Beam Instrumentation Availability

L4 Reliability Run – Mini workshop
 30 November 2016

F.Roncarolo/U.Raich on behalf of BE-BI

Diagnostics Park (including L4T)

S [m]	Type	Name
0.0		SOURCE
7.7	BSG	L4L.BSGHV.1173
7.8	FC	L4L.BIF.1185
8.2	BCT	L4L.BCT.1213
8.9		RFQ
12.2	BCT	L4L.BCT.3113
12.5		Buncher 1
12.7	WS	L4L.BWS.3312
14.0		Buncher 2
14.5	BPM	L4L.BPM.3711
14.5	WS	L4L.BWS.3712
15.3		Buncher 3
15.5	BCT	L4L.BCT.4013
15.7	BLM	L4L.BLM.4114
15.8		DTL1
19.8	BPM	L4D.BPM.0203
19.9	BLM	L4D.BLM.0208
20.0		DTL2
27.4	BPM	L4D.BPM.0303
27.5	BLM	L4D.BLM.0304
27.6		DTL3
35.0	BPM	L4C.BPM.0107
35.2	BLM	L4C.BLM.0114
35.3	BCT	L4C.BCT.0117
35.4	BSG	L4C.BSGH.0121
35.4	BSG	L4C.BSGV.0121
35.5		CCDTL 1
38.2	BPM	L4C.BPM.0207
38.4	BLM	L4C.BLM.0214
38.5	WS	L4C.BWS.0212
38.6		CCDTL 2
41.6	BPM	L4C.BPM.0307
41.8		CCDTL 3
44.9	BPM	L4C.BPM.0407
45.0	BLM	L4C.BLM.0414
45.1	BSG	L4C.BSGH.0421
45.1	BSG	L4C.BSGV.0421
45.2		CCDTL 4
48.5	BPM	L4C.BPM.0507
48.7		CCDTL 5
52.1	BPM	L4C.BPM.0607
52.3	BLM	L4C.BLM.0614
52.3	WS	L4C.BWS.0622

S [m]	Type	Name
52.4		CCDTL 6
56.1	BPM	L4C.BPM.0707
56.3		CCDTL 7
60.1	BPM	L4P.BPM.0107
60.2	BLM	L4P.BLM.0114
60.3	BCT	L4P.BCT.0117
60.5	BSG	L4P.BSGH.0121
60.5	BSG	L4P.BSGV.0121
60.6		PIMS 1
62.3		PIMS 2
63.9	BPM	L4P.BPM.0307
64.1		PIMS 3
65.6	WS	L4P.BWS.0402
65.7	BLM	L4P.BLM.0404
65.9		PIMS 4
67.5	BPM	L4P.BPM.0507
67.7		PIMS 5
69.2	BSG	L4P.BSGH.0601
69.2	BSG	L4P.BSGV.0601
69.5		PIMS 6
71.2	BPM	L4P.BPM.0707
71.4		PIMS 7
73.3		PIMS 8
75.0	BPM	L4P.BPM.0907
75.2		PIMS 9
76.9	WS	L4P.BWS.1002
76.9	BLM	L4P.BLM.1004
77.1		PIMS 10
78.9	BPM	L4P.BPM.1107
79.1		PIMS 11
81.1		PIMS 12
83.4	BCT	L4T.BCT.0107
87.0	BSG	L4T.BSGHV.0223
87.0	WS	L4T.BWS.0223
87.4	BPM	L4T.BPM.0227
88.1	BSM	L4T.BPLFS.0233
88.9	BPM	L4T.BPM.0237
89.3	BSG	L4T.BSGHV.0243
89.3	BWS	L4T.BWS.0243

