



# rMPP meeting

<https://indico.cern.ch/event/576967/>

13. October 2016

# Outline

- Approval of MDs for MD block #5 (rMPP remarks)
- Special runs
- Ion intensity ramp-up and BLM threshold strategy
- 
- AOB

# Schedule

	Oct				Nov			Dec		
Wk	40	41	42	43	44	45	46	47	48	
Mo	3	10	Xing red 7	24	31	7	14	21	28	
Tu	MD 4					lons setup				
We					TS3					
Th		★					Ion run (p-Pb)			
Fr		Pile-up		MD 5						
Sa										
Su									Pb MD	

- + Ion setup
- + closer TCT vs background ?
- + Full RF detuning ?
- + (de)coupling fill ?

# MD # 5 schedule

Thu 27/10	Fri 28/10	Sat 29/10	Sun 30/10	Mon 31/10
00:00 - 07:00 MD1434 (ded): Head-on beam-beam limit separation levelling and pile-up	17:00 - MD1878 (ded): C	20:00 - 04:00 MD652 (ded): Coupled-bunch stability with smaller emittance (all HOM)	22:00 - 06:00 MD979 (ded): Beta-beating correction on colliding beams	00:00 - 06:00 MD1850 (ded): Linear couplings dependence on intensity and a next step towards a feedback
=	01:00 - 03:00 ramp down	04:00 - 06:00 ramp down	=	=
07:00 - 09:00 ramp down	03:00 - 08:00 MD1826 (ded): Measurement of Quench Heater vertical kick	06:00 - 10:00 MD1787 (ded): Rise time versus chroma and damper settings at injection energy	06:00 - 12:00 MD1900 (ded): Measuring the beam halo population via SR Coronagraph	06:00 - preparation for a
=	=	=	=	=
09:00 - 15:00 MD1814 (ded): Calibration of all transverse beam profile monitors: WS, BSRT, BGV, LHCb beam gas vertex reconstruction	08:00 - recovery	10:00 - 20:00 MD1257 (ded): ATS	12:00 - 22:00 MD1879 (ded): Crystal Channeling in Dynamic Operational Phases	
=	09:00 - 15:00 MD1266 (ded): Injection of "high performance reach" 80b 25 ns beam	=	=	
15:00 - 17:00 ramp down	15:00 - 20:00 MD1405 (ded): Short term dynamic aperture with the AC-dipole and resonance driving terms	20:00 - 22:00 ramp down		
=	=	=		
17:00 - 01:00 MD1878 (ded): Operation with primary collimators at tighter settings	20:00 - 04:00 MD652 (ded): Coupled-bunch stability with smaller emittance (all HOM)	22:00 - 06:00 MD979 (ded): Beta-beating correction	22:00 - 00:00 ramp down	
			=	

# MD classification and remarks

- **MD1434: Head on beam beam limit separation levelling and pile-up – Class B**
  - See MDs in MD1 and MD3. BTF measurements. Injection optics with collision tunes: 3 -4 high int bunches, using ADT as noise source, small tune scans and phase advance changes IP1 and IP5, head on collisions. Full energy collision optics, separation of beams in IP1 and IP5 up to 1 sigma, single bunches max 3 -4, again ADT variations/ excitations, small tune scans, chroma and octupoles. No collimation changes.
- **MD1814: Calibration of transverse beam profile monitors – Class B**
  - Continuation of MD4 with fill of 10b, MP relevant aspects already discussed ad clarified during MD4 preparation
- **MD1878: Operation of COLL with tighter TCPs – Class B**
  - Impedance contribution from TCSG (incl crystal), with method as applied in MD 1446 and 1447) measuring via tune shift; 2 nom b of 0.6E11 and 1.2E11, re-align TCSG (and few TCP to beam), TCP @ 4 sigma, allowing TCS down to 5.5 sigma, idem for crystal
- **MD1826: Measurement of quench heater vertical kick – Class C**
  - See presentation by M.Valette

# MD classification and remarks

- **MD1266: Injection of 80b/25ns – Class B**
  - 80b injections at injection, filling entire machine, observe injection losses, emittance blow-up, ghost bunches, MKI vacuum and temperature
- **MD1405: Short term DA with AC dipole and resonance driving terms – Class B**
  - Pilots at injection, COLL at coarse settings with TCPs at 12 sigma for use of AC dipole and MKA. Inject with COLL already opened, should NOT mask the PIC input
- **MD652: Coupled bunch stability with smaller emittance – Class B**
  - Measure intensity threshold for coupled bunch instabilities using smaller longitudinal emittance. Modified RF settings for target bunch length of 1.0ns (instead of nominal 1.1ns), full machine with 2200b, then opening RF phase loop and observe stability using phase acquisitions. Keep AGC cleaning switched ON.
- **MD1787: Rise time versus damper and chroma settings at injection – Class A/B**
  - Single bunch growth rate and octupole current instability threshold at LHC injection. 1 nominal and 1 pilot per beam at injection. Change ADT, chromaticity and octupole settings.

