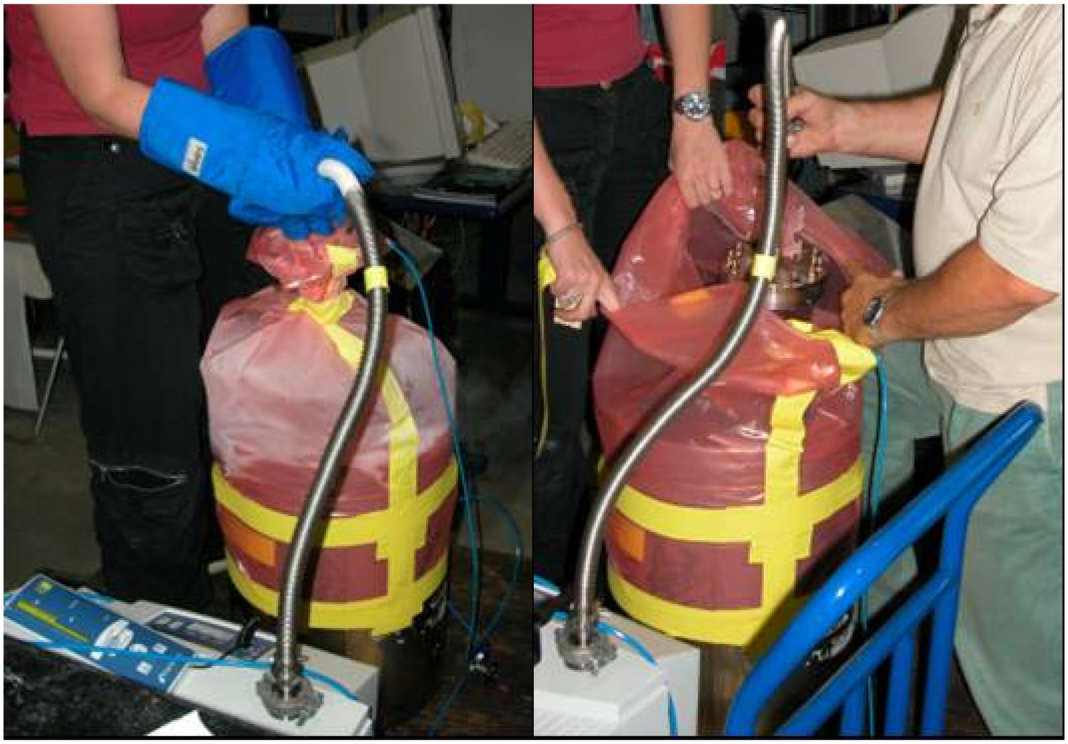


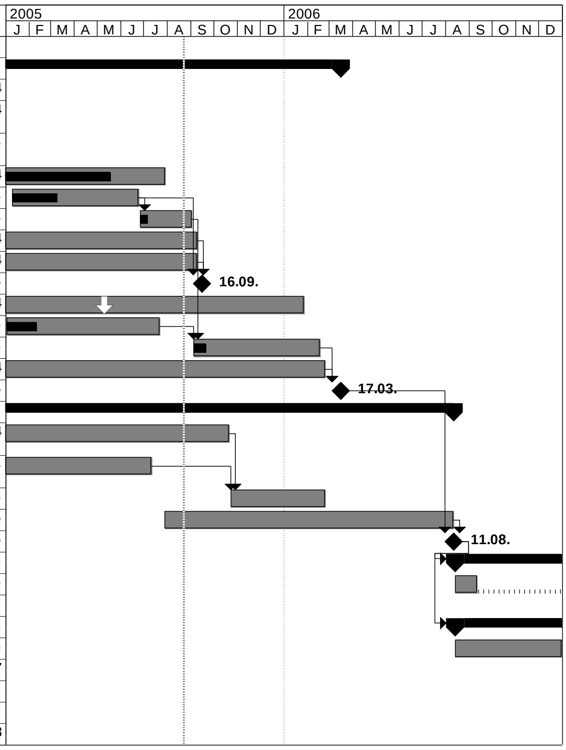
Figure 6: liquid nitrogen temperature leak test. The plastic bag is used to avoid water vapor condensation on the flanges and to ensure the proper confinement of the Helium gas during leak test.

References

[1] A. Roth, “Vacuum technology”, Second edition, North-Holland, 1982, p. 394.
[2] A. Roth, “Vacuum sealing techniques”, AIP Press, 1994, p. 411.

2.) Update of MS-Project

N°	MS, Deliverable	Task Name	Anfang
2.2		**Improved component design**	**Do 01.01.04**
2.2.1		**Documentation retrieving**	**Do 01.01.04**
2.2.1.1		Start up meetings	Do 01.01.04
2.2.1.2		Access and study of Jlab, DESY, LLAN, KEK experience	Do 01.01.04
2.2.1.3	**Summar Report**	**Summary report on the status of the ar on ancillaries**	Mi 13.10.04
2.2.1.4		Sealing material and shape design	Do 14.10.04
2.2.1.5		Flange preliminary design	Mo 10.01.05
2.2.1.6		Material and geometric compatibility	Mo 27.06.05
2.2.1.7		Final assembly design	Do 14.10.04
2.2.1.8		End plate preliminary design	Do 14.10.04
2.2.1.9	**Design Repor**	**Report about new design for compone**	Fr 16.09.05
2.2.1.10		Stiffness optimization	Do 30.09.04
2.2.1.11		Manufacturing procedure analysis	Mo 03.01.05
2.2.1.12		Final assembly design	Mo 05.09.05
2.2.1.13		Other ancillaries design	Do 14.10.04
2.2.1.14	**Report**	**Final Report for new components**	Fr 17.03.06
2.2.2		**Review of criticality in welding procedures**	**Do 01.01.04**
2.2.2.1		Review of available parameters on vendor welding machine	Do 01.01.04
2.2.2.2		Definition of prototype requirements for tests	Mi 13.10.04
2.2.2.3		Welding test on specimens	Mo 24.10.05
2.2.2.4		Analysis of the results	Fr 29.07.05
2.2.2.5	**Report**	**Report about welding parameters**	Fr 11.08.06
2.2.3		**Finalize new component design**	**Mo 14.08.06**
2.2.3.1		Do drawings	Mo 14.08.06
2.2.3.2	**Design repor**	**New components design finished**	Mo 30.07.07
2.2.4		**Finalize new cavity design**	**Mo 14.08.06**
2.2.4.1		Make drawings	Mo 14.08.06
2.2.4.2	**Design repor**	**New cavity design finished**	Do 14.06.07
2.2.5		**Fabrication of new cavity**	**Mo 30.07.07**
2.2.5.1		Fabrication	Mo 30.07.07
2.2.5.2		New cavity finished	Do 11.09.08



Task 2.3: EB welding

1.) Status of activities

The UHV-Motor has been delivered and tested for uhv-capability. The Desorption rate after 100 h pumping is $5*10^{-6}$ mbar l/ s. We judge the residual gas analysis as good. The construction for the mechanical conversion is in the final phase.

In the first stage of expansion the y-drive will be operated by hand. The integration in the PLC will be the next step.

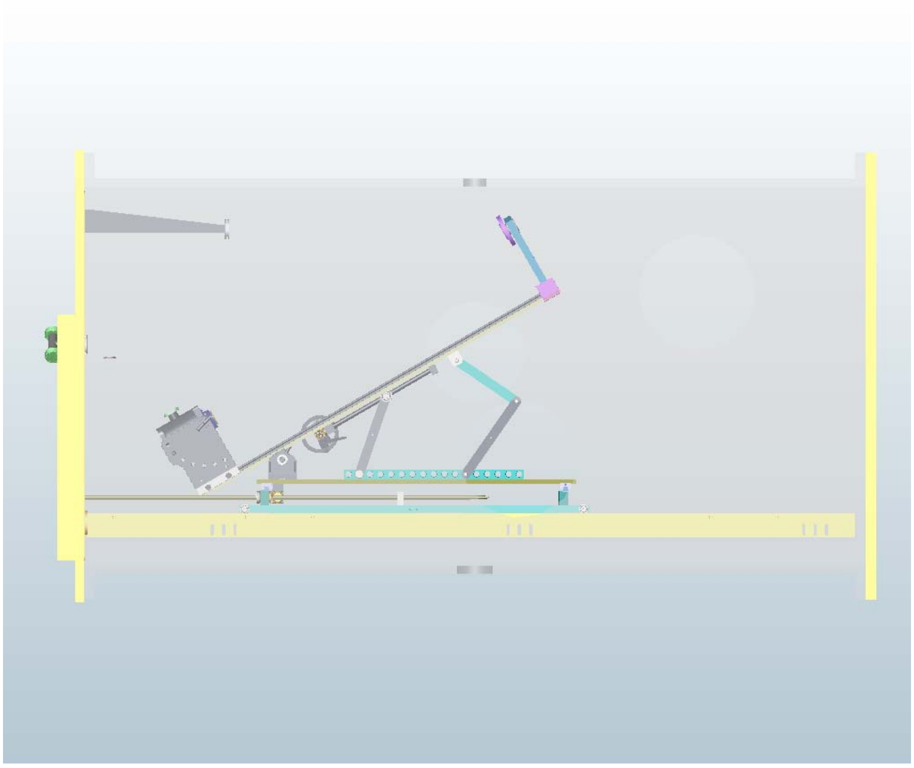


Figure 1: tilt fixture for 45°-seams

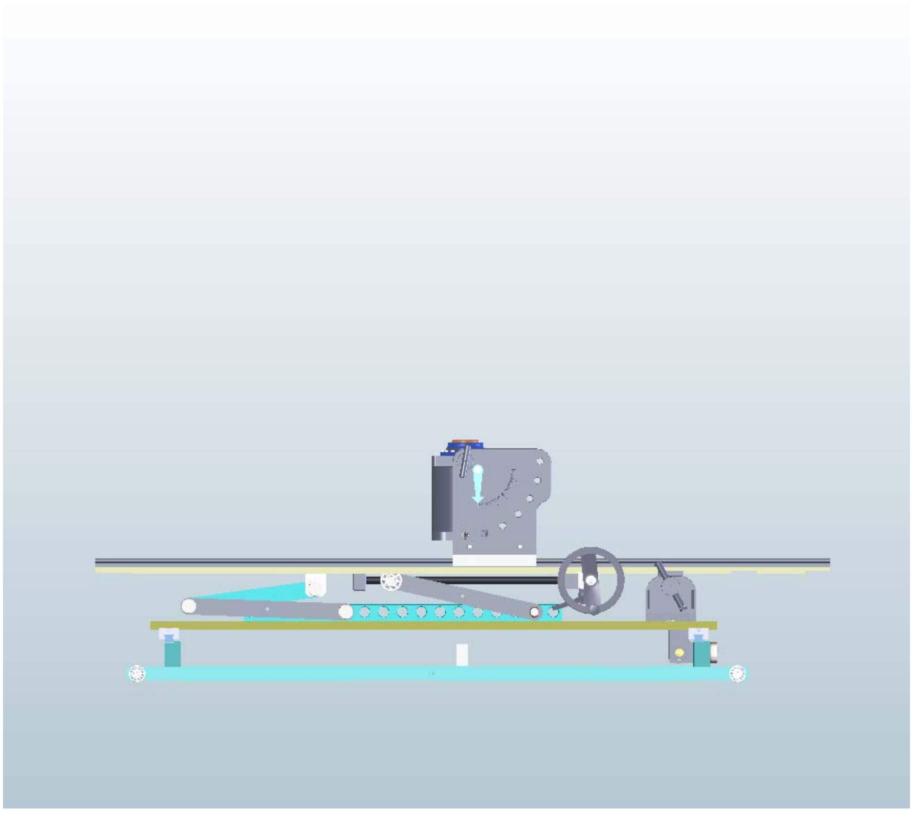
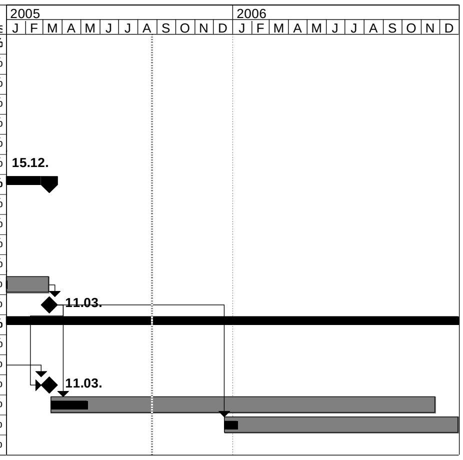


Figure 2: carousel operation for front seams

2.) Status of MS-Project

N°	MS, Deliverable	Task Name	Anfang	Ende	% eschlos
2.3.1		**Design tooling**	**Do 01.01.04**	**Mi 15.12.04**	**100%**
2.3.1.1		Tools for flange w elding	Do 01.01.04	Fr 20.02.04	100%
2.3.1.2		Tools for pipe w elding	Mo 23.02.04	Di 13.04.04	100%
2.3.1.3		Tools for stiffening rings	Mi 14.04.04	Do 03.06.04	100%
2.3.1.4		Tools for single cell w elding	Fr 04.06.04	Mo 23.08.04	100%
2.3.1.5		Tools for 9-cells	Di 24.08.04	Mi 15.12.04	100%
2.3.1.6	**Design repor**	**Tools design finished**	Mi 15.12.04	Mi 15.12.04	100%
2.3.2		**Tools production**	**Mo 23.02.04**	**Fr 11.03.05**	**74%**
2.3.2.1		Tools for flange w elding	Mo 23.02.04	Di 30.03.04	100%
2.3.2.2		Tools for pipe w elding	Mi 14.04.04	Do 13.05.04	100%
2.3.2.3		Tools for stiffening rings	Fr 04.06.04	Do 15.07.04	100%
2.3.2.4		Tools for single cell w elding	Di 24.08.04	Mi 27.10.04	100%
2.3.2.5		Tools for 9-cells	Do 16.12.04	Fr 11.03.05	20%
2.3.2.6	**Tools Ready**	**Tools fabrication finished**	Fr 11.03.05	Fr 11.03.05	15%
2.3.3		**Welding**	**Do 01.01.04**	**Fr 04.01.08**	**19%**
2.3.3.1		Commissioning w elding machine	Do 01.01.04	Fr 16.04.04	100%
2.3.3.2		Test w elding	Mo 19.04.04	Fr 03.09.04	85%
2.3.3.3	**Commissionin**	**Start production welding of component**	Fr 11.03.05	Fr 11.03.05	10%
2.3.3.4		Single cell w elding	Mo 14.03.05	Fr 24.11.06	10%
2.3.3.5		Multicell w elding	Mo 19.12.05	Fr 04.01.08	3%
2.3.3.6		**Welding of prototypes of components f**	Fr 04.01.08	Fr 04.01.08	5%



3,) Status of money spending

	Spent money	Value of new orders/ contracts	Expected spending of new orders/contracts until end 2005	Sum of column 2 & 4
Travel				
Consumables	15000		49000	64000
Manpower				
Durable				
			Total sum	64000

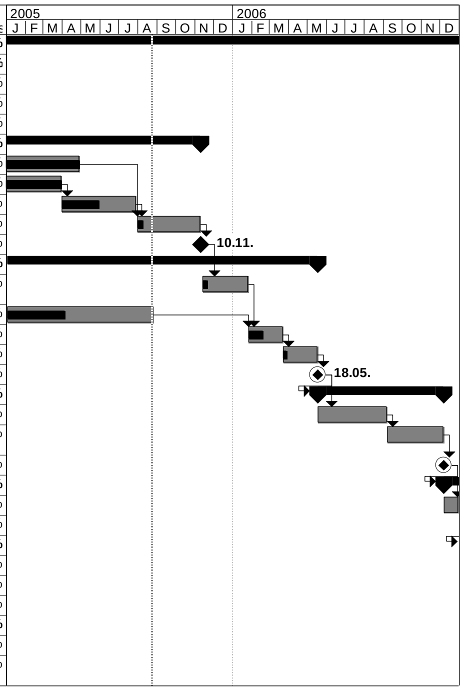
Work package WP3: Seamless Cavity Production

Task 3.1: seamless cavity production by spinning

The spinning machine has been finished and it is perfectly working. The new set of rollers needs still to be done, but since the material used for rollers is very expensive, the rollers will be fabricated after the end of the machine commissioning. This will allow us to do some modifications to the rollers on the basis of the acquired experience.
The new machine is equipped with a more powerful hydraulic station, in order to achieve higher values of pressure between lathe tailstock and headstock. This enables us to get a higher wall thickness at the cavity iris. Indeed, for long time, a thin wall at the cavity iris has represented a problem for seamless fabrication.
Since the machine is more powerful, all the spinning parameters must be changed. Higher values of the pressure applied to the rollers, and higher compression pressure along the axis of the cavity require a lower number of spinning steps. Indeed, by the standard procedure developed before, we helped the plastic deformation process increasing the number of spinning steps. However, the higher is the number spinning steps, the more the material hardens, increasing the risk of fracture propagations. Then, the evaluation of spinning parameters is a long procedure and a lot of attention must be paid on the preparation of samples.
The support system and turning mechanism, while swaging the cavity, is working but it is only temporary, since we are evaluating the possibility of using different rollers with a cavity-roller contact area that is much higher than the standard one. Of course, this will dramatically change spinning parameters.
In short, the milestones of drawing spinning machine was reached already time ago; the milestone of having ready the spinning machine is almost concluded apart from the commissioning, being the assembly of the machine already finished but still suitable for modifications. The evaluation of spinning parameters has only started and it will be the longest operation of the whole WP3.1.

2.) Status of MS-Project

N°	MS, Deliverable	Task Name	Anfang	Ende	% eschlos
3.1		**Seamless by spinning**	**Do 01.01.04**	**Fr 04.01.08**	**41%**
3.1.1		**Design spinning machine**	**Do 01.01.04**	**Fr 17.09.04**	**100%**
3.1.1.1		Drawings of the matrices	Do 01.01.04	Fr 16.04.04	100%
3.1.1.2		Drawings of the support system	Fr 16.04.04	Fr 17.09.04	100%
3.1.1.3	**Design repor**	**Drawings of spinning machine finished**	Fr 17.09.04	Fr 17.09.04	100%
3.1.2		**Fabrication of spinning machine**	**Mo 20.09.04**	**Do 10.11.05**	**76%**
3.1.2.1		Fabrication of machine parts	Mo 20.09.04	Fr 29.04.05	100%
3.1.2.2		Software for the machine	Mo 20.09.04	Do 31.03.05	100%
3.1.2.3		Assembly of machine	Fr 01.04.05	Fr 29.07.05	50%
3.1.2.4		Commissioning of the machine	Mo 01.08.05	Do 10.11.05	10%
3.1.2.5	**Commissionin**	**Spinning machine ready**	Do 10.11.05	Do 10.11.05	10%
3.1.3		**Evaluation of spinning parameters**	**Mo 03.01.05**	**Do 18.05.06**	**31%**
3.1.3.1		Drawings of the support system and turning mechanism	Mo 14.11.05	Do 26.01.06	10%
3.1.3.2		Drawings of the necking mechanism	Mo 03.01.05	Fr 26.08.05	40%
3.1.3.3		Fabrication of the tube necking machine	Fr 27.01.06	Do 23.03.06	40%
3.1.3.4		Commissioning of the machine	Fr 24.03.06	Do 18.05.06	10%
3.1.3.5		**Spinning parameters defined**	Do 18.05.06	Do 18.05.06	20%
3.1.4		**Spinning of 1-celll cavities**	**Fr 19.05.06**	**Do 07.12.06**	**0%**
3.1.4.1		Material and fabrication of bulk Nb test tubes	Fr 19.05.06	Do 07.09.06	0%
3.1.4.2		Material and fabrication of bimetallic NbCu test tubes	Fr 08.09.06	Do 07.12.06	0%
3.1.4.3		**1-cell spinning parameters defined**	Do 07.12.06	Do 07.12.06	0%
3.1.5		**Extension of spinning apparatus to multicel**	**Fr 08.12.06**	**Do 11.01.07**	**0%**
3.1.5.1		Computer simulation of the necking	Fr 08.12.06	Do 11.01.07	0%
3.1.5.2	**Start spinning**	**Start of Multi-cell spinning**	Do 11.01.07	Do 11.01.07	10%
3.1.6		**Spinning of multi-cell cavities cavities**	**Fr 12.01.07**	**Do 02.08.07**	**0%**
3.1.6.1		Computer simulation of the spinning	Fr 12.01.07	Do 02.08.07	0%
3.1.6.2		Spinning of bulk Nb 9-cell cavities	Fr 12.01.07	Do 12.07.07	0%
3.1.6.3	**Design repor**	**Parameters of multi-cell spinning defin**	Do 12.07.07	Do 12.07.07	0%
3.1.7		**Series production of multi-cell cavities**	**Fr 13.07.07**	**Fr 04.01.08**	**0%**
3.1.7.1		Spinning	Fr 13.07.07	Fr 04.01.08	0%
3.1.7.2		**Multi-cell cavities finished**	Fr 04.01.08	Fr 04.01.08	0%



Task 3.2 Seamless by hydroforming

1.) Status of activities

Functionality of the hydroforming machine was set up and commissioning of machine was done according the time table. The hydroforming of the double cell cavities of TESLA shape from copper tube was successfully done.

