

# Status of electron ID with ECL

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# Plan at November GM

## Conclusions (short term Plan)

- Belle II software design prefers the concept of Relations among objects w.r.t. object composition
  - Done →
    - Write code to make a `RelationArray<Track , ECLShower>` in the data-store
    - Done in my private release. Need to coordinate with `ECLGamma` object creation
  - Done → • Implement a first version of electron ID Likelihood
    - e/p only →
      1. E/p and E9/E25 are enough for a first prototype.
      2. Study the possible parametrizations the PDF and fit them on MC samples of single particles or BB events.
    - Single part. →
    - Done →
      3. Provide a `ECLPidLikelihood` class and a module that make the object based on results of point 2
    - Done →
      4. Update the `PIDLikelihood` class in reconstruction software to include ECL
  - In reconstruction Chain now → • At the end of this process e-ID will be in the reconstruction/analysis software (see T. Khur plenary talk on wednesday)

# Status

- Set up a the basic framework to build costruct a PID likelihood with ECL information compliant with the general Belle II PID strategy
- First prototype
  - Provides the complete information expected by Belle II Reconstruction
  - Simple implementation:
    - Pdfs for electrons, muons and hadrons(pions)
    - P.d.f of e/p only
    - Momentum dependent (coarse binning)
    - Calibrated with single particle MC

# Pdf classes in ecl/electronId

- An ECLAbsPdf abstract interface with two methods
  - Init(const char\*) to load the pdf parameters
  - pdf(double eop, double p) to calculate a momentum dependent p.d.f. based on e/p only
- ECLElectronPdf implementation for electrons
  - Crystall ball + gaussian
- ECLMuonPdf implementation for muons
  - Bifurcated gaussian + gaussian
- ECLPionPdf implementation for pions
  - Muon-like pdf + gaussian

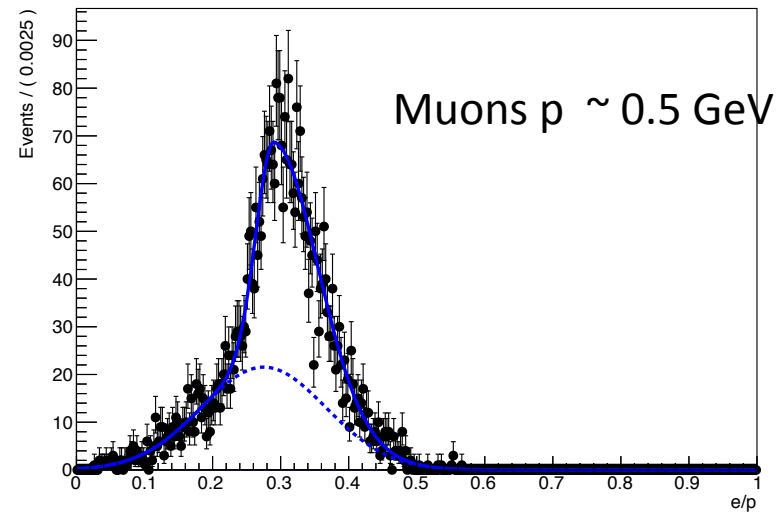
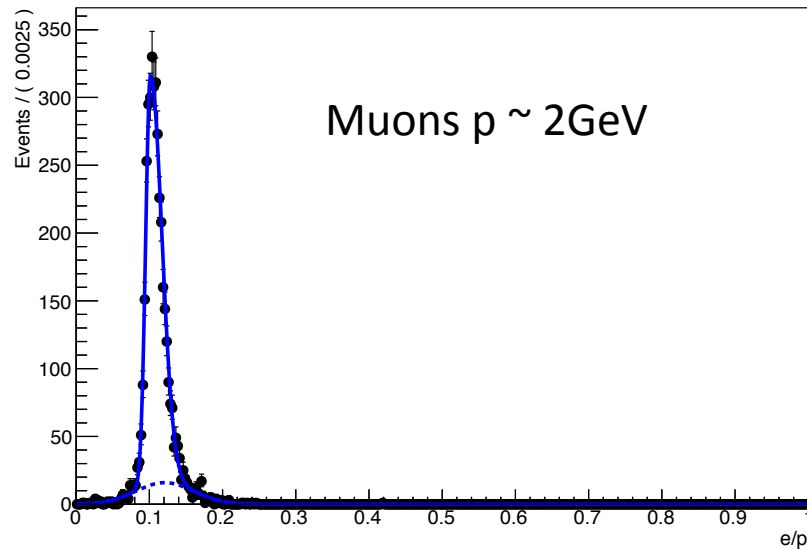
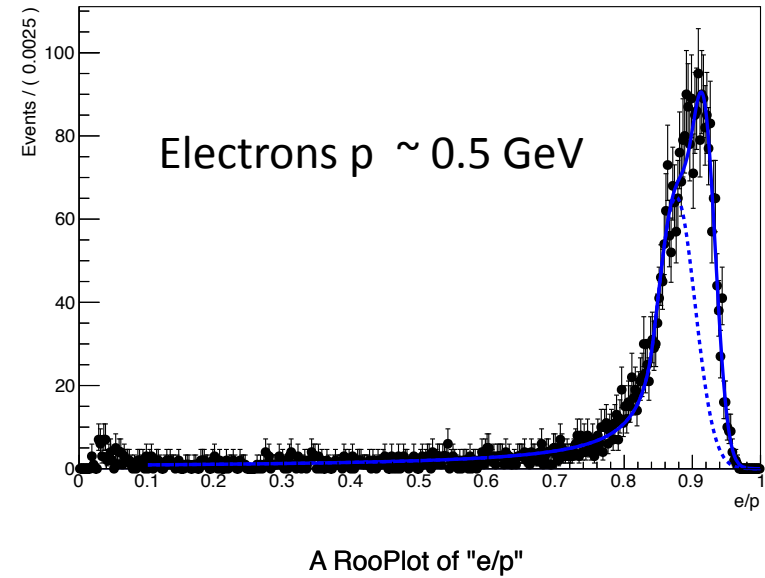
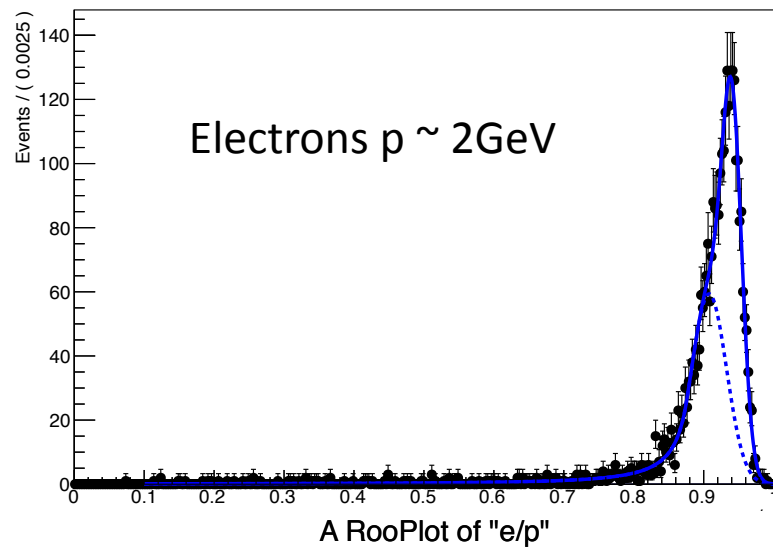
# Modules added to ecl package

