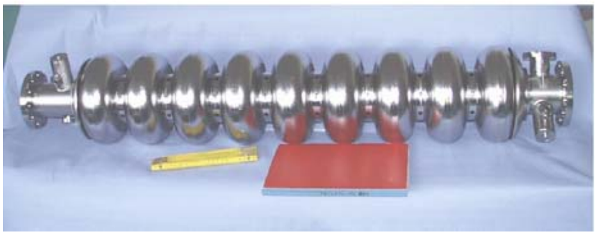
SRF



CARE/JRA1 Quarter report 1/2005

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

Acronym: SRF

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

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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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	
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IPJ Swierk (13)	IPJ	PL	M. Sadowski	M. Sadowski	

Industrial Involvement:

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

Table of content:

1. Milestones and Deliverables of the reporting period

No.	Deliverable (D) / Milestone (M)		WP/Task	Contractor	Taskleader	Planned	Expected
1	First operation of automated EP	M	5.3.1.4	INFN-Lnl	E. Palmieri	08.02.2005	ok
2	Final report on reliability issue	D	2.1.7	DESY	L. Lilje	10.02.2005	31.12.2005
3	Software ready	M	5.3.2.4	INFN-Lnl	E. Palmieri	21.02.2005	ok
4	Construction tube necking machine finished	M	3.2.3.5	DESY	W. Singer	24.02.2005	ok
5	Tools fabrication finished	M	2.3.2.6	DESY	J. Tiessen	11.03.2005	ok
6	Start production welding of components	M	2.3.3.3	DESY	J. Tiessen	11.03.2005	ok
7	Coating apparatus operational	M	4.1.1.6	IPJ	J. Langner	14.03.2005	ok
8	Calibration defects finished	M	6.2.1.3	INFN-Lnl	M.Valentino	23.03.2005	ok
9	Report about new design for components	M	2.2.1.9	INFN-Mi	P.Michelato	30.03.2005	16.09.2005
10	Best EP parameters	D	5.1.1.4	CEA	C. Antoine	31.03.2005	30.09.2005
11	3 cavities fabricated	M	5.1.2.2	CEA	C. Antoine	31.03.2005	30.09.2005
12	Installation finished	M	5.4.1.5	DESY	D. Reschke	11.04.2005	01.06.2005
13	First operation of EP set-up	M	5.1.3.4	CEA	C. Antoine	29.04.2005	31.10.2005

2. Publications

CARE Publications, Notes, Documents			Electronic version under:
CARE-Pub-05-xxx	Research activities within a frame of the CARE-JRA1 Thin film cavity production work-package	J. Langner, M.J. Sadowski, s. Tazzari	ELEKTRONIKA 2-3/2005 p.76
CARE-Note-2005-xxx-SRF	SC Cavity SIMCON User's Manual	K. T. Pozniak, T. Czarski, W. Koprek, R.S. Romaniuk	TESLA Report 2005-02
CARE-Note-2005-xxx-SRF	Design of eight channel 81 MHz IF downconverter board in digital RF feedback system for TTF2	T. Filipek, G. Moeller, H. Weddig, S. Simrock, R. Romaniuk, K. Pozniak	TESLA Report 2005-03
CARE-Note-2005-xxx-SRF	Modular & reconfigurable common PCB-platform of FPGA based LLRF control system for TESLA test facility	K. T. Pozniak, R. S. Romaniuk K. Kierzkowski	TESLA Report 2005-04
CARE-Note-2005-xxx-SRF	Software Layer for SIMCON ver. 1.1 FPGA based TESLA cavity control system User's Manual	W. Koprek, P. Kaleta, J. Szewinski, K.T. Pozniak R. S. Romaniuk	TESLA Report 2005-05
CARE-Note-2005-xxx-SRF	First Generation of Optical Fiber Phase Reference Distribution System for TESLA	K. Czuba, F. Eints, M. Felber, J. Dobrowolski, S. Simrock	TESLA Report 2005-08
CARE-Note-2005-xxx-SRF	FPGA based,full-duplex,multi-channel, optical Gigabit, synchronous Data transceiver for TESLA technology LLRF control system	K.T. Pozniak,R.S. Romaniuk,W. Jalmuzna, K. Olowski, K. Perkuszewski, J. Zielinski, K. Kierzkowski	TESLA Report 2005-07
CARE-Note-2005-xxx-SRF	DSP Integrated, Parameterized, FPGA based Cavity Simulator&Controller for VUV-FEL	W. Koprek, P. Pucyk, T. Czarski, K.T. Pozniak, R.S. Romaniuk	TESLA Report 2005-06
CARE-Note-2005-xxx-SRF	CHECHIA cavity driving with FPGA controller	T. Czarski, W. Koprek, K.T. Pozniak, R.S. Romaniuk, S. Simrock	TESLA Report 2005-12
CARE-Note-2005-xxx-SRF	Milestone Report: Construction tube necking machine (WP Task 3.2, 3.5)	W. Singer	
CARE-Note-2005-xxx-SRF	DOOCS environment for FPGA-based cavity control system and control algorithms development	P. Pucyk, W. Koprek, P. Kaleta, J. Szewinski, K.T. Pozniak, T. Czarski, R.S. Romaniuk	TESLA Report 2005-13

3. JAR – SRF Activities January – April 2005

JAR Activities	JAN	FEB	MAR	APR	Web sites
CARE & SRF					
Telephone Meetings		Feb 02			
WP Meetings	WP4 Jan 24 Rome	WP9 Feb 15 Hamburg	WP7 Mar 18 Orsay	WP8 Apr 01 Hamburg	WP4: http://ares.roma2.infn.it/ARCO/ WP7: http://sera.web.lal.in2p3.fr/ WP8: http://tesla.desy.de/~sekalski WP9: http://jra-srf.desy.de/
	WP8 Jan 24	WP4 Feb 8-9 Swierk	WP8 Mar 11		
			WP11 Mar 15		
TESLA Meetings			Mar30-Apr1 Hamburg		http://tesla-new.desy.de/content/meetings/collaborationmeetings/index_eng.html
Workshops					
Conferences			PAC05 May 16/20 Knoxville		http://www.sns.gov/pac05/

Work Package 2: Improved Standard Cavity Fabrication

Task 2.1: reliability analysis.

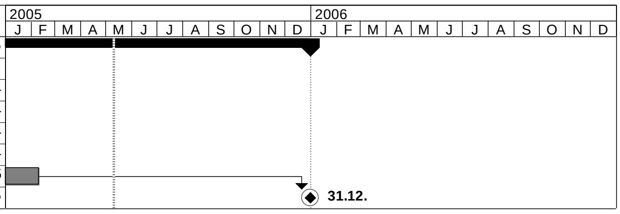
1. Status of activities

The activity relative to the reliability analysis is going ahead with some delay, primarily because the phase of retrievement and organization of data relative to all the TTF modules was finished only at the end of 2004.

We now plan to analyse the data using commercial reliability analysis software to perform a process FMEA on the procedure This work includes a complete verification and re-checks of the assembly protocols relative to cryomodules and clean room operations. We expect a delay, respect the past statements, of some months: with the information available today the final report on reliability issue, foreseen in the last scheduling for the 10 of February has to be shifted to the end of 2005.

2.) Status of MS-Project

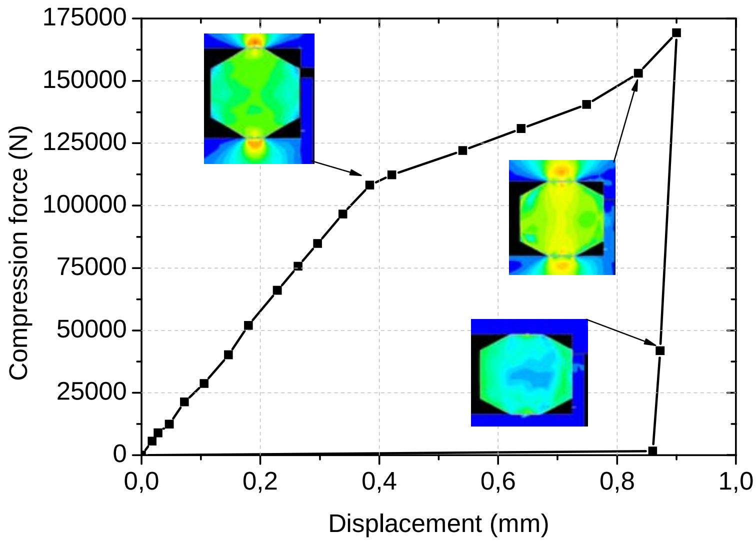
N°	Task Name	Anfang	Ende
2.1	**Reliability Analysis**	**Do 01.01.04**	**Sa 31.12.05**
2.1.1	Review of data bank: cavity fabrication	Do 01.01.04	Fr 13.02.04
2.1.2	Review of data bank :cavity treatment	Mo 16.02.04	Di 30.03.04
2.1.3	Review of data bank: cavity VT performance	Mi 31.03.04	Do 13.05.04
2.1.4	Review of data bank: string assembly	Fr 14.05.04	Do 05.08.04
2.1.5	Review of data bank: string performance	Fr 06.08.04	Do 28.10.04
2.1.6	Establish correlations	Fr 29.10.04	Do 10.02.05
2.1.7	**Final report on reliability issue**	Sa 31.12.05	Sa 31.12.05



Task 2.2: improved component design.

In February 2005, the milestone 2.2.1.3 has been satisfied with the delivery of the "Summary report on the status of art on ancillaries on the experience of various laboratories involved in SC RF" document.

Moreover some studies on the flanges behaviour have been performed in these months, following two different approaches: a numerical one by means of finite element method and an analytical analysis where thermal expansions have been taken in account. The following figure reports the results of the finite element analysis performed at room temperature on a TTF beam line seal, compressed up to the contact of flanges. The analysis shows a bilinear behaviour due to the plastic strains diffusion into the seal. For a compression higher than 0.8 mm, the seal goes in contact with the lateral side of the groove and an increasing of the whole stiffness is detected. The deformations recovered during unload are purely elastic.



The prosecution of the activity now foresees a comparison of the calculated data with experimental measurement, in a first step at room temperature. We have scheduled the use of a compression test machine that is available at LASA. The machine needs unfortunately a serious service that is producing at this moment a delay. This machine can also make cold tests over small samples: this possibility will be used, during the prosecution of the activity, to compare mechanical properties of the materials used in cold connections with the data available in literature.

Moreover we have now available in the laboratory a small cryostat for cold test on flanges up to 2 K.

During this activity, we have accumulated a certain delay that is reflected in the scheduling for the future milestones: in particular, the MS 2.2.1.9, foreseen in the current scheduling for June 17, is shifted to September 16, 2005. This delay will shift all the correlated milestones and scheduling: we have to shift the MS 2.2.1.14 to March 17, 2006.

2.) Update of MS-Project

N°	Task Name	Anfang	Ende
2.2	**Improved component design**	**Do 01.01.04**	**Do 11.09.08**
2.2.1	**Documentation retrieving**	**Do 01.01.04**	**Fr 17.03.06**
2.2.1.1	Start up meetings	Do 01.01.04	Mo 09.02.04
2.2.1.2	Access and study of Jlab, DESY, LLAN, KEK experience	Do 01.01.04	Mi 13.10.04
2.2.1.3	**Summary report on the status of the ar on ancillaries**	Mi 13.10.04	Mi 13.10.04
2.2.1.4	Sealing material and shape design	Do 14.10.04	Fr 29.07.05
2.2.1.5	Flange preliminary design	Mo 10.01.05	Fr 24.06.05
2.2.1.6	Material and geometric compatibility	Mo 27.06.05	Fr 02.09.05
2.2.1.7	Final assembly design	Do 14.10.04	Fr 09.09.05
2.2.1.8	End plate preliminary design	Do 14.10.04	Mi 09.03.05
2.2.1.9	**Report about new design for compone**	Fr 16.09.05	Fr 16.09.05
2.2.1.10	Stiffness optimization	Do 30.09.04	Fr 27.01.06
2.2.1.11	Manufacturing procedure analysis	Mo 03.01.05	Fr 22.07.05
2.2.1.12	Final assembly design	Mo 05.09.05	Fr 17.02.06
2.2.1.13	Other ancillaries design	Do 14.10.04	Fr 24.02.06
2.2.1.14	**Final Report for new components**	Fr 17.03.06	Fr 17.03.06
2.2.2	**Review of criticality in welding procedures**	**Do 01.01.04**	**Fr 11.08.06**
2.2.2.1	Review of available parameters on vendor welding machine	Do 01.01.04	Fr 21.10.05
2.2.2.2	Definition of prototype requirements for tests	Mi 13.10.04	Mo 11.07.05
2.2.2.3	Welding test on specimens	Mo 24.10.05	Fr 24.02.06
2.2.2.4	Analysis of the results	Fr 29.07.05	Fr 11.08.06
2.2.2.5	**Report about welding parameters**	Fr 11.08.06	Fr 11.08.06
2.2.3	**Finalize new component design**	**Mo 14.08.06**	**Mo 30.07.07**
2.2.3.1	Do drawings	Mo 14.08.06	Mo 30.07.07
2.2.3.2	**New components design finished**	Mo 30.07.07	Mo 30.07.07
2.2.4	**Finalize new cavity design**	**Mo 14.08.06**	**Do 14.06.07**
2.2.4.1	Make drawings	Mo 14.08.06	Do 14.06.07
2.2.4.2	**New cavity design finished**	Do 14.06.07	Do 14.06.07
2.2.5	**Fabrication of new cavity**	**Mo 30.07.07**	**Do 11.09.08**
2.2.5.1	Fabrication	Mo 30.07.07	Do 11.09.08
2.2.5.2	New cavity finished	Do 11.09.08	Do 11.09.08

Task 2.3 Single cell manufacture of a small series

After welding of three single cells we try to improve the quality and reliability of the complete manufacture sequence, starting at the entrance control, the etching, fixtures, machining, storing, transport, welding, production logs and end control. The series of 28 single cell cavities for different tests helps us to understand the problems of a cavity production. After this series we can pass the parameters for a multi cell cavity production.

Tools for preparation electron beam welding seam

Tools for machining equator and iris seam of a half cell

These fixtures are constructed for machining both sides of the half cell without changing the clamping. So you only have to mount and dismount the according caps and turn the fixture in the chuck. This trick enhances the accuracy of the seam geometry for eb-welding.

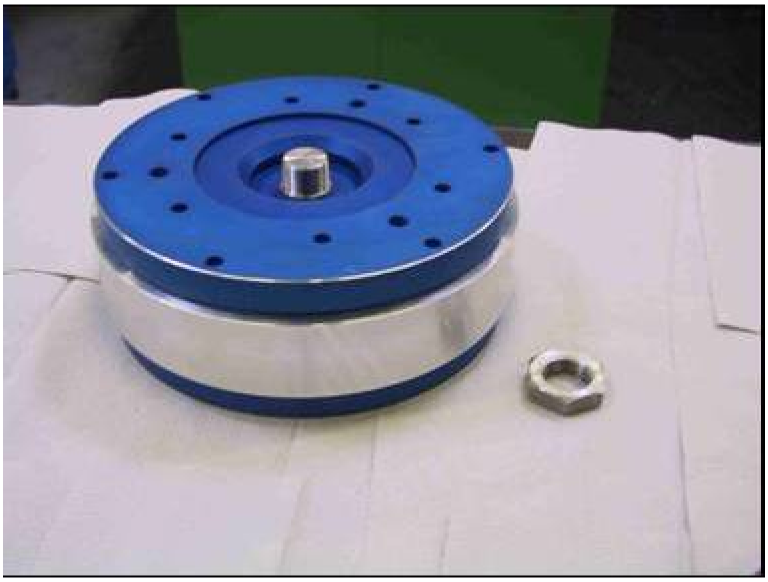


Figure 1: Complete Fixture for end half cells with both caps

Figure 2: Dismounted fixture

Figure 3 shows the same principle of fixture like in figure 1 and 2. This red fixture is for normal half cells and the blue one for end half cells. The cap on the iris side is dismounted. So we can machine the iris seam on the drilling machine

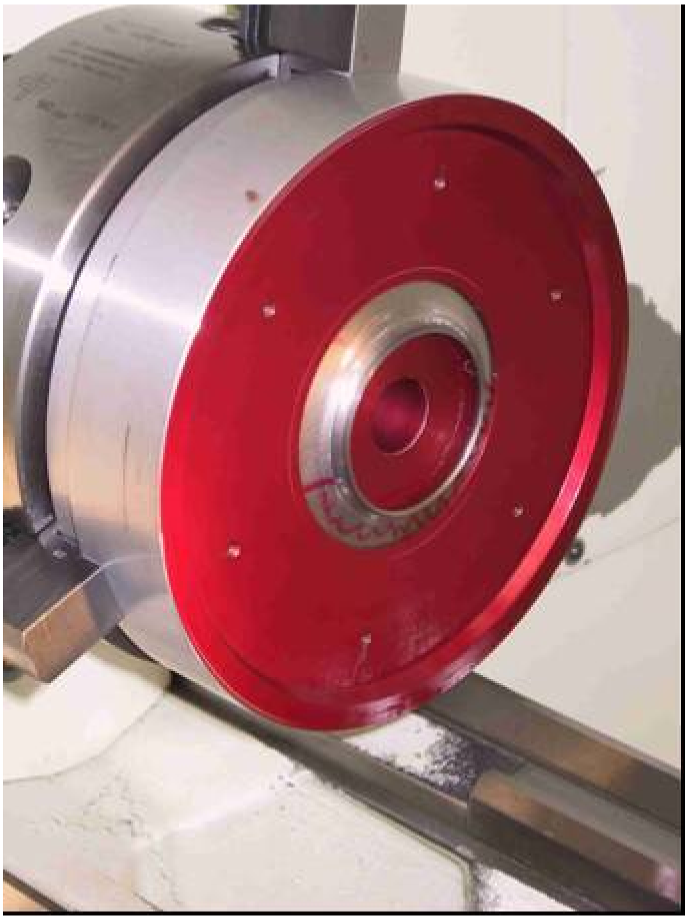


Figure 3: Fixture in use for machining the iris seam in a drilling machine

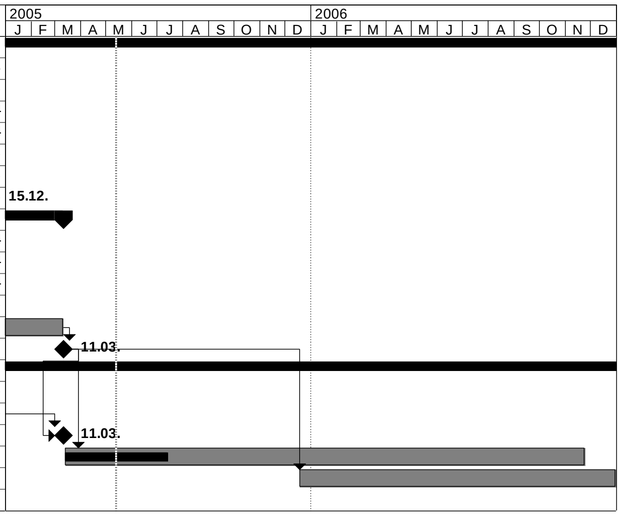
Preparation and welding of different guns

A next step of development is the superconducting gun with 1.6 cells. We are constructing the fixture for a 1.6 gun and started with the first welding tests.
In the following figure we'll change the brazed flange at the 0.6 BLN-Gun to welded Niobium/Titan flanges.

Figure 4: Preparation for welding gun coupler flanges on a milling machine

2.) Update of MS-Project

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



Work Package 3: Seamless Cavity Production

Task 3.1: Seamless cavity production by spinning

1) Status of activities

Both the design and the construction of the spinning machine for producing seamless multi-cell resonators starting from a tube have been completed. Fig. 1 shows the spinning lathe used up to now for the fabrication of seamless cavities. The lathe turret supporting the rollers moves along an axis of about 45 degrees respect to the spinning axis. Since the shear force is applied onto the spun piece by the roller only when this moves forward, the necking process works only for a half cell. Therefore, the forming process foresees that for every necking operation, the cavity must be dismounted from the lathe headstock and tilted, in order that the turret can apply its force onto the opposite half cell that has remained untouched during the previous operation.

Fig. 1: The spinning lathe used for the fabrication of seamless cavity prototypes. The lathe has only one turret which hold the rollers.

Due to this limit, that is normally found on all spinning lathes we know, the cavity needs to be dismounted from the lathe headstock, tilted and remounted several times for each necking operation.

This means wasting time, which can be easily avoided by adding a second turret working in the opposite direction to the standard one, as shown in Fig.2.

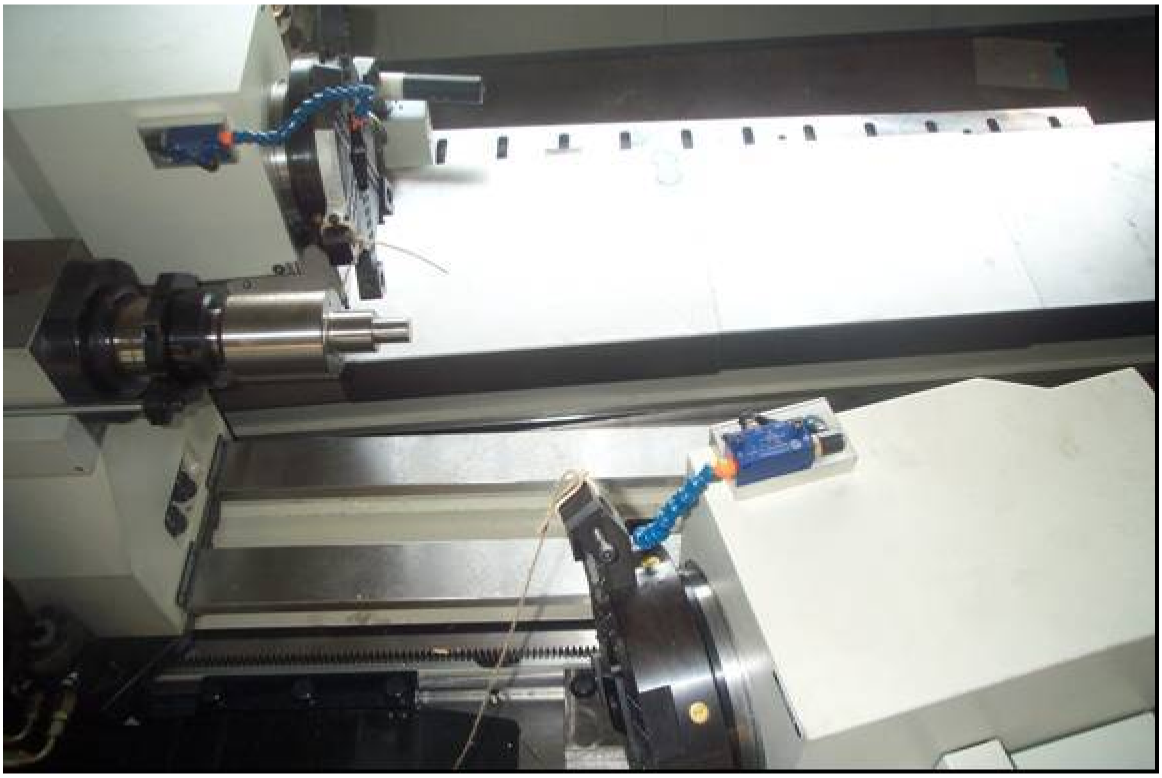


Fig. 2: The new spinning lathe with two turrets which hold the rollers. In this configuration, the rollers can work in opposite direction.

