



THE UNIVERSITY  
OF BIRMINGHAM

# EGSnrc in the cell nucleus (EGG YOLKS?)

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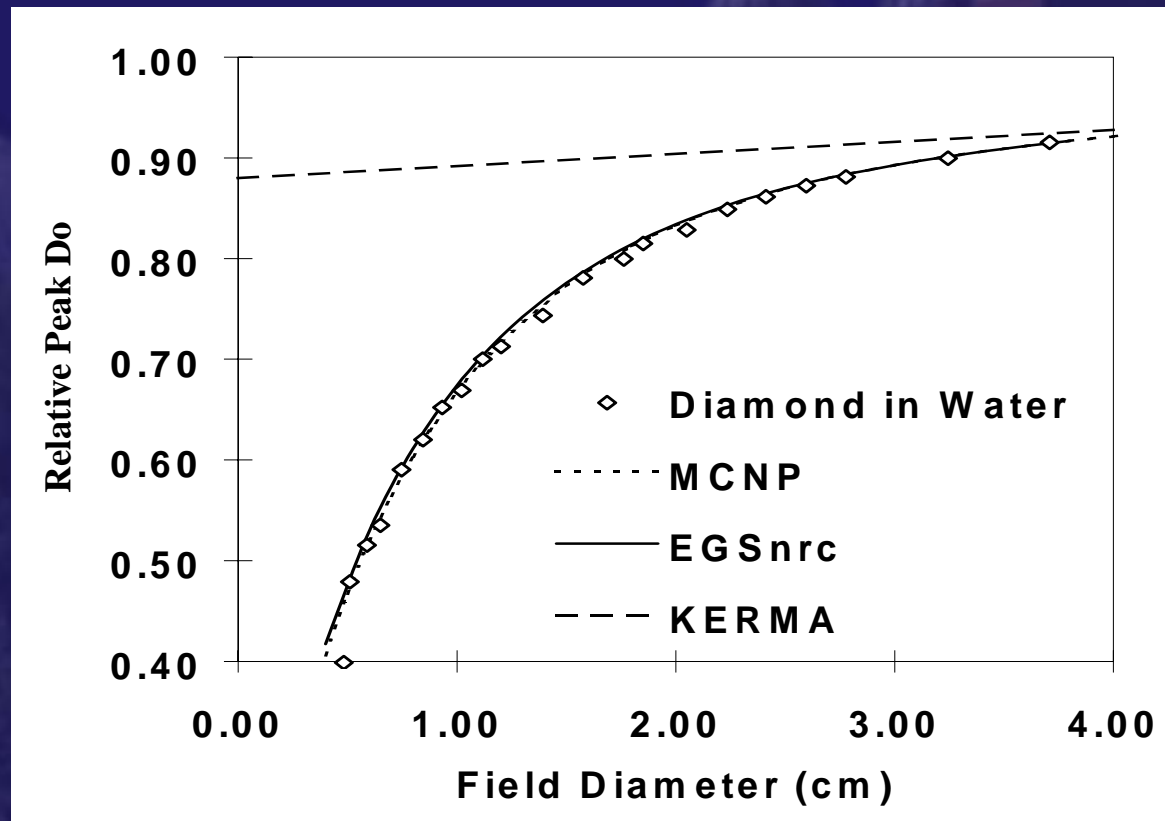
