PravdaMC: Status and Known Issues

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What is PravdaMC?

- The PravdaMC package is a fast simulation that parametrizes the detector responses in BaBar computing framework. [N. Kuznetsova, A. Ryd]
- Uses **EvtGen** to generate events (you got a list of truth **BtaCandidates**).
- The detector is described in ASCII files, to be read by the tracking algorithm **trackerr** which smear charged track candidates.
- Neutrals are smeared by simple resolution formula.
- Results are lists of charged and neutral **BtaCandidates** for your analysis.

Trackerr

- Trackerr [W. Innes, ca. 1991] is the core of the PravdaMC simulation.
  - Allows CYLINDER, CONE, and DISK geometries.
  - Tracks follow a helical trajectory to find intersections with active layers.
  - Does not scatter trajectory or lose energy at individual hits, only assign a global error matrix based on total energy loss and multiple scattering.
  - Implemented in Fortran.

Detector Description Files

- Read in by trackerr

```
ISIVF
! barrel Si  ( 390 microns equiv )
!       mat     r       thick   sig   zfi  zbi     stereo
! note: thickness must be in gr/cm2
! ____________________________________________________________
! layer 1
DETECTOR  SIS   1.5  0
LAYER   Si     3.30     0.091  0.0013  11.168 -5.815    0.     Si phi

DETECTOR  SIS   0.2  0.8
LAYER   Si     3.33     0.00 0.0015 11.168 -5.815    1.5708 Si z

! support ribs - diffused

LAYER    Cfbr  3.55     0.016  1e5   11.168 -5.815    0.
```

- BaBar geometry files are available in the package.
- A couple of perl scripts allow you to modify parts of the detector easily.

Neutrals

- Photon energies are smeared based on a simple energy resolution formula.
- EMC acceptance (and resolution) is hard coded in the C++ code. It doesn't look like having to do with the detector files used by trackerr.
- It's unclear to me how neutral hadrons are treated, perhaps not at all.

Particle ID

- DIRC and IFR responses are not available.
- Particle ID efficiencies/fake rates are achieved by “PID killing” based on Babar PID ASCII tables.

