Getting the ILC Software Ready for Background Simulations

Tales From the Tool Shed

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Guinea-Pig

Guinea-Pig simulates the beam–beam interaction

- “`acc.dat`” configuration file with ILC beam parameters
- now available: random engine initialisation for Grid jobs

Mokka reads simulated pairs as input

- interface for Guinea-Pig pairs included in Mokka
- needs filename extension “`.pairs`”
- one primary particle per event, one run per BX
  (100,000 primaries would bring Mokka to its knees)

Mokka – Detector Geometries

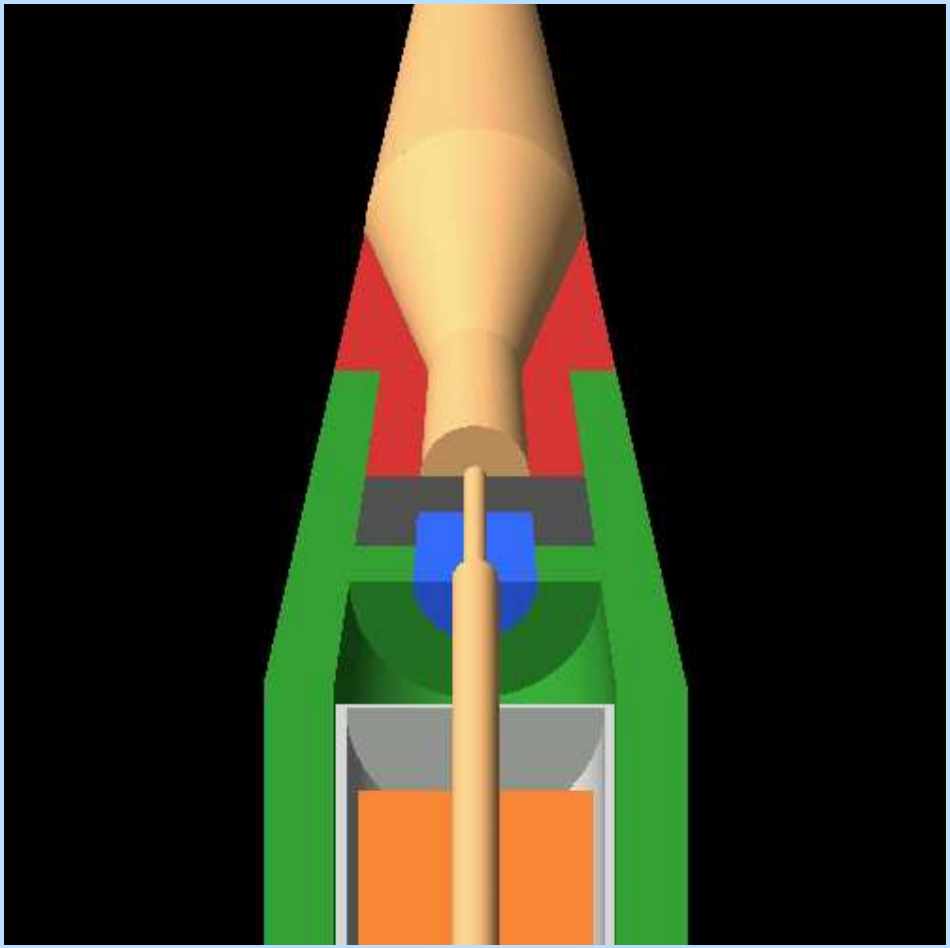
Detailed description of the forward region

- old TESLA design, new layouts with $L^* = 4.05\,\mathrm{m}$
- LumiCal, LHCAL, Low-Z Absorber, BeamCal
- beam tube with magnets up to 12.5 m

