The TOTEM Interlock Strategy and Implementation

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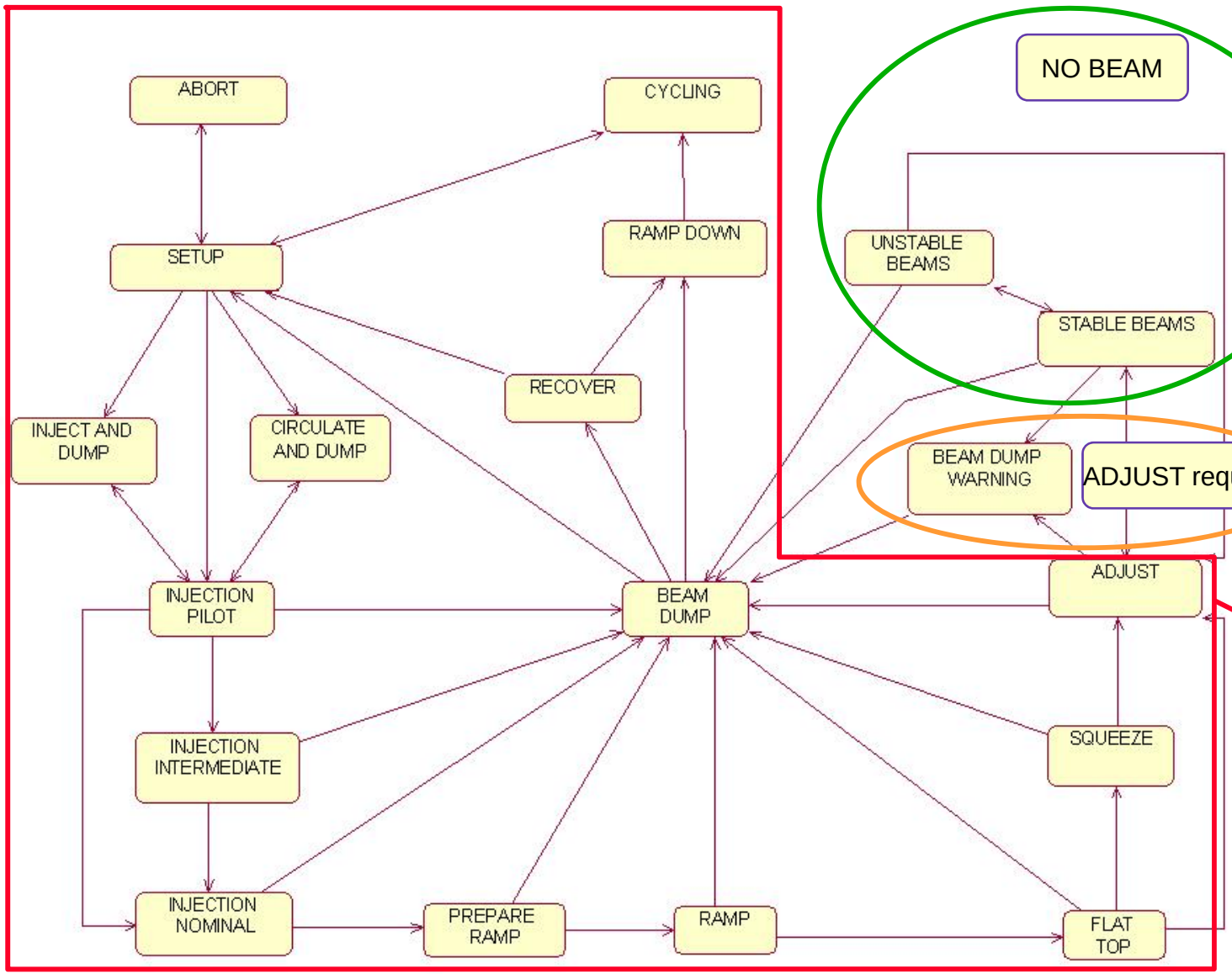
Contexts of RP Operation: The Beam Modes



A Closer Look at the Relevant Beam Modes (1)

1. NO_BEAM:

RP operation possible.

Injection prevented by USER_PERMIT1 = FALSE when not all RPs are at end switch

2. STABLE_BEAM:

Normal mode for RP operation.

