

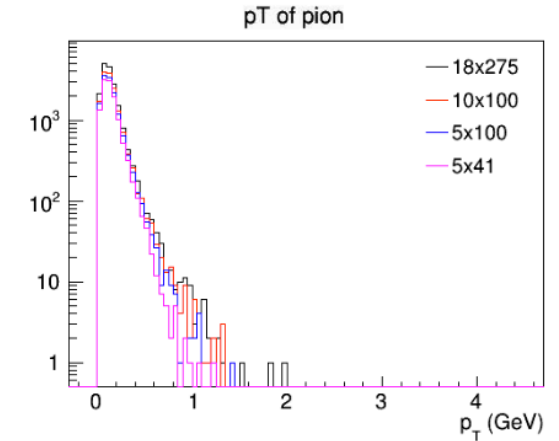
SIDIS Detector Matrix

Ralf Seidl, Justin Stevens Alexey Vladimirov, Anselm Vossen, Bowen Xiao

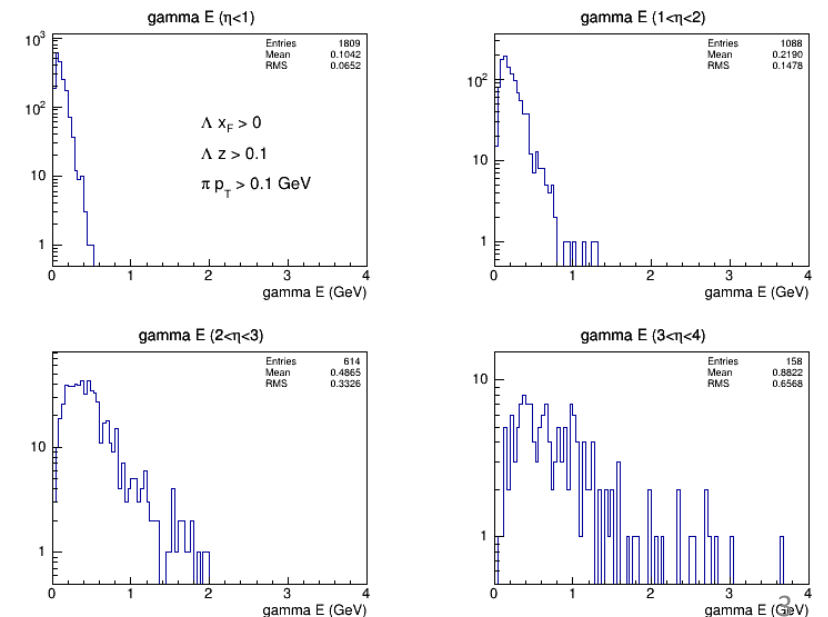
	A	B	C	D	E	F	G	H	I	J	K	L	M	N	O	P	Q										
1	η	Nomenclature			Tracking			Electrons		Photons	$\pi/K/p$		HCAL														
2		Resolution	Allowed X/X0	Si-Vortex	minimum-pT	Resolution $\sigma E/E$	PID	min E	p-Range (GeV/c)	Separation	Resolution $\sigma E/E$	Muons															
3	-6.9 to -5.8	$\downarrow p/A$	Auxiliary Detectors	low-Q2 tagger	$\sigma\theta/\theta < 1.5\%$; 10-6 < Q2 < 10-2 GeV2				2%/√E																		
4	...																										
5	-4.5 to -4.0				Instrumentation to separate charged particles from photons																						
6	-4.0 to -3.5																										
7	-3.5 to -3.0	Central Detector	Barrel	Backward Detector	$\sigma p/p \sim 0.1\% \oplus 0.5\%$ $\sigma p/p 0.1\% \oplus 0.5\%$	$\sim 5\%$ or less X	TBD	$\sigma_{xyz} \sim 20 \mu m$, $d0(z) \sim d0(r\Phi) \sim 20/pT GeV \mu m + 5 \mu m$	$< 100 MeV$ $< 100 MeV$	π suppression up to 1:104	$< 200 MeV$	$\leq 7 GeV/c$	$\geq 3\sigma$	TBD													
8	-3.0 to -2.5																										
9	-2.5 to -2.0																										
10	-2.0 to -1.5																										
11	-1.5 to -1.0																										
12	-1.0 to -0.5																										
13	-0.5 to 0.0																										
14	0.0 to 0.5																										
15	0.5 to 1.0																										
16	1.0 to 1.5																										
17	1.5 to 2.0											Forward Detectors			$\sigma p/p \sim 0.05\% \times p + 1.0\%$												
18	2.0 to 2.5																										
19	2.5 to 3.0																										
20	3.0 to 3.5																										
21	3.5 to 4.0																										
22	3.5 to 4.0	$\uparrow e$	Auxiliary Detectors	Instrumentation to separate charged particles from photons					(10-12)%/√E																		
23	4.0 to 4.5																										
24	...				Neutron Detection																						
25	> 6.2				Proton Spectrometer	$\sigma_{intrinsic}(t)/ t < 1\%$; Acceptance: $0.2 < pt < 1.2 GeV/c$																					
26																											
27																											
28																											

