TARGETRY RESEARCH AND DEVELOPMENT CAPABILITIES

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at the

MECO Collaboration Meeting

Brookhaven National Laboratory

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BROOKHAVEN NATIONAL LABORATORY

Recent Accelerator Experiment Activities

- APT (E-945A)
  - 1-2 GeV protons, high intensity
  - radiation damage in Cu and W metals
  - liquid helium temperature
- PRAD (E-945B/933/955)
  - 24 GeV protons, low intensity
  - thermal response of cryogenic structures
  - secondary radiation effects
- Muon Collider (E-951)
  - 24 GeV protons, high intensity
  - beam interactions with mercury jet
  - beam interactions with carbon target

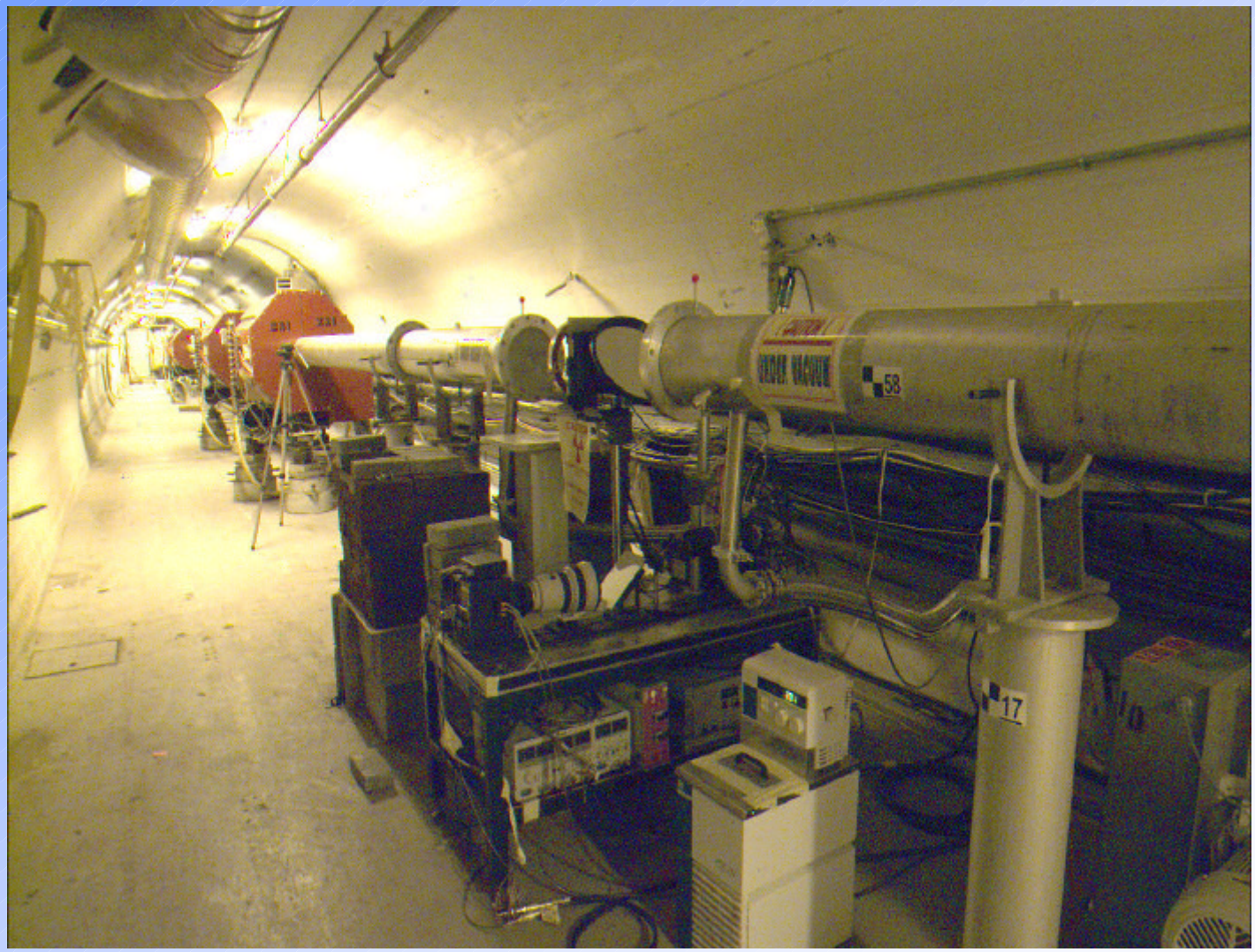
Experimental Laboratory Facilities

- Three experimental laboratories in Building 703
  - high-temperature laboratory
  - radiation laboratory
  - cryogenic/vacuum
- Fully-equipped machine shop
  - milling machines, lathes, other equipment
  - good stock of materials
- Electronics shop
  - computer data acquisition systems
  - Lab View, Test Point, Work Bench
  - well-stocked measurement and test equipment

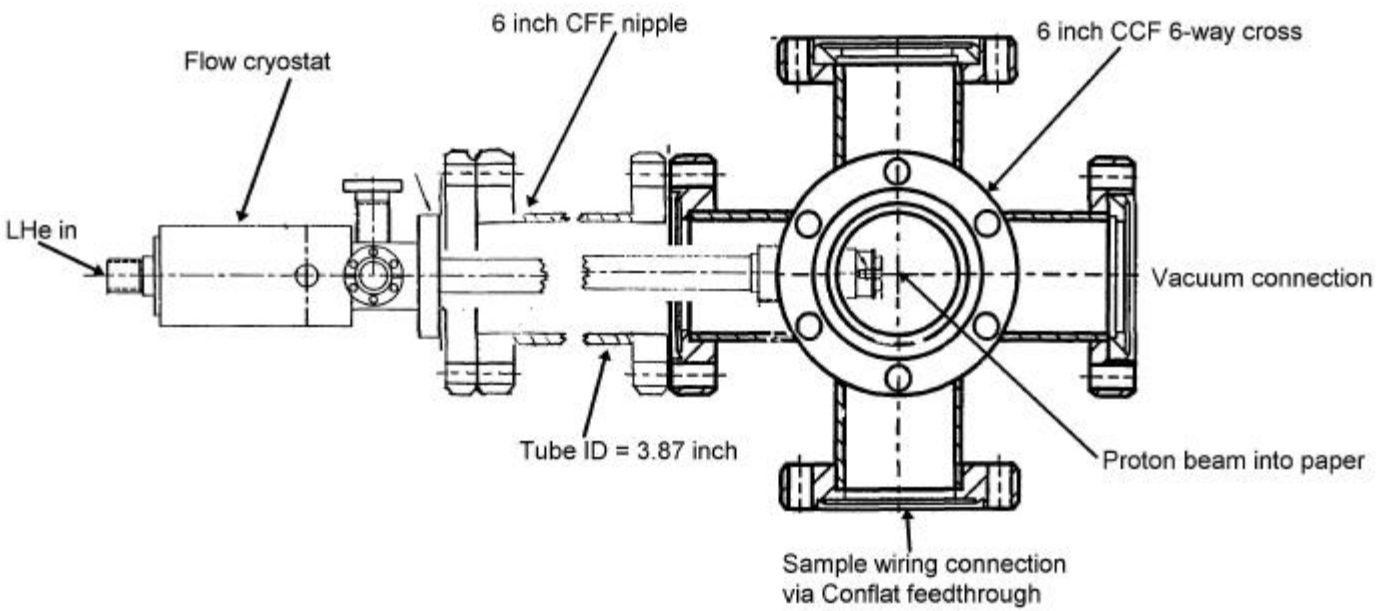
Engineering Capabilities

- Experienced in AGS operations and experiments
- Nuclear and mechanical engineering analysis capabilities
- Precision laboratory-scale experiments
- Design, fabrication, assembly of one-of-a-kind experiments
- Specialty engineering data acquisition and control
- Engineering instrumentation and calibration

