

# SuperB FastSim status

David Brown, LBNL

on behalf of the Fast Simulation Working Group

SuperB Workshop

Orsay

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# SuperB FastSim Goals

- Detector optimization studies
  - beampipe, tracker layout,  $Z=0?$ , ...
  - forward PID, forwards+backwards EMC, ...
  - Coordinated by the Geometry Task Force
- Physics reach studies
  - performance on benchmark channels
  - high-statistics studies of rare channels
- Both needed for TDR + mini-TDR



# SuperB FastSim Design

- Simplify detector element description
  - cylinders, rings, cones, ...
- Fully model particle passage through detector
  - Energy loss, multiple scattering, interactions, showering...
- Parameterize detector response
  - track hit resolution, cluster shape, Cherenkov ring resolution, ...
- ‘Reconstruct’ tracks, clusters, rings, ...
  - Model overlaps and background effects
- Output compatible with BaBar analysis tools
  - Vertexing, tagging, PID, BtuTuple, ...

# Progress since Elba

- Simulation of neutral particles
- Simulation of outer detector (coil+IFR)
- Ring and cone geometries
- Daughters for decay, conversion, and brems
- EM and hadronic shower modeling
- Tuning and refinement of detector response
  - Dirc, Emc, Svt, Dch, ...
- XML-based configuration description
- Release System prototype
- Update Layer0, DCH configuration
- **All in release FastSim/V0.0.2**



# Tracking Simulation

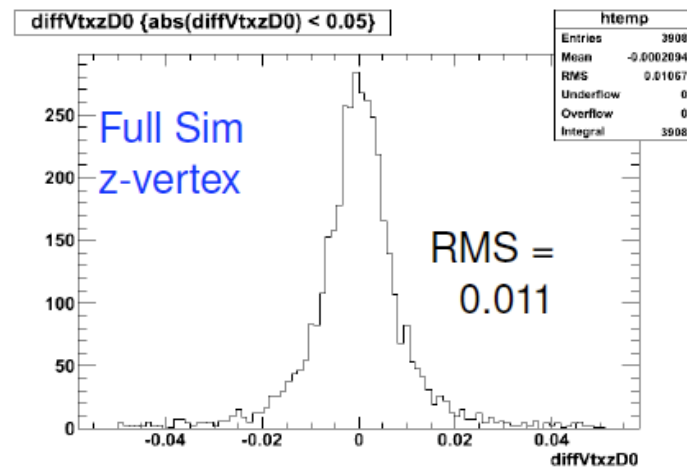
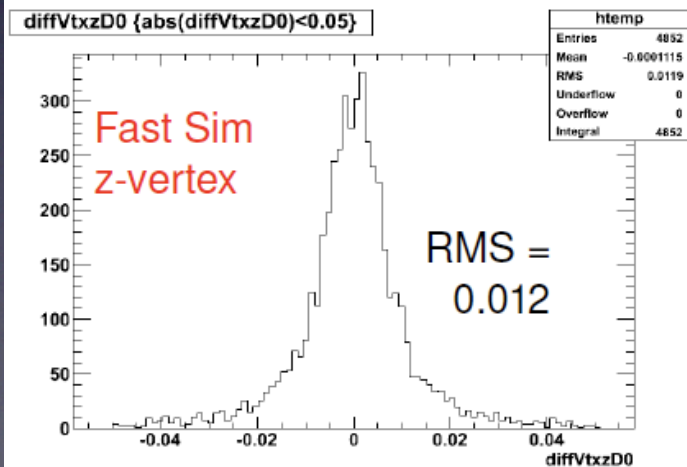
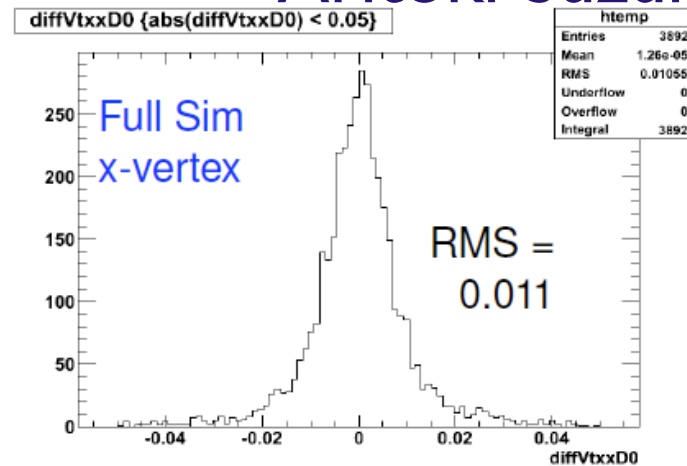
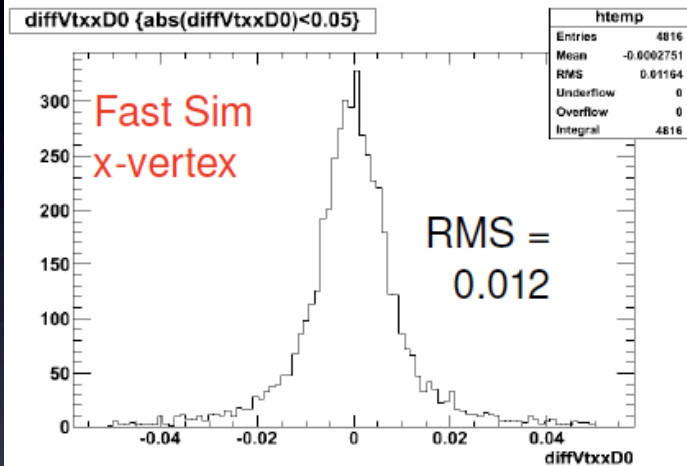
- Multiple measurement types supported
  - double-sided Si strips, Si pixels, wires, ...
  - Can be associated to any geometry
    - cylinder, cone, ring, ...
- Hit positions smeared by an analytic function
  - double-Gaussian for Svt, 'T2D' function for Dch
- Electronic Inefficiency, geometric overlaps and gaps modeled statistically
  - EG Svt support ribs are modeled as a thick layer of CF with very large gaps

