



IIFC Meeting

Status, Progress and Plans on SCRF Cavities

Presented by : Avinash Puntambekar

{on behalf of IIFC SCRF Cavity team}

11 July, 2012

FNAL: POC- Chuck Grimm, SPM- Camille Ginsburg

Team members: J Dwivedi, P N Prakash, P Shrivastava, G Mundra and S C Joshi



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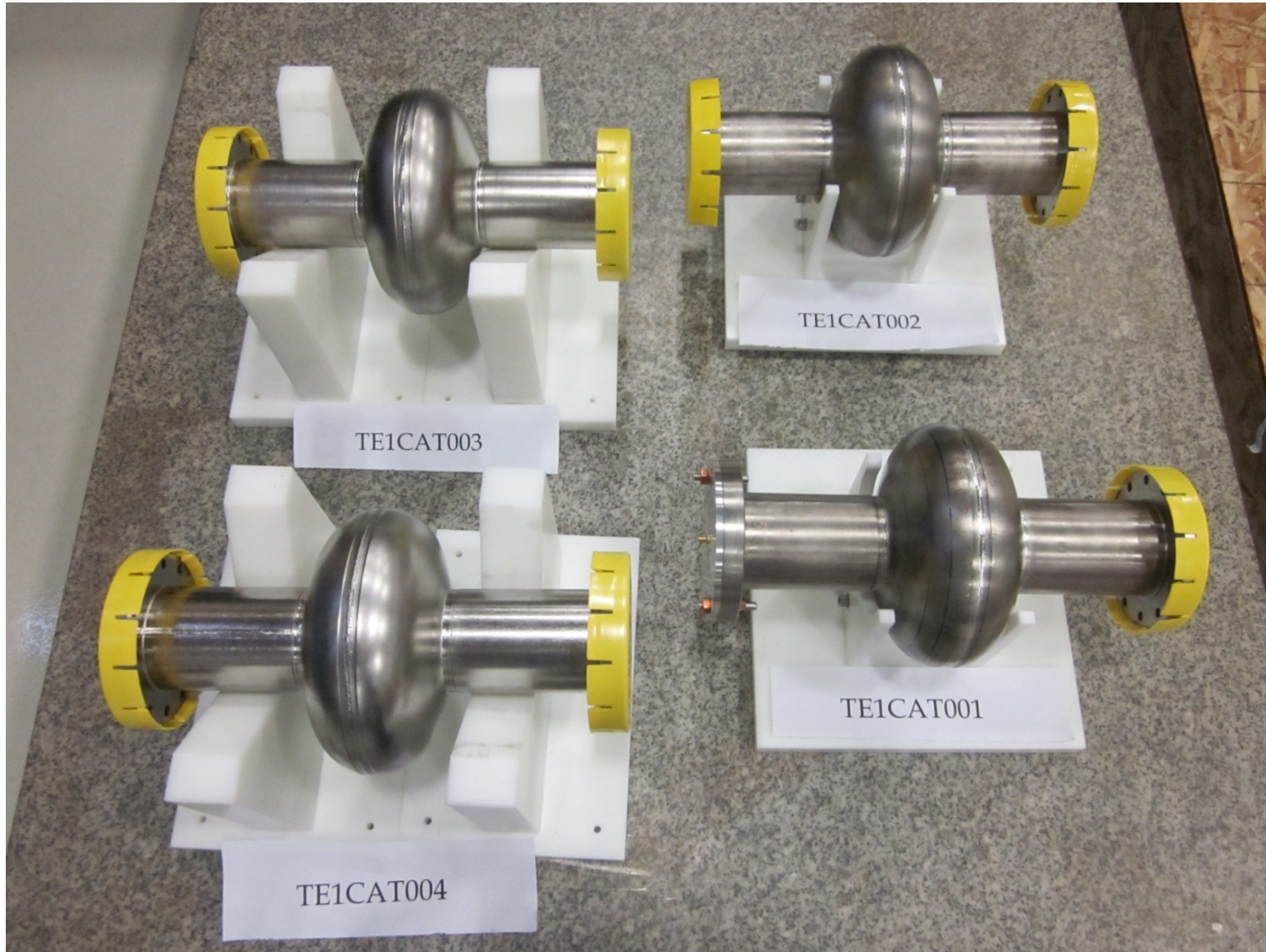


SCRF Cavity work agenda

Under MoU; Addendum

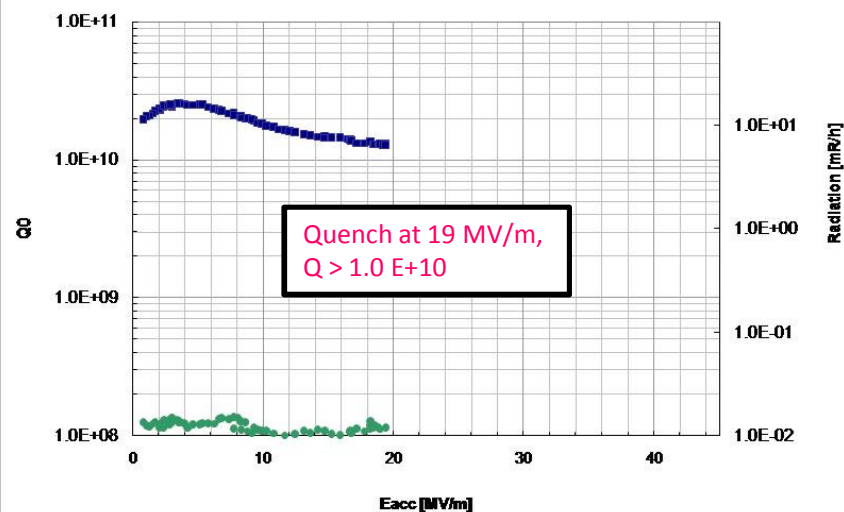
S No.	Item	Qty	Delivery date
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1.3 GHz Single cell SCRF cavities developed at RRCAT under IIFC



