LRFF (LHC RF FINGERS) TASK FORCE: STATUS REPORT

Elias Métral (for the LRFF Task Force)

- ◆ **What we planned to do**

- ◆ **What was done**

- ◆ **What remains to be done**

LRFF TASK FORCE

◆ **LRFF = LHC RF Fingers (Task Force to review the design of all the components of the LHC equipped with RF fingers) => Proposition made during the LMC meeting #119 (on 18/01/2012)**

◆ **Web site: http://emetral.web.cern.ch/emetral/LRFF/LRFF.htm**

◆ **Members**

- **Elias Metral** (chairman, BE/ABP).

- **Jose Miguel Jimenez** (alternate, TE/VSC) => Could be replaced by **Sergio Calatroni**.

- For TE/VSC (Vacuum, Surfaces and Coatings): **Vincent Baglin** and **Giuseppe Bregliozzi** (alternate).

- For EN/STI (Sources, Targets & Interactions): **Oliver Aberle** and **Roberto Losito**.

- For TE/ABT (Accelerator Beam Transfer): **Wim Weterings** (mechanical issues) and **Mike Barnes** (impedance-related aspects).

- For BE/RF (Radio Frequency): **Fritz Caspers**, **Alexej Grudiev** and **Oleksiy Kononenko**.

- For BE/BI (Beam Instrumentation): **Rhodri Jones** and **Raymond Veness** (alternate).

- For BE/ABP (Accelerators and Beam Physics): **Benoit Salvant**, **Hugo Day** and **Olav Berrig** (EM simulations and wire measurements), **Ralph Assmann** (task leader of the "Intensity limitations in the LHC" task within WP2 of the HL-LHC project) and **Stefano Redaelli** (LHC Collimation project leader).

- For EN/MME (Mechanical & Materials Engineering): **Alessandro Bertarelli** and **Marco Garlasche**.

- For TE/MSC (Magnets, Superconductors and Cryostats): **Vittorio Parma**.

- Others?

  • Someone from the Design Office (i.e. designer of a particular equipment) might be needed at some point => Alessandro Bertarelli will be the link person.

  • Someone from Cryo could be invited at some point (after the first recommendations of the Task Force).

MANDATE

◆ **Review the design of all components of the LHC equipped with RF fingers, evaluate the compatibility with ultimate (and HL-LHC) bunch populations (i.e. up to 2.2E11 p/b for the 25 ns beam and 3.5E11 p/b for the 50 ns beam) and (rms) bunch lengths (i.e. 7.5 cm but also ~ 4 cm which could be an option) regarding impedance and HOM screening and provide a list of maximum bunch currents, acceptable bunch lengths etc.**

◆ **Evaluate all associated mitigation solutions like ferrite absorbers and their collateral effects, in particular the induced heating and resulting outgassing**

◆ **Make proposals of design changes and/or mitigation measures for each configuration depending on its criticality for beam operation**

◆ **Approve functional specifications for all equipments by the end of the year (2012)**

WHAT WE PLANNED TO DO

◆ **Exhaustive review of all the equipments with RF fingers**

◆ **Ranking by criticality and action plan**

◆ **First recommendations of the Task Force**

◆ **New design and/or mitigation measures**

◆ **List of endorsed actions presented by the Task Force => To be presented at the LMC**

WHAT WAS DONE (1/4)

◆ **1st kick-off meeting on 20/03/12**

◆ **Today's meeting is the 13th**

◆ **1) Follow-up of the VMTSA**

  ▪ **Issues during the 2011 run**

  ▪ **Crash program during the 2011-2012 shutdown to change the RF fingers (shorter ones) + ferrite installed => No issue (i.e. no temperature increase) observed in 2012 yet => Seems it worked!**

  ▪ **Many simulations from BenoitS and OleksiyK for old (long) and new (short) RF fingers (conforming and non conforming)**

WHAT WAS DONE (2/4)

◆ **2) Review of past work and issue with the PIMs (what was wrong with the Plug-In Modules in the cold part of the LHC?)**

◆ **3) Review of past development work on RF contacts**

◆ **4) Past impedance studies with the RF fingers for some collimators**

◆ **5) Review of equipments from TE/VSC**

▪ **Vacuum modules in LHC experiments**

▪ **Vacuum modules in the LHC septa**

◆ **6) Review of equipments from BE/BI**

WHAT WAS DONE (3/4)

◆ **7) Review of equipments from TE/ABT**

◆ **8) Review of the wake field suppressor in the LHCb VELO**

◆ **9) New design for RF fingers**

◆ **10) Review of Non-Conformities in Warm Modules following the X-ray campaign**

WHAT WAS DONE (4/4)

◆ **Reminder on RF fingers**

    ▪ **The RF fingers should be made of Au (or Ag) plated CuBe (grade C17410) and they should be in contact with a Rh plated material**

    ▪ **In case of bake-out the grade of the CuBe is very important!**

    ▪ **Au has been used for the PIMs (as it is better for the cold welding) and Ag for the collimators (as Au cannot be used because of the bake-out at ~ 250 deg C => Due to the diffusion of the Cu into Au and then the Au layer disappears). The same problem happens with Ag but at a higher temperature**

    ▪ **SS (instead on Cu-Be, but still Au plated) is used for the MKI RF fingers because of the bake-out at ~ 350 deg C which would lead with Cu-Be to a very small residual elasticity of ~ 20% only**

WHAT REMAINS TO BE DONE (1/2)

◆ **1) Finalize the simulations for VMTSA by**

- ▪ **Introducing a more realistic gap shape (if not too difficult/ long as we already see what happens)**

- ▪ **Introducing the ferrite to see how/if it damps the mode in case of non conforming RF fingers**

- ▪ **Performing simulations to study temperature and heat transfer**

◆ **2) Review of ferrites used at CERN to damp HOMs: references, manufacturers, thermal treatments, etc.**

- ▪ **Today's talks**

- ▪ **Ferrite people have been nominated: FritzC and ChristineV**

- ▪ **Use TT2-111R due to high Curie temperature. Vacuum OK?**

- ▪ **Still, how can we cool the ferrite if it becomes too hot?**

- ▪ **Try and understand what happened to the ferrite of BSRT**

WHAT REMAINS TO BE DONE (2/2)

◆ **3) Finalize the validation of the new RF fingers design**

▪ **What happens if we have a transverse offset (~ 10 mm transverse and ~ 10 mm compression in longitudinal) as this is like this that we want to use it?**

▪ **What about the tolerances?**

▪ **What about transverse plane?**

◆ **4) Finalize the equipments review. Anything else?**

◆ **5) Summarize all the issues/observations on equipments with RF fingers during the past years of LHC operation**

◆ **6) NC (Non Conformity) in Warm Modules**

▪ **A sorting must be done by LRFF to propose the repair of critical VM and minimize the number of interventions**

◆ **…**