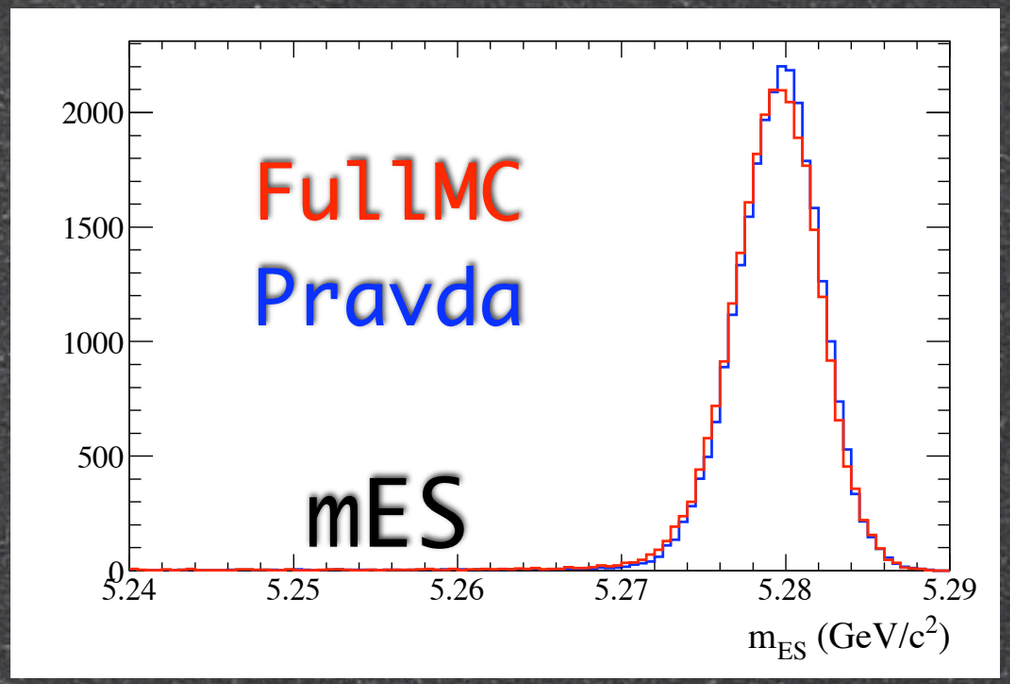
Beam parameters

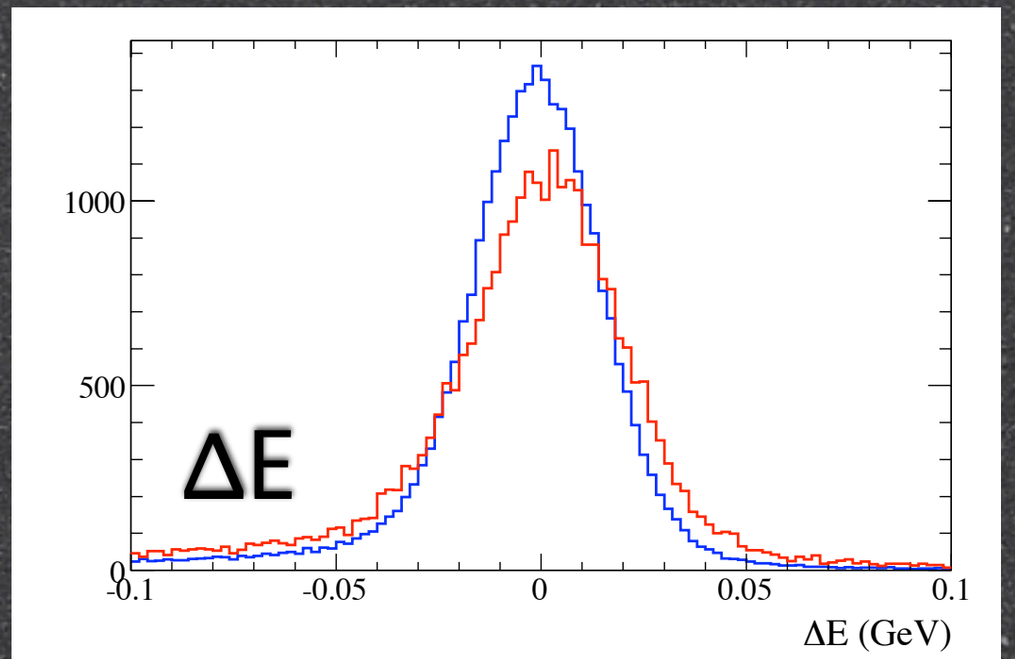
- Beam energies, boost, and beam spot parameters can be changed by pointing tcl parameters of **`PepBuildEnv`** to customized configuration files.

