Work progress and issues – WP7 Machine Protection

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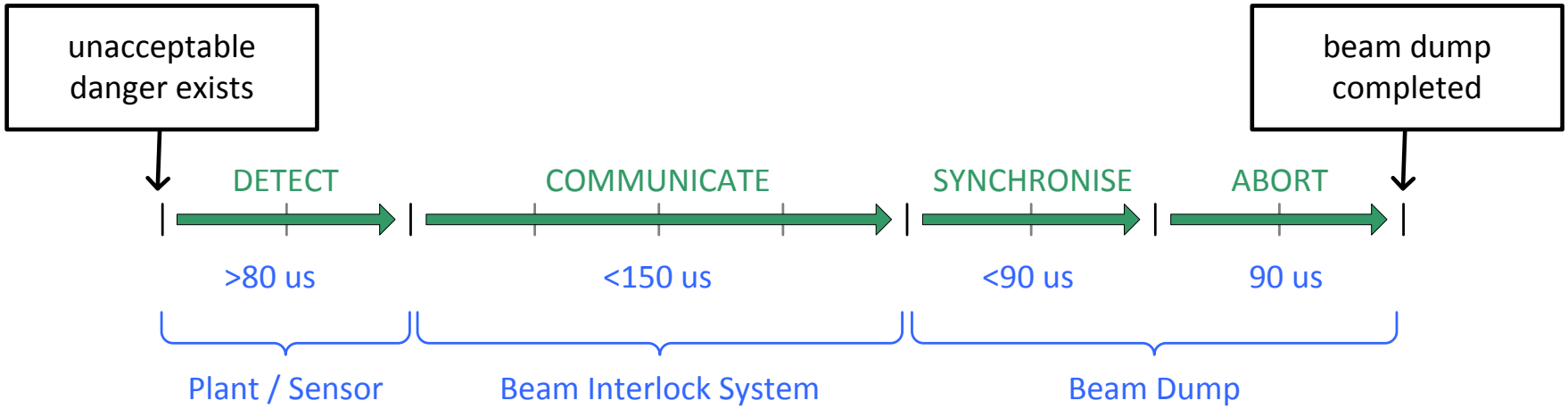
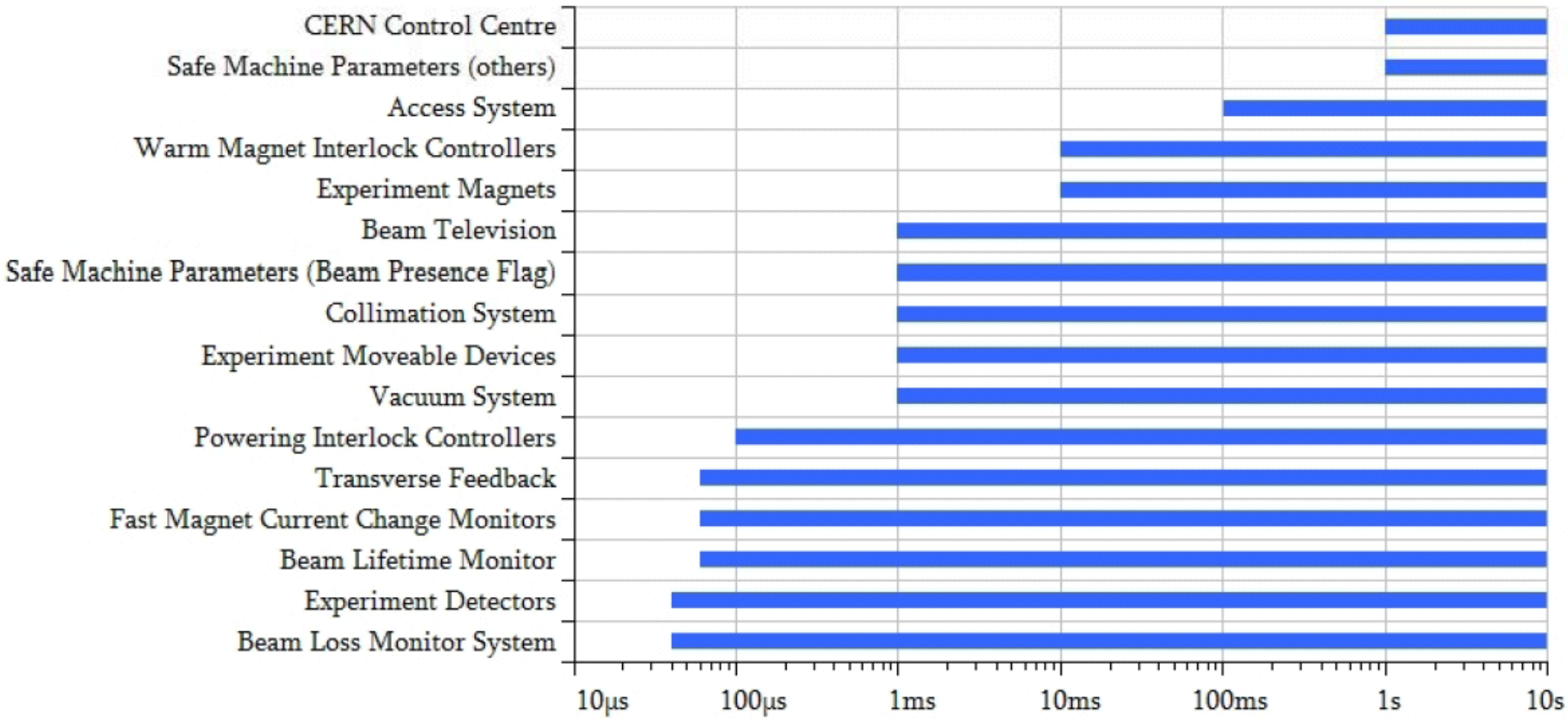
The HiLumi LHC Design Study is included in the High Luminosity LHC project and is partly funded by the European Commission within the Framework Programme 7 Capacities Specific Programme, Grant Agreement 284404.

- Much of detailed work will be dealt with in respective WPs
- Coordination and general overview of Machine Protection related question through expertise in LHC Machine Protection Panel (MPP)
- Experience shows very well protected machine (lot of redundancy) in absence of (very) fast kicker failures
- Identified list of main topics that are (or will have to be) addressed in view of HL-LHC

- MP implications of crab cavities
  - Current design would require 1.7σ aperture margin
  - MPS response by dumping the beams not sufficient for very fast failure cases < 1 turn



Failure detection time @ LHC



best failure detection time = 40 us = half turn

- Possible mitigations/improvements
  - Passive increase of τ for critical failures through LLRF and cavity design (available power, Qext,…)
  - Dependable & fast detection of failures
  - Introduce direct links IR1/5->IR6 for beam aborts?
  - Additional abort gaps?

- Dependable measurement & interlocks on tail population + head-tail oscillations to limit deposited energy
  - New instrumentation and interlock techniques (head tail monitor)
  - Hollow electron lens for cleaning
  - Other cleaning techniques?

- DIAMOND beam loss monitors for diagnostics + active protection
- Accept asynchronous dumps + local damage (e.g. new collimator materials and/or spare surfaces)?
- Re-iterate (realistic) damage thresholds for different failure cases
- Protection against magnet powering failures (cold D1 at β* ~ 15km, new insertion layout)
- Injection protection (TCDI, TDI, injection lines,…)
- Dump protection (TCDQ,..)
- Absence of LRBB kick during beam dump