Inclusion of wakefileds via a BDSIM/Placet interface

G A Blair

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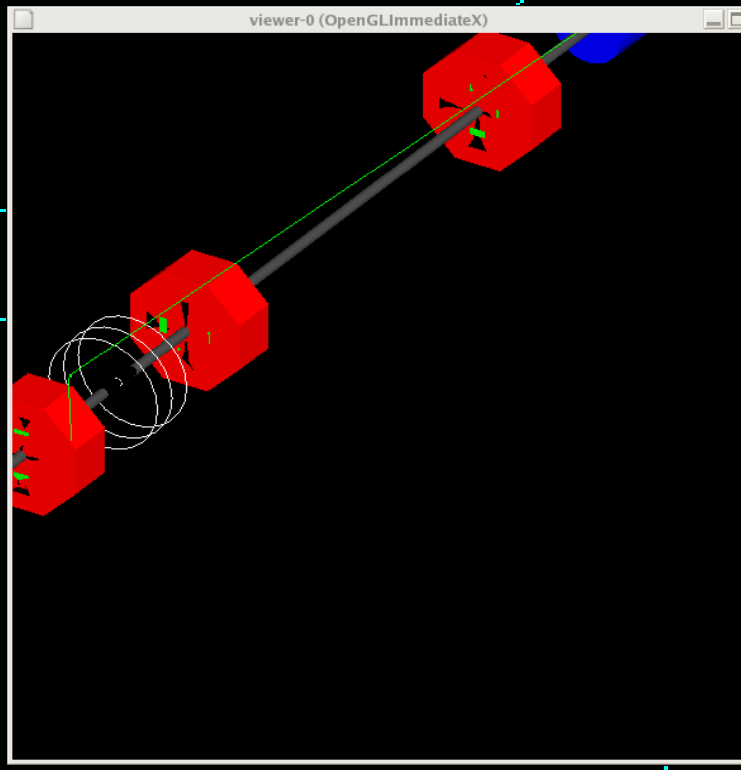
New work in progress by
S. Malton (RHUL) and
A. Latina (FNAL/CERN)