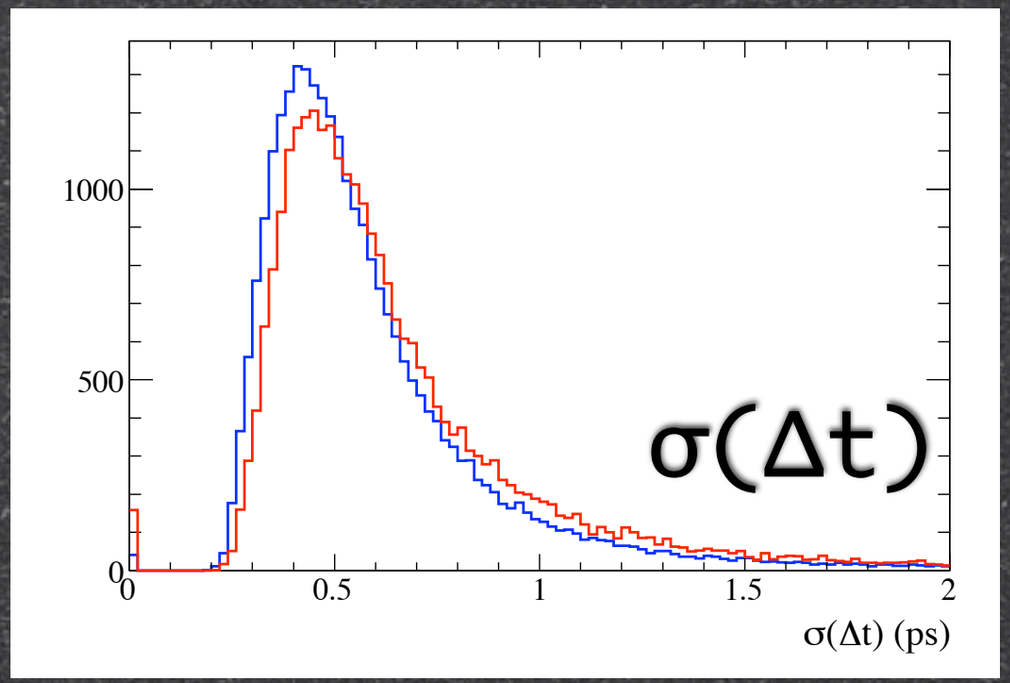
Status of the Package

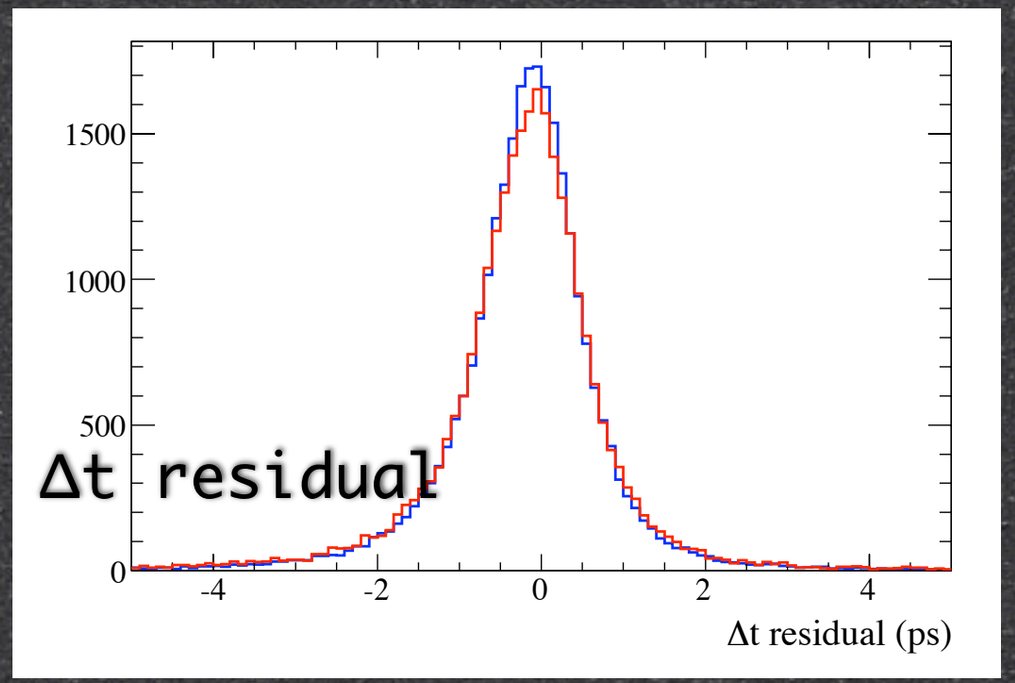
- It has been updated to be used in Babar software release 24.
- The code is sufficiently modulized. Easy to add classes to expand its function.
- A simple recipe in README of **PravdaMC V01-00-10**.
- No other packages need to be checked out.
- A couple of example tcl files allow you to create ntuples out of the box.

Example: B->J/ψ(μμ)Ks(π+π−)









Speed

- Generate 100k Υ(4S)->B0B0ar->pi+pi-X events, reconstruct B0->pipi, and dump a short ntuple:
  - CPU time= 14 ms/evt on 2GHz Dual Core AMD Opteron.
  - Top modules

```
--- ms ------ module --------------
 2.83690 | BtuTupleMaker
 2.48000 | PmcMakeBtaCandLists
 2.06960 | GfiEvtGen
 1.88860 | BtaMicroPidKilling
 0.68520 | RacTestInput
 0.57090 | MakeBasicLists
 0.40840 | RandomControl
 0.32180 | VtxEvent
 0.27590 | BtaLoadChiSqAssoc
-----------------------------------
```

dump ntuple

smear lists

event generator

PID killing

Known Issues

- The code seg-faults at the end of the job. It looks like problems in some ROOT class destructor, but can be memory allocation problem. The resulting ntuple is not affected.
- Lack of hit-level information, even the basic ones such as #DCH hits, #SVT hits, EMC clusters, DIRC Cherenkov angles, etc. Some analyses may not be able to perform.
- Trackerr is in a very long Fortran code, very difficult to understand/debug/maintain.

Known issues (cont.)

- There is no description of DIRC and IFR.
- How are neutral hadrons treated?
- Poor job on low momentum tracks because trackerr doesn't scatter or lose energy at hits.
- There are no reco objects and GHits. It is not clear whether events can be written to event store. We cannot persist BtaCandidates.
  - Eventually we want to generate billions of events. You want to put them into some kind of event store, not giant ntuples.

Conclusion

- PravdaMC is in a reasonably good shape for simple fast simulation studies.
- You can use virtually all BaBar modules/tools as long as they only deal with BtaCandidate parameters and nothing deeper.
- Many known (and likely more unknown) issues. Some need to be solved before we can do large productions.
- Detector developers and physics sensitivity analysts are encouraged to try it, give feedback and/or help develop.