

IHEP 9-cell Cavity Status and Plan

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IHEP

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Outline

- Large Grain Low Loss 9-cell Cavity
 - IHEP-01
 - IHEP-02
- Fine Grain TESLA-like 9-cell Cavity
 - IHEP-03
 - SCRF Infrastructures
- Other components R&D
 - Input coupler
 - Tuner & LLRF
 - Cryomodule

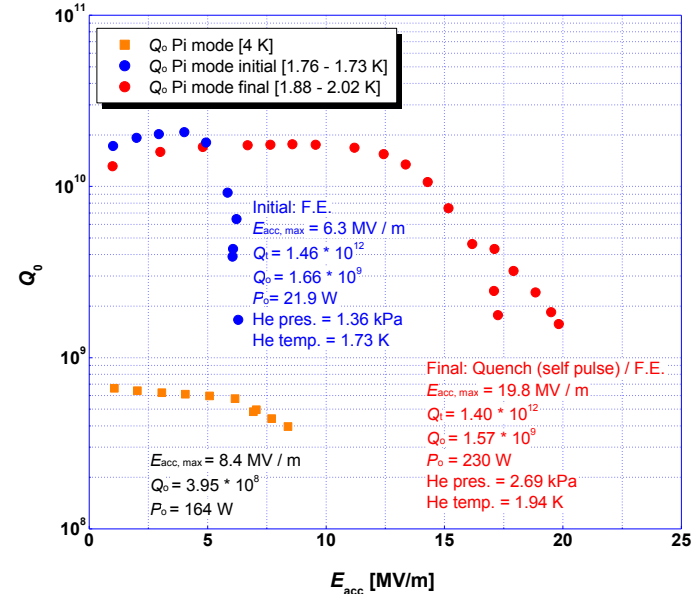
Large Grain Low Loss 9-cell Cavity



IHEP-01 Large Grain Low Loss 9-cell Cavity (without HOM couplers)

1st Vertical Test, July 1, 2010

CBP (190 μm), BCP (110 μm), Annealing (750°C, 3 h), Pretuning (94 %), Ultrasonic (Micro-90 2%, 50°C, 3 h), BCP (20 μm), Ultrasonic (UPW), Low Pressure Rinsing @ IHEP
Ultrasonic (Liquinox 2%, 43°C, 3 h), HPR (8.5 h), Baking (105°C, 48 h), VT @ KEK



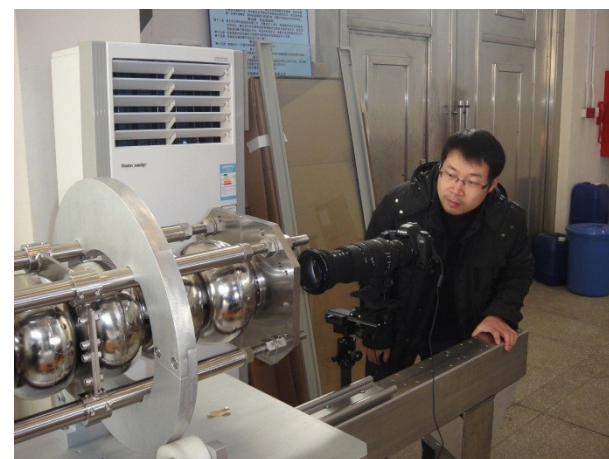
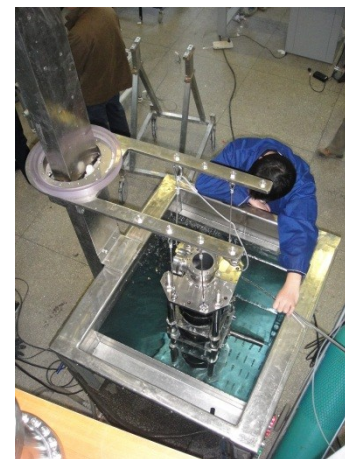
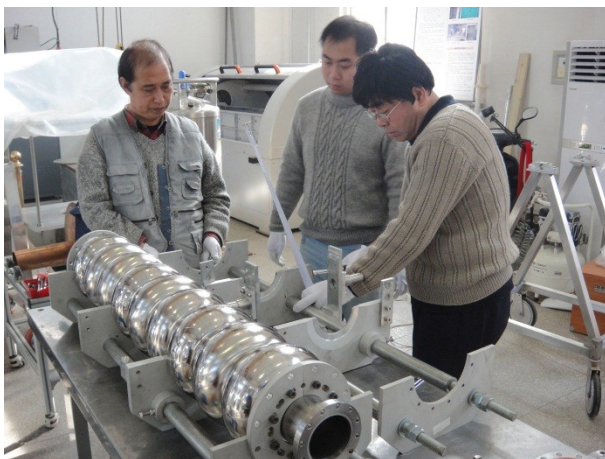
- IHEP-01 (w/o HOM)

- Fabrication and processing in IHEP
- 1st VT at KEK: 20 MV/m (quench), July 2010
- 2nd processing at IHEP: Jan.-Mar. 2011
 - remove equator defects by CBP, avoid white stains (may cause FE) during CP
- 2nd VT at KEK in April postponed

IHEP-01 2nd Test Loop

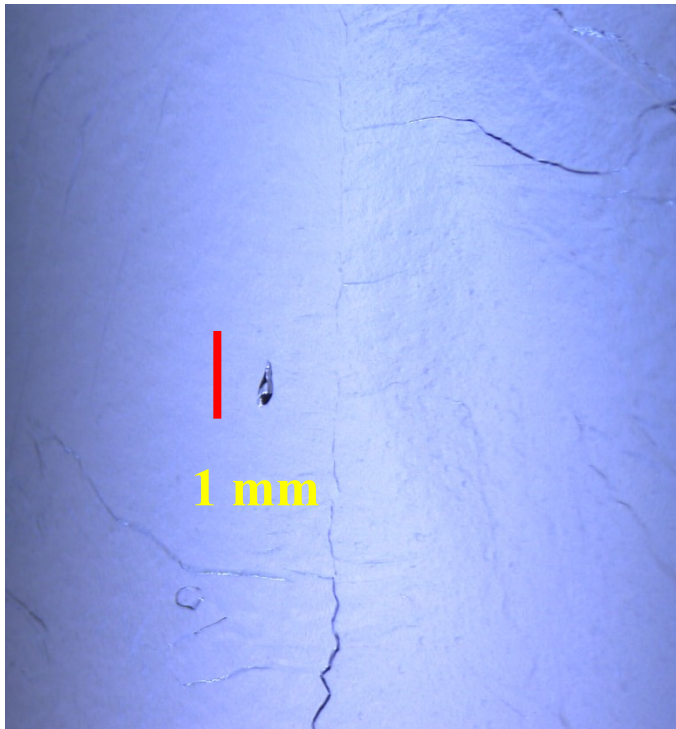
- **Second Surface Treatment: 2011.1.4-3.11**
 - **CBP** (tumbling) , 150 μm (*Jan. 10-18*)
 - **1st CP**, 60 μm ; low pressure water rinsing (LPR) (*Jan. 26*)
 - **inspection** with new camera (*Jan. 28*)
 - **annealing** (750 °C, 3 hours, 7E-5 Pa) (*Feb. 19-21, Ningxia*)
 - **1st pre-tuning** (98%) (*Feb. 22 -25*)
 - **2nd CP**, ~ 40 μm , ultrasonic (Micro-90 outside, Liquinox inside 2%, 50 °C) & LPR 15 bar (*Mar. 8*)
 - **re-pretuning** (95%) (*Mar. 9*)
 - **LPR** (30 bar, with new HPR facility) (*Mar. 11*)

