



# End point energy measurement technique for MeV X-rays



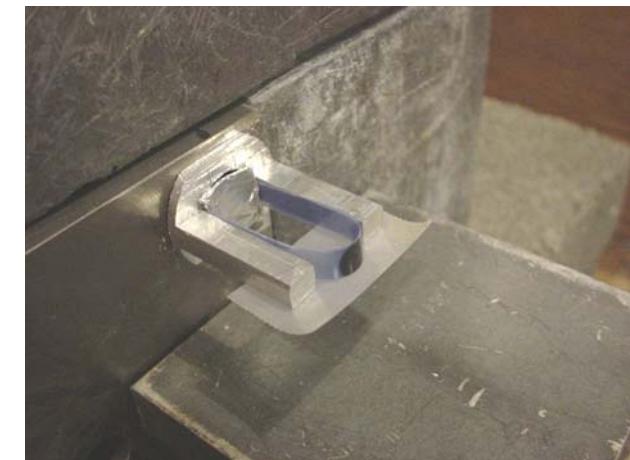
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***TECHNOLOGY DRIVEN. WARFIGHTER FOCUSED.***

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NIST Oct. 22 - 24, 2007  
Radiation Protection/Homeland Security Session, 22 Oct. 1400h.*

- Simple Hardware to identify e-beam energy
  - Magnet & film
- Quick response (small signal required)
  - <1 kR dose required using GAFchromic
  - <60 sec exposure on most Linacs
  - Immediate visual result
    - Quantitative result optional

**Linac****Radiography**

# Xray Facilities



300 keV Xray Src  
- 10 mA  
- CW  
- bremsstrahlung



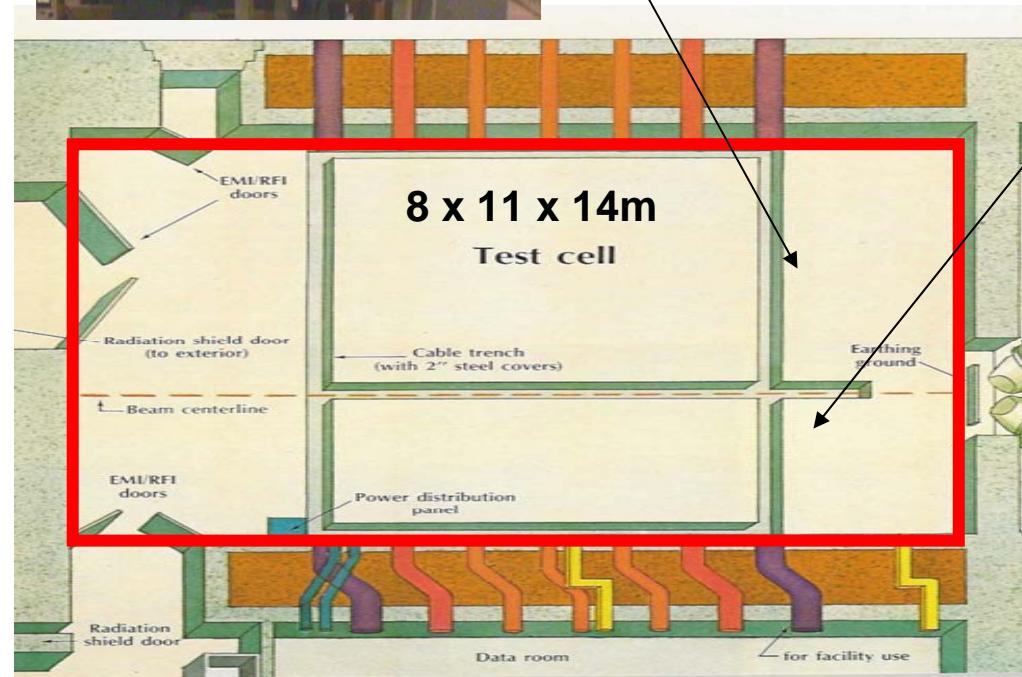
2 MeV Linac Xray Src  
- 150 mA  
- 5 us pulse  
- 250 Hz