Min track p_T and photon energies

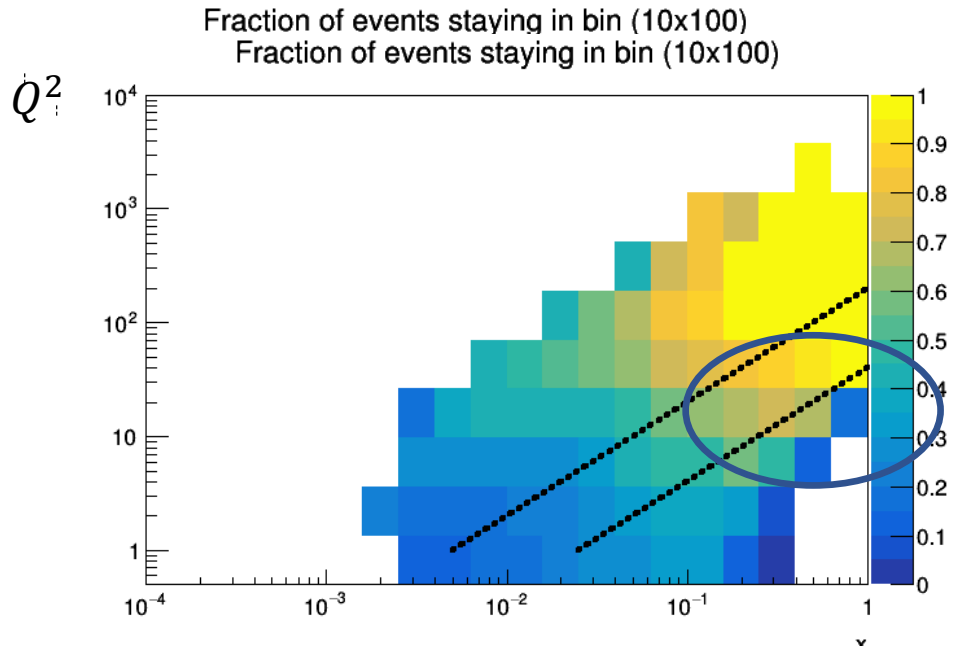
- Min track p_T studies concentrated on needs for Λ analysis and partial waves for di-hadrons
- For Λ analysis, need p_T resolution ≤ 100 MeV
 \rightarrow better resolution \rightarrow more lambdas
- For PWs 100 MeV is good, lower not much of an improvement (but 50% worse at 300 MeV)
- Min γ Energy requirement driven by $\Sigma \rightarrow \Lambda\gamma \rightarrow$ should be better than 200 MeV



