Proposal for Beamtest of FCAL in Hall B

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Goals of Beamtest

- gain experience working with actual hardware setup

- demonstrate FCAL has expected resolution

- show that GEANT simulation is accurately describing FCAL

- needs to be completely parasitic to Hall B

writeup of proposal to send to Hall B being prepared

Studies of Hall B Geometry
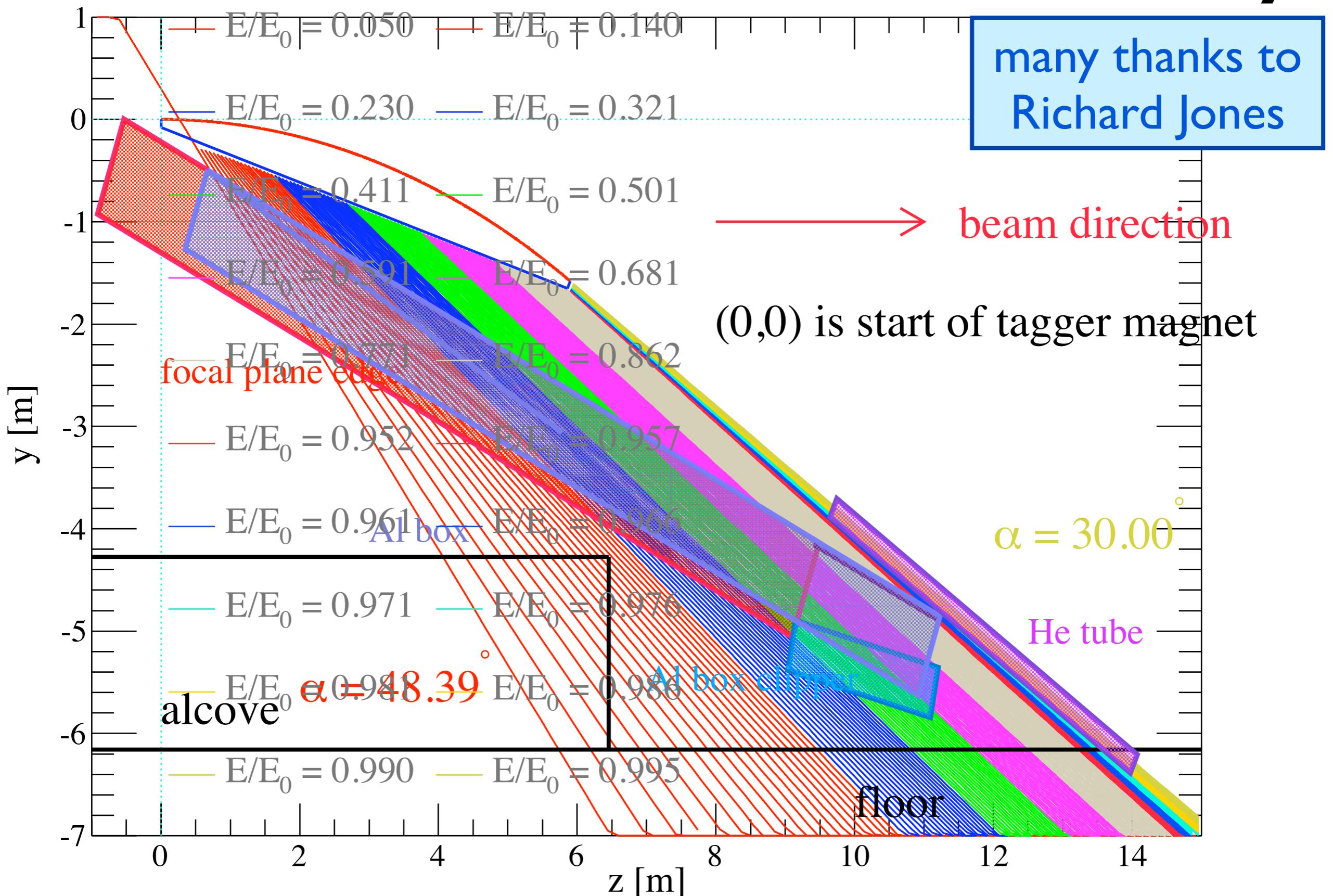
Focus On Tagger Alcove
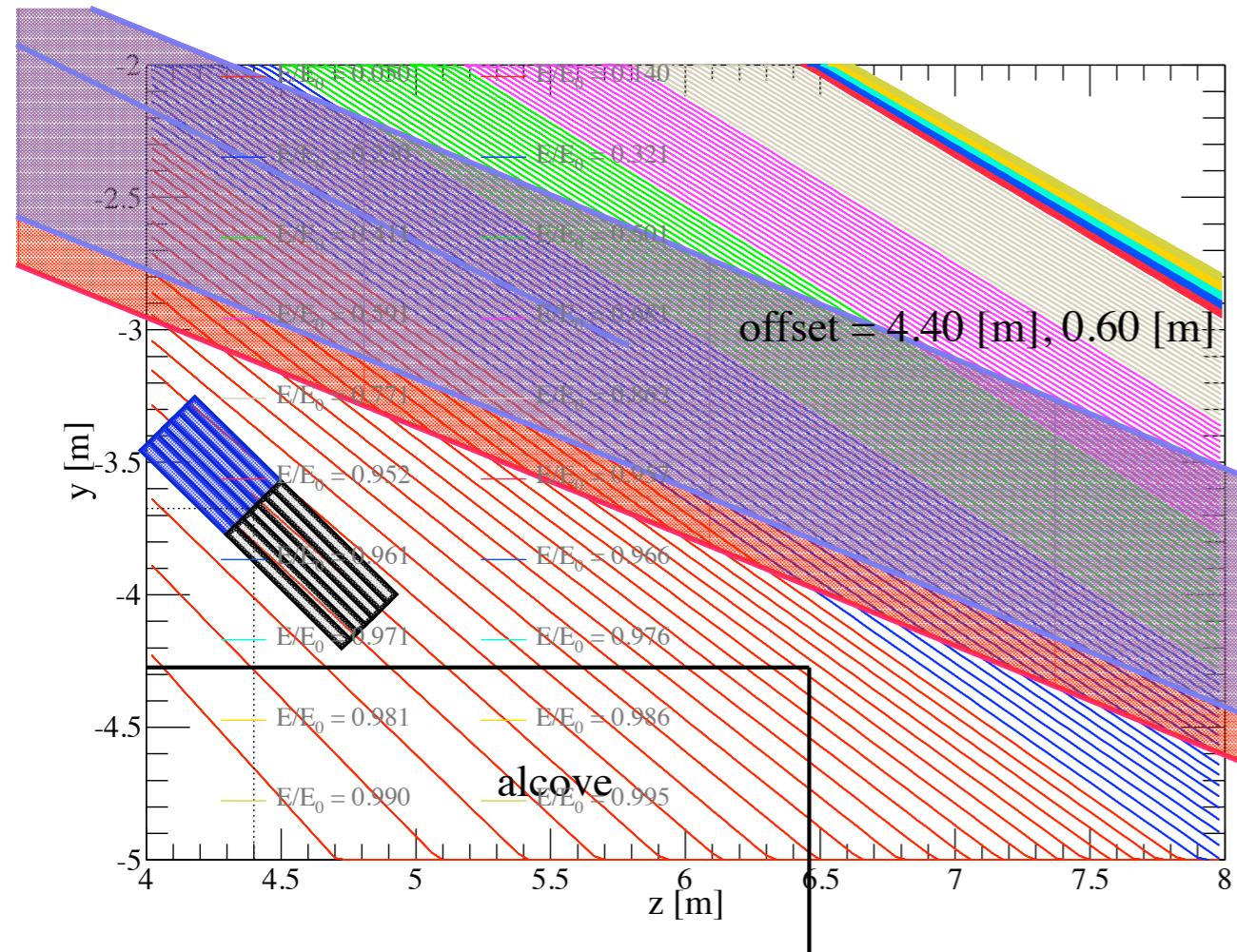
lower energy electrons
lower flux
smaller spread in energy
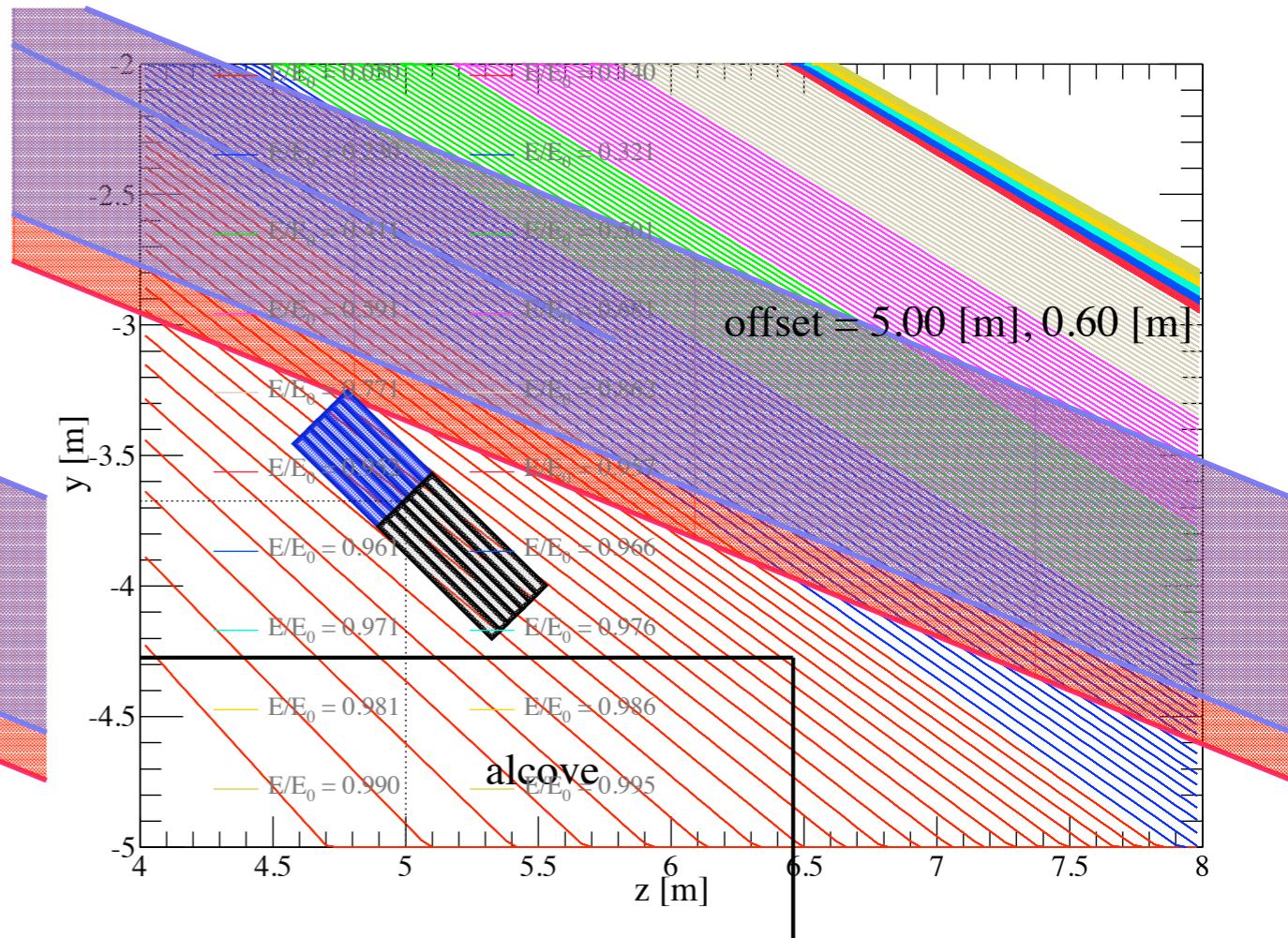
higher energy electrons
higher flux
larger spread in energy

