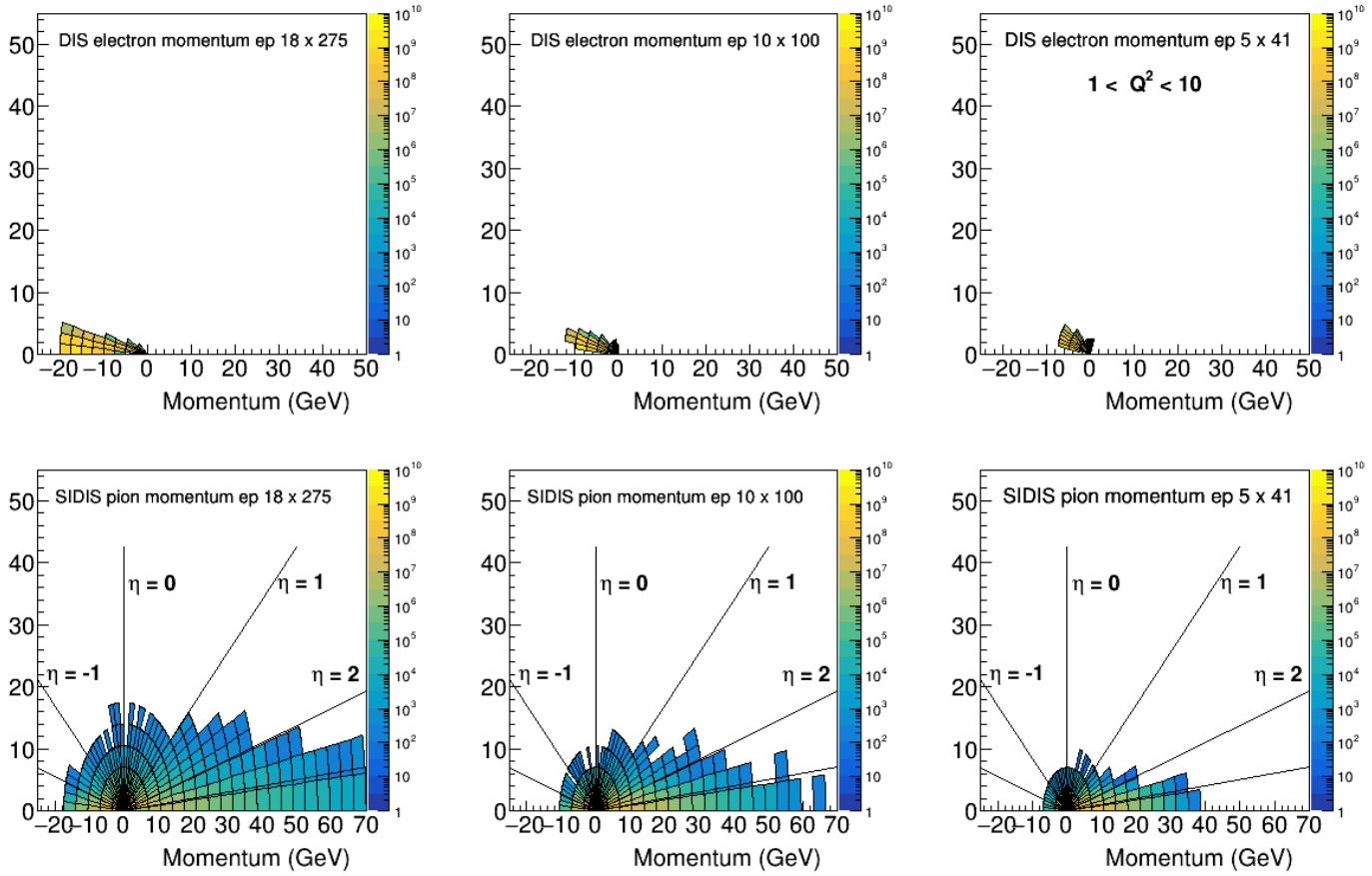
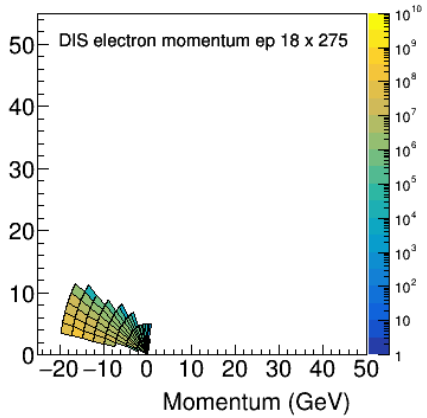
Acceptance studies

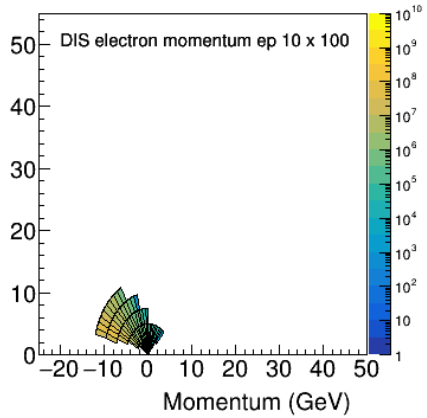
Ralf Seidl (RIKEN)

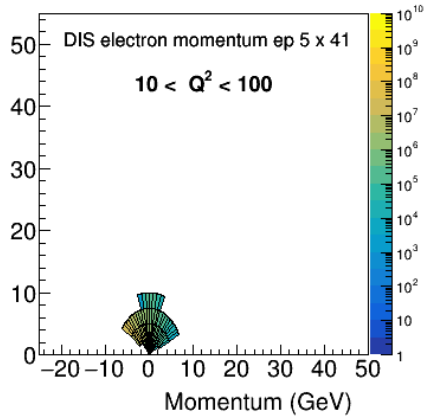
9/24 update

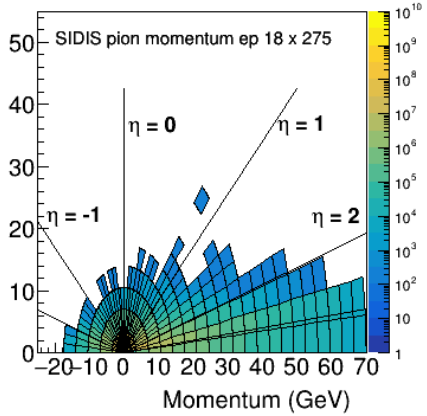
Estimated yields for 10fb^{-1}

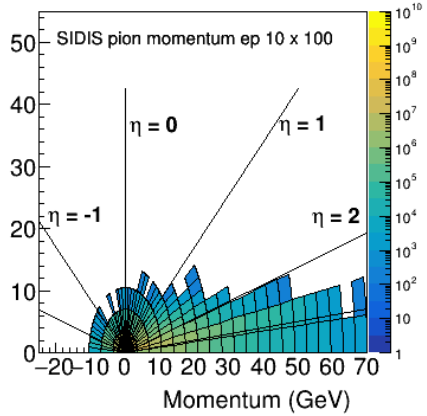



DIS electron momentum ep 18 x 275
Momentum (GeV)


DIS electron momentum ep 10 x 100
Momentum (GeV)


DIS electron momentum ep 5 x 41
10 < Q² < 100
Momentum (GeV)


SIDIS pion momentum ep 18 x 275
η = 0
η = 1
η = -1
η = 2
Momentum (GeV)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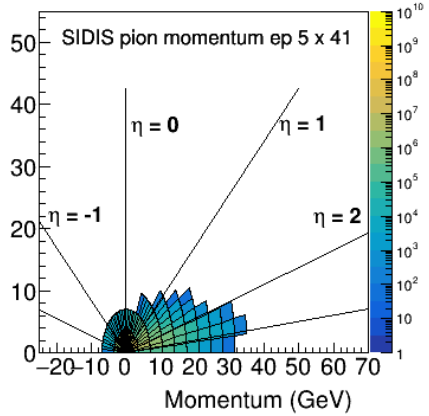
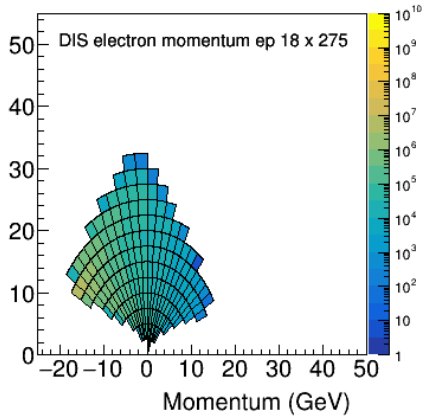
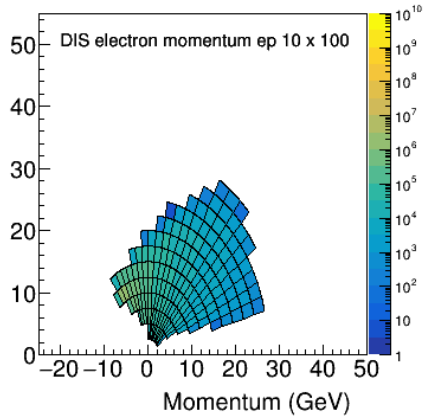
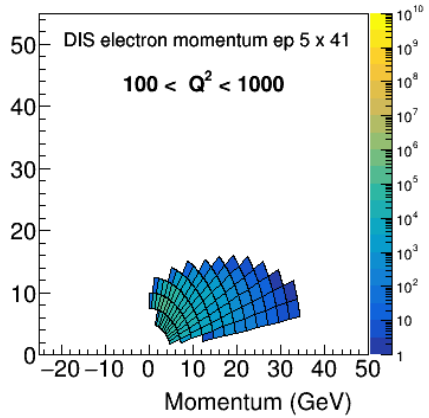
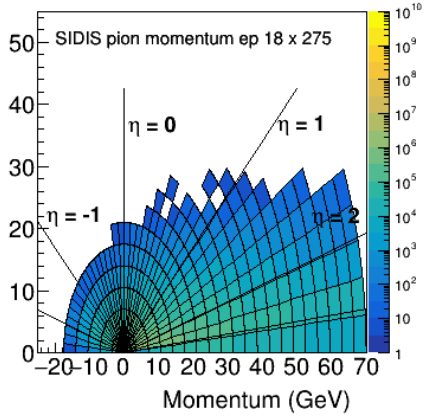
η = 0
η = 1
η = -1
η = 2
Momentum (GeV)


SIDIS pion momentum ep 5 x 41
η = 0
η = 1
η = -1
η = 2
Momentum (GeV)


DIS electron momentum ep 18 x 275
Momentum (GeV)


DIS electron momentum ep 10 x 100
Momentum (GeV)


