

# S1-Global (Design Status of Cryomodule)

KEK

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# S1-Global

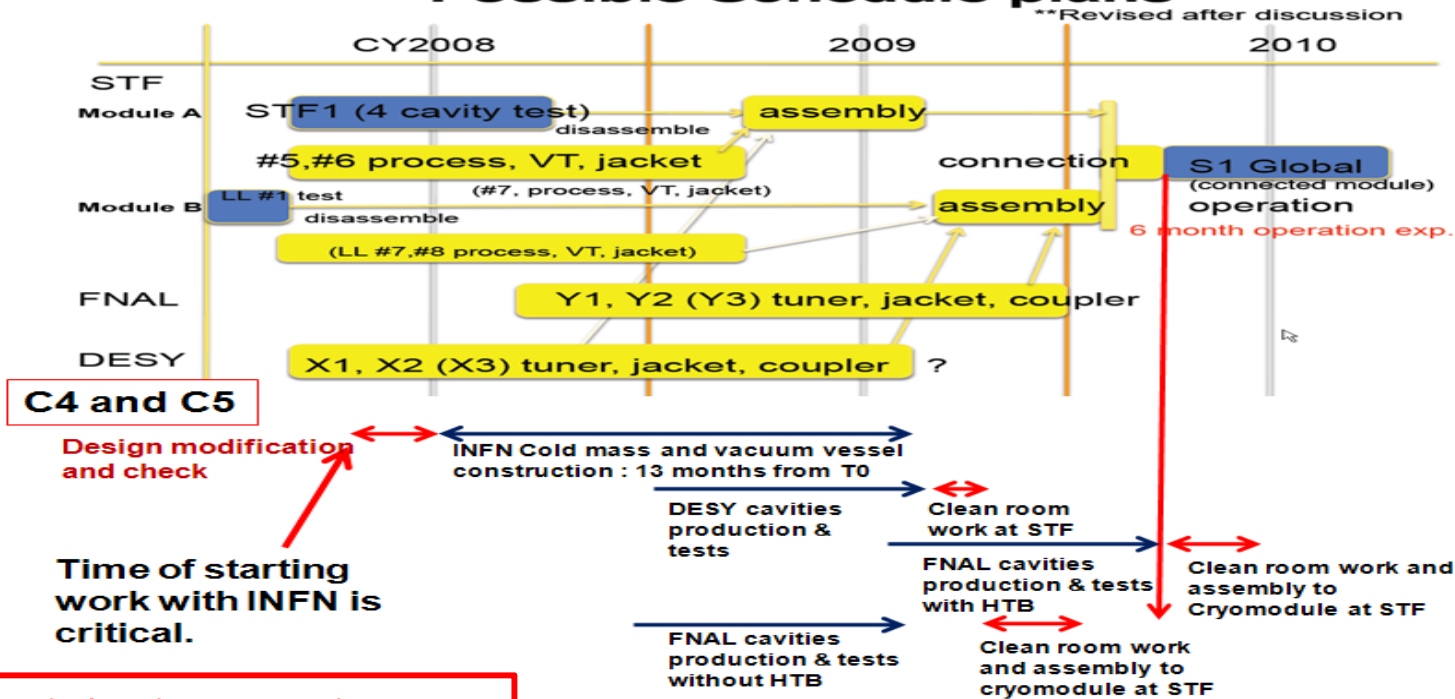
- 21~25 April 2008: S1-Global was discussed at FNAL SCRF Meeting.
  - Making the cryomodule with 8 cavities more than 31.5 MV/m from FNAL, DESY and KEK, and operating this module at KEK-STF.
    - FNAL: 2 Tesla-type cavities(Blade tuner)
    - DESY: 2 XFEL-Tesla-type cavities (Sacley tuner)
    - KEK: 4 BL-Tesla-type cavities(Slide Jack tuner)
  - Target average accelerating gradient=31.5MV/m
  - INFN will construct the new cryostat (Module C) for FNAL and DESY cavities.
  - KEK will prepare the interface between Module C and KEK components, and Module A for KEK cavities.
- July 2008: MOU between INFN and KEK (1 August 2008~31 March 2011)
  - 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

