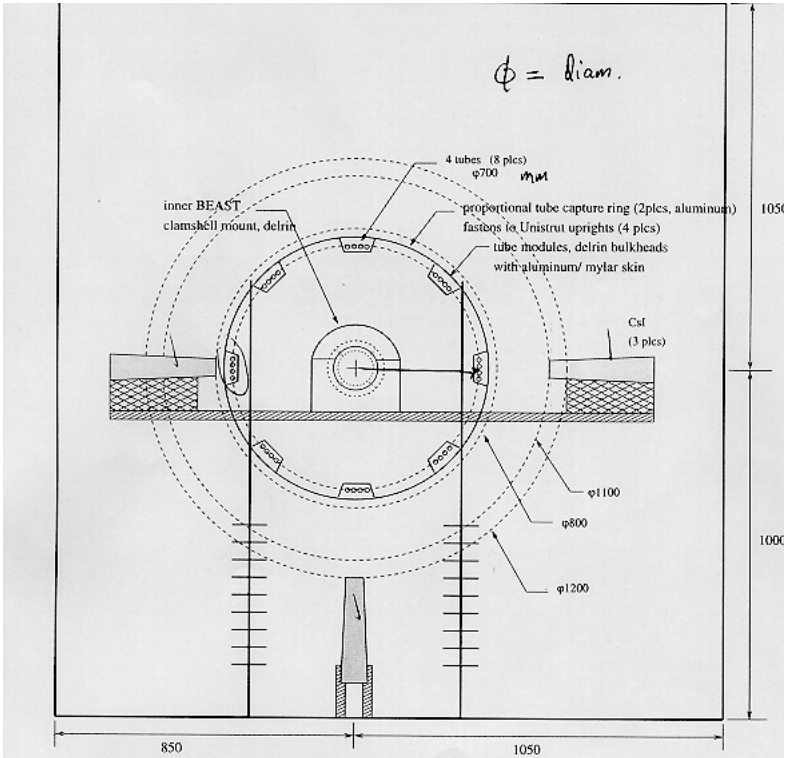
KEKB Commissioning in 1998

BEAST: Background Exorcism for a Stable BELLE Experiment

- Non-magnetic support structure surrounding IP
- No solenoid / Belle rolled out
- Particle/Radiation monitoring
  - Drift tubes (at r=7 and r=45 cm)
  - PIN diodes
  - MOSFETs
- Belle Detector Elements
  - CSI(Tl) Crystals
  - Two Silicon Strip Ladders
- Collaboration of KEK, Melbourne, Sydney, Hawaii, Cracow, BINP Novisibirsk, NTU