Spread of Energies

alcove
height offset: 0.60 [m]
z position: 4.00 - 5.97 [m]
angle φ: 45.00°

central block
all 7 blocks

$\delta=0.090\%$
$\delta=0.271\%$
$\delta=0.180\%$
$\delta=0.271\%$
$\delta=0.361\%$
$\delta=0.451\%$
$\delta=0.541\%$
$\delta=0.631\%$
$\delta=0.721\%$
$\delta=0.812\%$
$\delta=0.992\%$

$\delta=1.262\%$
$\delta=1.533\%$
$\delta=1.803\%$
$\delta=2.164\%$
$\delta=2.525\%$
$\delta=3.066\%$
$\delta=3.517\%$
$\delta=4.148\%$
$\delta=4.779\%$
$\delta=5.410\%$
$\delta=5.951\%$

E/E_0
position of central lead glass block [m]
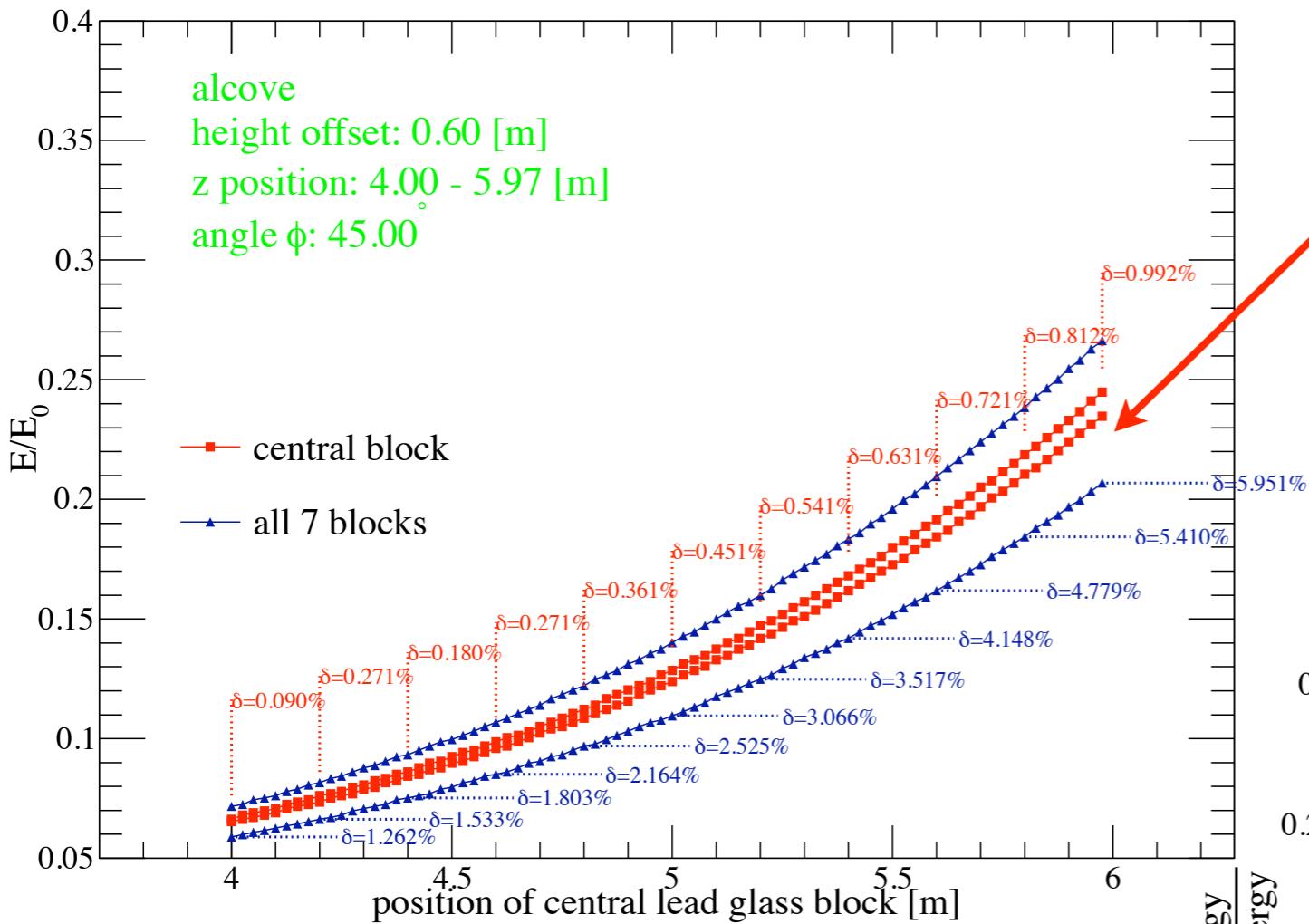
if we have a trigger on the central block, the spread in energy is <1% of **original beam energy**

