

Fastsim Status: Beam Boost

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Boost

- Babar software doesn't boost/rotate the c.m. frame correctly if the beams have non-zero crossing angle (see meeting on Jan.21).
- To fix it, need to use the full momenta of the beams, and calculate the c.m. frame's z-axis direction (no longer the boost direction).
- Changes at low level code are made: Beta/EventInfo, PepEnv, PepBeams, PepCollision, PepCond, BetaCoreTools/BtaBooster, etc.
- Code has been committed to svn. Lots of packages have to be recompiled. Unfortunately we don't have a tool to determine dependencies yet, so we don't know exactly which packages. You can check out all packages and compile them all if you want. It only takes ~1 hour to compile libs.

Build PepEnv

- Use beam momenta and beam spot, not energies/boostCal.
- % more SuperB_Beams.tcl

```
mod talk PepBuildEnv
  pepFillPatternFile      set PepCond/pepFillPattern.raw
  pepPackedBunchesFile    set PepCond/pepPackedBunches.raw
  pepBeamSpotCalFile      set PacMC/SuperBBeamSpotCal.raw
  pepBeamSpotCalMCGenFile set PacMC/SuperBBeamSpotCal.raw
  pepBeamMomentaFile      set PacMC/SuperBBeamMomenta-30mrad.raw
exit
```

- Boost is calculated using beam momenta, rather than using boost direction to define beam momenta.
- C.m. frame's z-axis is defined by boosting the e- beam back to the c.m. frame without rotation; direction stored in pepBeams, and then loaded into EventInfo.

Generators

- Generators always assume beams are along the z-axis of the c.m. frame.
- GfiBase/GfiGenerator is the base of all generators and it does boost/rotation to the generated stdhep particles.
 - ▶ It already did the right thing by boosting the e- beam to the c.m. frame to determine the rotation angles.
 - ▶ Didn't need to change it.

Current beam configuration

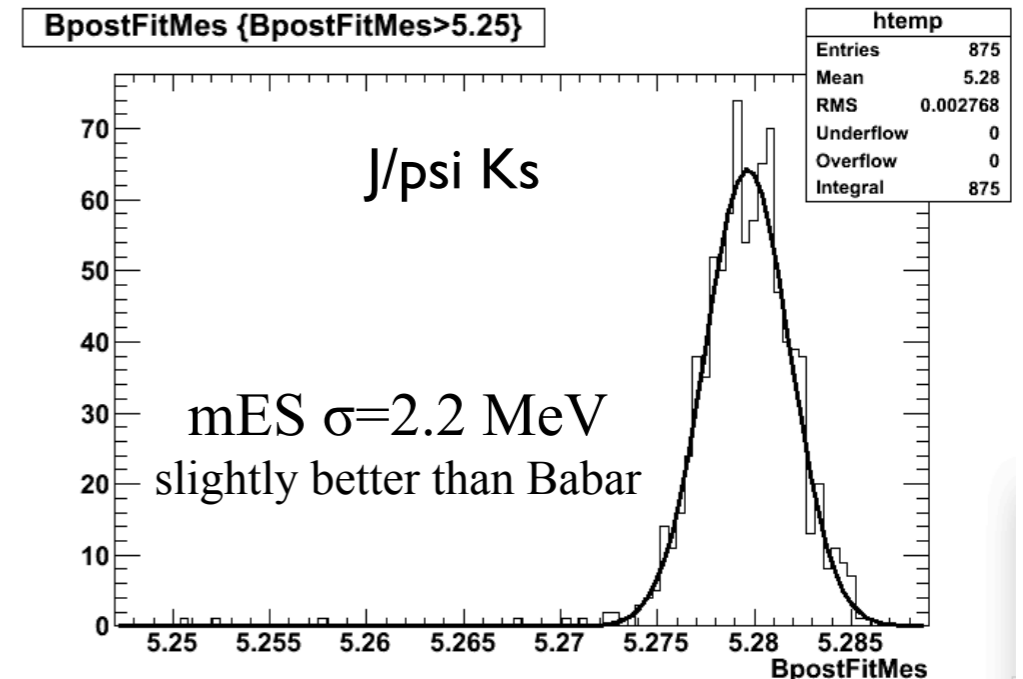
- % more ../../PacMC/SuperBBeamMomenta-30mrad.raw

```
electron (-0.20097,0,6.69699): Bbr Covariance Matrix:
  7.8e-06    0    0
    0    7.8e-06    0
    0    0    1.76e-05
positron (-0.125381,0,-4.17812): Bbr Covariance Matrix:
  1.69e-06    0    0
    0    1.69e-06    0
    0    0    5.42e-06
```

-30mrad

+30mrad

- Beamspot along the axes.
- Ignored the correlation for now.
- Energy spread: 0.0626% (HER), 0.0557% (LER), according to M. Sullivan [v11].



BetaCoreTools/BtaBooster

- BtaBooster is a common tool that most analyses use to boost a particle to the CM frame.
- Added constructors to take cm frame z-axis direction as an argument (if not given, it will use the boost direction). It is now using the z-axis direction for rotation, rather than the boost direction.
- BtaTupleMaker has been updated to use the new BtaBooster. Other analysis code (if not using BtaTupleMaker) should change too.

```
[HepLorentzVector]                [Hep3Vector]
BtaBooster booster(eventInfo->cmFrame(), eventInfo->cmFrameZaxis());
BtaCandidate tmp(booster.boostTo(*cand));
// or
HepLorentzVector p4cm=
booster.rotateAndBoost(BtaBooster::To) * (cand->p4());
```

Test with Bhabha events

- Generate Bhabha events at low angles (down to 1°).
- The final e^+ or e^- direction should be near the initial beams.

