

S1-Global status report

KEK

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S1-Global

As the mile-stone of ILC construction, the cryomodule over the ILC DESIGN GRADIENT is required to be realized internationally (S1).


1. The scheduled cryomodules for the S1
 - FNAL : CM2 [to be constructed at 2009]
 - International collaboration @STF : S1-Global [to be operated at 2010].
2. Target of the S1-Global
 - Attaining **the average operating gradient over 31.5 MV/m** by 8 cavities from FNAL, DESY and KEK.
3. International research collaboration
 - FNAL : Two Tesla-type cavities with Blade tuner
 - DESY : Two XFEL cavities with Sacley tuner
 - KEK : Four Tesla-like cavities with Slide Jack tuner
 - INFN : New cryostat (Module-C) for FNAL and DESY cavities
 - SLAC : Power distribution system for Module-C

S1-Global

(International collaboration works)

- MOU between INFN and KEK (1 August 2008~31 March 2011)
(Design and manufacturing of the Module-C)
 - FY 2008
 - Design and construction of the components (cooling pipes elements, radiation shield elements, vacuum vessel elements).
 - FY 2009
 - Assembly of the components at INFN, test upon components at INFN, transportation of the components to KEK, cryomodule assembly and installation at KEK.
 - FY 2010
 - Performance test of the cryomodule
- MOU between FNAL, DESY, SLAC, INFN and KEK
(Assembly, test and disassembly of S1-Global cryomodules)
 - Details will be discussed in the following session.

Schedule of S1-Global



Calendar Year	2008		2009				2010			
Month	7,8,9	10,11,12	1,2,3	4,5,6	7,8,9	10,11,12	1,2,3	4,5,6	7,8,9	10,11,12
Cryostat design	←→									
INFN cryostat construction		←→								
DESY and FNAL cavities at KEK					→					
Preparation of cavities for clean room work						↔				
Clean room work						↔				
Cryomodule C assembly							↔			
Modification of STF assembly area and clean room								↔		
Construction and preparation of BL cavities for S1	←→									
Cryomodule A disassembly			↔							
Clean room work of new BL cavities							↔			
Cryomodule A assembly with new BL cavities								↔		
Installation of Modules A and C in the tunnel								↔		
Operation of S1-Global cryomodules									↔	

←→
Detail design of components and assembled Module-C and Module-A

←→
Installation design of modules in the STF tunnel

Design work activity

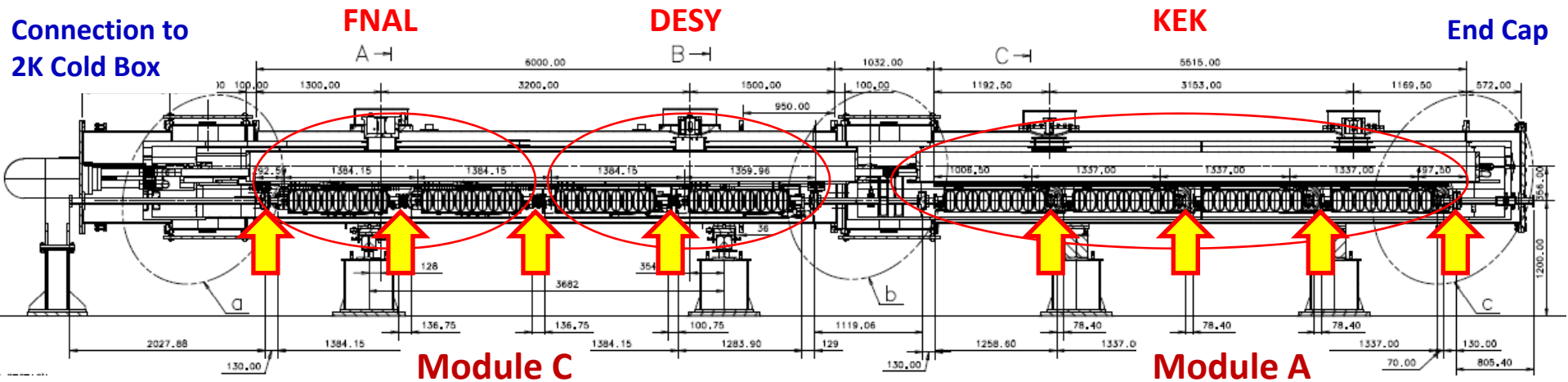
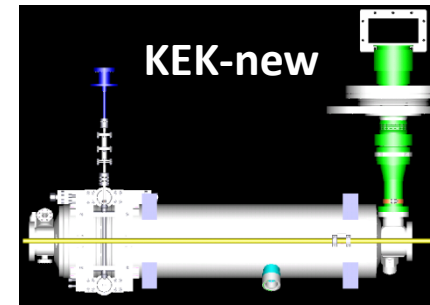
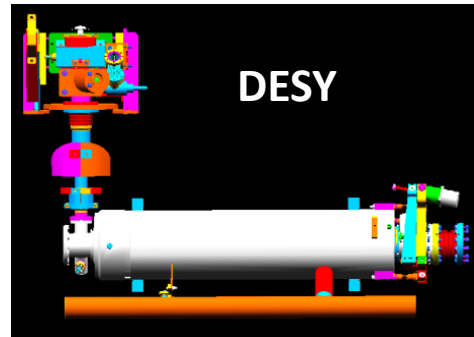
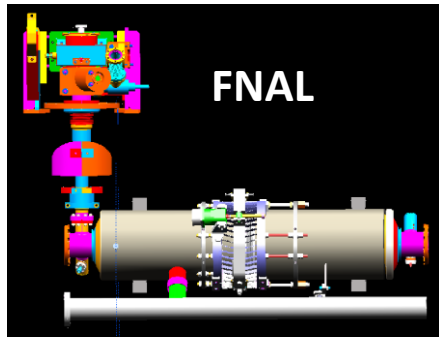
1. General design of S1-Global modules

