
Radiation Induced Demagnetization of Nd-Fe-B Permanent Magnets

P.K. Job

Radiation Physicist

NSLS II

Radiation Induced Demagnetization

- Dose Monitoring of insertion Devices
(photon and neutron dose)
- Demagnetization of APS Undulators
- Irradiation of Sample Magnets
- MCNPX Calculations for Comparison

Radiation Characterization Measurements of ID Magnets (Radiochromic Films)

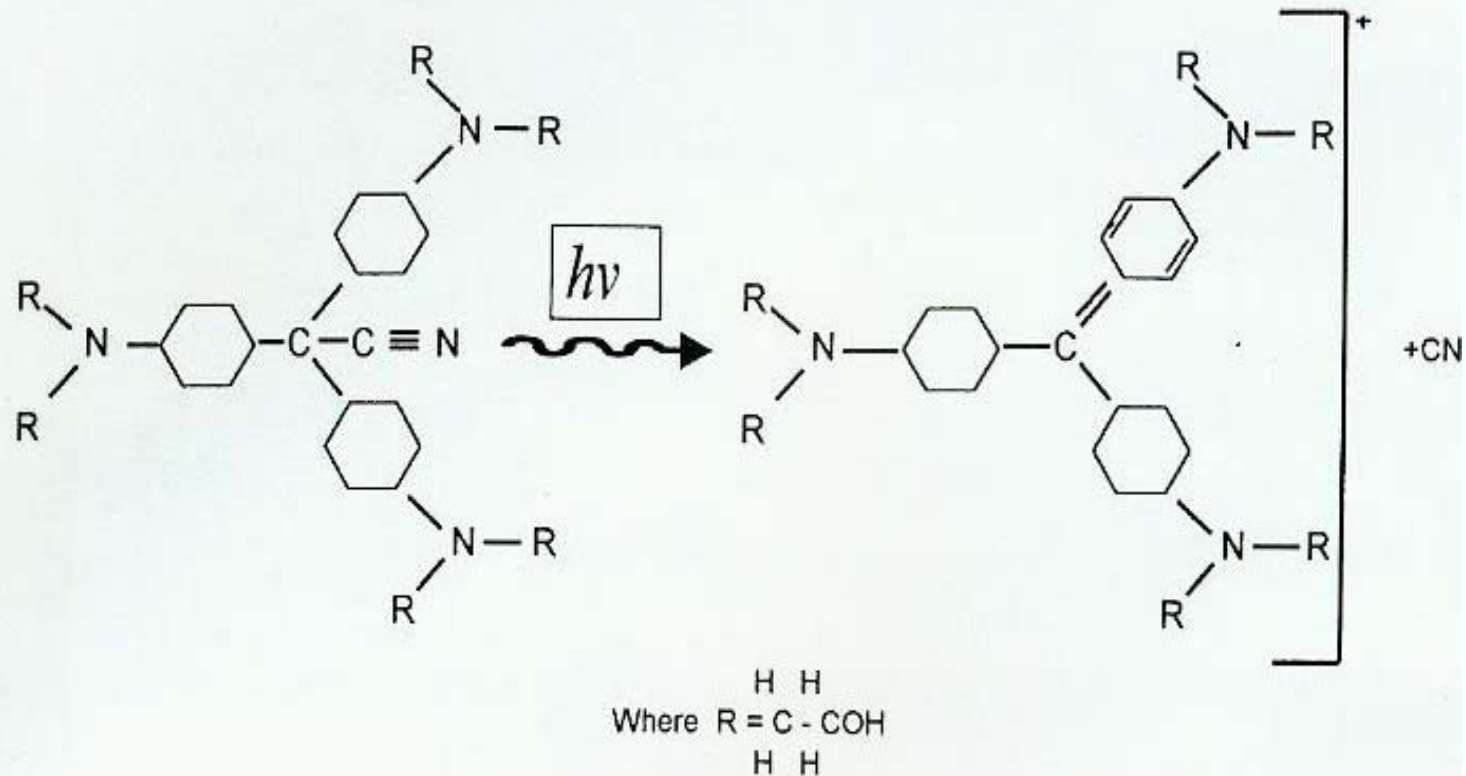
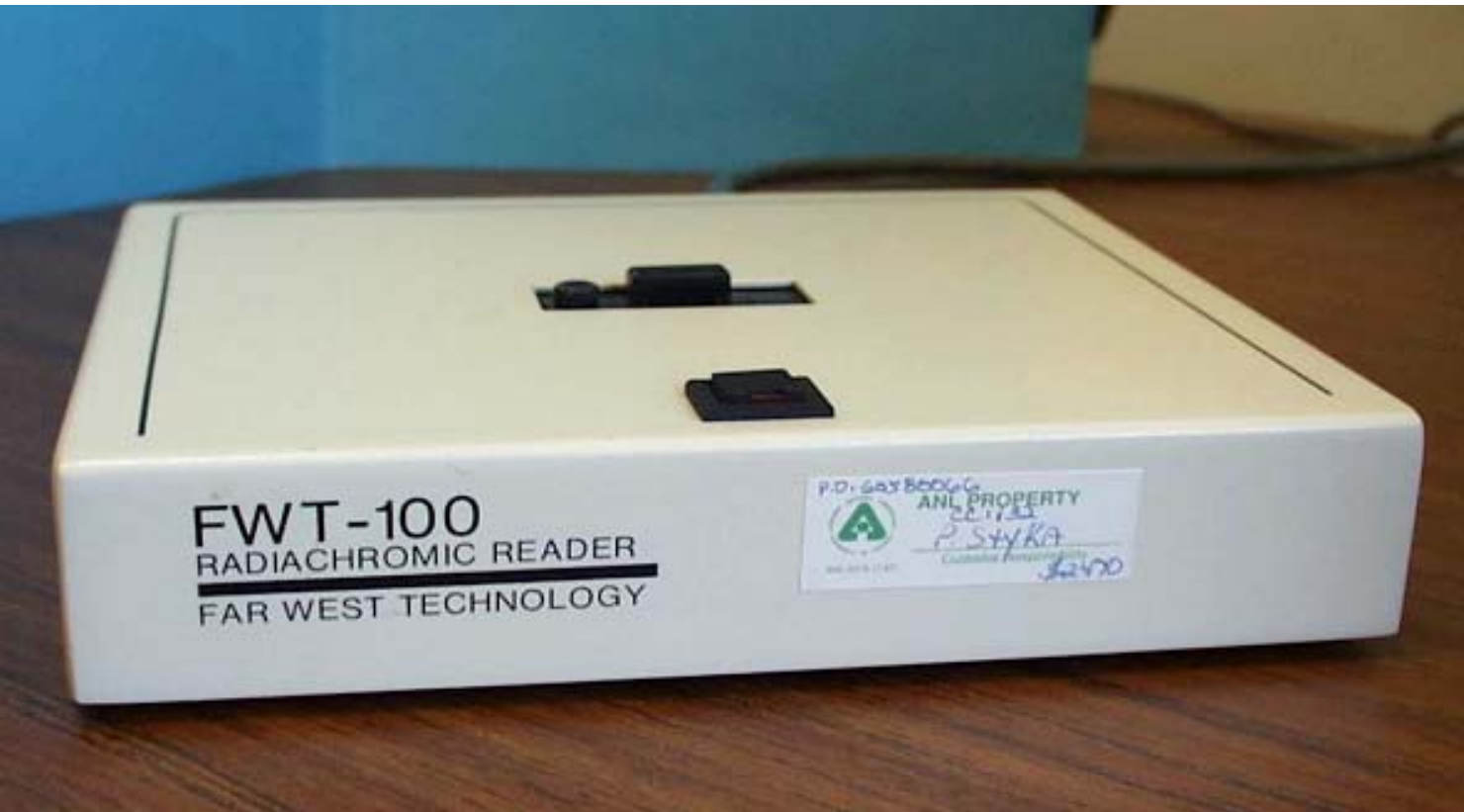
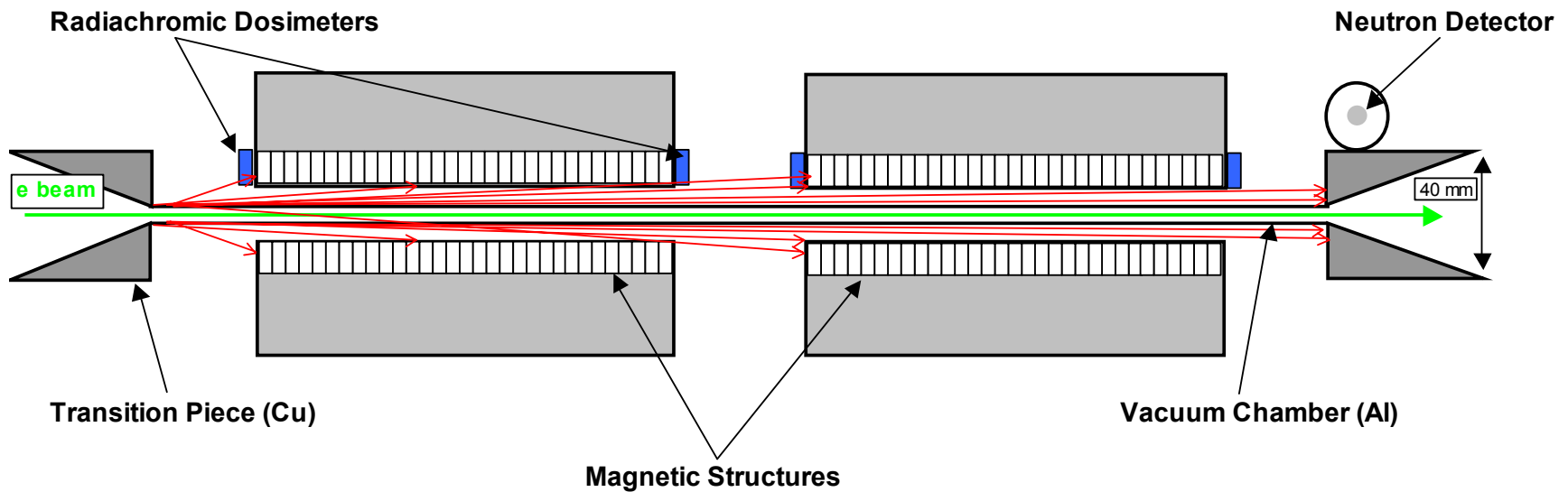


Figure 1: Radiation-Induced Photochemical Reaction

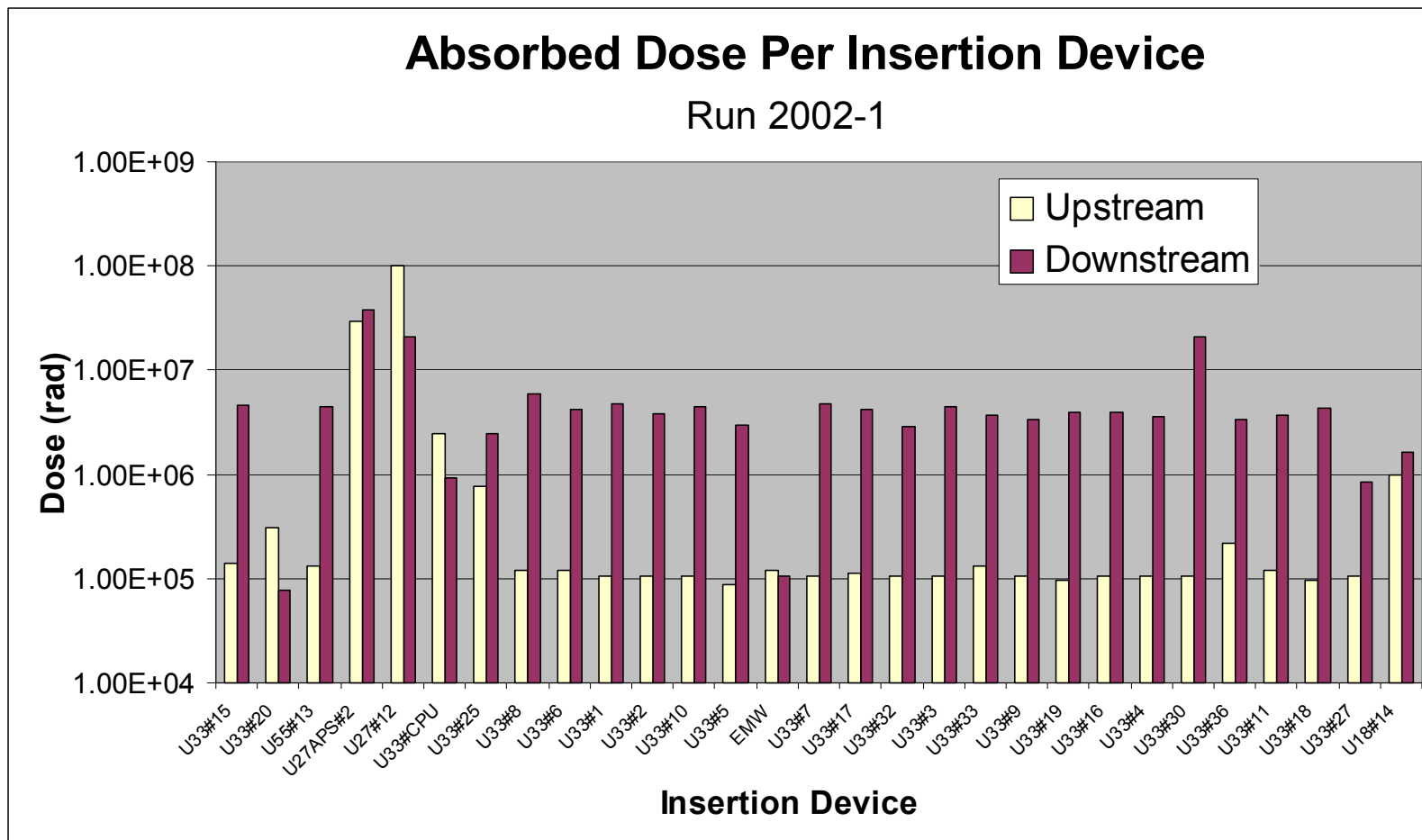
Radiation Characterization Measurements of ID Magnets (Radiochromic Film Reader)