In this configuration, the cavity remains mounted onto the lathe during the whole spinning operation (apart from when the internal collapsible die is dismounted), while is the operator to move around the lathe depending on the half cell he has to spin. This should make the fabrication procedure shorter in time, less expensive and therefore easier to industrialize. However, working with two rollers needs further investigation of the spinning process, since, despite the spinning time is strongly reduced, all the procedure parameters must be revised *ab initio*. The material wall thickness at the iris, at the end of the necking operation, should be not lower than the initial tube thickness. This is actually possible in the double turret configuration, but requires a severe control of the roller working pressures, of the spinning angular velocity, of the roller feed speed and finally of the pressure between headstock and tailstock. This work of settling the parameters is just started on copper tubes. Indeed, the niobium will be used in the final stage of the investigation due to an obvious problem of material cost.

Fig. 3: Phase of the double turret necking process during the spinning parameter definition action.

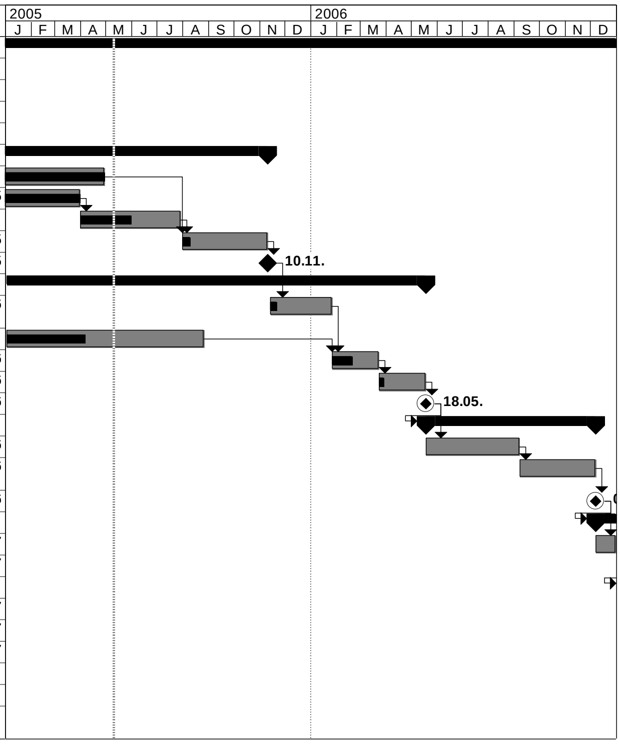
2.) Status of milestones

With great satisfaction both from our side and from the side of the industry that is hosting this activity, the milestone “Spinning Machine Fabrication” has been strongly anticipated. The machine is ready to work; nevertheless, further few additions are required in order to consider the milestone concluded. Indeed, for the Nb spinning, we will certainly need a second set of rollers made in self lubricating material to avoid galling. Furthermore, the internal collapsible die must be reinforce, maybe even rebuilt, in order to sustain the higher values of pressure that the new lathe design will exert. The software of the machine at the actual stage of the research program is sufficient and for the moment doesn’t seem to need further upgrading. The phases of spinning parameter evaluation is just started, since we are studying simultaneously the problem of monocell spinning and the problem of necking for multicells. The machine commissioning, being a very delicate operation, is a critical phase that will certainly take not little time.

In conclusion, for the Work package 3.1 the milestones have been fully respected.

3.) Update of MS-Project

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



Task 3.2: Seamless cavity production by hydroforming

1.) Status of activities

The tube necking machine was successfully constructed according the time table. The main schema and a machine photo can be seen in Figure 1 and 2.

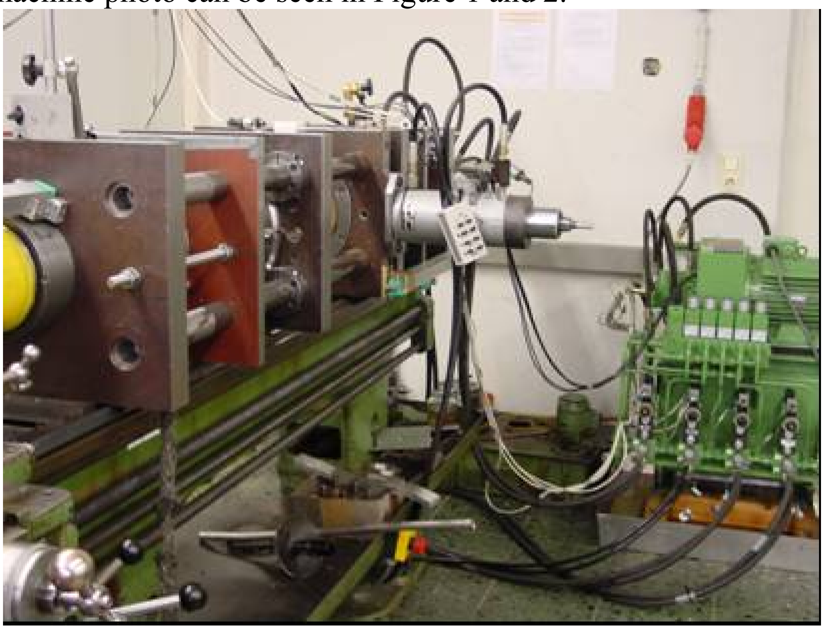


Fig. 1: View of the tube necking machine

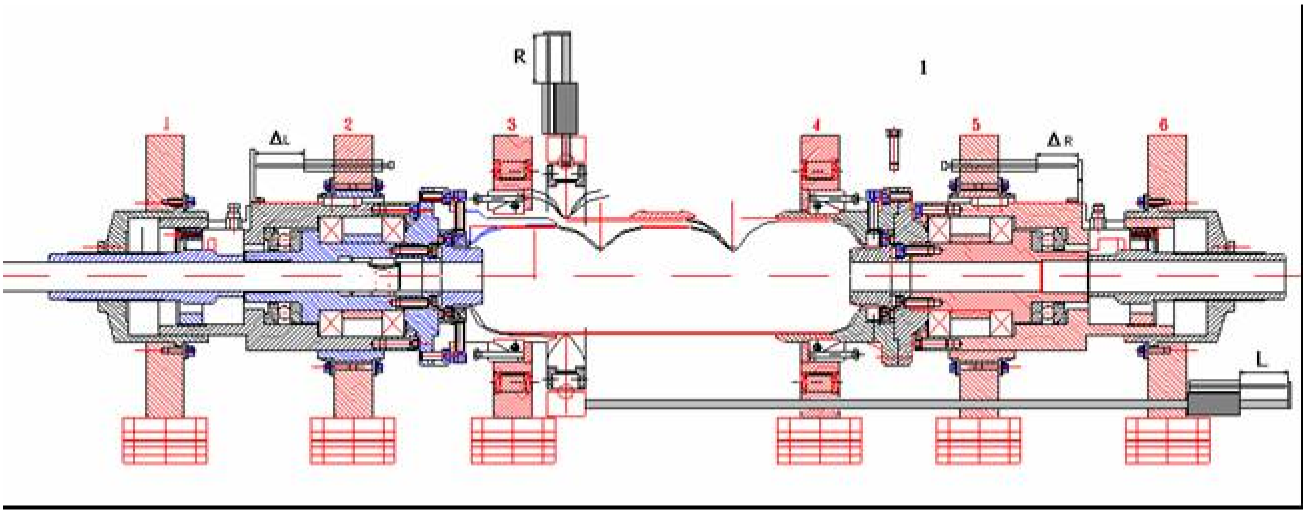


Fig.2: Schema of the tube necking machine (cross section)

The machine is foreseen for necking of Nb and NbCu tubes with diameter ID of 130 and 150 mm. The diameter should be reduced till 75.6 or 83.6 mm.

The machine consists of seven transversally oriented plates. Several hydraulic cylinders are fixed on the plates:

- Left and right cylinder for the application of axial pressure. Cylinder parameters: diameter 150 mm, stroke 125 mm, pressure 200 bar
- Cylinder for movement of the central plate. Cylinder parameters: diameter 100 mm, stroke 600 mm, pressure 200 bar
- Cylinder for movement of the instrument. Cylinder parameters: diameter 100 mm, stroke 45 mm, pressure 200 bar

All plates connected to each other using four bars of diameter 50 mm. Bars fixed on end plates.

All cylinders equipped with position and pressure sensors.

The necking machine is fixed on the lathe. The tube rotation is caused by lathe mechanism.

The machine is PC controlled. Two options of the software are created for two types of the tube necking (see Appendix 1 and 2):

Option 1: necking of the tube end to diameter of 75.6 or 83.6 mm (Software Neckend)

Option 2: necking of the tube middle (iris) to diameter of 75.6 mm (software Neckiris)

The first experiments have shown a good function of the machine. The necking of the Cu tubes both at the tube end and at the tube middle (iris) was successfully implemented (see figure 3). The optimization of the necking parameters is going on.

Fig. 3: Necking at the tube end and tube middle implemented by necking machine

Fig. 4: View of the hydroforming machine

In the frame of the task 3.2 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

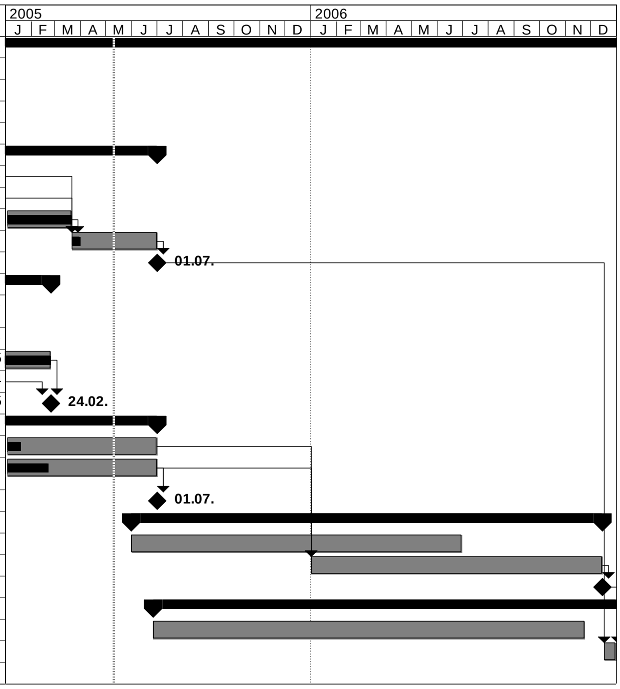
tube and with oil hydraulic system for the cylinder movements. The developed computer control system for the hydroforming allows the hydraulic expansion in stepwise as well as in continuous regime. A view of the machine can be seen in Fig. 4. The construction of the hydroforming machine is finished and first tests for commissioning of the machine are going on.
The multi cell seamless cavities are planned to be fabricated starting both from the tube with inside diameter ID=130 mm and ID=150 mm.
The main principles for the production of seamless Nb tubes for hydroforming are developed in cooperation with scientific institutes and industrial companies. The seamless tubes are ordered and expected to be delivered end of June 2005.

2.) Status of Milestones / Deliverables

The milestone “Construction tube necking machine finished” was reached in time.

3.) Update of MS-Project

N°	Task Name	Anfang	Ende
3.2	**Seamless by hydroforming**	**Do 01.01.04**	**Fr 16.11.07**
3.2.1	**Design hydro forming machine**	**Do 01.01.04**	**Fr 17.09.04**
3.2.1.1	Drawings of the matrices	Do 01.01.04	Fr 17.09.04
3.2.1.2	Drawings of the support system	Do 01.01.04	Fr 17.09.04
3.2.1.3	**Drawings matrix & support finished**	Fr 17.09.04	Fr 17.09.04
3.2.2	**Construction of hydro forming machine**	**Do 01.01.04**	**Fr 01.07.05**
3.2.2.1	Hydraulic for machine	Do 01.01.04	Mi 14.07.04
3.2.2.2	Software for the machine	Mo 23.02.04	Fr 17.09.04
3.2.2.3	Machine fabrication	Mo 20.09.04	Mo 21.03.05
3.2.2.4	Commissioning of the machine	Di 22.03.05	Fr 01.07.05
3.2.2.5	**Hydro forming machine ready**	Fr 01.07.05	Fr 01.07.05
3.2.3	**Construction of tube necking machine**	**Do 01.01.04**	**Do 24.02.05**
3.2.3.1	Drawings of the support system and turning mechanism	Do 01.01.04	Fr 27.08.04
3.2.3.2	Drawings of the necking mechanism	Do 01.01.04	Fr 27.08.04
3.2.3.3	Fabrication of the tube necking machine	Do 23.09.04	Do 24.02.05
3.2.3.4	Software for the tube necking machine	Mo 03.05.04	Do 30.12.04
3.2.3.5	**Construction tube necking machine fin**	Do 24.02.05	Do 24.02.05
3.2.4	**Development of seamless tubes for 9-cell c**	**Do 01.01.04**	**Fr 01.07.05**
3.2.4.1	Material and fabrication of bulk Nb test tubes	Di 03.08.04	Fr 01.07.05
3.2.4.2	Material and fabrication of bimetallic NbCu test tubes	Do 01.01.04	Fr 01.07.05
3.2.4.3	**Seamless tubes ready**	Fr 01.07.05	Fr 01.07.05
3.2.5	**Development of tube necking**	**Mi 01.06.05**	**Fr 15.12.06**
3.2.5.1	Computer simulation of the necking	Mi 01.06.05	Fr 30.06.06
3.2.5.2	Experiments on tube necking at iris	Mo 02.01.06	Fr 15.12.06
3.2.5.3	**Tube necking machine operational**	Fr 15.12.06	Fr 15.12.06
3.2.6	**Hydro forming of seamless cavities**	**Mo 27.06.05**	**Fr 16.11.07**
3.2.6.1	Computer simulation of the hydro forming	Mo 27.06.05	Fr 24.11.06
3.2.6.2	Hydro forming of bulk Nb 9-cell cavities	Mo 18.12.06	Fr 16.11.07
3.2.6.3	**Hydro formed 9-cell cavities ready**	Fr 16.11.07	Fr 16.11.07



4.) Status of money spending.

Status of money spending in Q1 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	*4100*			
Durable				
			Total sum	

5.) Talks

List of talks of JRA1 members

Subject	Speaker/Lab	Date	Web site
KEK-DESY Meeting	W. Singer	7.03.05	
TESLA Technology Collaboration Meeting	W. Singer	31.03.05	http://tesla-new.desy.de/content/meetings/collaborationmeetings/index_eng.html

Work Package 4: Thin Film Cavity Production

Task 4.1: Linear arc cathode coating

1. Status of activities

The prototype facility for the coating of single copper cavities has been put into operation at IPJ in Swierk, Poland, in the mid of November 2004, as documented in the 2004 annual report. The linear (cylindrical) cathode of the UHV arc-source has to be supplied by a DC high-current supply-unit. A prototype of the high-current pulse generator has also been commissioned and put into operation. During the 1st quarter of 2005 studies of the arc current reduction and stabilization, which are aimed on the optimization of the powering system, have been performed. Based on the results of these investigations a new DC/pulse power-supply unit has been designed and manufactured, as shown in Fig.1.

Fig.1. DC/pulse power-supply for linear arc.

Main parameters of this power-supply are as follows:

- max. current I = 350 A,
- voltage booster V = 200 V,
- modes: DC/pulsed,
- possible control by PC.

To perform tests of the coating, two TESLA-type cavities made of pure copper have been prepared by means of EB welding, as shown in Fig. 2. The linear arc cathode has been placed on the symmetry axis of the cavity, as presented in Fig.3.

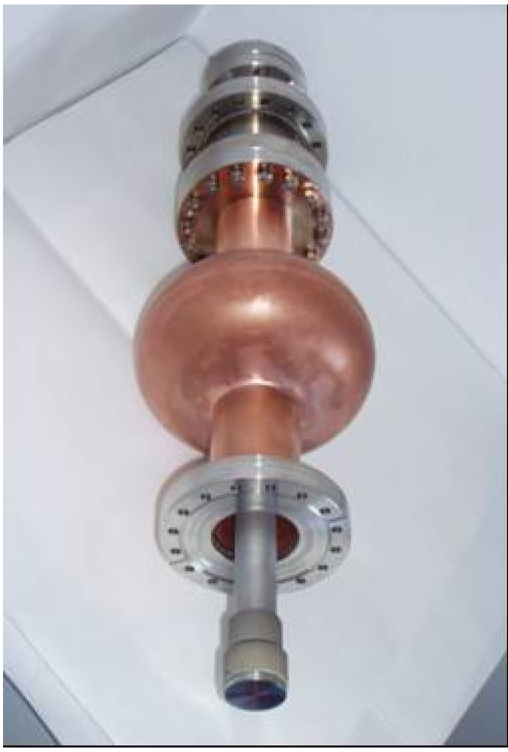


Fig.2. TESLA-type copper cavity equipped with vacuum flanges needed for installation at the UHV-arc stand.

Fig.3. Copper cavity connected with the inserted linear (cylindrical) cathode.

One of these two cavities has already been assembled at the UHV arc-coating apparatus, as shown in Fig 4. The whole facility has been pumped down in order to check possibility to obtain UHV conditions. No leak has been observed and the apparatus is ready for the RF-cavity deposition.

In addition, a new system of permanent magnet drive has been designed and manufactured at IPJ. The magnetic field, as sustained by the magnet placed inside the Nb cathode tube, stabilizes the arc discharge and focuses it on the cathode surface near the magnet position. This construction enables controlling of the discharge along the z-axis and uniform coating of the inner surface of the RF-cavity to be achieved.

A new system of the laser beam introduction (for arc triggering) has also been prepared. It consists of a shutter and an additional observation window. The system enables better calibration of the beam to be performed.

Fig.4. General View of the whole UHV-arc coating facility designed and constructed at IPJ in Swierk, Poland.

2.) Status of milestones/deliverables in this quarter

The milestone 4.1.1.6 "Coating apparatus operational" was achieved according to the up-dated time-schedule.

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	**1 185**			
Consumables	**6 850**			
Manpower	**4 000**			
Durable				
	12 035		**Total sum**	

4.) Meetings / Workshops

Meetings organized under JRA1

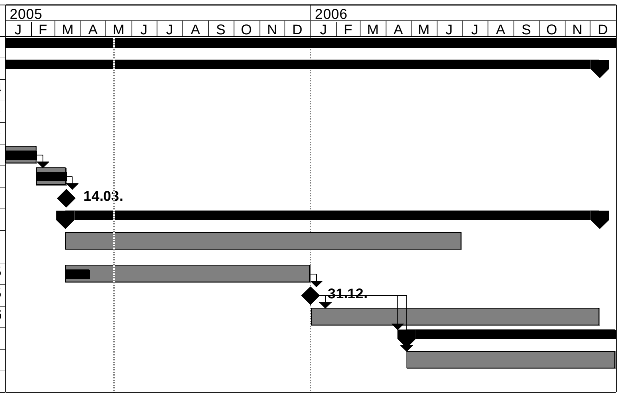
Date	Title/Subject	Location	Number of attendees	Website address
8-9 February 2005	**Collaboration meeting**	**Andrzej Soltan Institute for Nuclear Studies Swierk near Warsaw**	**6**	

5.) Publications

List of papers	Title	Authors	Journal/Conf.
CARE- pub			
	Research activities within a frame of the CARE-JRA1-WP4 Thin Film Cavity Production work-package	**J. Langner, M.J. Sadowski and S. Tazzari**	**Elektronika Vol. 46, Nos. 2/3 (2005) pp. 76-77**

6.) Update of MS-Project

N°	Task Name	Anfang	Ende
4.1	**Linear-arc cathode coating**	**Do 01.01.04**	**Fr 26.10.07**
4.1.1	**Installation & commissioning of coating app**	**Do 01.01.04**	**Di 12.12.06**
4.1.1.1	Modification of a prototype facility for single	Do 01.01.04	Di 14.09.04
4.1.1.2	Optimization of a triggering system	Mo 22.03.04	Mo 11.10.04
4.1.1.3	**Prototype facility ready**	Mo 11.10.04	Mo 11.10.04
4.1.1.4	Study of arc current reduction and stabilizati	Mo 11.10.04	Mo 07.02.05
4.1.1.5	Optimization of pow ering system	Mo 07.02.05	Mo 14.03.05
4.1.1.6	**Coating apparatus operational**	Mo 14.03.05	Mo 14.03.05
4.1.1.7	**Coating single cells**	**Mo 14.03.05**	**Di 12.12.06**
4.1.1.7.1	Coating of single cells w ithout micro droplet filtering	Mo 14.03.05	Fr 30.06.06
4.1.1.7.2	Design and construction of a micro drop	Mo 14.03.05	Sa 31.12.05
4.1.1.7.3	**Droplet filter ready**	Sa 31.12.05	Sa 31.12.05
4.1.1.7.4	Coating of single cell w ith micro droplet	Mo 02.01.06	Di 12.12.06
4.1.2	**Coating multi-cell**	**Mi 26.04.06**	**Fr 26.10.07**
4.1.2.1	Design and commissioning	Mi 26.04.06	Fr 26.10.07
4.1.2.2	First multicell coating	Fr 26.10.07	Fr 26.10.07



Task 4.2: Planar-arc coating

1.) Comments on status

The planar arc system, while fully tested and operational as far as vacuum conditions, arc ignition and stability are concerned, has still to be further improved on the filtering and heating sides. Because work is still in progress the percentage of completion is therefore still indicated as 75%. As for the micro droplet problem, a full investigation of the number of residual droplets after filtering and, more important, of the effect of these on field emission in a high RF field environment, has been missing because of the lack of adequate instrumentation. The percentage of completion is therefore still indicated as 30%. Very recent developments of such instrumentation in Karlsruhe, reported in the framework of the TESLA technology collaboration, promise to bridge the gap. Contact is therefore being made with the relevant Karlsruhe group.

Laser triggering

The new triggering laser has been delivered and is being commissioned. A support, allowing it to be easily and precisely positioned with respect to the arc cathode has been designed and is being manufactured. Activity continues with the INFN laser.

Sample production and characterization

The planar arc systems at present in operation are shown in Fig.1. The unfiltered system is mainly used for arc studies while, since there are indications that the quality of films obtained with magnetic filtering improves the film quality, samples are now mainly produced in the filtered apparatus.

As earlier reported, results obtained on both sapphire and copper small ($\approx$1 cm^2) samples appear to be in a good agreement with data for bulk Nb (T_c = 9.26 K, ΔT_c < 0.01 K). he Transition widths are narrow (0.01–0.02 K), proving that the deposited films are homogeneous. Results of X-ray diffraction and atomic force microscopy (AFM) investigations point to lower stresses and narrower widths of the diffraction peak compared to what observed on Nb-films sputtered on Cu-substrates and are consistent with the measured T_c. RF sample behaviour measurements were also made

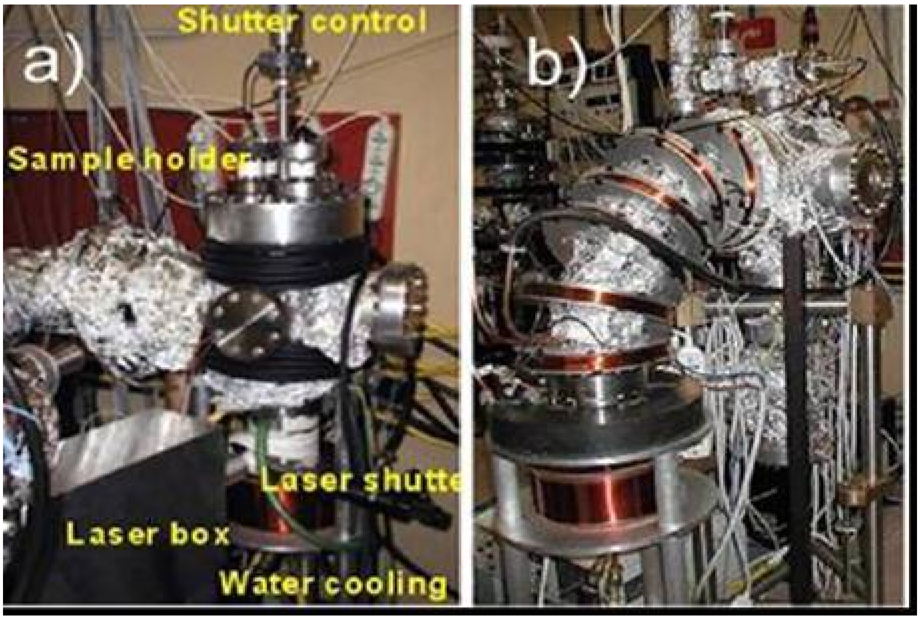


Fig.1. a) General view of the UHV unfiltered planar-arc device. b) Apparatus equipped with the elbow-shaped magnetic filtering system.

