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Workshop on Cryogenic Operations

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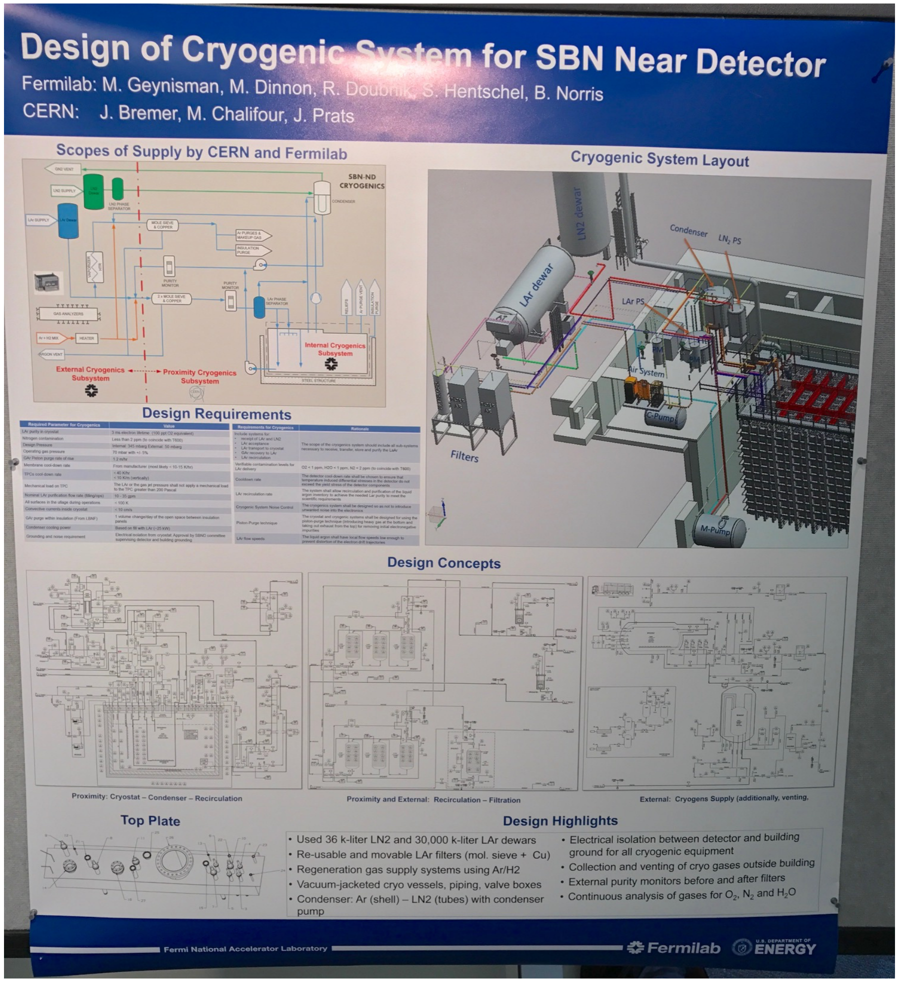
Poster Session II Summary

26 October 2016

List of Poster Session II Presenters

- *10. Design of Cryogenic System for SBN Near Detector*, Michael Geynisman (Fermilab)
- *11. Investigations of Purge and Cooldown Options for Liquid Argon Cryostats through CFD Analysis*, Erik Voirin (Fermilab)
- *12. Overview of the Long-Baseline Neutrino Facility cryogenic system,* David Montanari (Fermilab)
- *13. Overview of the cryogenic system for the ProtoDUNE Single Phase and Dual Phase prototypes at CERN*, Johan Bremer (CERN)
- *14. Low Energy RHIC electron Cooling (LEReC) 704MHz SRF cavity superfluid thermal analysis using ANSYS 17*, Paul Orfin (BNL)
- *15. Annual Maintenance of CHL2 Compressors*, Sasa Radovic (Jefferson Lab)