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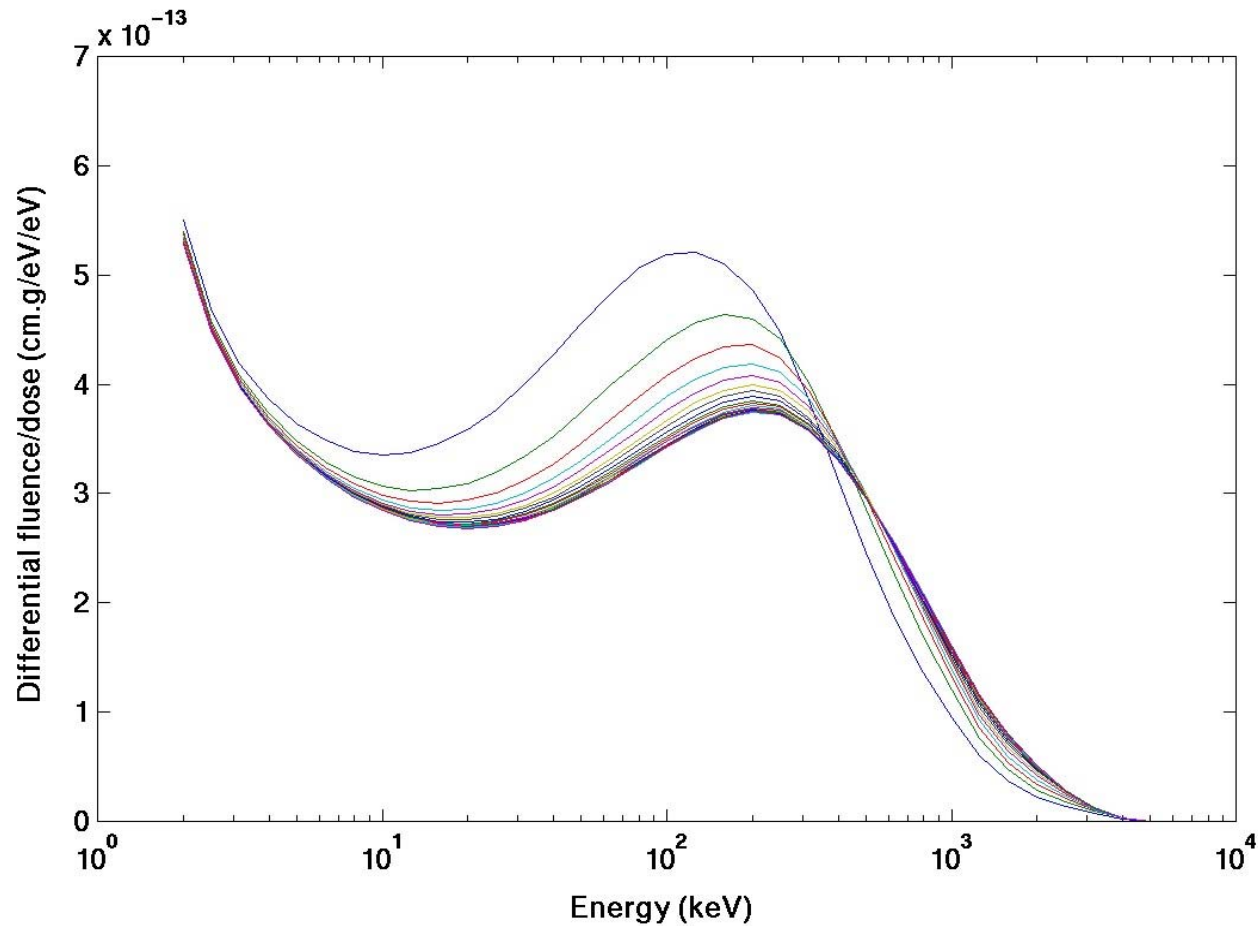
<http://members.lycos.co.uk/hugtenburg>