2 K Test results of the 1.3 GHz Single cell SCRF cavities

TE1CAT001 - Q vs E
Test on 5/12/2010



ILC-TE1CAT002 - Q vs E

Tested 12/17/10 : Tumbling, HT, Light EP, HPR/Assy, then 120°C Bake @ IB1

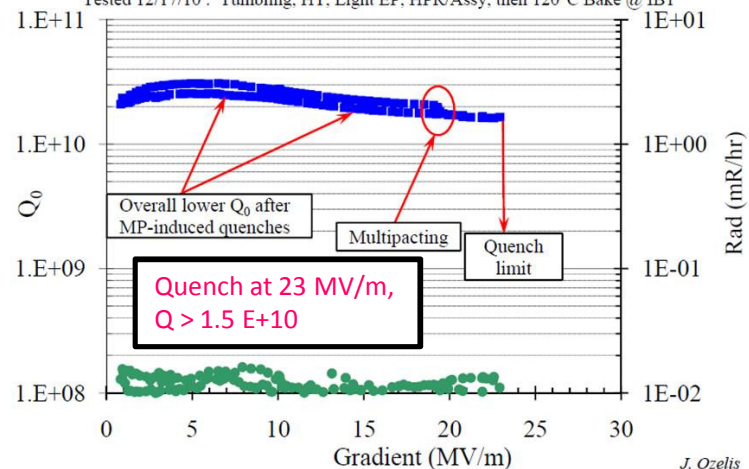
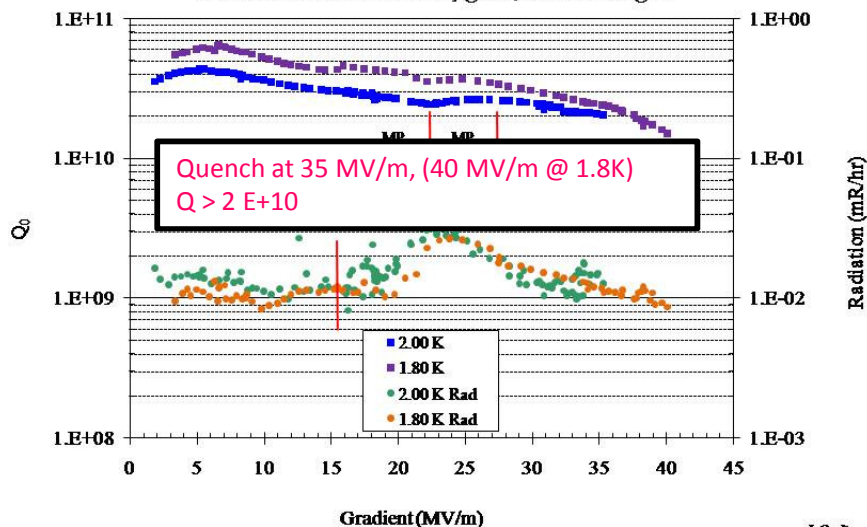


Figure 1. Q_0 vs E @ 2K.