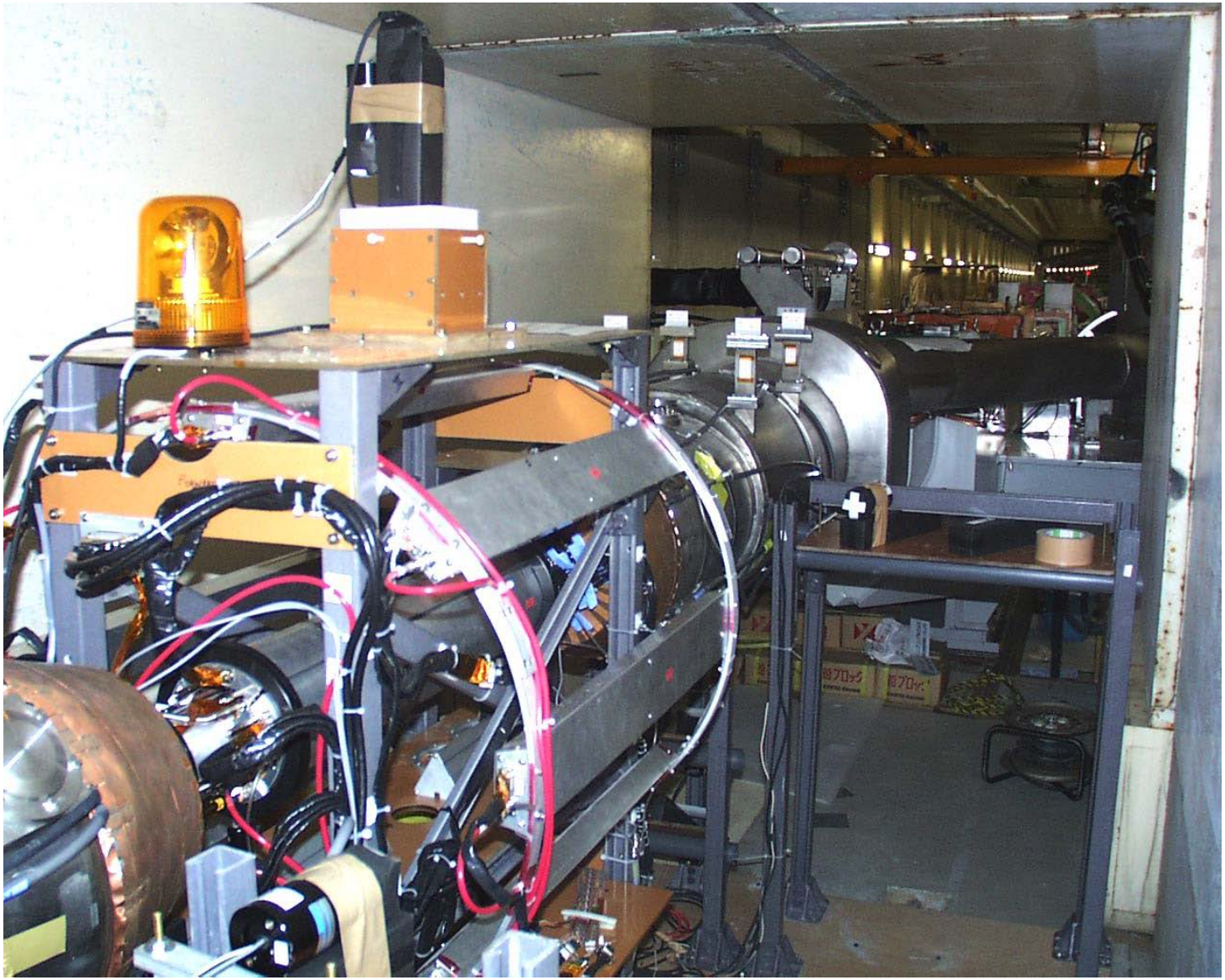


r/φ view @ Z -295 & +395 (from OHO)

