

MPE Workshop
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Post Mortem Project Status and Plans

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(on behalf of the PMA team)

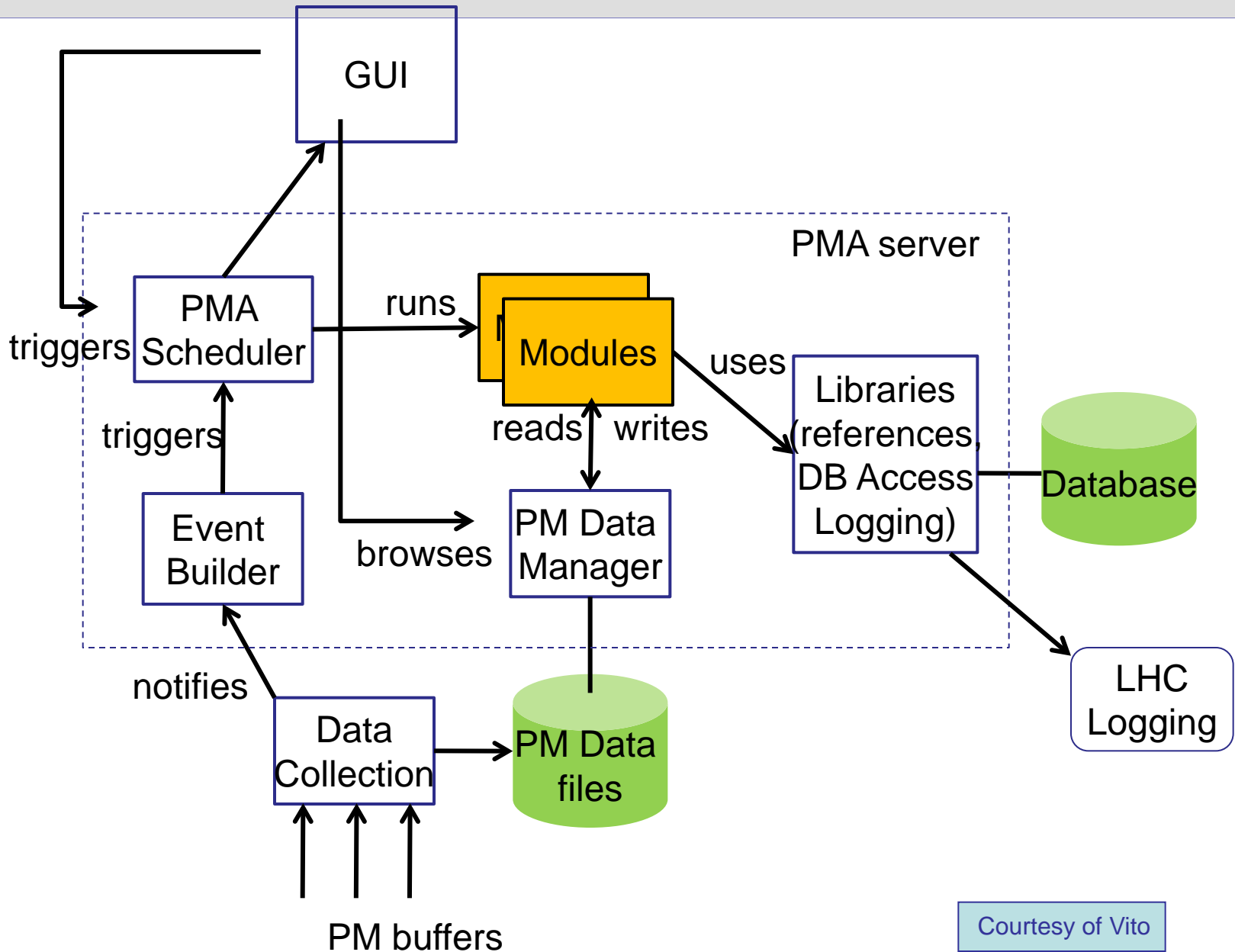


who we are and what is project ...

