Variables needed to calculate Lorentz Angle

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June 8, 2017

Abstract

We are proposing names of variable based upon the calculation that we have done and few documents that we are using as literature since we have started our work. The links and references corresponding literartures are given below in the reference section. We have collected some slides from different places but links to those are not defined instead those slides are very usefule. Keeping in mind importance of those slides we will give snapshot of the title page in the reference.The SiStripTree format, also called ShallowTree, is a common data format used by the SiStrip simulation, local reconstruction and calibration group. The aim of the data format is to provide easy access to the quantities used for the tasks performed by the group, in a way as backward/forward compatible as possible. The source code of the framework to produce these trees is located in the CMSSW sub-package CalibTracker/SiStripCommon. Official links are,
https://twiki.cern.ch/twiki/bin/viewauth/CMS/SiStripTreeFormat.
https://twiki.cern.ch/twiki/bin/view/CMS/LorentzAngle

1.Variables from ShallowClusterProducer

This module dumps information relative to all the clusters, no matter if they were used to build a track or not.

- Prefix: ShallowClusterProducer_cfi.py-*cluster*
(/CalibTracker/SiStripCommon/python/)
- Process: *'keep *_shallowClusters_clusterdetid_*'*
(/CalibTracker/SiStripLorentzAngle/python/ntuple_cff.py)

Name of the *variables* are,

- detid: Detector index.
- number: Cluster number: [0] global number, [≠0] number per subdetector_id.
- module: Moduleid.
- width: Number of strips forming cluster.
- variance: $\sigma^2 = \frac{\sum_{strips=i}^{i+1} x^2 q_i}{\sum_{strips} q_i} - (\frac{\sum_{strips=i}^{i+1} x q_i}{\sum_{strips} q_i})^2$ where q is charge and x is local x position of track.
- layerwheel: Layer for the barrel subdetectors / wheel for the endcap subdetectors.

- side: Side.
- seedcharge: Value of the maximum charge deposite on the strip cluster.
- ston: Signal Over Noise, e.g. charge over cluster noise rescaled by gain.
- noise: cluster noise rescaled by the gain, e.g. after computing Noise/APV_gain for each cluster strip, sum in quadratue all terms corresponding to strip then noise = sqrt(quadratic_sum/N_elements).
- seedindex: Strip Number (within cluster) having the maximum charge.
- seednoise: Noise rescaled by gain of the strip having the maximum charge deposit.

2. Variables from ShallowTrackClusterProducer

Computes quantities related to on-track clusters, i.e. clusters associated to a reconstructed track. Additionaly builds the necessary links to reach the corresponding tracks and general cluster informations in both directions.

- Prefix:ShallowTrackClusterProducer_cfi.py-*tsos*
  (/CalibTracker/SiStripCommon/python/)
- Process: *'keep *_shallowTrackClusters_tsostrackmulti_*'*
  (/CalibTracker/SiStripLorentzAngle/python/ntuple_cff.py)

Name of the *variables* are,

- onTrkClusterIdx: link: general cluster info→on track cluster.
- onTrkClustersBegin: link: track→onTrkInfo (range).
- onTrkClustersEnd: link: track→onTrkInfo (range).
- trackmulti: Number of tracks matched to the cluster (can be>1), all cluster stuff is related to the first match found .
- trackindex: link: on trk cluster→ track index.
- clusterIdx: on trk cluster→ general cluster info.
- localpitch: Strip pitch at impact points.
- globaltheta: theta of trajectory on module in global coordinates
- globalphi: phi of trajectory on module in local coordinates
- localtheta: theta of trajectory on module in local coordinates
- localphi: phi of trajectory on module in local coordinates
- global x,y,z: x,y,z of trajectory on module in global coordinates
- local x,y,z: local x,y,z position of the cluster with respect to the detector module frame.

- strip: Strip index corresponding to the position of the intersection of the trajectory with the module.
- projwidth: tan(localtheta)*cos(localphi).
- BdotY: Local-y projection of the magnetic field (in Tesla) on the module surface.
- globalZofunitlocalY: global z projection of unitary local vector (0,1,0)
- drift x,y,z: expected Lorentz drift along x,y,z.

3. Variables from ShallowTrackProducer

- Prefix:ShallowTrackProducer_cfi.py-*track* (/CalibTracker/SiStripCommon/python/)
- Process: *'keep *_shallowTracks_tsostrackmulti_*'* (/CalibTracker/SiStripLorentzAngle/python/ntuple_cff.py)

Name of the *variables* are,

- number: Number of tracks in the event.
- chi2: reco::Track::χ^2() χ^2 of the track fit.
- ndof: reco::Track::ndof() number of degrees of freeedom of the track fit.
- chi2ndof: normalized χ^2, $\frac{\chi^2()}{ndof()}$.
- charge: reco::Track::charge().
- momentum: momentum reco::Track::p().
- pt: reco::Track::pt().
- hitsvalid: reco::Track::numberOfValidHits() number of valid hits in the tracker.
- hitslost: reco::Track::numberOfLostHits() number of missing hits in the tracker.
- theta: reco::Track::theta().
- phi: reco::Track::phi().
- eta: reco::Track::eta().
- dxy: reco::Track::dxy() transverse impact parameter w.r.t the reference point.
- dsz: reco::Track::dsz() impact paramenter in the SZ plane w.r.t. the reference point.

In CalibTracker/SiStripLorentzAngle/python/ntuple_cff.py we can define all variables what we need with proper syntax, viz,*'keep *_shallowTracks_tsostrackmulti_*'*. The process is not defined here so that we have included another script *lantuple.py* written by *Mauro Verzetti*. After running these scripts under *cmsRun* we are getting a ntuple with low statistics. So we need to include all these variables in calibration tree which comes with in general Gain Calibration Tree and anEff. All variables that we have collected based upon different literatures. This list of variables comes with some prepared variables say for examples variance and from the list by implementing theoretical definitions we can manipulate other variables to prepare the same variance. There will be a slight difference in statistics because of manipulation. The list is long because few variables are necessary for correction factor raise of tiltedness of stereo detectors with respect to mono detectors, few are being used to set cut-offs and few of them will be using to select cluster associated with track. A good cluster is defined as number of strips would be 2 or 3 which are forming cluster. The existing clusterwidth is being produced by ShallowClusterProducer which dumps all information about clusters, no matter if they were used to build a track or not. So we need a new variable which will carry both the criteria of good cluster as well as reconstructed events(cluster associated with track).

-cmsrel CMSSW_8_0_12
-cd CMSSW_8_0_12/src
-cmsenv
-git-cms-addpkg CalibTracker
-cd CalibTracker
-scramv1 b -rj20
-cd SiStripLorentzAngle/python
-emacs/vim/nano -nw ntuple_cff.py
-define variables you need in the following way
-*'keep *_shallowTracks_tsostrackmulti_*'*
-git clone https://gist.github.com/mverzett/d6bde8ed6e6dec8a5ff4.git
-cmsRun lantuples.py

5. CalibTracker/SiStripLorentzAngle Pacakge

We have copied the whole package of CalibTracker in CMSSW_8_0_12/src. The problem is this package is showing it has updated 4 years ago in github. So many file (pythons scripts) are giving different kind of fatal errors. The file I am using to book ntuple is working in my local area. We think this whole package need to updated.

5. References

- Lorentz-Angle in irrediated Silicon, B. Henrich, R. Kaufmann,
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- https://indico.cern.ch/event/63615/contributions/1222515/attachments/1008855/1435255/presentation.pdfsearch=betchart
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