# Solid-state detectors for high spatial-resolution dosimetry

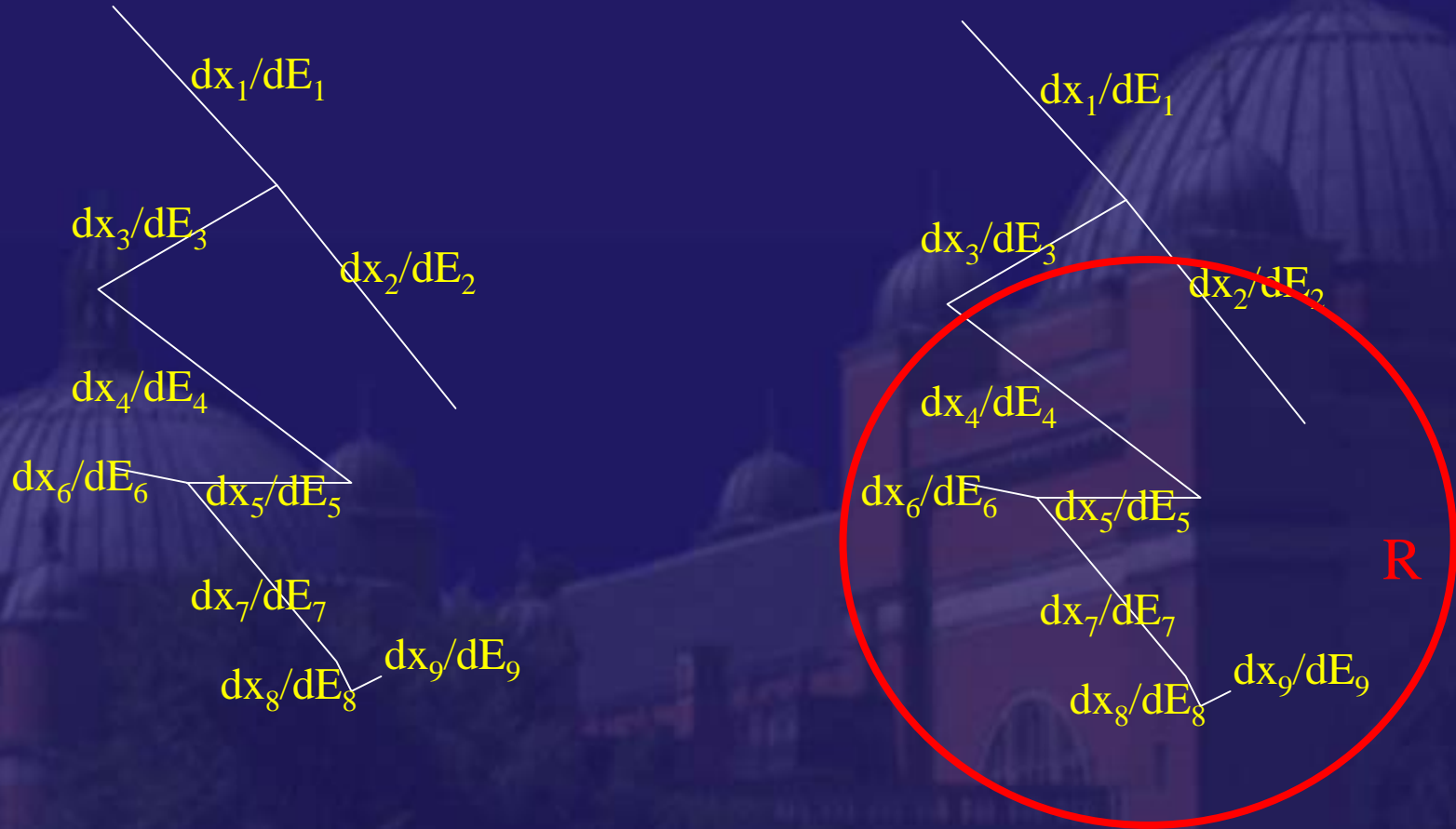
- Consequences of scattering and charge particle disequilibrium in IMRT
- Sub-mm resolution – diamonds and diode detectors, radiochromic film
- Cavity theories for handling solid-state materials