# Tracking Response

D<sup>0</sup> Vertex with Babar Detector Configuration

(SimpleComp - MC)

Aritoki Suzuki



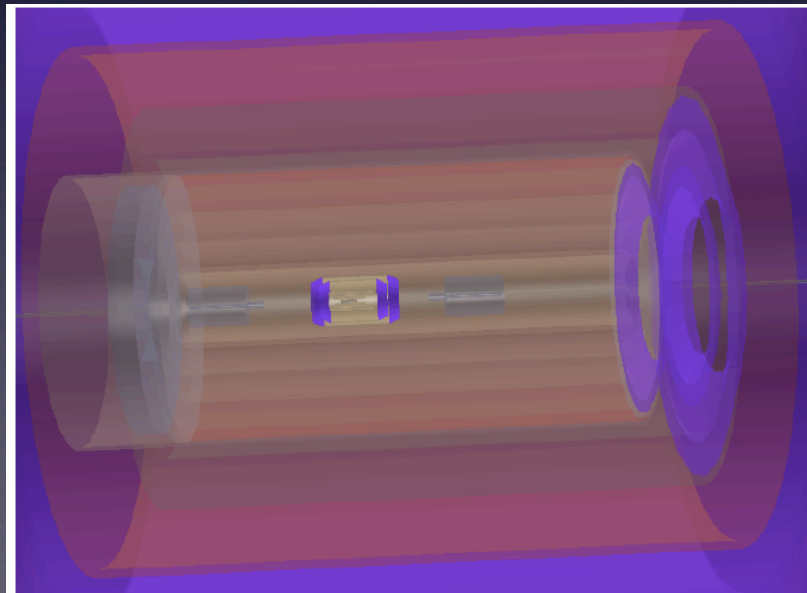
# Dirc Simulation (Rolf Andreassen)

- Seed rings on true position, direction
- Generate photons according to **ring dictionary**
- Smear  $\Theta_C$  with reconstructed track angle error
  - By adjusting parameters, can model BaBar Dirc or focusing Dirc



# Emc Simulation (Chih-hsiang Cheng)

- Parameterized clusters based on energy deposition on a grid
- Parameterized resolution and shape
- Also forward (LYSO) and backwards (Pb-Scintillator) calorimeters