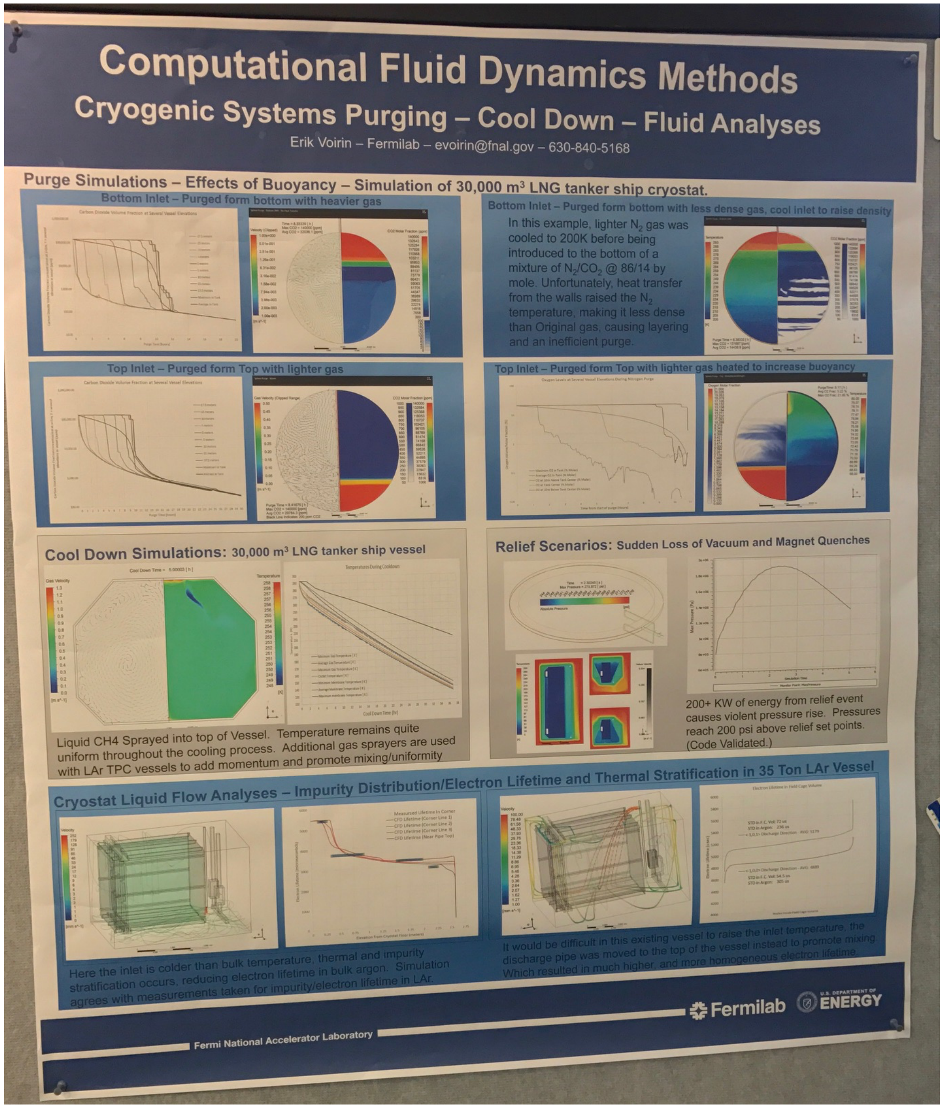
Poster #10 - Design of Cryogenic System for SBN Near Detector, Michael Geynisman



Notes

- Fermilab Short Baseline Neutrino Program (onsite)
- 260 ton LAr membrane cryostat
- LN2 dewar for refrigeration
- Tube/shell LN2/Ar HX
- LAr dewar for receiving LAr
- Regenerable and movable mole sieve and Cu filters to achieve < 100 ppt O2
- Commercial gas analyzers O2, N2, H2O
- Electron lifetime monitors
- Electrical isolation between all cryogenic services and physics detector

