Detector Matrix Input from the Inclusive Group

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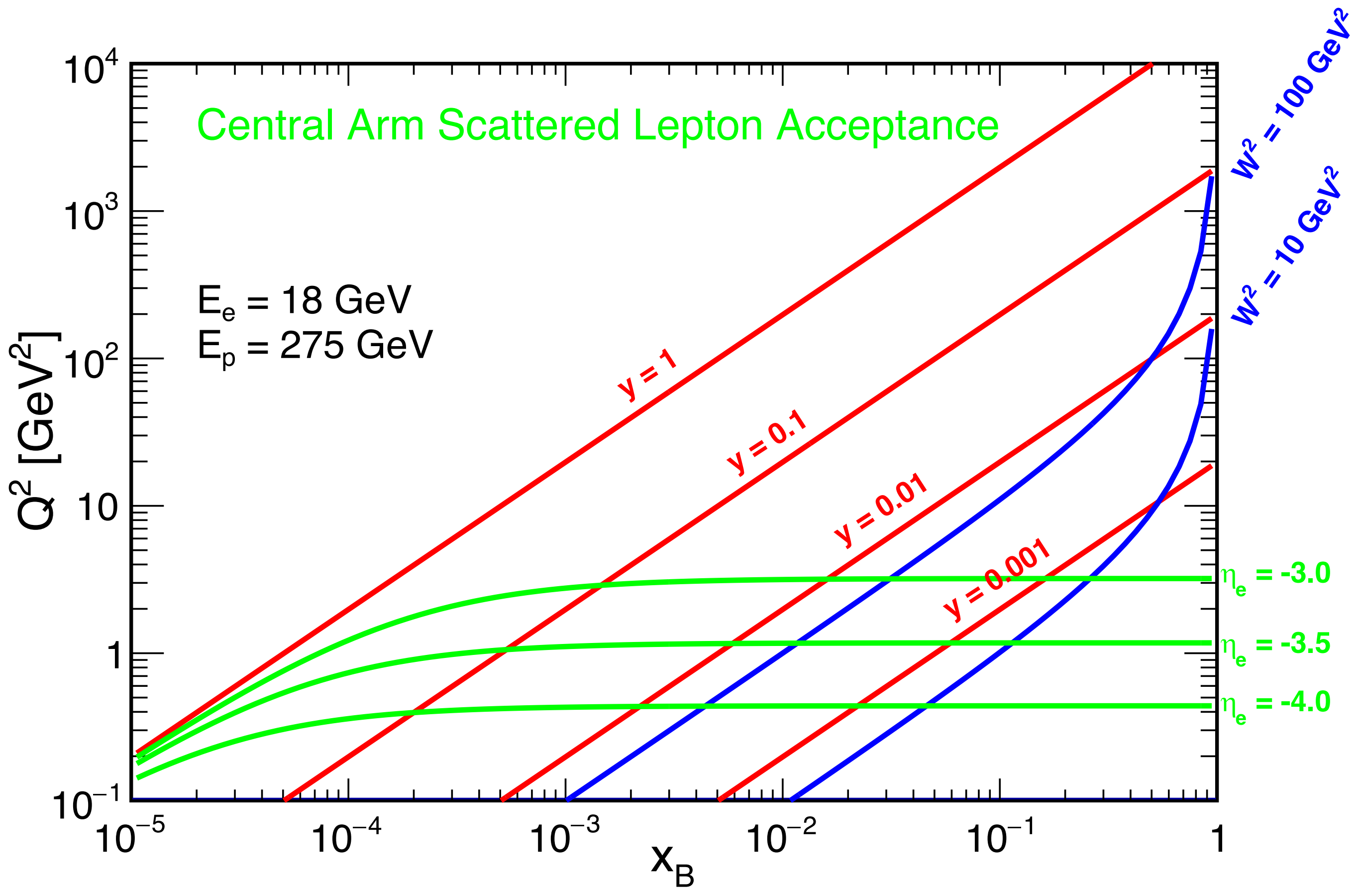
Points for Discussion

1) Forward coverage in tracking and calorimeters for JB reconstruction
2) Hadronic Calorimeter resolution for JB purity and stability
3) Pion suppression at mid-ish-rapidity η = (-2 -> 1)
4) Minimize material to reduce pair-symmetric background.