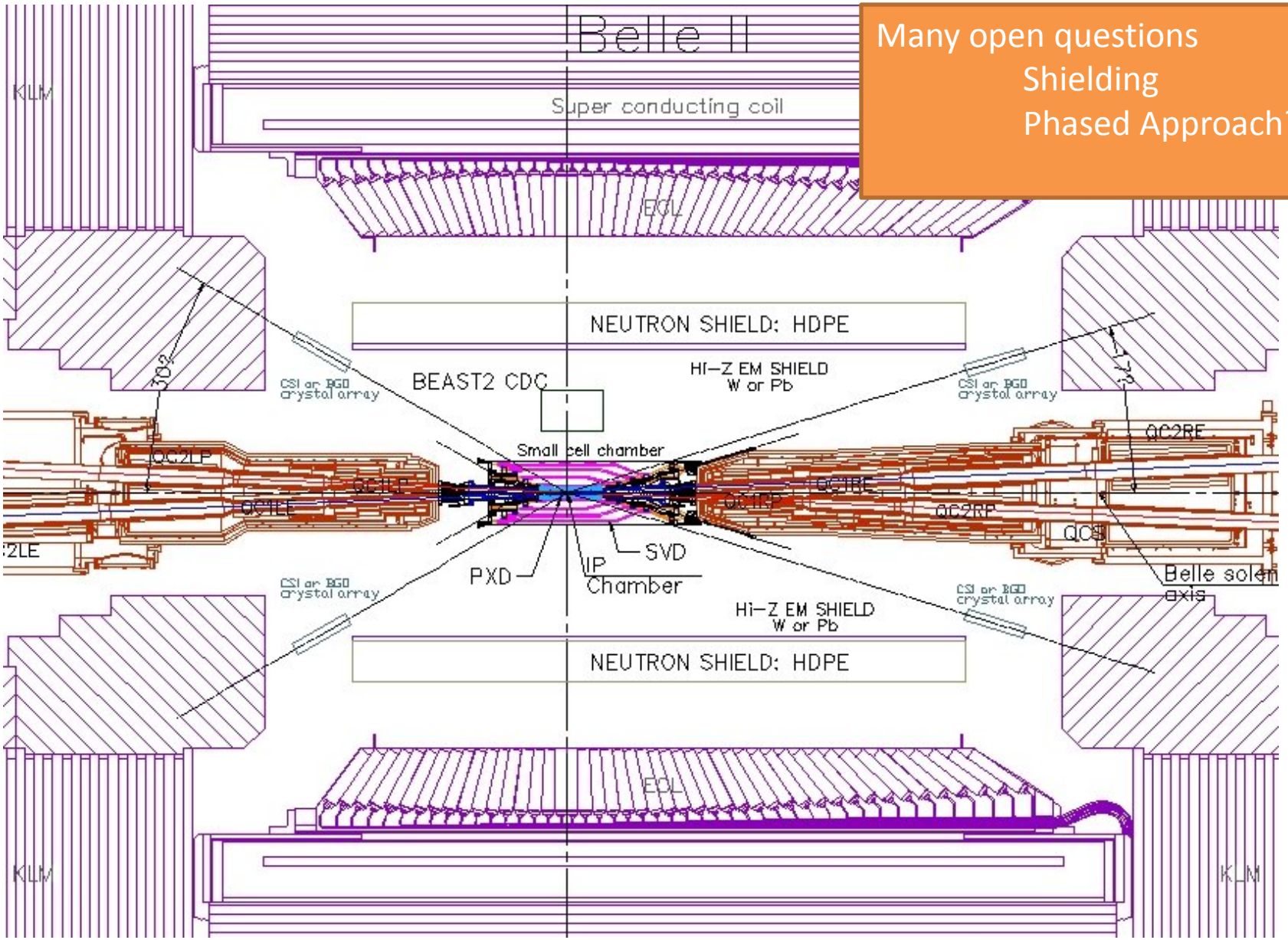
The temporary concrete tunnel is 1.9M wide by 2.05M high, walls must be avoided by 100mm, the beam center is 1M above the floor
CsI crystals are 300mm long, with amp and cabling, 350mm is needed. Crystal faces average 55mm wide.
This sketch shows 8 groups of four drift tubes each @ 45deg intervals, and radius 350mm. Each row of tubes is ~55mm wide.
The position of the bottom crystal takes full advantage of the beam center to tunnel floor relationship.
With the fine grid displayed, the approximate scale factor is 50mm/grid.