Radiation Characterization Measurements of ID Magnets (Photon Dose)

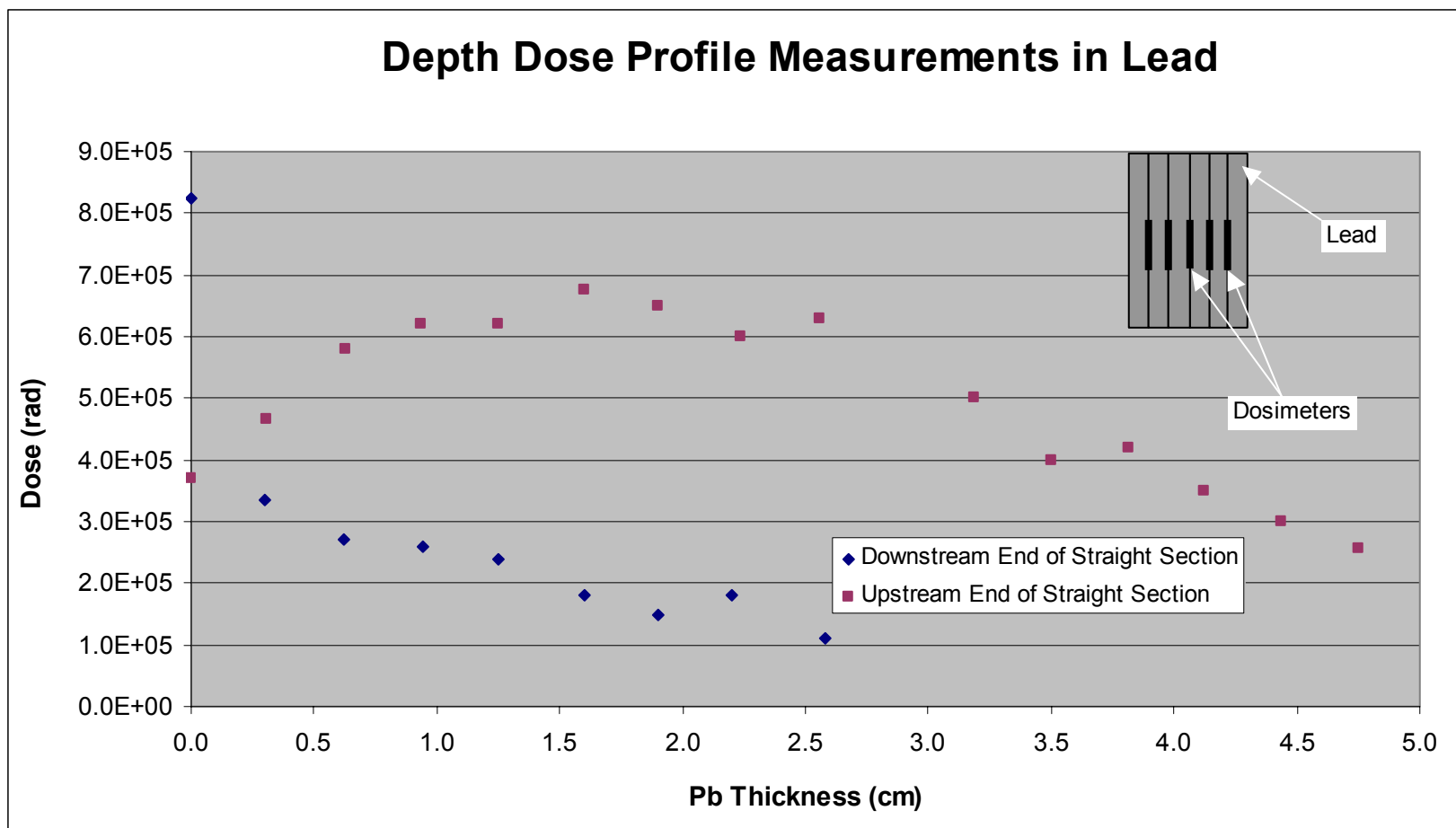


Photon Dose Measurements of ID Magnets (Radiochromic Film Results)

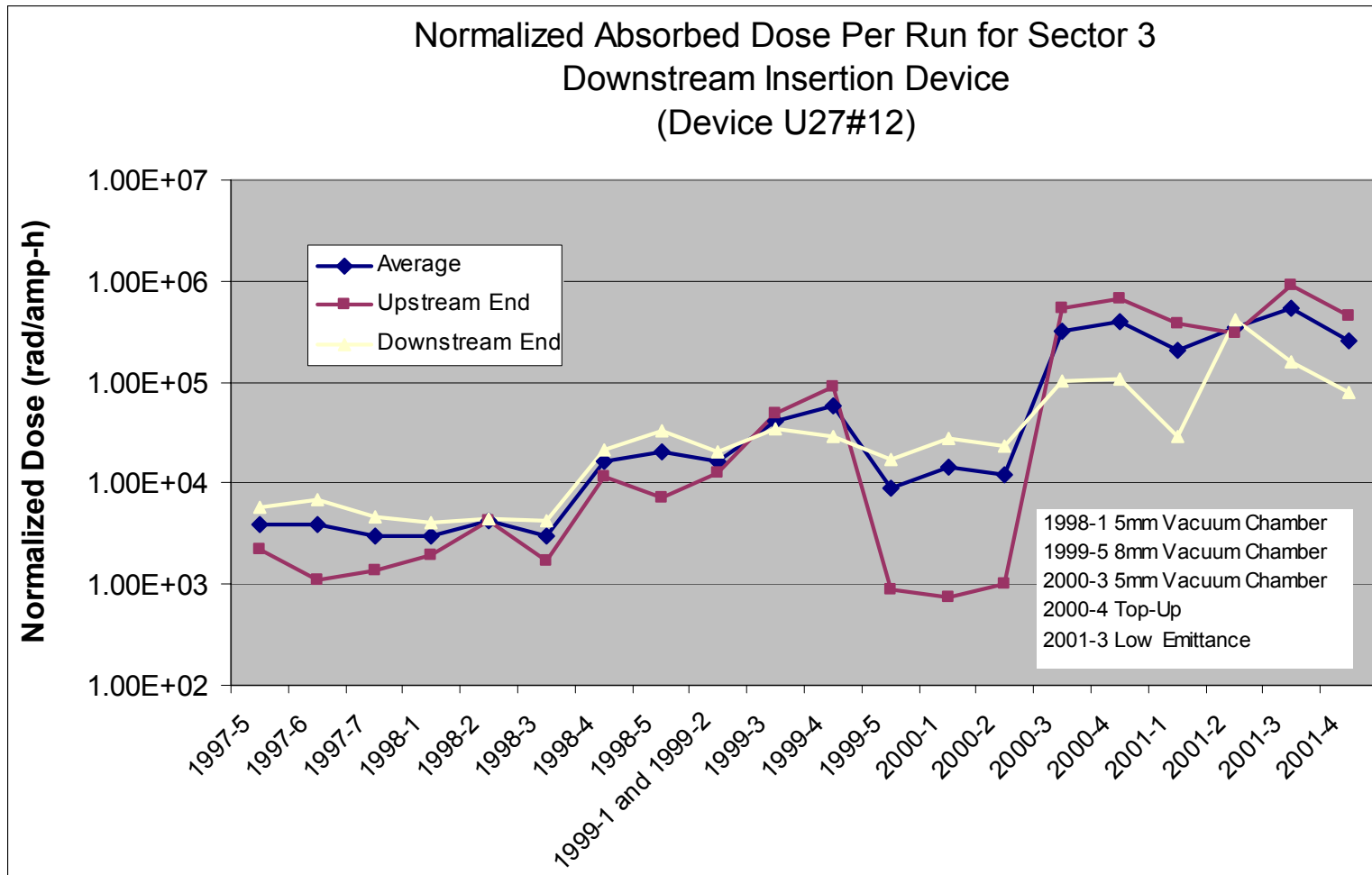


Photon Dose Measurements of ID Magnets (Radiochromic Film Results)

Depth Dose Profile Measurements in Lead



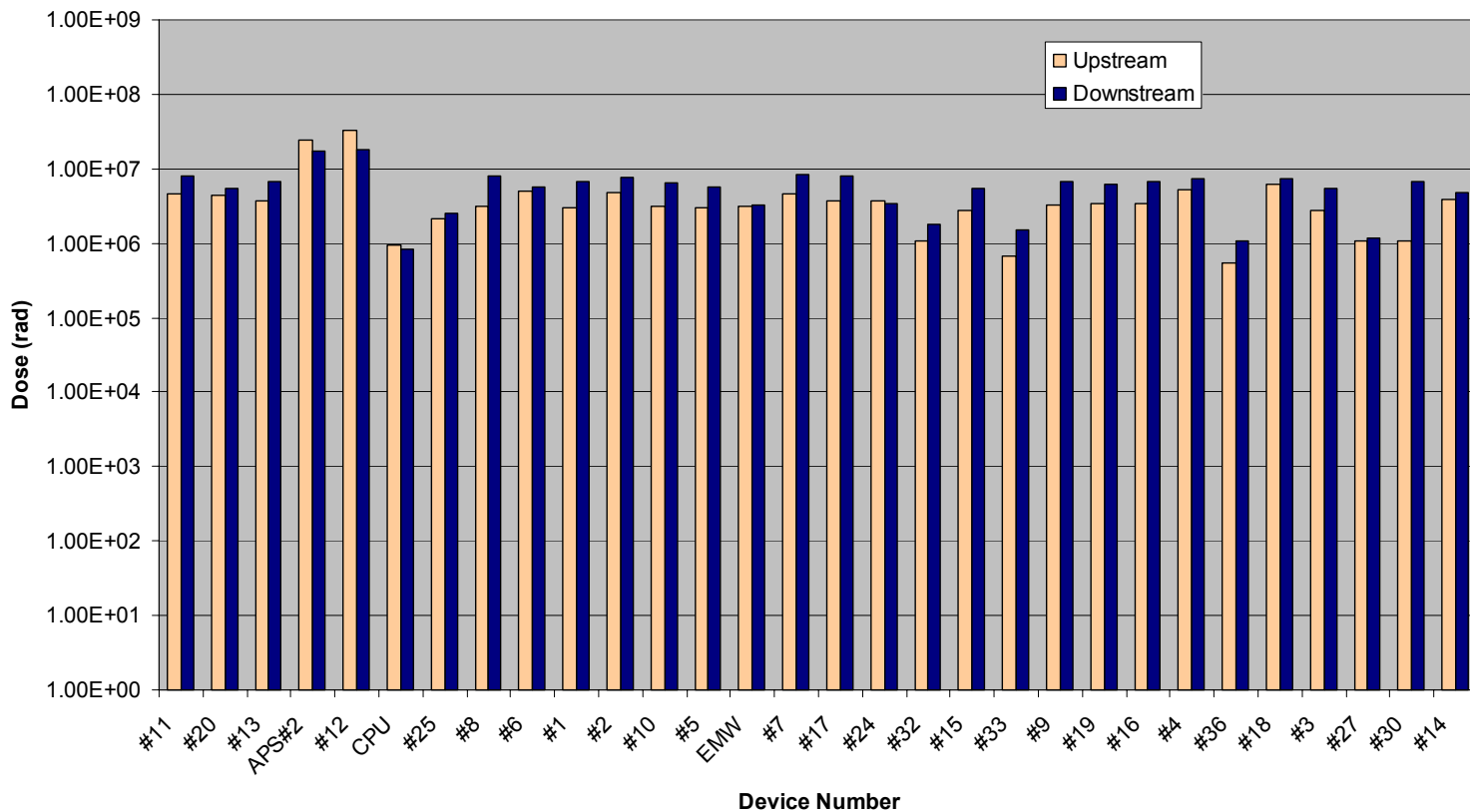
Photon Dose Measurements of ID Magnets (Radiochromic Film Results)



