DUNE-PRISM tools

v0r2p0

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1.1 Data Structures

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2.1 EDep Struct Reference

Energy deposit and GENIE passthrough output tree.

Data Fields

- int stop

  The detector stop number used, refer to input xml for stop offsets.
- double vtx [3]

  [GENIE P/T]: The vertex 3-position in cm
- double vtxInDetX

  [GENIE P/T]: The X position of the vertex relative to the centre of a stop in cm.
- double XOffset

  [GENIE P/T]: The X offset of stop, stop in cm.
- TObjString ∗ EventCode

  [GENIE P/T]: The GENIE interaction code.
- double nu_4mom [4]
- double y_True

  [GENIE P/T]: The elasticity of the interaction.
- double Q2_True

[GENIE P/T]: The square 4-momentum transfer of the interaction.

- double FourMomTransfer_True [4]

  [GENIE P/T]: The full 4-momentum transfer of the interaction.
- double W_Rest

  [GENIE P/T]: The reconstructed invariant mass
- int nu_PDG

  [GENIE P/T]: The PDG MC code of the neutrino.
- int PrimaryLepPDG

  [GENIE P/T]: The PDG MC code of the primary lepton
- double PrimaryLep_4mom [4]

  [GENIE P/T]: The 4-momentum of the primary lepton
- int NLep

  [GENIE P/T]: The number of final state leptons in the event.
- int NPi0

  [GENIE P/T]: The number of final state neutral pions in the event.
- int NPiC

  [GENIE P/T]: The number of final state charged pions in the event.
- int NProton

  [GENIE P/T]: The number of final state protons in the event.
- int NNeutron

  [GENIE P/T]: The number of final state neutrons in the event.
- int NGamma

  [GENIE P/T]: The number of final state photons in the event.
- int NOther

  [GENIE P/T]: The number of final state other particles in the event.
- double EKinPi0_True

  [GENIE P/T]: The total kinetic energy of all neutral pions at the end of the GENIE simulation.
- double EMassPi0_True

  [GENIE P/T]: The total mass energy of all neutral pions at the end of the GENIE simulation.
- double EKinPiC_True

  [GENIE P/T]: The total kinetic energy of all charged pions at the end of the GENIE simulation.
- double EMassPiC_True

  [GENIE P/T]: The total mass energy of all charged pions at the end of the GENIE simulation.
- double EKinProton_True

  [GENIE P/T]: The total kinetic energy of all protons at the end of the GENIE simulation.
- double EMassProton_True

  [GENIE P/T]: The total mass energy of all protons at the end of the GENIE simulation.
- double EKinNeutron_True

  [GENIE P/T]: The total kinetic energy of all neutrons at the end of the GENIE simulation.
- double EMassNeutron_True

  [GENIE P/T]: The total mass energy of all neutrons at the end of the GENIE simulation.
- double EGamma_True

  [GENIE P/T]: The total energy of all photons at the end of the GENIE simulation.
- double EOther_True

  [GENIE P/T]: The total energy of all other particles at the end of the GENIE simulation.
- double Total_ENonPrimaryLep_True

  [GENIE P/T]: The total energy of all non-primary leptons at the end of the GENIE simulation.
- double LepDep_FV

  [GEANT4]: The total lepton energy deposited within the stops fiducial volume.
- double LepDep_veto

[GEANT4]: The total lepton energy deposited within the stops veto volume, but within the active LAr volume of the stop.

- double ProtonDep_FV

  [GEANT4]: The total proton energy deposited within the stops fiducial volume.
- double ProtonDep_veto

  [GEANT4]: The total proton energy deposited within the stops veto volume, but within the active LAr volume of the stop.
- double NeutronDep_FV

  [GEANT4]: The total neutron energy deposited within the stops fiducial volume.
- double NeutronDep_ChrgWAvgTime_FV

  [GEANT4]: The charge-weighted average time of all neutron deposites within the stops fiducial volume.
- double NeutronDep_veto

  [GEANT4]: The total neutron energy deposited within the stops veto volume, but within the active LAr volume of the stop.
- double NeutronDep_ChrgWAvgTime_veto

  [GEANT4]: The charge-weighted average time of all neutron deposites within the stops veto volume, but within the active LAr volume of the stop.
- double PiCDep_FV

  [GEANT4]: The total charged pion energy deposited within the stops fiducial volume.
- double PiCDep_veto