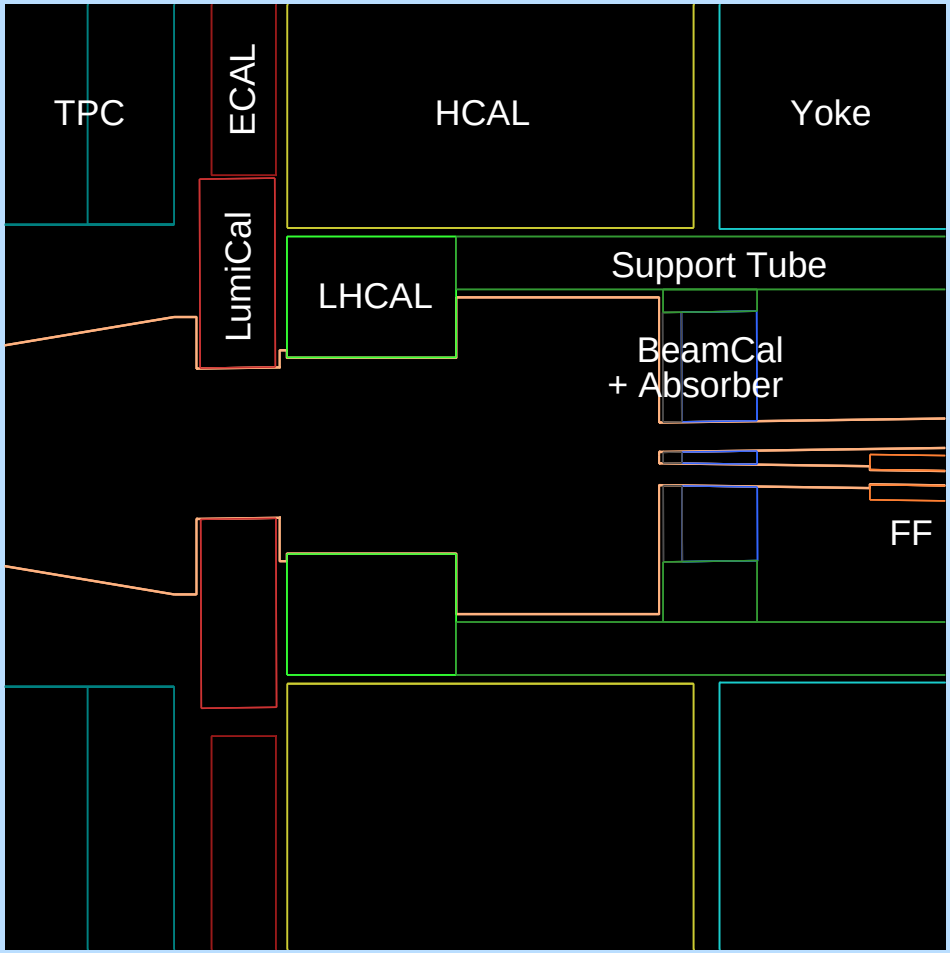
Support for a crossing angle

- forward calorimeters centred on the downstream axis
- X-shaped beam tube with delivery and extraction
- Lorentz transformation of primary particles (simulated for head-on, assuming crab crossing)

Mokka – Detector Geometries



TDR layout (L^* = 3.00 m)
head-on collision



Current design (L^* = 4.05 m)
14 mrad crossing angle

Mokka – Magnetic Fields

Better description of the main solenoid field

- field map instead of homogeneous field
- not perfect yet, but sufficient for background studies

Support for (anti-)DID fields

- field map superimposed on the solenoid
- has a major impact on backgrounds!

Magnets for beam delivery and extraction

- ideal quadrupoles along the beam lines
- outgoing pairs are overfocused and create showers