# Electron slowing down spectra for 1- 5mm diameter fields calculated with EGSnrc

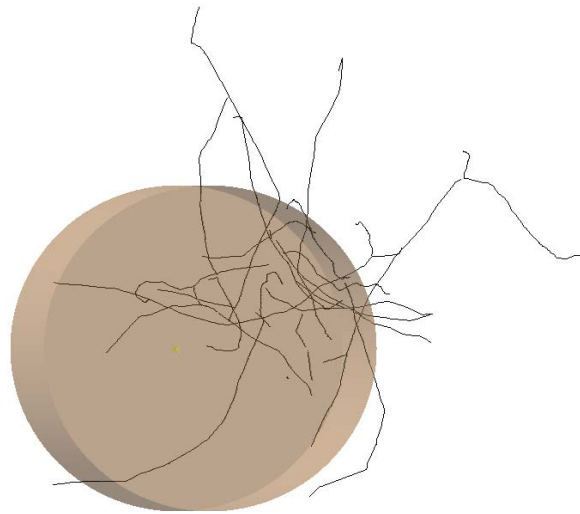
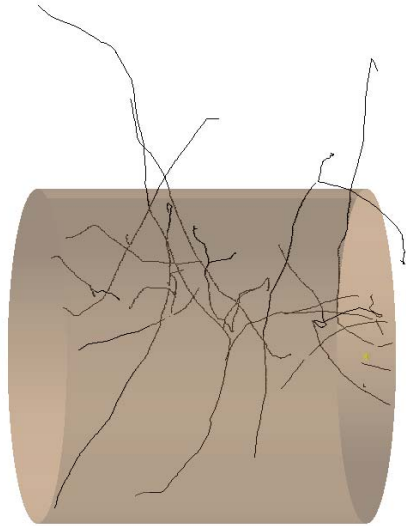


# LET and lineal energy spectra

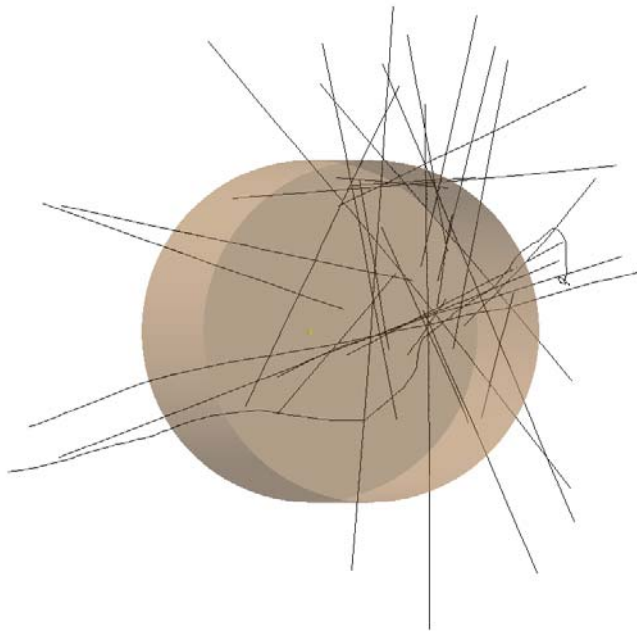
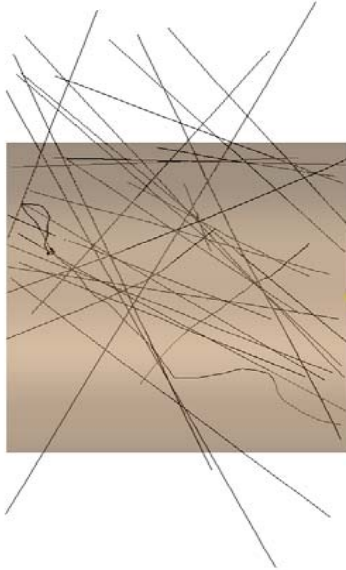


