CRAB CAVITY TECHNICAL COORDINATION WORKING GROUP

Meeting 01: 11 July 2012

Minutes of meeting

Present

Rama Calaga, Eric Montesinos, Philippe Baudrenghien, Paolo Chiggiato, Tobias Baer, Belen Salvachua, Rogelio Tomas, Bruce Rendon, Benoit Salvant, Thibaut Lefevre, Alick Macpherson

Agenda:

1. Working group introduction and mandate: Alick Macpherson
2. Crab cavity status: Rama Calaga.
3. Roundtable discussion: All
4. AOB

SUMMARY

- It was generally agreed that 2016 was the most feasible slot for the SPS crab cavity been tests. COLDEX running in post LS1 and the SPS schedule in 2015 implies that there is no possibility before that.
- The space requirements for an RF installation and 2/4K availability at the COLDEX regions makes it ideal. Therefore, compatibility with future COLDEX type program should be worked out.
- Cryogenics is working towards the availability of 4.5K at the end of 2012, and a subsequent 2K system towards the end of 2013. Details to be reviewed in September.
- Definition of the measurement program (aims, milestones, and techniques) needs to be drafted, and then used as an input into integration and installation planning. This is needed to define requirements and requests to other teams/groups.
- Functional specifications of the cavities is expected soon, and so for the next meeting, Rama agreed present them, and discuss the implications.
- A site visit to SPS Pt 4 is needed with all involved parties. Target date, next technical stop.
- Prior to the next meeting, teams will be contacted on an individual basis to firm up details and inputs needed.

Working group introduction and mandate

- Alick introduced the working group, and presented the mandate:
  - Mandate:
    - Prepare, organize, and run Crab Cavities beam tests in SPS.
      - Coordinate infrastructure requirements for these beam tests
      - Handle the complete integration of these beam tests
      - Implement agreed validation program for Crab Cavity functionality @LHC
      - Identify common design and infrastructure elements that facilitate both the SPS tests and potential verification tests in LHC Pt 4
      - Set and maintain schedules for crab cavity beam tests
    - Provide relevant specifications [functional and technical] that allow the LHC crab cavity project to proceed to a Technical Design Report and beyond.
    - Assess [in conjunction with Machine Protection] operational and machine safety risks associated with crab cavity operation in LHC [&SPS]

- It was noted that this working group is to pick up from where Elias Metral's working group (http://emetral.web.cern.ch/emetral/CCinS/CCinS.htm) finished in late 2009.
- The list of content person's has been updated and this forms the basis for the working group team. It was noted that nobody from the experiments is as yet involved.
- The location and tentative schedule for the SPS beam test was discussed
  - potential conflicts with COLDEX tests after LS1 were identified, which mean that if the COLDEX location is to be used (preferred option) then installation of the cavities is pushed to the 2015–2016 Christmas break.
  - The issue was raised as to whether the crab cavity installation could be done at SPS Pt 4 in a location adjacent to COLDEX. This needs to be more fully investigated.
  - The 2016 SPS run was identified as the most feasible timeslot for SPS beam tests of the crab cavities.

Crab cavity status

- Rama gave an overview on the current status of the crab cavity design, as well as some discussion of the short and longer term schedule.
- Questions were raised as to when a decision would be taken on which of the cavity designs will be chosen (at present 3 designs are being prototyped and will be field mapped late 2012–2013.) No clear answer on when a cavity design will be chosen, but certainly no decision will be taken before completion SM18 tests. it was noted that the selection decision should involve both cavity performance and cryostat considerations.
- For the SPS beam tests it was suggested that 2 cavities of the same type be installed (both understanding the measurements and for crabbing-uncrabbing of the beam). However, this may cause complications in testing the different cavity types, if the SPS schedule is to be respected, as in 2016 no extended technical stops are foreseen.
- Rama noted that a TDR is at the end of 2014 which will be included in the HiLumi Design study TDR, but that cavity and cryostat specifications need to be defined mid 2013.
- Questions of alignment constraints were raised, but it was stated that the SPS this is not so critical. Certainly some static alignment on the order of ~mm or better, but as for dynamic alignment and beam centering via feedbacks and orbit correctors, this has to be discussed further.

Roundtable discussion

- For vacuum considerations, Paolo Chiggiato noted that indeed COLDEX would be used after LS1 to make tests on carbon coating for the inner triplets, and so that specific location would not be available until after ~mid-2015. Removal of COLDEX would take 1.5-2 months, and so could only be done in the 2015-2016 Christmas break.
- Given that COLDEX is to be used in 2015, Paolo agreed that the crab cavity installation would benefit from its own Y-chamber, and production of this chamber should be launched as soon as feasible. He noted also that this whole area around the COLDEX was being refurbished in LS1, and so issues of Y-chamber and isolation valves should be addressed as soon as possible.
- Eric Montesinos noted that for the RF power for the crab cavities at SPS pt 4, the amplifiers should be on the platform (i.e. COLDEX location or very close to it). He proposed a visit to SPS Pt 4 to look at space constraints and possibilities.
- Thibaut Lefevre stressed that what was really needed by BI was a clear statement on the measurement program for the beam tests. In particular, a clear idea of instrumentation in and around the cryostat is needed.
  - The location of head-tail monitor(s) for measurements need to be specified

• SPS BLM integration times considered (option for faster LHC integration times/ diamond loss monitors)
• BPM resolution is not bunch by bunch, but batch by batch at best.
• LS1 wire scanner upgrade is foreseen
• Streak camera: to be decided if relevant for crab cavity tests, as monitor is in SPS pt 5 and so not clear what crabbing effects can be observed. Needs further investigation and specification of beam and crabbing parameters.

- Benoit Salvant noted that once the location of the cavity is fixed and the details of the Y-chamber is finalized, impedance calculations can be carried out.
- Tobias Baer noted that both RF trips, and coupler failures should be considered, and it was noted that both the failure scenarios and the diagnostics need to be reviewed, with the aim to understand both mitigation and also develop the interlock signals. For interlock signals, both RF and BI sources should be considered.
- Philippe Baudrenghien noted that despite the emittance growth of 20%/hr in SPS coast, measurements with effect of RF noise could be ascertained by using low intensity beams, turning up the noise until observable effects are seen, and then scaling down. This may help focus the simulations.
- For RF of trips and machine protection tests, he noted that with 2 cavities in the beam test, one could trip the 1st and then actively match the 2nd cavity to minimise distortion.
- Rogelio Tomas stated that he didn't see any optics issues that were significant, but he would check once the location and cavity functional specifications were settled.

AOB

- **Next Meeting**: The next meeting should not be convened until after the visit to SPS Pt 4 to examine space constraints allocation issues. This means the next meeting will be **after week 38** (next technical stop in SPS).
- A**genda for next meeting**
  - implications from functional specification of cavities [Rama]
  - results of location assessment for SPS beam Test.