

**EUROPEAN ORGANIZATION FOR NUCLEAR RESEARCH
ORGANISATION EUROPEENNE POUR LA RECHERCHE NUCLEAIRE**

CERN – PS DIVISION

PS/BD/Note 2002-086

**Review of Beam Diagnostics Systems in the PS Division:
An Executive Summary to Dec. 2001**

V. Chohan

Geneva, Switzerland
27 May 2002

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1 Background

The review mandate was defined in July 2001 with the understanding that the review process would take considerable time.[®] For that reason, an initial oral report on the review process, ie, means, methodology and directions where emphasis had to be laid, was foreseen for Dec2001 - as mentioned © {complete mandate is attached in the Appendix}.

The initial report was prepared for oral presentation on 10Dec01. However, the presentation was postponed twice at the behest of the Division Leader to an eventual presentation on 21Jan02. This presentation is available under minutes of the PSMB meeting of that date as well as in PS/BD/Note 2002-063 (attached as Appendix to this Summary). It is also appropriate to mention here that an overview of BD activities and work status for 2001 was presented to the PS Performance Committee (PPC) Meeting on 14Sept01 and is available under minutes of that meeting at <http://psdoc.web.cern.ch/PSdoc/ppc/ppc010914/ppc010914.html>.

The PPC presentation covered problems, status & work for all the PS machines and projects like CTF3 and provides further complementary background information.

2 Objectives of this Summary

The December Report gives the general lines followed in carrying out the review, i.e., (a) review procedure/method of approach, (b) systems identification, inventory together with correspondents from different machines, (c) status & improvements of systems, (d) new and urgent requirements and finally (e) issues of stream-lining, rationalization.

It had been increasingly clear from the onset that the machine correspondents were naturally more inclined to demand improvements or functionalities (new or foreseen) or having new systems for operational usage. Hence all discussions concerning status and improvements were on those lines only. A joint report on that and for all the five chapters would need considerably more discussions to conclude. That, together with current status of affairs in the accelerator sector and restructuring, it is imperative that the first step ideas in stream-lining, reducing duplication & rationalization - as already outlined in the Dec2001 report, should be separated and stated now in this summary format, so that the recommendations be analyzed and priorities accepted by management. The following represents only these immediate priority rationalization ideas (needing urgent manpower efforts or financial implications) suggested orally.

3 Emittance Measurements for LHC proton beams

As we are heading towards provision of operational LHC-type beams to SPS within the strict emittance budget, the provision of consistent tools for emittance measurements through the chain from PSB to PS and TT2, TT10 has been a subject of great importance and has been discussed repeatedly, particularly with machine representatives and therefore treated first.

[®]Excerpt from Mandate: *The Review will be carried out concerning the entire PS accelerator complex. It involves consultations and co-operation within the Division Given the complexity of the issues and continuous evolution in terms of beams and test facilities of the PS complex, the Review will need substantial work and refinement over several years and will be considered as an ongoing project with broadly defined aims above".*

©Excerpt from Mandate: *"An initial report on the review process will be presented in Dec 2001"*

- 3.1 *There are 4 systems or methods (Beamscope, Blade Scanner, SEMGrid (ring3) and pressure bump) for PSB Rings for which considerable manpower efforts have been dispersed to varying degrees in recent years; the latter two are supposedly used for machine development and in their experimental state. The 5th system (Wire Scanners) is under development. In 2001, the standard and only method to measure the emittance of LHC type beam in PSB is to send this to the BTM measurement line and to use the system of 3 Sem-grids.*

Recommendation for PSB: Put all emphasis on PSB Wire Scanners to make them work. This was not possible in 2001 because the CTF3 preliminary phase startup & its commissioning would have been seriously jeopardized. Corollary: Minimize &/or abandon the multiplicity/usage of other methods or systems, thus gaining in effort in manpower as well as in hardware maintenance cost. (Controversial: disconnection from the machine enclosures of the unused devices, if a natural opportunity permits).

- 3.2 *Emittance Measurement in the PS for circulating beams is also done by wire scanners, for which the results are often controversial. There is also a duplication of devices, often yielding conflicting measurement results.*

Recommendation for PS: Upgrade these scanners to the same software and specific hardware standards as done for the PSB. This implies that PSB Scanners **must** be proved to work prior to this upgrade and would require financial and manpower resources. Corollary: In the long run, keep only one pair of wire scanners instead of the two pairs in PS Ring sectors 54,64,75,85. Mechanically, the pair would be identical to the PSB devices but the modifications would require major specific electronics and software to be identical to the PSB devices before one can claim operational availability.

- 3.3 *Emittance Measurements in TT2 for LHC-type beams to date have been performed using Sem-Wires in TT2 but without the last stage bunch rotation in PS, i.e., 16 ns LHC-type bunches and not the true 4 ns as specified because the electron-cloud problems on sem-Wires renders the measurement useless for 4 ns bunches. However, an alternative method has been proved to work using OTR techniques, on the lines developed by SL Division in TT10. One such device has been installed in TT2 (at MTV201) as one of the key installations in early 2001 to prove its viability & functionality during the year 2001. Today, the single OTR device is used for MD's in coupling studies but sem-wires and sem-grids are the other devices also used in TT2 for all the different beams and purposes. Hence, reduction and rationalization is extremely hard to achieve on a short time scale due to different and operationally valid reasons, e.g., Sem systems are also used for beam steering today.*