$$\text{LET} = \text{Sum}(dx_i/dE_i, i = 1..9)$$

$$\text{Lineal energy} = \text{Sum}(dE_i, i \text{ in } R) / x_R$$



30 kVp X-rays from a  
molybdenum target  
absorbed in a 5x5  
micron cylinder

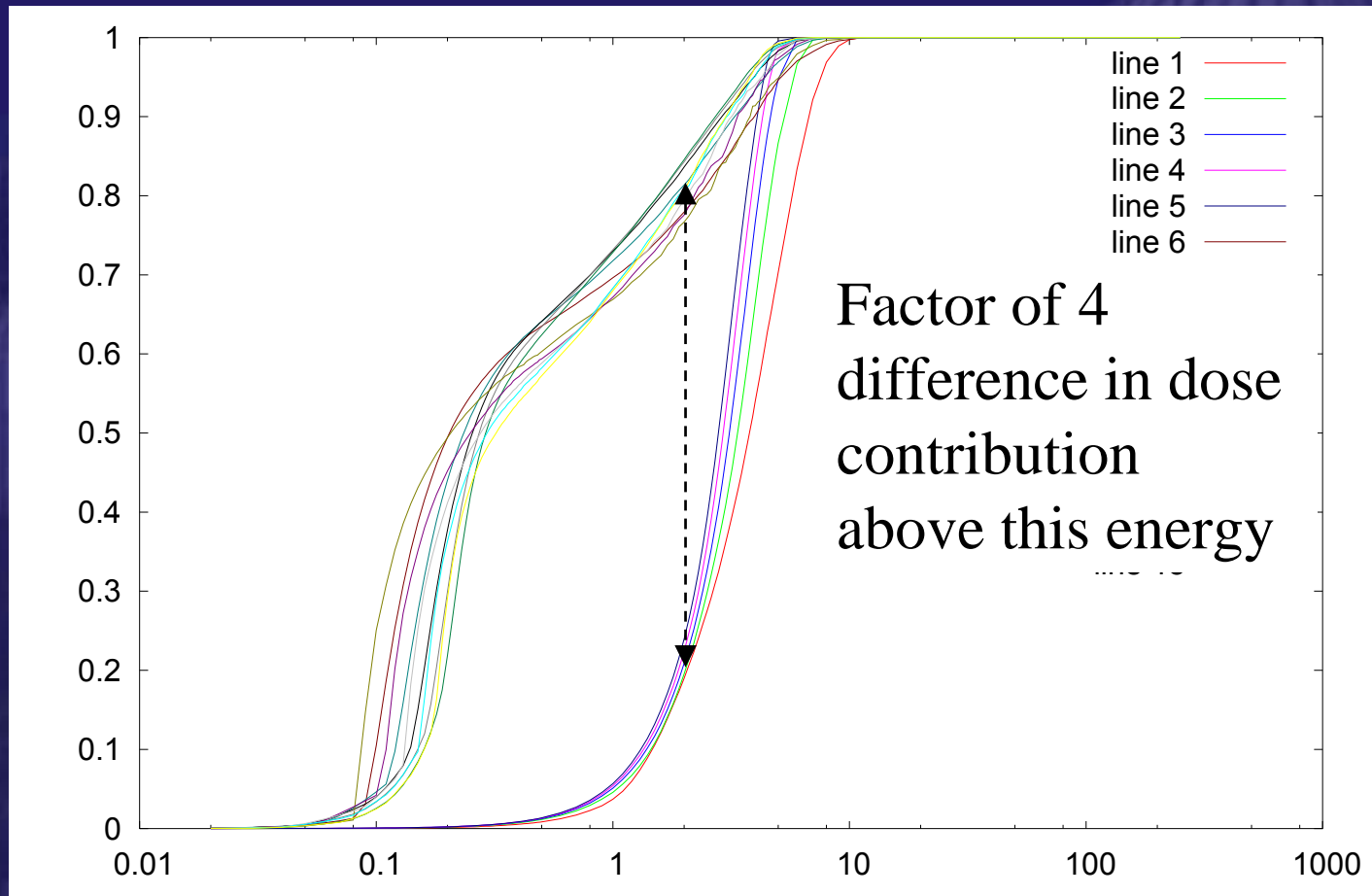


Sr/Y-90 - up to 1 MeV  
betas - absorbed in a  
5x5 micron cylinder

# Post processing of histories to improve variance

- sample an event in the layer of interest
- uniformly sample a deposition point within the volume of interest  
e.g. a cell nucleus, 5 x 1 micron cylinder
- translate the sampled event to the deposition point  
along with rest of the history
- compute sum of energy deposition lying within volume of interest
- possibly repeat process a number of times