DIS electron momentum ep 5 x 41
100 < Q² < 1000
Momentum (GeV)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η = 0
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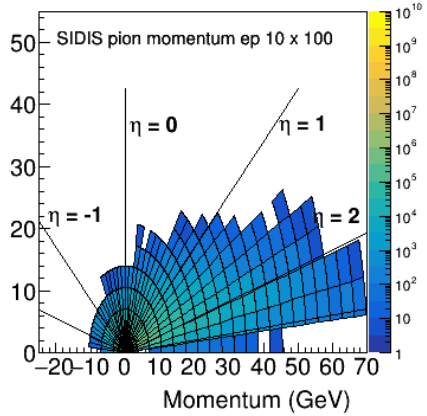
η = 2
Momentum (GeV)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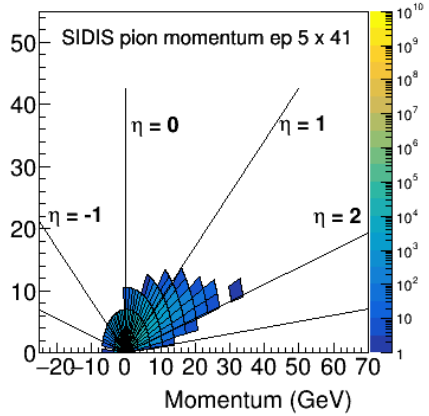
Momentum (GeV)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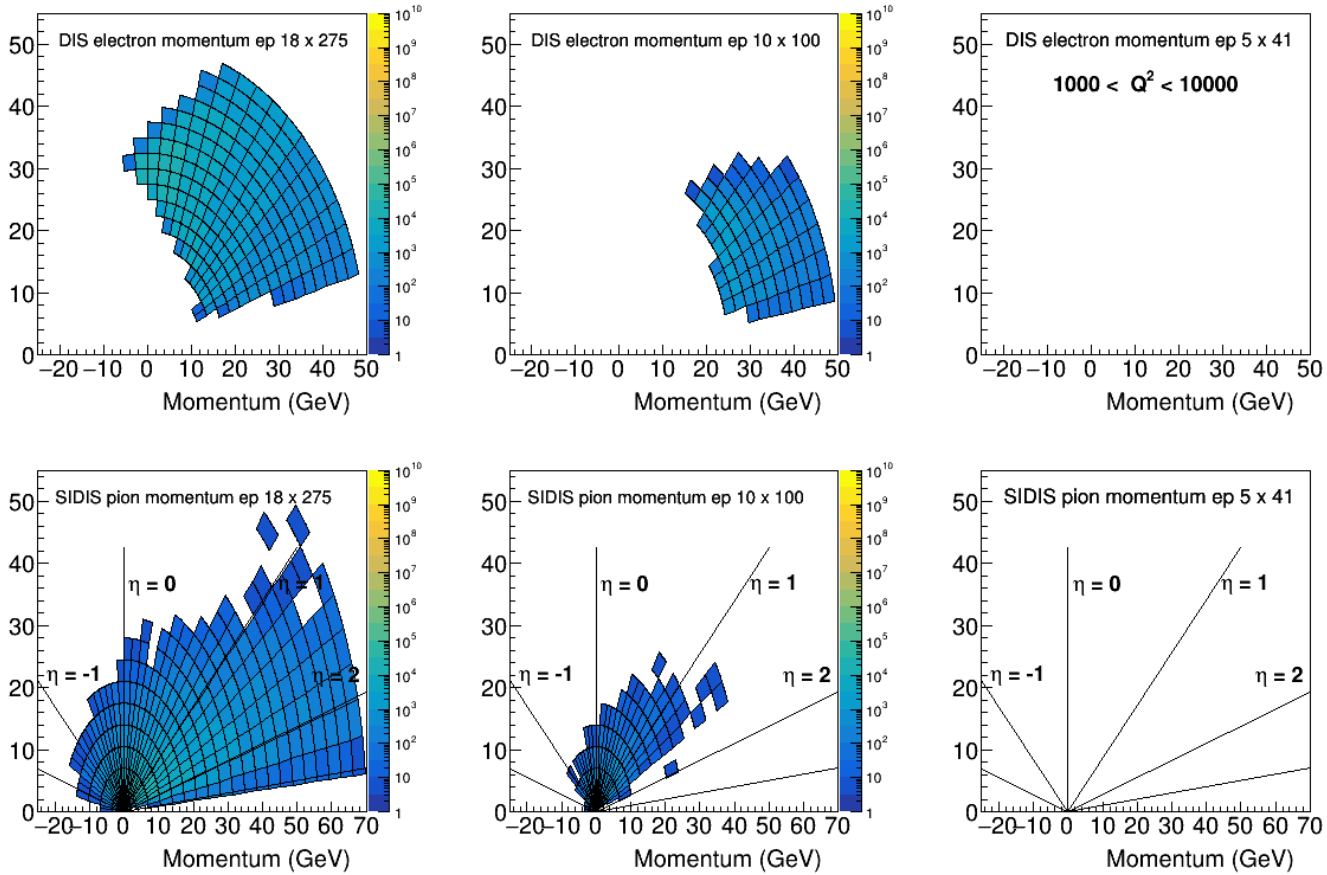
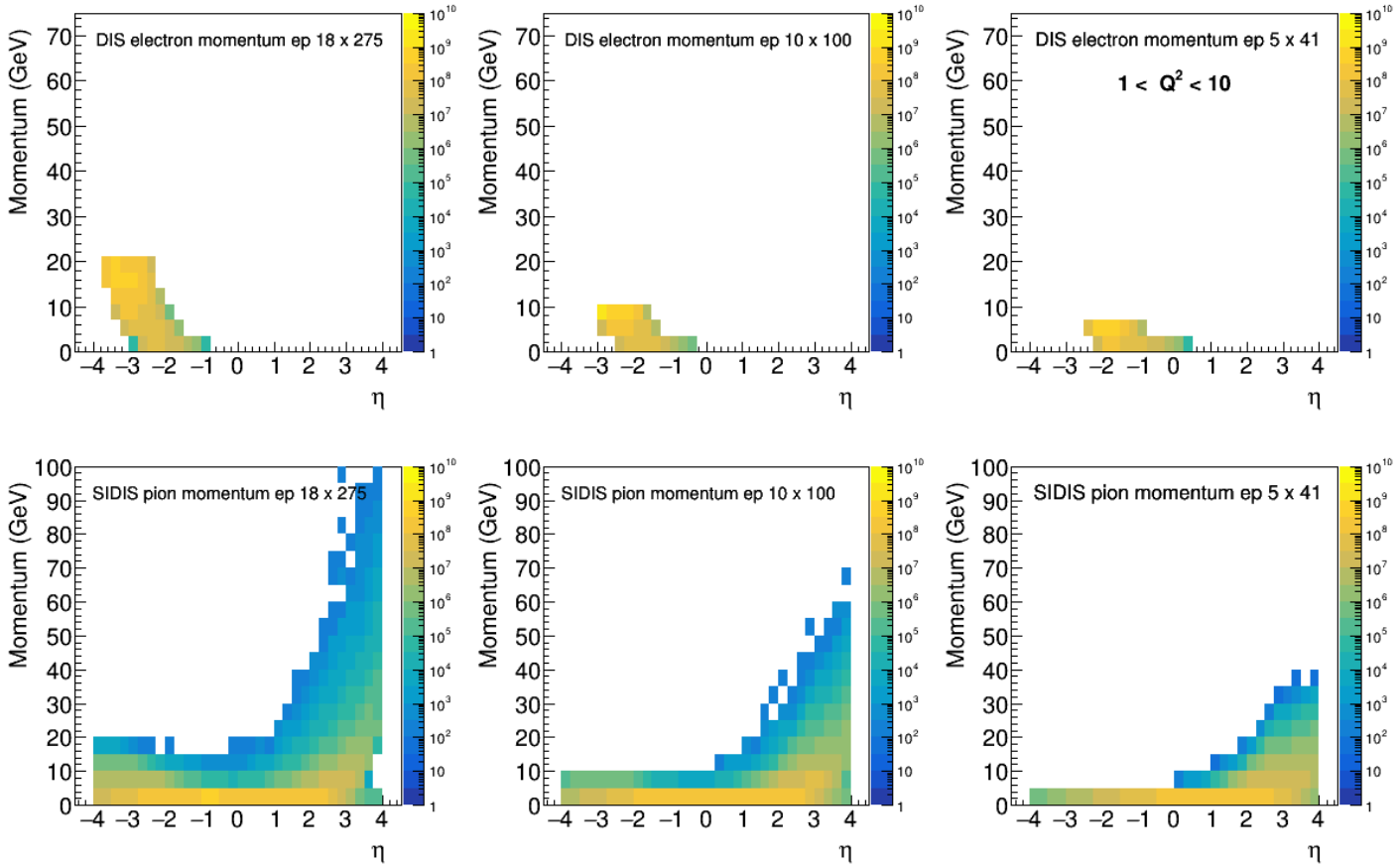
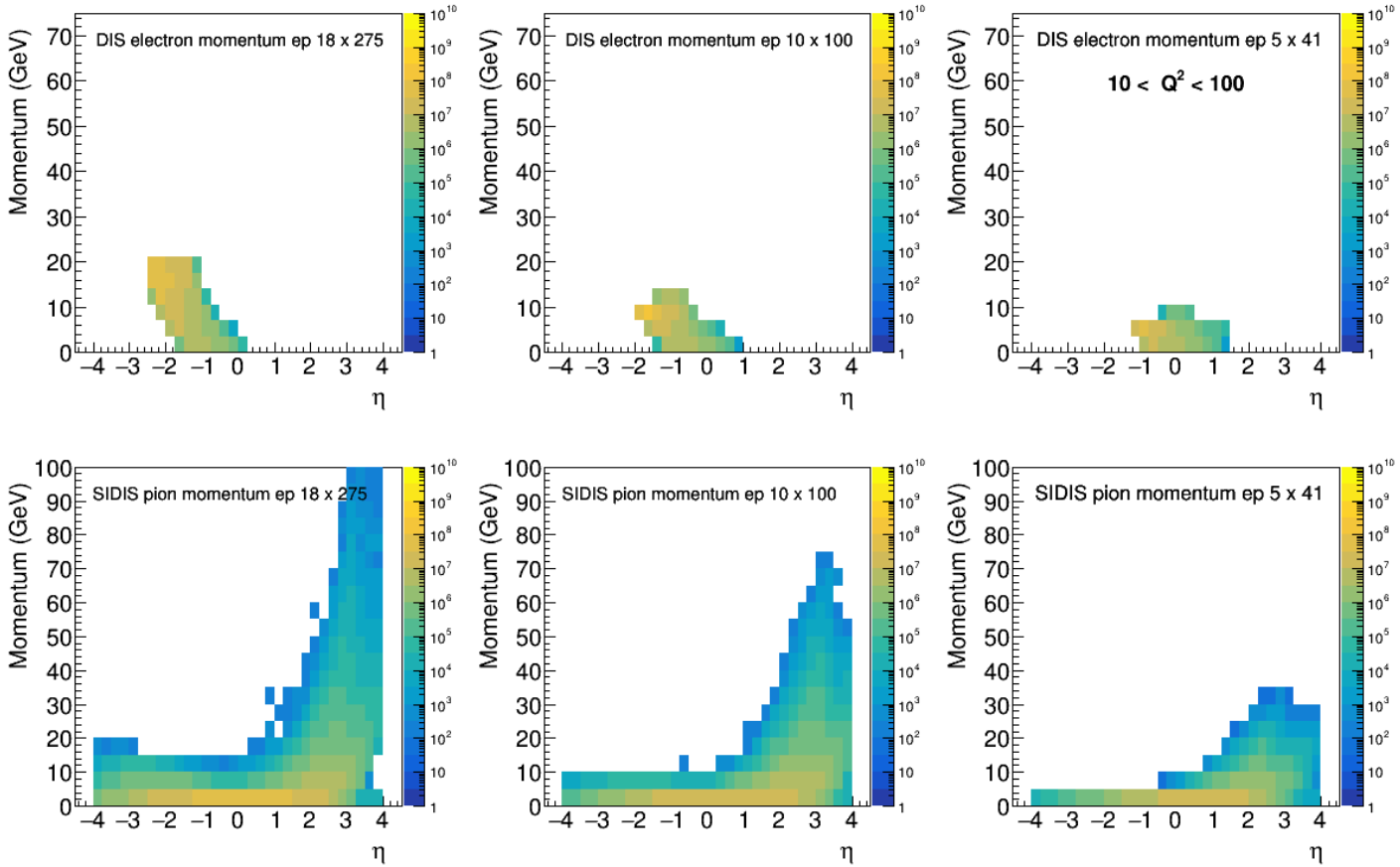
η = 2
Momentum (GeV)


