



INSTRUMENTATION PERFORMANCE IN 2011 & WISHES FOR 2012

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CERN Switzerland

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Acknowledgements:

We would like to thank the whole BI group:

The LHC injectors enjoy since the last 2 years an awaited increase in the level of attention and support. Many new systems and/or improvements were made, making powerful diagnostics possible.

Thanks to:

Christian Carli, Karel Cornelis, Klaus Hanke, Detlef Kuchler, Gabriel Metral, Bettina Mikulec, Richard Scrivens,

for their input in this presentation.

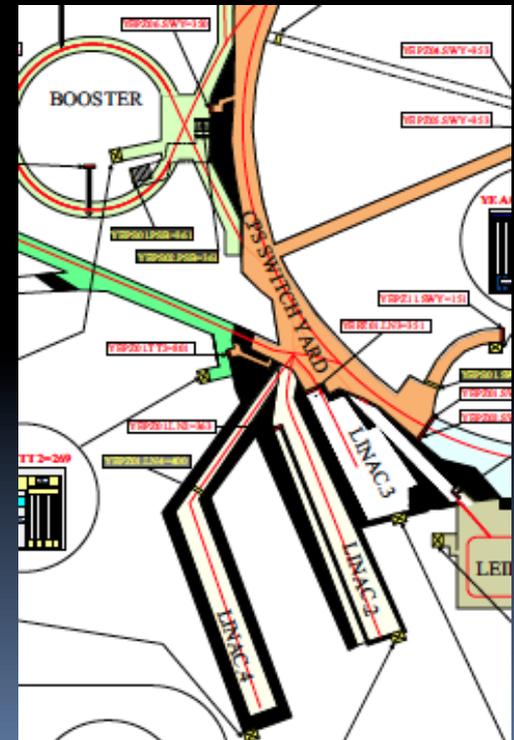


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LINAC3

- The energy measurement of the ions is only possible in the LBS and it is due to the coupling with PSB a quite tricky procedure, critical for setting up of the de-buncher cavity.
- No emittance measurement in the linac and after the linac.
- The beam sent to LEIR cannot properly be quantified.
- Without additional diagnostics the setup of new ion beams becomes a trial-and-error exercise.

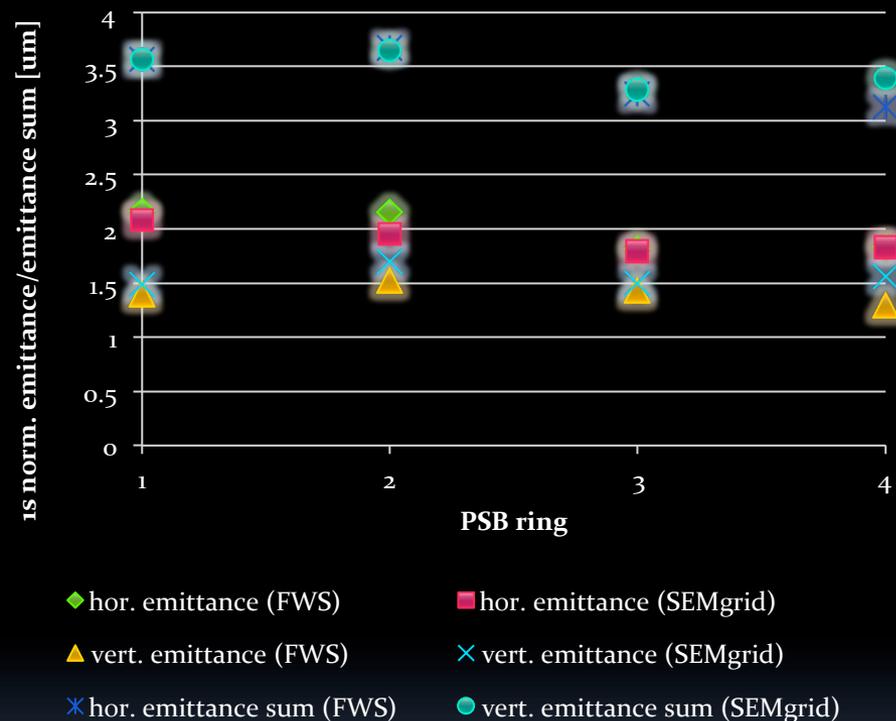


PSB: Profile Measurements (FWS and SEMgrids)

- After a lot of effort from BI, both FWS and SEMgrids give good and consistent results.

