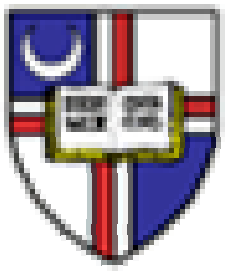


Beamline and Tagger status

GlueX Tagged Beam Working Group
(U.Conn., Glasgow U., CUA)

Hall-D Collaboration Meeting March 29-31, 2007

Photon beam properties

(argumentation at Hall-D Beamline and Tagger Review Jan.'06)

Direct connections with the physics goals of the GlueX experiment:

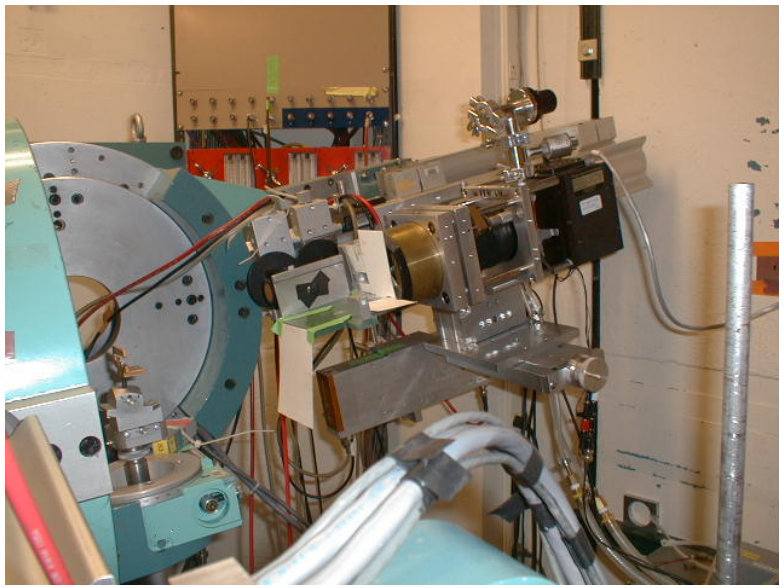
• Energy	9 GeV	solenoidal spectrometer meson/baryon resonance separation lineshape fidelity up to m_X=**2.8GeV/c²**
• Polarization	40 %	adequate for distinguishing reactions involving **opposite parity exchanges**
• Intensity	10^7 $\vec{\gamma}$/s	provides sufficient statistics for **PWA** on key channels in initial three years
• Resolution	10^{-3} $\frac{\delta E}{E}$	matches resolution of the GlueX spectrometer tracking system

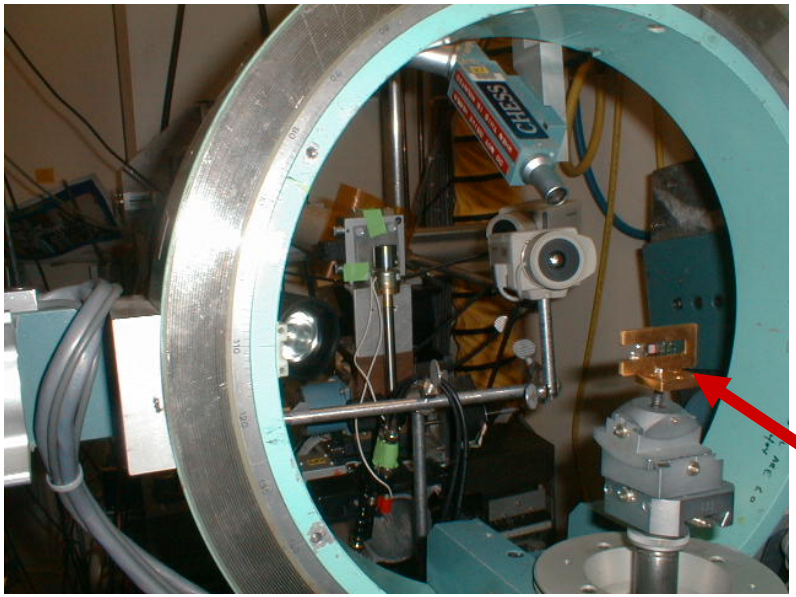
Are these parameters consistent with latest detector simulations, PWA?

radiator crystals

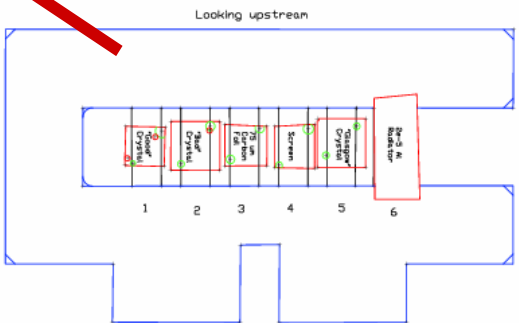
First test at CHESS (Nov.'06)
(more to come after C1 beamline upgrade)