Fig. 1: View of the hydroforming machine

As mentioned earlier the hydroforming machine was provided with new moulds for fabrication of multi cells and also with water hydraulic system for the internal pressure in the tube and with oil hydraulic system for the cylinder movements. The developed computer control system for the hydroforming allows the hydraulic expansion in stepwise as well as in continuous regime. A view of the machine can be seen in Fig. 1.

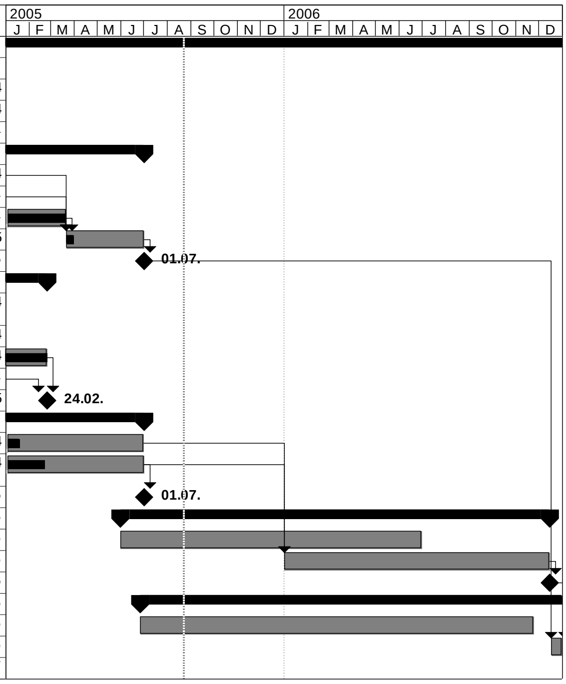
Fig. 2 Seamless niobium tubes for cavity fabrication by hydroforming

The multi cell seamless bulk Nb cavities are planned to be fabricated starting from the tube with inside diameter of ID=150 mm. The main principles for the production of seamless Nb tubes for hydroforming are developed in cooperation with industry. The seamless tubes built starting from the thick sheet having already rather small and uniform grain structure. Tubes are produced by combination of spinning and flow forming (Fig. 2). Combination of spinning with flow forming allows improving the surface and significantly reducing the wall thickness variations. Flow forming was done in forward direction (Fig. 3). This method allows producing tube with wall thickness tolerances of +/- 0.15 mm what should be sufficient for subsequent hydroforming.

Fig. 3: Flow forming of the seamless niobium tubes

2.) Update of MS-Project

N°	MS, Deliverable	Task Name	Anfang
3.2		**Seamless by hydroforming**	**Do 01.01.04**
3.2.1		**Design hydro forming machine**	**Do 01.01.04**
3.2.1.1		Drawings of the matrices	Do 01.01.04
3.2.1.2		Drawings of the support system	Do 01.01.04
3.2.1.3	**Design repor**	**Drawings matrix & support finished**	Fr 17.09.04
3.2.2		**Construction of hydro forming machine**	**Do 01.01.04**
3.2.2.1		Hydraulic for machine	Do 01.01.04
3.2.2.2		Software for the machine	Mo 23.02.04
3.2.2.3		Machine fabrication	Mo 20.09.04
3.2.2.4		Commissioning of the machine	Di 22.03.05
3.2.2.5	**Commissionin**	**Hydro forming machine ready**	Fr 01.07.05
3.2.3		**Construction of tube necking machine**	**Do 01.01.04**
3.2.3.1		Drawings of the support system and turning mechanism	Do 01.01.04
3.2.3.2		Drawings of the necking mechanism	Do 01.01.04
3.2.3.3		Fabrication of the tube necking machine	Do 23.09.04
3.2.3.4		Software for the tube necking machine	Mo 03.05.04
3.2.3.5	**Design repor**	**Construction tube necking machine fin**	Do 24.02.05
3.2.4		**Development of seamless tubes for 9-cell c**	**Do 01.01.04**
3.2.4.1		Material and fabrication of bulk Nb test tubes	Di 03.08.04
3.2.4.2		Material and fabrication of bimetallic NbCu test tubes	Do 01.01.04
3.2.4.3	**Design repor**	**Seamless tubes ready**	Fr 01.07.05
3.2.5		**Development of tube necking**	**Mi 01.06.05**
3.2.5.1		Computer simulation of the necking	Mi 01.06.05
3.2.5.2		Experiments on tube necking at iris	Mo 02.01.06
3.2.5.3	**Commissionin**	**Tube necking machine operational**	Fr 15.12.06
3.2.6		**Hydro forming of seamless cavities**	**Mo 27.06.05**
3.2.6.1		Computer simulation of the hydro forming	Mo 27.06.05
3.2.6.2		Hydro forming of bulk Nb 9-cell cavities	Mo 18.12.06
3.2.6.3		**Hydro formed 9-cell cavities ready**	Fr 16.11.07



3.) Status of money spending in Q2 2005

	Spent money	**Value of new orders/ contracts**	**Expected spending of new orders/contracts until end 2005**	**Sum of column 2 & 4**
Travel				
Consumables			*45120*	*45120*
Manpower	*3690*		*12300*	*15990*
Durable				
			Total sum	*61110*

Work Package 4 - Thin film cavity production

Task **4.1: Linear arc cathode coating**

1.) Status of activities

Studies of arc-current reduction and optimization of powering system

The prototype linear-arc facility, which was designed for single cells coating and put into operation at IPJ in Swierk, Poland, in October 2004, has recently been investigated under different experimental conditions. The main aim was to study possibility of the arc current reduction and stabilization. This study has been performed with the use of a special stainless-steel chamber of the shape and dimensions similar to an original single RF cell. This chamber has been equipped with 2 end flanges of the UHV standard, which are used as connections with the UHV pumping stand (at the bottom) and a magnet driving system (at the top). The chamber has also been equipped with 4 side-on (radial) ports distributed symmetrically in the central symmetry plane of the cell, where a distance between the cathode and wall of the cell is the largest. The first port, equipped with a transparent glass (or quartz) window, is used for optical observation of arc discharges. The second port, equipped with an ion-current collector, is used for measurements of the ion current flux. Two other ports are used for the introduction of substrate holders.

Studies of the current reduction and stabilization have been performed by means of a new power supply unit and a special solid-magnet system, which was placed inside the cathode tube in order to drive the arc discharge along the cathode surface. These studies have just been finished, according to the previous plan, and stable discharges can be produced at current reduced to about 60A. Measurements performed with the ion-current collector,

placed at a distance corresponding to the cell wall, have shown that at the operational conditions the ion-current density amounts 45mA/cm^2. The test substrates made of sapphire, which were placed inside the side-on diagnostic ports, have been coated and analyzed with an optical microscope. Some distinct micro-droplets have been found upon the coated surfaces, but more detailed optical analysis requires more time.

The optimization of the powering system has been performed and the coating apparatus for single cells has just been put in the operation. The system will still be optimized during operations when the real single cavities are coated.

Coating of single-cells without micro-droplet filtering

The first single-cavity, cut out of the real accelerator unit, has been equipped with appropriate UHV flanges, and after that it has been installed within the prepared facility. The coating of this single cell has just been performed without any micro-droplet filtering. The coated single-cell has been cut along its symmetry axis in order to perform an analysis of inner surfaces. The coated surfaces are shown in Fig.1.

Fig.1. Inner surfaces of a single cell, which have been coated without any micro-droplet filtering

Design and construction of a micro-droplet filter system

A cylindrical magnetic filter for the elimination of micro-droplets from the vacuum-arc plasma within the linear-arc facility has been designed and constructed. It consists of a tubular set of thin copper tubes distributed symmetrically around the cylindrical surface. These tubes are connected at the ends by special connectors, which enable an appropriate magnetizing-current and cooling-water flows to be realized. To fix the tubes in proper positions the use is made of special ceramic-insulator plates and an auxiliary support, as shown in Fig. 2 and 3

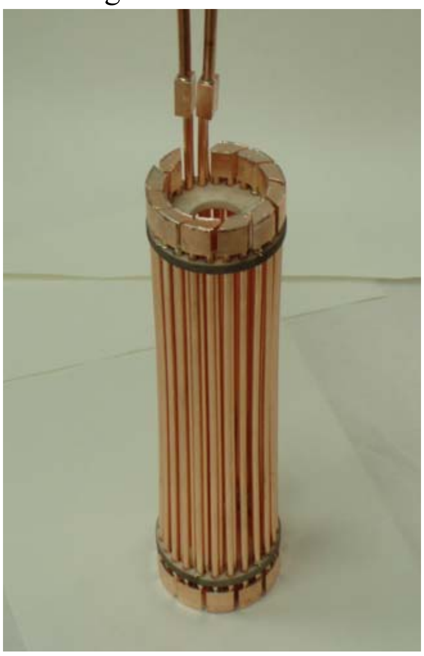


Fig.2. General view of the cylindrical magnetic filter before installation.

Fig.3. The cylindrical magnetic filter fixed upon the linear (cylindrical) cathode.

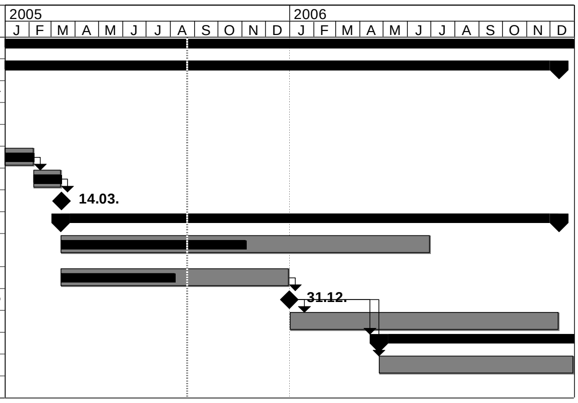
The cylindrical magnetic filter is a new concept and it requires extensive theoretical studies and experimental tests. Some preliminary modelling of the magnetic field distribution has been performed and the presented prototype filter has been constructed upon this basis. In order to carry out experimental tests this prototype, together with the linear (cylindrical) cathode (shown in Fig.3), has been installed within an auxiliary high-vacuum stand. The vacuum tightness of the whole system has been checked at the background pressure below 10^{-7} Torr and no leak has been detected. In order to test an influence of the thermal load, the water cooling system has been activated and the filter has been supplied from a current source delivering 400 A. No considerable over-heating of the filter tubes has been observed at the maximum available current.

According to the model computations, it will be necessary to use currents of the order of 1 kA. Therefore, a new high-current power supply unit has been designed and manufactured. It has been based on a 3-phase transformer and Hitachi rectifiers, which can deliver the required currents. The main characteristics of this unit are as follows: operational mode – DC, the maximum current load - I_{max} = 1000A, and the maximum power - P_{max} = 7.5 kA. A general view of the new current supply unit is shown in Fig. 4.

Fig.4. High-current supply unit for the cylindrical magnetic filter.

2.) Updating of MS-Project

N°	MS, Deliverable	Task Name	Anfang
4.1		**Linear-arc cathode coating**	**Do 01.01.04**
4.1.1		**Installation & commissioning of coating app**	**Do 01.01.04**
4.1.1.1		Modification of a prototype facility for single	Do 01.01.04
4.1.1.2		Optimization of a triggering system	Mo 22.03.04
4.1.1.3	**Commissionin**	**Prototype facility ready**	Mo 11.10.04
4.1.1.4		Study of arc current reduction and stabilizati	Mo 11.10.04
4.1.1.5		Optimization of powering system	Mo 07.02.05
4.1.1.6	**Apparatus read**	**Coating apparatus operational**	Mo 14.03.05
4.1.1.7		**Coating single cells**	**Mo 14.03.05**
4.1.1.7.		Coating of single cells without micro droplet filtering	Mo 14.03.05
4.1.1.7.		Design and construction of a micro drop	Mo 14.03.05
4.1.1.7.	**Hardware read**	**Droplet filter ready**	Sa 31.12.05
4.1.1.7.		Coating of single cell with micro droplet	Mo 02.01.06
4.1.2		**Coating multi-cell**	**Mi 26.04.06**
4.1.2.1		Design and commissioning	Mi 26.04.06
4.1.2.2		First multicell coating	Fr 26.10.07



3.) Status of money spending for Task4.1

	Spent money	Value of new orders/ contracts	Expected spending of new orders/contracts until end 2005	Sum of column 2 & 4
Travel	**5031.64**			
Consumables	**8123.62**			
Manpower	**7854.90**			
Durable	**1305.01**			
			Total sum	**22315.17**

Task: 4.2: Planar arc cathode coating

1.) Status of activities

A summary report on "Quality of UHV planar-arc Nb-coating", which is submitted as ANNEX 1, includes the most recent low- and high-field RF measurements performed upon filtered sapphire and copper samples.
Commissioning of the unfiltered test-apparatus, as designed and constructed for studying the deposition of superconducting layers upon a cell-like chamber, which can contain several sample holders, has just been started. Picture of the whole test-chamber and that of the inner surface of the half-chamber are presented in Fig. 5

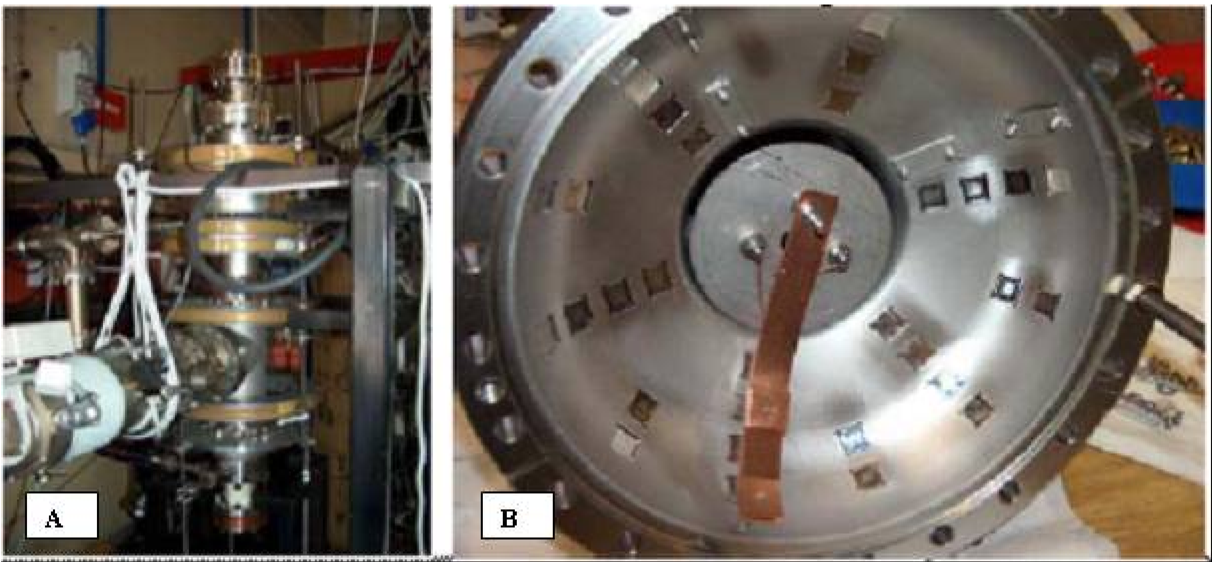


*Fig.5. General view of the unfiltered single-cell deposition test chamber after its complete assembling (**A**) and a picture of the inner surface of the half-cell equipped with several sample holders (**B**).*

A new computer-controlled system for our prototype of the filtered deposition apparatus has been designed and put into operation. The system can control the arc ignition and recovery after its extinction automatically. An example of the recorded traces is shown in Fig. 6.

Fig.6. Picture of the arc-discharge control panel

An up-graded filtered apparatus with a planar cathode and T-shaped magnetic filter has been designed and constructed in the cooperation with the WP4.1 team. The device has been equipped with a sample holder with the temperature controller. It has also been equipped with additional coils in order to improve the spatial distribution of magnetic field lines, as shown in Fig. 7.

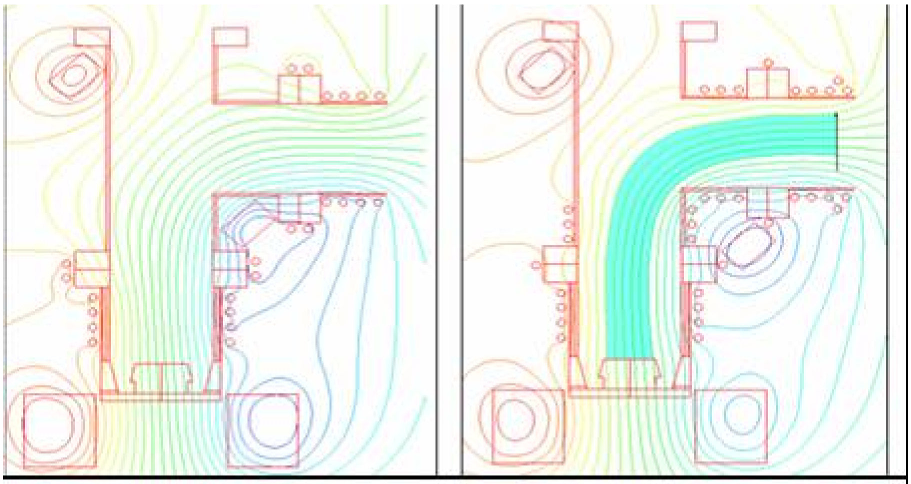
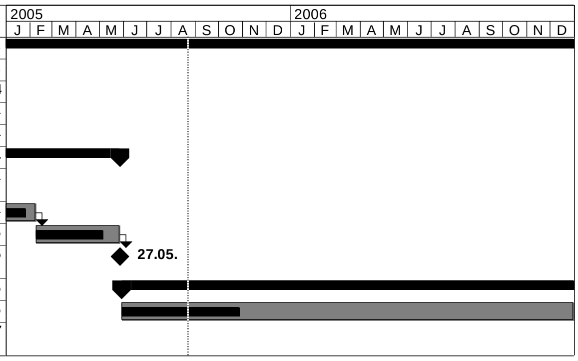


Fig.7. Possible magnetic field configurations within the T-shaped

The commissioning of a new controlled-gas-flow system, as designed for studies of nitride coatings, has encountered some problems with the arc stability, which are under present investigation.

2.) Updating of MS-Project

N°	MS, Deliverable	Task Name	Anfang
4.2		**Planar-arc cathode coating**	**Do 01.01.04**
4.2.1		**Modification of a planar-arc & trigger syste**	**Do 01.01.04**
4.2.1.1		Modification	Do 01.01.04
4.2.1.2		Optimization of the laser triggering system	Mo 19.04.04
4.2.1.3	**Status Repor**	**Planar arc system fully tested**	Fr 03.09.04
4.2.2		**Routine Operation of planar arc system**	**Mo 06.09.04**
4.2.2.1		Characterization of samples coated at different conditions	Mo 06.09.04
4.2.2.2		Characterization of Nb-coated sapphire	Mo 06.12.04
4.2.2.3		Characterization of Nb-coated copper s	Mi 09.02.05
4.2.2.4	**Status Repor**	**Summary report on quality of planar arc coating**	Fr 27.05.05
4.2.3		**Studies of other HTC superconducting coat**	**Mo 30.05.05**
4.2.3.1		Study of superconducting properties	Mo 30.05.05
4.2.3.2		**Report on quality of superconducting properties**	Sa 30.06.07



3.) Status of money spending for WP4.2

	Spent money	Value of new orders/ contracts in 2005	Expected spending of new orders/contracts until end 2005	Sum of column 2 & 4
Travel	7808.00		3000	10800
Consumables		16328.74	8000	25000
Manpower	Data will be provided by INFN Adm.		Data will be provided by INFN Adm.	Data will be provided by INFN Adm.
Durable	1121.29		15000	16000
			Total sum	51800

Work package 5: Surface preparation

Task: 5.1: EP on single cell

1.) Status of activities

5.1.1 EP on Samples
The tasks **5.1.1.1** and **5.1.1.2** are **completed**

Task **5.1.1.3** is **underway**.
First interesting results have been presented at the last TTF meeting (April, 1-3, 2005). Design of a new acquisition set-up is now completed and gave interesting results, now under analysis.

Task **5.1.1.4**: **started**;
Influence of HF concentration in aging and Sulphur generation evidenced.
Changing the bath composition to higher HF content works on sample: less or not S produced, lifetime extended, but might not apply to cavities due to the potential-current features.
Further experiments are needed.

5.1.2 completed

5.1.3 Build EP chemistry for single cell cavities
5.1.3.1 completed, but the study of the condenser for HF gas failed.

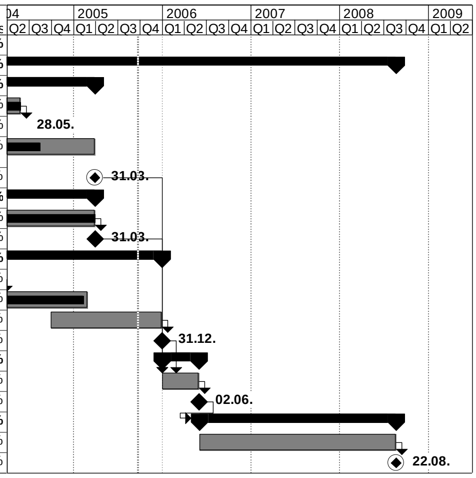
5.1.3.2 underway,
reconstruction of lab hoods has been completed, most ordered parts have arrived, and acquisition system has been studied and developed. Mounting of parts is 95% completed.

