HL-LHC Crab Cavity Meeting on "DQW design improvements"

Location:	video conference
Date:	20 January 2017
Time:	9:30am EDT
Indico event:	https://indico.cern.ch/event/603221/
Attendees:	Marco Garlaschè, Carlo Zanoni, Ofelia Capatina, Raphael Leuxe, Rama Calaga, James Alexander Mitchell, Joanna Sylwia Swieszek, Laurene Giordanino, Paula Freijedo Menendez, Kurt Artoos, Stefanie Langeslag (CERN); Graeme Burt (STFC / U. Lancaster); Qiong Wu, Silvia Verdu-Andres (BNL); Alex Ratti (SLAC)

Scope of the meeting: identify, discuss and define possible design improvements for the DQW crab cavity, and assign responsible(s) for the feasibility study of such improvements.

Points discussed and actions:

1. Study the possibility to extend the flat region at the edge of both end cap subassemblies so that the trim line is lower in a less sensitive area.
   Actions: the study shall quantify how much the flat region should be extended, determine if the new cavity shape can be manufactured and evaluate the new trim tuning sensitivity.
   Responsibles: Silvia Verdu-Andres, Raphael Leuxe, Marco Garlasche.

2. Review connection of inductive rod and capacitive cylinder in HOM filter.
   a. Jamie started inspecting some RF design alternatives.
   b. Qiong says that Binping discussed alternative fabrication methods for the current HOM filter design in a former presentation.
   c. Rama wonders if closed cylinder is needed or instead open cylinder would provide similar response. Graeme says he already looked at both options.
   d. Rama requests if the hook section (currently circular once past the high-pass filter section) could be rectangular with curved edges (easier to manufacture).

   Responsibles: Binping Xiao, Graeme Burt, James Alexander Mitchell, Paula Freijedo Menendez.

3. Increase damping of 930 MHz high order mode.
   a. Binping proposed an HOM filter that is 4 cm longer than current design.
   b. Ofelia points out that a longer filter may pose some issues for cooling and integration. Part of the filter for port HOM1 will be above the He line. The space at the bottom of the cavity is pretty limited, so there are clearance issues for the filters in ports HOM2 and HOM3.

   Responsibles: Binping Xiao, EN-MME.

4. Increase damping of 1.7 GHz high order mode.
    a. CERN says that "niobium chapeau" of current pickup design is difficult to fabricate and there is no much clearance between the pickup coupler and the port tube.
    b. *Action:* simplify pickup design to ease insertion into tube and fabrication of 1.75 MHz coupler.
    c. *Action:* review the location of the HOM ports and also their orientation. A different HOM port location may lead to better coupling to some HOMs (Qiong). Ofelia highlights that from the mechanical point of view a more symmetrical cavity is preferred (the current DQW SPS-series design leads to asymmetric displacement of plates when using pre-tuning, see Carlo Zanoni's study).
    d. Binping suggested separating pickup and 1.7 MHz couplers.
    e. *Action:* evaluate the possibility to add an extra port in the beam pipe so that pickup and 1.75 MHz mode couplers are not the same one. EN-MME should provide preferred location in beam pipe (remember clearance with second beam pipe).

    Responsibles: Binping Xiao, EN-MME, others.

5. Reinforce end cap subassemblies to avoid deformation during W03 welds.
    a. Not desirable as rigid plates would limit the tuning range and capabilities of the cavity.

6. Revisit port-cavity interface to simplify manufacturing.
    a. *Action:* EN-MME will propose interface models that can be manufactured to RF people.

7. Ofelia remarks that further studies need to be done to satisfy beam aperture requirement by design. That is, anticipate changes in aperture due to tuning, cool-down, weld, shape accuracy, and update the functional specification drawing with a realistic tolerance. Remember that the beam aperture determines not only the distance between capacitive plates but also the beam pipe diameter. For example, the tolerance given to the beam pipe diameter should account for error associated to tube manufacturing and error from alignment of one beam pipe tube, the other beam pipe tube and the capacitive plates.

8. Ofelia requests additional studies to determine the length of cavity ports (especially beam pipes) such that flanges for cold RF tests do not need coating.

9. Revisit the design of niobium covers for ports used for high temperature baking.

10. Revisit the design of the trim tuning clamp. It would be useful to have a tuning bench with appropriate ancillary to facilitate the handling of the parts and their alignment during warm RF measurements.

Others:

- The vendor bid for the fabrication of the DQW HL-LHC pre-series cavities should get started soon. Thus, Ofelia emphasizes that the revision of the cavity design is now more important than the revision of HOM filters or ancillary.

- Rama requests information about the status of the NWV-DQW-001 cavity assembly in clean room. Some of the coated flanges provided by CERN did have threaded holes instead of through holes (through hole flanges are preferred to avoid generating dust that may contaminate the interior surface of the cavity). The threaded holes were in metric. Only silver-coated threads available for assembly were imperial standard. Some stainless steel studs were finally used to close the flange connection. One stud got stuck in the blank flange for port HOM2. Thus, only seven bolts secure the connection. Qiong reported that cavity is already assembled and leak test is scheduled for Monday.

- *Action*: Organize follow-up meetings. Experience during BCP and cryogenic RF testing may bring up other design aspects that need to be reviewed.

Minutes taken by Silvia Verdu-Andres (BNL) and reviewed by Carlo Zanoni (CERN)