Total of 15 crystals

The BEAST in the Cave

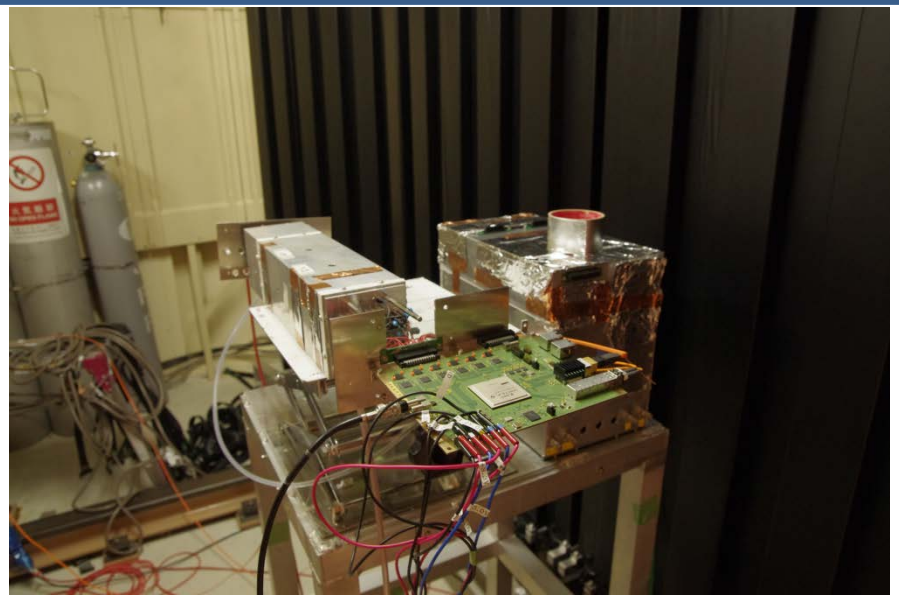


BEAST II *v0.1*



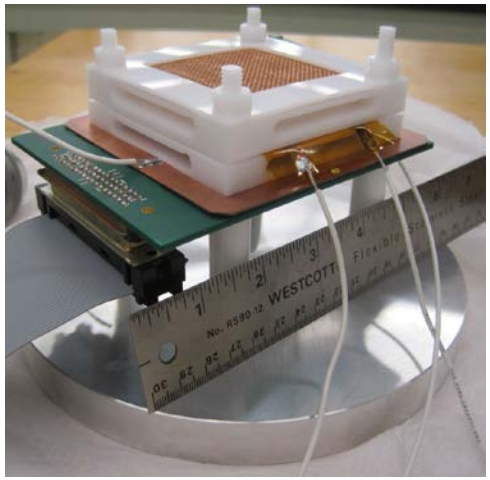
Many open questions
- Shielding
- Phased Approach?

BEAST II Ingredients



CDC prototype (KEK) 20cmx30cmx30cm, 20 layers and 96 sense wires

Diamond sensor (~2x6cm^2) and 16 FEI3 readout chips (Bonn)

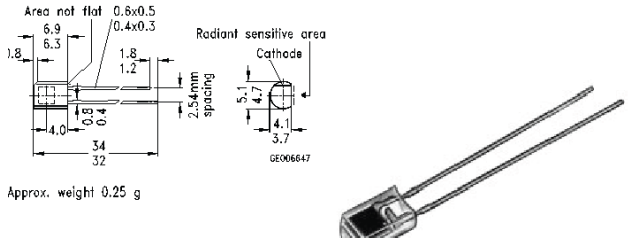


microTPC protoype (Hawaii)

CLEO-III/-c Radiation Monitor Diodes

David Cinabro, Wayne State, Mikhail Dubrovin, now SLAC

- System based on Siemens SFH 206K PIN Diodes.



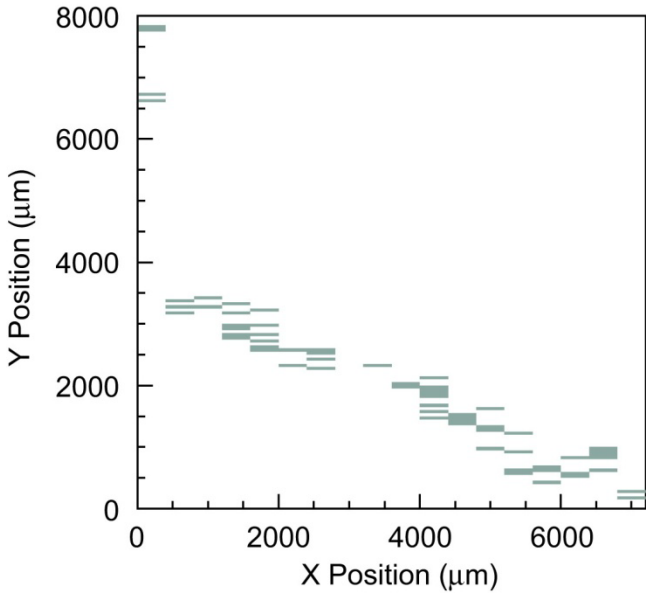
PIN diodes (Wayne State)