Low field measurements of the RF surface impedance Zs (T, H) were also carried out as a function of temperature, by collaborators of the Naples University „Federico II", using the dielectric resonant cavity technique. The 9.5mm diameter cylindrical cavity built from high purity (RRR > 500) Nb resonator operates at 20 GHz. Its resonant frequency and Q-factor are measured comparing the situation when pure bulk-Nb end caps are used with that when the caps are replaced by two of our samples. Results show again that bulk Nb and filtered films show the same behaviour to within the measurement errors. More small samples are in Naples waiting to be measured due to a hardware problem. A preliminary measurement of small samples on Cu was also carried out at lower frequency in Cornell, kindness of Prof. H. Padamsee, with similar results. The Cornell setup operates at lower frequency, is capable of higher fields and can accept much larger samples, which allows determining RF properties of the film, such as Q, more precisely. A number of large (≈10 cm ø) Cu samples have therefore been manufactured. The first four, SUBU cleaned at CERN, courtesy of S. Calatroni, were deposited and shipped to Cornell where they are being measured. One of them, before and after deposition, is shown in Fig.2; the groove is there due to RF requirements.

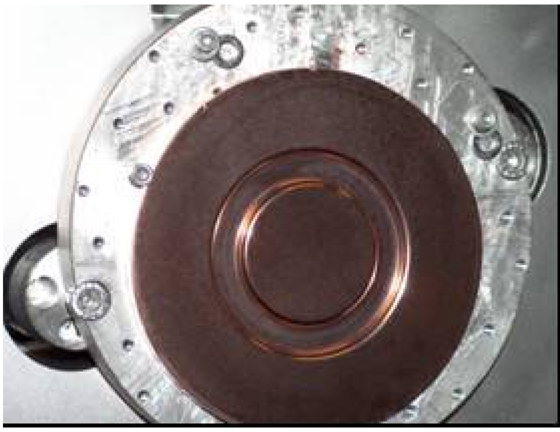
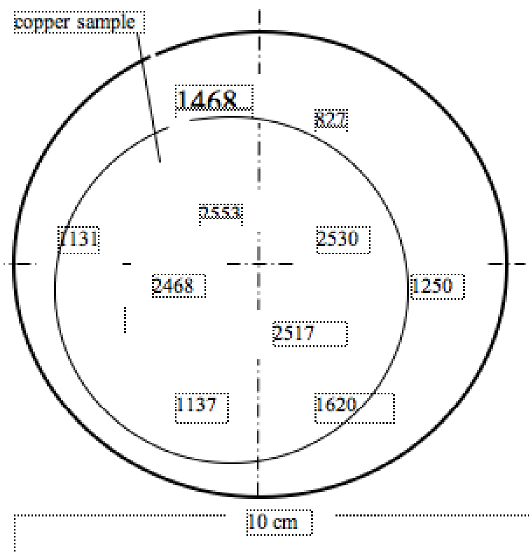


Fig.2a. Large Cu sample on its holder before deposition.

Fig.2b. Large Nb-coated Cu sample.

Deposition of such large samples in a magnetically filtered arc system required a study of the deposition rate as a function of position of and on the sample. This because in the filter elbow shaped chamber electric fields due to plasma currents make the plasma flow deviate from the chamber axis, the direction depending on the magnetic field polarity. An example of measured deposition rates on different parts of the sample are shown in Fig.2. Careful positioning of the sample (see Fig.3 (a)) and alternate magnetic fields are used to minimize the effect.



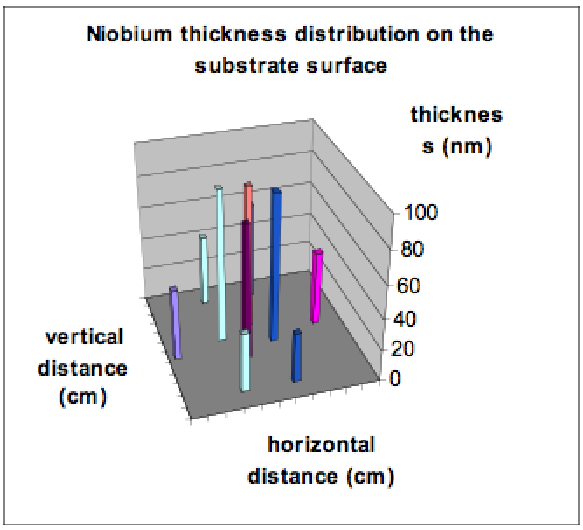
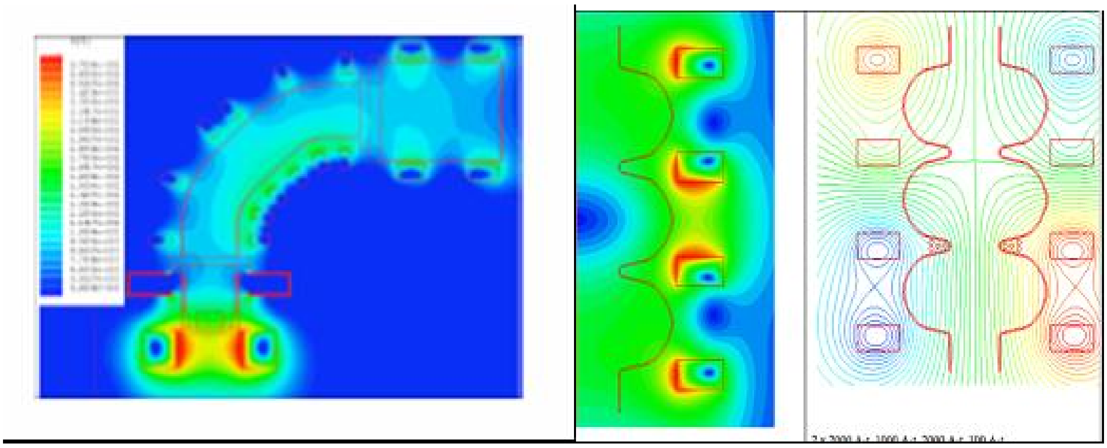


Fig.3 (a) Positioning of the sample on sample holder. (b) Nb thickness for given deposition time as a function of position.

The maximum ion current obtained on the present system is ≈0.3 A at a total arc current of ≈100 A. To improve this ratio and minimize the asymmetry problem new planar system filter configurations, both unfiltered and filtered, are being actively studied through collaboration with our Swierk colleagues. Examples of magnetic field computations in progress are shown in Fig.4.
Collaborations have been set-up with the Tor Vergata Chemistry department for further structural characterisations of the produced films and with ENEA to study details of the SC properties.

New setups
New setups and components have been or are being built.
- A new cooled flange, design is expected to reduce heating problems on our apparatus; the first prototype has been delivered and will be tested during the next month.
- New cathode assemblies and other spare chambers have been designed, ordered and delivered, to reduce turn-over times of the apparatus.



a) b)

Fig.4. Magnetic field configurations for filtered (a) and unfiltered (b) planar arc systems

- The design of a T-shaped filter chamber to be built for testing the new configuration performance has also been prepared and is shown in Fig.5

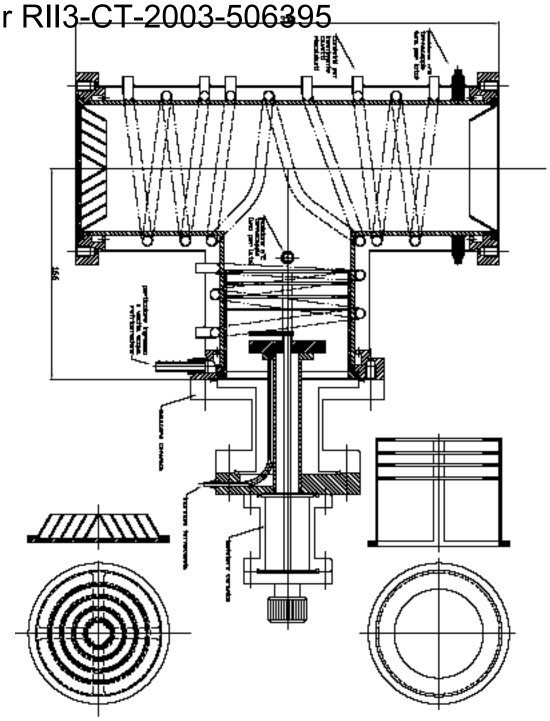


Fig.5. T-shaped magnetic filter chamber

A new unfiltered planar arc system, shown in Fig.6, is being assembled to start studying methods for best depositing TESLA single cells. A single-cell-like SS chamber carrying on the inside several sample holders at different positions will allow studying the distribution of film thickness.

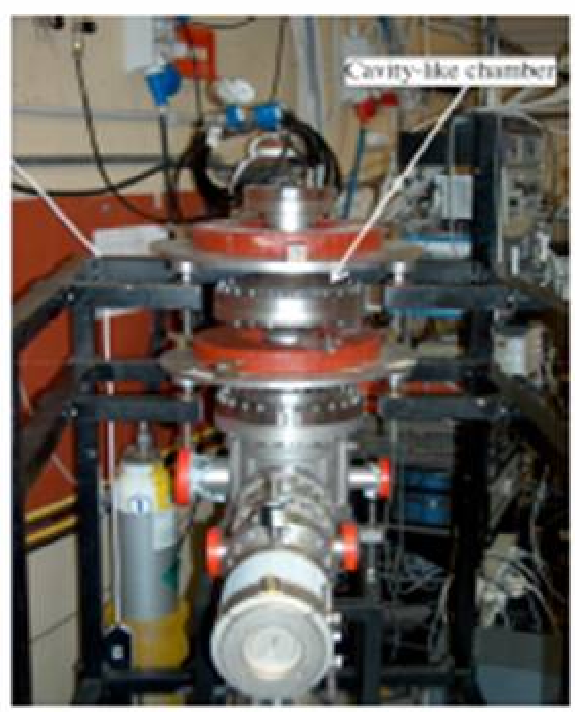


Fig.6. Unfiltered planar arc setup with TESLA-cell-like chamber.

- A second new system, equipped with a controlled-flow, pure nitrogen line, has been built, through additional INFN funding, to start studying deposition of NbN films and is in the commissioning phase. First samples have been produced and are being analyzed.

- A new arc power supply has been purchased, installed and commissioned--

- An electronic logbook, accessible to all work package collaborators, has been set up to acquire and store data and information in general on a day-to-day basis.

Publications

J. Langner, M.J. Sadowski and S. Tazzari, „Research activities within a frame of the CARE-JRA1-WP4 Thin Film Cavity Production work-package", Elektronika **46,** N. 2/3, 76-77 (2005)

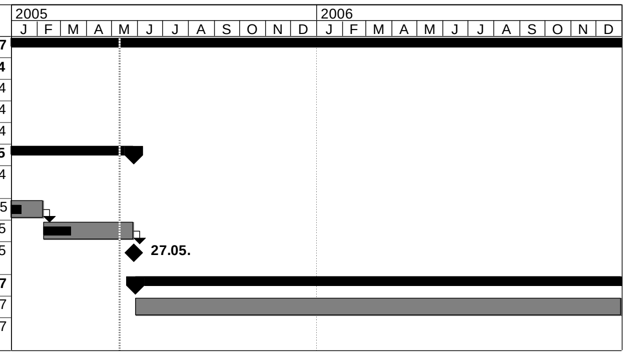
Costs

The following are the items we have ordered during this first quarter and their cost. Not all has of course been paid-out. Exact figures should be supplied by INFN administration.

Supplier	description	cost	quot. Date
Tecnicom	semicella	1950,00	1-10-2004
Tecnicom	10 dischi rame	800,00	1-10-2004
Italfit magneti	gaussmetro	1200	19/1/2005
pfeiffer	filamento X2	1196	21/2/2005
Tecnicom	dischi rame	1000	24/2/2005
Tecnicom	pulizia anodi	150	24/2/2005
rial	parti vuoto	337,6	25/2/2005
Tecnicom	flangia raffreddata	745	3-01-2005
Varian	gasket	300	3-10-2005
Tecnicom	pul.meccanica	250	21/3/2005
Tecnicom	catodo W	500	21/3/2005
db	rotaia	297	29/3/2005
rial	T cf100	540	4-04-2005
Tecnicom	anodo	1500	19/4/2005
TOT		10765,60	

Update of MS-Project

N°	Task Name	Anfang	Ende
4.2	**Planar-arc cathode coating**	**Do 01.01.04**	**Sa 30.06.07**
4.2.1	**Modification of a planar-arc & trigger syste**	**Do 01.01.04**	**Fr 03.09.04**
4.2.1.1	Modification	Do 01.01.04	Fr 16.04.04
4.2.1.2	Optimization of the laser triggering system	Mo 19.04.04	Fr 03.09.04
4.2.1.3	**Planar arc system fully tested**	Fr 03.09.04	Fr 03.09.04
4.2.2	**Routine Operation of planar arc system**	**Mo 06.09.04**	**Fr 27.05.05**
4.2.2.1	Characterization of samples coated at different conditions	Mo 06.09.04	Fr 03.12.04
4.2.2.2	Characterization of Nb-coated sapphire	Mo 06.12.04	Di 08.02.05
4.2.2.3	Characterization of Nb-coated copper sa	Mi 09.02.05	Fr 27.05.05
4.2.2.4	**Summary report on quality of planar arc coating**	Fr 27.05.05	Fr 27.05.05
4.2.3	**Studies of other HTC superconducting coat**	**Mo 30.05.05**	**Sa 30.06.07**
4.2.3.1	Study of superconducting properties	Mo 30.05.05	Sa 30.06.07
4.2.3.2	**Report on quality of superconducting properties**	Sa 30.06.07	Sa 30.06.07

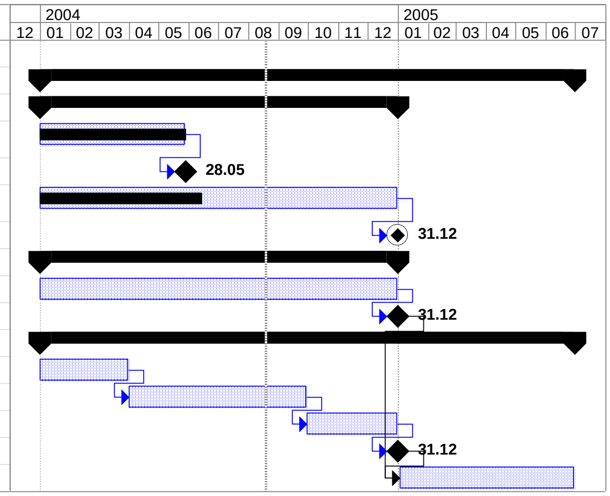


Work package 5: Surface Preparation

Task 5.1 EP on single cells

1.) Status of activities

N°	Task Name
5	**WP5 SURFACE PREPARATION**
5.1	**EP on single cells**
5.1.1	**EP on samples**
5.1.1.1	Establishing method of surface characterization (roughness, reflectometry)
5.1.1.2	**Surface characterization fixed**
5.1.1.3	Series of EP with samples for surface investigations
5.1.1.4	**Best EP parameters**
5.1.2	**Single cell cavities**
5.1.2.1	Order Nb and fabricate 3 cavities
5.1.2.2	**3 cavities fabricated**
5.1.3	**EP chemistry on single cells**
5.1.3.1	Design of EP set-up
5.1.3.2	Fabrication of EP set-up
5.1.3.3	Commissioning of EP set up
5.1.3.4	**First operation of EP set up**
5.1.3.5	Operation of EP set-up



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 has delayed this task for ~ 4 months, but should give rise to a lot of new interesting results.
Task **5.1.1.4**: **started**; results waited within the next 3 months

5.1.2 Completed

5.1.3 Build EP chemistry for single cell cavities
5.1.3.1 Completed, except for the study of the condenser for HF gas (former study failed)
5.1.3.2 Underway, reconstruction of lab hoods has been completed, most ordered parts have arrived, acquisition system has been studied and developed. Mounting of parts is underway.
Security procedures inside the lab have been revised and must be accepted by the authority concerned. Authorization is waited before June 2005.
Still missing: completion of the whole connections (tubing, valves…), design and fabrication of the condenser, wiring of the gas sensor (nitrogen) for security
5.1.3.3, 5.1.3.4 and 5.1.3.5 will be delayed: second half of 2005.

2.) Status of milestones / deliverables in this quarter

All these milestones are ~ 6 months delayed.

3.) Financial report

K €	Spent money	Value of new orders/ contracts	Expected spending of new orders/contracts until end 2004	Sum of column 2 & 4
Travel	*754*			*754*
Consumables* component part for EP bench, acid mixtures,	*19 575*	*52 537*	*30 545*	*50 120*
Manpower *temporary*	*5 555*	*75 000*	*11 110***	*16 666***
permanent	*93 000***		*24 000***	*117 000***
Durable				
			Total sum	*~185 000*

** includes component parts for EP bench, acid mixtures, and indemnity for the visiting candidates (engineer position)*
*** Estimation*

4.) Publications and meetings

TTF-meetings

Task 5.2 EP on multi-cells

1.) Status of activities

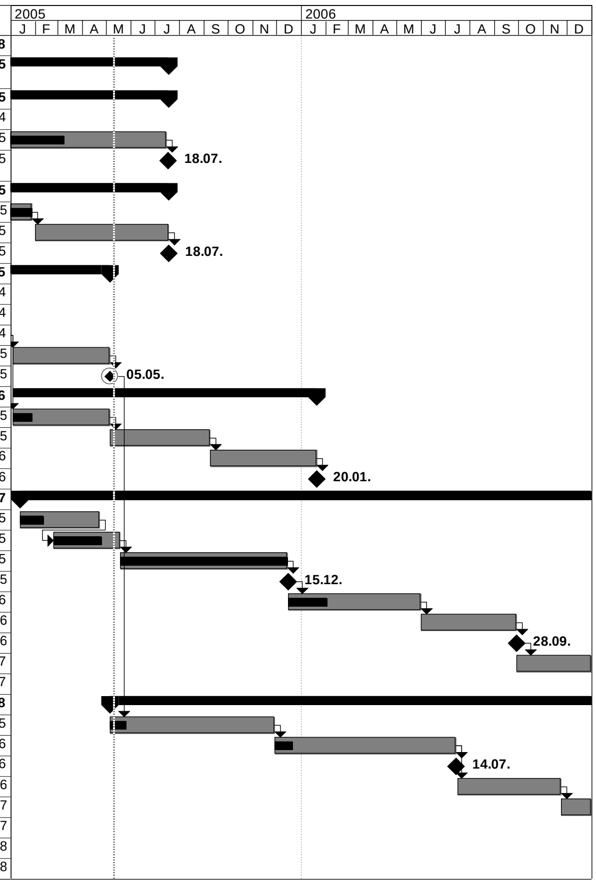
5.2	EP on multi-cells	
5.2.1	Transfer of parameters from 1 cell to multi cell equipment	
5.2.1.1	Finish EP setup nine-cells at DESY	Set up finished long term experiences on system live time under way
5.2.1.1.1	Improved gas cleaning system	Installed and in use since summer 04
5.2.1.1.2	Design for hot water rinsing	Basic calculations done experiments with 9cell system to expensive and risky stoped !
5.2.1.1.3	Proof-of-Principle experiment hot water rinsing	Discussions under way to test with single cells at Industry (set up available)

5.2.1.2	Optimize electrode shape	
5.2.1.2.1	Develop computer model / Evaluate software	Soft ware found and benchmarked
5.2.1.2.2	Design improved electrode	
5.2.1.2.3	Electrode design fixed	
5.2.1.3	Fix process parameters/ Quality control	Parameters fixed in the range possible with the existing set up, Improvements for more stable parameter steering under way (heat exchanger / HF content)
5.2.1.3.1	Setup chemical lab	Done. Laboratory experiments continuously running
5.2.1.3.2	Bath aging	Basic Experiments nearly finished
5.2.1.3.3	Bath mixture	Experiments under preparation
5.2.1.3.4	Alternative (salt) mixtures	No respond from the experiments done
5.2.1.3.5	Process parameters fixed	
5.2.2	Laser roughness	
5.2.2.1	Evaluate existing systems	System ordered at the university of Wuppertal, according to the experiences qualification and specifications can be done
5.2.2.2	Specify laser system	
5.2.2.3	Built laser system	
5.2.2.4	Roughness measurement finished	
5.2.3	Oxipolishing as final chemical cleaning	Actually no straight forward change / extension of existing infrastructure possible. Basic lay out combination of ep and OP under way
5.2.3.1	Laboratory studies	Experimental set ups under construction
5.2.3.2	Design of OP system	
5.2.3.3	Setup one-cell system	
5.2.3.4	Proof-of-Principle experiment Oxipolishing	
5.2.3.5	Design OP for nine-cells	
5.2.3.6	Build OP for 9-cells	
5.2.3.7	OP for 9-cells ready	
5.2.3.8	Study op with 9-cell cavities	
5.2.3.9	Evaluate experiments	
5.2.4	Transfer Electropolishing technology to industry	
5.2.4.1	Qualify industry with one-cells	
5.2.4.2	Industrial design study on setup for multi-cells	Preparation for industrial study started
5.2.4.3	Report on industrial design	

5.2.4.4	Fabricate EP multi-cell industrial prototype	
5.2.4.5	Commission EP multi-cell industrial prototype	
5.2.4.6	EP multi-cell industrial prototype ready	
5.2.4.7	Operate EP multi-cell industrial prototype	
5.2.4.8	Final report on industrial EP	