RP positions measured by LVDT;
limits received from LSA collimation database via FESA. } → in PXI: comparison at 50 Hz

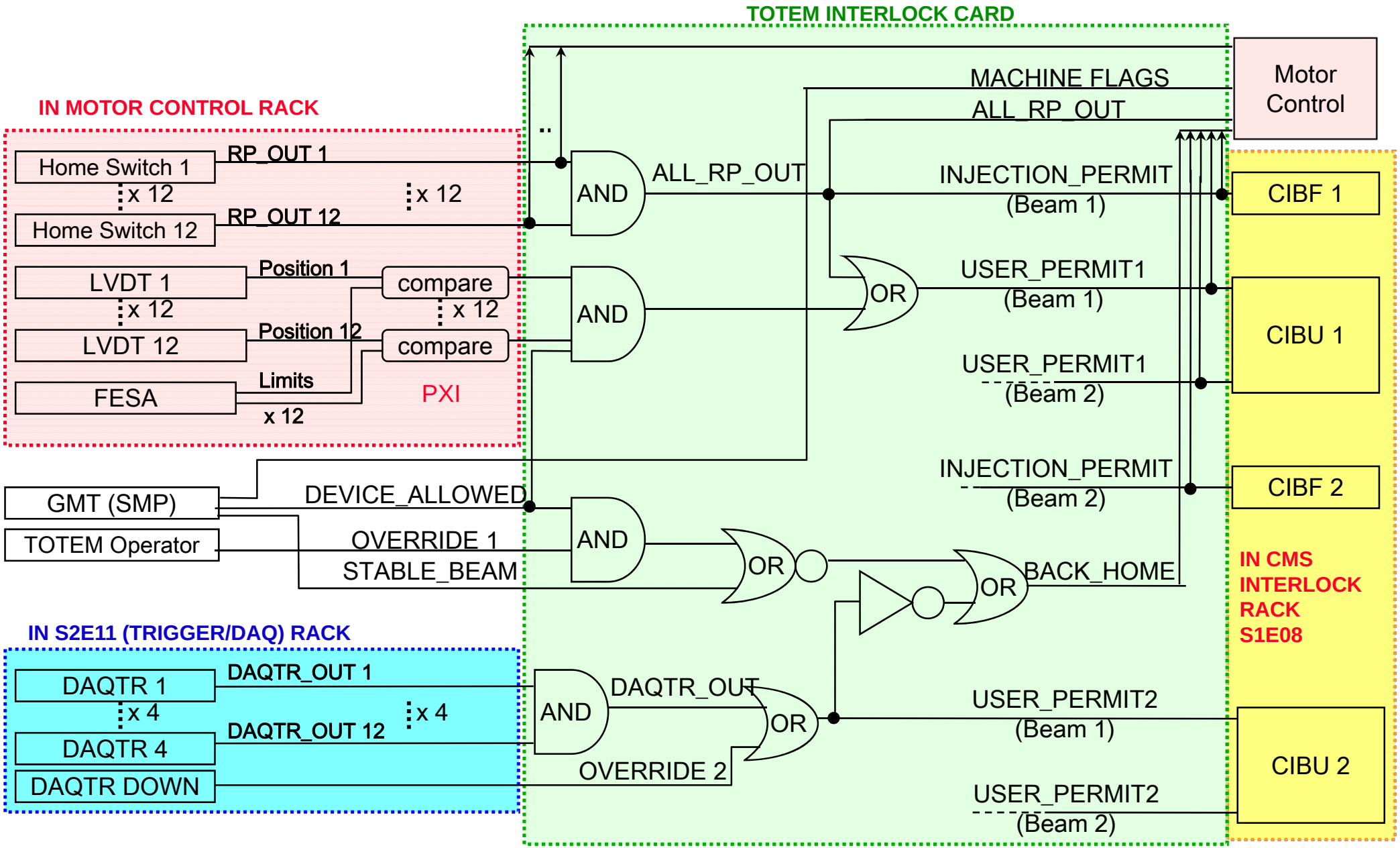
If out of limits:

- level 1 (warning limit): warning to DCS and CCC; extraction
- level 2 (critical limit): alarm; emergency extraction;
  USER_PERMIT1 = FALSE → beam dump

When not all RPs are at end switch: INJECTION_PERMIT = FALSE

During data taking: manual movement inhibit to prevent undesired manual RP movements
But: extraction in emergency situations always possible! (SW → motors; HW → springs)

Interlock Block Diagramme



A Closer Look at the Relevant Beam Modes (2)

3. UNSTABLE_BEAM:

No normal RP operation.

If not all RPs are at end switch:

- no interlock action (DEVICE_ALLOWED = STABLE_BEAM .or. UNSTABLE_BEAM)
- but automatic RP extraction with motors

