



rMPP meeting 16/08/2016

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Intensity Checklist July

Bunch pattern / intensity	25ns 2076b 2064 1717/1692/1681 1767/1765/1772 96bpi 23inj;
Start date	30-JUN-2016 03.38.37.541000
End data	08-AUG-2016 15.35.22.713953
Fill numbers	43 fills from 5059 - 5181, ~500h stable beams; ~11.5fb-1
Comment	Intensity cruise at 2076b, including IP3 water infiltration, ramp-up after MD1 and spark-problems with MKI-D B1
Next intensity	Intensity cruise till max 2300b

Dump statistics		
Dump caused by	# of dumps	Comments
Programmed dump (EOF)	22	
Fault of BPM IR6 (BPM IR6)		
Fault of LBDS (LBDS)	1	
Operator fault (OP)		
Controlles fault (CO)		
Orbit excursions (Orbit)		
Fault of Orbit feedback (FB1)		
Fault of Tune feedback (FB2)		
Beam losses (Beam loss)		
Fault of BPM system (BPM)		
Electrical network glitch (EL Net)	3	
Water fault (Water)		
Fault of BLM system (BLM)	1	
Fault of SIS (SIS)		
Machine Protection test (MPS test)		
Fault of Cryogenic system (Cryogenic)	2	
Fault of QPS (QPS)		
Fault of Collimation control (Coll Sys)	2	Caused by IP3 water infiltration

Dump statistics		
Dump caused by	# of dumps	Comments
Wrong collimator positions (Coll Ad)		
Fault of BCM (BCM)		
Experiments (EXP)		
Fault of vaccum system (VAC)		
Fault of BIS (BIC)		
Fault of PIC (PIC)		
Fault of FMCM (FMCM)		
Power converter fault (PC)	3	
RF fault (RF)	3	
Fault of access system (Access)	1	
Fault of tune kicker (MKQ)	1	
Transv. beam instability		
Long. beam instability		
Machine Development (MD)		
Fault of MKI or MKD (Inj./Extr. Kicker)		
UFO	3	
Magnet Quench	1	
Total	43	

MP3

Magnet powering (MP3)	Status	Who	Comments
No magnet quench after beam dump in RQ4.R/L6.	OK	ZCh	
No unexplained quench or powering event in a circuit.	OK	ZCh	Quadrupole 15L1 - training quench, 17-JUL-2016
No problems with loss of QPS_OK for main circuits following injection process.	OK	ZCh	
No unexplained firing of quench heaters.	OK *	ZCh	2nd time the heater firing event on MB.A31L2 ,160803-150004.870, at 295A during ramp down, most likely cased by inter-turn short (see comments below).
No un-validated change to the magnet circuit protection system	OK	ZCh	
No un-validated configuration change detected in the QPS configuration management system	OK	ZCh	
No magnet quench due to too high BLM thresholds	OK	ZCh	C28L5 - UFO quench, 12-JUL-2016
In case of quench: redundancy between QPS and detection of losses (via BLMs or BCCM) due to orbit changes caused by the decay of the magnetic field, as expected.	OK	ZCh	
Not blocking, but should be cleaned up asap, ideally during office hours (te be arranged with QPS team -> Jens)			
Some open issues at 10:00 15/08/2016:			
RQ-circuits: iQPS DQQDLs: 22R8, 32L8, 10R5, 25R5, 20L3 lost communication. Crates need a remote intervention to establish communication or remote power cycling.			
Possible Inter-Turn Short on MB.A31L2:			
For operation in presence of an inter-turn short, we should reduce as much as possible the probability of a quench of magnet A31L2 as well as the probability of a FPA in sector 12.			
- iQPS threshold on MB.A31L2 was increased to 235mV			
- BLM thresholds were reduced on complete MB and MQ S12 arc families to the end of RUN1 values			
- global protection mechanism for IPQs and RQD/F in S12 was removed			
- PXI diagnostic system remains installed to be able to record relevant events on MB.A31L2			

