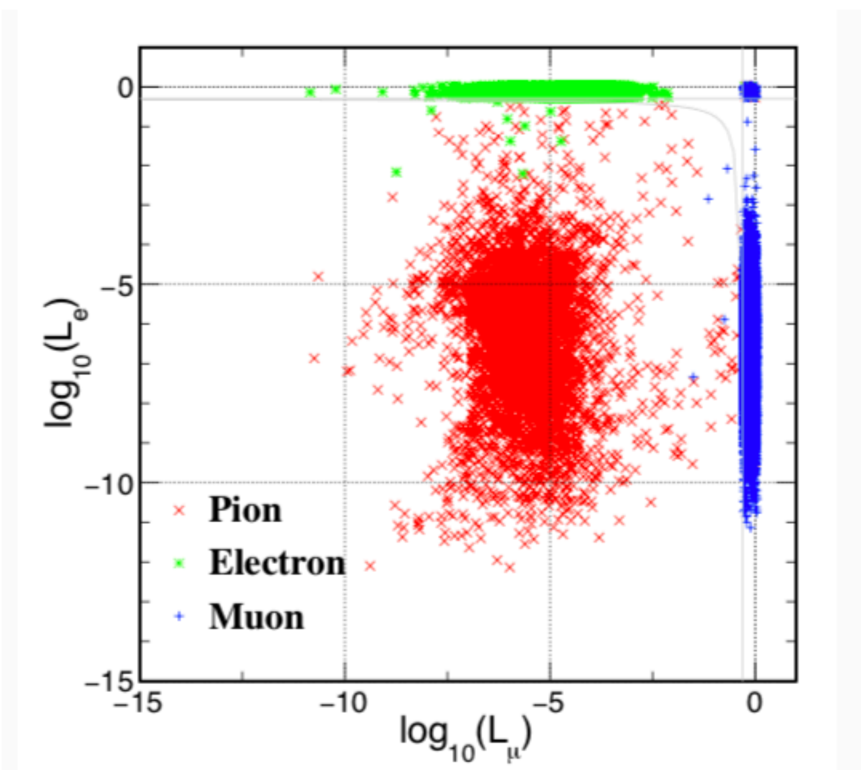
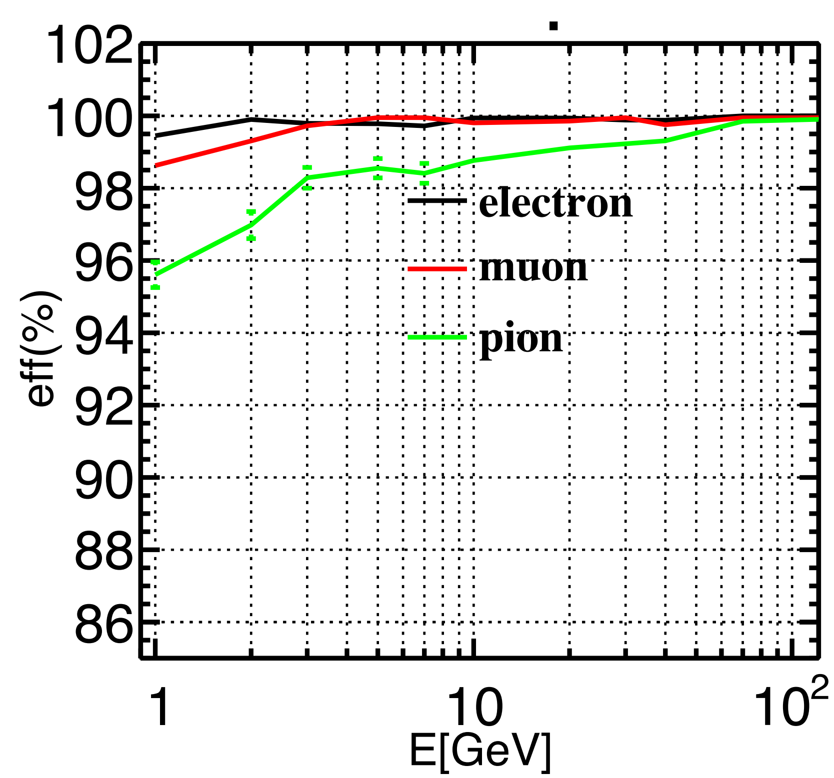
Lepton Identification in Jets