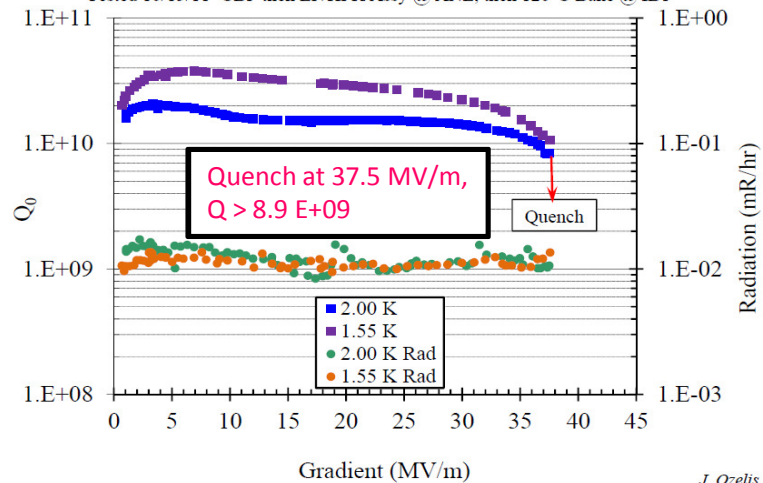
ILC- TE1CAT003 - Q vs E

Tested 10/11/11- CBP then EP/HPR/Assy @ ANL, then 120°C Bake @ IB1



ILC- TE1CAT004 - Q vs E

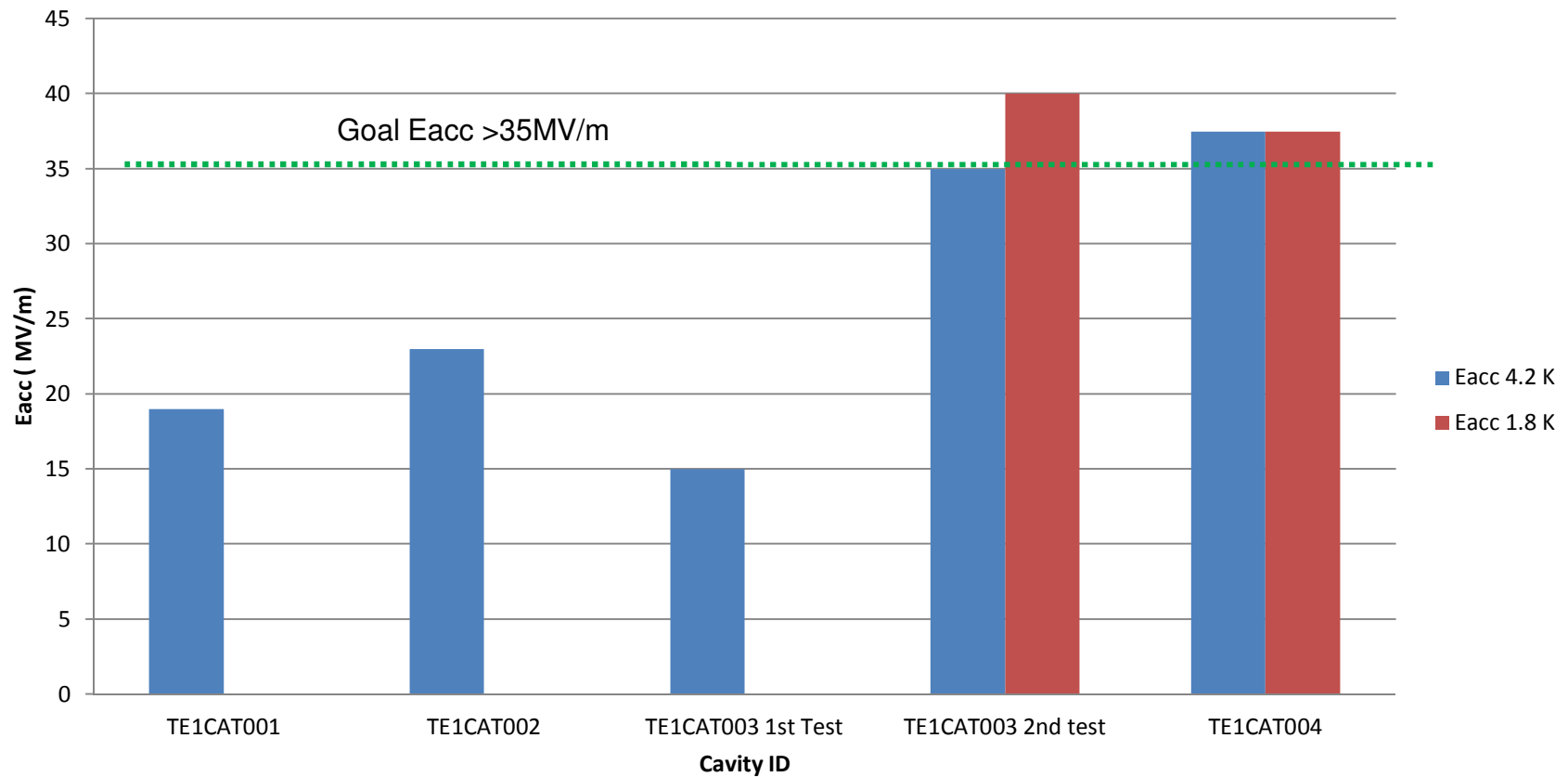
Tested 10/15/11- CBP then EP/HPR/Assy @ ANL, then 120°C Bake @ IB1