- Modeling work is performed with I-Deas 3D CAD by KEK.
- Modification of the module design is required by the design change of the FNAL and KEK cavity-vessels.

2. Design details are discussed and confirmed between INFN, FNAL, DESY and KEK at the biweekly Webex meeting.

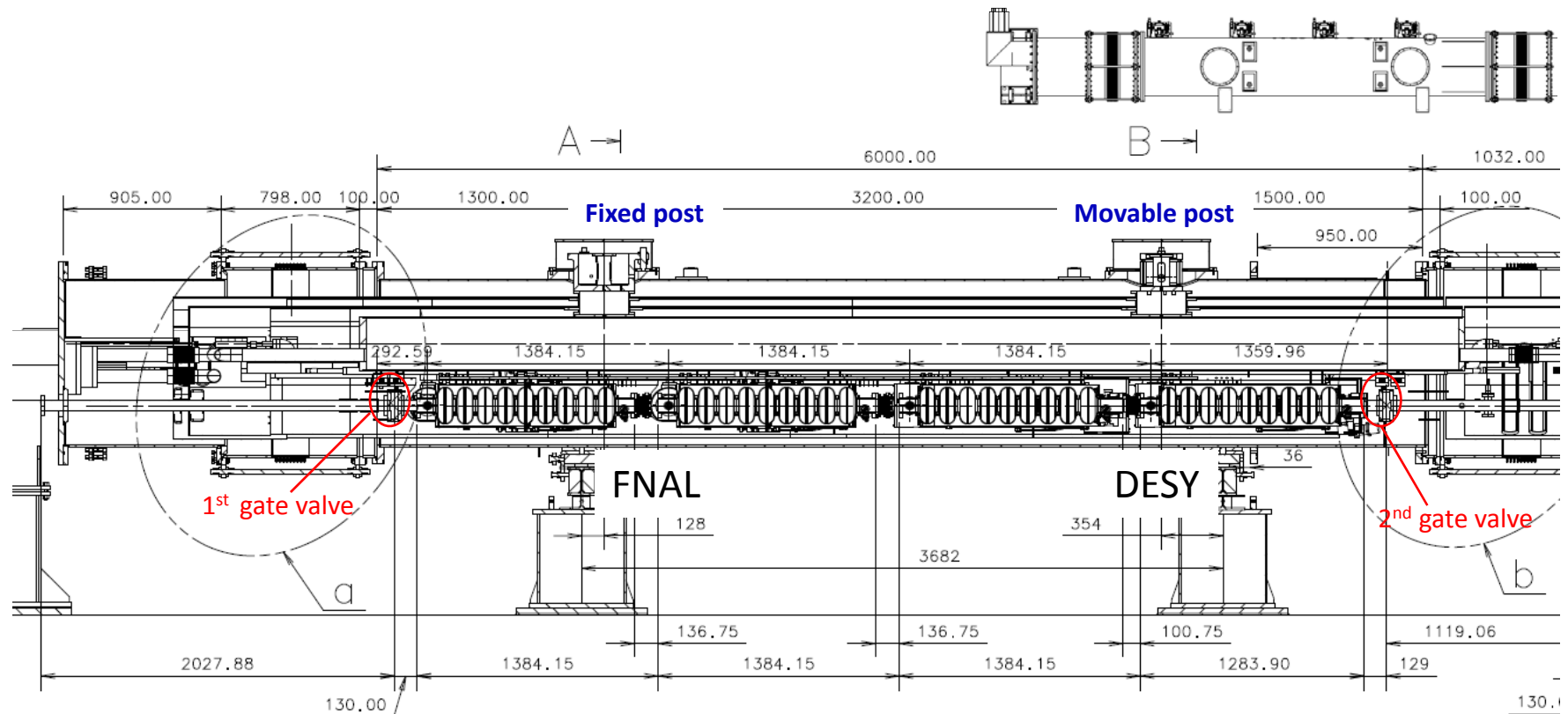
- The 1st meeting at Oct. 29.
- The 2nd meeting at Nov. 11.
- The presentations and summary are uploaded in Indico.

