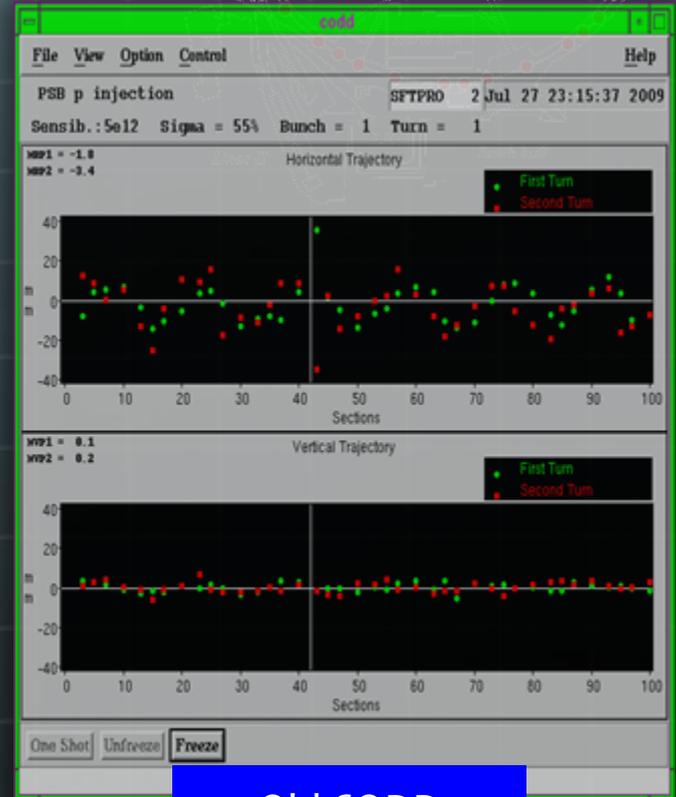# The 1ˢᵗ year of TMS operations

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BE-BI-SW November 2011

Before the TMS

🌐 Old PS Orbit (*CODD*) system

- ✓ Trajectories from the 40 pickups, for max 2 turns and one bunch at a given CTIM

- ✓ Mean Radial Position acquired along the cycle every 5ms

Old CODD
OP application

Why a new acquisition system?

- Obsolete acquisition hardware

- Trajectories retrieved only with CTIM in ms

- Critical periods (*injection, transition, extraction, rotation bunch*)
  - ✓ Difficult to analyze with only 2 turns
  - ✓ Important phases at injection already finished after 5 ms

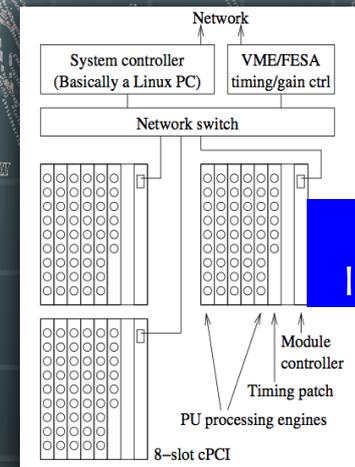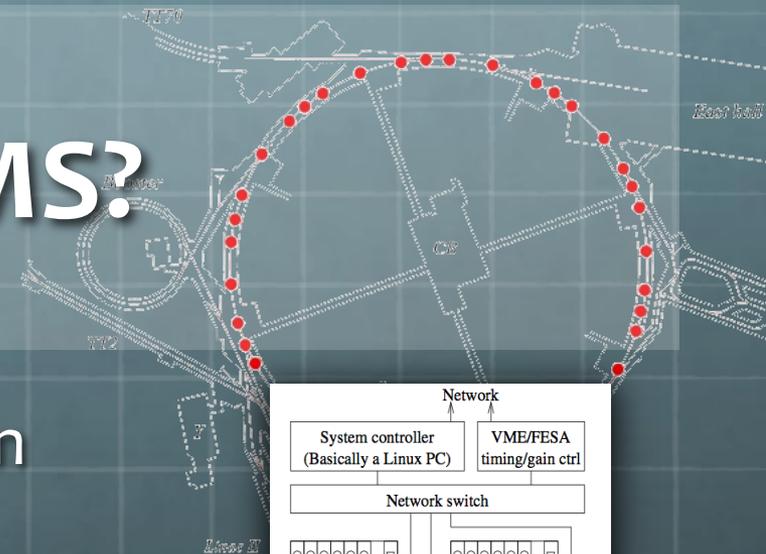- Low level hardware settings (*gate, BLR…*)
  - ✓ To be set manually

