

BDSIM for Background Calculations

G.A. Blair (RHUL)
LCWS05, Stanford
21st March 2005

- Overview
- IR Region
- Physics processes
- Future plans

Motivation and History

- Work dates back several years.
- Grew out of initial plans to include Geant processes in Merlin.
- Then “fast” tracking incorporated into Geant4.
- Now a stand-alone approach and an alternative tracking code.
- All Geant4 processes included automatically
 - Multiple scattering
 - Bremsstrahlung ...
- New processes modified (eg new SR, muons, laser-wire).
- MAD “optics” file input

So far, applied to:

CLIC BDS

ILC BDS

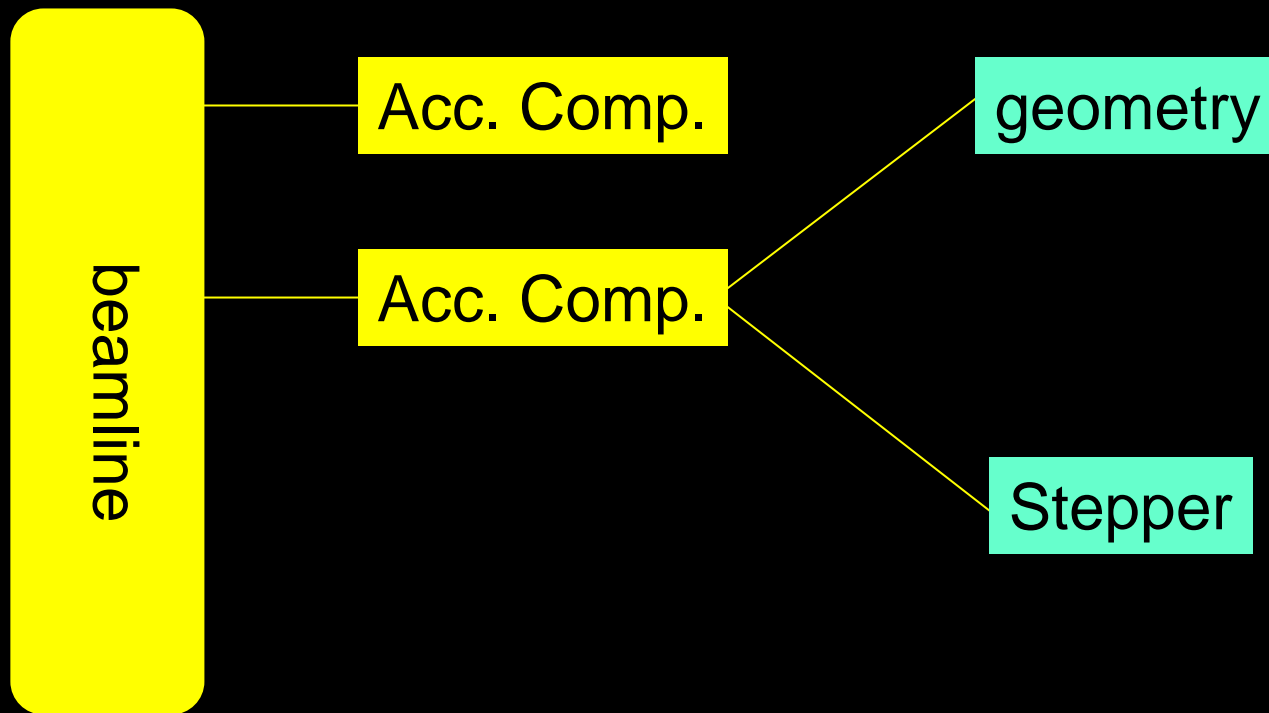
PETRA Laser-wire (benchmark SR)

1st public release under CVS. (I. Agapov) Jan 05.