Cryomodule design in detail



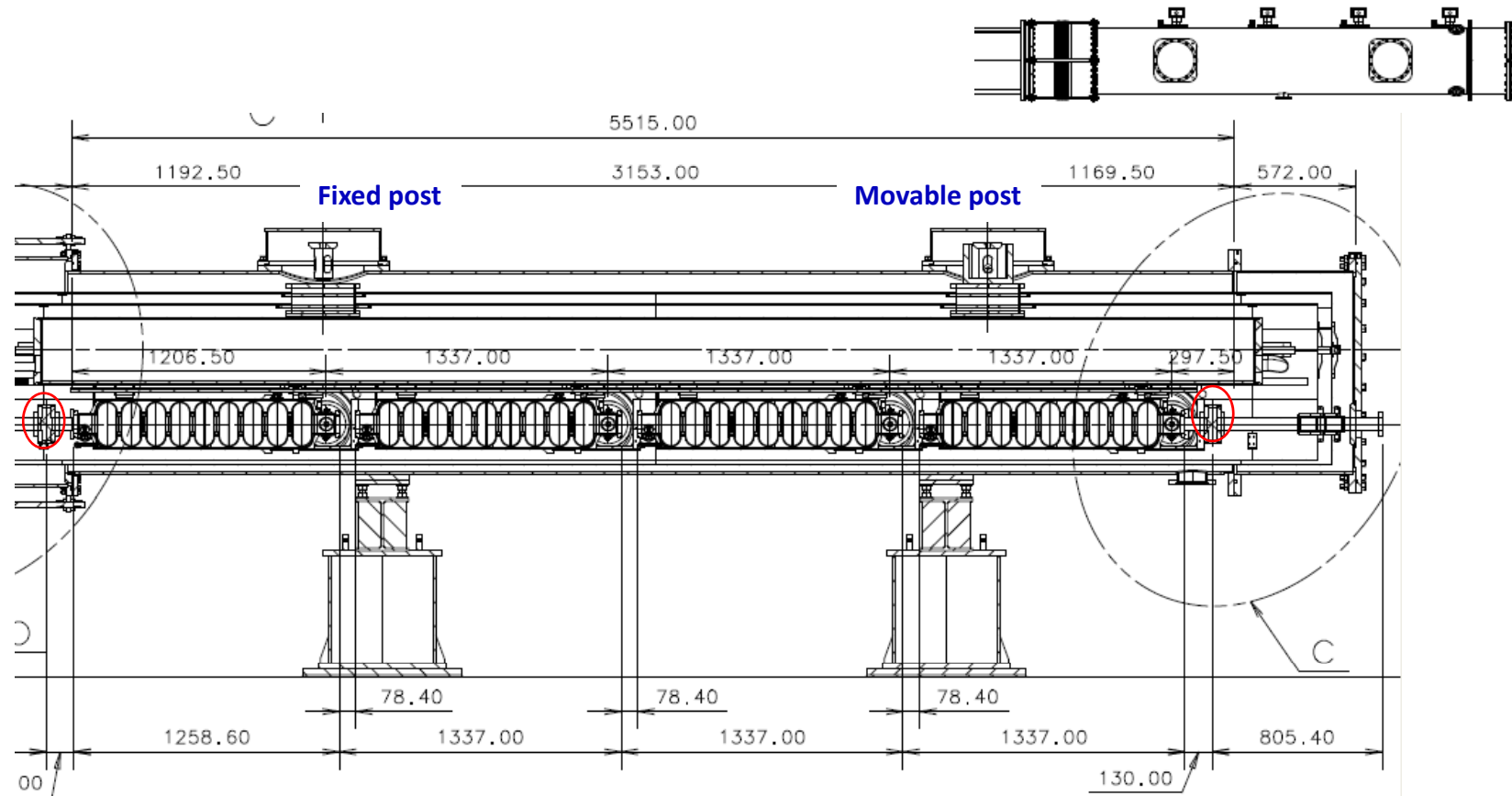
- **Module C**: 2 FNAL cavities and 2 DESY cavities, **Module A**: 4 KEK Tesla-like cavities
- The total length=14978mm
 - Module-C = 6000 mm, Module-A = 5515 mm