IHEP-01 Second Surface Treatment



Equator Defects Removed by CBP

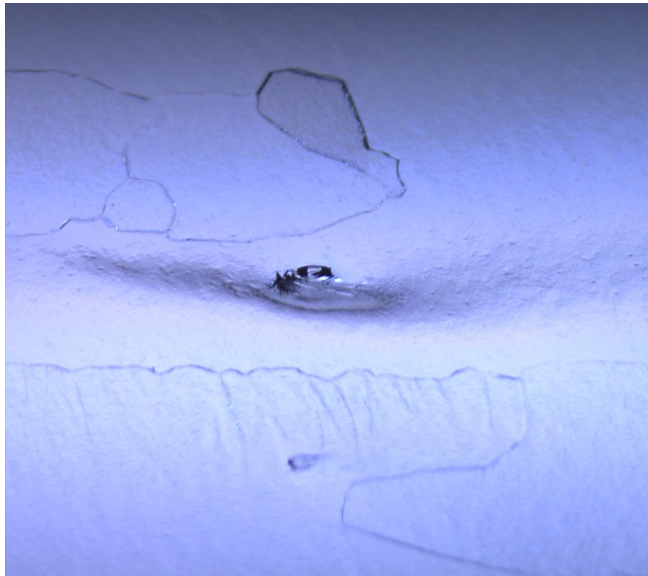
340deg@cell#2 (32 MV/m quench defect)
after VT1 with Kyoto camera



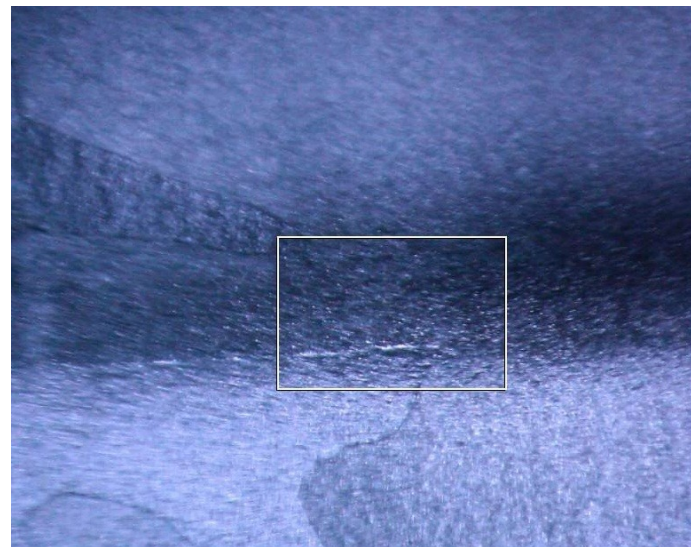
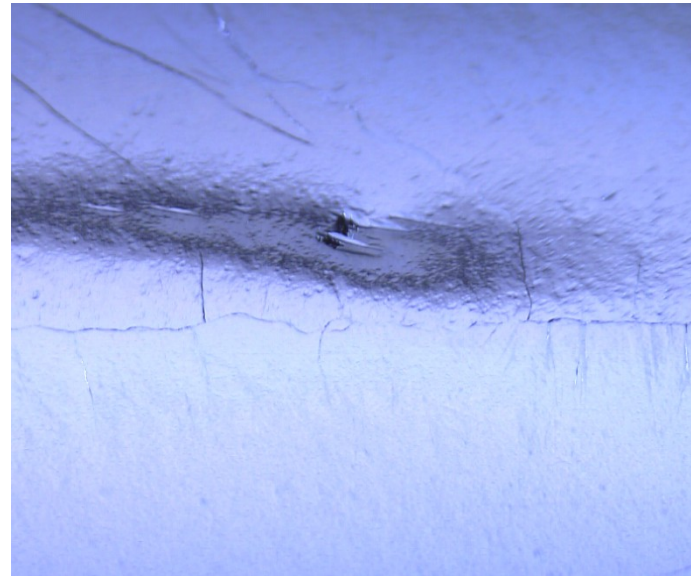
after CBP and CP again
with IHEP high resolution camera