- BDSIM
- Implementation of wakefields
- Future plans

Geant4 Simulation of Beamlines



BDSIM

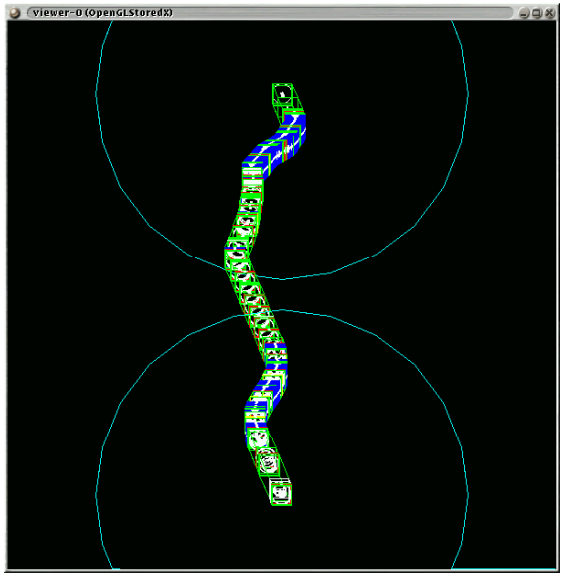
S. Malton,
G. Blair,
L. Deacon

Fast accelerator-style
Tracking within beam-pipe
'Normal' G4 tracking outside

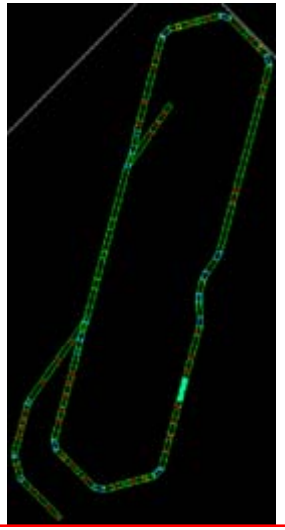
http://flc.pp.rhul.ac.uk/bdsim.html