1Mb CCD camera





4-axis goniometer



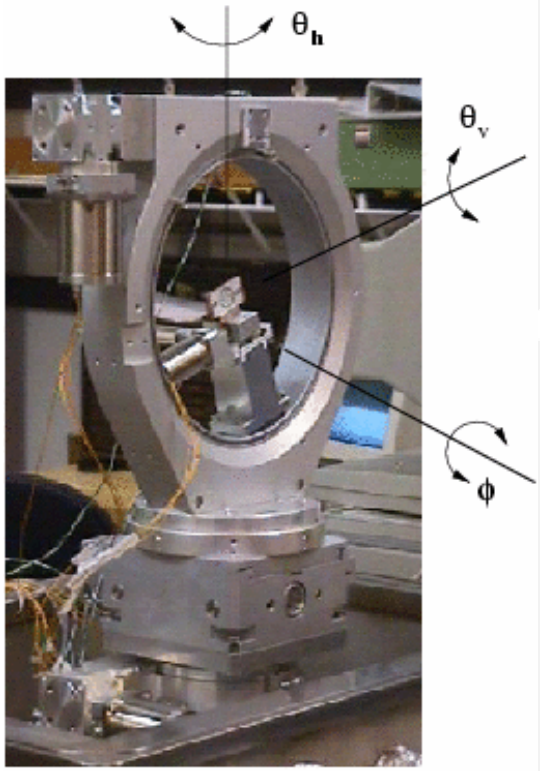
Hall-B goniometer target ladder with 2x 50um, 1x 20um crystals

Crucial: procurement of high-quality, thin diamonds

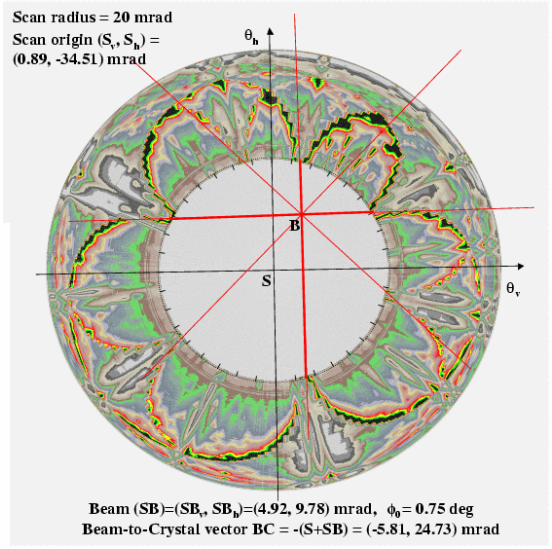
Note: 20um crystal broke while remounting

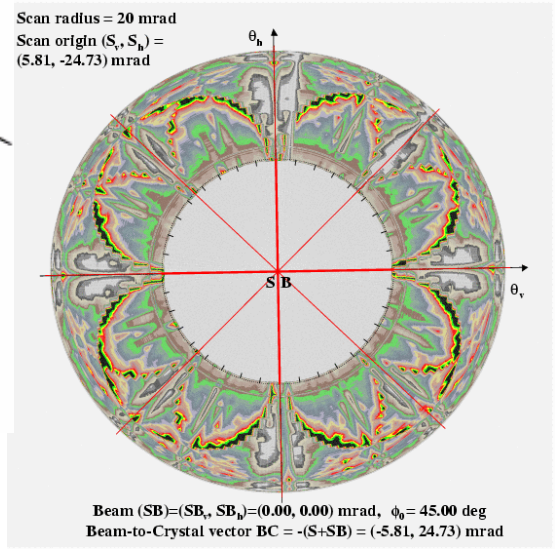
radiator crystal alignment

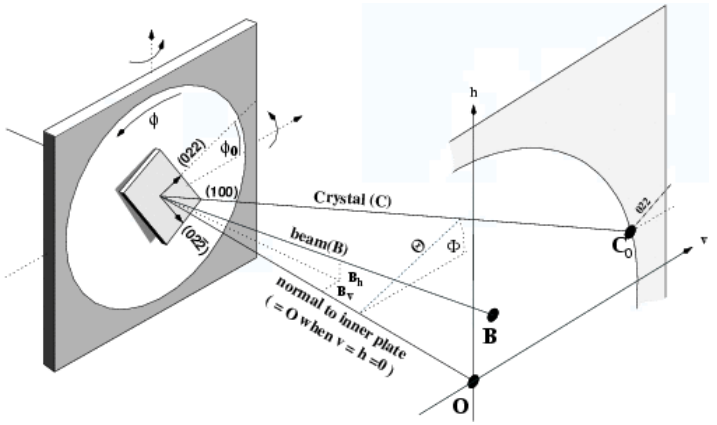
like Hall-B alignment via "Stonehenge" method:

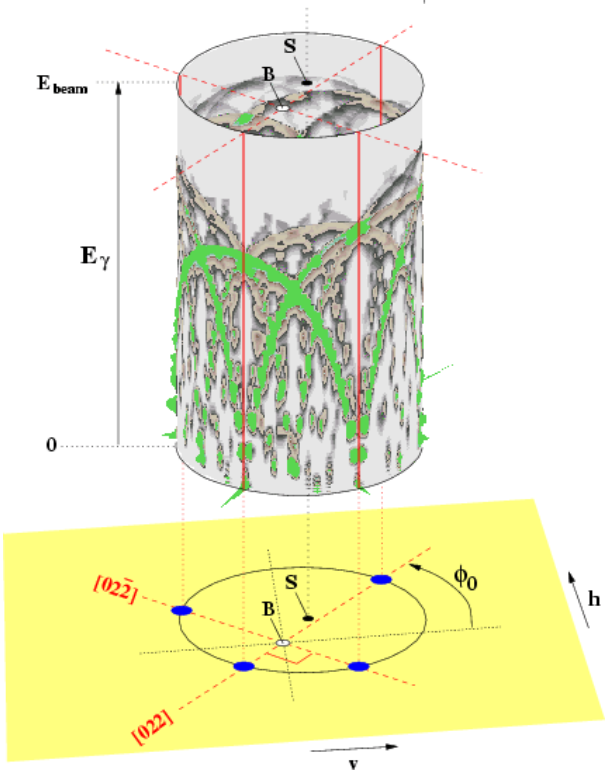


Hall-B goniometer (6 d.o.f.) for crystal positioning



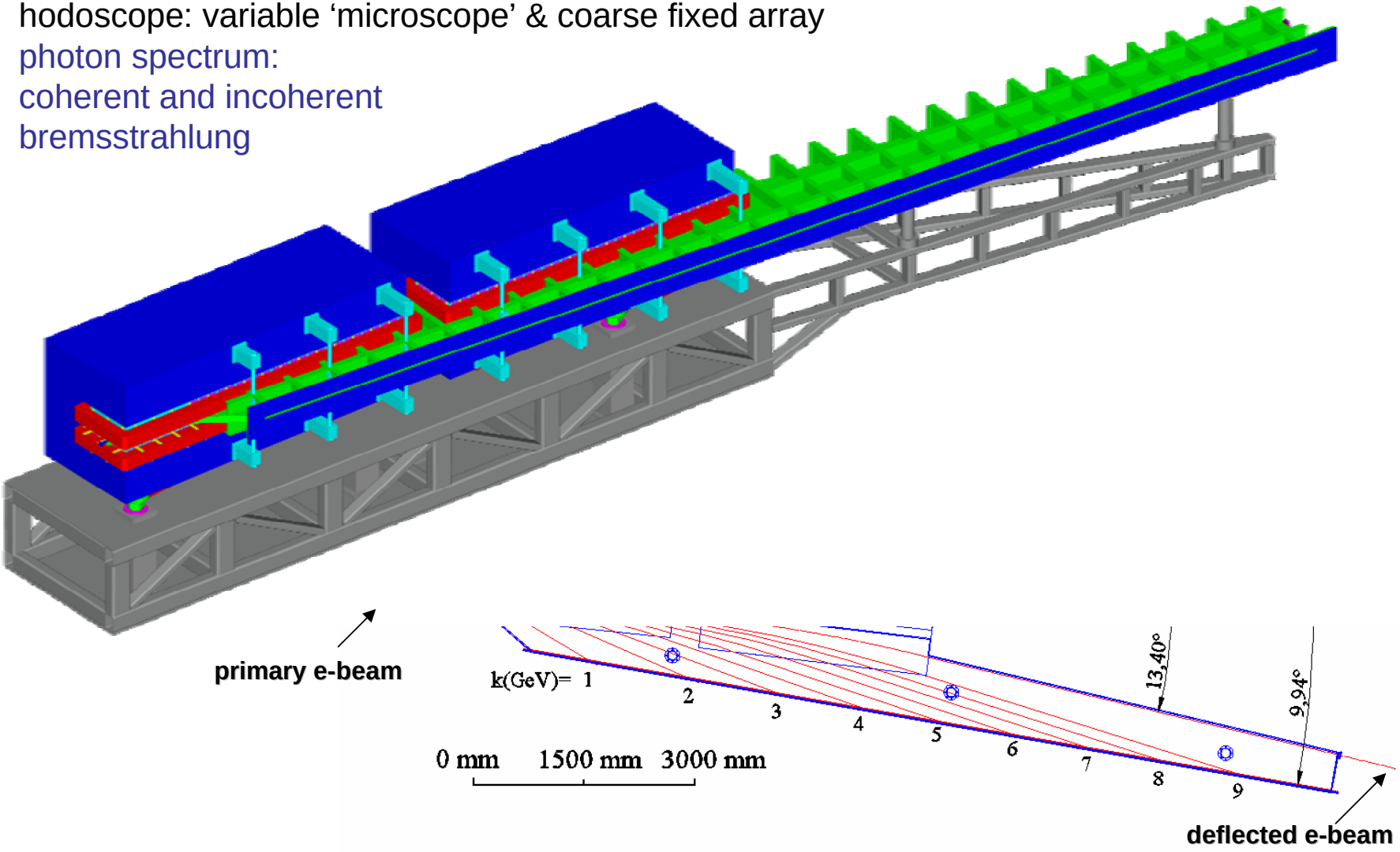






Hall-D tagger

- two-magnet design with horizontal deflection
- hodoscope: variable ‘microscope’ & coarse fixed array
- photon spectrum:
  coherent and incoherent
  bremsstrahlung