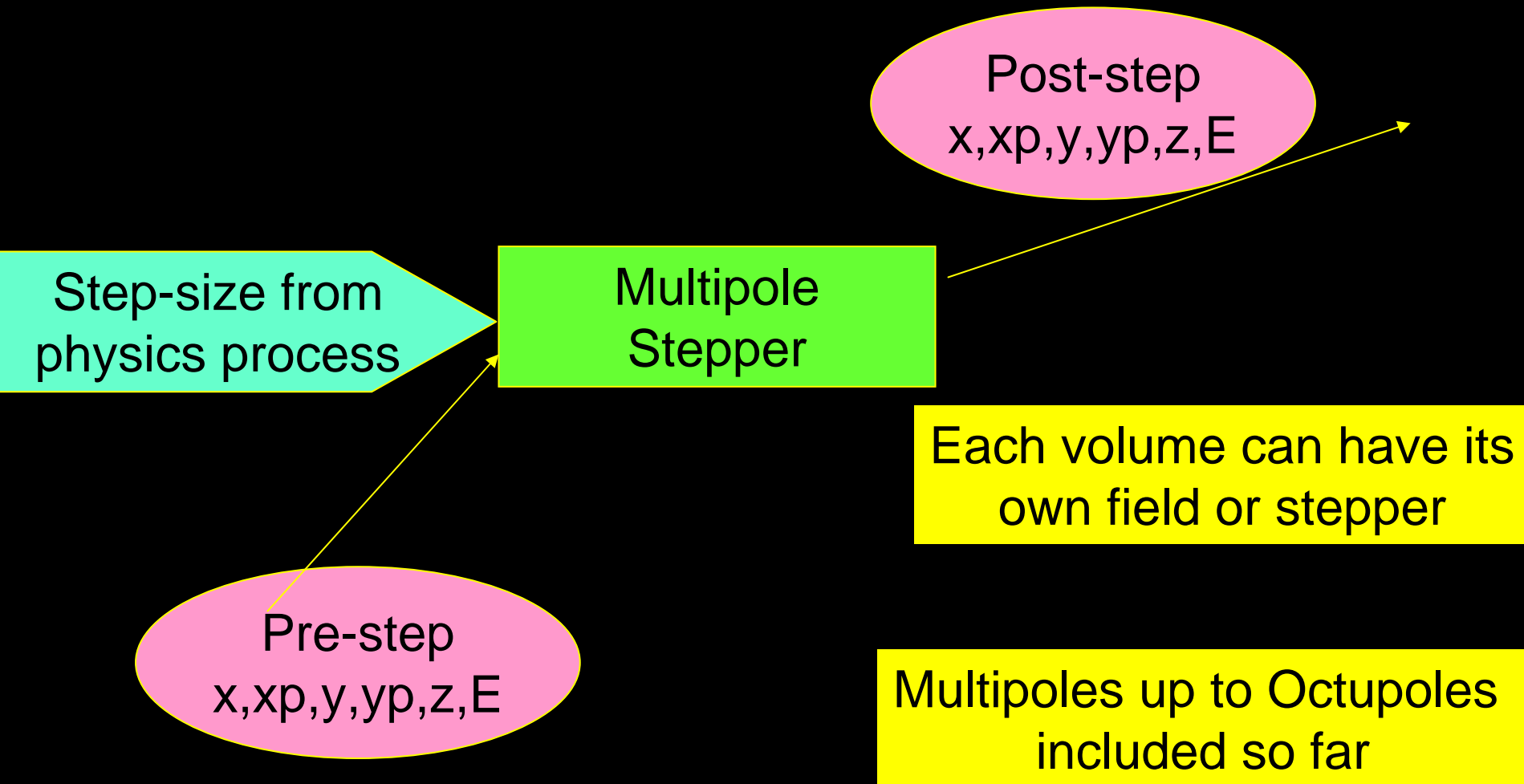
Future GRID implementation

Basic Structure of Code

Object oriented approach natural for beamline structure



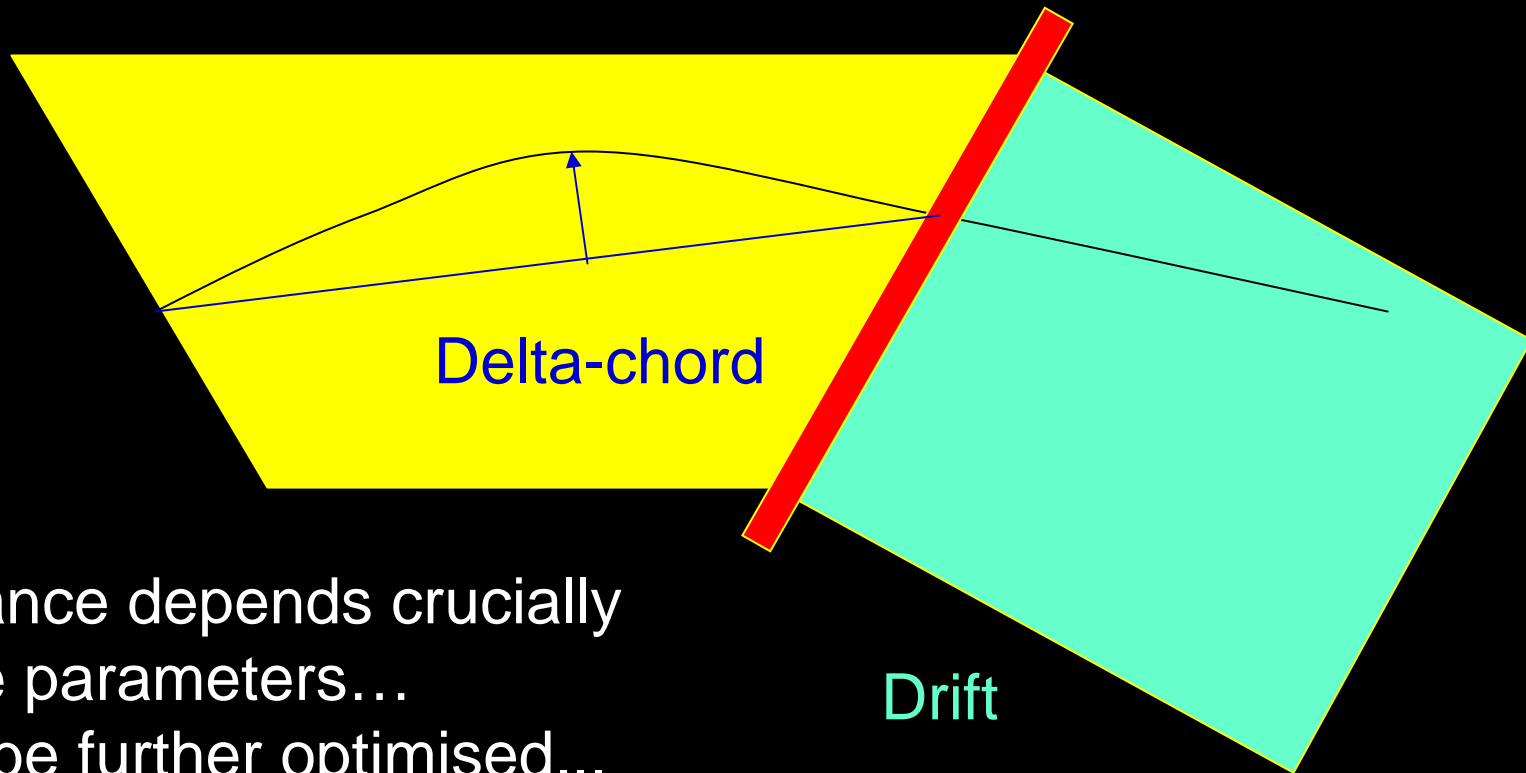
G4 Stepper



“Fast” Tracking

Sector Bend

Accuracy of volume intersection



Performance depends crucially
on these parameters...
Can still be further optimised...

People

RHUL:

Ilya Agapov

GB

John Carter

Chafik Driouichi

- Optics design, beam diagnostics
- Collimation, muons, backgrounds
- SR, beam diagnostics, IR layout
- Laser-wire design

Orsay:

O. Dadoun

- IR layout, extraction line simulation

Daresbury:

R. Appleby

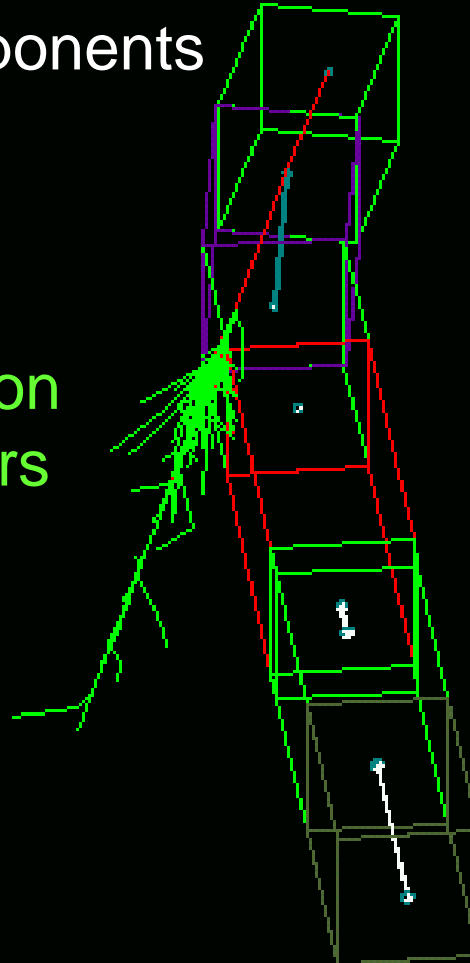
F. Jackson

- IR layout, extraction line simulation
- Collimation studies

Overview of Approach

Beam-lines are built up out of modular accelerator components

Full simulation
of em showers

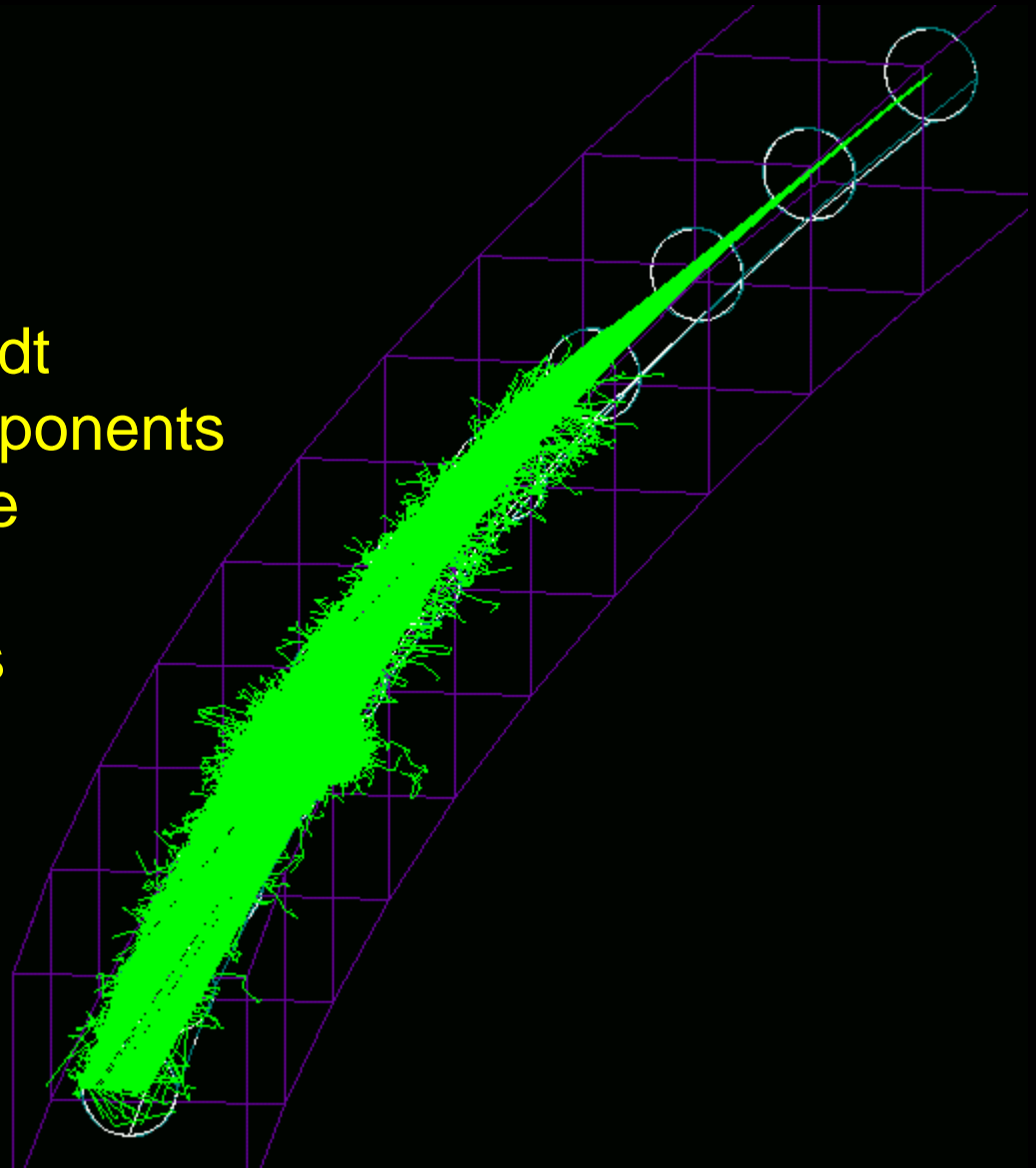


All secondaries
tracked

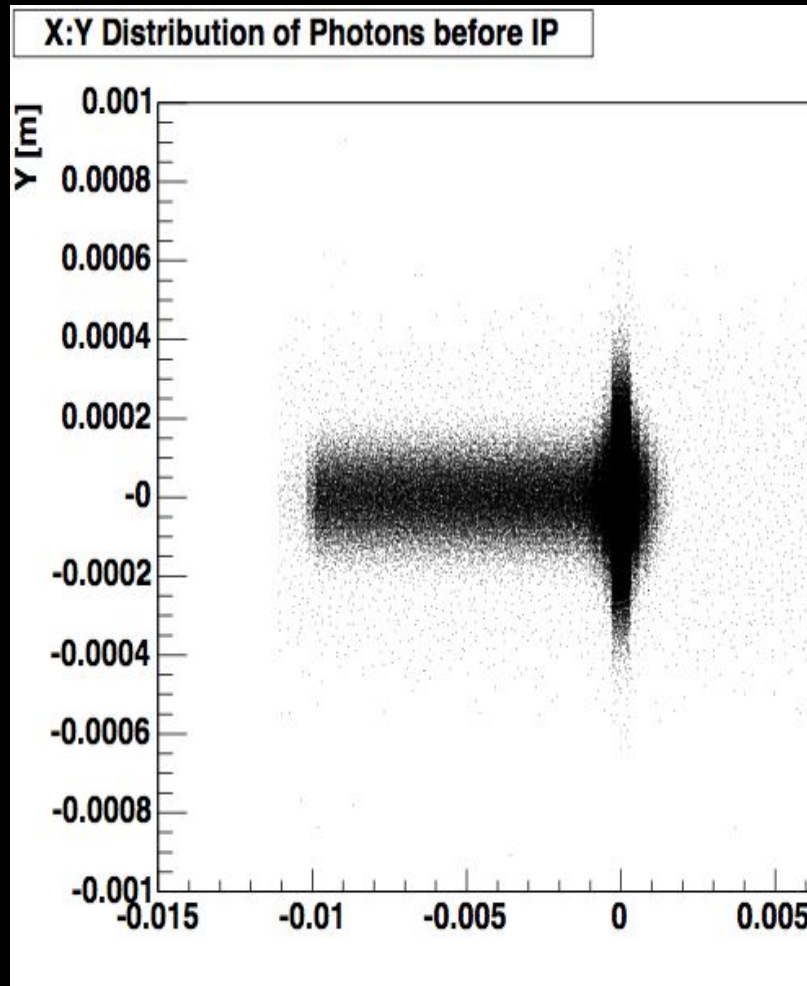
Synchrotron Radiation

Generator of H. Burkhardt
Implemented for all components
Based on local curvature
Individual photons from
individual parents

