



# AIP Review: Linac Klystron Modulator Safety and Reliability Upgrade (67-28)

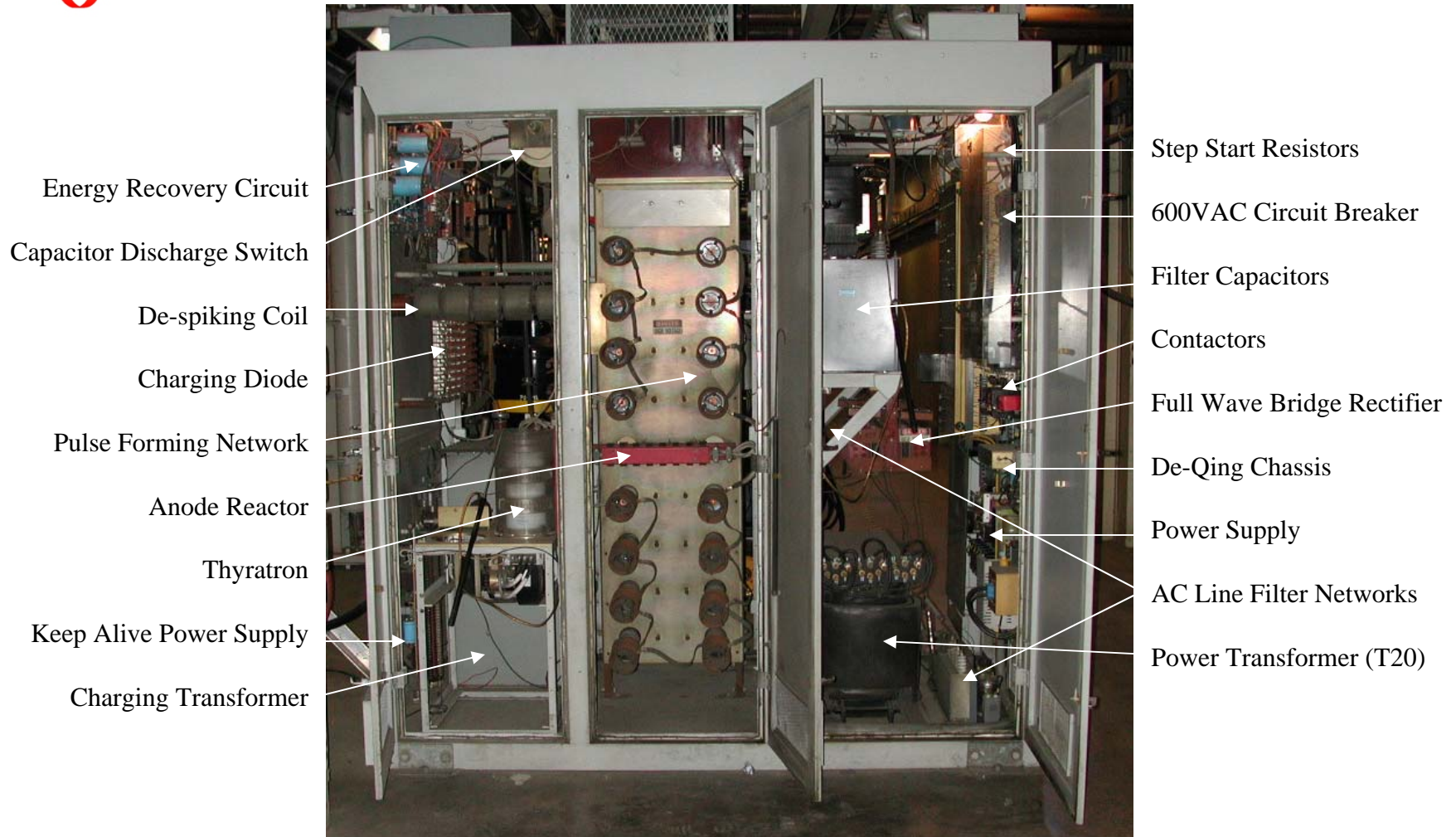
C. Burkhart  
Power Conversion Department  
October 31, 2007