η	Nomenclature			Tracking: Resolution	Tracking: Allowed X/X_0	Tracking: Si-Vertex	Electrons: Resolution σ_E/E	Electrons: PID	π/K/p: p-Range (GeV/c)	π/K/p: Separation	HCAL: Resolution σ_E/E	Muon
-6.9 to -5.8			low-Q2 tagger	σθ/θ < 1.5%; 10-6 < Q2 < 10-2 GeV2								
...												
-4.5 to -4.0	↓ p/A	Auxiliary Detectors	Instrumentation to separate charged particles from photons				2%/√E					
-4.0 to -3.5												
-3.5 to -3.0								π suppression up to 1:104 cannot evaluate without full detector simulations and PID				
-3.0 to -2.5				σp/p ~ 0.1%⊕0.5%								
-2.5 to -2.0			Backward Detector	σp/p 0.1%⊕0.5%		TBD	2%/√E		≤ 7 GeV/c		~45%/√E+ 6%	
-2.0 to -1.5				σp/p 0.05%⊕0.5%	~5% or less X cannot evaluate without full detector simulations. Critical that this is minimized		7%/√E					
-1.5 to -1.0							7%/√E					
-1.0 to -0.5												
-0.5 to 0.0		Central Detector	Barrel	σp/p ~0.05%×p+0.5%		σxyz ~ 20 μm, d0(z) ~d0(rΦ) ~ 20/pTGeV μm + 5 μm			≤ 5 GeV/c	≥ 3 σ		TBD
0.0 to 0.5												
0.5 to 1.0												
1.0 to 1.5												
1.5 to 2.0				σp/p ~0.05%×p+1.0%					≤ 8 GeV/c			
2.0 to 2.5			Forward Detectors			TBD					~45%/√E+ 6%	
2.5 to 3.0							(10-12)%/√E		≤ 20 GeV/c			
3.0 to 3.5				σp/p ~ 0.1%×p+2.0%					≤ 45 GeV/c			
3.5 to 4.0	↑ e	Auxiliary Detectors	Instrumentation to separate charged particles from photons	Forward coverage critical for JB reconstruction							Forward coverage critical for JB reco-nstruction	
4.0 to 4.5												
...			Neutron Detection									
> 6.2			Proton Spectrometer	σintrinsic(|t|)/|t| < 1%; Acceptance: 0.2 < pt < 1.2 GeV/c								

