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Why you should upgrade to Geant4.10.1.p02

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22nd September 2015, **LArSoft Coordination Meeting**

Outline

- About the current version of Geant 4.
- Physics of LArIAT as example for IF exp.
- Changes affecting physics of interest for LArIAT.
- More info.

About Geant 4.10.1.p02

- Geant4.10.1.p02 released on 19 June 2015
- > 4.10 releases include support for multi-threaded Geant4 applications (event level).
- No more changes to Geant4.9.6 (currently p04) series by the end of the year.
- There are some interface changes compared to 4.9.6 but migration should be very easy.
- Good to be able to compare to previous versions of Geant 4.

e.g. Science outlook for LArIAT as example for IF exp.

ELECTRON VS PHOTON SHOWER DISCRIMINATION

Experimental confirmation for the separation efficiencies (MC determined) - key feature of LArTPC technology

MUON SIGN DETERMINATION (W/OUT MAGNETIC FIELD)

Explore a LArTPC feature never systematically considered (decay vs capture in LAr)

STUDY OF NUCLEAR EFFECTS

Pion Absorption, π^0 from π^\pm Charge Exchange, Elastic Cross-Section

Kaon interaction channels

Antiproton annihilation (relevant for n-nbar oscillations)

DEVELOPMENT OF A NEW CONCEPT FOR LAR SCINTILLATION LIGHT COLLECTION

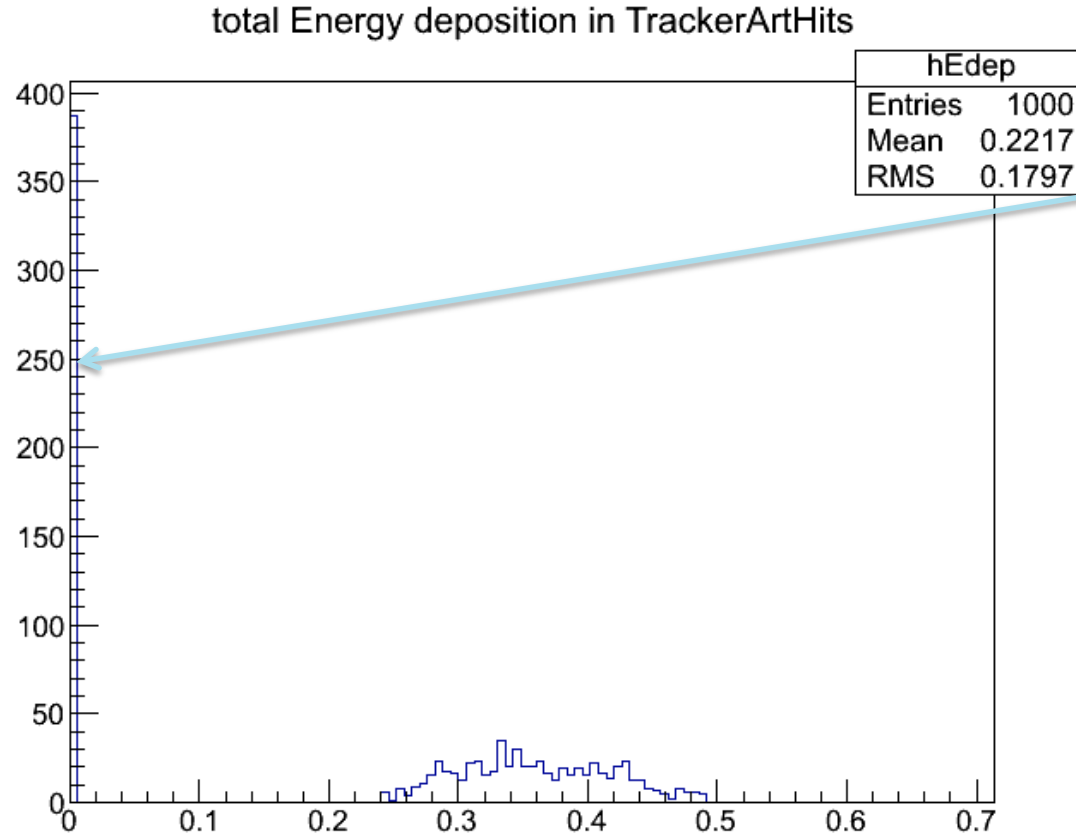
Relate energy deposited to **charge** and **light** for an improved calorimetric energy resolution

Changes affecting physics of interest (previous slide) for LArIAT

- All the six electromagnetic variants of the physics lists: `_EMV`, `_EMX`, `_EMY`, `_EMZ`, `_LIV`, `_PEN` are available by using the physics list factory `G4PhysListFactory`. This option can be specified as part of the physics list name.
- Expect 5% speed up in electromagnetic physics. Better performance in general.
- Labeling tracks originating from the muon stopping by the (sub) process which created them, `dio`, nuclear capture, atomic cascade.
- Replaced native `PreCompound` model with Bertini in `G4MuonMinusCapture` giving better agreement with the data
- Bug in charged Kaon response in Bertini model fixed in > 4.10
- Three new physics lists have been introduced: `QGSP_INCLXX_HP`, `FTFP_INCLXX`, `FTFP_INCLXX_HP`.
- More compact, complete and correct xs datasets.