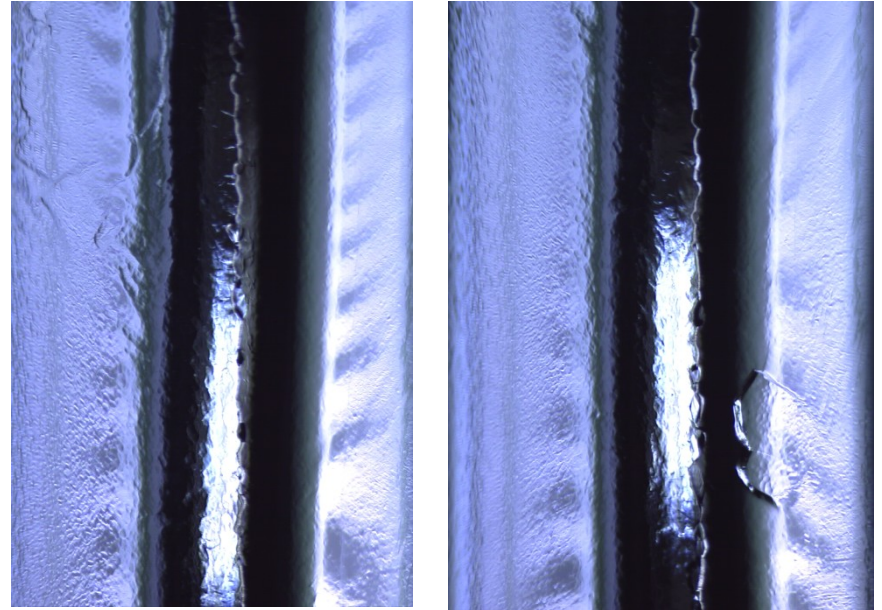
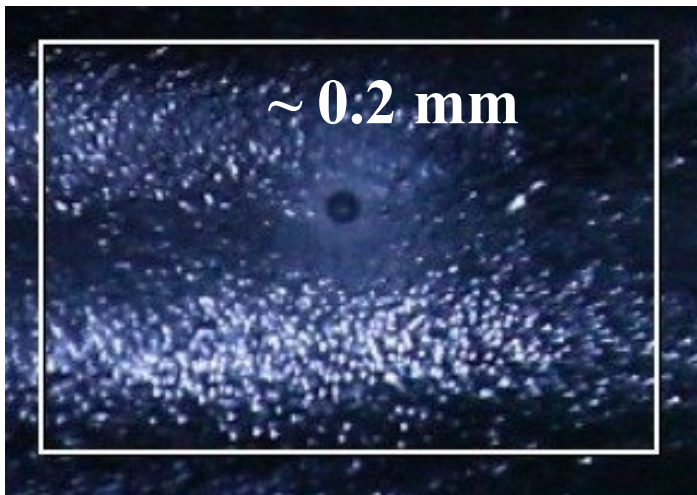
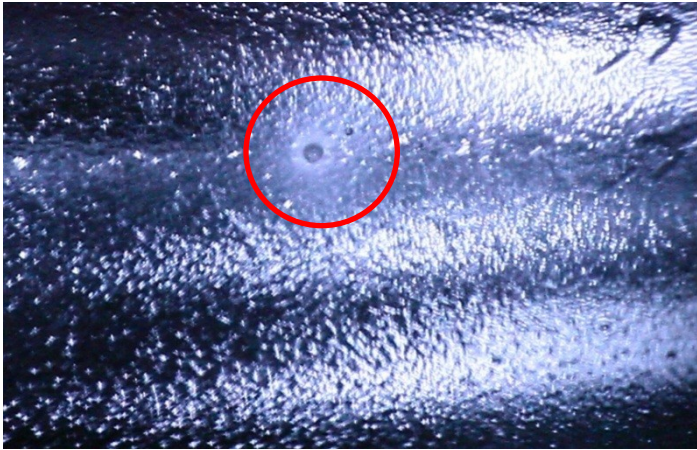
85 deg @ cell # 3



90 deg @ cell # 3



Pit on cell # 3-4 iris (120 deg)



Didn't find the pit after VT1 with Kyoto Camera

The defect for field emission? Or new (under surface)?

IHEP-01 2nd processing summary

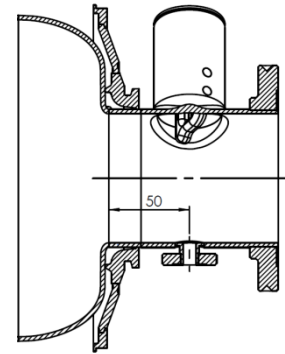
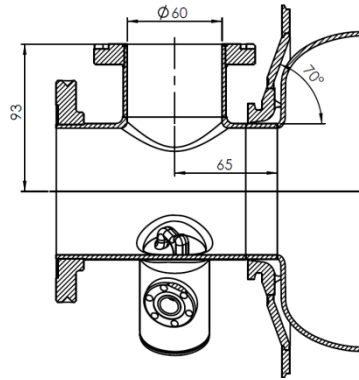
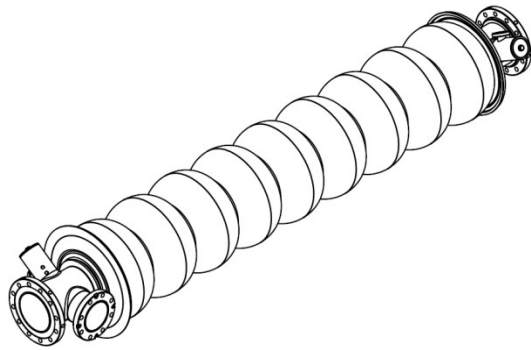
- Removed almost all the camera “seen” defects near equators
- Can’t find anything abnormal near the 20 MV/m quench location of cell # 9
- No large area of white stains after 2nd CP (temperature control)
- The main purpose of IHEP-01 VT2 is to eliminate strong field emission and/or to find the reason, hope to get higher gradient and find the real quench “defects”

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Large Grain Low Loss 9-cell Cavity

- IHEP-02 with HOM



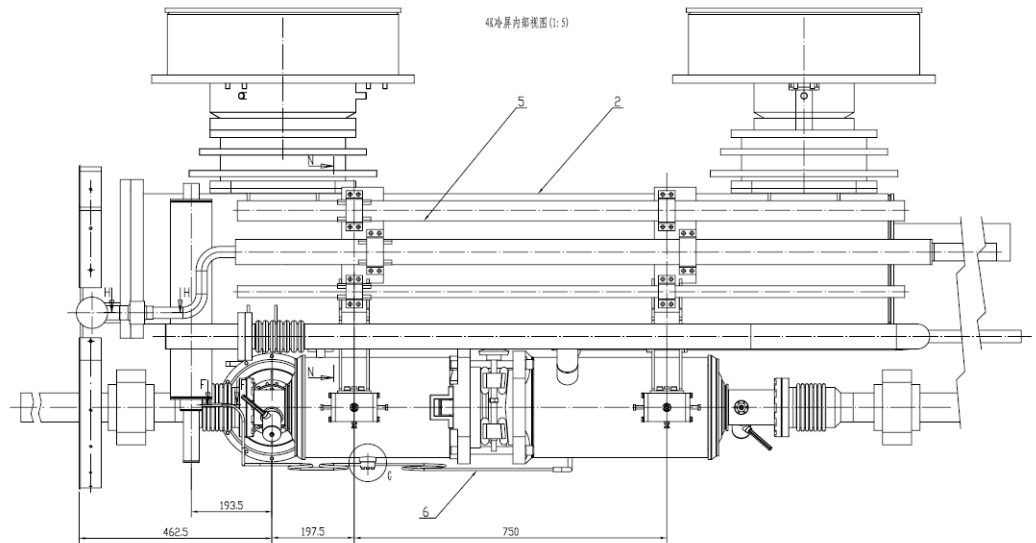
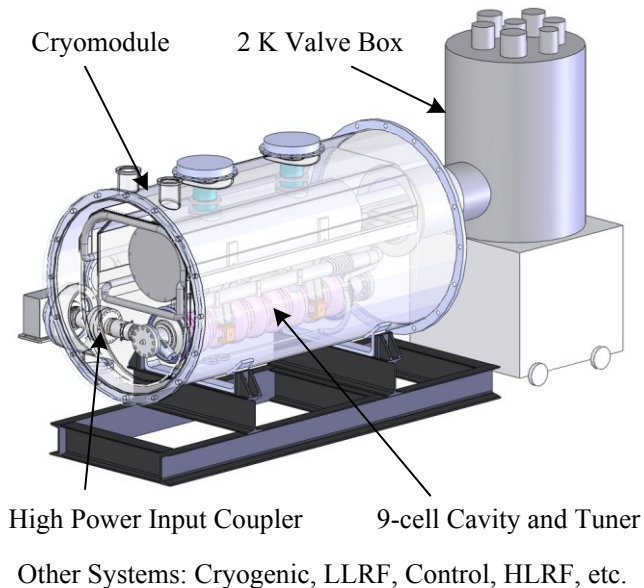
2011 schedule