Dosimetry  
and Gamma  
Detection  
(HPGe &  
NaI)

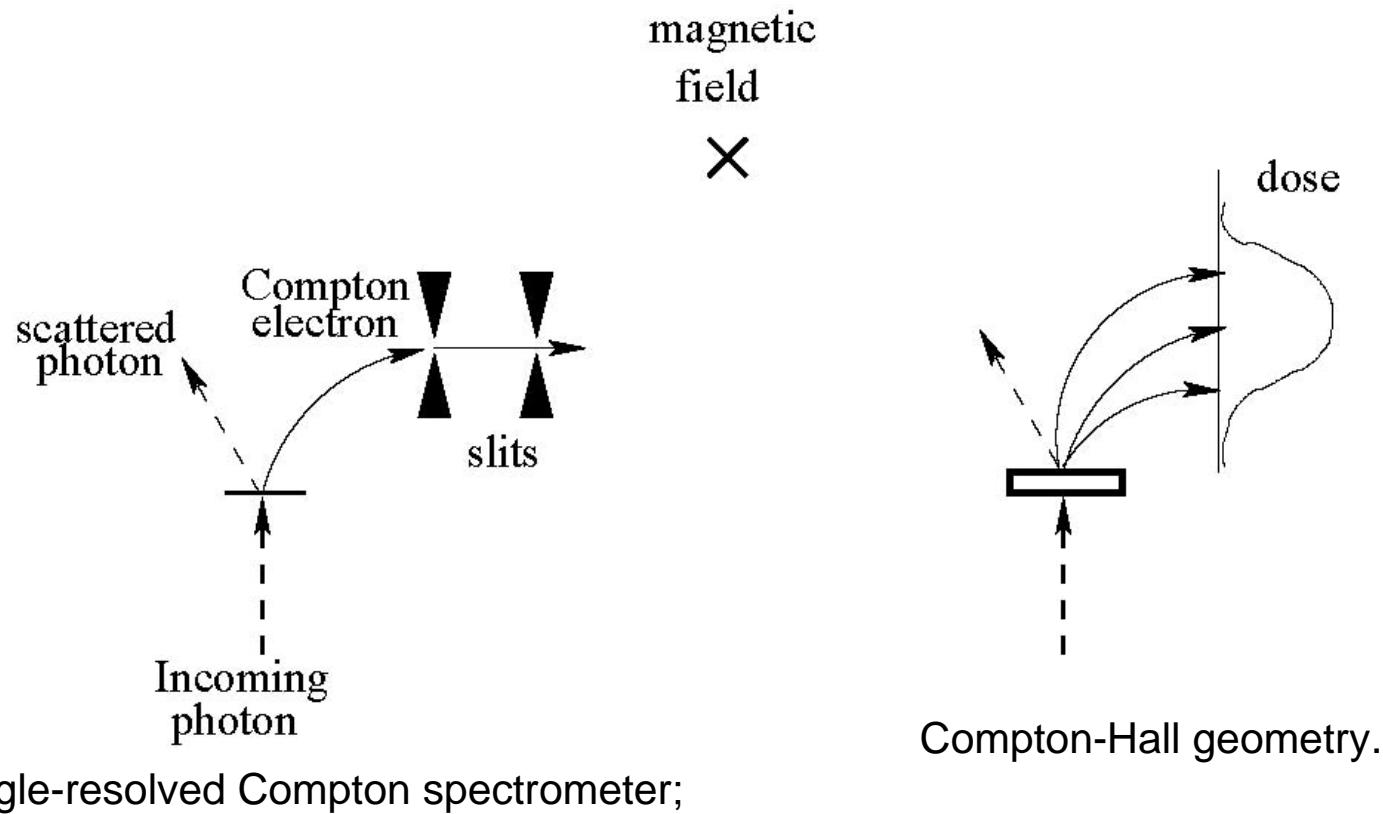


**TECHNOLOGY DRIVEN. WARFIGHTER FOCUSED.**



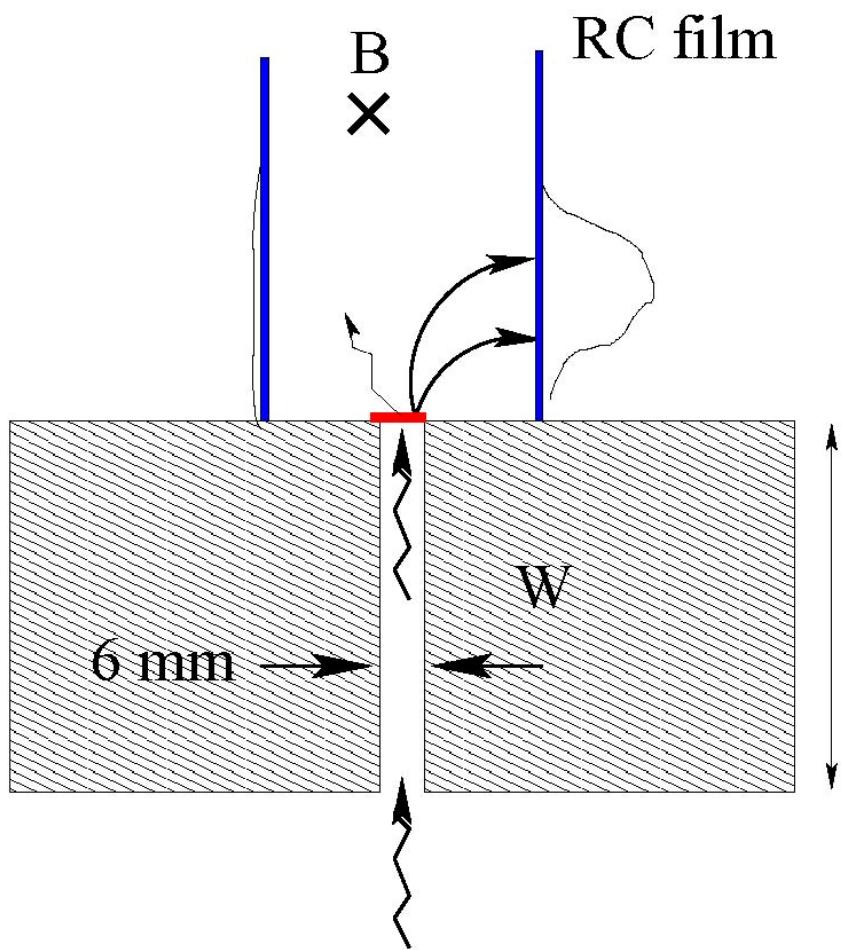
- MeV-type X-rays make Compton electrons, &
- Cross-beam magnet sweeps them aside
  - X-ray energy asymmetry is signal
- Computations for 2-8 MeV bremsstrahlung
- Preliminary results at 0.3, 1, and 2 MeV
- Further analysis & development needed



