Global PID

MICE CM 44

Software Session

Celeste Pidcott

Outline

- Status of PID
- Producing PDFs
- MC for PDFs
- Using PID
- PID Variables

Status of PID

- PID framework, variables, and example scripts for using PID in MAUS.
- Most up-to-date PID work can be found in my branch lp:~c-e-pidcott/maus/1389a.
- Collection of PID variables, for Step IV and commissioning, now exists, using all detectors.
- Updates to MAUS user guide should be in next release.

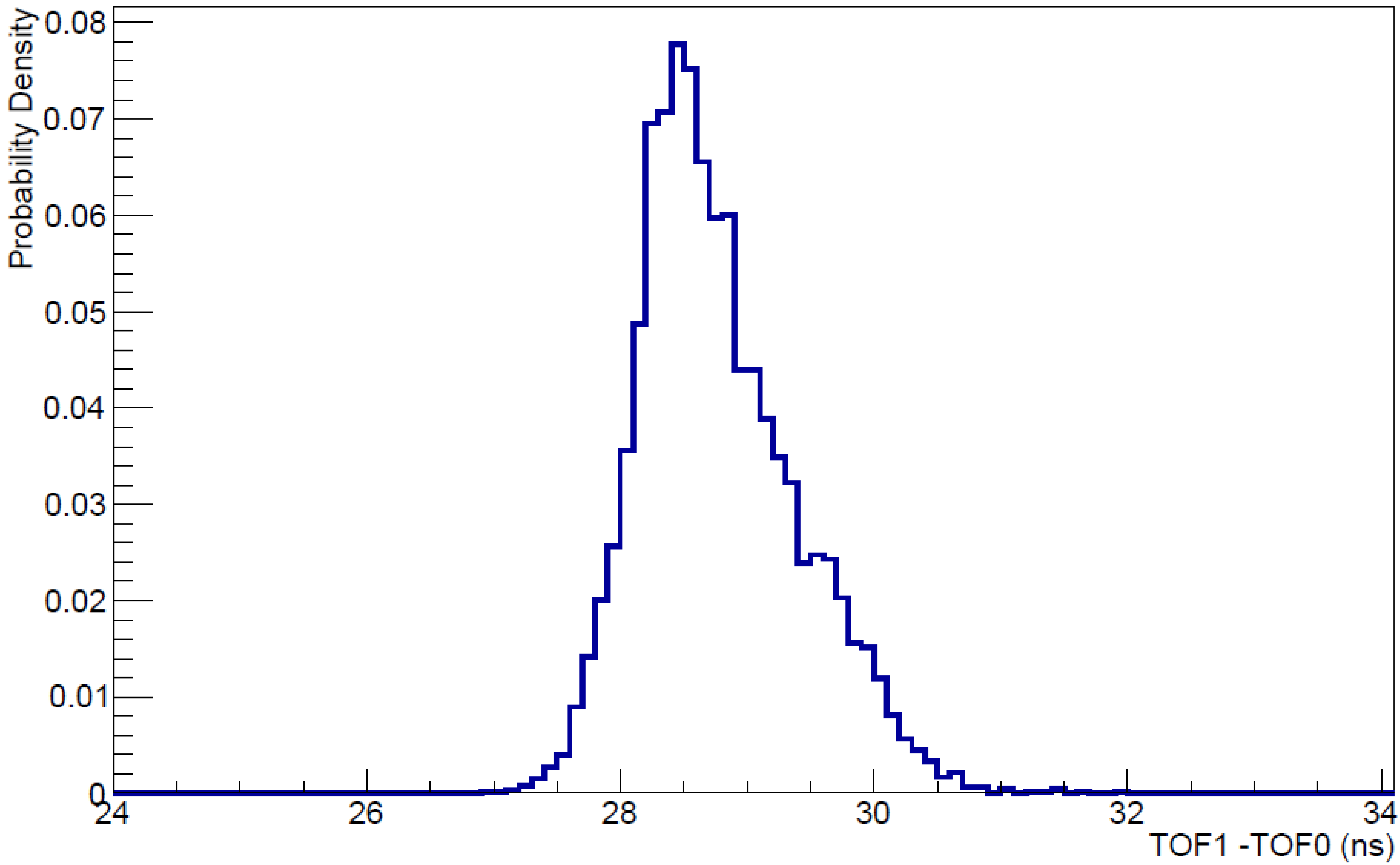
Producing PDFs

- PDF production performed using pid_pdf_generator.py in bin/Global
- pdf_example_datacard.py contains the datacards that the user should set and explains their purpose.
- PDFs are saved to files/PID, and can be combined into a single file using hadd.
- Datacards of particular note are:

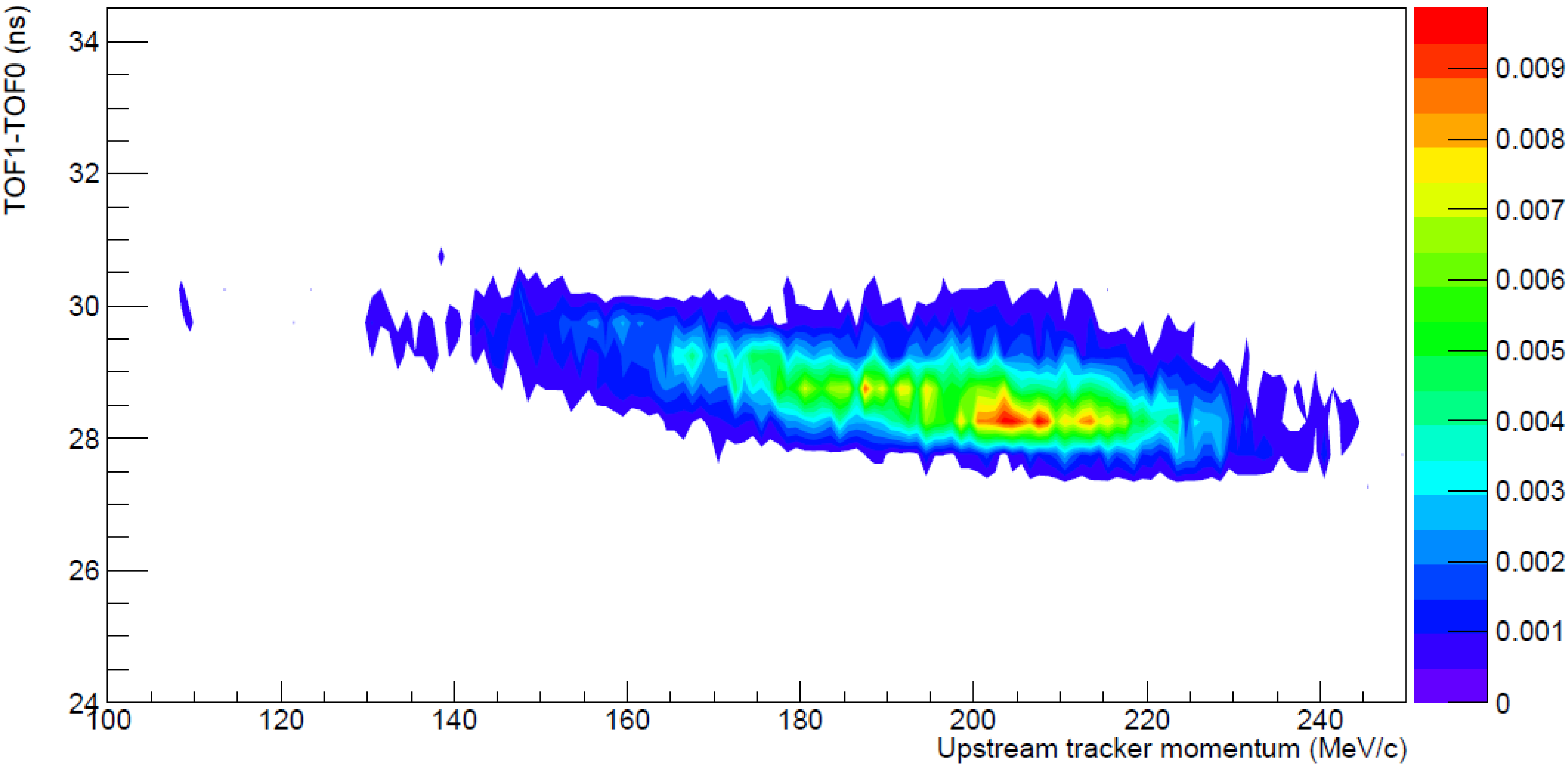
Producing PDFs

- pid_config defines which set of variables (commissioning or step_4) to make PDFs for.
- pid_beam_setting is used in both PDF production and PID to tag the PDFs/select the PDFs. To perform PID against a set of PDFs, these tags must match.