  [GEANT4]: The total charged pion energy deposited within the stops veto volume, but within the active LAr volume of the stop.
- double Pi0Dep_FV

  [GEANT4]: The total neutral pion energy deposited within the stops fiducial volume.
- double Pi0Dep_veto

  [GEANT4]: The total neutral pion energy deposited within the stops veto volume, but within the active LAr volume of the stop.
- double OtherDep_FV

  [GEANT4]: The total 'other' particle energy deposited within the stops fiducial volume.
- double OtherDep_veto

  [GEANT4]: The total 'other' particle energy deposited within the stops veto volume, but within the active LAr volume of the stop.
- double TotalNonlep_Dep_FV

  [GEANT4]: The total non-GENIE-simulated-lepton particle energy deposited within thestops veto volume, but within the active LAr volume of the stop.
- double TotalNonlep_Dep_veto

  [GEANT4]: The total non-GENIE-simulated-lepton particle energy deposited within thestops veto volume, but within the active LAr volume of the stop.
- bool LepExit

  [GEANT4]: Whether the primary lepton left the active stop volume.
- bool LepExitBack

  [GEANT4]: Whether the primary lepton left the active stop via the +Z face.
- bool LepExitFront

  [GEANT4]: Whether the primary lepton left the active stop via the -Z face.
- bool LepExitYLow

  [GEANT4]: Whether the primary lepton left the active stop via the -Y face.
- bool LepExitYHigh

  [GEANT4]: Whether the primary lepton left the active stop via the +Y face.
- bool LepExitXLow

  [GEANT4]: Whether the primary lepton left the active stop via the -X face.
- bool LepExitXHigh

  [GEANT4]: Whether the primary lepton left the active stop via the +X face.
- int LepExitTopology

[GEANT4]: The exit topology of the primary lepton.

- double LepExitingPos [3]

  [GEANT4]: The exit 3-position of the primary lepton.
- double LepExitingMom [3]

  [GEANT4]: The exit 3-momentum of the primary lepton.
- bool IsNumu

  [EVENT SUMMARY]: Whether interaction involved a (anti-) muon neutrino
- bool IsAntinu

  [EVENT SUMMARY]: Whether interaction an anti-neutrino
- bool IsCC

  [EVENT SUMMARY]: Whether interaction was charged current
- bool Is0Pi

  [EVENT SUMMARY]: Whether the GENIE simulation produced no final state pions.
- bool Is1PiC

  [EVENT SUMMARY]: Whether the GENIE simulation produced one final state charged pion.
- bool Is1Pi0

  [EVENT SUMMARY]: Whether the GENIE simulation produced one final state neutral pion.
- bool Is1Pi

  [EVENT SUMMARY]: Whether the GENIE simulation produced one final state pion.
- bool IsNPi

  [EVENT SUMMARY]: Whether the GENIE simulation produced multiple final state pions.
- bool IsOther

  [EVENT SUMMARY]: Whether the GENIE simulation produced other final state particles.
- int Topology

  [EVENT SUMMARY]: The summarised event topology
- bool HadrShowerContainedInFV

  [EVENT SUMMARY]: Whether the hadronic shower is contained within the stop fiducial volume.
- bool PrimaryLeptonContainedInFV

  [EVENT SUMMARY]: Whether the primary lepton deposits are contained within the stop fiducial volume.

2.1.1 Detailed Description

Energy deposit and GENIE passthrough output tree.

2.1.2 Field Documentation

2.1.2.1 double EDep::EMassNeutron_True

[GENIE P/T]: The total mass energy of all neutrons at the end of the GENIE simulation.

N.B. It is most often the case that the mass energy of nucleons was not created during the neutrino interaction or subsequent cascade. A proxy reconstructed neutrino energy will often not use this energy.

2.1.2.2 double EDep::EMassProton_True

[GENIE P/T]: The total mass energy of all protons at the end of the GENIE simulation.

N.B. It is most often the case that the mass energy of nucleons was not created during the neutrino interaction or subsequent cascade. A proxy reconstructed neutrino energy will often not use this energy.

2.1.2.3 double EDep::EOther_True

[GENIE P/T]: The total energy of all other particles at the end of the GENIE simulation.

N.B. These do not include GENIE bindinos or nuclear PDG codes. By eye, these are most often Kaons or Lambdas.

2.1.2.4 bool EDep::HadrShowerContainedInFV

[EVENT SUMMARY]: Whether the hadronic shower is contained within the stop fiducial volume.