1.3 GHz Single cell cavity

Comparative test performance of 1.3 GHz Single cell SCRF Cavity-RRCAT



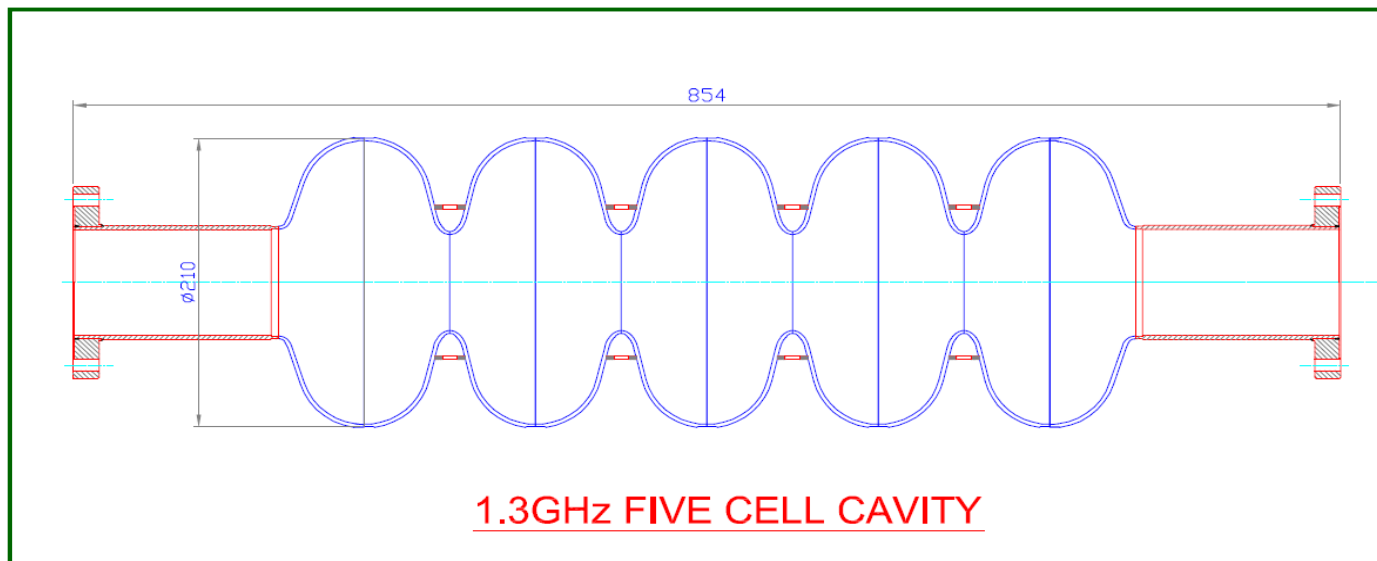


SCRF Cavity work agenda

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1.3 GHz Five cell cavity

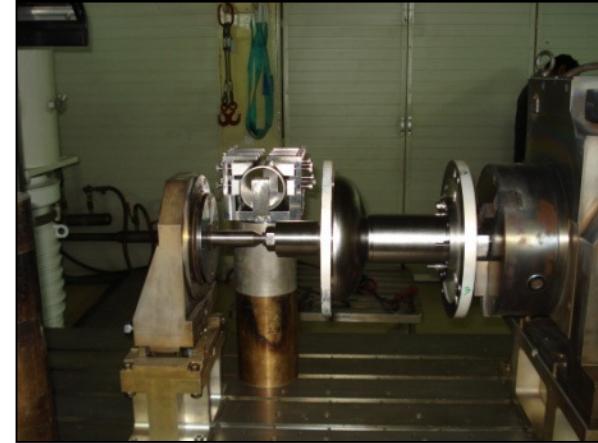
- After successful fabrication and testing of 1.3 GHz Single cell cavities, the next target we are working is to develop a multicell SCRF cavity.
- The issues with multicell SCRF cavities are much more complex than 1-cell cavities.
- In order to learn these, it has been proposed to develop a 1.3 GHz Five cell cavity with simple end group.
- This is also feasible within available EB welding capacity at IUAC.
- Progress has been made on development of dumbbells and simple end groups.
- Efforts are ongoing to generate the experience in the dumbbell development.



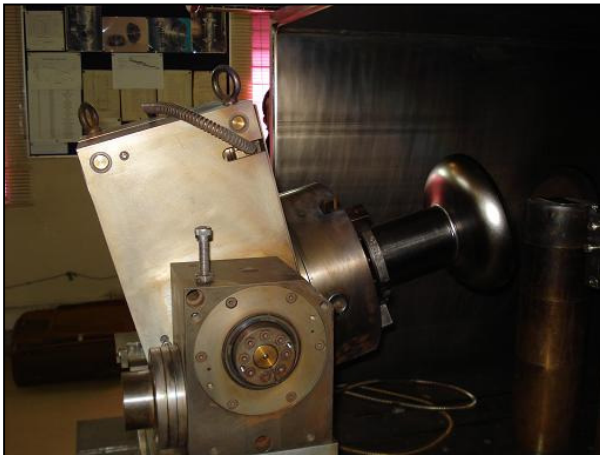
Work progress 1.3 GHz Five cell SCRF cavity (End Half cell assembly)



