

# ***Cryogenic Improvements for the ATLAS Energy Upgrade***

*Cryogenic Operations Workshop  
May 9-11, 2006*

*Presented by Steve MacDonald*

***Argonne National Laboratory***



A U.S. Department of Energy  
Office of Science Laboratory  
Operated by The University of Chicago



# ***Presentation Overview***

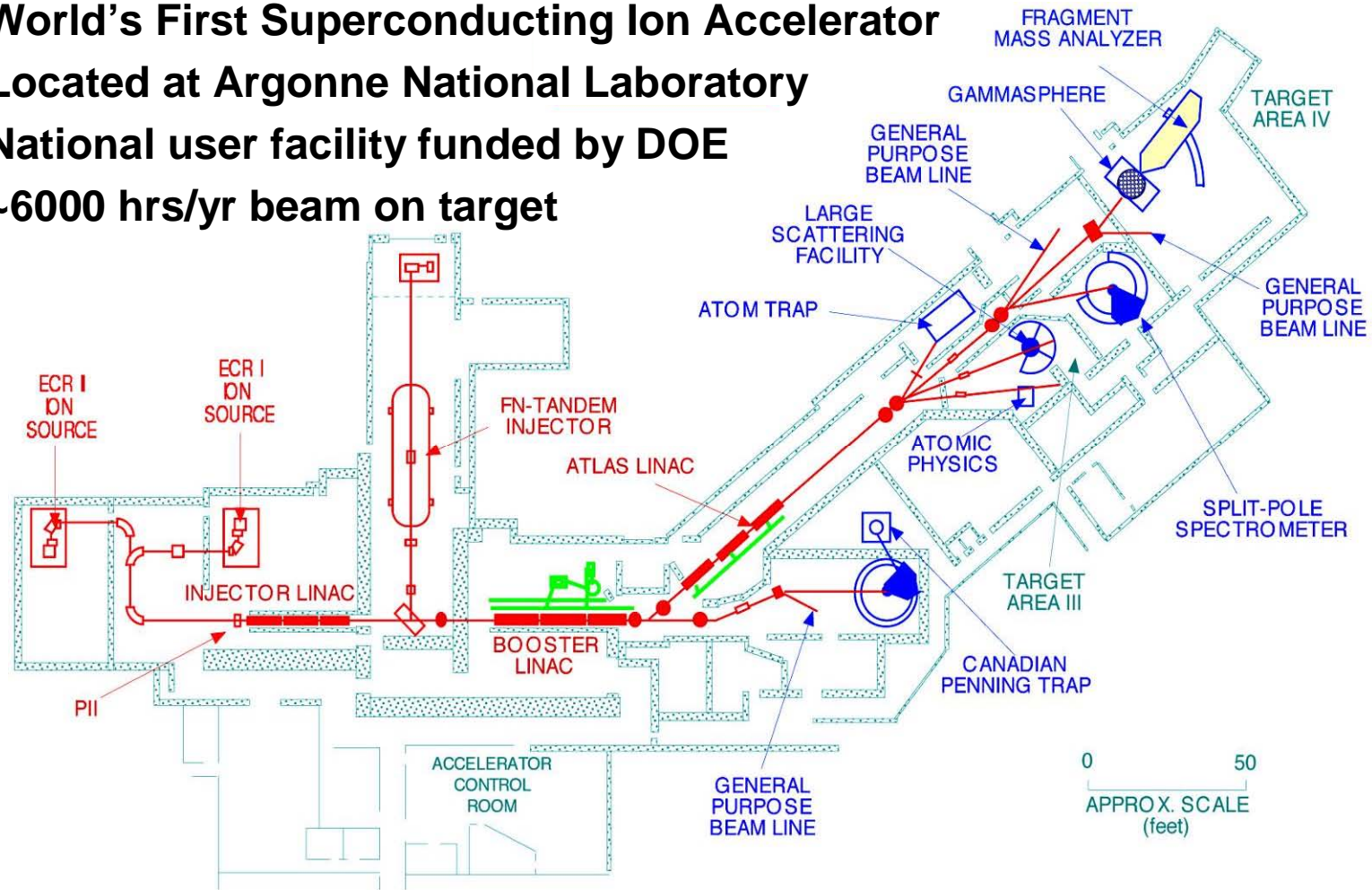
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- **ATLAS Overview**
- **Cryogenic System Staged Construction**
- **Energy Upgrade**
- **Refrigerator Installation Project**
- **Expected Benefits**
- **Questions**