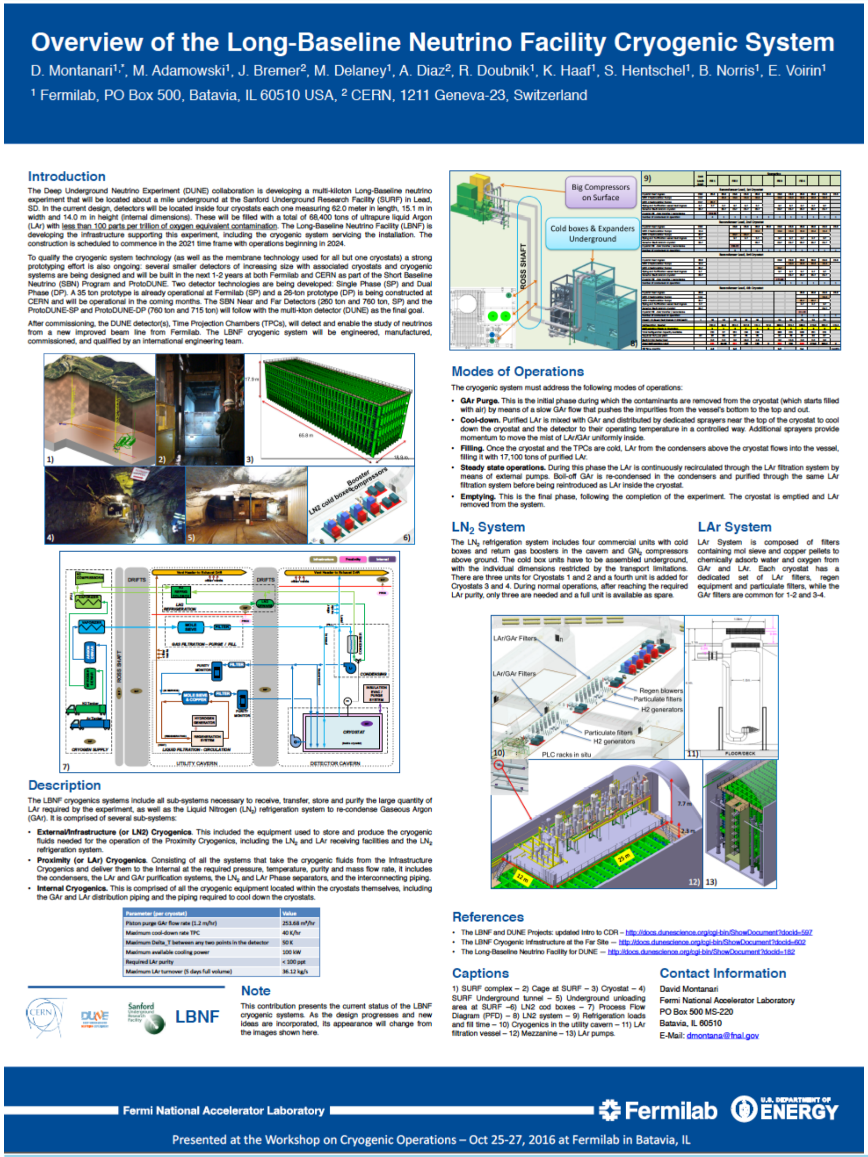
Poster 11 - Investigations of Purge and Cooldown Options for Liquid Argon Cryostats through CFD Analysis, Erik Voirin



Notes

- CFD analysis of many cryogenic processes
- Purging of large tanks to remove air (no evacuation)
- Dynamic simulation of pressure in piping during a quench and LOV for a LHe system
- Cool down of LAr membrane tanks with physics detectors
- Temperature distribution and stratification in liquid argon cryostats – verified by measurements

