

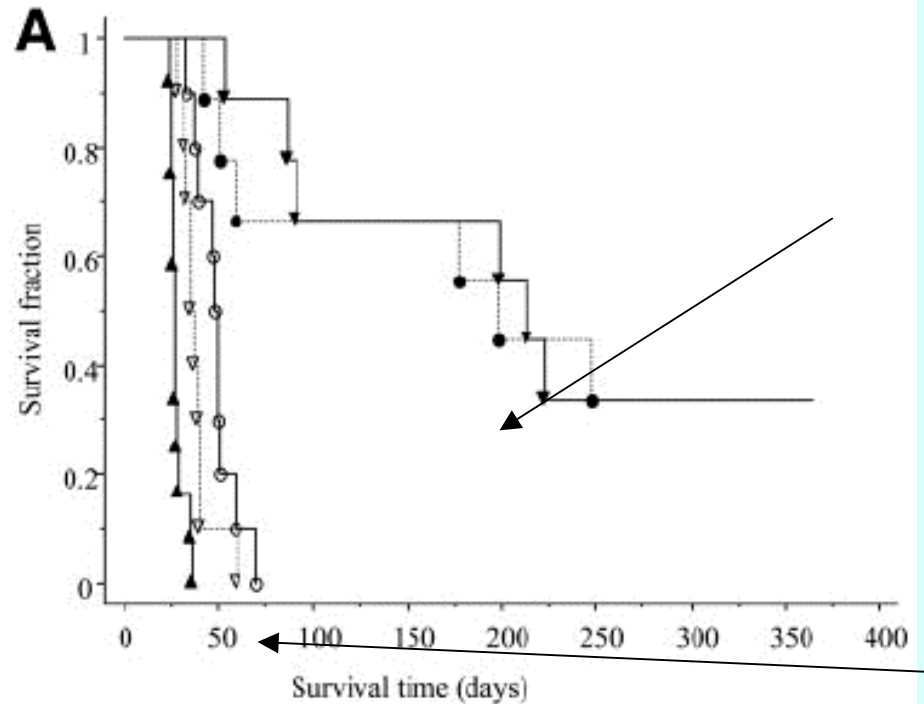
Dose and microdosimetry in sub-cellular volumes associated with the uptake of high-Z materials

Richard P. Hugtenburg^{1,2}

1. School of Physics and Astronomy, University of Birmingham, U.K

2. Queen Elizabeth Medical Centre, University Hospital Birmingham, U.K.

Synchrotron binary therapy at ESRF with cisplatin (Pt) better than BNCT for F98 Glioma cells in Fischer rats