Interlocks

Beam, powering interlocks and post mortem	Status	Who	Comments
No unexplained IPOC failure in Post Mortem for FMCM.	OK	MZ	Minor issue with FMCM IPOC visualisation detected in PM Playback mode - Data is not fully shown, works however perfectly fine for Online analysis. I.Romera informed and will verify after his holidays (not urgent issue).
No unexplained IPOC failure in Post Mortem for PIC.	OK	MZ	PM_Machien_Prot OK reset required after cryo PLC issue in IR4 (terminating fill 5154). Minor excess of reaction time, as this is recurrent (but not critical) the criteria could be slightly increased to avoid this in future.
No unexplained IPOC failure in Post Mortem for BIC.	OK	MZ	
No unexplained false beam dump from any of the MPS systems.	OK	MZ	2 MPS dumps by BLMs (faulty transmission between tunnel and surface cards) and electrical breakdown of TSU cards. Equipment replaced and revalidated.
No unexplained abort of the previous fills by FMCM.	OK	MZ	3 dumps due to network perturbation in period of 22nd - 23rd of July.
No failure of BIS pre-operational check.	OK	MZ	
No unexplained PM event with intensities > 8 nominal bunches	OK	MZ	
No unexplained PM event above 450 GeV.	OK	MZ	
No unexplained glitches of the Setup Beam Flag (SBF)	OK	MZ	
UFO occurrences.	OK	MZ	3 UFO occurrences (2 BLM dumps in 5R6, 5L1 and 1 magnet quench in C28L5)
13/08/2016 @ 00:55 PM event incomplete due to RDA timeout.			

RF & BI

RF	Status	Who	Comments
Temperatures in all HOMs during all fills with the current intensity ok.	OK	Luca Arnaudon	Temperature for all HOM in range
Power levels in all HOMs during all fills with the current intensity ok.	OK	Luca Arnaudon	Power level for all HOM in range

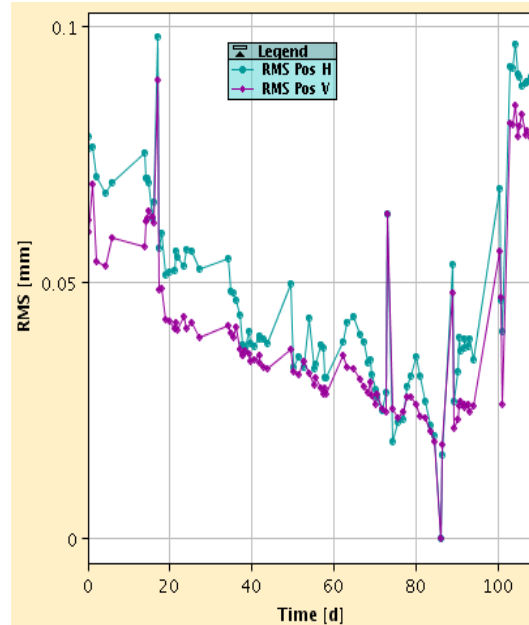
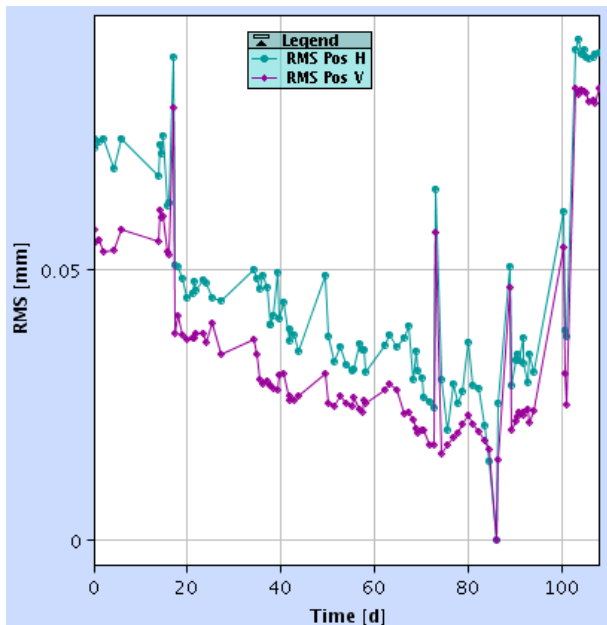
Beam Instrumentation	Status	Who	Comments
BLM Internal sanity checks results must be true.	ok	EBH	
Rise time (10 to 90%) of fast losses must be larger then 200 us.	very fast UFOs	EBH	e.g. 4.7. ~250us; 12.7. ~120us; 5.8. ~ 200us
No unexplained BLM check failures.	ok	EBH	
BLM system modification (ECRs) have to be agreed on, EDMS: notified persons signature is needed.	3 urgent changes ECR missing (see below)	EBH	
No nonconformities in the energy transmission to the BLM crates.	ok	EBH	
BSRA functioning and abort gap population always properly monitored	ok	Stefano Mazzoni	
Change of BLM thresholds	yes		
BLM threshold changes in the current period:			
UFO changes LSS MQM, MQML, MQY and MBRC; and XRPs/TCLs/TCTs (ECR to be published)			
flat to correction for physics debris and collimation and XPR			
LSS for UFO losses			
MQM Q10 magnets for protection against symmetric quenches			
injection TDI big filter (instead of small) in IP2 (ECR to be published)			
sector 12 reduction of thresholds for MB protection (ECR to be published)			