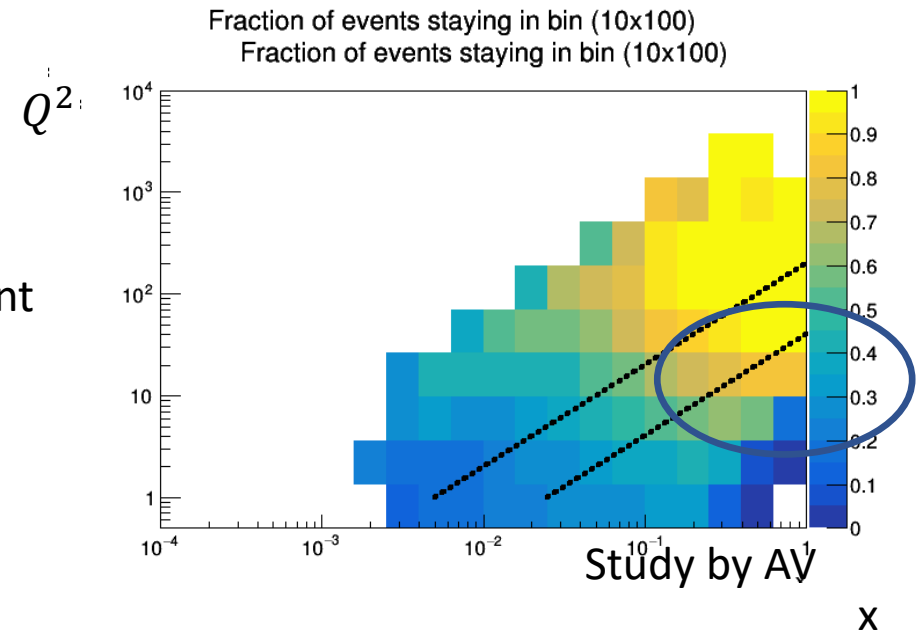
5x41 but other options similar



Extended coverage to eta of 4



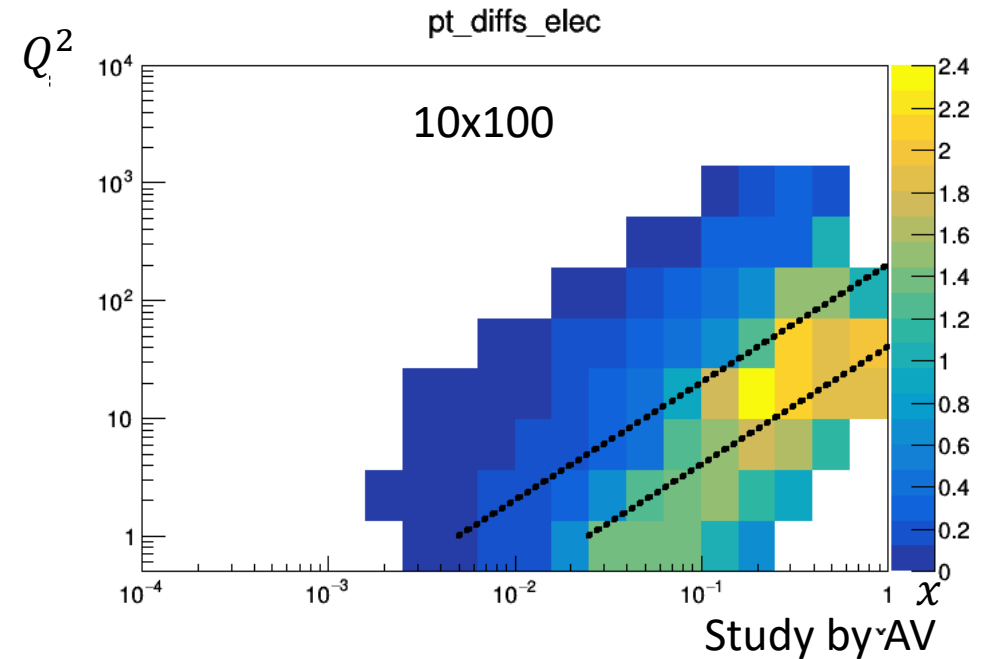
Some improvement
At low x high Q^2



- Extending coverage will help with extending kinematic range with hadronic methods

Tracking resolution

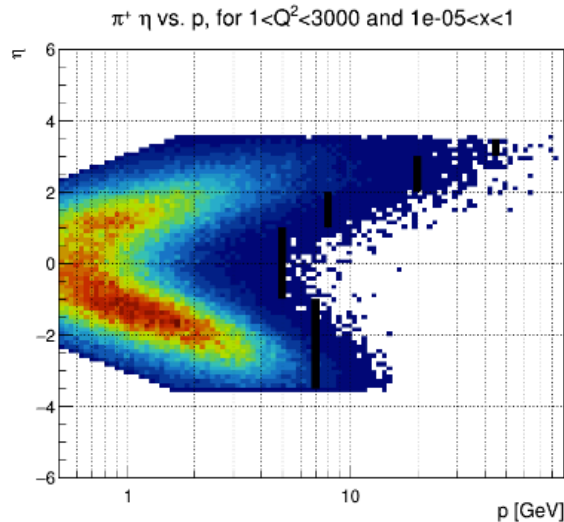
- Tracking resolution sufficient on hadron side
- Momentum resolution on electron side limits access to high x /low Q^2