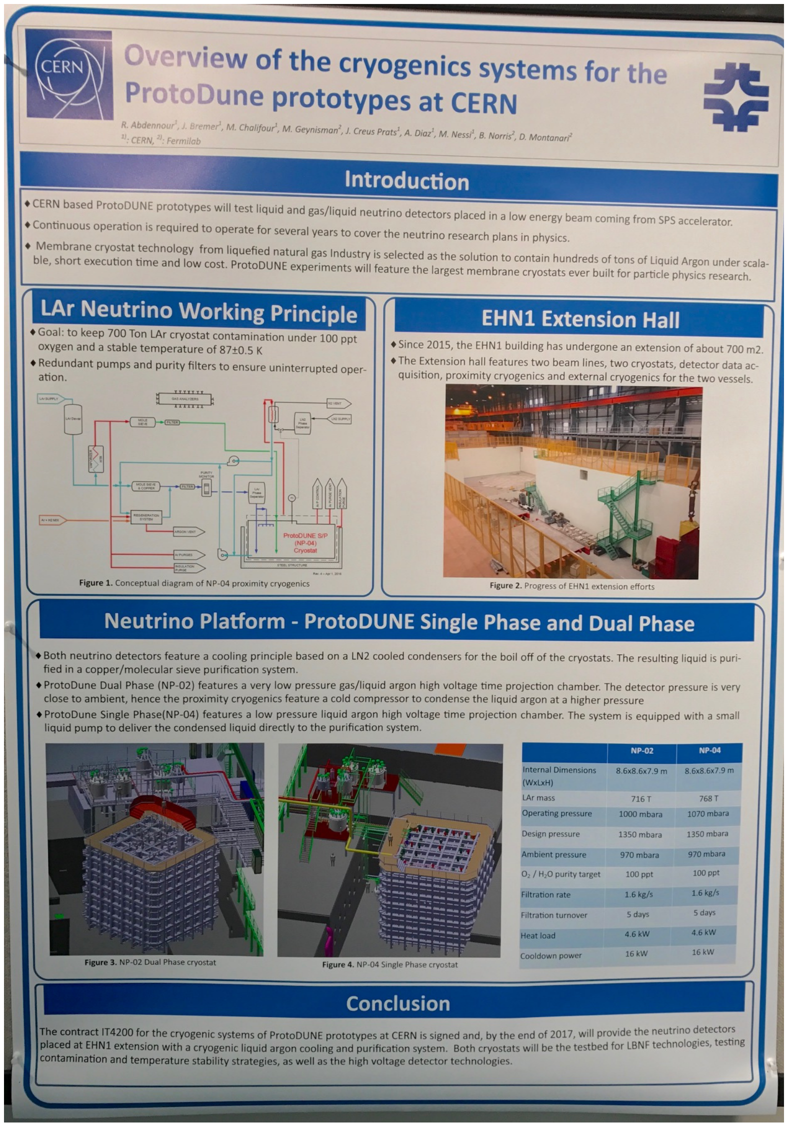
Poster 12 - Overview of the Long-Baseline Neutrino Facility cryogenic system, David Montanari



Notes

- Four very large liquid argon detector membrane cryostats
  - 1 mile underground
  - 15 m W x 14 m H x 62 m L (each!)
  - 68,400 tons of LAr (total)
  - Achieve <100 ppt purity
  - Major prototyping efforts at FNAL and CERN are underway
  - LAr purification
    - Mole sieve and copper catalyst
  - LN2 refrigeration
    - Surface compressors
    - Cavern coldboxes & return gas boosters
  - 2024 operation