- Dumbbell fabrication and tuning finished
- End Group Fabrication & EBW: March-June
- Surface Treatment: July-August
- **Vertical Test in FNAL: September-October**
- Helium Vessel and magnetic shield: November-December

IHEP-02 install to IHEP short cryomodule

2012 plan

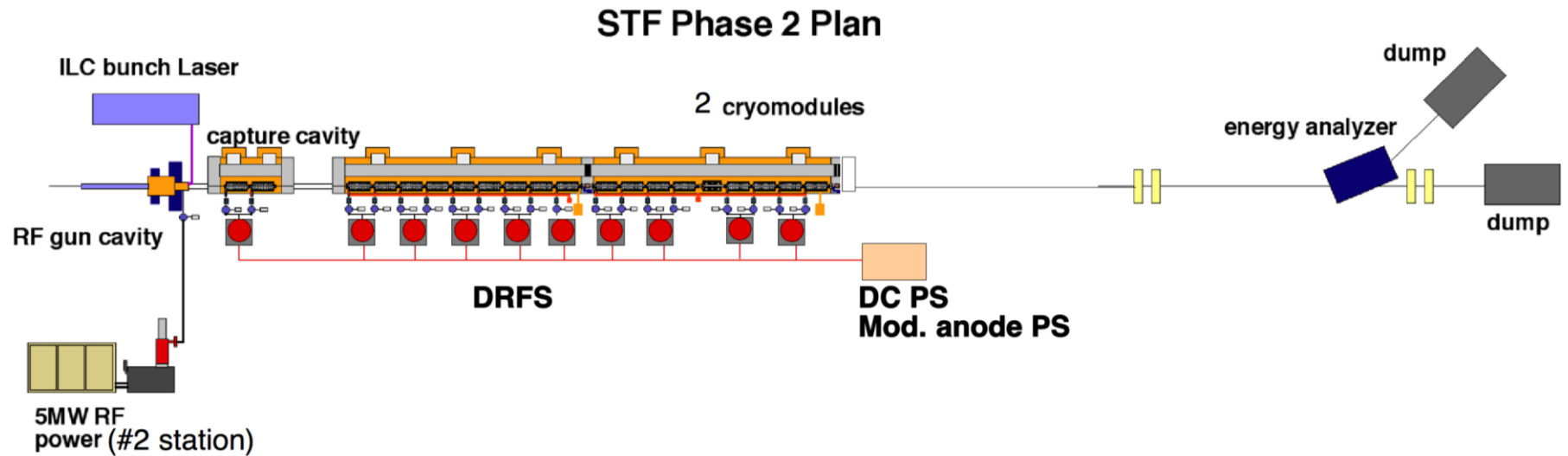
- Clean room assembly, tuner install, 2K helium pipe welding
- Install to IHEP short cryomodule



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IHEP-03 install to STF for beam test



- In collaboration with KEK, follow Japanese High Pressure Code
- Nb / NbTi material ordered, disks delivered, press-dies in fabrication
- Cavity fabrication and test: 2011 to 2012
- Install to KEK STF2 for beam test: after 2012 (under discussion)

Outline

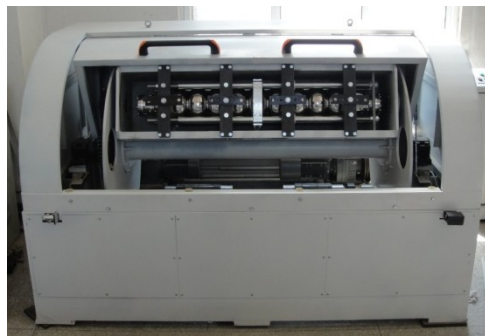
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Existing and Planned SCRF Facilities

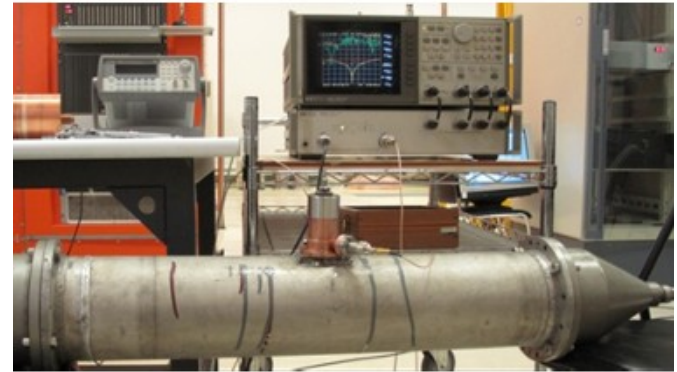
- CBP (single cell and 9-cell cavity tumbling machine)
- BCP facility
- Pretuning machine (vertical and horizontal)
- Large ultrasonic cleaner
- HPR facility
- High resolution inspection camera
- Clean room, pure water system,

- Vertical test dewar with heat exchanger (design finished, fabrication this year)
- T-mapping system (fabrication this year)
- Vertical EP (under investigation)
- Local grinding tool (under investigation)
- Cryoplant (600W@4.4K) for cavity and cryomodule test (funded)
- EBW machine