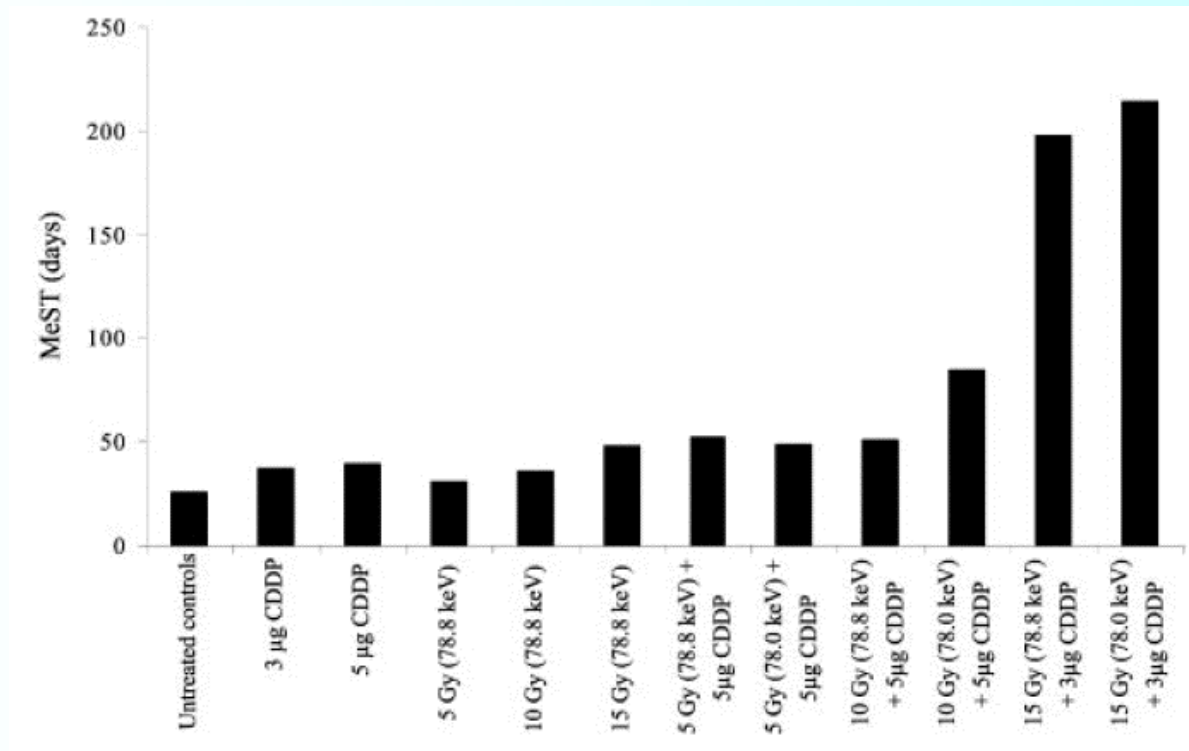


Cisplatin +
radiotherapy

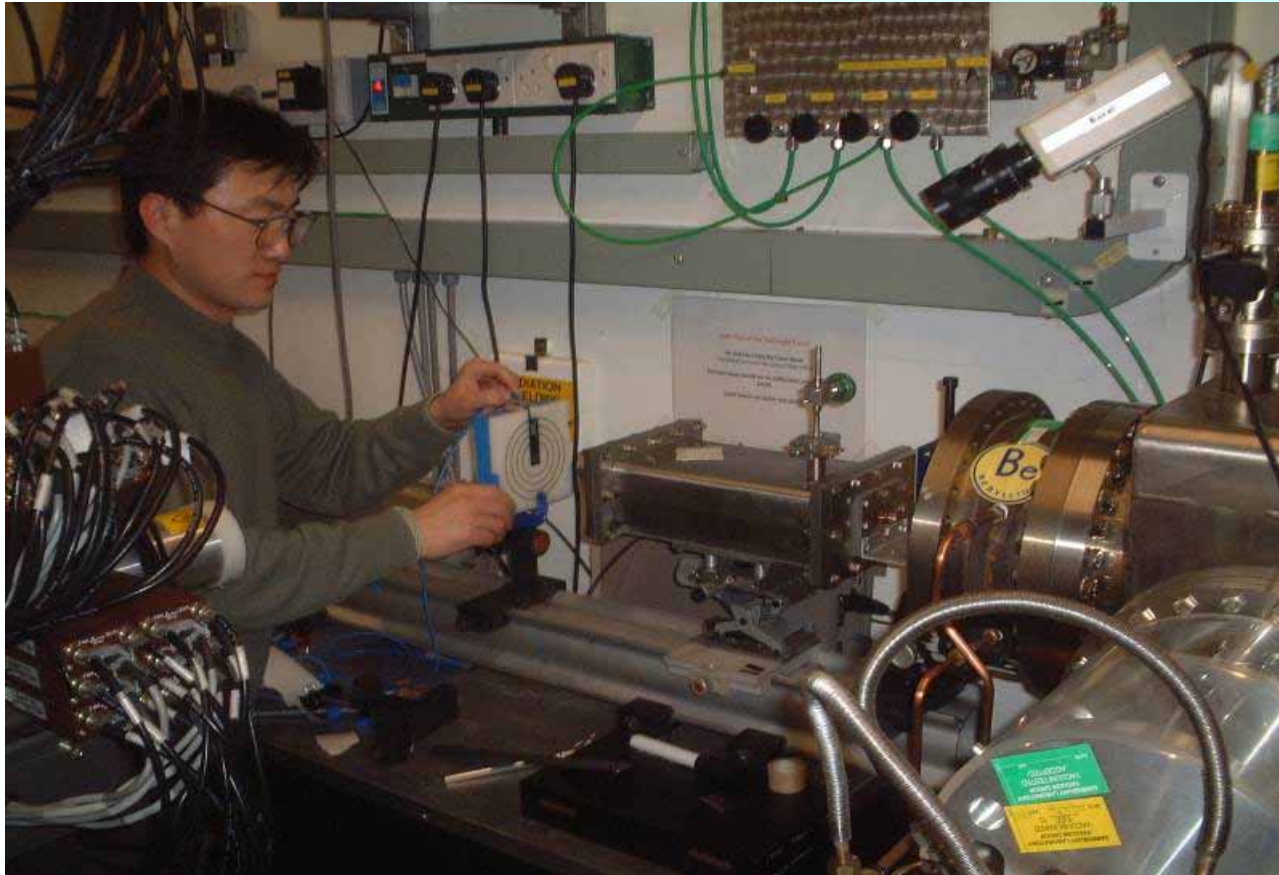
Controls

Biston *et al.*, 2004, *Cancer Research* 64 2317–2323

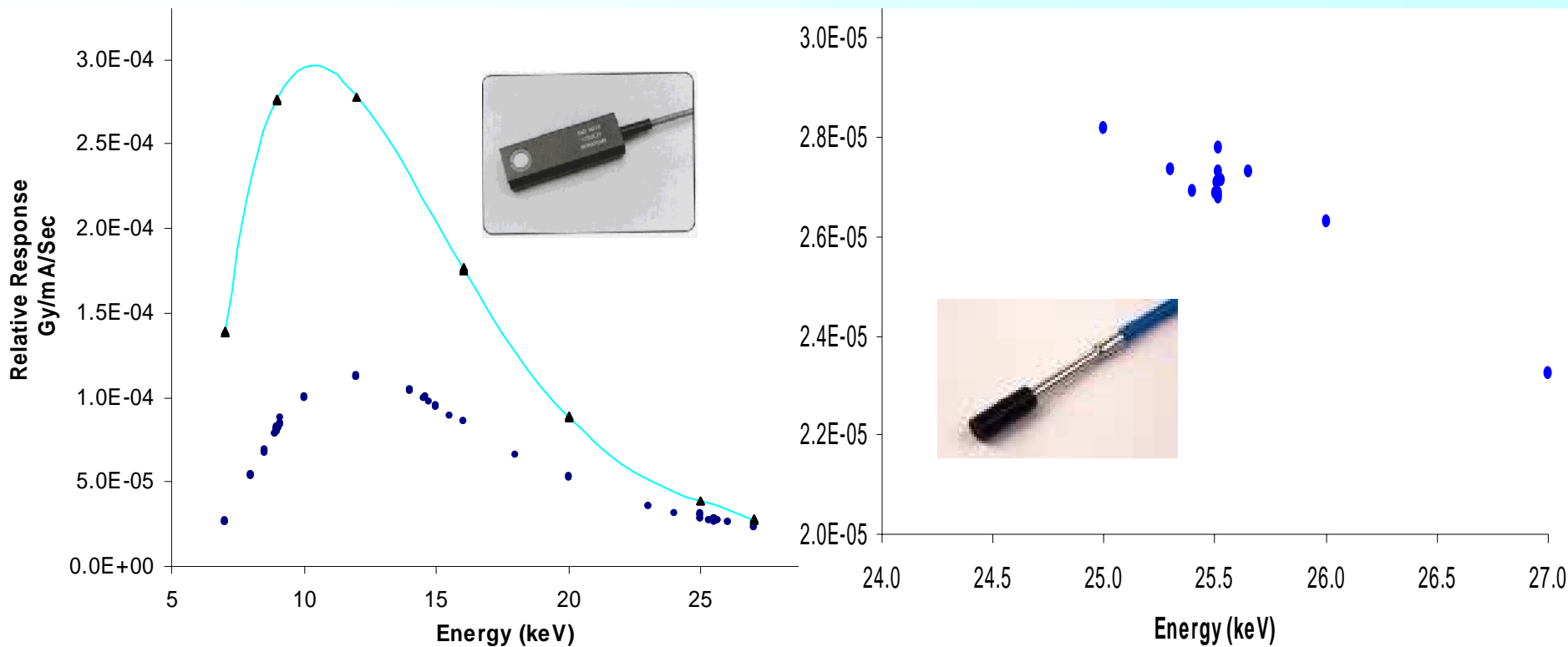
Biston et al., 2004, show that irradiation with monoenergetic synchrotron X-rays less than 500 eV above and below K-edge of Pt are indistinguishable



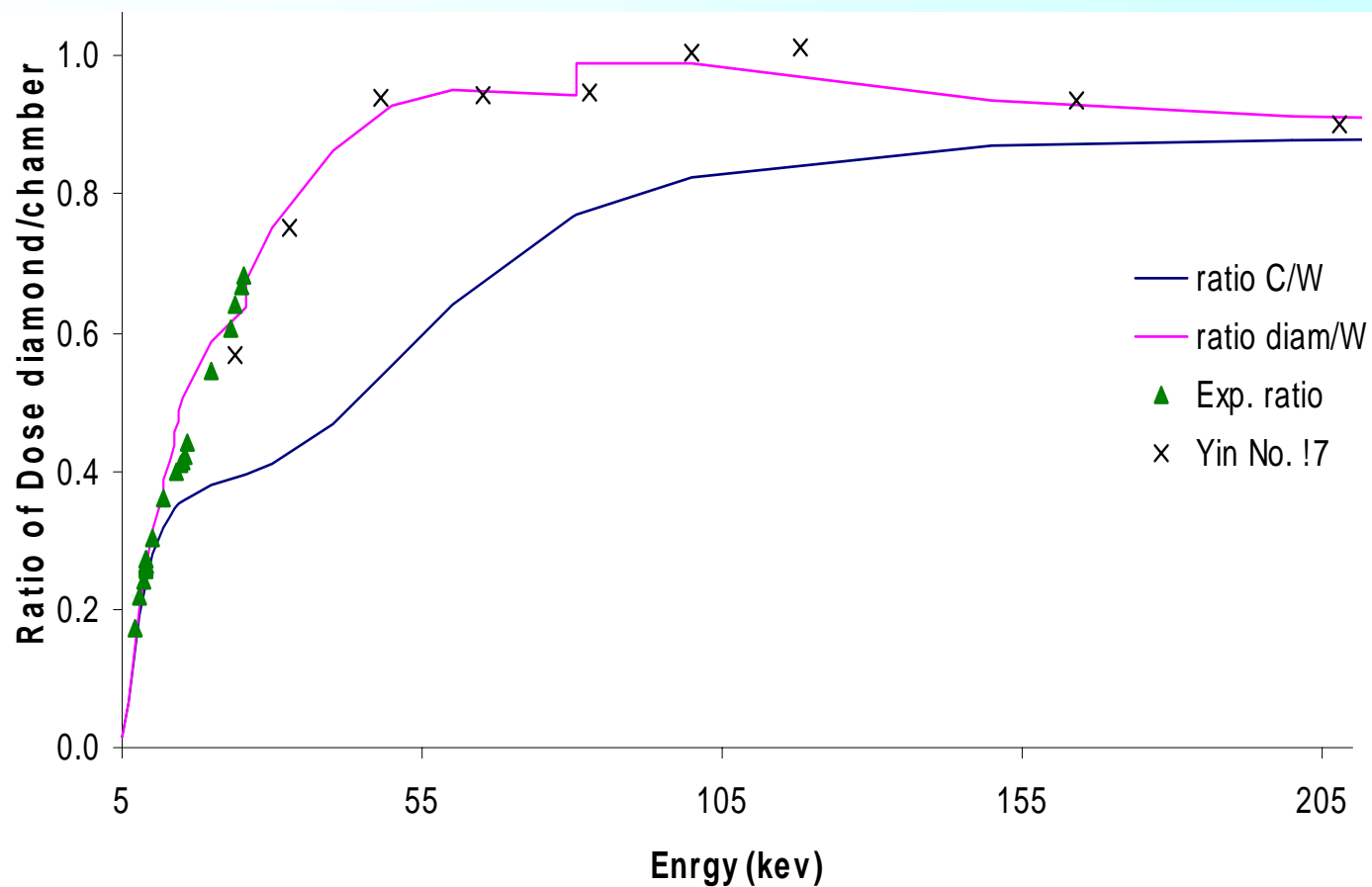
Dosimeter intercomparisons on Station 16.5 – SRS



Measurement of variation of dose-rate on Wiggler 16 at the SRS (Daresbury, UK)

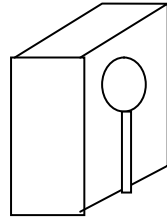


Models of the response agree with expt to within 5% over a wide range of energies (5 keV – 5 MeV)

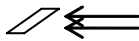


Experimental set-up and Monte Carlo models

Parallel Plate Chamber

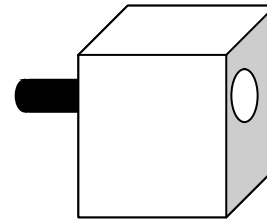


Synchrotron beam

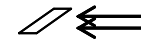


1x10 mm

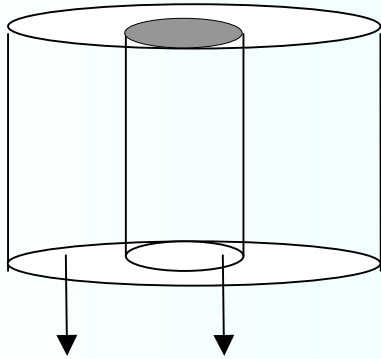
Diamond Detector Impeded in RW-1



Synchrotron beam

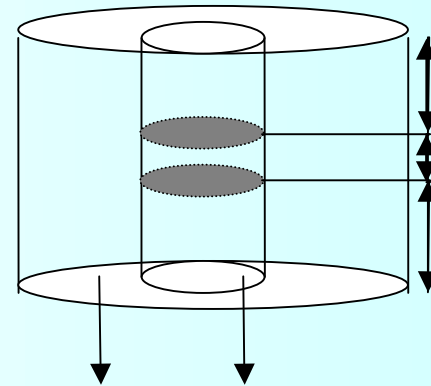


1x10 mm



PHANTOM
(WATER)

DETECTOR
(WATER)



0.15 cm
POLYTHENE

0.03 cm
DIAMOND

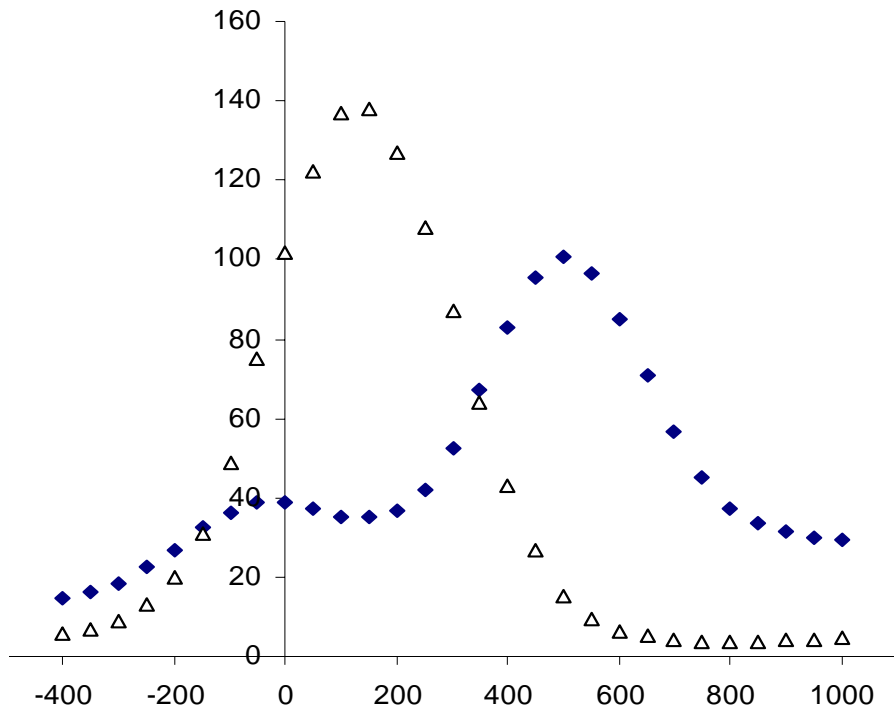
2 cm
POLYTHENE

PHANTOM
(rw-1)