2.) Update of MS-Project

N°	Task Name	Anfang	Ende
5.2	**EP on multi-cells**	**Do 01.01.04**	**Di 08.04.08**
5.2.1	**Transfer of parameters from 1 cell to multi cell equipment**	**Do 01.01.04**	**Mo 18.07.05**
5.2.1.1	**Finish EP setup nine-cells at DESY**	**Do 01.01.04**	**Mo 18.07.05**
5.2.1.1.1	Improved gas cleaning system	Do 01.01.04	Mi 05.05.04
5.2.1.1.2	Design for hot water rinsing	Do 06.05.04	Fr 15.07.05
5.2.1.1.3	**Proof-of-Principle experiment hot water rinsing**	Mo 18.07.05	Mo 18.07.05
5.2.1.2	**Optimize electrode shape**	**Fr 10.09.04**	**Mo 18.07.05**
5.2.1.2.1	Develop computer model / Evaluate softv	Fr 10.09.04	Do 27.01.05
5.2.1.2.2	Design improved electrode	Di 01.02.05	Mo 18.07.05
5.2.1.2.3	**Electrode design fixed**	Mo 18.07.05	Mo 18.07.05
5.2.1.3	**Fix process parameters/ Quality contro**	**Do 01.01.04**	**Do 05.05.05**
5.2.1.3.1	Setup chemical lab	Do 01.01.04	Mi 24.03.04
5.2.1.3.2	Bath aging	Do 25.03.04	Mi 16.06.04
5.2.1.3.3	Bath mixture	Do 25.03.04	Mi 08.09.04
5.2.1.3.4	Alternative (salt) mixtures	Di 04.01.05	Do 05.05.05
5.2.1.3.5	**Process parameters fixed**	Do 05.05.05	Do 05.05.05
5.2.2	**Laser roughness**	**Di 04.01.05**	**Fr 20.01.06**
5.2.2.1	Evaluate existing systems	Di 04.01.05	Do 05.05.05
5.2.2.2	Specify laser system	Fr 06.05.05	Do 08.09.05
5.2.2.3	Built laser system	Fr 09.09.05	Fr 20.01.06
5.2.2.4	**Roughness measurement finished**	Fr 20.01.06	Fr 20.01.06
5.2.3	**Oxipolishing as final chemical cleaning**	**Do 13.01.05**	**Mi 04.04.07**
5.2.3.1	Laboratory studies	Do 13.01.05	Fr 22.04.05
5.2.3.2	Design of OP system	Do 24.02.05	Mi 18.05.05
5.2.3.3	Setup one-cell system	Do 19.05.05	Mi 14.12.05
5.2.3.4	**Proof-of-Principle experiment Oxipolisl**	Do 15.12.05	Do 15.12.05
5.2.3.5	Design OP for nine-cells	Fr 16.12.05	Mi 31.05.06
5.2.3.6	Build OP for 9-cells	Do 01.06.06	Do 28.09.06
5.2.3.7	**OP for 9-cells ready**	Do 28.09.06	Do 28.09.06
5.2.3.8	Study op with 9-cell cavities	Fr 29.09.06	Mi 04.04.07
5.2.3.9	Evaluate experiments	Mi 04.04.07	Mi 04.04.07
5.2.4	**Transfer Electropolishing technology to ind**	**Fr 06.05.05**	**Di 08.04.08**
5.2.4.1	Qualify industry with one-cells	Fr 06.05.05	Mo 28.11.05
5.2.4.2	Industrial design study on setup for multi-cel	Di 29.11.05	Fr 14.07.06
5.2.4.3	**Report on industrial design**	Fr 14.07.06	Fr 14.07.06
5.2.4.4	Fabricate EP multi-cell industrial prototype	Mo 17.07.06	Do 23.11.06
5.2.4.5	Commission EP multi-cell industrial prototype	Fr 24.11.06	Do 15.03.07
5.2.4.6	**EP multi-cell industrial prototype ready**	Do 15.03.07	Do 15.03.07
5.2.4.7	Operate EP multi-cell industrial prototype	Fr 16.03.07	Di 08.04.08
5.2.4.8	**Final report on industrial EP**	Di 08.04.08	Di 08.04.08



Task 5.3: Automated Electro-Polishing

1 Status of activities

The automated program has been mostly completed in its architecture. Just a few details (e.g. the form in which to save data, the automation reset procedure, the position of the vertical bar that indicates the working point, etc.) still need to be added, but this will be done while commissioning the work. The philosophy is the following:

- The I-V characteristic is firstly recorded and screened (fig. 1). The time passing from one point acquisition to another is adjustable and normally it is one of the parameters that mostly influence the final finishing of the electropolished surface.
- The I-V curve is recorded and screened several times up to the moment in which it seems to be stabilized.
- At that point, it is applied the procedure for the I-V curve plateau according to the flow chart of fig. 2
- The working point is recognized as the minimum of the first derivative of the I-V curve. The process is voltage controlled, by a dynamical search of the a.m. minimum

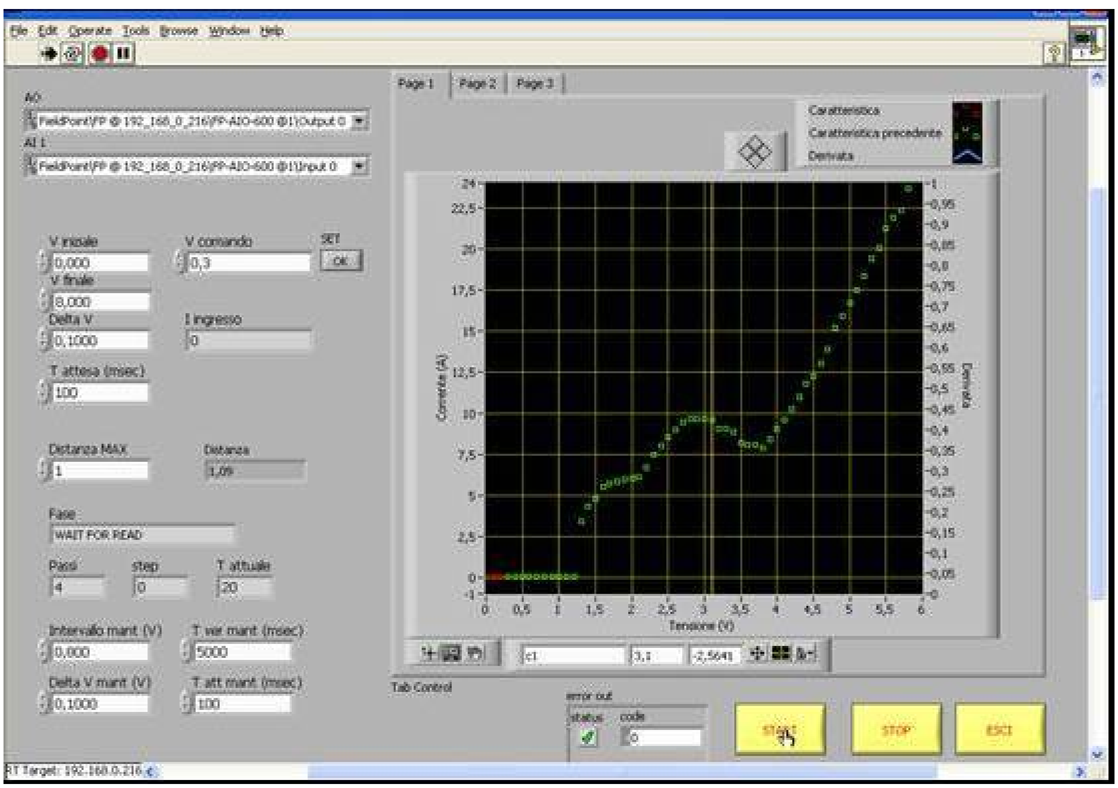


Fig.1: The screen displays the Electro-Polishing polarization curve while acquiring couples of Current-Voltage points. The curve refers to the Cu Electropolishing in H_3PO_4

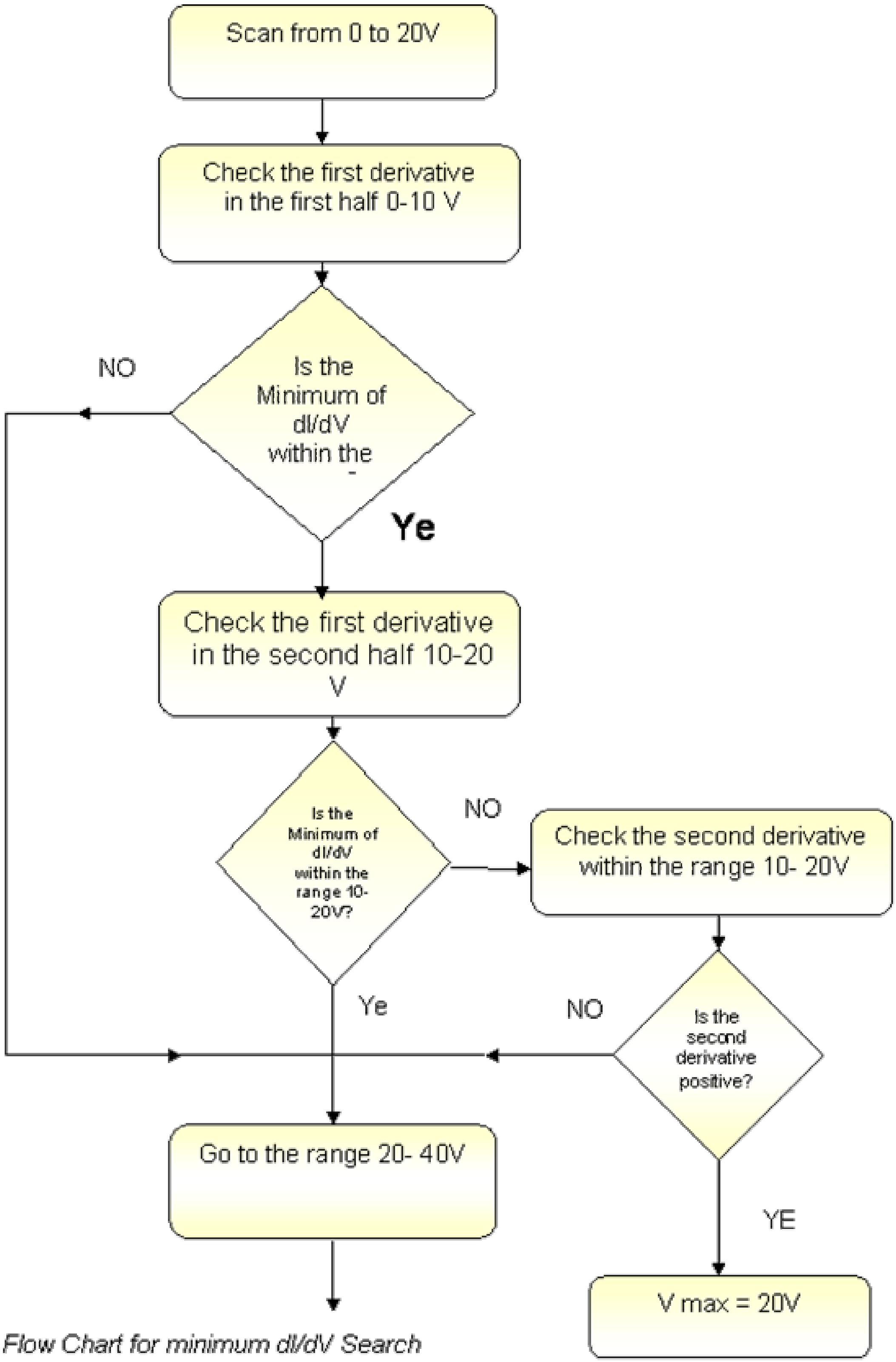


Fig.2: Flow Chart for minimum dI/dV Search

The minimum in the first derivative of the I-V polarization curve corresponds to the minimum in the differential conductance, which corresponds, in other words, to the maximum resistance of the viscous layer grown during the electropolishing. The automation program has been successfully tested onto Copper and it is still under study for the electropolishing of the niobium, whose I-V Characteristics is displayed in fig. 3 with its peculiar oscillations due to the forming and breaking of the oxide growing onto the Niobium surface while electropolishing. Just due to the oscillations in the Nb case, the automatic recognizing of the Working point is more difficult

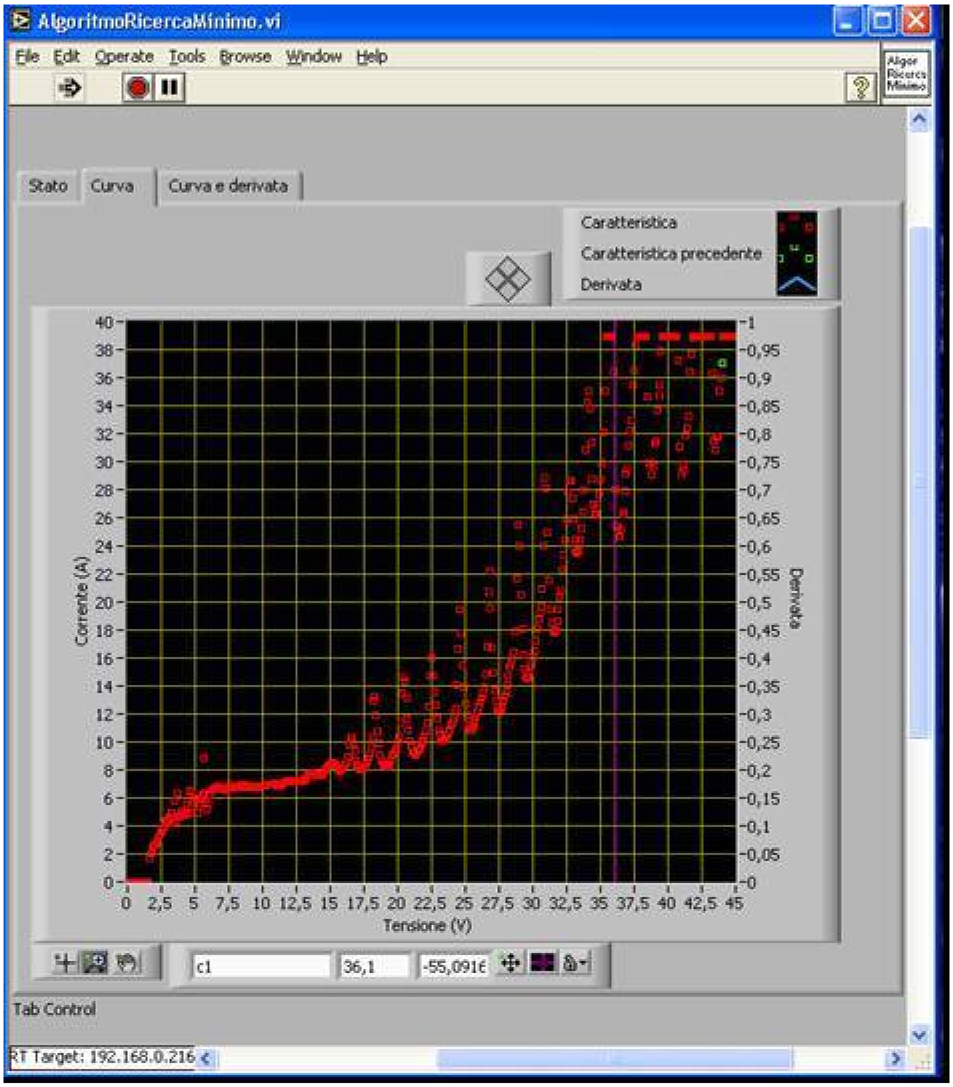


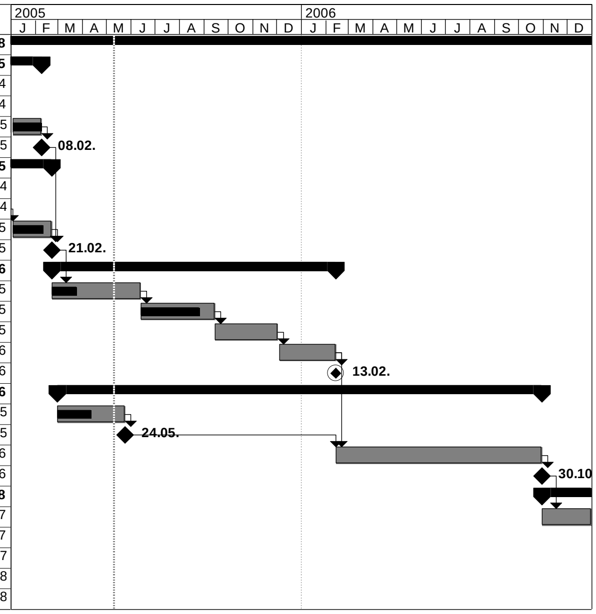
Fig.3: Electro-Polishing polarization curve while acquiring couples of Current-Voltage points. The curve refers to the Electropolishing of Copper in orto-phosphoric acid.

2. Status of milestones

The automated EP process has been fully installed and the starting of operating procedure proceeds according the schedule, with milestones fully respected.

3. Update of MS-Project

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



Task 5.4 Dry-Ice Cleaning

1.) Status of activities

Commissioning started successfully with a first operation of the CO_2 – and N_2 – system. The new CO_2 cooler/purifier unit operated as expected and a stable dry-ice jet was achieved.

Nevertheless the Milestone "Installation finished" is delayed. Main reason is a man-power problem for the complex control system. Though substantial progress is made the important interlock system is not completed yet. Also the programming of the motion control is not finished. It is expected to finish both mid to end of May 2005.

Fig. New CO_2- cooler/purifier unit (left) and horizontal spraying cane assembled on the linear drive (right)

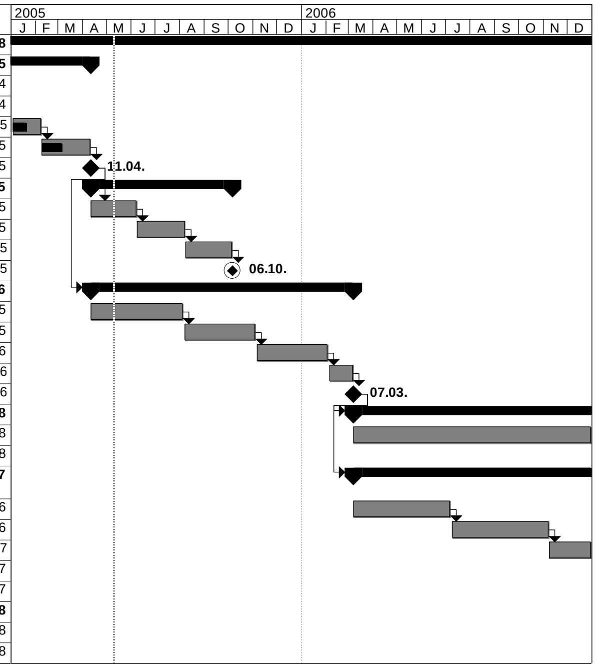
List of talks of JRA1 members

Subject	Speaker/Lab	Event	Date
New Instrumentation for Surface Roughness and Contamination Control of Nb samples	G. Müller / Uni Wuppertal	TESLA Technology Collaboration Meeting	31.3.2005
EP Installation at Saclay: Next Steps	F. Eozenou / CEA Saclay	“	“
EP at DESY	N. Steinhau-Kühl	“	“
Cavity Preparation at TTF	L. Lilje	“	“

Web site:
https://ilcsupport.desy.de/cdsagenda/fullAgenda.php?ida=a053&stylesheet=standard&dl=&dd=

2.) Update of MS-Project

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



Work package 6: Material Analysis

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

1.) Status of activities

A system for non-destructive inspection of niobium sheets, based on eddy current principle is in construction. To receive the necessary detection sensitivity a SQUID sensor for measuring the local eddy current density is used.

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

As the Fig.1 shows that the main components of the SQUID scanner are assembled. 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. The amount of compensation current necessary to keep the SQUID's flux constant is then taken as measurement value from the control loop. This signal is then processed by a lock in amplifier to eliminate noise with a spectral density apart from the excitation frequency. Different filters are implemented into the lock in amplifier to improve the Signal/Noise ratio. The system works in a non-shielded environment.
It is planned that the SQUID system will be completed and testing of function will be finished end of June 2005.

2.) Status of milestones / deliverables in this quarter

No milestones foreseen for the first quarter of 2005

3.) Financial report

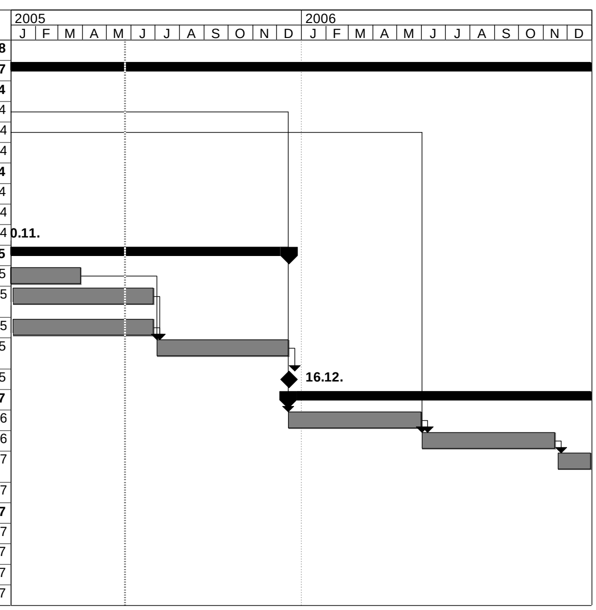
K €	Spent money	Value of new orders/ contracts	Expected spending of new orders/contracts until end 2005	Sum of column 2 & 4
Travel				
Consumables			*27650*	*27650*
Manpower	*4260*			
Durable				
			Total sum	

4.) Publications and meetings

Squid Scanner was presented on 19. Control. Internationale Fachmesse für Qualitätssicherung, 25.April - 29.April 2005, Sinsheim, Deutschland

5.) Update of MS-Project

N°	Task Name	Anfang	Ende
6	**WP6 MATERIAL ANALYSIS**	**Do 01.01.04**	**Mi 11.06.08**
6.1	**SQUID scanning**	**Do 01.01.04**	**Mo 31.12.07**
6.1.1	**Produce calibration defects**	**Do 01.01.04**	**Do 12.08.04**
6.1.1.1	Production of surface defects	Do 01.01.04	Fr 18.06.04
6.1.1.2	Production of bulk defects	Do 12.02.04	Do 12.08.04
6.1.1.3	**Calibration defects finished**	Do 12.08.04	Do 12.08.04
6.1.2	**Design components of Squid scanner**	**Do 01.01.04**	**Di 30.11.04**
6.1.2.1	Design of the scanning table and support	Do 01.01.04	Mi 30.06.04
6.1.2.2	Design of the SQUID cooling system	Mi 28.01.04	Di 30.11.04
6.1.2.3	**Design Scanner finished**	Di 30.11.04	Di 30.11.04
6.1.3	**Construction of scanning apparatus**	**Mi 01.12.04**	**Fr 16.12.05**
6.1.3.1	Fabrication of the SQUID	Mi 01.12.04	Mi 30.03.05
6.1.3.2	Fabrication and purchase of components for SQUID apparatus	Mi 01.12.04	Do 30.06.05
6.1.3.3	Software for the SQUID scanner	Mi 01.12.04	Do 30.06.05
6.1.3.4	Commissioning and calibration of scanning apparatus	Mo 04.07.05	Fr 16.12.05
6.1.3.5	**Scanning apparatus operational**	Fr 16.12.05	Fr 16.12.05
6.1.4	**Scanning of sheets with artificial defects**	**Fr 16.12.05**	**Do 08.02.07**
6.1.4.1	Scanning of sheets with artificial surface de	Fr 16.12.05	Do 01.06.06
6.1.4.2	Scanning of sheets with artificial bulk defect	Fr 02.06.06	Do 16.11.06
6.1.4.3	Development of algorithm for material defects classification	Mo 20.11.06	Do 08.02.07
6.1.4.4	**Classification of defects finished**	Do 08.02.07	Do 08.02.07
6.1.5	**Scanning of production sheets**	**Mo 12.02.07**	**Mo 31.12.07**
6.1.5.1	Scanning of sheets of different producers	Mo 12.02.07	Do 20.09.07
6.1.5.2	Identification of defects by (EDX, SURFA etc	Mo 02.04.07	Fr 28.09.07
6.1.5.3	Conclusive comparison with eddy current da	Fr 21.09.07	Mo 31.12.07
6.1.5.4	**Final report on SQUID scanning**	Mo 31.12.07	Mo 31.12.07



Task 6.2: Flux gate magnetometry

1.) **Status of activities**

The flux gate scanning apparatus has been designed and built, so that it can perform:

i) A tomography of the electrolytic cell, in order to configure the effect of cathode geometry on Electropolishing,
ii) The distinction of Niobium with different RRR by relative measurements of conductivity by detecting the eddy current decay.