Module-C design



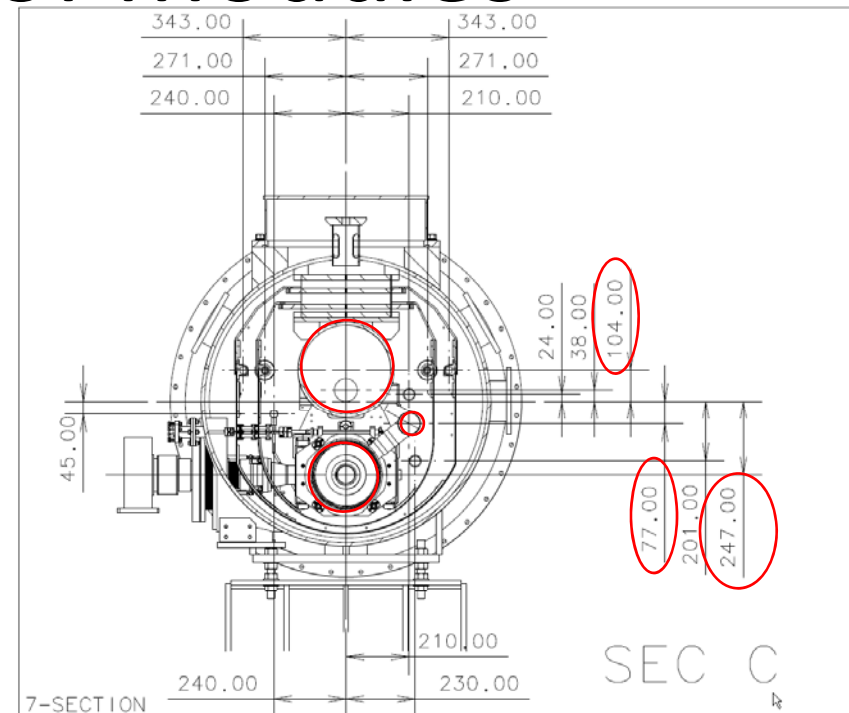
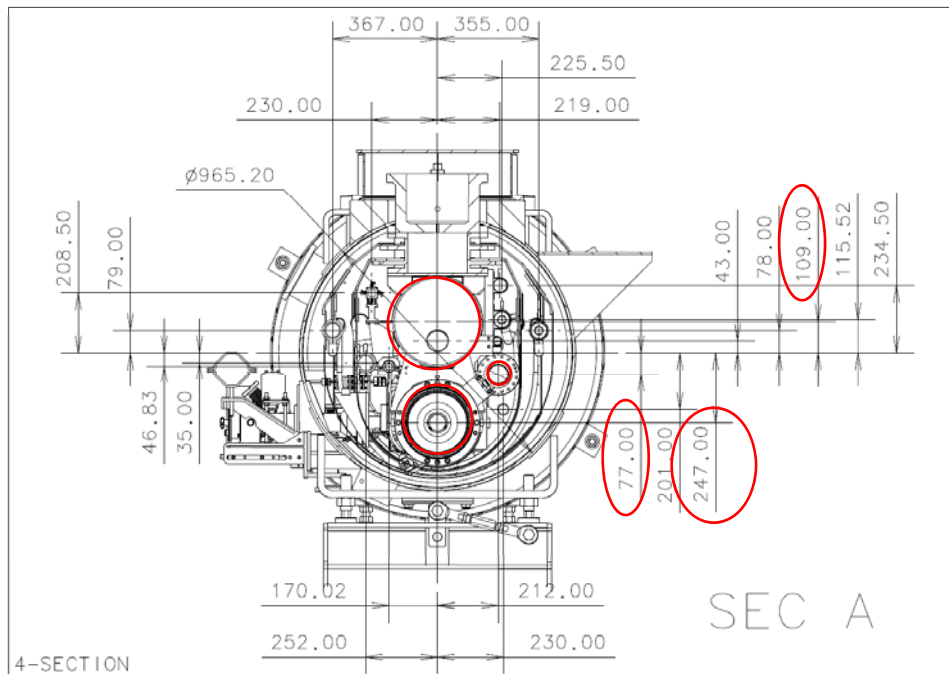
- Distance between input couplers = 1384.15 (same as XFEL module)
- Cavity length (flange to flange)
 - FNAL = 1247.4 mm, DESY = 1283.4 mm
 - 1st cavity to 2nd cavity = 136.75mm, 2nd to 3rd = 136.75mm, 3rd to 4th = 100.75 mm
 - 1st gate valve center to 1st cavity = 130 mm, 2nd gate valve to 4th cavity = 130 mm