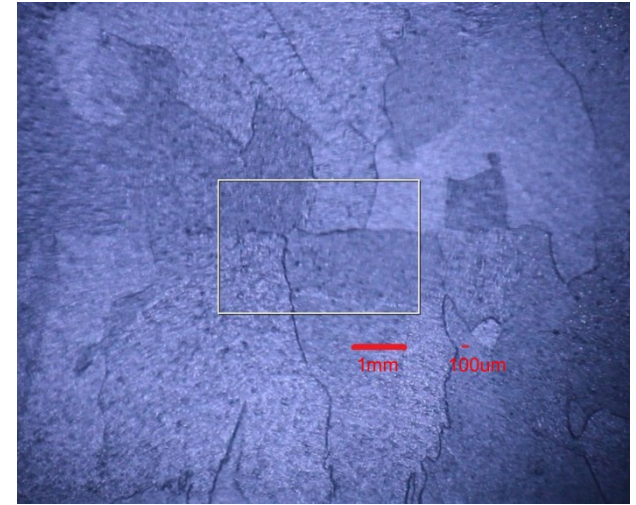
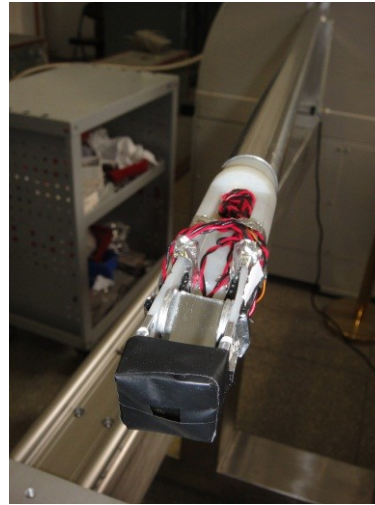
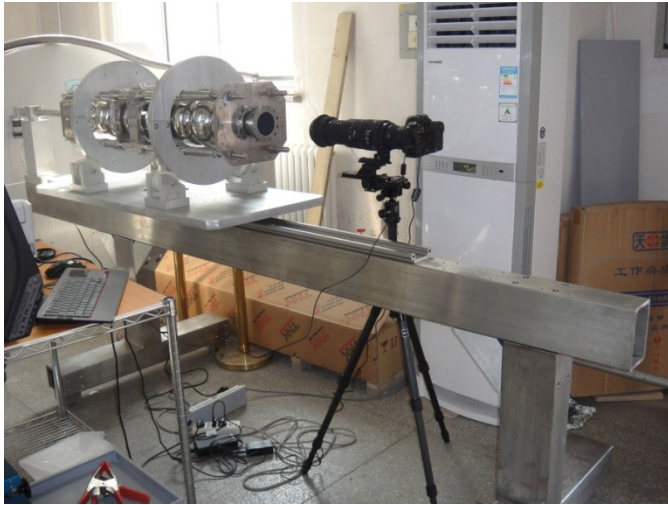
IHEP SCRF Infrastructures



Cavity RF and LLRF Lab



High Resolution Inspection Camera



NEXT STEPS

Better image: clearer

- improve the lighting and optical lens system

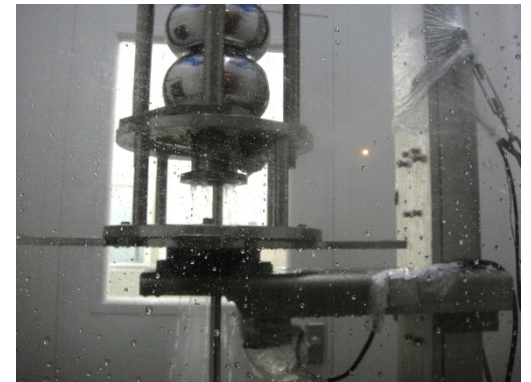
Automatic:

- install motors for cavity moving & rotation
- better camera moving base
- auto photo-taking

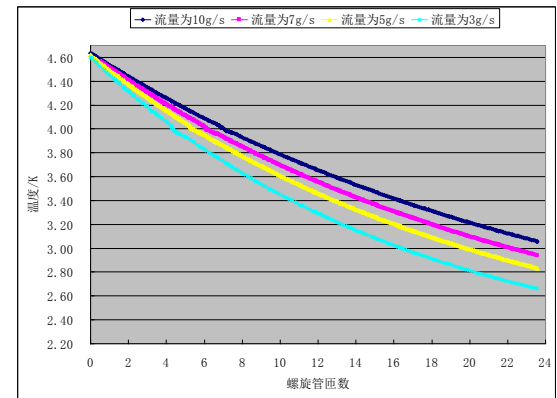
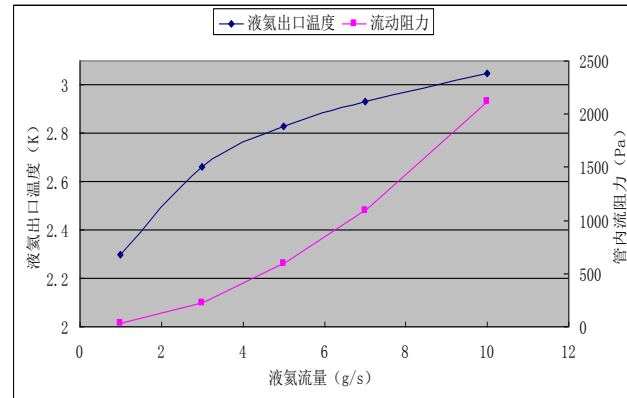
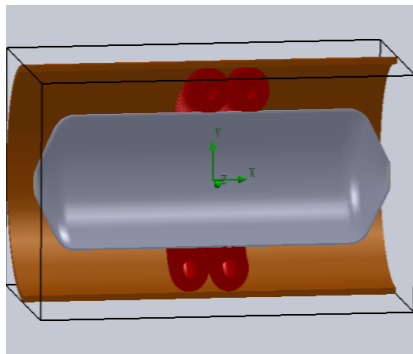
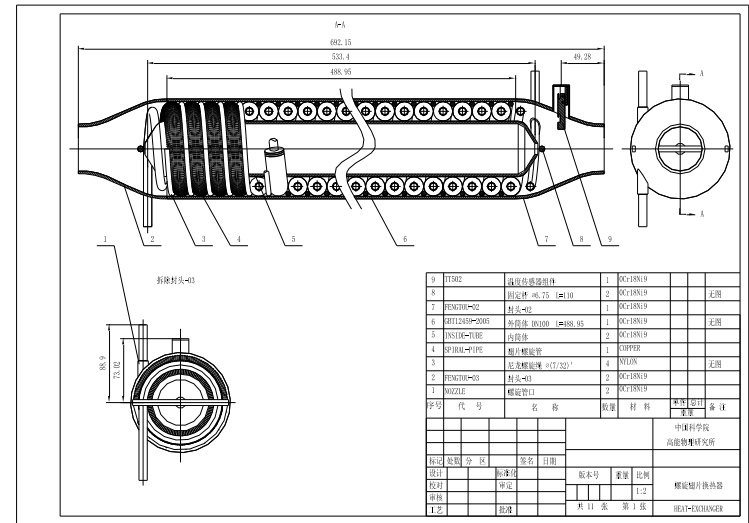
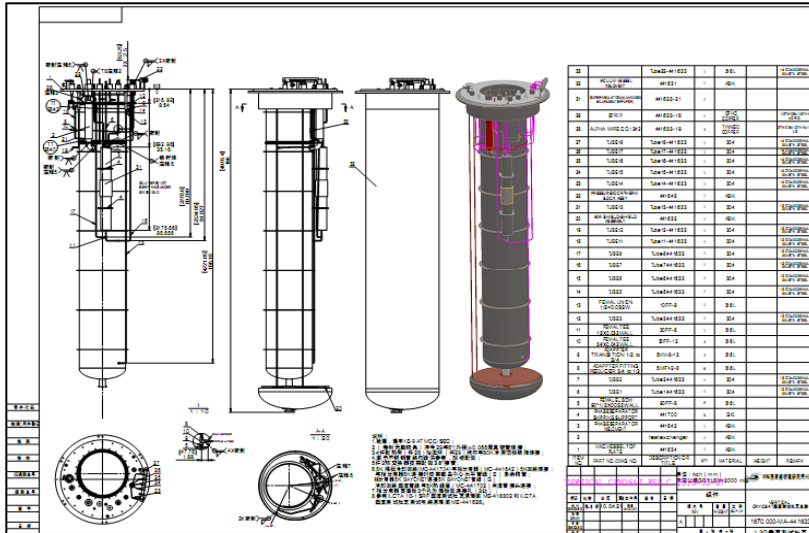