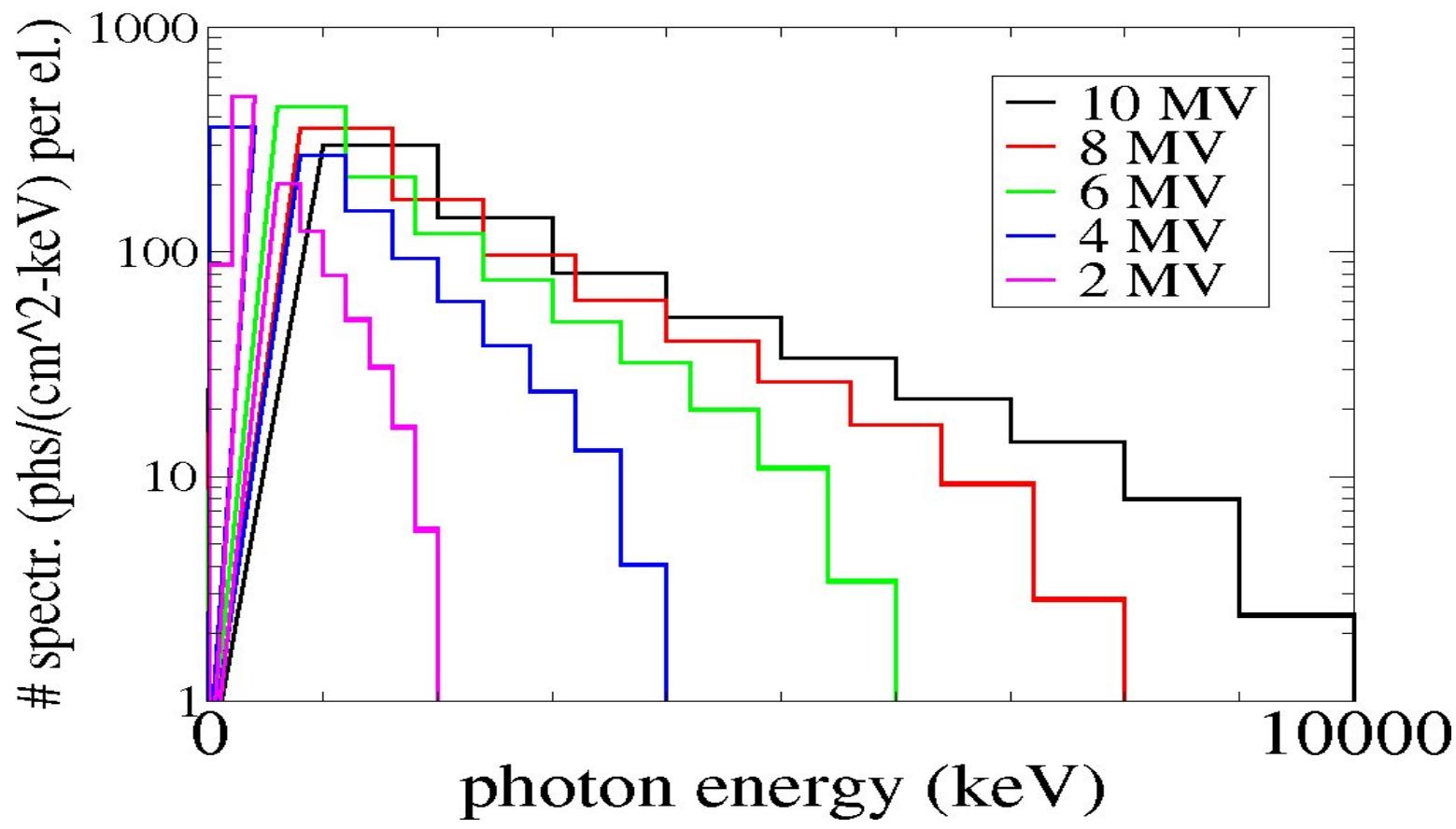


angle-resolved Compton spectrometer;

