Overview

- Status: PID in the BaBar-like software
  - ➔ for individual detectors
  - ➔ global PID
- $\bar{p}\,p \rightarrow e^{+}\,e^{-}$
  - ➔ preliminary results
  - ➔ detector studies

PID with EMC

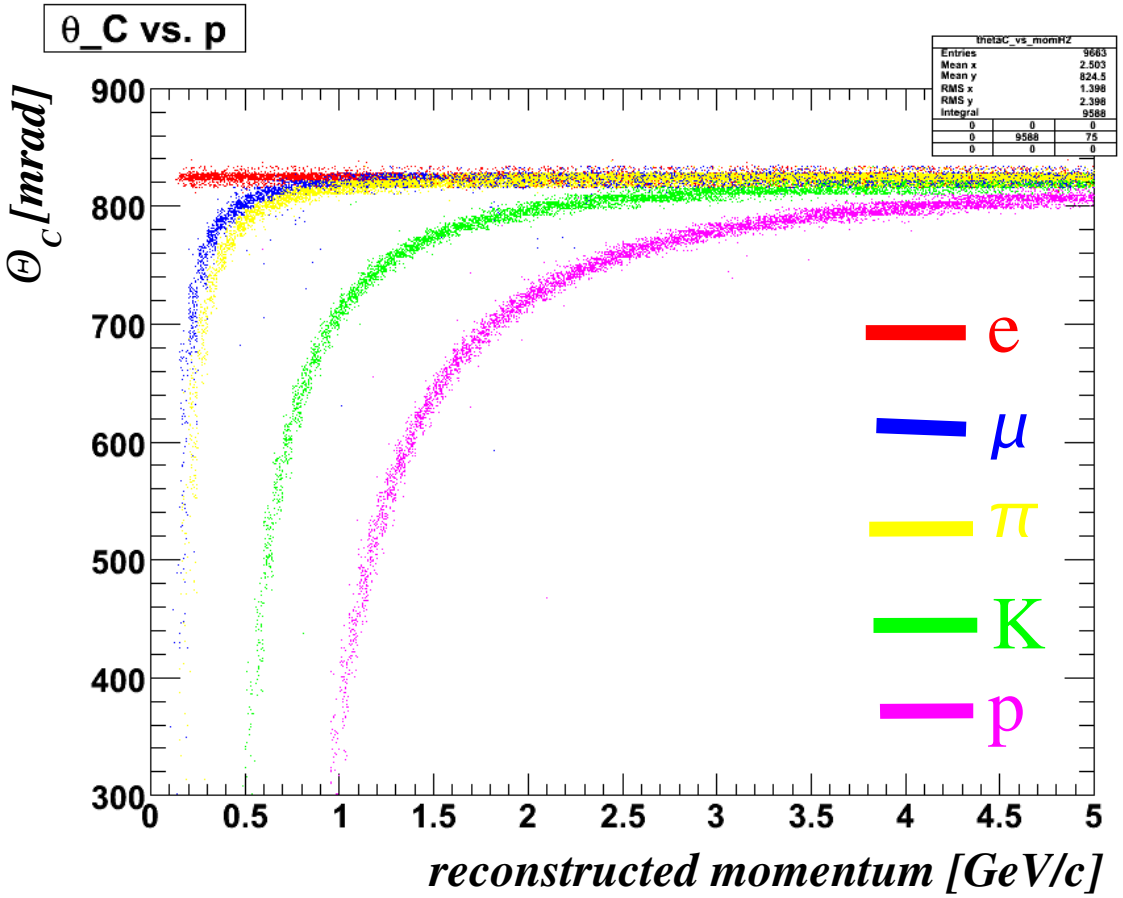
- Very useful for electronID

- Making use of
  - complete cluster and bump reconstruction for EMC
  - complete global tracking
    - Kalman filter incl. material budget
  - track <-> cluster/bump matching
  - E/p and shower shape analysis with MLP neuronal network