High Pressure Water Rinsing (HPR)

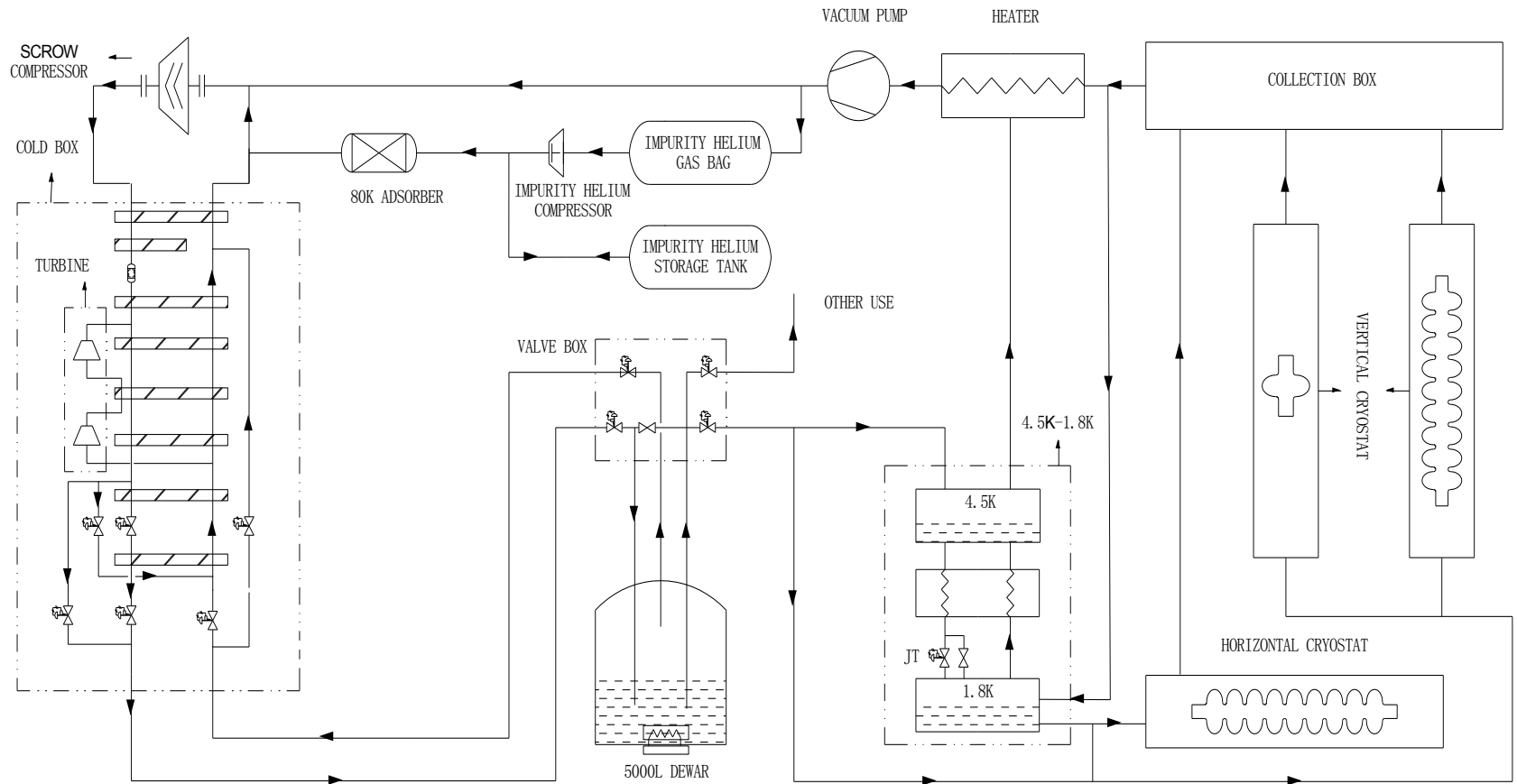
- Nozzle fixed, Cavity rotate and move



Vertical Test Dewar and Heat Exchanger



New Cryogenic System (2011-2013)