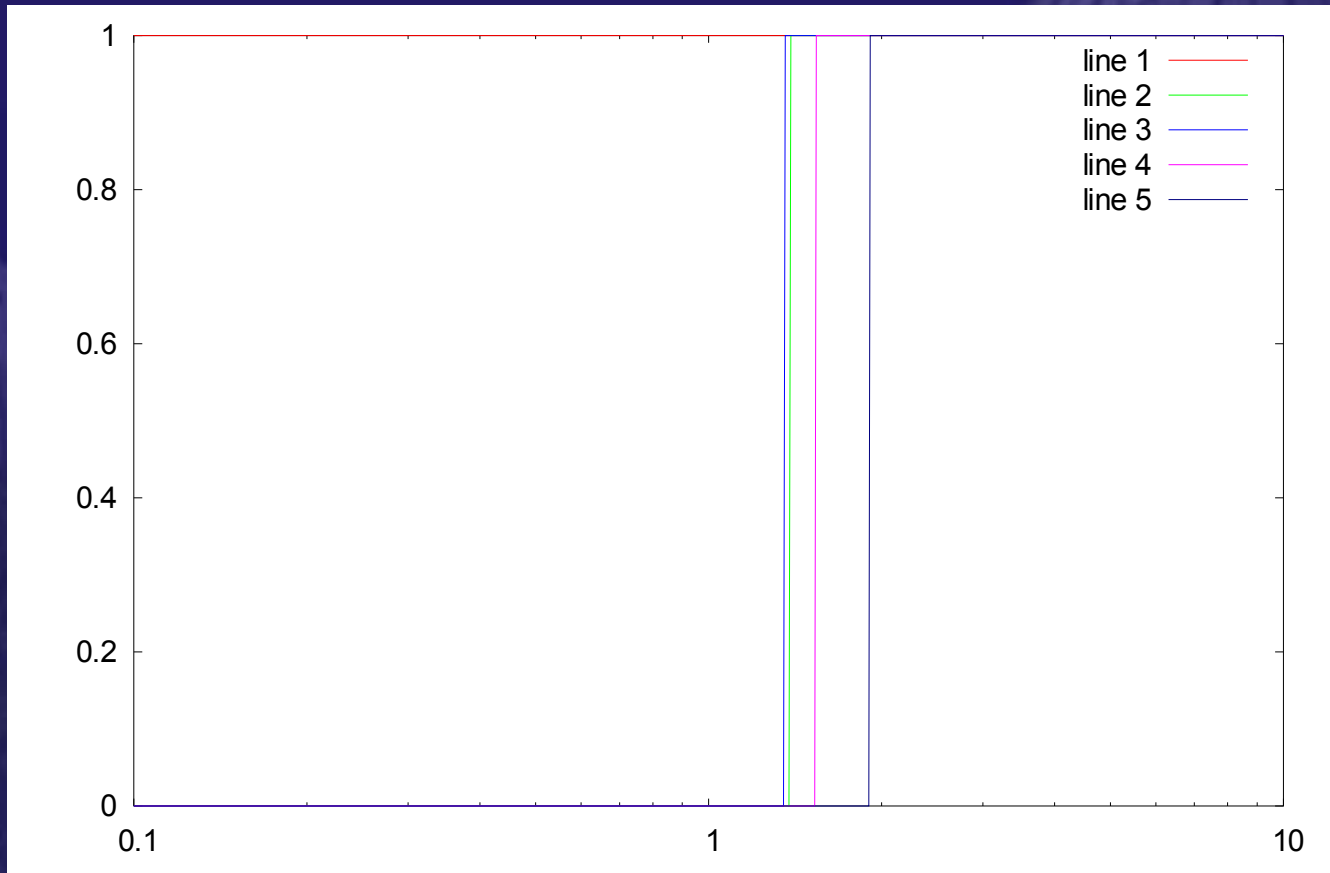
# Cumulative lineal energy spectra for 6 MV linac, Sr/Y-90 irradiator and 30 kVp Mo X-rays