Still to be done:

- FWS filters! (filter wheel position gets blocked).
- FWS calibration of certain wire speeds not correct.
- Consolidate SEMgrid readout electronics.

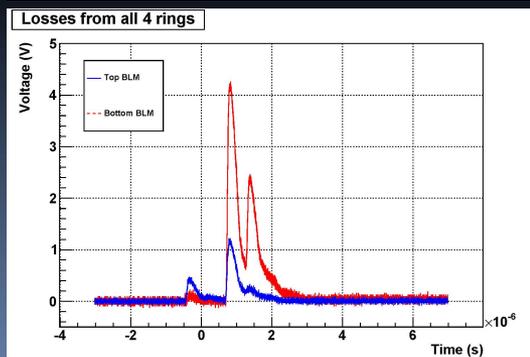
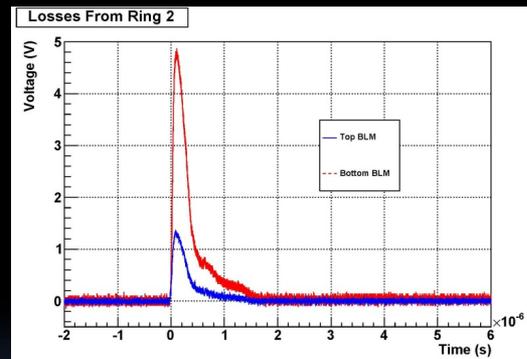
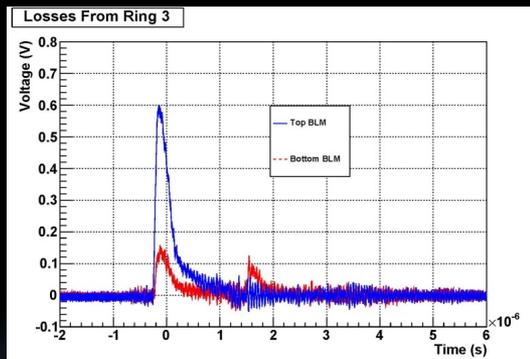


Emittance measurement of LHC50ns DB high-intensity beam.

A. Akroh and B. Mikulec

PSB: Beam Loss Measurements (1)

- LHC-type ionisation chambers installed for tests at Booster extraction.
- Losses generated ring by ring detected by the upper and lower monitor.
- Losses from LHCINDIV beam in different rings can be distinguished; losses from individual bunches are also visible.



E. Nebot del Busto,
E. Effinger, D. Allen,
B. Mikulec

to be completed in 2012:

- comparison between ACEM and ionization chambers at injection energy.

PSB: BCTs and Pick-Ups

Pick-ups:

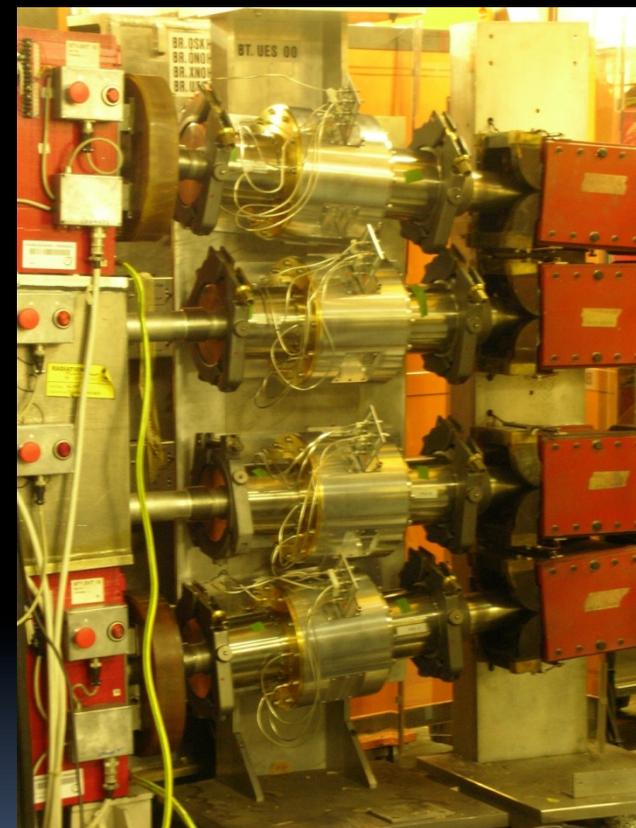
Renovation in the extraction lines in progress.

OP requirements:

- Replace obsolete orbit acquisition chain; needed for operation with Linac4 at the latest; simultaneous turn-by-turn observation for all 4 rings (H&V) without multiplexing.
- replace electrostatic PUs in the extraction line by inductive ones (robust against beam loss).

Transformers:

- Cross calibration between the machines is still an issue.

