

An aerial photograph of a rural landscape, likely in France, showing a patchwork of agricultural fields in various shades of brown and green. A large, semi-transparent blue rectangular box is centered over the image, containing white text. The text is arranged in three lines: a main title, a name, and a date. The background shows a winding road and some buildings in the distance.

Follow-up of recent MPP anomalies - CMS Solenoid trip + LHCb trip

M. Zerlauth

MPP

14th September 2012

Beam dump on 10.08.2012

- LHC beams dumped on 10.08.2012 @ 08:20:04 by SIS, following a failing BLM HV check in IR7

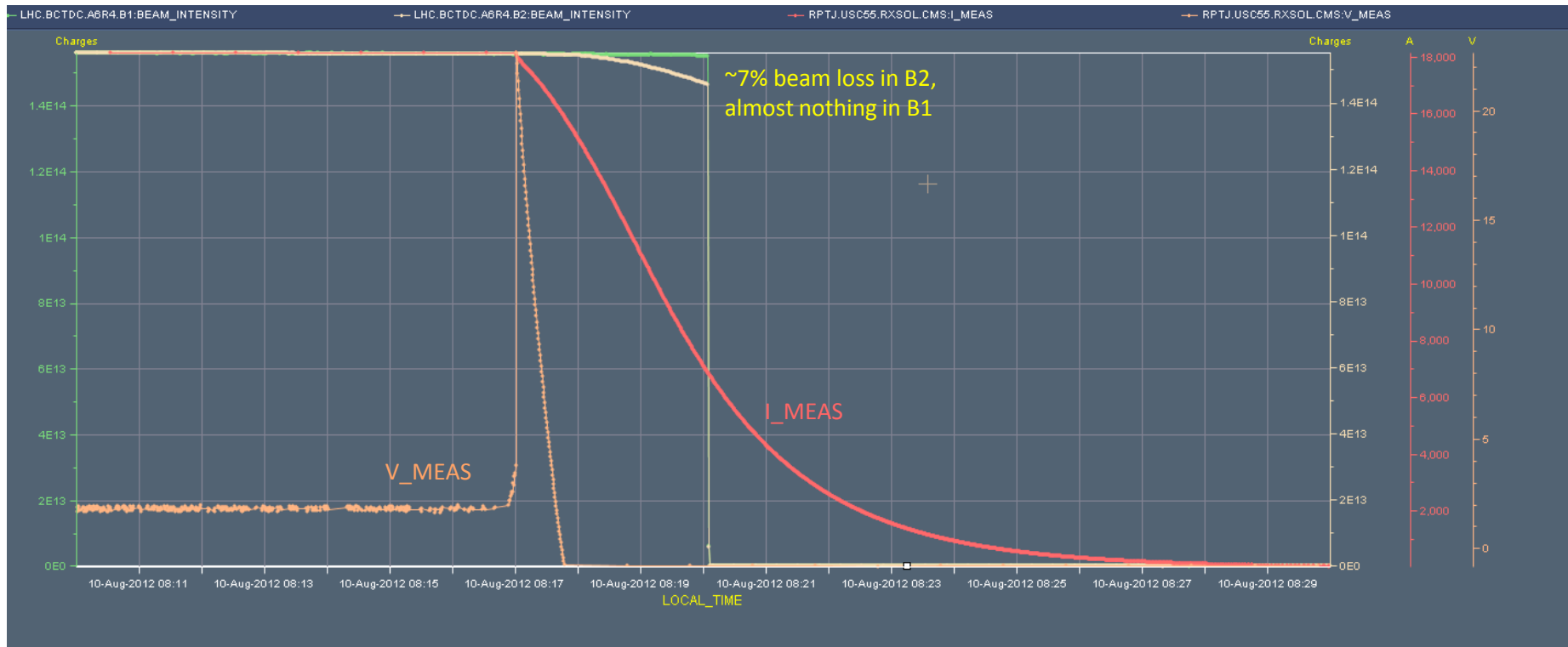
The screenshot displays the 'Final analysis is confirmed' window for a beam dump event. The interface is divided into several sections:

- Dump context:** Provides event details such as timestamp (2012.08.10 08:20:04 CEST), fill number (2934), and beam mode (PROTON PHYSICS / STABLE BEAMS).
- Event sequence:** Lists event category (PROTECTION_DUMP) and classification (MULTIPLE_SYSTEM_DUMP). A highlighted box contains the 'Triggered BIC inputs' and 'SCEvents' (No power converter events found).
- Machine protection features:** Shows a list of protection systems with green checkmarks indicating they are active or successful, including BIC IPOC, FMCM ISA, PIC IPOC, XPOC B1, XPOC B2, and PM Overall.
- Comments:** A highlighted box contains the text: 'Fast discharge of CMS solenoid (due to cooling problem). The orbit became bad and in a bit more than a minute the SIS dumped the beams on BLM HV status in IP7.' Below the comment are buttons for 'Confirm', 'Discard', and 'Release SIS'.

At the bottom left, a status bar indicates '21:55:24 - session confirmed by: msolfaro'.

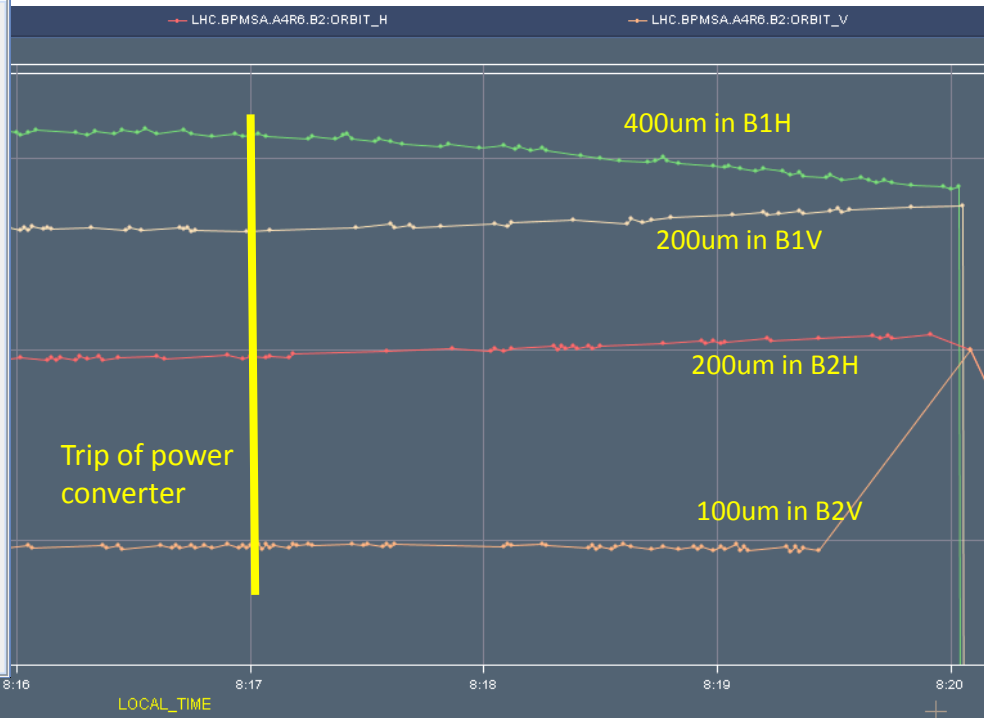
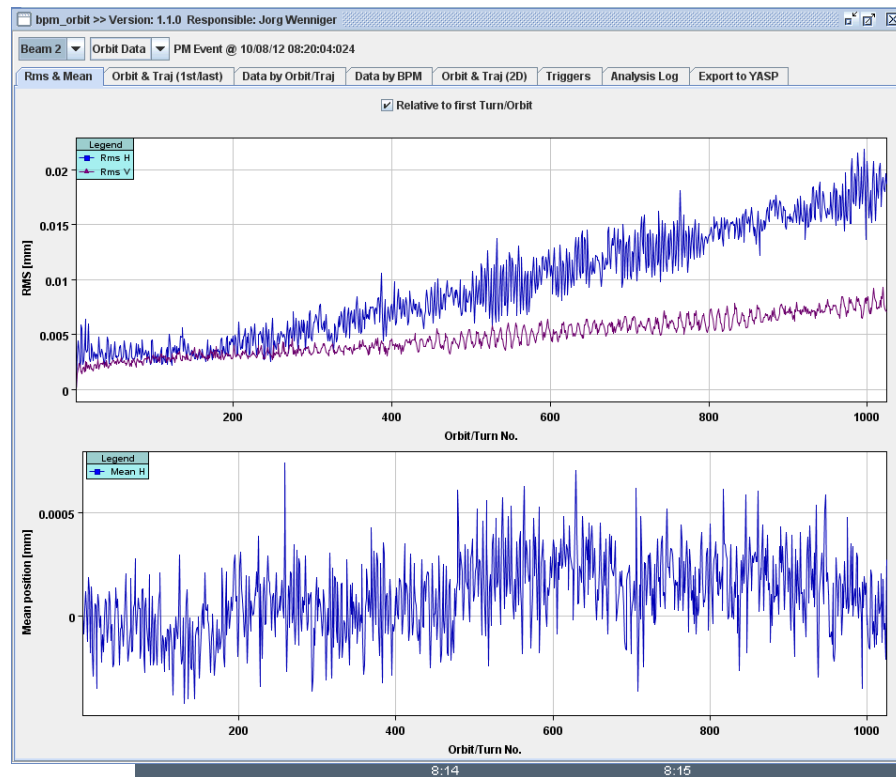
Event Sequence 10.08.2012