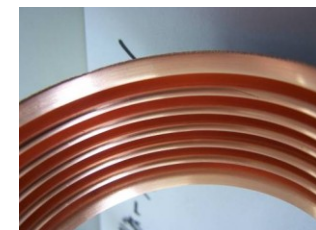
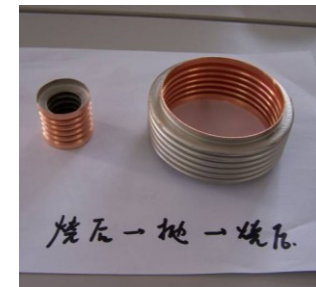
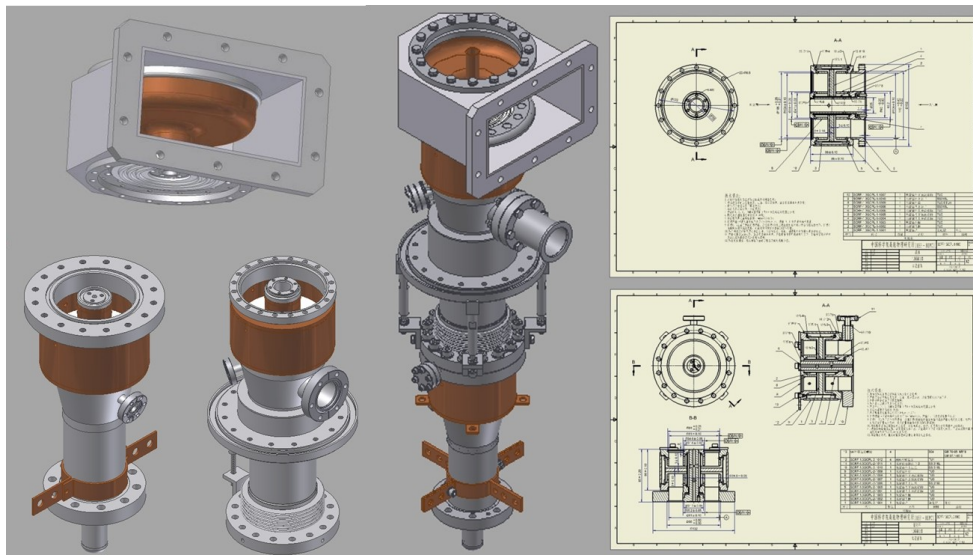
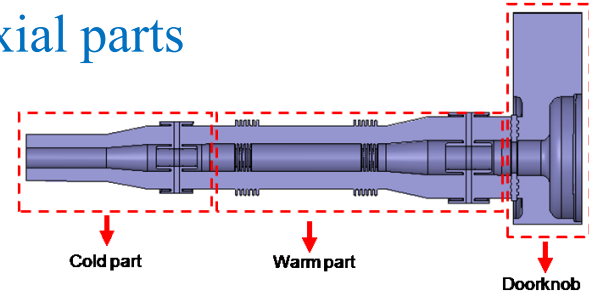
For VTS & HTS

Outline

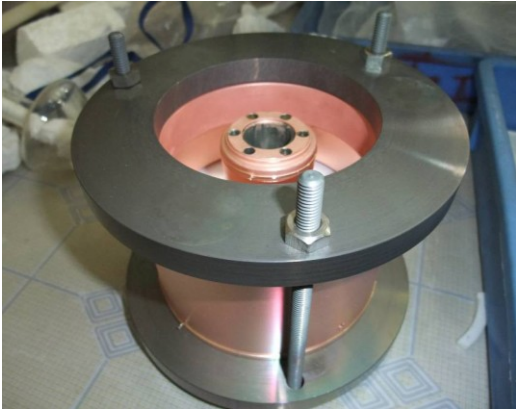
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High Power Input Coupler

- Two double-choke-window input couplers
 - components fabrication finished
 - uniform copper plating on bellows and coaxial parts
 - TiN coating on ceramics
 - Finish fabrication: May 2011
 - High power test at KEK: June to July 2011
 - Install to IHEP-02 cavity and cryomodule: 2012



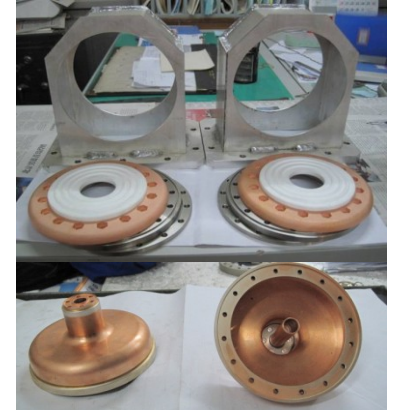
Welded Coupler Parts



Warm Window



Cold Window



Door knob



Warm outer part



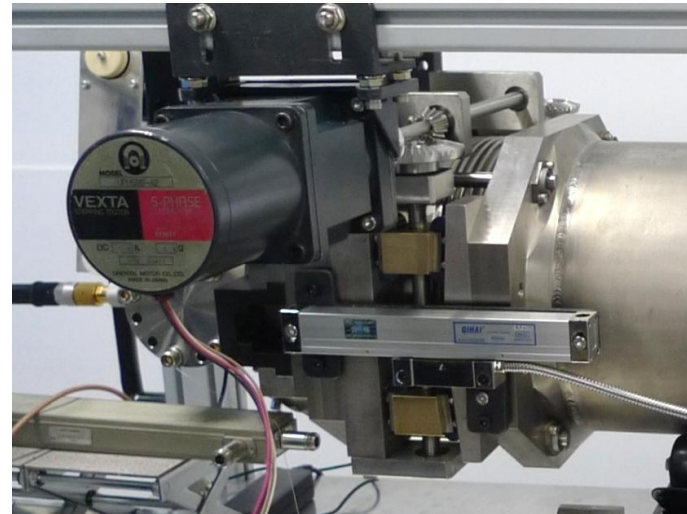
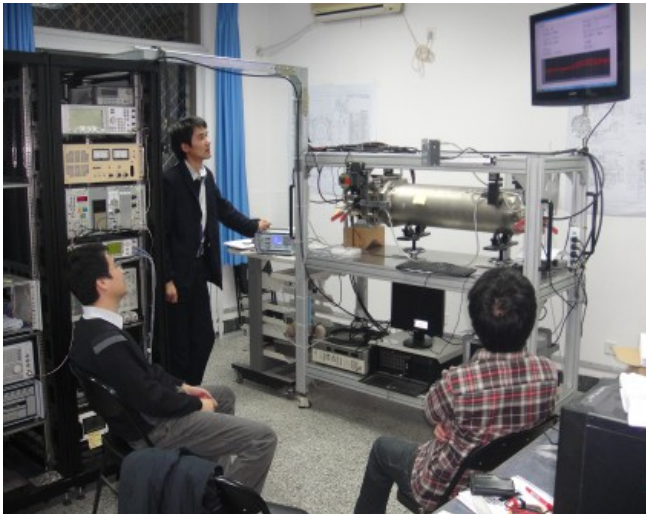
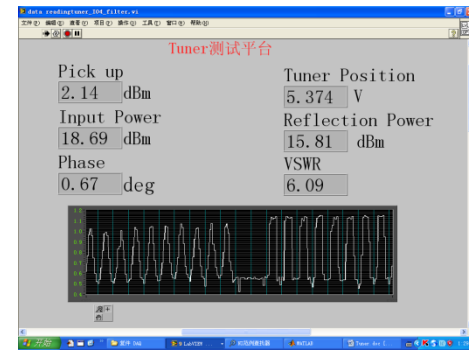
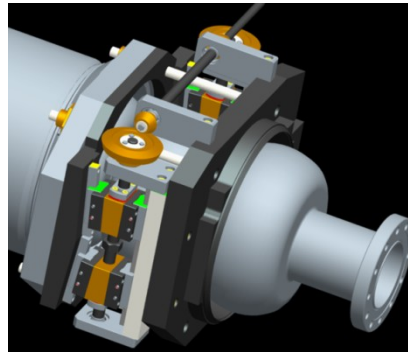
Warm inner part