Referring to tomography of the electrolytic cells, we have fabricated a few elementary rectangular cells for the procedure calibration and several shaped electrolytic cell having the possibility to test different cathode shapes.

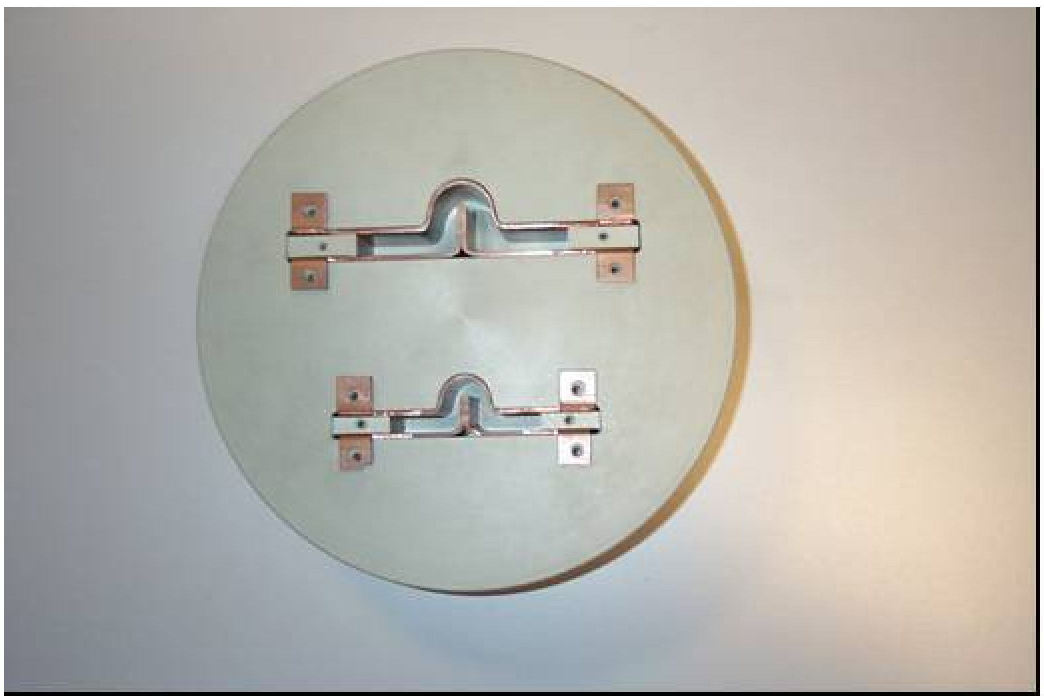


Fig. 1 The cavity shaped electrolytic cells with a cathode that totally enters into the cell.

Due to the large dimensions (around 5-6 mm diameter) of the flux gate, the quality of the tomography done up to now is not excellent. We have then bought fluxgates of much more reduced dimensions, which are at the moment under test.

In the meanwhile, is it ready for testing the inversion program that extracts the current distribution from the magnetic field inverting the three-dimensional Biot –Savart law.

Referring to the problem of detecting the defects onto
Niobium slabs, we have also designed the experiment to monitor two different kind of defected samples:

- Physical defects like surface scratches and foreign particle embedded onto Niobium
- Samples with degraded RRR to distinguish from samples with RRR 300.

Fig. 2 The scanning flux gate apparatus.

2.) Status of the milestones

For this WP the milestones have been respected. The apparatus has been correctly designed and it is working. As correctly indicated in the plan, more time will be needed for a complete investigation.

3.) Status of money spending, not mandatory but information is appreciated.

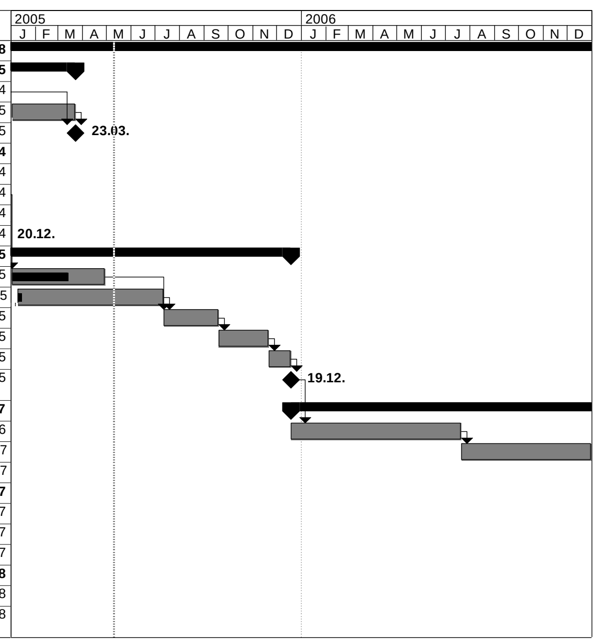
Total for

- **Work Package 3; Task 3.1**
- **Work Package 5; Task 5.3**
- **Work Package 6; Task 6.2**

	Spent money	**Value of new orders/ contracts**	**Expected spending of new orders/contracts until end 2004**	**Sum of column 2 & 4**
Travel	-	-	-	-
Consumables	-	-	-	-
Manpower	*24,381.54*	-	-	*24,381.54*
Durable	-	-	-	-
			Total sum	*24,381.54*

4.) Update MS-Project

N°	Task Name	Anfang	Ende
6.2	**Flux gate magnetometry**	**Do 01.01.04**	**Mi 11.06.08**
6.2.1	**Produce calibration defects**	**Do 01.01.04**	**Mi 23.03.05**
6.2.1.1	Production of surface defects	Do 01.01.04	Fr 07.05.04
6.2.1.2	Production of bulk defects	Do 01.01.04	Mi 23.03.05
6.2.1.3	**Calibration defects finished**	Mi 23.03.05	Mi 23.03.05
6.2.2	**Design components of flux gate head**	**Do 01.01.04**	**Mo 20.12.04**
6.2.2.1	Design electronics	Do 01.01.04	Fr 16.04.04
6.2.2.2	Design of flux gate head	Mo 02.08.04	Fr 17.12.04
6.2.2.3	Design of operations software	Do 01.01.04	Fr 04.06.04
6.2.2.4	**Design flux gate head finished**	Mo 20.12.04	Mo 20.12.04
6.2.3	**Fabrication of flux gate detector**	**Mo 21.06.04**	**Mo 19.12.05**
6.2.3.1	Fabrication of flux gate head	Mo 03.01.05	Fr 29.04.05
6.2.3.2	Fabrication of mechanics	Mo 21.06.04	Di 12.07.05
6.2.3.3	Implementation of software	Di 12.07.05	Mo 19.09.05
6.2.3.4	Commissioning of flux gate detector	Mo 19.09.05	Mo 21.11.05
6.2.3.5	Calibration of flux gate detector	Mo 21.11.05	Mo 19.12.05
6.2.3.6	**Flux gate detector operational**	Mo 19.12.05	Mo 19.12.05
6.2.4	**Commissioning of flux gate detector**	**Mo 19.12.05**	**Do 04.01.07**
6.2.4.1	Operational tets tests	Mo 19.12.05	Fr 21.07.06
6.2.4.2	Evaluation of test results	Fr 21.07.06	Do 04.01.07
6.2.4.3	**Flux gate scanner commissioned**	Do 04.01.07	Do 04.01.07
6.2.5	**Operation of flux gate detector**	**Do 04.01.07**	**Mo 17.09.07**
6.2.5.1	Regular operation	Do 04.01.07	Mi 06.06.07
6.2.5.2	Report of operation	Mi 06.06.07	Mo 17.09.07
6.2.5.3	**Conclusion of flux gate scanning opera**	Mo 17.09.07	Mo 17.09.07
6.2.6	**Comparison with SQUID scanner**	**Mo 17.09.07**	**Mi 11.06.08**
6.2.6.1	Compare measurements	Mo 17.09.07	Mi 11.06.08
6.2.6.2	**Conclude SQUID scanner vs. flux gate detector**	Mi 11.06.08	Mi 11.06.08



Task 6.3: DC field emission scanning

1.) **Status of activities**

I Status of activities

The automated field emission scanning measurements, programmed in LabVIEW, have been started successfully in the beginning of the year 2005 at University of Wuppertal. Besides FE current and regulated voltage scans, the LabVIEW programming has also been completed for local measurements.

Measurements on the two electro polished (EP) Nb samples (#10, # 11) from DESY showed that the sample surface has the concave curvature with the height difference > 100 µm. Therefore the scanning at fixed distance (< 100 µm) on these samples in FESM was not possible. To solve this problem some modifications in the sample design have been proposed and are under construction at DESY.

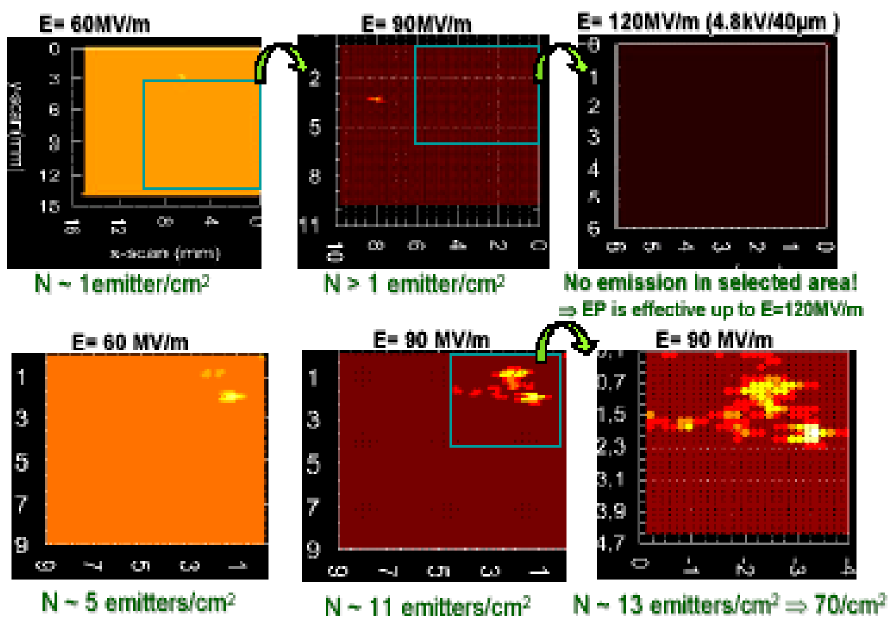


Fig.1 Regulated V-scans on EP-Nb sample (SEP1). The scans were done with an anode of 300 µm diameter and at a fixed distance (Δz) of 50 µm (± 5 µm) from the sample surface. The scans were started on (1.5 x 1.5) mm² area at the field level of 60 MV/m. For higher field level scans, smaller areas were chosen inside previously scanned area.

First regulated voltage scans were done on the Nb sample electropolished at Saclay (SEP1). As shown in fig1, in one of the scanned areas, no emitters were observed till 120MV/m, showing that EP might be effective for this field level. On the other hand, in a different scanned area, high emitter density of 70 cm^{-2} was observed at the field of 90 MV/m. Improved performance is expected after high pressure rinsing (HPR).
Next measurements were done on the Cu sample (DCu1), requested by K. Flotmann to investigate the surface quality of the rf gun cavity. Fig 2 and fig3 show the regulated voltage scans and the local measurements respectively. Obviously Cu surface preparation needs to be improved for the surface fields above 60 MV/m.

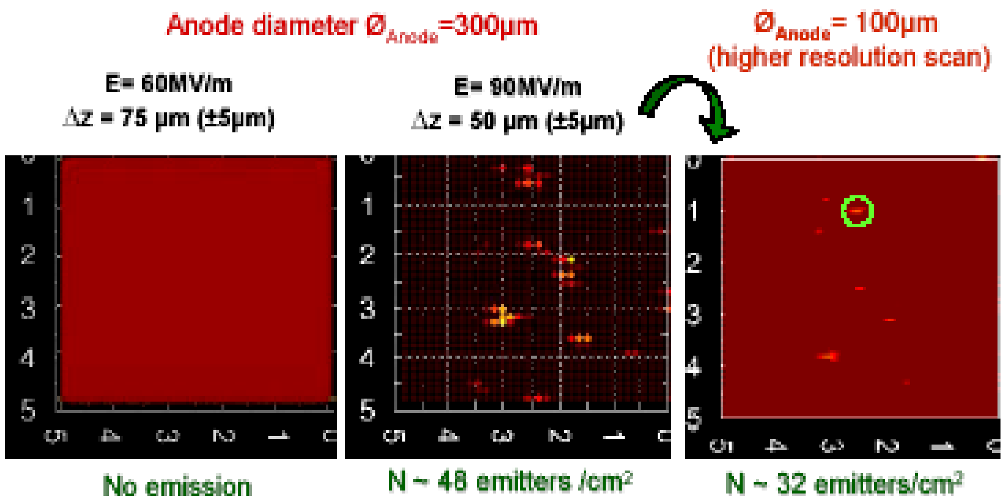


Fig 2. Regulated voltage scans on Cu sample (DCu1) from DESY, show emitter density of 32 cm^{-2} at 60MV/m. The circled emitter is chosen for the local measurements.

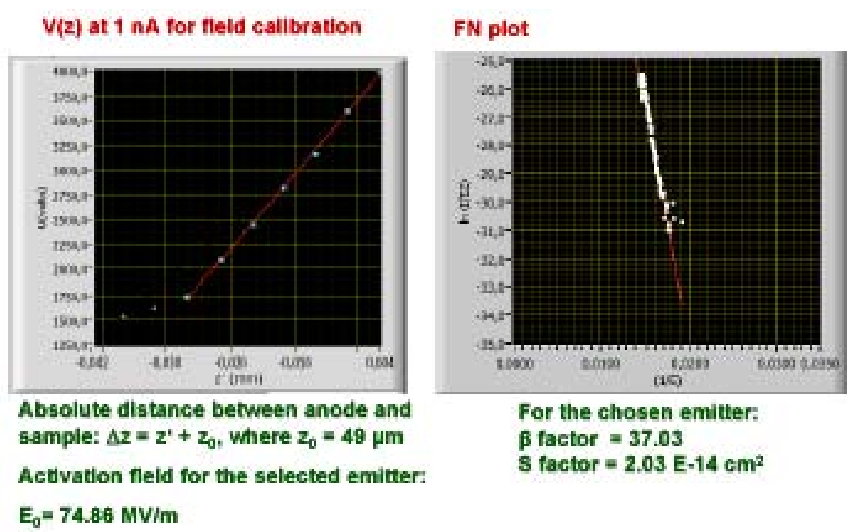
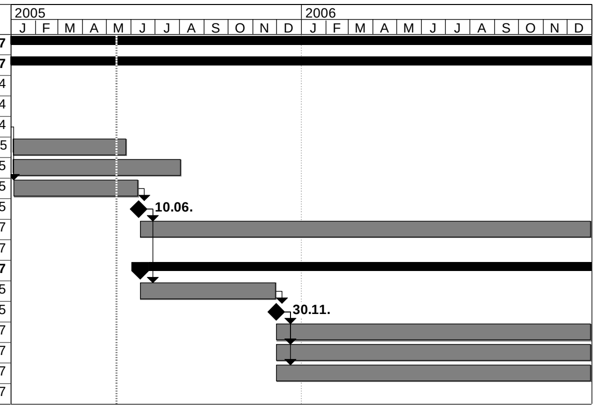


Fig 3. Local measurements on a strong emitter of DCu1, showing the activation field of the emitter equal to 74.86 MV/m and β factor of 37.

Further measurements will be focused on the sample SEP2 from Saclay and new electro polished samples from DESY.

2.) Update of MS-Project

N°	Task Name	Anfang	Ende
6.3	**DC field emission studies of Nb samples**	**Do 01.01.04**	**Mi 26.12.07**
6.3.1	**Quality control scans**	**Do 01.01.04**	**Mi 26.12.07**
6.3.1.1	Modification of Scanning apparatus	Do 01.01.04	Fr 02.04.04
6.3.1.2	Calibration of Scanning apparatus	Mo 05.04.04	Fr 04.06.04
6.3.1.3	**Start scanning activity**	Fr 04.06.04	Fr 04.06.04
6.3.1.4	BCP and HPR samples	Mo 07.06.04	Do 26.05.05
6.3.1.5	EP and HPR samples	Fr 10.09.04	Mi 03.08.05
6.3.1.6	BCP/EP and DIC samples	Mi 05.01.05	Fr 10.06.05
6.3.1.7	**First report on BCP/EP and DIC surface**	Fr 10.06.05	Fr 10.06.05
6.3.1.8	Continue QA scanning	Mo 13.06.05	Mi 26.12.07
6.3.1.9	**Evaluation of scanning results**	Mi 26.12.07	Mi 26.12.07
6.3.2	**Detailed measurements on strong emitters**	**Mo 13.06.05**	**Mi 26.12.07**
6.3.2.1	Calibrate apparatus for high current	Mo 13.06.05	Mi 30.11.05
6.3.2.2	**Start strong emitter evaluation**	Mi 30.11.05	Mi 30.11.05
6.3.2.3	I/V curves and current limits	Do 01.12.05	Mi 26.12.07
6.3.2.4	SEM and AES	Do 01.12.05	Mi 26.12.07
6.3.2.5	Influence of heat treatment and ion impact	Do 01.12.05	Mi 26.12.07
6.3.2.6	**Evaluate strong emitter investigations**	Mi 26.12.07	Mi 26.12.07



Work package 7: Couplers

1.) Status of the activity:

Task 7.1: New prototype coupler
Task 7.2: Fabrication of TiN coating system

- 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. 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. The mechanical conceptions are complete (see first annual report of JRA1).

For the TTF5 couplers, the call for tender is finished and ACCEL GmbH has the contract to build 4 of theses couplers. The contract has been notified to ACCEL end of March 2005. The delivery of the couplers is expected one year later.

For the TW60 couplers, a call for tenders is open and will be closed in mid May 2005.

In addition to these proto-types, we have purchased two couplers from industry (CPI) which, from a radio-frequency point of view, are of the type TTF-III currently used on the TESLA Test Facility. The two new couplers are manufactured, however, in a different way as certain TIG and/or electron-beam welds are replaced by brazing operations. These prototypes will allow us to perform conditioning studies (task 7.3) in 2005, ahead of the original schedule.

Task 7.2 should normally begin in January of 2005 however we have already begun to perform some bibliographic research on coating benches. A preliminary technical specification of the bench we wish to build is given in an internal note (Conception et fabrication d'un banc de dépôt de nitrure de titane pour traitement de surfaces de céramiques et de coupleurs – reference TESLA-COU-CDC-TiN-01). Moreover a dedicated engineer (Ms Albane Benardais) is working on this matter since April 2005. She will first have contact with industries specialised in the fabrication of coating bench and think about the general concept of our future system.

Task 7.3 concerns conditioning studies which normally should begin in 2006. However, while awaiting the construction of the prototypes we have began to put in place many of the tools which will be required for their reception and preparation before conditioning. In particular we have been developing the control system, hardware and software, necessary for automatic conditioning of the couplers. The "loan" of TTF-III couplers from our JRA partner, DESY, has allowed us to obtain invaluable experience with this system prior to delivery of the new prototypes.

At end of April 2005 six couplers have conditioned, with various results in respect to conditioning time.

We also have begun to think about a test bench to validate if NEG coating, that might improve the vacuum in couplers, is relevant to RF technologies (behaviour of the NEG coating in respect to High Power RF fields). End of April 2005 the drawing of this test bench is nearly finished.

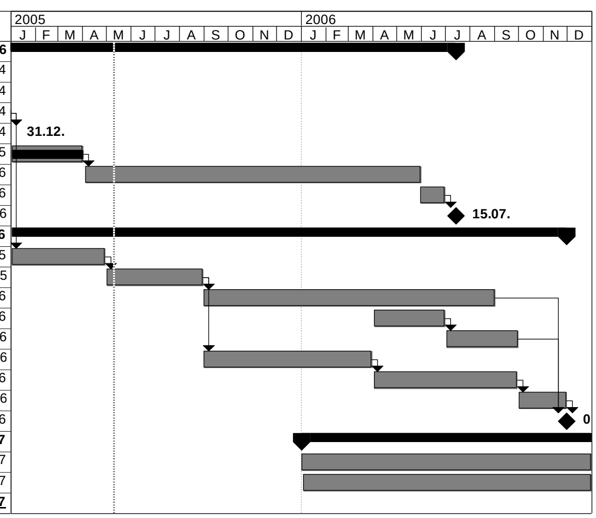
2.) Meetings / Workshops

Meetings organized under JRA1

Date	Title/Subject	Location	Number of attendees	Website address
18-03-05	WP 7 meeting	Orsay	9	

3.) Update of MS-Project

N°	Task Name	Anfang	Ende
7.1	**New Prototype Coupler**	**Do 01.01.04**	**Sa 15.07.06**
7.1.1	RF Simulations of Coupler	Do 01.01.04	Mi 30.06.04
7.1.2	Report on Simulation	Mi 30.06.04	Mi 30.06.04
7.1.3	Detailed Engineering Drawings	Do 01.07.04	Fr 31.12.04
7.1.4	Engineering complete	Fr 31.12.04	Fr 31.12.04
7.1.5	Call for tenders	Mo 03.01.05	Fr 01.04.05
7.1.6	Prototype Fabrication in Industry	Di 05.04.05	Mi 31.05.06
7.1.7	Low Power tests	Mi 31.05.06	Fr 30.06.06
7.1.8	**Ready for High Power Tests**	Sa 15.07.06	Sa 15.07.06
7.2	**Fabrication of TiN Coating System**	**Mo 03.01.05**	**Fr 01.12.06**
7.2.1	Mechanical design of vacuum chamber	Mo 03.01.05	Fr 29.04.05
7.2.2	Fabrication drawings	Mo 02.05.05	Di 30.08.05
7.2.3	Construction of vacuum chamber	Do 01.09.05	Fr 01.09.06
7.2.4	Define vacuum needs	Mo 03.04.06	Fr 30.06.06
7.2.5	Appropriation of vacuum equipment	Mo 03.07.06	Sa 30.09.06
7.2.6	Design of electronic circuitry	Do 01.09.05	Do 30.03.06
7.2.7	Fabrication of electronics in industry	Mo 03.04.06	Fr 29.09.06
7.2.8	Installation and Test at Orsay	Mo 02.10.06	Do 30.11.06
7.2.9	**First Window Coating**	Fr 01.12.06	Fr 01.12.06
7.3	**Conditioning Studies of Proto-type Couplers**	**Mo 02.01.06**	**Fr 30.11.07**
7.3.1	Conditioning of couplers	Mo 02.01.06	Fr 30.11.07
7.3.2	Evaluate conditioning results	Mi 04.01.06	Fr 30.11.07
7.3.3	**Final report on conditioning**	**Fr 30.11.07**	**Fr 30.11.07**



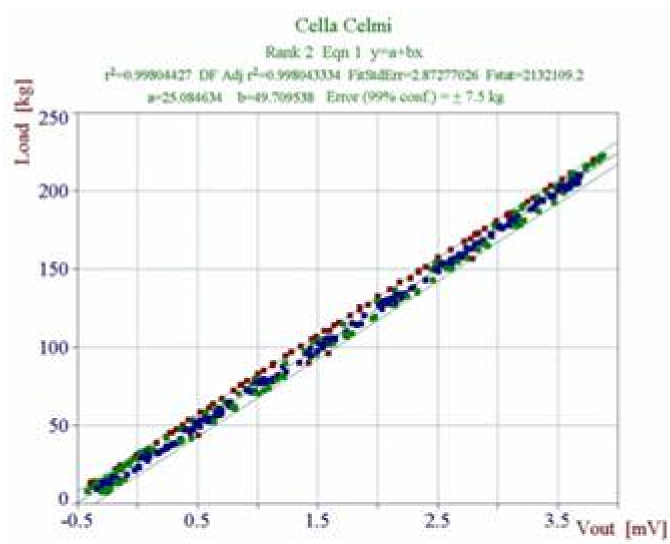
Work package 8: Tuners

1.) Status of activities

8.1. UMI Tuner

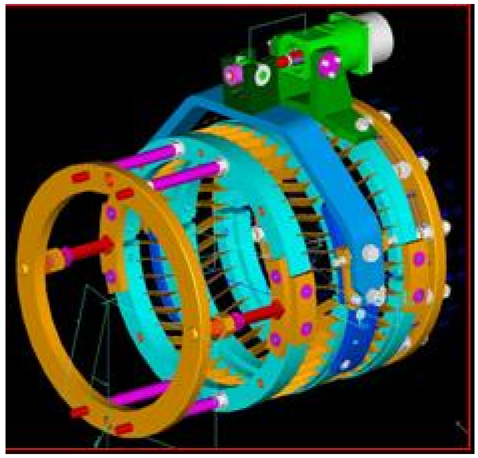
A lifetime test has been performed on a piezoceramic stack. The purpose of this test is to investigate the behavior of piezoelectric ceramics in condition equivalent to 10 years of operation as actuator in active frequency tuner for ILC superconducting cavities (SC).
To do this a **Physik Instrumente PI P-888.90 PIC255** piezoelectric ceramic has been cooled down in LN_2 and has been excited uninterruptedly for a month up to its limits, sustaining about 1.5 10^9 cycles of switching, up to nearly the maximum stroke, a good estimate of ten years as actuator for ILC cavities. After about one month of operation in LN2 environment under extreme conditions, and after more than 1.5×10^9 oscillations driven between (nominal) operating voltage limits, the PI P 888.90 piezo is still working with almost the same characteristics.