- Solenoid magnet actually trips 3 minutes prior to the beam dump (@ 08:17) due to cooling problem
- Solenoid current at time of dump already < 40% of I Nom



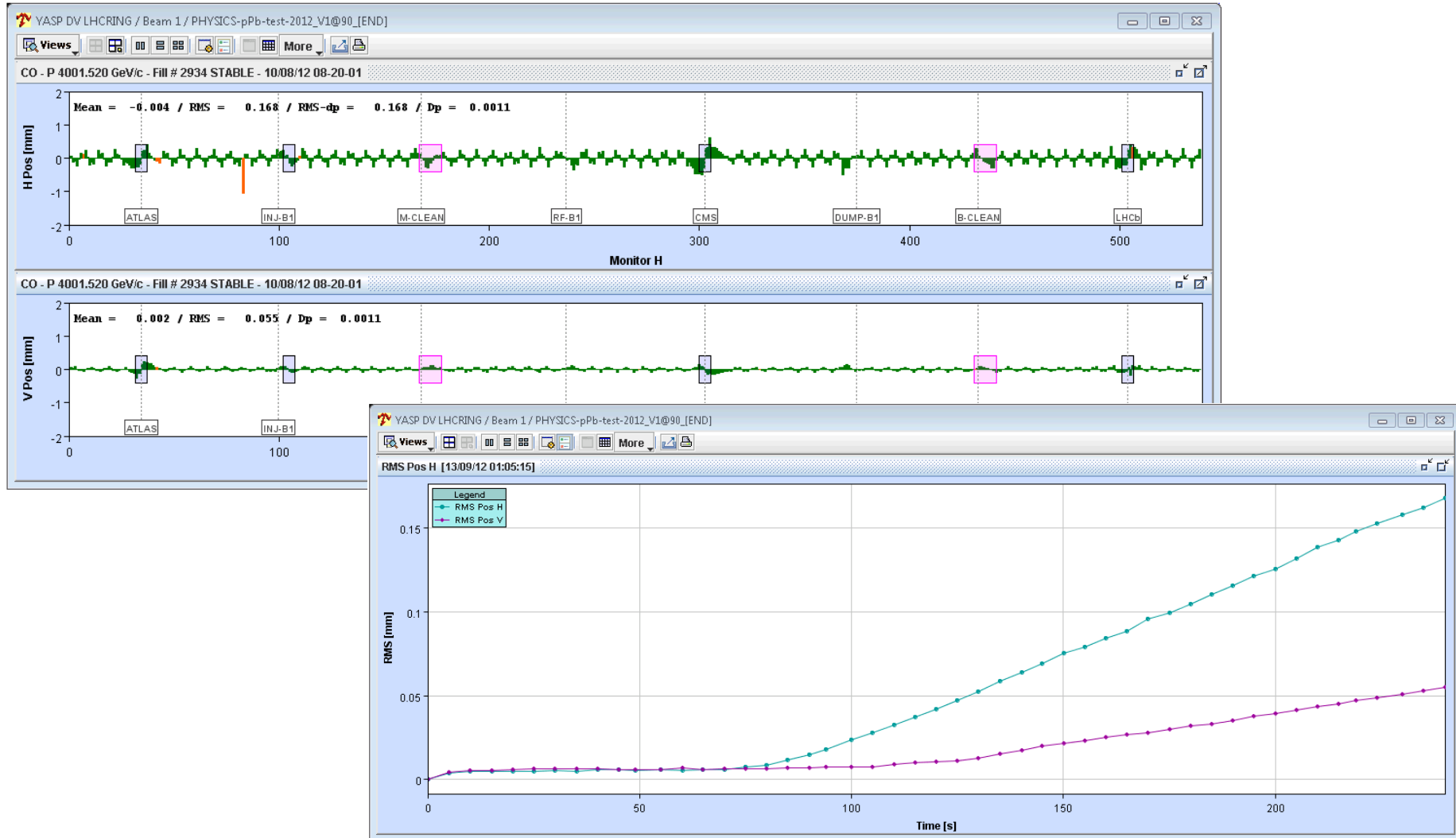
Orbit changes

- PM recordings did not show big orbit