What is TMS?
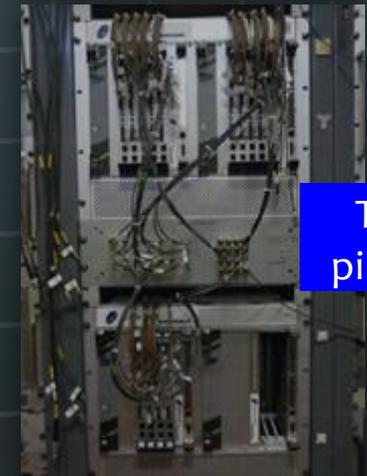
- Trajectory Measurement System
  - ✓ Provided by an external company
  - ✓ Analogue signals from 40 BPMs digitized
  - ✓ 14 modules distributed over 3 cPCI crates
  - ✓ Firmware under the responsibility of BE-BI-PI
  - ✓ Setting and continuous acquisition
  - ✓ 3s buffer acquired by a server (*Linux PC*)
  - ➔ Project leader : J. Belleman

- FESA server (*BPMOPS*) on LynxOs
  - ✓ Data published on request
  - ✓ Extraction and conversion from the TMS
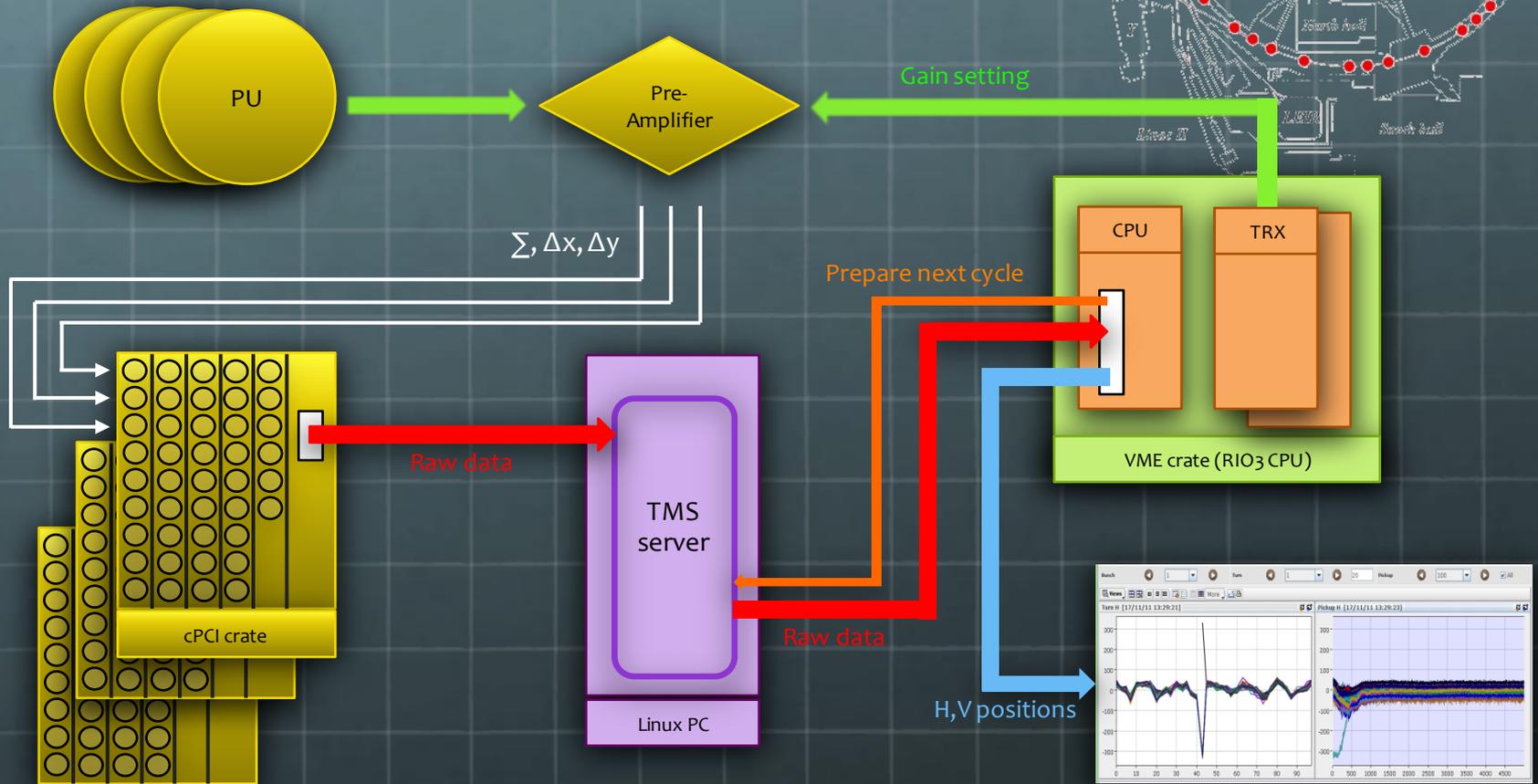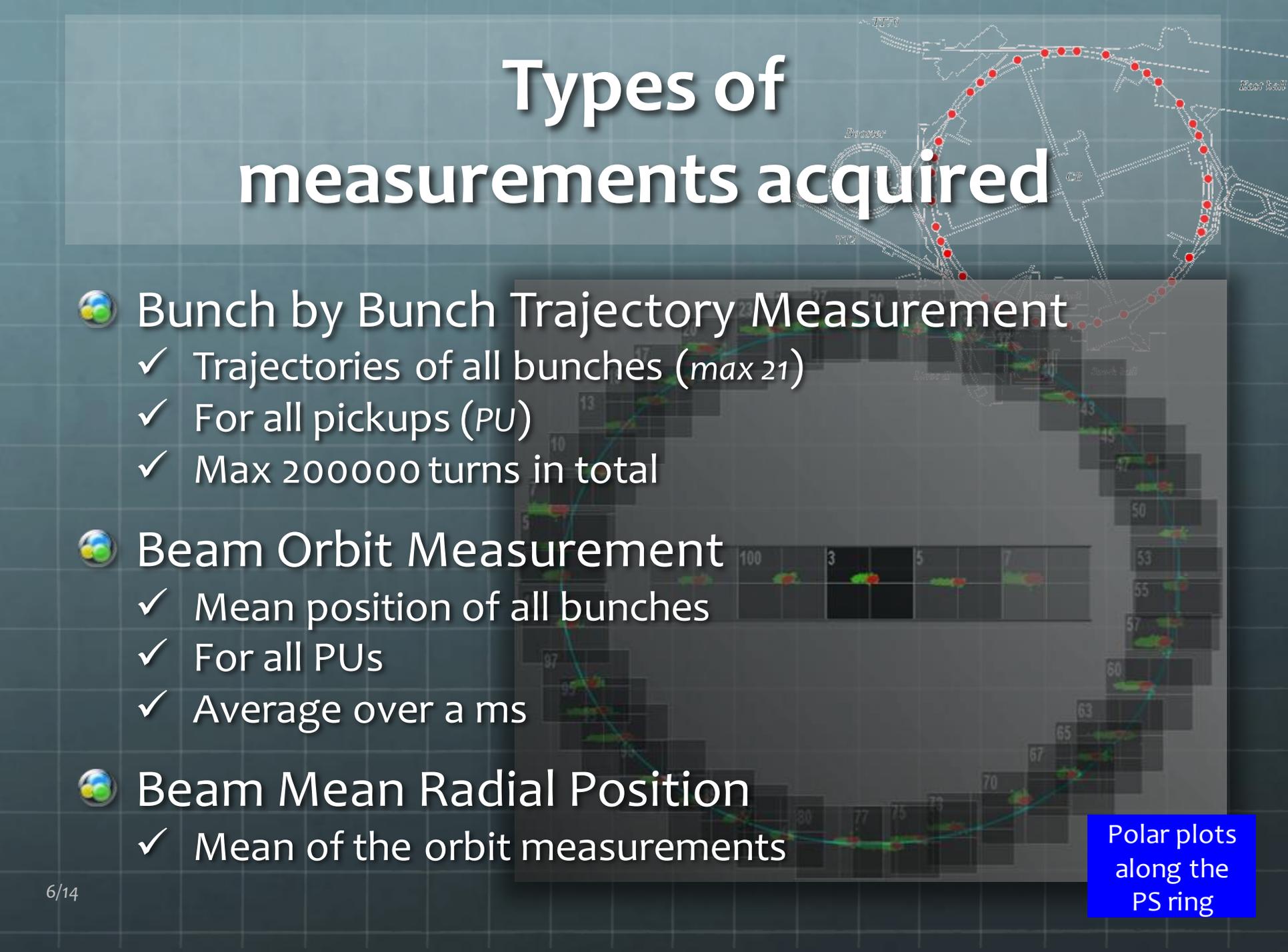 - ✓ Control of the pickup sensitivities

TMS layout

TMS picture

Hardware Installation Layout

PU

Pre-Amplifier

Gain setting

$\Sigma, \Delta x, \Delta y$

CPU

TRX

Prepare next cycle

VME crate (RIO3 CPU)

