PID Selectors Status

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- PID selectors in a nutshell
- Issues & fixes
- Next steps

PID in FastSim

- Directly related packages
  - **PacDirc**: DIRC-like PID barrel simulation
  - **PacForwardPid**: Forward PID code (designs, simulation and reco.)
  - **PacPid**: Definitions of PID selectors and sequences
  - **PacPidCalib**: Tools to test selectors using clean track samples
  - **BetaMicroAdapter**: Containers with basic detector (⊃ PID) info.

  ] + all packages from systems providing input information to the selectors

- Documentation in the SuperB wiki: (likely not up-to-date)
  - **PacPid** http://mailman.fe.infn.it/superbwiki/index.php/FastSimDoc/PID_simulation#PacPid
  - General documentation http://mailman.fe.infn.it/superbwiki/index.php/FastSimDoc/PID_simulation

- 'Real' (= not based on truth information) selectors
  - **PacPidFirstElectronSelector**: Piti *et al.*, frozen since September
  - **PacPidCutsMuonSelector**: Marcello *et al.*, needs tuning (← FullSim)
  - **PacPidLHPionSelector**
  - **PacPidLHKaonSelector**

  } Leonid *et al.*; various inputs: SVT, DCH, PID
  → Cuts to be retuned when inputs change

- **PacPidTableBasedSelector**: Leonid + Alejandro
  - Generalize **PacPidTruthBasedSelector**
  - New tables soon: more bins + variable bin width to match detector boundaries

Tools to test PID selectors

- **PacPidCalib** package
  → Development by Piti and Leonid after initial commits by NA
- Twofold goal:
  - To test the selector performances: efficiency and misID rates
  - To test the (hadron) selector inputs: SVT & DCH dE/dx, θ_C and N_γ from DRC, etc.
- Single track generator: generation flat in momentum and $\cos(\theta_{lab})$
  → angular-integrated results need reweighting before physics use

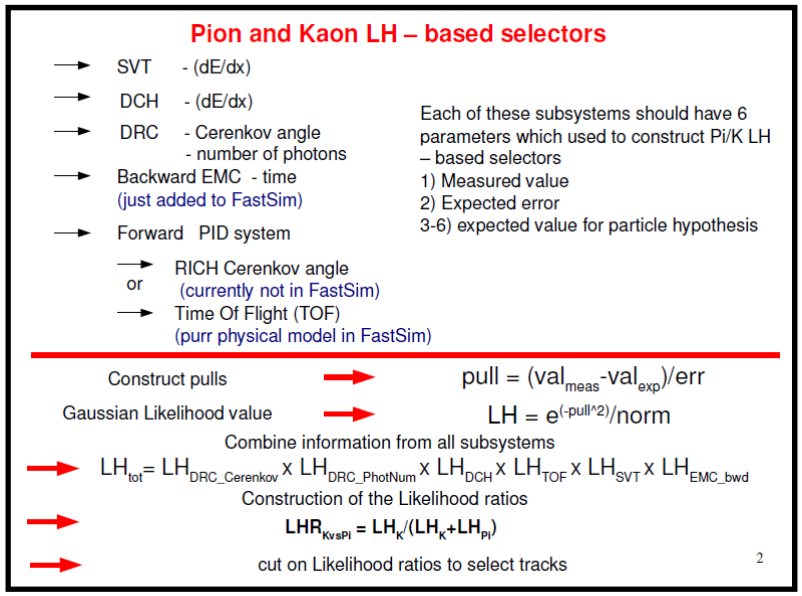
Example tcl snippet extracted from **PacPidCalib/PacPidCalibMC.tcl**

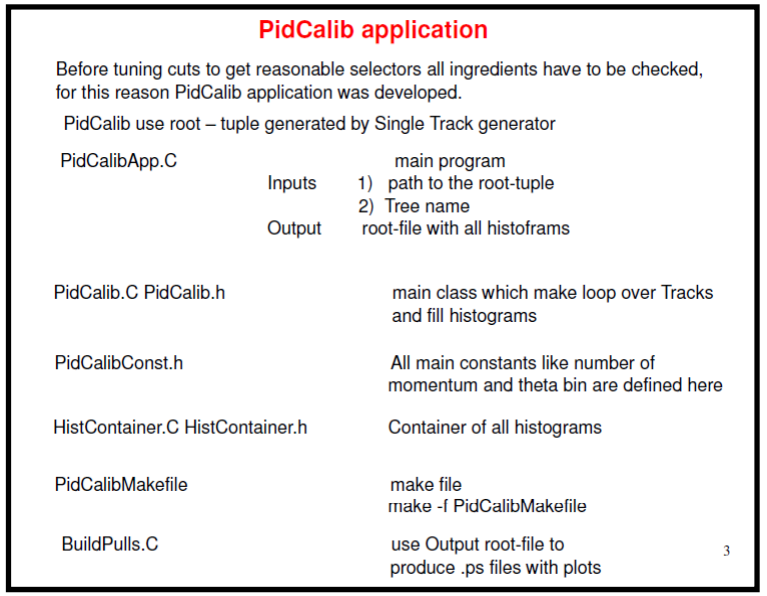
```
(…)
disableGenerators 0
module enable GfiSingleParticle

talkto GfiSingleParticle {
  GENERATE set $particleType   <-- « K+», «π-», etc.
   Pmin set 0.4
   Pmax set 5.0
   usePt set false
   CosThetamin set -0.98
   CosThetamax set 0.98
   ipX set 0
   ipY set 0
   ipZ set 0
   ipT set 0.0
}
(…)
```

