Status and Prospects for Drift

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for the Drift II Collaboration
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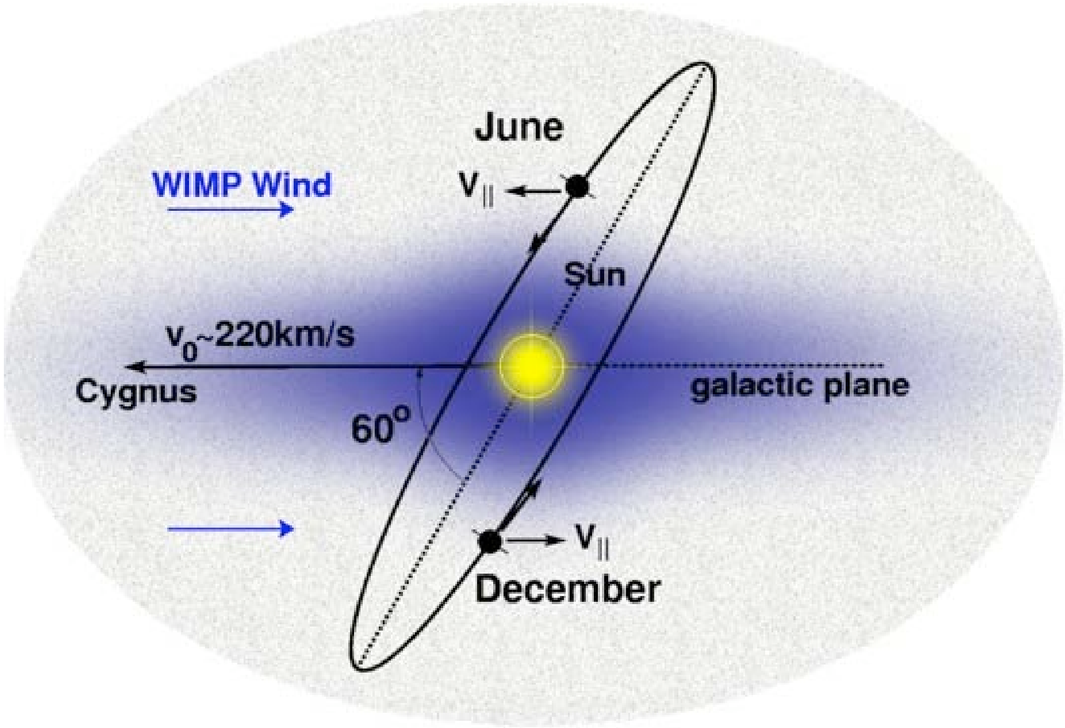
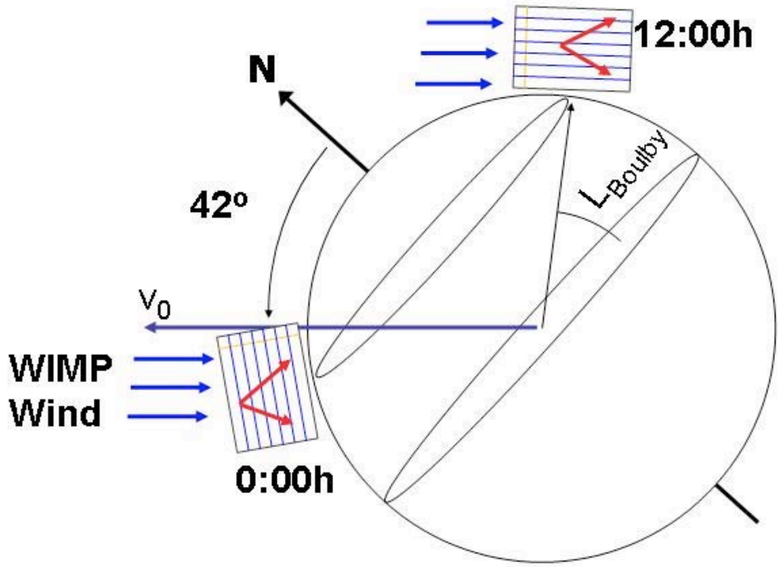
Imperial College

"Hunt for Dark Matter" Fermilab, May 2007

lure of a directional signature: "more difficult, but possible", T. Baltz



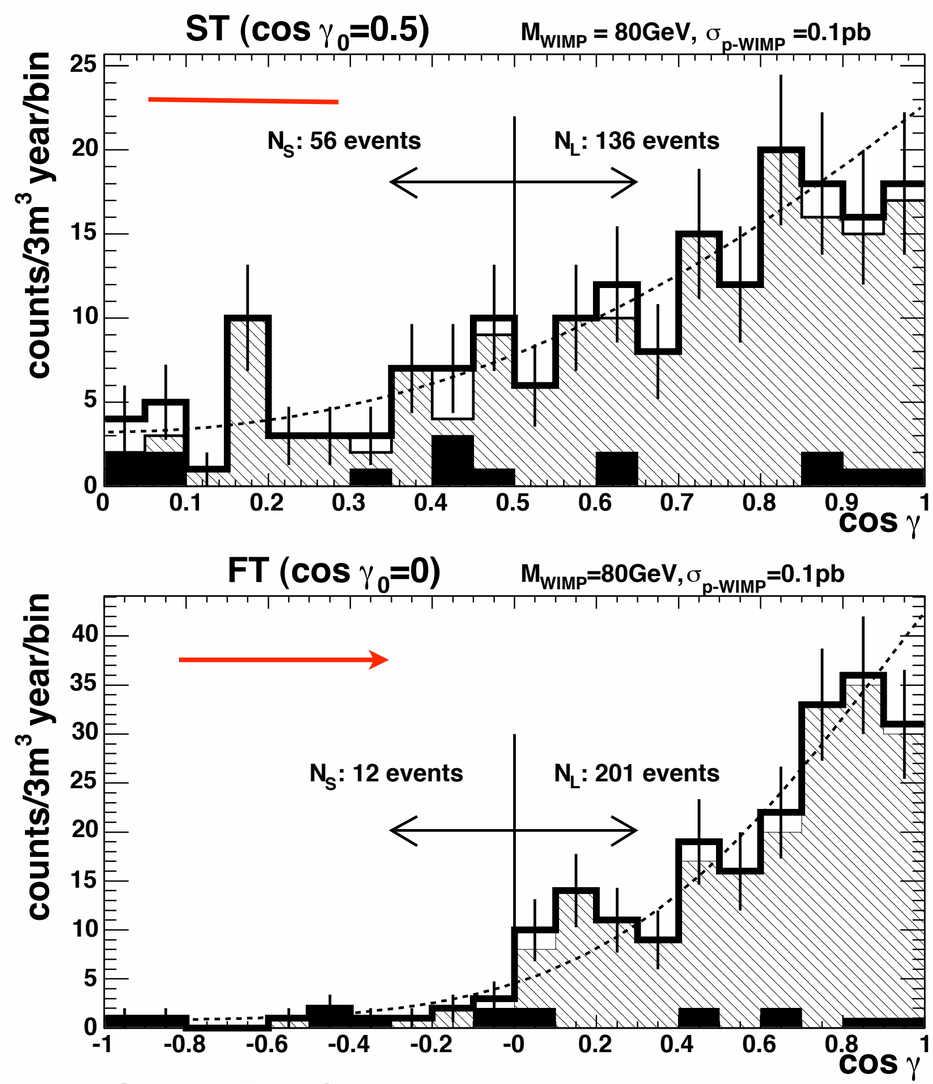


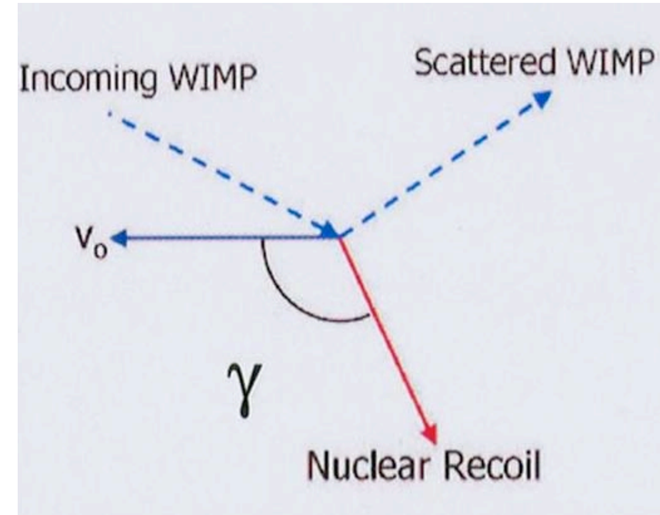
- background discrimination
- a "smoking gun" signature
- measure wimp momentum distribution