All secondaries tracked

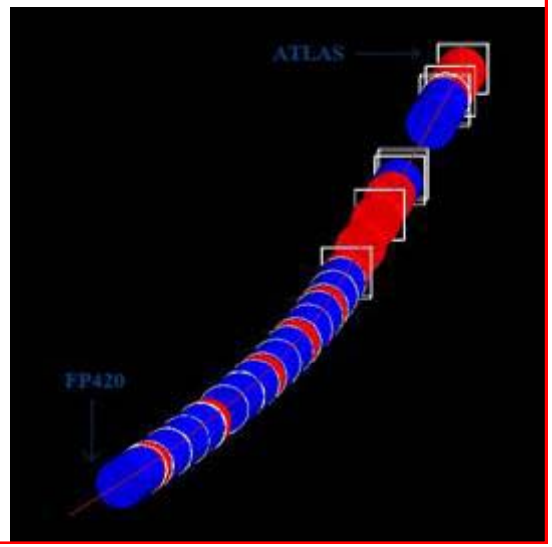
ILC,
ATF,
PETRA



ERLP



LHC

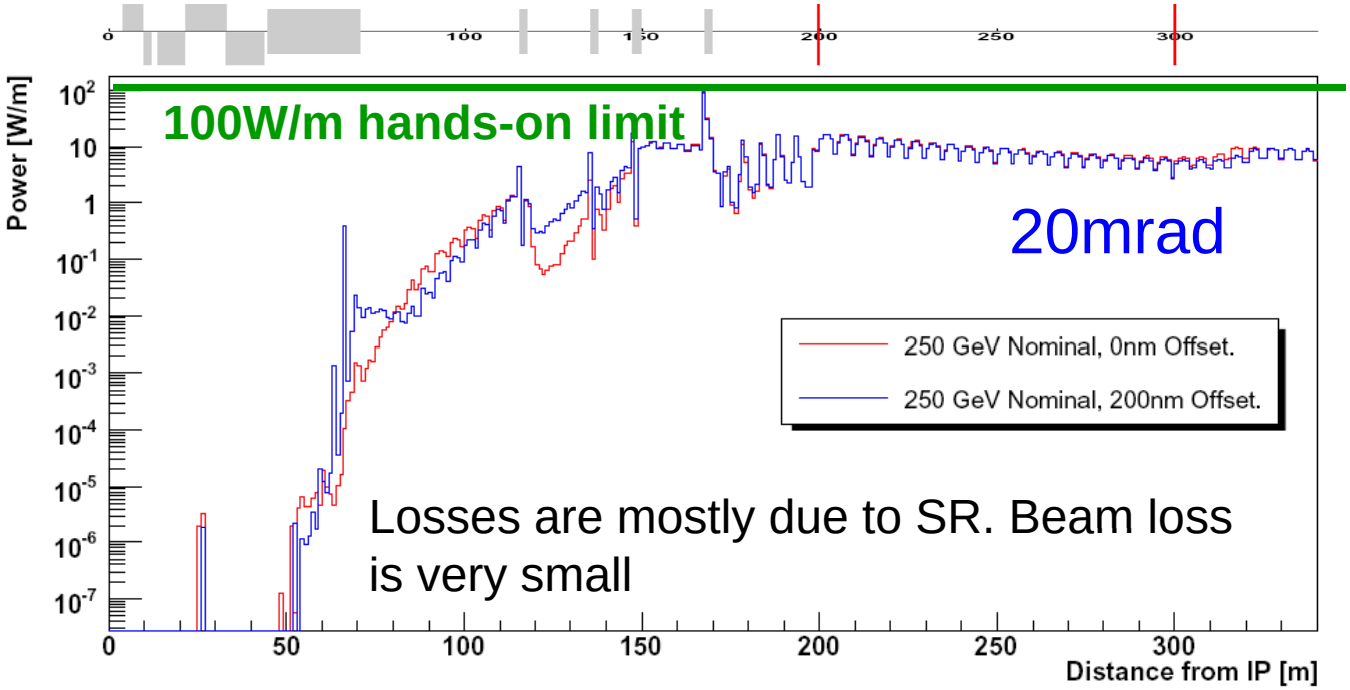


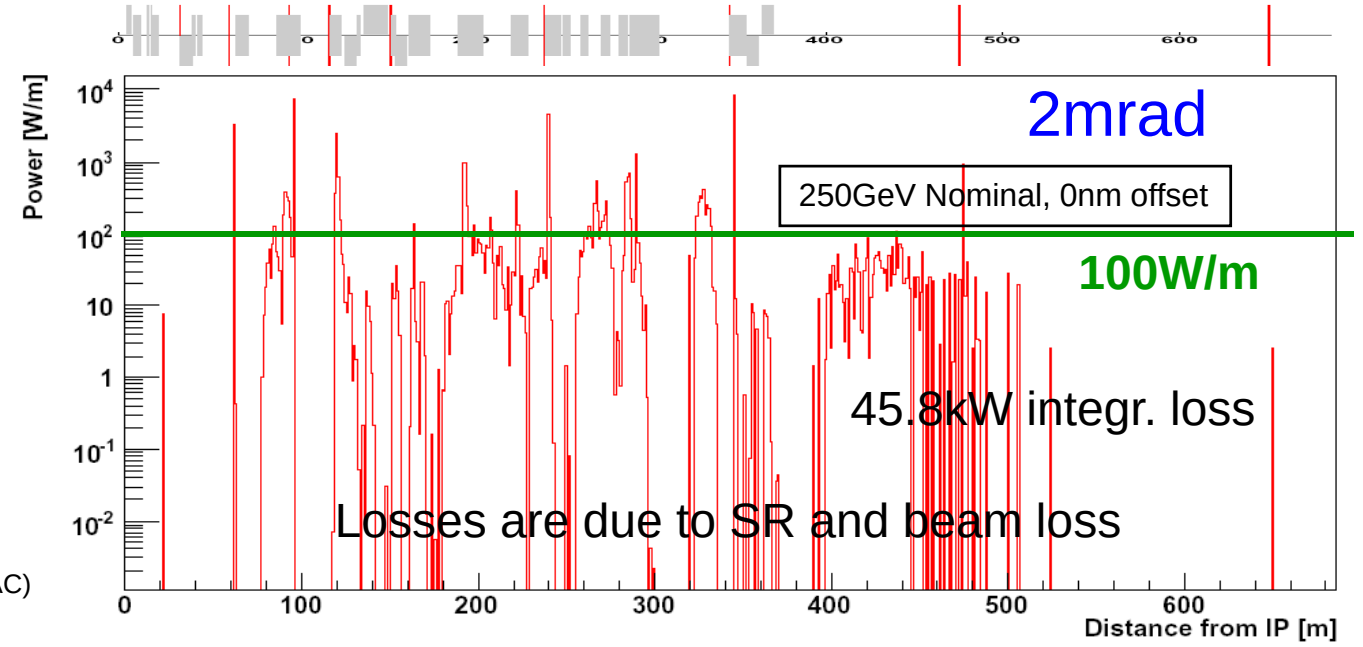
Losses in ILC extraction line

20mr: losses < 100W/m at 500GeV CM and 1TeV CM

2mr: losses are at 100W/m level for 500GeV CM and exceed this level at 1TeV