Beam Pipe- Flange Assembly



Outside welding at Iris

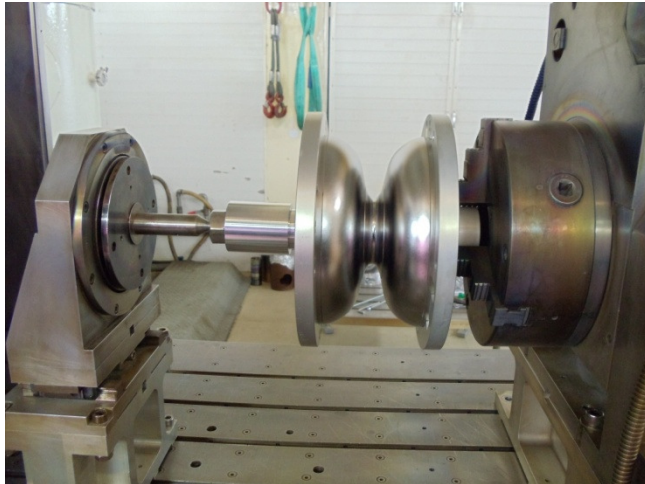


Inside welding at Iris

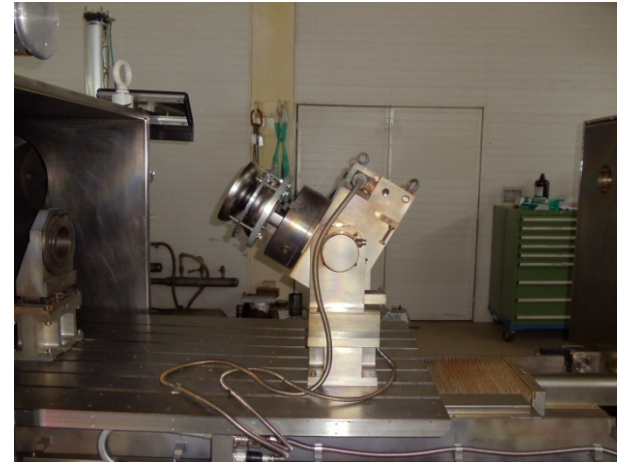


End Half cell Assembly

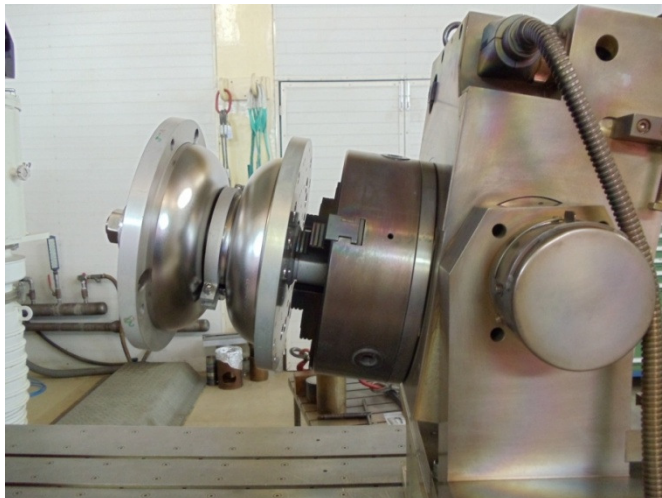
Work progress 1.3 GHz Five cell SCRF cavity (Dumbbell assembly)



Iris Outside welding



Iris Inside welding



Stiffening Ring welding

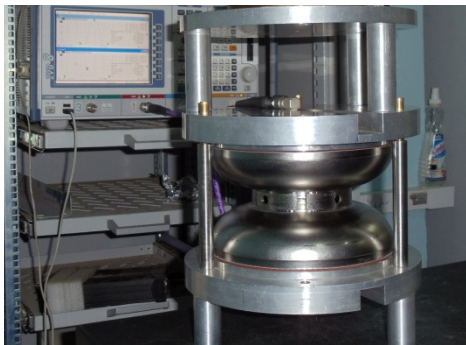


Welded Dumbbells

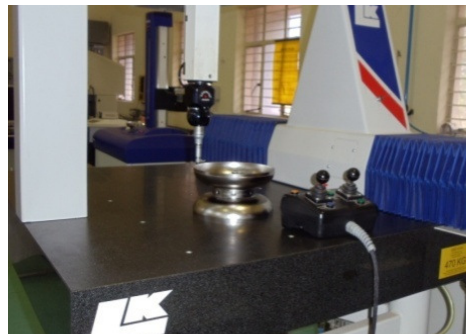


Dumbbell data Mech & RF testing and analysis

- Mechanical measurement was done followed by RF inspection.
- It revealed more weld shrinkage than estimated.
- If we would have followed normal process of trimming the dumbbells to get the correct frequency, we would have hit the wrong length.
- So we planned and proposed to Tune the cell using special tuning fixture.
- Initially a test on dummy aluminium dumbbell was done.
- The data was presented to FNAL for their comments and suggestion.
- Useful inputs were received from Timer, Mike & Chuck.
- Based on that the cell tuning and then trimming was adopted on test Niobium dumbbell with intermediate RF measurements.