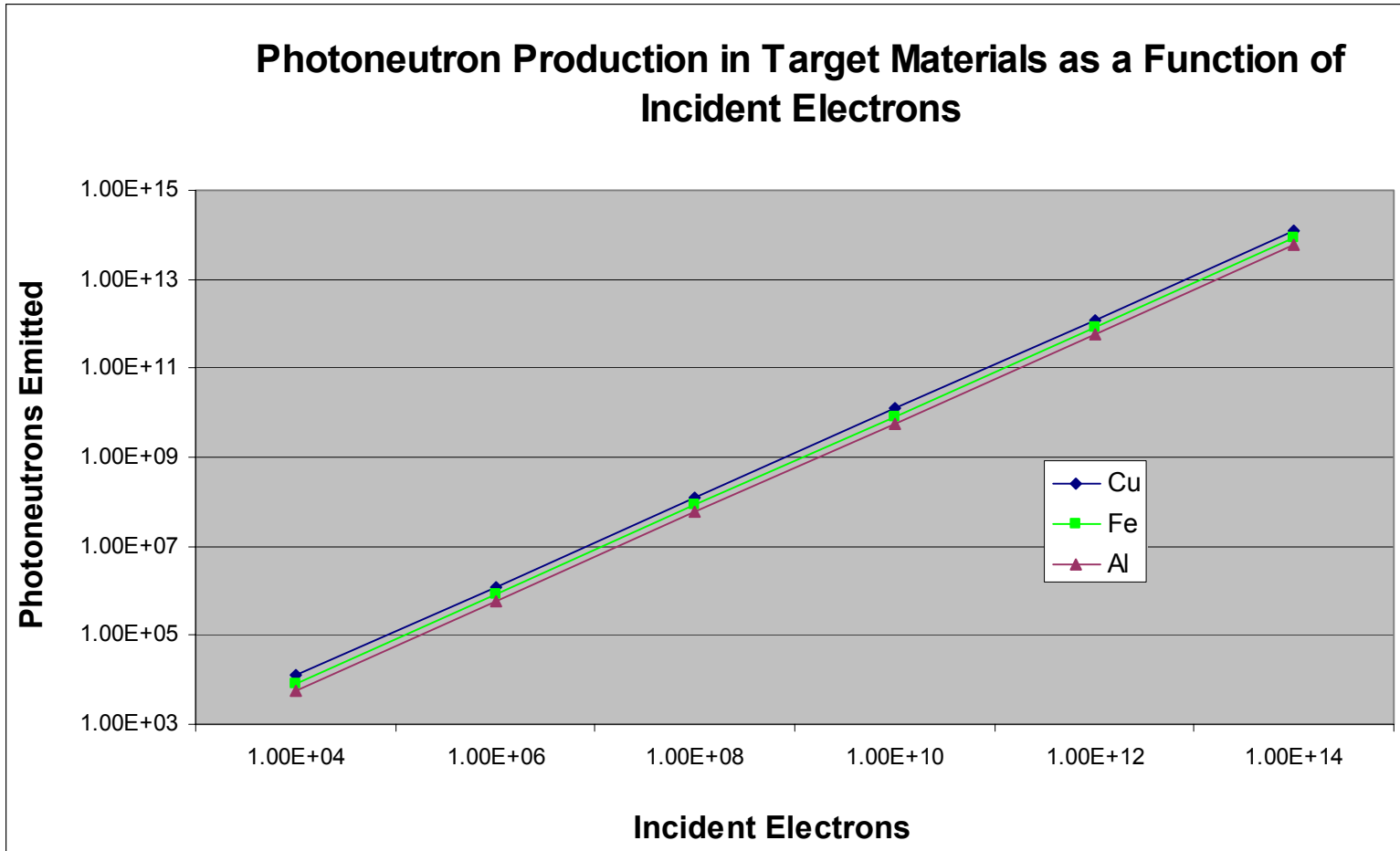
Photon Dose Measurements of ID Magnets (Radiochromic Film Results)

Cumulative Insertion Device Dose

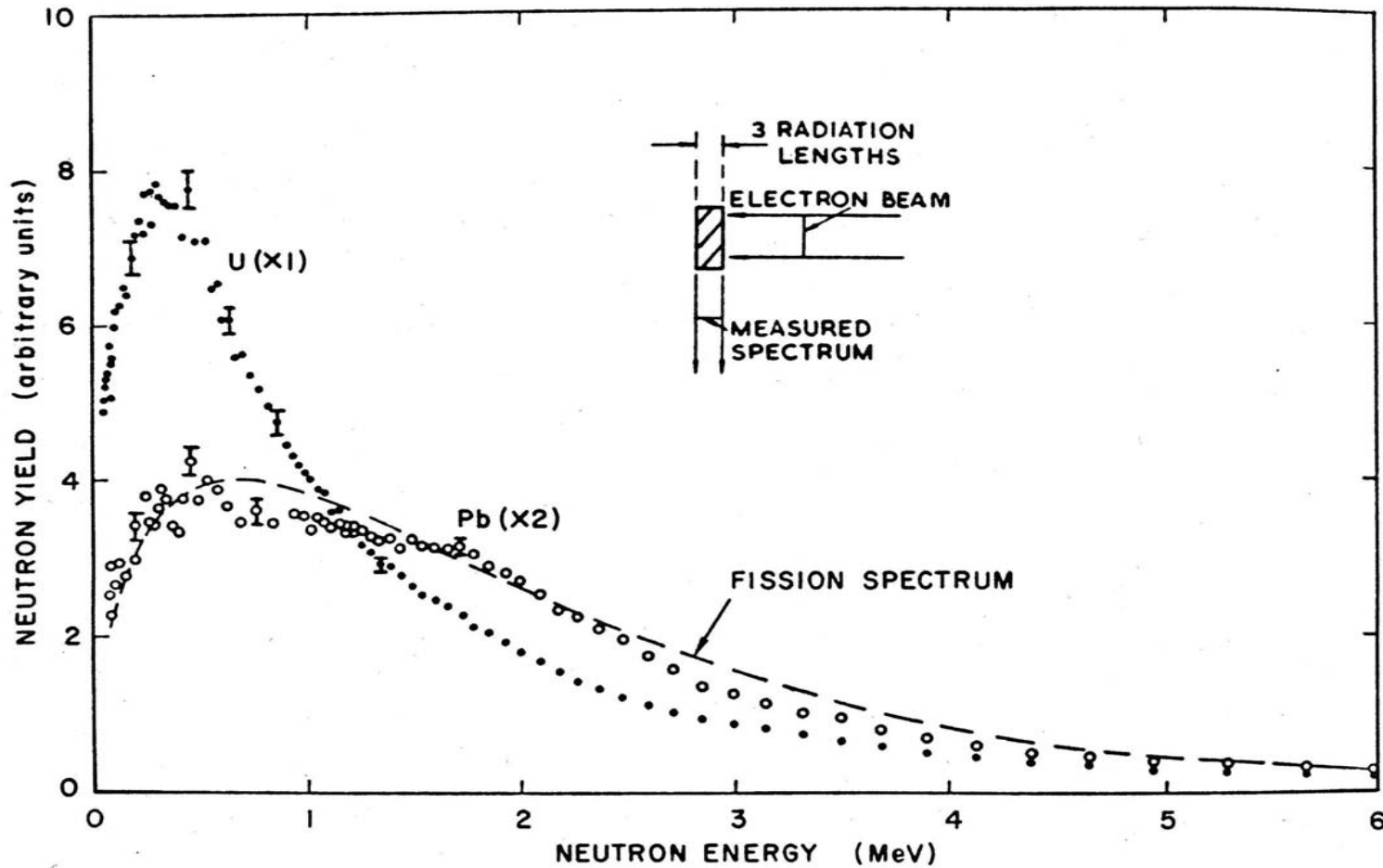
Run 1996-6 through Run 2002-3



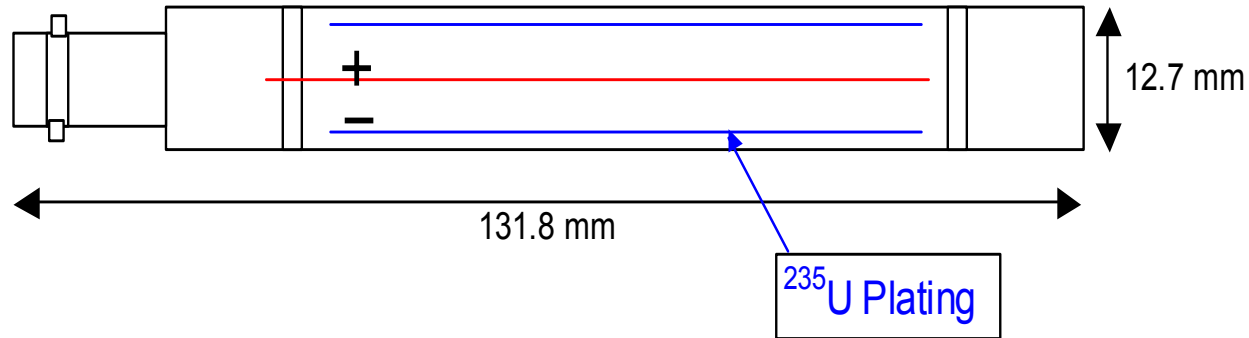
Neutron Production Estimates in the Storage Ring



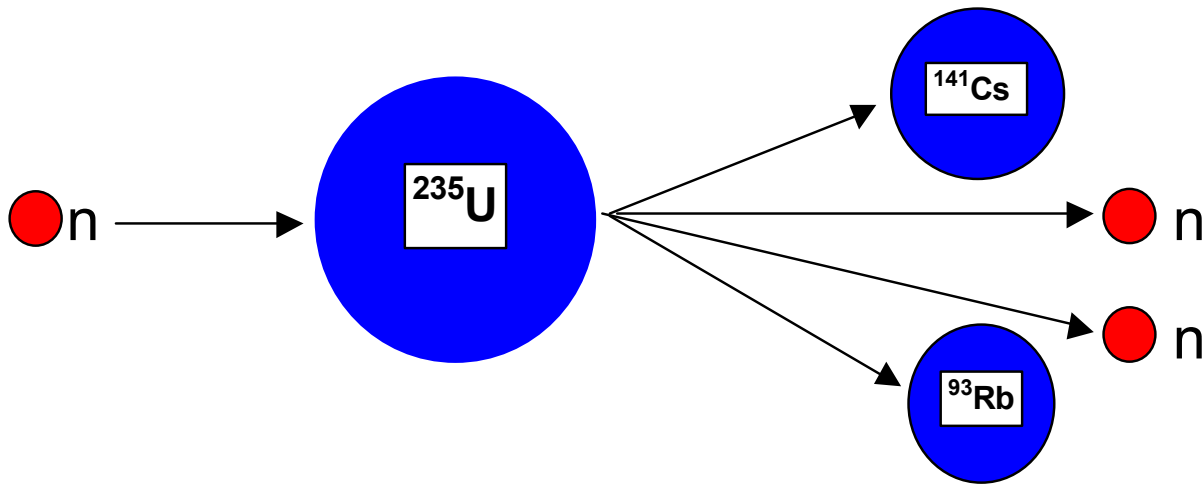
Neutron Production in the Storage Ring (Photoneutron Spectra)



Neutron Fluence Measurements in the Storage Ring (235U Fission Detectors)

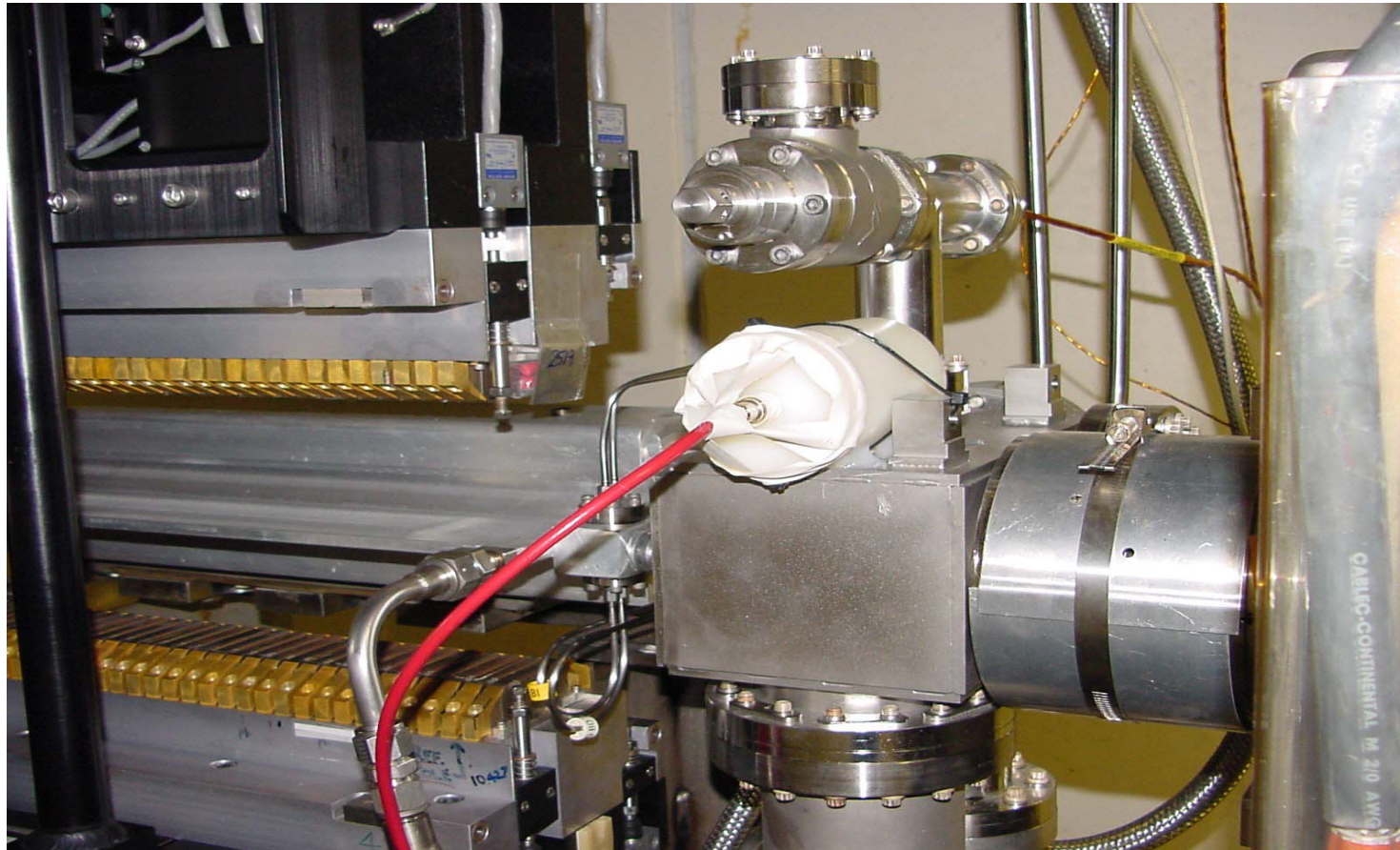


Neutron Fluence Measurements in the Storage Ring (235U Fission Detectors)