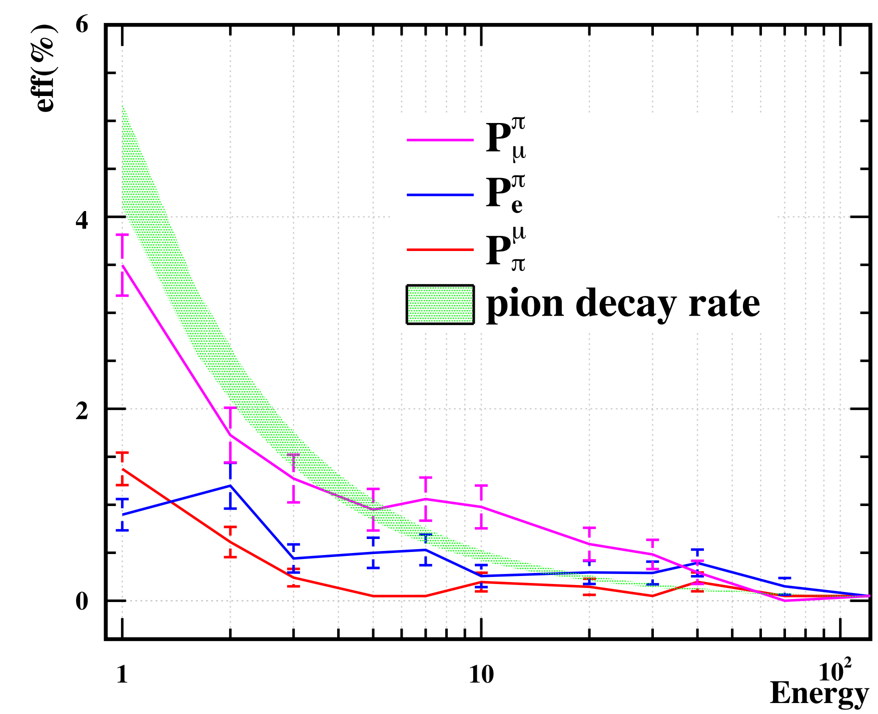
Dan YU

Single Lepton Identification

- LICH uses TMVA methods to summarize 24 input variables into two likelihoods, corresponding to electrons and muons.
- The efficiency for electron and muon is higher than 99.5% (E>2 GeV). Pion efficiency ~ 98%.







Migration Matrix at 40GeV (LICH)

Type	e^- *like*	μ^- *like*	π^+ *like*
e^-	99.71 ± 0.08	< 0.07	0.21 ± 0.07
μ^-	< 0.07	99.87 ± 0.08	0.05 ± 0.05
π^+	0.14 ± 0.05	0.35 ± 0.08	99.26 ± 0.12