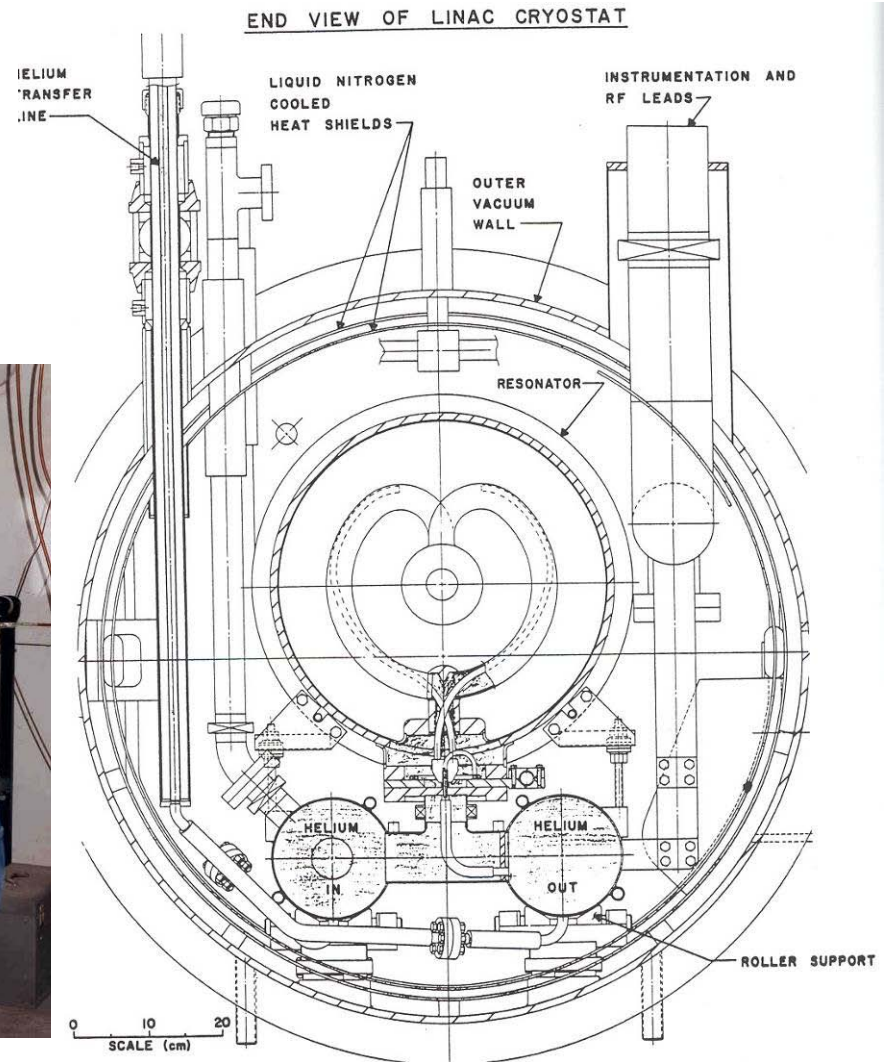
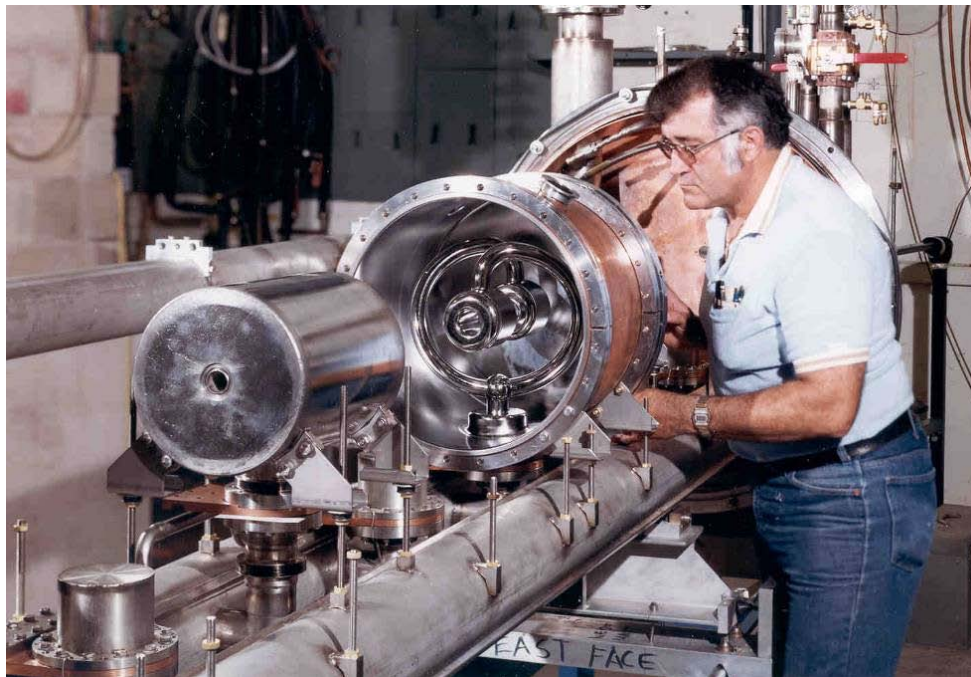
# ATLAS Facility Overview

- Argonne Tandem Linear Accelerating System (ATLAS)
- World's First Superconducting Ion Accelerator
- Located at Argonne National Laboratory
- National user facility funded by DOE
- ~6000 hrs/yr beam on target