DIS electron momentum ep 18 x 275
DIS electron momentum ep 10 x 100
DIS electron momentum ep 5 x 41
1000 < Q² < 10000
SIDIS pion momentum ep 18 x 275
SIDIS pion momentum ep 10 x 100
SIDIS pion momentum ep 5 x 41
η = -1
η = 0
η = 1
η = 2
Momentum (GeV)

Same, vs rapidity




DIS electron momentum ep 18 x 275
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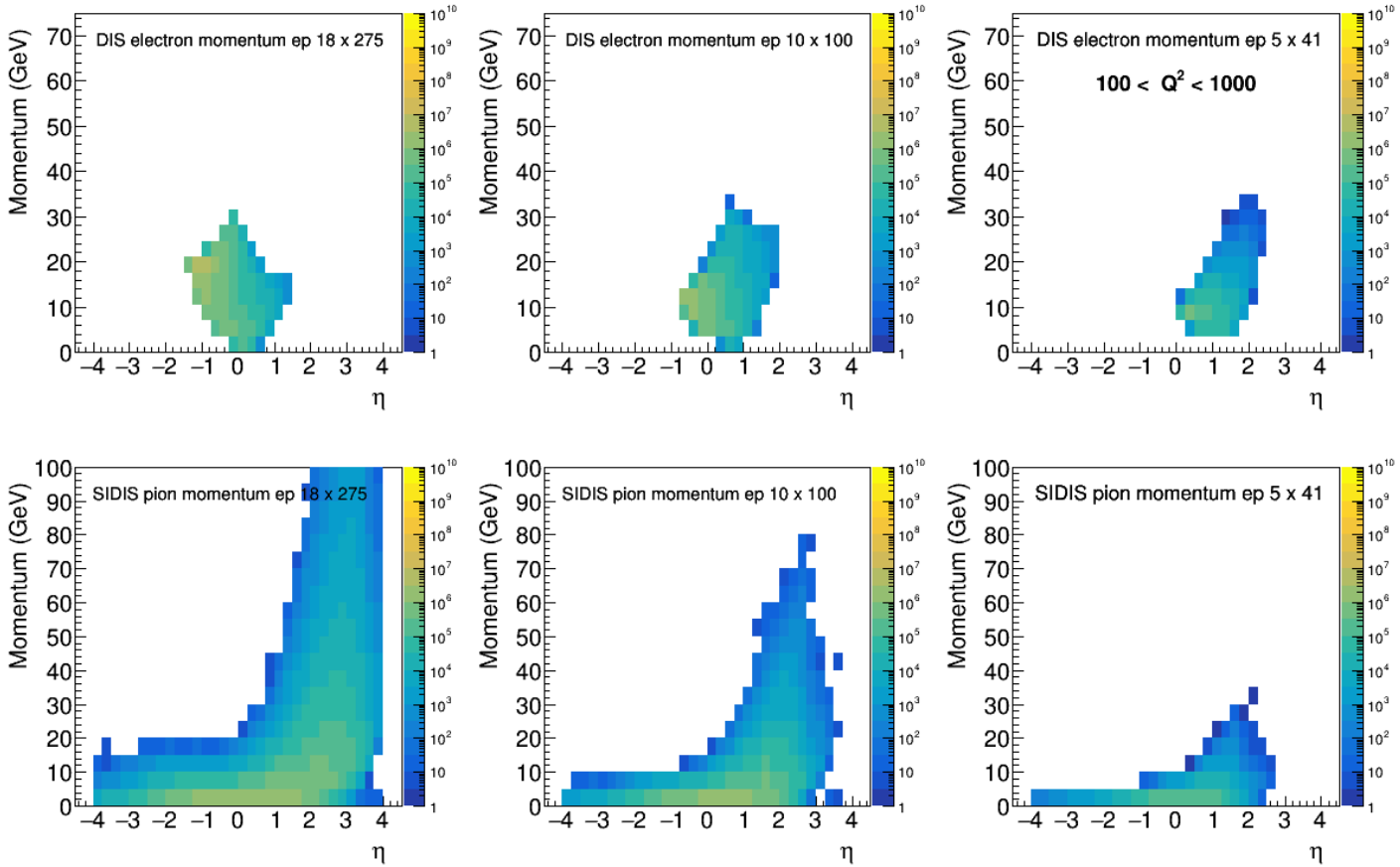
DIS electron momentum ep 5 x 41
10 < Q² < 100
SIDIS pion momentum ep 18 x 275
SIDIS pion momentum ep 10 x 100
SIDIS pion momentum ep 5 x 41
Momentum (GeV)
η


DIS electron momentum ep 18 x 275
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100 < Q² < 1000
SIDIS pion momentum ep 18 x 275
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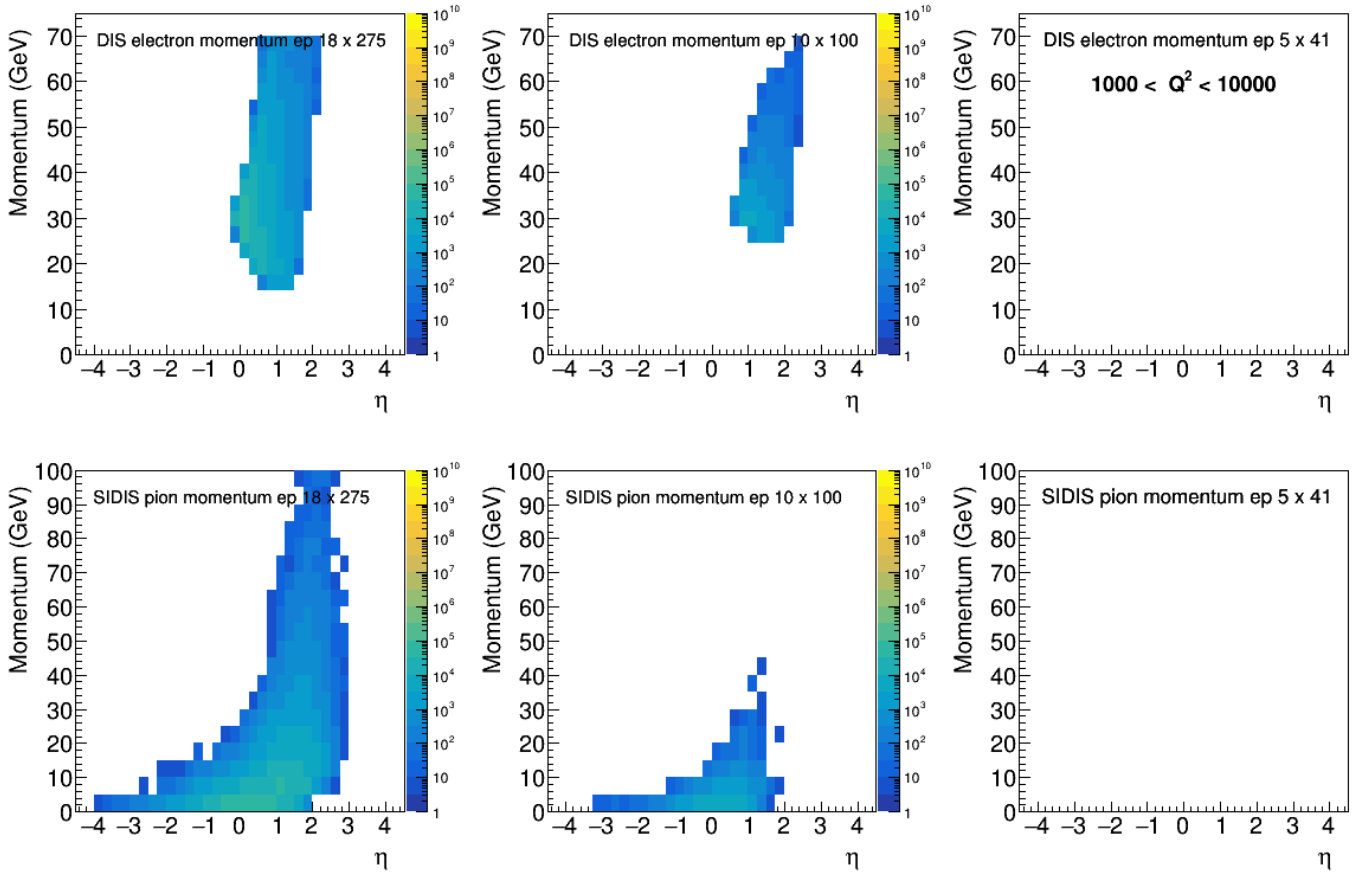
SIDIS pion momentum ep 5 x 41
Momentum (GeV)
η