S [m]	Type	Name
89.8		1st BEND H
108.3	BPM	L4T.BPM.0827
109.8	BPM	L4T.BPM.0837
119.2	BPM	L4T.BPM.1027
120.7	BPM	L4T.BPM.1037
123.1	BCT	L4T.BCT.1043
124.2	BLM	L4T.BLM.1074
125.3	BLM	L4T.BLM.1084
129.8	BPM	L4T.BPM.1227
131.0	BCT	L4T.BCT.1243
131.3	BPM	L4T.BPM.1245
131.9	BSG	L4T.BSGHV.1247
131.9	BWS	L4T.BWS.1247
133.3	BLM	L4T.BLM.1249
133.3		1st BEND V
137.8	BLM	L4T.BLM.1409
143.3		2nd BEND V
144.4	BCT	L4T.BCT.1553
144.7	BPM	L4T.BPM.1557
145.7	BPM	L4T.BPM.1627
146.0	BLM	L4T.BLM.1634
146.1	BSM	L4T.BPLFS.1663
146.3	BLM	L4T.BLM.1709
91.0	BSG	L4Z.BSGHV.0253
91.0	BWS	L4Z.BWS.0253
92.4	BSG	L4Z.BSGHV.0267
92.4	BWS	L4Z.BWS.0267
93.3	BCT	L4Z.BCT.0273
94.3	BLM	L4Z.BLM.0294

25	BPM
15	BSG
11	BCT
12	WS
19	BLM
2	BSM
1	FC
1	BTV
2	LEM (2017)

Systems linked to interlock

- **BCT watch dogs**
  - Protect against bad transmission
- **BLM thresholds**
  - Protect against losses
- **SEM grids and WS**
  - Protect wires
  - SIS, to limit the pulse length
- **Laser emittance meter**
  - diamond detectors can't be IN when upstream bend is OFF
  - When L4T dump removed: not possible to operate diamond detectors, monitor will measure beam profile and not emittance, no interlock

Systems operation

- **SEM and WS**
  - OP Expert GUI as in PS complex
  - Setting up (gains) straight forward
- **BCT**
  - BI expert GUI
    - used as fixed display by ABP
    - used by BI for setting up
    - watch dog OP setting (and reset) via OP GUI
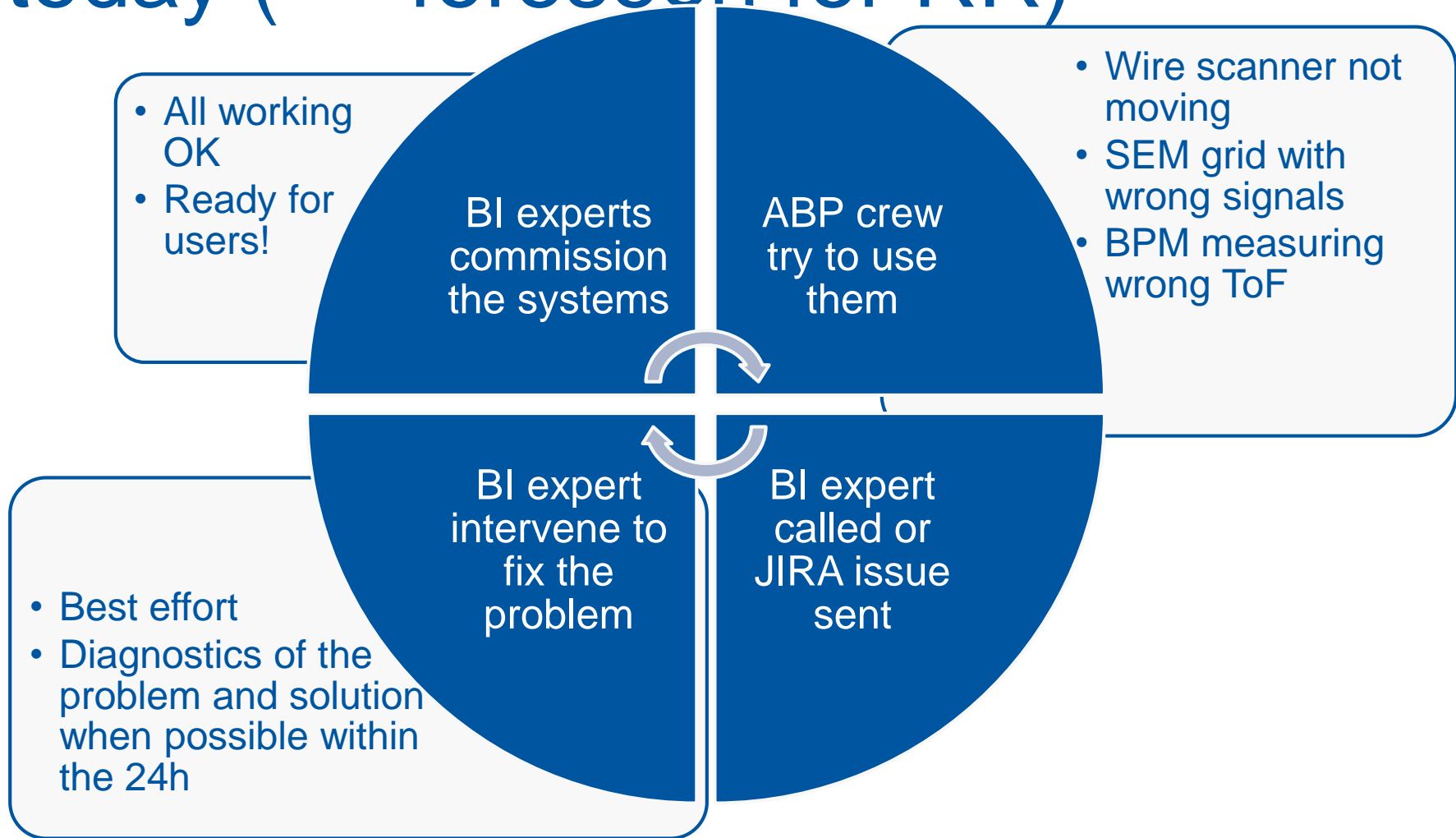   - Thresholds (SW) decided by ABP