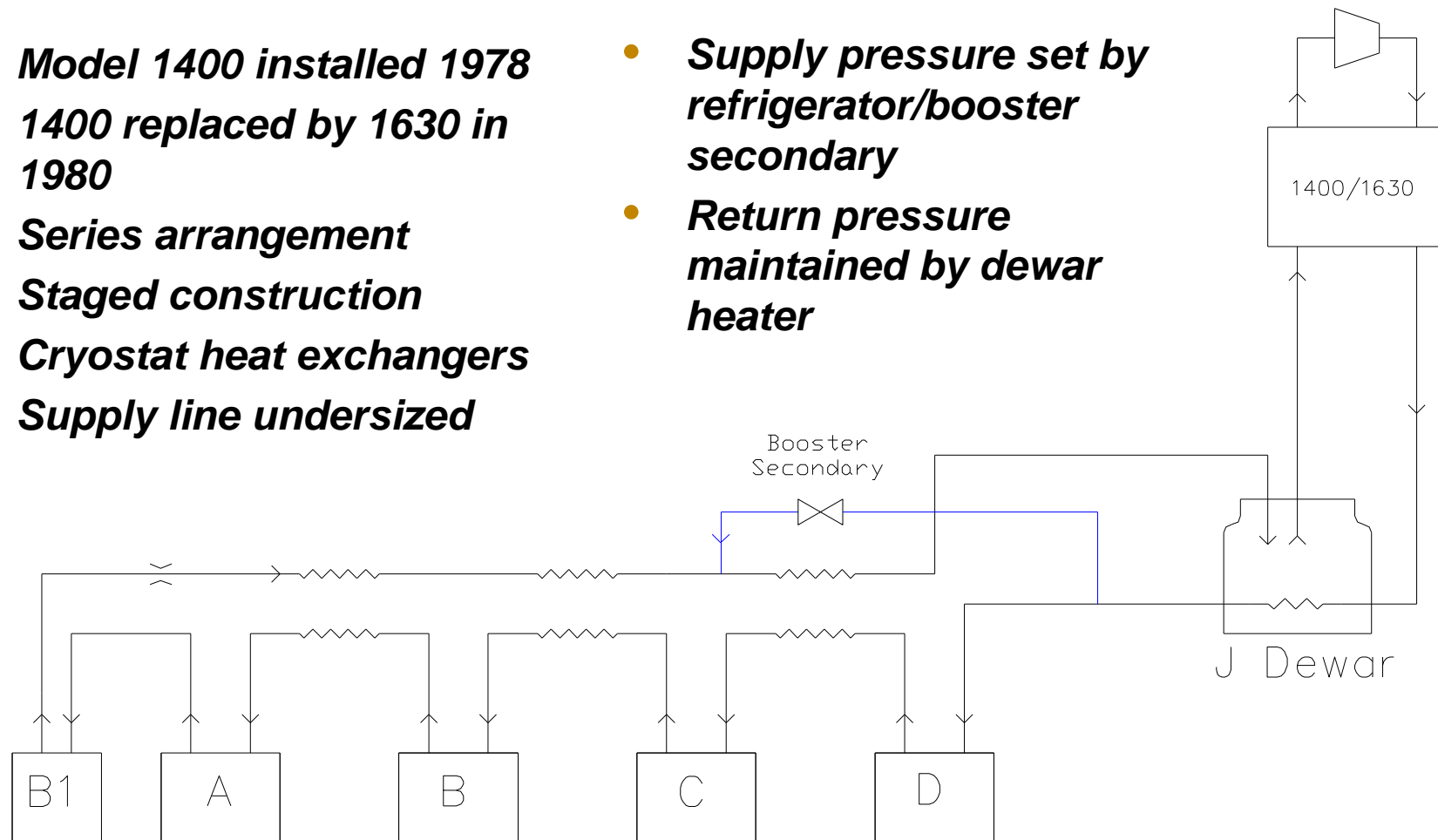
# Split Ring Type Superconducting RF Cavities

- 47 Total
- 12 Cryostats
  - 7 Accelerating, 6 cavities each
  - 5 Bunchers, 1 cavity each