We are an **inter departmental** co-operation (BE/CO, TE/MPE and EN/ICE) of over 10 people + another ~ 5 module developers

- ✓ Post Mortem Files contain transient data from LHC equipment, pushed to a redundant central data storage architecture
- ✓ Arriving data files will trigger an Event Builder, automatically recognizing interesting powering, beam dump, XPOC,...events
- ✓ **Online mode** – for operational data analysis in CCC
- ✓ **Playback mode** – allows play-pack of previous events for additional expert analysis, debugging,...

PMA server architecture





... what is the main aim of the PM project?

In case of event, provide efficient and deterministic analysis of transient data recordings:

- ✓ **Check if all the devices and systems behaved as expected with an emphasis on machine protection systems**
 - ✓ Provide evidence for the cause of the beam dump / event
 - ✓ Decide if it is safe to continue with the next injection
 - ✓ Block the next injection if the analysis is not satisfactory
 - ✓ **Super Lock the circuit if the analysis result failed**
-
- ✓ **Give a brief summary when, where and what happened**

Currently **4 servers** running on SAME infrastructure:
PMA (beam dumps), **PMP** (Powering), **XPOC** (Beam Dumping System) and **IQC** (Injection Quality Check)



PMA Powering Server Status ...

✓ Modules implemented:

- BIS, PIC, FMCM IPOC
- BLM Losses
- BPM Orbit
- XPOC
- FGC ext for Feedback
- Fill Statistics
- ...

✓ Behavior:

- Injection Interlock
- sending email / sms notifications
- Page 1 entry

Event Sequence

System: BIC
 Class: EVENT_SEQ
 Source: ISA
 Event stamp: 20:33:48.166 22/03/10
 Version: 0.3.23
 Encoding: BIC-EVENT_SEQ
 Qualifier:
 Analysis tags: [NORMAL]

pmAnalysisModuleVersion: 0.3.23
 Analysis result description: First input change detected: USER_PERMIT: Ch 12(PIC_MSK) A T -> F on CIB US15L1 B2
 Triggered BIC inputs: Ch 12(PIC_MSK), Ch 5(PIC_UNM), Ch 3(LBDS-b1), Ch 3(LBDS-b2), Ch 12(FMCM_RD34LR3), Ch 6(P...
 Beam 1 propagation delay to LBDS: 63000 ns
 Beam 2 propagation delay to LBDS: 62000 ns
 OVERALL: 38 BICs triggered valid PM data

HC Page1 **Fill: 973** **E: 3567 GeV** **21-03-2010 08:16:27**

BEAM SETUP: RAMP DOWN

Energy: 3567 GeV **I(B1): 5.40e+08** **I(B2): 0.00e+00**

Post Mortem Information
 PM event ID: Sun Mar 21 07:59:45 CET 2010
 PM event category: EMERGENCY_DUMP
 PM event classification: MULTIPLE_SYSTEM_DUMP
 PM BIS Analysis result: PM BIS Analysis result: First input change detected: USER_PERMIT: Ch 12(PIC_MSK);
 PM comment: LBDS dumped due to missing vacuum information

Comments 21-03-2010 08:06:06 :
 Beam dumped
 Triplets tripped
 Ramp down and reinject

BIS status and SMP flags		B1	B2
Link Status of Beam Permits		false	false
Global Beam Permit		false	false
Setup Beam		true	true
Beam Presence		false	false
Moveable Devices Allowed In		false	false
Stable Beams		false	false

Operation in CCC : 77600, 70480 **PM Status B1: ENABLED** **PM Status B2: ENABLED**

0.00 / 0.00 : x1.00 "LHC Page 1"

Ver: [Graph showing vertical position vs Monitor No.]