Module-A design



- Distance between input couplers = 1337.0
- Cavity length (flange to flange)
 - KEK-Tesla-like = 1258.6 mm \Rightarrow 1247.6 mm
 - Cavity to cavity = 78.4 mm \Rightarrow 89.4 mm
 - The gate valve to the cavity flange = 130 mm

Cross-section of modules



Cross section of Module-C

Cross section of Module-A

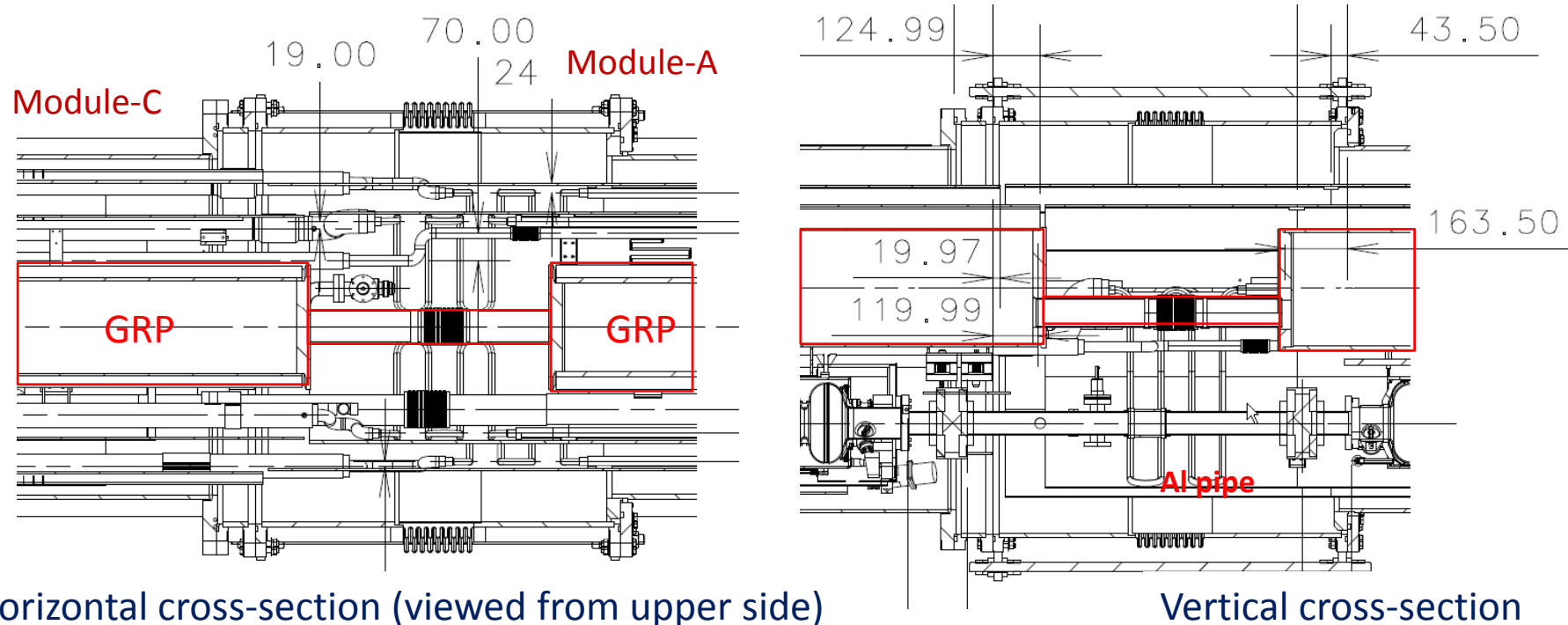
- Distance between the cavity vessel center and the vacuum vessel center
 - FNAL and DESY = 247 mm, KEK= 247 mm
- Distance between the helium supply pipe center and the vacuum vessel center
 - FNAL and DESY = 77 mm, KEK= 77mm
- Distance between the gas return pipe center and the vacuum vessel center
 - FNAL and DESY = 109 mm, KEK = 104 mm
 - Dia. of gas return pipe in Module-C= 312 mm, dia. of gas return pipe in Module-A=318.5 mm