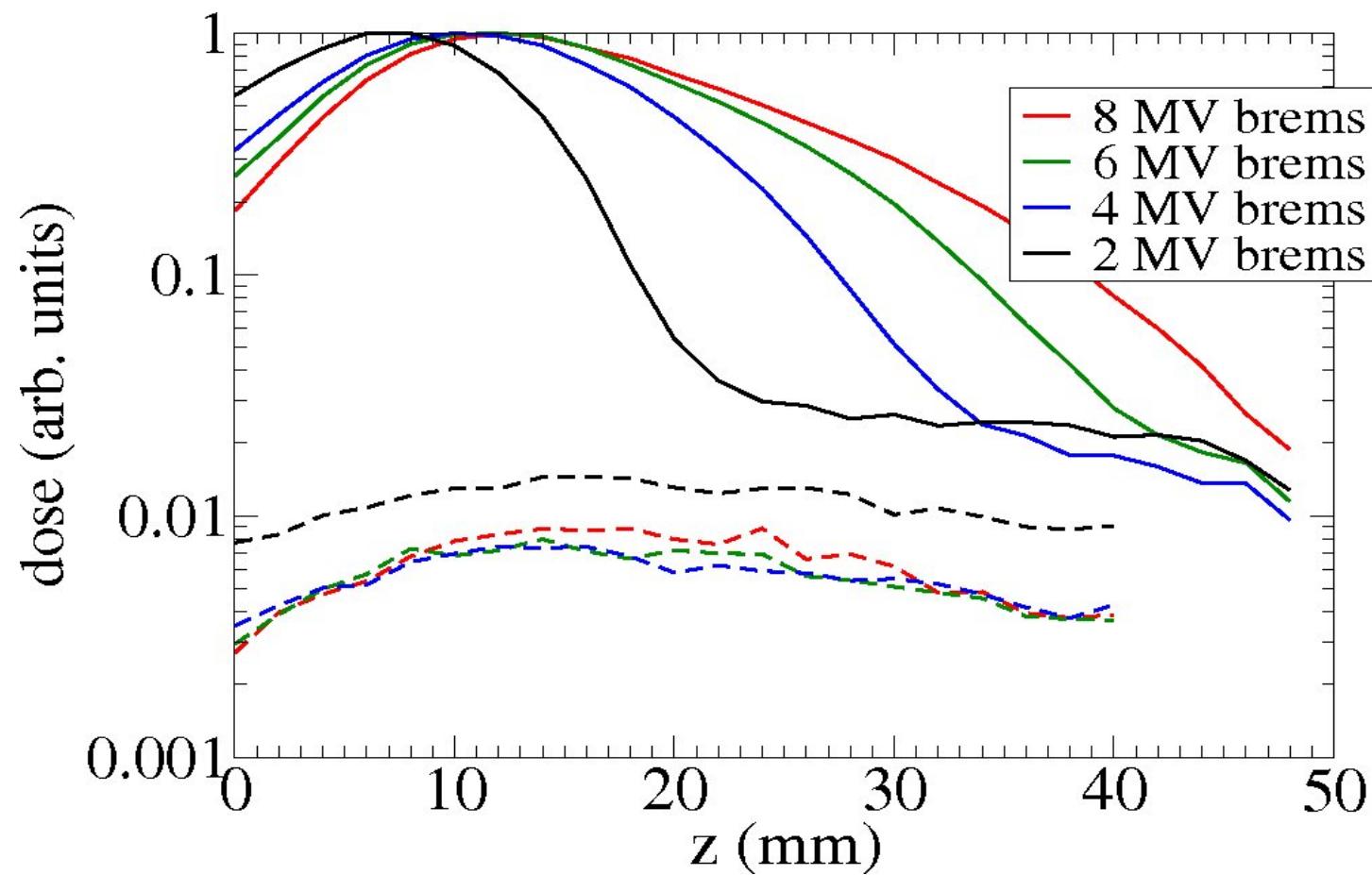
- gyroradius  $r_c = \frac{eV}{ecB} * \sqrt{(\gamma + 1)(\gamma - 1)}$



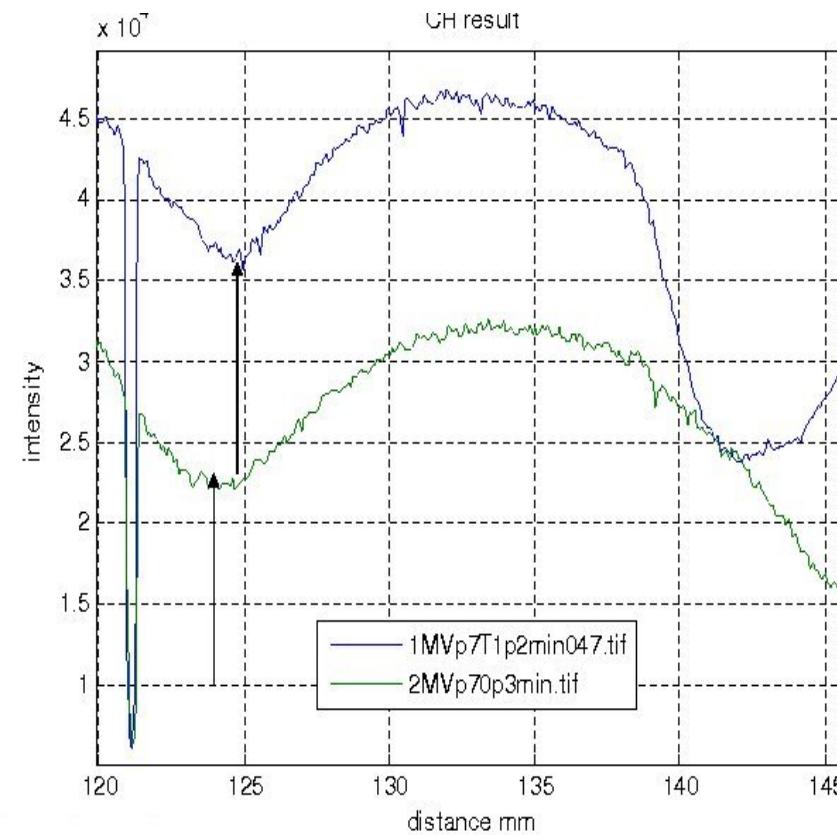
- Monte Carlo radiation transport (ITS/Accept)
- Thick bremsstrahlung spectrum (pre-computed, for electrons w/ energy eV)
- Choices:
  - (Compton) converter
  - position of side wall
  - B
  - ...