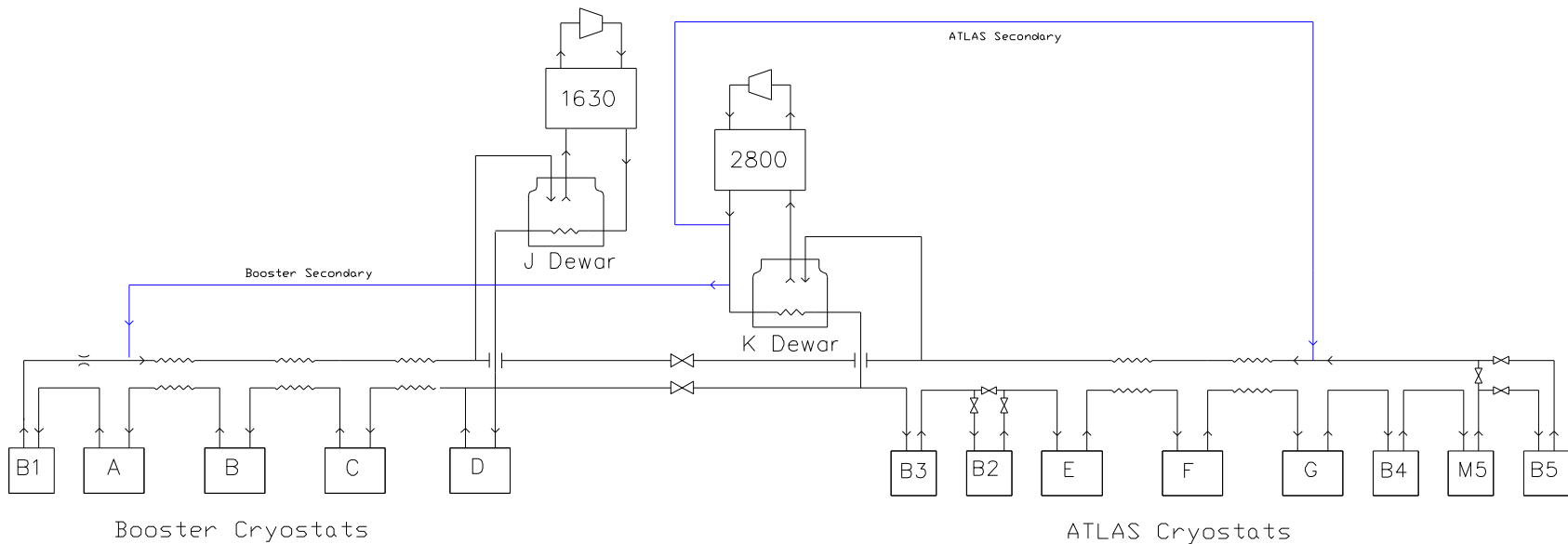
# Original LHe Flow Schematic

- **Model 1400 installed 1978**
- **1400 replaced by 1630 in 1980**
- **Series arrangement**
- **Staged construction**
- **Cryostat heat exchangers**
- **Supply line undersized**
- **Supply pressure set by refrigerator/booster secondary**
- **Return pressure maintained by dewar heater**

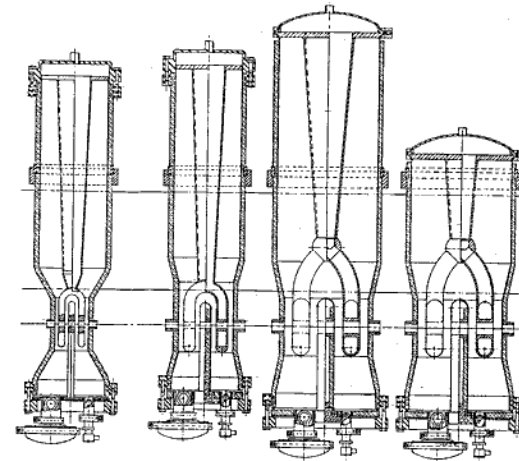


# ATLAS Section Dedicated 1985

- Added 300 watt CTI model 2800
- Increased supply line size
- Need for cross-connect
- Higher pressure in Booster
- Dewar level control
  - Requires ~30 watts excess
  - Susceptible to load changes



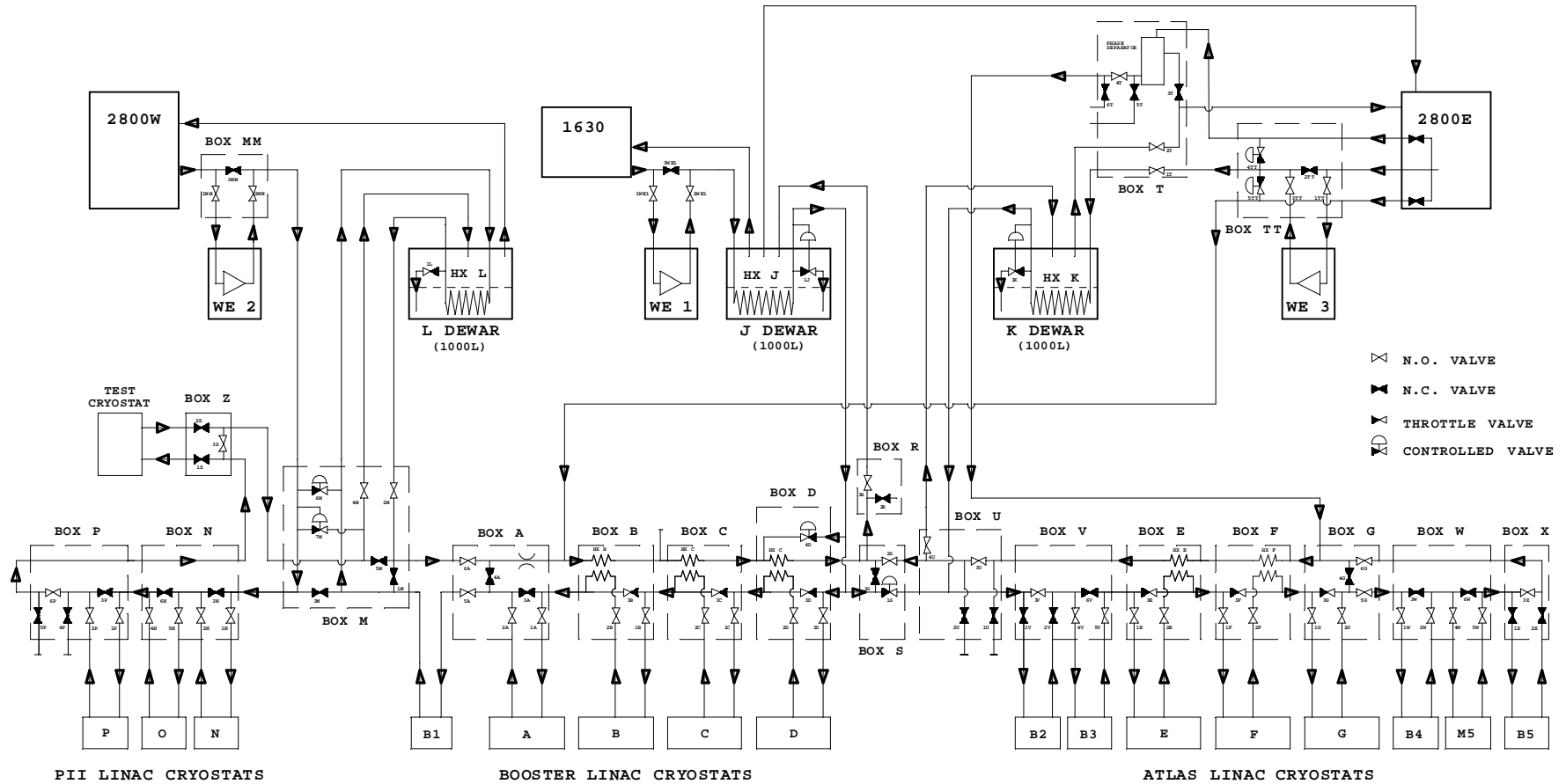
# Positive Ion Injector (PII) Cryostats and Cavities 1992



