Cryogenic Options for ArgonCube

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Introduction

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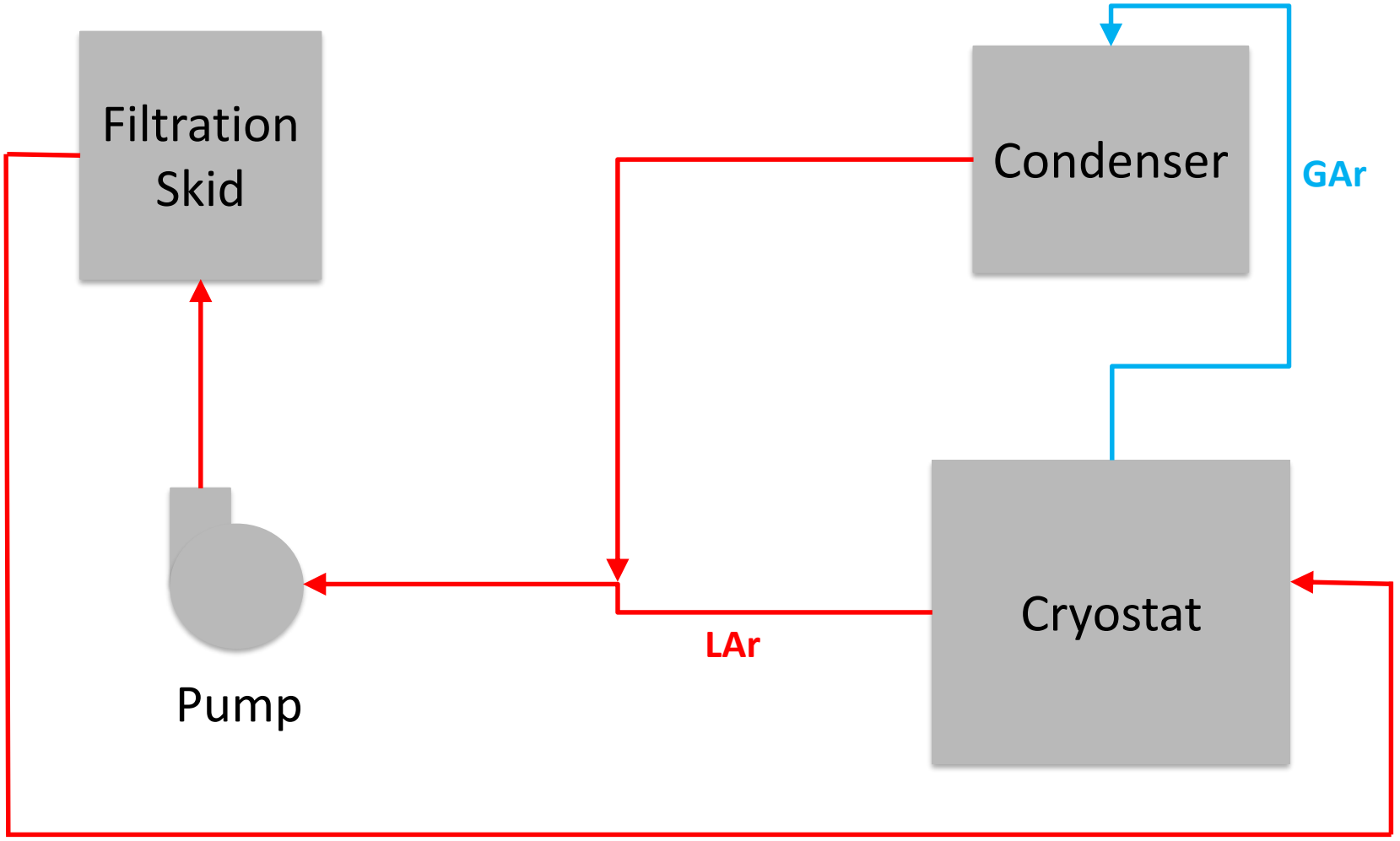
Outline

- FNAL Cryogenic Resources
- Current Simplified LAr Purification Method
- Our Understanding of Key Design Requirements
- Topics to Clarify
- DUNE Prism

FNAL Cryogenic Resources

1. Neutrino Division has a Technical Support Department
2. Subset of people from TSD has been allocated to contribute to ArgonCube
3. Experience with detector cryostats up to ~200 tons LAr

Current Simplified LAr Purification Method



Benefits of Current Filtration Method

1. Proven reliability
2. Carried lessons learned into future designs
3. Experience operating systems of this type
4. Potential cost savings in design phase

Our Understanding of Key Design Requirements

1. Ability to isolate a contaminated module
2. Minimal space between modules, no room for physical partition between
3. Neutrino beamline (need cryo/ODH infrastructure)
4. Liquid argon must be drained back into common bath before removing module
5. Need to follow FNAL safety requirements, poses potential issues with module removal/insertion
6. Any others? A complete list of all requirements is needed to work toward final design

Topics to Clarify

1. Frequency of removing modules
2. Draining and filling mechanism for each module
3. Maintaining purity of common LAr bath
4. Regenerating filters for each module
5. Insertion speed of warm module
6. Desired operating pressure
7. Personnel limitations

DUNE Prism

- Cryostat Experience:
  - FNAL has utilized a membrane cryostat (35 ton)
  - Designing larger membrane cryostat for SBND
- Cryostat Options:
  1. Continuous movement
     - Assumes one set of cryo equipment that moves with the detector
     - No need to disconnect cryo equipment
     - Will create challenge for cryogenic utilities such as cooling
     - Likely the most costly option
  2. Specified Positions
     - Alternative to option #1 if the desired rate cannot be achieved
  3. 35m-long cryostat
     - Low-radiation length wall would need support