Charged Kaon response

Bug in Bertini cascade
K not passed to process
decaying the particle



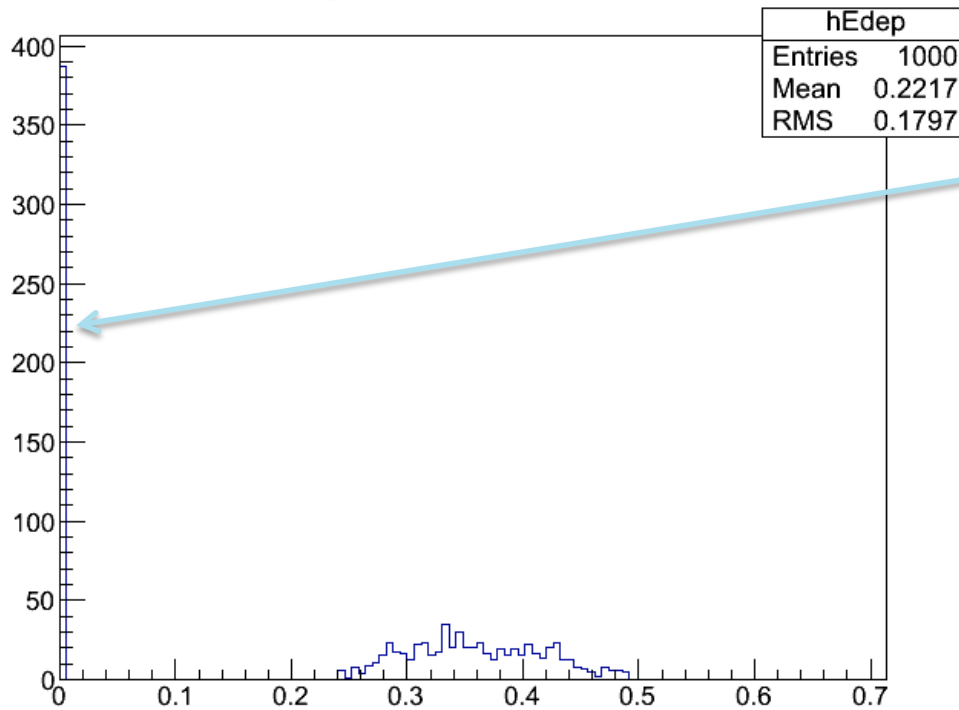
More info:

- <http://geant4.web.cern.ch/geant4/support/ReleaseNotes4.10.0.html>
- <http://geant4.web.cern.ch/geant4/support/ReleaseNotes4.10.1.html>
- Next week the Geant 4 collaboration meeting will be at FNAL. There will be a technical forum next Friday Oct. 2 at 1:30 pm in WH1W.

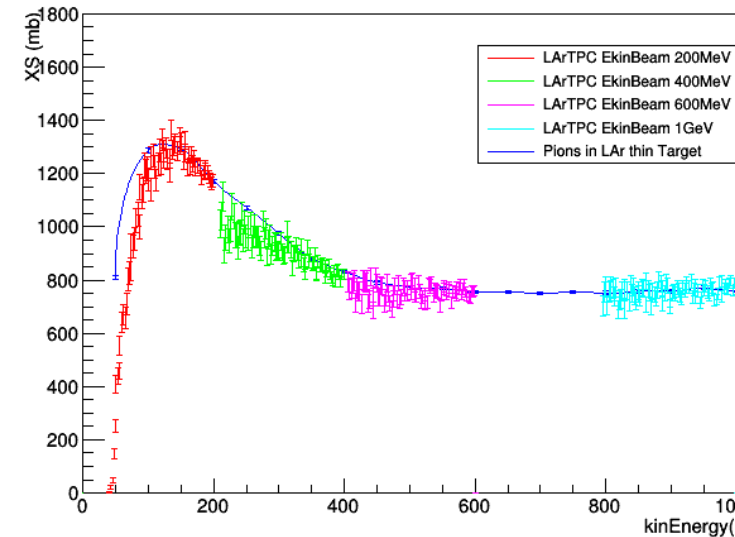
Backup

Science outlook (cont.)

total Energy deposition in TrackerArHits



Total cross section per nucleon for pions in LAr



Smooth ride from here on!