A load cell working in LHe environment has been design and successfully tested. The purpose of this device is the measure of the correct pre-load force to be applied to piezoelectric ceramics placed in fast tuners, to maximize their lifetime. The test on CELMI prototype has proved that the glue and strain gauge sensors used *can work* in LHe cryogenic environment with good *repeatability* and *sensitivity.*



Load cell voltage response in function of applied load (at LHe temperature)

In the picture above you can see the load cell calibration curve, showing the good linear behavior.



Coaxial tuner

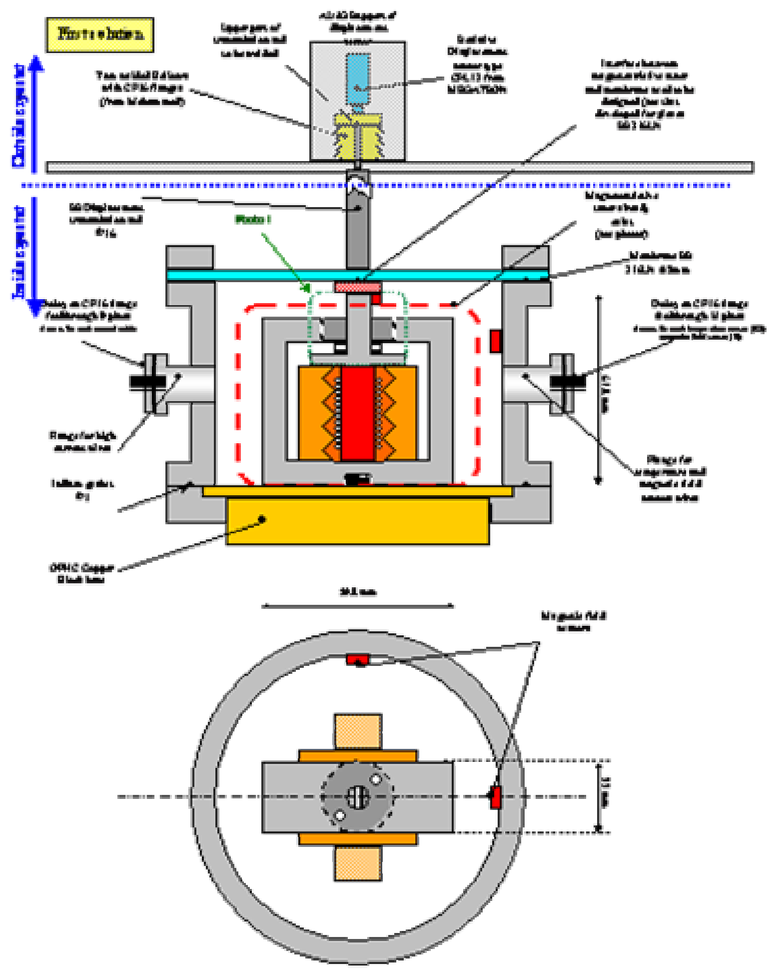
The coaxial tuner mechanical design is in advance state. The integration piezo design is completed. Different piezos with different lengths and cross sections can be used (up to 72 mm length). Two piezos are inserted. There is the possibility to use both as actuators, or to use one as a sensor. The cavity elasticity is used to provide the piezo preload. We plan to have a test of the integrated system before the end of the year.
In the picture you can see the coaxial blade tuner assembly, showing the leverage arm, the Ti ring welded on the tank and the two piezos.

8.2. Magnetostrictive tuner

After the first test at LHe temperature, in which magnetostrictive tuner shows that it might work in such an environment, the next test for the precise characterization is planed. The experimental insert was planed (overview is shown below) and will be designed by IPN Orsay and fabricate in Poland or in France depending on the cost. The test will be performed at DESY.
Three rods made of KELVIN ALL (1 rod) and GalFeNOL (2 rods) materials will be evaluated. The second material is expected to have worse properties at LHe, but it is cheaper even than piezo stack. Especially the following parameters will be investigated:

- elongation versus applied current, (magnetostriction coefficient) or/and displacement versus magnetic field applied for different preload settings
- max. stroke,
- slew rate of elongation (dynamics of motion),
- heat generation – coil is made of Nb_3Sn (critical temperature 18K),
- magnetic field distribution (if possible) – proper sensor need to be found,
- Young modulus of magnetostrictive rod

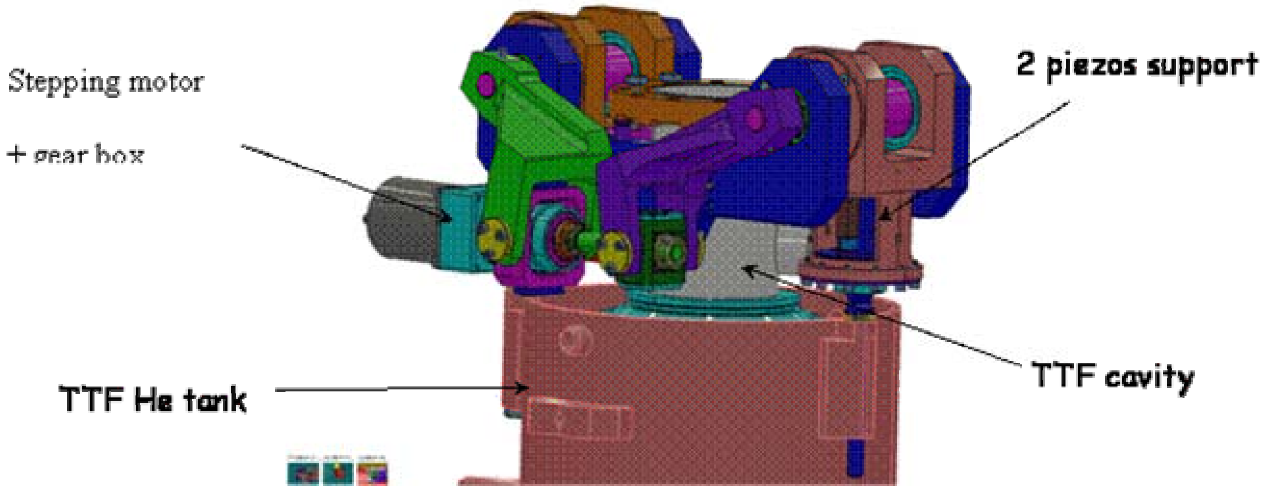
At least there is need to verify if magnetostrictive rod might acts as a force sensor. To achieve this output current if rod is stressed, need to be measured



Overview of magnetostrictive element characterization experiment

8.3. CEA Tuner

Two Piezo Tuning Systems (PTS) are being fabricated and will be delivered at the end of May 2005. In the meantime the control system is being made for the stepping motor and for the piezos, allowing cavity vibration and Lorentz forces compensation analysis. Preliminary tests of the tuner will be made on a test stand and also on a cavity at 300K before summer 2005. Final integrated tests at 2K with a TTF cavity equipped with a PTS and a power coupler are scheduled in CRYHOLAB in September 2005. Preparation of these RF power tests is in progress in the framework of WP10.



New Piezo Tuning System

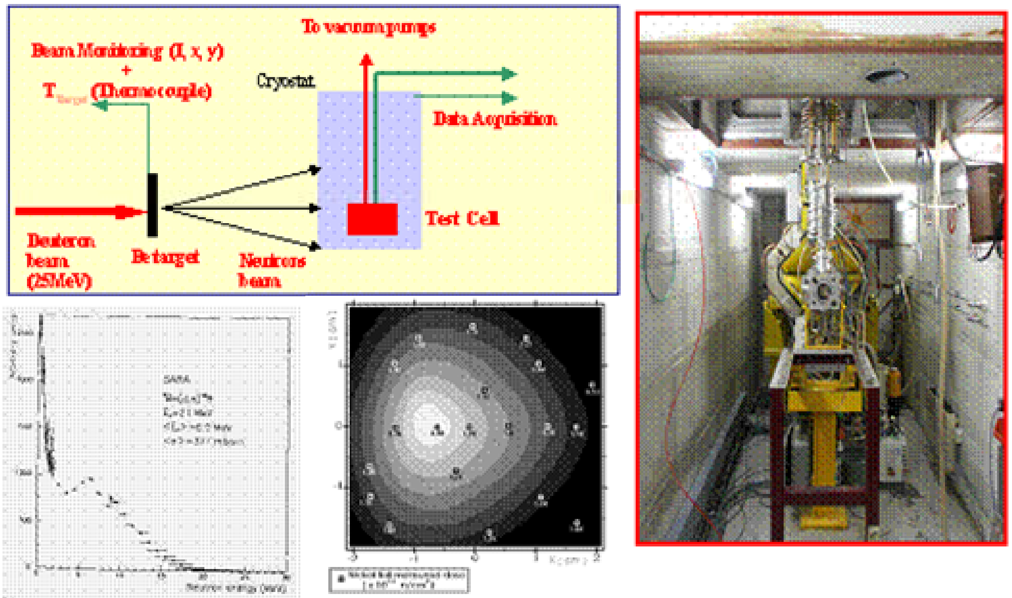
8.4. IN2P3 Activity

The study is aimed at characterization of piezoelectric actuators at low temperature. A new experimental facility was developed for testing various prototypes piezoelectric actuators and successfully operated for T in the range 1.8 K-300 K. Different parameters were investigated:

- piezoelectric actuator displacement vs. applied voltage V and T,
- capacitance vs. T,
- dielectric properties vs. T,
- thermal properties, and
- heating due to dielectric losses vs. modulating voltage and frequency as function of T.

The experimental data show that the full range displacement of the actuator decreases with T reaching a value between 1.8 µm and 4 µm depending on both material and fabrication process of the piezo-element. Note that both these parameters (material and process) have a strong influence on displacement vs. T dependence. Moreover, the variations of losses tangent with temperature show a maximum at a T in the range 30 K-120 K.

Finally a dedicated facility located at CERI (Orléans, France) for radiation hardness tests of piezo-element with fast neutrons at liquid helium temperature (T=4.2 K) was developed and successfully operated (see figure below): beam tests were performed with PICMA and NOLIAC type actuators and the corresponding results are reported.



Overview of radiation test

2.) Meetings / Workshops

Meetings organized under JRA1

Date	Title/Subject	Location	Number of attendees	Website address
24.01.05	Magnetostrictive tuner development	DESY, Hamburg, Germany	5	
11.03.05	Preparation of magnetostrictive test characterization	IPN, Orsay, France	5	
30.03-01.04.05	TESLA Technology Meeting	DESY, Hamburg, Germany	117	tesla.desy.de
1.04.05	WP 8 Meeting	DESY, Hamburg, Germany	10	tesla.desy.de/~sekalski

3.) Talks

List of talks of JRA1 members

Subject	Speaker/Lab	Event	Date	Web site
Full Characterization at Low Temperature of Piezoelectric Actuators	M. Fouaidy, IPN Orsay	TESLA Technology Meeting	31.03.05	tesla.desy.de
Magnetostrictive tuner	P. Sekalski, TUL-DMCS	TESLA Technology Meeting	31.03.05	tesla.desy.de
Experiences and Reliability with Cold Saclay Frequency Tuner in CHECHIA and Cryomodules and with Cold Blade Frequency Tuner in CHECHIA and Superstructure Module	R. Lange, DESY	WP 8 Meeting	1.04.05	
New CEA Piezo tuning system	P. Bosland, CEA Sacley	WP 8 Meeting	1.04.05	
UMI tuner	A. Bosotti, INFN Milan	WP 8 Meeting	1.04.05	
Blade tuner	N. Panzeri, INFN Milan	WP 8 Meeting	1.04.05	
Full Characterization at Low Temperature of Piezoelectric Actuators Used for SRF Cavities Active Tuning	M. Fouaidy, IPN Orsay	WP 8 Meeting	1.04.05	
Magnetostrictive tuner and piezo control system	P. Sekalski, TUL-DMCS	WP 8 Meeting	1.04.05	

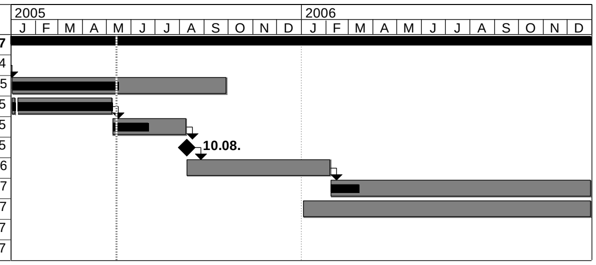
4.) Publications

[See SRF homepage for the categories of publications.]

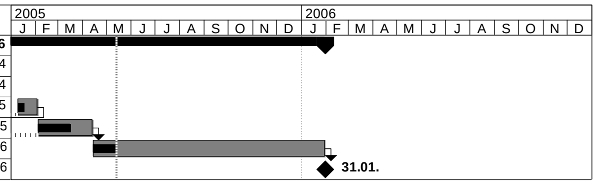
List of papers	Title	Authors	Journal/Conf.
CARE-Note			
	PI piezo Life Time Test Report	Angelo Bosotti Rocco Paparella Fabio Puricelli	

5.) Update of MS-Project

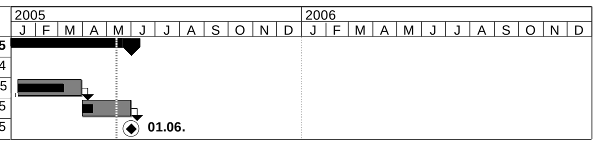
N°	Task Name	Anfang	Ende
8.1	**UMI TUNER**	**Do 01.01.04**	**Mo 31.12.07**
8.1.1	Control electronics	Do 01.01.04	Fr 02.07.04
8.1.2	Mechanical tuner design, leverage system/motor	Mo 03.01.05	Do 29.09.05
8.1.3	Integration piezo design	Mo 03.01.05	Mo 09.05.05
8.1.4	Choice of transducer/actuator	Mo 09.05.05	Mi 10.08.05
8.1.5	**Report UMI tuner**	Mi 10.08.05	Mi 10.08.05
8.1.6	Tuner fabrication	Mi 10.08.05	Di 07.02.06
8.1.7	Piezo fabrication and bench tests	Di 07.02.06	Di 06.02.07
8.1.8	Cavity-tuner-coupler integration	Mi 04.01.06	Sa 30.06.07
8.1.9	Pulsed RF tests	Mo 02.07.07	Mo 31.12.07
8.1.10	**Evaluation of tuner operation**	Mo 31.12.07	Mo 31.12.07



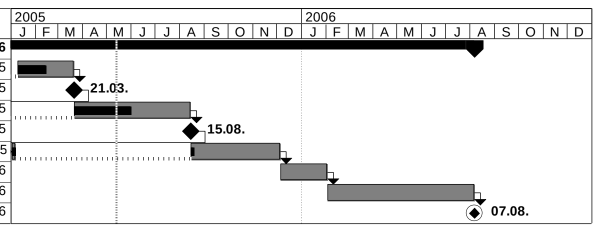
N°	Task Name	Anfang	Ende
8.2	**Magneto-strictive Tuner**	**Do 01.01.04**	**Di 31.01.06**
8.2.1	Complete specification	Do 01.01.04	Fr 30.01.04
8.2.2	Conceptual design	Mo 02.02.04	Mi 31.03.04
8.2.3	Prototype and performance evaluation	Do 01.04.04	Fr 04.02.05
8.2.4	Finalize tuner and drive electronics design	Do 01.07.04	Do 14.04.05
8.2.5	Test of tuner	Do 14.04.05	Di 31.01.06
8.2.6	**Report on magneto-strictive Tuner**	Di 31.01.06	Di 31.01.06



N°	Task Name	Anfang	Ende
8.3	**CEA Tuner**	**Mo 05.01.04**	**Mi 01.06.05**
8.3.1	Design Piezo + Tuning System	Mo 05.01.04	Fr 18.06.04
8.3.2	Fabrication	Mo 21.06.04	Do 31.03.05
8.3.3	Installation RF	Fr 01.04.05	Mi 01.06.05
8.3.4	**Start of Integrated Experitments**	Mi 01.06.05	Mi 01.06.05



N°	Task Name	Anfang	Ende
8.4	**IN2P3 Activity**	**Do 01.01.04**	**Mo 07.08.06**
8.4.1	Characterize actuators/piezo-sensors at low tem	Do 01.01.04	Mo 21.03.05
8.4.2	Report on actuator/piezo sensor	Mo 21.03.05	Mo 21.03.05
8.4.3	Test radiation hardness of piezo tuners	Do 01.07.04	Mo 15.08.05
8.4.4	Report on radiation hardness tests	Mo 15.08.05	Mo 15.08.05
8.4.5	Integration of pieco and cold tuner	Mo 03.01.05	Di 06.12.05
8.4.6	Cryostat tests	Di 06.12.05	Fr 03.02.06
8.4.7	Tests with pulsed RF	Fr 03.02.06	Mo 07.08.06
8.4.8	**Report on IN2P3 tuner activities**	Mo 07.08.06	Mo 07.08.06



Work package 9: LOW-LEVEL RF (LLRF)

1.) Status of activities

9.1 Operability and technical performance

9.1.1 Transient detector

Beam induced transient detection

Before 2005 hardware for single bunch detection was prepared. This hardware was tested with a test setup that proved that attenuation of more than 80dB up to 100dB is achievable. Several measurements were done with real signals from cavities in TTF2 ACC1. Transients Detected at this time did not comply with expectations. During this period IQ demodulator from Analog Devices was used as a vector detector. Measurements with this device did not give expected results (too much noise). Another concept for vector measurements was prepared. This concept is based on the Low of Cosine. Phase is calculated only from measured magnitudes. As the only active device in this hardware is a magnitude detector based on a schottky diode, noise is very small.
During first quarter of the 2005 year several things have been done. Measurement with a new device for vector measurements finished successfully (Fig. 1, Table 1). In a first figure real and imaginary part changes are visible. These changes correspond to transient induced by single bunch. On a basis of real and imaginary part change phases were calculated and results were close to expected values that is to -10 degrees. Because of this successful measurement concept for automation of hardware for transient detection was prepared (Fig. 2). With an automated setup and connection to DOOCS system more tests and measurement will be done.

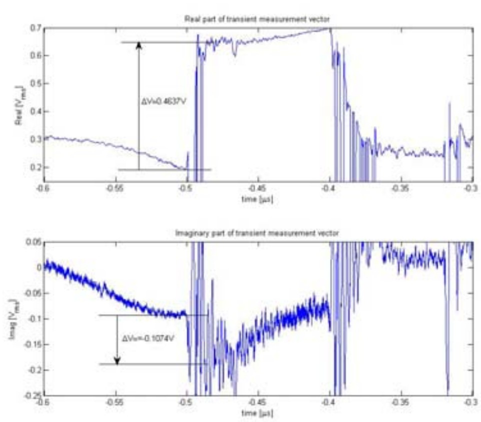


Fig. 1 Measurement result for 3nC single bunch induced transient

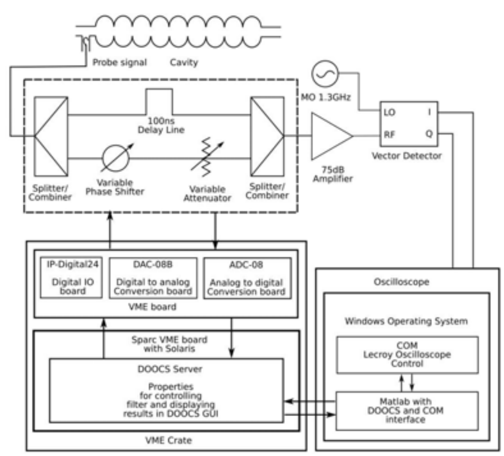


Fig. 2 Concept for automation of transient detection

Charge [nC]	Phase [deg]	Phase error [deg]
1	-12.3	-2.3
2	-11,3	-1,3
3	-13,0	-3,0

Table 1 Single bunch induced transient measurement results.

In future hardware will be automated and connected to DOOCS system. Other future work includes tests with a different ADC board with a higher bit resolution (10 bits) for signal to noise ratio improvement, development of algorithms and methods for removing distortions and noises from the signal. During May verification tests with automated hardware for phase detection are planed.

9.1.2 LLRF Automation

Progress: In line with schedule.

The FSM machine for the klystron/modulator was implemented in DOOCS server and initial tests were performed (using step mode of operation). Some problems were recognized and corrected. The testing process is in progress.

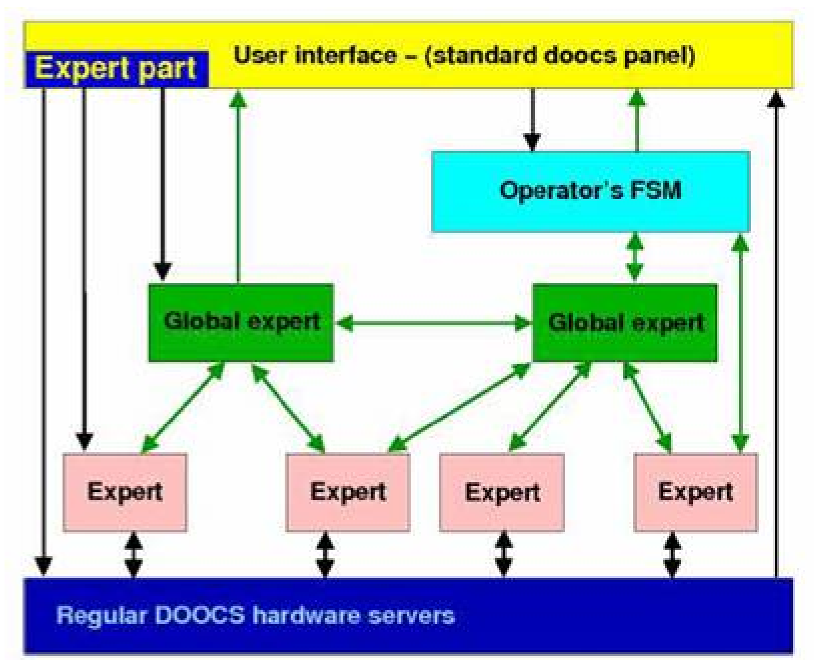


Fig. 1. Internal software structure of the LLRF FSM

The measurements of klystron characteristics were made focusing on nonlinearities of klystron and other system components (amplifiers). That will allow to linearize of the klystron characteristics what will enable linearization of the control loop. The procedure for klystron linearization will be realized as a part of LLRF FSM.

