Reconstruction, recent developments

Yuri Fisyak, BNL

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fisyak@bnl.gov

BROOKHAVEN NATIONAL LABORATORY

Outline

- Revision of relationship between reconstruction and response simulators:
  1. Truth information => Validation tools to control efficiencies and fake rate.
  2. Response simulators has to reproduce real data on the level of DAQ.
  3. Goal: to increase robustness of embedding.
- Main steps of propagating simulation upgrade in reconstruction
- One more platform
- dE/dx
- Summary

Why?

- We need to revisit relationship between simulation and reconstruction because we are making right now major steps in upgrading our reconstruction:
  - DAQ100 (FCF) clustering,
  - ITTF as basic track reconstruction tool,
  - Moving towards to Virtual Monte Carlo,
  - (New) subsystems reconstruction
  - ...

The relationship includes two major items:

1. Reconstruction has to be instrumented with tools which allow to propagate “Truth” information from simulation (GEANT track ID,..) to reconstructed objects.
2. Simulation has to provide reliable description of real data accounting alignment, calibration, ...

The goal is to provide a possibility to use the same chain for reconstruction of real and simulated data.

This will simplify embedding production and analysis.

Truth information

- A possibility to match reconstruction with simulation based on simulated track ID (Truth) has been discussed in STAR for a number of years.
- Till now we are still using “ Association” based on proximity method. This method makes essential assumption that any corrections applied during reconstruction are small.
- To access to the Truth information becomes more important now with:
  - increasing statistics and knowledge of systematical effects,
  - significant increase of magnitude of applied correction, and
  - New reconstruction software: ITTF,FCF, …
- Some new software (SSD) is coming with Truth information already built in.
- As the first step we started pilot project with implementing of Truth information for TPC

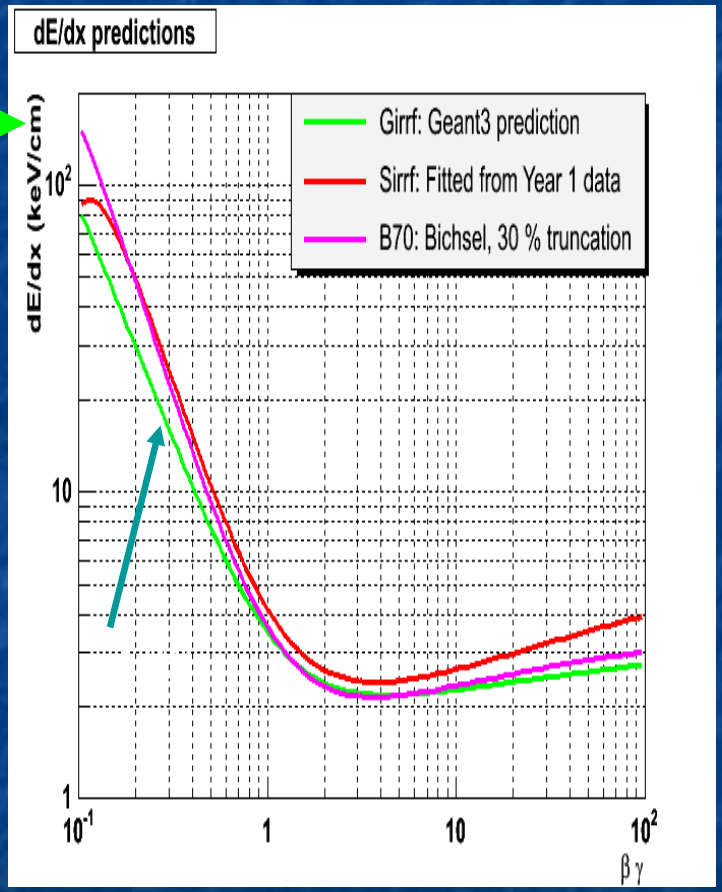
Truth in TPC

- To instrument TPC response simulator and reconstruction with Truth information it has been modified:

  StEvent, StMcEvent, StTrsMaker, St_tpcdaq_Maker, StMixerMaker, St_tcl_Maker, tfs, tcl, StAssociationMaker and StAnalysisMaker.
- Main changes are:
  - StHit has now 2 additional data members (with corresponding access methods) which keep:
    - IdTruth – GEANT track Id associated with this hit,
    - Quality - ratio of deposited energy (charge) produced by the above track to total reconstructed energy of the hit.
  - tcl (old TPC) cluster module fills the above Truth information.
  - StAssociationMaker is aware now about Truth information:
    - If the information exists then it is used to match with StMcEvent otherwise it used proximity method
- These modifications do work and now are in CVS.
- fcf is still needed to be instrumented. Tonko promised to do this in March.

TPC response simulator revision

- Revision of TPC response simulator (Trs) requires in order to:
  - Replace dE/dx model (tss based on GEANT3) by Bichsel's one
  - Add all known effects distorting data
    - Misalignments,
    - ExB, space charge, shorts, …
    - dE/dx: gain, pedestals, absorption, ADC saturation, ..
- Development of existing StTrsMaker looks like as wasting of time. Package has already ~50 classes but most of them are not used or duplicate codes from StTpcDbMaker / StDbUtilities packages.
- The proposal is to create revised Trs, validate it and replace old one in time scale ~ 1 month.



Truth information (cont.)