Recommendation for TT2: Install further OTR devices in TT2, similar to the prototype installation done already (MTV201) in 'treble' type MTV stations (e.g., at MTV218, 326, 374, 379) and give full priority in MD's, tests so that full compatibility to SPS Injection measurements is achieved and establish reasons for differences (beam blow up ..?) in measurement (both, for LHC type beam emittances and coupling issues). ***The OTR devices must be made to be fully operational and not just for MD's.*** This way, for high-density LHC type beams, the same type of device will be used for emittance measurements for extracted beams in TT2, TT10 up to SPS Injection. Note: The TT2 is also used for **high-density** LHC type beams as well as **high intensity** AD Production beam, SPS CT beams, nTOF beam, future CNGS beams etc. In

addition, till the TTL2 loop usage is formally abandoned for sending 3.5 GeV test beams to AD, TT2 is also the beam-line for these beams. For these reasons, the existing Sem-Wires (sectors 257/267/277) or Sem-grids (258/268/278) that have different acceptances (hence, used for high-density or high-intensity beams respectively) will continue to play a complementary role to OTR's in providing useful measurement functionality for these beams. Furthermore, for ion beams the Sem- devices were used to date and were foreseen to be used for the future; this needs further study/confirmation due to the LHC ion beam characteristics in TT2. One possible way to reduce the number of TT2 beam size measurement devices would be to have a **new design of Sem-wires system** with at least the same spacing as today (0.5 mm generally except in Sem-Wire 267H it is 0.35 mm) but an increased number of wires to cover the full acceptance, unlike today. These devices **should** also be free of electron-cloud problems that persist in today's devices. These new devices, if conceived correctly, would perform in an almost non-destructive manner and eventually, would cater for all non-LHC type beams, as well as complement OTR usage for LHC type beams – in which case the usage of sem-grids 258/268/278 could be eventually abandoned.

In general, one can conclude that for transverse beam size measurements of LHC type proton beams, one can standardize on similar wire scanner devices in PSB & CPS and OTR screens in TT2, TT10 if the above recommendations (a long-term issue) are followed. For non-LHC beams the new Sem-Wires (if built) could provide the appropriate functionality.

4 Sem-grids (MSG 48/52/54) at Injection in PS

Apart from emittance measurements, one of these devices has been equipped in an experimental set-up to permit multi-turn measurements and permit matching studies. However, the system is only available for MD's – similarly, the quadrupolar pick up method (a non-destructive technique), also conceived for similar studies, is similarly only available for studies, i.e., not routinely operational. Until further results and evaluation are done on the latter, it is not possible to make specific recommendations today (but see recommendation 1 under chap. 6).

5 Closed Orbit Measurement System in PS

The PS CODD system is a trajectory measurement system having highly specialized hardware and low-level software involving a considerable number of electronic crates, racks and is manpower intensive in terms of upkeep and evolution. In addition, for heavy ions, CODD does not provide the beam position measurements and alternative methods, hardware (e.g. MRP system) and software have been developed, which are also manpower intensive in upkeep and evolution. For these reasons, a system based on the normalizer approach in giving average beam position and closed orbit, as done in other machines like PSB (and in the past: AA, AC, .etc) would reduce our hardware & electronics diversity and permit economies of maintenance manpower and re-deployment/ optimization.

Recommendation: Full priority should be given to make the normaliser approach work in the PS so that we can achieve some hardware Interchangeability and standardization between PSB, CPS and possibly even for future LEIR. There are also substantial gains in reducing software multiplicity /diversity. Corollary:

Abandon the usage of existing CODD system in the PS when the normaliser solution proves to work and **alternatives have been fully accepted for other applications where CODD system of today is essential**, i.e., Inj studies (see below) etc. The enormous hardware (BD + CO) and software outlay in CODD for maintenance and evolution signifies considerable global savings.

6 Injection Studies in CPS and PSB and new CT beams studies in CPS

For new CT beam studies for future CNGS, I proposed in May 2001 the purchase of 500 MHz Acqiris Digitizer system for transverse phase space studies (x , x' over several thousands of turns) in the PS. This is a PCI based system that was indeed purchased in July 2001 and was proved to work for this purpose in the later half of the year, with successful machine development sessions.

Recommendation 1: Give full priority to all hardware and software development so that this system can also be used for Injection studies where CODD has been used to date. This implies (a) availability of switched /multiplexed pickup signals and so forth as well as (b) full integration of PCI based PC systems into standard controls. The latter implies that the project in CO Group to permit PC's to act, as a front-end DSC should be given a very high priority. If pickup signals can be suitably multiplexed, the same 500 MHz system may also be used for the Quadrupolar pickup signals. One would then have one 500 MHz Digitizer system satisfying 3 different needs, namely, (i) transverse phase studies and application for CNGS, (ii) Injection Coherent oscillations & corrections and (iii) quadrupolar pickup signals and application.

Recommendation 2: apply the same Acqiris 500 MHz system type of approach to the PSB half-turn pickup Inj studies. (In fact, this recommendation was indeed followed in March this year by M Benedikt and a system similar to the one for PS was ordered).

Corollary of above 2 recommendations: Abandon the maintenance and use of multifarious oscilloscope based systems that have been installed and developed in the MCR by different OP persons (all for valid reasons). These are often marred by limited & slow interfaces to standard controls with applications maintained by them and for which, there is often only one person capable of system maintenance and to assure continuity.