Tools to test PID selectors (cont'd)

- Check of selector inputs: see Leonid's talk @ Frascati for details

  http://agenda.infn.it/getFile.py/access?contribId=116&sessionId=33&resId=0&materialId=slides&confId=1165





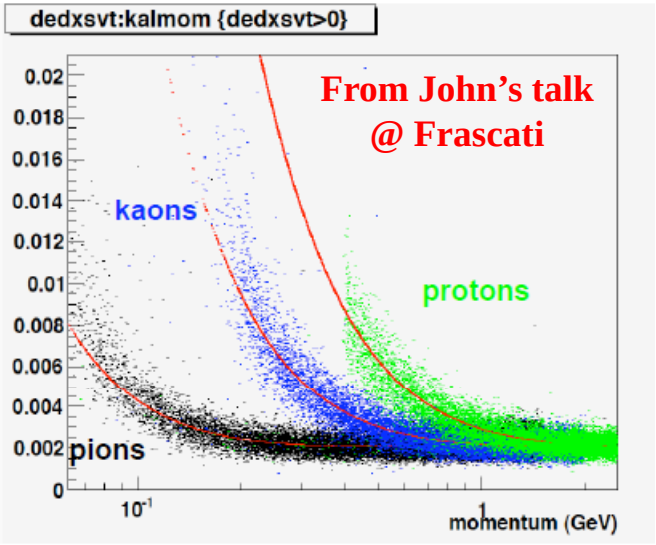
→ Classes, macros and execution script to be put in SVN soon

→ Wiki documentation to be updated accordingly

- 'Quality' of selectors checked by comparing 'FastSim BaBar configuration' with the performances of actual selectors in BaBar.

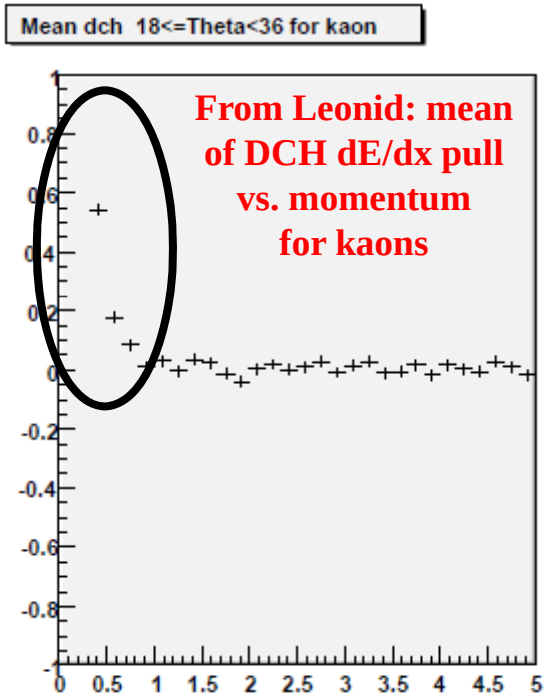
Status of SVT contribution for PID

- SVT dE/dx code developed by John; feedback by Leonid *et al.*
- $(dE/dx)_{expected}$ flawed for first implementation
  → Cuts had to be retuned when SVT input was added to the LH selectors
  - This selector configuration was used for the November production
  → Re-tuning mandatory before next production [true for any significant change]
- Problem fixed but strong θ-dependence found for $(dE/dx)_{measured}$
  → see John's talk @ Frascati
  - Work in progress to fix this or account for this effect when computing $(dE/dx)_{expected}$
- Looking again at John's presentation:
  is there a bias at low momentum?
  → Effect of momentum reconstruction?
  [See next slide]