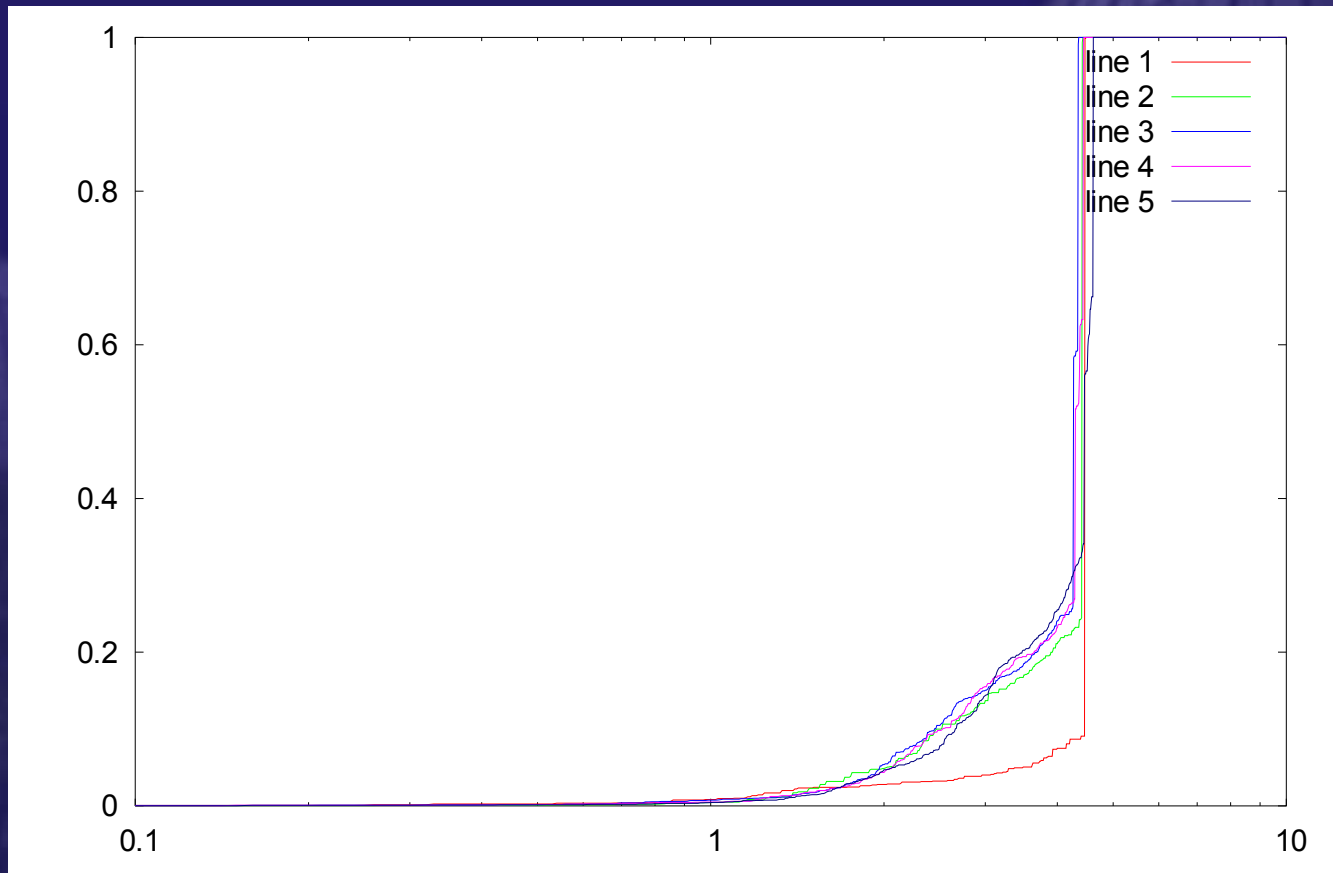
# Post processing of a single history in MATLAB

