



Cryomodule Interface definition

N. Ohuchi



Cryomodule-1

- Cryomodule components to be designed with another group
 - **Thermal calculation: cryomodule and cryogenic**
 - Calculation of heat load, temperature profile in the cryomodule, cool-down and warm-up calculation
 - **Mechanical calculation including vibration: cryomodule, cavity and beam dynamics**
 - Support design for the nine cavity cryomodule
 - Cavity from gas return pipe, gas return pipe from vacuum vessel
 - Movement of cavities by cool-down and warm-up
 - Vibration analysis of the cryomodule components and its effect on the beam dynamics.
 - **Pipe design: cryogenic and cryomodule**
 - Pressure drop calculation of gas return pipe, helium supply pipe, shield cooling pipes and 2.2 K helium pipe
 - Piping in the cryomodule



Cryomodule-2

- Cryomodule components to be designed with another group
 - **Cold mass assembly inside and outside clean room: cryomodule and cavity**
 - String assembly of nine cavities inside the clean room
 - Installation of cavity string to the cold mass
 - Alignment of cavity to the cryostat target
 - **Gate valve: cavity and cryomodule**
 - Assembly and support of gate valve
 - **Beam line HOM absorber: ?? and cryomodule**
 - Assembly and thermal calculation in the cryomodule: cryomodule
 - HOM absorber: ??
 - **Beam pipe pumping: vacuum and cryomodule**
 - The beam-line vacuum is segmented into strings of 154.3m.
 - Pumping system design
 - Thermal calculation



Cryomodule-3

- Cryomodule components to be designed with another group
 - **Insulating vacuum break** : vacuum and cryomodule
 - Vacuum breaks are installed into strings of 154.3 m
 - Design of vacuum break: heat load through the break
 - Insulating pumping system of strings
 - **Coupler vacuum system**: cavity, vacuum and cryomodule
 - **Fast acting cold gate valve**: vacuum and cryomodule

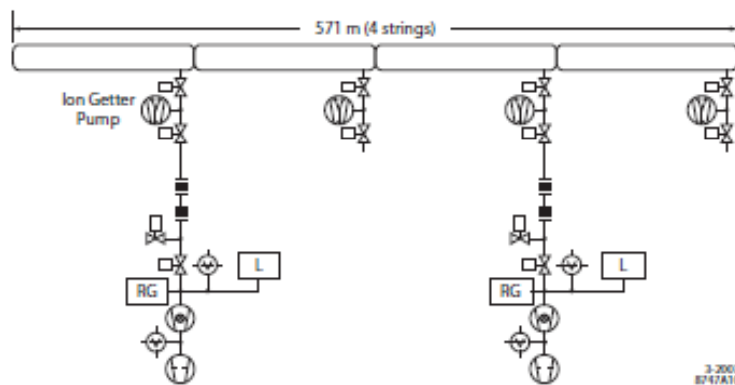


FIGURE 3.2-1. Beamline vacuum system – 2 turbo-molecular pumps (TMP) with high sensitivity leak detector (LD) and residual gas analyzer (RGA), safety, clean venting system, slow start pumping etc.

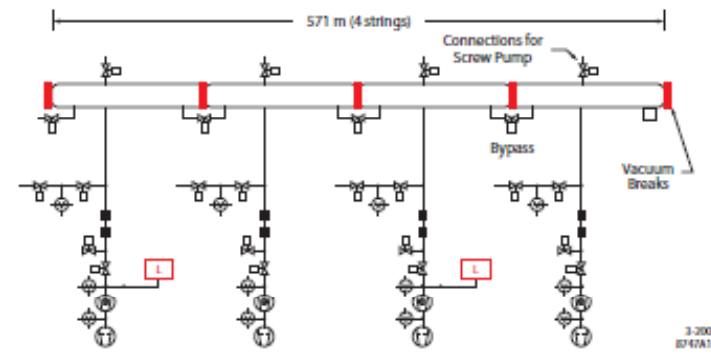


FIGURE 3.2-3. Insulating vacuum system – 4 TMP pumping units: 2 with LD (leak detector) + 2 large screw pump for fore pumping.



Cryomodule-4

- Cryomodule components to be designed with another group
 - **Cryomodule 2D and 3D CAD work: cryomodule**
 - All group should confirm the design from EDMS.