5.1.3.3 Security procedures inside the lab have been revised and must be accepted by the authority concerned. Authorization and commissioning is waited for the 13th of October 2005.
5.1.3.4 will be delayed: end of 2005.

Status of milestones / deliverables in this quarter
All these milestones are delayed.

2.) Update of MS-Project

N°	MS, Deliverable	Task Name	Anfang	Ende	% eschlos
5		**WP5 SURFACE PREPARATION**	**Do 01.01.04**	**Fr 19.09.08**	**32%**
5.1		**EP on single cells**	**Do 01.01.04**	**Fr 22.08.08**	**40%**
5.1.1		**EP on samples**	**Do 01.01.04**	**Do 31.03.05**	**58%**
5.1.1.1		Establishing method of surface characterizat	Do 04.03.04	Fr 28.05.04	100%
5.1.1.2	**Design Repor**	**Surface characterization fixed**	Fr 28.05.04	Fr 28.05.04	100%
5.1.1.3		Series of EP with samples for surface investigations	Do 01.01.04	Do 31.03.05	50%
5.1.1.4		**Best EP parameters**	Do 31.03.05	Do 31.03.05	0%
5.1.2		**Single cell cavities**	**Do 01.01.04**	**Do 31.03.05**	**100%**
5.1.2.1		Order Nb and fabricate 3 cavities	Do 01.01.04	Do 31.03.05	100%
5.1.2.2	**Cavities read**	**3 cavities fabricated**	Do 31.03.05	Do 31.03.05	100%
5.1.3		**Build EP chemistry for single cells**	**Do 01.01.04**	**Sa 31.12.05**	**43%**
5.1.3.1		Design of EP set-up	Do 01.01.04	Fr 27.02.04	90%
5.1.3.2		Fabrication of EP set-up	Do 01.04.04	Mo 28.02.05	95%
5.1.3.3		Commissioning of EP set-up	Do 30.09.04	Sa 31.12.05	0%
5.1.3.4	**Commissionin**	**First operation of EP set-up**	Sa 31.12.05	Sa 31.12.05	0%
5.1.4		**Operation of single cell EP**	**Mo 02.01.06**	**Fr 02.06.06**	**0%**
5.1.4.1		Continous single cell operation	Mo 02.01.06	Fr 02.06.06	0%
5.1.4.2	**Design Repor**	**Define working parameters for single c**	Fr 02.06.06	Fr 02.06.06	0%
5.1.5		**Continuous operation, search for best para**	**Mo 05.06.06**	**Fr 22.08.08**	**0%**
5.1.5.1		Parametrising EP procedure	Mo 05.06.06	Fr 22.08.08	0%
5.1.5.2		**EP parameters fixed**	Fr 22.08.08	Fr 22.08.08	0%



3.) Status of money spending

K €	Spent money	Value of new orders/ contracts	Expected spending of new orders/contracts until end 2005	Sum of column 2 & 4
Travel	*754*			*754*
Consumables* component part for EP bench, acid mixtures,	110 500 €	*300*	*700*	*120 500*
Manpower *temporary*	**	**	**	**
permanent	**	**	**	**
Durable				
			Total sum	*~185 000*

** includes component parts for EP bench, acid mixtures, and indemnity for the visiting candidates (engineer position)*
*** See with O.Napoly*

Task 5.2: EP on multi cells

1.) Status of activities

The Ep stet up is running continuously. First information on aging of system components is available. Due to this information some redesign is necessary and shifts the expected end dates of the WP 5211.
Data of acid aging are available now and a system for online control and to re fresh the acid by adding HF acid automatically is under development. This part of the WP is finished in the sense of the basic goal
The parameters for continuous runs are fixed and quality control is established. Some modifications and additional QC steps are needed due to new results showing up during the last 100 h of operation. This will lead to an extension of the WP bath aging. Even if all proposed steps are ready now.
The software for electrode optimization is ordered and installed on a DESY computer. Training of personal and parameter for input data of the software are ordered
A Laser roughness instrument is under installation at the University of Wuppertal. This system looks to be the relevant one for the measurements. On samples the roughness measurement system will be tested.
Industrialization of the ep will be made in parallel to the study of industrialization of the electro polishing funded under the XFEL preparation investigations.

Action Items
Discussion needed:
For the realization of an industrial prototype of the electro polishing system, the time foreseen under this work package is not enough to build up and operate such a system
Fabricate EP multi-cell industrial prototype
Commission EP multi-cell industrial prototype
EP multi-cell industrial prototype ready
Operate EP multi-cell industrial prototype

Discussion needed:
Actually no relevant data are available for salt mixtures. The information from 5113 gives a variation in the existing Ep bath mixture. It has to be discussed who and under which WP the test of this mixture will be done. Actually the single cell infrastructure is not available. On the other side industrial companies should have the capability to change the mixture in use for the single cell test program at DESY.

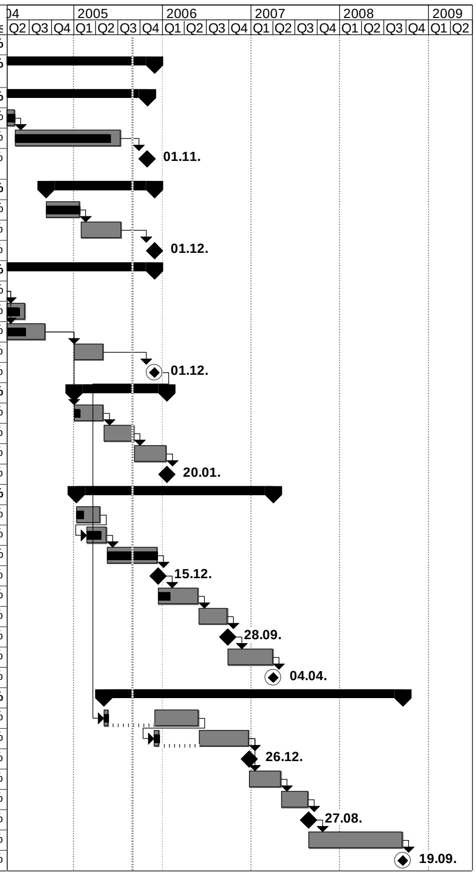
Alternative (salt) mixtures
Discussion needed
In which way the results found within the single cell Program at DESY can be used for this WP item. A test set up with improved mechanic and parameters can be set up built there are no test cavities available. To be discussed are

a) need to build up a separate 1 cell set up or use the Industrial once
b) Use of date of single cell program.
c) Availability of single cells

Setup one-cell system
Design for hot water rinsing

2.) Update of MS-Project

N°	MS, Deliverable	Task Name	Anfang	Ende	% eschlos
5.2		**EP on multi-cells**	**Do 01.01.04**	**Fr 19.09.08**	**36%**
5.2.1		**Transfer of parameters from 1 cell to multi cell equipment**	**Do 01.01.04**	**Do 01.12.05**	**66%**
5.2.1.1		**Finish EP setup nine-cells at DESY**	**Do 01.01.04**	**Di 01.11.05**	**92%**
5.2.1.1.1		Improved gas cleaning system	Do 01.01.04	Mi 05.05.04	100%
5.2.1.1.2		Design for hot water rinsing	Do 06.05.04	Fr 15.07.05	90%
5.2.1.1.3	**Status Repor**	**Proof-of-Principle experiment hot water rinsing**	Di 01.11.05	Di 01.11.05	0%
5.2.1.2		**Optimize electrode shape**	**Fr 10.09.04**	**Do 01.12.05**	**45%**
5.2.1.2.1		Develop computer model / Evaluate softw	Fr 10.09.04	Do 27.01.05	100%
5.2.1.2.2		Design improved electrode	Di 01.02.05	Mo 18.07.05	0%
5.2.1.2.3	**Design repor**	**Electrode design fixed**	Do 01.12.05	Do 01.12.05	0%
5.2.1.3		**Fix process parameters/ Quality contro**	**Do 01.01.04**	**Do 01.12.05**	**49%**
5.2.1.3.1		Setup chemical lab	Do 01.01.04	Mi 24.03.04	100%
5.2.1.3.2		Bath aging	Do 25.03.04	Mi 16.06.04	70%
5.2.1.3.3		Bath mixture	Do 25.03.04	Mi 08.09.04	50%
5.2.1.3.4		Alternative (salt) mixtures	Di 04.01.05	Do 05.05.05	0%
5.2.1.3.5		**Process parameters fixed**	Do 01.12.05	Do 01.12.05	1%
5.2.2		**Laser roughness**	**Di 04.01.05**	**Fr 20.01.06**	**6%**
5.2.2.1		Evaluate existing systems	Di 04.01.05	Do 05.05.05	20%
5.2.2.2		Specify laser system	Fr 06.05.05	Do 08.09.05	0%
5.2.2.3		Built laser system	Fr 09.09.05	Fr 20.01.06	0%
5.2.2.4	**Equipment read**	**Roughness measurement finished**	Fr 20.01.06	Fr 20.01.06	0%
5.2.3		**Oxipolishing as final chemical cleaning**	**Do 13.01.05**	**Mi 04.04.07**	**40%**
5.2.3.1		Laboratory studies	Do 13.01.05	Fr 22.04.05	30%
5.2.3.2		Design of OP system	Do 24.02.05	Mi 18.05.05	70%
5.2.3.3		Setup one-cell system	Do 19.05.05	Mi 14.12.05	100%
5.2.3.4	**Status Repor**	**Proof-of-Principle experiment Oxipolish**	Do 15.12.05	Do 15.12.05	0%
5.2.3.5		Design OP for nine-cells	Fr 16.12.05	Mi 31.05.06	30%
5.2.3.6		Build OP for 9-cells	Do 01.06.06	Do 28.09.06	0%
5.2.3.7	**Commissionin**	**OP for 9-cells ready**	Do 28.09.06	Do 28.09.06	0%
5.2.3.8		Study op with 9-cell cavities	Fr 29.09.06	Mi 04.04.07	0%
5.2.3.9		Evaluate experiments	Mi 04.04.07	Mi 04.04.07	0%
5.2.4		**Transfer Electropolishing technology to ind**	**Fr 06.05.05**	**Fr 19.09.08**	**4%**
5.2.4.1		Qualify industry with one-cells	Fr 06.05.05	Fr 02.06.06	10%
5.2.4.2		Industrial design study on setup for multi-cel	Di 29.11.05	Di 26.12.06	10%
5.2.4.3	**Report**	**Report on industrial design**	Di 26.12.06	Di 26.12.06	0%
5.2.4.4		Fabricate EP multi-cell industrial prototype	Di 26.12.06	Mo 07.05.07	0%
5.2.4.5		Commission EP multi-cell industrial prototype	Mo 07.05.07	Mo 27.08.07	0%
5.2.4.6	**Commissionin**	**EP multi-cell industrial prototype ready**	Mo 27.08.07	Mo 27.08.07	0%
5.2.4.7		Operate EP multi-cell industrial prototype	Mo 27.08.07	Fr 19.09.08	0%
5.2.4.8		**Final report on industrial EP**	Fr 19.09.08	Fr 19.09.08	0%



3.) Status of money spending

	Spent money	Value of new orders/ contracts	Expected spending of new orders/contracts until end 2005	Sum of column 2 & 4
Travel	6000		2000	8000
Consumables		16000	16000	32000
Manpower		45000		45000
Durable				
			Total sum	85000

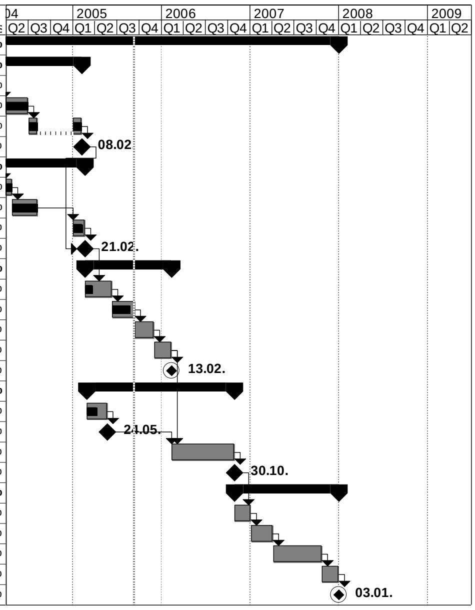
Task 5.3: Automated Electro-Polishing

1.) Status of activities

The Automated EP System has been satisfactory tested on copper. The program has been written in LabView and has been installed onto PLC Field point. This has the big advantage of not loosing the control of the working point during the locking procedure around the minimum of the EP bath differential conductivity. That was indeed the main problem we faced during our preliminary attempts of dynamic control of the EP differential conductivity by a simple PC, due to the fact that standard PCs often interrupt the process just while refreshing so that the dynamic control often is lost. The operation on Niobium is more critical, not only from the DATA processing point of view, due to the presence of plateau oscillations, but also from the security aspect. Therefore, the application of the Automated EP to the Niobium is in progress. The EP design control architecture is finished and the software has been already tested successfully. While testing, however, we decided to improve the algorithm trying to insert the possibility of self-recognition of minima by the program itself. Moreover, we decided to add a few more buttons to work manually, semi-automatically and totally automatically. This last possibility is very complex; so, reaching this milestone requires further investigation.
As far as the new electrolytes are concerned, we have found alternative recipes based on oxalic and boric acids instead of sulphuric acid. Hydrofluoric is still present; we are evaluating the possibility to get rid of it, which means that the milestones are not complete and that it will be finished by December.

2.) Update of MS-Project

N°	MS, Deliverable	Task Name	Anfang	Ende	% eschlos
5.3		**Automated EP (AEP)**	**Do 01.01.04**	**Do 03.01.08**	**38%**
5.3.1		**Prototype EP installation**	**Do 01.01.04**	**Di 08.02.05**	**99%**
5.3.1.1		Design installation	Do 01.01.04	Fr 05.03.04	100%
5.3.1.2		Fabricate/ order components	Mo 08.03.04	Fr 02.07.04	100%
5.3.1.3		Assemble EP installation	Mo 05.07.04	Di 08.02.05	100%
5.3.1.4	**Commissionin**	**First operation of automated EP**	Di 08.02.05	Di 08.02.05	0%
5.3.2		**EP computer control**	**Mo 08.03.04**	**Mo 21.02.05**	**95%**
5.3.2.1		Design control architecture	Mo 08.03.04	Di 27.04.04	100%
5.3.2.2		Developed software	Mi 28.04.04	Di 10.08.04	100%
5.3.2.3		Test of software	Di 04.01.05	Mo 21.02.05	80%
5.3.2.4	**Status Repor**	**Software ready**	Mo 21.02.05	Mo 21.02.05	80%
5.3.3		**Operation of AEP prototype**	**Di 22.02.05**	**Mo 13.02.06**	**30%**
5.3.3.1		Correlate surface finish/ conductance	Di 22.02.05	Mo 13.06.05	30%
5.3.3.2		Determine optimum conductance	Di 14.06.05	Mi 14.09.05	80%
5.3.3.3		Optimize automated operation	Do 15.09.05	Fr 02.12.05	0%
5.3.3.4		Design report on AEP	Mo 05.12.05	Mo 13.02.06	0%
5.3.3.5		**Automated EP is defined**	Mo 13.02.06	Mo 13.02.06	0%
5.3.4		**Alternative electrolytes**	**Di 01.03.05**	**Mo 30.10.06**	**13%**
5.3.4.1		Review of EP chemistry	Di 01.03.05	Di 24.05.05	50%
5.3.4.2	**Report**	**Proposal for alternative electrolytes**	Di 24.05.05	Di 24.05.05	50%
5.3.4.3		Experiments with alternative electrolytes	Di 14.02.06	Mo 30.10.06	0%
5.3.4.4	**Status Repor**	**Conclude experimental results**	Mo 30.10.06	Mo 30.10.06	0%
5.3.5		**Define best AEP**	**Di 31.10.06**	**Do 03.01.08**	**0%**
5.3.5.1		Compare standard/new electrolyte method	Di 31.10.06	Fr 05.01.07	0%
5.3.5.2		Modify AEP installation for best electrolyte	Mo 08.01.07	Fr 06.04.07	0%
5.3.5.3		Operate modified AEP	Mo 09.04.07	Do 25.10.07	0%
5.3.5.4		Design report on best AEP	Fr 26.10.07	Do 03.01.08	0%
5.3.5.5		**Conclude on best electrolyte**	Do 03.01.08	Do 03.01.08	0%



Task 5.4: Dry ice cleaning

1.) Status of activities

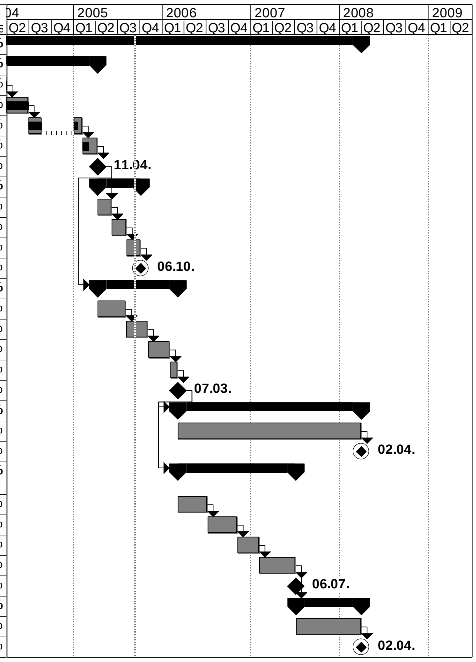
During the commissioning of the system unexpectedly the efficiency of the heater unit was identified to be insufficient. The heater unit shall prevent strong cooling of the cavity during the dry-ice treatment. After some preliminary tests on niobium material, a bid for a new high efficiency infra red heater unit is on hand and the order is under preparation.

In addition the complex control system is further delayed. Main reason is a man power problem caused by unexpected repair and maintenance work for the HERA accelerator at DESY. The gas alarm system for the personal interlock system is ordered.

The above listed problems result in a significant delay of the Milestone "Installation finished", which cannot be achieved before Dec 15th, 2005.

2.) Update of MS-Project

N°	MS, Deliverable	Task Name	Anfang	Ende	% eschlos
5.4		**Dry ice cleaning**	**Do 01.01.04**	**Mi 02.04.08**	**12%**
5.4.1		**Installation of full system for 1-3 cell cavitie**	**Do 01.01.04**	**Mo 11.04.05**	**83%**
5.4.1.1		Installation of CO2 piping	Do 01.01.04	Mi 31.03.04	100%
5.4.1.2		Installation of motion system	Do 01.04.04	Mi 30.06.04	100%
5.4.1.3		Installation of control system	Do 01.07.04	Di 08.02.05	80%
5.4.1.4		Commissioning	Mi 09.02.05	Mo 11.04.05	40%
5.4.1.5	**Commissionin**	**Installation finished**	Mo 11.04.05	Mo 11.04.05	40%
5.4.2		**Optimization of cleaning parameters**	**Di 12.04.05**	**Do 06.10.05**	**0%**
5.4.2.1		Sample cleaning	Di 12.04.05	Mi 08.06.05	0%
5.4.2.2		1-cell cavity cleaning	Do 09.06.05	Mo 08.08.05	0%
5.4.2.3		Fix best cleaning parameters	Di 09.08.05	Do 06.10.05	0%
5.4.2.4		**Cleaning parameters fixed**	Do 06.10.05	Do 06.10.05	0%
5.4.3		**VT 9-cell cleaning apparatus**	**Di 12.04.05**	**Di 07.03.06**	**0%**
5.4.3.1		Design 9-cell apparatus VT	Di 12.04.05	Fr 05.08.05	0%
5.4.3.2		Fabricated 9-cell apparatus	Mo 08.08.05	Fr 04.11.05	0%
5.4.3.3		Installation of 9-cell apparatus	Mo 07.11.05	Fr 03.02.06	0%
5.4.3.4		Commissioning of 9-cell apparatus	Mo 06.02.06	Di 07.03.06	0%
5.4.3.5	**Commissionin**	**VT Cleaning Installation finished**	Di 07.03.06	Di 07.03.06	0%
5.4.4		**VT Cleaning of 9-cell cavities**	**Mi 08.03.06**	**Mi 02.04.08**	**0%**
5.4.4.1		Continuous cleaning	Mi 08.03.06	Mi 02.04.08	0%
5.4.4.2		**Evaluation of experimental results**	Mi 02.04.08	Mi 02.04.08	0%
5.4.5		**Design & construction of H 9-cell cleaning apparatus**	**Mi 08.03.06**	**Fr 06.07.07**	**0%**
5.4.5.1		Design 9-cell apparatus VT	Mi 08.03.06	Fr 07.07.06	0%
5.4.5.2		Fabricated 9-cell apparatus	Mo 10.07.06	Mi 08.11.06	0%
5.4.5.3		Installation of 9-cell apparatus	Do 09.11.06	Di 06.02.07	0%
5.4.5.4		Commissioning of 9-cell apparatus	Mi 07.02.07	Fr 06.07.07	0%
5.4.5.5	**:ommissionnin**	**Start H 9-cell cleaning**	Fr 06.07.07	Fr 06.07.07	0%
5.4.6		**Cleaning of horizontal nine-cell cavity**	**Mo 09.07.07**	**Mi 02.04.08**	**0%**
5.4.6.1		Continuous cleaning	Mo 09.07.07	Mi 02.04.08	0%
5.4.6.2		**Evaluation of experimental results**	Mi 02.04.08	Mi 02.04.08	0%



3.) Status of money spending

	Spent money	Value of new orders/ contracts	Expected spending of new orders/contracts until end 2005	Sum of column 2 & 4
Travel				
Consumables	35000			35000
Manpower	22000		19000	41000
Durable				
			Total sum	76000

Work package 6: Material Analysis

Task 6.1: Development of SQUID based equipment for detection of defects in Nb

1.) Status of activities

The construction of the system for non-destructive inspection of niobium sheets, based on SQUID sensor is finished.