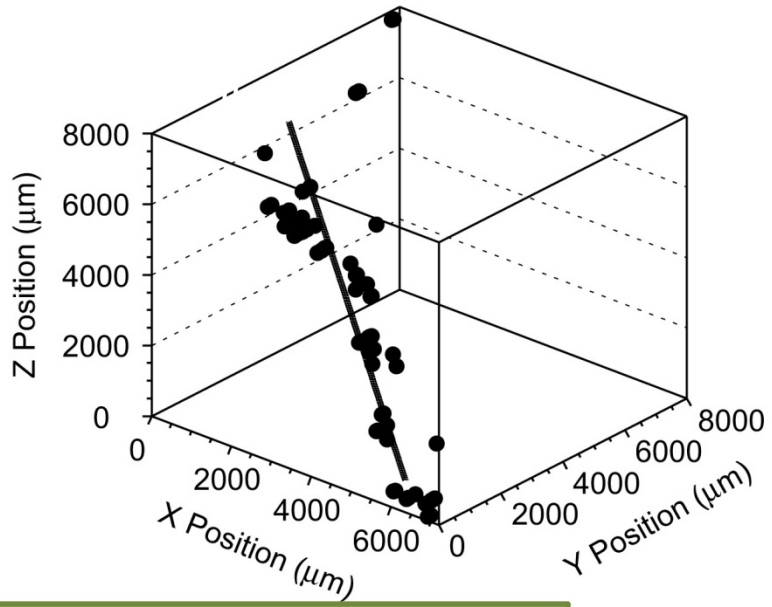
BACKUP SLIDES

Detection of Charged Tracks

- Large sample of cosmic rays
- Require >10 pixel hits
- 3D track at least 4.5mm long
- Gain=9000, threshold=1800e-

	track fit residual	Diffusion	$\sigma_{GEM+Pixel}$
σ_X (μm)	170	110	130
σ_Y (μm)	130	110	70
σ_Z (μm)	240	190	150



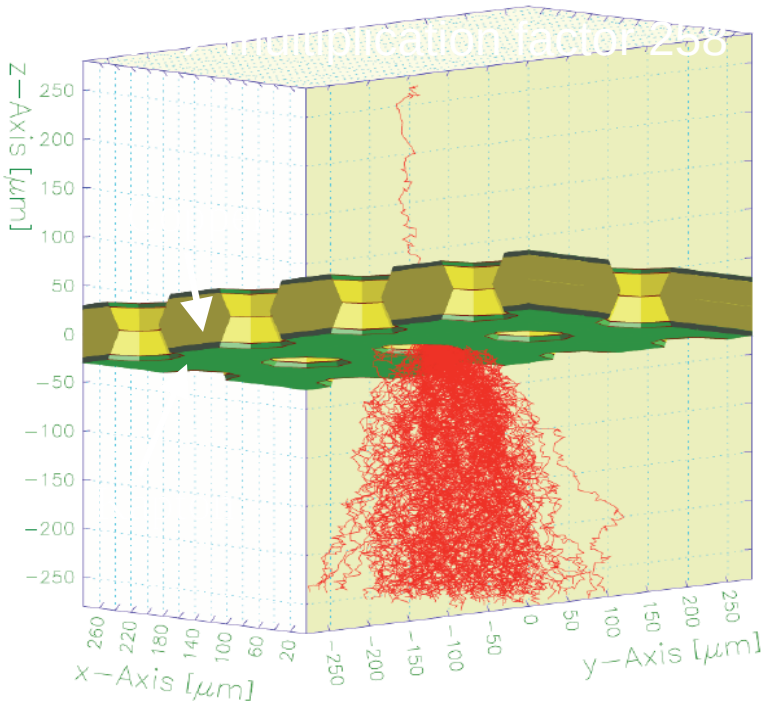


Readout of TPC tracking chambers with GEMs and pixel chip. T. Kim, M. Freytsis, J. Button-Shafer, J. Kadyk, S.E. Vahsen, W.A. Wenzel (LBL, Berkeley) . 2008. 12pp. NIM (2008)