Primaries and secondaries
tracked

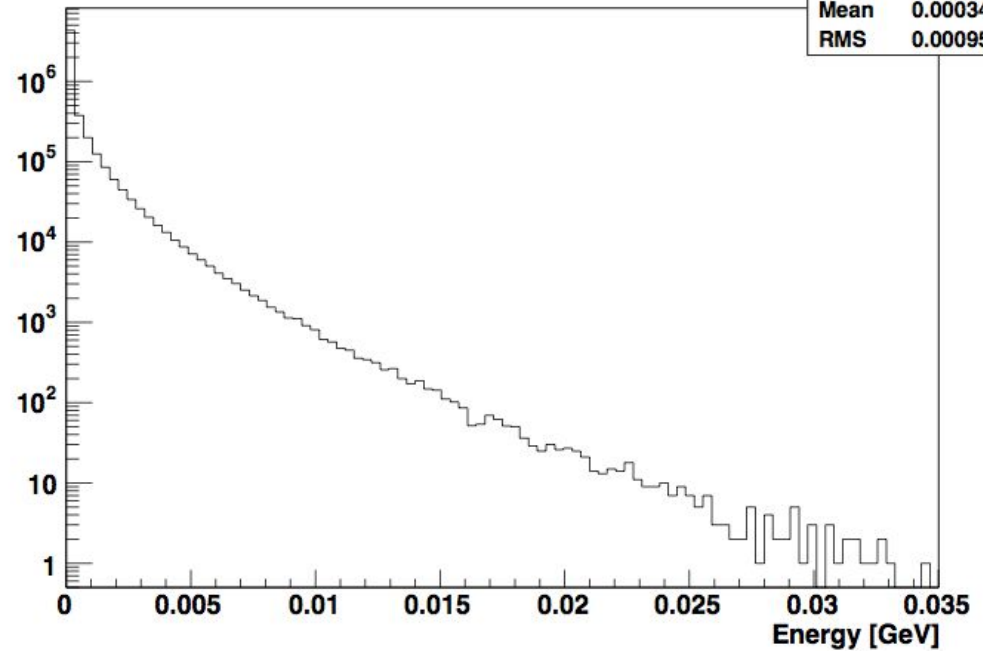


SR within beampipe

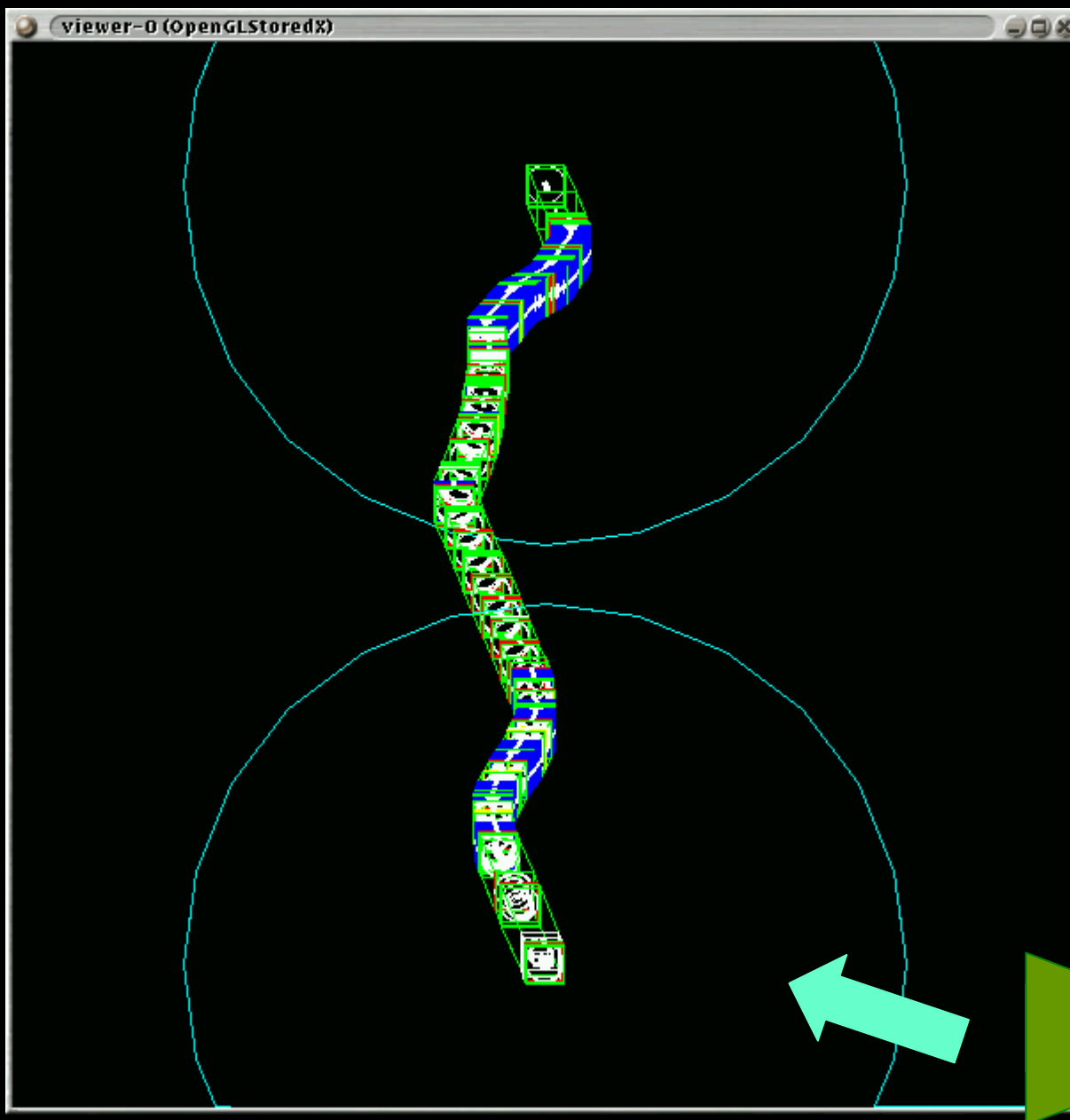


- J. Carter currently building IR model and simulation.
- Interface to Guinea-Pig format for SR of disrupted beam (track reflections back to IR)
- Implements low-energy G4 package

