Machine protection requirements for the pilot beam test

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This presentation

- Define & agree required commissioning status of machine protection and related systems for the pilot beam test in October 2021
- Proposal to be complemented by system experts

Machine conditions

- Injection energy of 450 GeV, no ramping
- Injection of single nominal bunches
- Up to three nominal bunches distributed along circumference
- Stable beams with 3 colliding nominal bunches per beam

Full validation required

- Beam Interlock System (BIS)
- Powering Interlock System (PIC)
- Vacuum System (Vac)
- Warm Magnet Interlock System (WIC)
- Safe Machine Parameter System (SMP)
- Beam presence flag

Partial validation (1/2)

- Injection protection (Inj)
  - Optics, dispersion and aperture measurements in TL
  - MSI and injection region aperture measurements
  - Transfer line collimators at coarse settings (no beam based alignment)
  - TDIS at proper position (beam based alignment to be tested but no pre-requisite for injection of nominal bunches)
  - IQC
- Beam Dump System (LBDS)
  - Full validation required for:
    - Triggering and synchronisation of MKD and MKB
    - BETS (not TCDQ-BETS)
    - Aperture measurements of extraction region and channel
    - MKB waveform check
    - Beam based alignment of TCSP
    - TCDQ setting based in TCSP alignment
    - XPOC
- Fast Magnet Current Change Monitor (FMCM)
  - Full testing of FMCMs critical at injection
  - Validate FMCM triggers (no testing with masked FMCM)
- Beam Loss Monitor System (BLM)
  - Full validation required excluding:
    - Direct dump BLMs
    - Injection interlock inhibit
  - In case BLM tests with radioactive source cannot be performed for all BLMs prior to the pilot run, most relevant BLMs will be prioritised (IP7, injection, dump regions, experiments/triplets/TCTs, etc.)
  - Proposal to start with reduced monitor factors in IP7 to ensure that BLMs trigger first in IP7 in case of issues → to be followed-up by BLMTWG

Partial validation (2/2)

- Software Interlock System (SIS)
  - Commissioning of all HW monitoring
  - PC interlock to be verified with basic checks during pilot run

- Collimation
  - Full validation of interlocks and movement
  - Full beam based alignment for reduced set of collimators
  - Coarse settings (as defined by collimation team):
    - TCPs IR7 @ 8 sigma
    - TCSP IR6 @ 10 sigma
    - TCPs IR3 @ 12 sigma
    - TCTs @ +- 15 mm
  - Full set of loss maps at collision (stable beams)

Miscellaneous

- Roman Pots (ARP, TOTEM/CTPPS)
  - Validate movement and interlocks
  - Beam modes versus XRP retraction for ARP proposed before pilot run as insertion to 20 mm planned.
- ADT
  - Full commissioning of excitation (required for aperture measurements and loss maps)
  - Verify damping with probe bunch
- BCCM
  - Parasitic tests not interlocking

Discussion