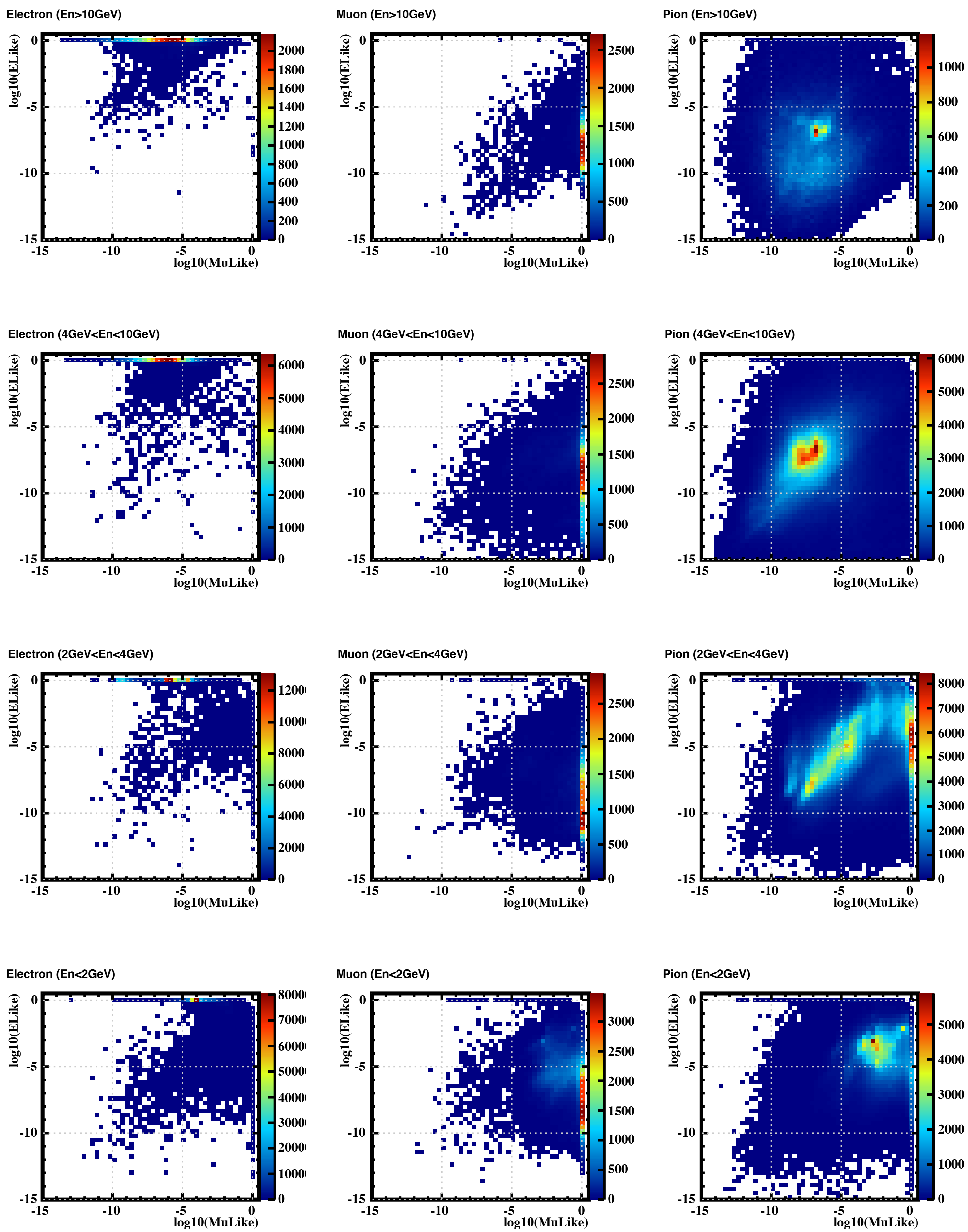
Migration Matrix for ALEPH PID (> 2GeV)(Eur.Phys.J.C20:401-430,2001)

Type	e^- *like*	μ^- *like*	π^+ *like*	undefined
e^-	99.57 ± 0.07	< 0.01	0.32 ± 0.0	0.09 ± 0.04
μ^-	< 0.01	99.11 ± 0.08	0.88 ± 0.08	0.01 ± 0.01
π^+	0.71 ± 0.04	0.72 ± 0.04	98.45 ± 0.06	0.12 ± 0.03

Performance in jets

- The performance for lepton in jets degrades comparing to the single particle results because of because of the high statistics of background and the cluster overlap.

	<2GeV	2GeV-4GeV	4GeV-10GeV	>10GeV
eff_e(%)	87.51	97.75	97.62	97.04
eff_mu(%)	33.17	72.63	78.47	95.69
pur_e(%)	80.97	80.79	96.07	96.91
pur_mu(%)	20.85	29.32	79.04	94.42
N_e	263449	84782	66514	30528
N_mu	128336	57777	60810	34178
N_pi	3888694	1436396	852860	112739