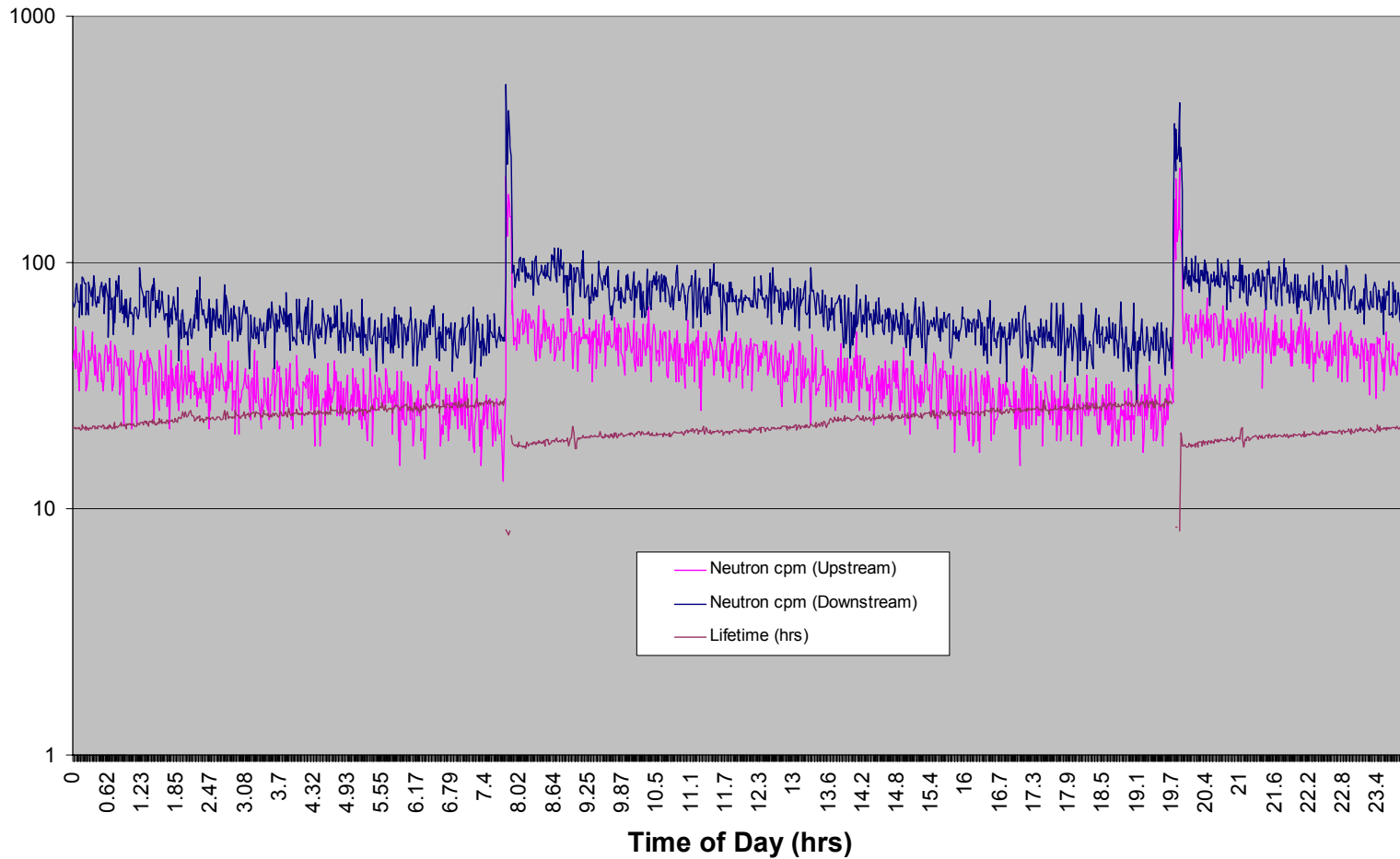


Typical Fission Fragments
(~80 MeV each)

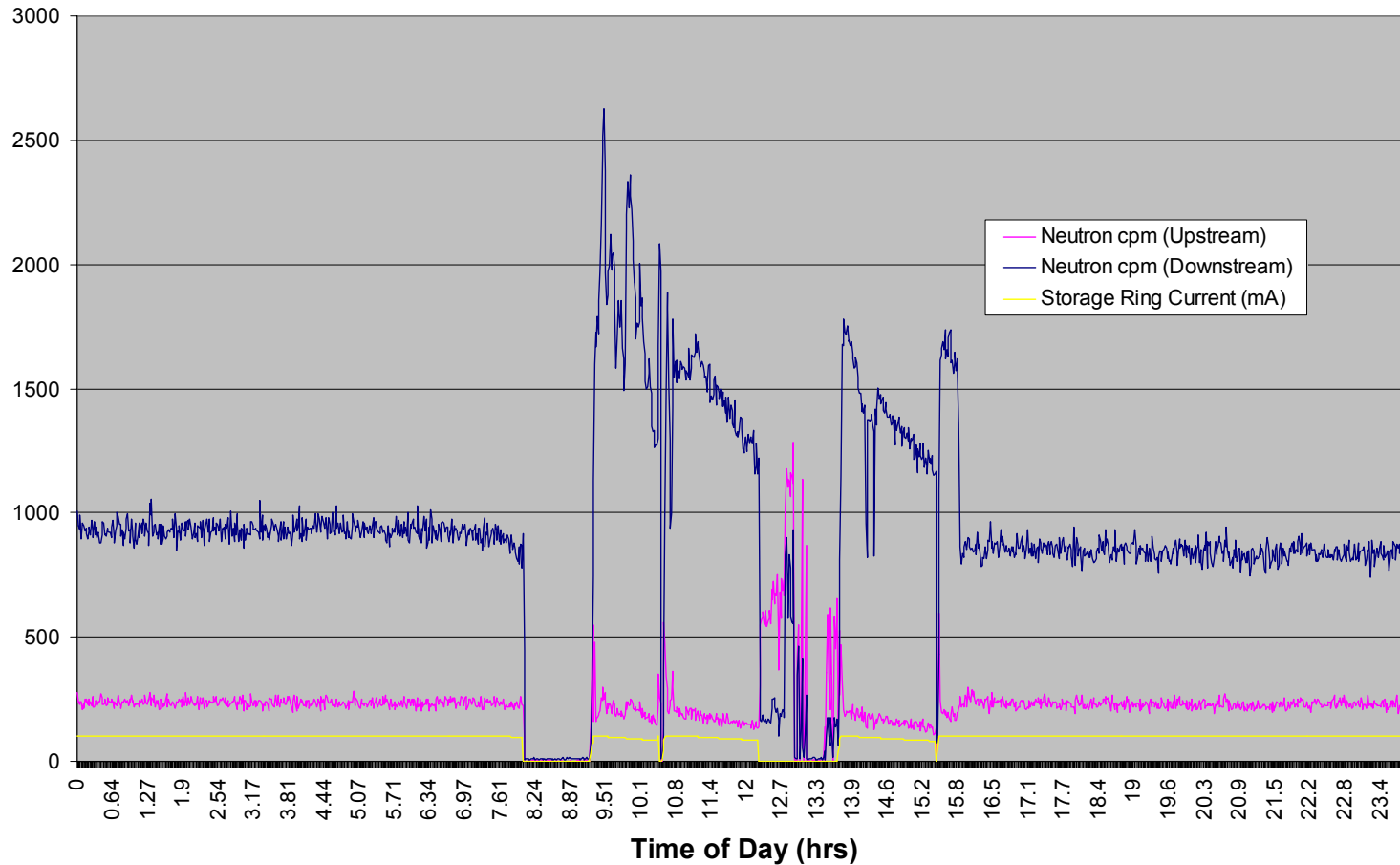
Neutron Fluence Measurements near Insertion Devices



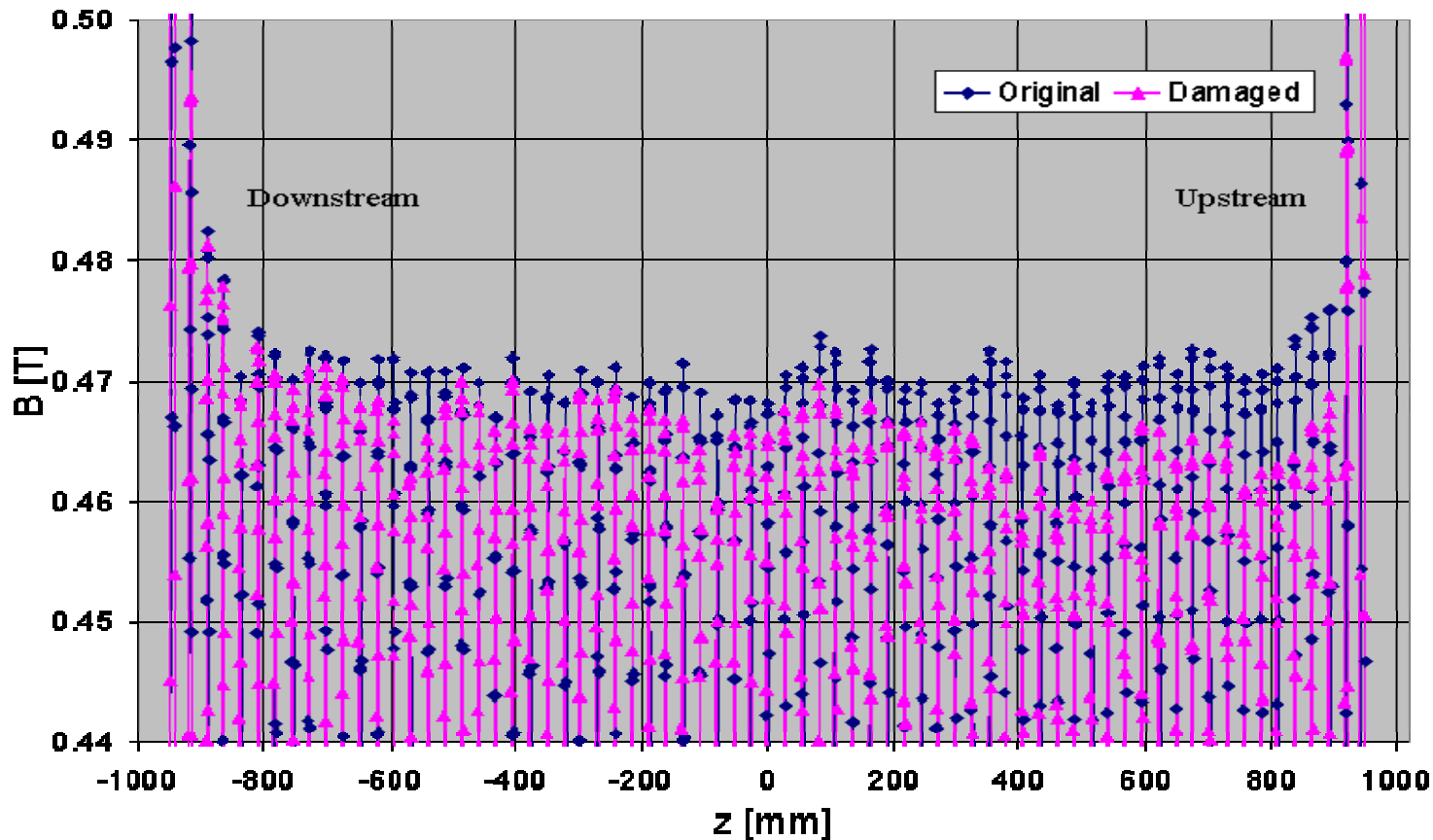
Neutron Fluence Measurements near Insertion Devices (Normal Mode)