(e.g. P. Godolo Phys.Rev.D66:103513,2002)

directional signature

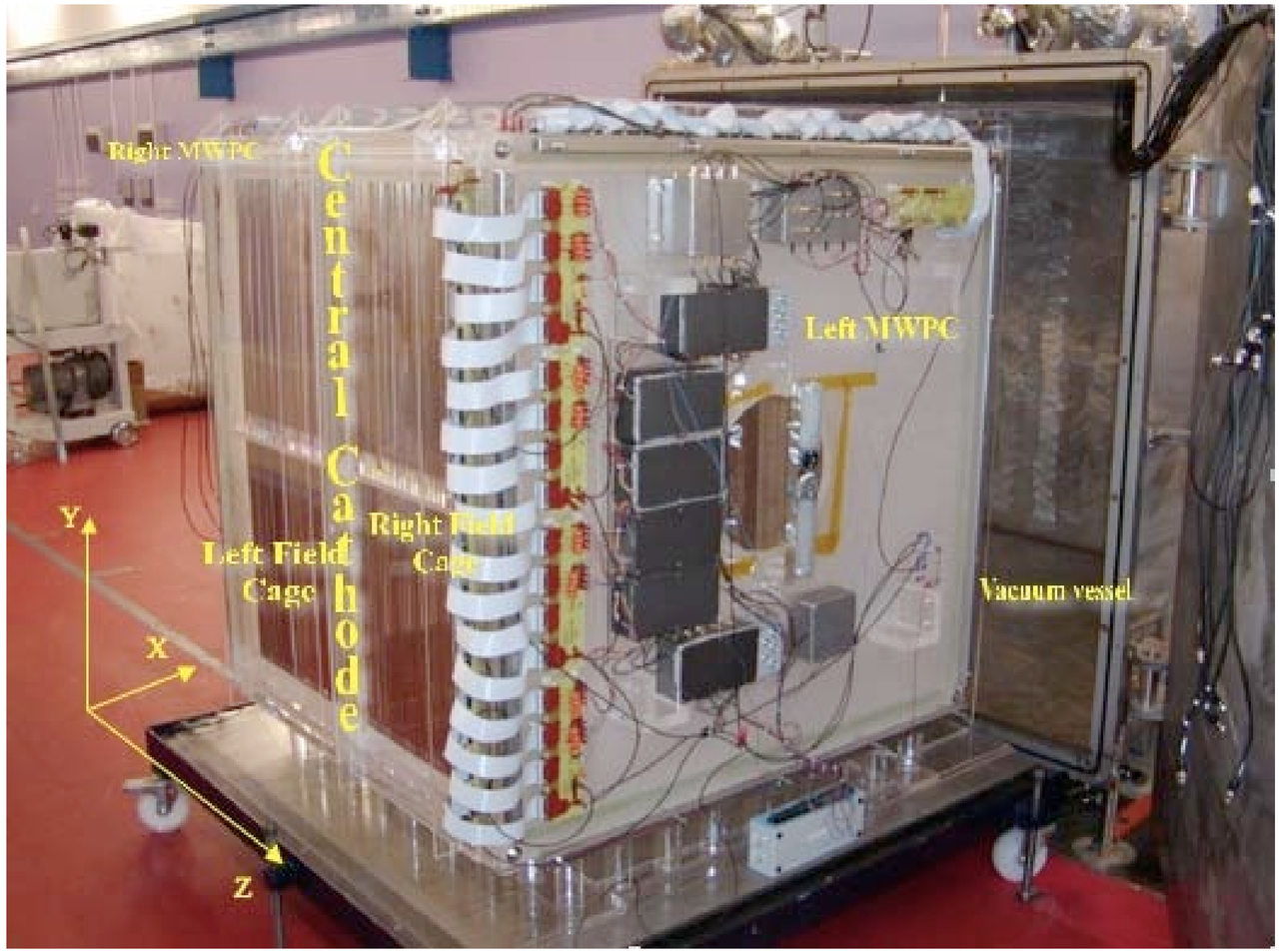
Tanimori et al., Phys Lett B578 (2004)





recoil sense known(unknown)
10-20(100-400) events
needed to reject isotropy at
95% CL Morgan et al.
Phys.Rev.D71:103507,2005

NITPC operating at Boulby (1070 m/ 2805 m.w.e.)



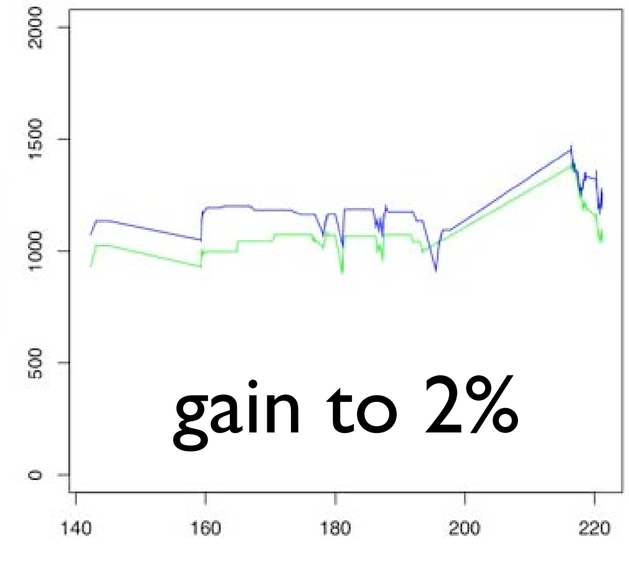
- $1 m^3$ / 167 g
- 40 torr CS_2
- 620 V/cm
- low cost
- simple operation

-ion drift suppresses diffusion (J. Martoff)

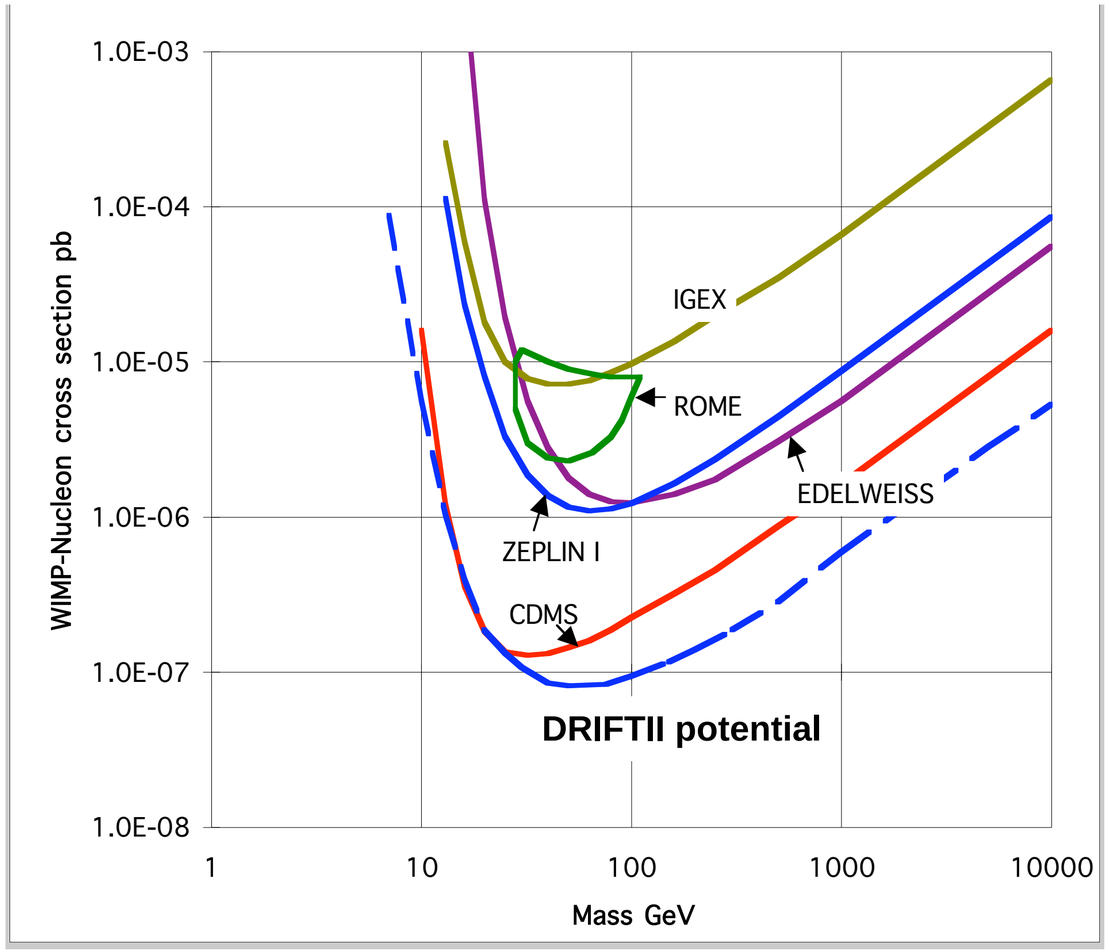
Drift II Operations:

- IIa '05 run- 85% live-time 12+6 kg-days
- neutron and Fe-55 calibration runs
- remote monitoring

M. Gold Drift II



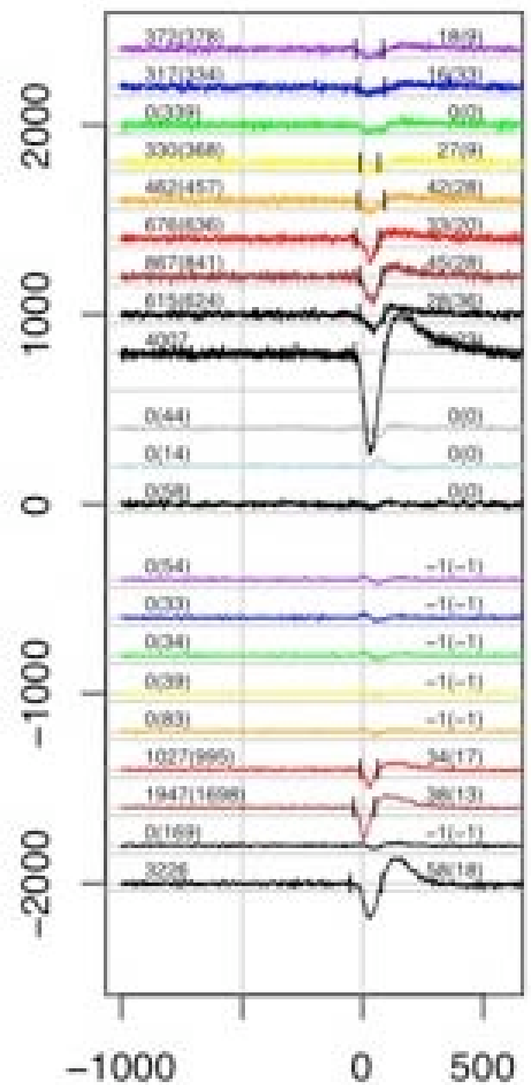
Potential Sensitivity



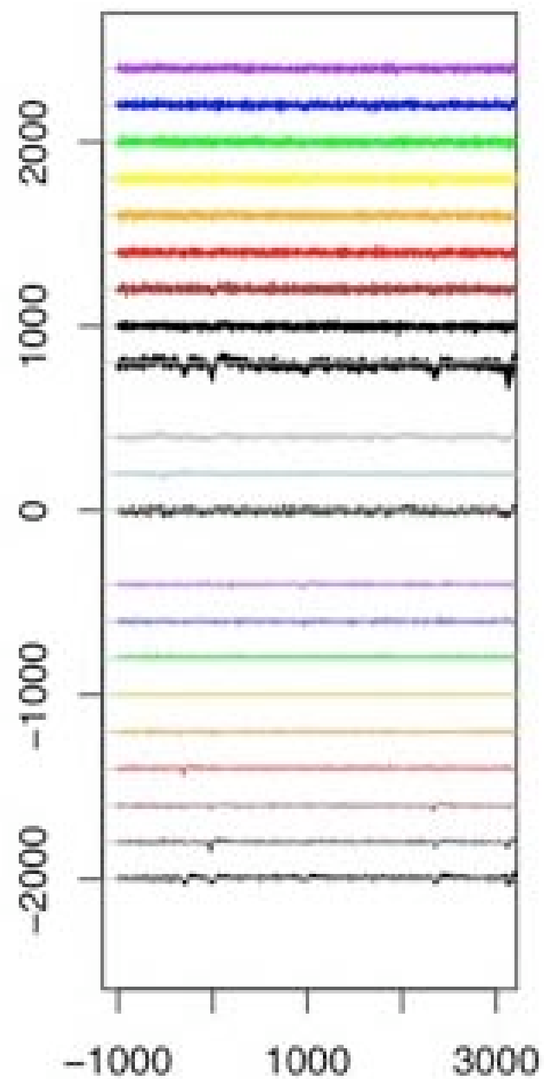
example: 3 m^3 of CS_2
3.4 years
40 Torr E(S)>20 keV

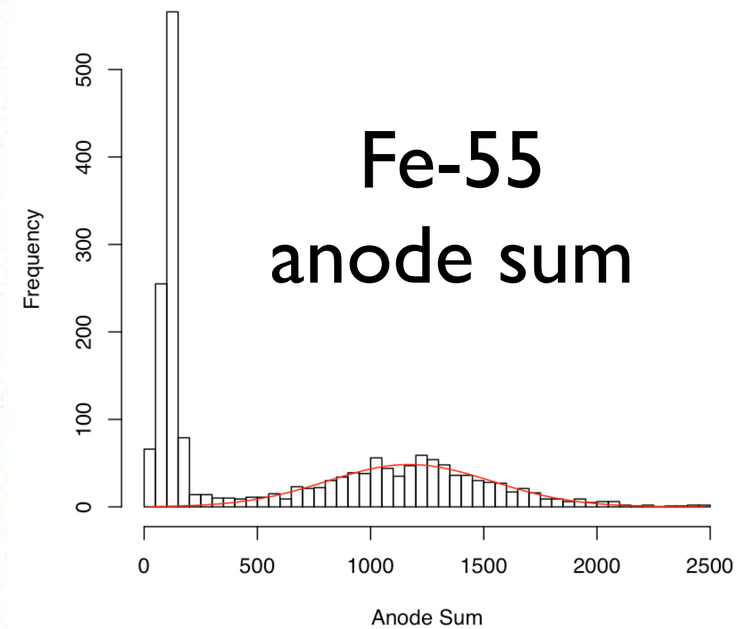
calibration events:

neutron



Fe-55

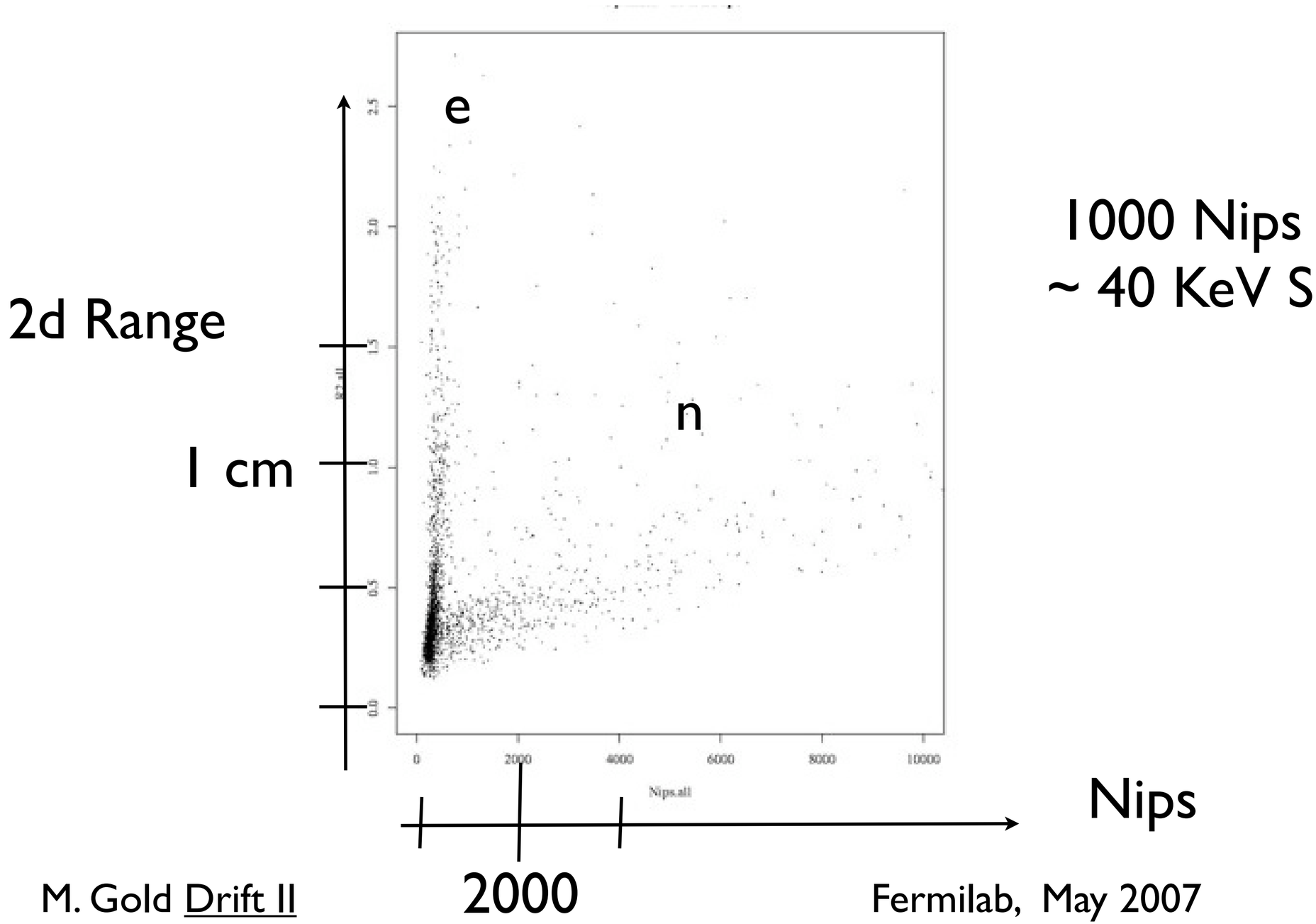


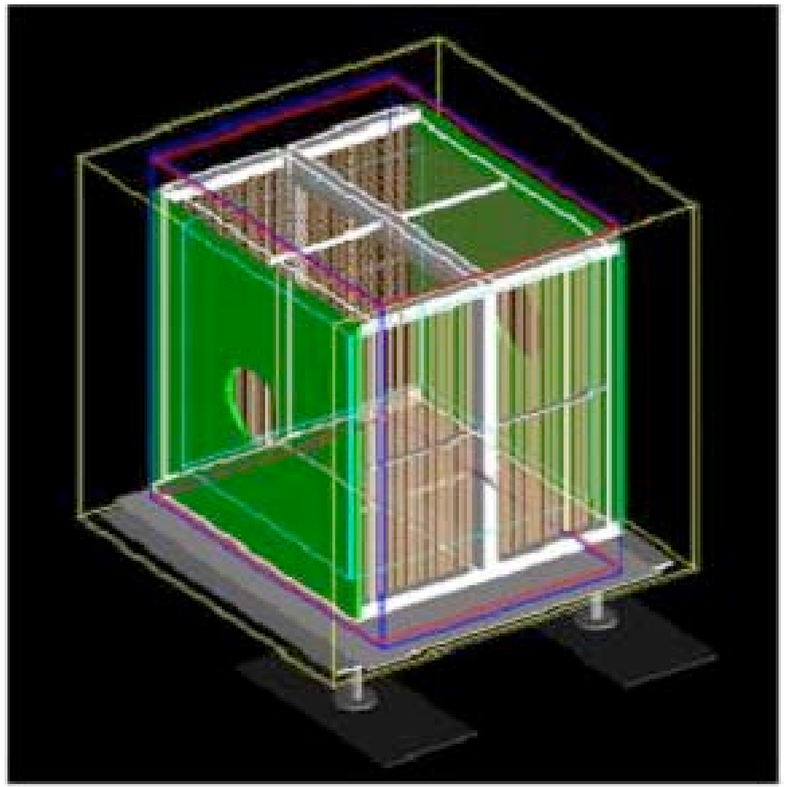


Fe-55
anode sum

$\longrightarrow$ time (μs)

e discrimination





Complete GEANT 4 simulation

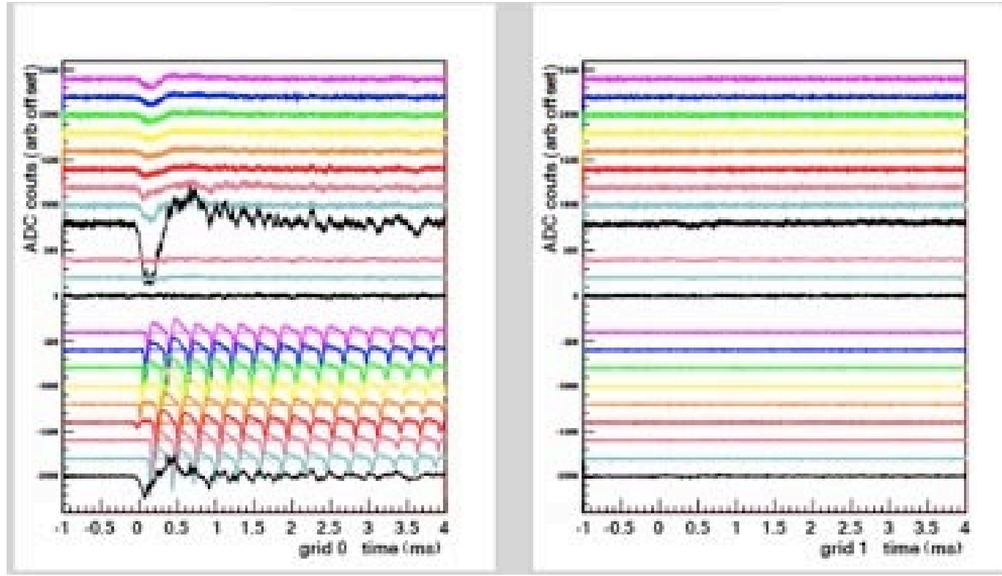
^{60}Co source run:

measured rejection factor of $<5\times10^{-6}$ (90%CL)

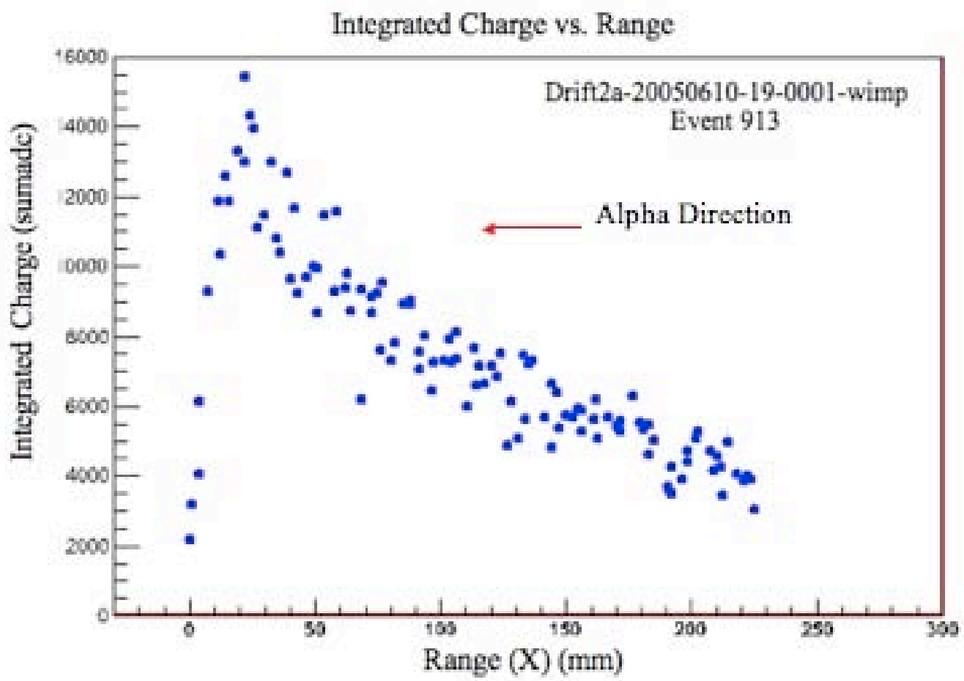
^{252}Cf directed neutron runs:

rate agrees to 5%

alpha event



alpha track



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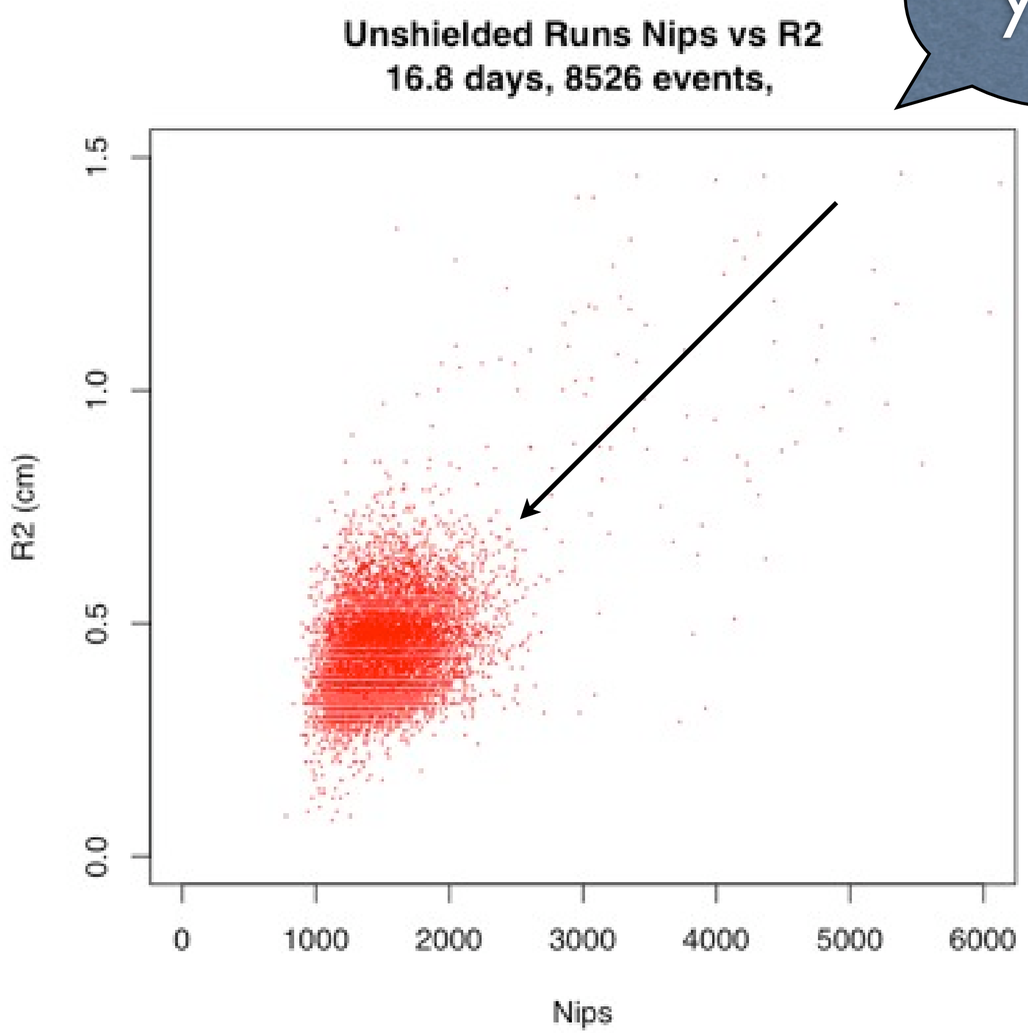
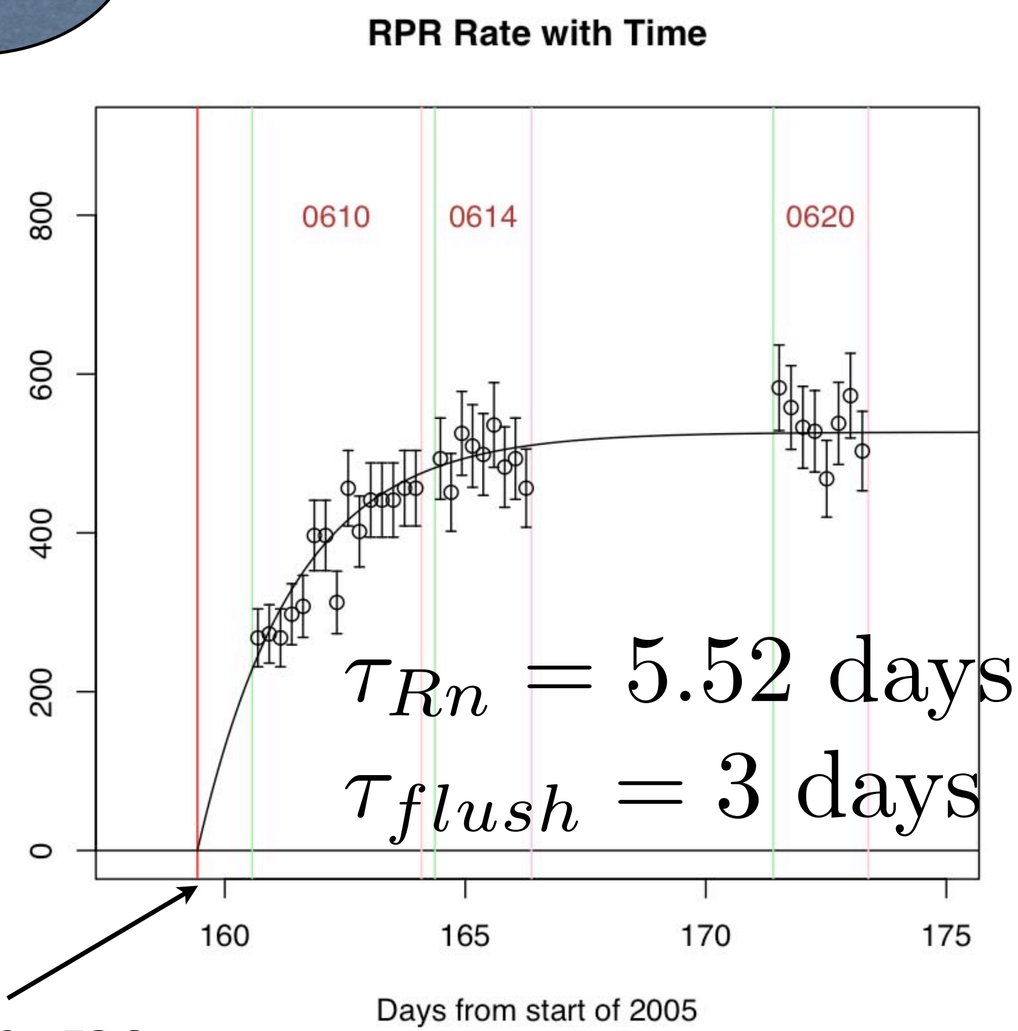
Fermilab, May 2007

a setback:

yuk!