- ECLTrackShowerMatch
  - Associates tracks to ecl showers using ext package output
- ECLEElectronId
  - Create and fill an ECLPidLikelihood structure with logLike values for each charged track hypothesis
  - Store ECLPidLikelihoods objects and their Relations with tracks in the Event Store
- The Belle II reconstruction chain includes now the ECL info in the PidLikelihood

# Electrons and muons pdf

eop

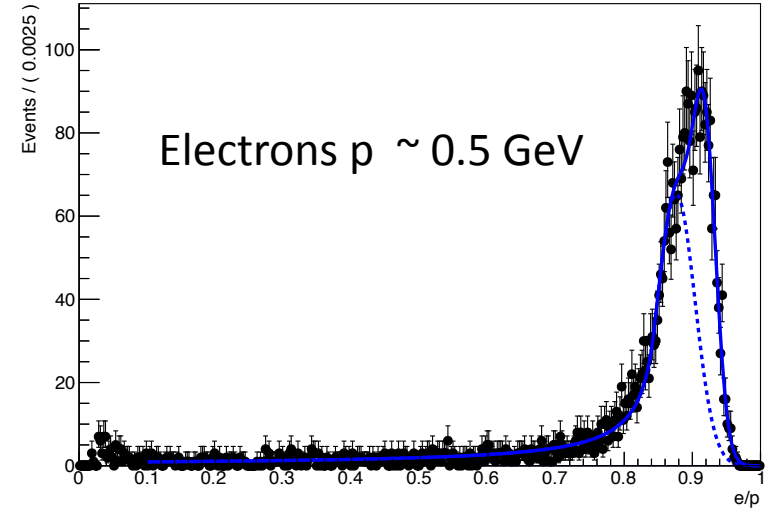
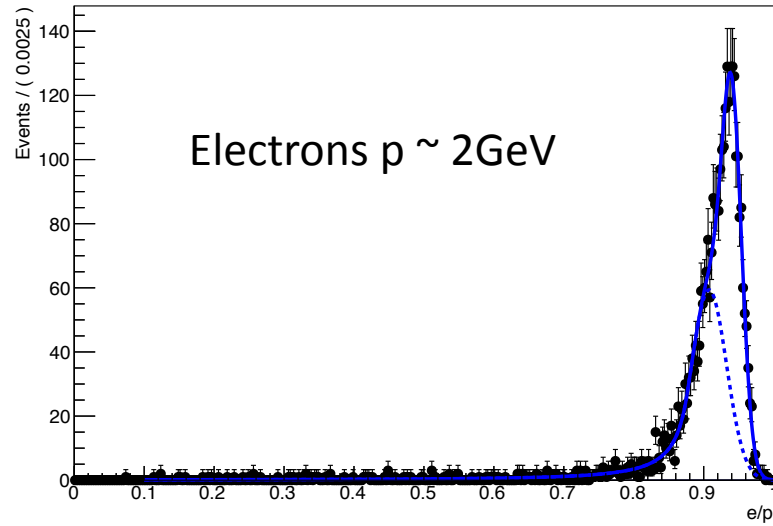
ecp