In general, one can conclude from 2 & 3 above that significant rationalization may be achieved in applying the Normalizer approach for the PS Closed Orbit system and providing switched pickup signals as necessary for needs at Injection and other studies. The integration of PCI based systems into standard controls is essential to provide versatility, interchangeability of hardware and software in the CPS and PSB and reduce maintenance overheads.

7 Transfer Line Pickup Systems Development and standardization

For PSB to PS BTP Line, we have used techniques of base-line restitution, auto-calibration and digitizing of signals with appropriate /sufficient sample rate digitizers in VME based systems.

Recommendation: The same approach as mentioned should now be applied for all currently approved or future transfer-line type pickup projects. This approach will permit standard hardware and software solutions and reduce considerably the respective overheads in long-term upkeep. The CTF3 and LEIR to PS transfer line pickups would both have similar systems and similarly, if resources permit, same type of systems may also be used for AD beam lines pickups as well as pickups in PSB to Isolde line. Commercially available Bipolar VME ADC Modules with sample rate of at least 100 MHz and or higher with enough memory would meet the beam characteristic requirements in all the above-mentioned applications. An added bonus would be that the 100 MHz modules could also replace CAMAC-based 100 MHz Digitizers in the AD. Note: This recommendation was followed particularly for recent discussions about CTF3 pickups and it has been agreed that while a 65MHz sample-rate is sufficient, the manufacturer will ensure transparency/compatibility in hardware/software for 100 MHz versions of the module to be produced and made available in the future.

8 Fast Transformers in all Beam Lines, BT, BTP, BTY, TT2, TTL2, nTOF, LEIR-PS

Over the last few years, sample-hold, integrator techniques with same specific electronic modules in NIM has been implemented as a major standardization effort and a very significant reduction in diversity. The controls interface is via a simple, commercial ADC module MPV908 – a versatile and well-established device used widely and completely supported by the CO Group.

Recommendation: This approach should continue and would be the most economical for all new fast transformer type of requirements, particularly the 3 new devices required for LEIR to PS ion beam transfers. Any alternative approach based on digital techniques would imply serious cost considerations (hardware, software, manpower) if one wants to maintain uniformity/standardization because all the lines mentioned in the heading would eventually need to be converted to the same digital approach.

9 Standardization of Electronics and software for Wire-based Devices

This subject was mentioned in the Dec report as a subject which is under study by a small working party with potential in substantial reduction and diversity in electronics for all wire based devices, i.e., Sem-wires, sem-grids, MWPC's, silicon strip detectors etc. Further ideas or recommendations can only come after progress is known from this ongoing work.

[At the user interface software level for MWPC's, I had already launched the idea to standardize on same user interface for these devices as for Sem-grids. This was possible only after the MWPC's in East Hall were hardware interfaced in the right manner [use of IP-Octal RS232 VME module] and amenable to that approach. This indeed was done in 1999 and the idea was to extend that to AD MWPC's. For AD, this has still not be done but would be the approach which can already

simplify software interfaces to these systems at the console level until the new method emerges from the working party recommendations]

10 Reduction in number of fast transformers in L2, L3 common line and measurement lines.

There is a possibility of reducing the number of transformers in this domain. However, all these are operationally stable systems with little maintenance overheads and are reasonably established both in hardware and software. Until a major upgrade/modifications in infrastructure hardware and ensuing software is carried out of necessity, I see little gain in rationalization here.

11 Final remarks

This summary attempts to put in as brief form as possible the ideas behind rationalization and standardization presented in the oral report and within the terms of reference of the BD review launched in July 2001. It is done within the constraints of our existing operating machines, habits of operation and a tacit acceptance of these constraints. However, one should also state that if a unique operation and control room for all CERN accelerators becomes a reality, further stream-lining may be possible for certain diagnostics equipment in transfer lines TT2/TT10, particularly in emittance and position measurements.

12 Acknowledgements

I am grateful to my machine correspondents, particularly, M.Giovanozzi(PS), M.Benedikt (PSB) and R. Scrivens(Linac2 & 3) for the lively discussions and providing the necessary food for thought in trying to drive forward some of these rationalization proposals.

APPENDIX 1

July 4th, 2001

Mandate for the Review of the Beam Diagnostics Systems of the PS accelerator complex including new test facilities

(Jean-Pierre Delahaye)

Objectives

The PS Division, comprising various Accelerators, Beam Areas and Facilities has disparate Beam Diagnostics Systems of variable usage and ages and is confronted with reduced resources and maintenance limits. This, together with the effectiveness and improved efficiency that needs to be achieved in the CERN injection chain for the approaching LHC requires a critical review of the beam diagnostics systems of the PS accelerator complex, including the planned new test facilities.

Mandate

Within the framework for rationalisation of the beam diagnostics systems, review all systems and instruments used in the PS accelerator complex, taking into account the characteristics and properties of the beam at the entrance and exit of each accelerator as well as during acceleration or transfer to other machines or facilities.

The review will be carried out with the persons responsible for a given machine and its operation, as well as with the persons responsible for the instrumentation systems and should cover the following points:

1. Identify the existing devices and systems used, both in terms of measurements and in type of usage, i.e., routine operation, beam studies and so on.
2. Evaluate the pertinence and performance of the systems with respect to the required beam characteristics – at present and as foreseen in the near future.
3. Identify redundancies and duplication, as well as a lack of systems for particular measurements or needs.
4. Propose a rationalisation of the systems, taking into account the routine usage, standardisation and maintenance aspects, rejuvenation, upgrade or construction of new devices, as well as suppression where applicable.
5. Attempt to develop collaborative efforts with other laboratories or industry for the evolution and maintenance of different measurement systems, taking into account the interests of CERN in maintaining knowledge, potential and motivation of in-house staff.