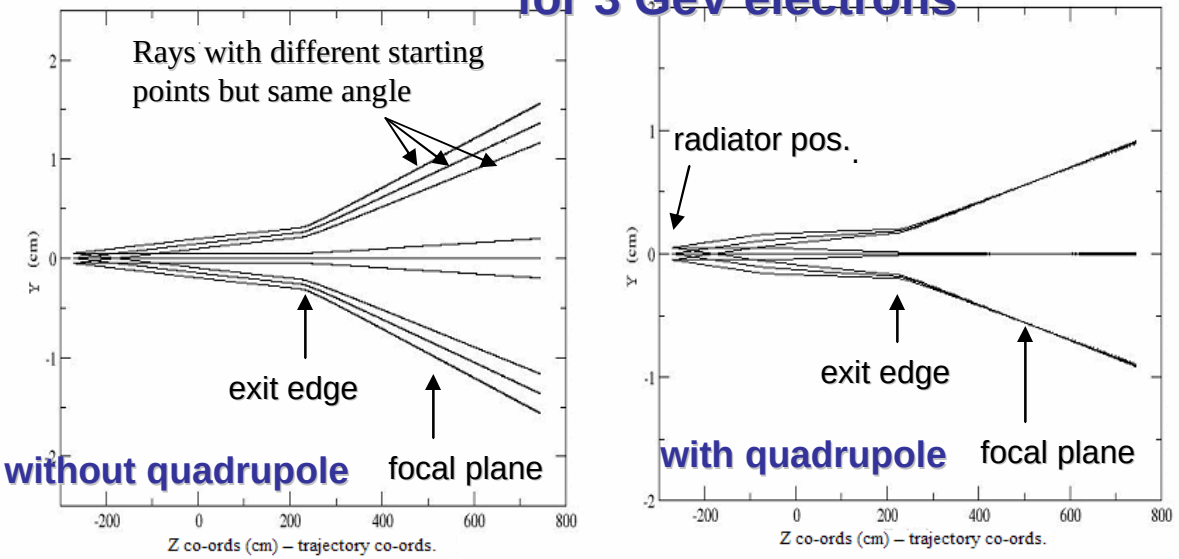


magnets+vacuum chamber

-**Tosca field calculation,**
-**variation of e$^-$ trajectories**
- **> add. quadrupole**

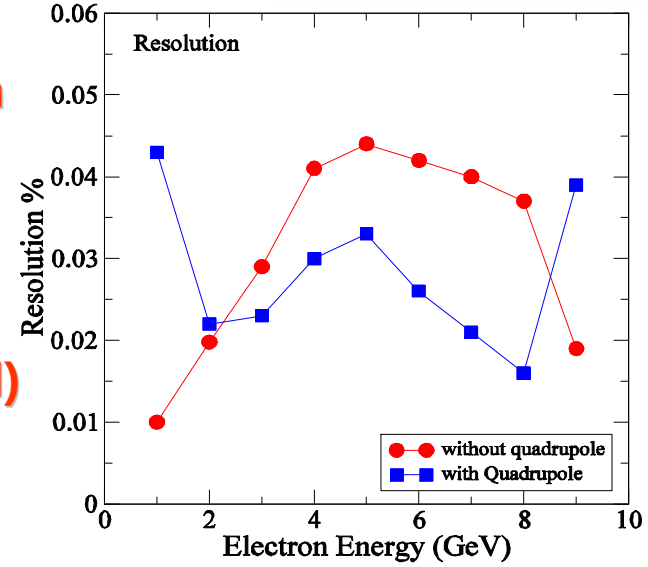
Note: setup insensitive to positioning errors of the 2 magnets (±2mm, 0.1º)

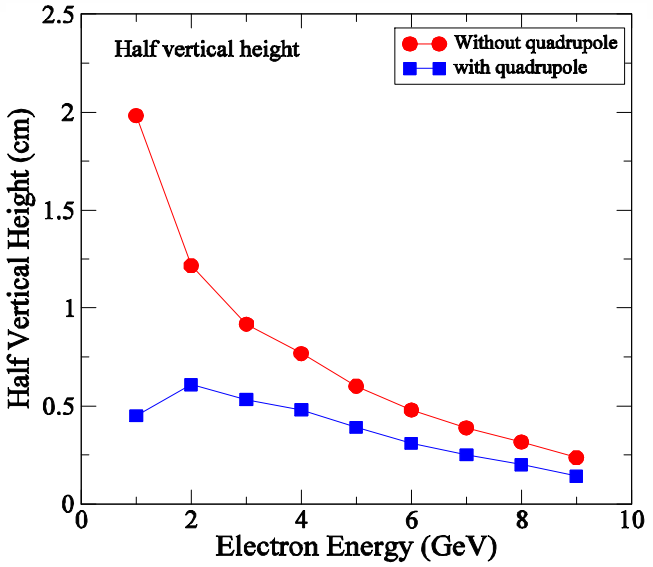
for 3 GeV electrons



detailed design at Glasgow U.