cPCI crate

Raw data

TMS server

Linux PC

Raw data

H, V positions

Types of measurements acquired

🔵 Bunch by Bunch Trajectory Measurement
- ✓ Trajectories of all bunches (*max 21*)
- ✓ For all pickups (*PU*)
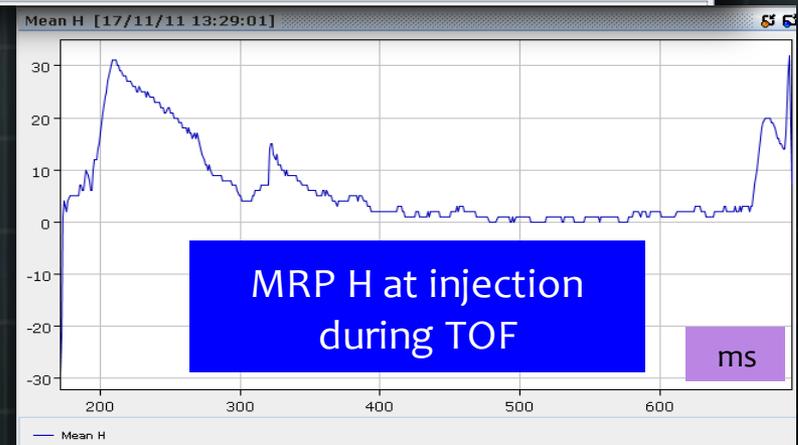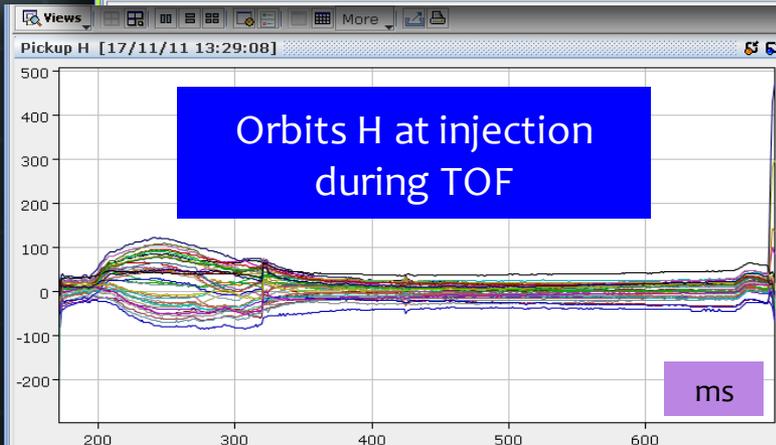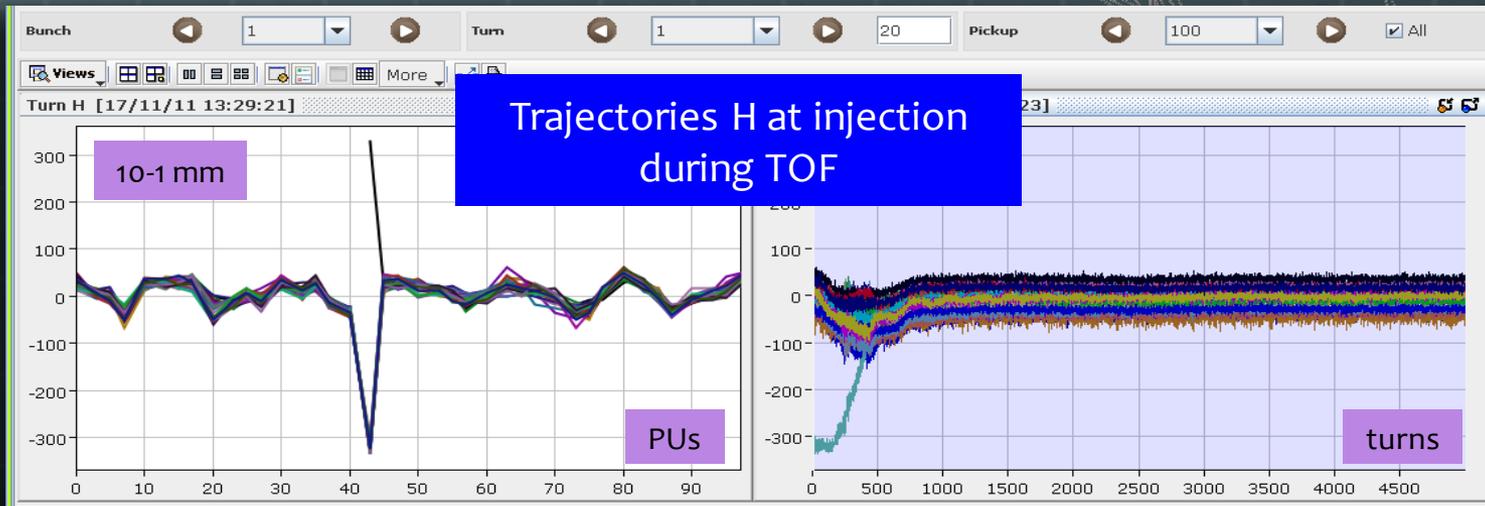- ✓ Max 200000 turns in total