Dumbbell RF inspection



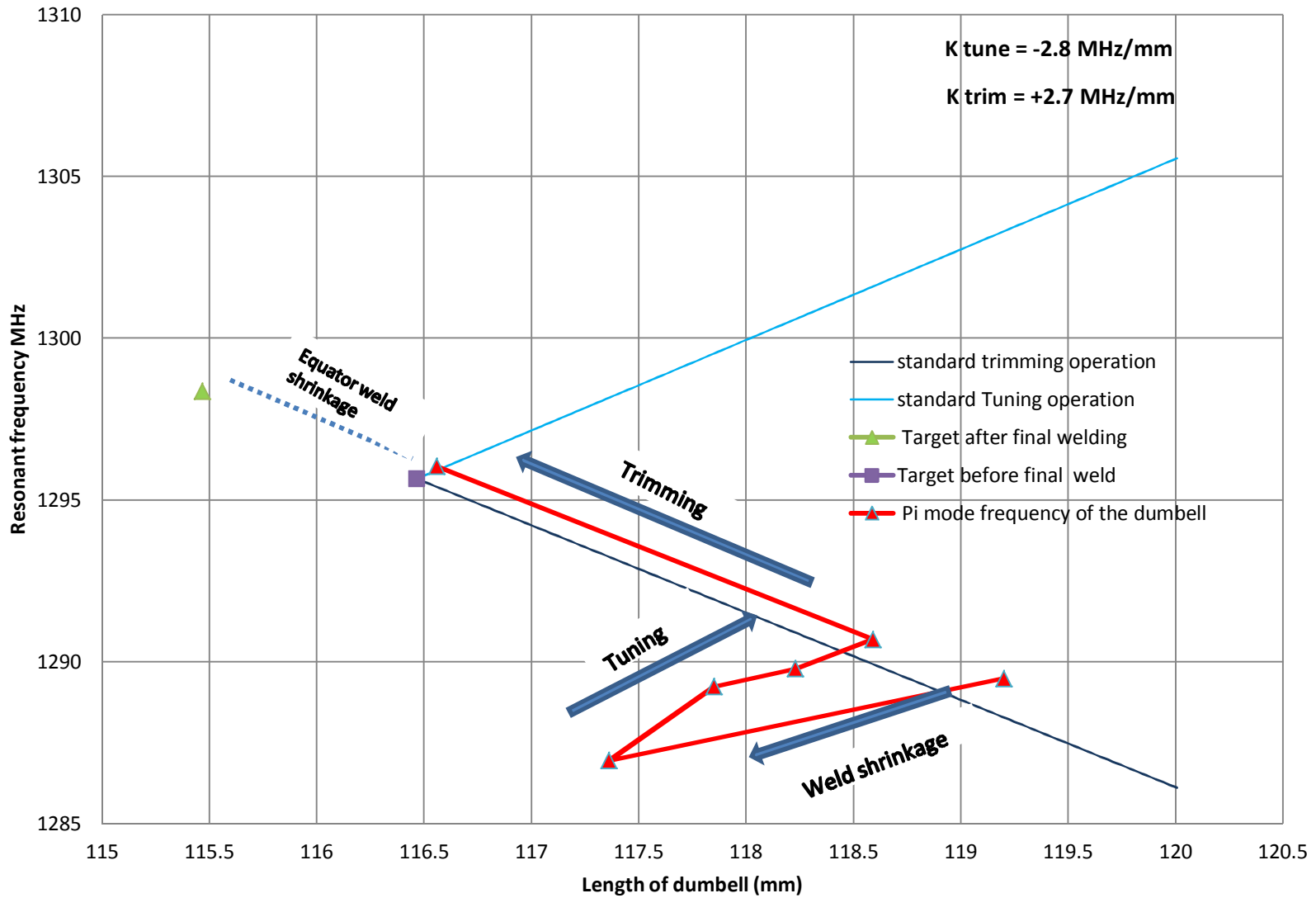
Dumbbell mechanical inspection



Dumbbell Tuning Fixture



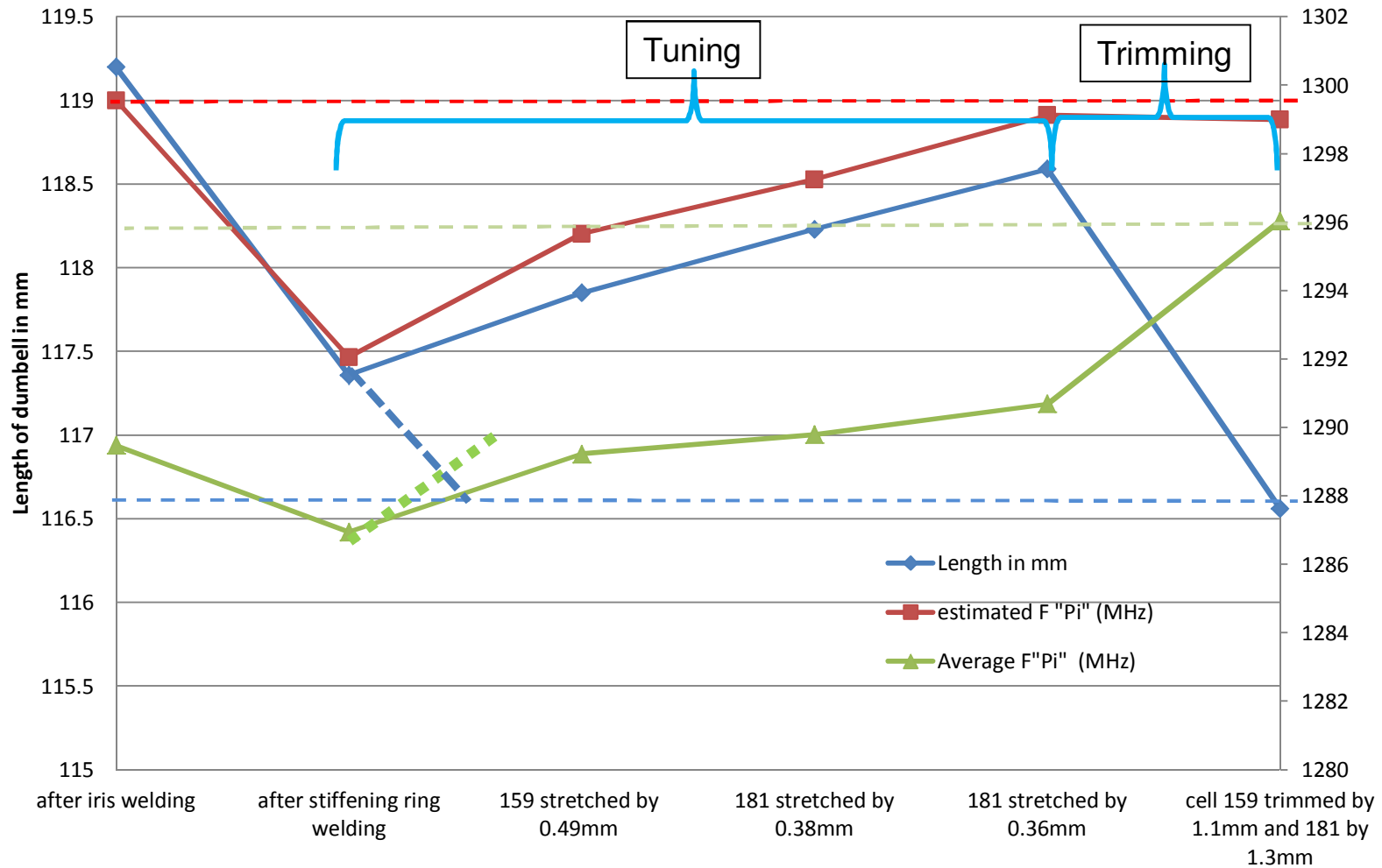
Nb 159-181 trimming and tuning case history