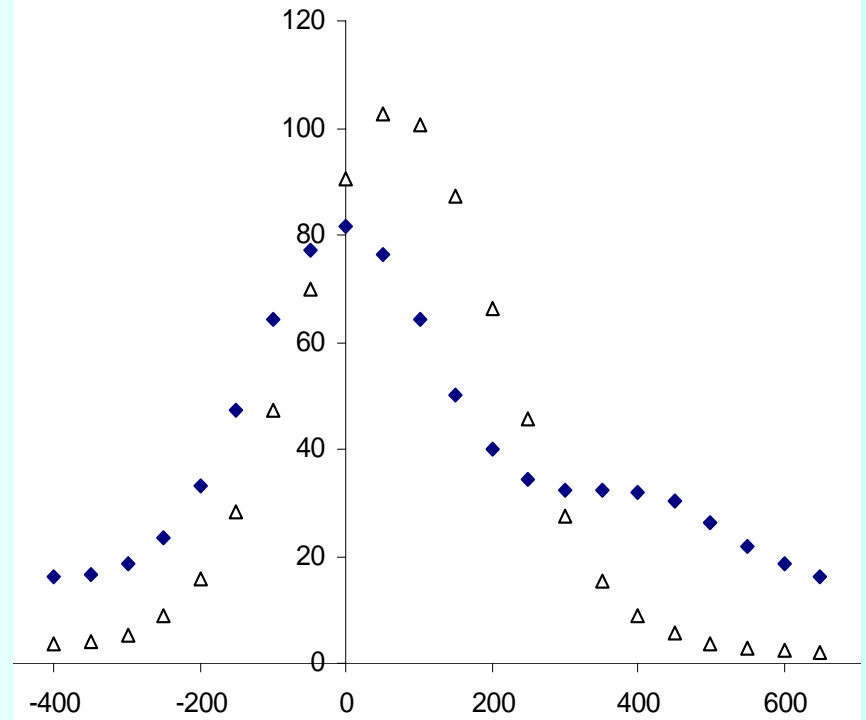
DETECTOR
DIAMOND

More detailed Monte Carlo models incorporating data obtained from μ XRF

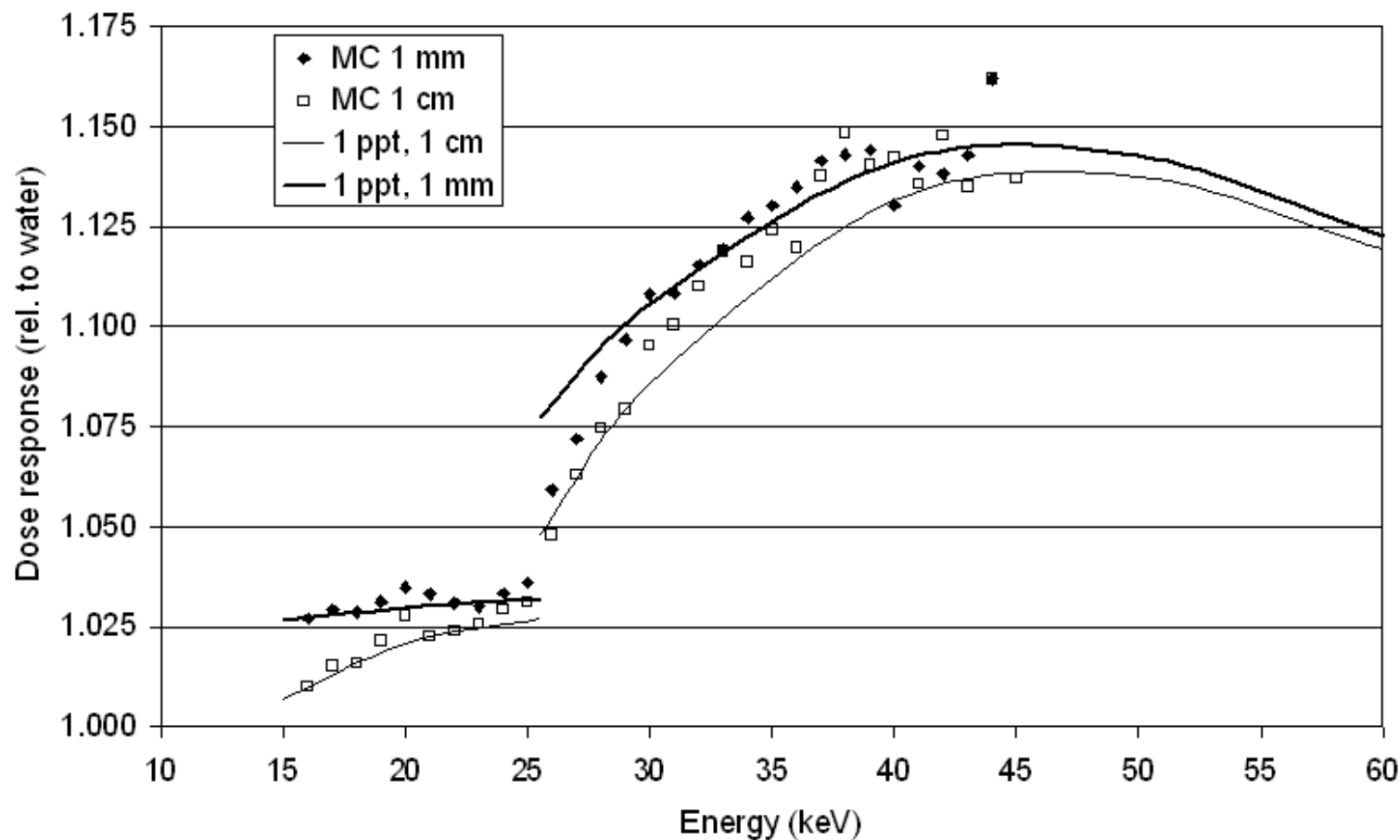
Silver FLUORESCENT



Gold FLUORESCENT

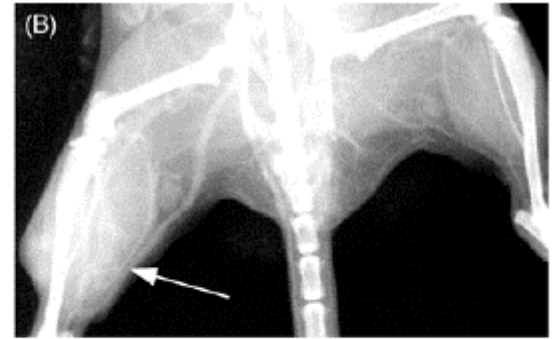
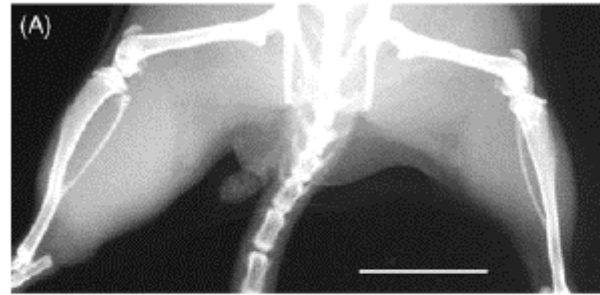


EGS4/LSCAT v. absorption models for Ag

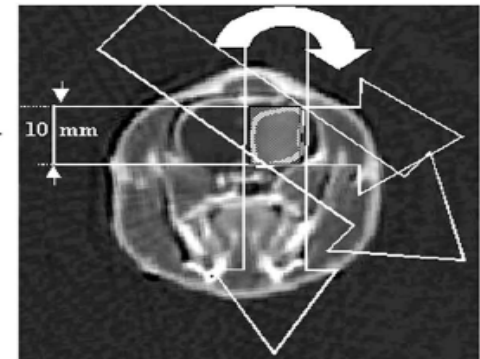
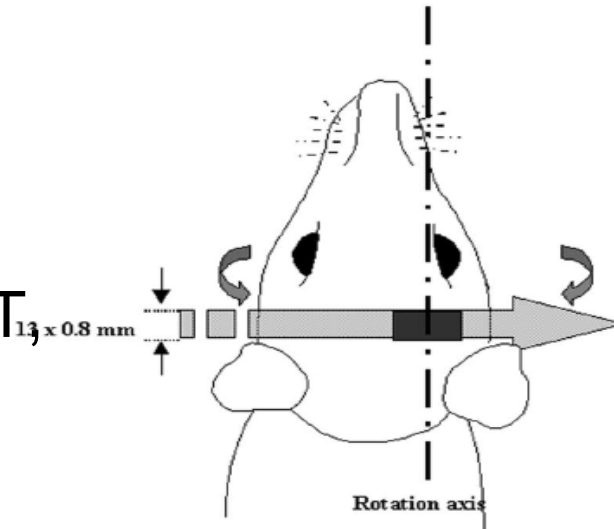