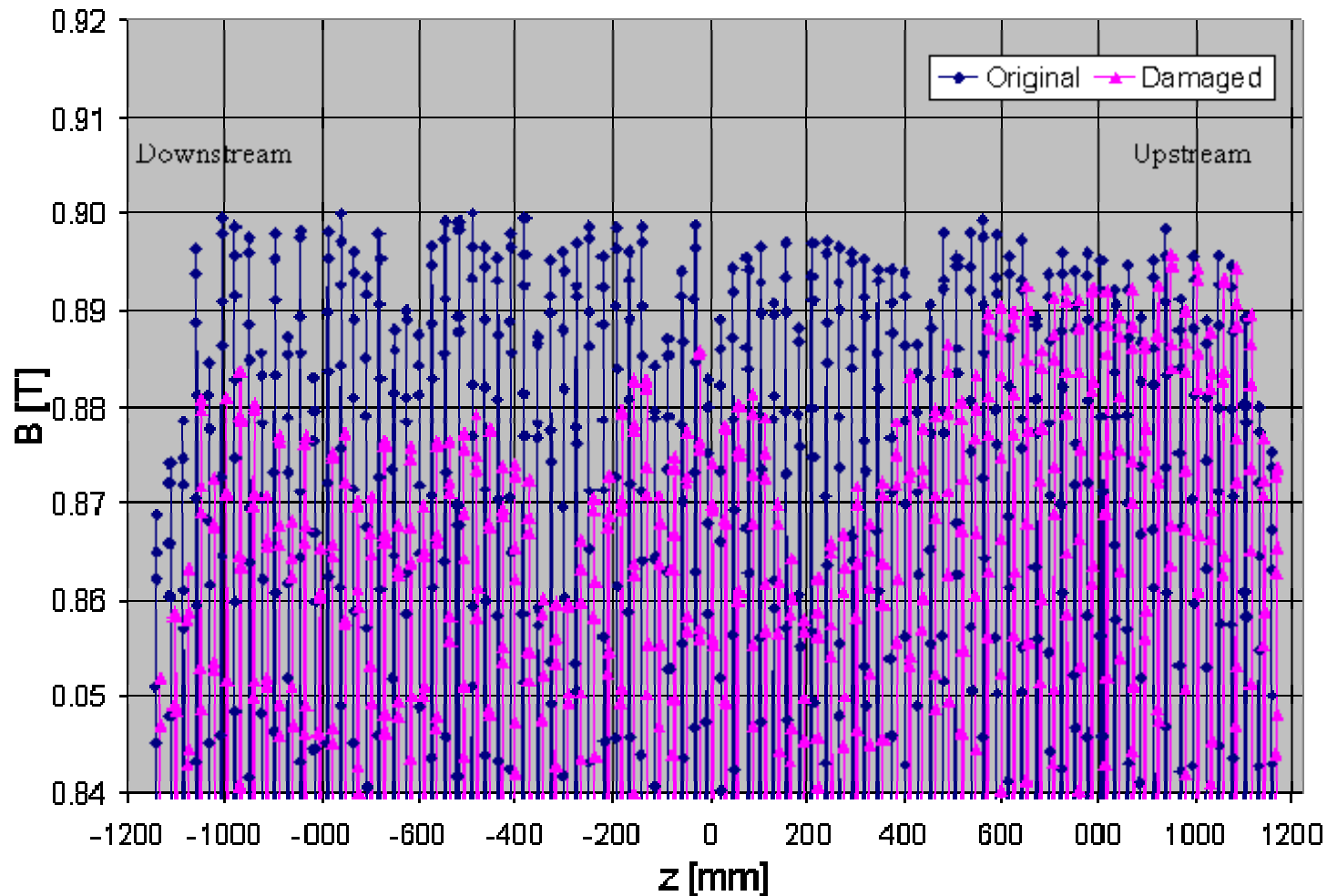
Neutron Fluence Measurements near Insertion Devices (TopUp and Injection Mode)



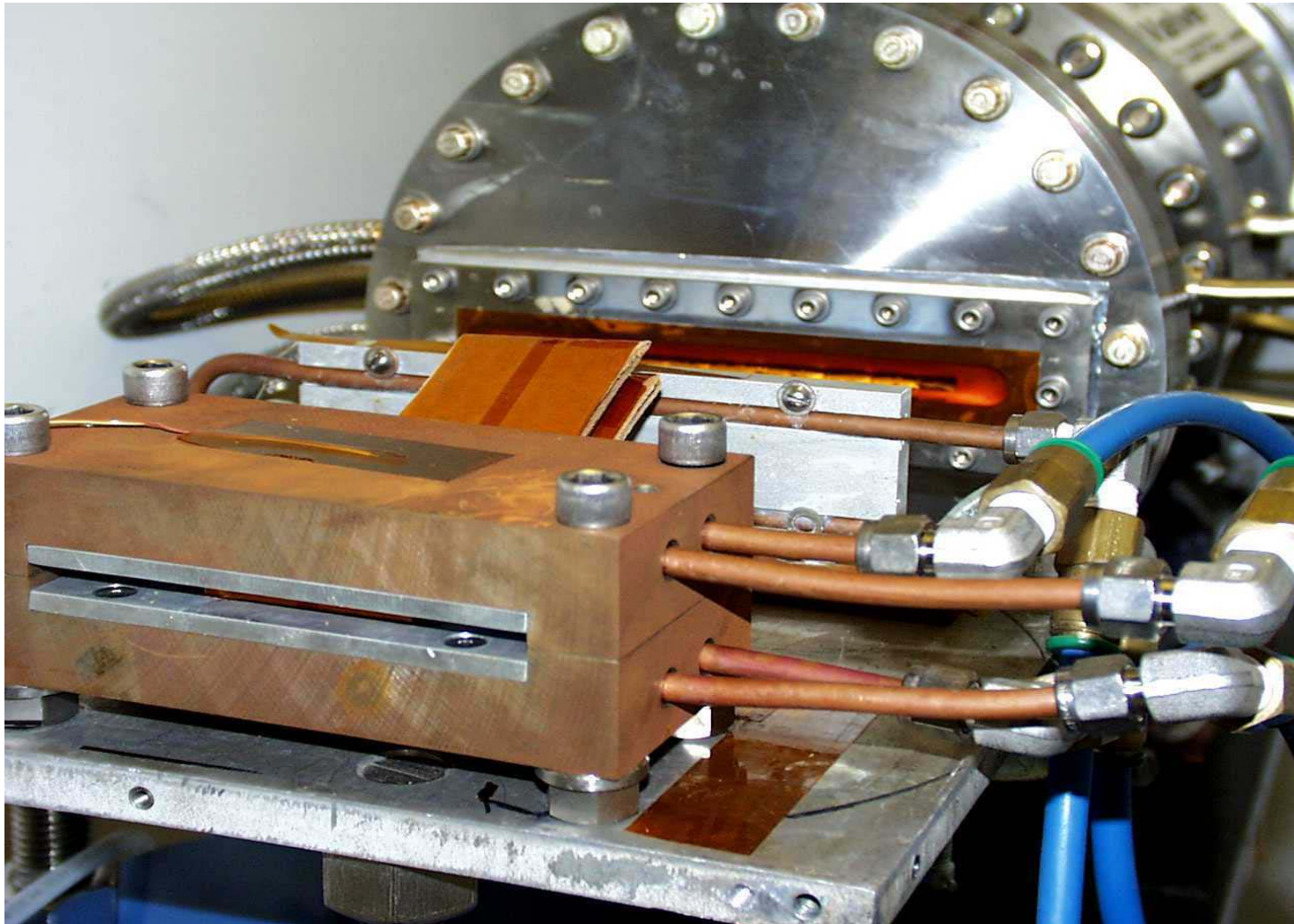
Radiation Induced Demagnetization of Insertion Devices (APS – 3 ID Upstream)



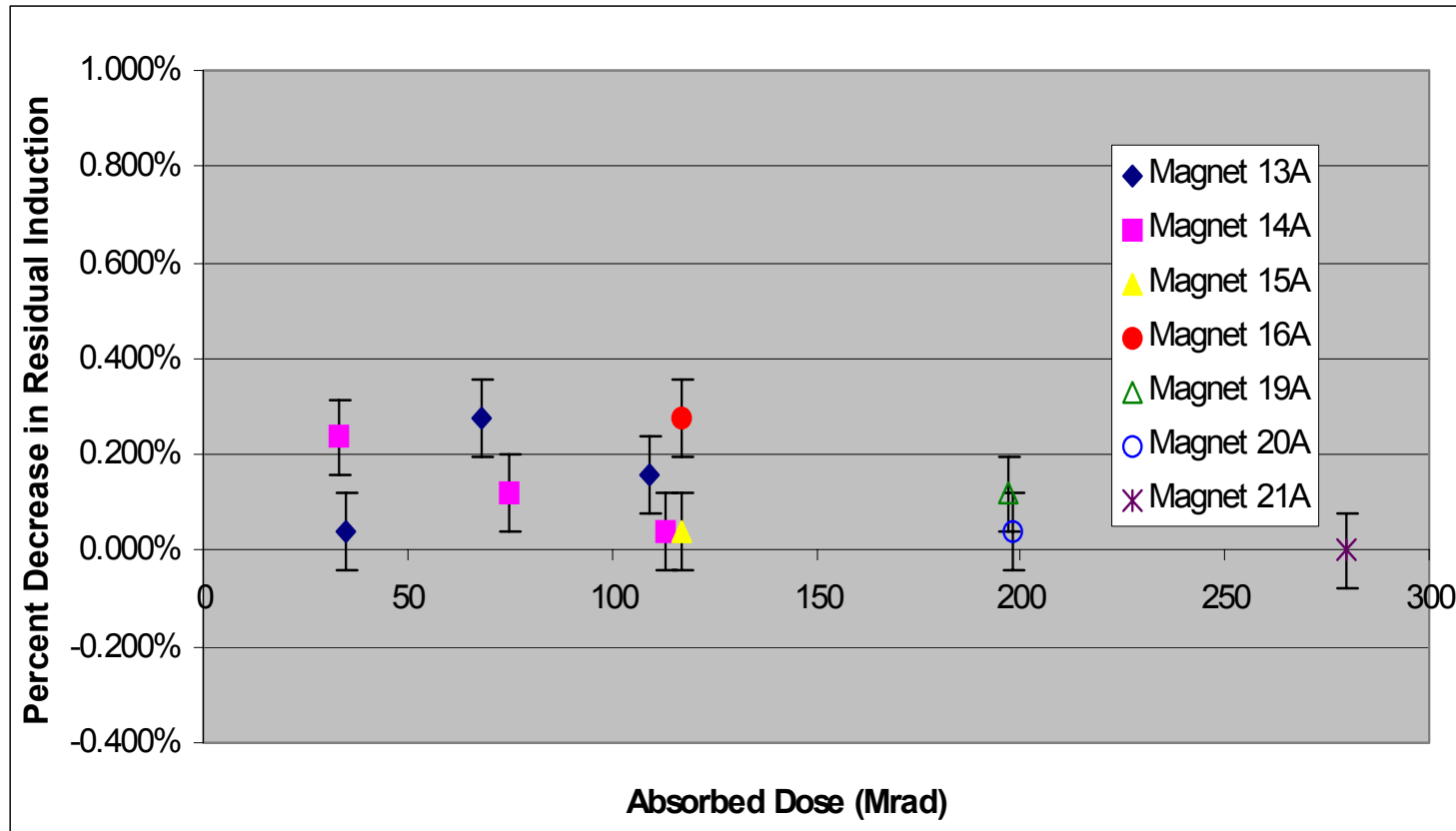
Radiation Induced Demagnetization of Insertion Devices (APS-3 ID Downstream)