13 Means, Resources and time-scale

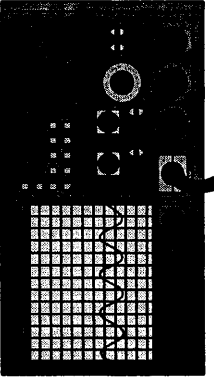
The Review will be carried out concerning the entire PS accelerator complex. It involves consultations and co-operation within the Division and may entail formation of ad hoc consultative groups if necessary; these would then provide the essential feedback from user requirements and so on. Given the complexity of the issues and the continuous evolution in terms of beams and test facilities in the PS complex, the Review will need substantial work and refinement over several years and will be considered as an ongoing project with broadly defined aims as above.

An initial report on the review process will be presented to the PS Management Board at the end of 2001.

APPENDIX 2

Review of Beam Diagnostics Systems in PS Division

(Interim Oral Report presented to PSMB, January 2002)



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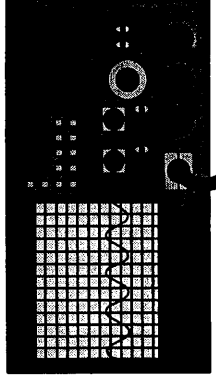
PS/BD/Note 2002-063

REVIEW OF BEAM DIAGNOSTICS SYSTEMS IN PS DIVISION

V. Chohan

Copies of transparencies presented to the PS Management Board

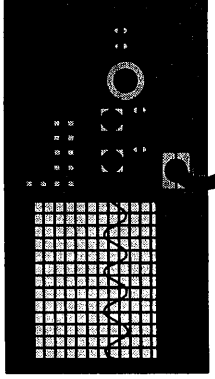
Geneva, Switzerland



Review Of Beam Diagnostics Systems in PS Division :- Mandate remit

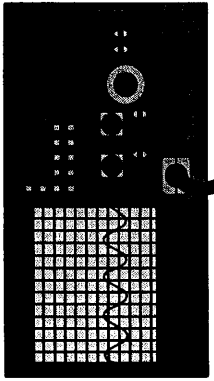
Excerpts from Mandate (JPD :4July2001) :

- ◆ The review should be carried out with the persons responsible for a given machine and its operation as well as with the persons responsible for the instrumentation systems and should should cover the following points:
- *Identify the existing devices and systems used in terms of measurements and in terms of type of type of use, i.e routine operation, beam studies and so forth.*
- *Evaluate the pertinence and performance of the systems with respect to the required beam characteristics - presently and as foreseen in the near future.*
- *Identify redundancies and duplication as well as lack of systems for particular measurements or measurements or needs.*
- *Propose a rationalisation of the systems, taking into account the routine usage, standardisation standardisation and maintenance aspects, rejuvenation, upgrade or construction of new devices devices as well suppression where applicable.*
- *Attempt to develop collaborative efforts with other laboratories or industry for the evolution and evolution and maintenance of different measurement systems but, taking account the interests of interests of CERN in maintaining knowledge, potential and motivation of in-house staff.*
- ◆ **An initial report on the review process should be presented to the PS Management Board at the end of 2001.**



Review Of Beam Diagnostics Systems: how & what ?

1. **Review Methodology:**
 - **Nomination of Machine Correspondents**
 - **Systems Identification**
 - **Usage**
 - Protons &/or ions, Routine Operation, Machine Experiments & Development
 - **Status**
 - Interlude on Current Issues - PPC Presentation 14Sept2001
<http://psdoc.web.cern.ch/IPSdoc/ppc/ppc010914/ppc010914.html>
 - Outstanding Problem Issues
 - New Requests
 - **Identification of Duplication & Redundancy**
2. **Rationalisation: (a) launched, (b) under study, (c) further proposals**
3. **Collaboration & outside contracts**
4. **Urgent Remedies**
5. **Discussion**



Accelerator or Areas Correspondents

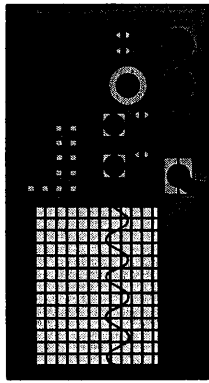
Excerpts from : *M E M O R A N D U M* dated *March 2001*

To: PS management, group leaders, project leaders and deputies
From :Jean-Pierre Potier

In order to coordinate and rationalise our efforts for all existing accelerators in the PS Division and for the planned ones (LEIR, CTF3), I have asked V.Chohan to act as Accelerator Instrumentation Requirements Co-ordinator. His role will be to collect and discuss the requests arising in the projects or the upgrades or rationalisation possibilities of existing systems prior to a discussion within the BD group for a possible introduction in its work plan.