Energy of Photons before IP



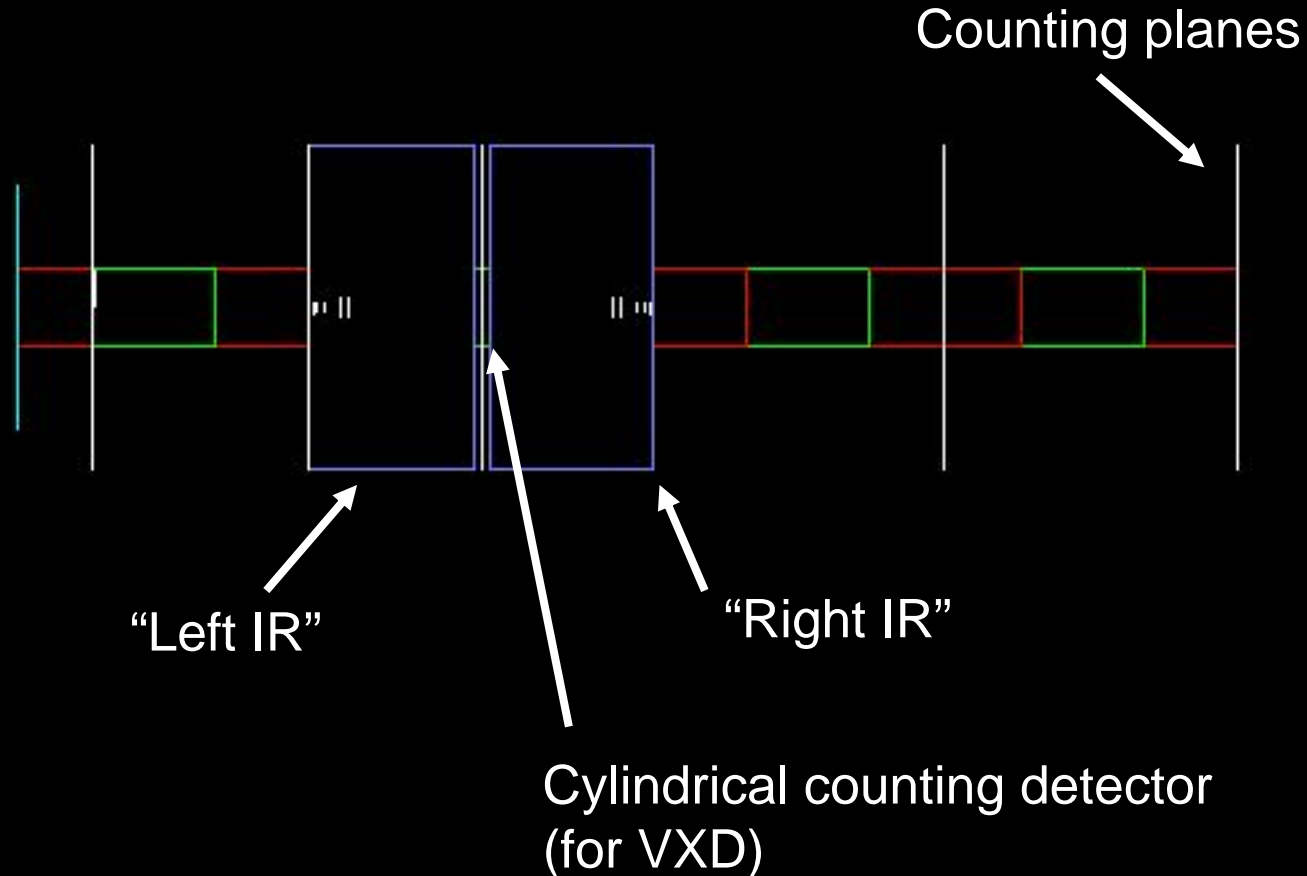
Axes scales are m



Add any detector IR
as a BDSIM object

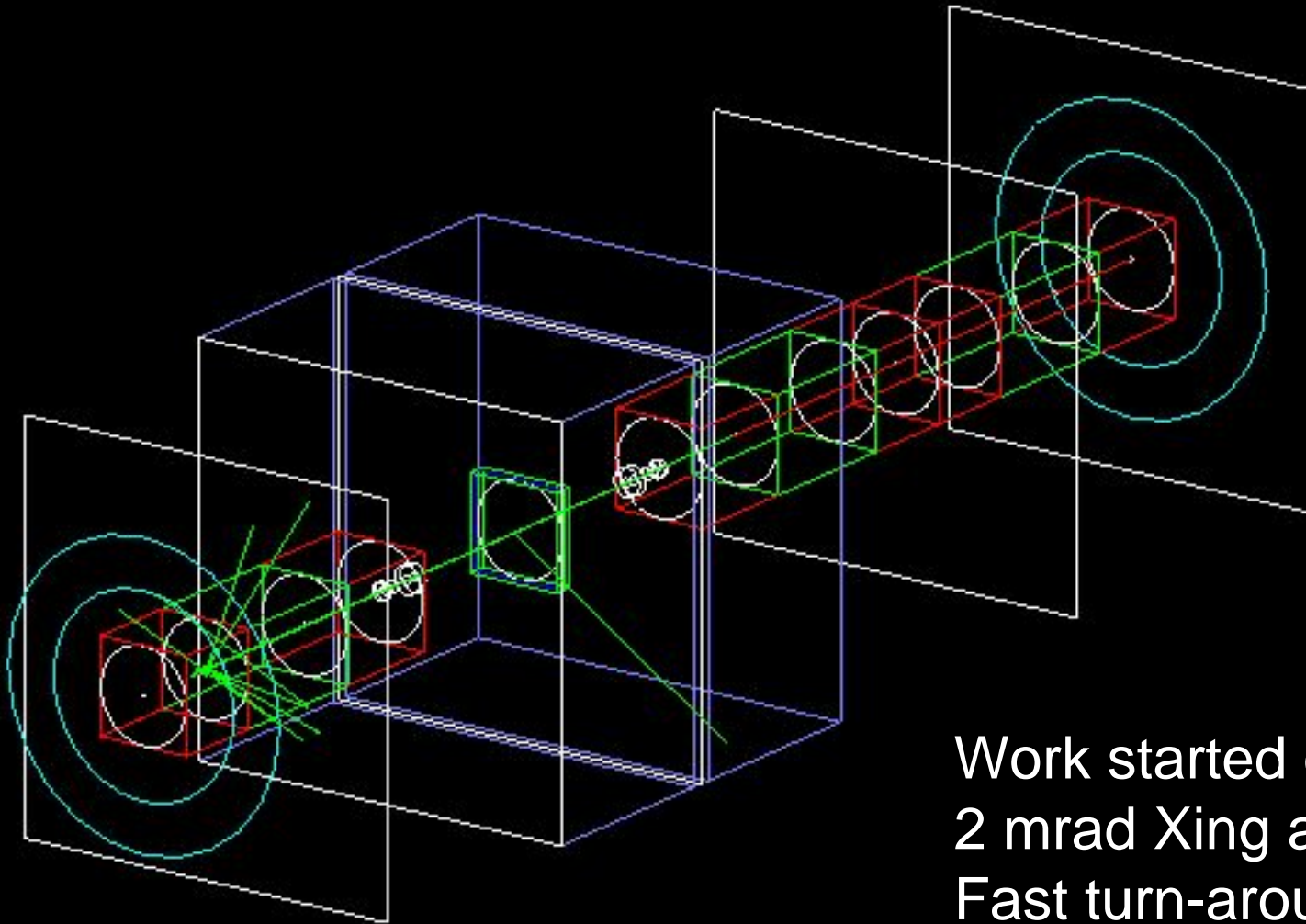
Ideal for MDI studies
For various detectors

IR Region



Need to define suitable interface to detector description in Geant4.