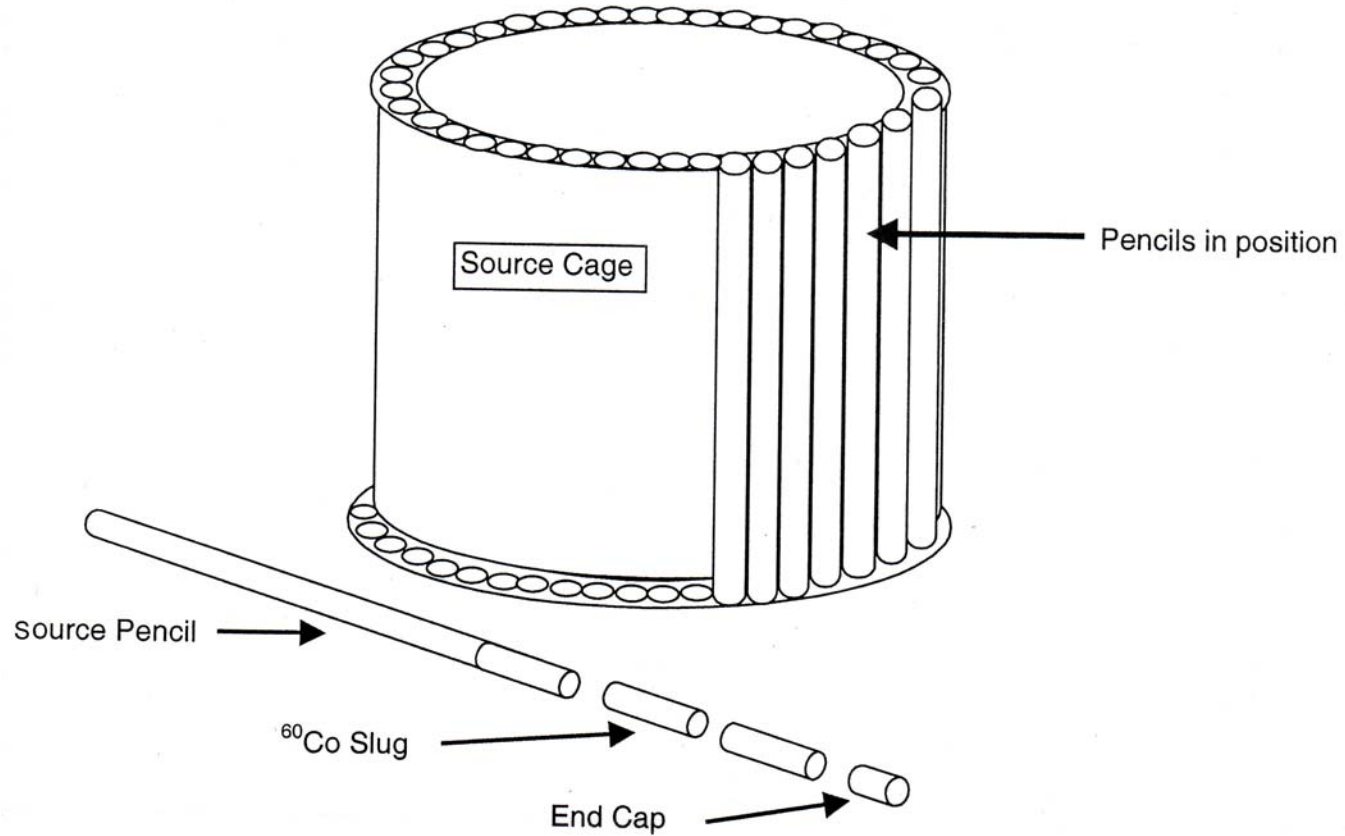
Sample Magnet Irradiation with X-Rays (9 BM)



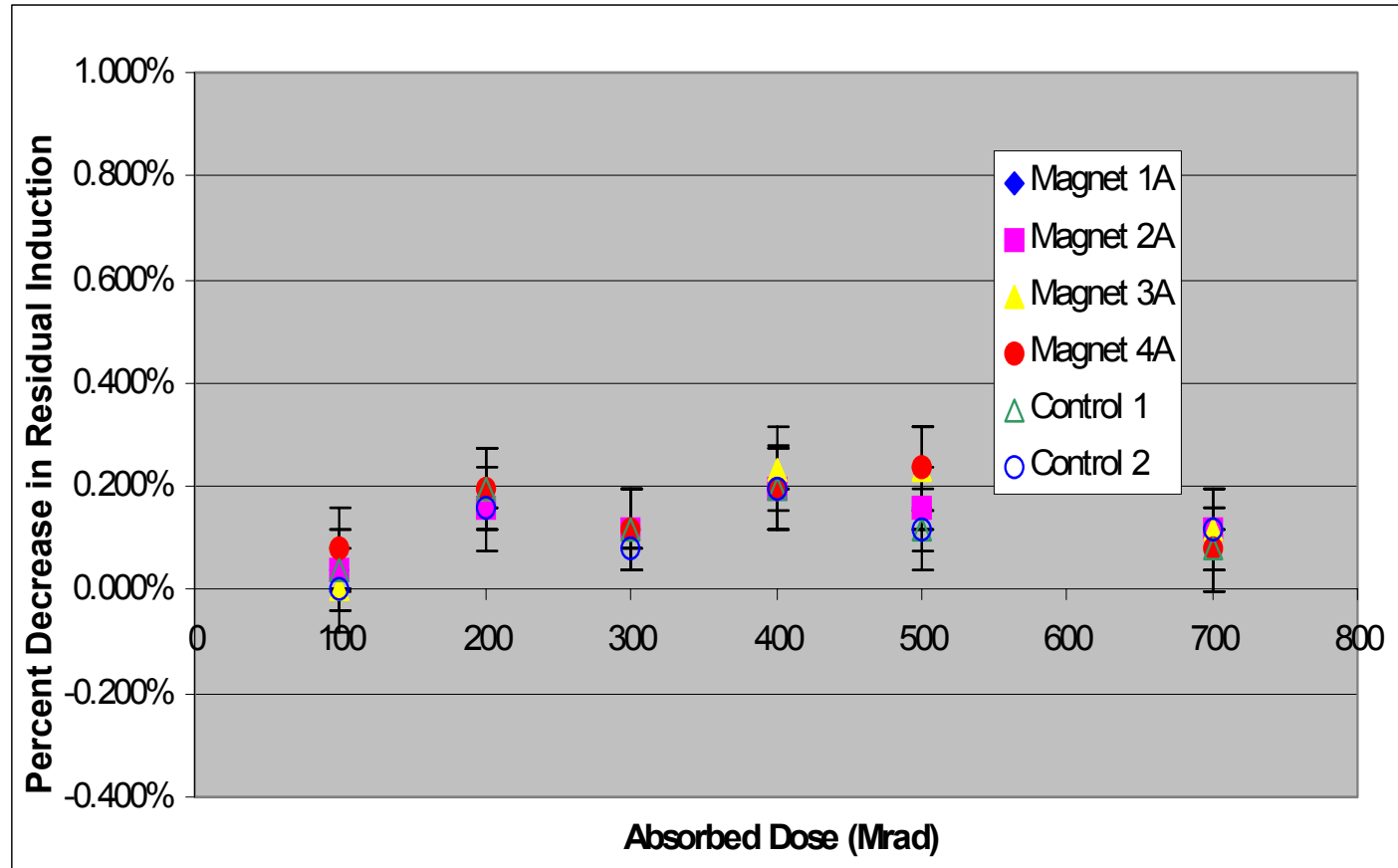
Results of Sample Magnet Irradiation with X-Rays (9 BM)



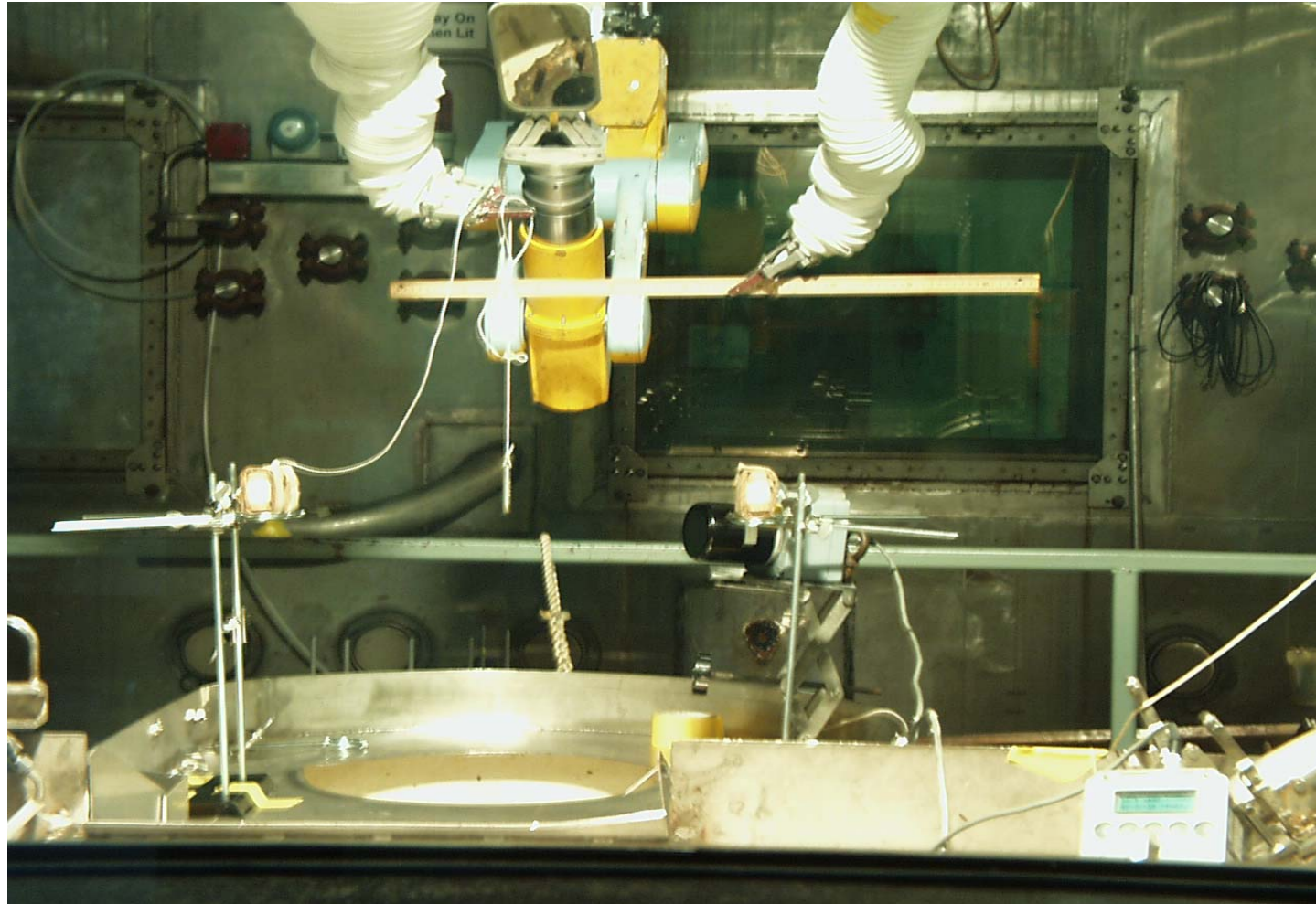
Sample Magnet Irradiation with Co60 γ -rays



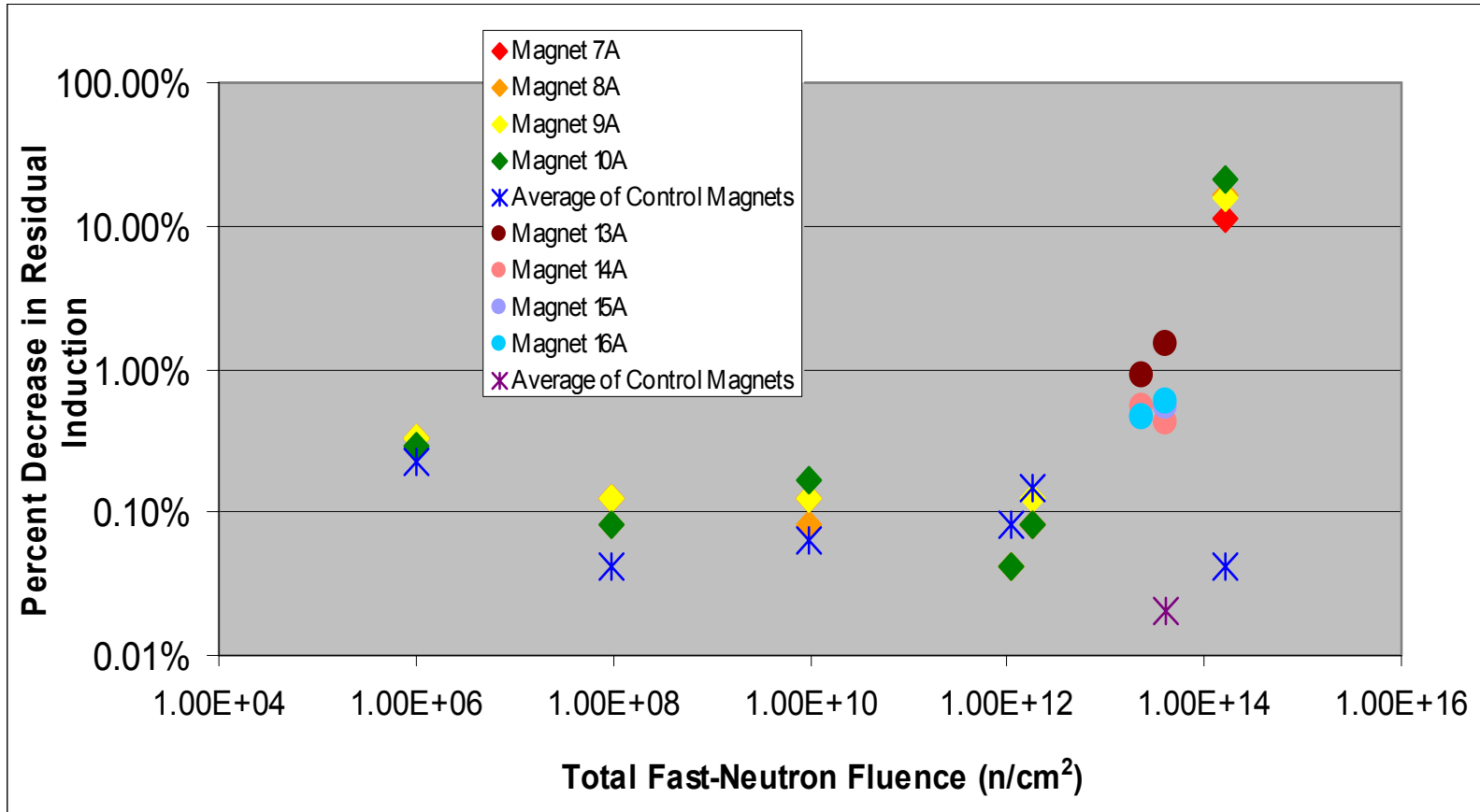
Results of Sample Magnet Irradiation with Co60 γ -rays