    -> talk given at last PANDA Meeting in Genoa

PID with (Disc) DIRC

- Complete geometry and G4 tracking
- Digitization/reconstruction simplified (no photon propagation)
- Parametrization: Σ of γ's and Θ_C based on G4Track info
  - momentum @ intersection point
  - track length through bars
  - particle type
  - refraction index



Global PID

- DIRC, Disc DIRC and EMC so far
- Each detector provides PID probabilities
  - ➔ $PID_{global} = PID_{det1} \times PID_{det2} \times \ldots$

- Example: 4 electron list are available
  - ➔ very loose: p >= 20%
  - ➔ loose : p > 80%
  - ➔ tight : p > 98%
  - ➔ very tight : P > 99%

- Single particles
  - ➔ 10k e^+, π^+, K^+, μ^+, p each
    - ➢ homogeneous in $25^0 < \Theta < 140^0$
    - ➢ homogeneous in 0.2 < p < 5.0 GeV/c

	identif. as e
# e^+	93,15%
# π^+	3,78%
# K^+	2,71%
# μ^+	0,95%
# p	0,11%

very loose cut

very tight cut

	identif. as e
# e^+	70,00%
# π^+	$6*10^{-4}$
# K^+	$4*10^{-4}$
# μ^+	$< 10^{-4}$
# p	$< 10^{-4}$

$\bar{p}\,p \to e^+\,e^-$

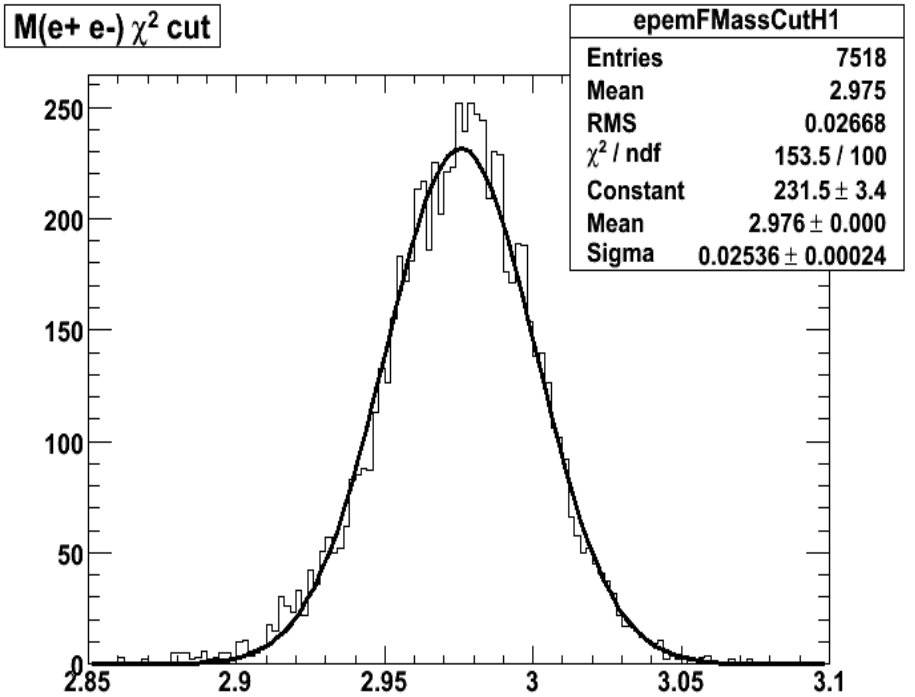
- Physics case
  - measurement of the differential cross section
  - determination of the electromagn. form factor of the proton

- Major background
  - $\bar{p}\,p \to \pi^+\,\pi^-$
  - cross section appr. 10^6 times higher

- Goal
  - $\pi^+\,\pi^-$ background rejection: 10^{-8}
  - cuts on kinematics not efficient
  - big challenge for PID
  - only possible by applying very tight cuts