Dose enhancement through high-Z targeted RT

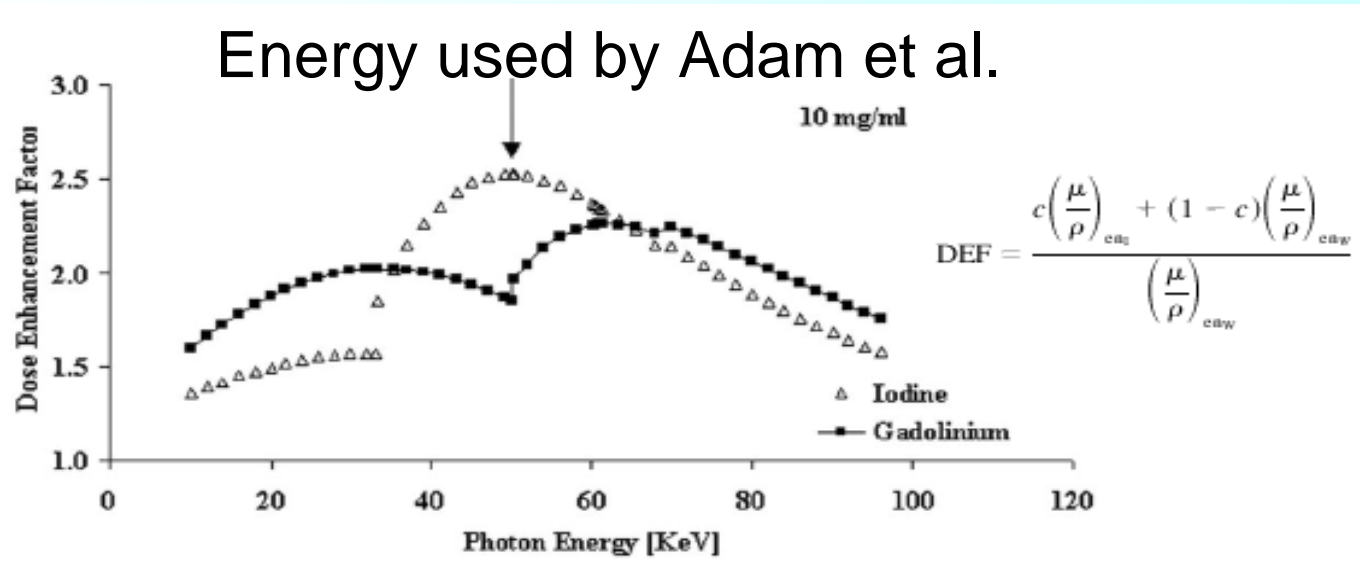
Adam et al, 2003,
Synchrotron RT of I
and Gd loaded
glioma, *IntJ
RadiatOncBiolPhys*
57: 1413



Hainfeld et al., 2004
Au nanoparticles for
enhanced 250 kVp RT,
PMB, 49: N309, 2004

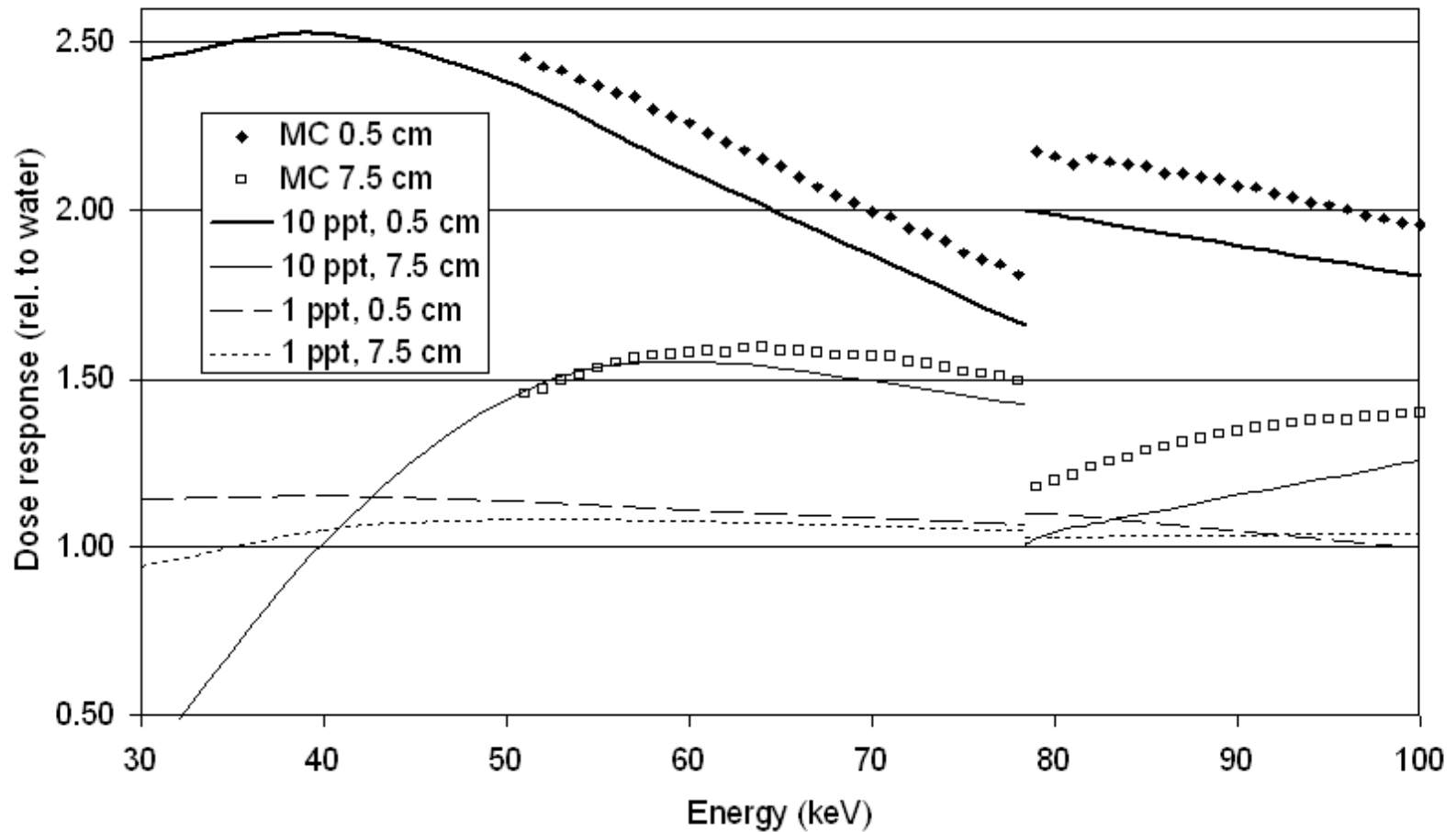


Maximum enhancement occurs beyond K-edge



Biston et al., 2004, Irradiation above or below K-edge radiobiologically indistinguishable, *Cancer Res.*, 64: 2317

EGS4/LSCAT versus absorption models for Pt

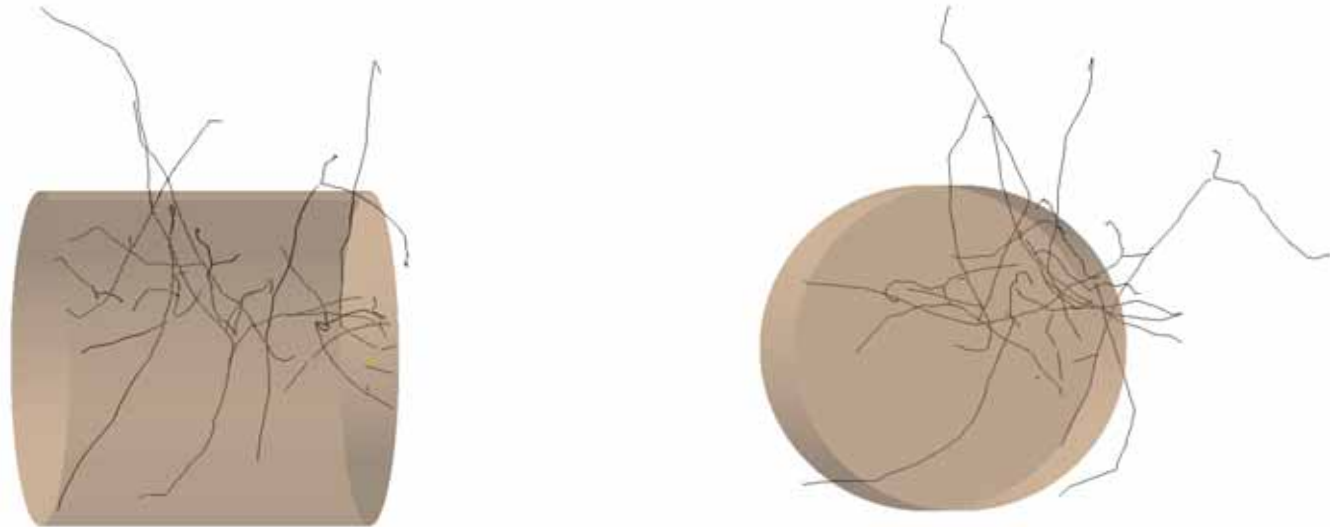


**Dose enhancement for localised 10 mg/ml concentrations
of Pt relative to that of a water-filled volume**

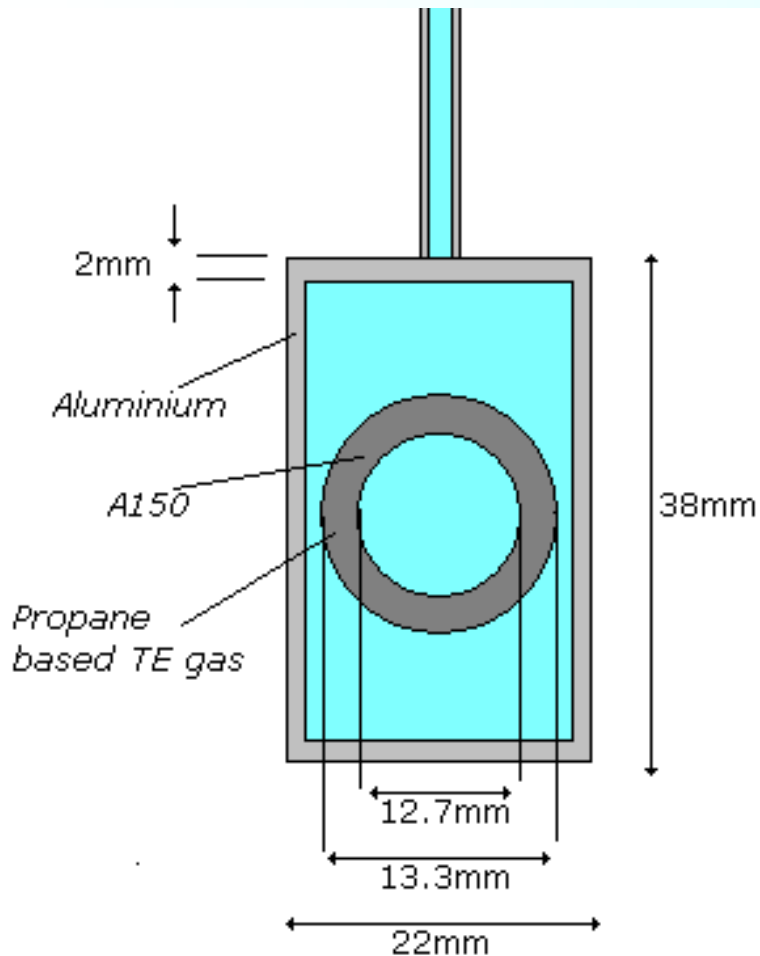
Region size @ 10 mg/ml	78.0 keV	78.8 keV	90 keV
0.2 micron	1.02	1.20	1.16
2 micron	1.10	1.33	1.38
20 micron	1.26	1.53	1.51