PID \rightarrow arguably most important change

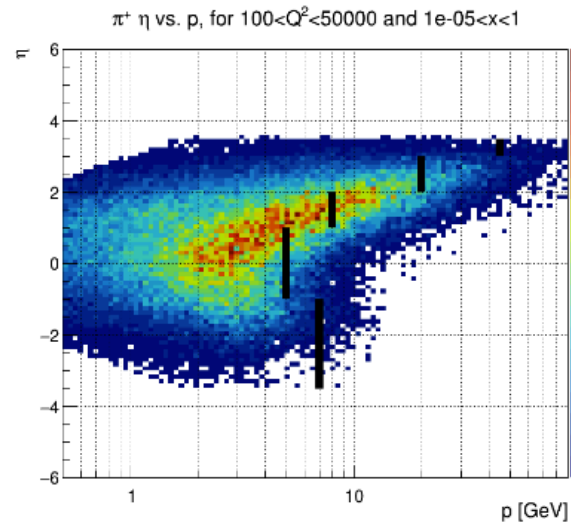
- PID of utmost importance in SIDIS (in particular π/K)
- Original matrix cuts severely in high Q^2 , moderate to high z
- NB: Electron/pion separation at forward η will be important for spectroscopy program, but details still being investigated

$Q^2 > 1 \text{ GeV}^2$



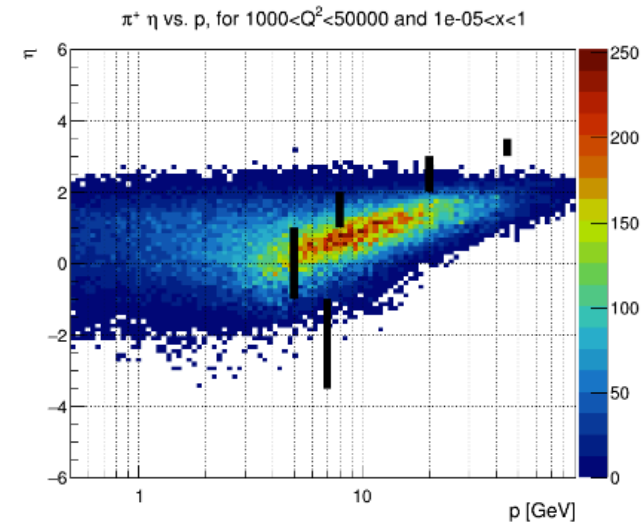
With $z > 0.2$

$Q^2 > 100 \text{ GeV}^2$



This is equal counts, not equal *lumi*!!
(equal lumi in backup)