DIS electron momentum ep 18 x 275
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1000 < Q² < 10000
SIDIS pion momentum ep 18 x 275
SIDIS pion momentum ep 10 x 100
SIDIS pion momentum ep 5 x 41
Momentum (GeV)
η

Different PID ranges tested for 4D acceptance

Matrix 1	π/K/p
-3.5 - -1.0	0.2 - 7
-1.0 - 1.0	0.2 - 5
1.0 - 2.0	0.2 - 8
2.0 - 3.0	0.5 - 20
3.0 - 3.5	0.5 - 45

SIDIS 2	π/K/p
-3.5 - -1.0	0.2 - 7
-1.0 - 1.0	0.2 - 8
1.0 - 2.0	0.2 – 10
2.0 - 3.0	0.5 - 20
3.0 - 3.5	0.5 - 45

Pi0 highp 4	π/K	p
-3.5 - -1.0	0.2 - 5	0.2 - 8
-1.0 - 1.0	0.2 - 4	0.2 - 4
1.0 - 2.0	0.2 – 100	0.2 – 100
2.0 - 3.0	0.5 – 100	3.0 – 100
3.0 - 3.5	0.5 – 100	3.0 – 100

SIDIS request 5	π/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

Old 3	π/K	p
-3.5 - -1.0	0.2 - 5	0.2 - 8
-1.0 - 1.0	0.2 - 4	0.2 - 4
1.0 - 2.0	0.2 - 50	0.2 - 50
2.0 - 3.0	0.5 - 50	3.0 - 50
3.0 - 3.5	0.5 - 50	3.0 - 50

High pt 6	π/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

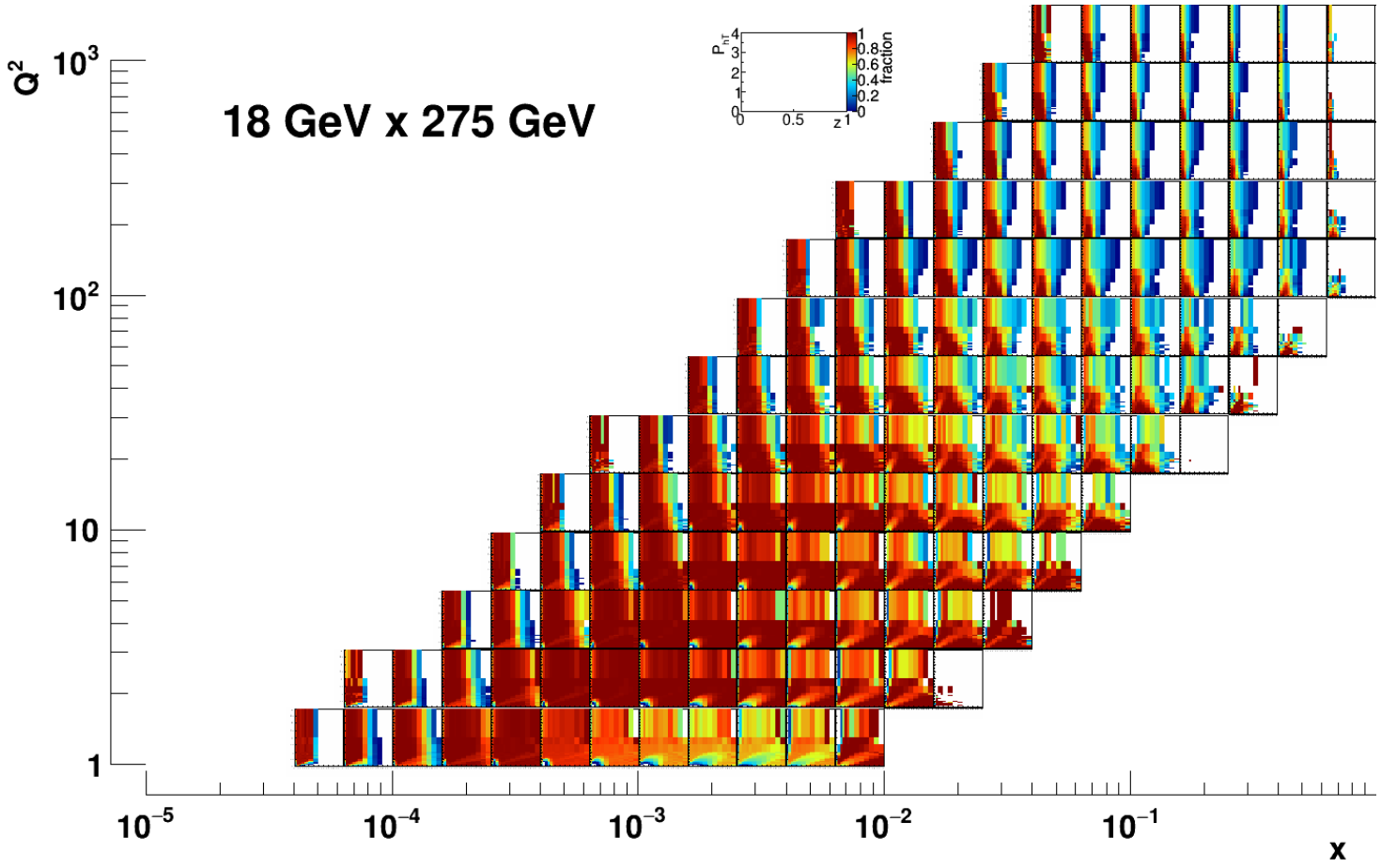
Low pt: 7	π/K/p
-3.5 - -1.0	1.5 - 7
-1.0 - 1.0	1.5 - 10
1.0 - 2.0	1.5 – 40
2.0 - 3.0	1.5 – 45
3.0 - 3.5	1.5 – 50

- Compare max momentum requirements for
  - Old (used by Charlotte et al for SIDIS PDF/FF paper)
  - Official Detector Matrix (by DWG/conveners)
  - SIDIS group preference for central detectors
  - Pi0 high p (2-3.5 Old 50 →100 GeV)
  - Official SIDIS group request
- Color coding (yellow higher than Matrix, red lower)

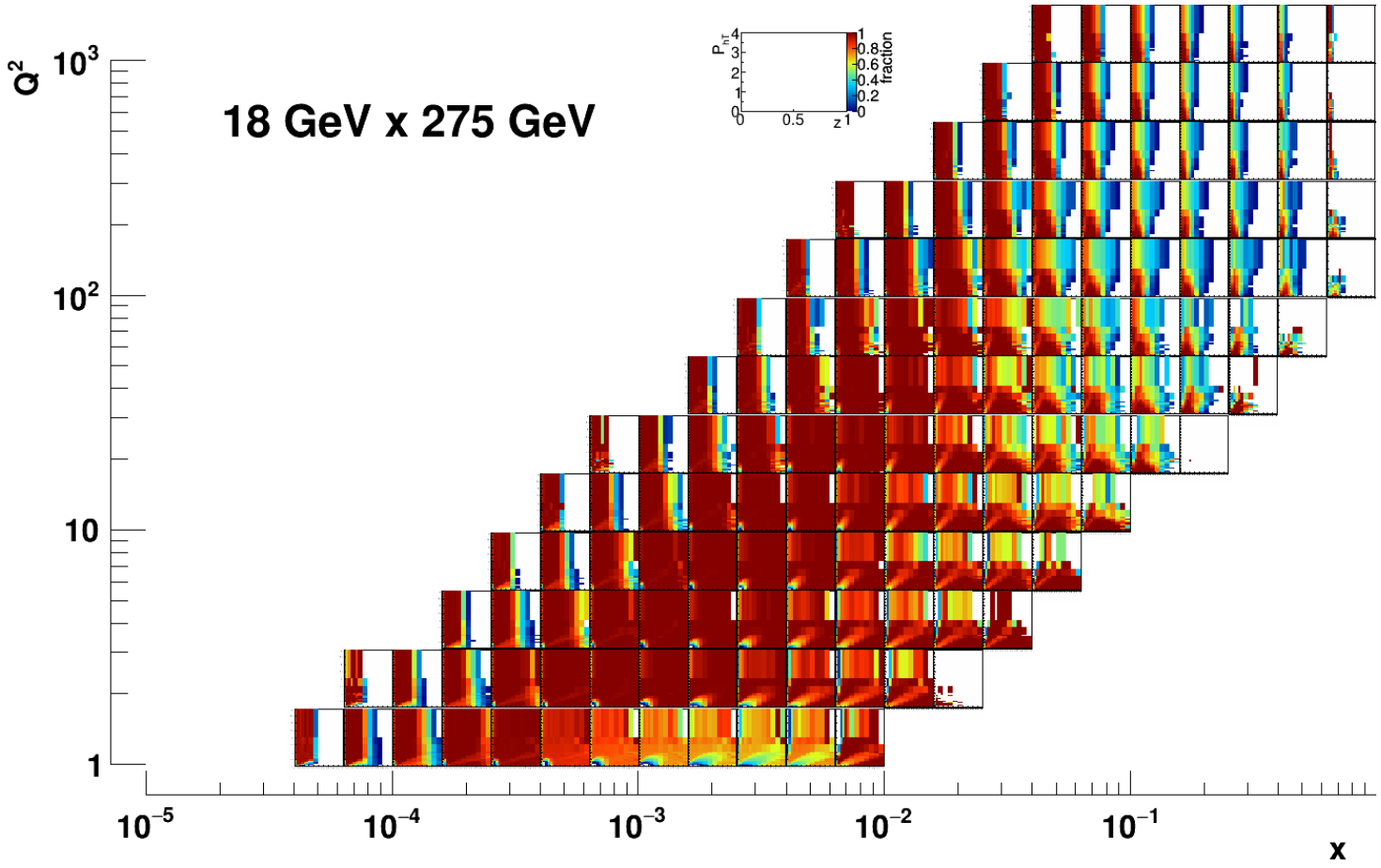
Final PID ranges accd to DWG

Final 8	π/K/p
-3.5 - -1.0	0.2 - 7
-1.0 - 1.0	0.2 - 6
1.0 - 2.0	0.2 – 50
2.0 - 3.0	0.5 – 50
3.0 - 3.5	0.5 – 50