## Choice of S1-Global Cryomodule (in the discussion at FNAL-SCRF-Meeting)

	Module A	Module B	Module C	Required items for construction S1-Global
C 1	4 KEK-BL cavities	2 DESY cavities 2 FNAL cavities		Module A : No requirement Module B : <ol style="list-style-type: none"> <li>1. Gas return pipe, LHe supply pipe, cooling pipes</li> <li>2. Vacuum vessel extension (1.2 m)</li> <li>3. Additional thermal shields of 5K and 80K</li> <li>4. Sliding C-clamp supports and sensors, etc</li> <li>5. Modification of coupler ports on vacuum vessel</li> <li>6. Connection parts between the couplers and the ports</li> </ol>
C 2	3 KEK-BL cavities 1 KEK-LL cavities	2 DESY cavities 2 FNAL cavities		Module A: <ol style="list-style-type: none"> <li>1. Additional components between support legs and tabs for LL cavity</li> <li>2. Additional flange for connecting the input coupler of LL cavity to the coupler port on the vacuum vessel</li> <li>3. No modification of Module A vacuum vessel</li> </ol> Module B: <ol style="list-style-type: none"> <li>1. Same as case 1</li> </ol>
C 3	4 KEK-BL cavities	4 cavities with DESY, FNAL and 1 KEK-LL cavities		Module A: No requirement Module B : <ol style="list-style-type: none"> <li>1. Re-designing the helium vessel of LL cavity to be matched to FNAL and DESY cavities</li> <li>2. Same items as Case-1, however, for three types of cavity packages</li> </ol>
C 4	4 KEK- BL cavities		2 DESY cavities 2 FNAL cavities	Module A: No requirement Module B (Short Type III+): No modification of STF-module B. <ol style="list-style-type: none"> <li>1. <b>Short vacuum vessel and cold mass by INFN</b> (complete matching between cavities and cold-mass.</li> <li>2. KEK should make attachments of the assembly tools well functioned under the STF infrastructure by helps of DESY and FNAL groups.</li> <li>3. Connection bellows and flanges are supplied by DESY and FNAL.</li> </ol>
C5	4 KEK- BL cavities	2 DESY cavities 2 FNAL cavities		Module A: No requirement Module B (Short Type III+): No modification of STF-module B. <ol style="list-style-type: none"> <li>1. Short vacuum vessel , cold mass and components by KEK</li> <li>2. KEK need all drawing for constructing the cryomodule.</li> </ol>