Forward Tracking and Calorimeter Coverage

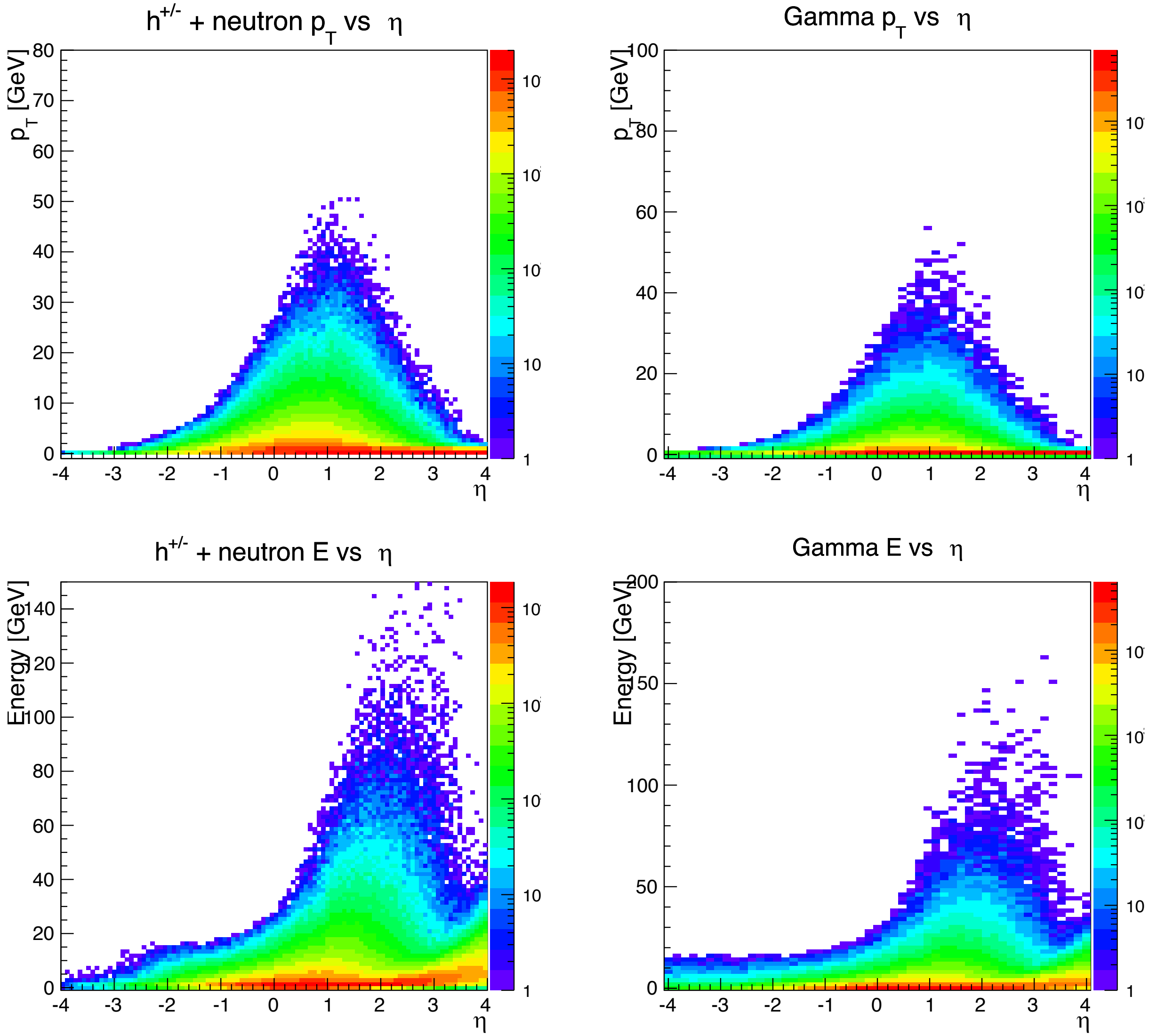


- Extending electron reconstruction out to $\eta = -4$ is not critical for majority of inclusive channels.
- The only exception may be studies on deviations from DGLAP and color glass condensate studies.
- Kinematic losses at $Q^2 < 1$ GeV^2 for all beam configurations.
- Work by Barak Schmookler.

Forward Tracking and Calorimeter Coverage

$$x_{JB} = \frac{Q^2_{JB}}{s y_{JB}}; \quad y_{JB} = \frac{(E - p_z)_h}{2E_e}; \quad Q^2_{JB} = \frac{p^2_{t,h}}{1 - y_{JB}}$$

- JB reconstruction is the only option for reconstruction of charged-current observables.
- But JB reconstruction is also important for neutral current channels at small inelasticity, which is also high x.
- JB requires tracking as well as electromagnetic (photons) and hadronic calorimeters.