🔵 Beam Orbit Measurement
- ✓ Mean position of all bunches
- ✓ For all PUs
- ✓ Average over a ms

🔵 Beam Mean Radial Position
- ✓ Mean of the orbit measurements

Polar plots along the PS ring

Screenshots

Trajectories H at injection during TOF

10-1 mm

PUs

turns

Orbits H at injection during TOF

ms

MRP H at injection during TOF

ms

Some improvements
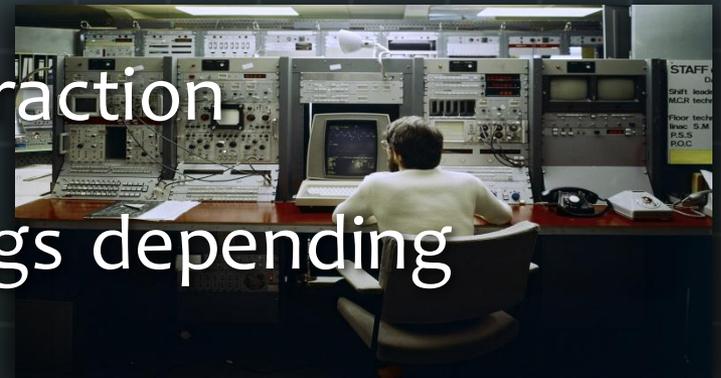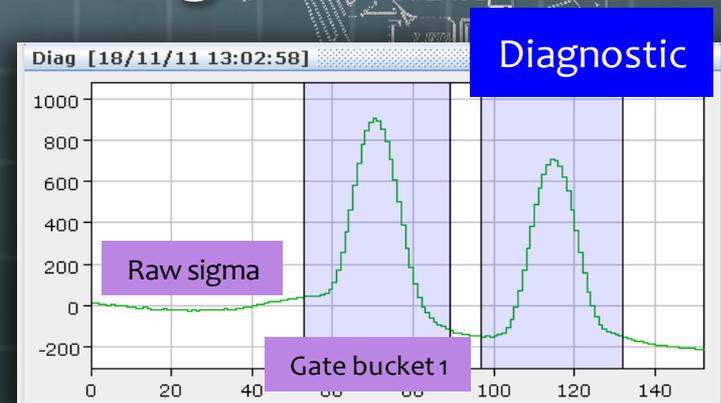# with respect to the old CODD

- On-demand oscilloscope-like diagnostic

- Analyze and tuning of the injection

- Bump synchronization more easy

- Bunch behavior before extraction

- Automatic low-level settings depending on the harmonic number

Diag [18/11/11 13:02:58]

Diagnostic
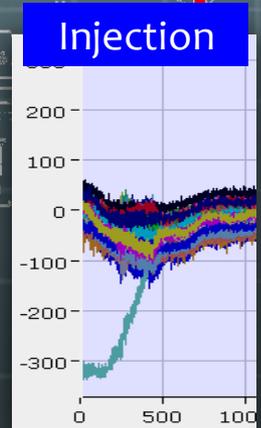
Raw sigma

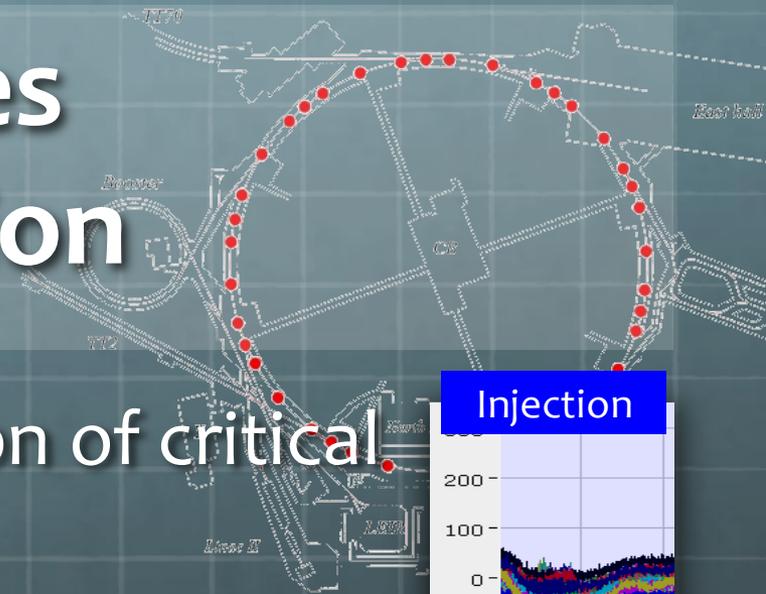Gate bucket 1

New types of operation

- Visualization and optimization of critical processes
  - ✓ 5000 turns per cycle in one shot