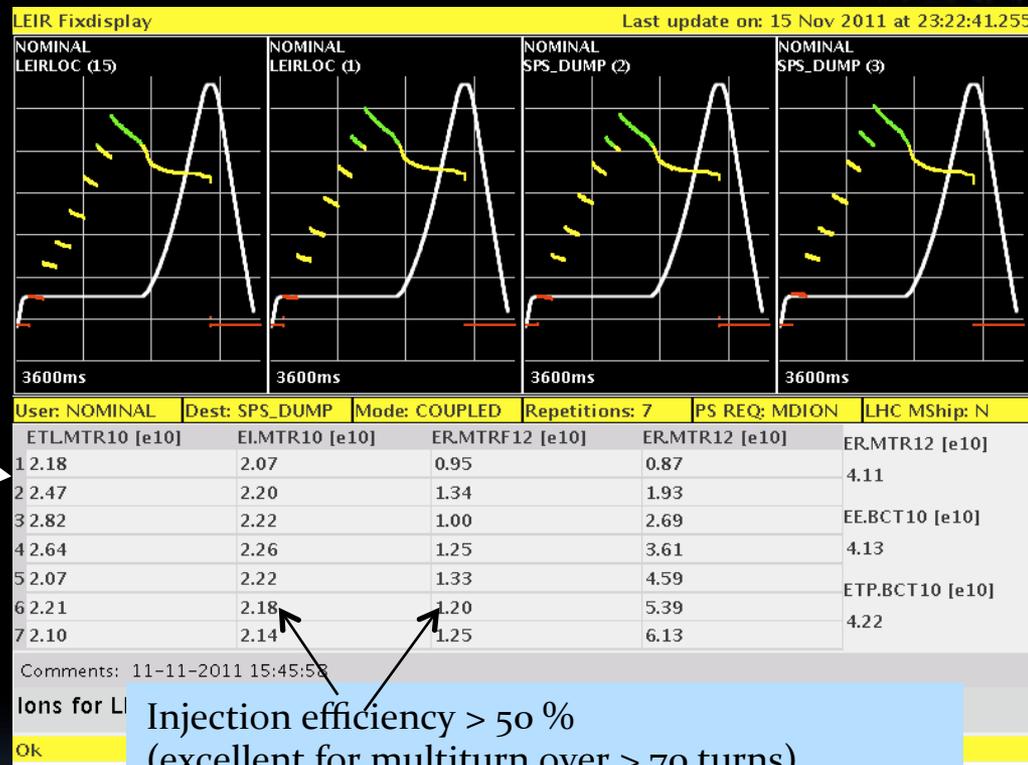


inductive PUs in the PSB

J. Tan & PSB supervisors

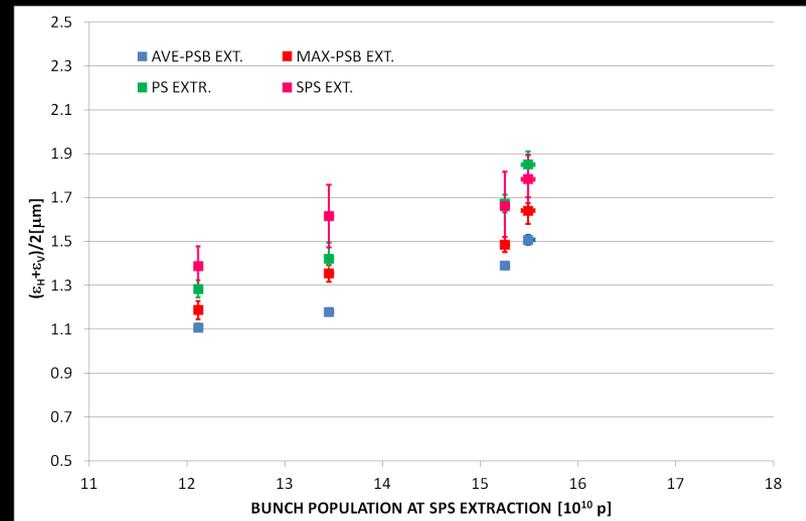
LEIR

- LEIR instrumentation in 2011
 - Most instruments well tested and operational for the start-up (thanks Ana!).
 - Minor problem with SEMs in the transfer line (for ejected beam).
 - In general adequate and working
 - Digitized acquisitions for transformers reliable (TRIC card) and available for new Vistar. →
 - ☹ Negotiations on a reduction of the number of BCT acquisition channels.
- Wishes for the future:
 - SEMs (in combined injection/ejection line) with slow electronics for injected beam (excellent injection efficiency this year ... matching & emittance measurement to understand and reproduce).
 - Ionization profile monitor (only emittance measurement in ring).
 - (Note: Schottky diagnostics with commercial spectrum analyzer – non-standard solution).



PS: Transverse Profile Measurements

- Very good joint (BI-OP-ABP) effort made on the BWS.
- Measurement campaign stopped due to bellow breaking risk.
- Good improvement not only in PS, but also across the different machines.
- Filter position not always coherent.
- All measurements & parameters to be put in DB (shutdown).

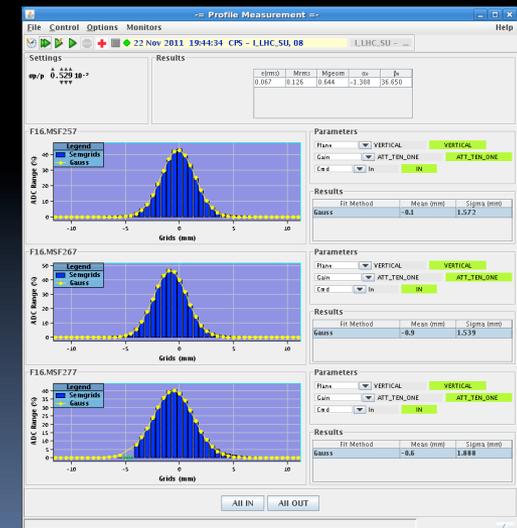
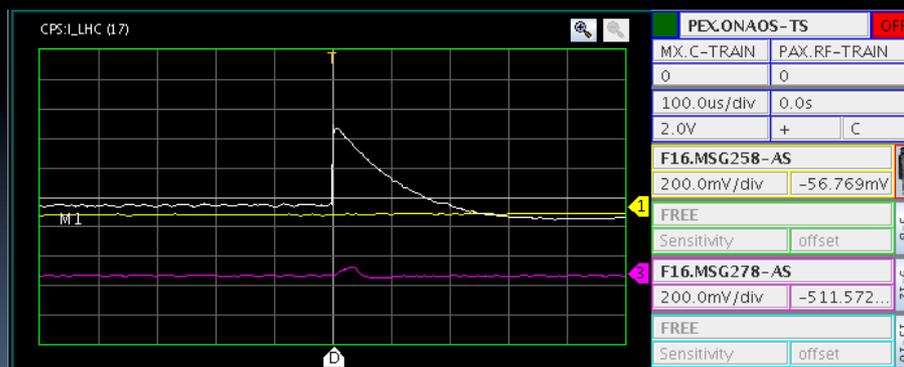