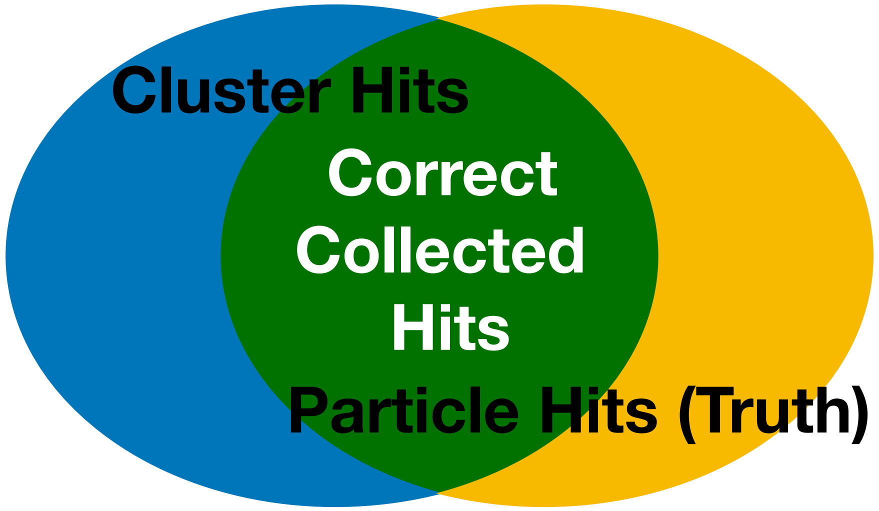


- Sample: Zpole->bb
- High Energy:
  - easy to separate
- Low Energy:
  - muons mixed with pions
  - large statistics of pions
  - What is wrong with pion (2GeV - 4GeV)?

Clustering Performance

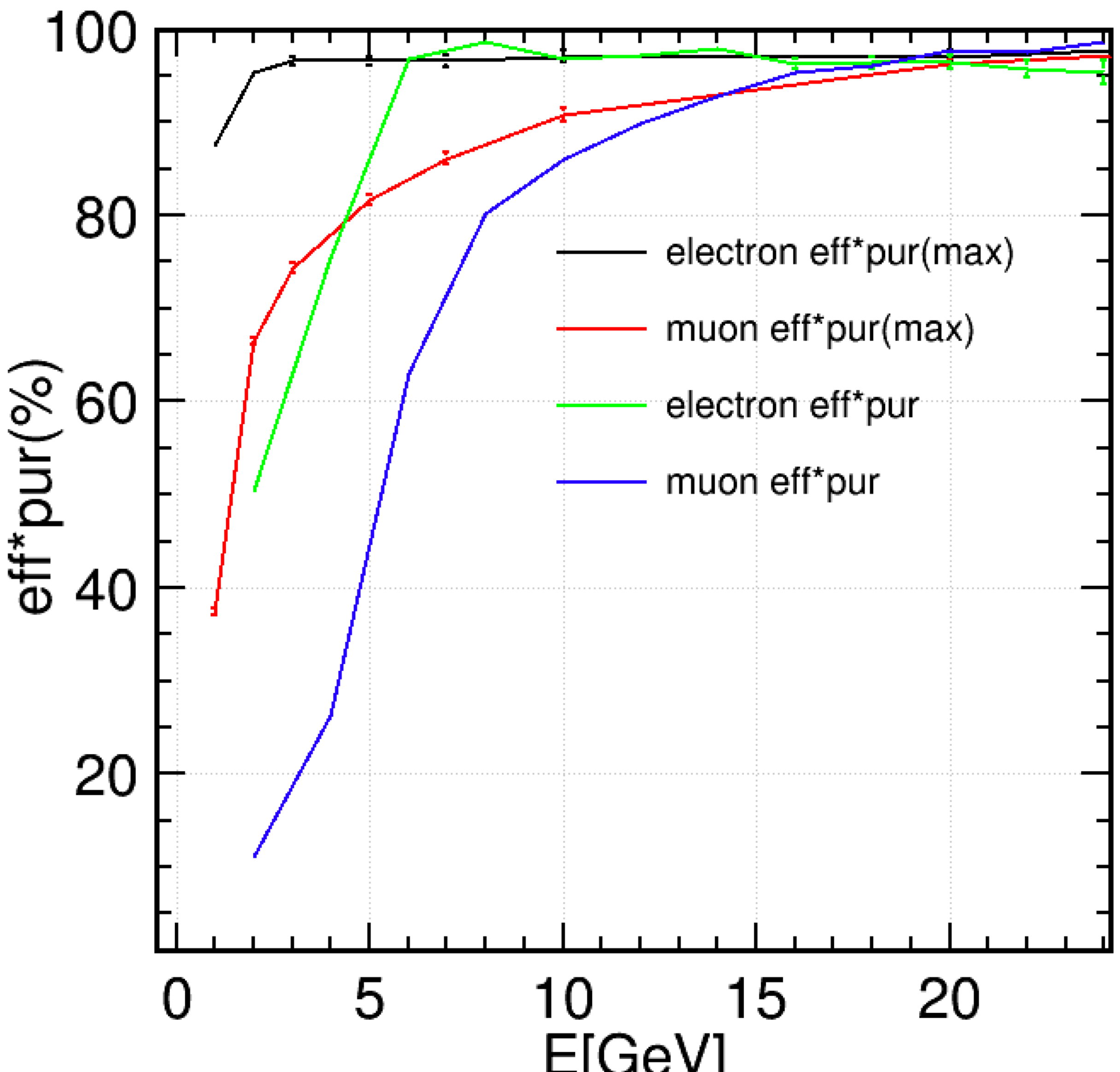
- Use clustering efficiency (correct collected hits/particle hits) and purity (correct collected hits/cluster hits) to characterize clustering performance