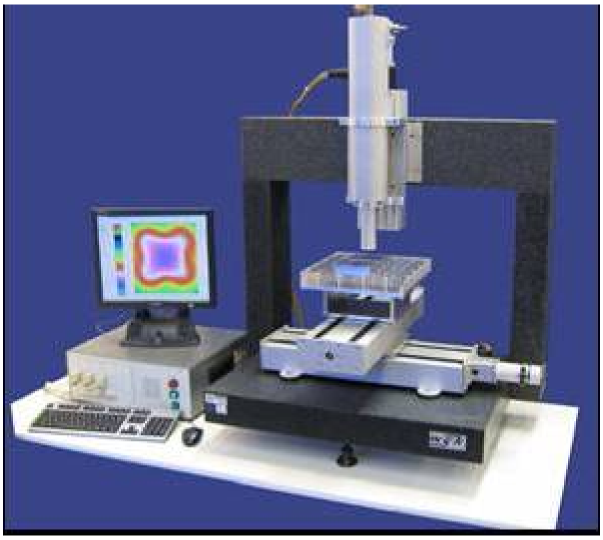


Fig. 1: View of a SQUID scanner for Nb sheets

Fig.1 shows the main components of the SQUID scanner. The scanner is based on a xyz table with ca. 300mm x 300m travel area. The SQUID sensor is electronically controlled by a flux modulation and control loop, in order to keep the magnetic flux through the SQUID constant. Compensation current is controlled by the flux measurement. Different filters are implemented into the lock in amplifier to improve the Signal/Noise ratio. The system works in a non-shielded environment.
The first testing of functionality was done end of June 2005. The specially prepared test sample was used in measurements. Eleven Ta spheres with diameters of about 0.1 mm were embedded into a 30 x 30 cm2 niobium sheet by electron-beam melting of the surface. First test results can be seen in Fig. 2

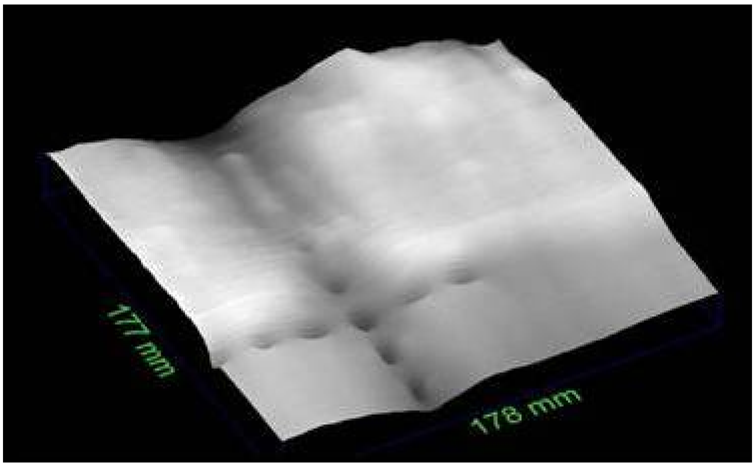
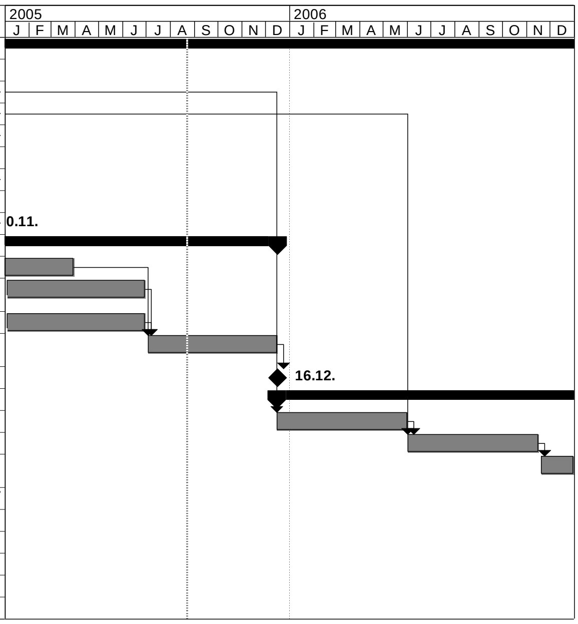


Fig. 2: Three-dimensional distribution of the eddy-current field above the niobium test sample.

The eddy-current frequency was 6 kHz. Nine of eleven embedded Ta inclusions are clearly detected. The system is in position to detect defects in Nb. Further optimization of the system set up is in work.

2.) Update of MS-Project

N°	MS, Deliverable	Task Name	Anfang
6.1		**SQUID scanning**	**Do 01.01.04**
6.1.1		**Produce calibration defects**	**Do 01.01.04**
6.1.1.1		Production of surface defects	Do 01.01.04
6.1.1.2		Production of bulk defects	Do 12.02.04
6.1.1.3	**Status Repor**	**Calibration defects finished**	Do 12.08.04
6.1.2		**Design components of Squid scanner**	**Do 01.01.04**
6.1.2.1		Design of the scanning table and support	Do 01.01.04
6.1.2.2		Design of the SQUID cooling system	Mi 28.01.04
6.1.2.3	**Design repor**	**Design Scanner finished**	Di 30.11.04
6.1.3		**Construction of scanning apparatus**	**Mi 01.12.04**
6.1.3.1		Fabrication of the SQUID	Mi 01.12.04
6.1.3.2		Fabrication and purchase of components for SQUID apparatus	Mi 01.12.04
6.1.3.3		Softw are for the SQUID scanner	Mi 01.12.04
6.1.3.4		Commissioning and calibration of scanning apparatus	Mo 04.07.05
6.1.3.5	**Commissionin**	**Scanning apparatus operational**	Fr 16.12.05
6.1.4		**Scanning of sheets with artificial defects**	**Fr 16.12.05**
6.1.4.1		Scanning of sheets w ith artificial surface de	Fr 16.12.05
6.1.4.2		Scanning of sheets w ith artificial bulk defect	Fr 02.06.06
6.1.4.3		Development of algorithm for material defects classification	Mo 20.11.06
6.1.4.4	**Status Repor**	**Classification of defects finished**	Do 08.02.07
6.1.5		**Scanning of production sheets**	**Mo 12.02.07**
6.1.5.1		Scanning of sheets of different producers	Mo 12.02.07
6.1.5.2		Identification of defects by (EDX, SURFA etc	Mo 02.04.07
6.1.5.3		Conclusive comparison w ith eddy current da	Fr 21.09.07
6.1.5.4		**Final report on SQUID scanning**	Mo 31.12.07



3.) Status of money spending Task 3.1, 5.3 and 6.2

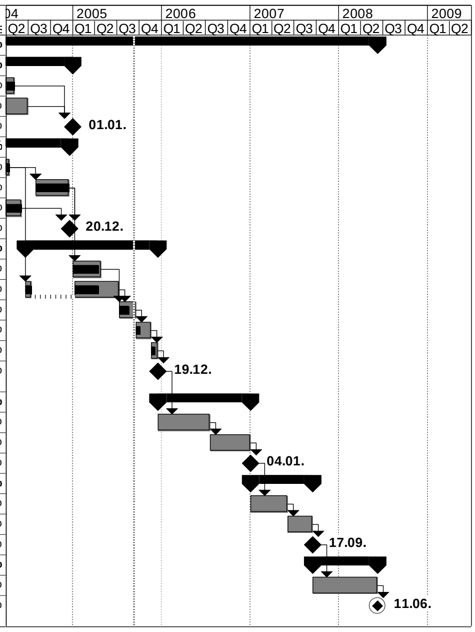
	Spent money	**Value of new orders/ contracts**	**Expected spending of new orders/contracts until end 2005**	**Sum of column 2 & 4**
Travel	*1628*			*1628*
Consumables			*27650*	*27650*
Manpower	*9090*			*9090*
Durable				
			Total sum	*38368*

Task: 6.2 Flux gate magnetometry

The Flux Gate apparatus is finished, it is already working, but it is susceptible of modifications. Indeed, it is not yet clear if it is really convenient to move the flux gate onto the sample rather than the sample onto the flux gate. The application of flux gate Magnetometry is twofold: the diagnostic of an electrochemical cell and the non destructive evaluation of Niobium surface. As for the former evaluation, we have observed that a cavity shaped electropolishing cathode works in a more efficient way than a simple straight tube. At present, we are able to plot the magnetic field tomography of a cavity shaped electrolytic cell. Lots of efforts were paid for the numerically inversion of the Biot-Savart law, by which we obtain directly the tomography of the current distribution for simple rectangular electrolytic cells driven at different voltages. For the cavity shaped cell, the inversion problem is more difficult and it is under study.
As for the latter application, we are trying to measure the RRR value by non contact methods, just pulsing a current onto the Niobium surface and detecting the expiring time by a magnetometer. In addition to that, we started to explore how fine we can detect a scratch onto the Niobium, being the resolution of flux gate detectors much less than the resolution of Squids. In order to improve the spatial resolution, we are also investigating the possibility to use alternative magnetometers.

2.) Update of MS-Project

N°	MS, Deliverable	Task Name	Anfang	Ende	% eschlos
6.2		**Flux gate magnetometry**	**Do 01.01.04**	**Mi 11.06.08**	**40%**
6.2.1		**Produce calibration defects**	**Do 01.01.04**	**Sa 01.01.05**	**41%**
6.2.1.1		Production of surface defects	Do 01.01.04	Fr 07.05.04	100%
6.2.1.2		Production of bulk defects	Do 01.01.04	Do 01.07.04	0%
6.2.1.3	**Status Repor**	**Calibration defects finished**	Sa 01.01.05	Sa 01.01.05	63%
6.2.2		**Design components of flux gate head**	**Do 01.01.04**	**Mo 20.12.04**	**100%**
6.2.2.1		Design electronics	Do 01.01.04	Fr 16.04.04	100%
6.2.2.2		Design of flux gate head	Mo 02.08.04	Fr 17.12.04	100%
6.2.2.3		Design of operations software	Do 01.01.04	Fr 04.06.04	100%
6.2.2.4	**Design repor**	**Design flux gate head finished**	Mo 20.12.04	Mo 20.12.04	100%
6.2.3		**Fabrication of flux gate detector**	**Mo 21.06.04**	**Mo 19.12.05**	**63%**
6.2.3.1		Fabrication of flux gate head	Mo 03.01.05	Fr 29.04.05	90%
6.2.3.2		Fabrication of mechanics	Mo 21.06.04	Di 12.07.05	60%
6.2.3.3		Implementation of software	Di 12.07.05	Mo 19.09.05	60%
6.2.3.4		Commissioning of flux gate detector	Mo 19.09.05	Mo 21.11.05	30%
6.2.3.5		Calibration of flux gate detector	Mo 21.11.05	Mo 19.12.05	60%
6.2.3.6	**Design report start operatio**	**Flux gate detector operational**	Mo 19.12.05	Mo 19.12.05	58%
6.2.4		**Commissioning of flux gate detector**	**Mo 19.12.05**	**Do 04.01.07**	**0%**
6.2.4.1		Operational tets tests	Mo 19.12.05	Fr 21.07.06	0%
6.2.4.2		Evaluation of test results	Fr 21.07.06	Do 04.01.07	0%
6.2.4.3	**Status Repor**	**Flux gate scanner commissioned**	Do 04.01.07	Do 04.01.07	0%
6.2.5		**Operation of flux gate detector**	**Do 04.01.07**	**Mo 17.09.07**	**0%**
6.2.5.1		Regular operation	Do 04.01.07	Mi 06.06.07	0%
6.2.5.2		Report of operation	Mi 06.06.07	Mo 17.09.07	0%
6.2.5.3	**Status Repor**	**Conclusion of flux gate scanning opera**	Mo 17.09.07	Mo 17.09.07	0%
6.2.6		**Comparison with SQUID scanner**	**Mo 17.09.07**	**Mi 11.06.08**	**0%**
6.2.6.1		Compare measurements	Mo 17.09.07	Mi 11.06.08	0%
6.2.6.2		**Conclude SQUID scanner vs. flux gate detector**	Mi 11.06.08	Mi 11.06.08	0%



Task 6.3: DC field emission scanning

1.) Status of activities

Systematic field emission scanning, local measurements and surface analysis of emitters were performed on the electro polished Nb sample SEP2 (from CEA Saclay) before and after high pressure rinsing (at DESY). These results on both samples SEP1 (s. QR1-2005) and SEP2 have been summarized in the milestone report (see above), and was published as poster contribution and submitted to the Proceedings of the Int. Workshop on RF Superconductivity at Cornell University in July 2005. The main results of this work can be summarized as follows:

- Both EP Nb samples showed an onset of FE at surface fields around 40 MV/m and emitter number densities up to 30/cm^2 at 120 MV/m.
- The FE of SEP2 was clearly improved after HPR, i.e. the onset field increased to 60 MV/m and the emitter number density reduced to 14/cm^2 at 120 MV/m.
- Some strong emitters were localized by high resolution scans and showed nearly stable Fowler-Nordheim-like I-V curves with local field enhancement factors between 31 and 231 which are typical for particulates and surface irregularities.
- High resolution SEM and EDX measurements revealed three types of emitters: a thin conductive object with submicron protrusions, a scratch-like surface defect and a crystalline particle with S, Cl and K content.

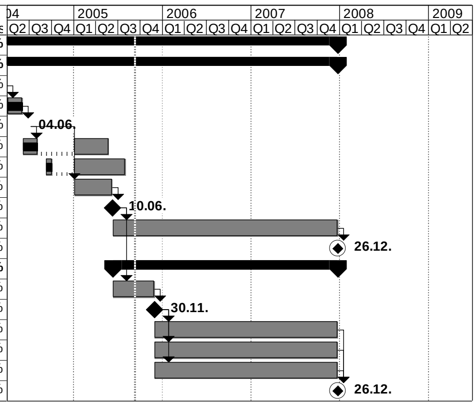
In order to get Nb samples electro polished and HPR within cavities at DESY, a series of new samples with improved mechanical strength has been fabricated and will be used for quality control analysis soon.

Milestones and Deliverables of the reporting period

As milestone No. 17 a first report on the dc field emission results on Nb samples was planned. Since the date of this milestone nearly coincided with the SRF2005 workshop at Cornell-University, to which an abstract about this subject has been submitted and accepted for presentation and publication within the conference proceedings, it was decided to combine both issues at the expense of some small delay of the milestone report.
According to the deadline of the proceedings, this paper has been written and submitted until September 16th 2005 and will also be now available within the TESLA Report series at DESY.

2.) Update of MS-Project

N°	MS, Deliverable	Task Name	Anfang	Ende	% eschlos
6.3		**DC field emission studies of Nb samples**	**Do 01.01.04**	**Mi 26.12.07**	**6%**
6.3.1		**Quality control scans**	**Do 01.01.04**	**Mi 26.12.07**	**14%**
6.3.1.1		Modification of Scanning apparatus	Do 01.01.04	Fr 02.04.04	100%
6.3.1.2		Calibration of Scanning apparatus	Mo 05.04.04	Fr 04.06.04	100%
6.3.1.3	**Start Operatior**	**Start scanning activity**	Fr 04.06.04	Fr 04.06.04	100%
6.3.1.4		BCP and HPR samples	Mo 07.06.04	Do 26.05.05	30%
6.3.1.5		EP and HPR samples	Fr 10.09.04	Mi 03.08.05	10%
6.3.1.6		BCP/EP and DIC samples	Mi 05.01.05	Fr 10.06.05	0%
6.3.1.7	**Interim Repor**	**First report on BCP/EP and DIC surface**	Fr 10.06.05	Fr 10.06.05	0%
6.3.1.8		Continue QA scanning	Mo 13.06.05	Mi 26.12.07	0%
6.3.1.9		**Evaluation of scanning results**	Mi 26.12.07	Mi 26.12.07	0%
6.3.2		**Detailed measurements on strong emitters**	**Mo 13.06.05**	**Mi 26.12.07**	**0%**
6.3.2.1		Calibrate apparatus for high current	Mo 13.06.05	Mi 30.11.05	0%
6.3.2.2	**'t Measuremen**	**Start strong emitter evaluation**	Mi 30.11.05	Mi 30.11.05	0%
6.3.2.3		I/V curves and current limits	Do 01.12.05	Mi 26.12.07	0%
6.3.2.4		SEM and AES	Do 01.12.05	Mi 26.12.07	0%
6.3.2.5		Influence of heat treatment and ion impact	Do 01.12.05	Mi 26.12.07	0%
6.3.2.6		**Evaluate strong emitter investigations**	Mi 26.12.07	Mi 26.12.07	0%



3.) Status of money spending

	Spent money	Value of new orders/ contracts	Expected spending of new orders/contracts until end 2005	Sum of column 2 & 4
Travel	200		800	1000
Consumables				
Manpower	20000		16000	36000
Durable				
			Total sum	37000

Work package 7: Couplers
Task 7.1 / 7.2 / 7.3

1.) Status of activities

Work-package 7 of JRA1 concerns the development of power couplers. This WP is broken down into three main tasks:
7.1 – New proto-type couplers,
7.2 – Fabrication of a titanium-nitride coating bench for the coupler ceramic windows,
7.3 – Conditioning studies of proto-type couplers.

For task 7.1 we have designed two new-proto-types named TTF5 and TW60 respectively (Fig. 1). The RF design of these couplers was completed in the first part of 2004 and a description of the proto-types is available in the first quarterly report of the JRA1.
For the TTF-V couplers, a contract for the production of four proto-types has been awarded to ACCEL GmbH, as reported in the last quarterly report. For the TW60 couplers, the call for tender is now also finished and ACCEL GmbH has again received the construction contract to build four of theses couplers as well as a test transition. The contract was notified to ACCEL in mid-July 2005. The delivery of the first pair is due ten months later (May 2006).
Following purchase of the simulation code ANSYS we have started to perform thermal calculations of the proto-type couplers as requested by the Scientific Review Committee.

For Task 7.2 we have already begun to perform some bibliographic research on coating benches. As stated in the first quarterly report of 2005, a preliminary technical specification of the bench we wish to build is given in an internal note. The first contacts with three companies specialised in the fabrication of coating bench have been started. Preliminary enquiries indicate that we can purchase an industrially built sputtering system well adapted to the ceramic geometry. Construction would require six months.

Conditioning studies of our TTF-III couplers continue to provide experience with our test bench which will be of value when we test the proto-types discussed above. A histogram showing conditioning times for different pairs of couplers is shown in Figure 2. The reasons for the variation in conditioning times will be the subject of future studies.
Electronic racks have been built which will allow couplers to be tested at low temperature in CryHoLab.

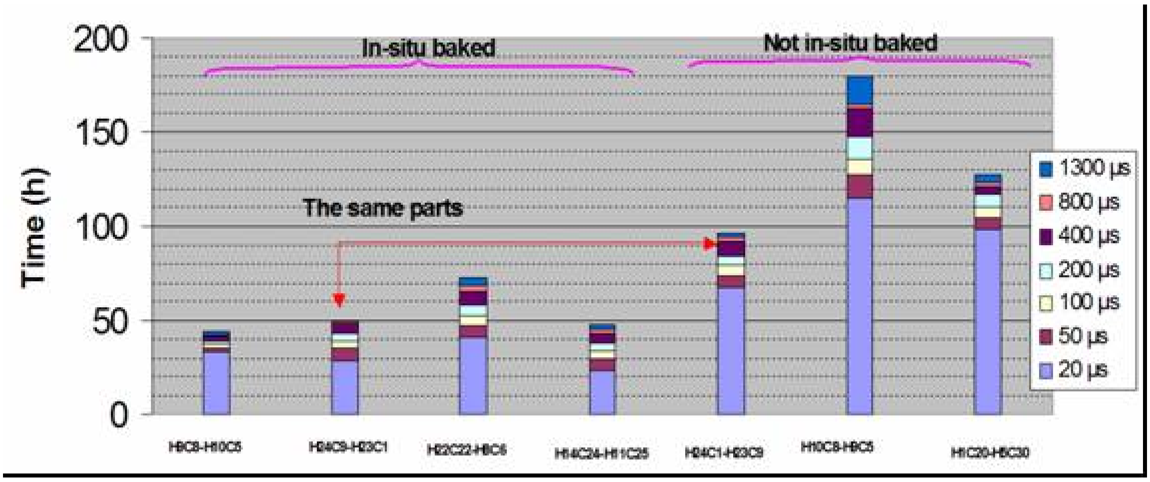


Figure 2. Conditioning times for TTF-III couplers.

