



# MPP Workshop 2013

## Executive summary

Acknowledgements: B.Dehning, S.Redaeli, J. Uythoven, J.Wenninger, D.Wollmann, M.Zerlauth in the name of all Workshop participants

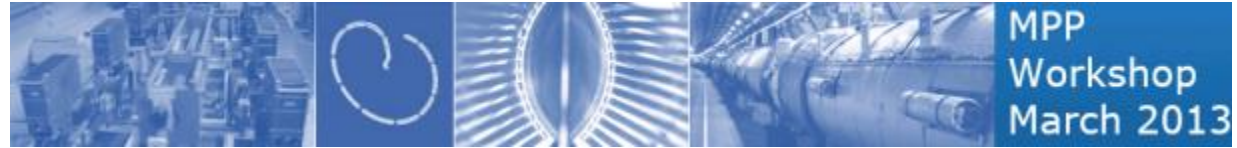
# Mandate



Discuss **mid-and longer-term improvements** of the **MP systems for the LHC + injector complex**:

- review of the current **operational experience** with MP systems during the first running period (2009-2013).
- understanding the **planned changes** of MP equipment during LS1 and the **consequences/potential limitations for operation** after LS1.
- identify areas where **improvements** are required.
- ensuring **coherence** between the different MP systems.
- identify **misses**.

# Program



- Indico Page
- 6 sessions, 2 ½ days, ~ 85 participants
  - MPS experience (2008-2012) and outlook (D.Wollmann)
  - Injection and LHC beam dumping system (J.Uythoven)
  - Beam Diagnostics (B.Dehning)
  - Collimation and movable devices (S.Redaeli)
  - Electrical circuit related protection (M.Zerlauth)
  - Operation after LS1 (J.Wenninger)
  - Summary and discussion (R.Schmidt)
- Executive summary @ CERN in special LMC (today)
- More detailed session summary in ATS Seminar (tbd)

# Goal today...

- Agree on a common MP view of issues
- Complete the list if needed
- Agree/define responsibilities for follow-up
- Definition of priorities to be completed for LMC
- More detailed session review in ATS seminar (tbc)
- Follow up of issues already started and will be coordinated in different WGs and MPP meetings

# Material Damage / failure scenarios

- Review/Update Setup Beam Flag parameters/functions (SMP) in view of updated damage limits, commissioning procedures, collimation setup, MDs etc. (MPP with Coll, FLUKA, MPE, ABT)
  - Onset of damage? Dependency on emittance (BCMS beams); 7TeV
  - Conclusion by beginning 2014
- Use of collimators with new materials (molybdenum, copper-diamond?). (ABP, EN-MME/STI, ABT, MPE) [replacing winter stop 2015/16?]
  - Mini-WG to analyse results of material tests and feedback into Coll upgrade strategy (CWG).
  - Update failure cases for asynch beam dump (worst case phase advance / realistic phase advance). (later 2013; Coll [Roderik, Luisella], ABT)
  - Study ion beam damage. (ABP [Luisella, Maria])
  - Planning of new tests with beam in HiRadMat.

# Material Damage / failure scenarios

- Review / update LHC failure scenarios and expected damage (single/two kickers firing). → Expected beam offset/kick.
  - Estimate damage in case of one kicker firing (25ns, BCMS, new TCDQ, ... ). (MPE, ABT)
  - (Disposable) absorbers, redundant kickers.
- New working group to discuss beam induced heating issues & validate new designs (ABP [Elias, Benoit, et al.], Equipment teams, MPP)
- Review operational scenarios in the view of MP (D1 failure, etc.) and collimation. (OP, Coll, ABP → LBOC / Evian like workshop in 2014 ?!):
  - combined ramp +squeeze.
  - beta\* leveling.
  - lower beta\* at injection.
  - Optics changes in IR2 + IR8 for 7TeV.

# Injection / LBDS

- BIS-LBDS retriggering: high reliability required. Reliability run planned for beginning of 2014 (04.2013 → ABT, MPE [Stephane]).
- Scan of MKD waveform with beam and direct BLM dump → Test @ injection during commissioning 2015? (LIBD [Jan])
- TDE block: pressure rise may reach venting level, when repeated dumps occur 6.5/7TeV. What is the criticality? (LIBD [Jan])
- TCDQ in BETS (masking for set-up). Review failure cases. (04.2013 → LIBD [Jan], MPP).
- MSI current and TDI gap (how measured?) into BETS. Re-do failure analysis. How tight need the tolerances to be? (04.2013 → LIBD [Jan], Coll [Stefano], MPP)



# Injection / LBDS

- TCDIs: virtual beta\* and interlocking in SIS via SMP timing. → Specifications (OP [Jorg, Verena], LIBD [Jan], Coll [Stefano]).
- SPS extraction interlocking. (OP [M. Interlock])
- TDI gap supervision from SIS to BIS. Redundant gap measurement? (EN-STI, MPP)
- Beam position in TCSG (IR6) interlock from SIS to BIS. (MPP)
  - Keep for start-up as is, then interlock with buttons implemented in jaws.
  - Functional spec on how to use buttons ([COLL])