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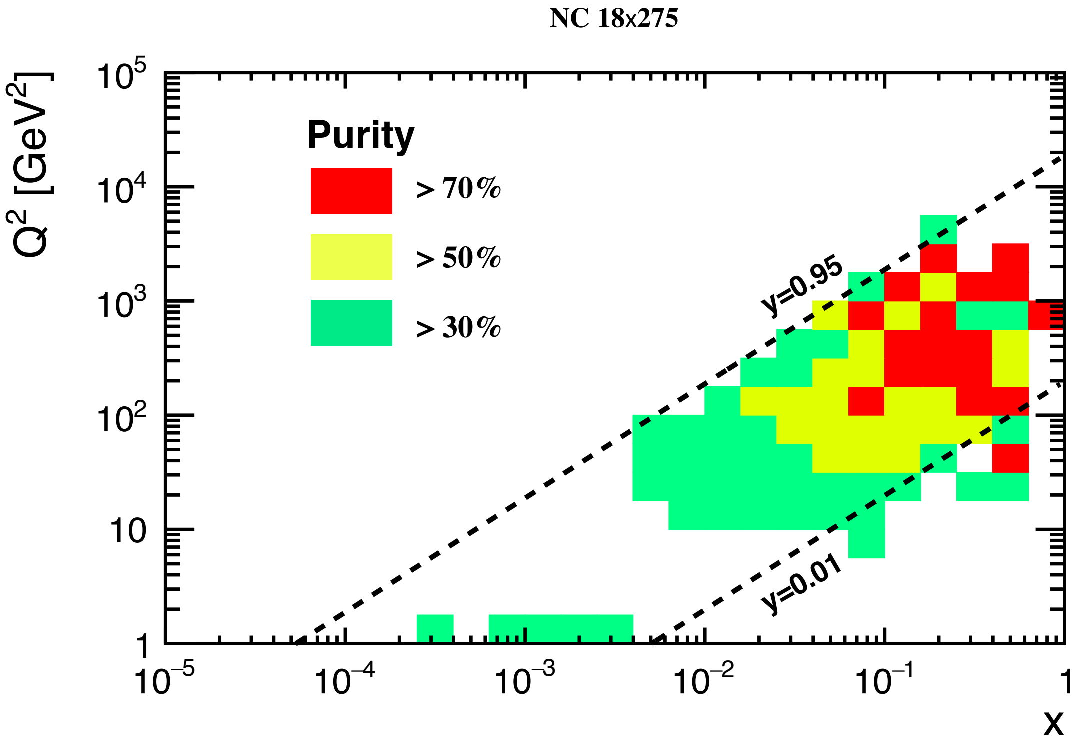
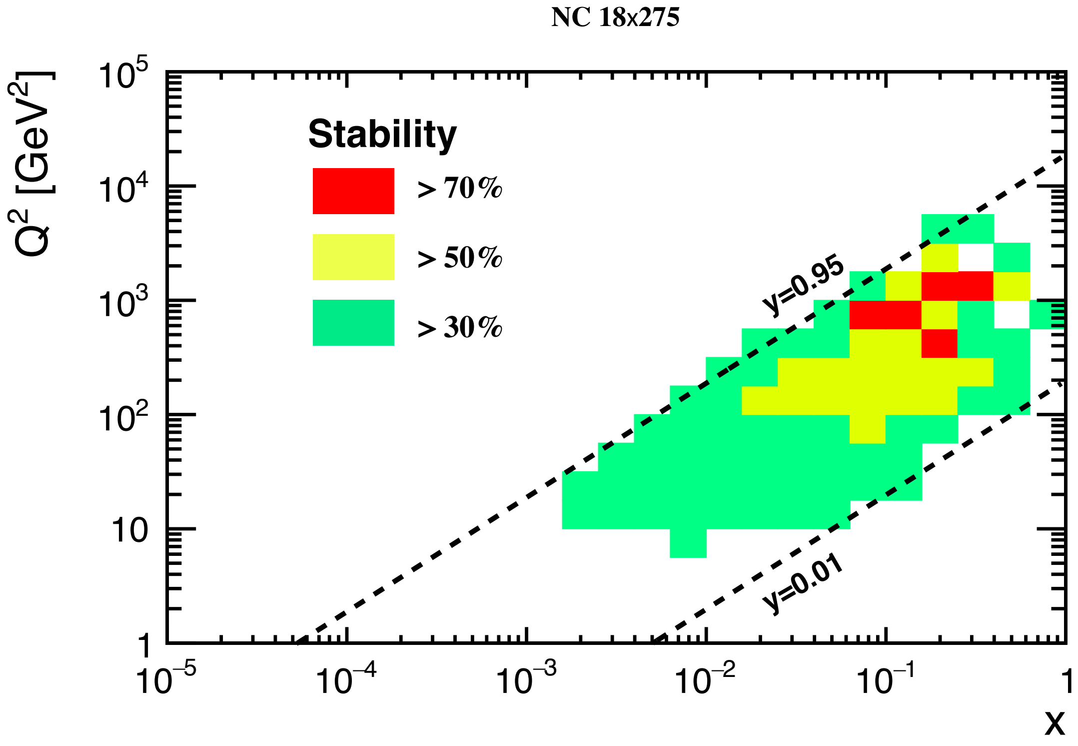
Hadronic Calorimeter Resolution

Need > 30% and higher is better for Purity and Stability.





Purity : Fraction of events reconstructed in a bin i that were generated in bin i. Reflects migration into bin i.

Stability : Fraction of events generated in a bin i that were reconstructed in bin i. Reflects event migration out of bin i.