clean gas

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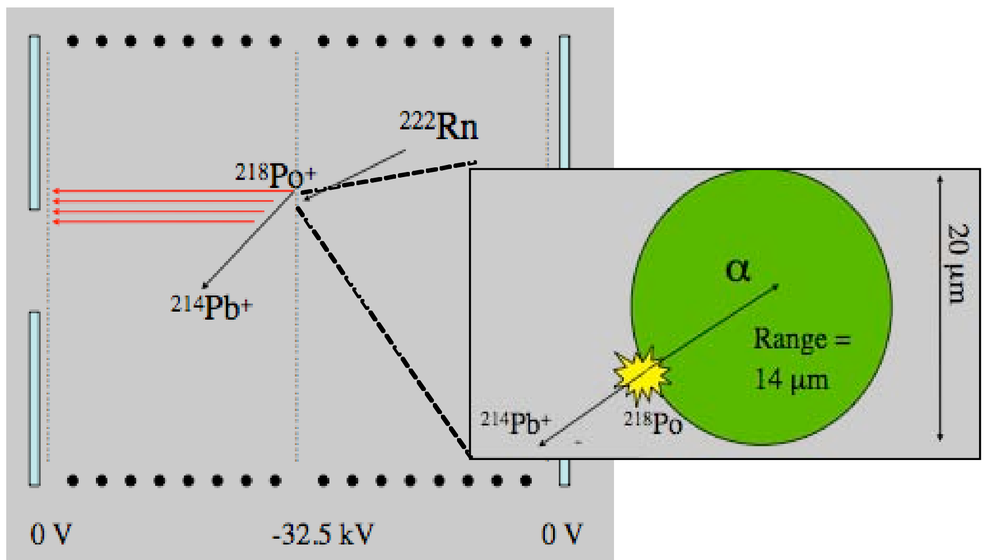
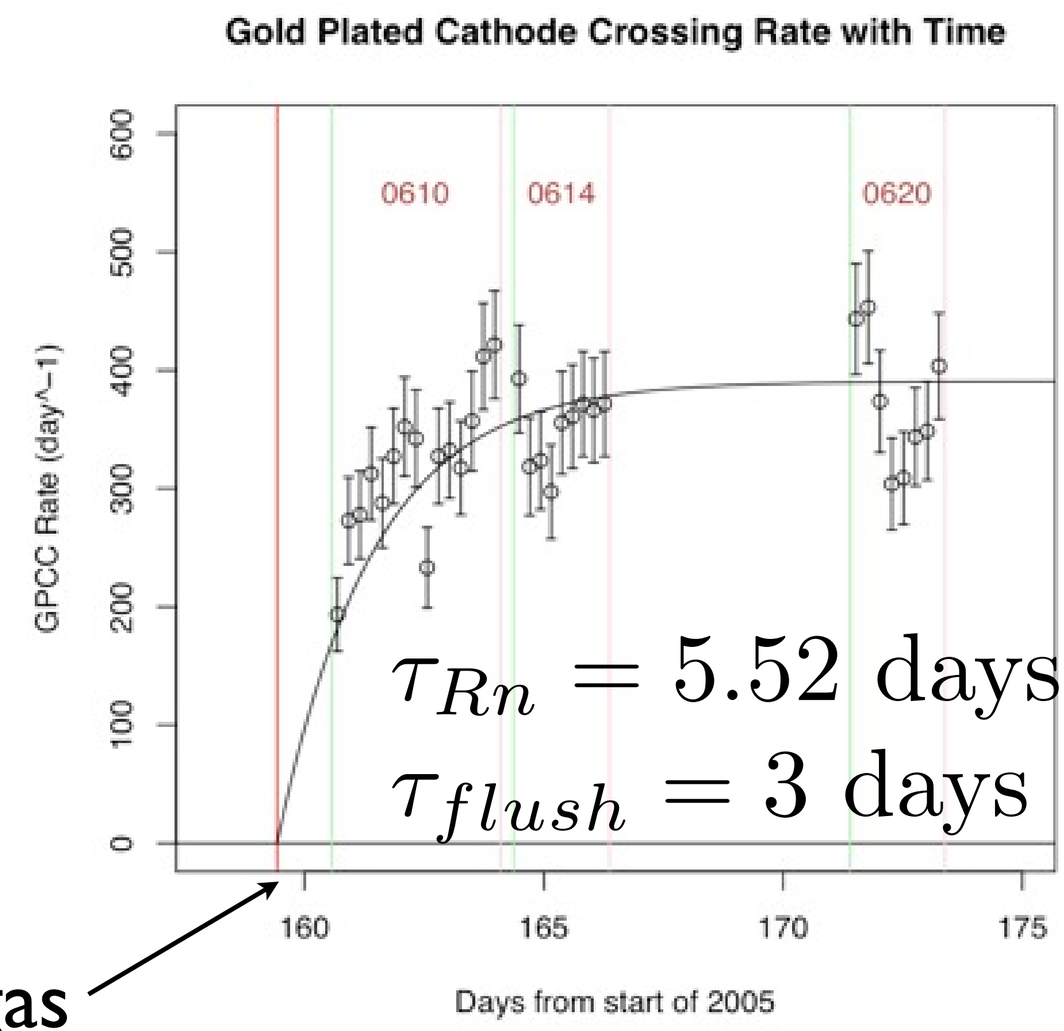
Radon and her daughters

"murder by polonium"





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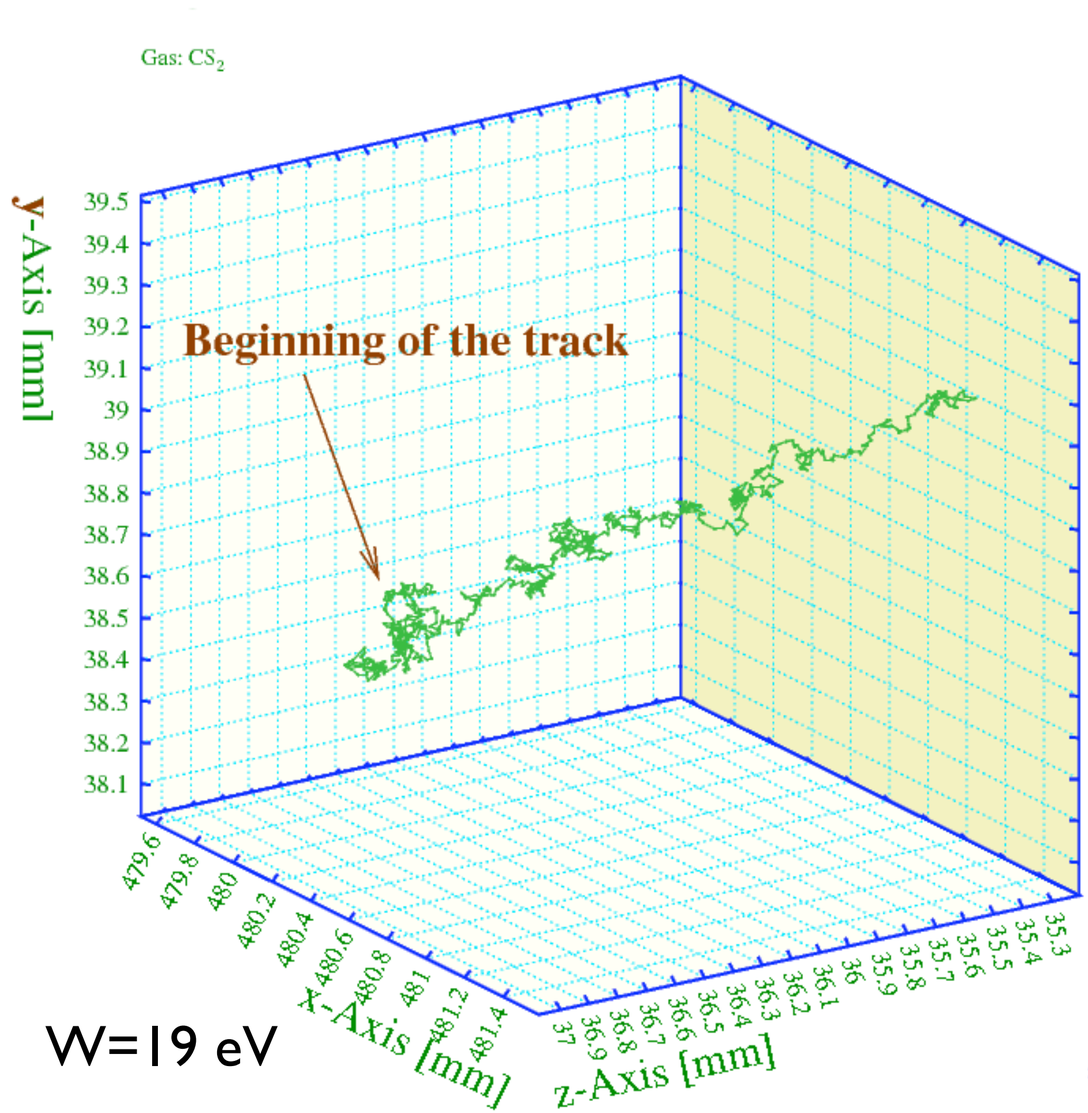
run planned for this summer

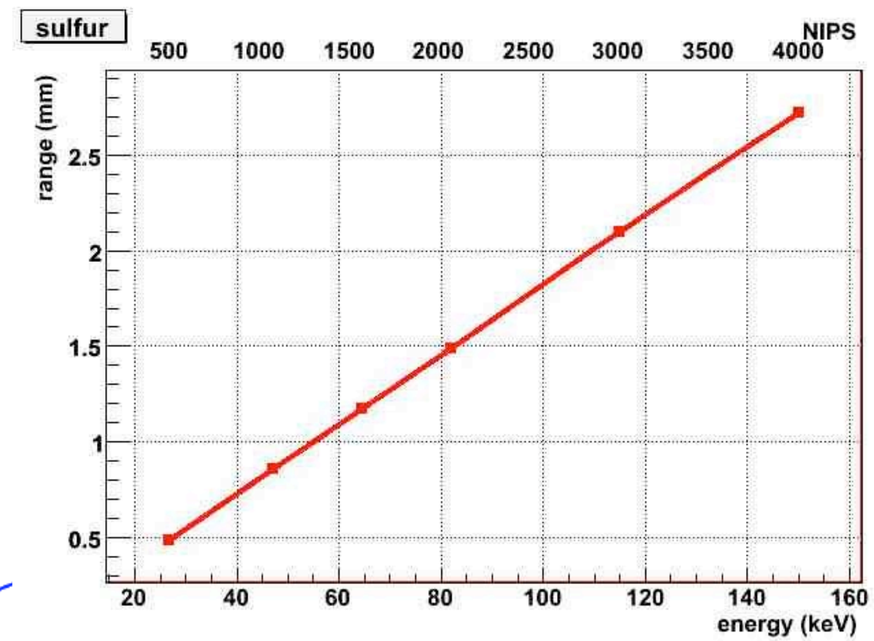
- ☑ identification and removal of radon-containing components
- ☑ improved CS_2 flow
- ☑ clean cathode
- ☐ active veto?