Radiation conditions and shielding to be studied



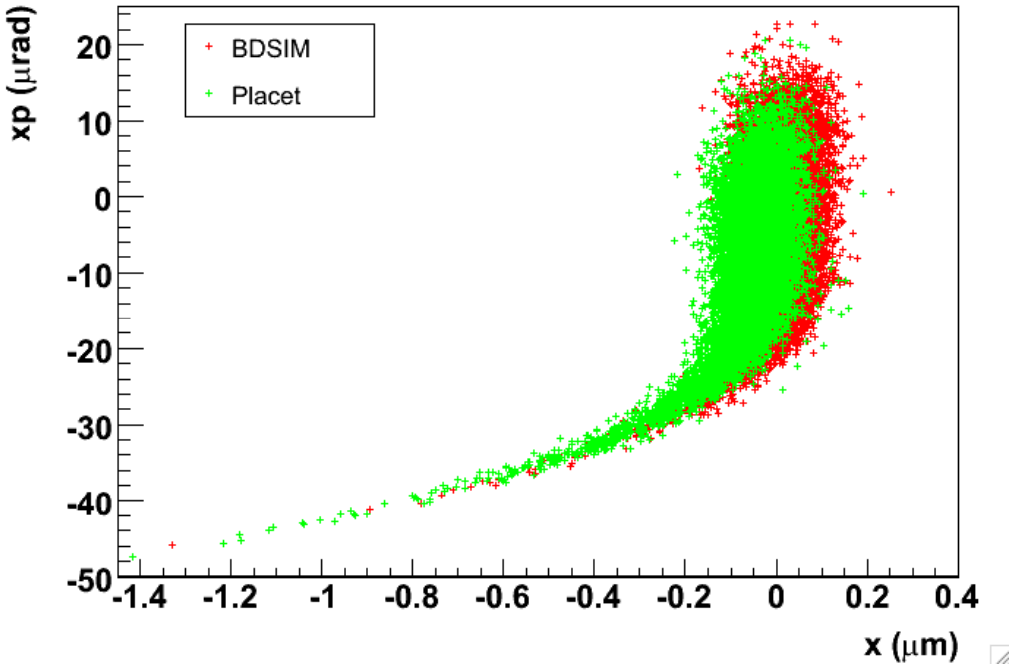


J. Carter, I. Agapov, G.A. Blair, L. Deacon (JAI/RHUL), A.I. Drozhdin, N.V. Mokhov (Fermilab), Y.M. Nosochkov, A.A. Seryi (SLAC)

J. Carter

CLIC

- BDSIM benchmarking of tracking wrt Placet.
- Agrees well; sub nm tracking precision over km of beamline.