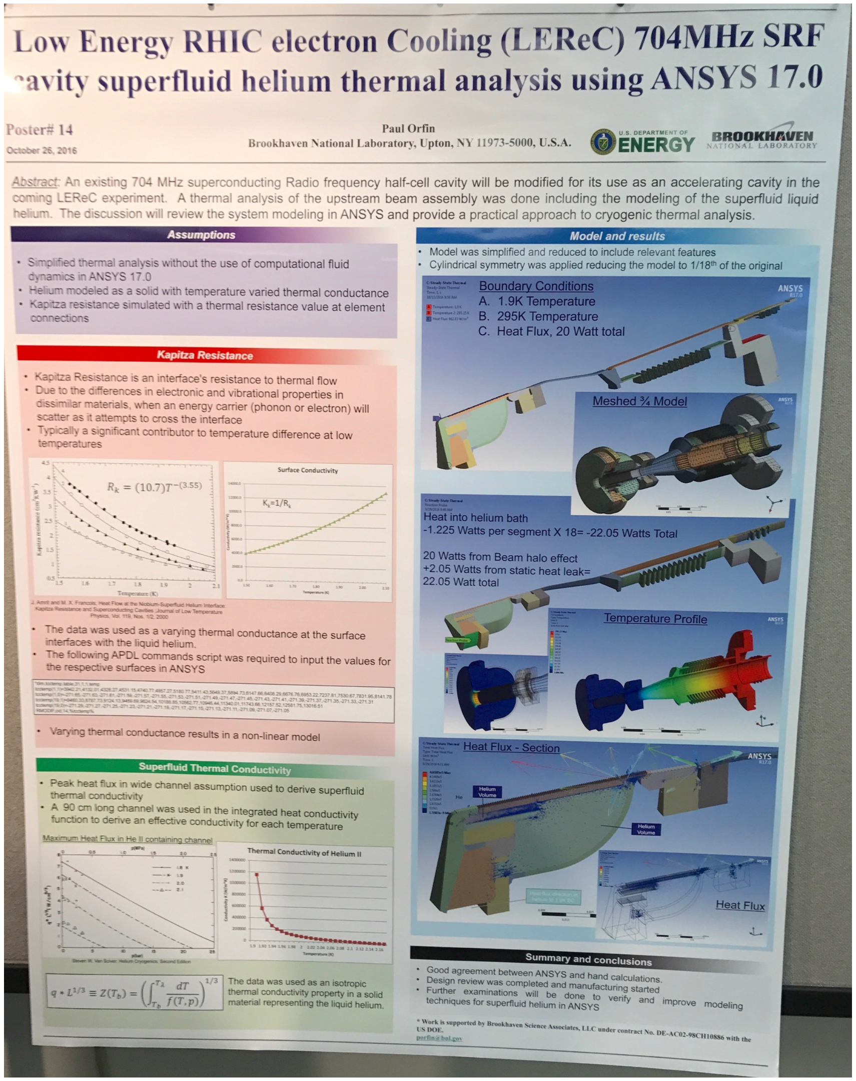
Poster 13 - Overview of the cryogenic system for the ProtoDUNE Single Phase and Dual Phase prototypes at CERN, Johan Bremer



Notes

- Two prototype membrane cryostats at CERN for the Long Baseline Neutrino Facility
- 700 tons LAr each
- Tank fabrication is underway
- 8.6 m W x 8.6 m L x 7.9 m L
- Testing two detector technologies
  - Single Phase
    - TPC contained in LAr
  - Dual Phase
    - TPC contained in LAr with gas phase detector
    - Requires tight liquid level control
- LN2 refrigeration
- Mole sieve and Cu filters to achieve < 100 ppt O2

Poster 14 - Low Energy RHIC electron Cooling (LEReC) 704MHz SRF cavity superfluid thermal analysis using ANSYS 17, Paul Orfin



Notes

- Super fluid thermal analysis of a SRF cavity
- Existing half cell cavity to be modified for the LEReC experiment
- ANSYS used to determine cavity temperature distribution while in a super fluid helium bath
- 20 W of beam heating and 2 W of ambient heat leak
- Helium modeled as a solid with k(T)
  - Avoids complications of CFD
- Kapitza resistance modeled at element connections
  - Significant at low temps when photons and electrons scatter at an interface

Poster 15 - Annual Maintenance of CHL2 Compressors –
Sasa Radovic

Notes
- Six compressor skids designed
- Four 800 hp and two 2,500 hp
- Annual maintenance schedule
- Electrical
  - Tighten all 4160VAC, 480VAC 120 VAC, 24 VDC connections
  - Check all wires for chaffing
  - Calibration check of instruments
  - Upgrades/replacements
  - Cleaning of vents/filters
- Mechanical
  - Alignment of motor couplings
  - Bearing inspection and replacements
  - Oil changes, regreasing
- Started in 2013