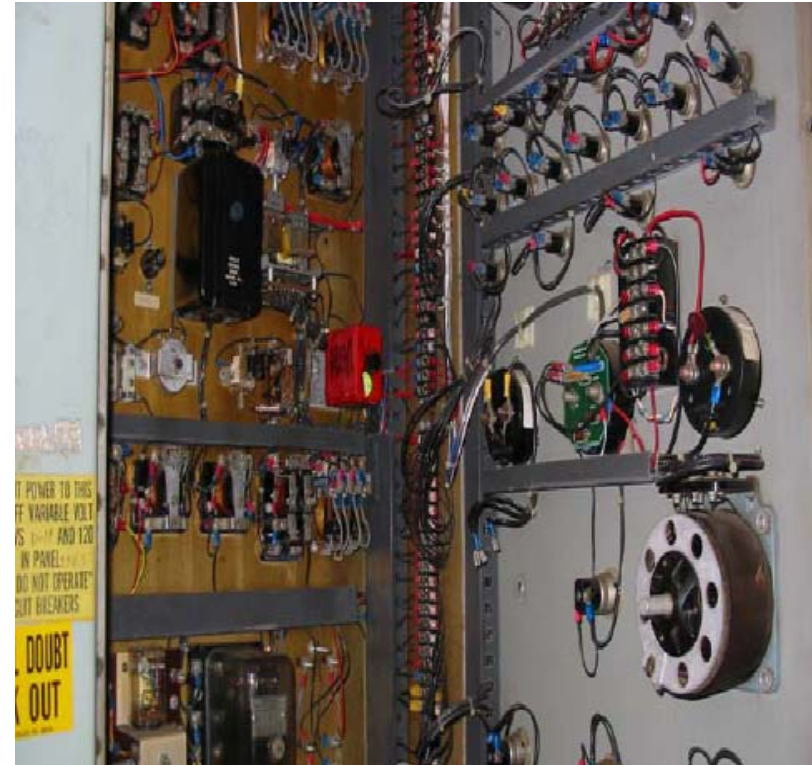
# Project Overview

- Scope of AIP
  - Implement safety & reliability upgrades to Sector 28 klystron modulators
- Review
  - 6575 Modulator Safety & Reliability Issues
  - Description of Upgrades
  - Budgetary Costing
  - Schedule
  - Project Team