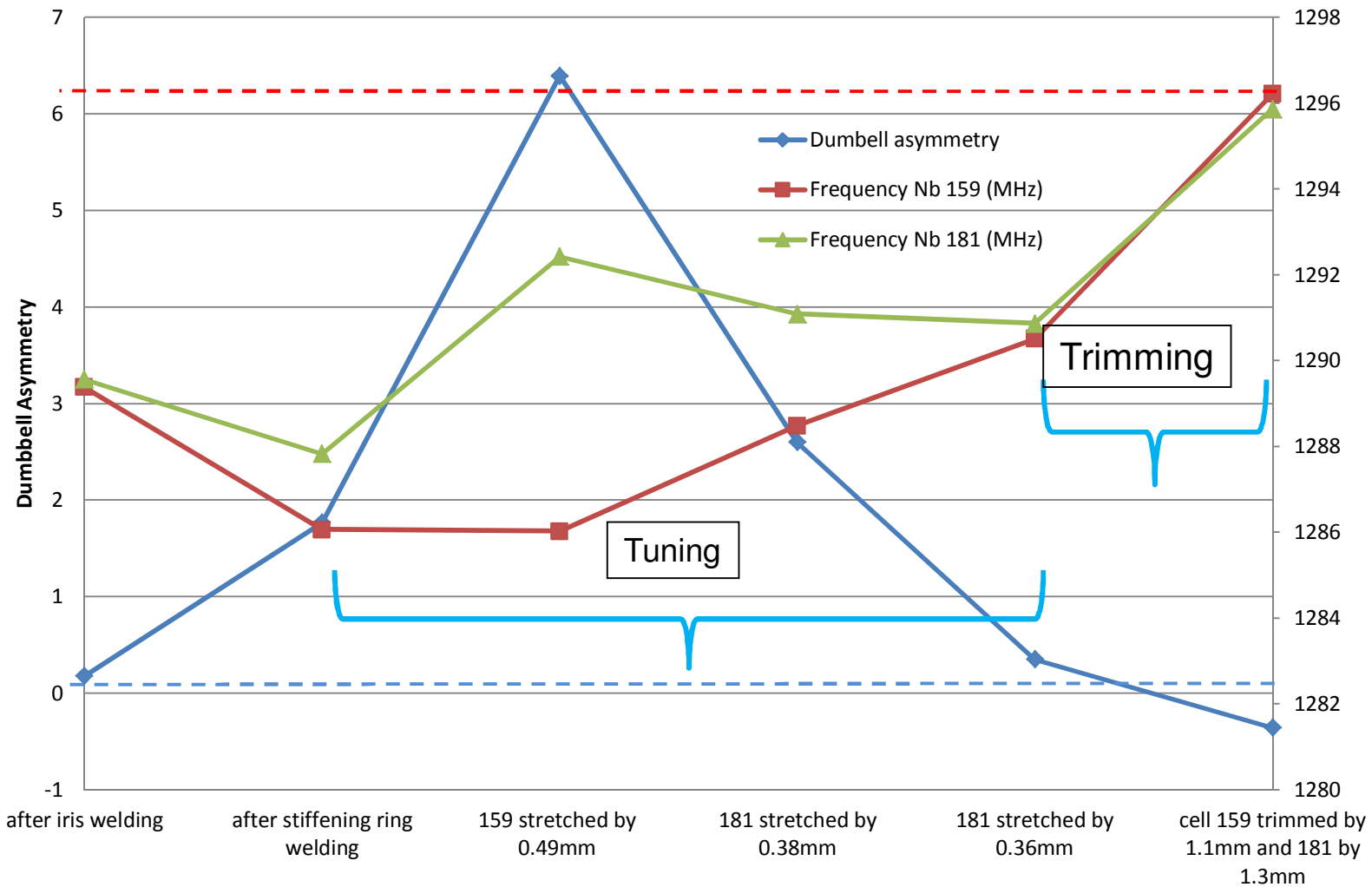
Dumbbell data Mech & RF testing and analysis

Dumbbell tuning and trimming work on Nb 181-159



Dumbbell data Mech & RF testing and analysis

Dumbbell Tuning-Trimming exercise (# 181-159)





Work progress 1.3 GHz Five cell SCRF cavity

- Finally we could achieve the correct length and frequency for this dumbbell (#159-181).
- This exercise is ongoing now on remaining dumbbells.
- This has been a great learning experience, however still a lot of issues needs to be learned.
- After all dumbbell tuning and trimming for their goal Frequency and Length, they will be ready for final equator welding.
- Planned during August 2012.
- After pre-dispatch testing & qualification, 1.3 GHz Five cell cavity will be sent to FNAL for processing & performance evaluation.

Inputs required from Fermilab

- Need information and support on dumbbells development and its tuning-trimming procedure.
- Sharing of FNAL and industry experience on mechanical & RF data and dumbbells fabrication and tuning / trimming procedure adopted.
- FNAL also to confirm the adoptability of 1.3 GHz Five cell cavity for various processing & testing infrastructure (Length 854 mm).



