

FCC related MDs

Faster LHC ramp MD

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Faster LHC ramp MD

MOTIVATION

The interest in the faster ramp for the LHC magnets comes from a possible re-use as a hadron booster (in the view of FCC). **LHC operation could obviously also profit of this in case of positive results.**

MD CONDITIONS

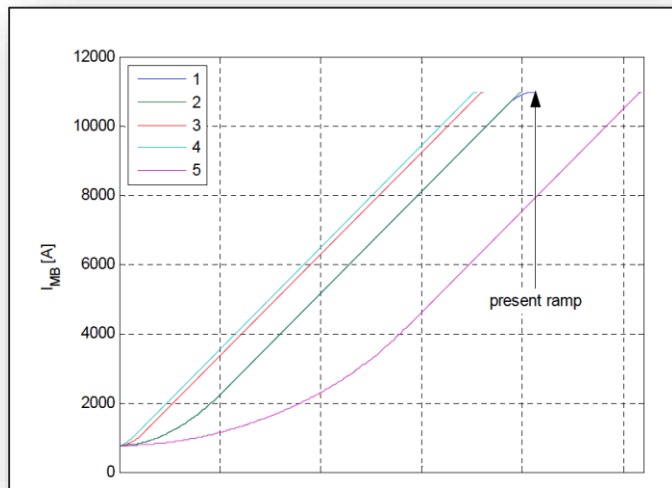
- Pilot beam **ONLY**
- Some ramps (as many as possible)
- NO changes in machine configuration
- Dedicated hypercycle (totally separated settings)

Faster LHC ramp MD

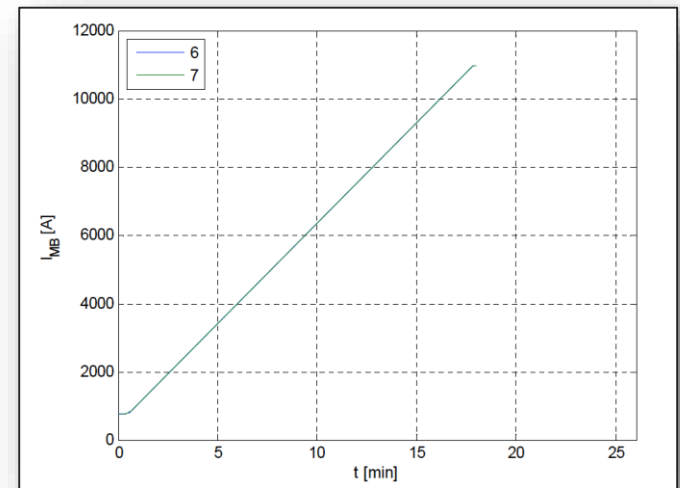
Possible ramps (in order of priority):

1. 2x faster snapback + maybe (to be investigated)
 1. Shorter parabolic round-off
 2. Higher di/dt
2. PPLP (vs present PELP)
3. 2x slower snapback (maybe better located in a OP MD)
4. 3x faster snapback (very aggressive)

This should be feasible



Example



PELP 1210 sec (8.4 A/s in average)

PPLP 1074 sec (9.5 A/s in average)

para ex n linear para

para para linear para

Faster LHC ramp MD

MD description

- Injection of a pilot beam in both rings with nominal conditions (no change in optics, coll hierarchy,...).
- **Ramp** with configuration #1
- Dump at flatop and rampdown
- **Ramp** with configuration #2
- Dump at flatop and rampdown
- **Ramp** with configuration #3
- Dump at flatop and rampdown
- ...

MD on 225 GeV LHC injection

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MD on 225 GeV LHC injection

MOTIVATION

- For **FCC**:
 - input for crucial design choice of injection energy, since x30 energy swing in FCC would mean 1.6 TeV injection. Key question for snapback
 - Recommendation from recent [Injection Energy Review](#) to test this in LHC
- For **possible future LHC energy upgrades**:
 - important to check the possibility of increasing the energy swing in the LHC
- For **operating LHC**:
 - improve understanding of magnetic model and snapback with additional data points

MD on 225 GeV LHC injection

Possible scope of MD

- **Cycle tests without beam**

- Define cycle(s), generate settings, deploy, dry powering, test on interlock loops

- **Cycle tests with decelerated beam**

- Inject @450 GeV, decelerate (225 GeV??), start ramp
- How representative for magnets?
- Keeping BIS loop closed? Disable the LBDS?

- **Full test**

- 225 GeV cycle in SPS, TI 2 and/or TI 8 threading, trajectories, injection, LHC threading, capture, orbit, ramp
- Major changes to SPS extraction interlocking
- Major changes to LHC injection interlocking
- Many issues: LHC beam dump, E related interlocks, SMP, ..., ..., ...,

Beam conditions

- Single bunch (pilot – INDIV?)
- Ramping from 225 GeV to 450 GeV/few TeV

MD on 225 GeV LHC injection

COMMENTS ON TIMING

- Once configuration decided and settings generated, the **cycle tests** could be done during a shift without beam (already in 2016)
- The “**deceleration**” **test** would need some interlocking changes in LHC, so it needs accesses, validations, 2-3 shifts of beam tests and not negligible recovery time
- The **full test** probably needs:
 - 1 day of interlocking changes in SPS and LHC
 - Dedicated MD in the SPS to test the cycle
 - 1 day of commissioning
 - 1 day of measurements
 - Long recovery time (to be planned before a TS or (better) a YETS)

MD on 225 GeV LHC injection

MACHINE PROTECTION CLASSIFICATION