Cooling pipe size in two modules

	Module-C (Type-III)	Module-A
GRP	OD=312, ID=300	OD=318.5, ID=297.9
2K LHe Supply Pipe	OD=75, ID=72.1	OD=76.3, ID=72.2
5K Shield (forward)	ID=60.3	OD=30, ID=22
5K Shield (return)	ID=60.3	OD=30, ID=22
80K Shield (forward)	ID=60.3	OD=30, ID=22
80K Shield (return)	ID=60.3	OD=30, ID=22
Precooling	ID=42.2	OD=27.2

- KEK will design, manufacture and assemble the connection pipes between two modules.
- In the TTF III cryomodule, the pipe for the 2.2 K line is designed. In the S1-global modules, this line is excluded because of the non-requirement of the system.

Connection area between Module-C and Module-A



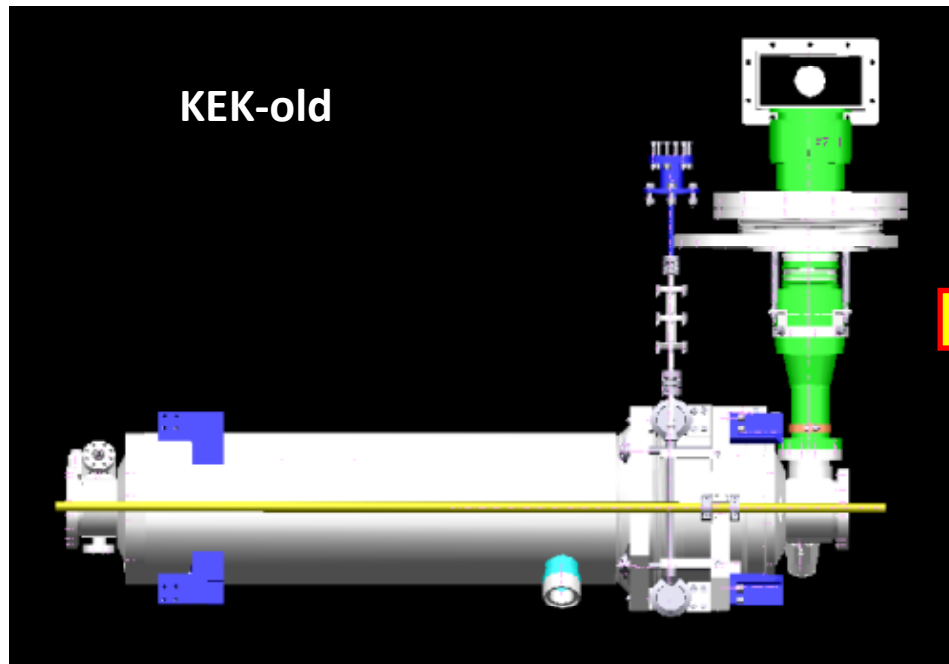
Horizontal cross-section (viewed from upper side)

