# ILC TDP R&D Plan
# Cryomodule Integration

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# 1) Cryomodule design for S2

1. Thermal shield design
   - The proposed design of the ILC cryomodule in RDR has two sets of thermal shield of 5 K and 70 K as same as the TTF-Type-III and XFEL cryomodules. In the previous GDE meetings, the heat load by thermal radiation to 2 K region without the 5 K shield and the total cost including the operation cost of 10 years were studied, and the total cost without the 5K shield by optimizing the cooling scheme can be less than that with 5K shield. In the cryomodule design for S2, the cryomodule components need to be designed to make the study of this thermal concept possible, and the cryomodule cost should be re-evaluated with the 12 m cryomodule for S2.
2. Magnetic shield design
   - The magnetic shield design will be discussed in the cavity integration, however, the shield inside or outside of the cavity jacket has a big impact on the cryomodule assembly and the required man-hour outside of the clean room. The performances of two types will be compared in the S1-G cryomodule cold test. The overall cost including manufacturing shield components, assembly time and man-hour needs to be studied.
3. Plug-compatibility
   - The cryomodule for S2 should be designed for accommodating the “Plug-compatible” concept. In the S2 cryomodule design, the connection flange of the vacuum vessel, the size and position of cooling pipes, thermal shield shape and input coupler flange on the vacuum vessel should be considered.
   - The alignment process and the fiducial target of cavities and cryomodule should be discussed in designing the S2 cryomodule from the “Plug-compatible” point of view.

# 2) Assembly study of the cryomodule

1. The S1-G cryomodule consists of three types of cavities and two types of 6-m cryomodules.
   - From the assembly experiences of these different components, the assembly processes and man-hours are able to be compared and reviewed. The data are necessary to estimate the assembly cost of the ILC cryomodule.

# 3) Thermal test plan of the S1-G cryomodule

1. Heat load measurements
   - Static heat loads of the modules and the calibration measurements by a heater
   - Dynamic heat loads of three types of cavities
     - Individual cavity at its maximum operating field
     - Two sets of 4 cavities at the average field gradient of 31.5 MV/m
     - All 8 cavities at the average field gradient of 31.5 MV/m
2. Measurement of temperature profile in the two 6-m modules
   - Temperature profiles of the components measured with 201 thermal sensors
   - Comparison between the measured profiles and thermal calculations
3. Position deviation of cavities and GRP during the cold test
   - Positions and deformations of the gas return pipes
   - Movement of four KEK cavities by 8 WPMs