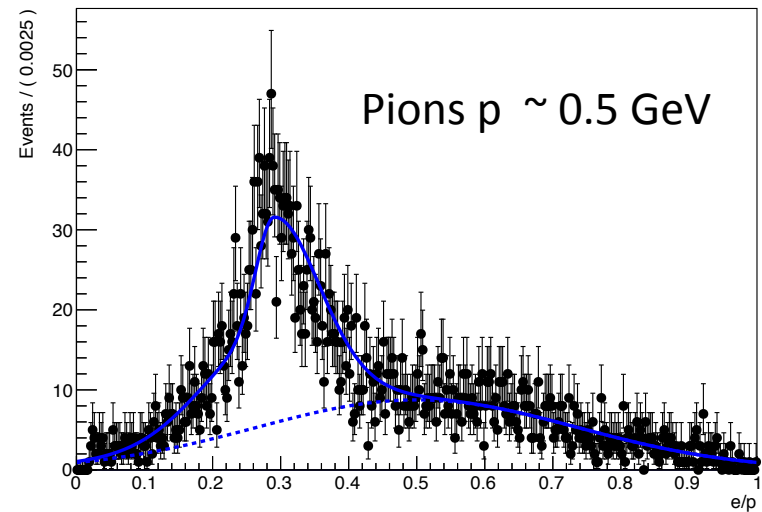
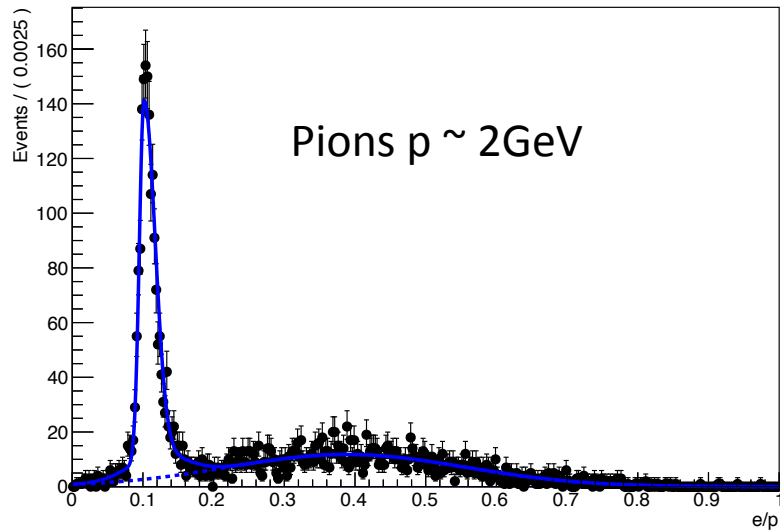
# Electrons vs pions pdf

eop

eop



eop



# Next steps

- Other functions for p.d.f. may be tried
  - Current one look accurate enough
- Produce higher statistics MC sample to calibrate p.d.f.
  - Finer momentum binning, add angular dependence
  - Add explicitly kaons, protons and anti-protons
  - Check charge dependence?
- Include more variables to improve pion rejection
  - We have a plethora of candidates for lateral shape from Belle and BaBar
  - Correlations must be studied
- Currently p.d.f. parameters are stored in a plain data file
  - Write software to get them from an appropriate database



# More work

- Study data control samples that will be used
  - To calibrate the p.d.f.
  - To measure efficiencies and mis-ids
- Study the impact of PID in interesting physics cases
- Study details of reconstruction effects
  - Track-shower matching efficiency, split-offs,...

# People involved

- Are you ready to have fun?
- i.e. it's time to get organized to minimize the painful part of the job and really enjoy the fun part.

# ECL Software

- We just started bi-weekly ECL software meetings on Friday 9.30 AM (in Italy)
  - Forum for all the ECL software related activities
  - Had already two meetings
- Current hot topic: ECL mdst definition
  - Belle II equivalent of BaBar “micro”
    - Actually much less info is foreseen
    - What really an analysis is expected to be based upon.