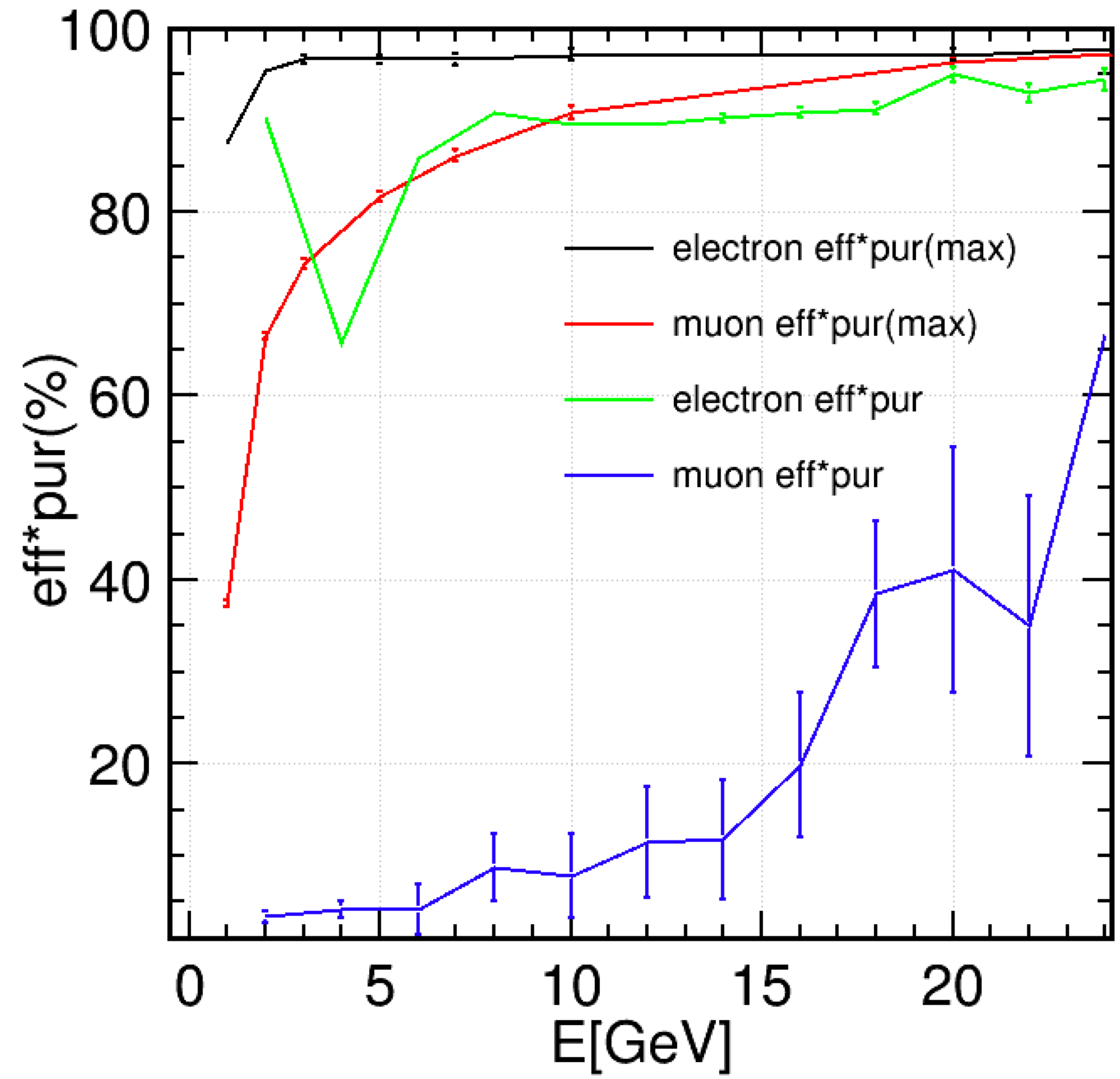
- We look into “nice” clusters (efficiency*purity>0.92) and “poor” clusters (efficiency*purity<0.44)