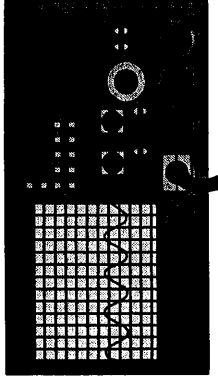
On the accelerator side, for each machine or project correspondents have been agreed by the responsible group leader or by the project leader:

Linac 2 and 3 including the transfer lines to the PSB	R.Scrivens	M.Benedikt
PSB including the transfer lines toward PS and Isolde		M.Giovannozzi
PS and the transfer lines toward AD and SPS	R.Steerenberg	
East area and the transfer lines from the PS	T.Eriksson	
AD and its experimental areas		M.Lindroos
Isolde		
CTF3 preliminary phase	R.Corsini	
CTF3 initial and nominal phase	H.Braun	
LEIR		M.Chanel



Existing and Installed Diagnostics Systems (inventory 03/2001)

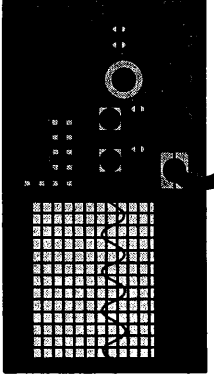
	Location	BT-P	BT-A	BT-DC	WCM	PU-E	PU-M	PU-C	PU-QUAD	PU-SCH	Q-MEAS	MTV	CLM	OTRM	SEM-GRID	MWPC	WS	WS-F	M-TARGET	SCRAPER	BSCOPE	BLADE	RGPM	RGLM	BLSM	SYLM	ION-CH	SEM-1	CUP	BLM	SCINT	Z
1	Linac 2	16					16								10										9						51	
2	Linac 3	10				7									18									1							37	
3	PSB injection and measurement lines	5					24				8				2														8		47	
4	PSB ring	4	8	4	4	136					8				1		8				8	1	1						32		215	
5	PSB - PS transfer line	2				28					5				2														8		45	
6	PSB measurement line	1				4					3				6																14	
7	Isolde line	4				4					7				6														2		23	
8	Isolde														16		56											27	1		100	
9	PS ring	1	1	1	3	122			2	2	2	5			6		4	2											100		250	
10	TT2 and dump	6				8						9			12														8		45	
11	TTL2	1									2																				3	
12	East Hall	1										12	1										1								34	
13	AD proton injection line (TT2 - target)	2									4				2																8	
14	AD pbar injection line (target - AD ring)	2				10						9																			21	
15	AD reverse injection line (TTL2 - AD ring)	2									4																				6	
16	AD ring			1		63			6	2	2	2								2			2							2	80	
17	AD pbar ejection line (AD ring - experiments)	1													30									3							34	
18	LIL V					4	1	6				2	2	1	1																17	
19	LIL W					3	13					7		2	2																27	
20	EPA ring			1			38				2	2					8								4						55	
21	CLIC Test Facility (CTF)					6	10					3	4															1			24	
	Σ:	58	8	7	22	383	107	0	2	6	14	81	6	5	84	44	66	12	2	2	8	1	6	0	10	4	0	5	32	158	3	1136



Criterion Used in Systems Identification

Decided to base on machine physics needs so, for the Circular Rings for example:

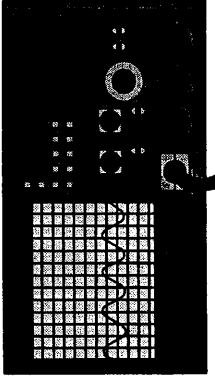
- **Intensity**
- **Position**
- **Size**
- **Other :**
 - **Bunch Shape**
 - **Tune**
 - **Loss Monitors**
 - **Special Systems e.g., Digitizers**
 - **etc**



Systems Identification

Activities launched to date for:

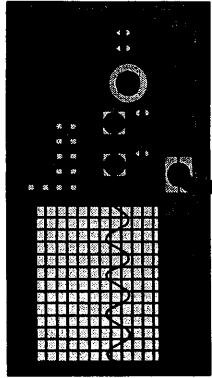
- **Proton & Ion Linacs, including**
 - All the Lines LTE, LTL, LBS, LBE
 - All the lines ITM, ITF, ITH ..
- **PSB**
 - Linac to PSB Inj line
 - 4 PSB Rings
 - Extraction Line BT(incl recomb.), BTP, BTM, BTY
- **CPS**
 - Injection & Extraction Processes,
 - PS Ring
 - TT2
- **East Hall Expt. Area systems**
- **AD**
 - Injection
 - Ring
 - Extraction and Physics lines



Systems Identification cont'd

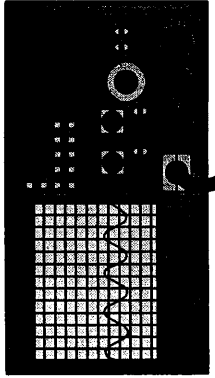
Other Activities in parallel for Projects:

- **LEIR & PIL** : Requirements & BD Implications well defined
- **CTF3 Preliminary**: Definitions, Modifications, installation and bring to operation done in 2001
- **CTF3 Other phases** : Definitions & Requirements in pipeline
- **ISOLDE** : ongoing work



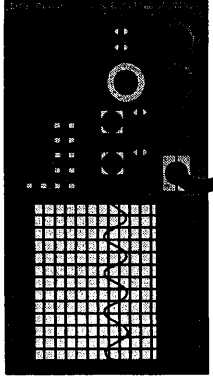
Example Summary of CPS Systems

	Injection	Circulating beam	Extraction	TT2
Intensity	6-turn transformer	DC transformer		TRA126 (CT) TRA203/372/379/386
Position	MSF42 SEM-grids (48/52/54)	CODD	Screen (MTV16)	SEM-fils (257/267/277) SEM-grids (258/268/278) OTR (MTV201) Screens (MTV138/201/218/326/352/374/387/379) WB pickups (208, 228) Couplers (SL)?
Size	SEM-grids (48/52/54)	Flying wire (H54/64, V75/85) Flip target (18-V/65-H)	Screen (MTV16)	SEM-fils (257/267/277) SEM-grids (258/268/278) OTR (MTV201) Screens (MTV138/201/218/326/352/374/387/379)
Other	WB pickup 03 Quad pickup Q measurement BLMs Transverse feedback Acquiris Fast Digitizer	WB pickup 03 Q measurement BLMs Acquiris Fast Digitizer	WB pickup 03 Q measurement BLMs Acquiris Fast Digitizer	