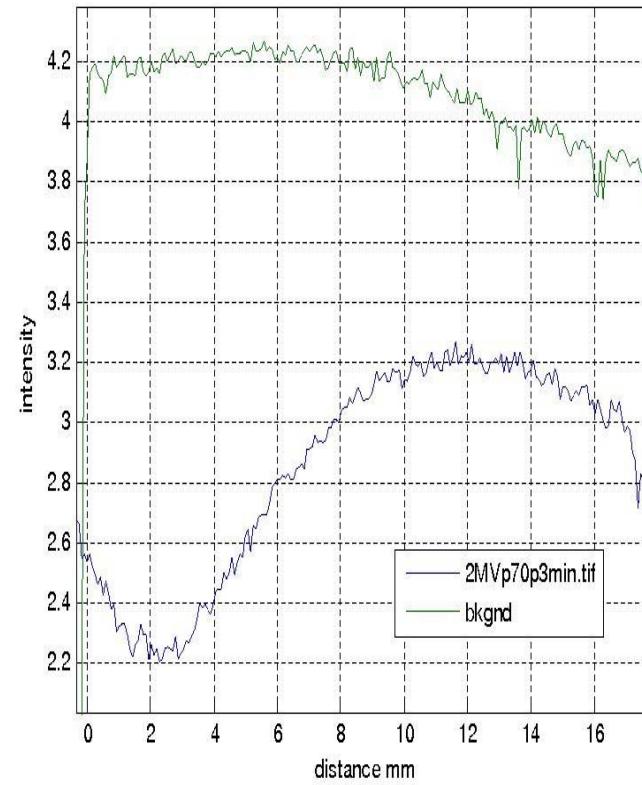
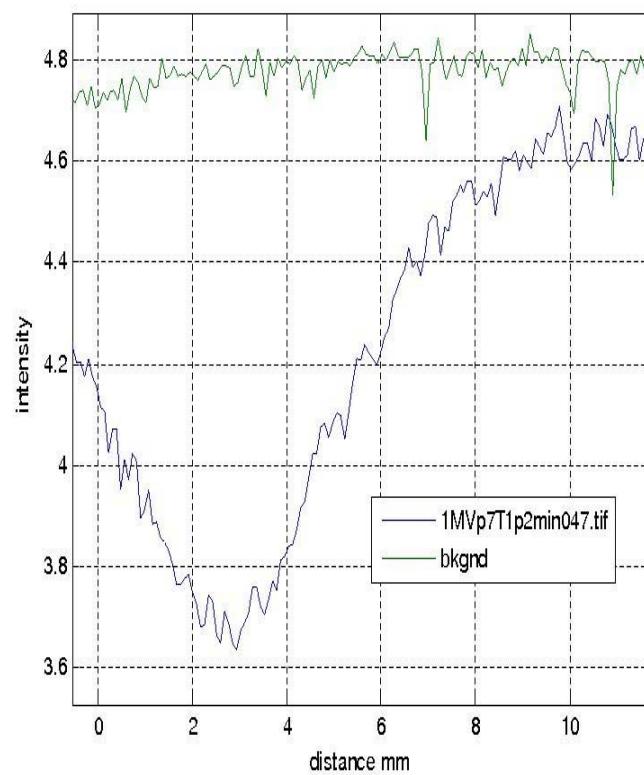
- range-thick W brems converter



