



CT-PPS XRP Recommissioning

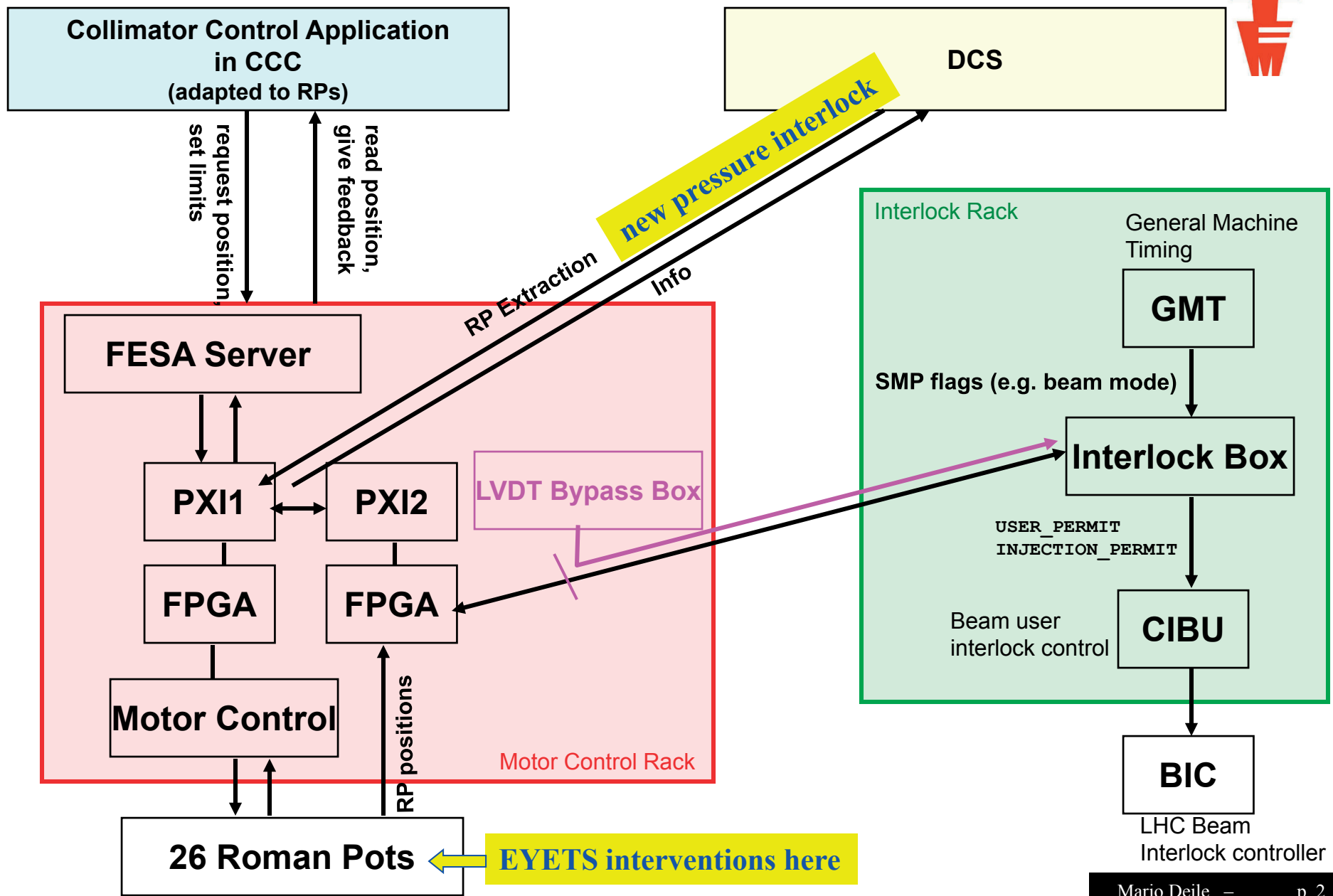


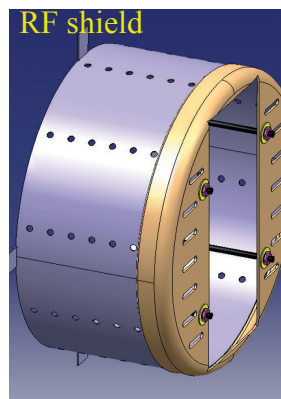
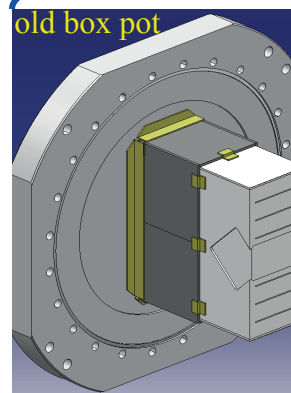
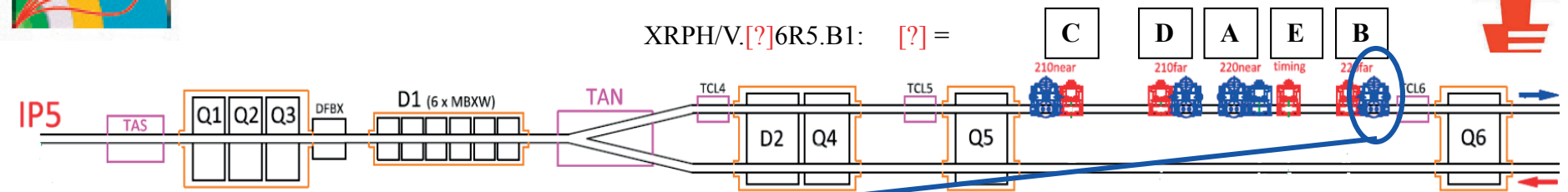
Mario Deile

**MPP Meeting
12 May 2017**



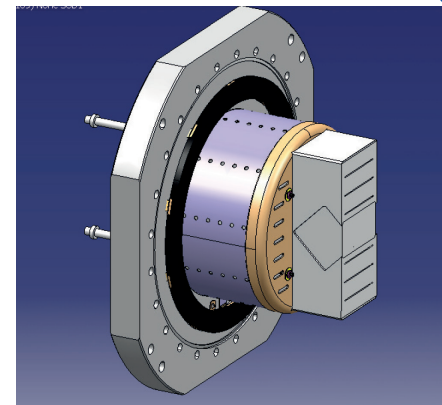
Movement System Architecture (strongly simplified)





+

+ Ferrite replacement



LHC-XRP-EC-0017
EDMS 1739683

Main work: XRPH.B6R5.B1 (and ~B6L5.B2) equipped with RF shield for impedance mitigation