Collimation

Collimation	Status	Who	Comments
Valid set of betatron loss maps (hor/ver at Inj., flat top, squeezed separated, colliding) done in last 3 months.	OK	Stefano	
Valid set of off-momentum loss maps (pos./neg. at Inj., flat top, squeezed separated, colliding) done in last 3 months.	OK	Stefano	
Loss maps for re-qualification after technical stop did not show unexpected losses distributions.	--	Stefano	Not applicable in the reference period
No observation of abnormal cleaning efficiency.	OK	Stefano	
No observation of abnormal passive protection.	OK	Stefano	
Collimators at agreed positions during cycle.	OK	Stefano	Flooding problem in IR3 caused collimator faults and malfunctionings that were traced to problem with cable connectors (they ended up under water following a problem by CV). Finally, cabling of all collimators had to be redone. Some shifts of jaw positions were observed after recabling that followed flooding. Within limits defined at the beginning of the run.
Correct LSA positions, thresholds, limits, warning levels.	OK	Stefano	
Orbit monitoring at TCSPs and TCTPs operational, no unexplained offset changes observed.	OK	Stefano	Some initially unexplained offsets seen in adjust (up to <300um) caused by small issue with orbit correction. Fixed.
No unexplained beam dumps due to collimators.	OK	Stefano	
No beam dumps from collimator temperatures.	OK	Stefano	
XRPs at agreed positions during cycle.	OK	Stefano	TOTEM stopped inserions in June because of radiation ware of sensors. No issues during their run at low beta. AFP: successfully tested insertion in the 600b fill that followed the MD1 period.
XRPs: Correct LSA positions, thresholds, limits, warning levels.	OK	Stefano	
No unexplained beam dumps due to XRPs.	OK	Stefano	
List of disabled/faulty sensors and masked channels			
Temporarily masked the LVDT RD of TCSG.4R3.B1 that showed noise after flooding problem.			

Operation, orbit and feedbacks

Operation, orbit and feedbacks	Status	Who	Comments
OFB operational status	OK	JW	OK
QFB operational status	OK	JW	Occasional issues with B1 BBQ quality at high energy. No problem thanks to accurate feed-forward and super-reproducible machine.
Global orbit in tolerance at 450 GeV (< 0.2 mm rms)	OK	JW	
Global orbit in tolerance in stable beams (< 0.2 mm rms)	"OK"	JW	The overall orbit reproducibility is excellent. The beam separation offsets at the IPs are very stable now that the IT thermal screen temperature is well stabilized by cryo. There is one issue on the global LHC orbit: between August 2nd and August 3rd (MKI B1 spark downtime) the orbit rms jumped by some 80 um rms. This is an incoherent effect that affects the entire machine (each BPM). It has the same signature than a BPM calibration error (pattern and amplitude). So far all checks seems however to indicate that the calibration tasks were executed correctly, the correct calibrator was used etc. BI investigating, but problem is not understood.
Orbit IR3/IR7 collimators within ± 0.2 mm at 450 GeV	OK	JW	
Orbit IR3/IR7 collimators within ± 0.2 mm in stable beams	"OK"	JW	See comment on orbit in stable beams
Orbit at TCTs in tolerance in stable beams (≤ 1 sigma in IR1/5, ≤ 3 sigma in IR2/8)	OK	JW	Due to the large betatron functions at the TCT, the orbit systematic errors mentioned above have a smaller impact.



The jump just after day ~100 affects both beams & planes, and carries the signature of incorrect BPM calibration (for example). But the origin is not understood yet.