$Q^2 > 1000 \text{ GeV}^2$

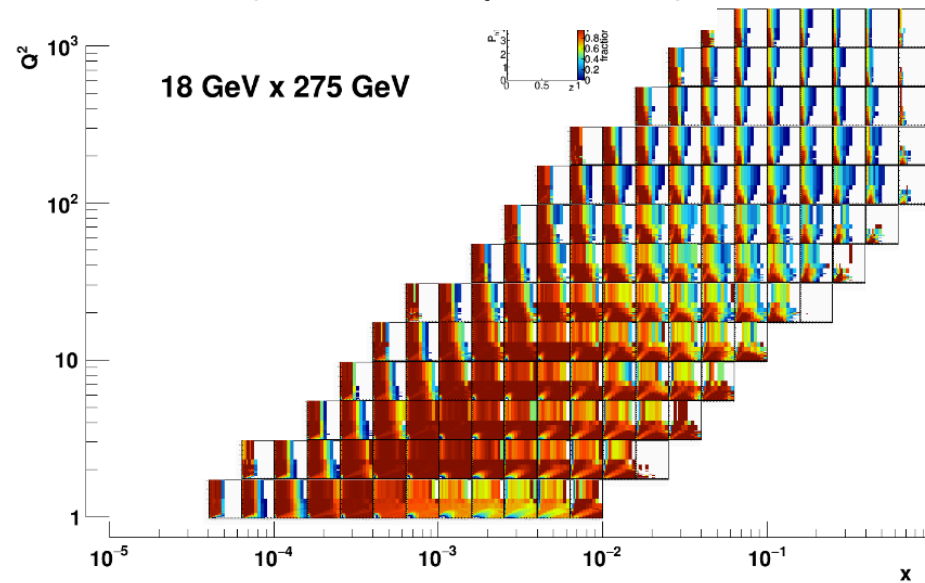


Study by Chris Dilks

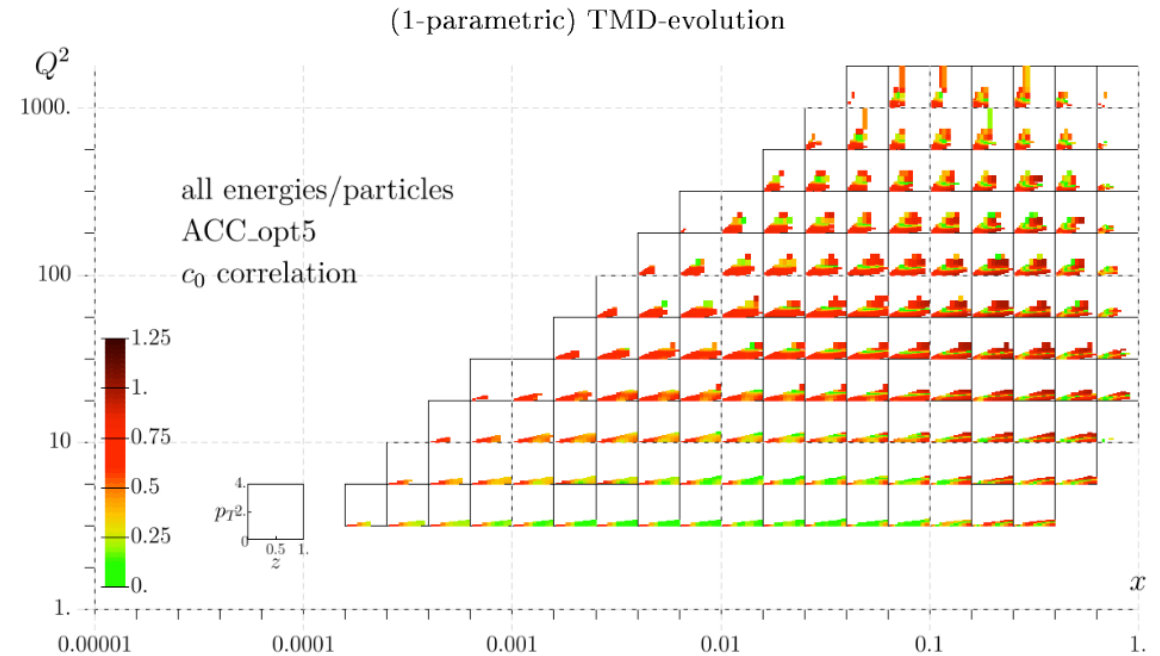
Original PID has low efficiency at high x /high Q^2

- Impact of data in this region large!

4D ratios (PID acc/perfect):



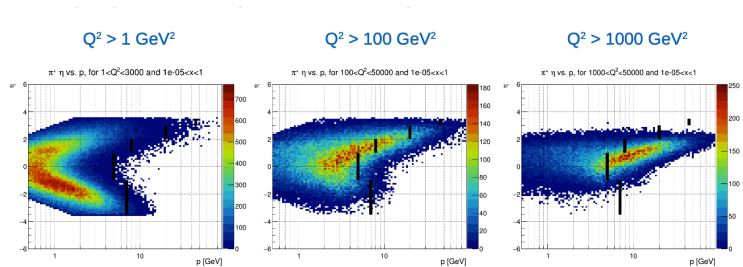
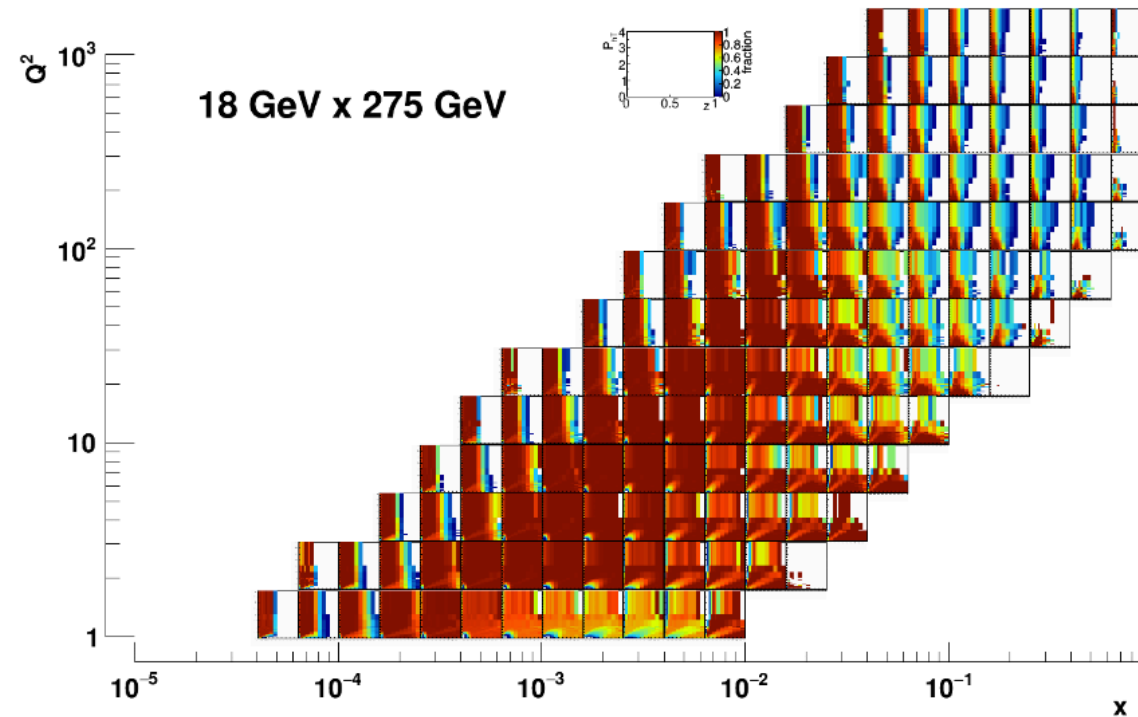
Study by Ralf Seidl



