



Update on the Status of BDSIM

Steve Malton

On behalf of:

Grahame Blair (RHUL)

Ilya Agapov (CERN)

Andrea Latina (CERN)

Olivier Dadoun (LAL)

Anyone else I've forgotten...

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LCWS07



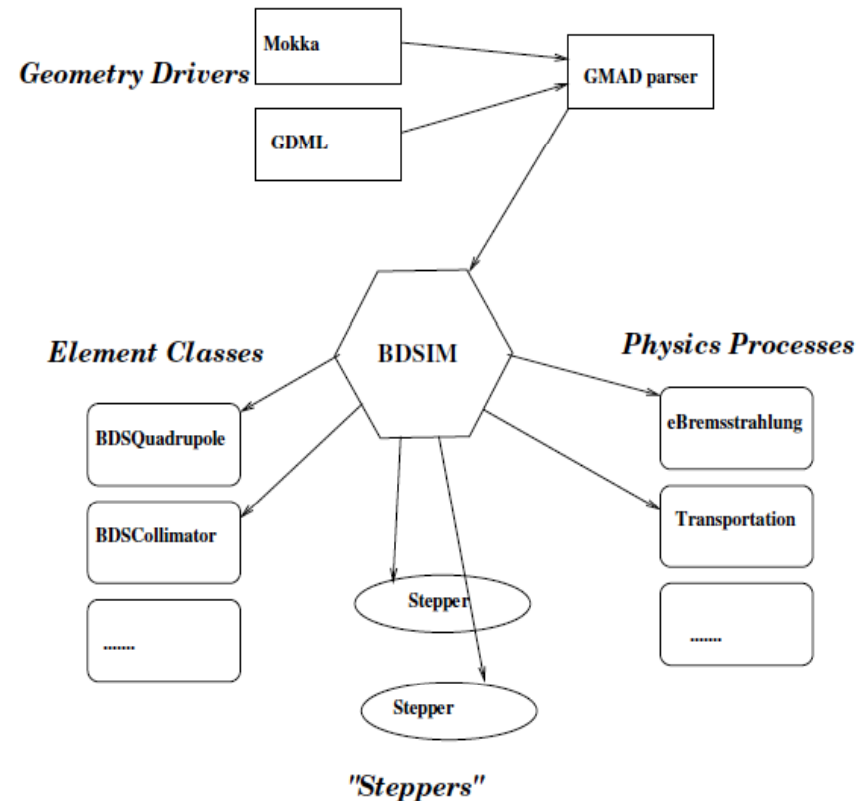
BDSIM



-
- What it is
 - What it does
 - What it looks like
 - What we're making it do now
 - What it should do in the future

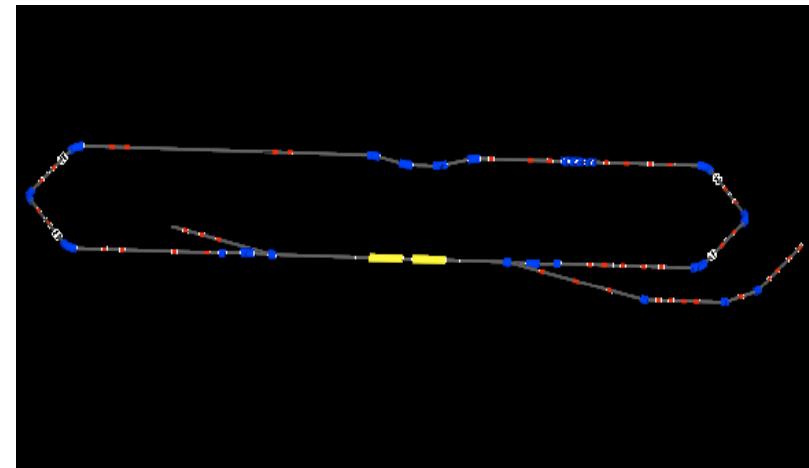
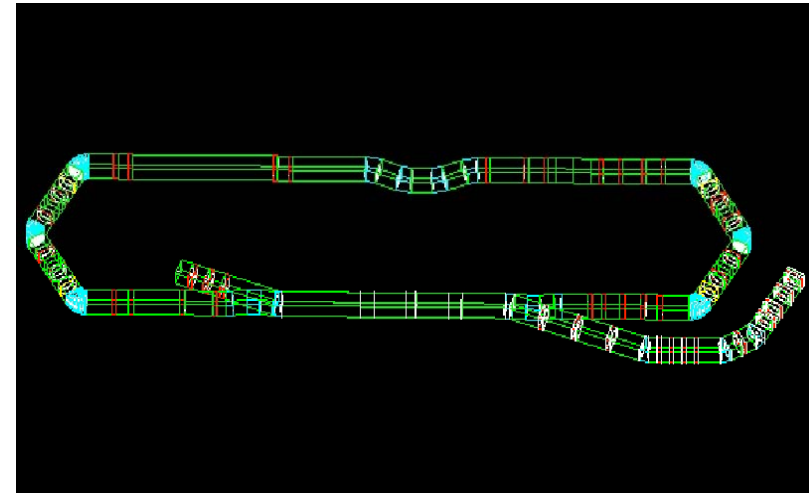
BDSIM is ...