Monitor No. [Graph showing monitor numbers]



PMP Powering Server Status

✓ Modules implemented:

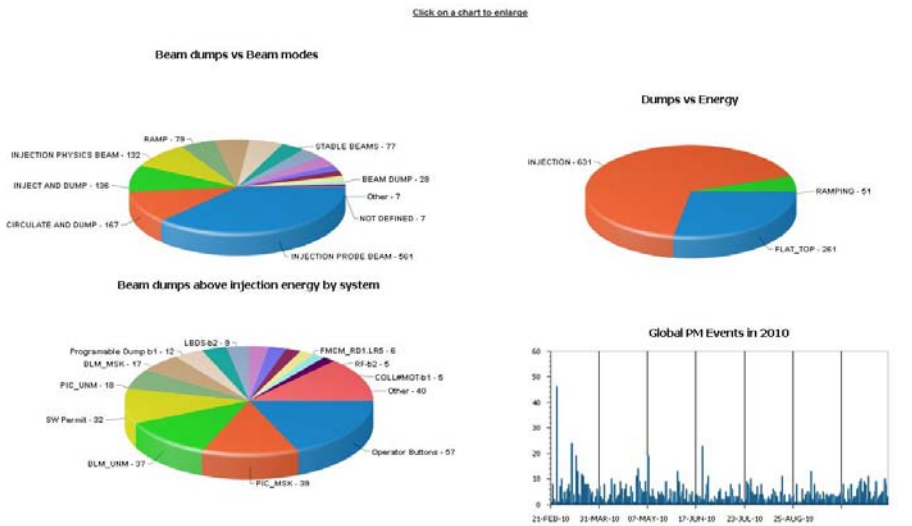
- EE 600A & EE 13kA
- Heater Discharge
- FGC
- 600A Anti-Quench

✓ Behavior:

- sending email / sms notifications
- Locking circuit

Event Timestamp is in the last 1 months

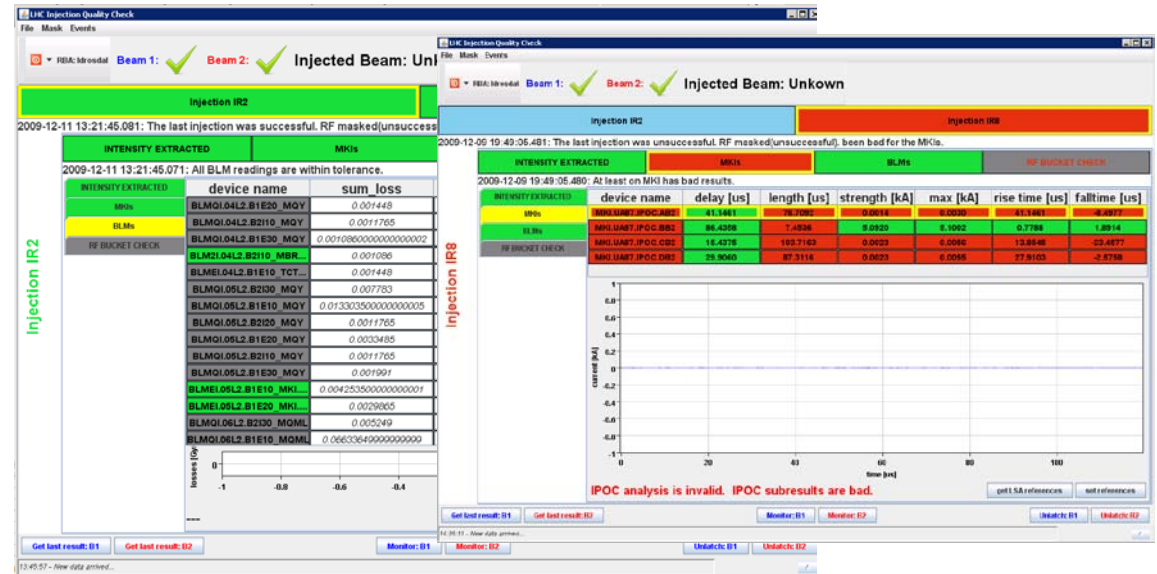
Event Timestamp	Circuit Name	Event Type
22-NOV-10 03.16.15.685217 PM	RQTL10.L3B1	SUBSECTOR_ABORT
22-NOV-10	RQTL10.L3B2	SUBSECTOR_ABORT
PM	RQTL11.L3B1	SUBSECTOR_ABORT
PM	RQTL11.L3B2	SUBSECTOR_ABORT
PM	RQTL11.R2B1	SUBSECTOR_ABORT
PM	RQTL11.R2B2	SUBSECTOR_ABORT
PM	RQ10.R2	SUBSECTOR_ABORT
PM	RQ6.R2	SUBSECTOR_ABORT
PM	RQ7.R2	SUBSECTOR_ABORT
PM	RQ8.R2	SUBSECTOR_ABORT
PM	RQ9.R2	SUBSECTOR_ABORT
PM	RQ6.R2B1	SUBSECTOR_ABORT