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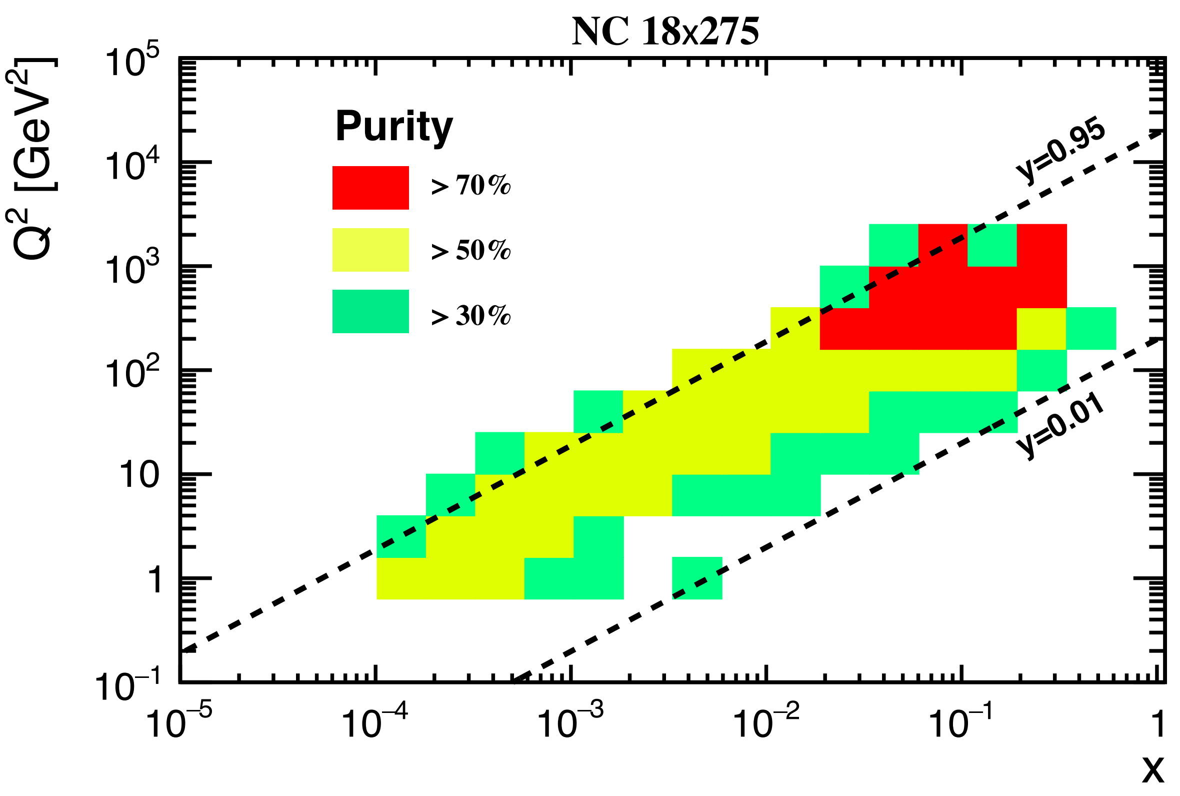
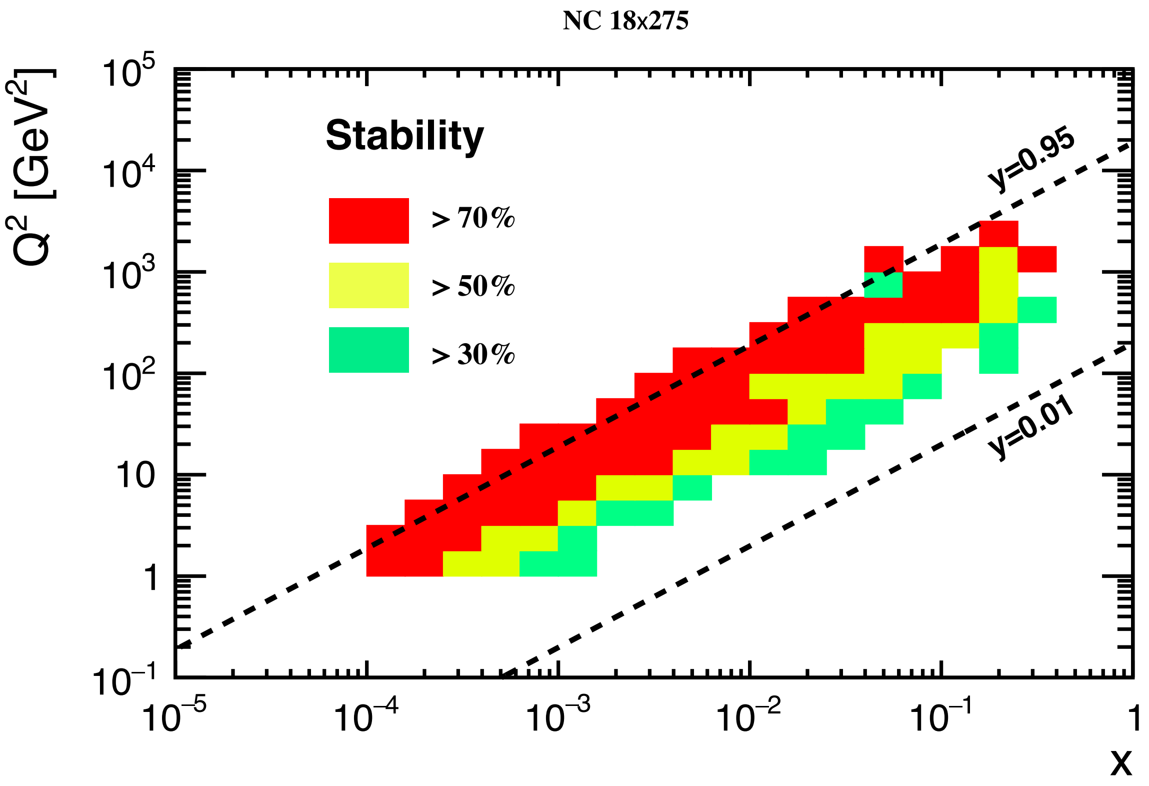
Purity and Stability Comparison for e- Reco