- We expect that this TPC response simulator and reconstruction revision will be used as template for all other detectors.
- I want to stress that usage of “ Truth” information is very import tool for validation our reconstruction software.
- This is especially important for precise detectors : SVT, SSD and pixels.

Upgrade simulation in root4star

- GEANT3 STAR simulation has been / being upgraded : gstar/staf = > starsim (Maxim's talk)
- A part of simulation in root4star is ~3 years old (asps/agi/gst/..) and it is not synchronized with gstar/staf.
- The plan is to have exactly the same simulation codes in starsim and root4star. It will obviously simplify development, debugging and validation of codes and data (embedding).
- This part is well under control and will move to repository just after the collaboration meeting.

Upgrade of root4star (cont.)

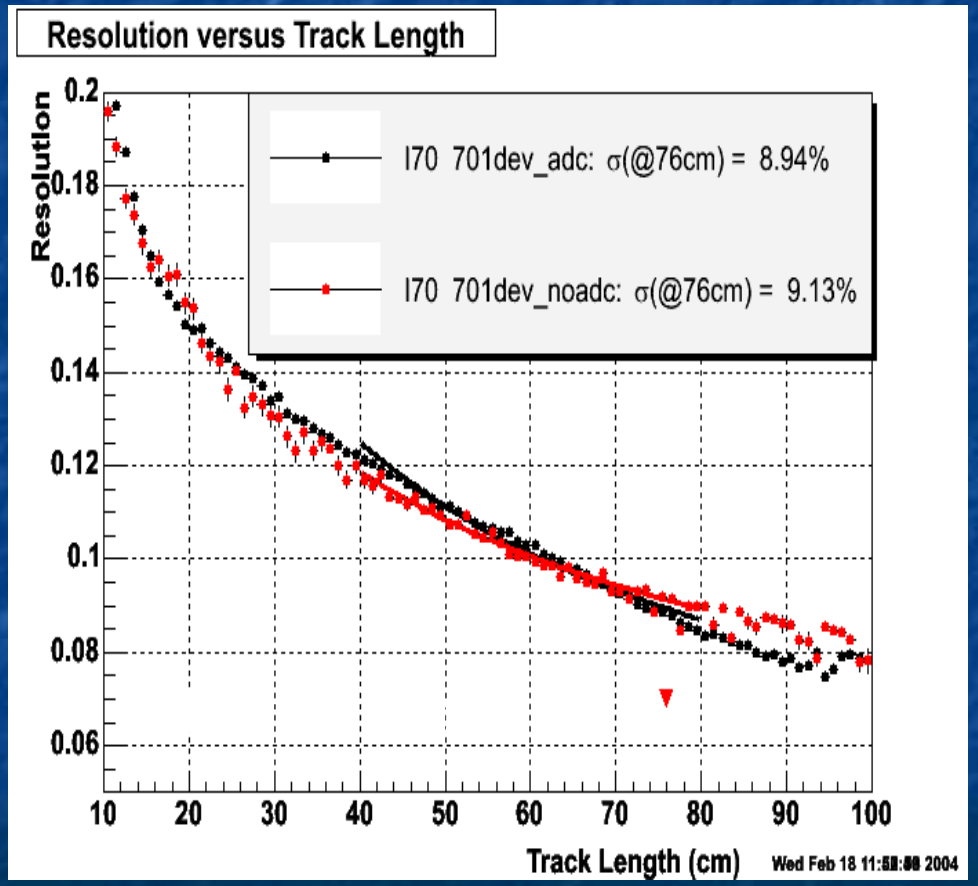
- The above upgrade will open possibility to validate ROOT tracking (Virtual Monte Carlo, TGeo) with respect to one in GEANT3.
- Success of this validation
  - will open avenue to use the same geometry for simulation with physics from GEANT3, FLUKA and/or GEANT4.
  - will give a possibility to use the same geometry for reconstruction
  - will rise the question about optimal geometry description and interface of this description with Data Base.
- Tracking within ROOT rises the question :
  - How to store hits obtained during the simulation ?
  - Old way i.e. in ZEBRA banks does look artificial.
  - It seems that much more natural way is to store hits in ROOT objects.
- At least as the first approximation the existing StMcEvent looks very attractive to be reuse in this way. Only obstacle is absence of persistency for StMcEvent which has to be added.

Additional platform

- In addition to RedHat 8.0 gcc 3.2 we got one more platform:
  - RedHat 8.0 with Intel icc/ifort compilers.
  - The STAR offline has compiled and running.
  - We are getting ~30% gain in performance of our codes.
  - Processing of daq files gives the same results as gcc
  - Results for simulated data is slightly different.
  - This platform will appear in dev next week.

Once again about dE/dx

- Resolution based on fast offline for old tcl (“ adc) and DAQ100 (“ noadc”) is ~9%.
- The fast offline uses calibration from dAu run.
- New data requires the new calibration. After calibration the resolution should be ~7.2%.
- A list of runs for TPC calibration has to be defined and processed at stable conditions in order to solve the issue.



Summary

- We need upgrade response simulators and reconstruction with Truth information as major step in validation software and data.
- This upgrade has been started for TPC and it expected to be completed and validated in a month.
- We have well understood road map towards to Virtual Monte Carlo.
- We have new platform for STAR software: RedHat 8.0 + icc/ifort.
- For dE/dx it is needed to select list of run for TPC calibration which have to be processed under stable condition.