wait for design drawings from IHEP (mid April)





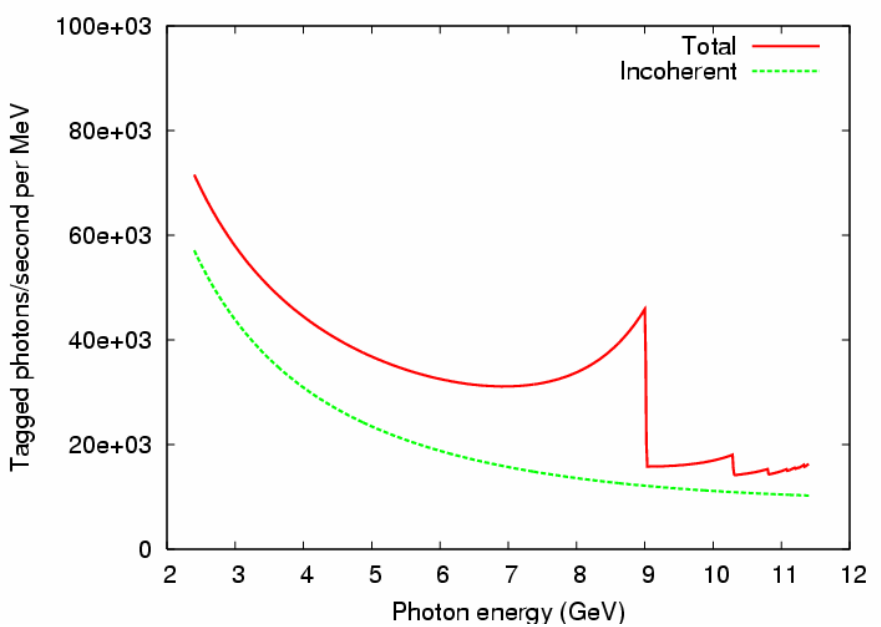
tagging hodoscopes

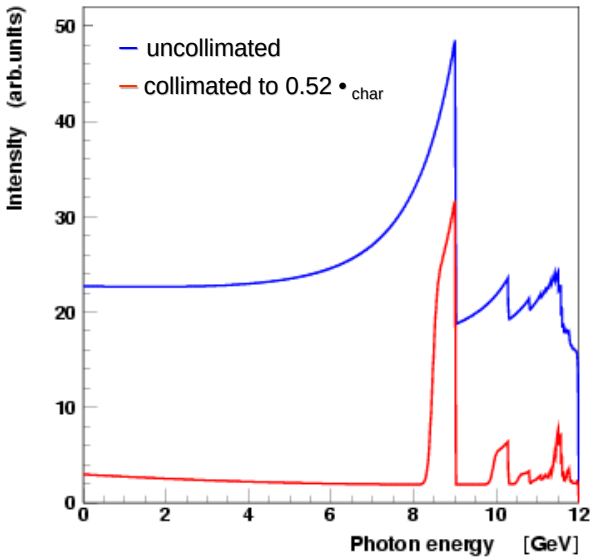
- Beam energy E_0=12 GeV
- coherent peak at 7-10 GeV (typically 9.0 GeV)
- **microscope tags ~600 MeV near coh. peak**
  - • E=0.1% (9 MeV) with transverse segmentation • **100 channels**
- **fixed hodoscope (tags 3.0-11.4 GeV)**
  - located 20 cm from true focal plane (to allow for microscope motion)
  - E.=3.0 - 9.0 GeV: 50% sampling with • E=60 MeV • **100 channels**
  - E.=9.0 - 11.4 GeV: photon beam monitoring:
  - options: • E=60 MeV (max.rate ~1.1 MHz/counter) • **40 channels**
    • E=20 MeV (max.rate ~0.34 MHz/counter) • **120 channels**