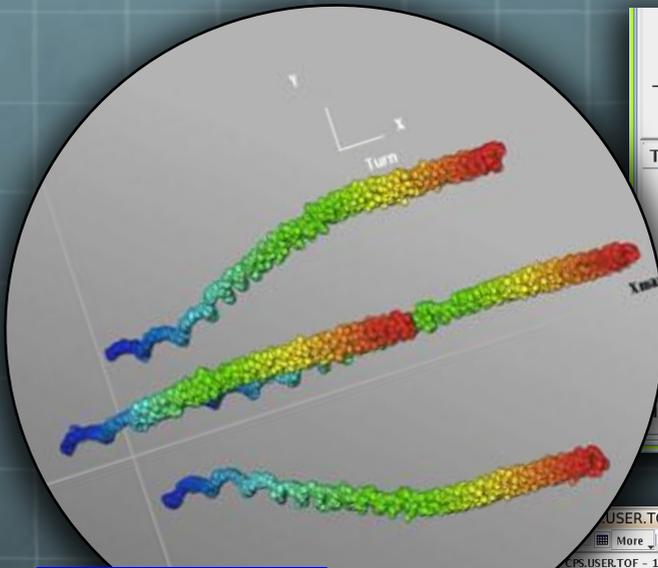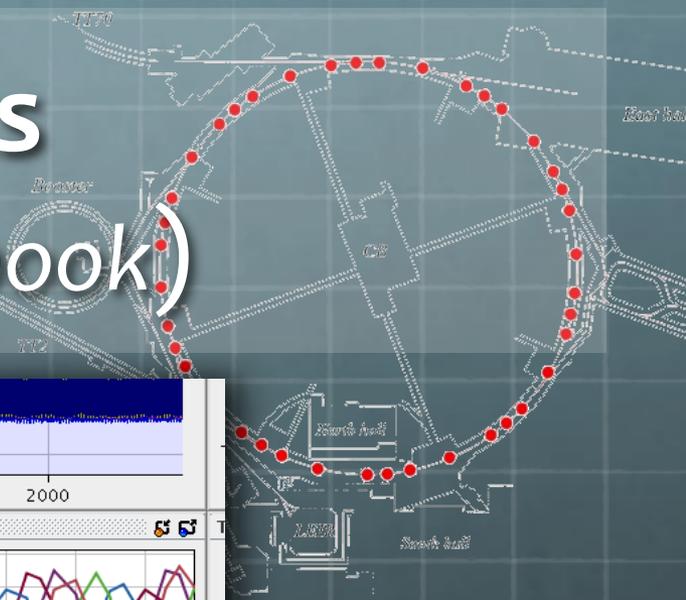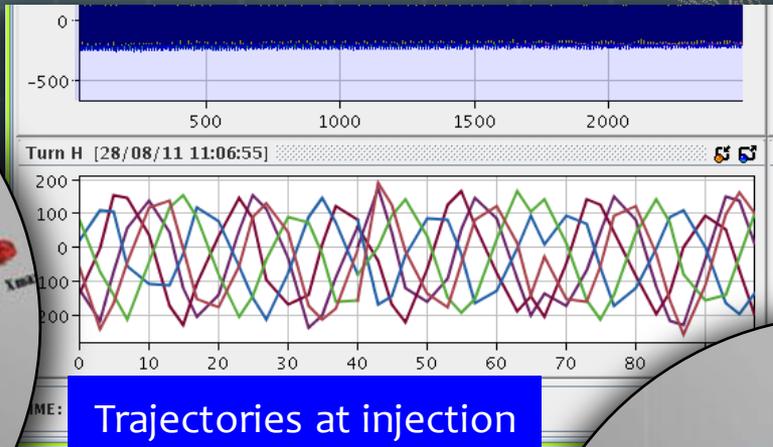- Beam steering (*YASP*) using 20 first turn trajectories