100 keV S−recoil track simulated with SRIM2006 and Garfield

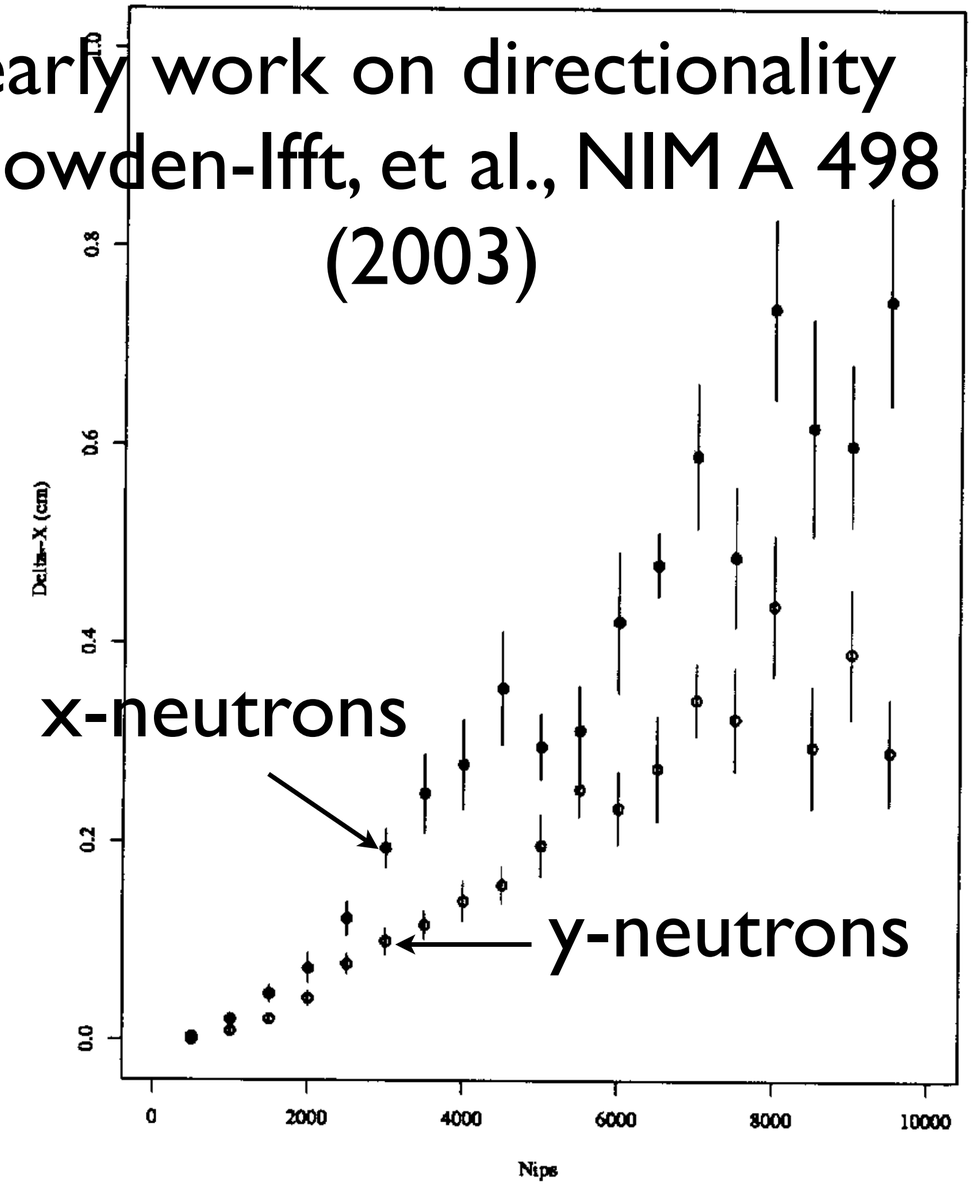


W=19 eV

SRIM
suggests distinct head-tail effect



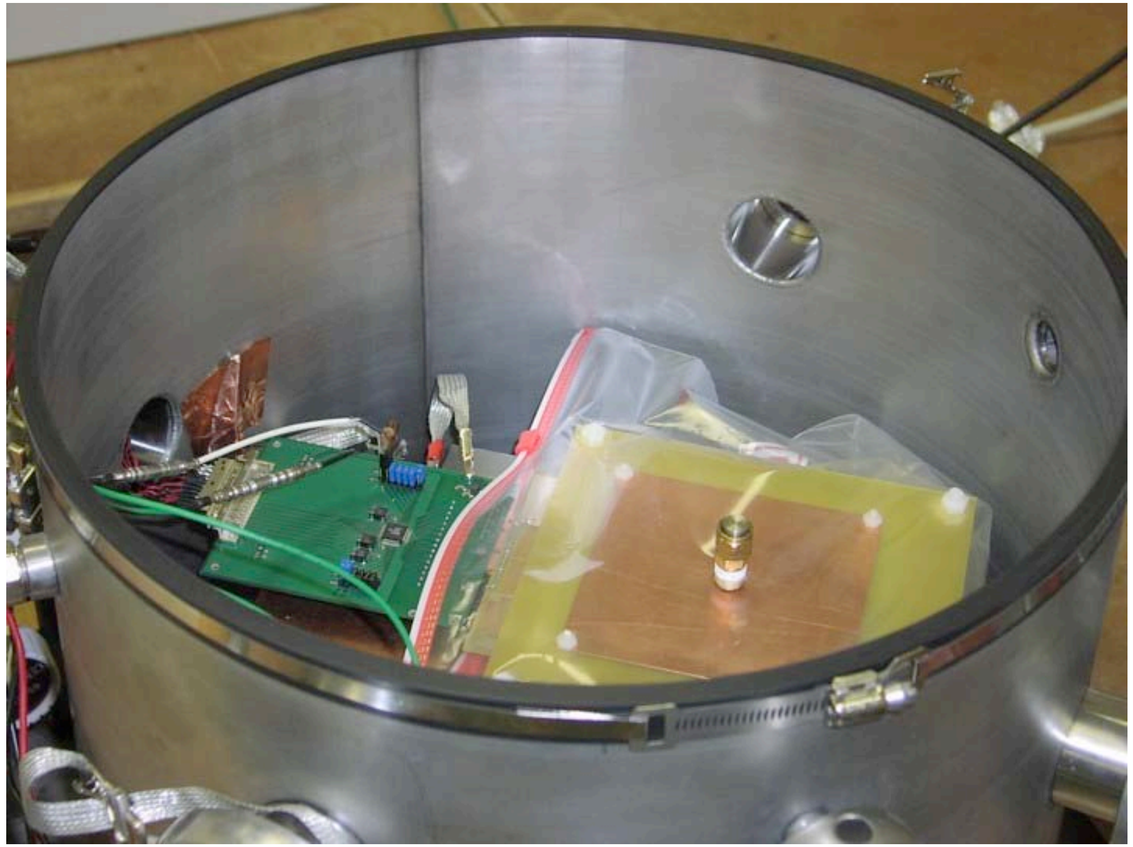
How directional is Drift II?



note: Anode wire direction has poorest resolution.