$\bar{p}\,p \rightarrow e^+\,e^-$

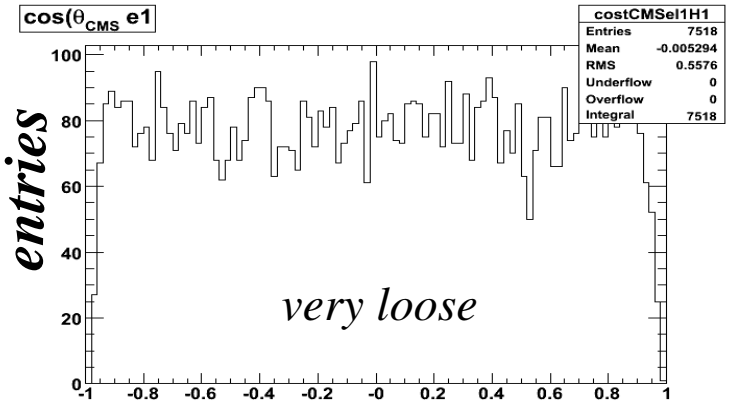
- Generated events (phase space)
  - 10k e+ e- @ η_C
  - 10^7 π+ π- @ η_C
- Results
  - cuts on
    - beam contraint
    - vertex fit probability
  - σ(M(e+ e-)) ~ 25 MeV/c^2
  - very tight list
    - e+ e- eff.: 37,4%
    - mis. Id for π+ π-: ~1*10^{-7}

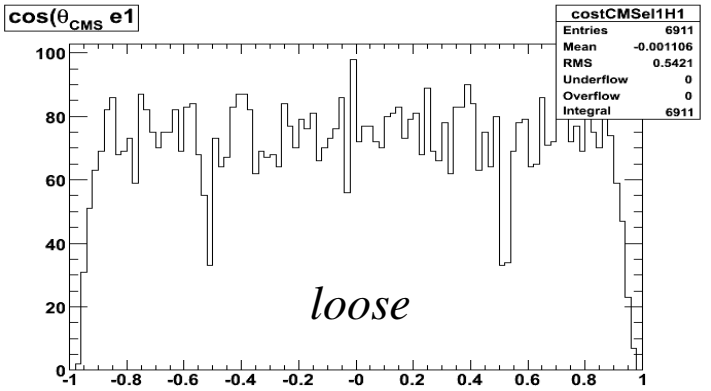


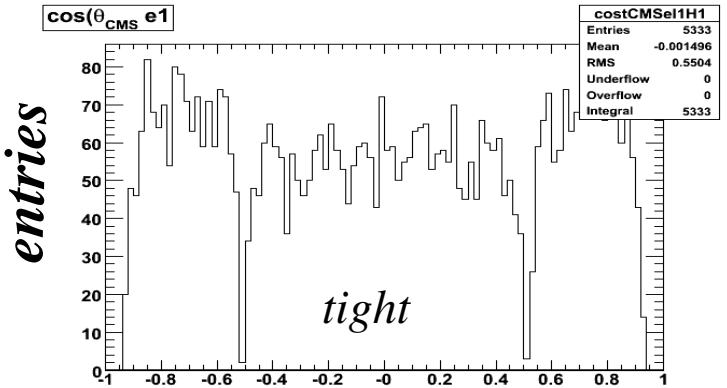
	$e^+\,e^-$	$\pi^+\,\pi^-$
very loose	75,10%	5,4 * 10^{-5}
loose	69,10%	4,5 * 10^{-6}
tight	53,30%	1,0 * 10^{-6}
very tight	37,40%	1,0 * 10^{-7}

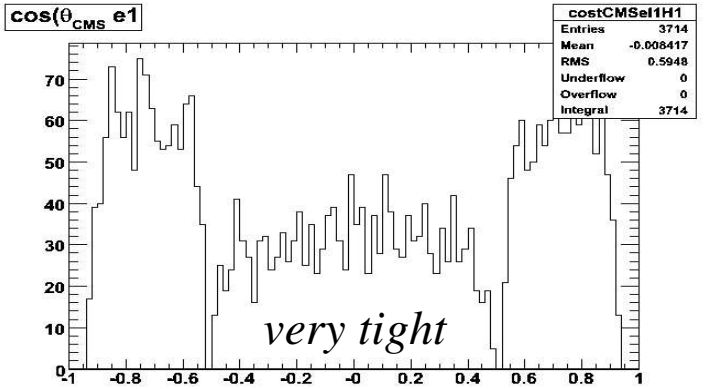
e+ e- physics seems to be feasible with PANDA, but ...