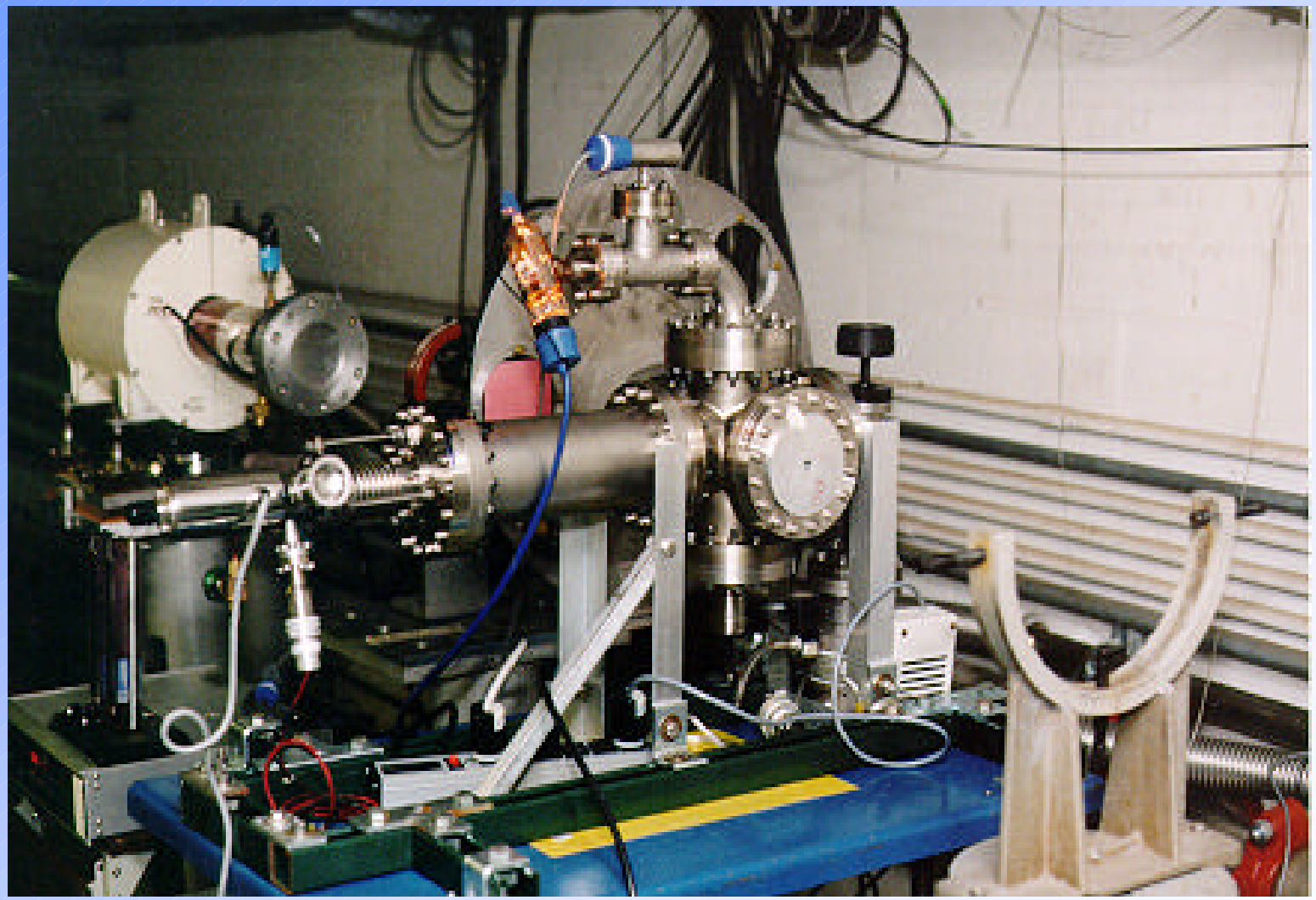
Perspective View Down the AGS U-Line



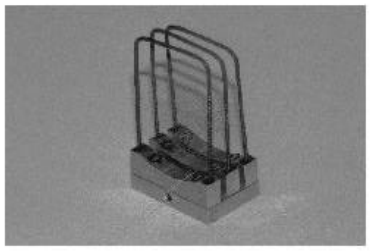
Radiation Effects Vacuum Cryostat Assembly