Status of DCH contribution for PID

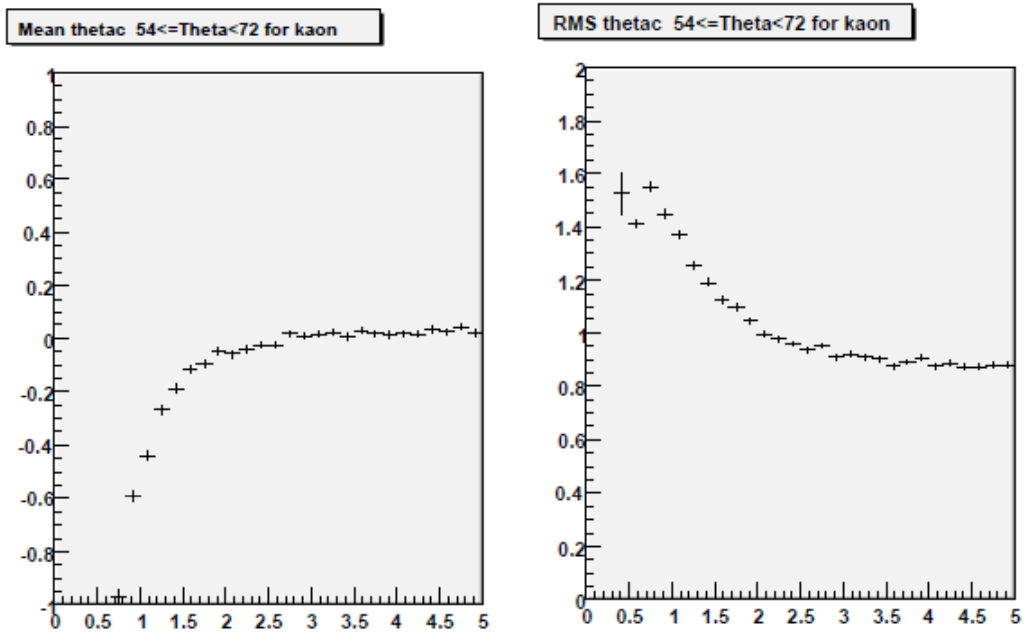
- DCH dE/dx code developed by Matteo; feedback by Leonid *et al*.
- Current implementation is quite satisfactory: pulls of mean ~0 and RMs ~1
- Bias at low momentum: $(dE/dx)_{measured} > (dE/dx)_{expected}$ mainly for kaons and protons
- Investigated by Matteo: dE/dx code OK, problem seems to come from a bias in the momentum reco, $p_{reco} > p_{true}$
- Two possible fixes for this problem:
  - improve the low momentum reconstruction
  - parameterize the bias and include it in the dE/dx simu.



→ Selector inputs to be re-checked after commit of a ‘fix’;
→ Need to retune LH selector cuts then.

Status of DRC contribution for PID

- Developments by Rolf *et al.*; feedback by Leonid *et al.*
- New simulation classes (**`PacSimpleDircModel`** and **`PacSimpleDircFitter`**) written at the end of Summer to fix features in the θ_C pull distributions coming from the fact that the full Kalman fit was OFF in the simulation to save execution time
  → Default algorithm since then
- Pulls still not perfect though
  - Leonid's observations not confirmed by Rolf !?
    → To be sorted out
- Full Kalman fit to be turned ON for next production
  → Dirc will switch back to **`PacDircFitter`** class
  → Crosschecks needed
  → Selectors to be retuned at the end



From Leonid: pull mean and RMS vs. momentum for K in a particular θ range: 54 → 72 degrees

News from the Forward PID

- DIRC-like TOF being simulated in Geant4 (Leonid et al., including Ukrainian folks)
  - Standalone simulation to test and improve the detector layout
    → Should benefit to FastSim sometimes in the future
  - Simple layout put in Bruno with Eugenio's help to get background estimations

- Implementation of FARICH in FastSim in progress (see previous Nsk. presentation)

- Detector configurations w/o any forward PID detector give 'minimal' PID performances (= just dE/dx outside of the DRC acceptance)
- Table-based Kaon selector 100% efficient in the forward region can show the maximum 'physics' gain expected by a particular analysis

→ Effect of an actual PID selector should be in between

- Open question: how to link the LH selector cuts with the detector configuration?
  → Should the likelihood ratio cuts depend on the tested configuration?
  [For now they don't…]

- Short time before next production and limited manpower: priorities to be identified

Other items to be discussed

- Not much feedback from users about the e^-/γ selector
  → Still very simple: cuts-based + using only a few calorimeter variables
  → Comparison with table-based selector to be performed soon

- Backward calorimeter
  - Chih-hsiang showed at Frascati that it can't really be used to reconstruct π^0
  - But its timing performances (~100 ps!?) could make it a decent TOF detector to separate π and K which have mostly low momentum in the backward side

  → Including it in the LH selectors would be interesting.
  → Question: is timing information ($t_{measured} + \sigma_t$) from bwd calo available in FastSim?

- Muon selector [Update from Marcello, this afternoon ☺]
  - Goal for Feb. production is to tune the hadronic shower sim. to match the FullSim
    → Tails + energy dependence of the shower length
  - Tuning the selector should be easy when previous step is completed

- PID & Tagging
  - Are current PID lists suitable for (and correctly used by) the tagging algorithm? [There are 4 (5) 'tightness levels' for the LH π (K) selectors]

  → Can contribute to this topic but not an expert…

Outlook

- PID in FastSim still evolving quickly
  - Improved (and more numerous) inputs from systems
  - Selectors (especially for hadrons) being worked on
  - New tools to debug/test/understand the selector performances

- Need to define a coherent path to prepare the February production
  - ❶ Systems commit their changes to SVN
  - ❷ LH Selector inputs are checked and validated
  - ❸ LH Selectors get tuned; the results of the optimization are commited to SVN

It's snowing in Paris area since this morning…