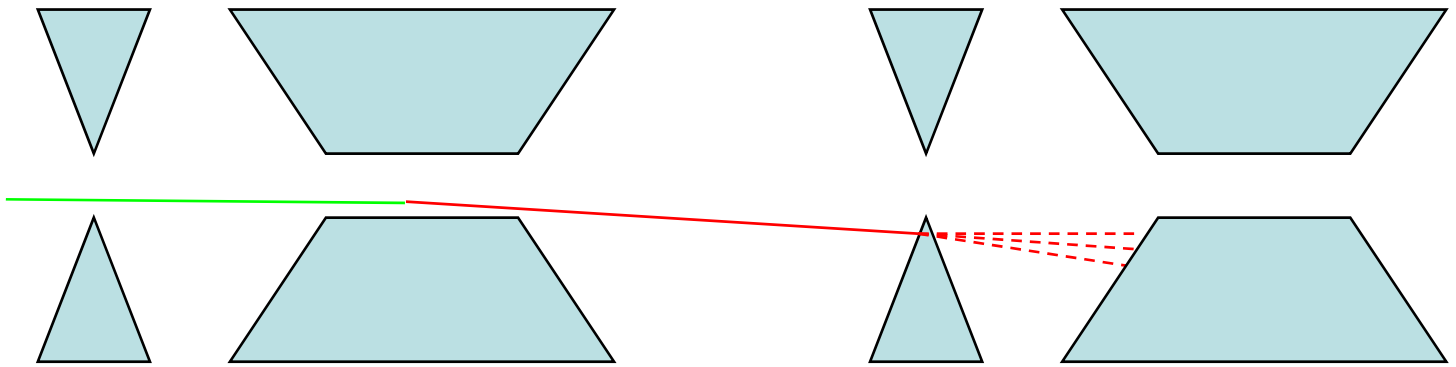


Higher order multipoles not included here

BDSIM

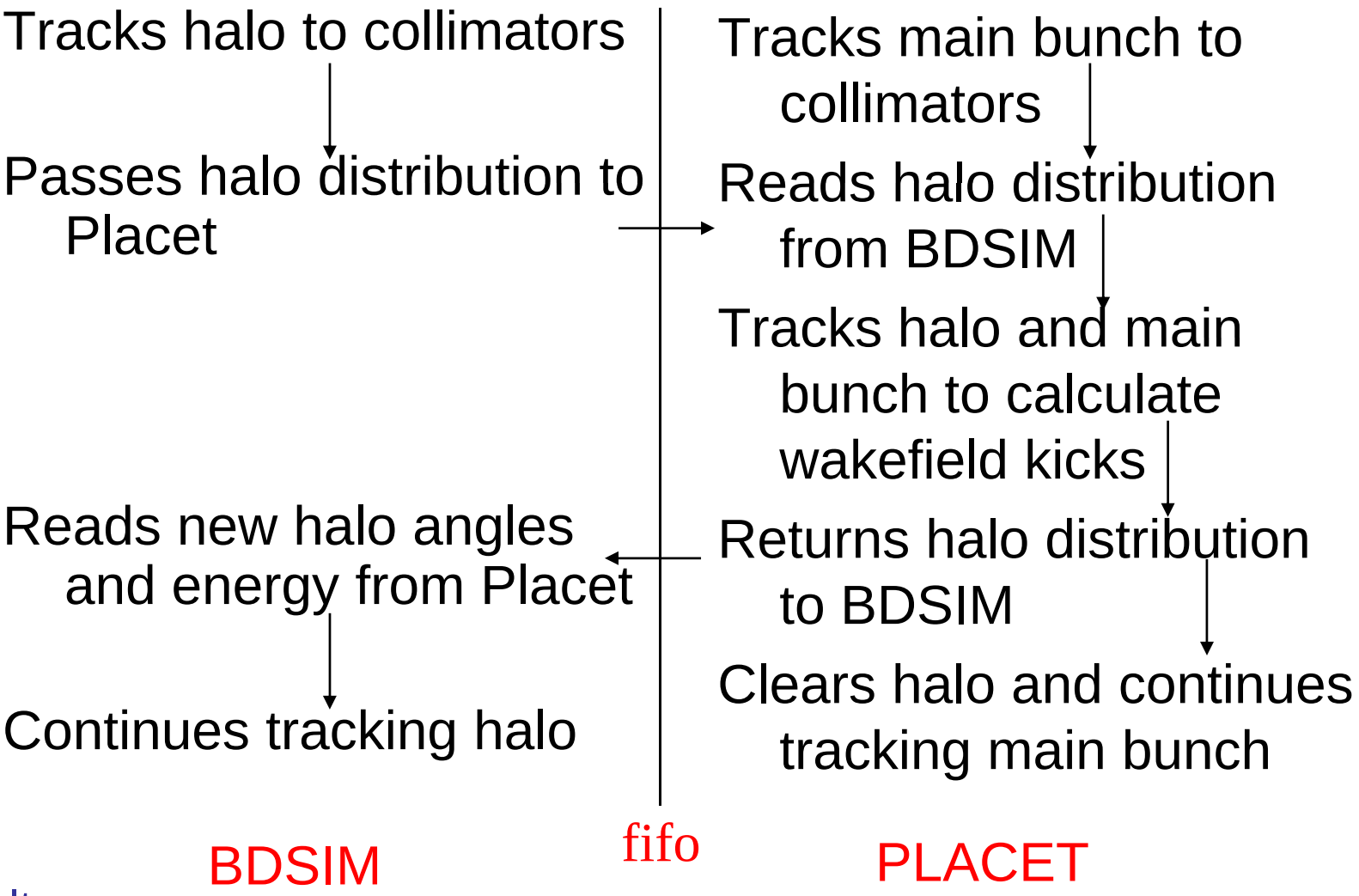
- In 2006 the beta-testing of BDSIM was complete and the first release (v.0.1) followed in February. The BDSIM user's guide was published EUROTeV-Report-2006-014, "The BDSIM Toolkit".
- BDSIM was used extensively for the ILC BDS simulations. Benchmarking tests were performed for particle tracking, electromagnetic and hadronic physics processes. The BDSIM distribution was deployed on the GRID to increase the performance. These developments were presented at EPAC 2006 "BDSIM – Beamline Simulation Toolkit Based on GEANT4", EUROTeV-Report-2006-035).
- The results for the ILC collimation system and extraction lines were checked against MARS and STRUCT simulations and published
- Simulation of the ILC Collimation System Using BDSIM, MARS15 and STRUCT EUROTeV-Report-2006-48.
- Wake-field implementation plus interface to Placet; a step-change in functionality.
- Discussions ongoing for including BDSIM formally within the Geant4 suite.
- Paper for “Computer Physics Communications” is currently being written, to be submitted in May08.