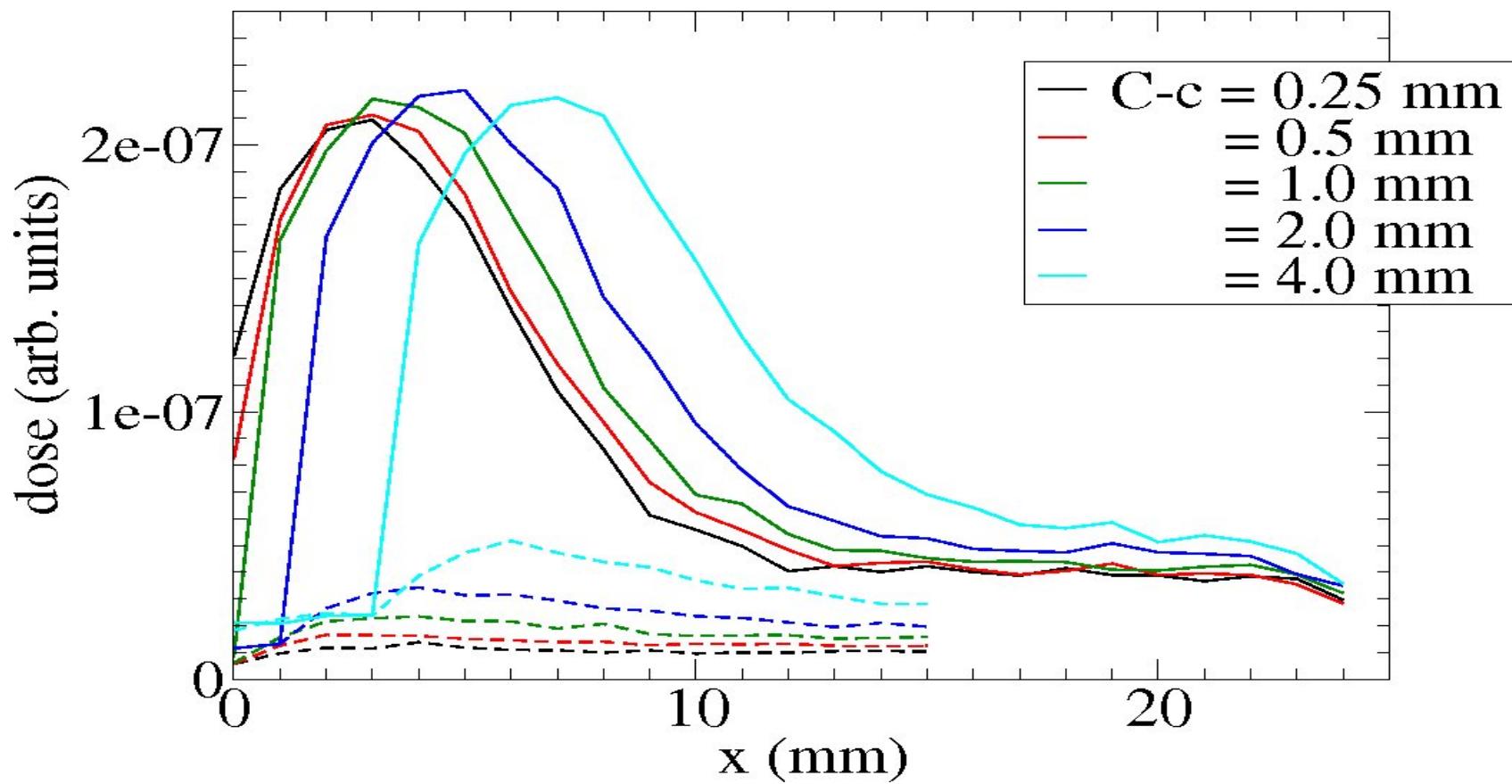
- $B = 0.4 \text{ T}$ , 5 mm side wall, etc.



