ILC Cryogenics Work Package Status and Plans

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ILC Cryogenics Work Status

- RDR cryogenic system effort totalled less than 1 FTE for the duration of the RDR effort
- Early EDR (now called TDR) work package development (2007) suggested tripling that to 3 FTE's (one from each region) for the duration of the TDR
- For the past year (2008) we have had less ILC cryogenics effort than during the RDR
- Result -- only a few minor updates to the ILC cryomodule heat load estimates and cryoplant size estimates have been done

Outlook for 2009

- In 2008, the scope of funding and resources for ILC limited work to certain critical R&D and planning tasks, mostly not cryogenics.
  - **Cryogenics for ILC is relatively well-understood since we have LHC cryogenics as a similar system**
  - **Issues like cavity processing for consistently high gradient need more R&D attention**
- The 2009 budget outlook indicates that we could get back up to about the RDR level of 1 FTE (1/2 FTE in U.S. plus KEK effort on cryogenics, plus small effort in Europe from INFN and DESY)

Summary of tasks for 2009

1.4.1.	Heat loads	The heat load to the entire cryogenics system is investigated under static and dynamic conditions. Static, dynamic, and distribution system loads are considered, including tolerances and uncertainties. Overall uncertainty factors and cryoplant sizes are re-evaluated.	Peterson (FNAL), Ohuchi (KEK), Pierini (INFN), Petersen* (DESY)
1.4.2.	Cryogenic process design, cryoplant design, and surface impact	The cryogenics plant engineering is to be carried out in cooperation with industry and in close communication with CF&S technical area engineers to optimize interface with the CFS system. The location and distribution of surface equipment such as large compressors and associated utilities are optimized for minimal local impact, reliability /maintainability and cost. The integrated cycle design is evaluated. Temperature and pressure levels in cryomodules, particularly in the thermal shields, should be evaluated in the context of the full process through the cryoplants.	Klebaner (FNAL), Peterson (FNAL), Arenius (JLAB), Ganni (JLAB), Tavian* (CERN)
1.4.3.	Venting, pressure limits, and piping and vessel standards	The peak pressure in the cryogenics system in various modes of pre-cooling, steady state operation, and emergencies such as vacuum failure and helium rupture into the vacuum should be assessed, along with venting design. Cryogenics system and components need to meet industrial high-pressure gas regulation standards, which includes regional code compliance for hardware manufactured in other regions.	Peterson (FNAL), Nakai (KEK), Hosoyama (KEK), Petersen* (DESY)

Some Project X synergy

- Although no ILC effort is foreseen for item 1.4.4, below, Project X effort has begun with respect to tunnel arrangements, string lengths, segmentation, and maintenance scenarios which, although for a smaller system, will be relevant for ILC.
  - **Klebaner (FNAL), Peterson (FNAL), Theilacker (FNAL)**

1.4.4.	Tunnel cryogenic system design and integration with Main Linac	Design of the cryogenic system arrangement and components within the Main Linac tunnel includes cryogenic distribution design, segmentation, load-sharing, and maintenance scenarios, special 4K to 2K heat exchanger design, and liquid helium level control. Trade-off studies that compare cryomodule complexity and cost for cryogenic system loads.	(on hold, no effort foreseen)

Postponed tasks

1.4.5.	Oxygen deficiency hazard	Safety plan against oxygen deficiency hazard (ODH) in tunnel and surface building is investigated.	(on hold, no effort foreseen)
1.4.6	Cryogenics outside of the main linacs (e+/- sources, damping ring, RTML, BDS)	Cryogenics for e+, e- source linac, undulators, DR, BDS, RTML, and associated distribution and special objects, as unique and separate from Main Linac. The cryogenic engineering should be similar to that of the main linac system, with a smaller scale. These systems must be properly integrated into the ML cryogenics system.	(on hold, no effort foreseen)
1.4.7	Cold vacuum systems	The vacuum systems for thermal insulation in all cryogenics systems in ML, e+/- sources, BDS, RTML are designed in close cooperation with cryogenics system design. The vacuum system for beam pipe is designed as separate system, in this work package.	(on hold, no effort foreseen)

Summary: 2009 work packages

- 1.4.1 Heat loads
  - **Peterson (FNAL), Ohuchi (KEK), Pierini (INFN), Petersen* (DESY)**
- 1.4.2 Cryogenic process design, cryoplant design, and surface impact
  - **Klebaner (FNAL), Peterson (FNAL), Arenius (JLAB), Ganni (JLAB), Tavian* (CERN)**
  - **Jefferson Lab (Arenius, Ganni) will provide assistance**
- 1.4.3 Venting, pressure limits, and piping and vessel standards
  - **Peterson (FNAL), Nakai (KEK), Hosoyama (KEK), Petersen* (DESY)**
- 1.4.4 Tunnel cryogenic system design and integration with Main Linac
  - **Part of Project X cryogenic effort but relevant to ILC**
- * CERN and DESY effort involves primarily just provision of information from their work on XFEL and LHC.