the spread in energy, **normalized to the central value**, is 2-4%, while the FCAL resolution σ_E/E is ~6-7%

$\dfrac{\Delta E}{E_{center}} = \dfrac{\text{difference in energy}}{\text{central value of energy}}$

alcove

7 blocks

1 block

fractional energy = 0.248
fractional energy = 0.192
fractional energy = 0.041
fractional energy = 0.014

position z [m]
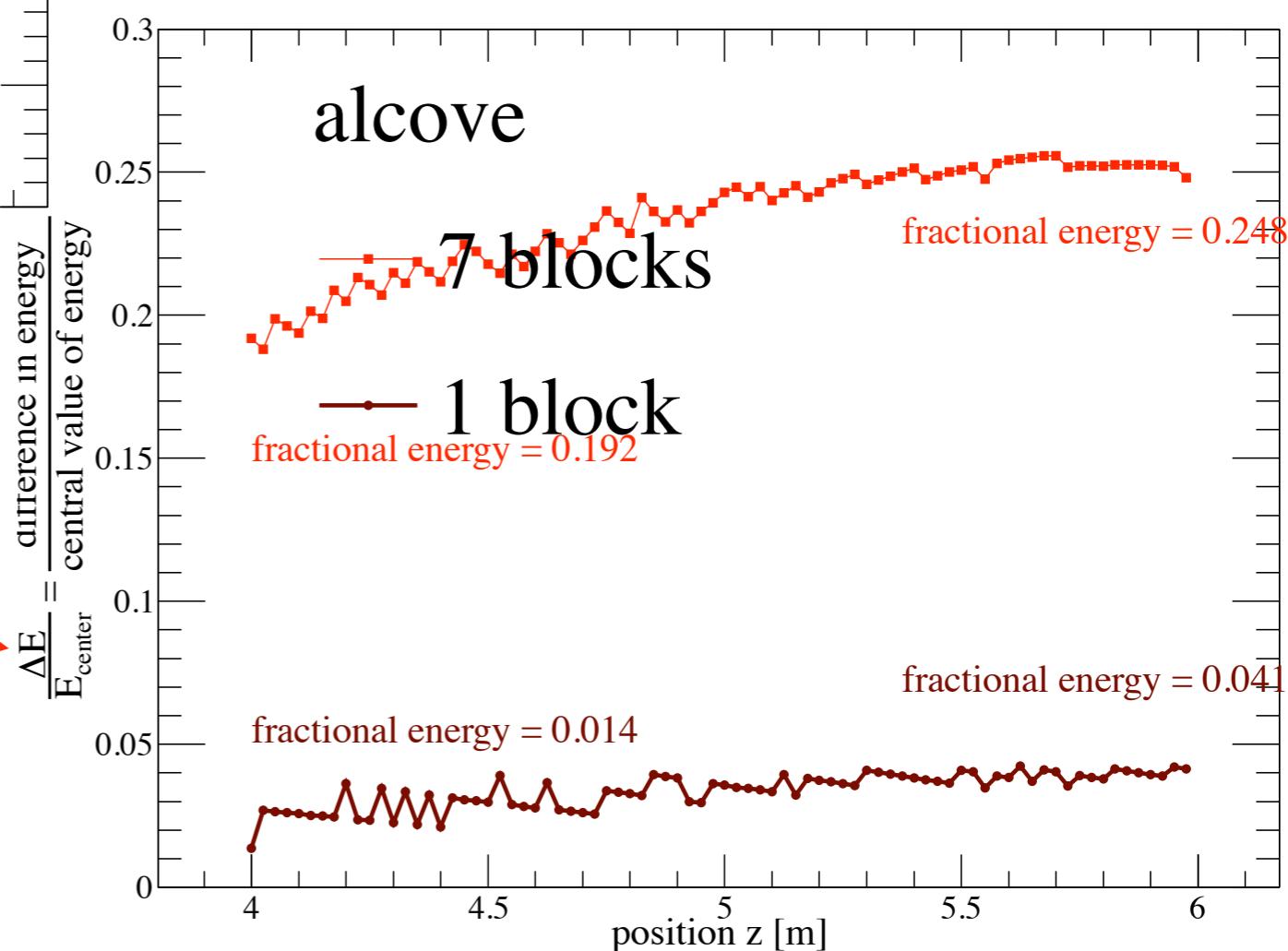
Rate of Electrons
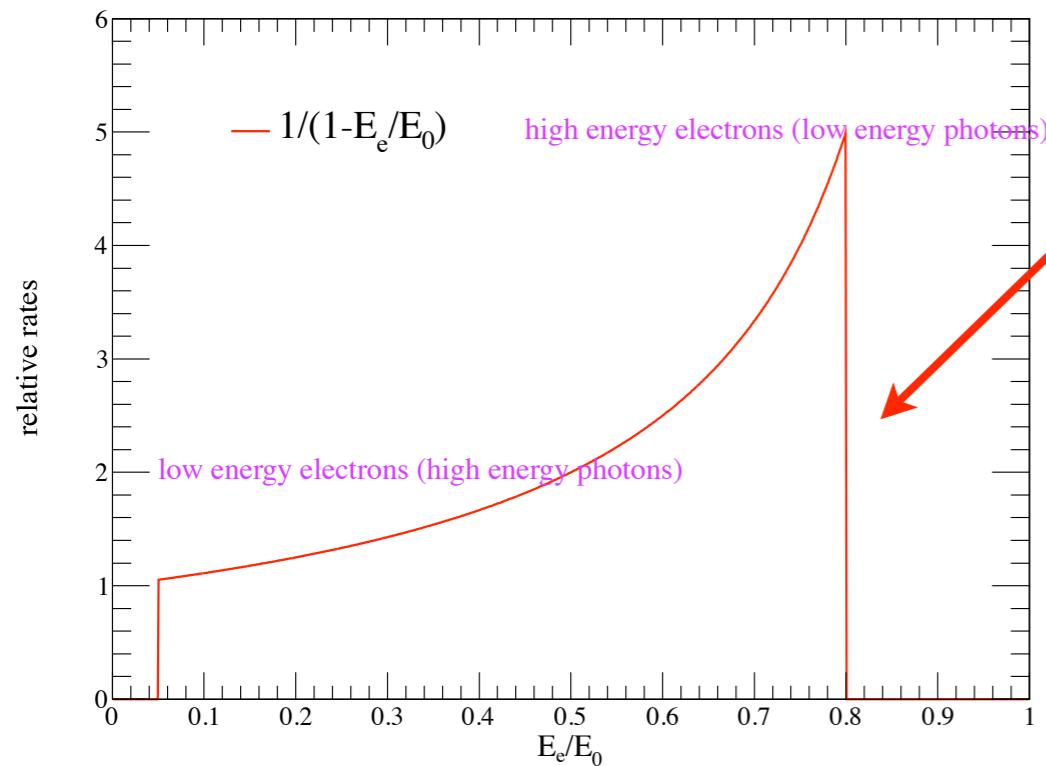
assume $1/E_\gamma$ distribution for CLAS tagging range