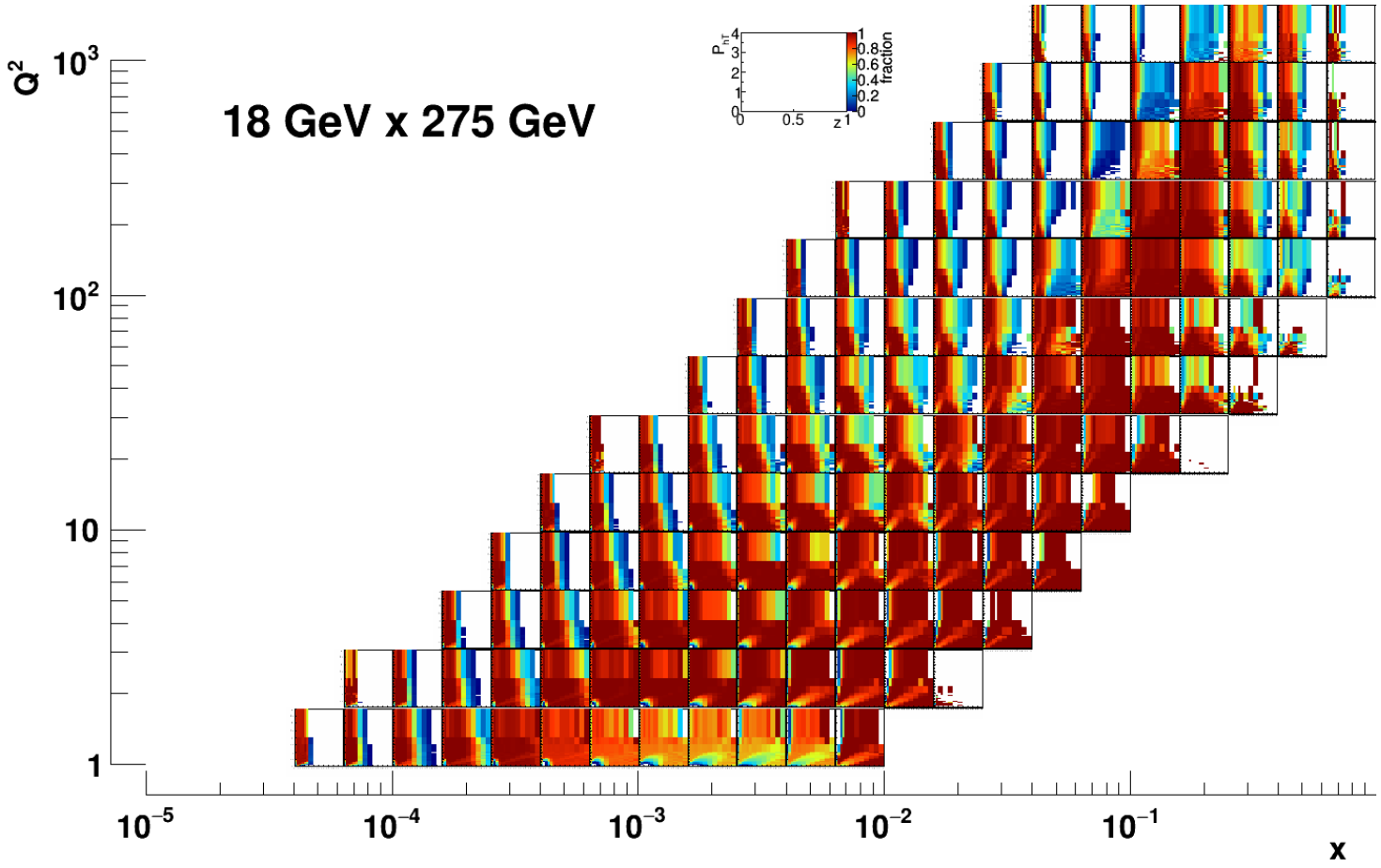
4D ratios (PID acc/perfect): Matrix



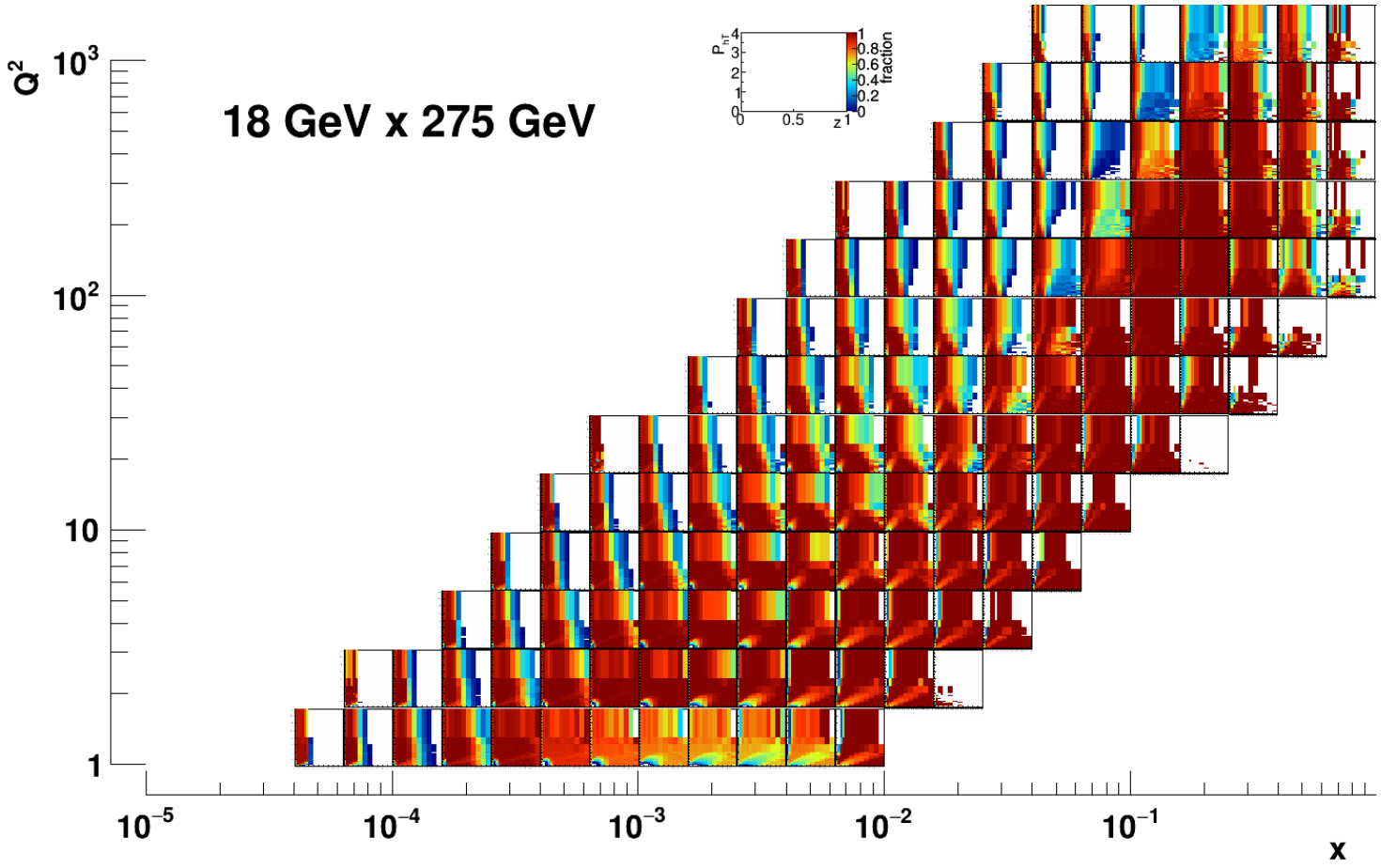
4D ratios (PID acc/perfect): SIDIS



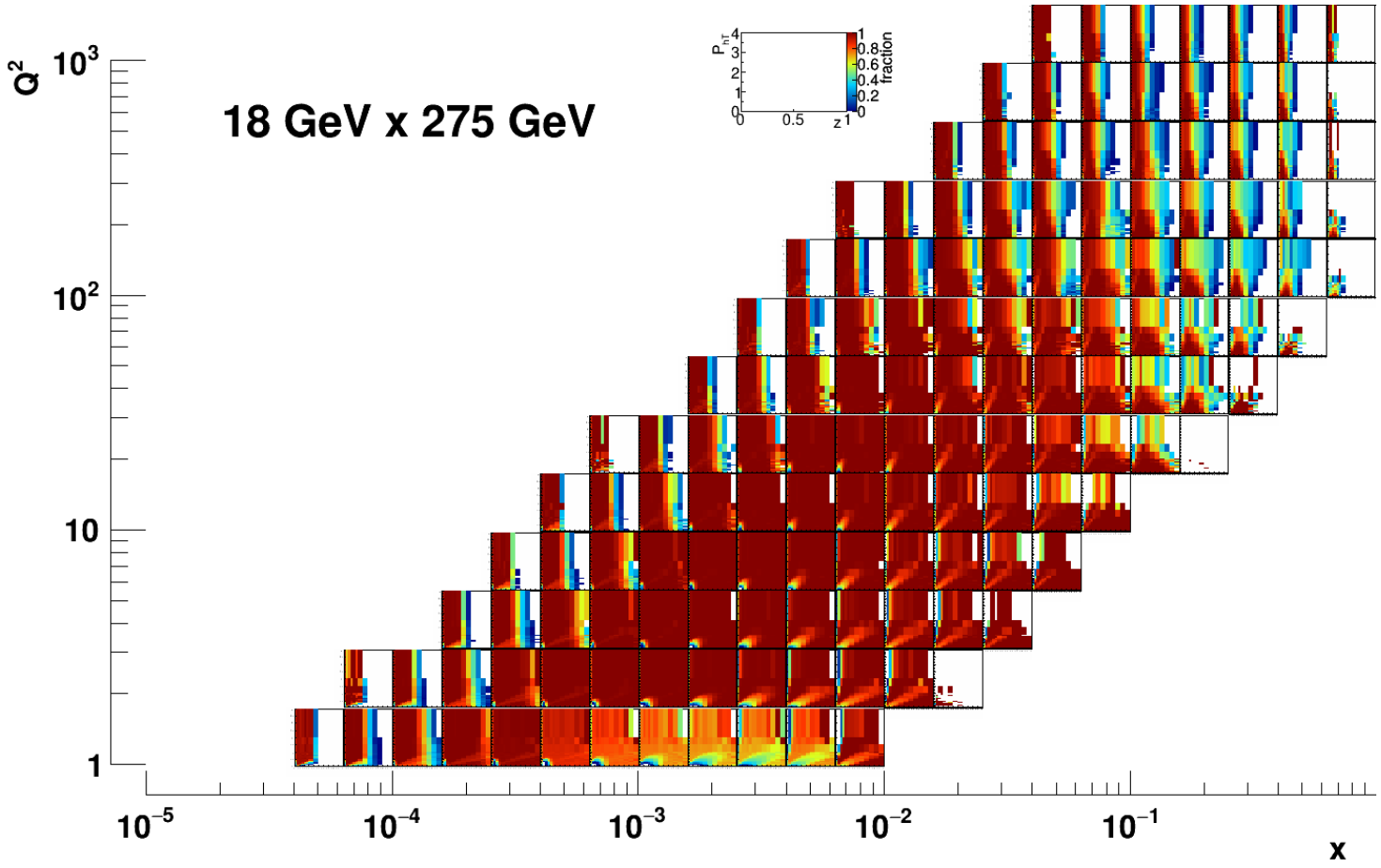
Old


18 GeV x 275 GeV
Q^2
10^3
10^2
10
1
10^{-5}
10^{-4}
10^{-3}
10^{-2}
10^{-1}
x
P_{hT}
z
fraction