N.B. This checks whether the total veto-region deposit is greater than the threshold passed by command line (or 10 MeV by default.). This can be fully recalculated given a different threshold by summing over the the XXXXDep_veto branches.

2.1.2.5 bool EDep::IsOther

[EVENT SUMMARY]: Whether the GENIE simulation produced other final state particles.

N.B. This is often due to gamma or kaon emission.

2.1.2.6 double EDep::LepDep_FV

[GEANT4]: The total lepton energy deposited within the stops fiducial volume.

N.B. This branch rolls up all deposits by all descendent particles in the GEANT4 simulation. i.e. This quantity will likely contain deposits from Michel electrons from stopped primary muon decays.

2.1.2.7 double EDep::LepDep_veto

[GEANT4]: The total lepton energy deposited within the stops veto volume, but within the active LAr volume of the stop.

N.B. This branch rolls up all deposits by all descendent particles in the GEANT4 simulation. i.e. This quantity will likely contain deposits from Michel electrons from stopped primary muon decays.

2.1.2.8 bool EDep::LepExit

[GEANT4]: Whether the primary lepton left the active stop volume.

N.B. This will track a primary electron, but that should shower very quickly. This branch is nominally designed for primary muons.

2.1.2.9 bool EDep::LepExitBack

[GEANT4]: Whether the primary lepton left the active stop via the +Z face.

N.B. This will track a primary electron, but that should shower very quickly. This branch is nominally designed for primary muons.

2.1.2.10 bool EDep::LepExitFront

[GEANT4]: Whether the primary lepton left the active stop via the -Z face.

N.B. This will track a primary electron, but that should shower very quickly. This branch is nominally designed for primary muons.

2.1.2.11 int EDep::LepExitTopology

[GEANT4]: The exit topology of the primary lepton.

- 0: Did not exit
- 1: Exit Back
- 2: Exit Front
- 3: Exit Y Low
- 4: Exit Y High
- 5: Exit X Low

- 6: Exit X High

N.B. This will track a primary electron, but that should shower very quickly. This branch is nominally designed for primary muons.

2.1.2.12 bool EDep::LepExitXHigh

[GEANT4]: Whether the primary lepton left the active stop via the +X face.

N.B. This will track a primary electron, but that should shower very quickly. This branch is nominally designed for primary muons.

2.1.2.13 bool EDep::LepExitXLow

[GEANT4]: Whether the primary lepton left the active stop via the -X face.

N.B. This will track a primary electron, but that should shower very quickly. This branch is nominally designed for primary muons.

2.1.2.14 bool EDep::LepExitYHigh

[GEANT4]: Whether the primary lepton left the active stop via the +Y face.

N.B. This will track a primary electron, but that should shower very quickly. This branch is nominally designed for primary muons.

2.1.2.15 bool EDep::LepExitYLow

[GEANT4]: Whether the primary lepton left the active stop via the -Y face.

N.B. This will track a primary electron, but that should shower very quickly. This branch is nominally designed for primary muons.

2.1.2.16 double EDep::NeutronDep_ChrgWAvgTime_FV

[GEANT4]: The charge-weighted average time of all neutron deposites within the stops fiducial volume.

N.B. This branch rolls up all deposits by all descendent particles in the GEANT4 simulation.

2.1.2.17 double EDep::NeutronDep_ChrgWAvgTime_veto

[GEANT4]: The charge-weighted average time of all neutron deposites within the stops veto volume, but within the active LAr volume of the stop.

N.B. This branch rolls up all deposits by all descendent particles in the GEANT4 simulation.

2.1.2.18 double EDep::NeutronDep_FV

[GEANT4]: The total neutron energy deposited within the stops fiducial volume.

N.B. This branch rolls up all deposits by all descendent particles in the GEANT4 simulation.

2.1.2.19 double EDep::NeutronDep_veto

[GEANT4]: The total neutron energy deposited within the stops veto volume, but within the active LAr volume of the stop.

N.B. This branch rolls up all deposits by all descendent particles in the GEANT4 simulation.

2.1.2.20 int EDep::NOther

[GENIE P/T]: The number of final state other particles in the event.

N.B. These do not include GENIE bindinos or nuclear PDG codes. By eye, these are most often Kaons or Lambdas.

2.1.2.21 double EDep::nu_4mom[4]

[GENIE P/T]: The 4-momentum of the incident neutrino in detector coordinates.