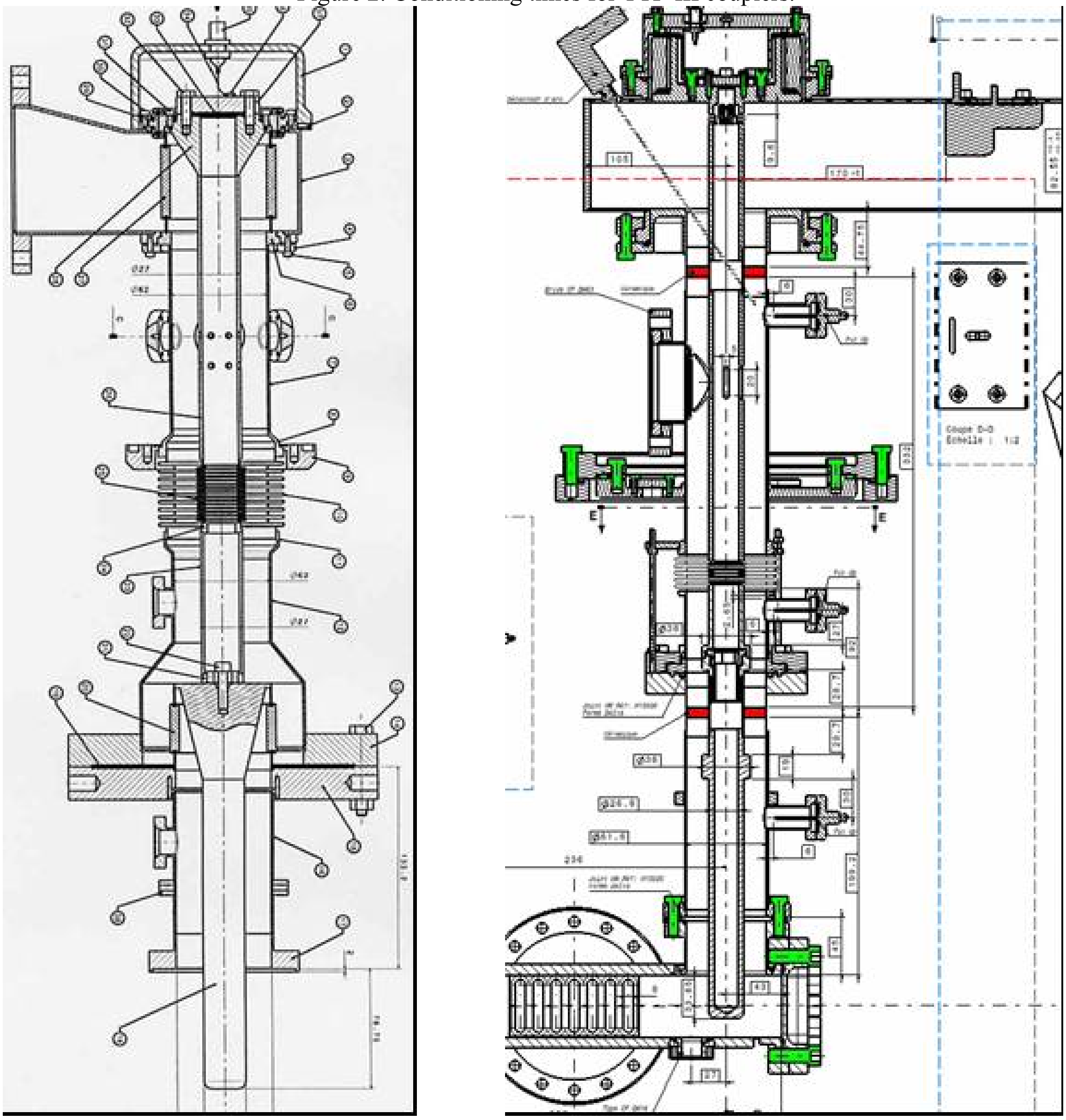
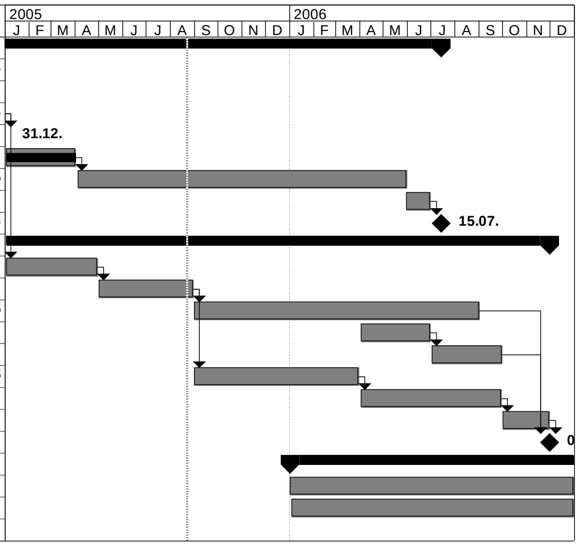


Figure 1. CAD views of the TTF-V (left) and TW60 (right) couplers.

2.) Update of MS-Project

N°	MS, Deliverable	Task Name	Anfang
7.1		**New Prototype Coupler**	**Do 01.01.04**
7.1.1		RF Simulations of Coupler	Do 01.01.04
7.1.2		Report on Simulation	Mi 30.06.04
7.1.3		Detailed Engineering Drawings	Do 01.07.04
7.1.4		Engineering complete	Fr 31.12.04
7.1.5		Call for tenders	Mo 03.01.05
7.1.6		Prototype Fabrication in Industry	Di 05.04.05
7.1.7		Low Power tests	Mi 31.05.06
7.1.8	**upler Prototyp**	**Ready for High Power Tests**	Sa 15.07.06
7.2		**Fabrication of TiN Coating System**	**Mo 03.01.05**
7.2.1		Mechanical design of vacuum chamber	Mo 03.01.05
7.2.2		Fabrication drawings	Mo 02.05.05
7.2.3		Construction of vacuum chamber	Do 01.09.05
7.2.4		Define vacuum needs	Mo 03.04.06
7.2.5		Appropriation of vacuum equipment	Mo 03.07.06
7.2.6		Design of electronic circuitry	Do 01.09.05
7.2.7		Fabrication of electronics in industry	Mo 03.04.06
7.2.8		Installation and Test at Orsay	Mo 02.10.06
7.2.9	**Commissionin**	**First Window Coating**	Fr 01.12.06
7.3		**Conditioning Studies of Proto-type Couplers**	**Mo 02.01.06**
7.3.1		Conditioning of couplers	Mo 02.01.06
7.3.2		Evaluate conditioning results	Mi 04.01.06
7.3.3		**Final report on conditioning**	**Fr 30.11.07**



3.) Status of money spending

	Spent money	Value of new orders/ contracts	Expected spending of new orders/contracts until end 2004	Sum of column 2 & 4
Travel				9,000
Consumables				161,000
Manpower				34,000
Durable				172,000
			Total sum	*376,000*

Work package 8: Tuners

1.) Status of activities

Task: 8.1 UMI Tuner

The integration of piezos for Lorentz forces and microphonics compensation is completed for what concerns the tuner prototypes. Many piezo models from different manufacturers have been deeply characterized relating to their main extensive properties, such as blocking force, maximum stroke, length, maximum load. The final choice, the Noliac SCMA/S1/A/10/10/40/200/60/4000, fits all the requirements. Moreover, the tuner is designed to be compatible with other active elements, be them other kind of piezos (ad-hoc devices have been designed so that piezos of different section and length up to 72 mm can be accommodated) or even magnetostrictive actuators.
The final drawing of the coaxial tuning apparatus has been delivered to ZANON for the fabrication. Two prototypes, including the modified helium tank, are expected by end of October 2005.
The tuner assembly is mainly composed of three parts: the movement leverage, the bending rings (three rings) and the piezo actuators. Two rings are welded to the helium tank. The blade tuner is fixed to one of them by means of twelve bolts, while the other ring can receive up to four piezo actuators.

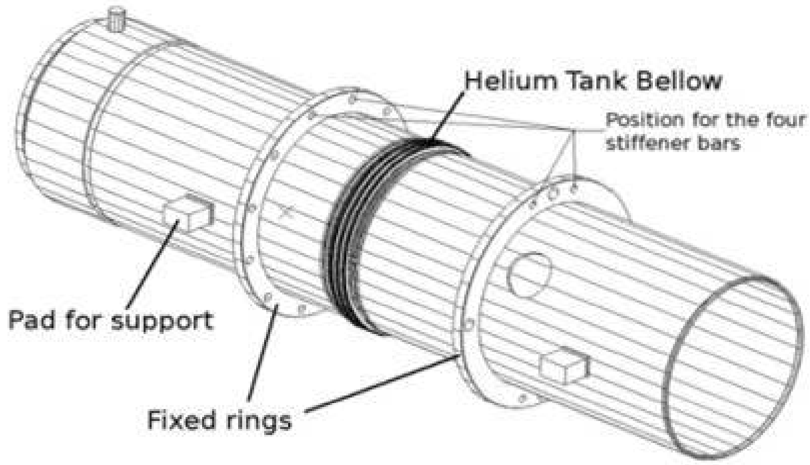


Figure 1: Helium tank

Because the tuner is fixed to the helium tank, a bellow is needed between the two fixed rings. The number of convolution has been computed in order to avoid any non-elastic strain in the bellow for a maximum axial displacement of 1.8 mm.
Due to the change of the Helium Tank with the introduction of the bellow, an accurate evaluation of the vertical displacement has been done (fig. 2). The maximum sagging computed (0.12 mm) is less than the admissible tolerance of concentricity of dumb bells (0.6 mm), therefore the new configuration can be accepted with confidence.

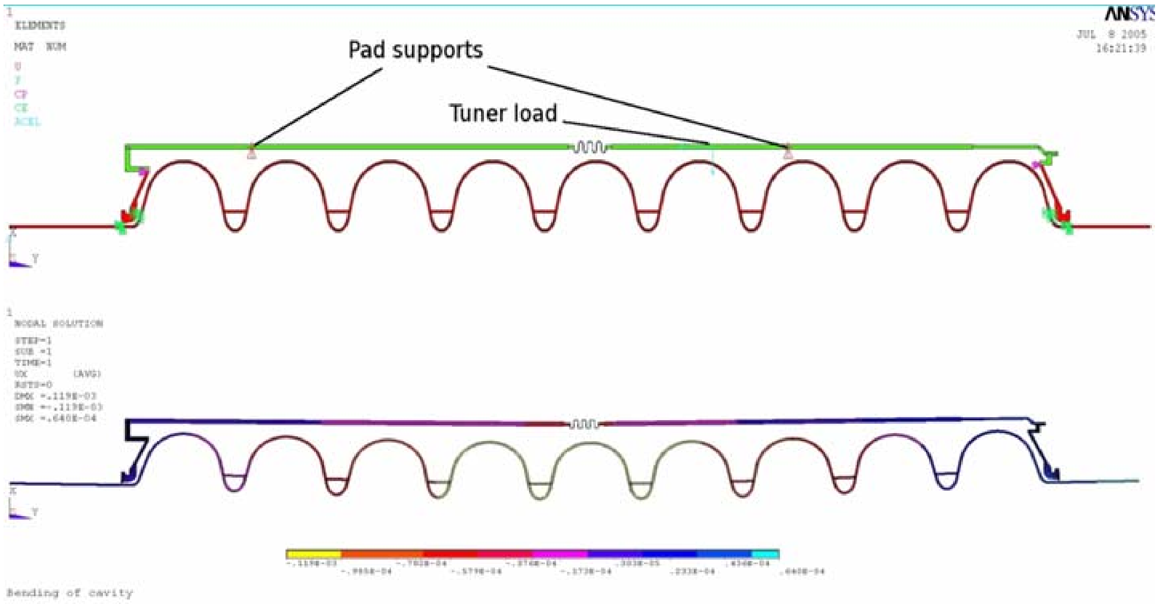


Figure 2: Analysis of displacements under dead load

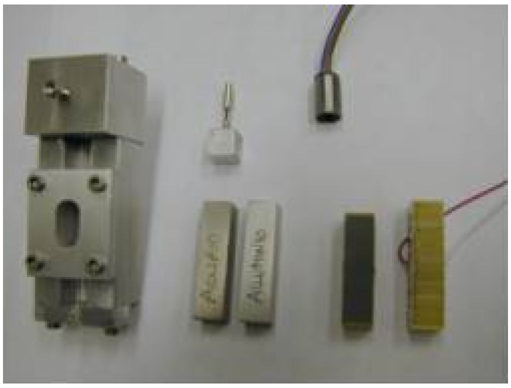


Figure 3: Device for the measurement of the thermal shrinkage

In parallel to the tuner design and construction, the activity of piezo characterization is still in progress. Among the others the piezo thermal shrinking and the piezo working area (in terms of stroke and blocking force) at cryogenic temperatures are currently under investigation. In figure 3 the device specially realized for the measurement of the thermal shrinkage is shown, based on the use of a LVDT position transducer and samples of well-known thermal shrinkages. Again we are making a great effort towards the use of the piezo as force sensor at cryogenic temperatures calibrating some of its parameters even involving the piezo modeling. Last but not least, after the successful test of our cryogenic load cell, we are trying to strong reduce its dimensions to the ones of the piezo supports in collaboration with the producer. The first samples are expected in the next months.

Magnetostrictive tuner

Further analysis over magnetostrictive rods was performed (see paper published on MIXDES Conf.). According to obtained results magnetostrictive active element might be a good option for electromechanical system for detuning compensation. Moreover, the two new rods purchased from ETREMA have been even less expensive than a single piezostack.

The detailed characterization is slightly delayed due to the fabrication process of proper insert box for cryostat. However, we decided to perform the test with cavity as it was scheduled.

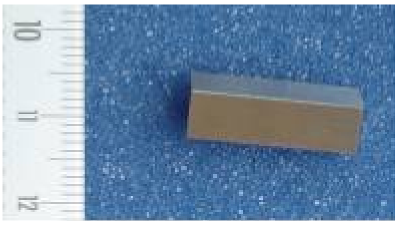


Figure 4. Magnetostrictive rod made of GALFENOL.

Furthermore, some minor modification has been made in tuner itself (mechanical fixture has been changed to fit new helium tank).

There is also further research on driver for magnetostrictive element. Mainly reliability is improving (Due to high power supplied to active element a temperature distribution in amplifier is an issue). However current electronic system allows operating magnetostrictive element in pulse mode with similar settings as the piezoelectric element is running.

CEA Tuner

Two PTS have been received at the beginning of June at Saclay. Some mechanical modifications are being made in order to finalize the system that should be available for tests at the mid of July.

In spite of these modifications some measurements can be performed with the incomplete system on a test bench at room temperature. A first estimation of the tuner stiffness is 35 kN/mm. Most part of the flexibility is due to the ball bearings housings. Additional measurements after several dismounting and remounting will be made to confirm this value.

The piezo electronics that was developed is being tested on the (incomplete) tuner. The full system should be ready for tests on the C45 TTF cavity at the beginning of September.

RF power tests of the C45 TTF cavity are being performed in CRYHOLAB until the end of August. These tests made by Bernard Visentin in the framework of the work package WP10, are in good progress. The cavity and its power coupler will be removed from CRYHOLAB at the beginning of September for assembling the piezo tuner.

Tests at 300K of the tuner mounted on the cavity are scheduled at the beginning of September. At the end of these tests, the cavity will be remounted in CRYHOLAB with its power coupler and piezo tuner for the integrated experiments.

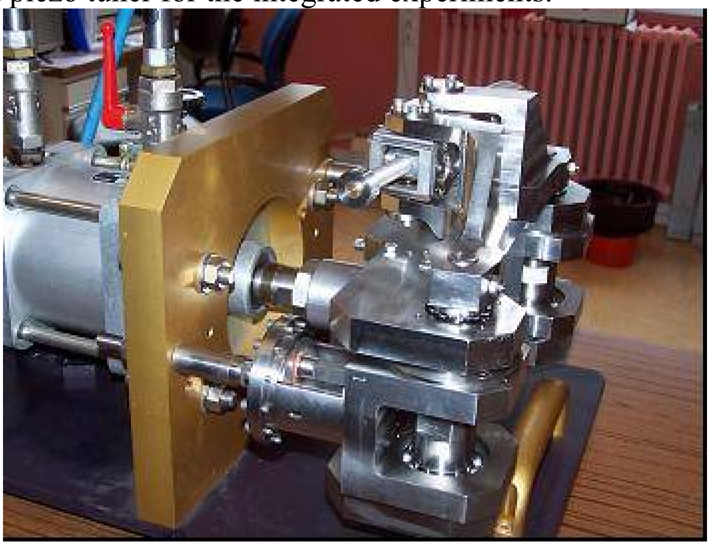


Figure 5. The piezo tuning system mounted on its test stand.

IN2P3 Activity

The R&D program of IPN Orsay in the frame of the CARE project was continued. A lot of progress was achieved since the previous quarter report and most of items of IN2P3 tasks for WP 8 are nearly completed: a large part of the results obtained so far are reported in our contributions to several international conferences and collaboration meetings.

Several piezoelectric actuators from three different companies were fully characterized at low temperature (e.g. full range displacement, dielectric and thermal properties), radiation hardness tests with fast neutrons at low temperature (4.2 K – 300 K) were performed (i.e. three beam tests with three types of piezostacks: four pieces of PICMA type from PI, four of NOLIAC type and three of JENA type from PIEZOSYSTEM JENA). Moreover, a preliminary room temperature measurement of resonant spectrum as function of the preloading force applied to piezostacks was successfully performed.

Finally, a new experimental set-up dedicated to the study of preloading effect on the piezostacks electromechanical behavior at low temperature was developed and successfully tested: the main results are illustrated in figure 6. The sensitivity $\Delta C_p/\Delta F$ of the piezoelectric actuator to preloading force F (F=733÷4022 N) was measured in the temperature range T = 1.68÷300 K: $\Delta C_p/\Delta F$ decreases monotonously with T from 426nF/kN @ T=295 K down to 16nF/kN @ T=1.7 K.

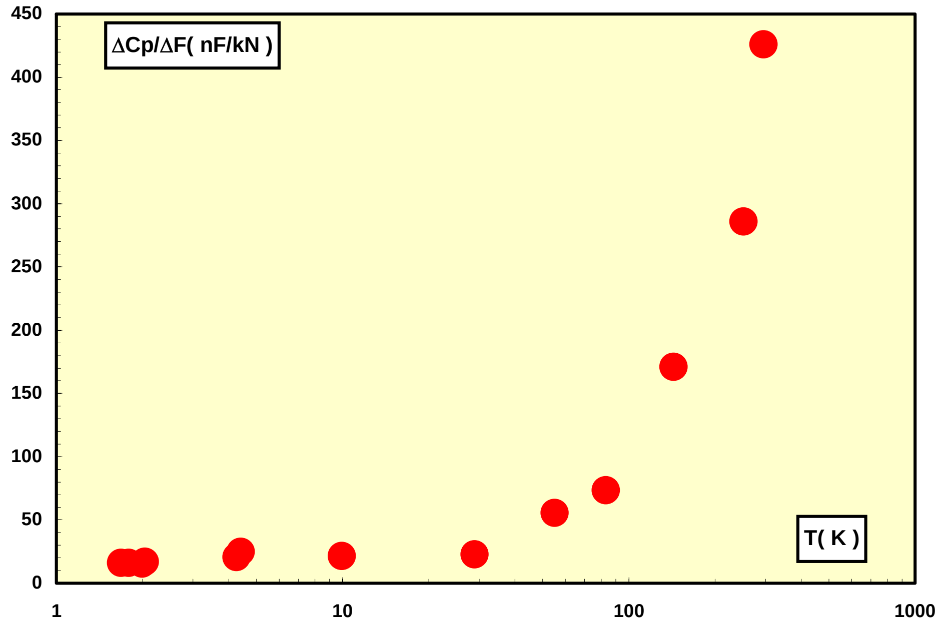


Figure 6. Sensitivity of piezoelectric actuator to preload force versus temperature

Moreover, the actuator capacitance increases linearly with the preloading force in the range 0.7kN- 4kN, at a given temperature (see figure 7).
Also, a ppiezoelectric actuator as a force sensor was tested at low temperature (i.e. capacitance variation, transient voltage, etc). A detailed report concerning this study is under preparation.