deviations (last ~25 seconds only), while LHC Logging shows orbit changes up to 400um (last 3 minutes) – Note: Measured at interlocked BPMs
- OFB not active in Stable Beams!

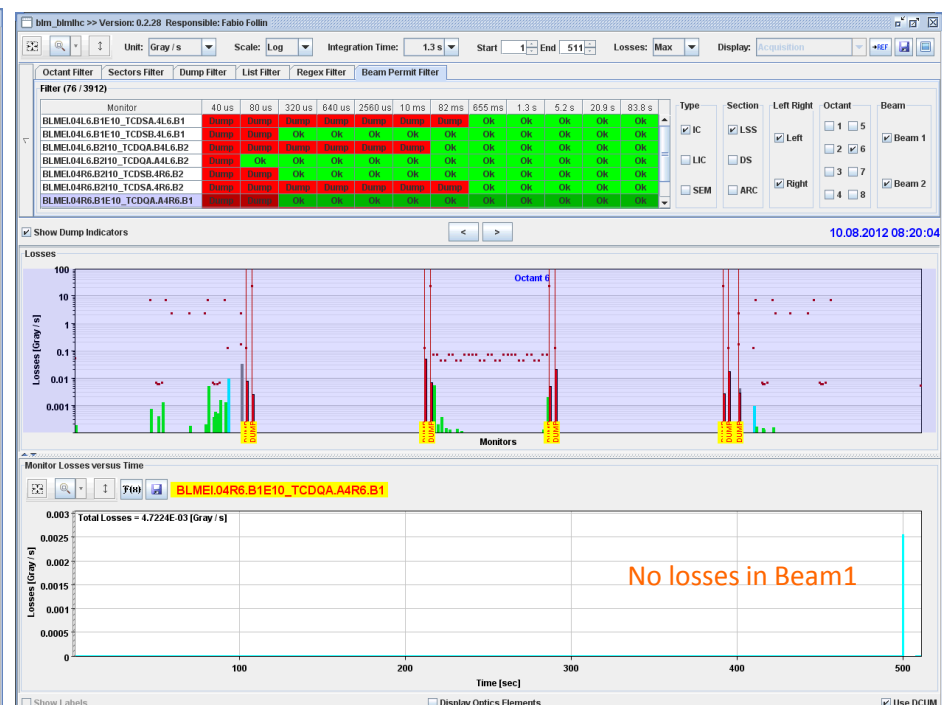
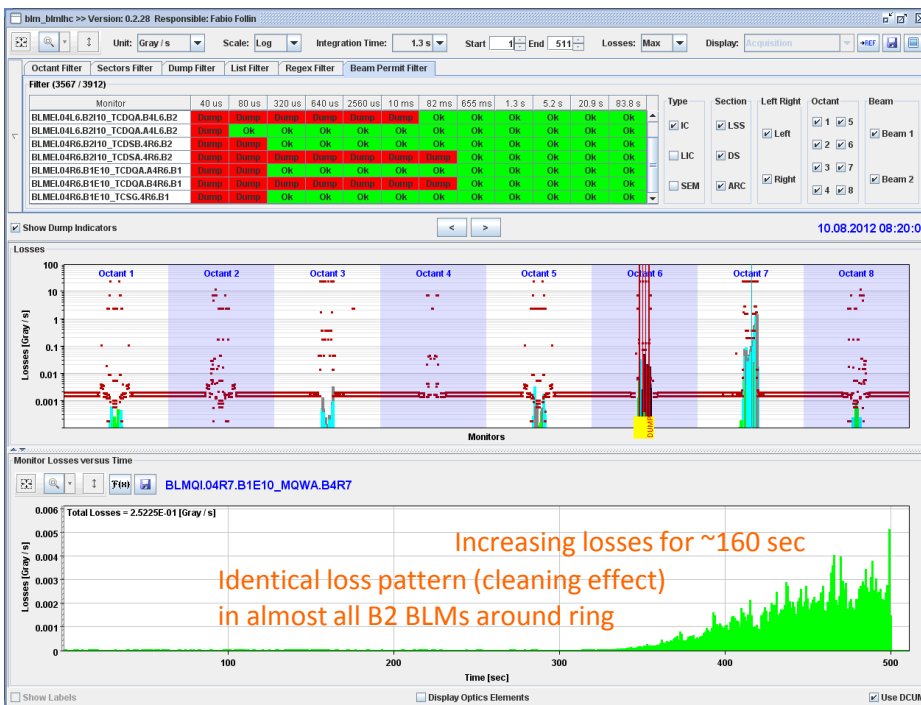


