

Proposal for Intensity Ramp-up and check list update

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Outline

- Proposal for intensity ramp-up 2017
- Proposal for insertion of CT – PPS and AFP XRP during intensity ramp-up.
- Ramp-up scenarios after stops and MDs
- Check list up-date

Intensity ramp-up 2016

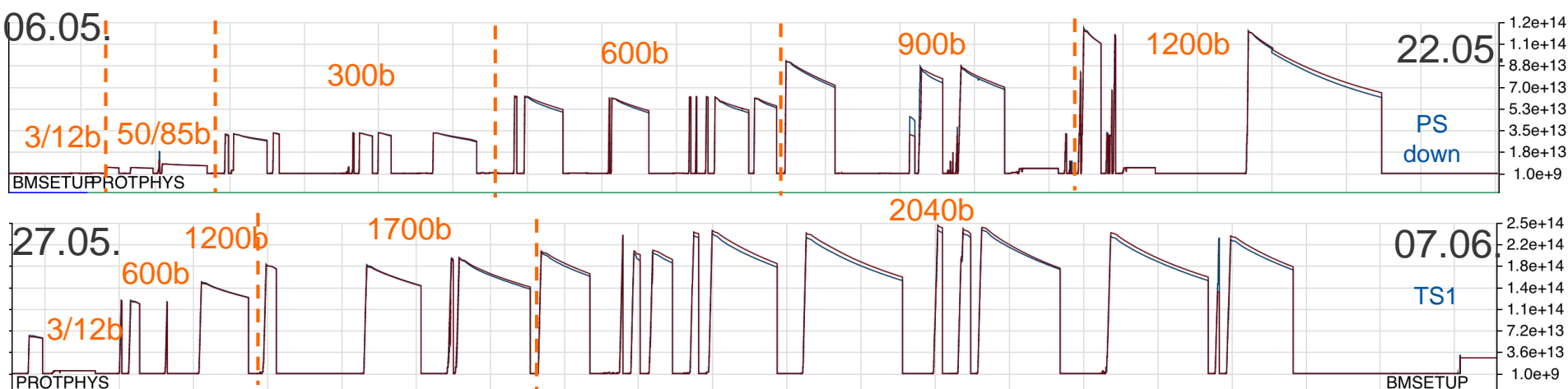
The plan:

Intensity ramp-up >12b: 3 fills, 20h stable beams, check list.

Interleave increase of injected intensity.

3 – 12 – 48/72 – 288 – 570 – 860 – 1200 – 1700 – 2300 – 2800

Establish cycle
MP dominated
Intensity dominated



- > 1700 b / 200 MJ after 15 days (excluding PS stop)
- Careful check of **high energy beam dumps** and documentation in **7 intensity ramp-up, 4 intensity cruise check lists** (EDMS). One check list for scrubbing. One **ion checklist** pending.
- Ion ramp-up: One **intermediate intensity** step after validation with ~50/25 nominal bunches equivalent → ~200b p / ~200b Pb.

Proposal Intensity Ramp-up 2017

- **Replacement of main dipole** in sector 1-2 during EYETS, **ATS** – optics, **CMS realignment** during EYETS, **CMS bump**, **full detuning** of accelerating RF, ...
- Intensity ramp-up > **12b**: 3 fills, 20h stable beams, check list
- Interleaved increase of injected intensity up to 144b
- **3 - 12 - 72 - 300 - 600 - 900 - 1200 - 1800 - 2400 – 2550**
- Scrubbing:
 - Verify **heating of critical** elements before stepping up in intensity
 - Intermediate checklist **after ~400 b** (RF power, heating, ...), final checklist **at the end** of scrubbing
 - RF: full detuning to be considered?
- Insertion of CT-PPS and AFP roman pots to agreed settings (CollWG):
 - **After > 3h** in **second fill** and full third fill at each intensity step.
 - AFP with **increase safety margin** (new equipment) – based on experience safety margin might be removed later in the year.

Establish cycle
MP dominated
Intensity dominated

Standard ramp-up scenarios after stops of nominal operation (> 48 h?)

Without massive HW + SW interventions

- One fill with either **pilot bunches or max 2-3 nominal** bunches into SB (cycle revalidation etc.).
- One fill with **600 bunches** and 2 - 5 hours of stable beams (known intensity step to disentangle wrong settings, de-conditioning, etc. from intensity dominated effects at full intensity).
- **Back to pre-stop** intensities.

Total 2 fills for ramp-up

With massive HW + SW interventions

- One fill with either **pilot bunches or max 2-3 nominal** bunches into SB (cycle revalidation etc).
- One fill with **~50 bunches** and about 1 - 2 hours of stable beams.
- One fill with **600 bunches** and 2 - 5 hours of stable beams (known intensity step to disentangle wrong settings, de-conditioning, etc. from intensity dominated effects at full intensity).
- If > 2000 bunches reached, one fill with about **half max number of bunches** and about 5 hours of stable beams.
- **Back to pre-stop** intensities.