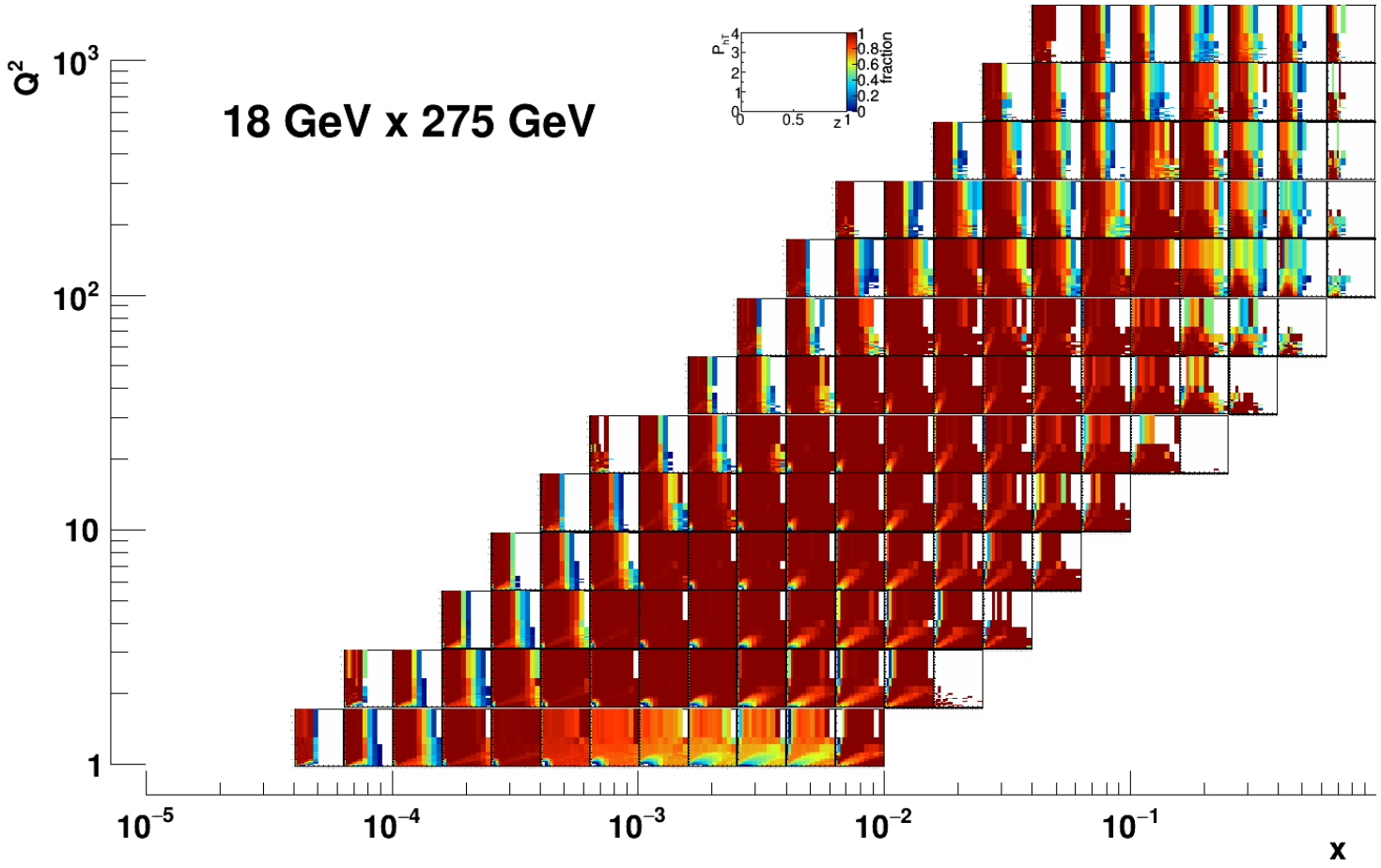
Very high forward P



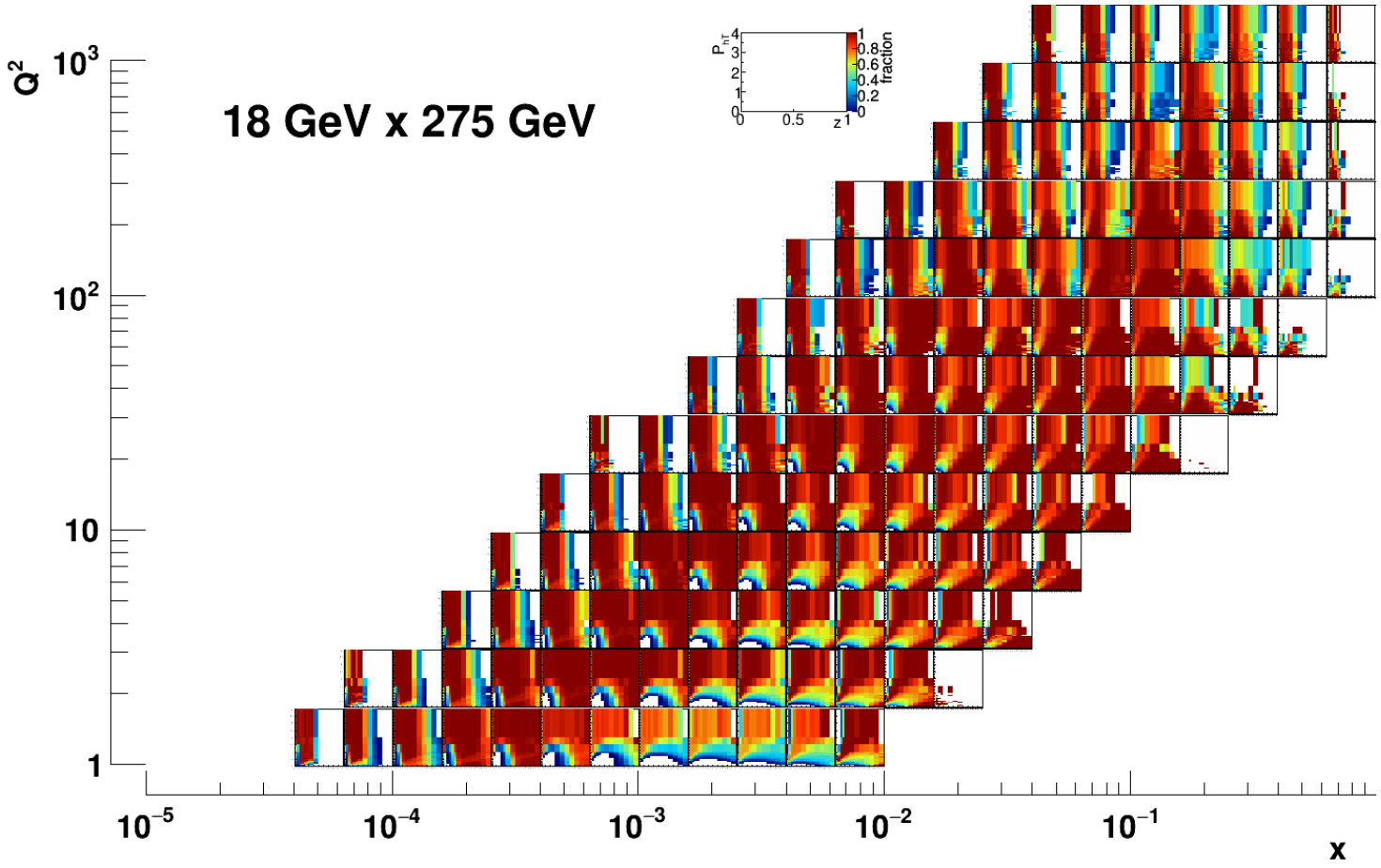
SIDIS Request



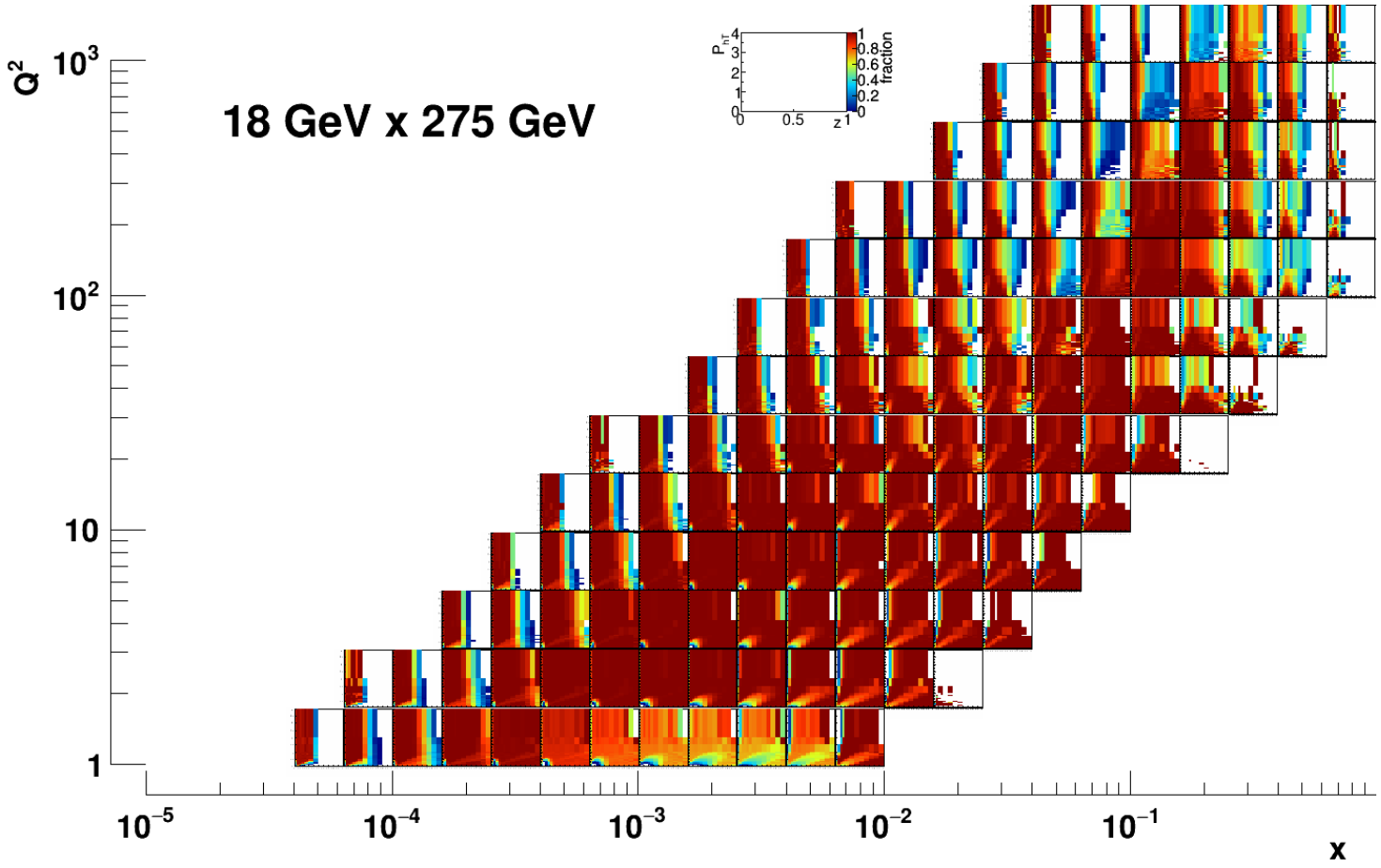
Anselm Request



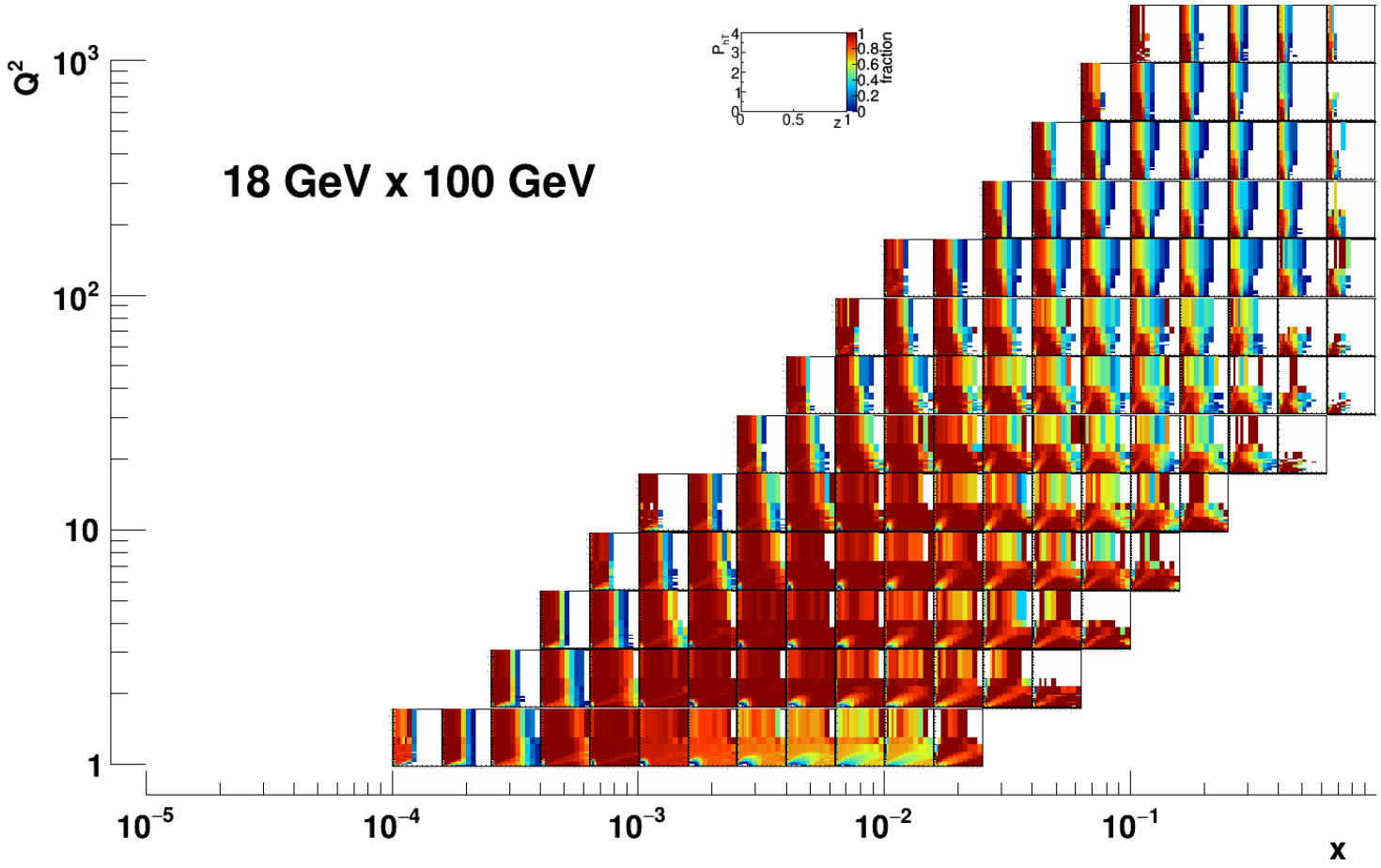
Low p cut


18 GeV x 275 GeV
Q^2
10^3
10^2
10
1
10^{-5}
10^{-4}
10^{-3}
10^{-2}
10^{-1}