- An extension to the Geant4 toolkit
 - Physics lists can be loaded from G4
 - Additional processes can also be added
- A geometry builder
 - gmad file parser
 - Mokka as external driver
 - Each element described as a C++ class
- A fast particle tracker
 - Each element has its own stepper process

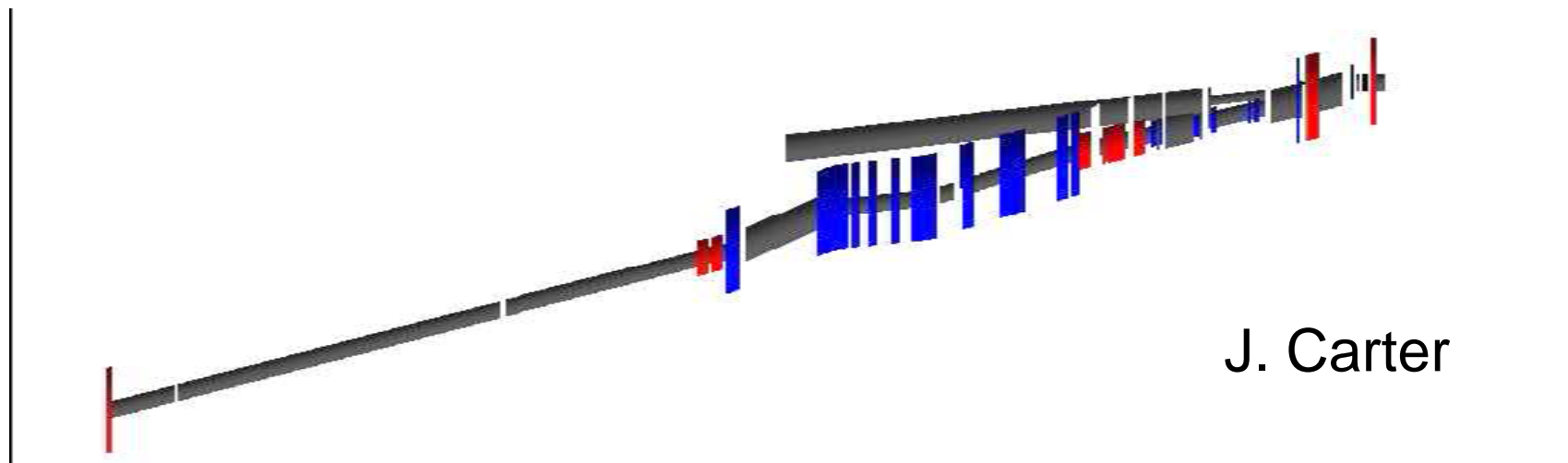


- Transportation of primary particles
 - Analytical solution to equation of motion used where one exists
 - Runge-Kutta elsewhere
- Automatic generation and tracking of secondary particles
 - Dependent on the loaded physics lists
- Automatic switching between fast tracking in vacuum and Geant4 tracking in material
 - Speeds up tracking inside beam pipe
 - Allows full generation of secondary particles elsewhere
- Logging of energy deposition in beamline elements
 - Beam losses, synchrotron radiation, spoilers, etc
- Optional sampling of particle distribution at chosen beamline elements
 - Good for benchmarking tracking against other codes

- v 0.1 - wireframe logical volumes
- v 0.3 - solid physical descriptions
- Batch mode also available (no visualisation)



- SQL or GMAD description allows for insertion of arbitrary definition of 3D beamlines and elements
- Also overlay arbitrary magnetic field descriptions



