Conclusions of mini-workshop on Mechanical issues SPL cavities/cryomodules

Ofelia Capatina / CERN

3rd SPL Collaboration Meeting CERN 11 – 13 Nov 2009

Mechanical issues Workshop

http://indico.cern.ch/conferenceDisplay.py?confId=68968

Mechanical issues SPL cavities/cryomodules

Wednesday 30 September 2009
from **10:00** to **18:00**
Europe/Zurich
at **CERN (*30-7-012*)**
chaired by:
Wolfgang Weingarten (CERN) , Ofelia Capatina, Vittorio Parma

Description: Mini-workshop on mechanical issues with regard to the SPL cavities and cryo-modules

~ 20 participants from CEA, CNRS, FNAL, CERN

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10:00->*12:30* 1st session

10:00	Welcome / Introduction (15') (Slides)	Wolfgang Weingarten (*CERN*) , Vittorio Parma
10:15	SPL cavities general parameters / design (15') (Slides)	Wolfgang Weingarten (*CERN*)
10:30	SPL cryomodule general parameters / design (15') (Slides)	Vittorio Parma (*CERN*)
10:45	Similar projects (not SPL) mechanical design experience (1h35')	Thomas Peterson (*Fermi National Accelerator Laboratory*) , Stephane Chel (*Centre d'Etudes de Saclay (CEA-Saclay)*) , Huimin Gassot (*IPN Orsay*)
	• Work toward Stainless Steel SRF Helium Vessels at Fermilab (15') (Slides)	Thomas Peterson (*Fermi National Accelerator Laboratory*)
	• CEA-Saclay (15') (Slides)	Stephane Chel (*Centre d'Etudes de Saclay (CEA-Saclay)*)
	• Mechanical design experience (15') (Slides)	Huimin Gassot (*IPN Orsay*)
12:30	Lunch break (1h30') (Restaurant 2)	

14:00->*17:00* 2nd session

14:00	Open points (20') (Slides)	Ofelia Capatina (*CERN*)
14:20	Magnetic shielding (20') (Slides)	Tobias Junginger (*Ruprecht-Karls-Universitaet Heidelberg-Unknown-Unknown*) , Guillaume Orly (*IPN Orsay*)
	• Magnetic shield for SPIRAL2 (15') (Slides)	Guillaume Orly (*IPN Orsay*)
14:40	Materials choices for SPL (1h30') (Slides)	Ofelia Capatina (*CERN*) , Sergio Calatroni (*CERN*)
16:10	Coffee break (20')	
16:30	Conclusions / Recommendations (30') (Slides)	Wolfgang Weingarten (*CERN*)

Conclusions – recommendations (1)

- Cavity RF design and layout issues
  - Outer conductor of coaxial power coupler in contact with lHe (for heat removal & stability reasons)
  - Position of pickup probes to be defined
  - No dedicated ports for antenna like HOM coupler including notch filter (→ to be confirmed by simulations); but a pickup antenna port is required that may be used in addition as beam position monitor and HOM damper, if → damping of HOM in bellows turns out as insufficient
  - Position of power coupler to be defined
  - Tuner must follow the → differential contraction of cavity/He-tank (advantage Ti tank)
  - Tolerances for fabrication to be provided from cavity design studies (CEA for beta=1)
  - Avoid flanges for interfaces to cryogenic piping
- Cavity preparation issues
  - XFEL is baseline (EP and moderate annealing 800 °C)
  - Stress relieving @ 600 °C possible
  - Brazed joint (for SS He tank) should be protected during EP

Conclusions – recommendations (2)

- Materials issues
  - Surface scanning of Nb sheets essential for quality assurance (which company?)
  - Flanges: Conflat + Cu gasket or NbTi + Al gasket, both OK
  - Is 800 °C annealing compatible with brazed SS flanges (metallurgical issue)
    - 650 °C favored but possibly with a longer annealing time; → studies needed
  - Magnetic shielding with Cryoperm®
    - → to be refined for different permeabilities
    - The second annealing after manufacture may be performed in vacuum (without H_2 residual gas)
    - Should the magnetic shield be actively cooled by lHe (IPN experience)?
    - 2nd shield at room temperature needed?
  - Ti vs. SS tank
    - **See recommendation at the end**
    - Alleviated stroke for tuner for Ti tank

Conclusions – recommendations (3)

- Cryo-module issues
  - Segmentation (→ cf. cryogenic workshop 9/10 November 2009)
  - Very stable cryogenic plant operation at 1.8 – 2 K (± 0.5 mbar → 7 Hz)
  - Alignment requirements of cryo-module: → ask beam experts
- Safety issues
  - EN mechanical safety codes allow safety assessment of non-conventional materials such as Nb
  - Design pressure for cavity & He tank: 2 bar (300 K) and 4 bar at low temperature; → to be confirmed
  - Longer certification process to be expected for Ti tank (wrt SS tank)

Conclusions – recommendations (4)

- **Recommendations by the chairpersons (collected after the meeting)**
  - The SPL-study, as far as the cavities and cryo-modules are concerned, should distinguish between the demonstrator and the project.
  - The demonstrator is scheduled in a relatively short time from now on. It will be composed of contributions by different laboratories that may very probably provide relatively limited resources.

    Nevertheless the demonstrator is important. Even if not engineered in all details, it will allow to obtain experience on a large number of topics, not directly related to the cavity itself. These concern, under the preservation of the relatively large accelerating gradient, ancillaries (coupler, tuner, etc.), clean assembly, electronic crosstalk and radiation issues, operation under super-fluid helium, cryogenic losses, mechanical damping, etc.

    Therefore we recommend (1) to build the demonstrator by using at maximum the existing experience, recipes and technical solutions, i.e. the CEA-Saclay/XFEL design as baseline, unless they turn out to be not adaptable to, or not needed for, the SPL project.
  - The project itself is subject to different suppositions, such as series production, quality assurance and cost issues, operational reliability, etc. These merit by themselves a detailed investigation.

    Therefore we recommend (2) to perform a comprehensive study, in parallel to the work on the demonstrator, about all the mechanical and electrical topics which were mentioned in the preceding conclusions (marked with →). The results of this study may require the manufacture of related hardware ,i.e. cavity equipped with stainless steel He tank and modified tuner.