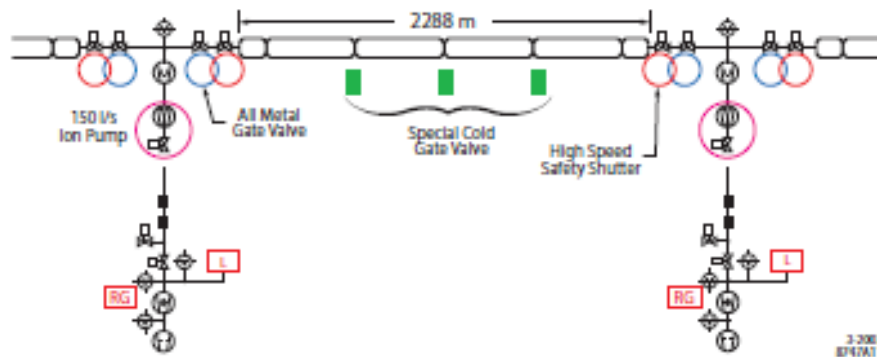


FIGURE 3.2-2. Beamline vacuum system gates and valves.

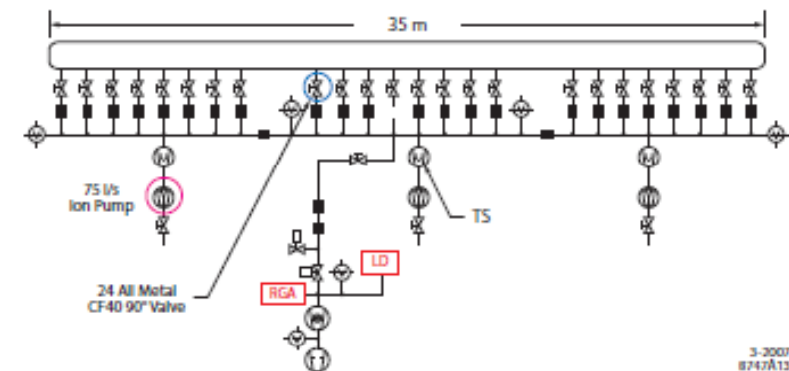


FIGURE 3.2-4. Waveguide and coupler vacuum system.



Cavity Package

- Design work with cavity group
 - **Helium jacket and magnetic shield**
 - Design of the connection pipe to LHe supply pipe and pre-cooling pipe
 - Cavity magnetic shielding combined with the vacuum vessel shielding
 - Fiducialization on the helium jacket with respect to the cavity center
 - High pressure gas regulation
 - **Tuner**
 - Thermal anchor design
 - Cabling
 - **Input coupler**
 - Coupler thermal anchor design
 - Warm coupler support flange design on the vacuum vessel
 - Thermal anchor design of RF cable (cabling in the cryomodule)
 - RF cable is study item to reduce thermal load.
 - **Temperature sensors**
 - Sensor type and position should be discussed with the cryogenic group.
 - Cabling



Quadrupole Package

- Design work with magnet group
 - **Helium jacket and magnetic shield not to leak the magnetic field**
 - Design of the jacket and the connection pipe to LHe supply pipe and pre-cooling pipe
 - Magnetic shield design
 - Support design and alignment method
 - Alignment of the magnetic center to the fiducials on the cryostat
 - High pressure gas regulation
 - **Current leads**
 - Cooling channel design including the electrical insulation
 - Terminal design
 - **Temperature sensors and voltage taps**
 - Sensor type and position should be discussed with the cryogenic group.
 - Cabling
 - **BPM**
 - Installation
 - Cabling



Cryogenic system

- Design work with cryogenic group
 - **Design of the end box and service end box**
 - Design of cryogenic components and cooling pipes between the cryomodule, the end box and the service end box
 - Control of the liquid helium surface in the supply pipe
 - **Study of Heat load of cryomodule**
 - Need the heat load for design of cryogenic system.

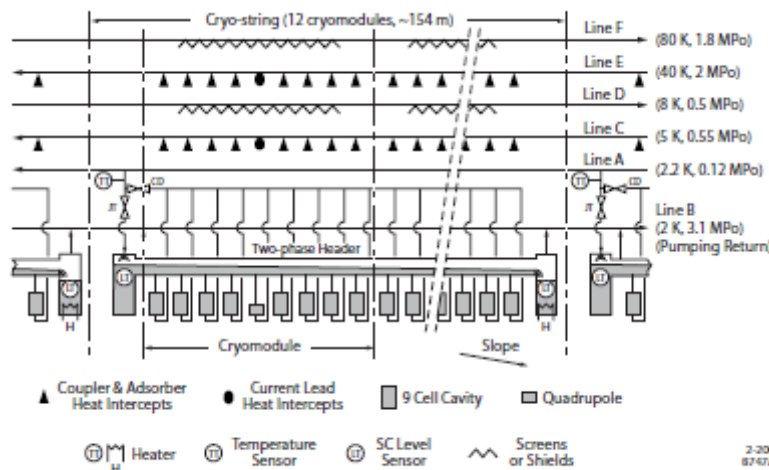


FIGURE 3.8-2. Cooling scheme of a cryo-string.