Wakefield-Induced Backgrounds

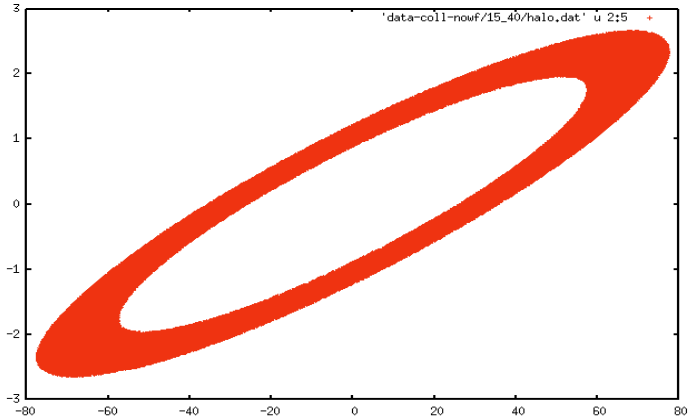


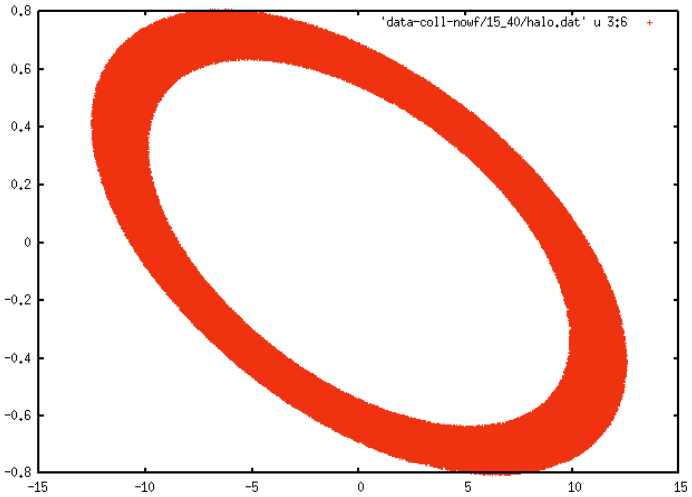
- Multi-particle effect
  - Particles at the head of the bunch cause a kick on trailing particles
- Transverse wakefield kick
  - Previously uncollimated particles can be kicked into beam elements
    - Direct hits to FD and VX
    - Secondary particles from beampipe scattering

