

Abstract: ALICE is a prototype ERL accelerator that is being developed at STFC Daresbury laboratory UK. Recently it has successfully demonstrated the energy recovery technique by accelerating an electron beam to more than 30 MeV. A new superconducting linac cryomodule is being developed for the operation in CW mode with high average beam current. ALICE will be used as a test bed for this new cryomodule, which will utilise cold helium gas to cool the radiation shield, HOM absorbers and the thermal intercepts for the high power RF input couplers as opposed to liquid nitrogen. The additional cooling power required at 80 K and 5 K will be provided by COOL-IT (a system for cooling to intermediate temperatures). All these modifications would require new instrumentation for diagnostics and control of the additional cryogenic processes, which will be integrated with the existing Linde cryogenic control system for ALICE. In this poster we present an overview of the additional instrumentation requirement with associated integration scheme.



### **COOLING CIRCUITS SCHEMATIC**

- International cryomodule will use GHe • The instead of LN2 for 80-K cooling.
- In addition, cold helium at 5 K is required to cool the thermal intercepts of the RF couplers.
- A heat exchanger system "COOL-IT" has been developed by Daresbury to supply the above intermediate cooling temperatures to the module.
- Input via the main compressor at 300 K, 5-10 bar.
- Output are two streams of GHe at 5 K and 80 K.
- GHe streams returning from the cryomodule pre-
- cool the gas to about 90 K in HX3 and 6 K in HX2. After the process the GHe returns to the main Linde Cryo-plant helium recovery system at 300K.



- Factory acceptance tests have been undertaken to ensure the system operation and the vacuum integrity of components during cold cycling conditions.
- Final adjustments are currently underway in preparation for installation at Daresbury by the end of October 2009.

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# **INSTRUMENTATION AND CONTROL SYSTEM FOR THE INTERNATIONAL ERL CRYOMODULE**

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Schematic of the cryogenic system for ALICE, including COOL-IT. Components. Inside the blue shaded box are the part of existing Linde Cryo-system for ALICE. The heat-exchanger box, the transfer lines TLx and TLy are the components of COOL-IT.



The DAQ system employs EPICS 3.14.10 running on Scientific Linux PC. DAQ equipment is connected to the PC via USB – Serial converters or ADAM network based analogue signal conversion. EPICS Channel Archiver is used to record the cool down and allow future data analysis.

# **Accelerator Science and Technology Centre**

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The synoptic display uses a Microsoft .Net client application. The .Net app communicates via a .Net Channel Access interface. The .Net software for the client and Channel Access have been developed at Daresbury laboratory.



## **PROCESS CONTROL**

- All the critical locations in the system are monitored by several temperature sensors, pressure transmitters and cryogenic level sensors for diagnostic and control purposes.
- 100-ohm platinum RTDs for T> 50 K.
- A combination of Cernox, TVO, RhFe and CLTS for T<50 K.
- The existing ALICE instrumentation and control system for 2-K operation will be unchanged.
- An independent instrumentation system has been developed for the additional cooling processes.
- All the hardware will be accommodated in a single instrumentation rack located adjacent to the cryomodule.

**COOL-IT FACTORY ACCEPTANCE TEST**