- other parameters (B=0.7 T, geometry, ...)

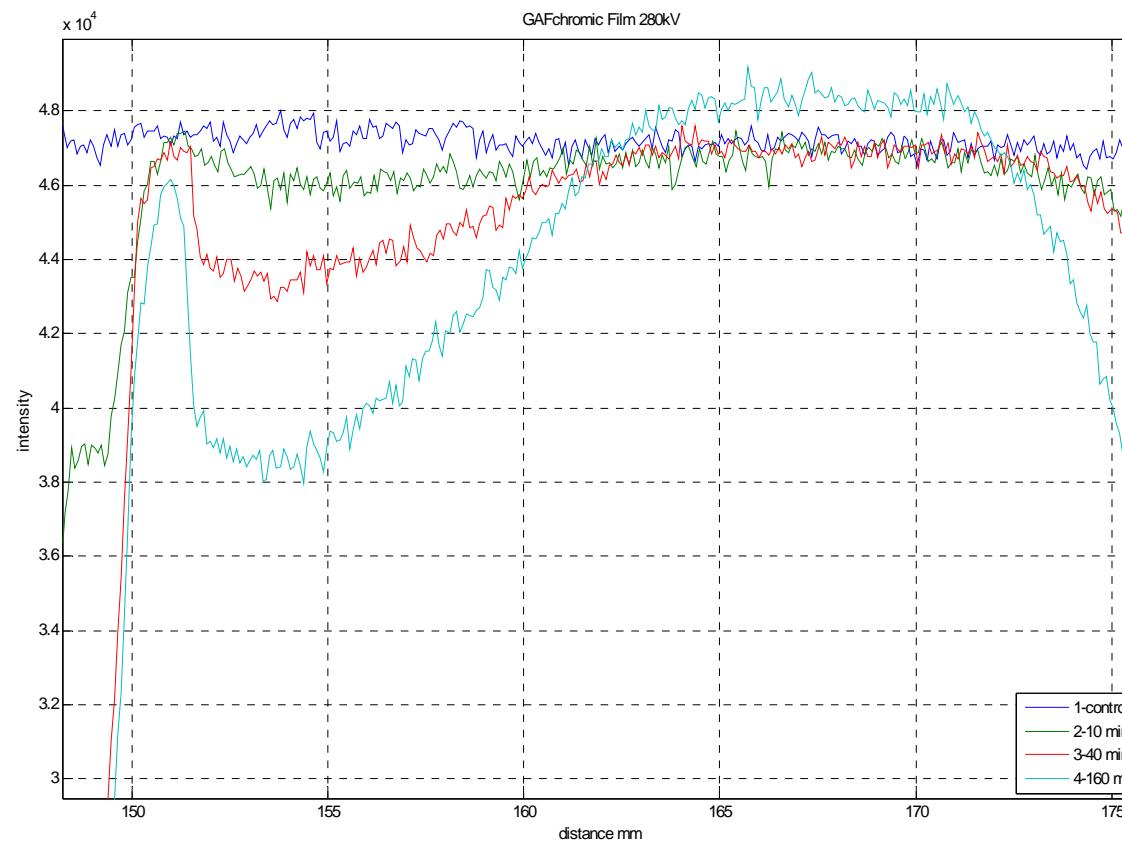


- Confirmed: B-field deflects Compton current



- Compton converter thickness barely affects dose ( here:  $B = 0.2$  T).

- Qualitative agreement with observation.



- Better measurements & computations
  - actual geometry for 1 MeV & 2 MeV linac
  - (results as presented are from 1 day running only)
- Other versions of C-H volt meter concept
  - non-interfering, passive beam energy monitor  
(medical & industrial? )
    - measure asymmetry in Compton dose RATE
- Patent application