- 3 Cryostats 6 Cavities Each
- Gravity fed



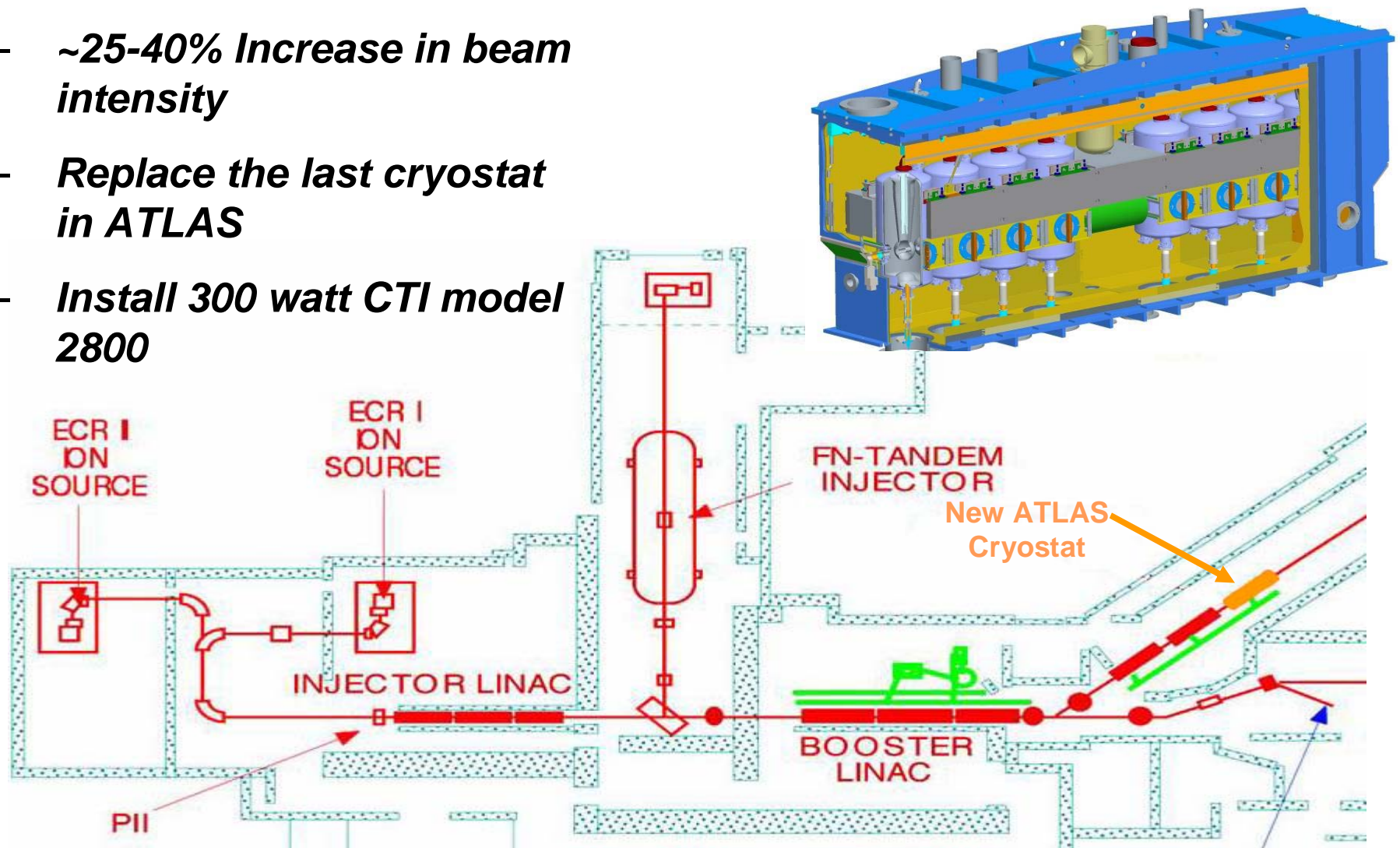
# Current ATLAS LHe Flow Schematic



J.R. Specht  
 1/15/96  
 REV 1: 09/03/03  
 File #  
 ATALSHE2.VC6

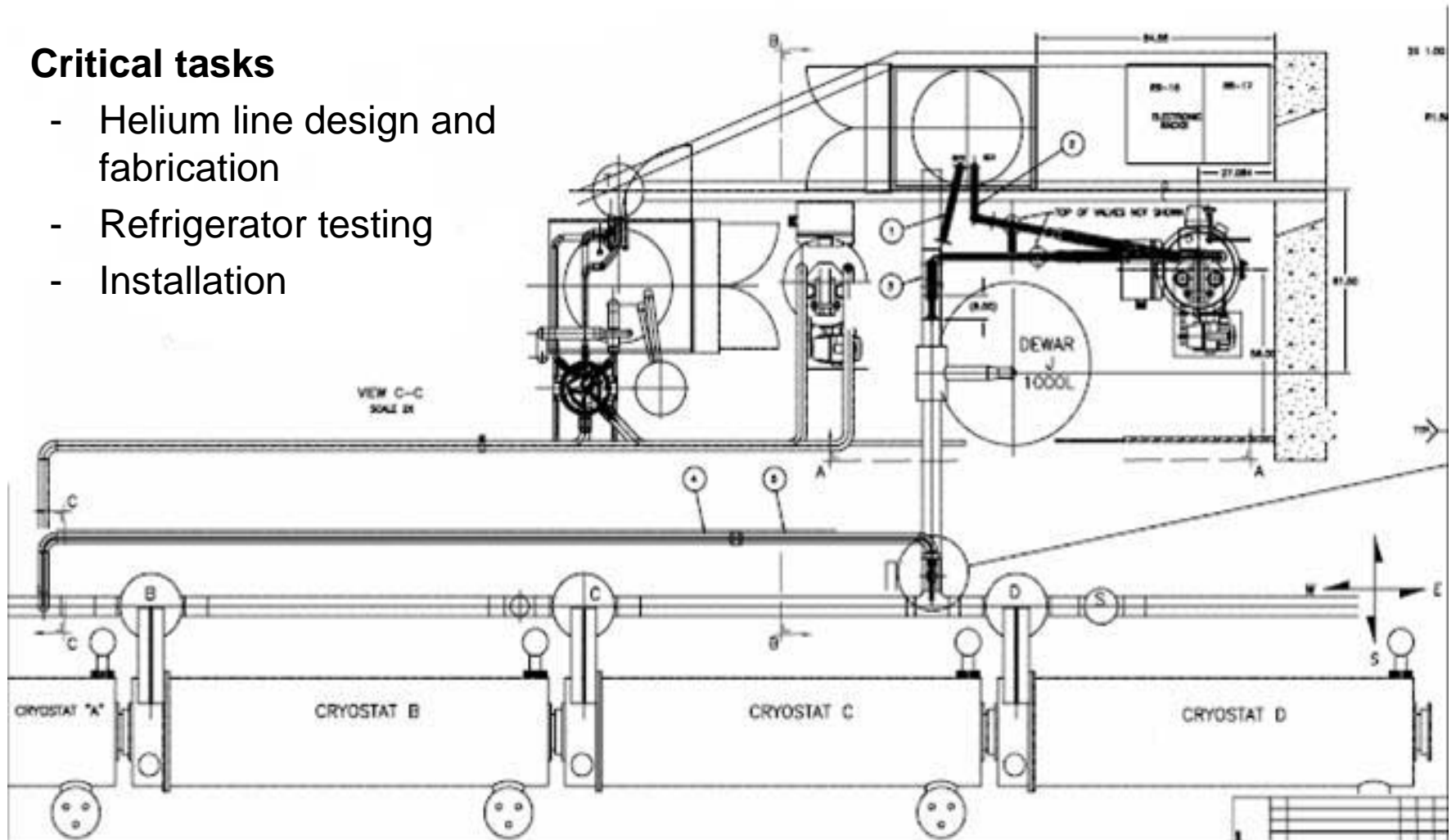
# ATLAS Energy Upgrade

- *~25-40% Increase in beam intensity*
- *Replace the last cryostat in ATLAS*
- *Install 300 watt CTI model 2800*



# 2800 Installation

- **Critical tasks**
  - Helium line design and fabrication
  - Refrigerator testing
  - Installation