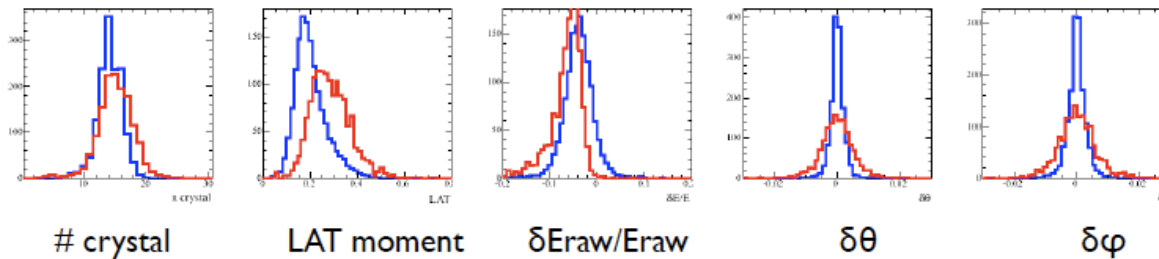




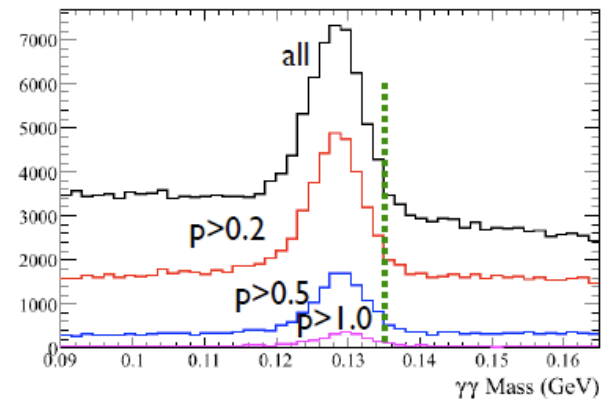
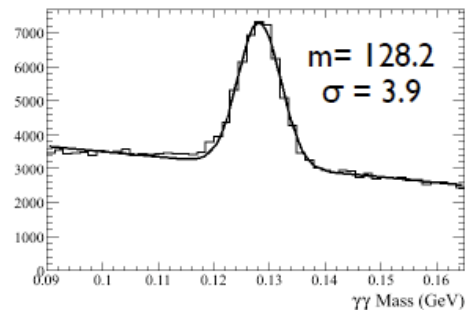
# EMC Response

## Performance

- One-GeV photons: Blue= **FastSim** (BaBar config); Red= **BaBar full Sim**



- $\pi^0$  from BB generic simulation



Need calibration. Resolution too high.

# Ifr Simulation (Marcello Rotondo, Giuliano Castelli)

- Outer-detector is modeled as 0-Field
  - straight-line trajectories
- (muon) hits are reconstructed as 2-D clusters
- Fit to hits gives chisquared
- mu/pi separation based on # of hit layers
  - reasonable agreement with full sim

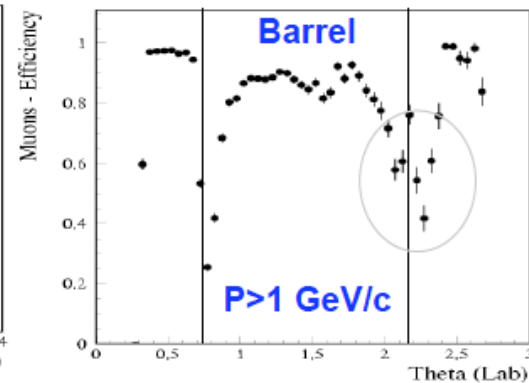
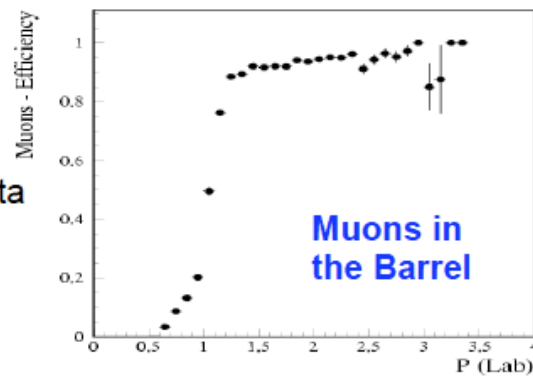