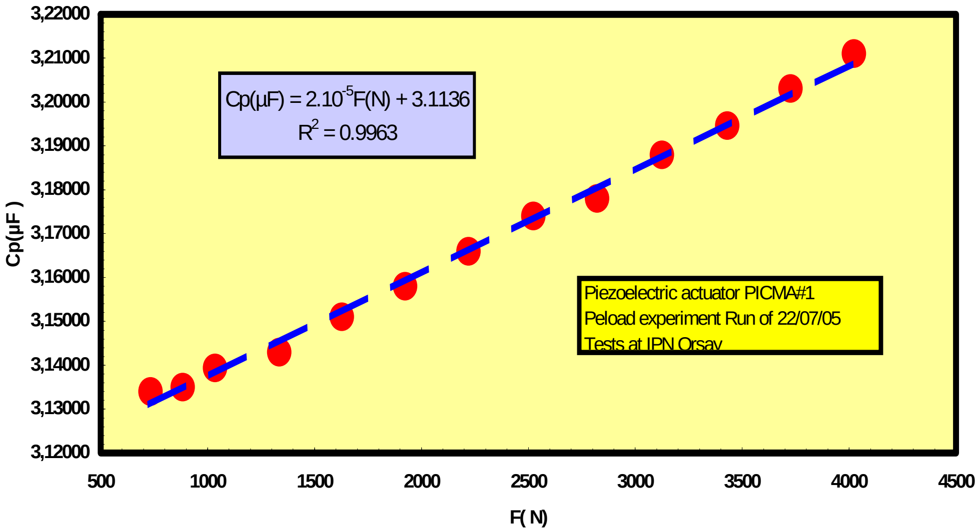
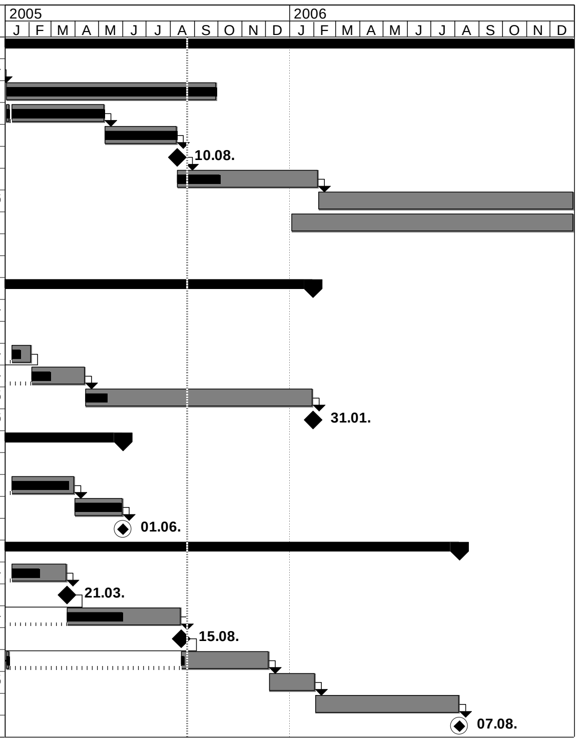


Figure 7. Piezoelectric actuator capacitance versus preloading force at T=4.4 K, vacuum pressure 10^{-5}mBar.

2.) Status of MS-Project

N°	MS, Deliverable	Task Name	Anfang
8.1		**UMI TUNER**	**Do 01.01.04**
8.1.1		Control electronics	Do 01.01.04
8.1.2		Mechanical tuner design, leverage system/motor	Mo 03.01.05
8.1.3		Integration piezo design	Mo 03.01.05
8.1.4		Choice of transducer/actuator	Mo 09.05.05
8.1.5	**Design repor**	**Report UMI tuner**	Mi 10.08.05
8.1.6		Tuner fabrication	Mi 10.08.05
8.1.7		Piezo fabrication and bench tests	Di 07.02.06
8.1.8		Cavity-tuner-coupler integration	Mi 04.01.06
8.1.9		Pulsed RF tests	Mo 02.07.07
8.1.10		**Evaluation of tuner operation**	Mo 31.12.07
8.2		**Magneto-strictive Tuner**	**Do 01.01.04**
8.2.1		Complete specification	Do 01.01.04
8.2.2		Conceptual design	Mo 02.02.04
8.2.3		Prototype and performance evaluation	Do 01.04.04
8.2.4		Finalize tuner and drive electronics design	Do 01.07.04
8.2.5		Test of tuner	Do 14.04.05
8.2.6	**Status repor**	**Report on magneto-strictive Tuner**	Di 31.01.06
8.3		**CEA Tuner**	**Mo 05.01.04**
8.3.1		Design Piezo + Tuning System	Mo 05.01.04
8.3.2		Fabrication	Mo 21.06.04
8.3.3		Installation RF	Fr 01.04.05
8.3.4		**Start of Integrated Experitments**	Mi 01.06.05
8.4		**IN2P3 Activity**	**Do 01.01.04**
8.4.1		Characterize actuators/piezo-sensors at low tem	Do 01.01.04
8.4.2		Report on actuator/piezo sensor	Mo 21.03.05
8.4.3		Test radiation hardness of piezo tuners	Do 01.07.04
8.4.4		Report on radiation hardness tests	Mo 15.08.05
8.4.5		Integration of pieco and cold tuner	Mo 03.01.05
8.4.6		Cryostat tests	Di 06.12.05
8.4.7		Tests with pulsed RF	Fr 03.02.06
8.4.8		**Report on IN2P3 tuner activities**	Mo 07.08.06



Work package WP 9

1.) Status of activities

9.1 Operability and technical performance

9.1.1 Transient detector

Progress: In line with schedule.
During reporting period the connection of the measurement system and DOOCS environment have been developed (hardware connection, DOOCS server, DOOCS GUI). All hardware adjustments, setting and measurements can be done now remotely with a DOOCS graphical user interface. The automatic filter calibration was added to the nulling filter.

At the end of May and beginning of July hardware was tested. Results of these tests proved that hardware for transient detection is operating correctly and it allows to measure correct values for various beam phase and transient magnitude. Some of the results from one of the testing shift are presented below.

Set Charge [nC]	Toroid Mean Charge [nC]	Toroid std charge [nC]	Measured mean phase [deg]	Measured std phase [deg]	Measured mean tr. mag. [V/V]	Measured std tr. mag. [V/V]
0.5	0,51	0,012	-1,44	13,37	1,40E-04	3,00E-05
1.0	1,06	0,024	-0,46	6,01	3,08E-04	3,20E-05
1.5	1,66	0,023	0,52	3,86	4,62E-04	2,80E-05
2.0	2,21	0,03	2,93	2,96	5,94E-04	3,20E-05

Table 1 Measurement results from 02.07.2005

Milestones and deliverables: None defined in contract for this period
Significant achievements and impact:
Automated and remotely controlled measuring system has been design and assembled. The test measurements proved that the measurement method gives good results (accuracy of beam phase measurements are within some deg.).
Deviations from plan: None

9.1.2 LLRF Automation

Progress: In line with schedule.
During the previous reporting period the Matlab's simulator of the FSM for RF-power station has been prepared. This time it has been managed to implement equivalent software in C++. For the sake of compatibility with DOOCS it was necessary to integrate the FSM C++ code with standard DOOCS server code. The heart of the solution constitutes supervisory logic encoded by means of Finite State Machine formalism. This part is common for all RF-power stations and represents general functional model of power station. Because power stations differ among themselves, application communicates with hardware with generally defined functions which exact implementations ere defined for

each station separately. As depicted on Fig.1, code representing FSM logic was generated from formerly mentioned Matlab's model. Code of DOOCS server has been obtained from the CVS.
The FSM was equipped with user interface that reports to the operators overall state of the application and driven hardware. On top of that, despite automation supplied by the FSM, there have to be several buttons to drive the machine itself. For above reasons proper DOOCS graphical user interface has been implemented. It is compatible with standard methods used at the DESY and is going to be a part of the operators' panels. The layout of the panel is shown on Fig.2.
The current work is focused on FSM for LLRF system. The Matlab's Simulink implementation of preliminary version of this FSM was worked out and tested.

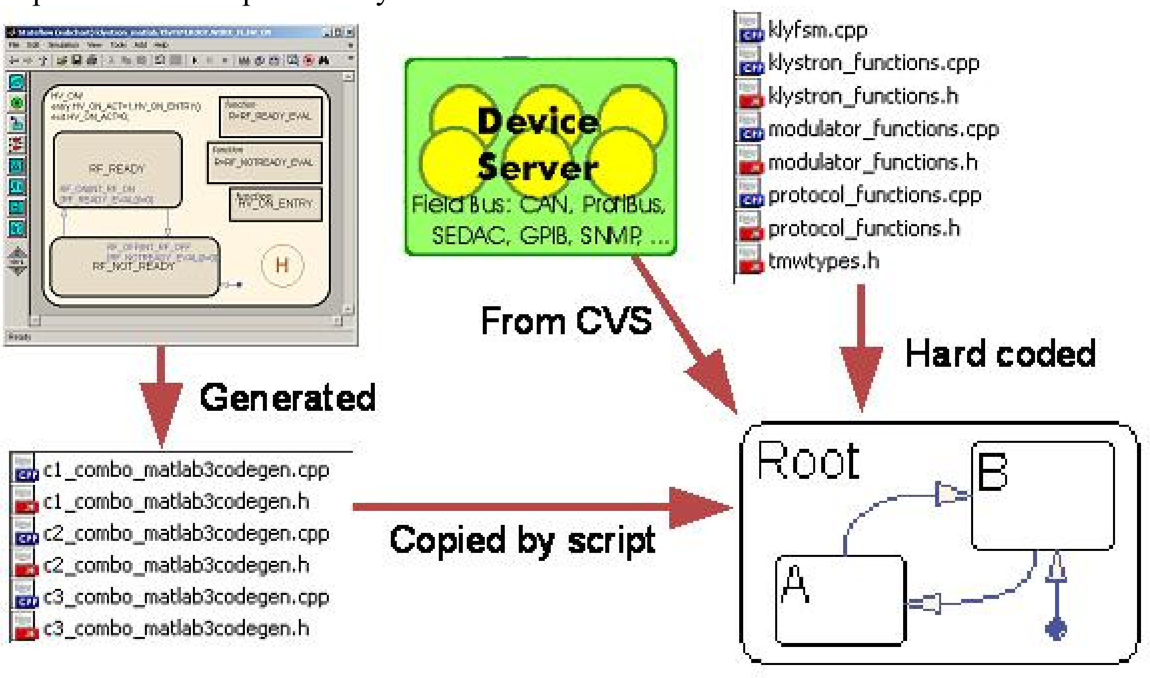


Fig.1. Code generation scheme for the FSM for RF-power stations.

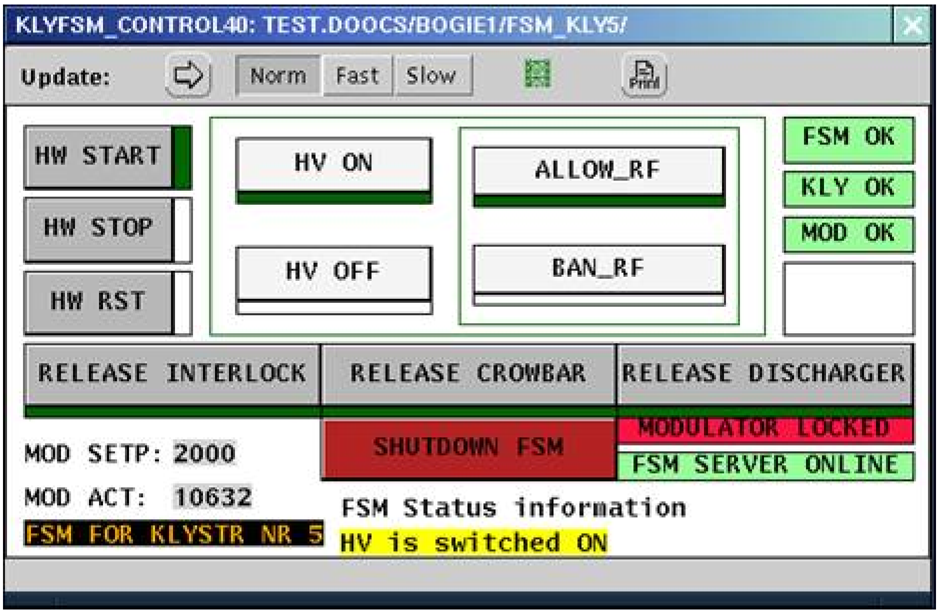


Fig.2. Layout of the control panel to the FSM for RF-power stations.

Besides the FSM development and tests the klystron and power amplifiers characteristics was investigated focusing on non-linearities compensation. The klystron operation close to the saturation point degrades performance of the cavity field controller and compensation of non-linear effects is highly desirable. During the reporting time period several measurements of klystron characteristics and power modulators and amplifiers were performed.

As it is presented in Fig.3 there are nonlinearities in the preamplifiers and the klystron response. Further investigation has to be done in order to estimate how nonlinearities of the different devices have an influence on the klystron work. There is also noticeable some concentration of points near to the side of the grid (bottom right figure). This phenomenon can be caused by the klystron saturation.

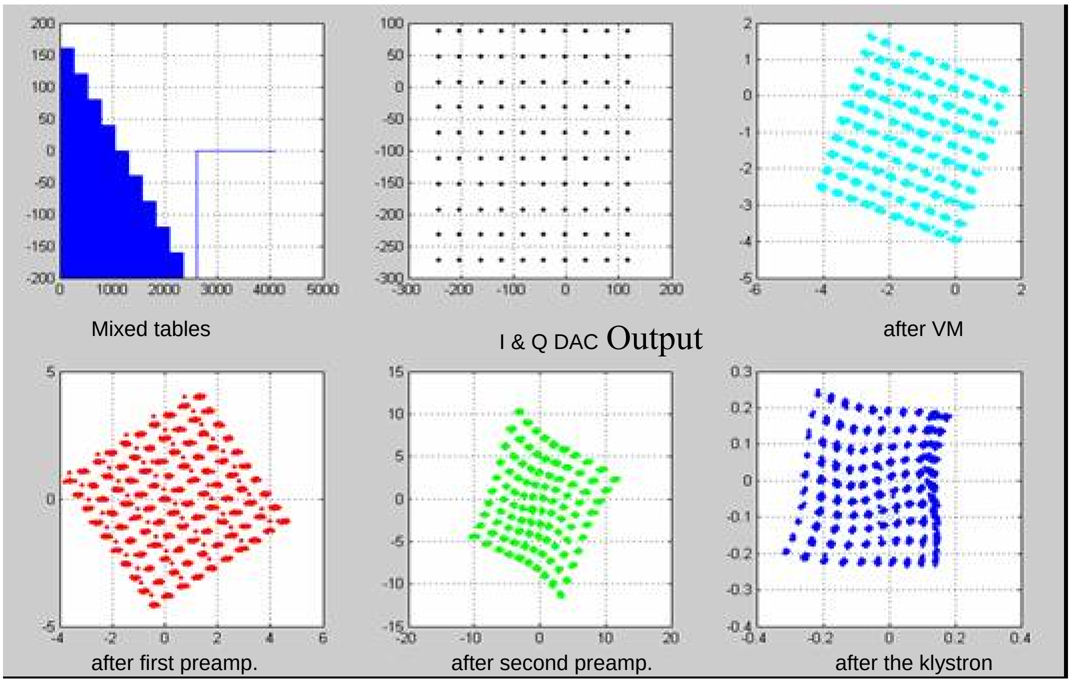


Fig 3. The result of the modulator/amplifiers/klystron nonlinearity measurement (HV pulse=104kV, pulse duration 1300us, I&Q max value = 200bit (in bit DAC resolution), grid – 10 x 10).

Milestones and deliverables: None defined in contract for this period
Significant achievements and impact:
FSM for RF-power station implemented as DOOCS server has been prepared and tested.
Measurements of klystron nonlinearity have been performed.
Deviations from plan: None

9.1.3 Control Optimization
Progress: In line with schedule

Guido Koch has developed improved model for the cavity including corrections for forward and reflected power. This model will be used for the synthesis of the optimal controller.

Since the optimal controller will have to deal with some spread in cavity performance (maximum operable gradients are different by up to +- 10%) a simulation program has been develop to optimize operating parameters such as loaded Q, incident phase and cavity detuning (constant and time varying). Markus Huening has found a solution for the time varying detuning which allows flat-top operation at different gradient with unchanged power distribution. With time constant detuning a low of half of the spread is expected.

Deviations from plan: None

9.2 LLRF cost and reliability

9.2.1 Cost and reliability study
Progress: In line with schedule

Have had meeting with the commercial company Nallatech to discuss the development of the LLRF system in industry. Expect industrial proposal by beginning of 2006.

Larry Doolittle at LBNL has developed a low cost scheme for the ILC. This layout does cover 14 inputs of +7 dBm F.S. 1300 MHz on two PkZ coaxial connectors (possibly suitable for robotic swap). The LO is also provided on one of these connectors. The input is down converted to 55.8282 MHz with a Mini-Circuits SYM-25DMHW, and sampled at 77.7607 MS/s (LO/16) by a 14-bit LTC2249. The XC3S1500-4FG456C FPGA scales and phase shifts the samples, and puts out a sum waveform (also at 77.7607 MS/s) on the digital connector on the right. Eight signal processing channels are shown; the other six will be on the back side.

This board will dissipate about 5 Watts and has a parts cost of about US$600. Combine eight of these with a backplane, RF output channel, networking, more power supplies, and a fan. The resulting 14 x 14 x 22 cm package would dissipate 50 W and could probably be manufactured and tested in volume for under US$15K, meaning US$9M for the whole ILC. Engineering not included. YMMV. All components are apparently available and in-stock now.

Deviations from plan: None

9.2.2 Radiation damage study

Progress: In line with schedule.
The RadMon system was installed for permanent operation in VUV-FEL accelerator near the Bunch Compressor II (BC II), 3 m from the main beam line. The system detects SEUs in the accelerator tunnel in real time. It uses 1 MB SRAM memory (bq4016) produced by Texas Instruments as the radiation sensor. The characteristics of SEU generated in the memory can be displayed using www-based interface. The example of stepwise curve of increasing number of SEU in the memory is presented in Figure 4. About 530 SEUs were registered within eight days. Big number of SEUs was registered during five days because of dark-current measurement in the tunnel.

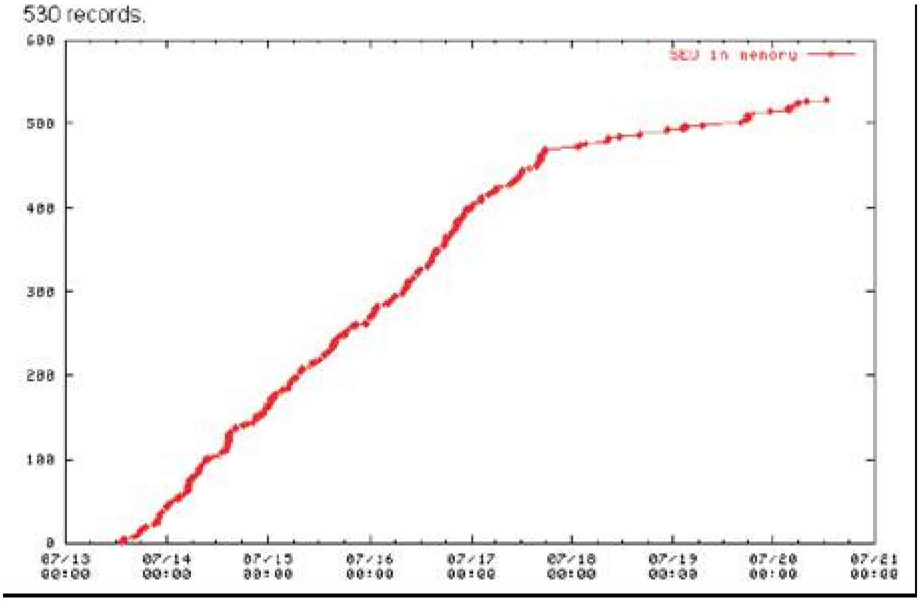
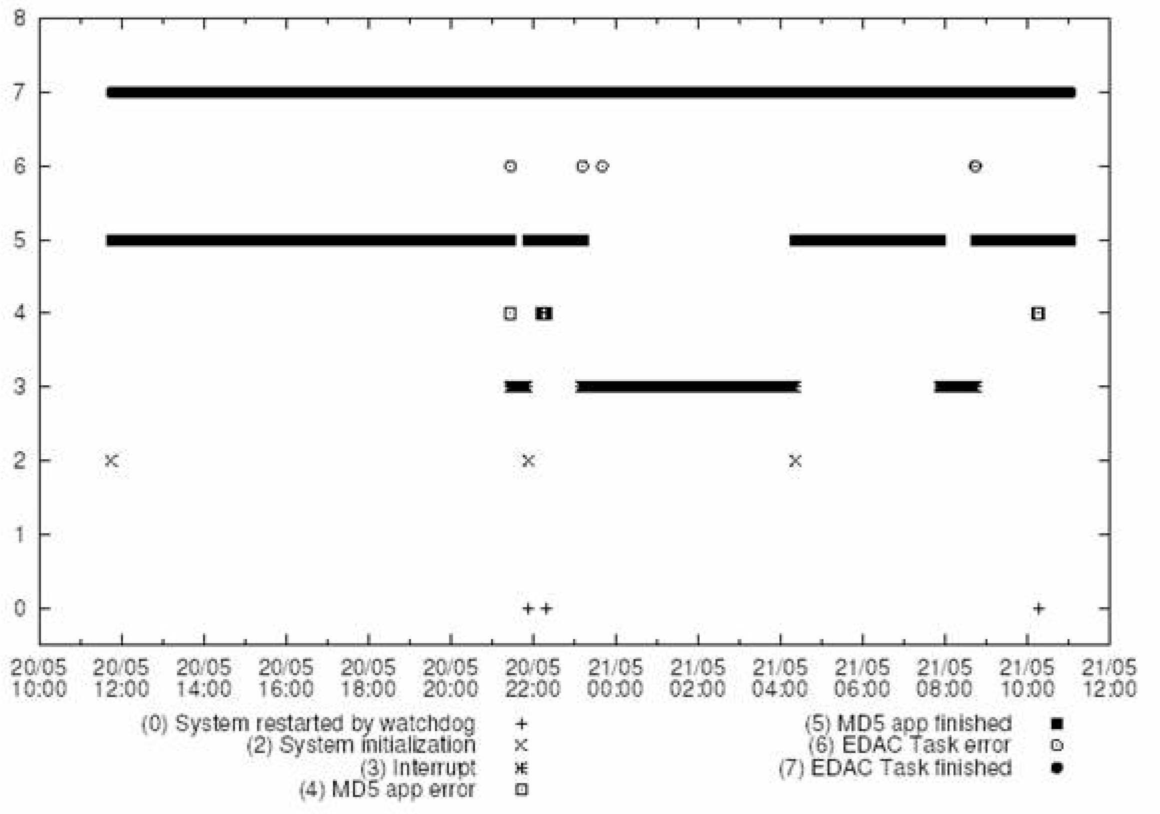


Fig. 4. SEU registered by RadMon2.5 in VUV-FEL tunnel within one week

During the reporting time period also the tests of radiation tolerate operating system was performed. In this experiment special version of the sCore operating system was used. The sCore is real-time micro-kernel. It is used only for test purpose and after tests the developed methods and algorithms will be implemented in the Linux kernel. The sCore provides only an indispensable functionality such as pre-emptive multitasking environment. Software redundancy and error detection and correction (EDAC) algorithm can be easily built in sCore system (implementation of EDAC in much more complicated kernel like Linux will be difficult). The sCore kernel was changed to provide the software redundancy. The special process (EDAC task) was built in sCore. The system memory was divided by EDAC task for three parts: program memory it's and two copies. The EDAC task is run periodically by the sCore scheduler. System memory is checked by the EDAC task and compared with one of copy. If occurs any difference the EDAC task chooses a validity data and copy it to system memory region.