Clustering Categories

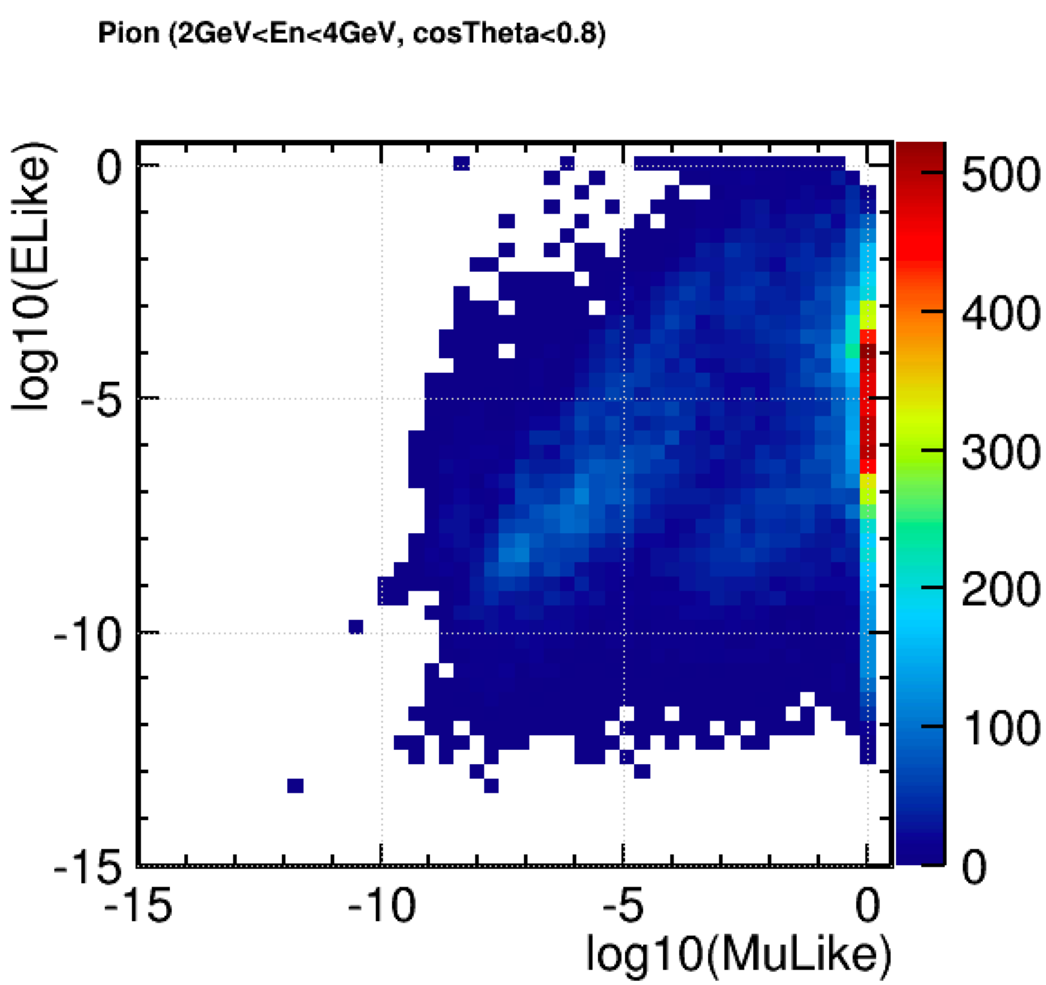
- Comparison of lepton id efficiency*purity for “nice”/“poor” clusters and the extrapolated performance using single particle results and the statistics (up limit to be achieved)