Study by Alexey Vladimirov

SIDIS request improves high x /high Q^2

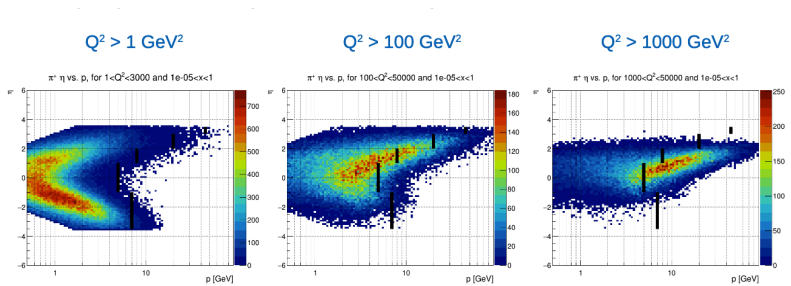
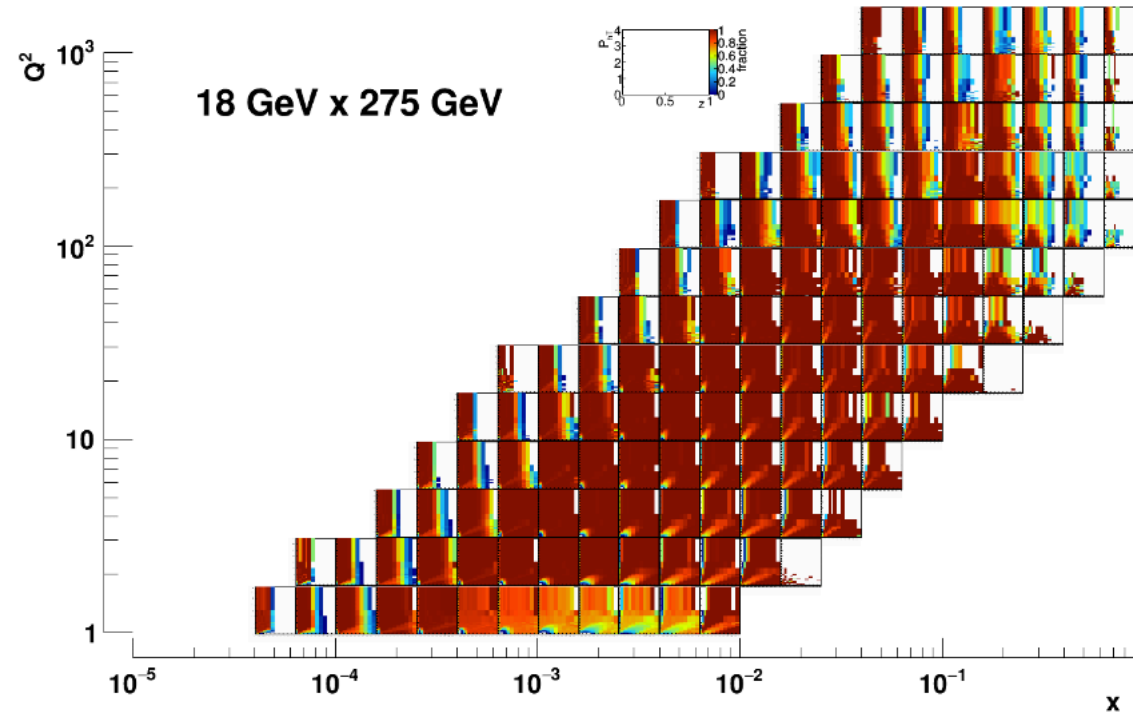
- Request driven by our understanding of detector limitations