Discussed schedule at the FNAL-SCRF-Meeting

Possible Schedule plans



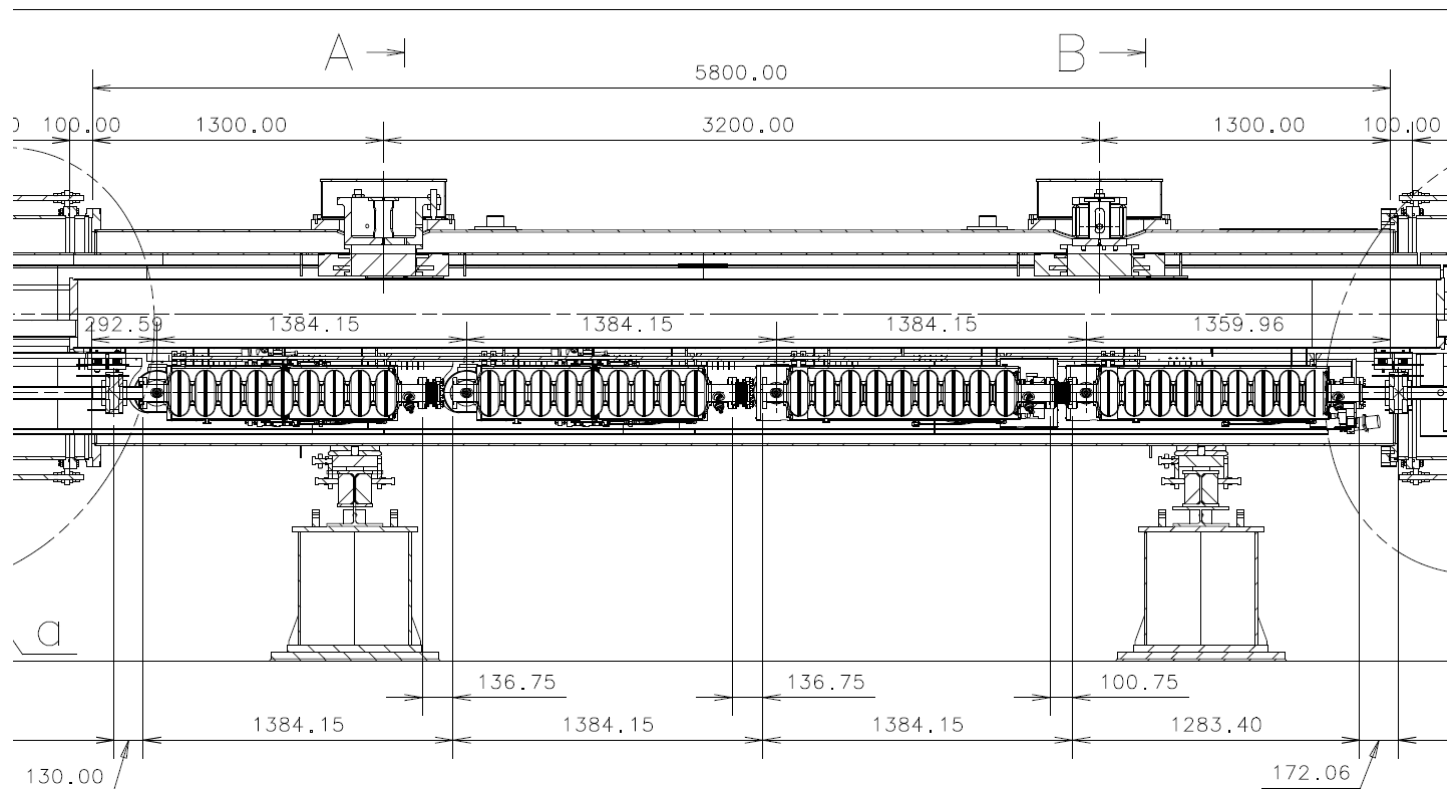
Latest schedule discussed at KEK

Calendar year	2008			2009			2010				
Months	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	1,2,3
S1-Global											
Cryostat design	←	→									
INFN cryostat construction		←									
DESY and FNAL cavities at KEK					→						
Preparation of cavities for clean room work						↔					
Clean room work							↔				
Cryomodule C assembly								↔			
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											↔