Determination of energy deposition within small volumes – Going beyond dose and LET

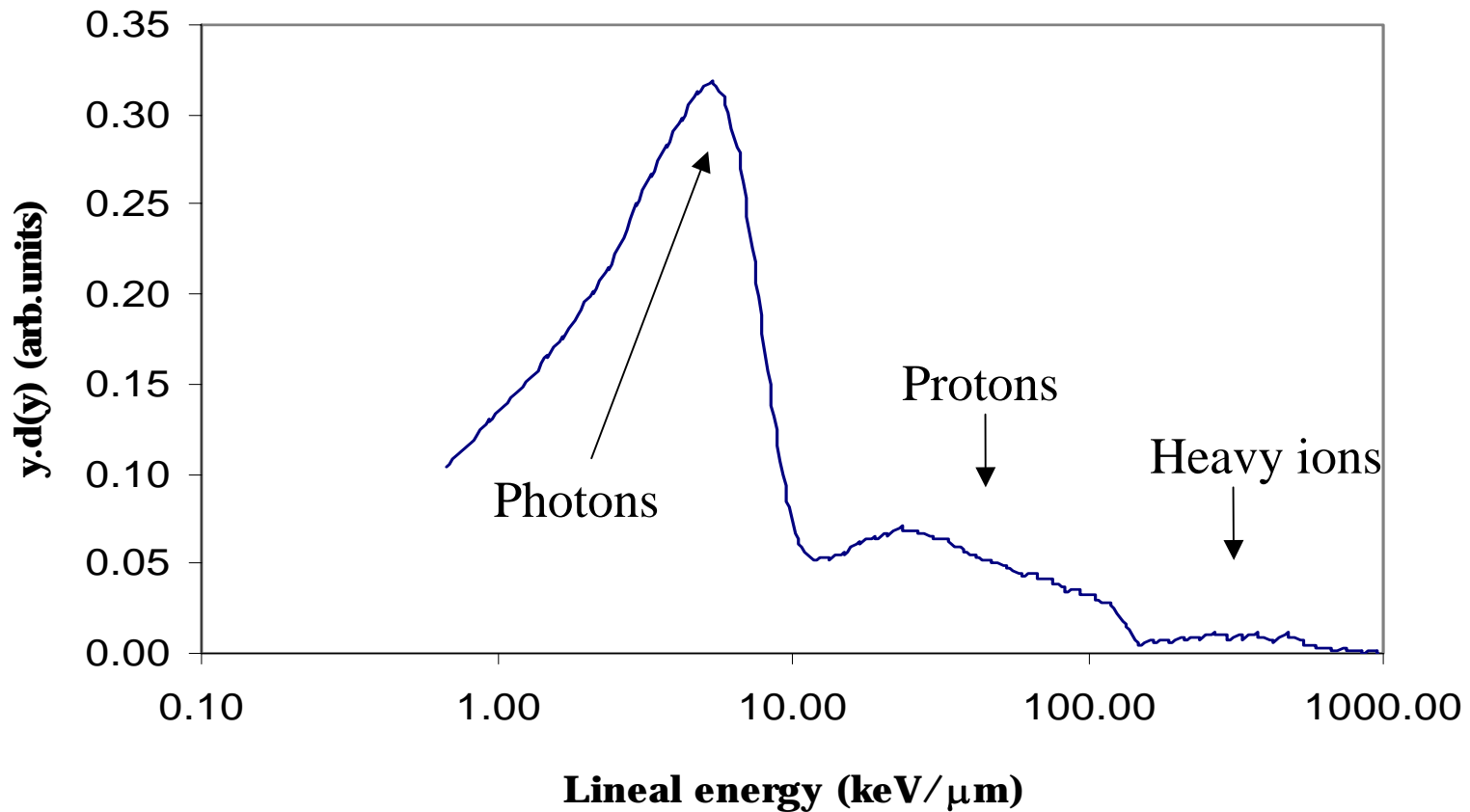
- Tissue equivalent proportional counter (TEPC)
- Lineal energy calculations via PENELOPE



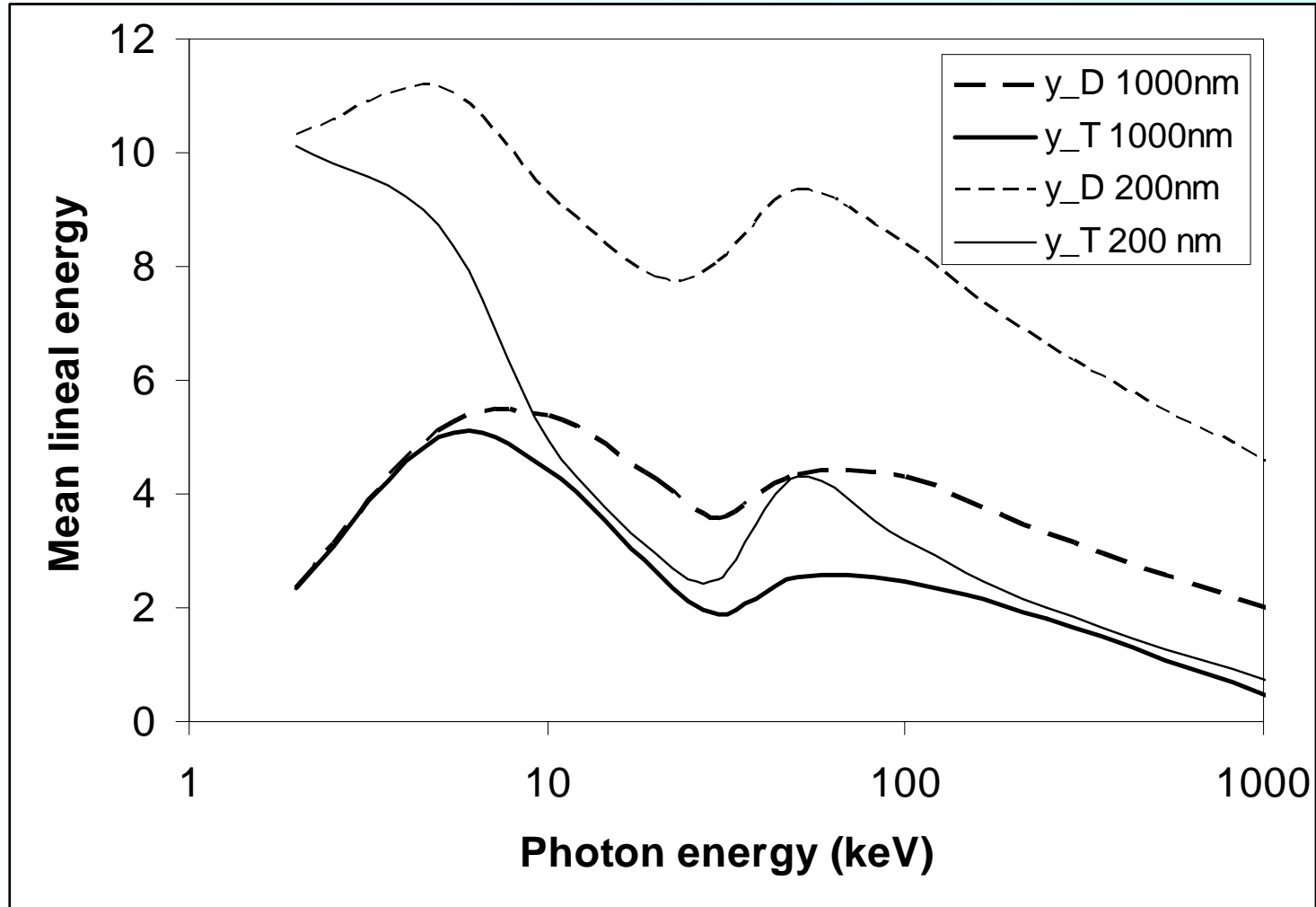
Schematic and photograph of a single wire TEPC microdosimeter