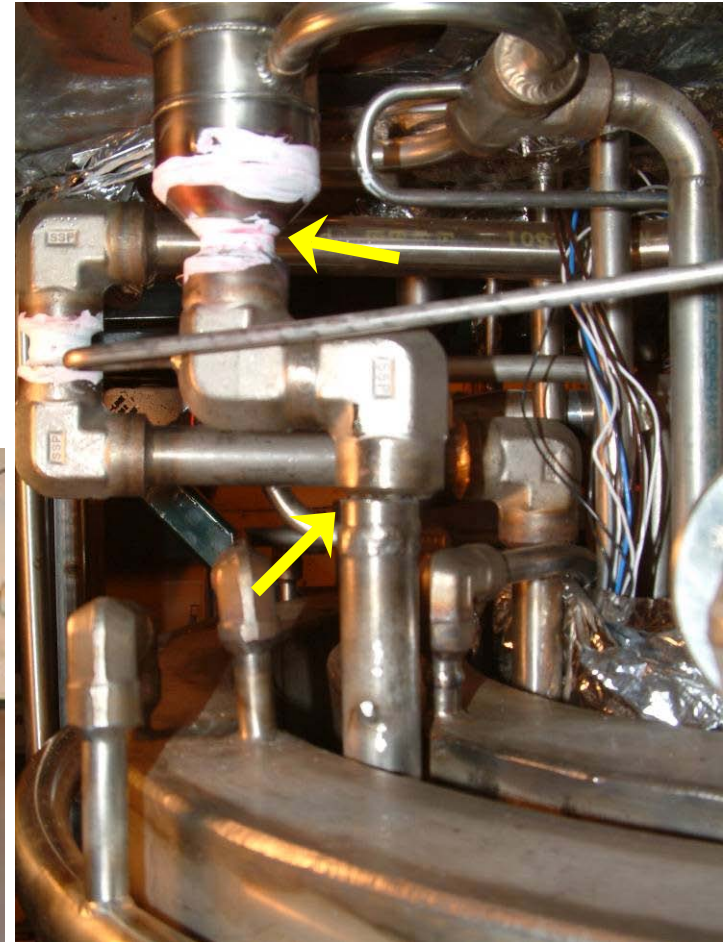
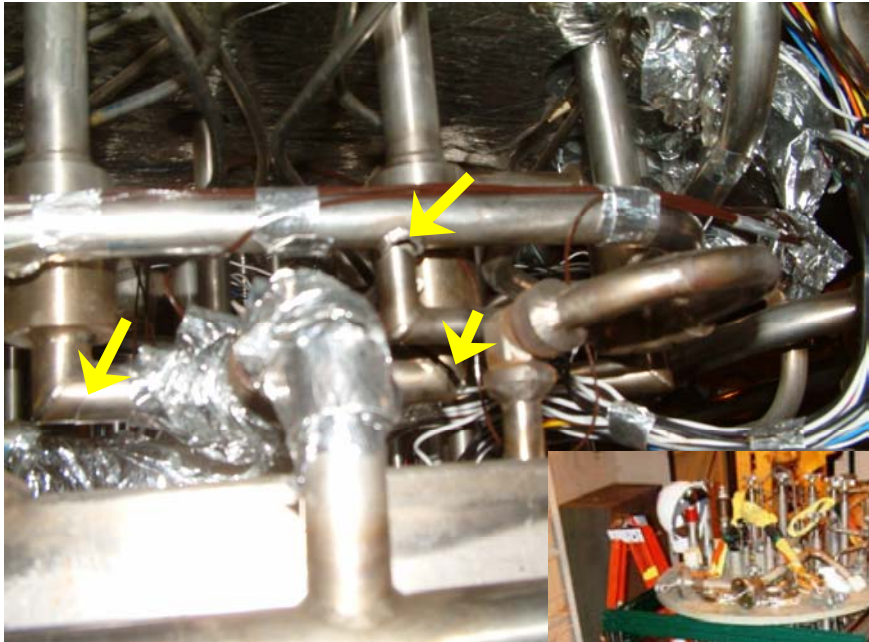
# 2800 Center Test

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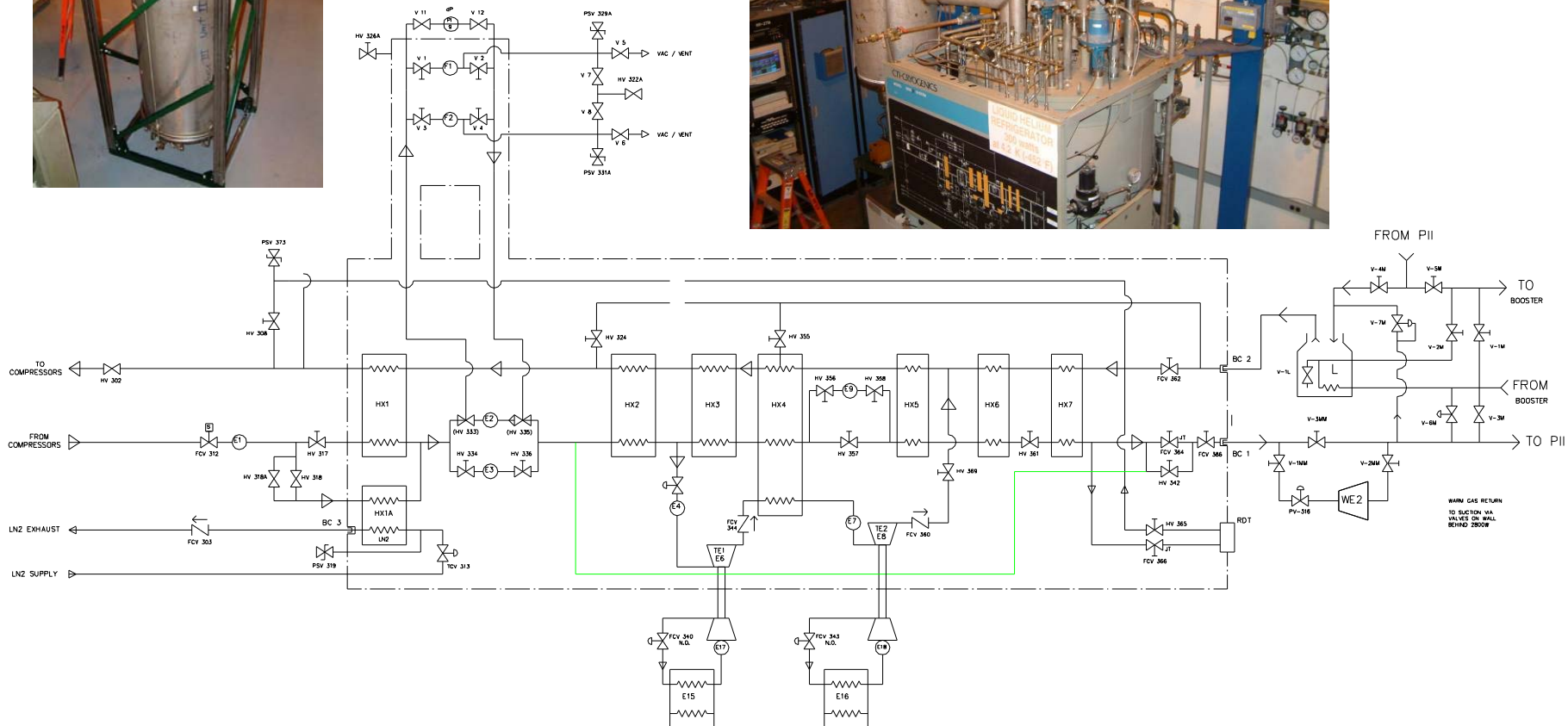
- Last operated in late 90's
- Test the repair of shipment damage/modification
- 80 K trap differential pressure
- Control system operation
- Capacity check
- Equipment
  - Existing spare compressors
  - RDT Transfer line
  - 250 Liter portable dewar w/heater