- New MTE observation types
  - ✓ Evolution of the islands

Injection

Happy operators

Screenshots
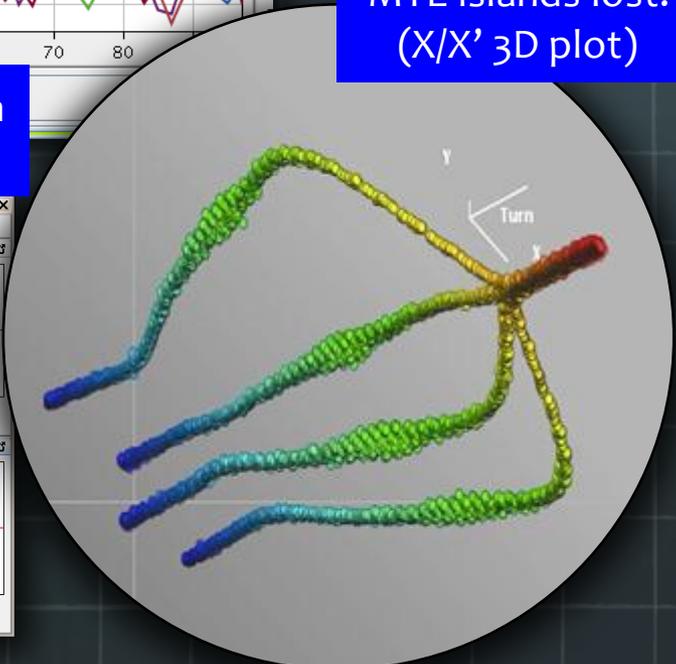## (*from cpsop elogbook*)
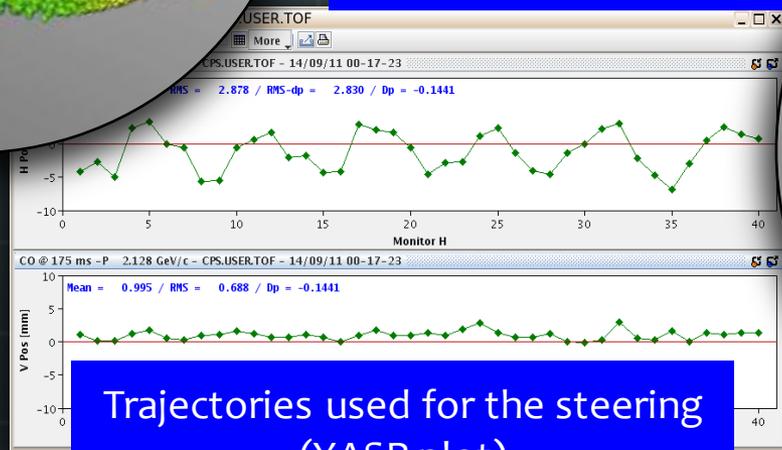

MTE islands
(X/X' 3D plot)

Turn H [28/08/11 11:06:55]

Trajectories at injection
There is a problem…
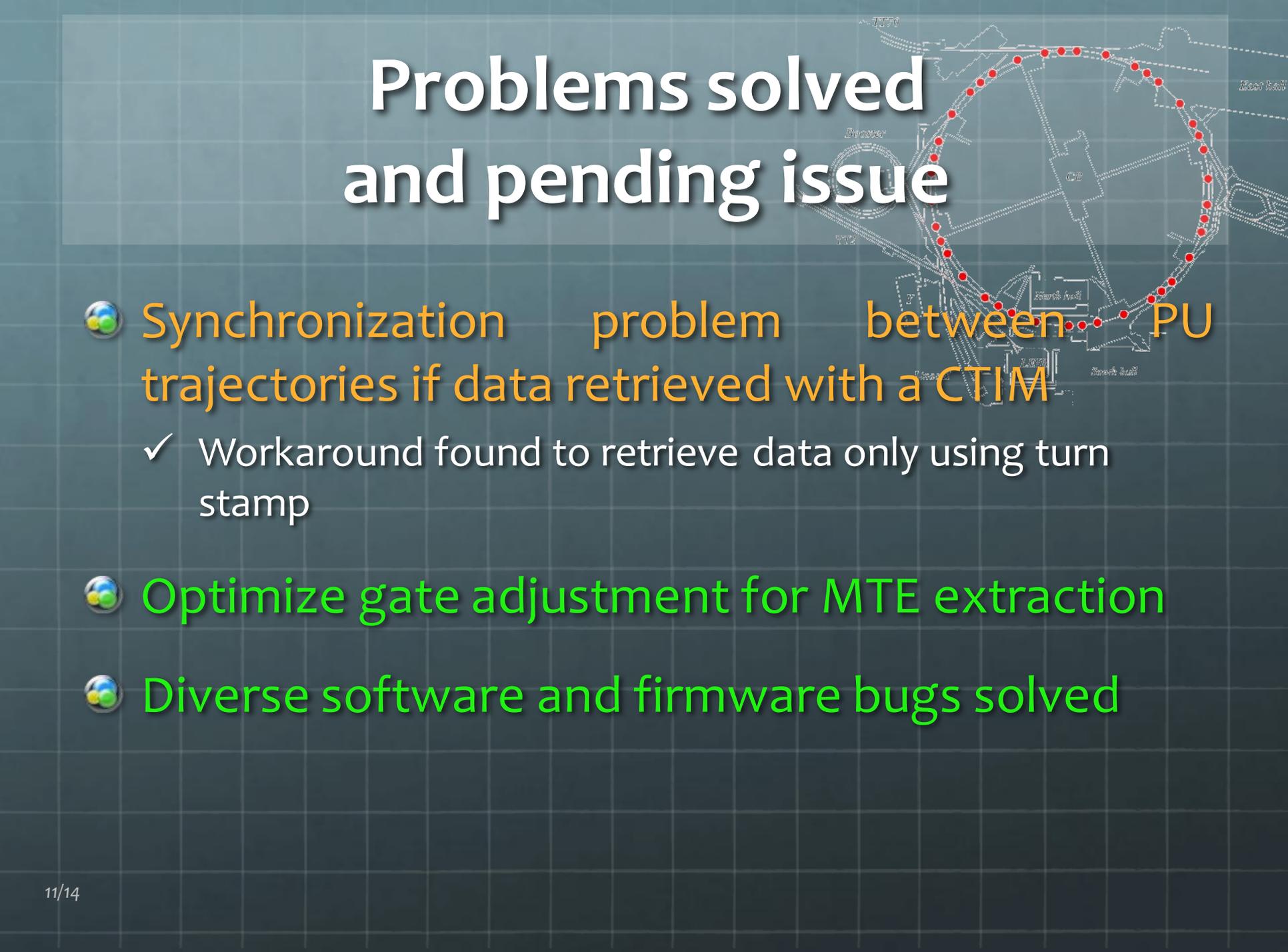
MTE islands lost!
(X/X' 3D plot)