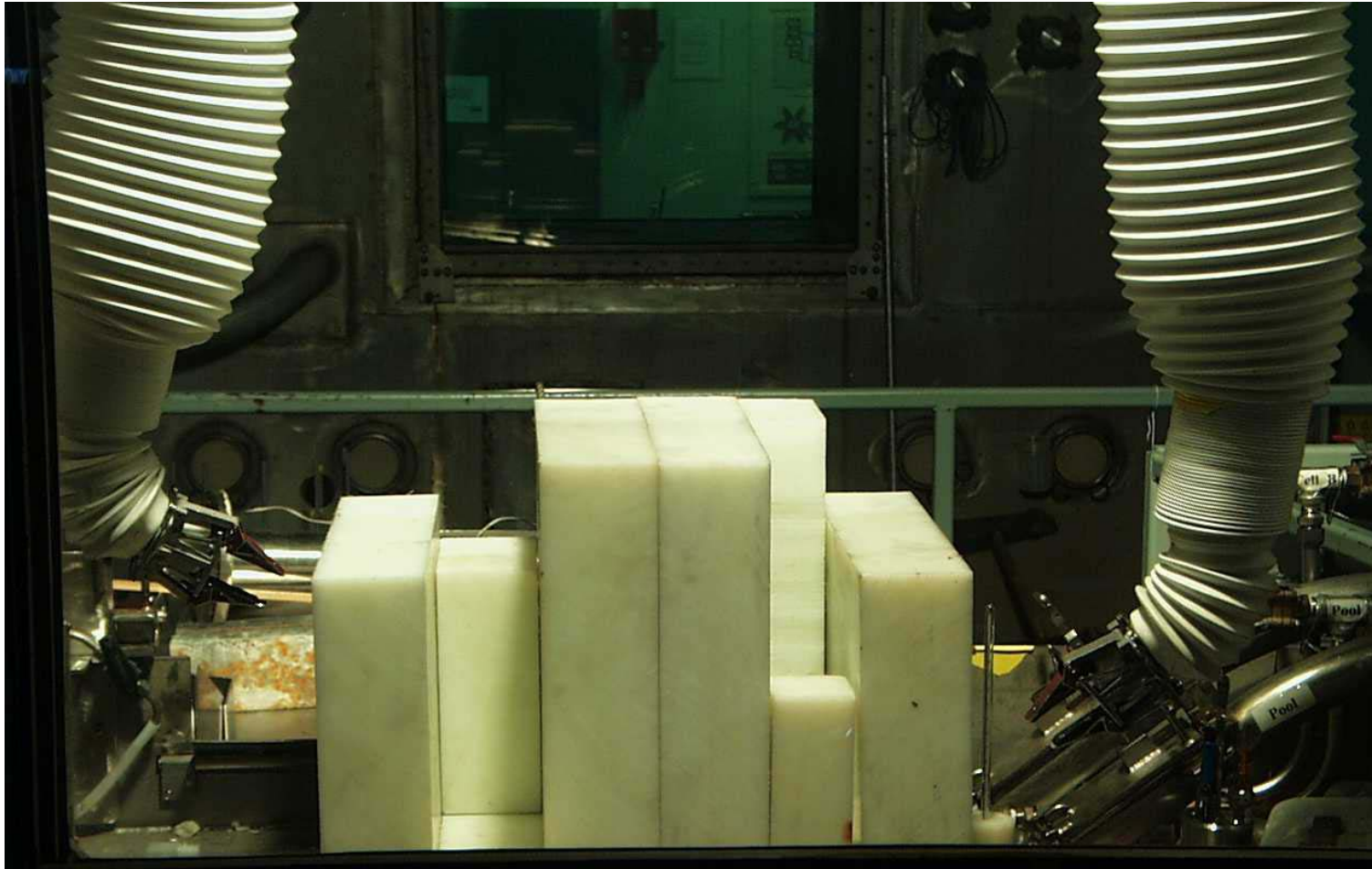
Sample Magnet Irradiation with Cf-252 Fission Neutrons



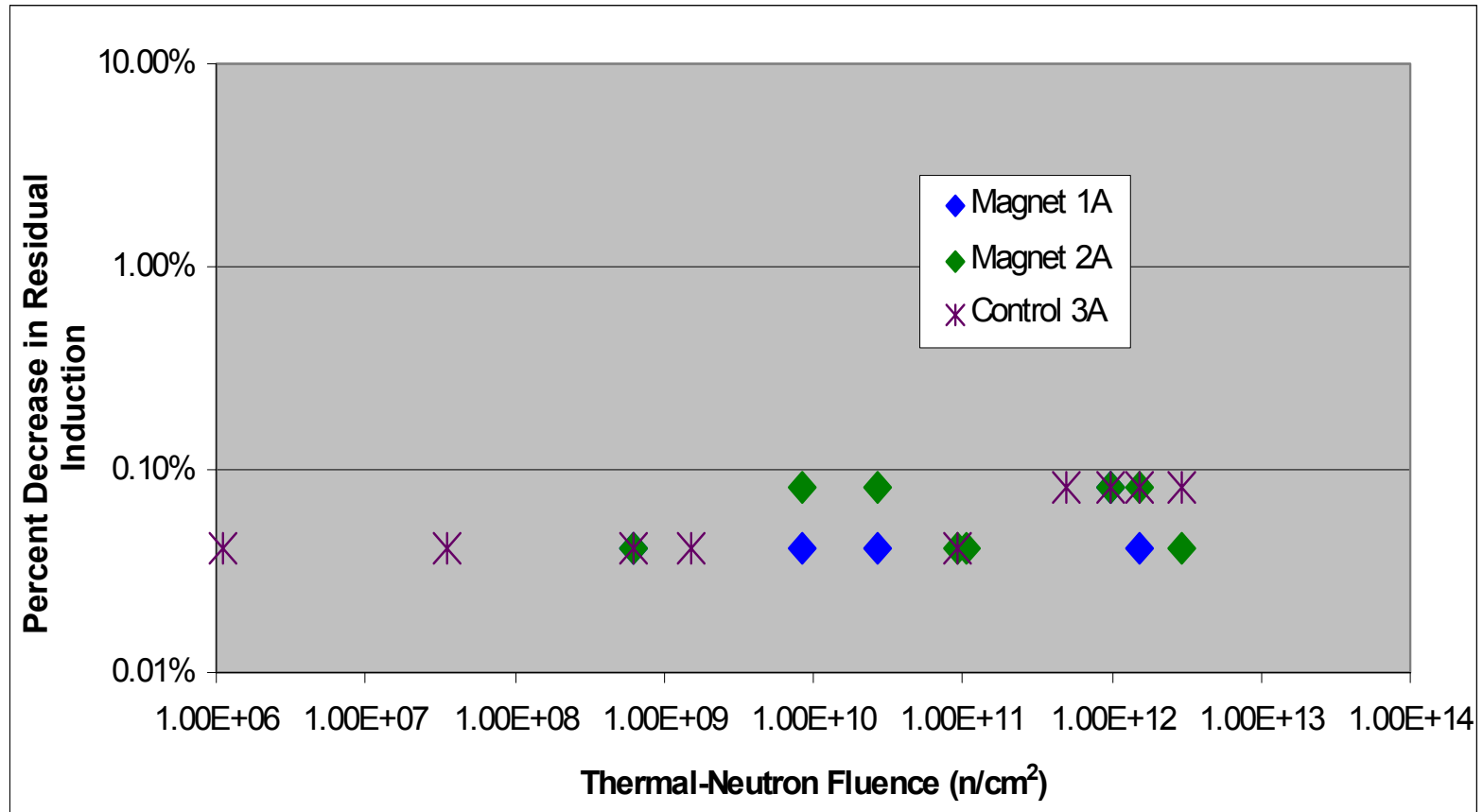
Results of Sample Magnet Irradiation with Neutrons



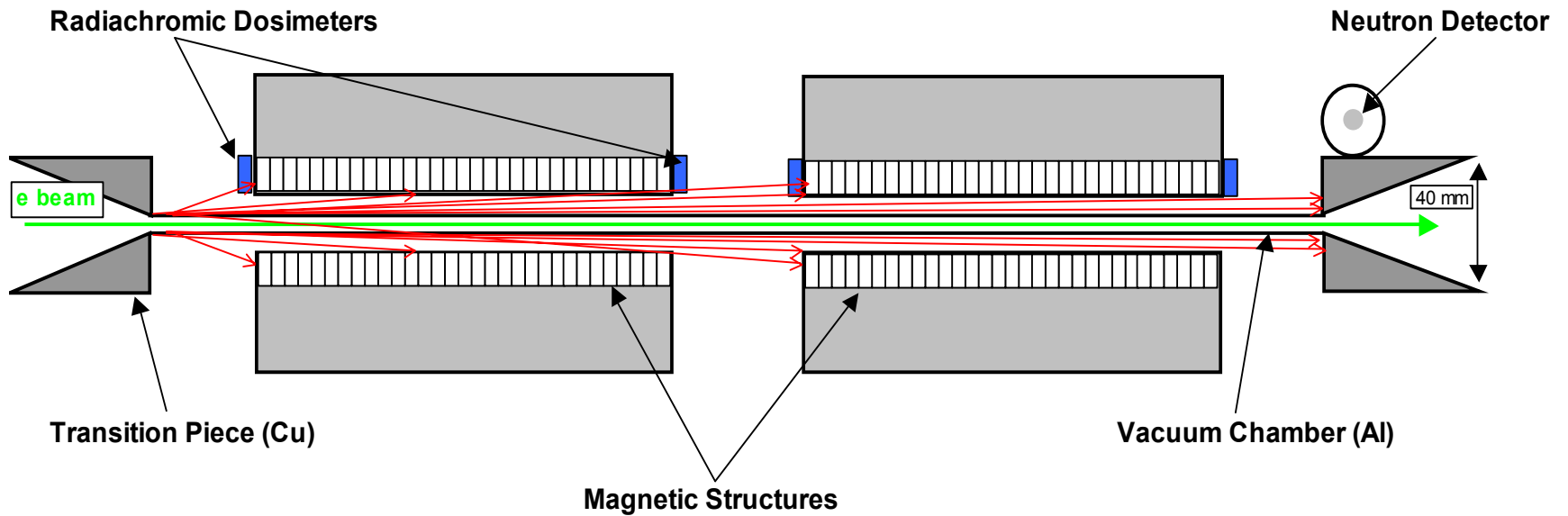
Sample Magnet Irradiation with Thermal Neutrons



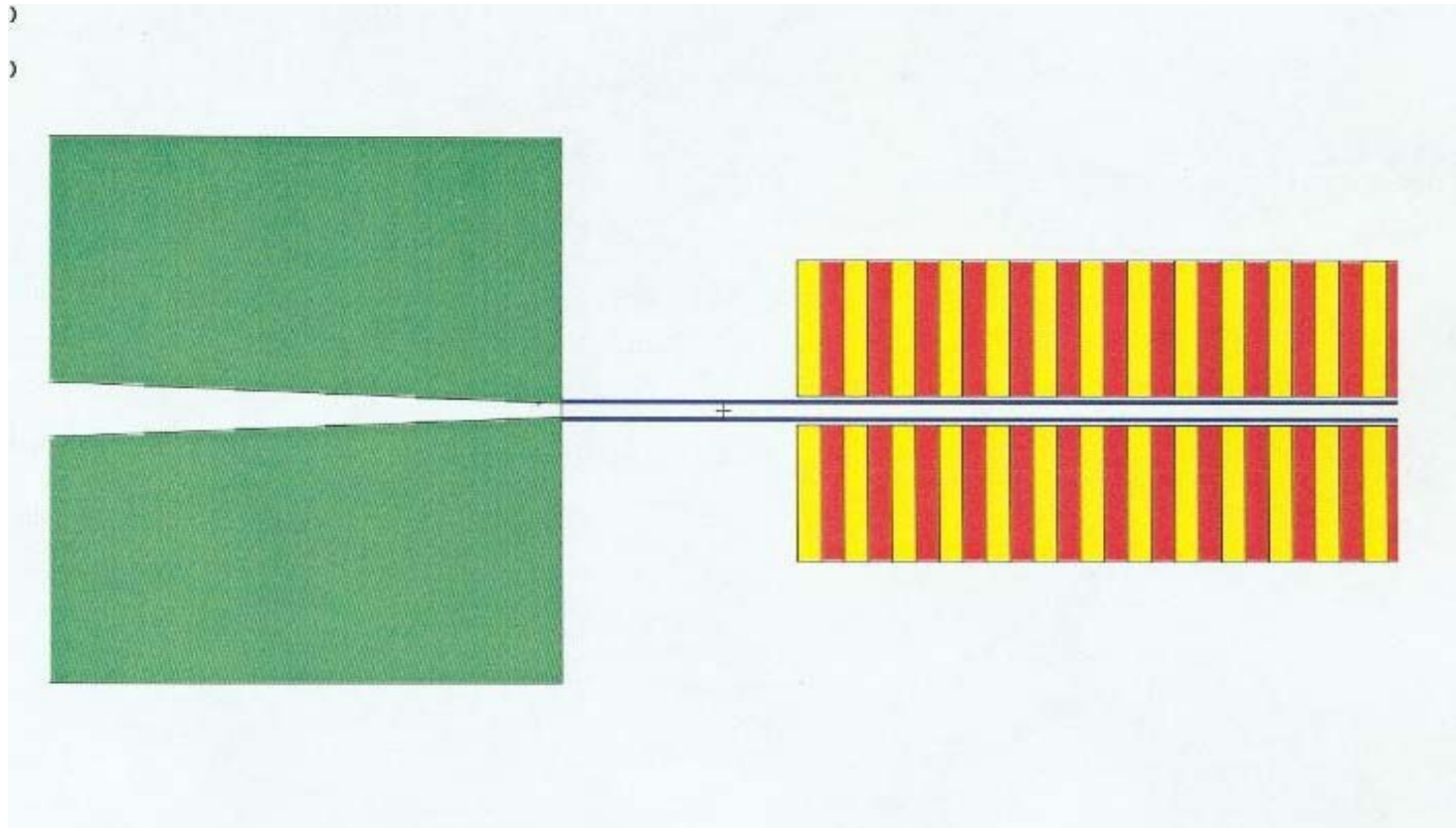
Results of Magnet Irradiation with Thermal Neutrons