Example muon PDFs for old 7469 MC – Time of flight



Example muon PDFs for old 7469 MC – TOF vs Tracker mom



MC for PDFs

- Low numbers of e/pi in MC beams mean insufficient statistics for e/pi PDFs.
- Need a way to produce more e/pi that are representative of those in original MC.
- Current plan is to use xboa to get beam parameters from particles in MC to use as input to InputPySpillGenerator.
- However haven't been able to test this properly due to separate issues with MC.

Using PID

- PID performed using GlobalPID.py in bin/Global
- pid_example_datacard.py contains the datacards that the user should set and explains their purpose.
- Datacards of particular note are:

Using PID - input

- PID_PDFs_file file containing PDFs.
- pid_config defines which set of variables (commissioning or step_4) to perform PID for.
- pid_mode selects within those sets of variables which ones to actually use. Can be “offline”, “online”, or “custom” (however custom should only really be used in PID development, not general use).

Using PID - input

- pid_beam_setting is used in both PDF production and PID to tag the PDFs/select the PDFs. To perform PID against a set of PDFs, these tags must match.
- pid_confidence_level sets the margin (in %) between the confidence levels of competing particle hypotheses before one is selected as the correct hypothesis.

Using PID - input

- pid_track_selection allows the user to choose which tracks from TrackMatching to run PID against. Can be all tracks, all US or all DS tracks, through tracks, or the US or DS constituent tracks of the through tracks.

Using PID – input/output

- TrackMatching supplies multiple potential tracks to the PID, each with an assigned pid.
- The PID clones these tracks, into Candidate PID tracks, and performs PID on each of them.
- Each candidate track is then assigned an object that holds the likelihoods for each hypothesis.

Using PID – output

- The confidence level for each hypothesis is calculated for the track. If the confidence level of a given hypothesis clearly distinguishes it from the others, this is set as the pid of the candidate track.
- If the pid of the candidate track matches the pid of the original trackmatching track, then this is taken to be the correct track, and is added to the global event as the Final PID track.

Using PID - output

- All candidate tracks are retained by the event, so that during analysis they can be referred back to by the user.
- The output track can be obtained by looping over global tracks, and selecting tracks with mapper names containing "MapCppGlobalPID-Final".

PID Variables - Straight tracks

Class Name	Variable Name	Description
ComPIDVarA	diffTOF1TOF2	TOF1-2 time of flight.
ComPIDVarB	KLChargeProdvsDiffTOF1TOF2	KL ADC charge product and TOF1-2 time of flight.
ComPIDVarC	CommissioningKLADCChargeProduct	KL ADC charge product.
ComPIDVarD	CommissioningEMRRange	Range of particle in EMR.
ComPIDVarE	CommissioningEMRRangevsDiffTOF1TOF2	Range of particle in EMR and TOF1-2 time of flight.
ComPIDVarF	CommissioningEMRDensity	Plane hit density in EMR.
ComPIDVarG	CommissioningEMRDensityvsDiffTOF1TOF2	Plane hit density in EMR and TOF1-2 time of flight.
ComPIDVarH	CkovAvsDiffTOF1TOF2	Number of photoelectrons in CkovA and TOF1-2 time of flight.
ComPIDVarI	CkovBvsDiffTOF1TOF2	Number of photoelectrons in CkovB and TOF1-2 time of flight.

PID Variables - Helical tracks

Class Name	Variable Name	Description
PIDVarA	diffTOF1TOF0	TOF0-1 time of flight.
PIDVarB	diffTOF0TOF1vsTrackerMom	TOF0-1 time of flight and momentum measured in upstream tracker.
PIDVarC	KLChargeProdvsDSTrackerMom	KL ADC charge product and momentum measured in downstream tracker.
PIDVarD	KLADCChargeProduct	KL ADC charge product.
PIDVarE	EMRRange	Range of particle in EMR.
PIDVarF	EMRRangevsDSTrackerMom	Range of particle in EMR and momentum measured in downstream tracker.
PIDVarG	EMRDensity	Plane hit density in EMR.
PIDVarH	EMRDensityvsDSTrackerMom	Plane hit density in EMR and momentum measured in downstream tracker.
PIDVarI	CkovAvsUSTrackerMom	Number of photoelectrons in CkovA momentum measured in upstream tracker.
PIDVarJ	CkovBvsUSTrackerMom	Number of photoelectrons in CkovB momentum measured in upstream tracker.

Summary

- Number of updates to use and functionality of PID.
- Plan to produce MC input for PDFs.
  - Once done efficiency and purity studies can start right away, scripts etc. ready to go.
- PID variables now include all detectors.
- Example scripts to produce PDFs and use PID in MAUS, updates to user guide written and to be pushed soon.