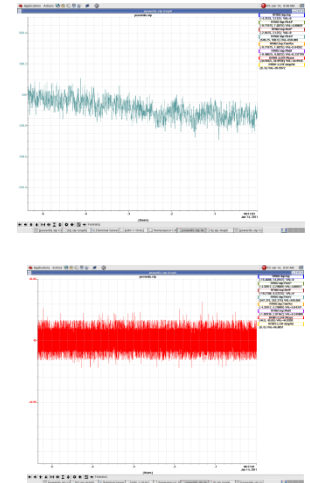
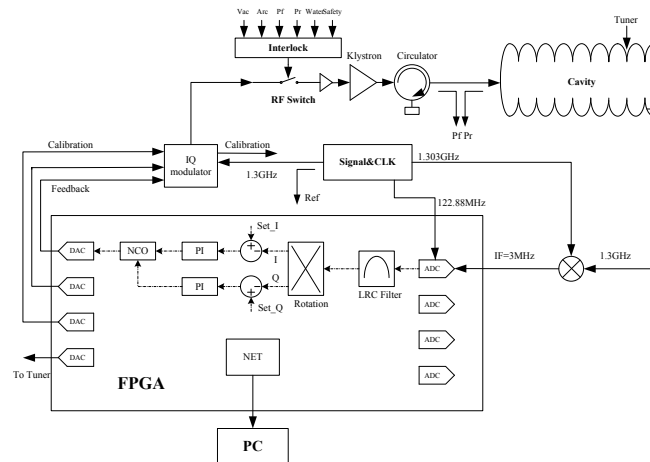
Cold outer and inner parts

Tuner and LLRF

- Home-made slide jack tuner
- Performance test with MHI-04 from KEK
 - Tuner stroke
 - Piezo
 - Stability

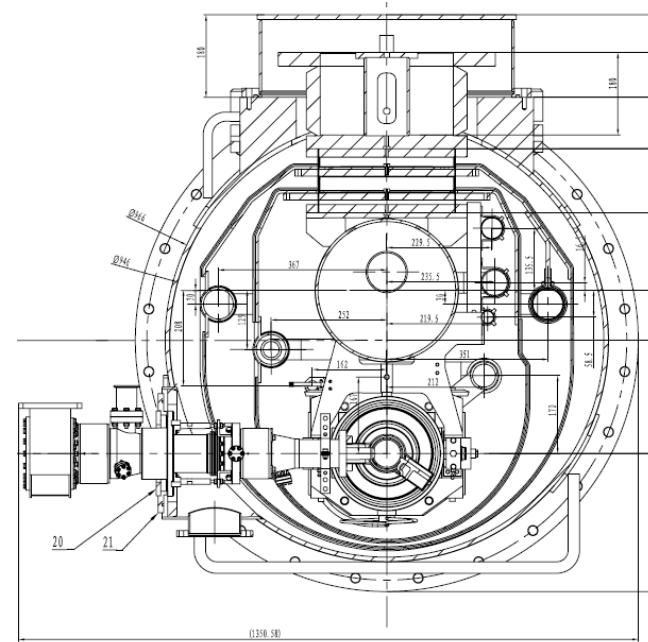
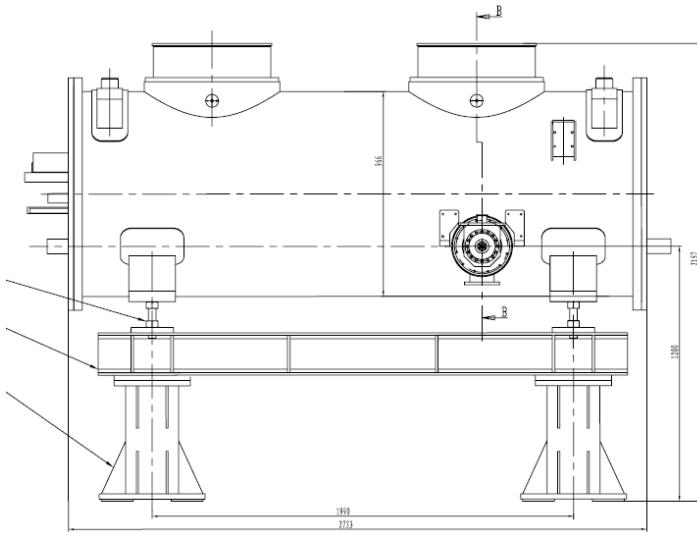


LLRF Performance @ RT



Frequency stability	± 1 kHz (room temperature)
Amplitude stability	± 0.05 % (peak to peak)
Phase stability	$\pm 0.035^\circ$ (peak to peak)
Response time	70 μ s
Dynamic range	20 dB

Cryomodule for the 9-cell Cavity



- Based on PXFEL1 success and XFEL cryomodule mass production
- Design finished, interfaces final check
- Fabricate and assemble in 2011-2012
- Horizontal test with IHEP's new cryogenic system

Summary

- **Three 9-cell cavities (LG, FG, LL, TESLA-like) R&D**
 - IHEP-01 waiting for 2nd VT, for S0 study (ACD)
 - IHEP-02 1st VT in Sept, install to IHEP cryomodule for HT
 - IHEP-03 in fabrication, install to KEK STF for beam test
- **Various SCRF facilities developed**
- ILC-type short cryomodule with the 9-cell cavity, input coupler, tuner, LLRF etc. will be assembled in 2012
- **International collaboration with KEK and FNAL**

A composite image featuring a view of Earth from space in the lower half and the Milky Way galaxy in the upper half. The Earth's horizon is visible, showing a blue atmosphere and a white cloud layer. The sun is low on the horizon, creating a bright orange and yellow glow that reflects on the clouds and the surface below. The Milky Way galaxy is visible in the upper half, showing a dense field of stars and a dark dust lane. The text "Thank you!" is centered in the middle of the image in a gold, serif font.

Thank you!