Vertical cross-section

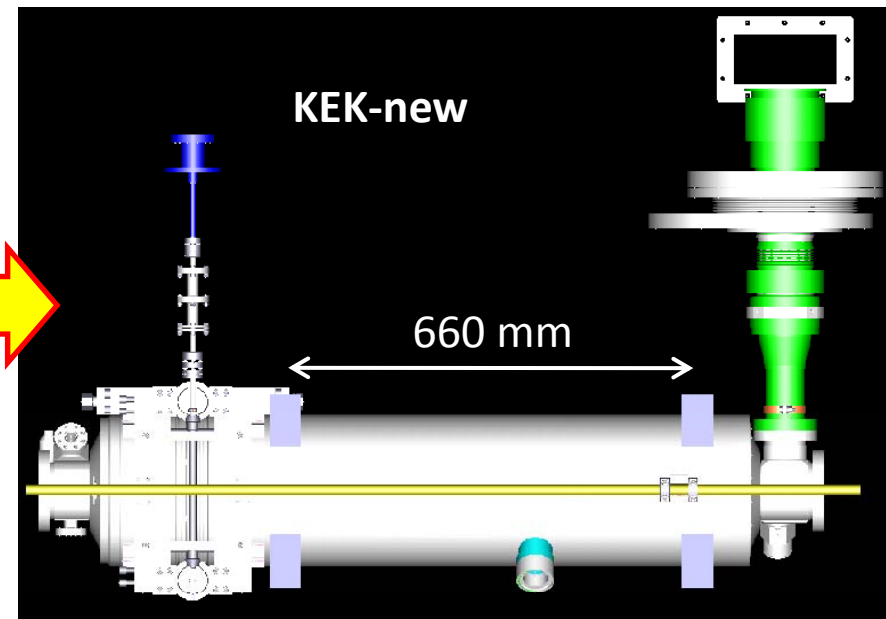
- The GRPs of Module-C and Module-A are connected with the pipe of O.D. 76.3 mm and bellows.
- Al pipes of thermal shields of the both modules are connected by welding.
 - The connection Al pipes are shaped like a snake in order to accommodate the position change of pipes and shields due to the thermal shrink.
- The vacuum flanges of Module-C and the vacuum bellows are connected with claw cramps.
- The vacuum flanges of Module-A and the vacuum bellows are connected with bolts and nuts.

Design change of KEK cavity-vessel

- Position of the slide jack tuner
 - Motor-drive-shaft moves to the opposite side of input coupler.
- Cavity length (1258.6mm \rightarrow 1247.6mm)