x
P_{hT}
z
fraction

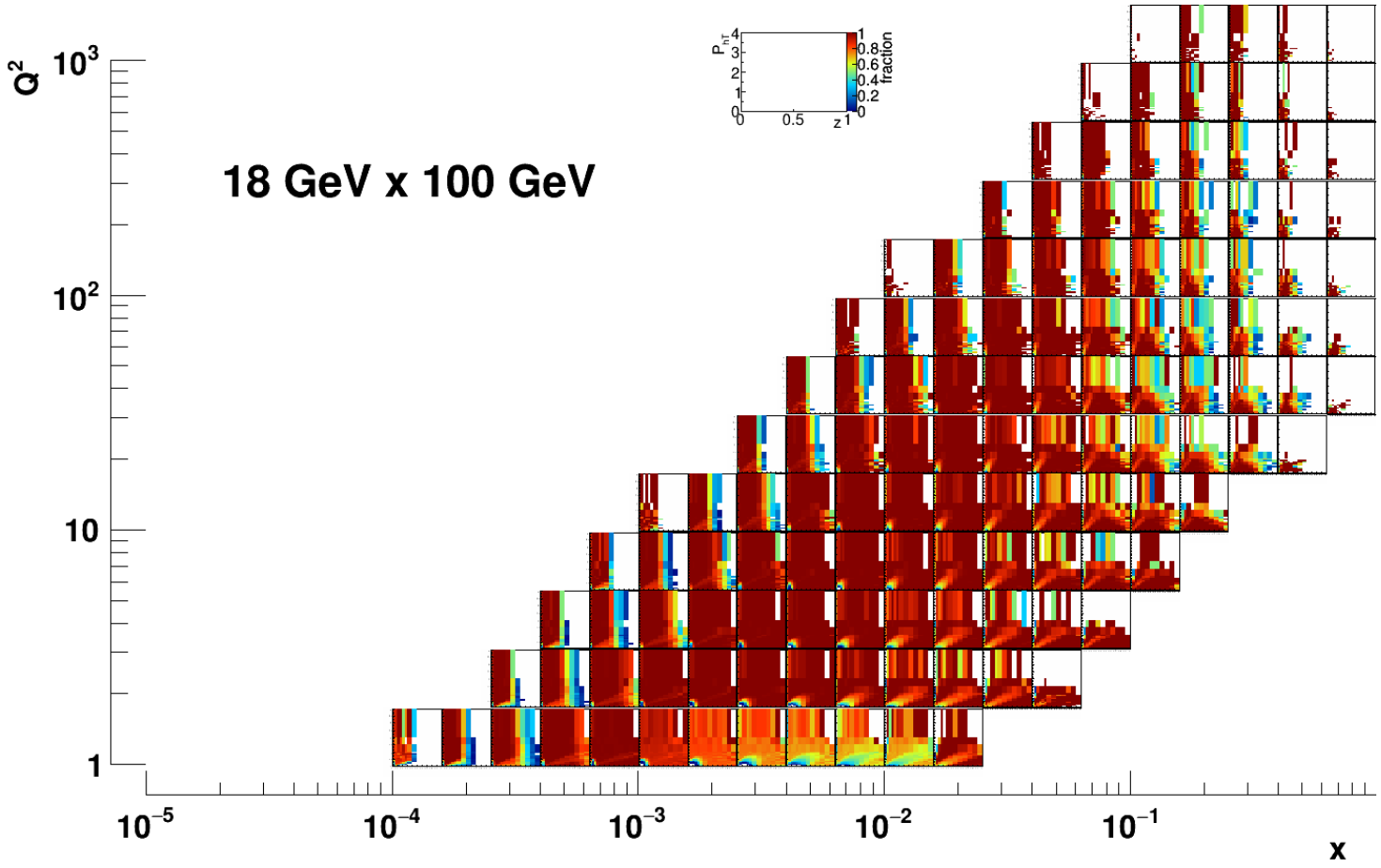
Final PID


18 GeV x 275 GeV
Q^2
10^3
10^2
10
1
10^{-5}
10^{-4}
10^{-3}
10^{-2}
10^{-1}
x
P_{hT}
z
fraction

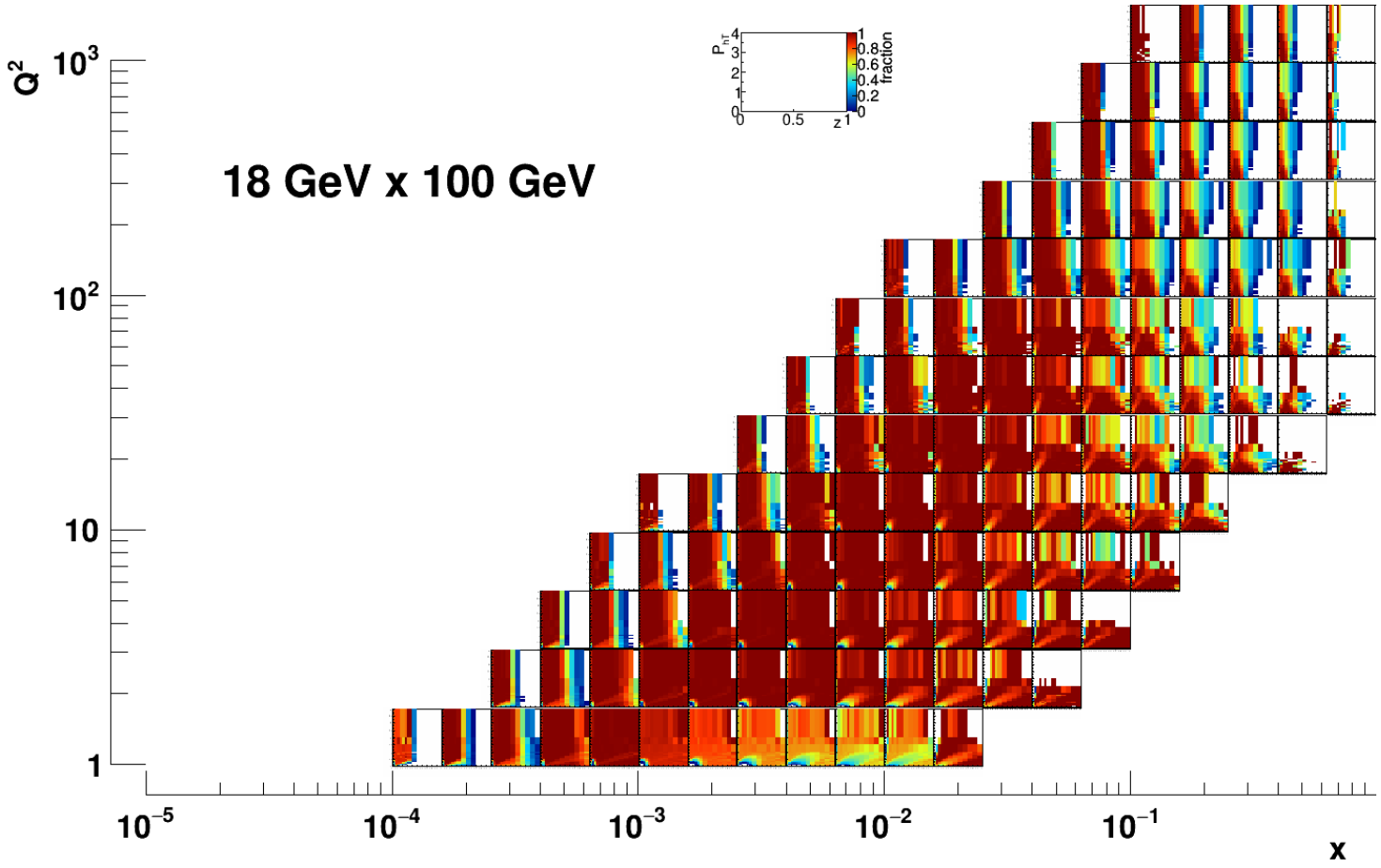
Matrix


18 GeV x 100 GeV
Q^2
10^3
10^2
10
1
10^{-5}
10^{-4}
10^{-3}
10^{-2}
10^{-1}
x
P_{hT}