# Commissioning / Revalidation of MP systems / Powering tests

- Review / update commissioning procedures: (All teams, MPP)
  - Update existing commissioning procedures. (Coll [Belen], Powering Interlocks [Ivan], ABT [Yan et al?], ...)
  - ACCTEST framework for commissioning and revalidation.
  - Define (non-negotiable) re-validation tests for MP systems in case of system changes (Asynch dump, Loss maps, PC tests, QPS tests, ... ). → Risk analysis (600A, main bends, ... ). → Define procedures accordingly.
  - Tracking of Changes (see also software tools).
- Powering tests: efficient execution tools, but analysis bottle neck. More automatic analysis tools needed/possible? (MP3, MPE)

# Powering Interlocks / QPS / Electrical distribution

- QPS and BLM systems will be completely removed from the tunnel and re-installed during LS1 (ECR [BLM team])
- QPS: Change of strategy for implementation of critical upgrades when running at 6.5TeV/7TeV? Currently: firmware improvements can only be implemented in long shutdowns? (MPE)
- FMCM: improve performance, dependability analysis. (MPE)
- UPS consolidation + new switching frequency: 4kHz, 7kHz ... discuss frequency change (tune, ... )? (EN-EL, ADT-Team)
- COD current checks from SIS to PC-Interlock. (OP, MPE)
- Extend PC interlocks (Kajetan) to other PCs. (OP, MPE)
- Interlocking fast power aborts for CMS / LHCb / 60A corrector states in BIS. Redundancy to BLM system. (MPP)

# Software tools / Operation

- Tracking of changes in MP systems (HW exchange, expert masking, ... ) → Software tool, procedures (MPP with input from equipment teams?).
- XPOC: improve/reduce number of false latching (warning level / latching). (ABT, OP, MPP)
- IQC: improve to require fewer resets (warning level / latching). (ABT, OP, MPP)
- Additional PM modules. (OP, ABT, Coll, MPE) [after powering tests, during 2015?]
- Review Alarms in LASER, Review / Improve fixed displays, Review SIS GUI. (LBOC, OP with Equipment teams)
- Aperture meter for ring and transfer lines. (LBOC, OP, ABP, ABT)
- Online model for ring and transfer lines. (ABP)

# Software tools / Operation

- Applications for BLM system: Internal parameters app, system status app, system management app, monitor factor app. Additional RS and higher resolution of BLMs in PM. (BI, MPP)
- Facilitating loss-map checks. (Coll, OP)
- Masks /SFB consistency check before beginning of ramp to avoid false dumps. (Sequencer task [OP])
- Testing of BIS inputs: automatically (Acctest), manually?
  - Regular re-check of BIS-channels (once per year?).
  - Review BIS-channel triggering from TIMBER after dumps, during ramp-down, access, ... .

# MPP / rMPP / MDs / Fault tracking

- Maintain rMPP after LS1:
  - Update membership.
  - rMPP piquet: dump analysis, follow-up on operational issues, contact to coordinators and operational crews.
- MPP <-> MP3 improved interplay for magnet powering systems.
- MD documents: Prepare / propose table of required information. (LSWG, MPP)
- Review / Update MP procedures for OP. (MPP)
- Availability Matrix for all LHC systems with use case for ~2 weeks with examples for the different equipment. (AWG)
- Implementation of a fault tracker. (AWG)

# Moveable Devices

- TCDQ upgrade: new interlocking strategy as other ring collimators? (ABT, MPP)
- How to use Collimators with buttons? (Coll [Stefano, Gianluca], BI, MPP)
  - Interlocking (TCSG-IR6, TCT, OFB, ... )
  - How to link LVDT-gap measurements and button measurements?
- Momentum loss maps with reduced RF frequency change? (Coll)
- Verification of settings. (Coll)
- Collimator (TCT) position limits as function of separation. (Coll) [04.2013]

# Beam Instrumentation (high priority)

- BPMS (IR6) improved dynamic range and PM buffers (to XPOC). (MPP)
- DIDT ?!
- LICs in injection region. Thresholds / protection / energy level 0? (MPP, BI, ABT)
- Inhibit BLMs in injection region? Which BLMs? What discrimination time? Which signal? (MPP, BI, ABT)
- Reliable/redundant abort Gap Monitoring: System which can also dump?! (MPP, BI, MPE, ABT, Alice, ADT-team)
- Improved reliability of OFB. (Review in May 2013, BI)



# Beam Instrumentation

- BLM thresholds for 7TeV (QP3 extrapolation, Quench test analysis). (TWG, QTAWG, MPP)
- BLM threshold generation via LSA. (BI, MPP)
- BI follow-up on BLM thresholds after Eduardo? Two people follow-up?
- BLM displacement → ECR. (BI)

# Internal Reviews

- Direct link from BIS to LBDS retriggering line.
- LBDS retriggering (kicker testing, two kicker firing, ... ).
- QPS: Quench loop of RBs.
- Collimation (May 2013).

## HL-LHC

- Crab cavities studies: quench behavior of sc. Cavities. (MPP)
- Beam-beam kick in case of HL-LHC beam parameters. (MPP)
- Protection of beams with depleted beam halos (Movable devices, Vacuum valves, ... ) (Coll, MPP)
- Prototype crab cavity in SPS: interlocking?

- End