BDSIM-PLACET



Halo distributions

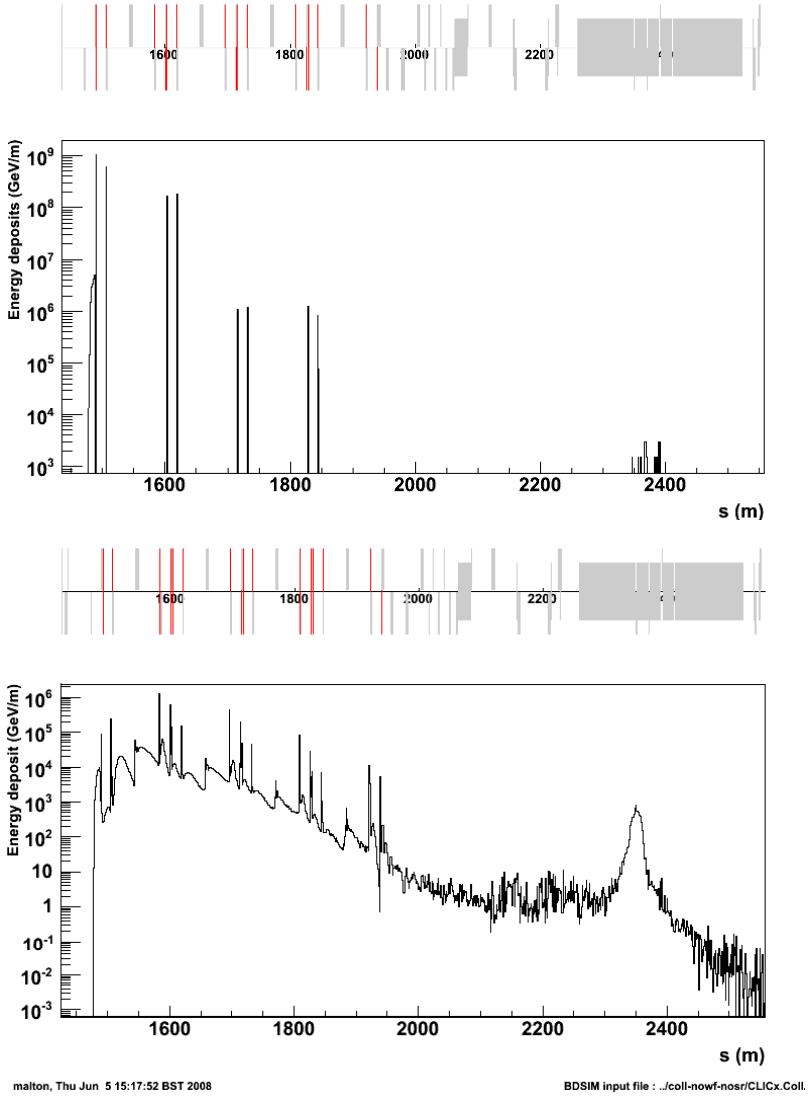




- 10000 particles per ring
- Rings of 5σ in x:xp
  - track distributions 0-5σ to 35-40σ
- Rings of 10σ in y:yp
  - track distributions 0-10σ to 180-190σ
- Generates an overall 1/r distribution with 1,520,000 particles
  - ~10^{-3} of main bunch

Energy losses along beamline

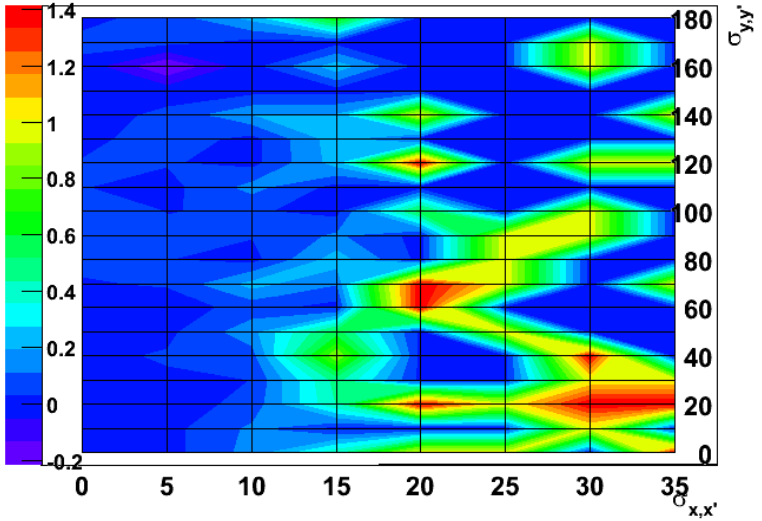
- ‘Black’ collimators
  - Energy deposits up to 10^9 GeV per bunch
  - Almost entirely lost on collimators
- Beryllium collimators
  - Energy deposits up to 10^6 GeV
  - Peak losses on collimators
  - Secondary particle losses distributed along collimation system



S. Malton

Number of particles at IP

- Beryllium collimators
  - Secondary particle generation on
  - No significant change in number of halo particles reaching IP
- ‘Black’ collimators
  - Wakefield effects turned on
  - Investigating effect on collimation efficiency; EPAC08 paper in preparation.



Colours depict number of sigma change.

All very preliminary at the moment!

Further Work

- Synchrotron radiation
- Apply tapers to BDSIM collimators
- Quantify direct hits in VXD
- Beam gas scattering
- Neutron backgrounds
- Halo backscattering from extraction line