→ ALL detector packages removed to allow bake-out of the sector, then re-installed, partly with completely new detectors:

now 4 technologies:

tracking: silicon strips, 3D pixels,

timing: ultra-fast silicon, diamond

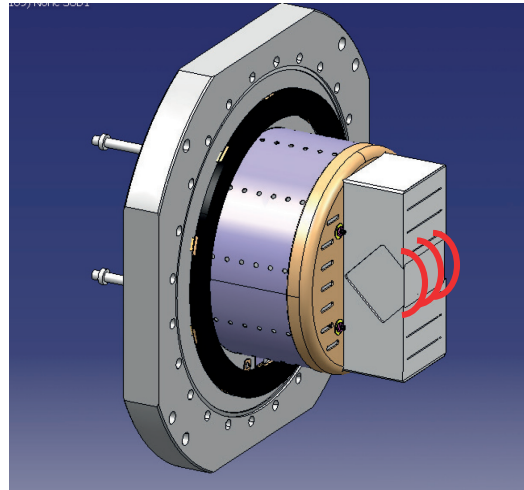
→ Interlock-relevant signal cables disconnected/reconnected (HOME switches, end stoppers, LVDT)

→ Communication between motor control rack and XRPs had to be re-tested.

+ New laser/LVDT/motor calibration curves for modified pots (EN-ACE-SU metrology) !