- Tighter PID cuts show more inhomogeneities in the detector acceptance





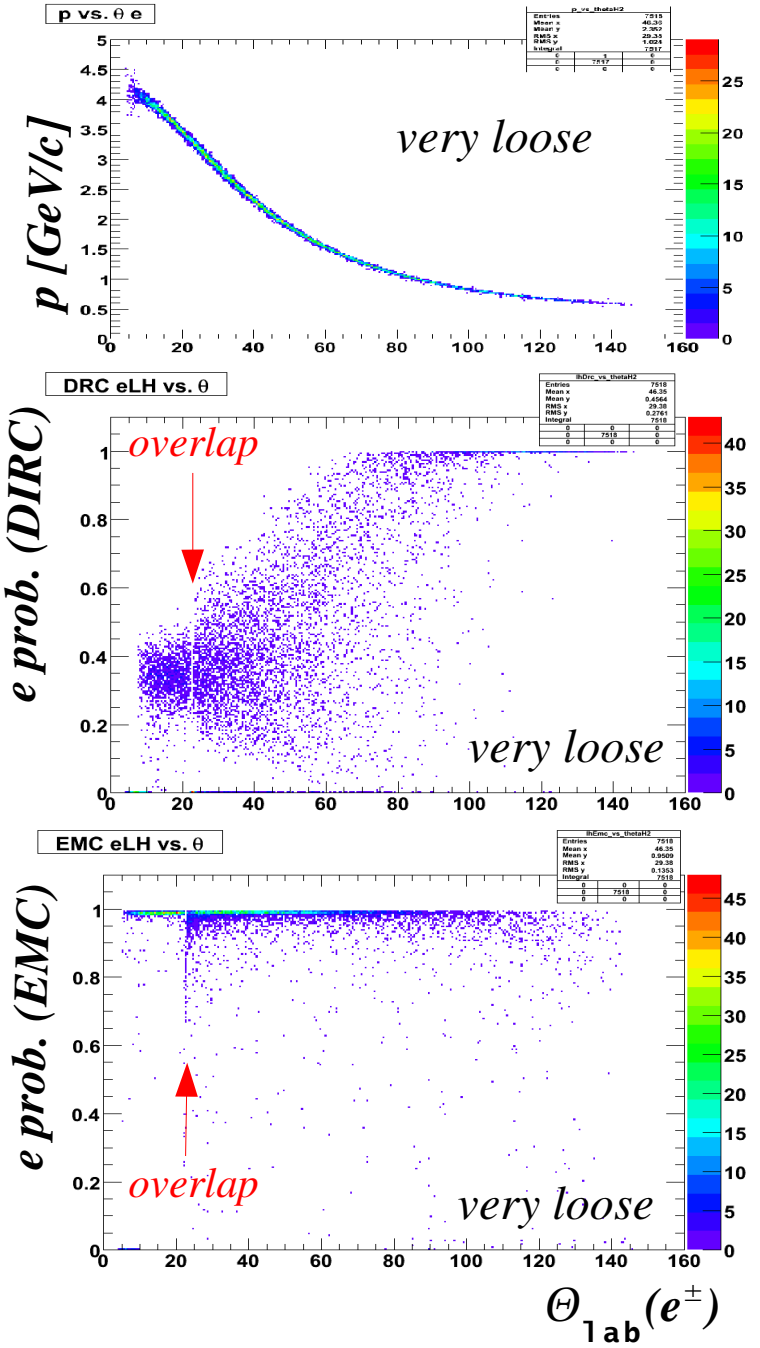




What can we learn from current design?