## - 1 sample of anchor and cylinder position

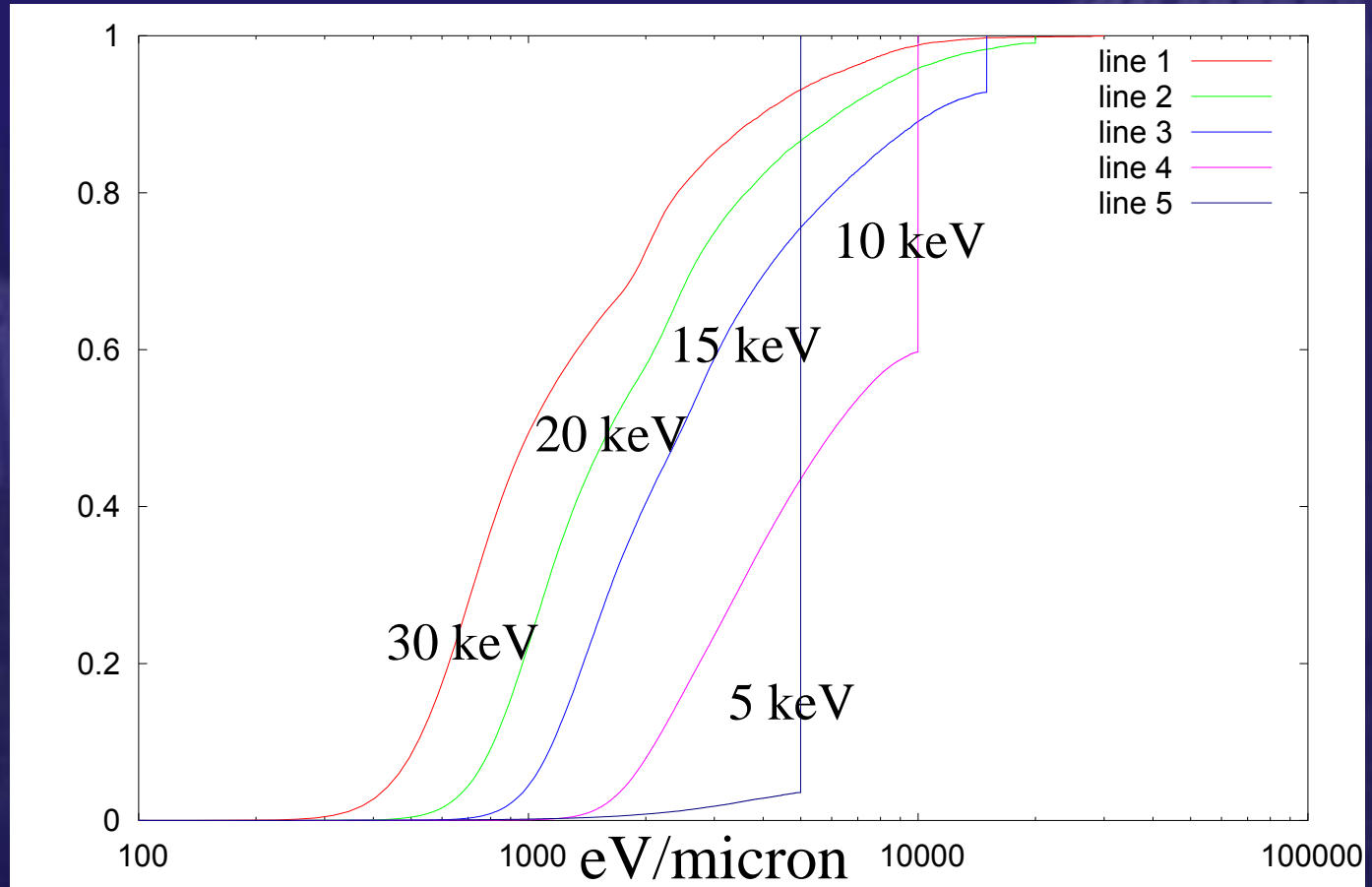




# Post processing of a single history in MATLAB - 1000 samples



# Lineal energy from PENELOPE for keV electrons



# Future developments

- Birmingham ideally placed to study bystander effects of low-LET X-rays at micron resolution
- Sub-micron resolution dosimetry – MOSFETs
- Development of a Laue diffractometer for biomedical imaging/ radiobiology- Station 16.3 at SRS (Daresbury)