SPS Interlocks for LHC Extraction

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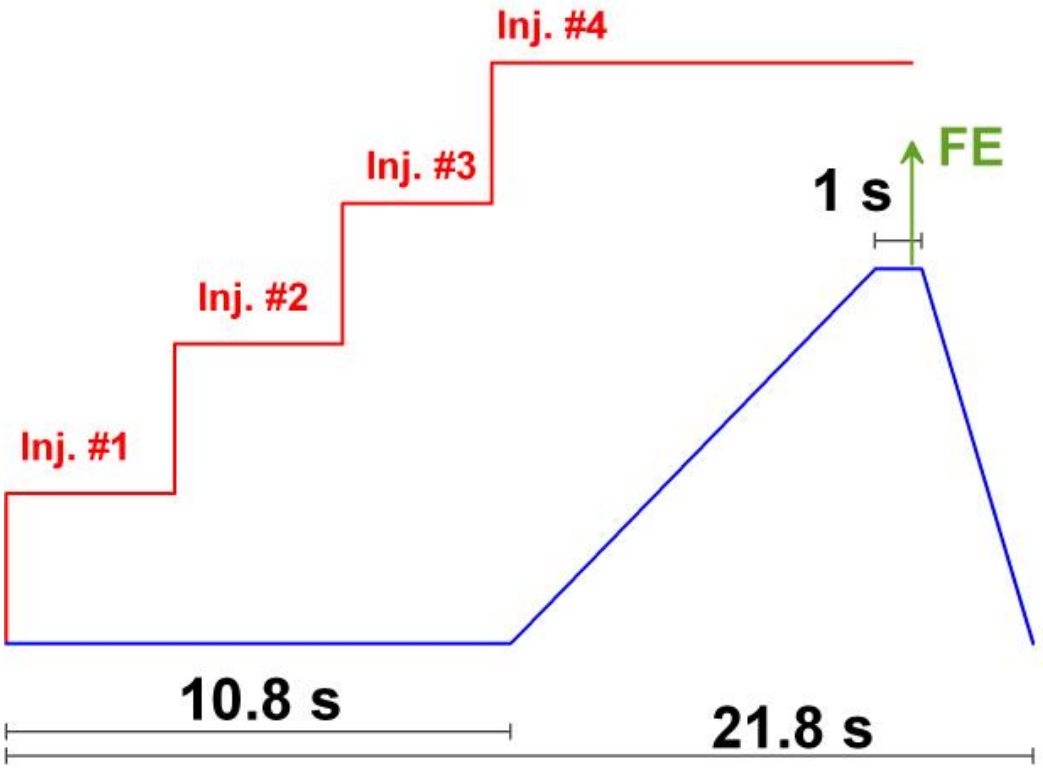
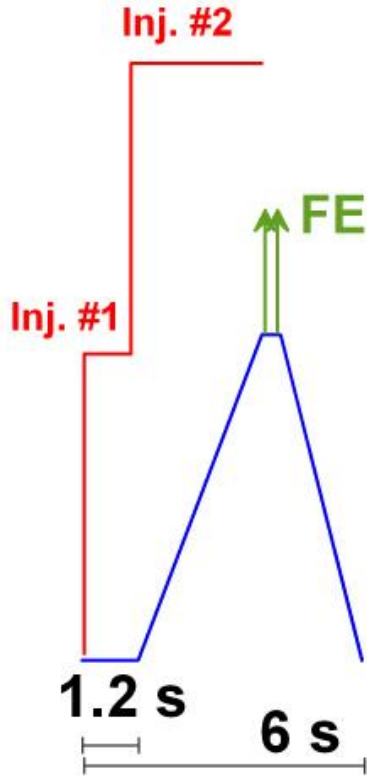
SPS cycles

Basic LHC cycle (protons)