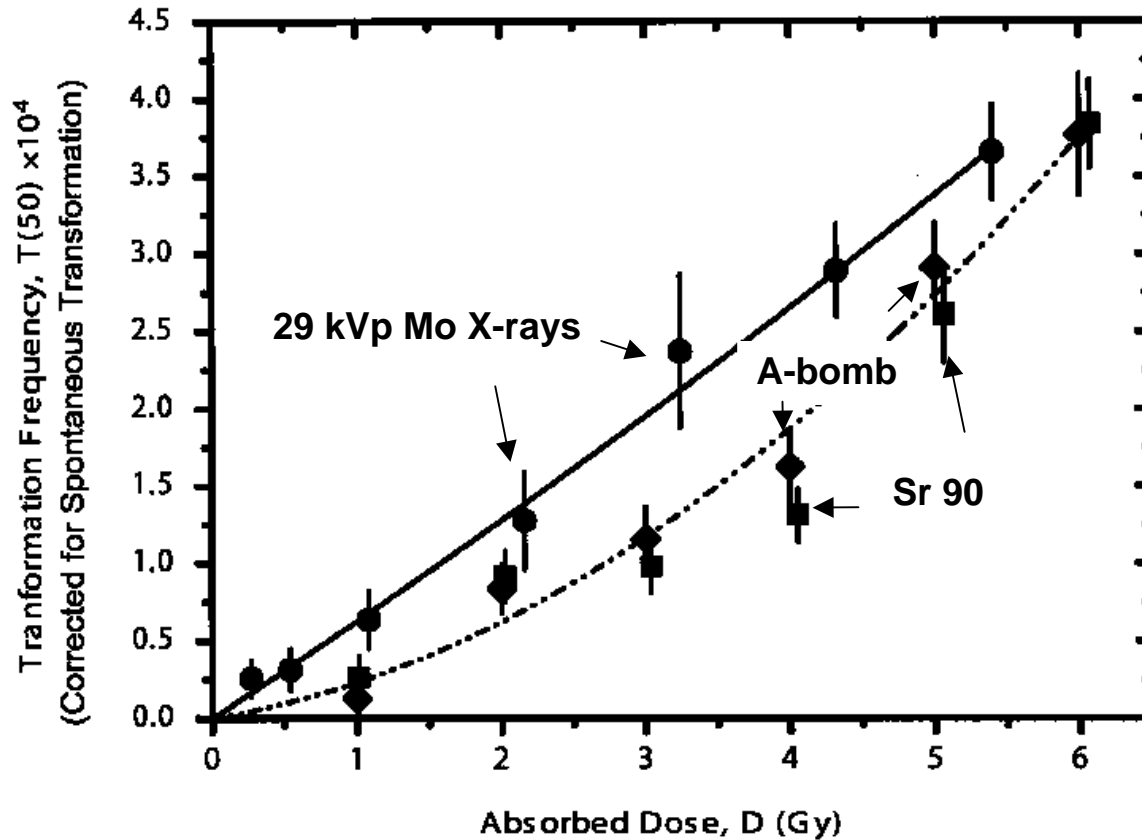
Microdosimetry measurements of mixed photon neutron field using TEPC



Variation in mean lineal energy with photons energy

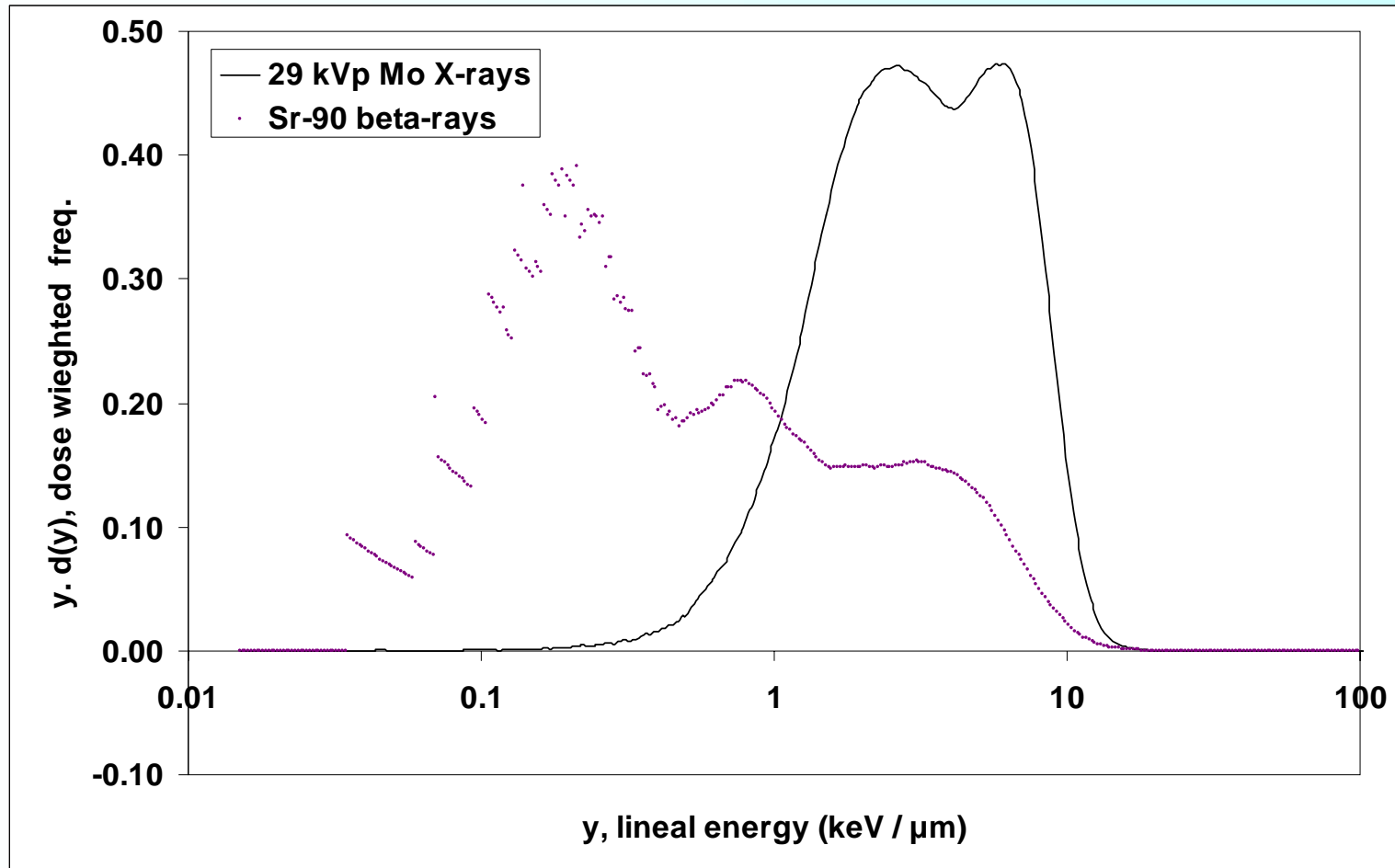


Transformation rate of CGL-1 for a 29 kVp Mo X-ray mammography set relative to Sr-90 beta electrons and A-bomb like linear accelerator irradiations