2.1.2.22 double EDep::OtherDep_FV

[GEANT4]: The total 'other' particle energy deposited within the stops fiducial volume.

N.B. This branch rolls up all deposits by all descendent particles in the GEANT4 simulation.

2.1.2.23 double EDep::OtherDep_veto

[GEANT4]: The total 'other' particle energy deposited within the stops veto volume, but within the active LAr volume of the stop.

N.B. This branch rolls up all deposits by all descendent particles in the GEANT4 simulation.

2.1.2.24 double EDep::Pi0Dep_FV

[GEANT4]: The total neutral pion energy deposited within the stops fiducial volume.

N.B. This branch rolls up all deposits by all descendent particles in the GEANT4 simulation.

2.1.2.25 double EDep::Pi0Dep_veto

[GEANT4]: The total neutral pion energy deposited within the stops veto volume, but within the active LAr volume of the stop.

N.B. This branch rolls up all deposits by all descendent particles in the GEANT4 simulation.

2.1.2.26 double EDep::PiCDep_FV

[GEANT4]: The total charged pion energy deposited within the stops fiducial volume.

N.B. This branch rolls up all deposits by all descendent particles in the GEANT4 simulation.

2.1.2.27 double EDep::PiCDep_veto

[GEANT4]: The total charged pion energy deposited within the stops veto volume, but within the active LAr volume of the stop.

N.B. This branch rolls up all deposits by all descendent particles in the GEANT4 simulation.

2.1.2.28 int EDep::PrimaryLepPDG

[GENIE P/T]: The PDG MC code of the primary lepton

i.e. the one that was born when the neutrino shed/absorbed an exchange boson

2.1.2.29 bool EDep::PrimaryLeptonContainedInFV

[EVENT SUMMARY]: Whether the primary lepton deposits are contained within the stop fiducial volume.

N.B. This is useful for checking whether electron neutrino events had contain EM showers, it is less useful for muon neutrino interactions.

N.B. This checks whether the total veto-region deposit is greater than the threshold passed by command line (or 10 MeV by default.). This can be fully recalculated given a different threshold by summing over the the LepDep_veto branch.

2.1.2.30 double EDep::ProtonDep_FV

[GEANT4]: The total proton energy deposited within the stops fiducial volume.

N.B. This branch rolls up all deposits by all descendent particles in the GEANT4 simulation.

2.1.2.31 double EDep::ProtonDep_veto

[GEANT4]: The total proton energy deposited within the stops veto volume, but within the active LAr volume of the stop.

N.B. This branch rolls up all deposits by all descendent particles in the GEANT4 simulation.

2.1.2.32 int EDep::stop

The detector stop number used, refer to input xml for stop offsets.

N.B. When overlapping stops are defined the event is randomly placed within one of the overlapping stops at the interaction position. The choice is weighted by the POTExposure branch in the input run plan xml.

2.1.2.33 int EDep::Topology

[EVENT SUMMARY]: The summarised event topology

Negative numbers indicate NC interactions.

- 1 : 0Pi
- 2 : 1PiC
- 3 : 1Pi0
- 4 : NPi
- 5 : other

2.1.2.34 double EDep::TotalNonlep_Dep_FV

[GEANT4]: The total non-GENIE-simulated-lepton particle energy deposited within thestops veto volume, but within the active LAr volume of the stop.

N.B. This branch rolls up all deposits by all descendent particles in the GEANT4 simulation.

2.1.2.35 double EDep::TotalNonlep_Dep_veto

[GEANT4]: The total non-GENIE-simulated-lepton particle energy deposited within thestops veto volume, but within the active LAr volume of the stop.

N.B. This branch rolls up all deposits by all descendent particles in the GEANT4 simulation.

2.1.2.36 double EDep::W_Rest

[GENIE P/T]: The reconstructed invariant mass

N.B. This assumes that the target nucleon was at rest and will not be the same W as thrown by the event generator during the cross-section calculation (single-pion production).

The documentation for this struct was generated from the following file:

- /home/luke/projects/DUNEPrismTools/G4ArSimulationTools/EDepTreeReader.h

2.2 FlatHistTMatrixD Struct Reference

2.2.1 Detailed Description

-n Nominal.root -f Nominal.far.root -v Name,Up.root,Down.root,FarUp.root,Down.root -E 3 -X 35 -M 1 -o Output.root

The documentation for this struct was generated from the following file:

- /home/luke/projects/DUNEPrismTools/src/app/BuildUncertaintyMatrix.cxx

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