Total 3-4 fills for ramp-up

Ramp-up after stops, TS and MDs

- **Scenario 1** applied: after **PS stop**, **TS1**, **MD1**, **MD2**, **MD4**
- **Scenario 2** applied: after **MD3/TS2**
- **Not applied** after 2 days stop for inter-turn short investigation in A31L2 (→ only low intensity cycle before stepping to > 2000b)



Proposal:

- Use **2017 same standard ramp-up** scenarios following the positive experience in 2016.
- **Apply scenario 1** also in case of **configuration changes** in future (e.g. switch back to 4 Z TeV after 15 days in 6.5 Z TeV).
- **Ensured systematic analysis** also after short ramp-up fills.

Intensity ramp-up checklist: system-responsibles

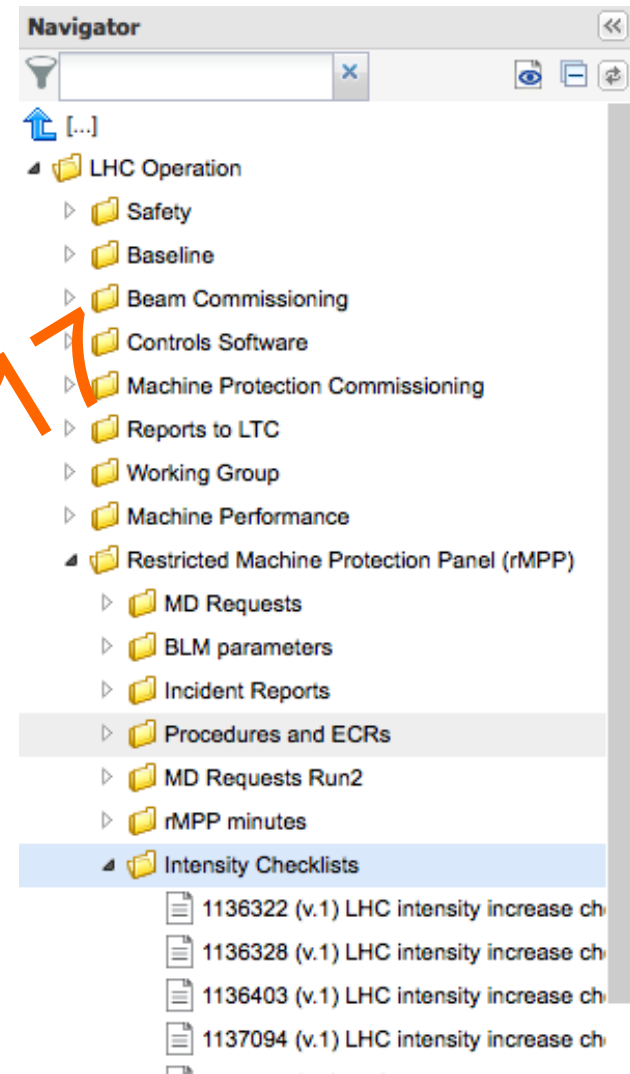
System / categories	Responsible / Deputy
Period	D. Wollmann / M. Zerlauth / J. Uythoven
Fills	D. Wollmann / M. Zerlauth / J. Uythoven
Dump Statistics	D. Wollmann / M. Zerlauth / J. Uythoven
Magnet Powering (MP3)	Z. Charifoulline / A. Verweij
Interlocks	I. Romera / J. Uythoven
RF	W. Hoelle / A. Butterworth / L. Arnaudon
Beam Instrumentation	G. Zamantzas / B. Holzer
Collimation	S. Redaelli / R. Bruce
Operation, orbit, feedbacks	J. Wenninger / L. Ponce
Beam dump	C. Bracco / W. Bartmann
Injection	C. Bracco / W. Bartmann
Heating of Equipment	B. Salvant / ?

Update by 11.05.2017

Check list update 2017

- Verify responsables → system experts
- Update system checks → system experts
- LHCIntensityIncreaseRun2V2
- LHCIntensityIncreaseScrubbingRun2V2
- Link to rMPP EDMS

Update by 11.05.2017



Conclusion

- Intensity ramp-up 2017 proposal based on **successful strategy** applied in 2016 (1700b reached after 15 days).
- **Check lists** during scrubbing and intensity ramp-up have proven **important** and useful to analyse and document correct **functionality and performance** of machine protection critical systems.
- **Two standard scenarios** for intensity ramp-ups after **short stops** were successfully established in 2016 → apply also for 2017.
- Intensity and scrubbing checklists: **update of system responsible and checks** by expert requested **until 11.05.2017**.



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