Study by Ralf Seidl

SIDIS request	$\pi/K/p$
-3.5 - -1.0	0.2 - 7
-1.0 - 1.0	0.2 - 8
1.0 - 2.0	0.2 - 20
2.0 - 3.0	0.5 - 30
3.0 - 3.5	0.5 - 45

What we would like in a better world:

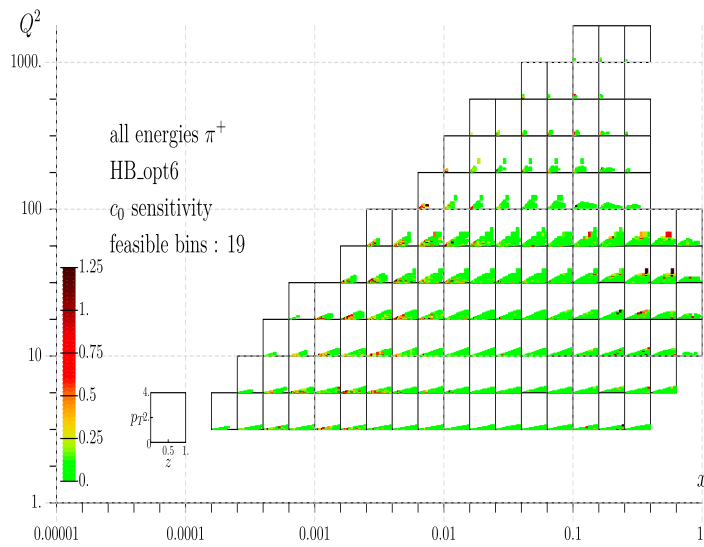


Study by Ralf Seidl

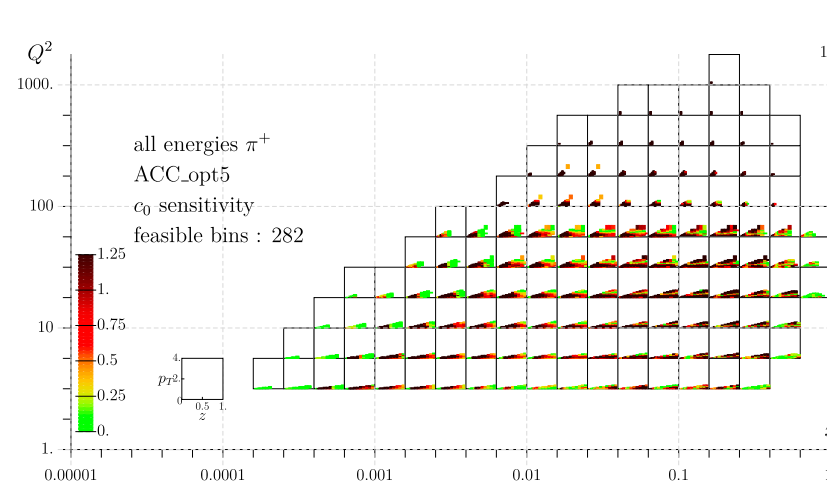
Anselm special	$\pi^0/K/p$
-3.5 - -1.0	0.2 - 7
-1.0 - 1.0	0.2 - 10
1.0 - 2.0	0.2 - 40
2.0 - 3.0	0.5 - 45
3.0 - 3.5	0.5 - 50