Beam Dump

Beam dump	Status	Who	Comments
Asynchronous dumps understood? Protection worked correctly?	OK	CB	No async. dump occurred
Parasitic asynchronous dump data (particles in abort gap during every fill) show no loss of protection.	OK	CB	
BPM IP6 (interlock BPM) working correctly during first beam with higher intensity and different bunch pattern.	OK	CB	
No positioning errors on TCSP/TCDQ.	OK	CB	
No settings or thresholds mistakes/wrong sequences/unexplained faults on TCSP/TCDQ.	OK	CB	
Loss leakage to TCTs below 0.5% of losses at TCDQ during beam dumps.	OK	CB	
No unexplained MKD, MKB kicker, TSU or BETS faults.	OK	CB	Failure of one TSU.B1 card on July 1st. The failure was detected by the redundant system and the beam was synchronously and cleanly dumped. The card was replaced, all TSU inputs rechecked and the system fully revalidated. The reason for the failure is not fully understood yet.
No potentially dangerous XPOC or IPOC failure on MKD or MKB.	OK	CB	
No unexplained synchronization problem with TSU.	OK	CB	
Pressure and temperature rise in TDE block within tolerances.	OK	CB	Pressure within limits (1.1-1.4 bar), minimum recorded pressure = 1.165 bar and maximum = 1.328 bar
Requalification passed OK at 450 GeV and 6.5 TeV with pilot in case of any important component exchange.	OK	CB	
Valid set of simulated asynchronous beam dumps (Injection, flat top, squeezed separated, colliding) performed in last 3 months by operator.	OK	CB	

Injection

Injection	Status	Who	Comments
Injection protection devices at agreed positions during cycle.	OK	CB	
Correct LSA positions, thresholds, limits, warning levels.	OK	CB	
Injection oscillations within tolerance for all injections.	OK	BG	Missing injection oscillation data on a few occasions: 9/8/16@18:54, 2/8/16@00:16. Some time taken to correct injection oscillations when switching to BCMS beams on 8/7/16
No unexplained large beam loss on TCDIs.	OK	CB	
Expected losses for the beam to be injected at least 30 % below threshold level.	OK	CB	Only losses at the TDI reached up to >90% to dump threshold in several occasions. This was due to satellites from the SPS, in particular when moving to BCMS beams. The situation was improved acting on the injection cleaning (cleaning also the MKI rise edge region) and losses went down to 30-40%. Losses at the TDI induced by satellites increased again when shortening the MKI flattop, to solve the sparking problems at the MKID of B1. A larger filter was installed on the critical BLM at the TDI (I10, only in IP2 on August 9th) and losses went back down to 30-40%. the injection cleaning had to be readjusted to be compatible with operation with a reduced AGK window.
Line has been re-steered successfully if losses have been to high.	OK	CB	
No issues in injection procedure, settings or tolerances.	OK	CB	
Orbit in injection region in tolerance wrt reference (tolerance <0.5 mm).	OK	BG	
Resetting of TL trajectories, TCDIs and optics done when needed.	OK	CB	
No increased rate of MKI flashovers.	Flashovers MKID in P2	BG	Two real magnet sparks seen on MKID in P2, on 25/7/16 and 3/8/16. Correlated to increased vacuum activity (below).
No increased rate of MKI switch erratics or missing.	OK	BG	
No unexplained MKI vacuum or temperature activity.	Activity MKID in P2	BG	Unexplained vacuum pressure rise during magnet pulsing, with onset on 31/7/16. Pressures of ~6e-9 seen during the softstart, and eventually on 2/8/16 this happened with every pulse, making the softstart impossible to complete. After investigations a mitigation was found by reducing the operational pulse length to 3 us and the softstart pulse length max to 4 us, which has limited the outgassing and (so far) allowed operation with injection of 96b. Preparations for exchanging the magnet were made in parallel. Bunch intensity and number were limited to 1.1e11 and 2072 total respectively for the first ~5 days after recovering the MKI.
No machine-protection related injection system hardware failures.	OK	BG	

Heating

From Benoit:

Issue for heating has been the fill for which the blow up for one beam did not work during the ramp and the super low bunch length triggered a temperature interlock of one collimator. That temperature sensor is most likely picking up electromagnetic noise or heating itself, but it is still important to keep it in the loop as it is the fastest sign that something is really wrong with bunch length (as in 2012). In agreement with Stefano, we therefore requested to OP and STI that it is reactivated.

Another collimator in IR3 is heating up more than the others during the ramp, but this seems to be linked to longitudinal losses. To be followed up though.

MDs

MD blocks #2 and #3

■ See:

https://social.cern.ch/me/dwollman/_layouts/15/WopiFrame.aspx?sourcedoc=/me/dwollman/Documents/MD%20block%202%20-%20rMPP%20comments.xlsx&action=default

■ General comments:

- New ADT functionalities to be checked first with pilots at injection
- ATS procedures to be updated (MD#3)
- Optics measurements at 6.5 TeV → keep minimal aperture protection of Arc 1-2. No masking of BLMs at IP1 and IP2.
- Often missing a precise list of signals to be masked, including SIS. PC (optics) interlock is activated in the SIS.

■ Recovery after MD

- Another 2.5 km development block
- Standard is a fill with 3 x 3 (check on cycle independent settings) and fill with 600 x 600 bunches (check on intensity effect)