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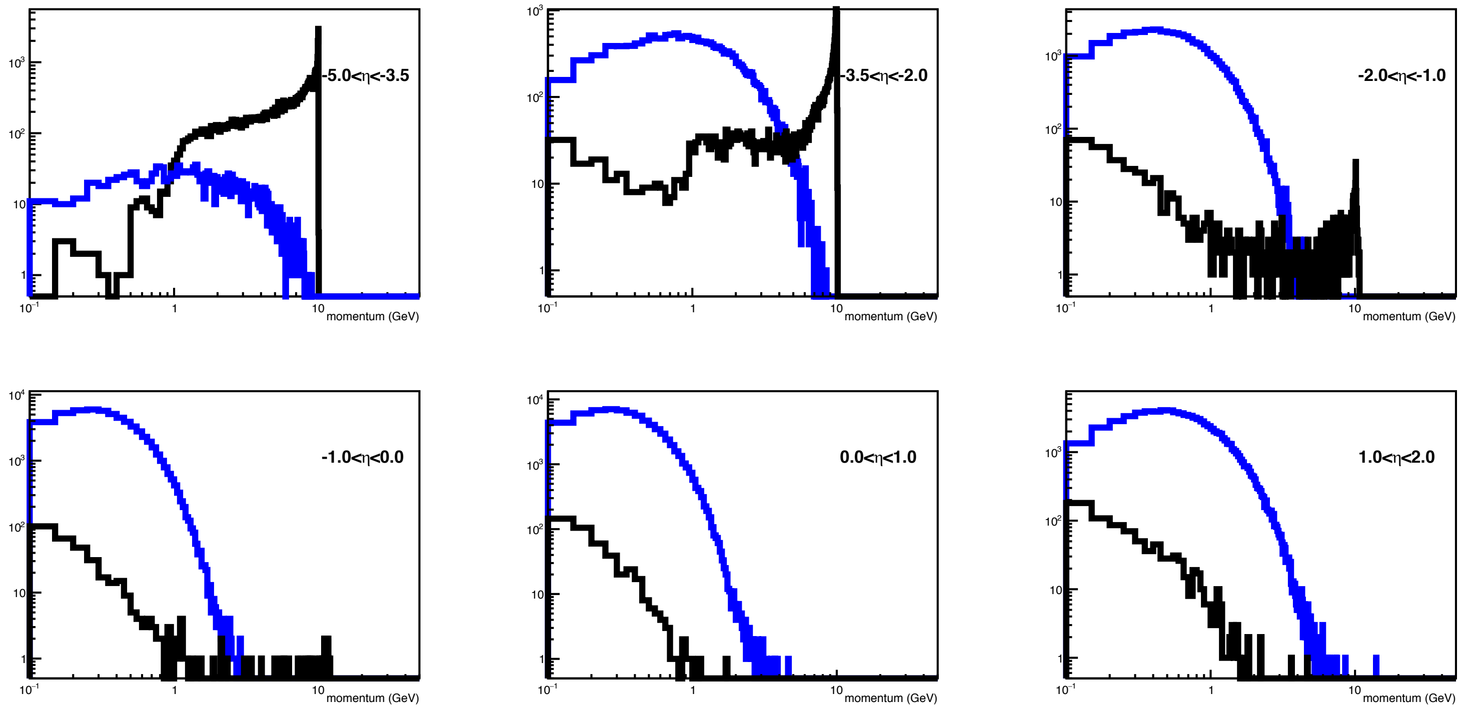
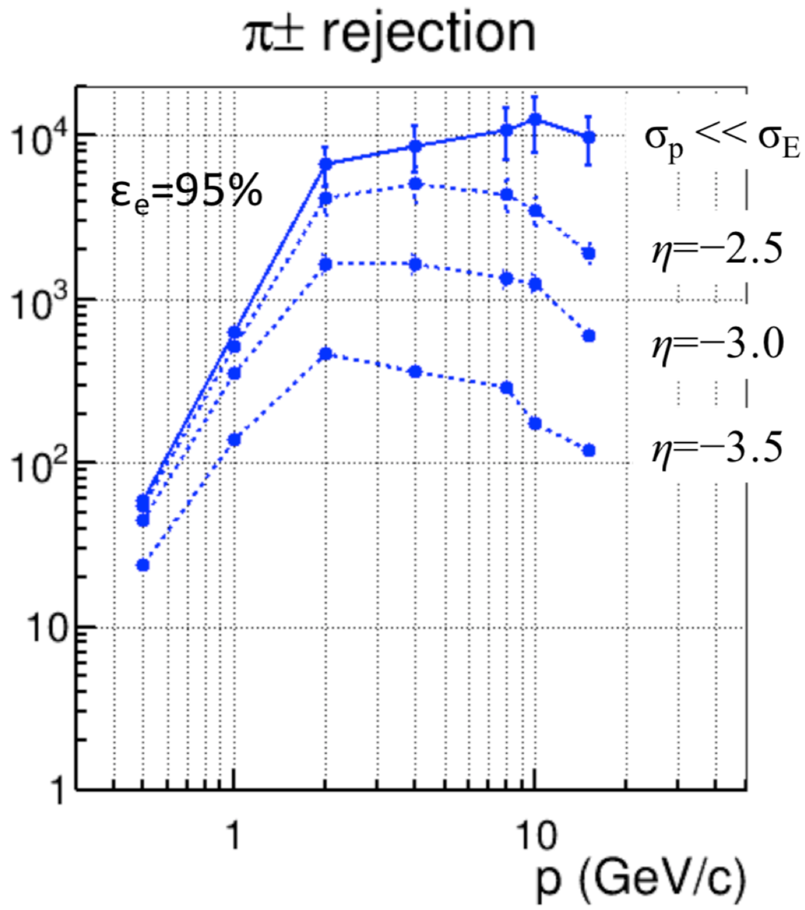
Charged pion suppression

NOTE: Detector matrix has 10^4 suppression. But GEANT studies show this is is idealized and only true at high electron momentum. ***Is 10^4 realistic?***

ΔG needs pi/e 10^{-3} , A_{PV} needs pi/e 10^{-4}. Using only raw yields and no algorithms, suppression in η bins -2 to 1 are marginal for ΔG and 10x too large for A_{PV}. Need full simulation and algorithm development for real answer.



10 x 100 GeV Pion/e- Ratio (Hanjie Liu)



GEANT Studies from A. Bazilevsky

Pair Symmetric Background

- Depending on material budget meson Dalitz decays and photon conversions into e+e- pairs may produce a large background for DIS electron ID.
- Rates cannot be determined without implementation of full detector material budget into full simulation.
- Estimates of suppression also require implementation of PID algorithms and special datasets taken to determine PS background per kinematic bin.
- Need to minimize material budget, ie X/X_0 for trackers.