XPOC and IQC Server Status

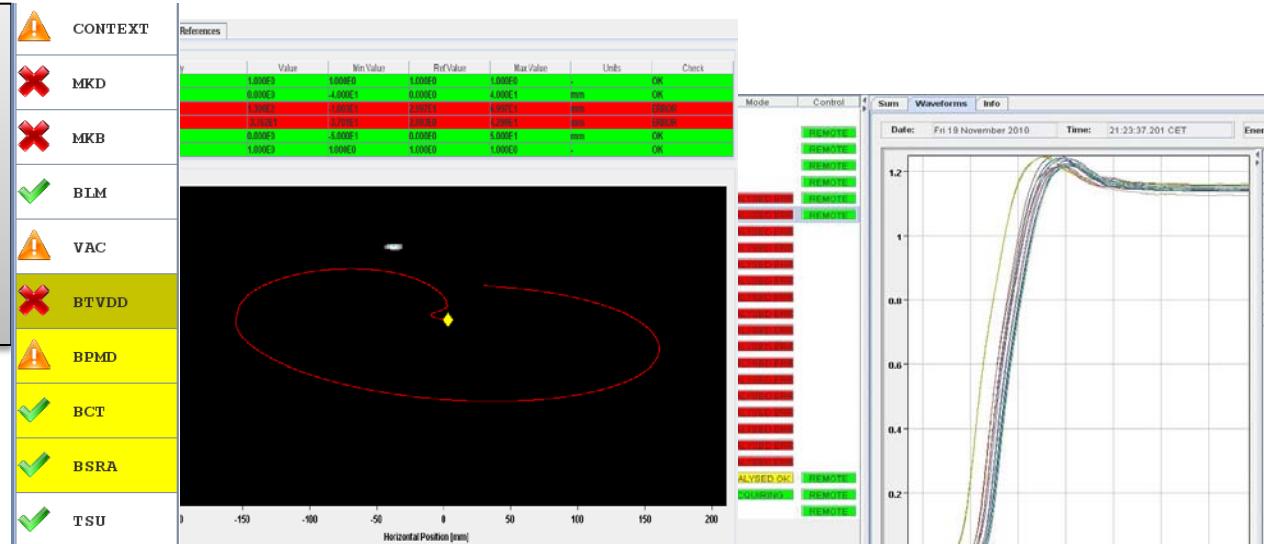
✓ Modules implemented:

- Automated analysis of injection quality and beam dump firing



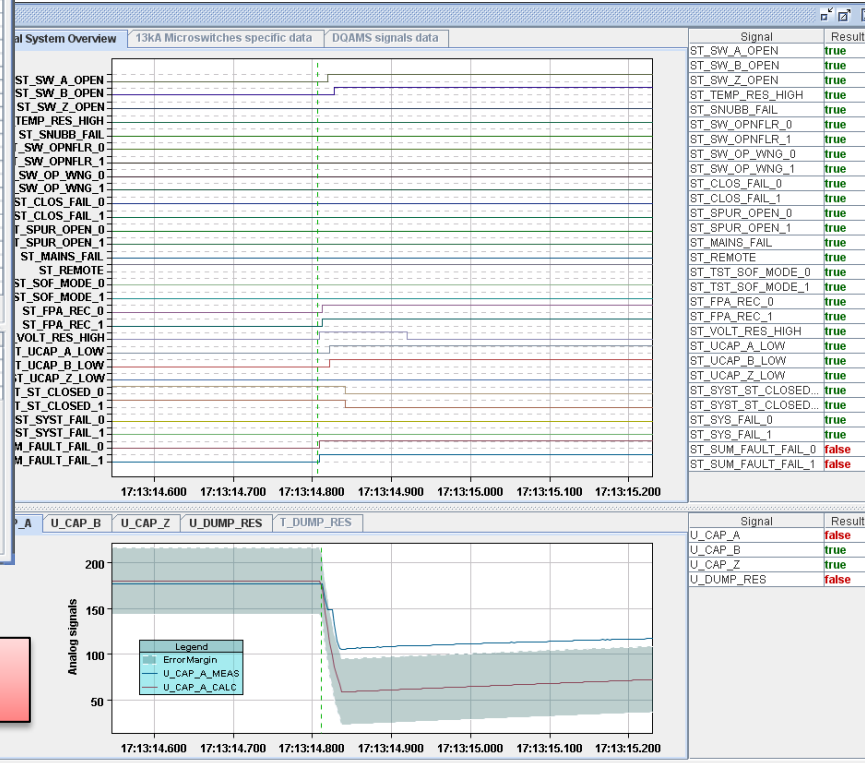
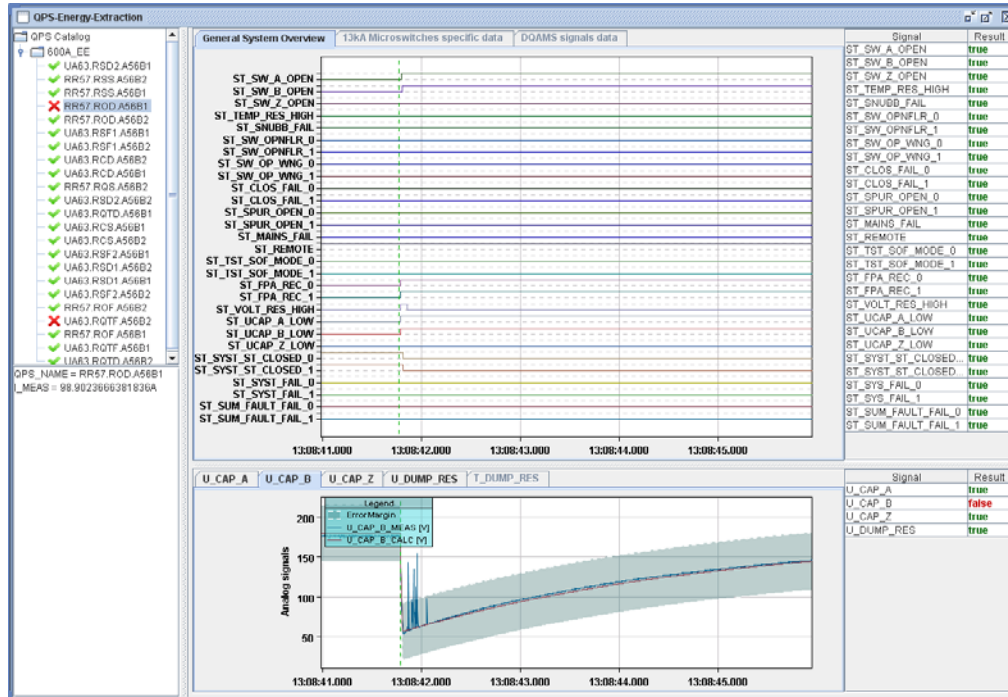
✓ Behavior

- sending email / sms notifications
- Fix Display
- Injection interlocks





Unforeseen discoveries...