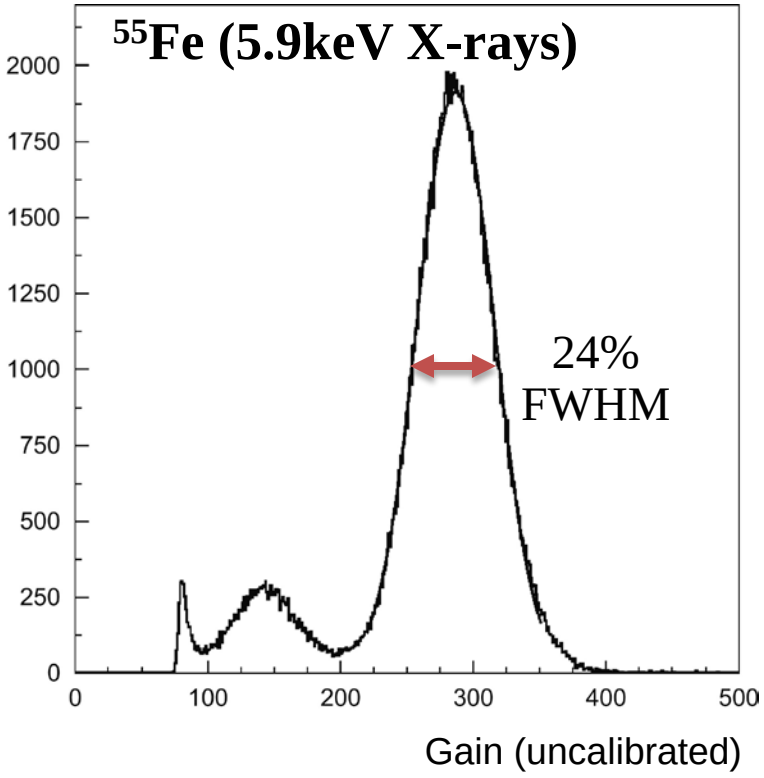
Excellent performance; single hit position resolution down to ~70 μm (limited by diffusion without magnetic field)

Detection of X-ray Lines

- Electrons multiplied by avalanching in GEMs
- Off-the shelf GEMs from CERN
  - 5cm x 5cm x 60 µm
  - Hole spacing: 140 µm