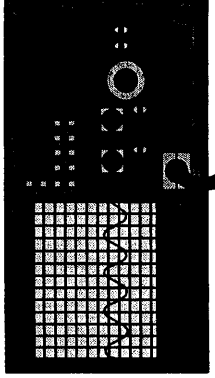
Points emerging from the first round discussion in systems identification

- ◆ LINAC II & LINAC III
 - lots of BD Equipment in Multiple Lines (historical..
 - No Major Issues other than for the Systems already under revision
 - BSM & BLVDs are NOT considered for Integration but *BD support in Hardware + troubleshooting essential*
- ◆ PSB RINGS and LINES
 - Emittance Measurement in Rings still not possible – only way is via Measurement Line
 - 5 different Systems in Rings installed for emittance m'tment
 - 1/2 turn PU Usage and Application needs non-BD Support + coordination
 - PU's in BT line need further attention
 - ISOLDE Line & 5 new PU's DESIRED



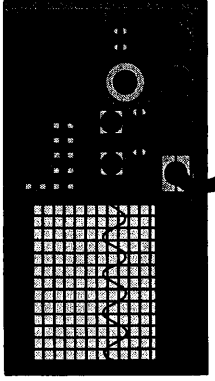
Points emerging from the first round discussion in systems identification

- ◆ CPS Ring Systems
 - Emittance M'ment & Flying Wire in PS Issues
 - CODD replacement by PSB type Normaliser Solution *feasible* if all current CODD usage (Inj, ABS etc) issues are resolved
 - New CT Beams & fast DGTZ + Excitation
- ◆ TT2 Systems
 - Emittance for LHC beams marred by electron Cloud problems on Sem-fils
 - OTR prototype & further development like as in TT10 (SPS) to *standardize Emittance M'ment*
 - Position PU's & SPS installations in TT2



Points emerging from the first round discussion in systems identification

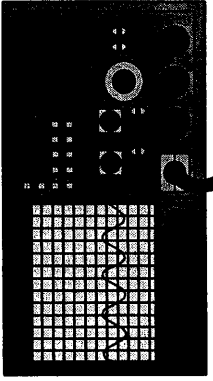
- ◆ East Hall Area Systems ◆ AD & Expt. Beam Lines
 - No serious problem Issues
 - MWPC with full Control & Display capability is a major wish
- Tune Measurements on Ramps and flat tops using DRX system should become operational
- Position PU's are highly desirable in physics beam lines
[10 Horiz & 10 Vert ?]



Rationalization Aspects: Launched

- Fast Transformers in all Beam Lines, BT, BTP, BTY, TT2, TTL, nTOF etc
 - Sample-and-hold, Integrator technique with same electronics already implemented over last few years as a major standardization using same VME ADC MPV908
 - Apply same for LEIR to PS line for 3 fast Transformers

- PS Closed Orbit System Using Normaliser Techniques
 - PSB, PS, future LEIR all would have similar systems –
[conceptually even AD but modules have factor 10 better resolution..]
 - Would reduce hardware complexity like in today's CODD (since '96 with new rf harmonics in PS)
 - Diversity in electronics heavily reduced +
{ interchangeability of modules PSB, PS, LEIR hoped for }
 - Closed Orbit Software aspects simplified in the long run while Inj. Oscillations treatment implemented differently

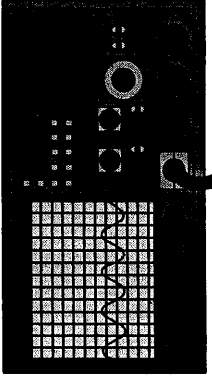


Rationalisation Aspects : Under Study

- Standardize Electronics for all Wire based Devices (and signals using integration) in PS , East Hall, Isolde etc , i.e.,
 - Sem-Grids+Sem-Fils
 - MWPC's
 - Silicon Stripline detectors
 - Etc.. BLM's ?

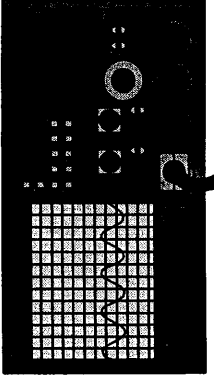
-Working Group set up...