J. Carter

- Script included in BDSIM distribution to convert MAD to GMAD
 - Deals with most unavailable elements
 - (Needs tweaking)
- Doesn't handle MADX pattern recognition

```
qd : quadrupole,l=0.5 * m, k1 = qdk1;  
qf : quadrupole,l=0.5 *m, k1 = qfk1;  
d : drift,l=2*m;  
dt : drift, l=3*m, tilt = pi/4;  
sex: sextupole, l=1 * m, k2 = 10;  
sbvu : sbend, l=2*m, angle=pi/7, tilt=pi/2;  
sbvd : sbend, l=2*m, angle=pi/7, tilt=pi;  
sbvr : sbend, l=2*m, angle=pi/7, tilt=0;  
sb1 : sbend, l=2*m, angle=pi/7;  
td: transform3d, z=0,phi=pi/4;  
td1 : transform3d, theta=-pi/3;  
td2 : transform3d, theta=pi/3;  
vrot : transform3d, psi=pi/2;  
ivrot : transform3d, psi=pi;  
! method 1 - using coordinate transformations  
test1:line=(d,vrot,sb1,d,ivrot,sb1,d,sb1,d,ivrot,sb1,d);
```

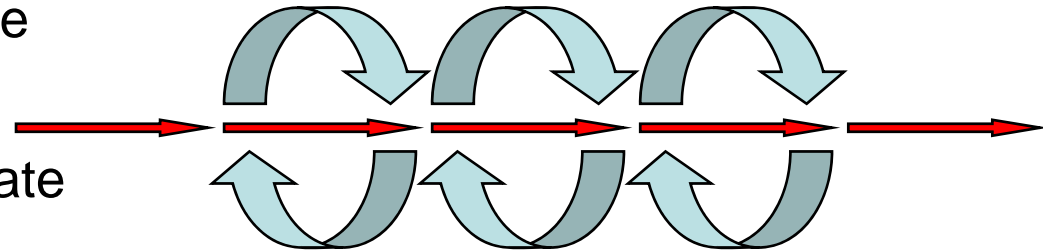
eg: ECOLHCEL(B01, SX, SY, SPOILER): LINE=(...)

- BDSIM tracks single particles
 - Generates secondary particles
 - Cannot calculate wakefield kicks
- Placet tracks bunch slices
 - Calculates wakefield kicks
 - Cannot generate secondary particles

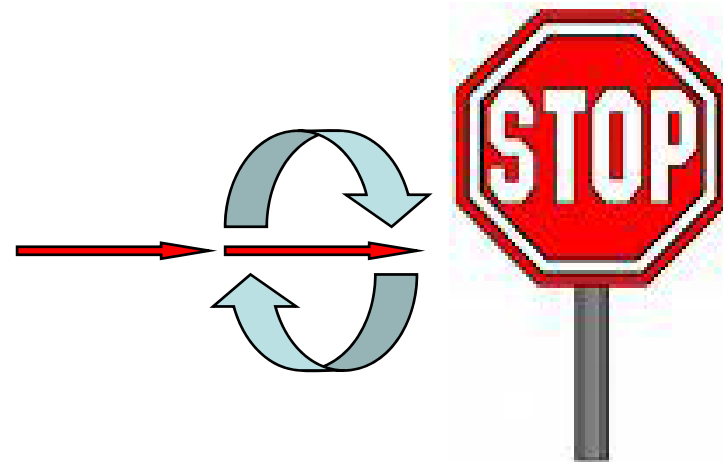


Combination:
Ilya Agapov
Andrea Latina
Daniel Schulte (CERN)
Steve Malton (RHUL)

- Main beam tracking in BDSIM
- At collimators and spoilers bunch is held on stack
- Bunch is passed to Placet and tracked to calculate wakefield kicks
- Placet passes appropriate kicks to BDSIM
- BDSIM restarts at held position and applies kicks
- Repeat through wakefield region and then continue standard tracking



- Main beam tracking in BDSIM
- At **DUMP** sensitive volume, particles are postponed until final event
- Bunch data is piped to Placet, which tracks through the element and calculates wakefield kicks
- Placet passes appropriate kicks and bunch data back to BDSIM
- **BDSIM exits**



WORK ONGOING

- BDSIM reverts to GEANT-based tracking when material is non-vacuum
 - Introducing beam gas is a problem
- Several methods under investigation
 - Thin, dense beam gas plug?
 - Need to randomise location at each step of tracking
 - Large interactions file?
 - Determine mean free path from gas density profile
- Need to avoid beam absorption losses
 - Replace interacting particle on stack with identical particle that has same initial parameters?

“To Do” List

- Interactive pan and zoom
- Realistic magnet geometries
- Material descriptions input from gmad file
- Mad2gmad script update
- XML geometry input
- Polarisation tracking
- Better output data
 - Energy deposition by element?
 - Activation and dosimetry?
- Update to gcc4.0, CLHEP2.0.x.x and G4.8.3?
- Anything else? Taking requests ...



Further details



- <http://ilc.pp.rhul.ac.uk/bdsim.html>
- <http://cvs.pp.rhul.ac.uk>
- malton@pp.rhul.ac.uk