Assembled 1.3 GHz Five cell SCRF cavity

(getting closer to final equator welding)



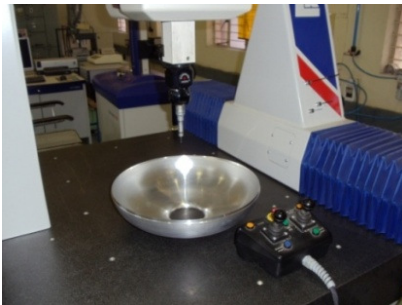


650 MHz single cell cavity

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650 MHz $\beta=0.9$ single cell cavity

- Initially the first forming tool set was made & prototype trial forming was done in aluminum and copper.
- Based on the CMM measurement of profile, the new set of forming tool is now ready.
- Copper half cells will be formed again to qualify the profile.
- We are planning to make a prototype single cell cavity in aluminum to get the experience and qualify the tooling & fabrication procedure.
- Aluminum End flanges have been machined and beam pipe have been rolled. Prototype machining & welding fixtures have been made.
- Work on niobium blanks and cell forming has also been taken-up. Nb End Flange machining and Nb Beam tube rolling is also progressing. Expected during Q3 (CY 2012).
- EB welding activities at IUAC facility may be taken up during Oct 2012 (after the 1.3 GHz Five cell cavity completion).
- 650 MHz $\beta=0.9$ Prototype single cell cavity will then be sent to FNAL for processing & performance evaluation.



Half cell inspection



Half cell machining fixture



Parts of 650 MHz 1-cell aluminum cavity



650 MHz single cell cavity

- Inputs required from Fermilab:
 - Need information on activities and progress of work on design and development of 650 MHz ($\beta=0.9$) single cell cavity work at FNAL and Industry.
 - Final Functional Requirement Specification,
 - Cavity Engineering Design report(s),
 - Manufacturing specification documents etc.
 - Cavity fabrication, inspection, processing & testing experience on industry made 6 single cell cavities; including
 - 650 MHz RF testing
 - RF measurement setup design
 - Measurement procedure document



650 MHz first five cell cavity

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- 650 MHz First Five cell cavity :
 - Various activities on cavity design for manufacturing, design and development of new forming tooling, welding & machining fixture to be initiated.
 - Niobium procurement activities has been initiated for these work. Expected delivery December 2012.
 - First Five cell cavity will be tried out at IUAC / RRCAT facilities.
 - The work on 650 MHz first five cell cavity will follow the progress & results of 1.3 GHz Five cell cavity (1-b) and 650 MHz Single cell cavity (1-c).



650 MHz first five cell cavity

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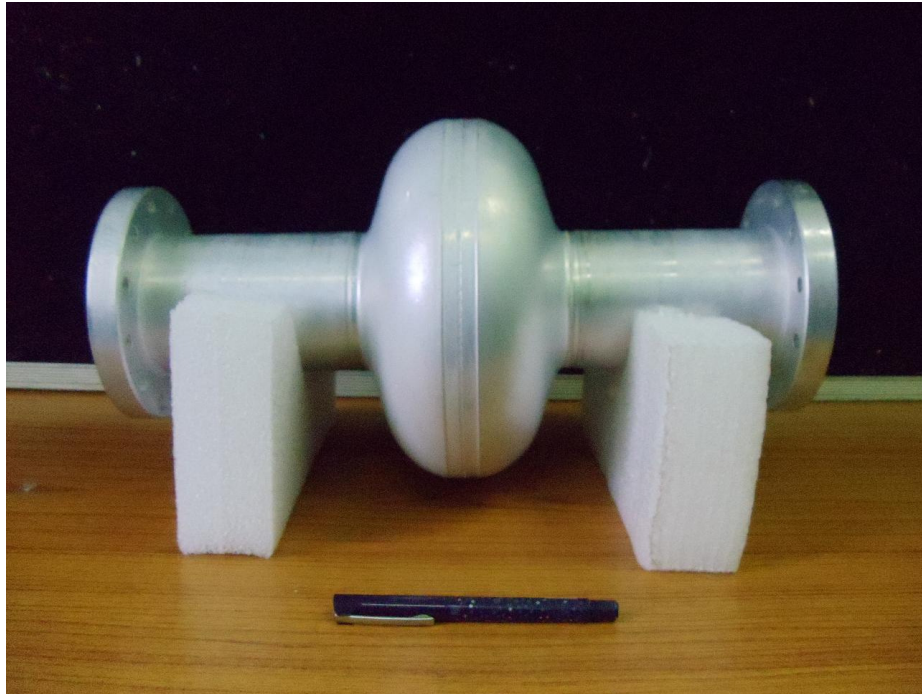
- 650 MHz next five cell cavity :

- The work on 650 MHz next five cell cavities will follow the progress & results of 650 MHz first Five cell cavity (1-d).
- Niobium procurement activities are being initiated for these work.
- It is planned to make series 650 MHz Five cell cavity on RRCAT EBW machine.
- PO in place for EBW machine., Call for PDI : March 2013
- Transportation and delivery : June 2013, Installation, commissioning expected: December 2013
- 2nd Five cell cavity at RRCAT facility planned : December 2014



1.3 GHz Aluminum Single Cell cavity

RRCAT has sent one prototype 1.3 GHz single cell cavity “TE1CAT005” during October 2011. This was intended for niobium thin film deposition R&D program. We would request FNAL to update us on the progress made in this matter.



1.3 GHz single cell cavity “TE1CAT005”

Thank you for
your attention