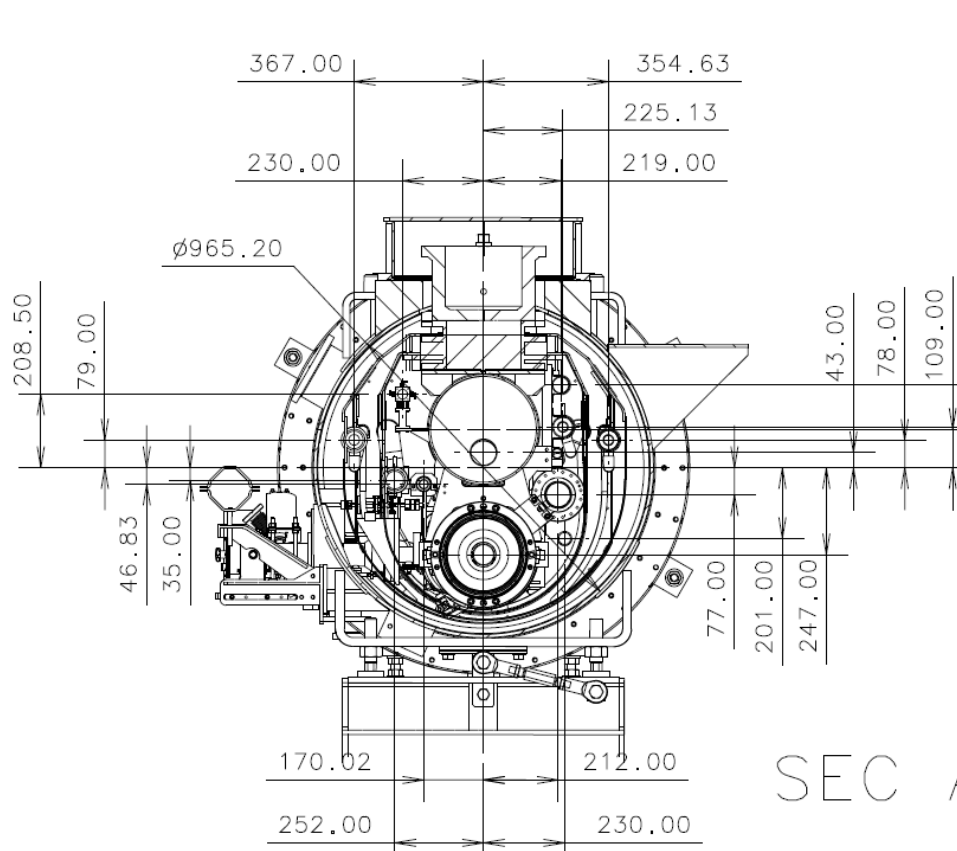


# Module-C (INFN) Vacuum Vessel

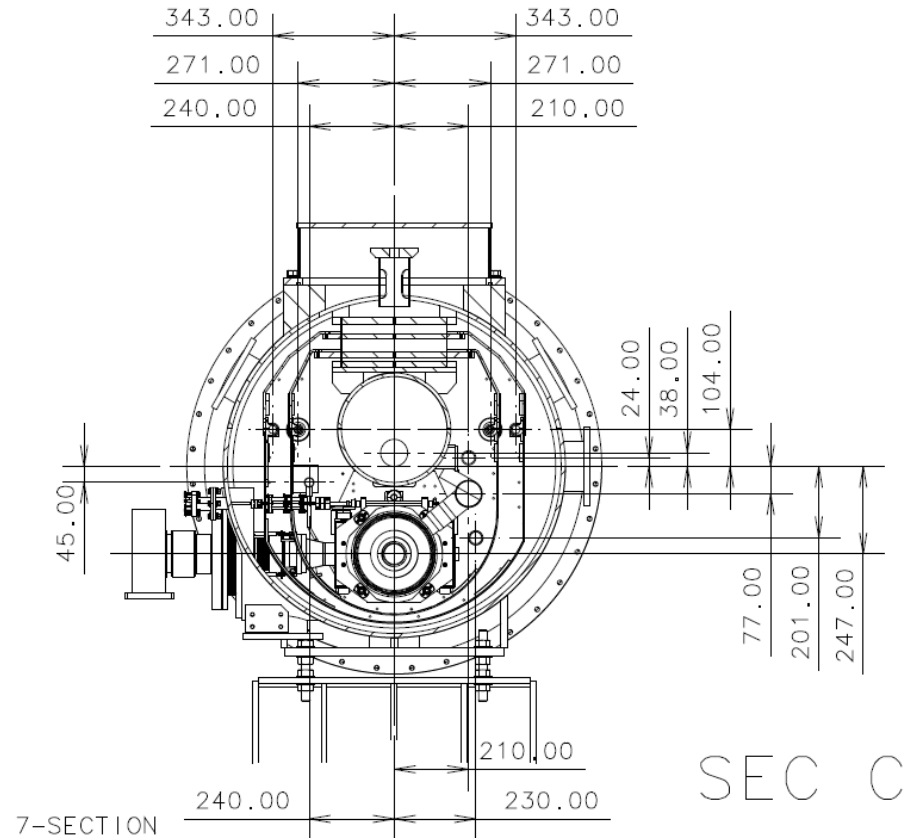
- Length of the cryostat : 5800mm, outer diameter= 965.2mm
- KEK will construct the additional components at the interface of cooling pipes.
- Position of the support post : distance from the end flange=1300mm, distance between posts=3200mm
  - Deformation of GRP : 47 $\mu$ m at both ends, 37 $\mu$ m at the center



# Cross section design of Module-A and C



Cross section of Module C  
(FNAL cavity)



Cross section of Module A  
(KEK-BL cavity)

# Design work from NOW

- Checking the constructed CAD Data (general design) with INFN, DESY, FNAL and KEK
  - The 2D drawing of the general design in pdf was sent to INFN, DESY and FNAL on 2 September.
  - After getting comments from three labs, we finalize the general design of S1-Global.
- Starting the design of Module C component (collaboration work between INFN and KEK)
  - Important issue: transportation of CAD data between INFN, DESY, FNAL and KEK
    - EDMS(?) : need to build the environment for using EDMS-CAD(I-Deas) in KEK
- CAD work of the components in the KEK-Module A and the Interface
  - Design work of the Module-A components (3D Modeling Data) based on the general design.
  - Construction of the CAD data for the installation of cryomodule in the STF tunnel.
    - Design of RF Wave-guide system to the cryomodules
  - Making 2D drawings for confirmation of the design between the different groups
- Preparation for the future CAD work by KEK
  - At present, KEK has only one license of I-Deas 3D CAD
  - We will plan to increase the license of I-Deas and man-power.



# Collaboration Work (International S1-Global Team)

- Cryomodule
  - Cryomodule design
  - Assembling Module A and Module C with INFN, DESY, FNAL and KEK
    - Developing assembly tool, auto-welding machine and pipe cutting machine
    - Alignment strategy and alignment tool
    - Exchange information for the assembly of the cryomodule
    - Understanding interfaces (for plug-compatible design)
- Cavity and Cavity-Package
  - Assembling cavities in STF clean room
    - Making a cavity string, assembling input couplers
- Cold test (including RF components)
  - Operation of 8 cavities over 31.5 MV/m as ILC design operating value
  - Comparison of three different tuner systems
  - Measurement of thermal characteristics of three types cavity packages at one station
    - Static and Dynamic losses → Important information for Cryogenic Spec.