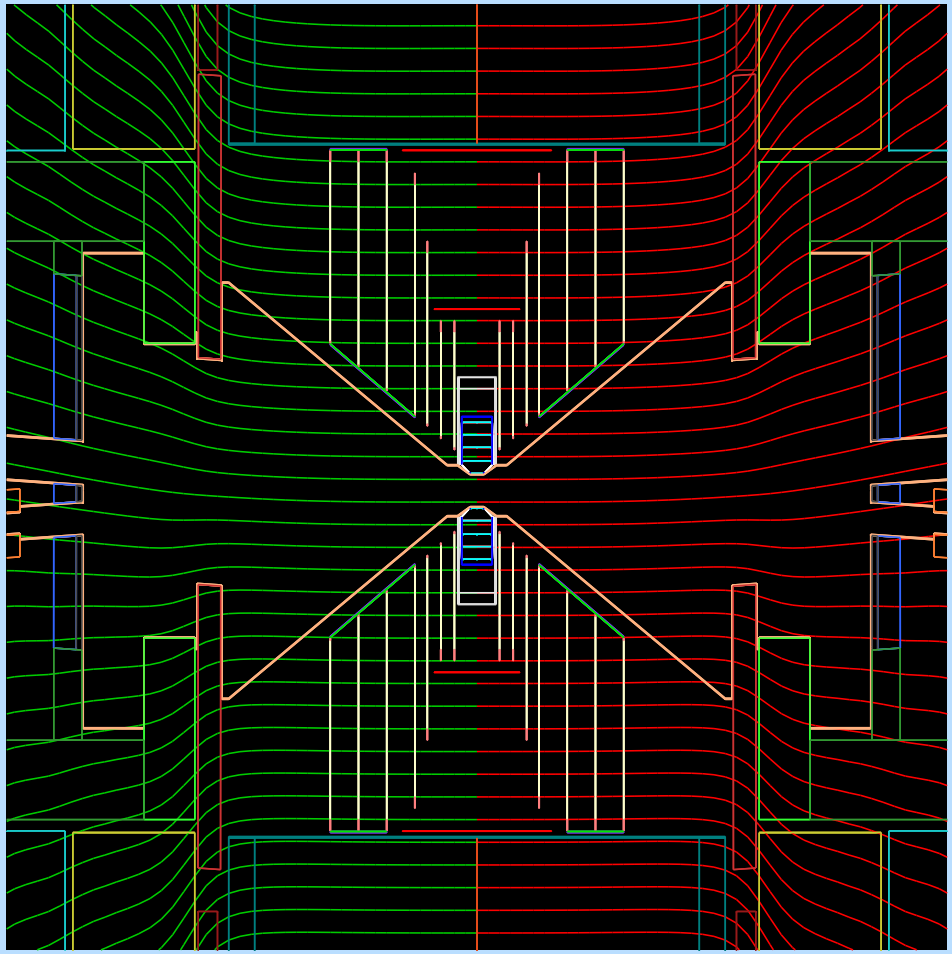
Mokka – Magnetic Fields

Visualisation of magnetic field lines

- helpful for debugging
- adjustment of the (anti-)DID strength

Available as a Mokka plugin (since 06-00)

- controllable via user interface
- port to Jupiter



14 mrad crossing angle with anti-DID field (1:10)

Mokka – Physics

Choice of a good physics list for neutron simulations

- QGSP_BERT_HP is generally considered best
- try different models, test low energies
- what happens to neutrons – capture?

Adjustment of cuts and limits in Mokka

- default cuts are much too high for backgrounds
- main tracker (TPC) is implemented for large p_t
- new implementation limits the step length
- need to find a time/space/accuracy tradeoff

Running on the Grid

First lesson: read the middleware manual

- Computing Elements: job control
- Storage Elements: data management

Second lesson: read the `bash` manual

- one script takes control on the worker node
- local record keeping can become tedious

Third lesson: find out why it still failed

- take your time to read the log files
- ask your local Grid Guru for help

It would be nice if things were simpler – but how?

Marlin – Analysis

Marlin is the common analysis framework

- main development currently focusing on PFAs
- tracking algorithms work fine for physics events
- TPC-specific developments mainly for prototypes

Additional functionality needed for background studies

- proper digitisation of background “hits” from Mokka (down to which level of raw-ness?)
- superposition of 160 BX at a given time in the TPC
- overlay with physics events
- pattern recognition / filtering before reconstruction

Simulation Results

A couple of findings so far (no numbers, no plots . . .)

- large *L** helps in the reduction of background
- crossing angle is not a problem (with an anti-DID)
- background hits on the VTX don’t seem to hurt
- HCAL endcaps get a certain dose, but probably OK
- TPC background occupancy looks (easily) manageable
- quencher with hydrogen (CH_4) should be no problem

You don’t have to worry about the pairs background,
but please don’t forget it, either