Secondary vacuum loss in XRP (leak + pump failure)

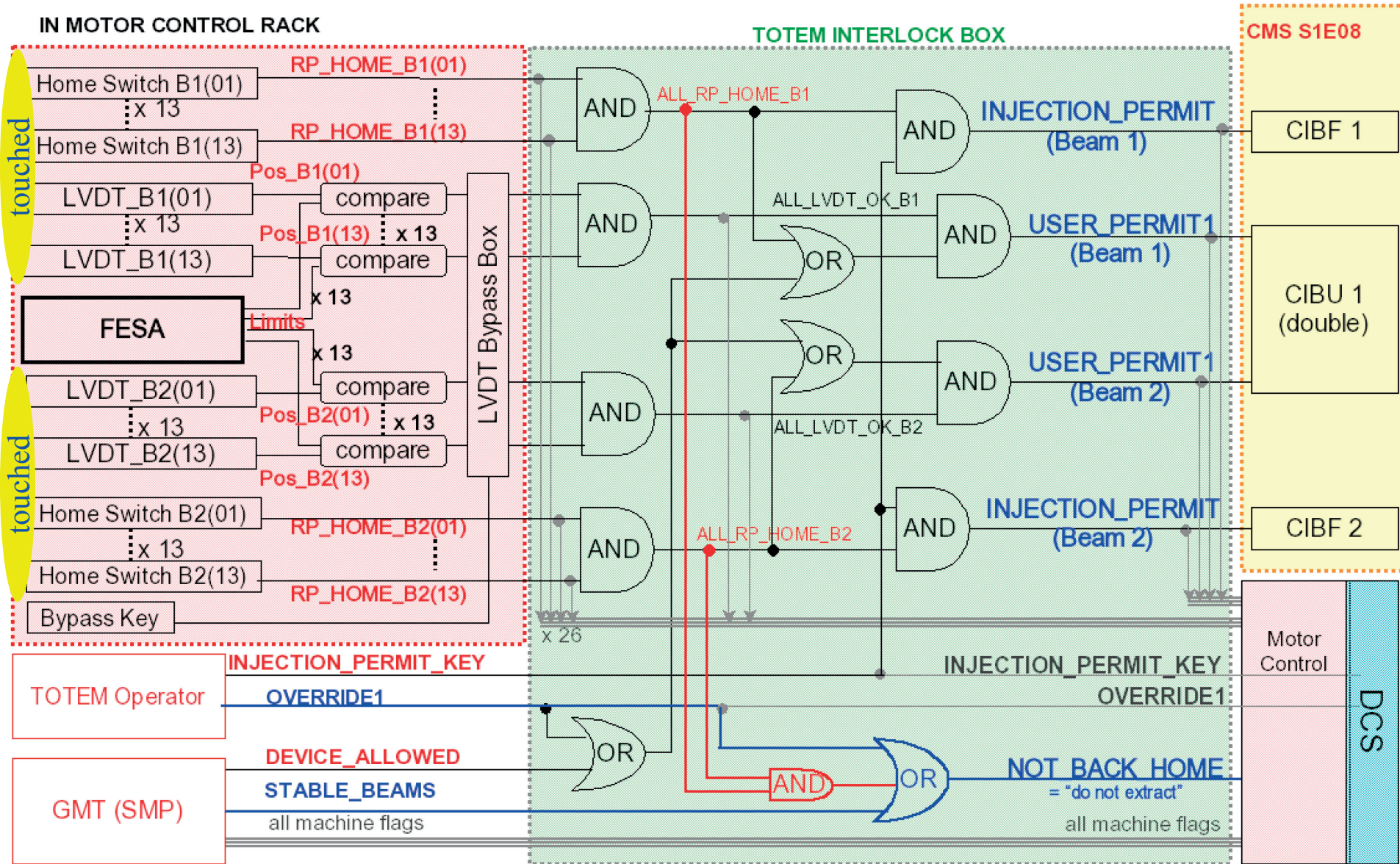
→ thin pot window bulges towards beam into primary machine vacuum (0.5 mm for cylindrical pot)



During EYETS: implementation of a new local DCS interlock
(no interference with interlock box feeding into machine BIS):

- DCS samples secondary vacuum pressure every 35 ms
- If pressure increase > 200 mbar → XRP extraction via springs and prevention of re-insertion
extraction speed ~ 15 mm/s,
i.e. the first 0.5 mm within 33 ms
→ not as fast as BLM but additional protection layer

Interlock Logic 2015



Simplified Interlock Functionality



- **User Permits** (1 per beam):

User Permit is removed if:

(a pot is outside garage in the wrong beam mode) or (a pot is not within position limits)
→ beam dump and retraction of all RPs with the springs

- **Injection Permits** (1 per beam):

Injection Permit is removed if a pot is outside garage (defined by electrical link from HOME switch)

... apart from an Override key and an LVDT bypass key (consult the full logic)

Logic implemented on a programmable circuit (“Interlock Box”)



- Beam-mode dependent tests not done
(They concern the logic in the hardware “interlock box”: not touched)
- Retested:
 1. Correct reaction of the injection permits (by moving pots out of garage and back)
 2. Correct transmission of all position limits to the interlock PXI and read-back to the CCC collimator application
 3. Correct system reaction to violations of the limits
(RP retraction for violation of warning limits,
RP retraction + dump for violation of dump limits)

For all 26 RPs (even the ones not used in 2017 since not immobilised by hardware) and for all inner limits:

- old inner dump
- new inner dump (“IPL”)

Inner warning limits tested for a subset of pots.

Outer limits: no operational meaning → retraction and dump tested for a subset of pots.

EDMS 1803133 in work.

Example from Collimation Elog (27.04.2017)



1. Move pot to 35 mm
2. Set IPL to 36 mm with Trim Editor
- 3a. USER_PERMIT to false
- 3b. pot is extracted with springs
- 4. USER_PERMIT back to true

Permit	Timestamp	Visibility	Event Type	Description
27-04-17 17:34:33.580574	ALL	USER_PERMIT	2 A F-T	4
27-04-17 17:34:33.580574	ALL	USER_PERMIT	2 B F-T	
27-04-17 17:34:33.430731	ALL	USER_PERMIT	2 A F-T	3a
27-04-17 17:34:33.430730	ALL	USER_PERMIT	2 B T-F	
27-04-17 17:32:41.339716	ALL	USER_PERMIT	2 A F-T	
27-04-17 17:32:41.339715	ALL	USER_PERMIT	2 B F-T	
27-04-17 17:32:41.119880	ALL	USER_PERMIT	2 B T-F	
27-04-17 17:32:41.119879	ALL	USER_PERMIT	2 A T-F	
27-04-17 17:30:31.438415	ALL	USER_PERMIT	2 A F-T	
27-04-17 17:30:31.438415	ALL	USER_PERMIT	2 B F-T	
27-04-17 17:30:31.248584	ALL	USER_PERMIT	2 B T-F	
27-04-17 17:30:31.248582	ALL	USER_PERMIT	2 A T-F	
27-04-17 17:28:17.877902	ALL	USER_PERMIT	2 A F-T	
27-04-17 17:28:17.877901	ALL	USER_PERMIT	2 B F-T	
27-04-17 17:28:17.728071	ALL	USER_PERMIT	2 B T-F	
27-04-17 17:28:17.728069	ALL	USER_PERMIT	2 A T-F	
27-04-17 17:25:35.577278	ALL	USER_PERMIT	2 A F-T	
27-04-17 17:25:35.577278	ALL	USER_PERMIT	2 B F-T	
27-04-17 17:25:35.427445	ALL	USER_PERMIT	2 B T-F	
27-04-17 17:25:35.427444	ALL	USER_PERMIT	2 A T-F	
27-04-17 17:23:27.737969	ALL	USER_PERMIT	2 A F-T	
27-04-17 17:23:27.737969	ALL	USER_PERMIT	2 B F-T	
27-04-17 17:23:27.568137	ALL	USER_PERMIT	2 B T-F	
27-04-17 17:23:27.568135	ALL	USER_PERMIT	2 A T-F	
27-04-17 17:21:29.356532	ALL	USER_PERMIT	2 A F-T	
27-04-17 17:21:29.356532	ALL	USER_PERMIT	2 B F-T	
27-04-17 17:21:29.196703	ALL	USER_PERMIT	2 B T-F	
27-04-17 17:21:29.196701	ALL	USER_PERMIT	2 A T-F	
27-04-17 17:19:23.625006	ALL	USER_PERMIT	2 A F-T	
27-04-17 17:19:23.625006	ALL	USER_PERMIT	2 B F-T	
27-04-17 17:19:23.455176	ALL	USER_PERMIT	2 B F-T	
27-04-17 17:19:23.455175	ALL	USER_PERMIT	2 A T-F	
27-04-17 17:16:42.857184	ALL	USER_PERMIT	2 A F-T	
27-04-17 17:16:42.857183	ALL	USER_PERMIT	2 B F-T	
27-04-17 17:16:42.677350	ALL	USER_PERMIT	2 B T-F	
27-04-17 17:16:42.677348	ALL	USER_PERMIT	2 A T-F	
27-04-17 17:14:20.425856	ALL	USER_PERMIT	2 A F-T	
27-04-17 17:14:20.425855	ALL	USER_PERMIT	2 B F-T	