# IFR Response

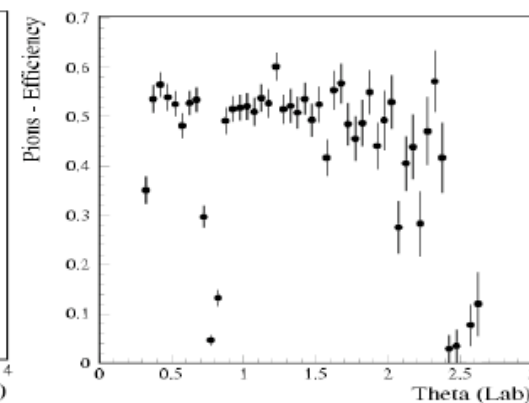
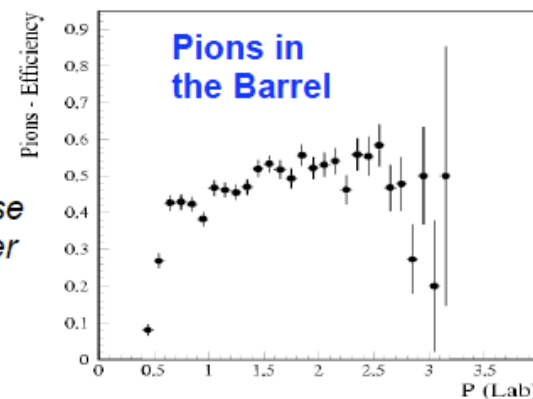
## Performances: muon selector

- mu/pi separation based on the # of traversed layers in the Iron:  $N > 9$  Layers*

Muon efficiency too optimistic, but the general features (shape of the efficiency versus theta and p) are in reasonable good agreement with the expectation



Pions efficiency is too high!  
We need to better simulate the IFR response when a hadronic shower is produced



# XML-based configuration

```
<edml>
  <measures>
    <device id="SiCyl" type="DoubleSiliconCylinder" phirms="0.0015" zrms="0.002"
    phieff="0.95" zeff="0.95" />
    <device id="Axial" type="DriftChamber" rms="0.0125" eff="0.99" angle="0.0" />
    <device id="Stereo+" type="DriftChamber" rms="0.0125" eff="0.99" angle="0.06" />
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    ...
  </measures>

  <detector name="PacCylDetector">
    <cyl name="Beampipe" zmin="-5.366314" zmax="10.033158" radii="2.500" thick="0.250"
    mat="pep-BPipeB" />
    <cyl name="SvtL1" zmin="-6.763534" zmax="12.923769" radii="3.300" thick="0.034"
    mat="svt-Silicon" meas="SiCyl" />
    <cyl name="SvtL2" zmin="-7.986102" zmax="15.453053" radii="4.000" thick="0.034"
    mat="svt-Silicon" meas="SiCyl" />
    ...
    <ring name="EmcForward" z="207" lowradii="81" hiradii="105" thick="30.0" mat="emc-
    CsI" meas="Emc" />
    <ring name="IfrIron1" z="239.5" lowradii="81" hiradii="300" thick="2" mat="ifr-
    Iron" />
    ...

  </detector>
</edml>
```



# FastSim SuperB Computing

- **Subversion** code repository
- Release definition and configuration system
  - ie Releases/FastSim/V0.0.2
- BaBar package access for SuperB users
- First attempts to build a standalone SuperB release

# Ongoing Development

- Decays-in-detector (Mike, Gabriele)
  - mostly working code, still chasing leaks
- Hadronic interaction daughter generation (Dave)
- Cluster merging (Chih-hsiang)
- Hadronic showers in lfr (Marcello)
- Add 'time' to PacSimHit (Nicolas)
- N-agon geometry (Dave)



# Missing Pieces

- Track hit confusion (Doug)
- $dE/dx$  simulation
  - Svt and Dch!
- Trigger simulation
- Background mixing
- Forward PID alternative measurements
- PID selectors (Orsay group)
- Tagging for SuperB
- Other?