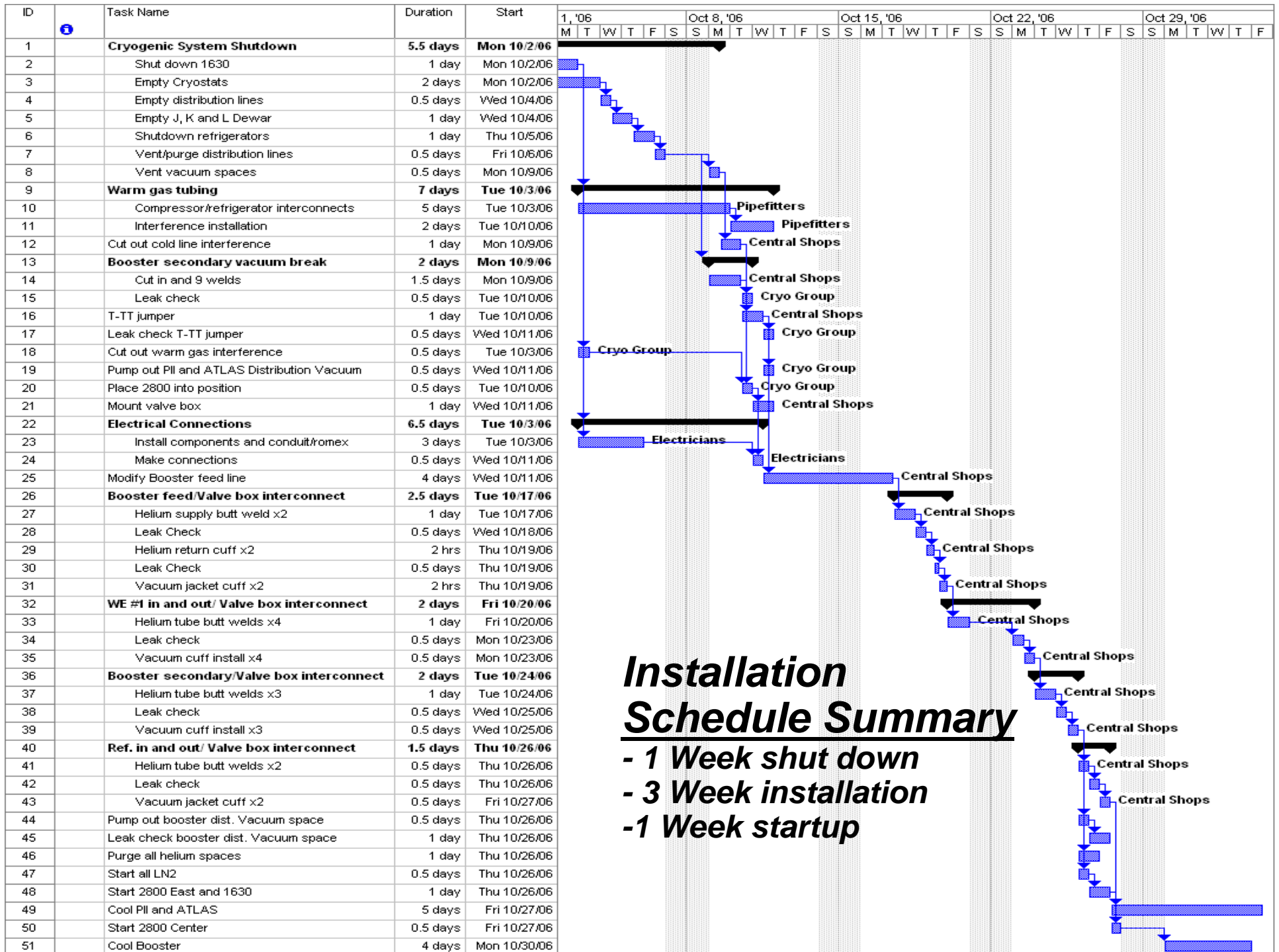


# 2800 Damage



# 2800 West Flow Schematic





## Installation Schedule Summary

- 1 Week shut down
- 3 Week installation
- 1 Week startup

# Benefits

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- **Provide capacity for new cryostat**
- **Add stability and decrease operating costs**
  - Increase operating margin ~10%
  - Abandon dewar level control
    - *Half of the cryo group call-ins*
  - 1630 is highest maintenance item
    - *~20% of cryogenic budget/yr*
    - *Shut down every 4-6 months as opposed to 18 months*
- **Easier to shutdown 2800 East**
- **Run 2-3 cryostats with 2800 East down**
- **Vacuum break**



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