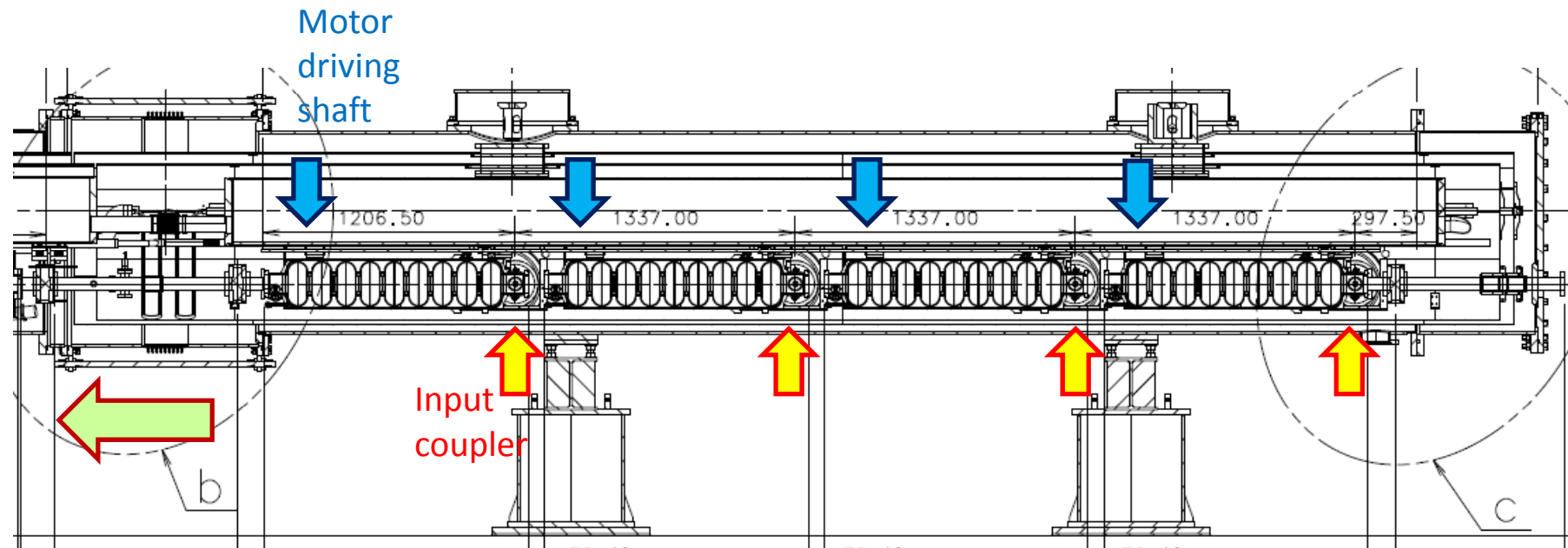


Flange to flange = 1258.6 mm



Flange to flange = 1247.6 mm

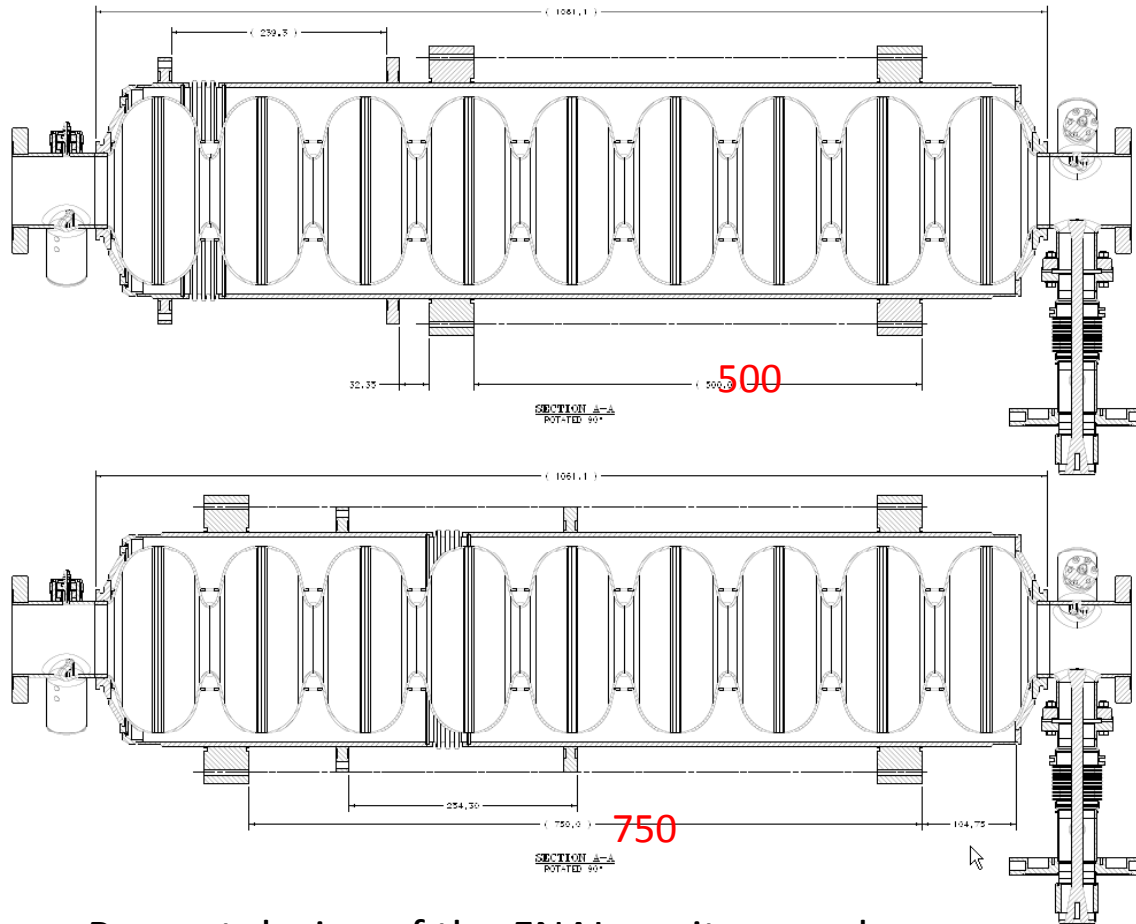
Design change of KEK cavity-vessel



- The vacuum bellows was designed to move on the side of Module-A.
 - Interference between the vacuum bellows and the motor-drive-shaft.
 - The big vacuum bellows need to be re-designed in order to move to the side of Module-C.
- For the ILC-module design, the flange for the drive-shaft should be re-designed without interference with the big vacuum bellows.

Proposal of the design change of FNAL cavity-vessel

Modified design of the FNAL-cavity vessel



Present design of the FNAL-cavity vessel

- The positions of the support lags between the DESY and the present FNAL cavities have the compatibility.
- FNAL group proposed the change of the blade tuner position.
- By this design change, the support legs under the GRP should be re-designed in order to accommodate the FNAL cavities.

Summary

- S1-Global is scheduled to be operated from July ~ Dec. 2010.
- General design of S1-Global modules are almost completed.
 - By the design change of KEK and FNAL cavity-vessels, the design modifications are required.
 - The new design of KEK and FNAL cavity-vessel should be completed as soon as possible.
- Detail design of the modules has started between FNAL, DESY, INFN and KEK.
 - Biweekly Webex meeting
 - Design of components and assembled modules should be completed in March 2009.
 - Installation design of modules into tunnel should be completed in Sept. 2009.