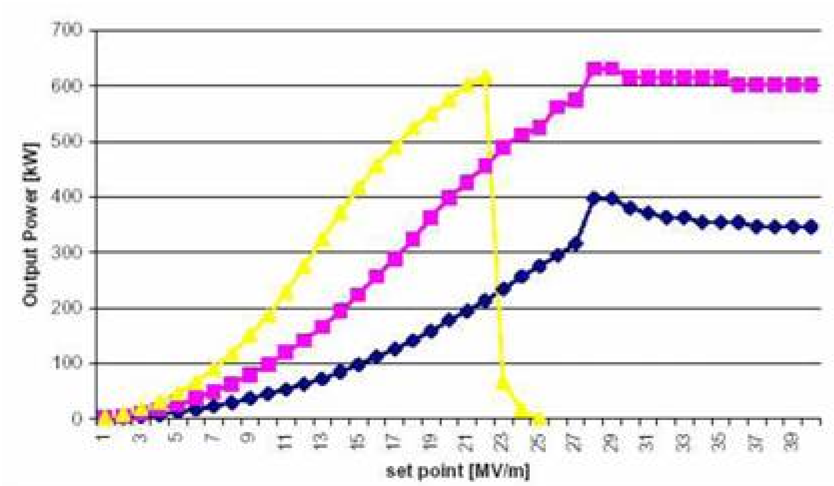


Fig. 2. Results of klystron nonlinearity measurements

Milestones and deliverables: None defined in contract for this period
Significant achievements and impact:
Klystron state machine implemented in DOOCS initial tests in the accelerator performed.
Deviations from plan: None

9.1.3 Control Optimization
Have found diploma student from university of Harburg (department of control theory by Prof. Werner) who will start on June 1, 2005 with his thesis work on the optimal controller and rf system modelling.

9.2 LLRF cost and reliability

9.2.1 Cost and reliability study

9.2.2 Radiation damage study
New version of SRAM based radiation on-line monitor RADMON has been tested and installed for test operation. Its performance and reliability will be estimated during accelerator operation. Also hardware (composite shielding) and software countermeasures against radiation influence on electronics were developed and are under tests in real accelerator environment.

Fig. 3. RADMON V2

Milestones and deliverables: None defined in contract for this period
significant achievements and impact:
Development of a new version of SRAM based radiation on-line monitor RADMON, development of composite materials for radiation shielding.
Deviations from plan: None

9.3 Hardware

9.3.1 Multichannel downconverter

New frequency conversion unit in measurement circuit for RF Feedback System:

Cavities in individual accelerating stages are impulse-supplied by the power dividers. The change of gradient of a field in cavities is synchronized with the beam source of accelerated particles. The time of flight of each particle falls on the highest level of a field gradient. That's why obtaining the required parameters of the field is required only on the flat top. 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%, which 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.
The first stage enables us to equalize power levels for different cavities, while the second to establish power in a broad range for different experiments with automatic possibility of changes [Fig.1]. Then the signal from the power level block, is filtrated, frequency-converted, amplified and ADC converted.

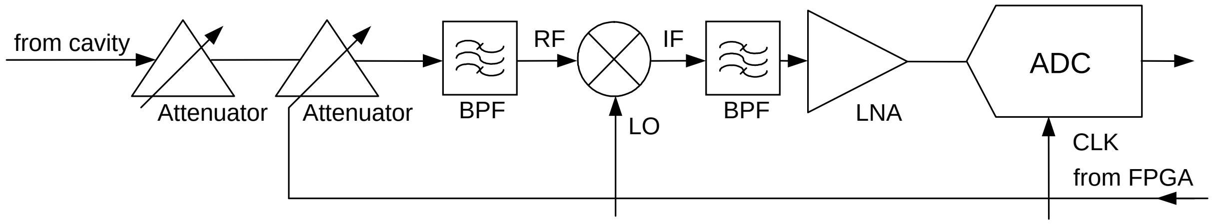


Fig.1. Frequency conversion circuit block diagram.

In order to obtain the gradient and of the field phase in thirty two cavities on levels: $(\sigma_E/E)_{RMS} < 10^{-4}$ and $(\sigma_\varphi)_{RMS} < 0{,}01°$, the single measurement track must fulfill the following criteria (1) for circuit from Fig.3.

$$_{add}(\sigma_{out})_{RMS} << 2\sqrt{2}(\sigma_{in})_{RMS}$$

In order to obtain the given accuracy of a field gradient and phase stabilization, must be satisfy a following requirements:

1. Input frequency 1.3 GHz $\pm 10[MHz]$
2. Spurious Free Dynamic Range $SFDR \geq 83[dB]$
3. Input impedance RF and LO $Z_{in} = 50[\Omega]$
4. Input VSWR: max. 1.5:1 desired, 1.8:1 acceptable
5. Nominal Input power range: -20 to +3dBm
6. Output impedance $50[\Omega]$
7. Output level signal $v_{out} \leq 1.1[V_{pp}]$ on $1[k\Omega]$, $@P_{RF} = -7[dBm]$, $@P_{LO} = -5[dBm]$

9.3.2 Third generation rf control

Progress: In line with schedule

FPGA board SIMCON 2.1 was tested in CHECHIA with success. The firmware, software and Matlab algorithm for control one superconductive cavity were tested with this board.

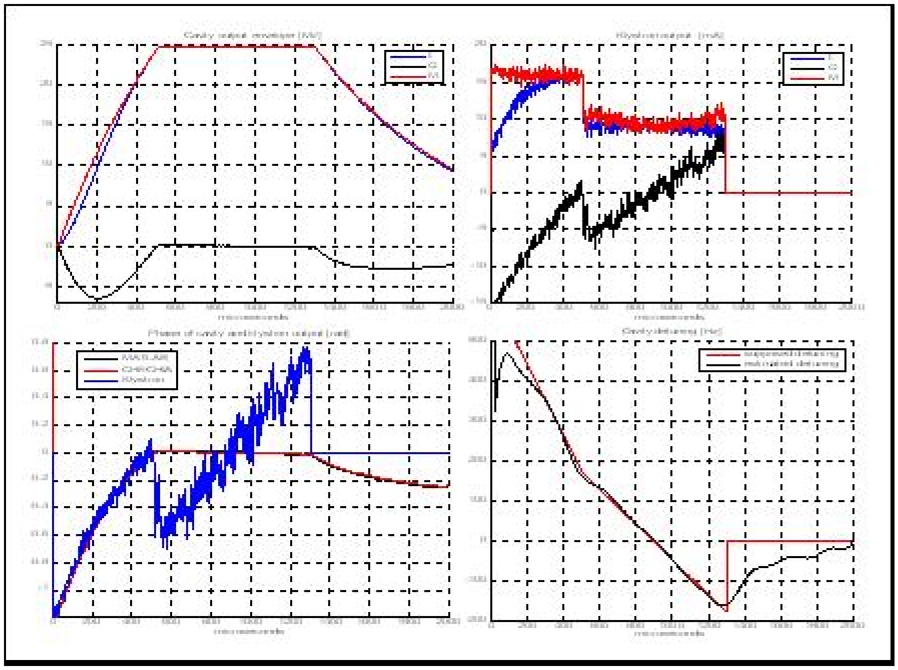


Figure. Results from CHECHIA

New firmware for FPGA board called SIMCON 3.0 was developed. This firmware is written in VHDL and it allows to use 8 input channels with ADC and 4 output channels with DAC. This firmware consists of multi-channel controller to drive multi-cavities accelerating modules (up to 8 cavities). Hardware and software of SIMCON 3.0 will be tested in TTF2 on accelerating module ACC1 in May.

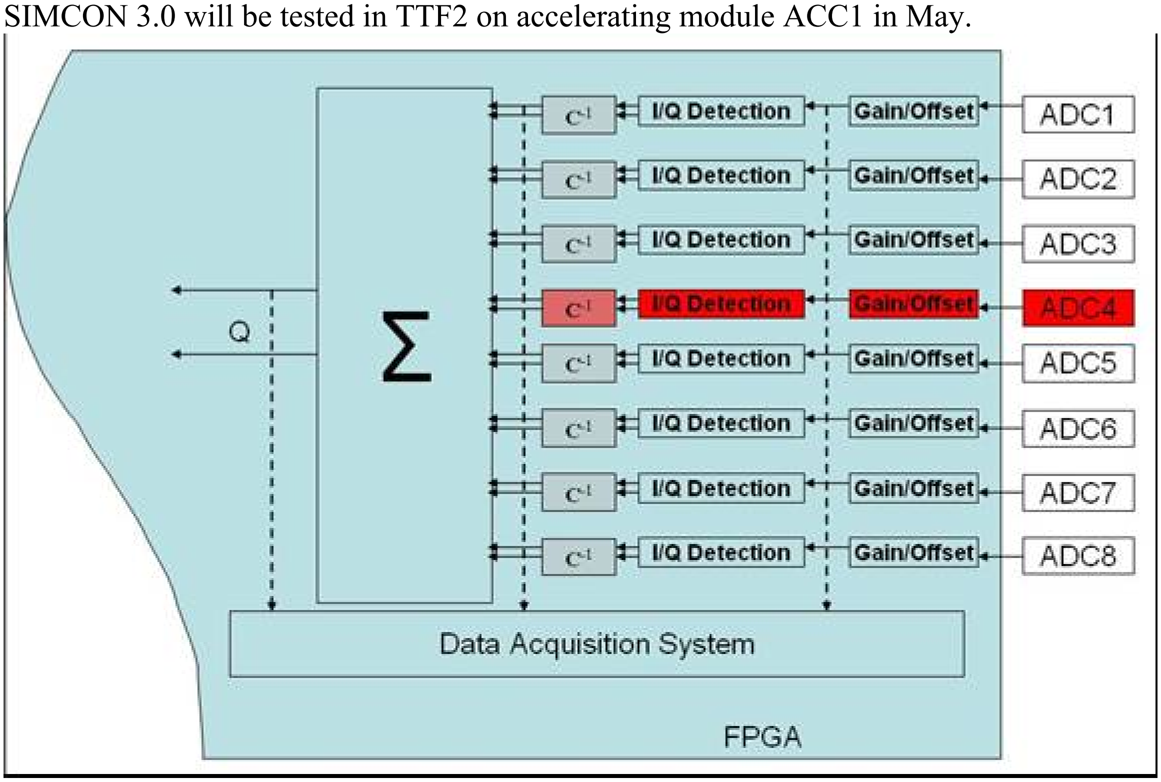


Figure. Block diagram of VHDL architecture in SIMCON 3.0 which was expanded in relation to SIMCON 2.1

The schemes for new FPGA board SIMCON version 3.1 was developed. Within next months the PCB project will be developed.

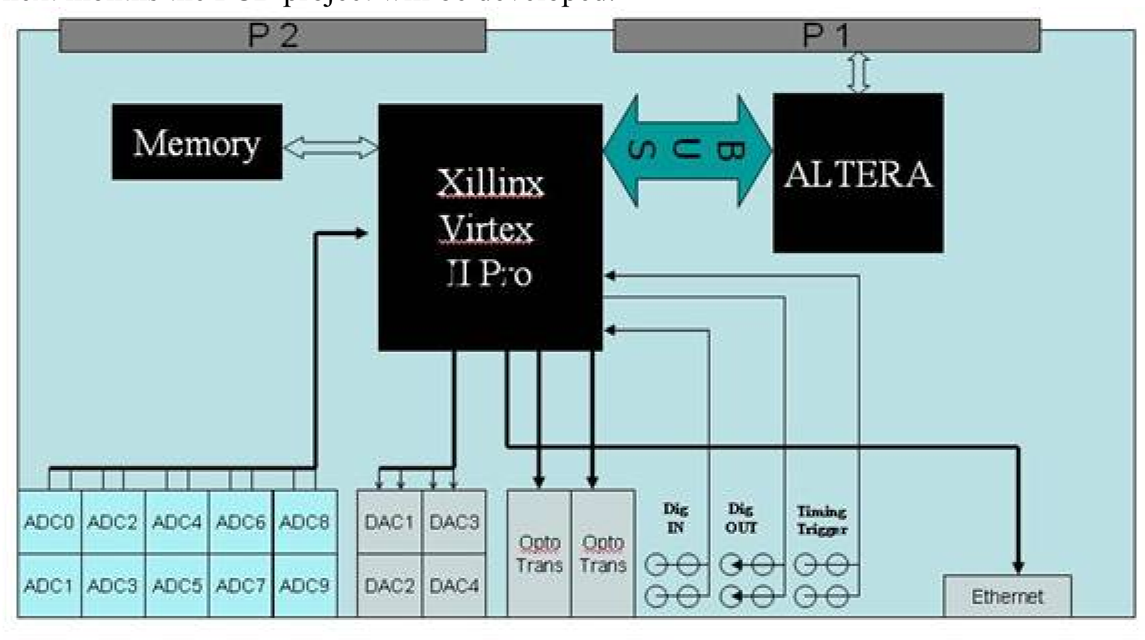


Figure. Block diagram of SIMCON 3.1

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

Test of control algorithm with SIMCON 2.1
Developed firmware for SIMCON 3.0.
Developed schemes for SIMCON 3.1

Deviations from plan: None

9.3.3 Stable frequency distribution

Progress:
New Master Oscillator:
Low power part: a lot of modules were tested but had to be redesigned in order to meet our spec; e.g. low phase noise dividers (108 MHz – 27 MHz; 81 MHz – 9 MHz) are tested, TTL drivers for 9 MHz and 1 MHz are tested and ready, module (81 MHz VCXO; 108 MHz VCXO and post amplifier) has to be redesigned, 9 MHz OCXO from MTI does not meet the spec given in their data sheet (but was the baseline for our spec), therefore 9 MHz OCXO from Wenzel Associated is ordered, SAW oscillators to generate the 1.3 GHz and 2.856 GHz signals do not meet the spec given by the manufacturer, selection of other vendors of low phase noise oscillators is being considered.
High power part: amplifiers for 1.3 GHz and 81 MHz and associated monitoring circuitry are being designed and partly assembled into their 19´´ crates, complete assembly has to be tested prior to installation

Frequency Distribution
Temperature control circuitry for stabilizing the temperature of the coaxial cables in the TTF II tunnel is being installed

Fiberoptic distribution
The performance of the FO “long link” is being tested in a climatic chamber.

Milestones and deliverables: None defined in contract for this period
significant achievements and impact:
Still must use the old and existing Master Oscillator

9.4 Software

9.4.1 Data management development

Progress: In line with schedule.
The database for data management was developed and implemented in DOOCS server. The API (Application Programming Interface) was written as a set of C++ classes and can be used in new and existing (requires recompilation) DOOCS servers. In next months the database will be tested in the real environment.

```
#include <cdb.h>

cdb c_db("TTF2.RF\ADC\GUN.CH24");
cdb_object_property_double *copd;
double val;
cpod=c_db.get_property("TTF2.RF\\GUN\\CH24\\ADC\\CONVERSION");
val=cpod->value;
delete cpod;
```

Fig. 4. Example of data read through database API

Milestones and deliverables: None defined in contract for this period
Significant achievements and impact:
Developed API interface for database
Deviations from plan: None

9.4.2 RF Gun control
Progress:
Detector:
Development of a new Detector (high linear and low noise) for IQ-Detection of forward and reflected power.
The old Detector (AD8749) has a noise figure (NF) of 38dB. The new Detector (Linear Technologies LT5516) has a NF of 14dB, which is much better. The linearity (1dB compression point) of the new detector is about 14 dB better than the old one.
Hopefully we get better measurement results and therefore better

regulation of GUN field stability.
Milestones and deliverables: None defined on contract for this period
Significant achievements and impact: None
Deviation from plan: None

2.) Meetings / Workshops

Meetings organized under JRA1

Date	Title/Subject	Location	Number of attendees	Website address
15.02.05	WP 9 Meeting	DESY, Hamburg, Germany	~15	ttfinfo.desy.de/LLRFelog/

3.) Talks

List of talks of JRA1 members

Subject	Speaker/Lab	Event	Date	Web site
Radiation Damage Study on Electronics	M. Grecki / TUL-DMCS	WP 9 Meeting	15.02.05	ttfinfo.desy.de/LLRFelog/
Data management for DOOCS Operating System	M. Greck M. Grecki/TUL-DMCS	WP 9 Meeting	15.02.05	ttfinfo.desy.de/LLRFelog/
Amplitude and Phase Calibration Based on beam Induced Transient Detection	P. Pawlik / TUL-DMCS	WP 9 Meeting	15.02.05	ttfinfo.desy.de/LLRFelog/
Automation of LLRF and Klystron Operation for VUV-FEL	W.Cichalewski / TUL-DMCS	WP 9 Meeting	15.02.05	ttfinfo.desy.de/LLRFelog/

4.) Update of MS-Project

N°	Task Name	Anfang	Ende
9	**WP9 LOW LEVEL RF (LLRF)**	**Do 01.01.04**	**Fr 08.12.06**
9.1	**Operability and technical performance**	**Do 01.01.04**	**Fr 08.12.06**
9.1.1	**Transient detector**	**Do 01.01.04**	**Fr 08.12.06**
9.1.1.1	Define requirements	Do 01.01.04	Fr 30.01.04
9.1.1.2	Electronics design	Mo 02.02.04	Fr 27.02.04
9.1.1.3	Build prototype and evaluate	Mo 01.03.04	Fr 30.07.04
9.1.1.4	Final design of detector	Mo 02.08.04	Fr 01.10.04
9.1.1.5	Installation and commissioning	Mo 04.10.04	Mi 09.02.05
9.1.1.6	Test with beam	Mi 09.02.05	Fr 08.12.06
9.1.1.7	**Report on transient detector test**	Fr 08.12.06	Fr 08.12.06
9.1.2	**LLRF Automation**	**Do 01.01.04**	**Fr 23.06.06**
9.1.2.1	Dialogue with industrial experts	Do 01.01.04	Fr 27.02.04
9.1.2.2	Develop full specification	Mo 01.03.04	Fr 26.03.04
9.1.2.3	Implement FMS for subsystems	Mo 29.03.04	Fr 29.10.04
9.1.2.4	Test and evaluation	Mo 01.11.04	Mi 23.02.05
9.1.2.5	Implement improvements	Mi 23.02.05	Di 26.04.05
9.1.2.6	Evaluation and acceptance by operators	Di 26.04.05	Fr 23.06.06
9.1.2.7	**Report on LLRF atomization design**	Fr 23.06.06	Fr 23.06.06
9.1.3	**Control optimization**	**Do 01.01.04**	**Fr 13.10.06**
9.1.3.1	Specification of system	Do 01.01.04	Fr 02.04.04
9.1.3.2	Conceptual design of controller	Mo 05.04.04	Fr 30.04.04
9.1.3.3	Performance simulation	Mo 03.05.04	Fr 27.08.04
9.1.3.4	Implementation in DSP hardware	Mo 30.08.04	Mi 02.02.05
9.1.3.5	Implementation and tests on TTF	Do 03.02.05	Fr 13.10.06
9.1.3.6	**Evaluation of test results**	Fr 13.10.06	Fr 13.10.06
9.1.4	**Exceptional handling routines**	**Do 01.01.04**	**Fr 02.12.05**
9.1.4.1	Specification	Do 01.01.04	Fr 23.01.04
9.1.4.2	Design of exceptional handler	Mo 26.01.04	Fr 30.04.04
9.1.4.3	Implementation and test on TTF	Mo 03.05.04	Fr 02.12.05
9.1.4.4	**Report on exceptional handler operatic**	Fr 02.12.05	Fr 02.12.05
9.2	**LLRF cost and reliability study**	**Do 01.01.04**	**Fr 27.10.06**
9.2.1	**Cost and reliability study**	**Do 01.01.04**	**Fr 29.09.06**
9.2.1.1	Identify cost drivers of present LLRF	Do 01.01.04	Fr 27.02.04
9.2.1.2	Develop cost reduction ideas	Mo 01.03.04	Fr 02.04.04
9.2.1.3	Build prototypes and evaluate	Mo 05.04.04	Fr 21.01.05
9.2.1.4	Final design of LLRF system	Fr 21.01.05	Fr 29.09.06
9.2.1.5	**Complete design of LLRF system for reduced cost**	Fr 29.09.06	Fr 29.09.06
9.2.2	**Radiation damage study**	**Do 01.01.04**	**Fr 27.10.06**
9.2.2.1	Identify critical electronics issues	Do 01.01.04	Fr 27.02.04
9.2.2.2	Evaluate TESLA radiation	Mo 01.03.04	Fr 02.04.04
9.2.2.3	Develop tests for components	Mo 05.04.04	Fr 28.05.04
9.2.2.4	Procure and assembles test set up	Mo 31.05.04	Fr 23.07.04
9.2.2.5	Data acquisition from radiation tests	Mo 26.07.04	Fr 29.10.04
9.2.2.6	Analyze results and develop countermeasures	Mo 01.11.04	Mi 09.02.05
9.2.2.7	Implement countermeasures and verify	Mi 09.02.05	Fr 27.10.06
9.2.2.8	**Report on radiation damage studies**	Fr 27.10.06	Fr 27.10.06
9.3	**Hardware**	**Do 01.01.04**	**Mi 01.03.06**
9.3.1	**Multichannel downconvertor**	**Do 01.01.04**	**Mi 26.01.05**
9.3.1.1	Study and compare technologies	Do 01.01.04	Fr 27.02.04
9.3.1.2	Select optimum PCB design	Mo 01.03.04	Fr 23.04.04
9.3.1.3	Build prototype and evaluate	Mo 26.04.04	Fr 02.07.04
9.3.1.4	Finalize multichannel downconverter	Mo 05.07.04	Fr 03.09.04
9.3.1.5	Determine characteristics	Mo 06.09.04	Mi 26.01.05
9.3.2	**Third generation RF control**	**Do 01.01.04**	**Mo 11.04.05**
9.3.2.1	Integrate system generator with VHDL	Do 01.01.04	Fr 30.01.04
9.3.2.2	Complete specification	Mo 02.02.04	Fr 02.04.04
9.3.2.3	Demonstrate simulator	Mo 05.04.04	Fr 04.06.04
9.3.2.4	Final design of RF electronic board	Mo 07.06.04	Fr 28.01.05
9.3.2.5	Evaluate performance	Mo 03.01.05	Mo 11.04.05
9.3.3	**Stable frequency distribution**	**Do 01.01.04**	**Mi 01.03.06**
9.3.3.1	Complete specification	Do 01.01.04	Mi 04.02.04
9.3.3.2	Concept ional design of frequency	Do 05.02.04	Fr 05.03.04
9.3.3.3	Build prototype and evaluate	Mo 08.03.04	Fr 06.08.04
9.3.3.4	Final design	Mo 09.08.04	Fr 22.10.04
9.3.3.5	Procurement and assembly of subsystems	Mo 25.10.04	Fr 28.01.05
9.3.3.6	Installation and commissioning	Mo 03.01.05	Fr 18.03.05
9.3.3.7	Performance test with beam	Mo 21.03.05	Mi 01.03.06
9.3.3.8	**Report on new LLRF hardware compon**	Mi 01.03.06	Mi 01.03.06
9.4	**Software**	**Do 01.01.04**	**Fr 06.10.06**
9.4.1	**Data management development**	**Do 01.01.04**	**Mi 14.09.05**
9.4.1.1	Specification	Do 01.01.04	Fr 30.04.04
9.4.1.2	Conceptional design with DOOCS	Mo 03.05.04	Fr 09.07.04
9.4.1.3	Prototype	Mo 12.07.04	Fr 10.09.04
9.4.1.4	User evaluation	Mo 13.09.04	Fr 05.11.04
9.4.1.5	Finalize design	Mo 08.11.04	Fr 31.12.04
9.4.1.6	Implementation in TTF	Mo 03.01.05	Mi 14.09.05
9.4.1.7	**Report on data management developm**	Mi 14.09.05	Mi 14.09.05
9.4.2	**RF gun control**	**Do 01.01.04**	**Fr 06.10.06**
9.4.2.1	Write specification	Do 01.01.04	Fr 30.01.04
9.4.2.2	Design of controller	Mo 02.02.04	Fr 23.04.04
9.4.2.3	Procurement and assembly	Mo 26.04.04	Fr 27.08.04
9.4.2.4	Installation and test	Mo 30.08.04	Fr 06.10.06
9.4.2.5	**Report on RF gun control tests**	Fr 06.10.06	Fr 06.10.06

Work package 10:

1.) Status of activities

During its first cooling down (1.8K) in January 2005, we have qualified in CryHoLab the 9-cell cavity equipped with its “high power coupler TTF3”. No specific trouble appeared, except the very long time of the whole structure thermalisation; as a consequence, we plan to improve the thermal connections between cavity support and cryostat base. After this preliminary test, the 9-cell cavity was taken out of CryHoLab for two months, time necessary to make experiments scheduled in CryHoLab with a 5-cell proton cavity.