On going analysis to measure in Drift II

On going R&D : GEMS/Micromegas for increased gain and position resolution



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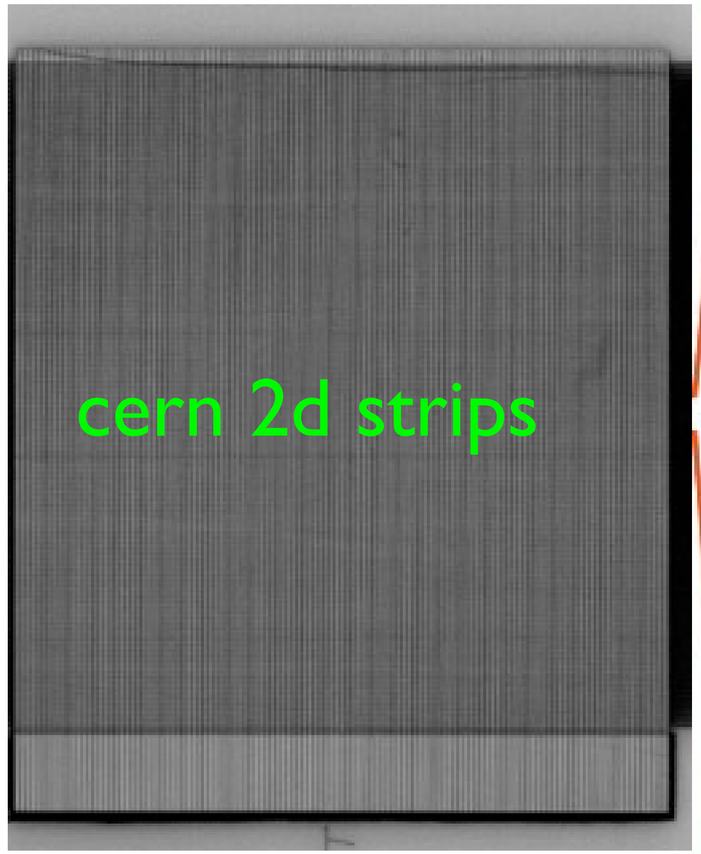
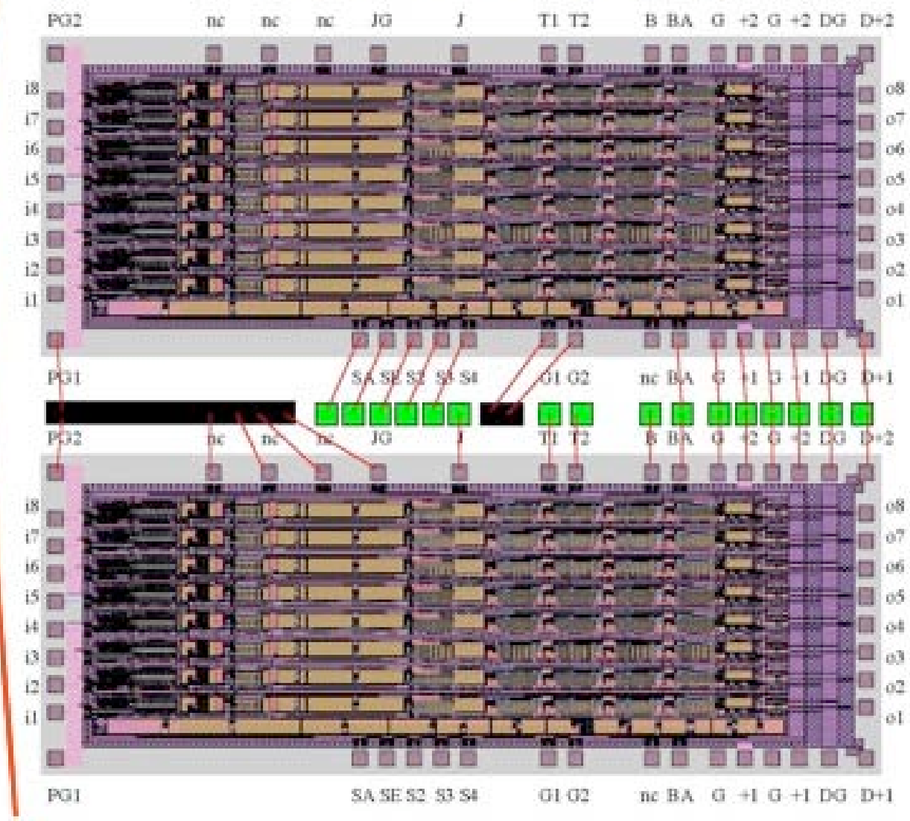
goal-- high resolution measurements of neutron recoils

BNL electronics (O'Conner, de Geronimo)



8 channel, high capacitance ASIC w/ progammable gain & shaping time. Noise: 50+10/pF e^-. ASIC die size perfectly matched for 200 μm strips.



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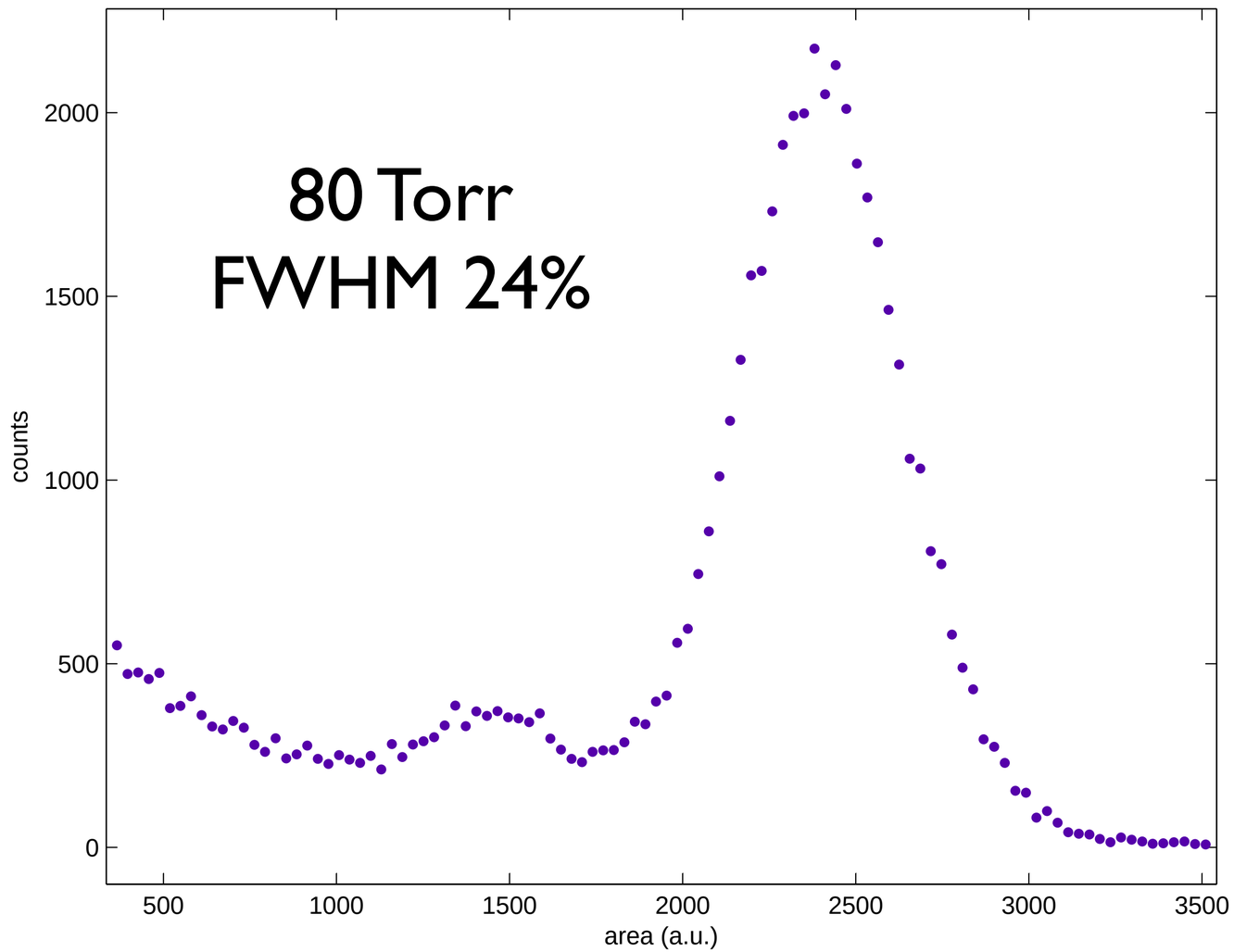
Fe-55 spectrum in CS_2 with GEM



Conclusion:

- Drift II modules constructed and successfully operated demonstrating that technology is cheap and robust
- An unexpected background problem has been understood and work is ongoing to solve the problem
- High quality, low background data expected this summer
- Ongoing analysis and R&D on directionality
- No show stoppers!