This simple method was tested in a PC computer running sCore and user application (MD5 calculation for huge data block) irradiated by ^{241}AmBe and Linac II tunnel (DESY). The experiment proved that EDAC task running in the sCore environment is able to detect and correct most of the errors caused by SEUs, however not all of them. The plot of system operation during one of the test is presented in Fig. 5.



Milestones and deliverables: None defined in contract for this period.
Significant achievements and impact:
Radiation monitoring system (RadMon) installation and permanent operation. Performed tests of software countermeasures against SEU effects.
Deviations from plan: None

9.3 Hardware

9.3.1 Multichannel downconverter

A design of a meter circuit (downconersion and ADC circuit) was done with using requirements specification that was made before. As a result of a additionally analysis was shown, that a better solution is 9MHz intermediate frequency than 81MHz, that follow from phase noise distribution in analog-to-digital stage.

The dynamic range of a measurement circuit is highly dependant on possible levels of field gradient fluctuations on the flat top. With the appropriate control of a klystron, the gradient of a field changes in range of 10%. The results in the approximate change of power level on the output of the coupler by 1dB. The level of required gradients is different for each cavity in the acceleration structure; additionally it depends on concrete experiment. Then the signal from the power level block is filtrated, frequency-converted, amplified and ADC converted. In order to obtain the both gradient and phase of field in thirty two cavities on levels: $(\sigma_E/E)_{RMS} < 10^{-4}$ and $(\sigma_\varphi)_{RMS} < 0{,}01°$.

$$(G_{mixer}+G_{LNA})\sigma^2_{att}+G_{LNA}\sigma^2_{mixer}+\sigma^2_{ADC} \ll 8(\sigma^2_{in})_{RMS} \tag{1}$$

where:

$(\sigma_{in})_{RMS}$ - maximum acceptable value of field interference in a single cavity, G - power gain

In the measurement circuit a bandwidth sampling is taken. With respect to this bandwidth oversampling is applied. Therefore:

$$\bar{x}(t)=v(t)*\prod\left(\frac{t-\frac{T_s}{2}}{T_s}\right)*\frac{B}{f_S}\sum_{n=-\infty}^{\infty}x(nT_S)Sa(\omega_m(t-nT_S)) \tag{2}$$

The block diagram of realized device is shown in Fig. 1.

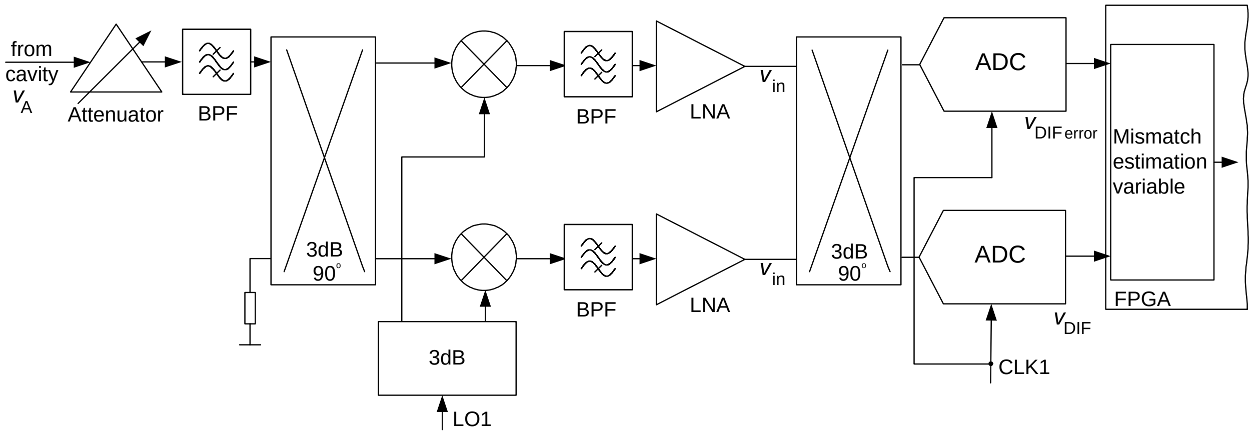


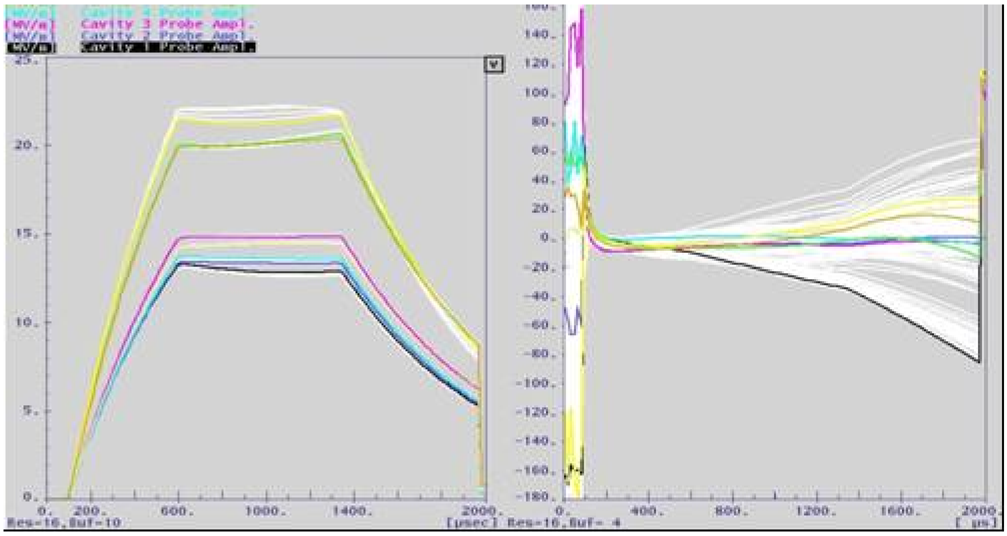
Fig. 1. Block diagram of the measurement receiver.

In order to compensate the unbalance of both measurement circuit stages of frequency conversion, the measurement of summation and differential component is done, to enable minimization of a measurement error.

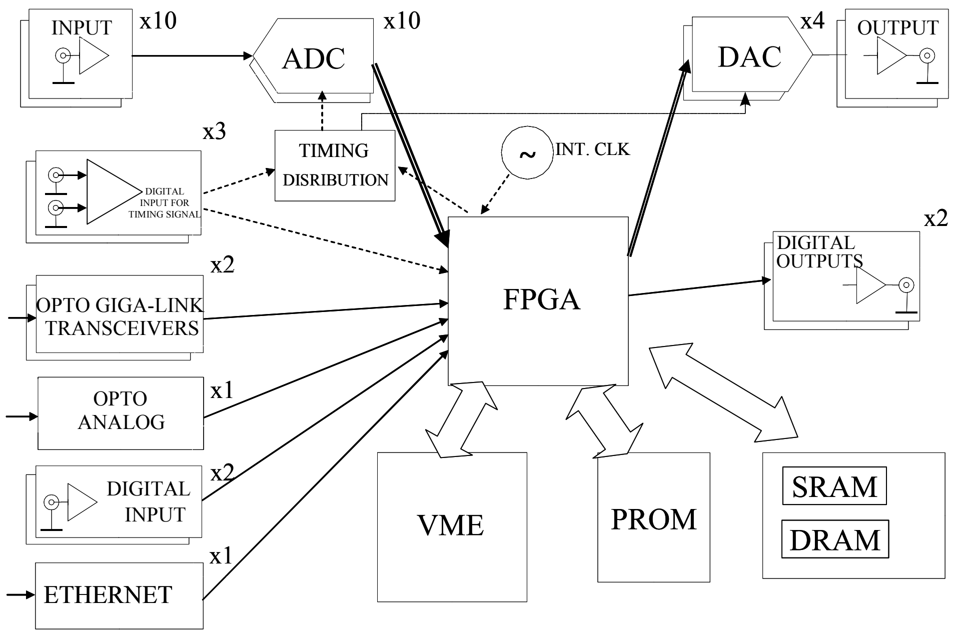
9.3.2 Third generation rf control

Progress: In line with schedule

New firmware for FPGA board called SIMCON 3.0 was tested. This firmware was written in VHDL and the idea was presented in previous report. Additional functionality is the detection of vector sum deviation and handler to it, which cut the controller driving signals. Hardware and software of SIMCON 3.0 was tested in TTF2 on accelerating module ACC1. The test was performed in May. The picture presents plots of working system.



New 3rd generation LLRF system called SIMCON3.1 is based on Xilinx FPGA chip XC2VP30 Virtex-IIPro with 2 built-in processors and DSP blocks as a main control element. Board under developing consists of 10 input analogy broadband channels of 270 MHz and the voltage range ±1 V (matched to the wave impedance of 50 Ω) as well as 4 DACs channels with corresponding to ADCs parameters. Several digital inputs and outputs are supplied for timing and triggering signals. Board is also equipped with precision timing distribution system with planned jitter performance about 0.3 ps (RMS) and memory blocks – static, of capacity 512K of 36-bit words and dynamic, of capacity 128Mb and the word width of 32-bit for data storage.
Board is developing as VME 6U card which can work also as stand-alone board using for communication additional interfaces like fast opto-giga-link with maximum throughput 2.125 Gbps as well as standard Ethernet 100Mbps link.
PCB board for SIMCON3.1 device is almost finished currently routing is being finished.



Milestones and deliverables: None defined in contract for this period

Significant achievements and impact:

Test of control algorithm with SIMCON 3.0
PCB board for SIMCON 3.1 is being finished

Deviations from plan: None

9.3.3 Stable frequency distribution

Progress: In line with schedule

Have all components for first master oscillator for VUV-FEL in-house. Will be assembled September and performance evaluated in October and November. Installation will be in climatized rack which will be exchanged with old master oscillator in December.

Deviations from plan: None

9.4 Software

9.4.1 Data management development

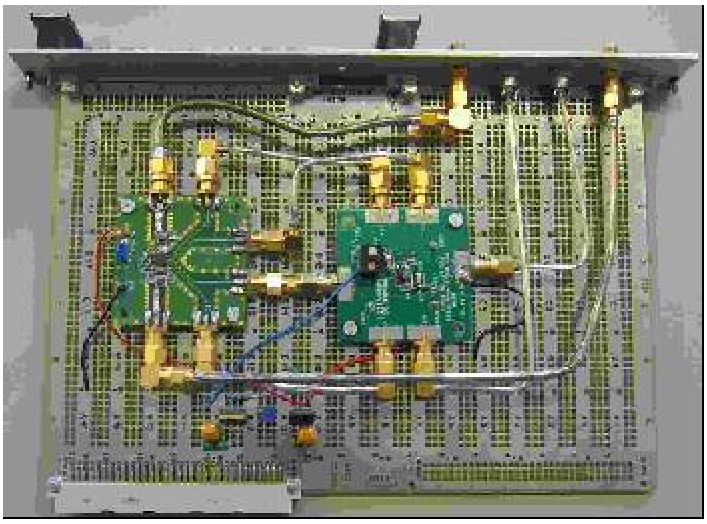
Progress: In line with schedule.
During reporting period the calibration parameters database has evolved slightly, new features like templates of devices stored in database has been added. Also the range of object types was extended – now any object may be stored in database. This feature allows storing not only parameters related to hardware but DOOCS servers parameters as well. Also the new java communication library was developed.

Milestones and deliverables: None defined in contract for this period
Significant achievements and impact:

Deviations from plan: None

9.4.2 RF Gun control

Progress:
Detector:
An improved version of new IQ-Detector LT5516 was developed and will be tested.



New version of IQ-detector LT5516 installed on breadboard for evaluation.

FPGA Control:
Try to regulate the calculated field vector (P_forw - P_refl) of the RF GUN.
To get the right field vector, one has to get calibration factors by a preferably simple procedure. This procedure was
tested.
The goal is to decrease the delay time of the control-loop to increase the proportional gain.

Milestones and deliverables: None defined on contract for this period

Significant achievements and impact: None

Deviation from plan: None

2.) Update of MS-Project

N°	MS, Deliverable	Task Name	Anfang	Ende	% eschlos	2005 J F M A M J J A S O N D 2006 J F M A M J J A S O N D
9.1		**Operability and technical performance**	**Do 01.01.04**	**Fr 08.12.06**	**45%**	
9.1.1		**Transient detector**	**Do 01.01.04**	**Fr 08.12.06**	**36%**	
9.1.1.1		Define requirements	Do 01.01.04	Fr 30.01.04	100%	
9.1.1.2		Electronics design	Mo 02.02.04	Fr 27.02.04	100%	
9.1.1.3		Build prototype and evaluate	Mo 01.03.04	Fr 30.07.04	100%	
9.1.1.4		Final design of detector	Mo 02.08.04	Fr 01.10.04	100%	
9.1.1.5		Installation and commissioning	Mo 04.10.04	Mi 09.02.05	100%	
9.1.1.6		Test with beam	Mi 09.02.05	Fr 08.12.06	0%	
9.1.1.7	**Status Repor**	**Report on transient detector test**	Fr 08.12.06	Fr 08.12.06	0%	
9.1.2		**LLRF Automation**	**Do 01.01.04**	**Fr 23.06.06**	**50%**	
9.1.2.1		Dialogue with industrial experts	Do 01.01.04	Fr 27.02.04	100%	
9.1.2.2		Develop full specification	Mo 01.03.04	Fr 26.03.04	100%	
9.1.2.3		Implement FMS for subsystems	Mo 29.03.04	Fr 29.10.04	100%	
9.1.2.4		Test and evaluation	Mo 01.11.04	Mi 23.02.05	100%	
9.1.2.5		Implement improvements	Mi 23.02.05	Di 26.04.05	70%	
9.1.2.6		Evaluation and acceptance by operators	Di 26.04.05	Fr 23.06.06	0%	
9.1.2.7	**Status Repor**	**Report on LLRF atomization design**	Fr 23.06.06	Fr 23.06.06	0%	**23.06.**
9.1.3		**Control optimization**	**Do 01.01.04**	**Fr 13.10.06**	**35%**	
9.1.3.1		Specification of system	Do 01.01.04	Fr 02.04.04	100%	
9.1.3.2		Conceptual design of controller	Mo 05.04.04	Fr 30.04.04	100%	
9.1.3.3		Performance simulation	Mo 03.05.04	Fr 27.08.04	100%	
9.1.3.4		Implementation in DSP hardware	Mo 30.08.04	Mi 02.02.05	80%	
9.1.3.5		Implementation and tests on TTF	Do 03.02.05	Fr 13.10.06	0%	
9.1.3.6	**Status repor**	**Evaluation of test results**	Fr 13.10.06	Fr 13.10.06	0%	**13.10**
9.1.4		**Exceptional handling routines**	**Do 01.01.04**	**Fr 02.12.05**	**67%**	
9.1.4.1		Specification	Do 01.01.04	Fr 23.01.04	100%	
9.1.4.2		Design of exceptional handler	Mo 26.01.04	Fr 30.04.04	100%	
9.1.4.3		Implementation and test on TTF	Mo 03.05.04	Fr 02.12.05	60%	
9.1.4.4	**Status Repor**	**Report on exceptional handler operatic**	Fr 02.12.05	Fr 02.12.05	0%	**02.12.**
9.2		**LLRF cost and reliability study**	**Do 01.01.04**	**Fr 27.10.06**	**44%**	
9.2.1		**Cost and reliability study**	**Do 01.01.04**	**Fr 29.09.06**	**47%**	
9.2.1.1		Identify cost drivers of present LLRF	Do 01.01.04	Fr 27.02.04	100%	
9.2.1.2		Develop cost reduction ideas	Mo 01.03.04	Fr 02.04.04	100%	
9.2.1.3		Build prototypes and evaluate	Mo 05.04.04	Fr 21.01.05	100%	
9.2.1.4		Final design of LLRF system	Fr 21.01.05	Fr 29.09.06	15%	
9.2.1.5	**Status Repor**	**Complete design of LLRF system for reduced cost**	Fr 29.09.06	Fr 29.09.06	0%	**29.09.**
9.2.2		**Radiation damage study**	**Do 01.01.04**	**Fr 27.10.06**	**42%**	
9.2.2.1		Identify critical electronics issues	Do 01.01.04	Fr 27.02.04	100%	
9.2.2.2		Evaluate TESLA radiation	Mo 01.03.04	Fr 02.04.04	100%	
9.2.2.3		Develop tests for components	Mo 05.04.04	Fr 28.05.04	100%	
9.2.2.4		Procure and assembles test set up	Mo 31.05.04	Fr 23.07.04	100%	
9.2.2.5		Data acquisition from radiation tests	Mo 26.07.04	Fr 29.10.04	100%	
9.2.2.6		Analyze results and develop countermeasures	Mo 01.11.04	Mi 09.02.05	80%	
9.2.2.7		Implement countermeasures and verify	Mi 09.02.05	Fr 27.10.06	10%	
9.2.2.8	**Status Repor**	**Report on radiation damage studies**	Fr 27.10.06	Fr 27.10.06	0%	**27.1**
9.3		**Hardware**	**Do 01.01.04**	**Mi 01.03.06**	**70%**	
9.3.1		**Multichannel downconvertor**	**Do 01.01.04**	**Mi 26.01.05**	**100%**	
9.3.1.1		Study and compare technologies	Do 01.01.04	Fr 27.02.04	100%	
9.3.1.2		Select optimum PCB design	Mo 01.03.04	Fr 23.04.04	100%	
9.3.1.3		Build prototype and evaluate	Mo 26.04.04	Fr 02.07.04	100%	
9.3.1.4		Finalize multichannel downconverter	Mo 05.07.04	Fr 03.09.04	100%	
9.3.1.5		Determine characteristics	Mo 06.09.04	Mi 26.01.05	100%	
9.3.2		**Third generation RF control**	**Do 01.01.04**	**Mo 11.04.05**	**80%**	
9.3.2.1		Integrate system generator with VHDL	Do 01.01.04	Fr 30.01.04	100%	
9.3.2.2		Complete specification	Mo 02.02.04	Fr 02.04.04	100%	
9.3.2.3		Demonstrate simulator	Mo 05.04.04	Fr 04.06.04	100%	
9.3.2.4		Final design of RF electronic board	Mo 07.06.04	Fr 28.01.05	90%	
9.3.2.5		Evaluate performance	Mo 03.01.05	Mo 11.04.05	20%	
9.3.3		**Stable frequency distribution**	**Do 01.01.04**	**Mi 01.03.06**	**50%**	
9.3.3.1		Complete specification	Do 01.01.04	Mi 04.02.04	100%	
9.3.3.2		Concept ional design of frequency	Do 05.02.04	Fr 05.03.04	100%	
9.3.3.3		Build prototype and evaluate	Mo 08.03.04	Fr 06.08.04	100%	
9.3.3.4		Final design	Mo 09.08.04	Fr 22.10.04	100%	
9.3.3.5		Procurement and assembly of subsystems	Mo 25.10.04	Fr 28.01.05	100%	
9.3.3.6		Installation and commissioning	Mo 03.01.05	Fr 18.03.05	30%	
9.3.3.7		Performance test with beam	Mo 21.03.05	Mi 01.03.06	0%	
9.3.3.8		**Report on new LLRF hardware compon**	Mi 01.03.06	Mi 01.03.06	0%	**01.03.**
9.4		**Software**	**Do 01.01.04**	**Fr 06.10.06**	**54%**	
9.4.1		**Data management development**	**Do 01.01.04**	**Mi 14.09.05**	**67%**	
9.4.1.1		Specification	Do 01.01.04	Fr 30.04.04	100%	
9.4.1.2		Conceptional design with DOOCS	Mo 03.05.04	Fr 09.07.04	100%	
9.4.1.3		Prototype	Mo 12.07.04	Fr 10.09.04	100%	
9.4.1.4		User evaluation	Mo 13.09.04	Fr 05.11.04	100%	
9.4.1.5		Finalize design	Mo 08.11.04	Fr 31.12.04	100%	
9.4.1.6		Implementation in TTF	Mo 03.01.05	Mi 14.09.05	20%	
9.4.1.7		**Report on data management developm**	Mi 14.09.05	Mi 14.09.05	0%	**14.09.**
9.4.2		**RF gun control**	**Do 01.01.04**	**Fr 06.10.06**	**47%**	
9.4.2.1		Write specification	Do 01.01.04	Fr 30.01.04	100%	
9.4.2.2		Design of controller	Mo 02.02.04	Fr 23.04.04	100%	
9.4.2.3		Procurement and assembly	Mo 26.04.04	Fr 27.08.04	100%	
9.4.2.4		Installation and test	Mo 30.08.04	Fr 06.10.06	30%	
9.4.2.5		**Report on RF gun control tests**	Fr 06.10.06	Fr 06.10.06	0%	**06.10.**

3.) Status of money spending

	Spent money	Value of new orders/ contracts	Expected spending of new orders/contracts until end 2005	Sum of column 2 & 4
Travel	6000		4000	10000
Consumables	1000		35000	36000
Manpower				
Durable				
			Total sum	46000

Work package 10

1.) Status of activities

The cleaning operation of the klystron modulator and the oil change (4500 litres) took more time than scheduled. The delay was due to the safety procedures for analysis of used oil and the authorizations for its transfer and its post treatment. This operation was only completed at the end of June.