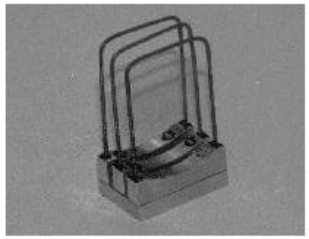


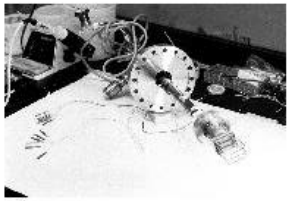
Photograph of Vacuum Cryostat Assembly

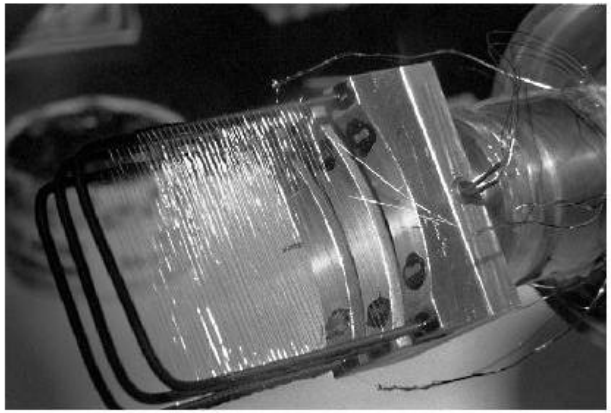


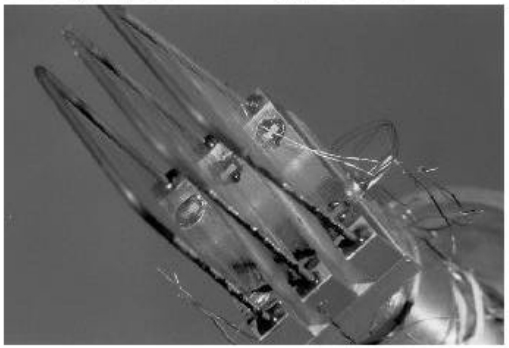
Collage From Radiation Damage: E-945A



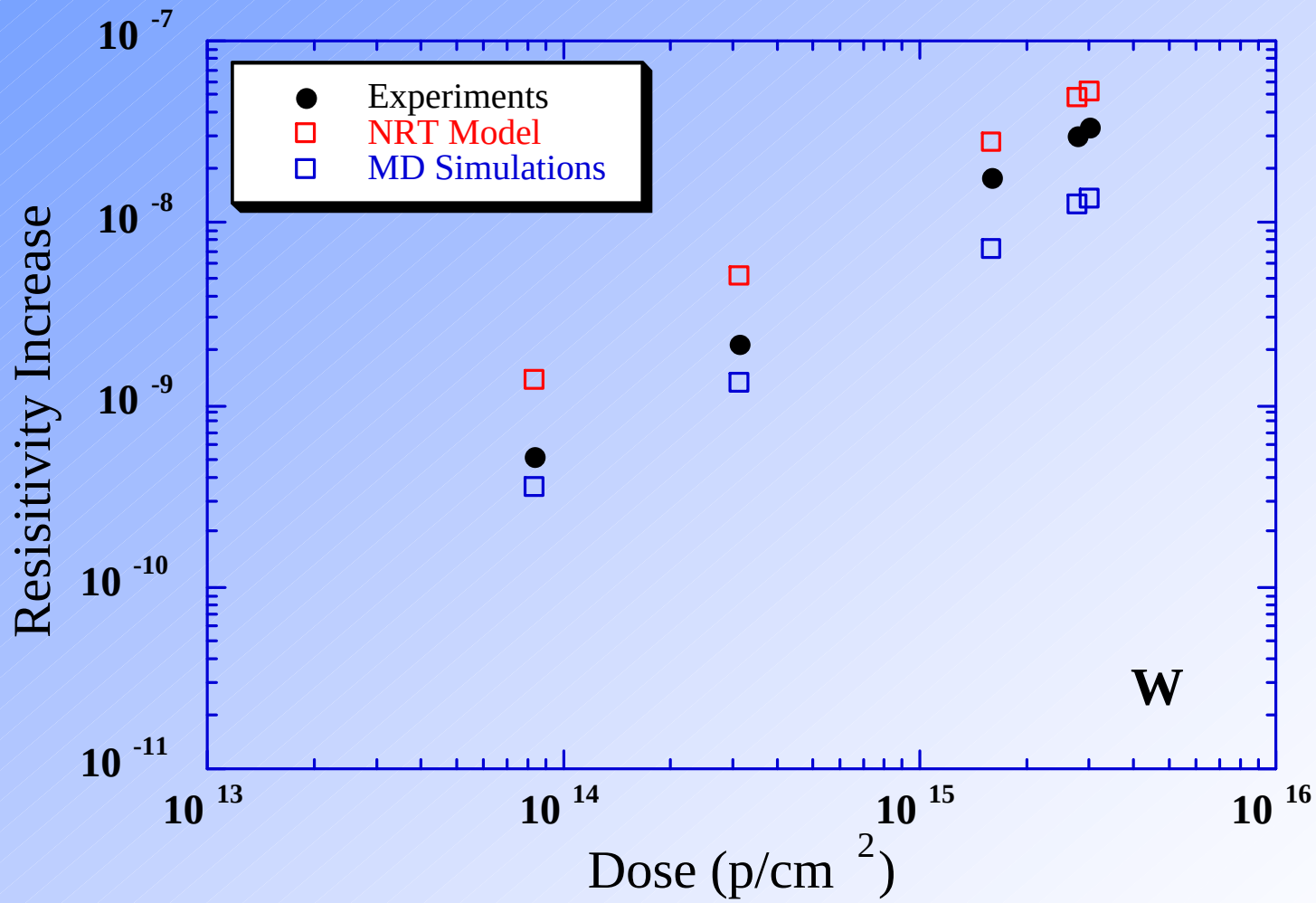




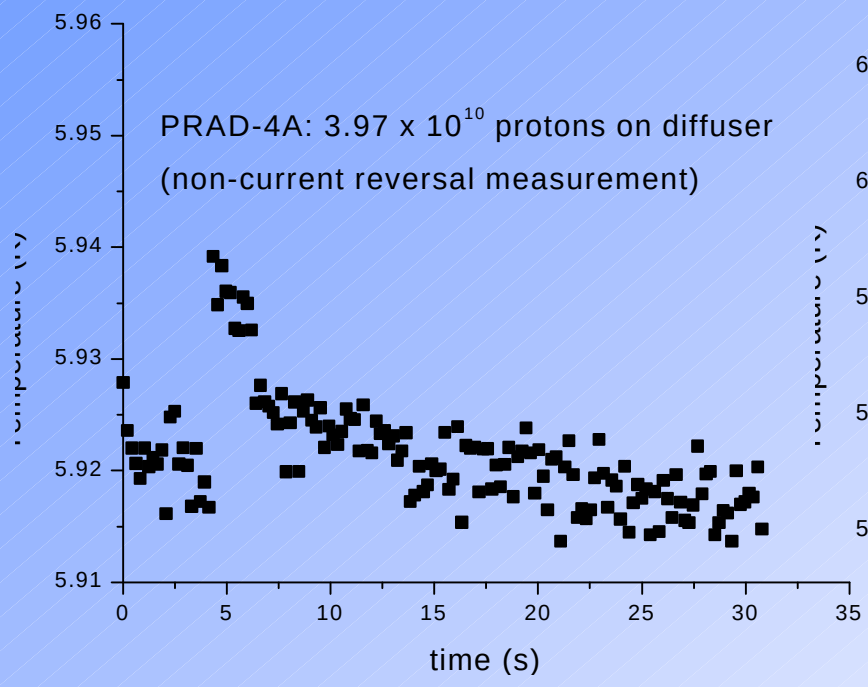