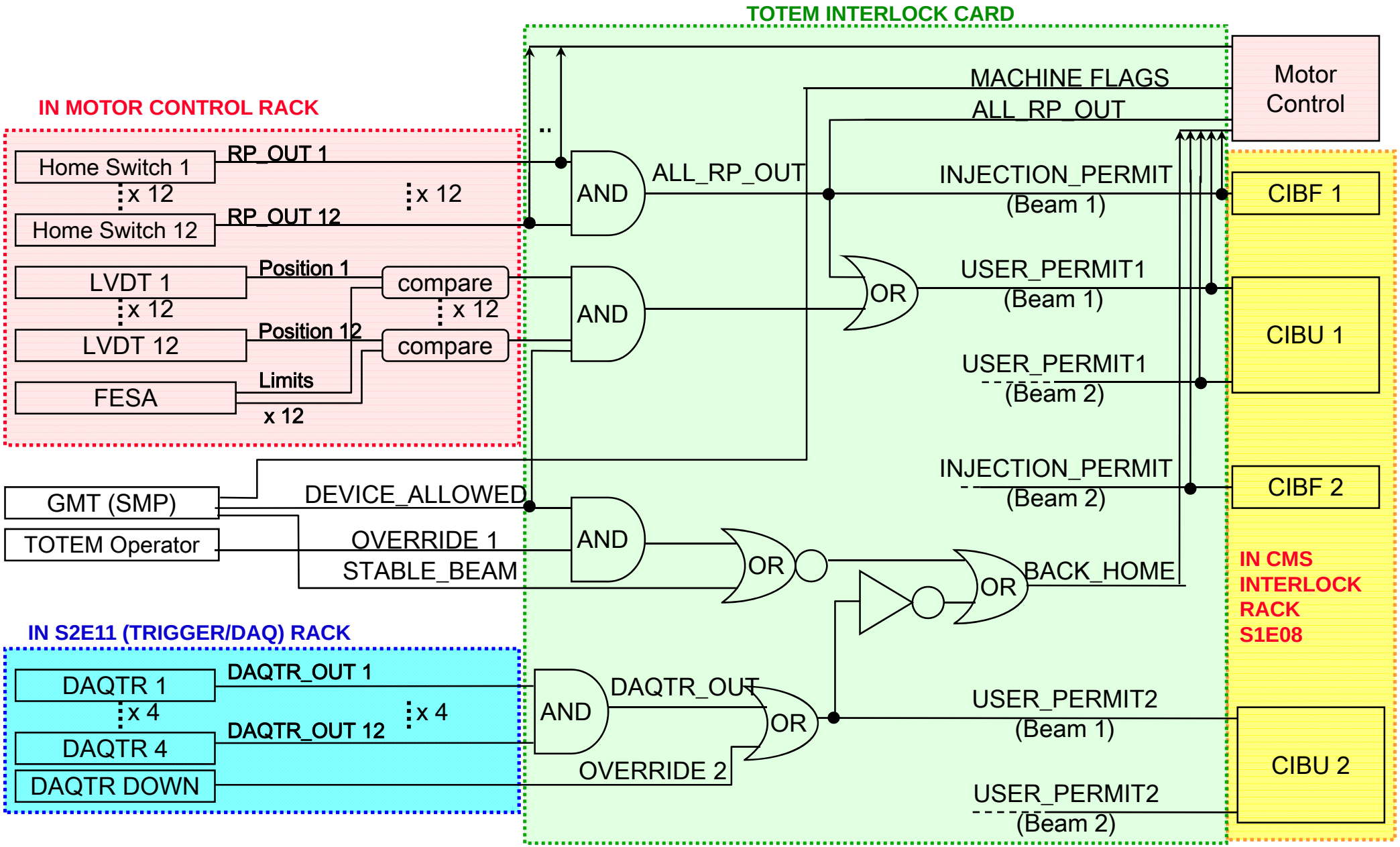
Exception: special RP/collimator position calibration runs requested by collimation group
→ manual OVERRIDE signal to prevent automatic RP extraction

4. Switching to ADJUST Mode:

To be preceded by handshake via DIP protocol (ADJUST request → ready for ADJUST) to allow for RP extraction.

Switching without RP extraction would lead to beam dump via USER_PERMIT1.

Interlock Block Diagramme



USER_PERMIT2 and CIBU2

CIBU2: second interlock box allowing to dump the beam based on RP information not related to the position: e.g. count rates, vacuum deterioration

- These conditions can usually be adequately addressed by RP extraction without beam dump.
- Reasonable dump thresholds need RP running experience.
  Particular example: RP detector count rates must be compared with BLM information

→ In the first running season: no dump possibility implemented.
Later implementation only if needed

TOTEM Interlock Card

- Logics part fully programmable (PLD)

- Inputs:
  - from 24 RP end switches
  - from PXI, motor control:
    - results of comparison between LVDT position data and limits from LSA DB
    - 4 spares
  - machine flags:
    - DEVICE_ALLOWED
    - STABLE_BEAM
    - SAFE_BEAM 1 and 2 (presently unused)
    - POST_MORTEM trigger (not yet used)
    - IMMINENT_BEAM_ABORT (hardware signal presently unused; also received via DIP → used for handshake)
    - 2 spares
  - from TOTEM operator / DAQ:
    - 2 OVERRIDE signals
    - 2 spares

- Outputs:
  - USER_PERMIT signals for CIBU1 and 2, each for beam 1 and 2
  - INJECTION_PERMIT signals for CIBF1 and 2
  - copies of all input and output signals for information to the motor control
  - 10 spares

Status and Planning

- Interlock card in production: to be finished by 4 May
- mounting components: + 1 week → 11 May
- lab tests and PLD programming: + 2 weeks → 25 May
- interlock commissioning and tests: to be discussed with machine