Orbit changes from YASP

- rms change is $\sim 150\mu\text{m}$ in H, a factor of 2 below SIS limit



- Clearly visible increase of beam losses in almost all B2 BLMs as of ~160 sec prior to the dump
- Despite bigger change of orbit almost no losses in B1



- Solenoid has a **slow but non-negligible effect** on the beams
- **Very slow and distributed losses**, not (yet) reaching BLM thresholds (set around 200kW), dump on known limitation of BLM HV (via SIS)
- Solenoid current at time of **dump** $\sim 40\%$ of I_{nom}
- **Agreement with CMS**: Provisions will be taken to provide an interlock in case of a Fast Discharge (new design of MSS already ongoing)
- **In parallel looking for $> LS1$ into slow OFB in Physics** (needed for levelling) and SIS interlocking

Beam dump on 19.08.2012

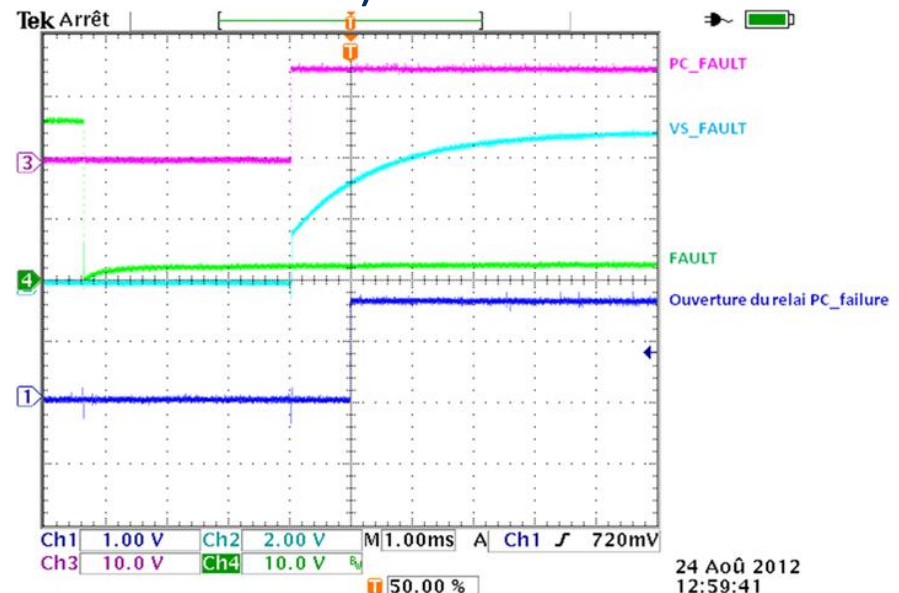
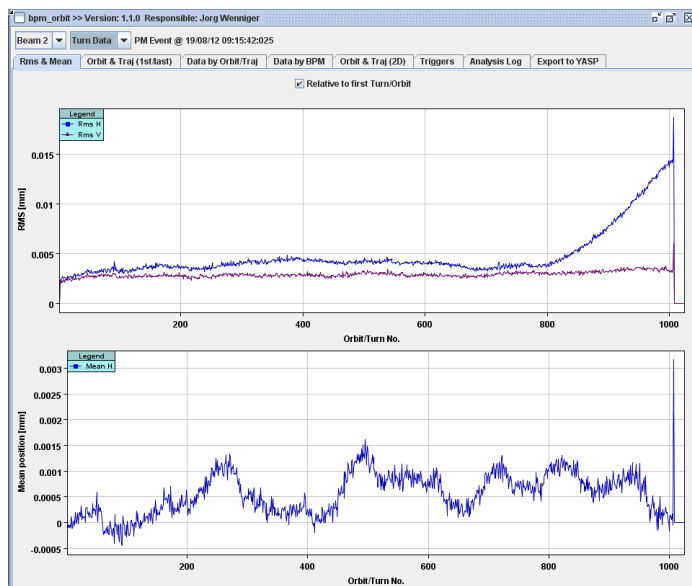
- LHC beams dumped on 19.08.2012 @ 09:15 by LHCb magnet trip, interlock took some 25 ms to be generated....