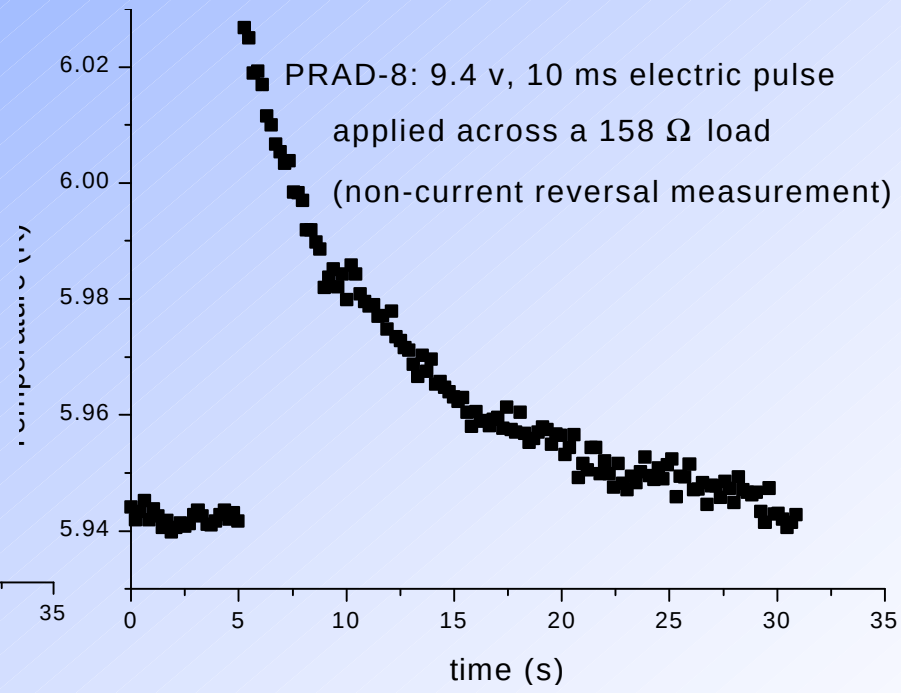


Radiation Damage in Tungsten

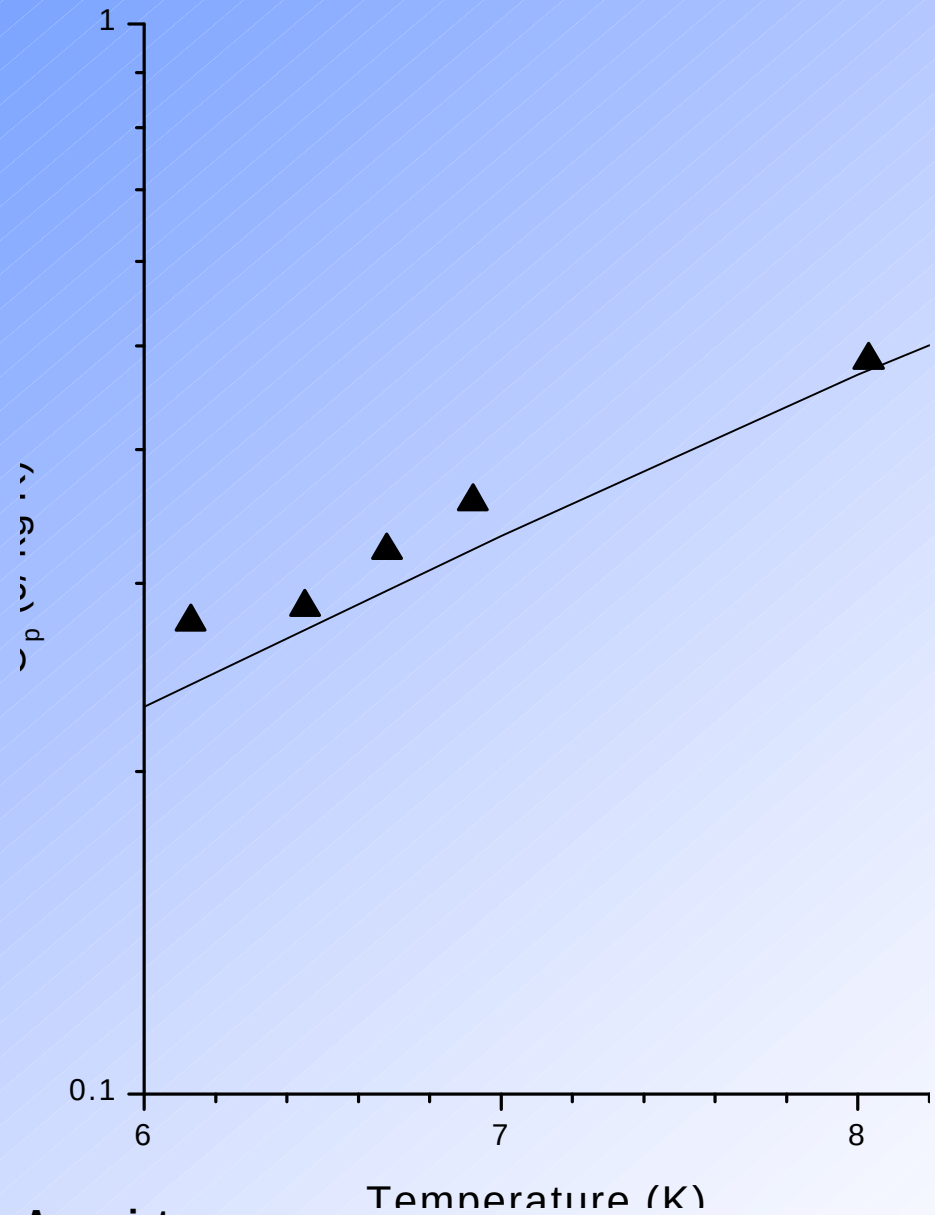


Typical Thermal Transient Due to Proton Pulse and Electric Pulse

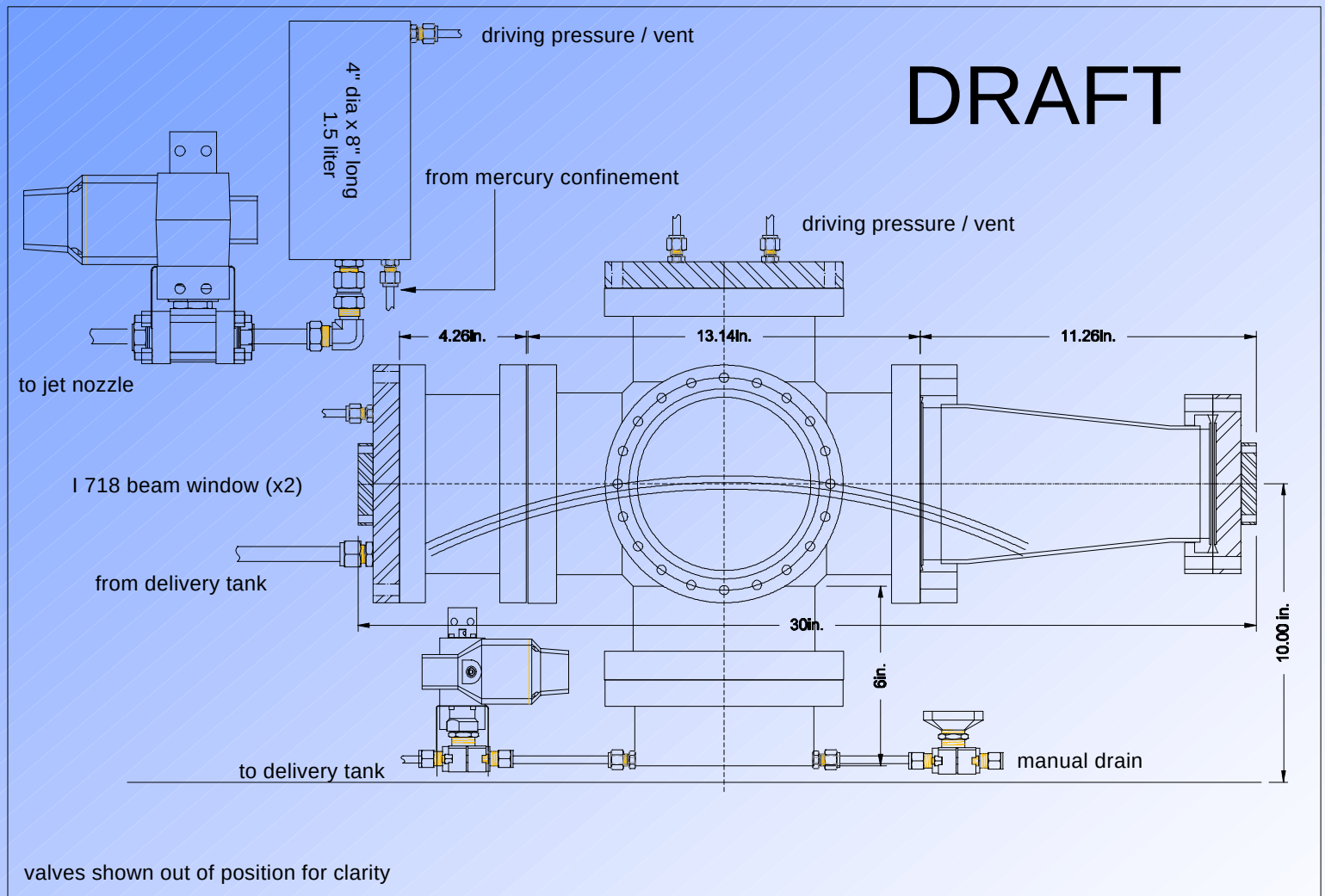




Specific Heat of OFHC Copper: 6K to 8K

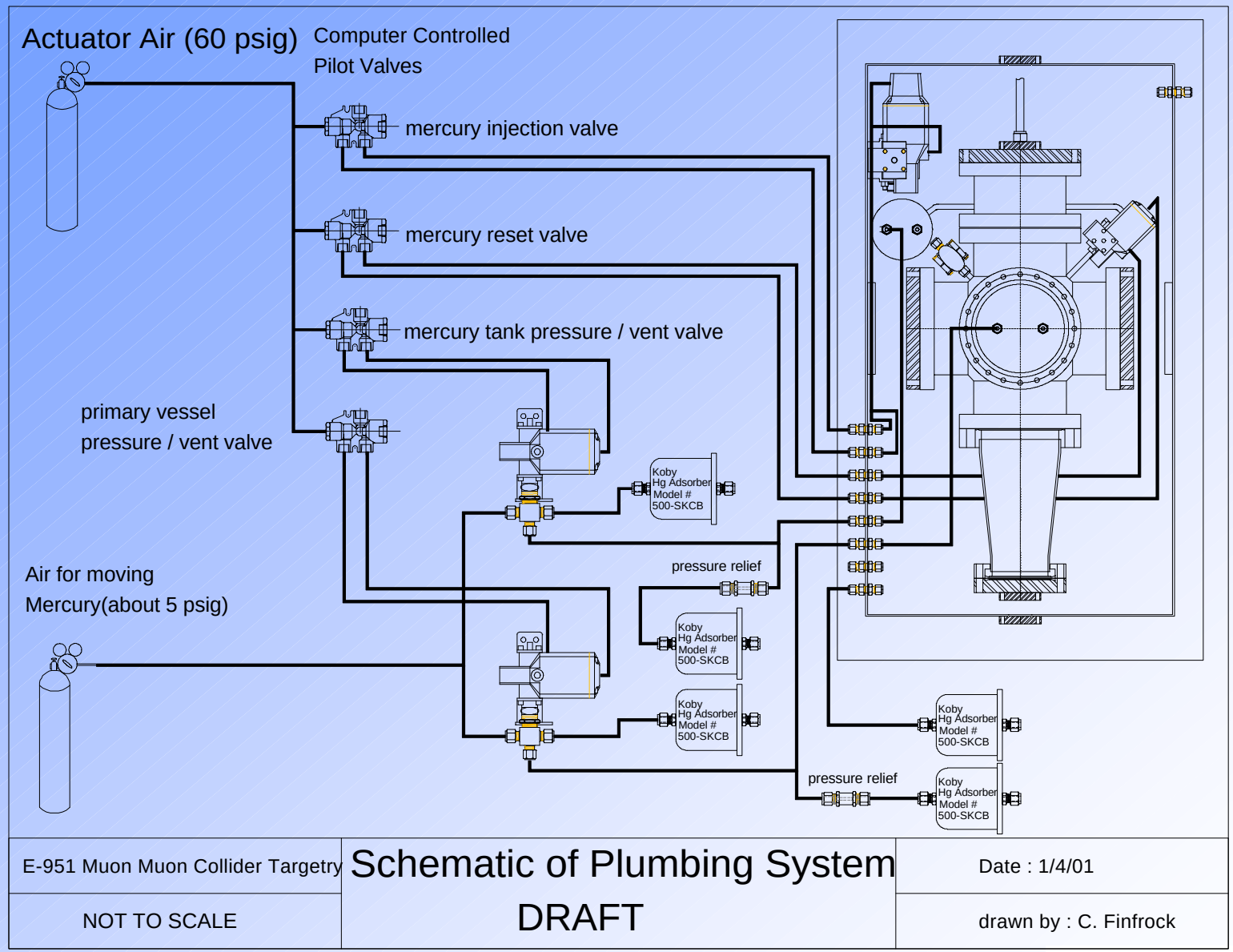