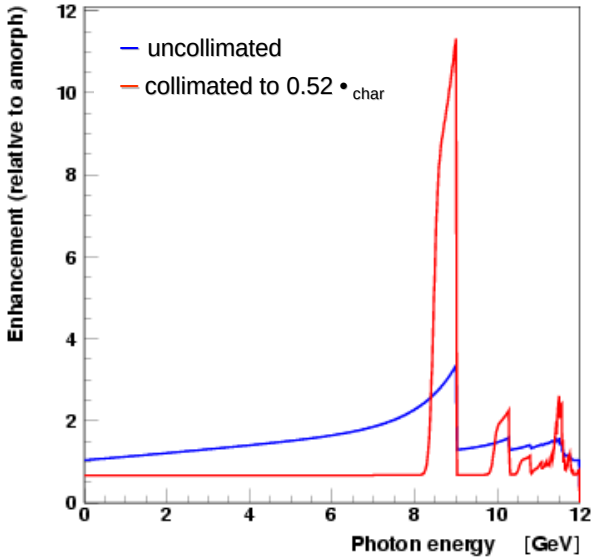
rate estimates

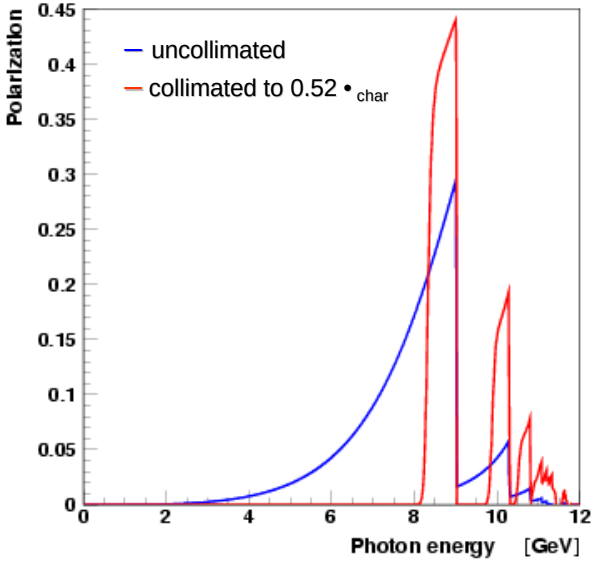
assuming:

- Jlab beam conditions
- 20• m crystal
- coh. peak at 9.0 GeV
- collimation to 0.525 • $_{char}$
- microscope tags 8.4-9.0 GeV
  - 25 MHz tagged photons in microscope
  - 10 MHz tagged photons on target (40% collimation)