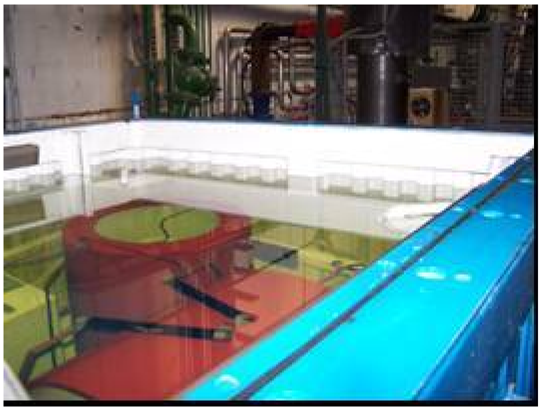


Fig.1 After cleaning, the klystron-modulator components are transferred in the oil-tank refilled with 4300 litres of new oil.

During this time, the 9-cell cavity and TTF III coupler were assembled in CryHoLab. The Power Coupler has been progressively conditioned at the room temperature with the RF power until the final parameters (1MW-1ms-3.8Hz) monitored by a Vacuum-RF feed back loop ($P < 4.10^{-8}$ mbar). The RF power is switched off if necessary: LAL-Orsay provided the electronic system to manage the interlock signals (ionic pump current, arc detection, thermal sensor, electron pick-up).

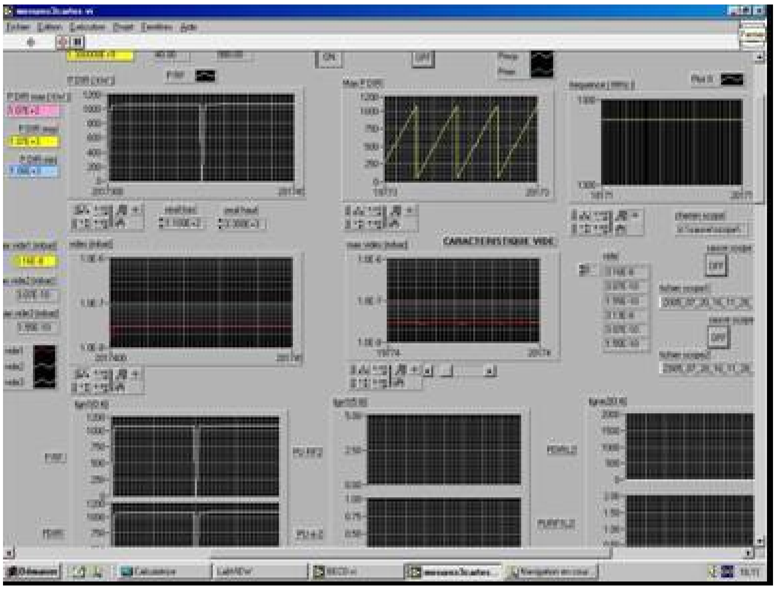


Fig.2 View of the computer display showing parameters (pulse shape, RF power increasing cycle and vacuum pressure)

After the RF coupler conditioning, the pulsed RF power (130 kW, 1 ms, 0.9Hz) was injected in the 9-cell cavity at 4K and 1.8K. We can see on figure 3 the reflected power and the transmitted power signals from pick-up probes.

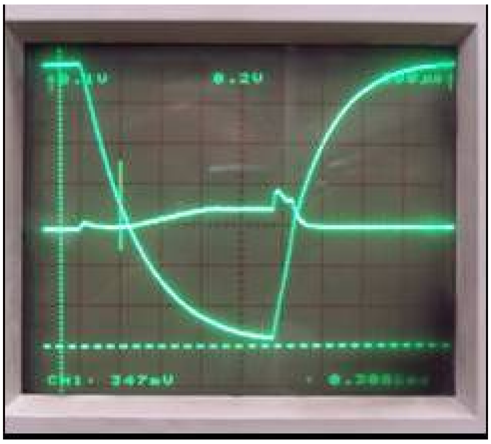


Fig.3 Oscilloscope traces of transmitted (upper) and reflected power (lower)

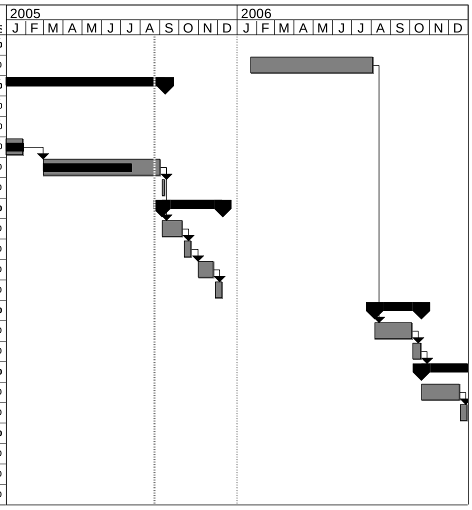
Experiments go on until the end of August:

- to modify the power profile stored in the cavity (rise time and a flat top)
- to test the phase-locked loop to keep the RF frequency at the peak of cavity resonance,
- to measure calorimetrically the dissipated power inside the cavity.

At the beginning of September, all the WP10 preliminary tests will be performed and the cavity will be equipped with the CEA cold tuning system to test it at room temperature and start then start the first CARE test series in CryHoLab.

2.) Update of MS-Project

N°	MS, Deliverable	Task Name	Anfang	Ende	% eschlos
10		**WP10 CRYOSTAT INTEGRATION TESTS**	**Mo 01.03.04**	**Mi 04.04.07**	**45%**
10.1		Displace CRYHOLAB	Mo 23.01.06	Fr 04.08.06	0%
10.2		**CRYHOLAB adaption to 9 cell**	**Mo 01.03.04**	**Fr 09.09.05**	**90%**
10.2.1		Mechanical adaption	Mo 01.03.04	Fr 29.10.04	100%
10.2.2		Low performance cavity and coupler	Mo 01.11.04	Di 30.11.04	100%
10.2.3		Assembly in CRYHOLAB and cryogenic test	Mi 01.12.04	Fr 28.01.05	100%
10.2.4		High performance coupler - High power pulsed te	Di 01.03.05	Fr 02.09.05	75%
10.2.5		Magnetic shielding with cryoperm	Mo 05.09.05	Fr 09.09.05	0%
10.3	**Status repor**	**Integration tests in cryostat (1st test)**	**Mo 05.09.05**	**Fr 09.12.05**	**0%**
10.3.1		CEA Cold Tuning System + Pezo (Assembly + wa	Mo 05.09.05	Fr 07.10.05	0%
10.3.2		Installation of 9-cell & coupler - Cooldown	Mo 10.10.05	Fr 21.10.05	0%
10.3.3		Cold test in CryHoLab	Di 01.11.05	Fr 25.11.05	0%
10.3.4		Evaluate experimental results	Mo 28.11.05	Fr 09.12.05	0%
10.4	**Status repor**	**Integration tests in cryostat (2nd test)**	**Mo 07.08.06**	**Do 19.10.06**	**0%**
10.4.1		Magnetostrictive tuner	Mo 07.08.06	Do 05.10.06	0%
10.4.2		Evaluate experimental results	Fr 06.10.06	Do 19.10.06	0%
10.5		**Integration tests in cryostat (3rd test)**	**Fr 20.10.06**	**Di 02.01.07**	**0%**
10.5.1		Piezoelectric tuner	Fr 20.10.06	Di 19.12.06	0%
10.5.2		Evaluate experimental results	Mi 20.12.06	Di 02.01.07	0%
10.6		**Integration tests in cryostat (4th test)**	**Mi 03.01.07**	**Mi 04.04.07**	**0%**
10.6.1		New coupler from LAL	Mi 03.01.07	Mi 21.03.07	0%
10.6.2		Evaluation of results	Do 22.03.07	Mi 04.04.07	0%
10.6.3		**Final evaluation**	Mi 04.04.07	Mi 04.04.07	0%



3.) Status of money spending

	Spent money	**Value of new orders/ contracts**	**Expected spending of new orders/contracts until end 2005**	**Sum of column 2 & 4**
Travel	*756* *1046*		*Legnaro + CERN*	*1802*
Consumables				
Manpower				
Durable	*6633* *1635* *202* *119* *2648*		*0*	*11237*
			Total sum	*13039*

Work package 11

1.) Status of Activity

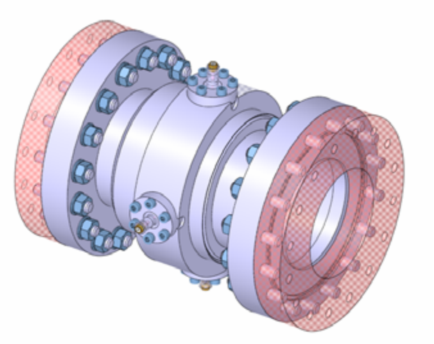
Task 11.1: The re-entrant BPM

The activity of the last months has been to design of the BPM cavity and the signal processing board.

New design of the BPM cavity

The mechanical structure (Fig. 8) has an overall length of 170 mm and is quite similar to the BPM in ACC1 on TTF2. The gasket is a conflat gasket.

The position and the design of feedthroughs changed (Fig. 1). Indeed, a critical point was the feedthrough fragility, 50% of the feedthroughs had to be rejected. With the new design, the feedthroughs are simpler and more robust. Moreover, this new design has no resonant mode. To have a higher Q and therefore a longer signal in time, the feedthroughs moved from 31.5 mm in the re-entrant part. With this moving, the distinguishing of the monopole and dipole signals is clearer and the rejection of the monopole signal is better.



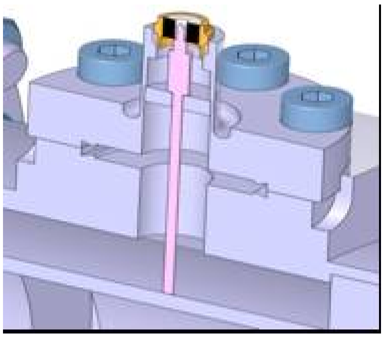


Fig. 1: Design of the new cavity BPM Fig. 2: Design of the new feedthrough

One of the biggest problems on the cavity in ACC1 was the cleaning. As the BPM is designed to be used in a clean environment and at the cryogenic temperatures, twelve holes of 5 mm diameter were drilled at the end of the re-entrant part. A simulation was carried out to check that the RF characteristics of the re-entrant cavity do not change. Cleaning tests were successfully preformed at DESY and validated the system for the cleaning.

The simulation, with HFSS, of the new design (Fig. 2) gives the RF characteristics (Tab. 1).

	New BPM			
	F (GHz)	Q	R/Q at 5mm of the center of cavity	R/Q at 10mm of the center of cavity
Monopole Mode	1.25	24	13 Ω	13 Ω
Dipole Mode	1.72	51.4	0.25 Ω	1.11 Ω

Tab. 1: RF characteristics of new BPM

The choice of resonant mode frequencies was determined according to the 180° junction hybrid available on the market. The resolution around 1 µm but also the mechanical feasibility of the structure determined the quality factors, Q, of the monopole and dipole modes. They are not able either to be too high to keep a time resolution around 10 ns or too low to have a centring accuracy better than 1 µm.

Development of new hybrid coupler

The new hybrid coupler is the Anaren model 3A0055. It's a 180° hybrid coupler and its isolation is more than 25 dB in the band 1-2 GHz. It can be optimized at the frequency of the dipole mode with attenuators and phase shifters to have an isolation around 50 dB.

Signal processing of the new BPM

The signal processing of the new re-entrant BPM is composed of a 180° hybrid junction, which is connected to each pair of opposite antennae with 33 m of semi-rigid cables. The rejection of the monopole mode proceeds in three steps. One is made by the new hybrid coupler, the second with the pass band filter, which rejects the monopole mode on the delta channel and the third with the synchronous detection. The noise is limited by the band pass filters. The one on the Δ channel has to have the centre frequency of the dipole mode and the one on the Σ channel the centre frequency of the monopole mode. To perform the synchronous detection, the signals must be amplified. The 9 MHz reference signal, from the control system on TTF2, combined with some PLLs generates some signals at the monopole and dipole modes frequencies. These ones are used as local oscillators for the mixers. Some phase shifters, controlled by the digital electronics, adjust the PLL signals, which have to be in phase with the signals coming from the hybrid. The digital electronics, also, makes the sampling, the calibration of the system and the control-command interface. The signal on the Σ channel is used in order to normalize the Δ signal, which determines the position of the beam. This normalization is, also, made by a digital electronics. The schematic of the new electronics is shown figure 3.

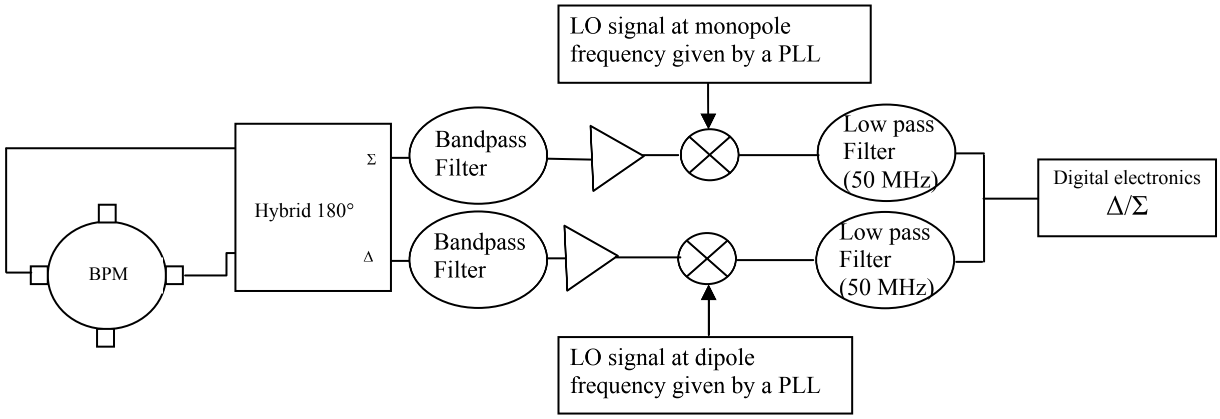


Fig. 3: Electronics of the new system

Planning of the re entrant BPM

The status and planning about the re-entrant BPM are the next:

- Design and mechanical drawings of the BPM cavity are ready.
- Design of the RF electronics and signal processing are made.
- Signal processing board will be fabricated for December 2005.
- A BPM cavity will be fabricated at the end of 2005.
- Tests on the electronics will be made at the beginning of 2006.
- Preliminary tests on this new BPM to verify RF characteristics of the cavity and validate the fabrication process: brazing, heat treatment, cleaning and dust free mounting, will be made at the beginning of 2006.

Task 11.2: The Emittance Monitor

The Diffraction Screen

In this period we produced different Diffraction Screens, learning how to avoid surface deterioration near the slit cut. We then mounted the best one on an UHV actuator. The actuator is driven by a stepping motor and has an accuracy of 1 μm, with a nominal resolution of 0.05 μm/micro step. The vacuum assembly has been installed on the bypass line of TTF linac during a machine shutdown in June. The screen can work also as a standard OTR screen, and this function is the only abilitated at the moment, for the routinely operation of the machine.

The Optical System

The design of the optical system has been fixed, and the optical elements (lenses, filters and polarizers) acquired. The mechanical drawing of the system has been completed and its construction started.

The electronic control is in construction, and the PC dedicated to the data acquisition and control of the experiment has been ordered.

Simulations and Tests

Simulations of the amount of the synchrotron radiation background from the last bending in different experimental condition have been performed. Different optical shielding aimed to reduce its influence on the measure is evaluated.

A machine shift has been dedicated to the study of the possible beam phase space manipulation at the Diffraction Radiation screen position using the quadrupoles on the bypass line. The possibility of having vertical waist of different dimensions has been verified. together with the possibility of having horizontally larger beam.

2.) Status of Ms-Project

N°	MS, Deliverable	Task Name	Anfang	Ende	% eschlos
11		**WP 11 BEAM DIAGNOSTICS**	**Do 01.01.04**	**Mi 28.05.08**	**44%**
11.1		**Beam position monitor**	**Do 01.01.04**	**Mi 12.12.07**	**46%**
11.1.1	**'t Measuremen**	**Present BPM installed in TTF module**	Mi 30.06.04	Mi 30.06.04	100%
11.1.2		Cryogenic measurements on BPM	Do 01.07.04	Fr 06.08.04	100%
11.1.3		Beam tests of BPM on TTF	Mo 09.08.04	Mo 03.10.05	60%
11.1.4		Design of BPM Cavity	Do 01.01.04	Fr 25.03.05	100%
11.1.5		Design of BPM cavity ready	Fr 25.03.05	Fr 25.03.05	100%
11.1.6		Fabrication of BPM Cavity	Fr 25.03.05	Fr 23.12.05	0%
11.1.7		BMP cavity ready	Fr 23.12.05	Fr 23.12.05	0%
11.1.8		Development of new hybrid coupler and electroni	Mo 05.07.04	Mo 05.09.05	100%
11.1.9		Design of Digital Signal Processing	Mo 03.01.05	Mi 17.08.05	80%
11.1.10		**New BPM ready for Installation**	So 01.01.06	So 01.01.06	0%
11.1.11		Beam Tests with new BPM	Mo 02.01.06	Mi 12.12.07	0%
11.1.12		**Evaluation of BPM operation**	Mi 12.12.07	Mi 12.12.07	0%
11.2		**Beam Emittance Monitor**	**Do 01.01.04**	**Mi 28.05.08**	**42%**
11.2.1		Slit width simulations	Do 01.01.04	Fr 02.04.04	100%
11.2.2		Slit design	Mo 05.04.04	Fr 02.07.04	100%
11.2.3		Optics simulations	Mo 05.04.04	Fr 02.07.04	100%
11.2.4		Optics appropriations	Mo 05.07.04	Mo 15.08.05	100%
11.2.5		System assembly and tests	Mo 25.10.04	Fr 30.09.05	50%
11.2.6		Mechanical assembly at TTF	Mo 03.10.05	Mi 02.11.05	100%
11.2.7		Optical assembly at TTF	Do 03.11.05	Do 01.12.05	0%
11.2.8		Integration of controls into TTF	Fr 02.12.05	Sa 31.12.05	25%
11.2.9	**'t Measuremen**	**Ready for beam test in TTF**	Sa 31.12.05	Sa 31.12.05	0%
11.2.10		Beam tests at TTF	Mo 02.01.06	Fr 02.06.06	0%
11.2.11	**Status Repor**	Evaluate first beam test result	Fr 02.06.06	Fr 02.06.06	0%
11.2.12		Successive measurements	Mo 05.06.06	Mi 28.05.08	0%
11.2.13		**Final evaluation**	Mi 28.05.08	Mi 28.05.08	0%