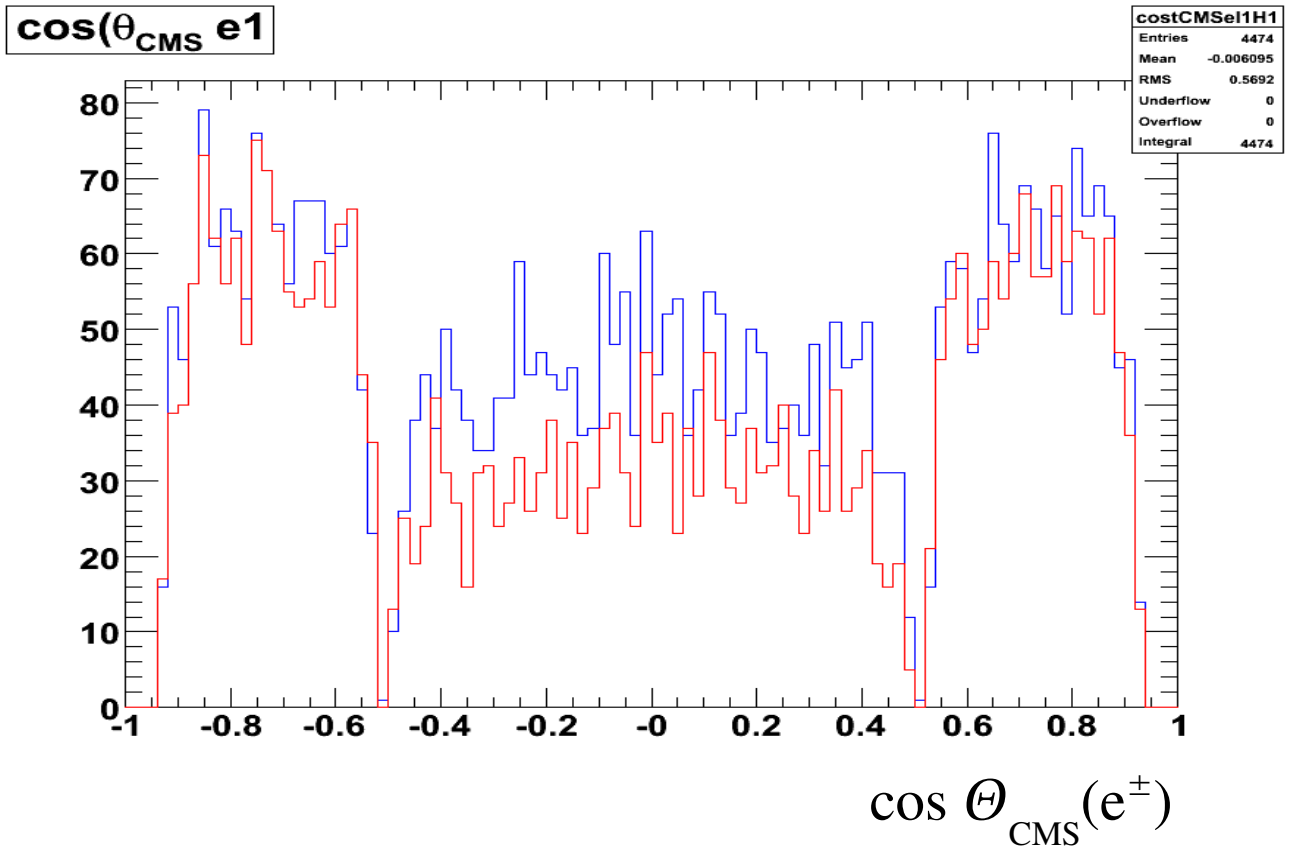
- (Disc) DIRC
  - ➔ also important for the backward TS
  - ➔ gap of ~1^0 in overlap region
    DIRC <-> Disc dirc

- EMC
  - ➔ excellent eId in forward endcap
  - ➔ poor eId in overlap region
    - ➢ shower leakage
  - ➔ worse eId for barrel part
    - ➢ DIRC pre-shower?
    - ➢ distance DIRC <-> EMC of ~11 cm too long?



$\bar{p}\,p \rightarrow e^+\,e^-$

- Comparison distance DIRC <-> EMC: 11cm vs. 1cm



- e+ e- efficiency for very tight cuts: 37,4% vs. 44,7%
- angular distribution still not flat but more homogeneous

----> distance DIRC <-> EMC as close as possible !!!