Trajectories used for the steering
(YASP plot)

Problems solved and pending issue

- Synchronization problem between PU trajectories if data retrieved with a CTIM
  - ✓ Workaround found to retrieve data only using turn stamp

- Optimize gate adjustment for MTE extraction

- Diverse software and firmware bugs solved
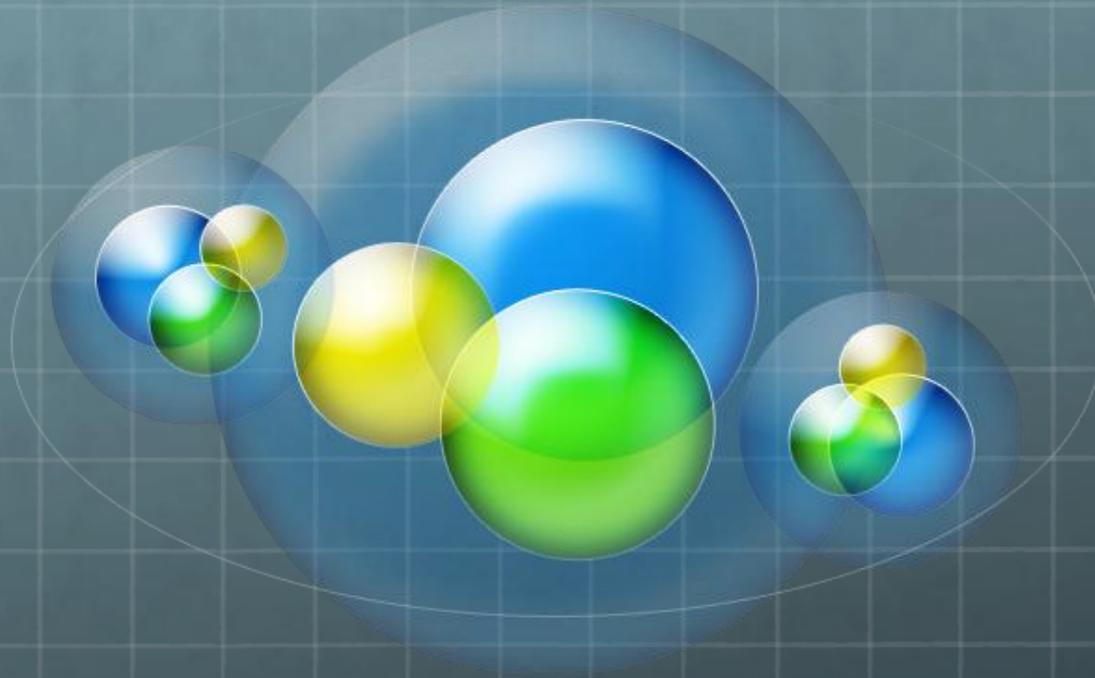
What is missing?

- Fast diagnostic of the gain setting

- More trajectories to acquire
  - ✓ Need to analyze trajectories during a period longer than 10ms
  - ✓ Study to calculate the tune over the whole cycle and with all PUs

- Linux based PC/VME card in order to increase performances
  - ✓ Acquisition server implemented
  - ✓ Gain control hardware to be tested

Conclusions

- Successful project
  - ✓ Very good collaboration inside BE
  - ✓ Interesting partnership with an external company

- System that will be re-used in another injector (*ex : PSB*)

- Firmware has given lots of worries
  - ✓ Firmware specialist (*fellow*) left CERN
  - ✓ Huge efforts for J. Belleman to correct bugs

Thank you!