# MD classification and remarks

- MD1257: ATS
  - See presentation by S.Fartoukh
- MD979: Beta beating corrections on coll bunches – Class B
  - 1 nominal in 1 beam, pilot in the other, test at injection, COLL changes + AC dipole measurements ONLY for ring with pilot for AC dipole measurements, then repeat with high brightness bunches in opposite ring.
- MD1900: Measuring halo population with the Chronograph – Class B
  - At injection, 36 bunches for B2, no B1. Scrape with TCPs. Use ADT for transverse emittance blow-up. change coupling. It says open the collimator position thresholds to parking for moving them in for scraping. Sufficient to open inner limits only as beam is unsafe at injection (energy limits at injection will not be modified, could also use the parking limits)
- MD1879: Crystal collimation in dynamic operational phases (ramp&squeeze) – Class B
  - 25 pilot bunches. B1. Ramp function collimators changed (being finalised), crystals at 5.5 sigma. First find channeling at injection, followed by energy ramp with crystals in. Continuous loss maps during ramp, nominal bunches eventually ONLY at injection



# MD classification and remarks

- MD1850: Linear coupling dependence on intensity – Class B
  - Full machine at injection, using ADT in special excitation mode. Test this excitation mode first with a nominal bunch at injection, then with 12b train to demonstrate excitation window / bunch.



# Special runs

- High Pile-up Test Fill – Jamie
- Closer TCT settings for EXP background - Roderik
- Reduction of Xing angle for ATLAS/CMS luminosity difference - Jorg
- RF with full detuning – Philippe and John

# Reduction of Xing angle

- study the luminosity calibrations in ATLAS and CMS by varying the half crossing angles between 140 urad and 0 urad
- Procedure of Xing angle change as already applied during MD 1669 (Levelling with Xing angle)
- Special fill with 4b with total intensity  $<3E11$  (Setup beam flag) to allow masking of orbit, PC currents and TCT collimators
- Sequence:
  - Stable beams with the standard crossing angle
  - Luminosity and Vdm scans
  - ADJUST, switch SBF to SETUP and mask BLMs in IR1/5
  - Move inner jaw of horizontal (IR5) and vertical TCT compatible with 0 Xing angle (settings prepare in special BP)
    - TCTPV.4L1.B1: -8.047 mm, TCTPV.4R1.B2: -7.092 mm, TCTPH.4L5.B1: -11.300 mm, TCTPH.4R5.B1:-12.260 mm
  - Reduce Xing angel in 3 steps to 100, 50 and 0urad, perform luminosity and VdM scans at each step (~30 min /step)

# RF with full detuning

- EOF MD following successful MD249 to test with full machine the ‘full detuning’ scheme (RF voltage phase modulation)
  - Towards the end of a physics fill, go to ADJUST
  - RF team will ramp the gain of the Voltage Phase Modulation algorithm, resulting in a modulation of bunch spacing along the ring.
  - Expect 10 degrees pk-pk at 400.8 MHz (70 ps pk-pk), i.e. ~12.5mm displacement of z-vertex in IP2 and 8
  - After checking that losses or debunching are “normal”, go back to STABLE
  - Physics for 1-2 hours to let the experiments observe possible problems with acquisitions.
- Feedback from John Molendijk
  - Installed firmware already features required algorithm, enabling done through non-persisted FESA property
  - Active phase modulation can be engaged/disengaged at any time, changes are done adiabatically



# Ion run ramp-up (proposal)

## 3 configurations

- 4 TeV p-Pb (11,2,11,10m)
- 6.5TeV p-Pb (0.6, 2, 0.6, 1.5m)
- 6.5TeV Pb-p (0.6, 2, 0.6, 1.5m)

## Intensity envelope:

- Protons:  $<702b$  of  $\sim 2-4E10$  -> Watch out to stay away from BPM sensitivity switch (probably initially use  $2E10$ )
- Ions:  $588b$  of  $\sim 1.4E8$  ions /  $\sim 1.15E10$  charges ( $\sim 65$  nom b equivalent)

Each configuration is preceded by appropriate validation fills (see slides by Daniele M. in Ion prep meeting) for collisions, orbit, loss-maps and asynchronous dumps

## rMPP recommendation for each configuration:

- After validation, 1 intermediate intensity step  $\sim 50/25$  nominal b equivalent, ie.  $200b$  of p of  $2E10$  vs  $200b$  of Pb of  $1.4E8$  in respective ring
- In 2<sup>nd</sup> part of run bunch intensity can be further increased, preceded by a short validation fill when crossing the BPM sensitivity range (e.g. with steps to  $6E10$ ,  $1E11$ )
- If firmware of BPMs + BPMS are modified, validation program needs tbd