E-951 Mercury Jet Target and Confinement



E-951 Muon Muon Collider Targetry	Mercury Jet	Date : 12/01/00 Revised: 12/19/00
projectile trajectory from left to right	Internal Confinement V	drawn by : C. Finfrock

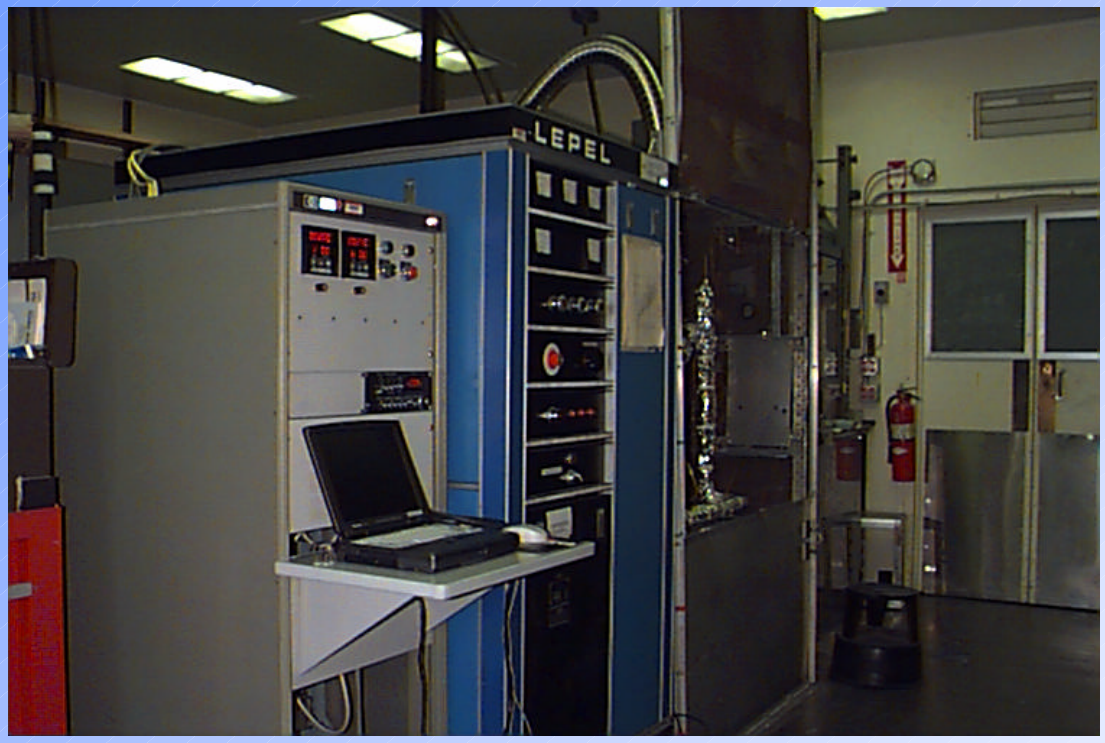
Pneumatic Control System for E-951 Mercury Jet Target