MSWG 11/11/2011

- Optics parameters to be defined in LSADB.
- Bunch-by-bunch or PSB ring by ring measurement is desired.
- Save of setting per user is very useful, but are not copied with LSA.
- New BPM's to become integral part of TMS/BPMOPS.
- Swap of one horizontal & vertical scanner to large beta places.

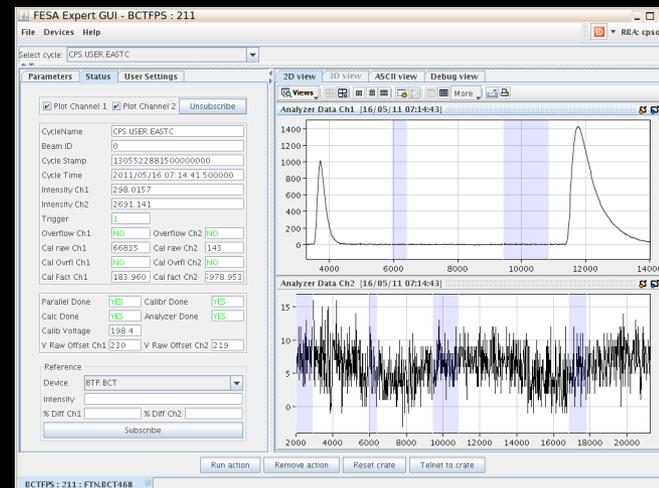
PS: Transverse Profile Measurements

- SEM-FIL/GRID:
 - The renovated system works well.
 - Only vertical grid in SMH42 did not work. Should be made operational with replacement of SMH42.
 - Central wires required on OASIS for all. This is the only means to guarantee good acquisition timing.
 - Optics parameters presently retrieved from files. The application will be modified to retrieve them from the LSA database
 - How is background noise handled with today ?



PS: Beam Intensity Measurement

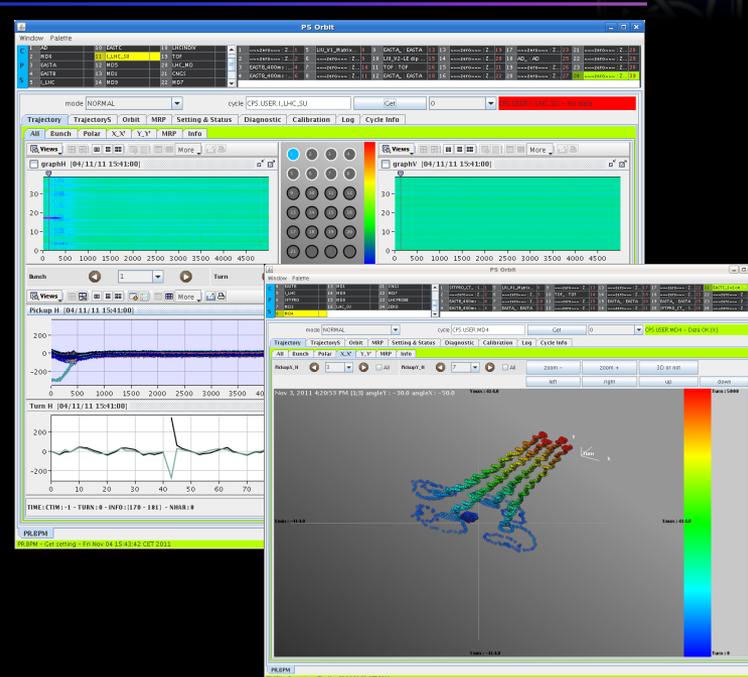
- BCT's:
 - Good improvement with TRIC cards.
 - Remains difficult to measure efficiencies at the 1% level.
 - online calibration suppressed to minimize fluctuations/drift.
 - TRIC settings should become integral part of control system.
- Circulating beam current transformer
 - B-train being reviewed/modernised. Consequences ?
- 1000 turns transformer:
 - Not yet fully operational, as it is not only for MD's.
 - Needs work on high intensity users.
 - Very important for loss control, mainly at injection.