expected relative rates

absolute rate normalized to total rate of 20 MHz
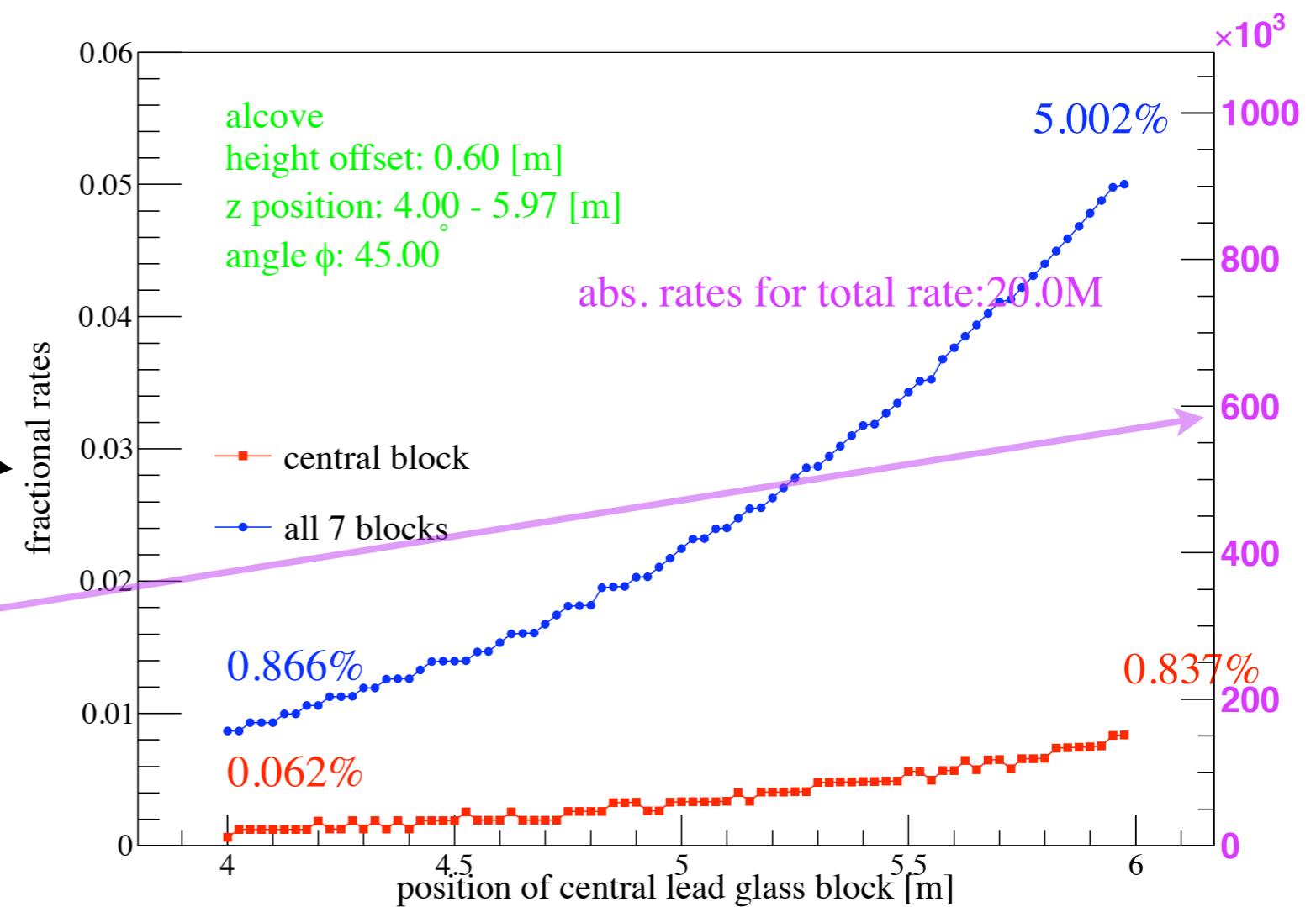
expect at least ~kHz, will accumulate enough statistics in short time (min?hrs?)