-Console level standardization also desirable. Something on these lines already done for MWPCs(East Area & AD) & Semgrids & Toposcope in recent years



Rationalization Proposals:

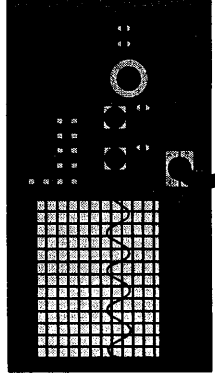
1. Emittance Measurements in PSB & PS Rings:
 - **Adopt same system as in PSB for PS**, (ie., after the Flying Wire systems in PSB start working in 2002)
 - PS system hardware is old (1994), approaching obsolescence and software written is complex with fitting & Eh / Ev evaluation in rt-task !! However, this project would need detailed study - Implementation time would be long
2. Emittance Measurement in TT2 Line
 - Present Semigrids/Semifils have electron cloud problems for LHC beams and have long-term maintenance to be considered together with complexity/diversity of devices, so
 - **Adopt SL techniques used in TT10 using OTR Screens**
 - 1 prototype already installed in TT2 & gave successful results
 - Further devices installation at 'treffe' type MTV stations under study (cables exist) but some crucial points need to be resolved like:
 - diaphragm control vs. use of filters
 - purchase image intensifier and new cameras
 - CCD radiation protection ideas..
 - ☹ LIMITATIONS: ≥ 14 GeV beams , AD Test beams dead anyway?...
 - ☺ ADVANTAGES: WOULD SETTLE DISCUSSIONS $< SL-PS >$ PERMANENTLY & AD Prod. beams Eh- Ev could also be measured same way



Rationalization Proposals

cont'd:

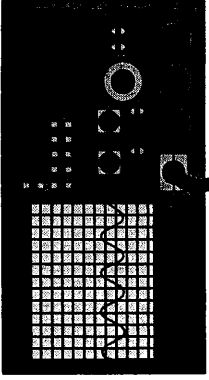
3. Transfer Line Pickup Systems Development & standardization
 - *Adopt techniques used in PSB-to-PS BTP line , ie., Base-line-restitution, auto-calibration, Digitising with High sample rate ADC's etc*
 - Need to purchase ≥ 200 MHz Sample-rate Digitizers (VME, PCI?)
 - Need Software Development Effort
 - *This approach would solve 'NEW' Requirements for ISOLDE, AD , LEIR lines with possible application in CTF3*
4. Undertake study & uniformise electronics for Linac2 Pickups using standard techniques
 - Present 8 Magnetic PU's 'Schindl type' use trafo for sum signal to 'normalise'



Collaboration & Contracts

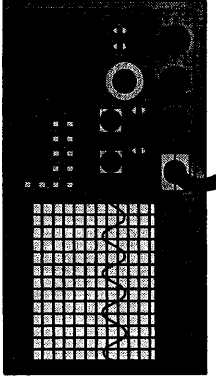
With SL Division

- ◆ **For Beam Current TRANSFORMERS**
 - LHC Beam Current Transformers Review done in Nov2001 (PS-BD/note 2001-014)
 - Four DC-BCTs for 2 LHC Rings to be supplied by PS/BD with industrially purchased &/or CERN built devices
 - 1 Fast-BCT from SL (LHC-type , low-droop, intensity-per-bunch) in TT2 for LHC use will be available via SL control system for PS use. We have negotiated that an analogue output from this device will also be available to us for our use i.e., we envisage usage for Continuous Transfer operation where our existing device (TRA126) is getting very fragile
 - We envisage future joint Maintenance Contract feasibility for transformers with 'Bergoz' components
- ◆ **For Other Systems:**
 - *MWPC's, TV monitors etc...*



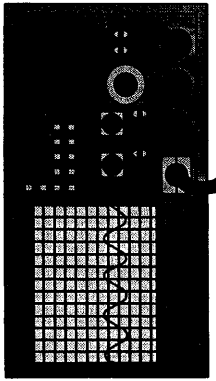
Collaboration & Contracts cont'd

- ◆ ***Maintenance or development Contracts for Pickups***
 - We have sensors and sensor mechanical drawings
 - For all currently known 'new' requirements (AD Beam Lines, ISOLDE, or LEIR-PS line), sensor design 'known' or easily adaptable & so drawings exist or need some modifications
 - For front-end electronics we have a vast in-house investment
 - Maintenance contracts with outside firms (e.g. Bergoz) *feasible only if we purchase front-end electronics from them*
 - Trade-off between keeping in-house front-end electronics knowledge or 'outsource' like done for specific accelerators, e.g., the big light-source machines(SLS, etc)
 - Ongoing INFN –Frascati collaboration for Pickup Systems development in further phases of CTF3