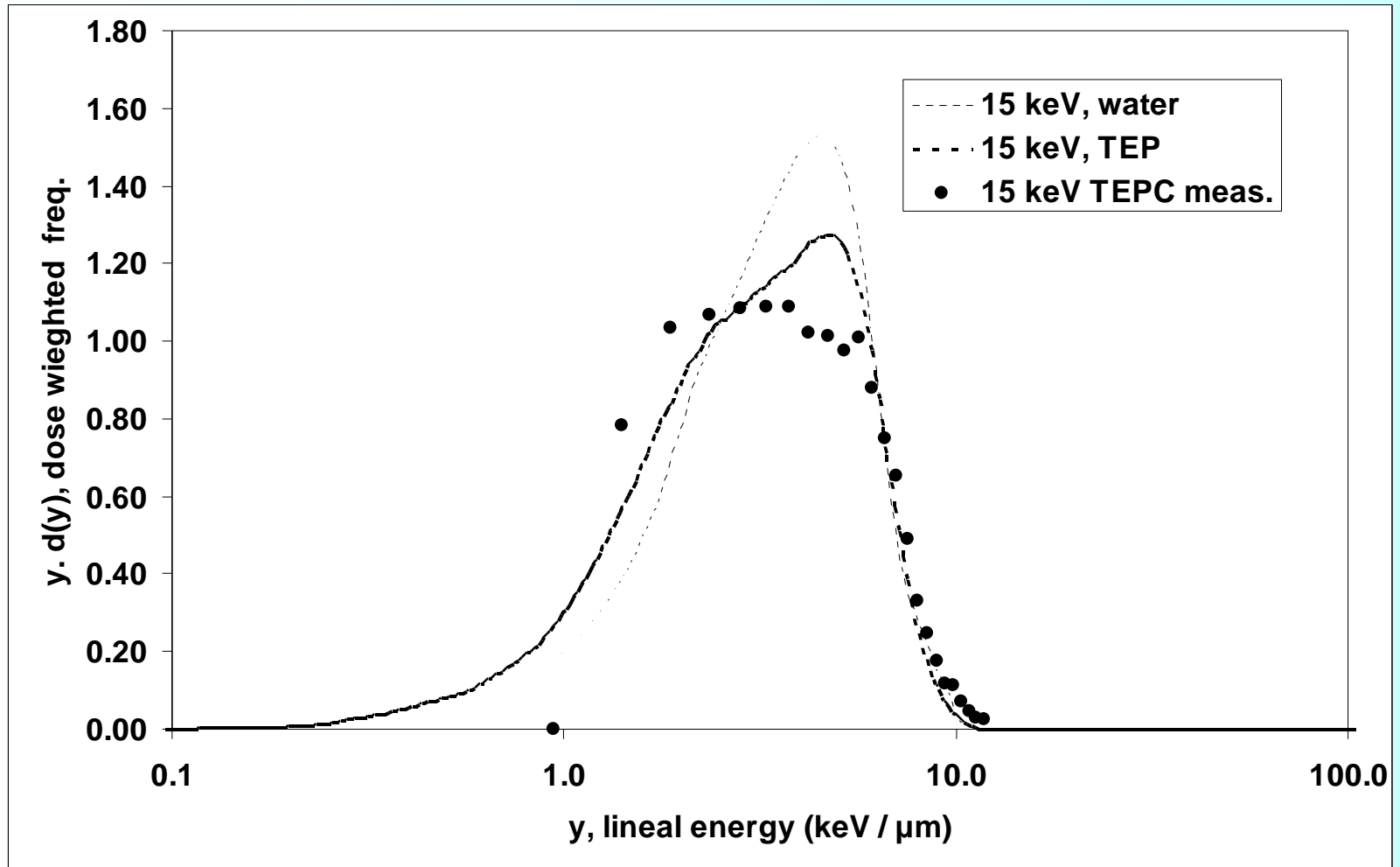


Heyes and Mill, 2004, *Radiat. Res.* 162: 120-7

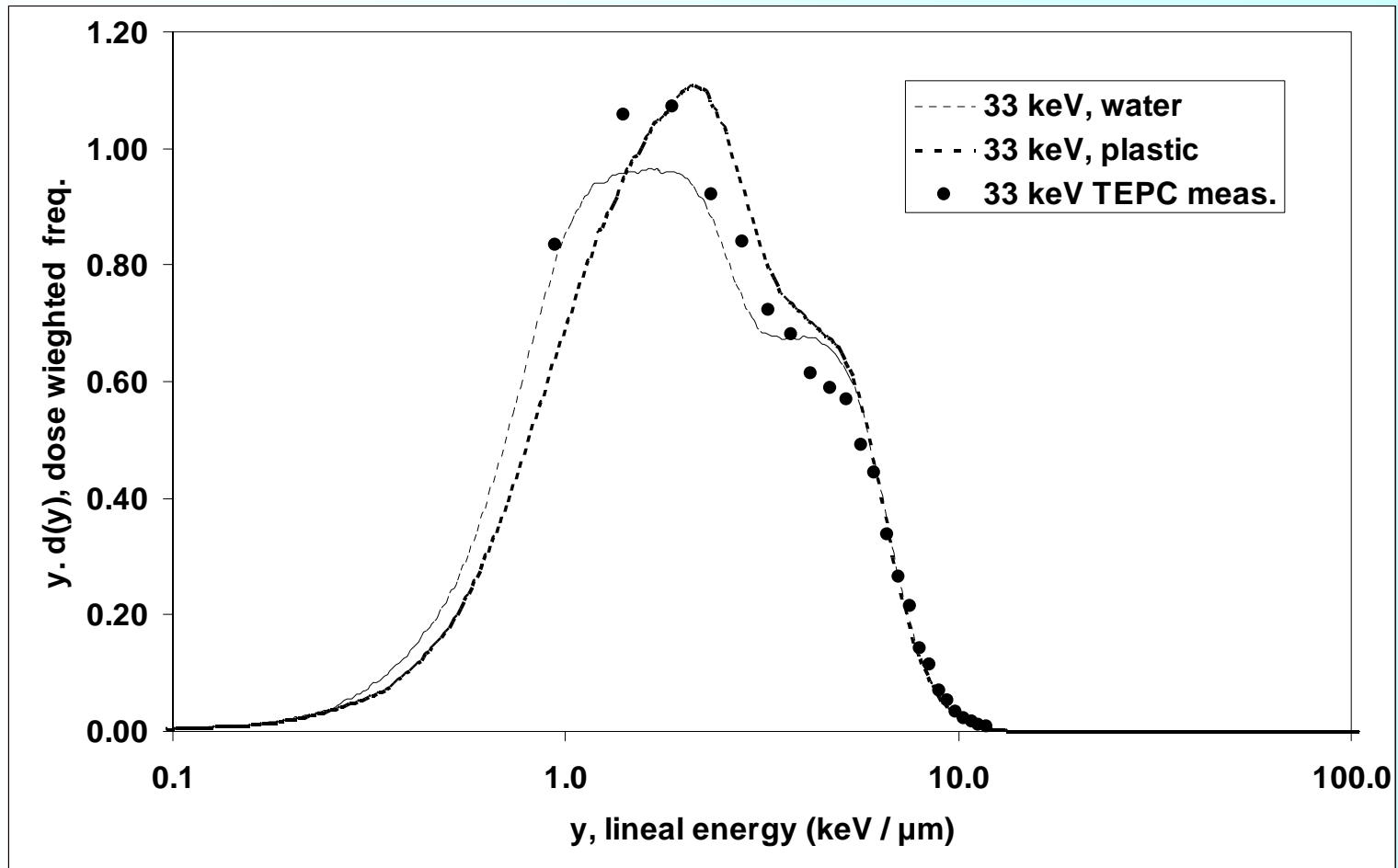
Lineal energy spectra for 29 kVp Mo X-rays relative to Sr-90 beta-electrons



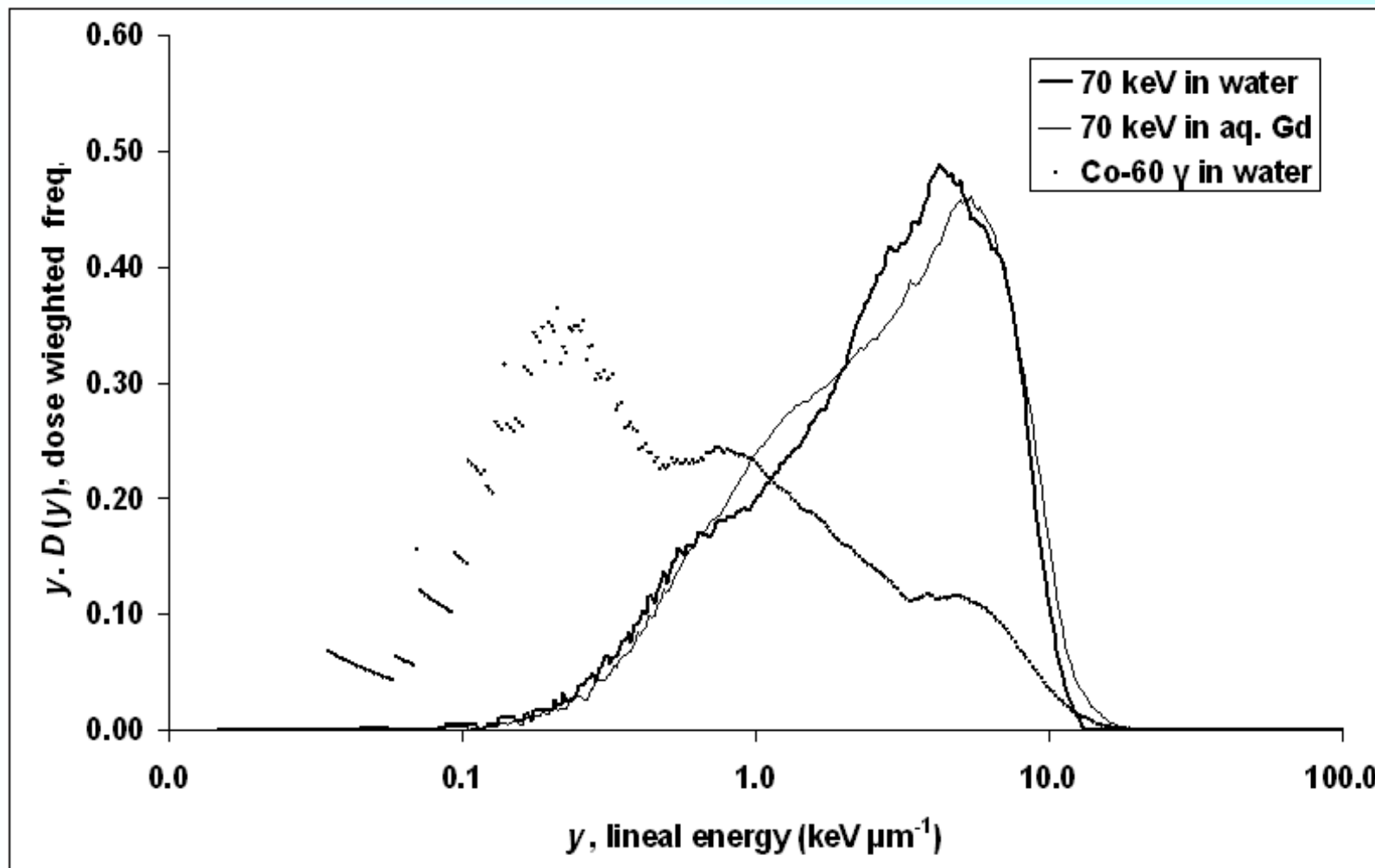
Lineal energy spectra for 15 keV photons in a 2 micron site



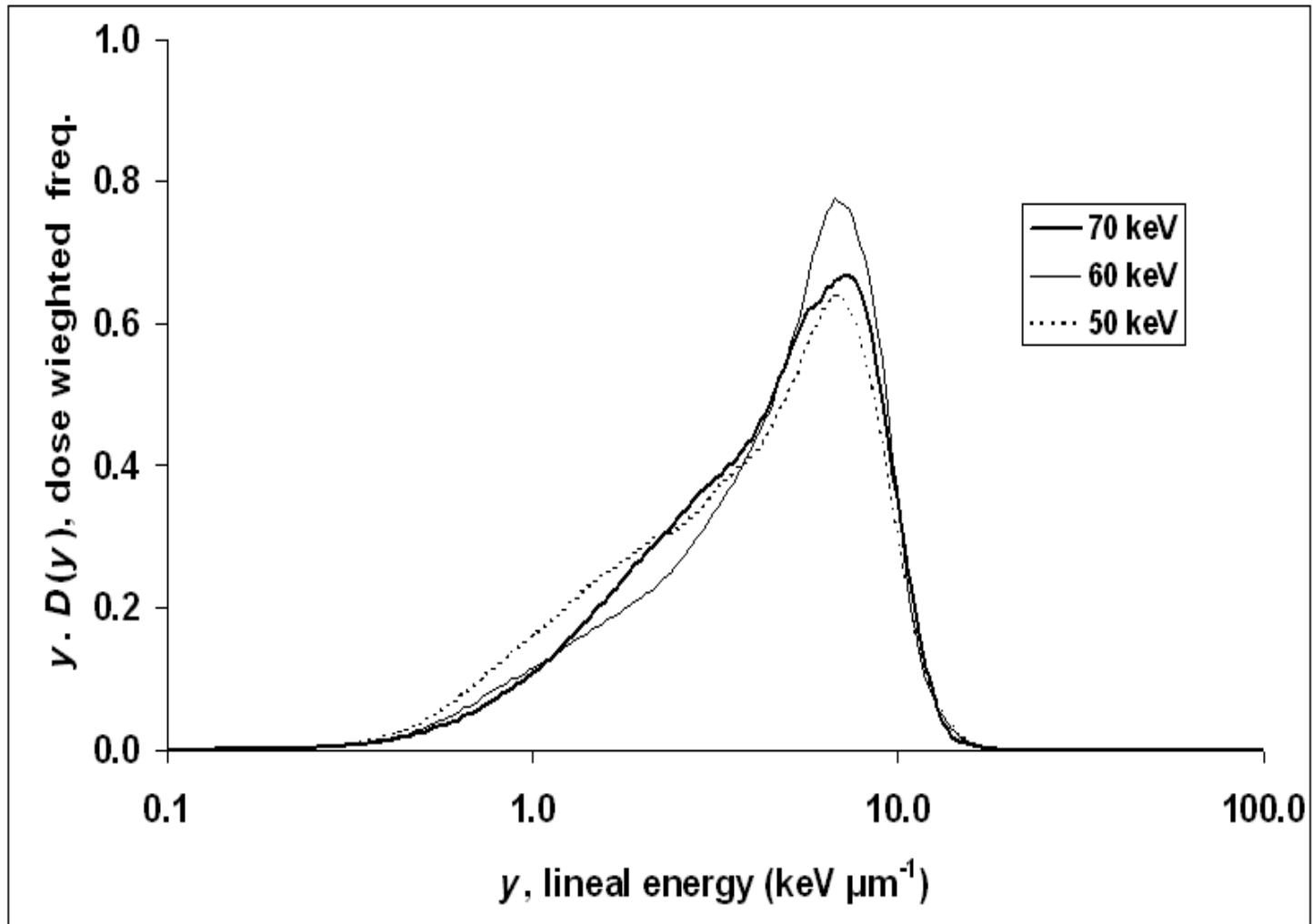
Lineal energy spectra for 33 keV for a 2 micron cell