PS: Beam Position Measurement

■ PS Trajectory, Orbit & MRP:

- Major improvement for the PS, with good support.
- Specialist application routinely used by OP.
- Few issues remain to be solved.
- Synchronisation for extraction will be solved by new server.



■ TT₂ BPM's:

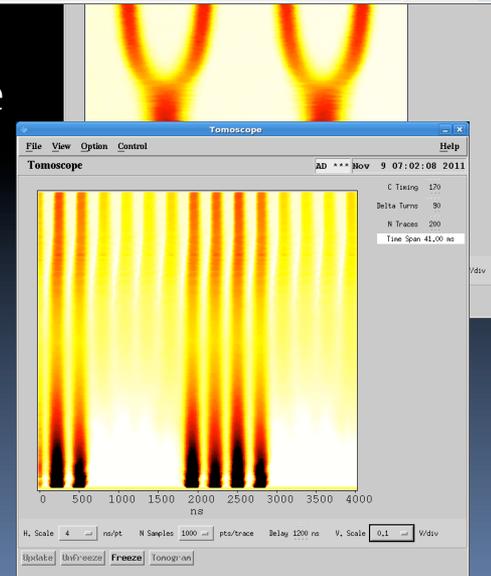
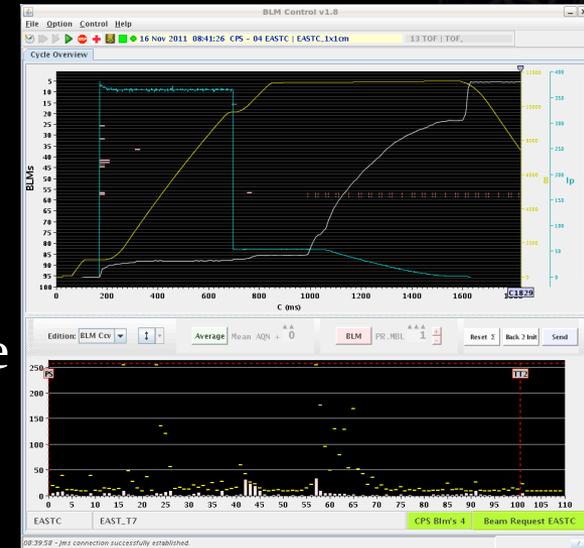
- Still to become integral part of PS.
- Can we expect them to be fully operational for 2012 for all beams ?
- Move TT₂ steering in YASP from SEM-GRID to BPM's.

PS: Other



- BLM's
 - Old system works quite well.
 - System is used as machine protection.
 - New application, replacing 3 old ones, is operational.
 - Functional specification for new system to be finished this shutdown: combination of ionization chambers and fast detectors (Diamonds ?).

- WCM:
 - New Bunch Shape Measurement and Tomoscope systems under development.
 - Will become very important for ghost bunch identification/qualification.
 - We have ideas to deploy a BQM in PS for better diagnosis of problems with LHC beams.
 - Will we have more new HF cables instead of splitters ?