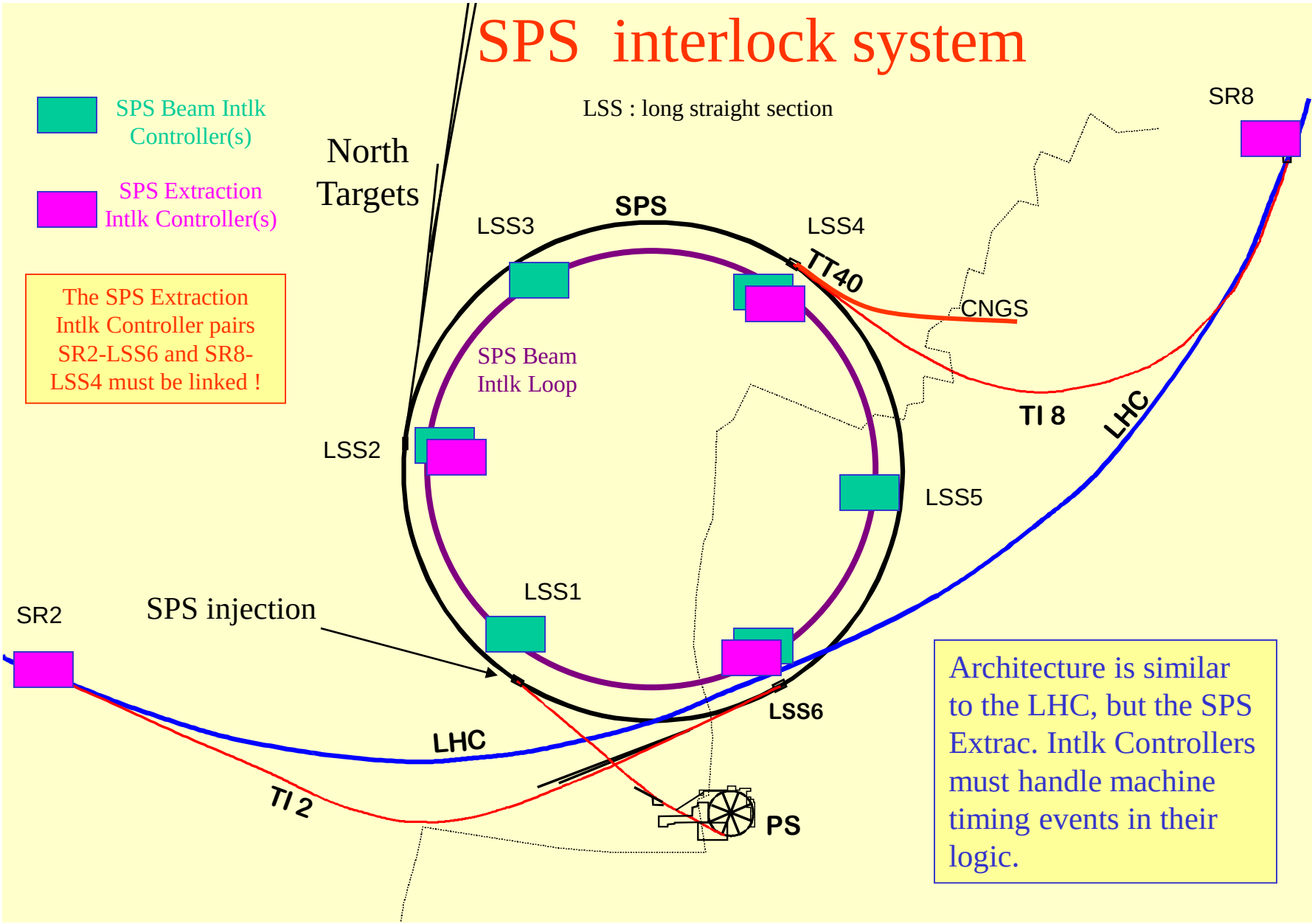
CNGS cycle

2 extractions spaced by 50 ms



FE : fast extraction

SPS interlock system



SPS beam interlocks

Based largely on present interlocks (new 'clients' in RED) :

- Vacuum chain
- Dump kicker (internal faults, tracking, energy…)
- Beam position > threshold (present : 30 mm) – present system analog → digital
- BCT : fast losses in the ramp
- Ring BLMs (response time 20 ms)
- Fast extraction BLMs (response time ~ μs) : LSS1, LSS2, LSS4(?),LSS6
- RF
- Main power converters state (not I tolerance !) : dipoles, quads, sextupoles
- Software interlock system - to be redefined !
- Extraction interlock systems :
  LSS2 (slow extraction), LSS4 (TI8+CNGS), LSS6 (TI2) if extraction is disabled.
- Extraction kickers in local control
- Beam intensity interlock – connection to LHC
- Power converter current surveillance (extraction energy …)
- …

Extraction Interlocks

Rough list – details vary between different LSS :

- Extraction kickers (not for LSS2 / slow extraction)
- Electrostatic septa (LSS2)
- Magnetic septa currents
- Bumper magnet currents
- Bumped beam position
- Transfer line magnet currents (if critical) and states
- Transfer line vacuum
- Transfer line beam losses (slow extraction, CNGS, LHC → software intlk ?)
- Dump blocks (IN/OUT – for masking)
- LHC beam interlock loop
- Other LHC ‘interlocks’

Power converter surveillance

Based on a permit signal that is set provided the current is within a given tolerance window → M. Jonker.

Issues :

- reference value
- cycle dependence