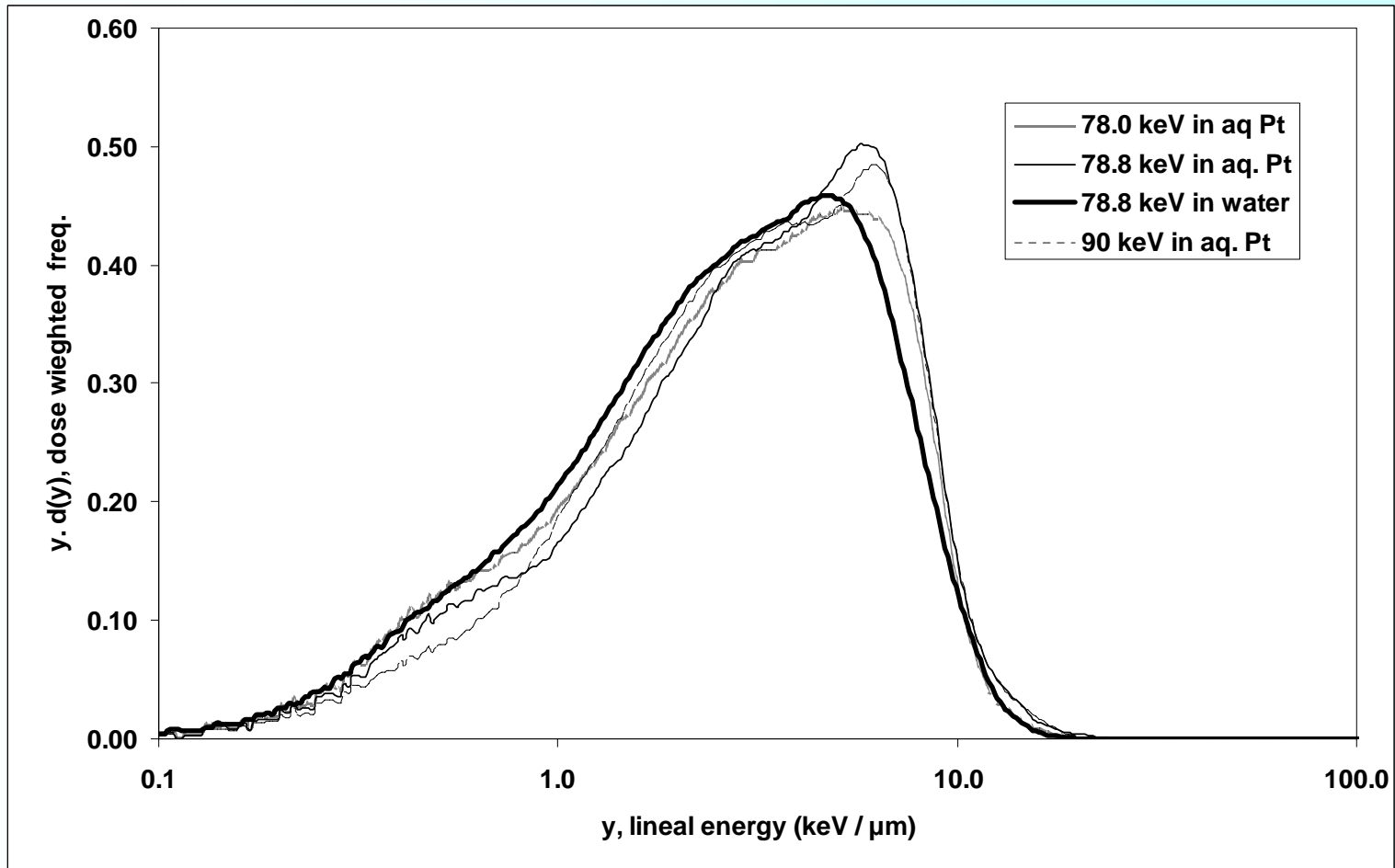
Lineal energy in water and aq. Gd inside a 1 micron cell



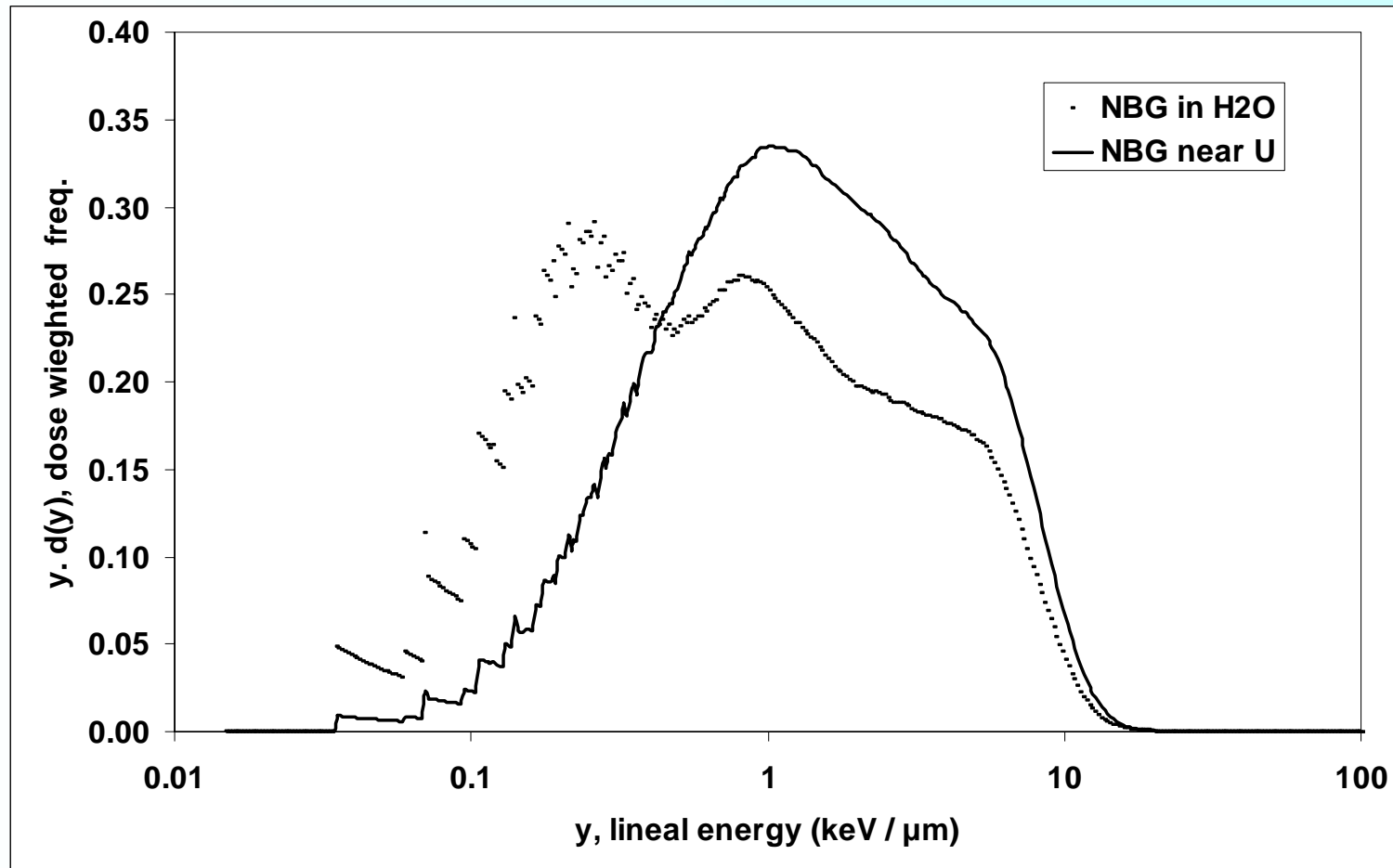
Lineal energy spectra from Gd particle outside a 1 micron site



Lineal energy spectra for Pt enhanced medical radiation (1 micron site)



Lineal energy spectra from U particle enhancing natural background radiation (1 micron site)



Acknowledgements and Participants:

University of Birmingham:

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University of Setif, Algeria:

Zine-El-Abidine Chaoui