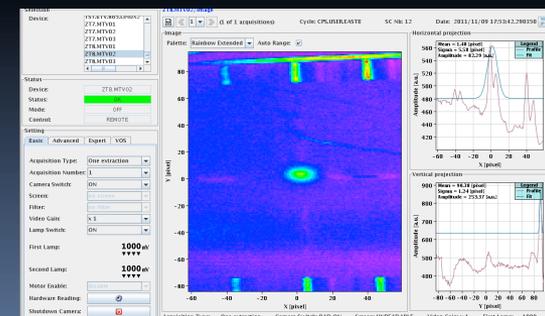
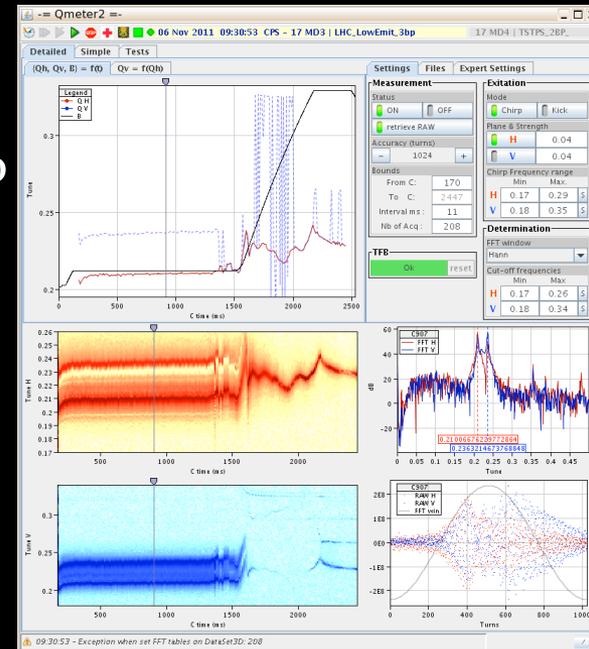


PS: Other

(2/2)



- **BBQ**
 - Works well (not yet fully for ions).
 - New Pick up proposed, impedance situation to be clarified.
 - Sometimes difficult to measure tune due to coupling between the planes:
 - Higher performance peak find routine at low level possible ?
 - New operational application became available in 2011.
- **BTV:**
 - SMH26 BTV (digitized and video) should become available in PS.
 - Complicated to visualize video signals.
- **East Area:**
 - Very old intensity measurements and spill monitor to be consolidated.





SPS: Trajectory & Position

- BPM's in TT10:
 - Often confusing measurements, depending also on bunch structure from PS.
 - An indication whether data are reliable or not would be welcome.
- Other trajectory measurement devices :
 - Problems with in/out positions of screens and SEM's in the beginning of 2011 run.
 - Mini scan on T2 is dead.
- Would it be possible to have a position measurement in TT41 with bunched beam?
- Could the camera on the CNGS target be made to work again (beam size on target issue)?



SPS: Orbit & Intensity

- Orbit measurement (MOPOS) :
 - Poor performance with low intensity beam (pilot/probe and Pb ions).
 - Problem to measure at the end of a long cycle (maximum number of turns).

- BCT
 - Slow BCT give reliable results.
 - Fast BCT's only used for relative bunch intensity measurements. Absolute value not reliable. Would be nice having the possibility to measure ratio captured / un-captured beam.



SPS: Transverse Profile Measurement

- Transverse emittance measurement:
 - BWS 2 sets out of 5 operational.
 - HV-settings on PM's are not reliable. A measurement of the PM voltage would be welcome.
 - After calibration campaign WS seem to give coherent results with pre-injectors and LHC.
 - For high intensity 50ns bunches there are indications of tail production and transverse blow up in the SPS. In order to study and combat this we need:
 - Bunch by bunch measurement on the WS.
 - A continuous emittance measurement : IPM should be the focus of 2012.



Concluding Remarks

- Since the last two years the injector complex receives the awaited support for and focus.
- OP appreciates the good collaboration.
- Many improvements made and some things remain to be completed.
- There are quite some wishes for 2012 (and beyond).
- We would like to see a higher degree of integration of parameters in the “standard control system”.
- Many “wishes” mentioned for the different machines are valid for all.

Together we have to keep up the good collaboration between BI and OP