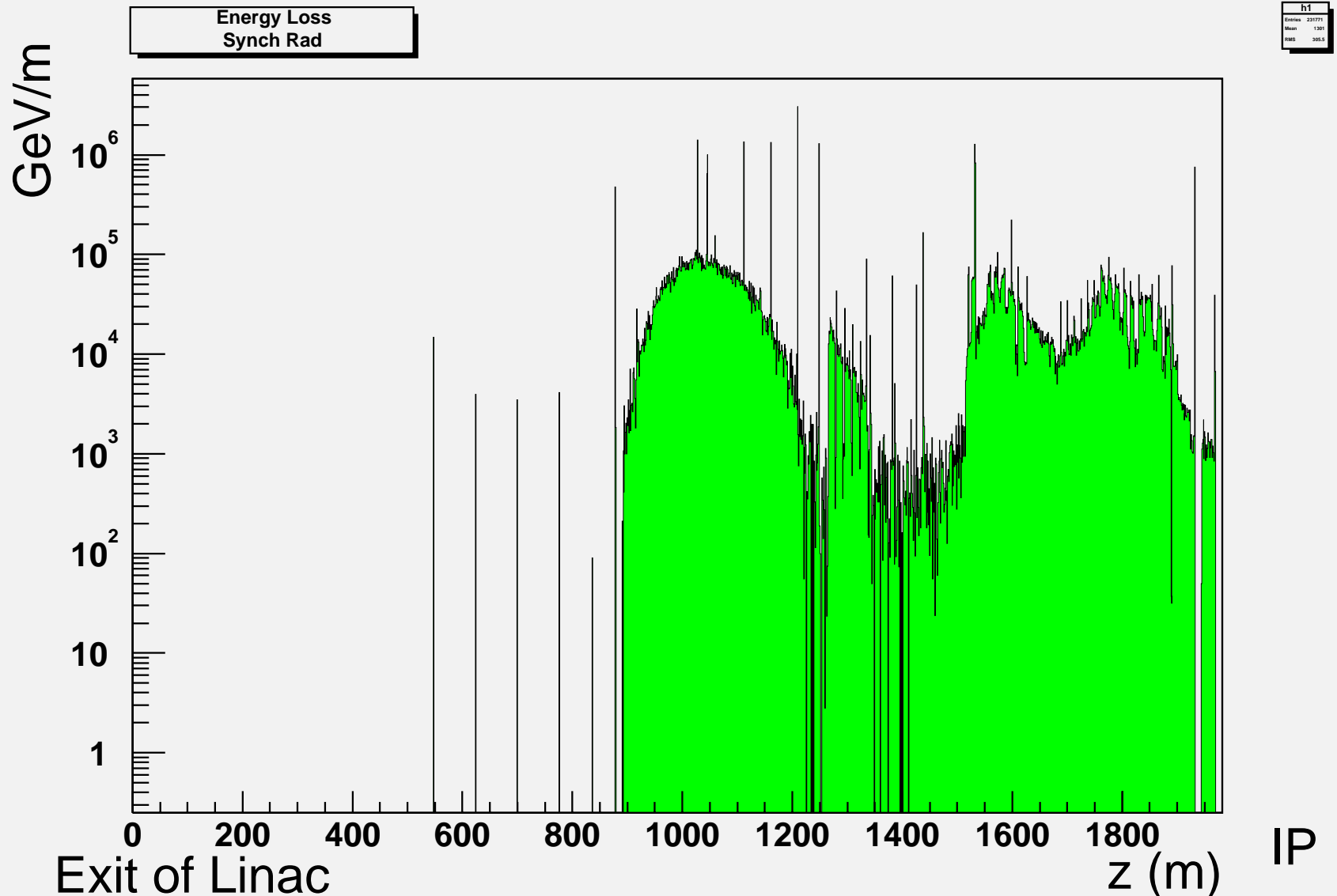
Collimation Depth Studies



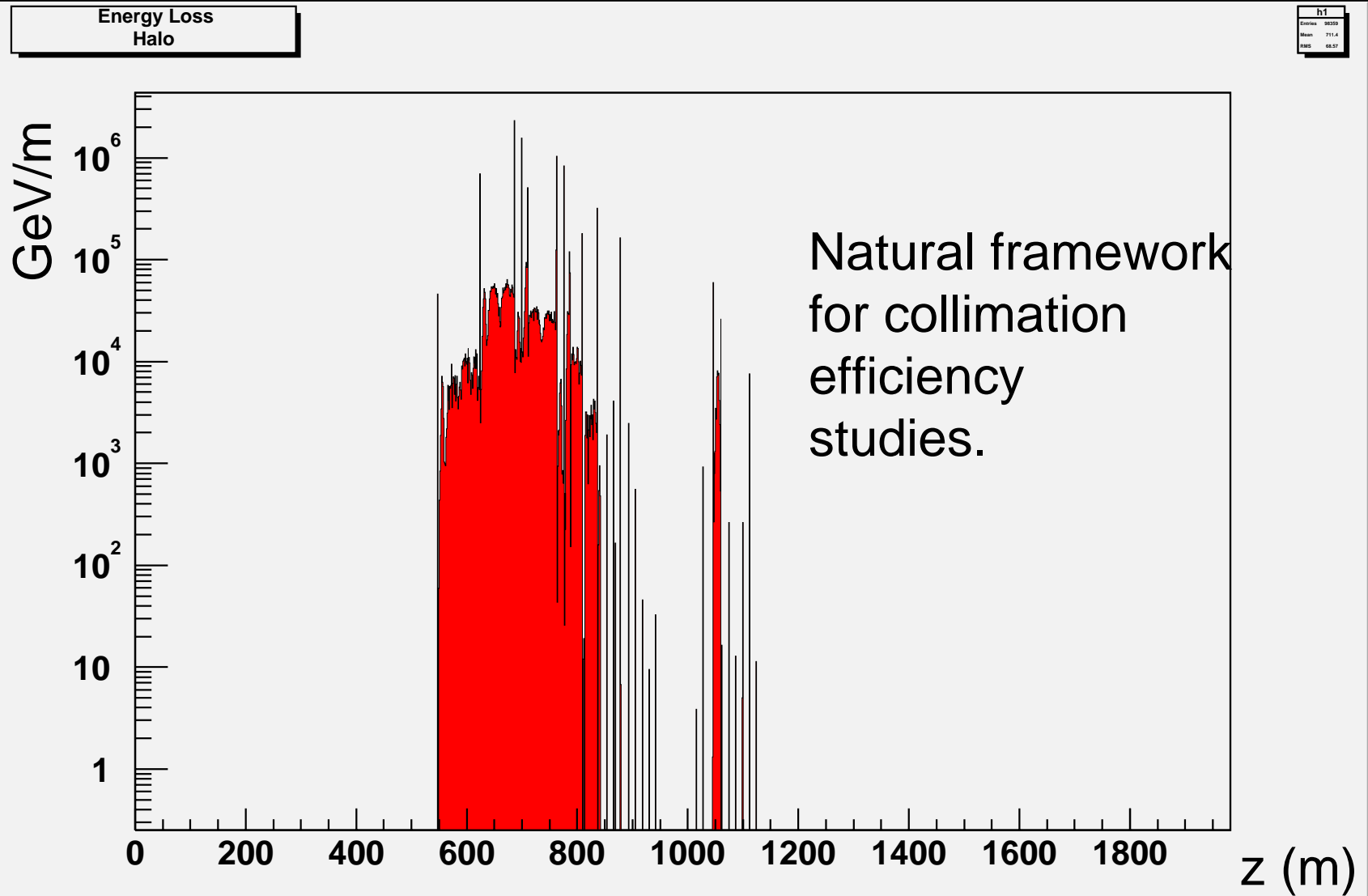
SR from halo

Work started on
2 mrad Xing angle;
Fast turn-around possible
for design upgrades

SR Absorption along ILC BDS



ILC Beam Halo



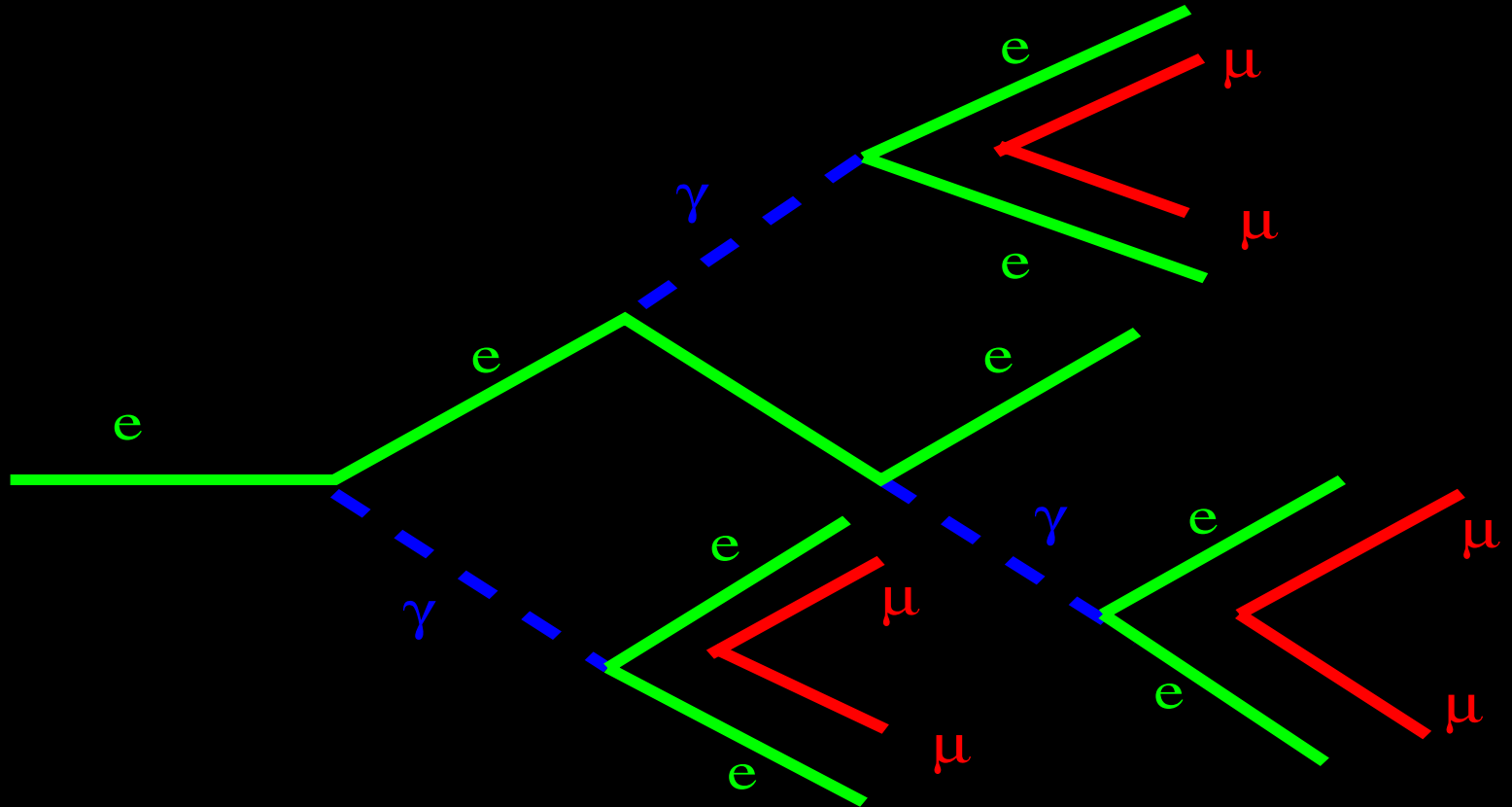
Muon Showers

Increase statistics for Bethe-Heitler by **forcing**

$$\gamma \rightarrow \mu^+ \mu^-$$

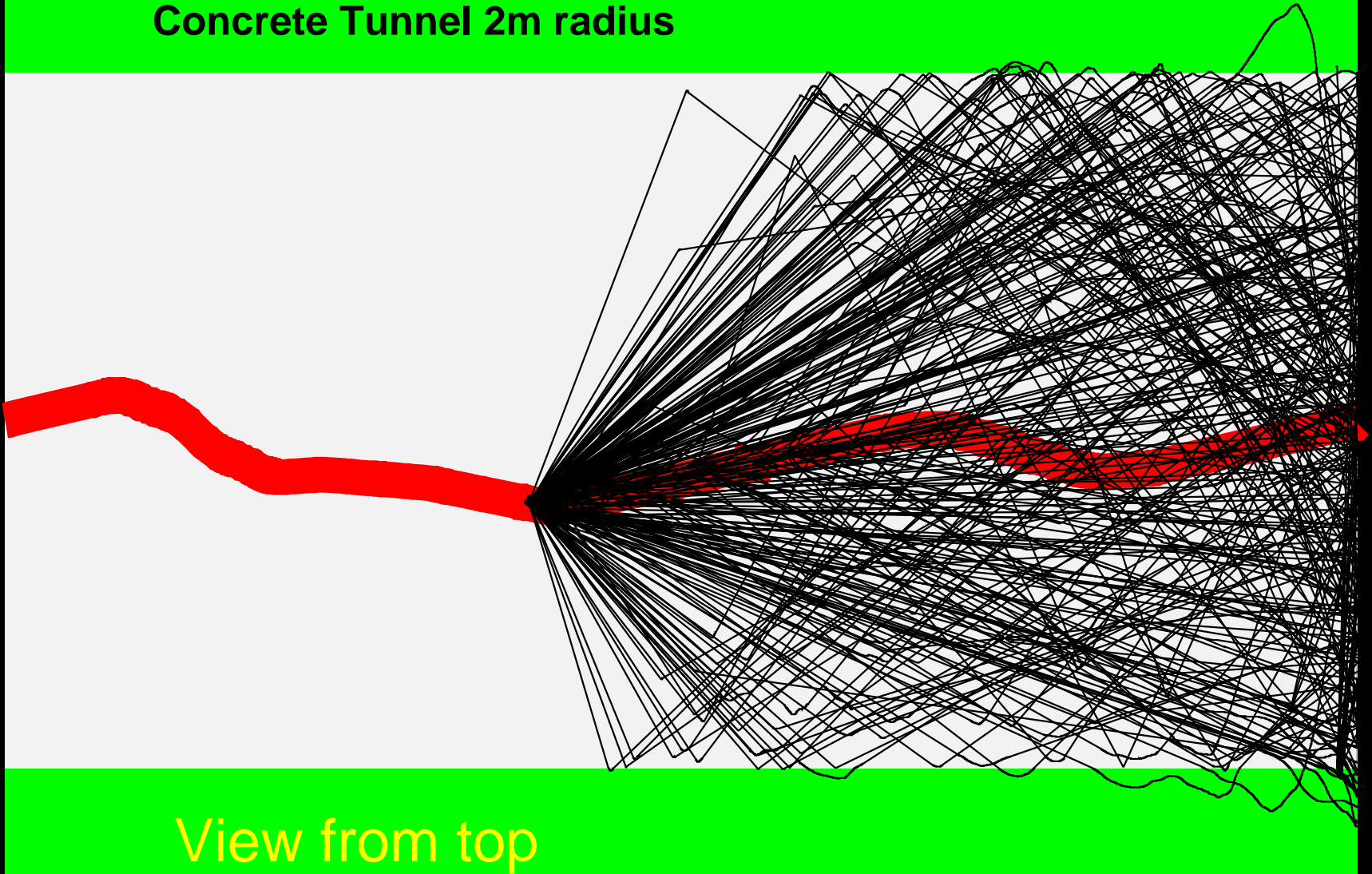
The muons are in addition to the electrons
(doesn't conserve energy)

correct spectra via track weighting:



TESLA: Muon Trajectories

Concrete Tunnel 2m radius



View from top

Other processes + plans

- Beam gas simulation is currently being planned – final implementation will need some optimisation for efficiency
- Neutrons; processes for generation and tracking exist within G4 package. Clever optimisation will be essential.
- Compton scattering implemented for laser-wire simulation and location optimisation.
- Need to think about simulation of extraction line to explore backgrounds to beam diagnostics.
- Currently working on using grid farms for high statistics; some early teething problems encountered.
- Plans are developing to include full field maps for large-aperture quads etc.

Summary

- First beta-release was this year
- Community of users is growing
- Benchmarking with data
- Benchmarking with other codes
- Broad use – diagnostics, IR design, ...
- Fast turn-around for ILC design changes