Systems operation

- **BPMs – trajectory**
  - Setting up by BI via expert GUI. Need to change settings for very short pulses (<100ns)
  - OP trajectory display (OP) as in PS complex
- **BPMs – ToF**
  - Setting up by BI
  - OP display being developed

Systems operation

- **BLMs**
  - BI expert GUI used by BI for setting up and display
  - OP display developed for HST (BCTs and BLM) very nice and useful!
  - Thresholds: to be studied!
    - Need ABP and OP support
  - BLMs not in INCA yet. Once done (EYETS?) OP-ABP can manage thresholds, BI support for threshold determination will be always needed

How instrumentation is operated today (~= foreseen for RR)

- All working OK
- Ready for users!

BI experts commission the systems

ABP crew try to use them

- Wire scanner not moving
- SEM grid with wrong signals
- BPM measuring wrong ToF

BI expert intervene to fix the problem

BI expert called or JIRA issue sent

- Best effort
- Diagnostics of the problem and solution when possible within the 24h

Operation and support during RR

- At the beginning of the RR and anytime the beam parameters will change, BI may ask for dedicated time to properly setup the various systems

- CERN wide BI support is granted on the best effort basis (apart from LHC BLMs piquet service)

- LHC BLM piquet likely not applicable to L4 RR since experts are not trained yet on LINAC4 systems

- What proposed by Maurizio (no nights, yes WE days) is ok for BI, remembering that : 'WE experts availability' is generally best effort (no piquet) and specifically outside working hours

- Operation from the CCC may speed up some intervention (SW and setting up) w.r.t. present operation from the L4 control room

Main BI system failures (guess)

- **WS, SEM grids, BSM**
  - Mechanics
    - pneumatic IN-OUT → may stop operation, need access
    - Wire breaking → need access and vacuum opening only if want to recover functionality
  - Electronics
    - Components failure. Easy to change, need access if pre-amps in tunnel fail
  - SW
    - Wrong configuration or FESA server crashes → fix remotely

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Post Mortem (BLMs)

- There is NO post mortem (LHC like) for the L4 BLMs

- When the interlock is triggered, the timestamp is recorded

- The BLM expert GUI will give the information on if it was losses or electronics failure → call expert

Technical Stops Schedule during the L4 RR

- Overlapping with Injectors and LHC TS is very risky, may end-up in resources problems

- Would be wise to have L4 TS the week after normal TSs ? Will be all L4 services available to run L4 during the injectors TSs?

Conclusions/Outlook

L4 instrumentation is in general ready for 24/7 operation

- Still need to install few SEM grid /WS in L4P (vacuum validation)
- Certainly need to train ABP and OP teams on L4 (some BI expert interventions are managed by OP elsewhere)
- BLM Interlock thresholds still to be studied and defined
- Still need few OP GUIs, like for ToF and BSM
- BI support during RR will be on best effort basis outside working hours
- Could be good to have a review (BI, ABP, OP) before the RR start
  - Summary (diagnostics wise) of the160 MeV commissioning
  - GUIs status and needs
  - Main failures and cures
  - ….

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