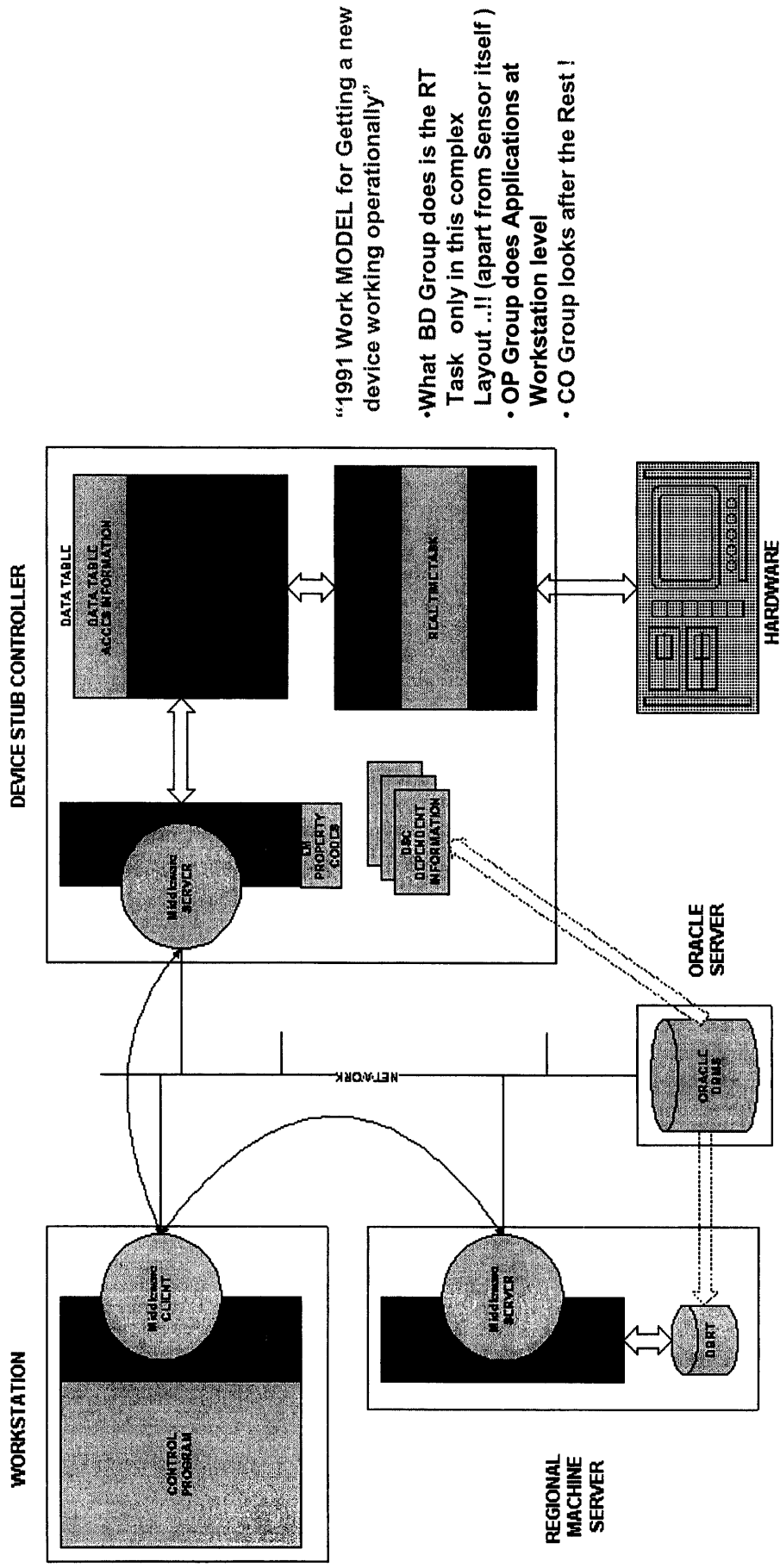


Possible Remedy for the FE Software bottleneck

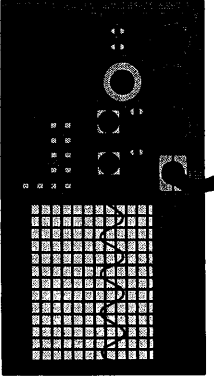
- ◆ Software bottleneck in front-end systems is not new: Management has been informed since early nineties
- ◆ Modern complex systems need modern tools and software is inherent and all encompassing - needing software persons of certain calibre
- ◆ Base-level 'software design' is very important – however, since years we have only taken “ quick, fire-fighting = pragmatic ” approach so in the same vein,
- ◆ Urgent problems can be solved by :
 - Task oriented teams (without respecting existing section/group structures for the completion life-time of a given task)
 - Money - ~ 150 KCHF /yr will permit 1 software engineer hire on a special industrial contract. IT Division contacts would permit such approach whereby we can squeeze such person(s) for next TWO years(2002/3) before new contract has to be passed thro' FC.



Reminder on Controls Architecture, where we fit our Diagnostics Systems & Who does what.....



- “1991 Work MODEL for Getting a new device working operationally”
- What BD Group does is the RT Task only in this complex Layout ...!! (apart from Sensor itself)
- OP Group does Applications at Workstation level
- CO Group looks after the Rest !



Review further steps..

Apart from continuing Identification and equipment improvement, availability , upgrade etc,

- (a) tackle Duplication & Rationalise,**
- (b) CLASSIFY needs per machine in categories or orientation based on:**

1. LHC beams Related including LEIR
2. SPS-CT and CNGS related
3. East Hall Expt. Beams related
4. ISOLDE Related
5. AD Related
6. CTF3 Related

PRIORITY WILL THEN HAVE TO BE CLEARLY AGREED UPON & would influence COMPOSITION OF TASK TEAMS AND hence realistic DEADLINES defined, so good PLANNING IS A MUST for OPTIMAL use of staff

Distribution :

PSMB

Simon Baird - PS
Jean Boillot - PS
Michel Chanel - PS
Gilbert Daems - PS
Jean-Pierre Delahaye - PS
Bertrand Frammery - PS
Roland Garoby - PS
Gunther Geschonke - PS
Jacques Gruber - PS
Helmut Haseroth - PS
Mats Lindroos - PS
Stephan Maury - PS
Klaus-Dieter Metzmacher - PS
Jean-Pierre Potier - PS
Jean-Pierre Riunaud - PS
Karlheinz Schindl - PS

Roberto Cappi - PS
Hermann Schmickler - SL
Vinod Chohan - LHC
Steve Myers - SL

Correspondants:

Michaël Benedikt - PS
Hans Braun - PS
Roberto Corsini - PS
Tommy Eriksson - PS
Massimo Giovannozzi - PS
Richard Scrivens - PS
Rende Steerenberg - PS