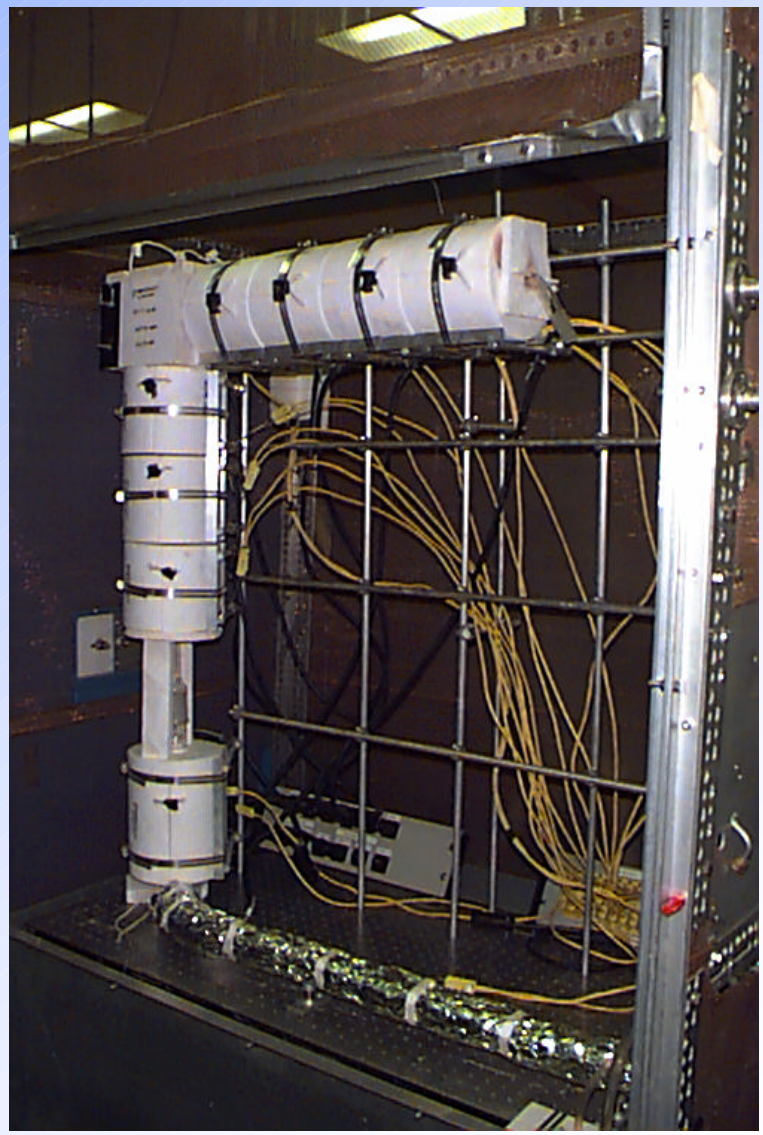


Isotopic Activation (Ci) of Mercury by 24 GeV/c Protons and Two-Month Decay

isotope	irradiation time		decay time							
	0 s	1 month	1 min	1 hr	12 hr	1 day	1 week	2 weeks	1 month	2 months
hg183	0.00E+00	1.08E-02	9.57E-05	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00
hg184	0.00E+00	1.57E-01	4.02E-02	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00
hg185	0.00E+00	3.24E-01	1.39E-01	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00
hg186	0.00E+00	1.12E+00	6.87E-01	1.00E-13	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00
hg187	0.00E+00	1.81E+00	1.37E+00	5.53E-08	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00
hg188	0.00E+00	3.90E+00	3.17E+00	3.55E-03	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00
hg189	0.00E+00	5.34E+00	4.91E+00	2.32E-02	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00
hg190	0.00E+00	1.04E+01	1.01E+01	1.32E+00	1.54E-10	2.23E-21	0.00E+00	0.00E+00	0.00E+00	0.00E+00
hg191	0.00E+00	1.29E+01	1.28E+01	5.55E+00	2.57E-04	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00
hg192	0.00E+00	1.38E+01	1.37E+01	1.20E+01	2.50E+00	4.52E-01	5.47E-10	6.01E-22	0.00E+00	0.00E+00
hg193	0.00E+00	2.43E+01	2.42E+01	2.06E+01	2.79E+00	3.13E-01	8.81E-09	2.28E-12	2.05E-21	0.00E+00
hg193m	0.00E+00	1.27E-03	1.27E-03	1.20E-03	6.30E-04	3.11E-04	7.86E-08	2.80E-11	1.74E-20	0.00E+00
hg194	**0.00E+00**	**3.97E-03**	**3.97E-03**	**3.97E-03**	**3.97E-03**	**3.97E-03**	**3.97E-03**	**3.97E-03**	**3.97E-03**	**3.97E-03**
hg195	0.00E+00	5.05E+01	5.04E+01	4.75E+01	2.24E+01	9.81E+00	2.57E-02	1.02E-03	2.51E-06	3.05E-10
hg195m	0.00E+00	5.83E-01	5.83E-01	5.74E-01	4.78E-01	3.91E-01	3.57E-02	1.44E-03	3.53E-06	5.55E-10
hg197	0.00E+00	1.47E+02	1.47E+02	1.46E+02	1.32E+02	1.18E+02	2.62E+01	3.26E+00	6.56E-02	2.76E-05
hg197m	0.00E+00	2.57E+01	2.57E+01	2.49E+01	1.81E+01	1.28E+01	1.93E-01	6.95E-04	3.54E-08	2.59E-17
hg199m	0.00E+00	1.36E+02	1.34E+02	5.13E+01	3.94E-03	2.67E-06	0.00E+00	0.00E+00	0.00E+00	0.00E+00
hg203	**0.00E+00**	**1.59E+01**	**1.59E+01**	**1.59E+01**	**1.58E+01**	**1.57E+01**	**1.43E+01**	**1.27E+01**	**1.02E+01**	**6.50E+00**
hg205	0.00E+00	1.95E-02	1.71E-02	6.51E-06	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00
hg206	0.00E+00	1.45E-28	1.32E-28	8.91E-32	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00
hg	0.00E+00	4.50E+02	4.44E+02	3.25E+02	1.94E+02	1.57E+02	4.08E+01	1.60E+01	1.02E+01	6.50E+00