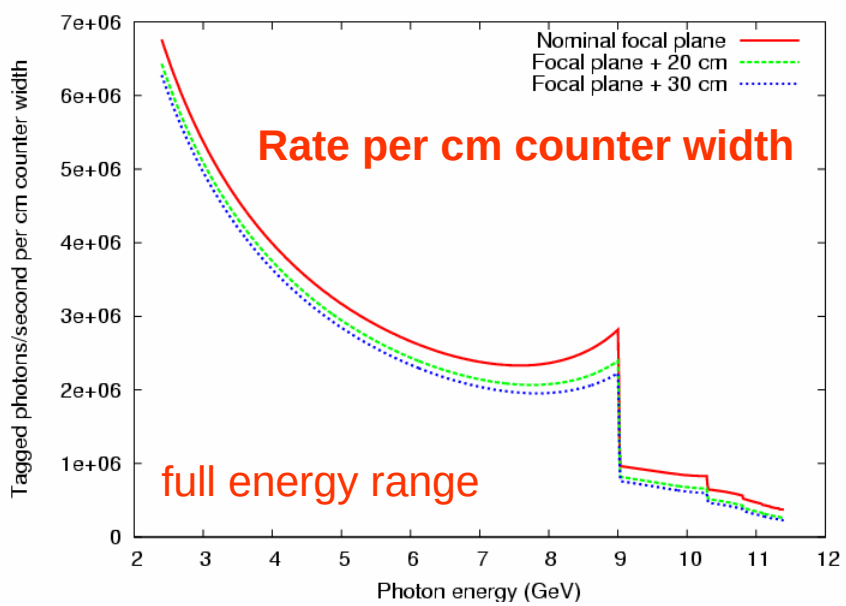


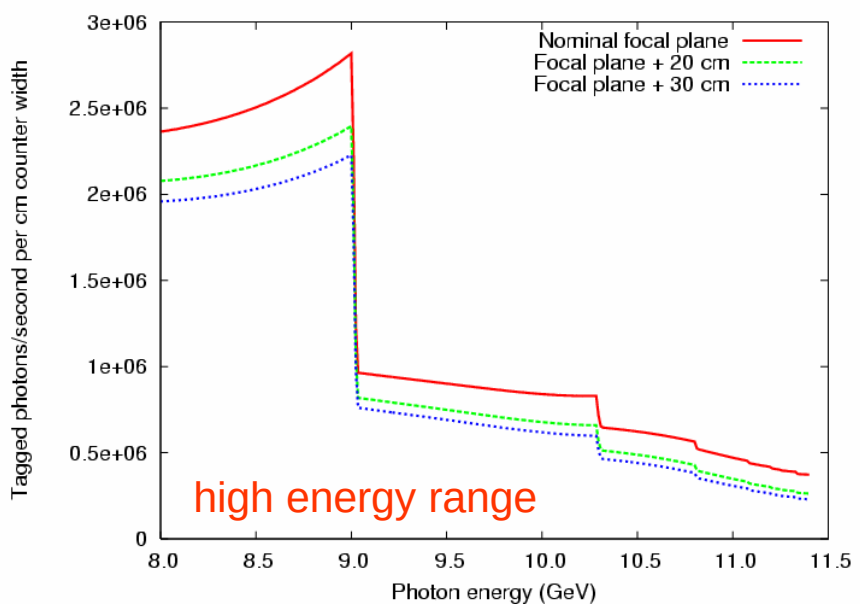






Fixed array: rate estimates

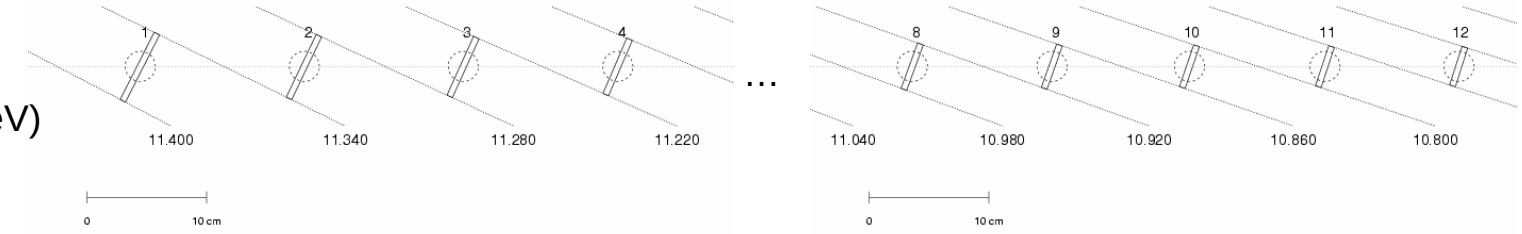




fixed array:
50% sampling of lower energy range
- crystal alignment: special runs@low intensity
photon beam monitoring @full intensity for E• >9 GeV

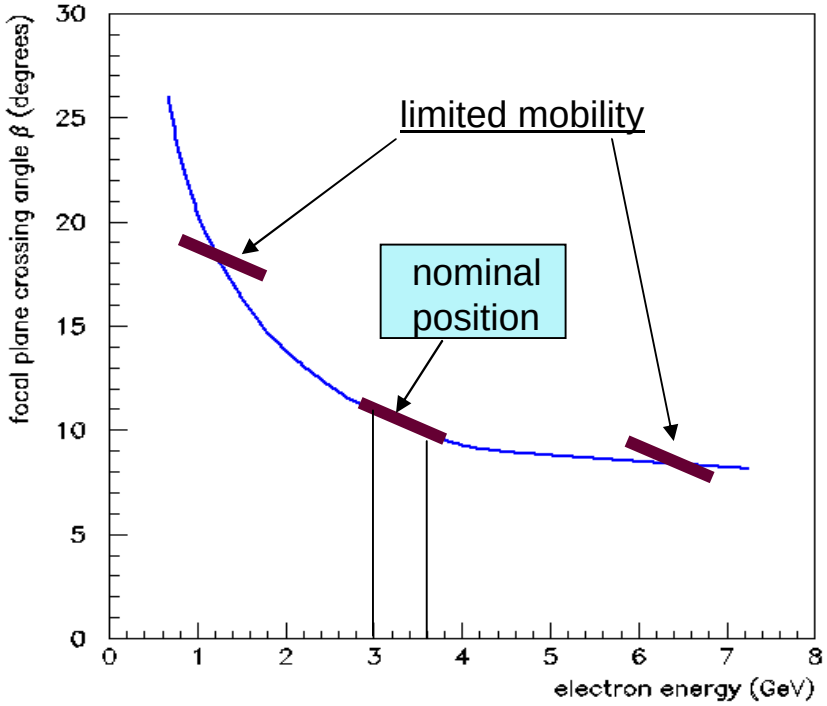
Counter width ~1.1-3.7cm
Resolution • E~60MeV
Rates at 10^7• /s ~0.8-1.1MHz

Example for
counter arrangement:
(11.4 GeV • 10.8 GeV)

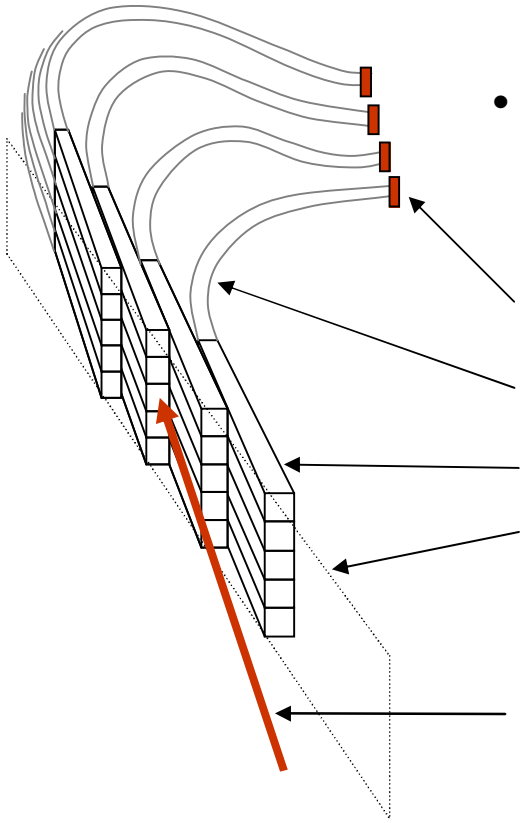


Microscope array:

- channel width: 9MeV (0.1%)
- overcome rate limitation by **transverse segmentation**
- focal plane coord. roughly linear with energy
- crossing angle changes with energy:
  microscope optimized for E• ~ 8-10 GeV