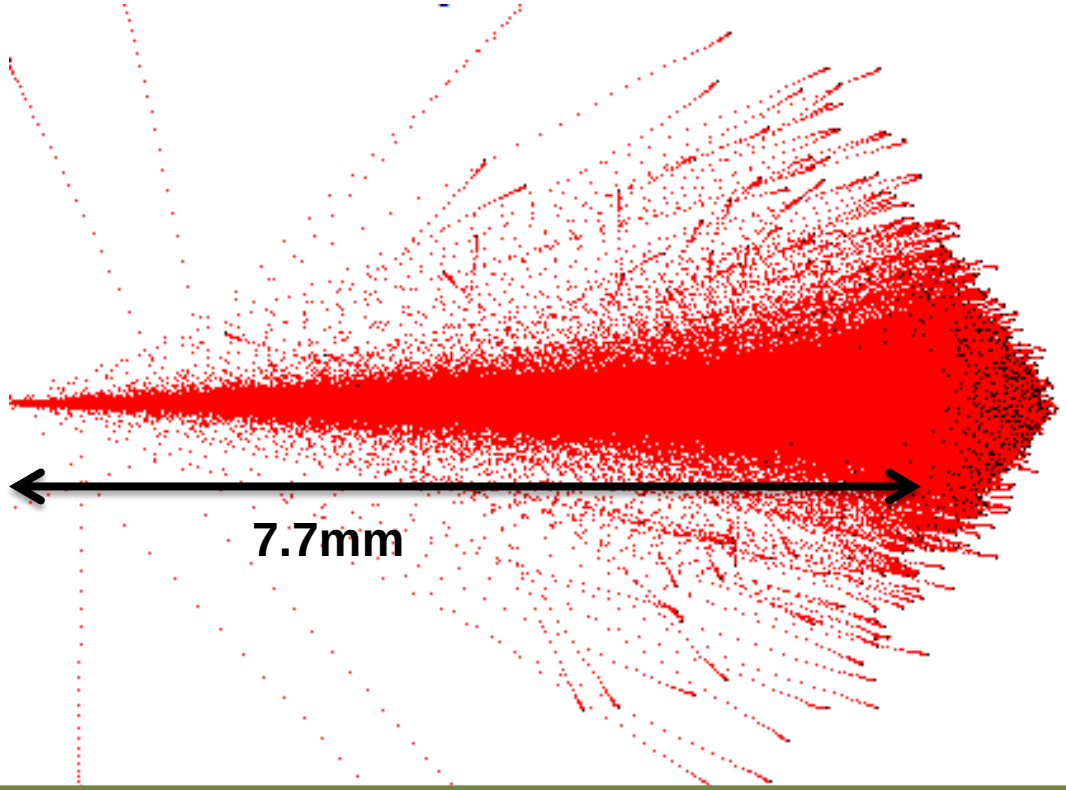


- Reliable without sparking with single-GEM gain up to 300 ($Ar/C0_2$)
- Two GEMS in series: higher gain with less risk of sparking:
  500V + 400V → gain = 40000



- *x-ray lines are the "smoking guns" for SR backgrounds*
- *Can measure x-ray spectrum in keV region with GEMs only (no pixels used)*

Detection of Neutrons



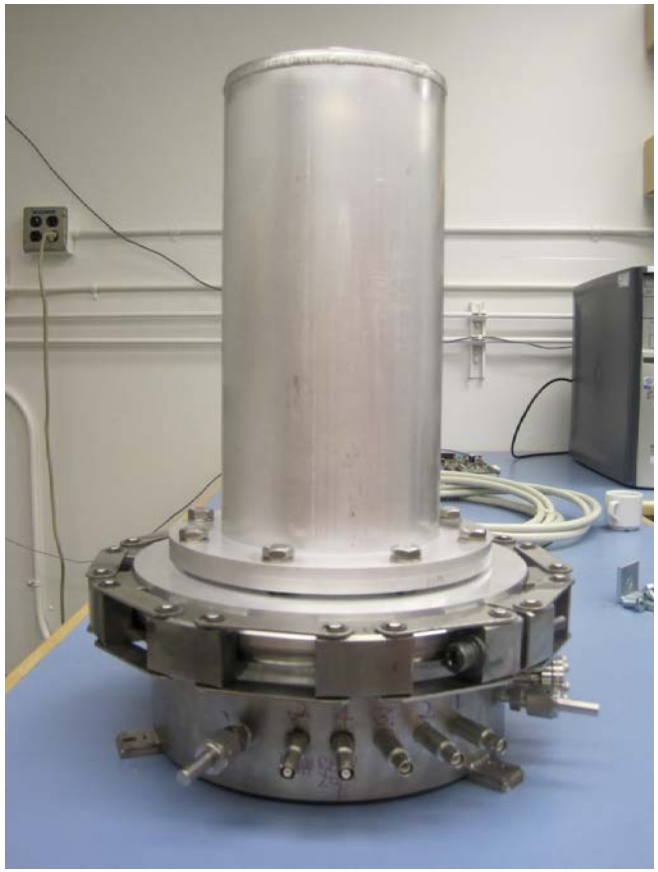
SRIM simulation

1-MeV Hydrogen nuclei recoiling in 1 atmosphere of C_4H_{10} gas. 10^5 recoils with identical start position and velocity have been superimposed