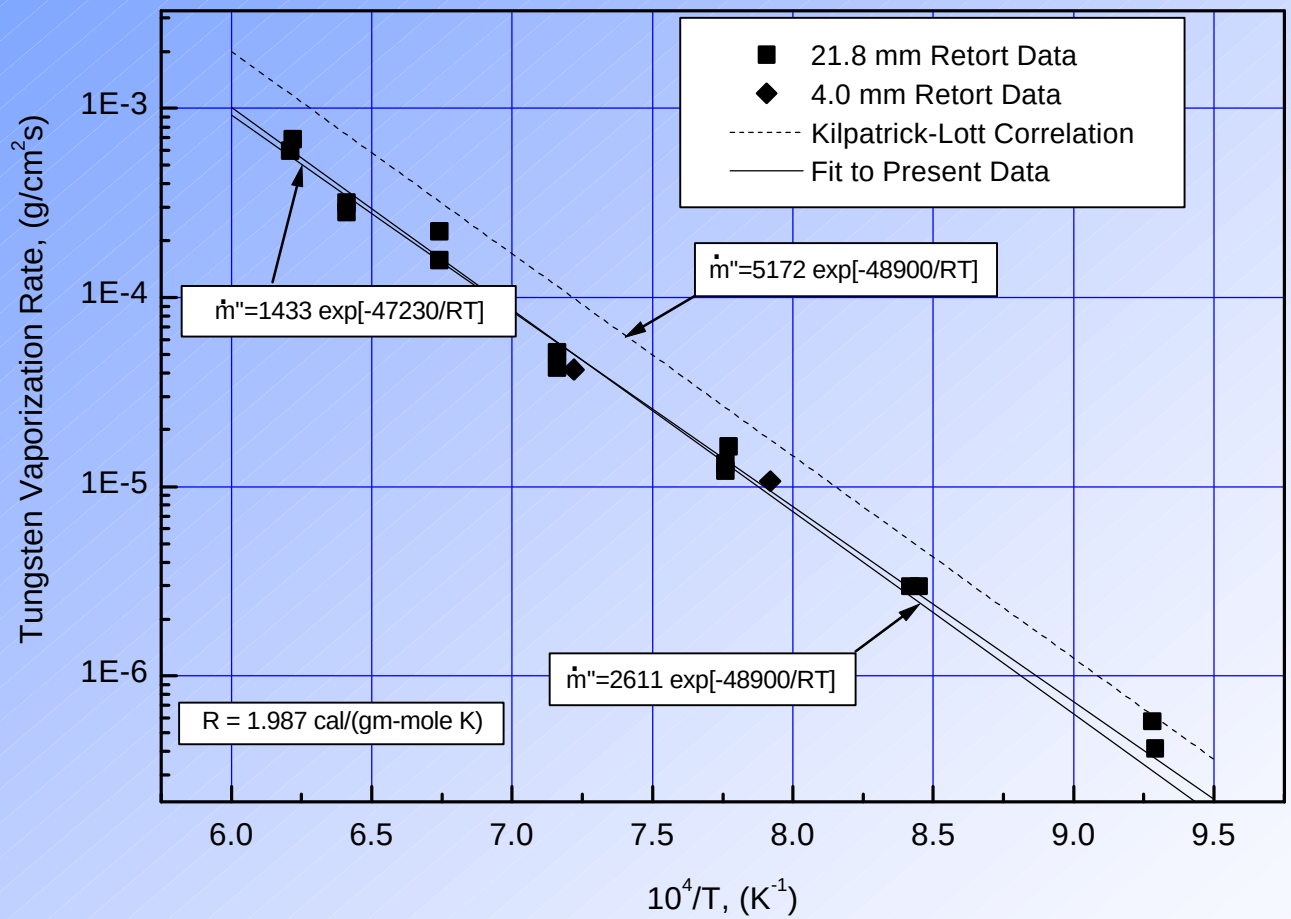
High-Temperature Tungsten Aerosol Facility