Note on the Spare Interlock Box



Present situation:

A spare interlock logic box is available on a shelf in a lab.

Electronic tests have been performed in the lab (logic and levels).

Steps to install and validate the spare box in case of need:

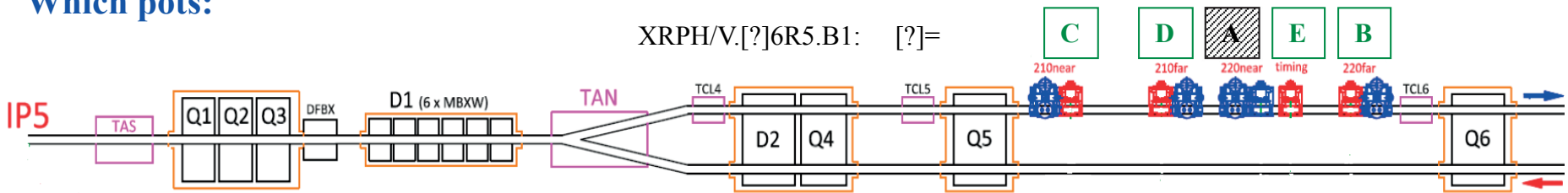
1. Installation needs expert intervention (EP-ESE)
2. Test of the electronic levels in situ
To be done by the team of Christophe Martin
(relatively easy and quick to allow resuming machine operation)
3. Test of the logic in situ → needs a sequence of machine modes to be set by OP
Is the lab test with emulated machine input flags sufficient ?

In each intensity step insert the XRP's:

- not in the first fill
- in the 2nd fill after 2 hours
- in the $\geq 3^{\text{rd}}$ fill immediately

If possible, not simultaneously with AFP (to separate the effects in the diagnostics)

Which pots:



Horizontal:

- D, E, B: always used
- C unit: for now empty, detector package possibly to be installed later
→ needs to participate in validation and intensity ramp-up, then stays out until further notice
- A unit: stays out for the full year

Vertical:

- Vertical pots of units D and B inserted in calibration runs, A and C stay out.

Wish: several hardware groups to keep flexibility during detector commissioning



2017 ATS Option 3bis ($\beta^* = 40$ cm): XRP Positions



$\sqrt{s} = 13$ TeV, $\beta^* = 0.4$ m, $\alpha_x = 300$ μ rad, $\epsilon_n = 3.5$ μ m rad
XRPs @ TCT + 3 σ + 0.3 mm

For TCT = 9 σ :

Sector 5-6 (Beam 1):

Horiz. XRP	$\sigma_{x,beam}$	XRP pos. max(12 σ + 0.3 mm, 1.5 mm)
C6R5 (210-N)	0.212 mm	2.844 mm = 13.4 σ
D6R5 (210-F)	0.144 mm	2.028 mm = 14.1 σ
E6R5 (220-C)	0.120 mm	1.740 mm = 14.5 σ
B6R5 (220-F)	0.094 mm	1.500 mm = 16.0 σ

Sector 4-5 (Beam 2):

Horiz. XRP	$\sigma_{x,beam}$	XRP pos. max(12 σ + 0.3 mm, 1.5 mm)
C6L5 (210-N)	0.208 mm	2.796 mm = 13.4 σ
D6L5 (210-F)	0.141 mm	1.992 mm = 14.1 σ
E6L5 (220-C)	0.118 mm	1.716 mm = 14.5 σ
B6L5 (220-F)	0.093 mm	1.500 mm = 16.1 σ

(12 σ + 0.3 mm < 1.5 mm)



Additional Material

Interlock Logic 2015

(Zoom on the motor control)