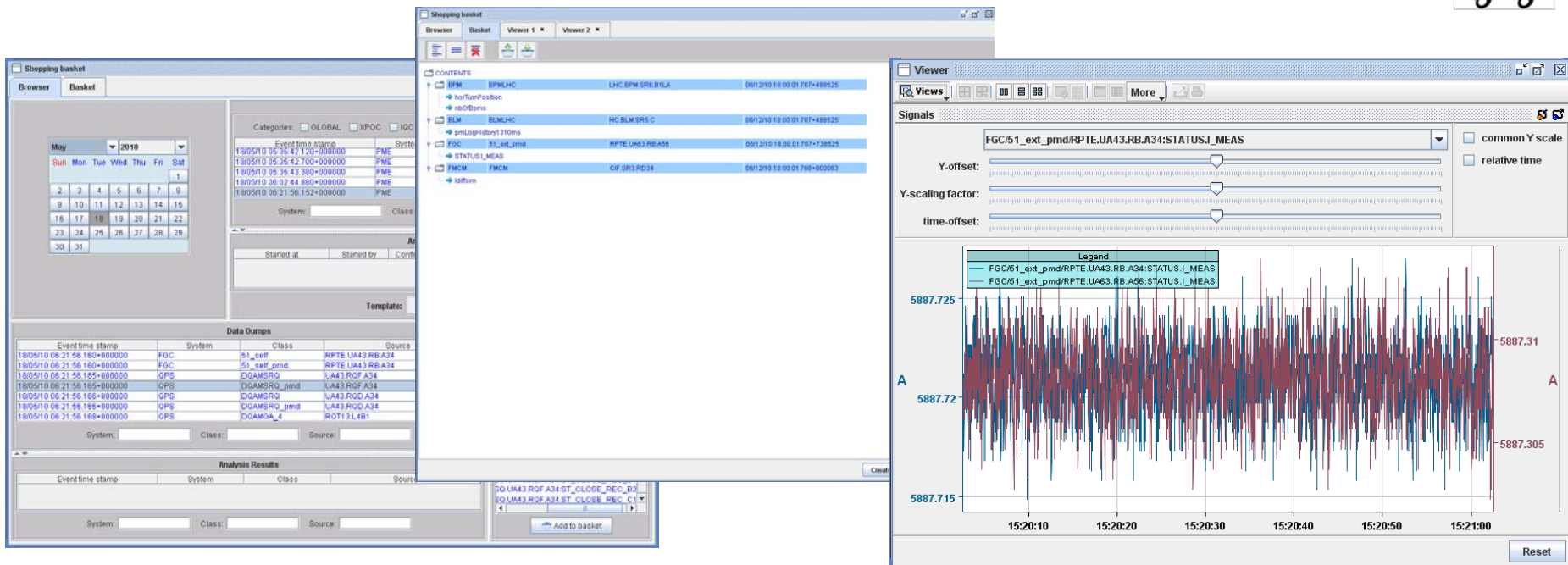


Some problems with Cap in 600A EE racks!!

- ✓ Development of 600A EE module revealed minor issue in EE firmware (present during all HWC campaigns)!
- ✓ Allowed to identify 5 600A EE systems needing intervention during Xmas stop

Data correlation with the Post Mortem Basket

- ✓ PM Project is not only performing automated analysis, but allows for manual analysis by providing configurable displays to operators/experts
- ✓ Work ongoing to allow correlation of any PM data set (beam, powering,..) against each other, preparations ongoing to include Logging Data
- ✓ PM Browser & **The PM Shopping Basket + Template Manager...**





Outlook and future challenges

Data collection infrastructure

- Continuous HW upgrades needed + need to follow CO evolutions (OS, middleware libraries,..)
 - Worrying evolution towards CORBA eradication, which would require ~ 2 months of new developments + testing
- Finalization of monitoring, diagnostics and synchronization tools
- Use standard data format for FGC/QPS data to avoid intermediate conversion? (time for validation and backward compatibility)

PM Basket/Template/Viewers

- Finish integration of all data types + 'alternative' x-scales (ie transformation of beam related data into time domain), eventually allow inclusion of Logging Data
- Finalize (J-)Data-Viewer (add standard data treatment features, scaling,...)

PM analysis Servers

- Extension of PMA servers towards expert system, development of additional modules ongoing (mostly outside of MPE)
- Further develop Powering Servers, e.g. for nQPS buffers, automated splice analysis, PC discharges... with ultimate goal to be used for Hardware Commissioning in 2012/13

Thanks a lot for your attention!