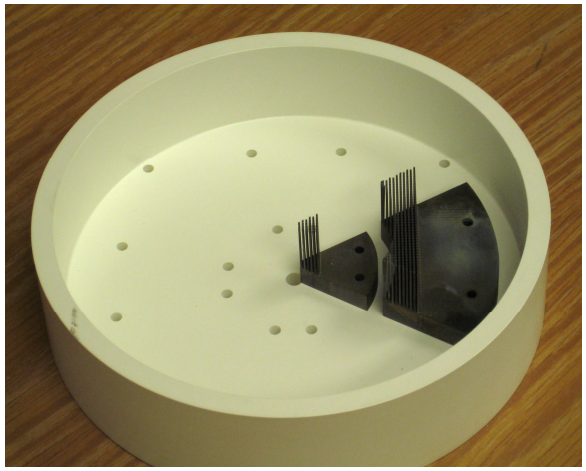
100 channels:
- square scint. fibers (2x2x20mm^3)
- SiPM readout



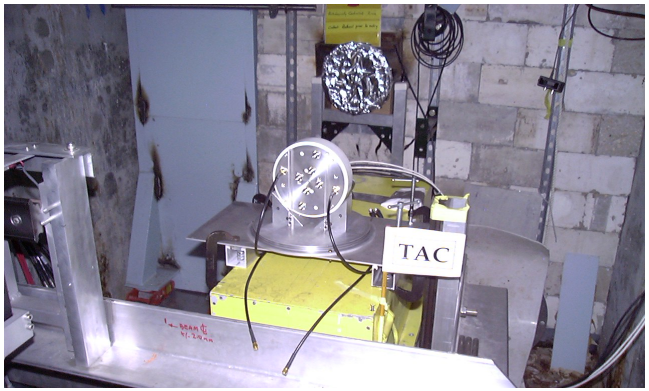
Instrumented collimator:

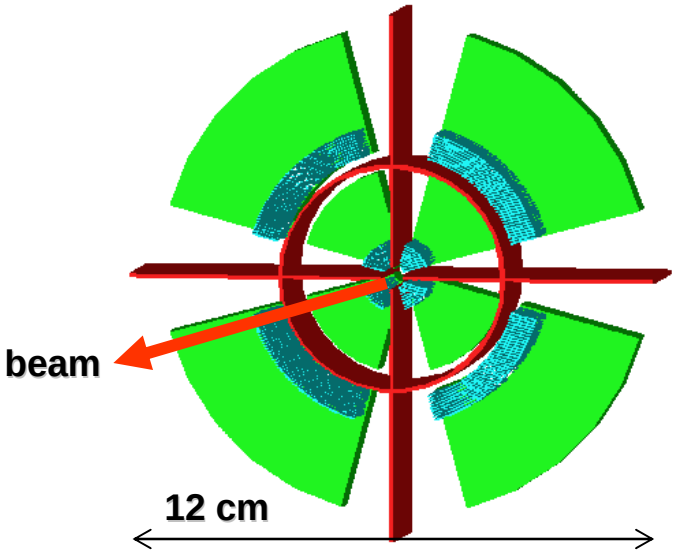
inner diam. 5mm, position-sensitive passive detector, 76m from radiator

Tungsten pin-cushion detector



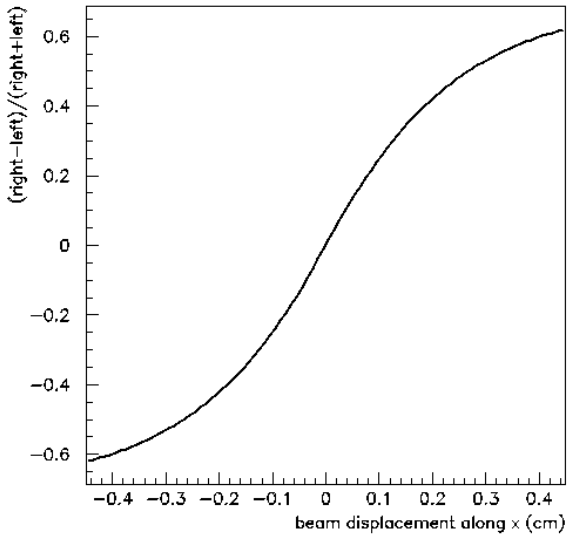
test setup in Hall B (TAC cave)





Simulation:

200• m motion of beam centroid
ó
5% change in left/right current balance of inner ring



Pair Spectrometer

- positioned downstream of instrumented collimator
- left-right coincidence (16 counters each side)
- relative flux monitoring of collimated photon beam (~600 MeV around coherent peak)
- trigger device for pair polarimeter (special runs)

optional: pair polarimeter (NSF proposal)

- measurement of photon polarization
- complimentary to photon spectrum analysis

Budget

	procurement	labor
magnets, vacuum chamber	$ 1,125k	$ 200k
hodoscope	$ 363k	$ 370k
goniometer	$ 127k	$ 50k
diamond radiators	$ 60k	$ 110k
collimator	$ 85k	$ 40k
pair spectrometer	$ 100k	$ 80k
sweep magnets, beampipe, lead wall	$ 55k	$ 20k

excludes electronics