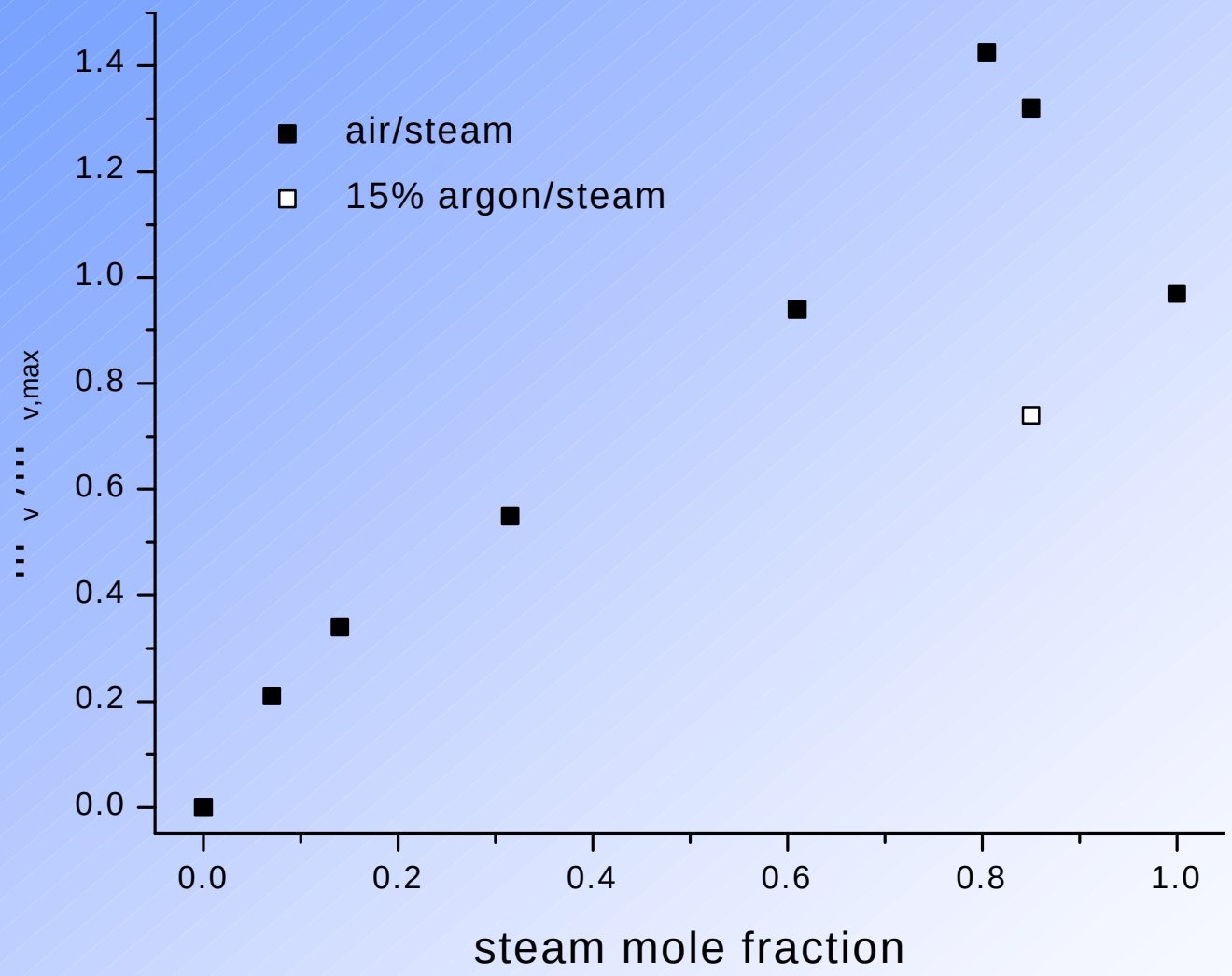


Tungsten Aerosol Photographs

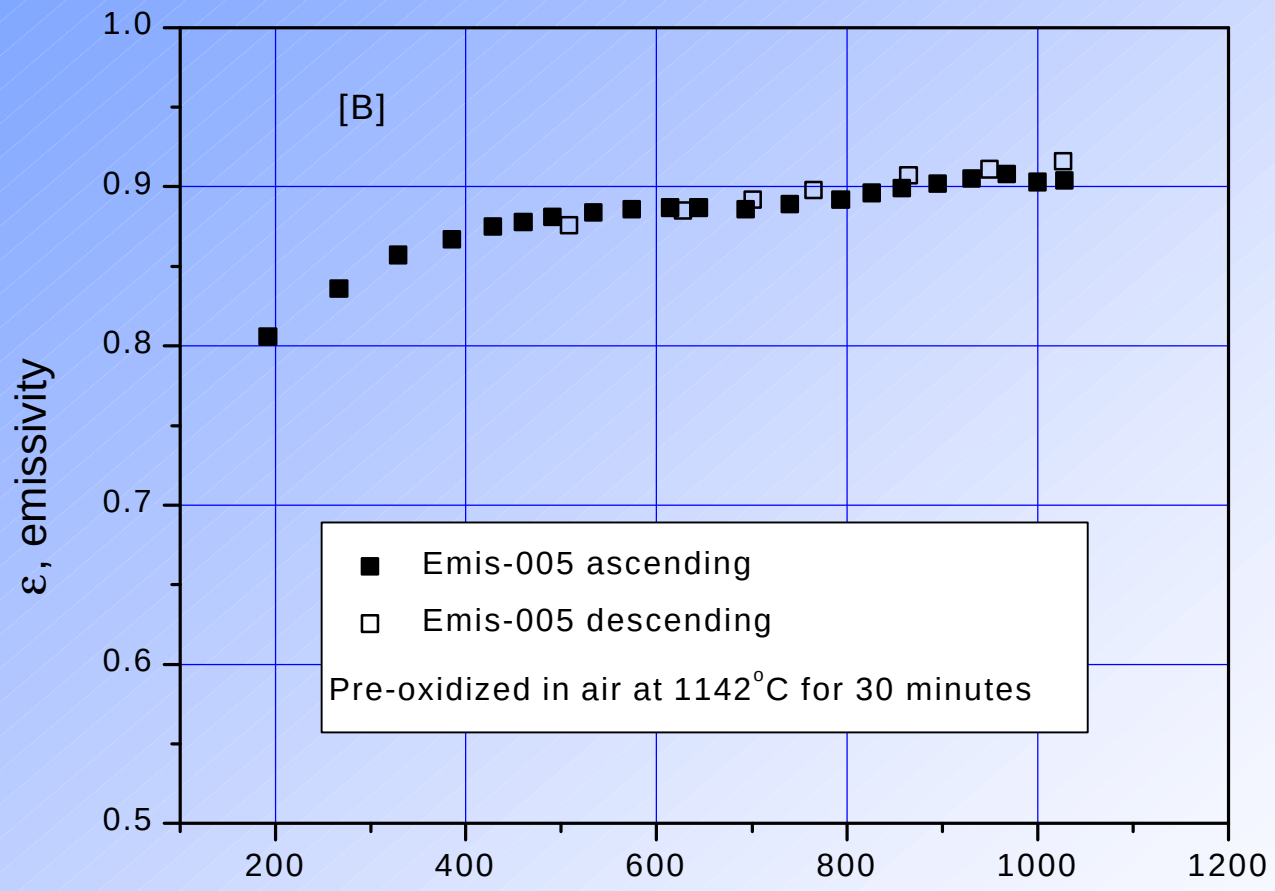
Tungsten Vaporization Rate vs Temperature



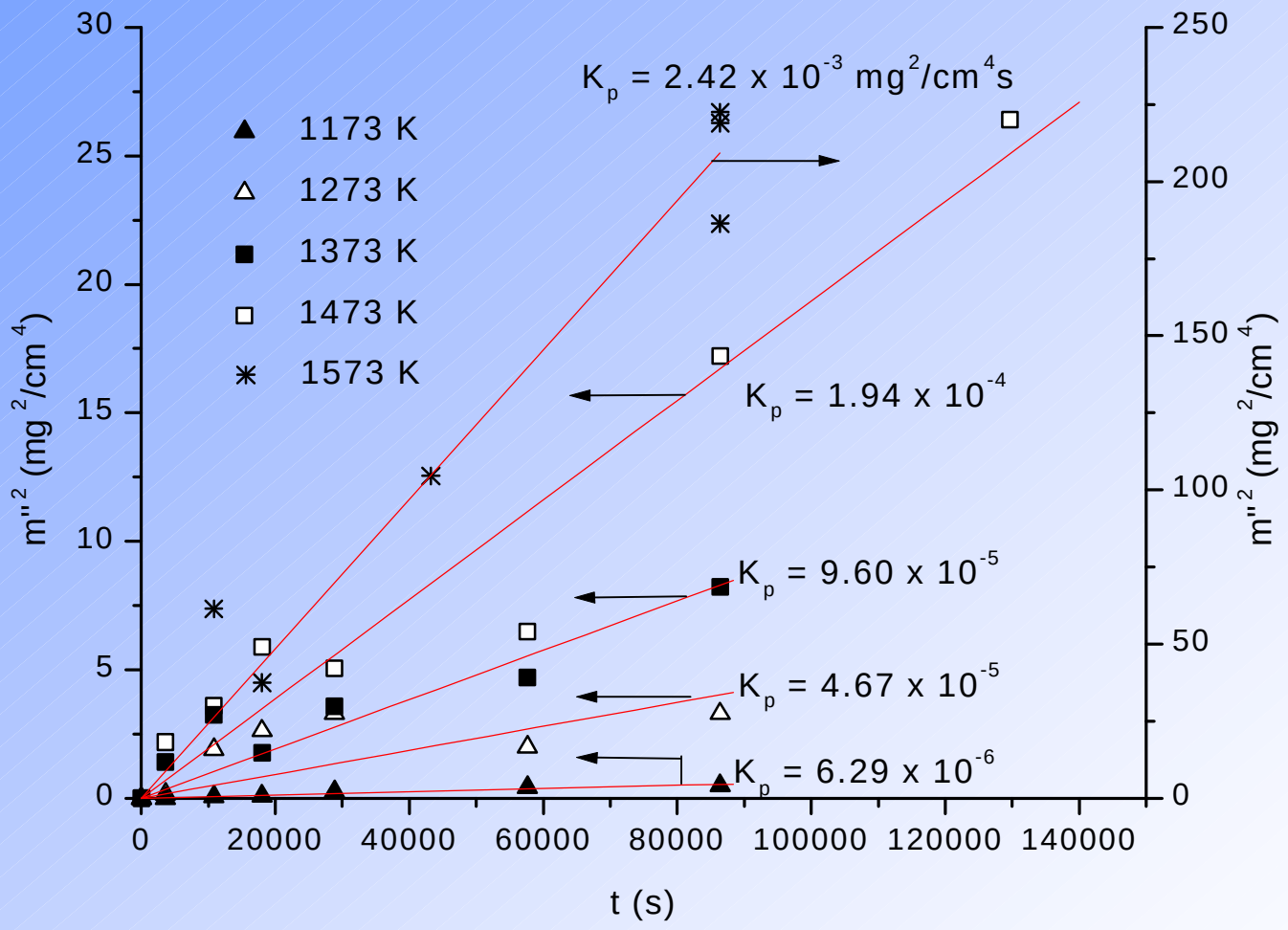
Tungsten Vaporization Rate vs Air/Steam Ratio



Thermal Radiative Emissivity of Inconel-718



Oxidation Rate of Inconel-718 in Air



Conclusions

- Can provide engineering expertise and facilities to the MECO experiment.
- Experienced at laboratory and beam line experiments.
- Experienced at high temperature, cryogenic and vacuum technologies.
- Full compliment of hardware and electronics to support engineering experiments.
- Available and enthusiastic to provide support to the collaboration on short order.