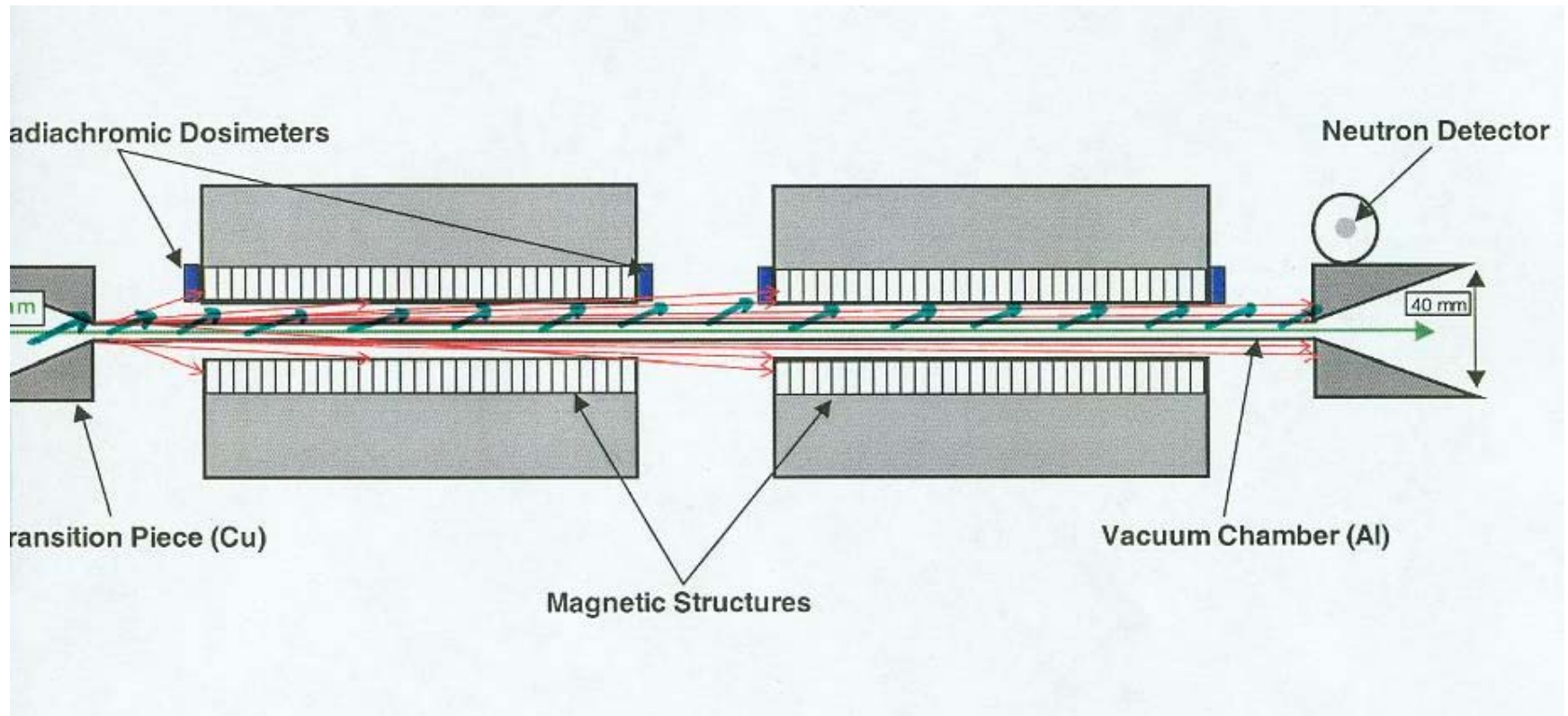
MCNP Simulation – Calculational Geometry



MCNP Simulation – Computational Geometry

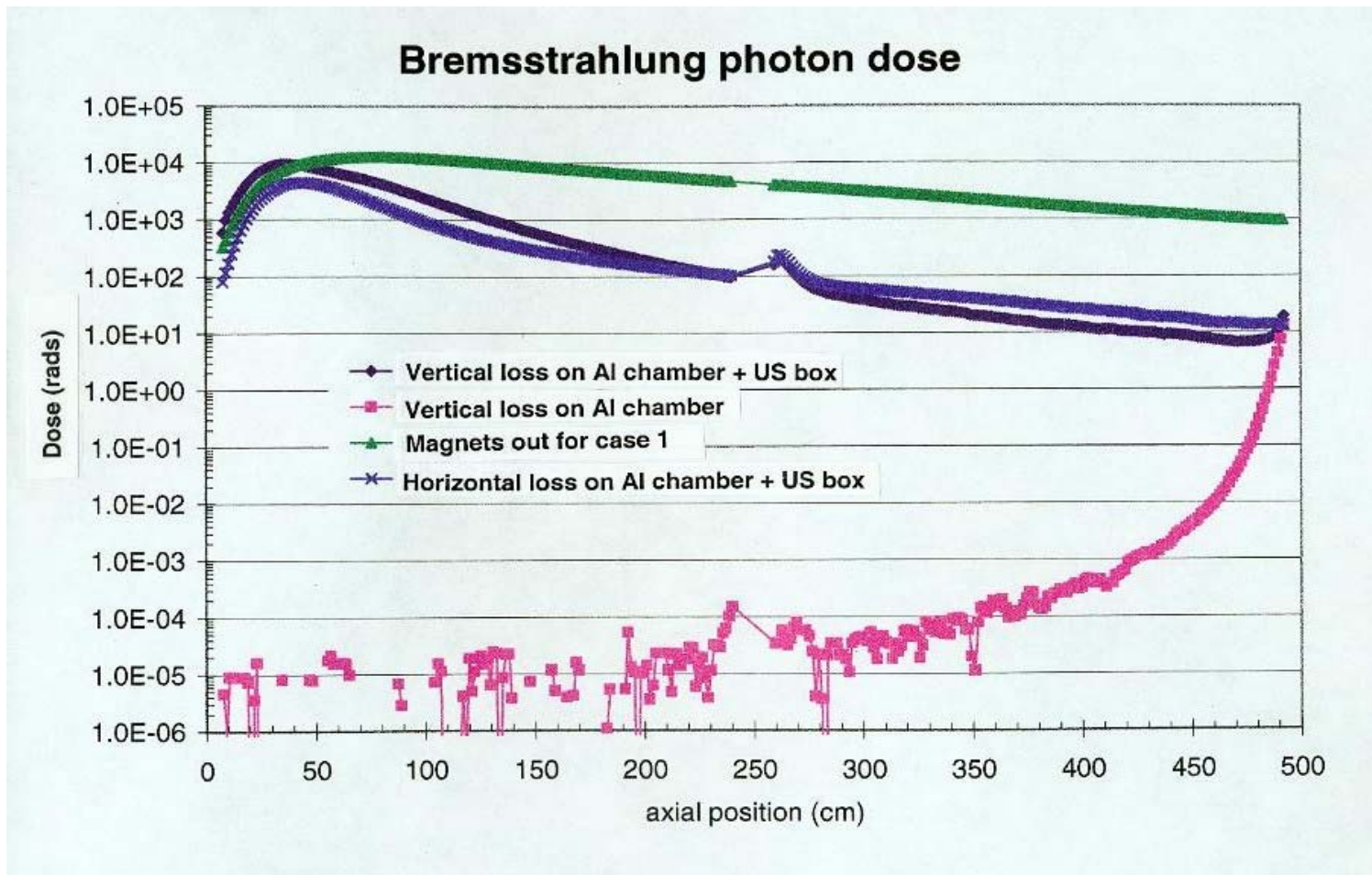


MCNP Simulation – Beam Loss Scenario 1



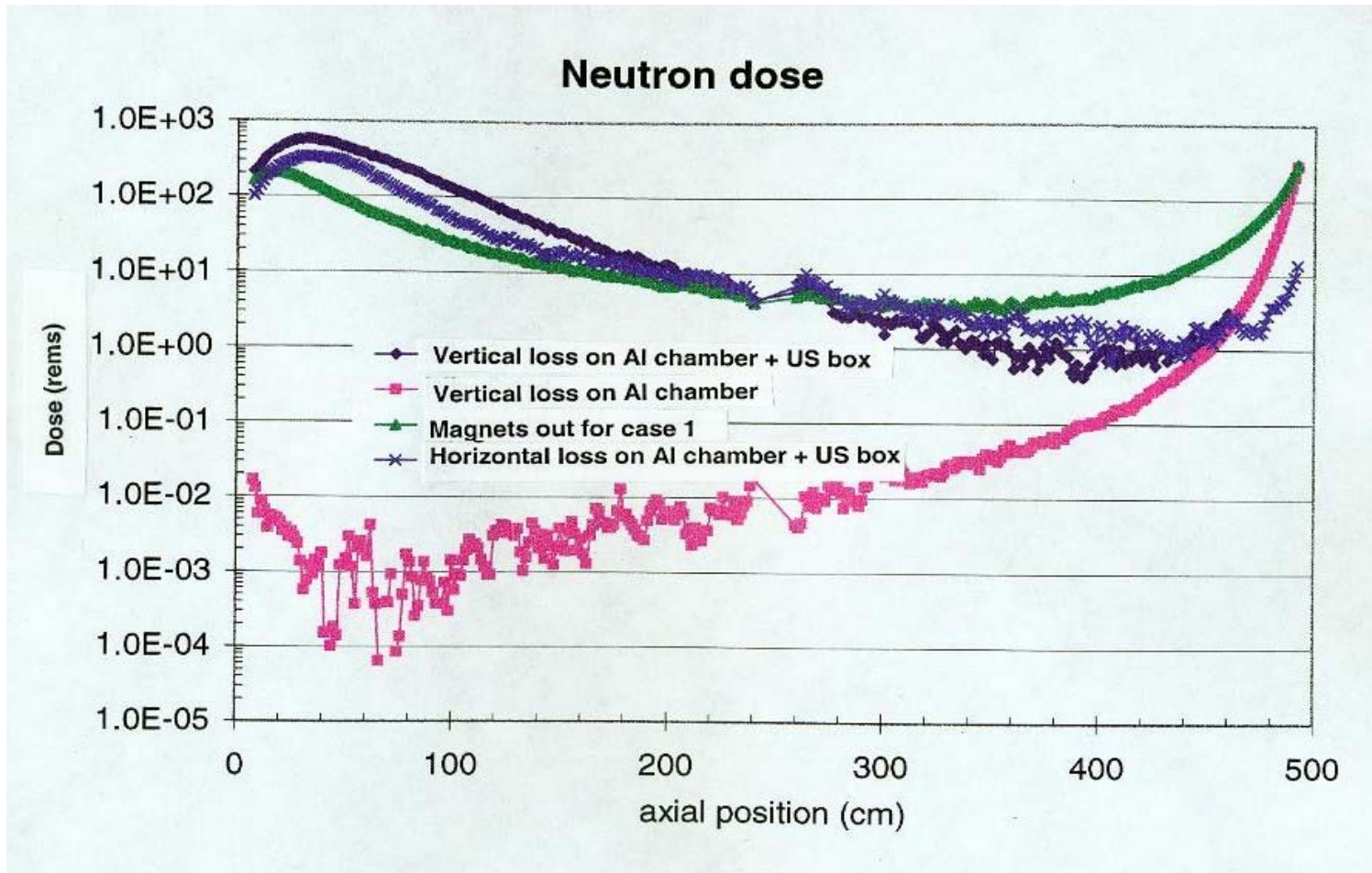
MCNP Results for Photon Dose due to Beam Loss

Beam Loss = 10^{10} electrons



MCNP Results for Neutron Dose due to Beam Loss

Beam Loss = 10^{10} electrons



Acknowledgements

- Julie Alderman and Tony Rauchas - APS
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- Rodger Martin and Cathy Simmons- ORNL

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