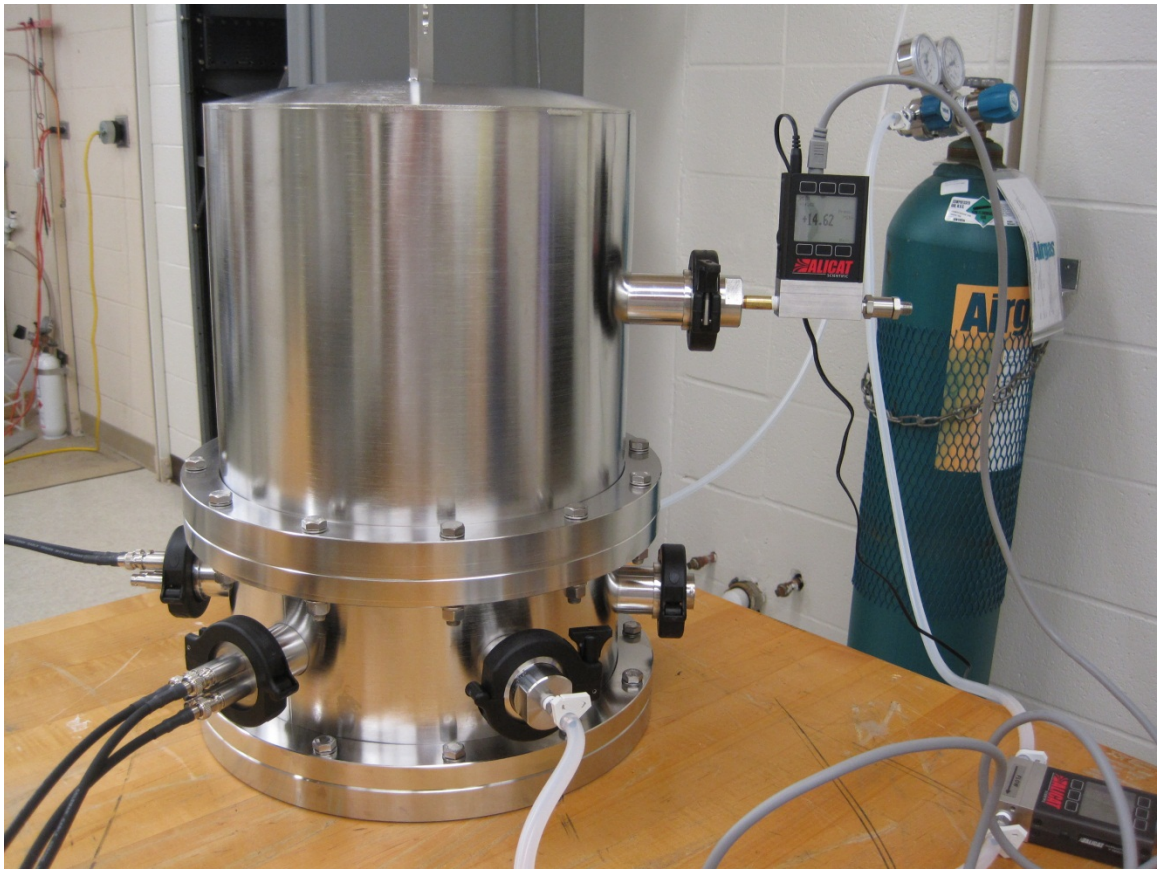
- With suitable gas, can detect neutrons via nuclear recoils
  - Large ionization signal (and we are sensitive even to single electrons)
  - Large tracklength: 7.7mm at 1 atm, versus ~100 micron readout resolution
- 3D measurement of recoils → sensitive to energy and direction of neutrons
- Distinguish neutrons from charged particles via dE/dX and length of tracks

2nd Generation Prototypes Built

Berkeley



Hawaii



Working to demonstrate neutron detection this year at Hawaii. Currently commissioning Hawaii prototype and constructing collimated neutron source. (note: vessels shown are *much* larger than what we are proposing for BEAST)