take many data points

GEANT Simulation

- ran full GEANT-based simulation of FCAL blocks

- radiate central block of 15x15 array at various energies

- check what energy deposition is for nxn array of blocks
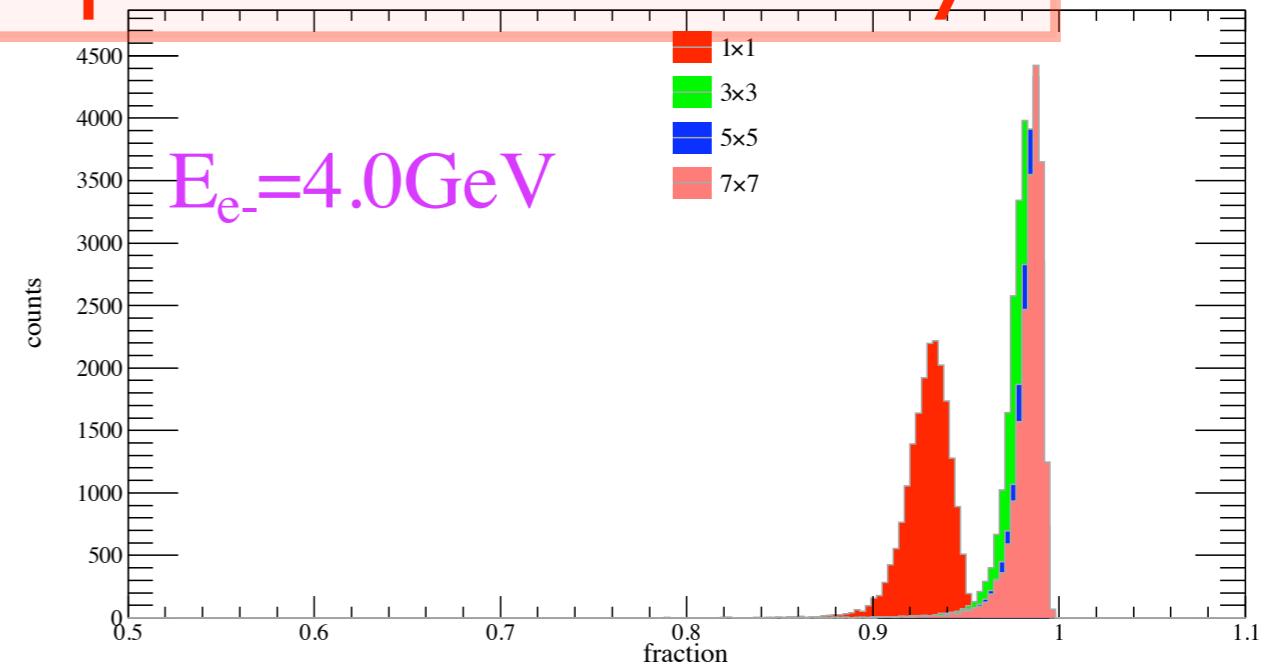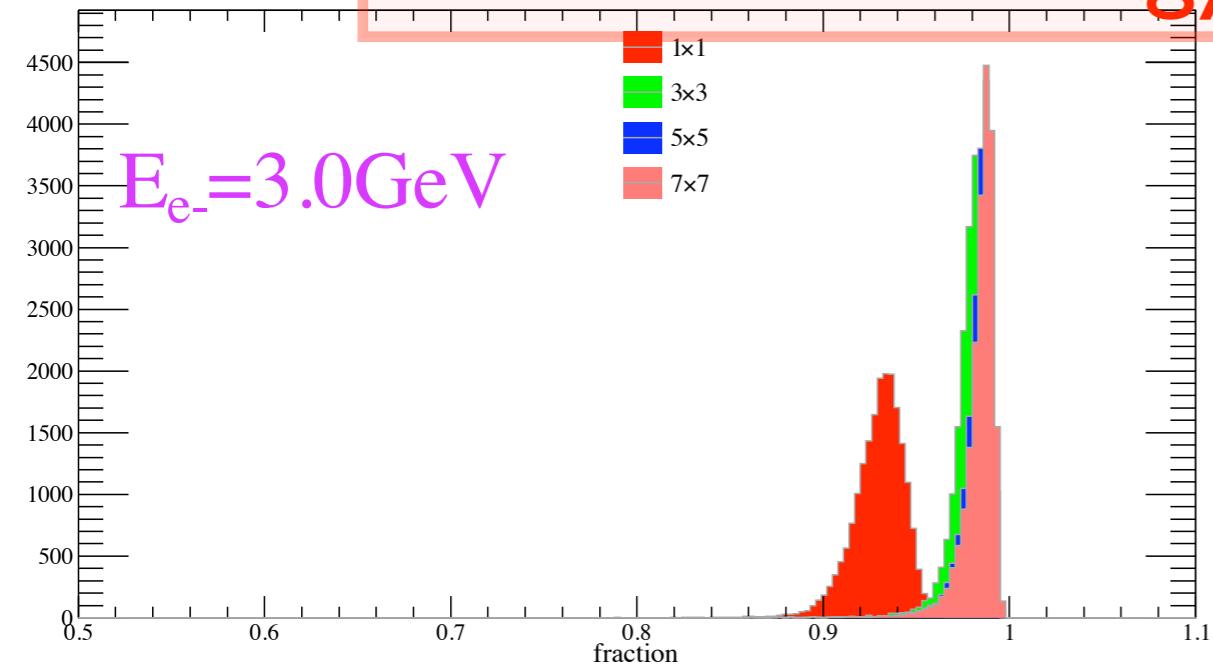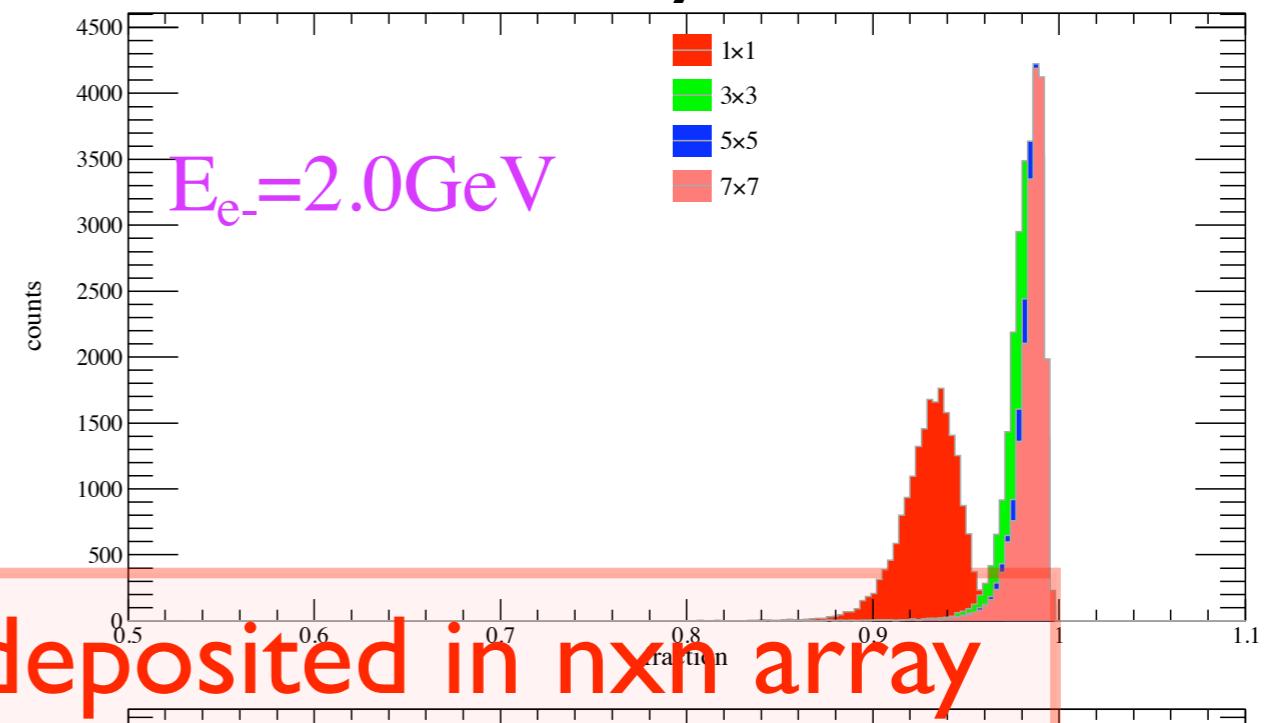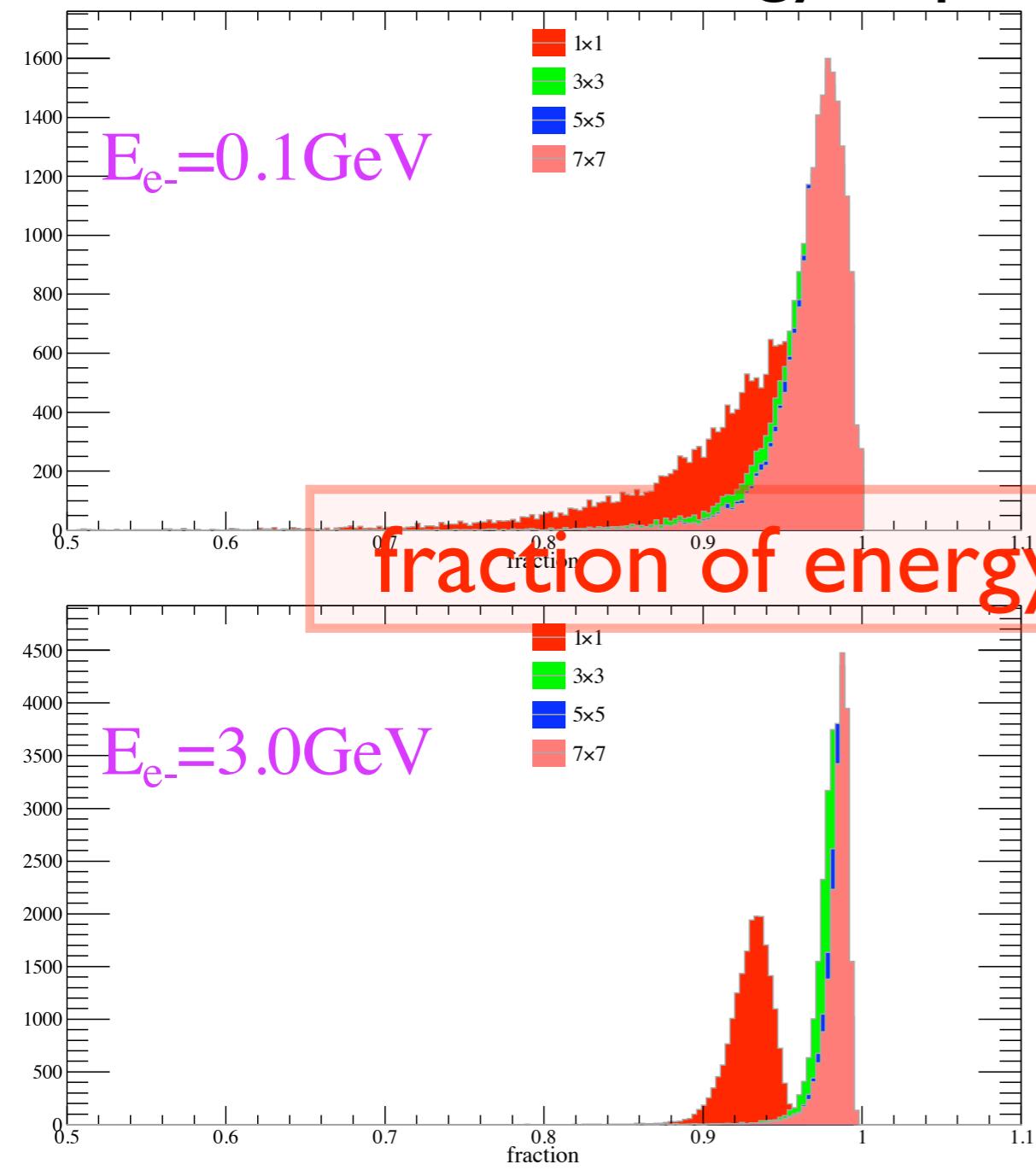
fraction of energy deposited in nxn array

GEANT Simulation

- fraction of energy absorbed by each nxn array

fraction of energy

Legend:
- 1×1 (red)
- 3×3 (green)
- 5×5 (blue)
- 7×7 (pink)

essentially no difference between 5x5 and 7x7 array

will start working on support structure and encasing