Hot off the press

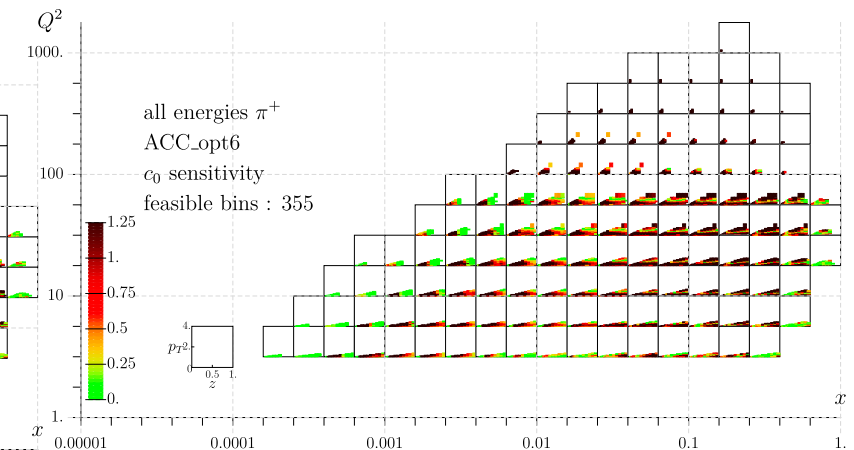
Study by Alexey Vladimirov



handbook



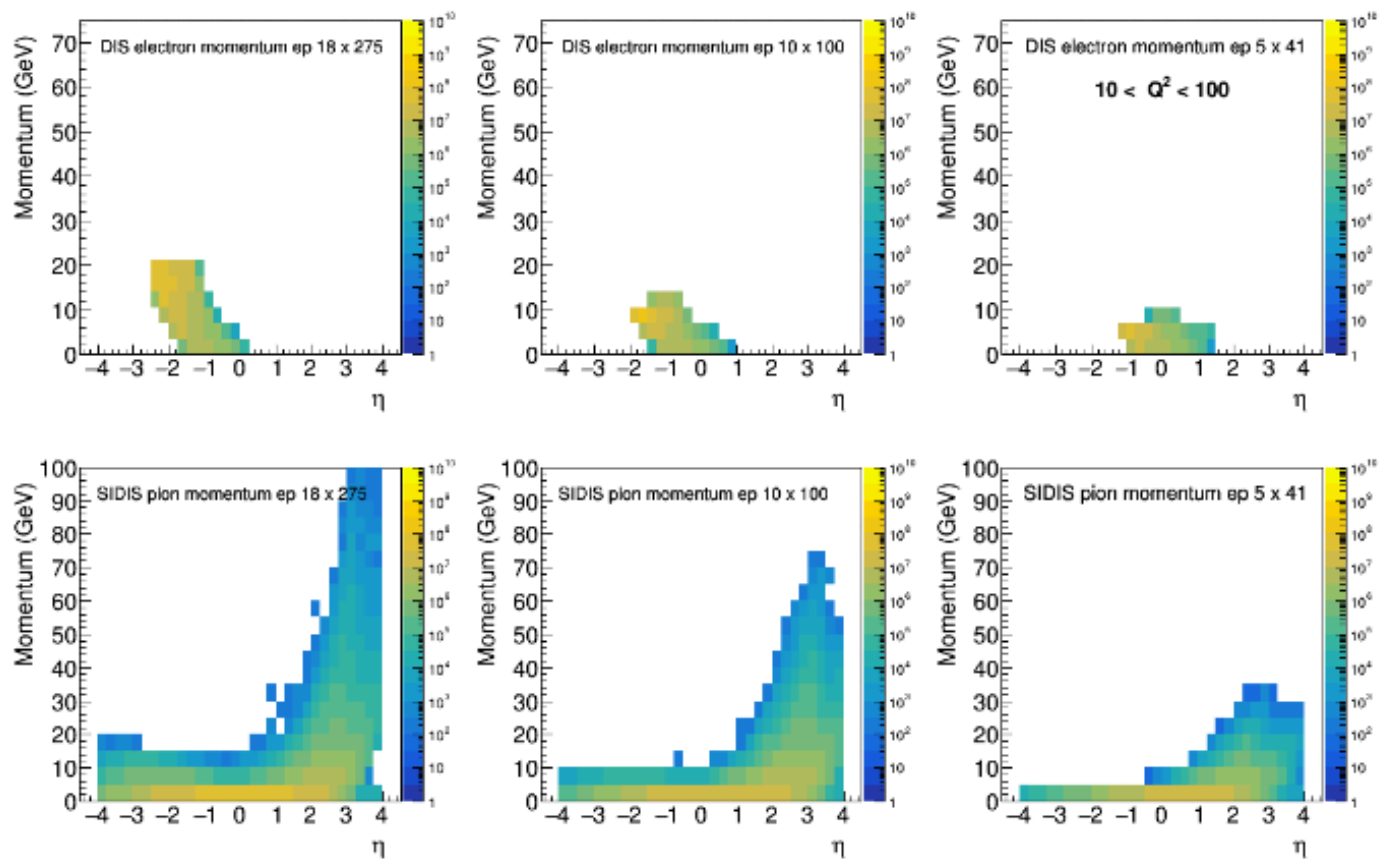
SIDIS request



Optimal request

Summary

- SIDIS requests
 - Min track $p_T < 100 \text{ MeV}$
 - Min photon energy < 200 (*mid/forward*), 400 (*far forward*) MeV
 - Extend coverage to $\eta = 4$
 - Significantly improve PID with focus on forward region \rightarrow SIDIS request should be seen as minimum



Study by Ralf Seidl