# FastSim in TDR Phase

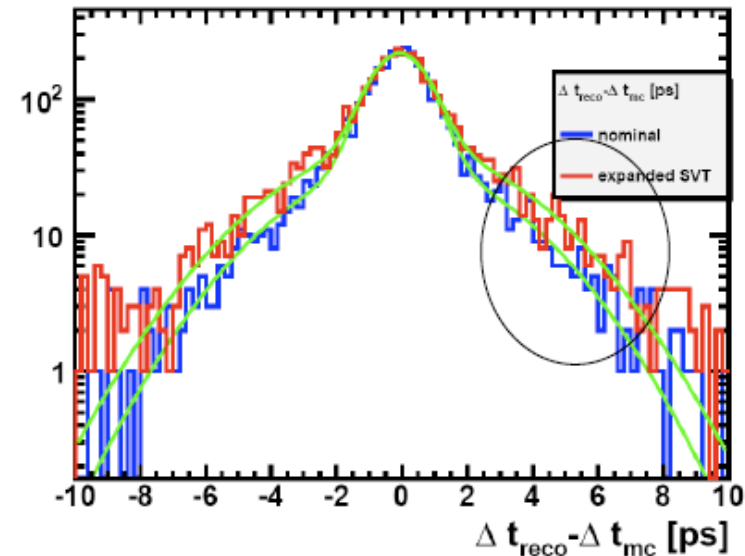
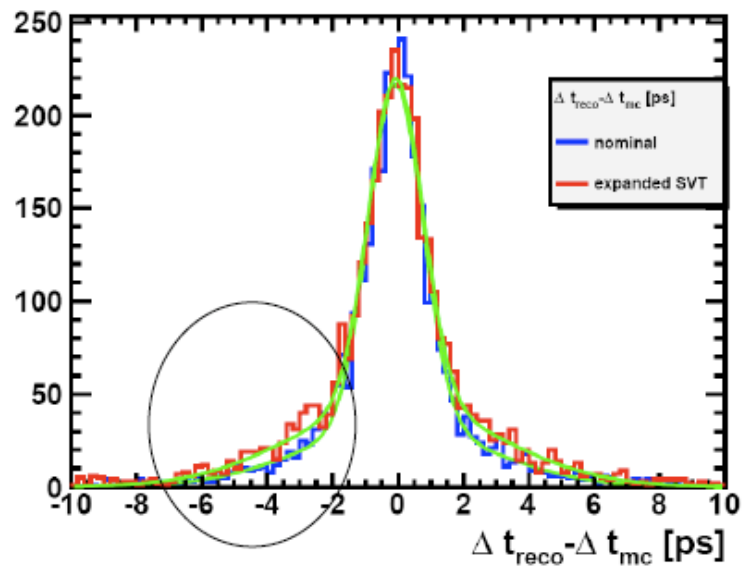
- For the TDR, FastSim must evolve from a development project to a production tool
  - Completion schedule of ongoing development
  - Describe known missing essential pieces and (if necessary) **find people to work on them**
- People are starting to use FastSim for real work
  - examples from DGWG meeting yesterday



# Expanded layer 4+5

$\Delta t$  resolution

Gabriele Simi



- most of the additional events are populating mainly the tails of the resolution

# BReco with FastSim

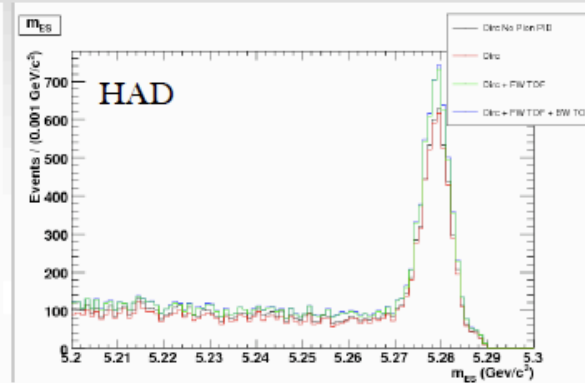
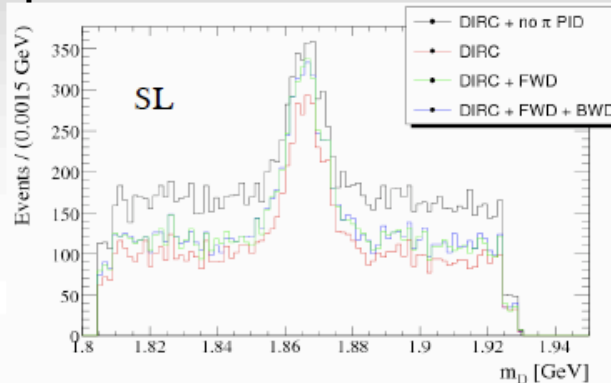
SuperB workshop Orsay

February 16, 2009



\*  $\pi$  VeryLoose, K Tight

## PID devices geometry (II)



HAD RECONSTRUCTION	signal region $m_{ES} > 5.27 \text{ GeV}/c^2$	sideband: $m_{ES} < 5.26 \text{ GeV}/c^2$
K PID + Dir	5140	5514
K PID + $\pi$ PID + Dir	5023	5005
K PID + $\pi$ PID + Dir + Fw TOF	5969	6273
K PID + $\pi$ PID + Dir + Fw TOF + Bw TOF	6045	6386

elisa manoni

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# Conclusions

- SuperB FastSim V0.0.2 is ready
  - Useful studies already possible
- Remaining features needed for TDR under development
  - Hope to make progress on key issues here
  - Aim for full functionality by April 2009 Physics Workshop
- Users and contributors are welcome!