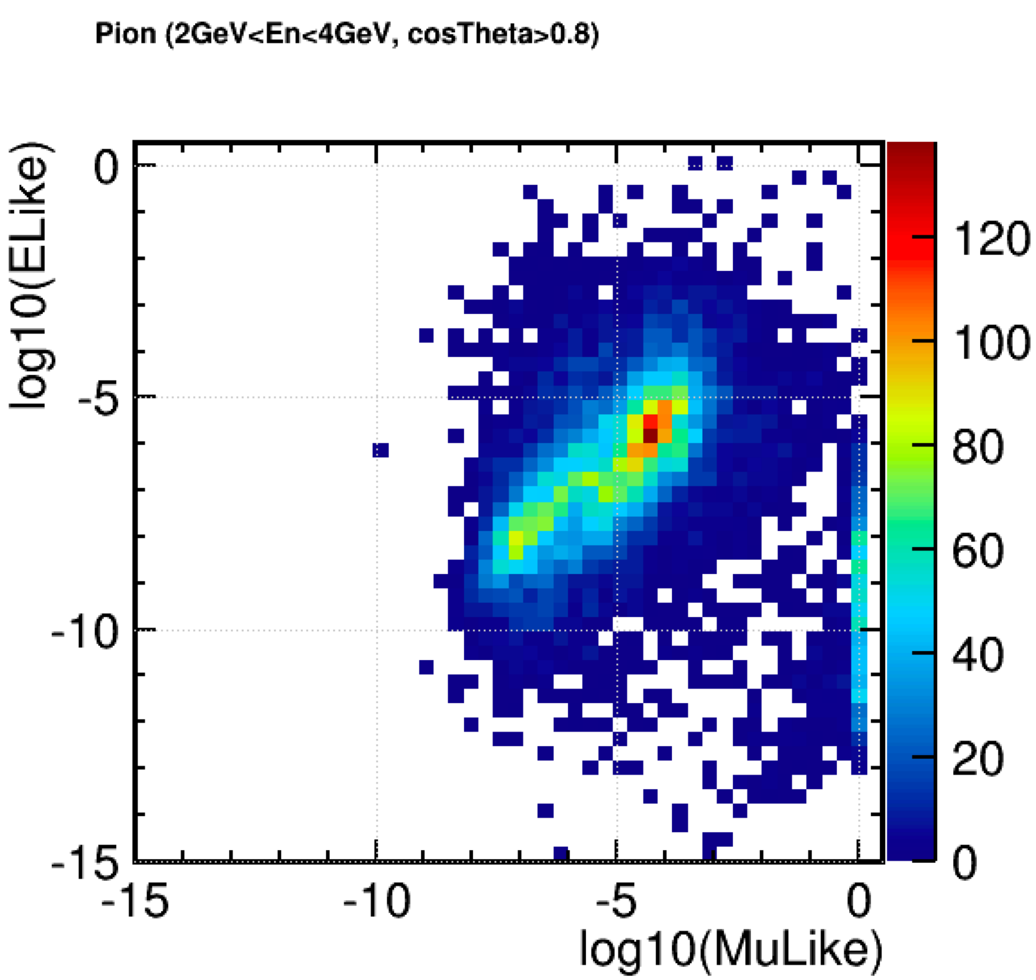




Angular Dependence

- low energy pions mixed with muons: better on endcap





The “best” performance

- “nice” clustering + small angle to the z-axis