# 6575 Modulator

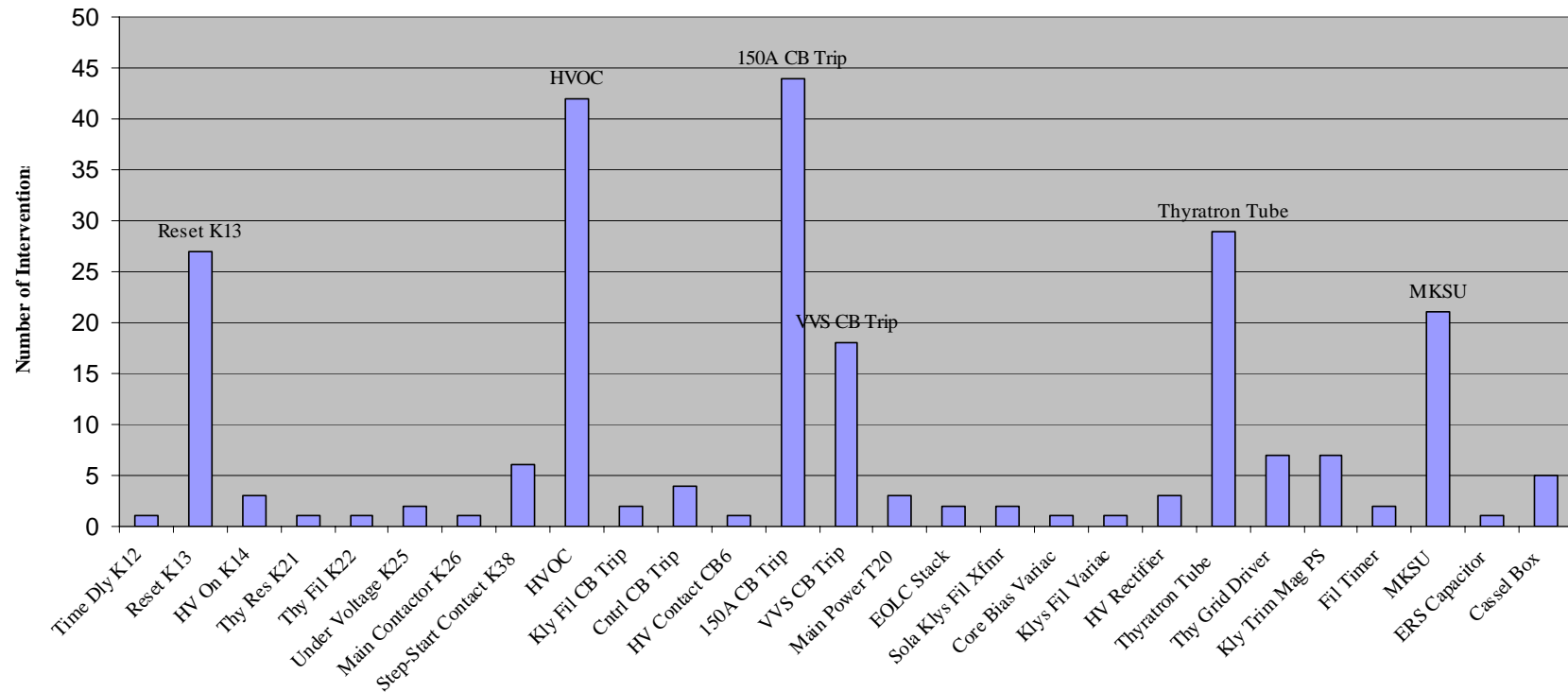


# Modulator Controls



# Reliability & Safety Issues

**Distribution of Linac Modulator Interventions between  
March 2005 and February 2007**





**Power Conversion**

*Solutions for Challenging Problems*

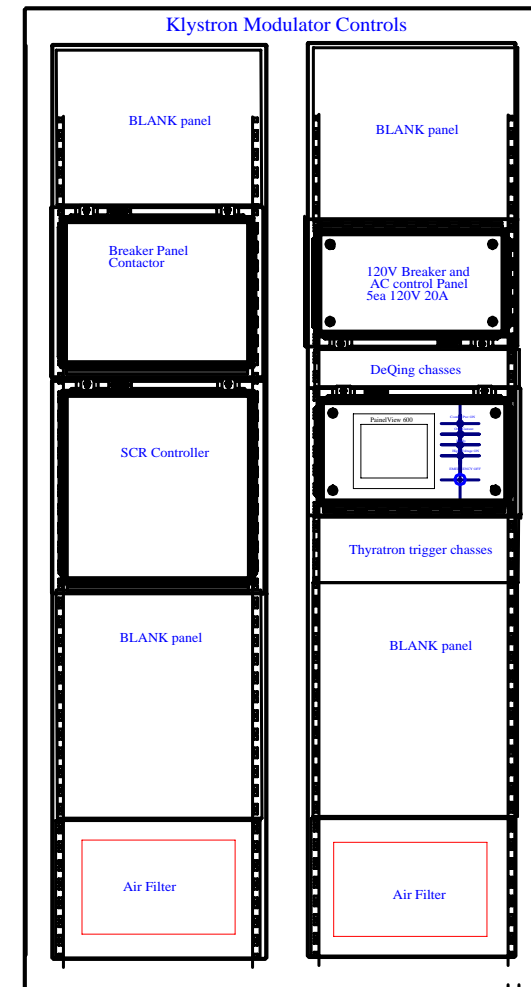
# Safety & Reliability Upgrades

- Implement primary SCR phase control for soft start, fast turn-off, and voltage/current regulation
- Rewire and redesign OC trip circuit
- Replace relay control system (120 VAC) with PLC (24 V)
- Replace heater & bias supplies with regulated AC controllers
- Replace de-Q'ing chassis
- Segregate 600 VAC & controls from 25 kV supply
- Rewire and redesign HV current & voltage metering
- Replace 25 kV bleeder resistors
- Replace HV rectifier diode stack (tentative)



# Upgraded Modulator Layout

- 600 VAC breaker/contactor
- 600 VAC SCR controller
- 120 VAC breaker & supplies
- De-Qing chassis
- Control PLC
- Thyatron trigger chassis
- All systems enclosed & front panel accessible



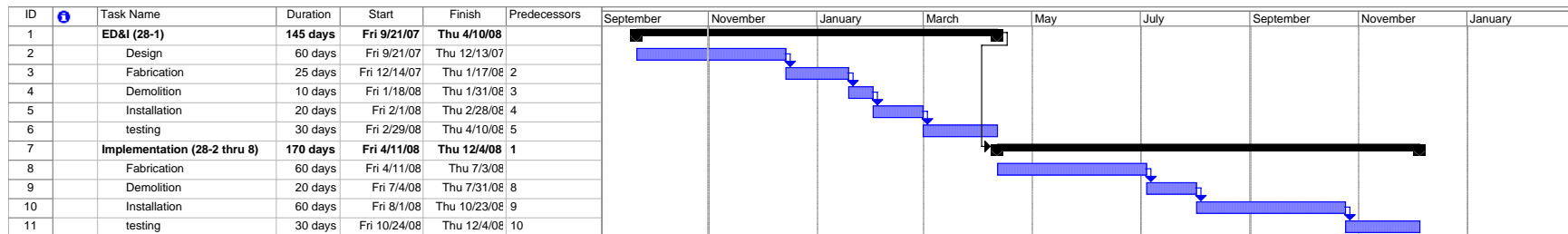


# Budgetary Costing

- ED&I (Upgrade 28-1) \$94k
  - EE (0.2), Co-ord (0.2), Tech (0.2) \$74k
  - M&S: \$20k
- Implementation on 28-2 thru 8 \$186k
  - EE (0.05), Co-ord (0.06), Tech (0.8) \$106k
  - M&S \$80k
  - add \$80k (\$56k M&S, \$24k labor, loaded) for diode
- Contingency \$88k
- Burden \$73k
- Total \$441k



# Initial Schedule





# Project Team

- Project Manager: Paul Stiles
- Engineering Design: Richard Cassel  
Minh Nguyen
- Co-ordinator: PCD Eng Services
- Technicians: PEM  
PCD Fab Shop