The screenshot displays the PM PLAYBACK PRO GUI interface. At the top, it shows the session name 'GLOBAL : GPM1 : 19.08.2012 09:15:42 (1345360542000000000) - PLAYBACK by zerlauth on 14.09.2012 at 14:30:56'. A green banner indicates 'Final analysis is finished'. The interface is divided into several sections:

- Dump context:** Contains fields for Event timestamp (2012.08.19 09:15:42 CEST), Fill number (2985), Filling pattern (50ns_1374_1368_0_1262_144bpi12inj), Acc / Beam mode (PROTON PHYSICS / RAMP), Energy (1516920 MeV), Intensity B1 (22290 e^10 charges), Intensity B2 (22235 e^10 charges), SMP flags (PRESENT / PRESENT), and BSTAR 1/2/5/8 (11.0 / 10.0 / 11.0 / 10.0 m).
- Event sequence:** Shows Event category (PROTECTION_DUMP), Event classification (MULTIPLE_SYSTEM_DUMP), and Triggered BIC inputs (Ch 13-LHCb_Mag(RB.B2), Ch 13-LHCb_Mag(RB.B1), Ch 2-LBDS-b1 (TSU)(L6.B1), Ch 11-BLM_MSK(L6.B1), Ch 10-BPMs L&R syst.'B'(L6.B1), Ch 8-BPMs L&R syst.'A'(R6.B2), Ch 10-BPMs L&R syst.'B'(L6.B2), Ch 3-LBDS-b1 (PLC)(L6.B1)).
- Machine protection features:** Lists event description (BIC_IPOC analysis finished with warnings), highest beam losses (BLMEI.04L6.B1E10_TCDSA.4L6.B1 BLMEI.04L6.B1E10_TCDSB.4L6.B1 BLMEI.04R6.B2I10_TCDSB.4R6.B2), magnet quenches (No magnet quenches found), nQPS triggers (No nQPS events found), and status indicators for BIC IPOC, FMCM ISA, PIC IPOC, XPOC B1, XPOC B2, Safe for injection, and PM Overall, all marked with green checkmarks.
- Comments:** Includes fields for User, Advised actions, and input parameters for session confirmation (Beam Losses, Loss type, Orbit Changes, Classification).

Buttons at the bottom right include 'Confirm', 'Discard', and 'Release SIS'. A red box highlights the 'Triggered BIC inputs' field in the Event sequence section.

- Discussion with Hugues and Sylvain Ravat:
- MSS (Magnet Safety System) re-design ongoing (see previous discussion for CMS) – same MSS is used for all experiments
- Re-design based on NI Rio FPGA card already ongoing, replacing (obsolete) fuse programmable FPGA
- Will investigate to improve input filtering at output relay contact to bring down MSS transit time to 5 ms (instead of 25ms)



24 Août 2012
12:59:41

MPP request to EXP (30th July 2014)

- After LS1 connect to the BIS (through MSS) as well ATLAS, ALICE and CMS solenoids
- Spectrometer magnets of ALICE and LHCb were already connected during run1 (see 2nd event)
- Toroidal field of ATLAS should normally not have an effect on the circulating beams and can hence be left out