Figure 1: 9-cell cavity set up in CryHoLab and high power coupler connected.

During this time, the RF power system was restarted with lot of problems linked to:

- The klystron cooling system: circuit refilling with DI water and failure on the electric power to start circulating pumps,
- The klystron high voltage: breakdown involving the complete cleaning of the modulator with the change of the insulating-oil (4500 liters).

The consequence of these disagreements is two months delay in the schedule for the “high power pulsed test”. Nevertheless the first integrated test should not be delayed: the “CEA Cold Tuning System” will be ready for test only at the beginning of September 2005.

Figure 2: RF modulator cleaning.

At the present time the 9-cell is put back again inside CryHoLab with the RF coupler, conditioned by LAL-Orsay. The cryostat cooling down is scheduled during the first part of May and the RF injection at the end of May.

For technical and financial reasons the policy decision for CryHoLab displace to the main Saclay Center is not yet taken by the CEA authorities. So the transfer should not be carried out before the end of 2005.

2.) 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				
Manpower				
Durable	*6 633 €*		*4 000 €*	*10 633 €*
			Total sum	

3.) Meetings / Workshops

Meetings organized under JRA1

Date	Title/Subject	Location	Number of attendees	Website address
18/03/2005	WP7 - Meeting	Orsay		

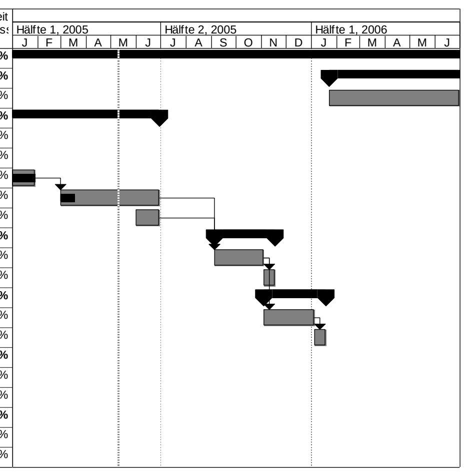
4.) Talks

List of talks of JRA1 members

Subject	Speaker/Lab	Event	Date	Web site
Status Report on WP10	B. Visentin / CEA	Orsay – WP7 Meeting	18/03/2005	

5.) Update of MS-Project

Nr.	PSP-Code	Nom de la tâche	Anfang	Ende	% Arbeit geschloss
1	**10**	**WP10 CRYOSTAT INTEGRATION TESTS**	**Mo 01.03.04**	**Do 18.01.07**	**0%**
2	**10-1**	**Displace CRYHOLAB**	**Mo 23.01.06**	**Fr 04.08.06**	**0%**
3	10-1.1	Move CRYHOLAB, commissioning	Mo 23.01.06	Fr 04.08.06	0%
4	**10-2**	**CRYHOLAB Adaptation to 9 cell**	**Mo 01.03.04**	**Mi 29.06.05**	**0%**
5	10-2.1	Mechanical adaptations (design-manufacturing-mounting)	Mo 01.03.04	Fr 29.10.04	100%
6	10-2.2	Low performance cavity and coupler transfert from DES	Mo 01.11.04	Di 30.11.04	100%
7	10-2.3	Assembly in Cryholab and Cryogenic test	Mi 01.12.04	Fr 28.01.05	100%
8	10-2.4	High performance coupler - High Power Pulsed Test	Di 01.03.05	Mi 29.06.05	0%
9	10-2.5	High performance cavity transfert from DESY	Mi 01.06.05	Mi 29.06.05	0%
10	**10-3**	**Integration tests in cryostat (1st test)**	**Mo 05.09.05**	**Do 17.11.05**	**0%**
11	10-3.1	CEA Cold Tunning System	Mo 05.09.05	Do 03.11.05	0%
12	10-3.2	Evaluate experimental results	Fr 04.11.05	Do 17.11.05	0%
13	**10-4**	**Integration tests in cryostat (2nd test)**	**Fr 04.11.05**	**Mi 18.01.06**	**0%**
14	10-4.1	Magnetostrictive tunner	Fr 04.11.05	Mi 04.01.06	0%
15	10-4.2	Evaluate experimental results	Do 05.01.06	Mi 18.01.06	0%
16	**10-5**	**Integration tests in cryostat (3rd test)**	**Mo 07.08.06**	**Mi 18.10.06**	**0%**
17	10-5.1	Piezoelectric tunner	Mo 07.08.06	Mi 04.10.06	0%
18	10-5.2	Evaluate experimental results	Do 05.10.06	Mi 18.10.06	0%
19	**10-6**	**Integration tests in cryostat (4th test)**	**Do 19.10.06**	**Do 18.01.07**	**0%**
20	10-6.1	New Coupler from LAL	Do 19.10.06	Do 04.01.07	0%
21	10-6.2	Evaluate experimental results	Fr 05.01.07	Do 18.01.07	0%



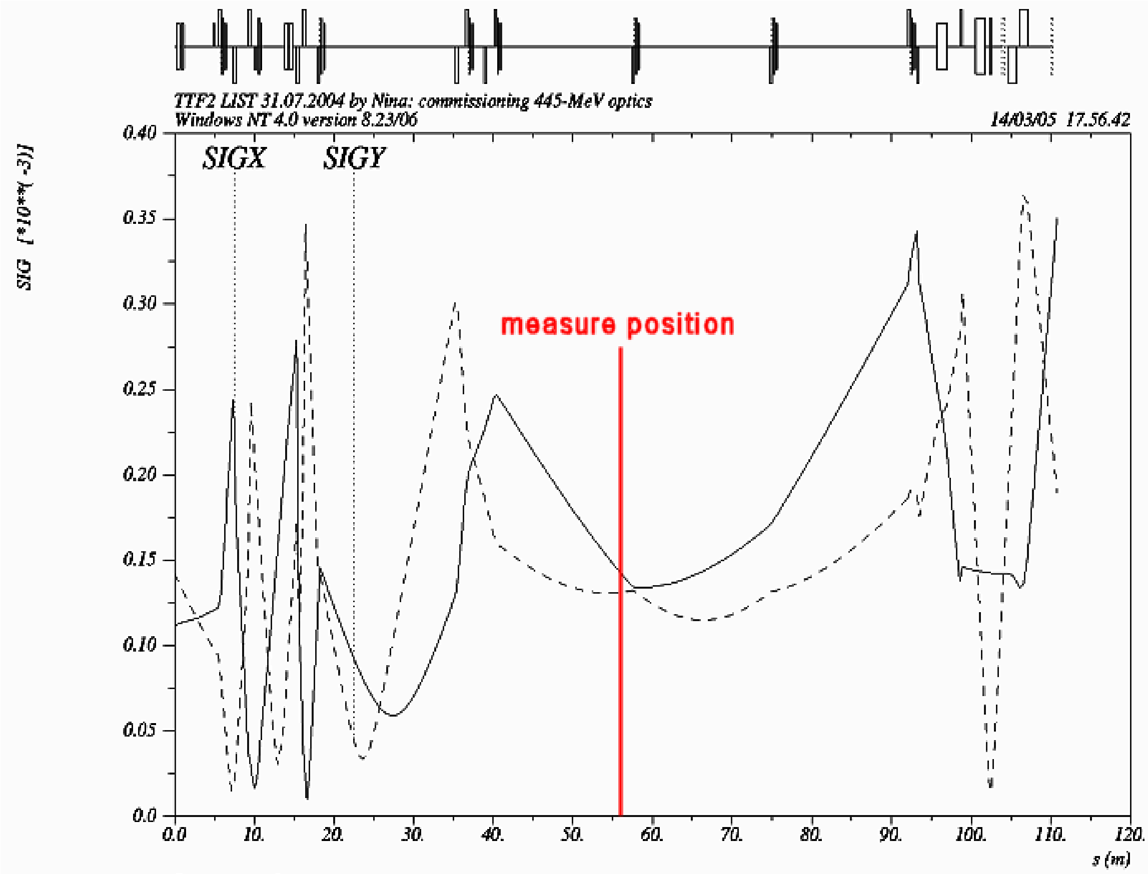
Work package 11: Beam Diagnostics

1.) Status of activities

The first quarter of the year was dedicated both to realize and prepare the hardware for the installation and to refine simulations in order to improve the measurement.

The first installation and test of the experiment will be performed at 445 MeV, while the interesting measures will be done at 1 GeV, an energy that is foreseen at TTF for the middle 2006.

An accurate study of the beam optics was required in order to evaluate the beam size in the position of the measurement. Simulations were performed at 445 MeV to check the achievable beam size at the measurement position.

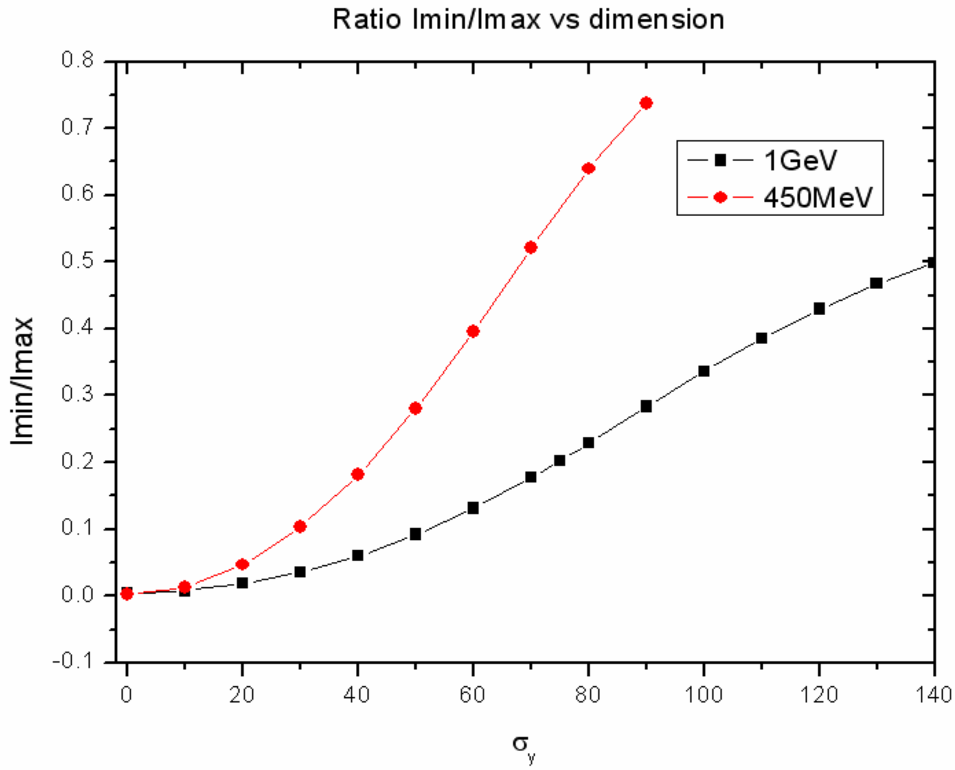


At 445 MeV the rms beam size is below 150 µm in both x and y plane.

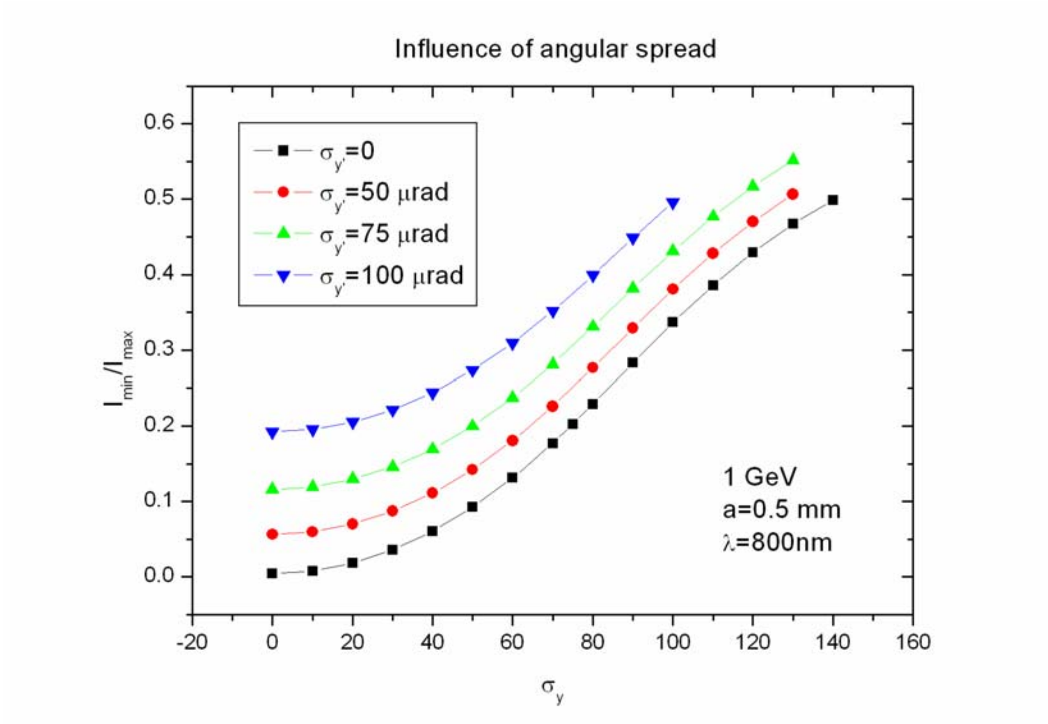
This value allows us to use a slit aperture of 0.5 mm also at this lower energy. The tracking shows also that the beam transport is smooth and simple up to the beam dump.

The transport was also checked for the 1 GeV case, showing that the available range of the quadrupoles current is well larger than the requirements.

Other simulations were run in order to optimize the future data analysis. A fit with all the beam parameters is always the best solution in order to estimate the beam parameters. Unfortunately it seems time consuming, while it could be interesting to have an almost on-line estimation, even if with less accuracy. The ratio between the maximum and the minimum of the angular distribution of the diffraction radiation is one of the proposed methods for having a fast evaluation of the beam dimension. This technique is more sensitive at 445 MeV than at 1 GeV, as shown in the following simulation calibrated for the TTF case.

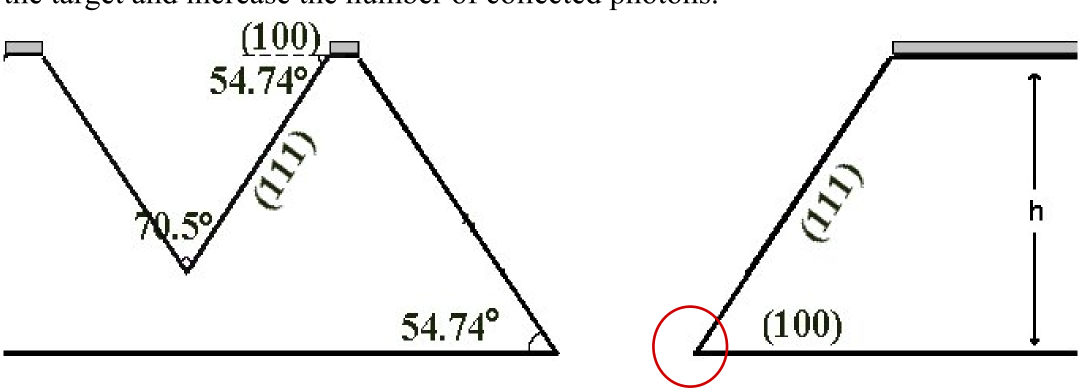


This method is also sensitive to the beam divergence. We are still investigating if is possible to have a simple estimation of the beam divergence also.



The diffraction radiation is emitted in the interaction of the electron beam with a metallic target. This target has two cuts at both sides, one of 1 mm size, the other of 0.5 mm. The realization of the target was a major task. The main requirement for this is the precision of the cut, so that non homogeneity can be tolerable only if they are few and in dimension less that the detected wavelength (800 nm in our case). Also the flatness is very important because the diffraction radiation is an interference effect between the parts of the target upper and below the cut.

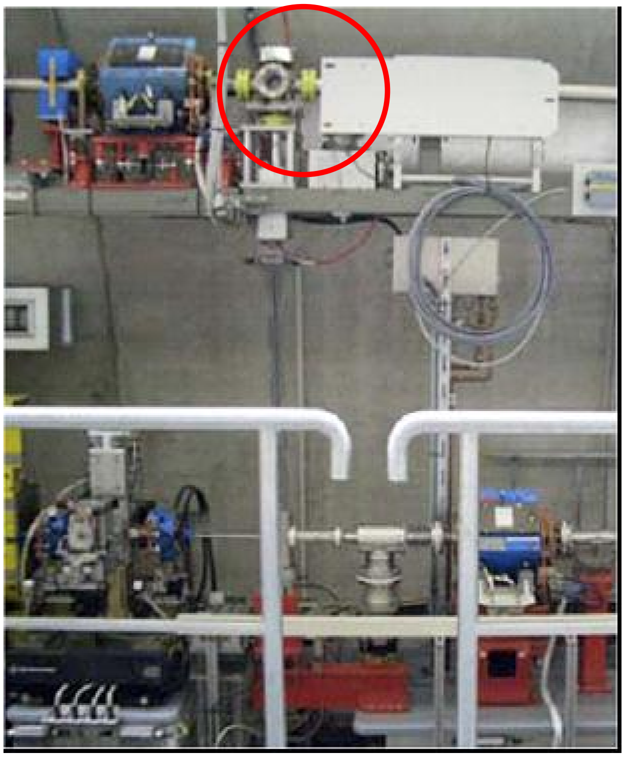
A silicon wafer with 1 μm of silicon nitrides was used to realize the target. By means of lithography technique and anisotropic chemical etching a clear cut was opened in the target. 1 μm of aluminium was also deposited by sputtering to increase the reflectivity of the target and increase the number of collected photons.



Simulations were also performed to define the optical setup for the experiment. We decide to use an achromatic doublet f=200 mm to make a beam image while the beam is intercepting the whole target using the optical transition radiation. A double convex lens with an antireflection coating with f=500 mm will be used to produce the angular distribution of the diffraction radiation on the detector.

An interferential filter at 800 nm with a 80 nm bandwidth, together with a Glan-Thompson polarizer, will select the radiation. All the optics have been ordered.

The position of the experiment was chosen in order to meet the requirement of our measurements and the TTF linac operation. It is located in the bypass line at z=202 m along the linac.



In this position two dosimeter will measure the integrate dose collected during the normal linac operation. This data will be useful in planning the amount of lead needed around the detector to protect it from the environmental radiation.

The full design of the mechanical and electronic stuff required by the experiment will be ready soon with the installation scheduled in September, while in the next June a high accuracy stepper motor actuator with the diffraction radiation screen will be placed in the beam line.

2.) Meetings / Workshops

Meetings organized under JRA1

Date	Title/Subject	Location	Number of attendees	Website address
15/03/2005	Emittance Monitor meeting	Desy (Hamburg)	10	

3.) Talks

List of talks of JRA1 members

Subject	Speaker/Lab	Event	Date	Web site
Measure the beam emittance with the DR	A. Cianchi / INFN-RM2	JRA1-WP11 meeting	15/03/2005	
TTF2 bypass setting for emittance measurement	G. Benedetti / INFN-LNF	JRA1-WP11 meeting	15/03/2005	

4.) Update of MS Project

N°	Task Name	Anfang	Ende
11.1	**Beam position monitor**	**Do 01.01.04**	**Mi 12.12.07**
11.1.1	**Present BPM installed in TTF module**	Mi 30.06.04	Mi 30.06.04
11.1.2	Cryogenic measurements on BPM	Do 01.07.04	Fr 06.08.04
11.1.3	Beam tests of BPM on TTF	Mo 09.08.04	Fr 03.09.04
11.1.4	Design of BPM Cavity	Do 01.01.04	Fr 25.03.05
11.1.5	Design of BPM cavity ready	Fr 25.03.05	Fr 25.03.05
11.1.6	Fabrication of BPM Cavity	Fr 25.03.05	Fr 23.09.05
11.1.7	BMP cavity ready	Fr 23.09.05	Fr 23.09.05
11.1.8	Development of new hybrid coupler and electroni	Mo 05.07.04	Mo 05.09.05
11.1.9	Design of Digital Signal Processing	Mo 03.01.05	Mi 17.08.05
11.1.10	**New BPM ready for Installation**	So 01.01.06	So 01.01.06
11.1.11	Beam Tests with new BPM	Mo 02.01.06	Mi 12.12.07
11.1.12	**Evaluation of BPM operation**	Mi 12.12.07	Mi 12.12.07
11.2	**Beam Emittance Monitor**	**Do 01.01.04**	**Mi 28.05.08**
11.2.1	Slit width simulations	Do 01.01.04	Fr 02.04.04
11.2.2	Slit design	Mo 05.04.04	Fr 02.07.04
11.2.3	Optics simulations	Mo 05.04.04	Fr 02.07.04
11.2.4	Optics appropriations	Mo 05.07.04	Mo 15.08.05
11.2.5	System assembly and tests	Mo 25.10.04	Fr 30.09.05
11.2.6	Mechanical assembly at TTF	Mo 03.10.05	Mi 02.11.05
11.2.7	Optical assembly at TTF	Do 03.11.05	Do 01.12.05
11.2.8	Integration of controls into TTF	Fr 02.12.05	Sa 31.12.05
11.2.9	**Ready for beam test in TTF**	Sa 31.12.05	Sa 31.12.05
11.2.10	Beam tests at TTF	Mo 02.01.06	Fr 02.06.06
11.2.11	Evaluate first beam test result	Fr 02.06.06	Fr 02.06.06
11.2.12	Successive measurements	Mo 05.06.06	Mi 28.05.08
11.2.13	**Final evaluation**	Mi 28.05.08	Mi 28.05.08