z
fraction

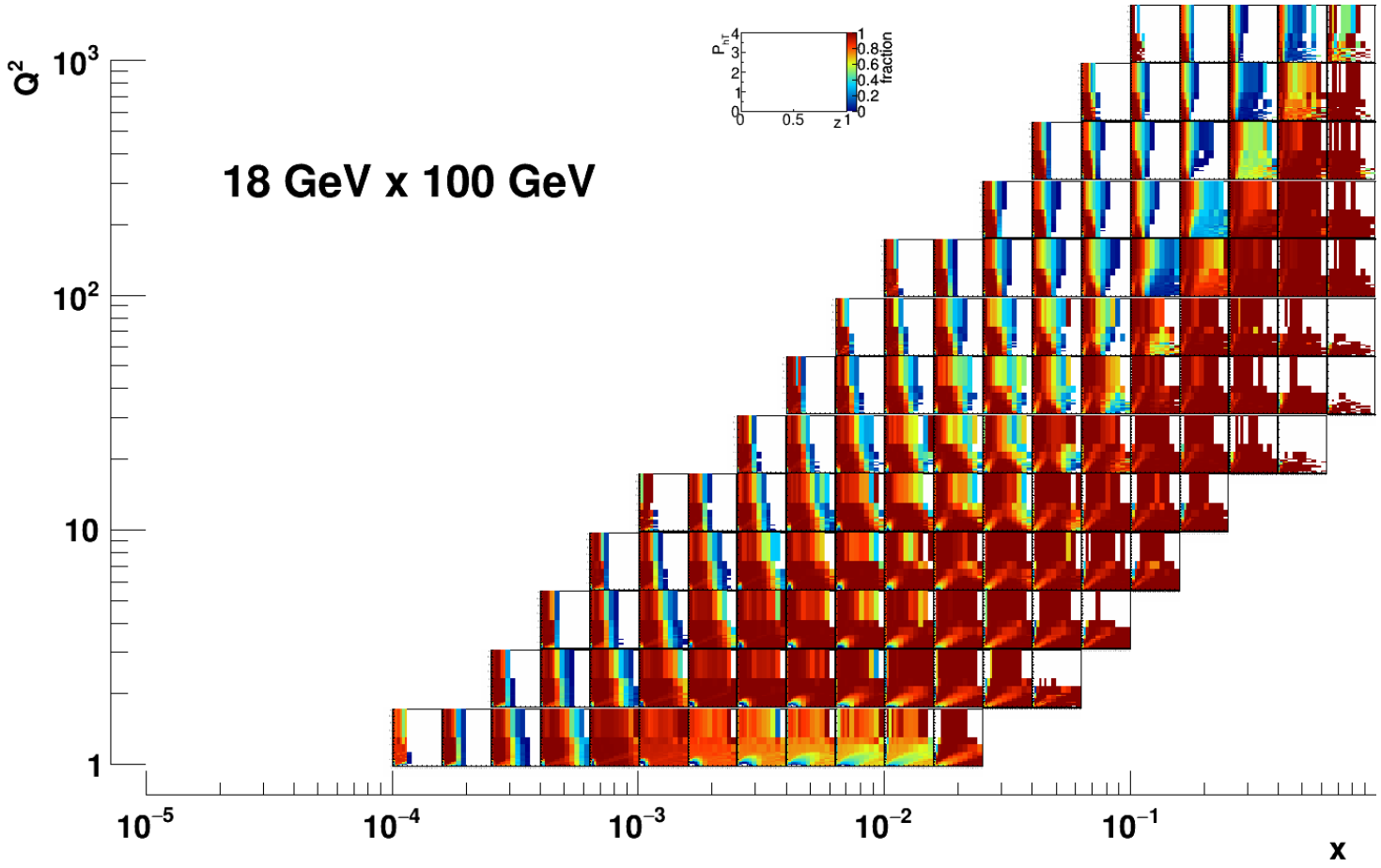
SIDIS


18 GeV x 100 GeV
Q^2
10^3
10^2
10
1
10^{-5}
10^{-4}
10^{-3}
10^{-2}
10^{-1}
x
P_{hT}
z
fraction

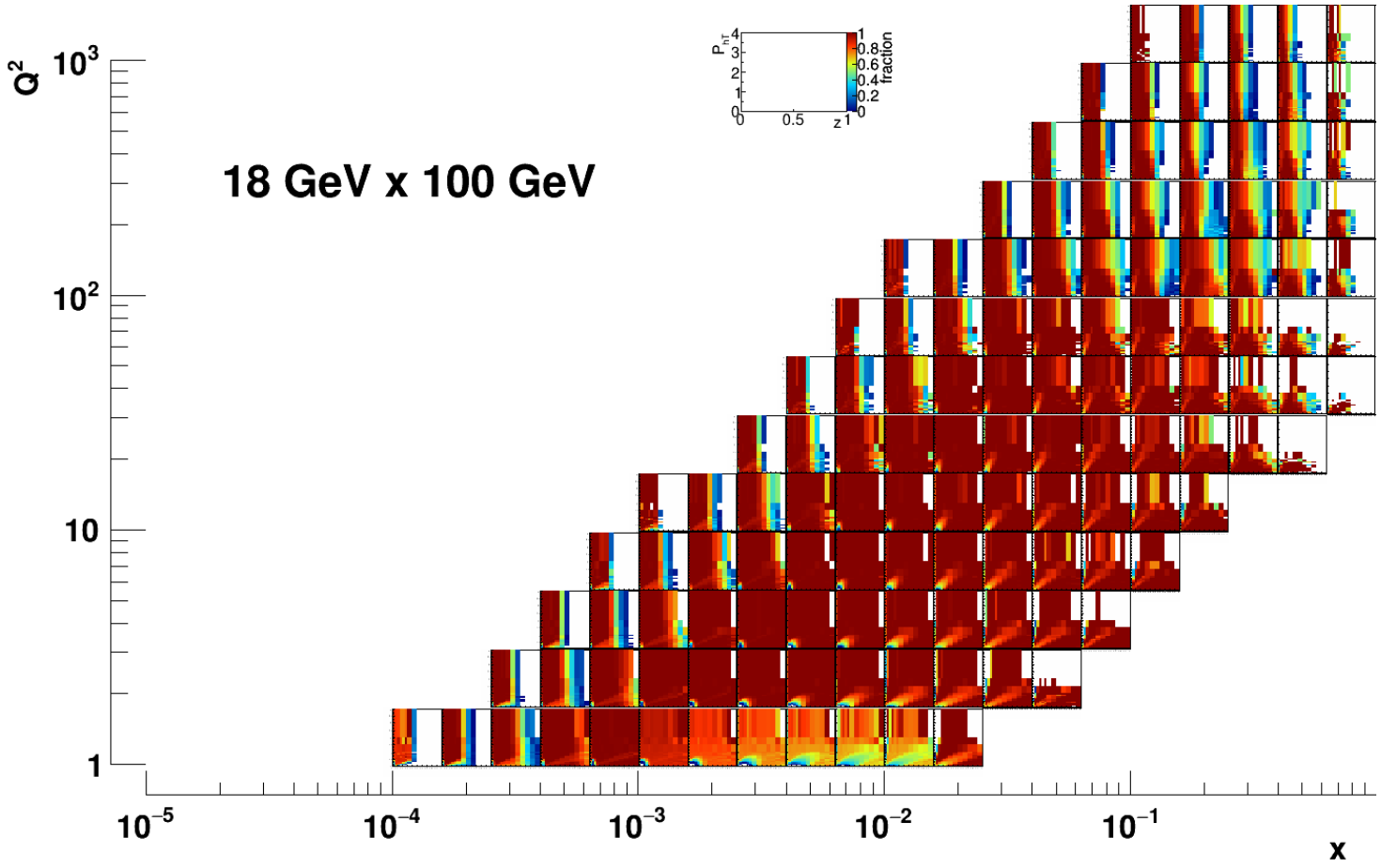
old


18 GeV x 100 GeV
Q^2
10^3
10^2
10
1
10^{-5}
10^{-4}
10^{-3}
10^{-2}
10^{-1}
x
P_{hT}
z
fraction

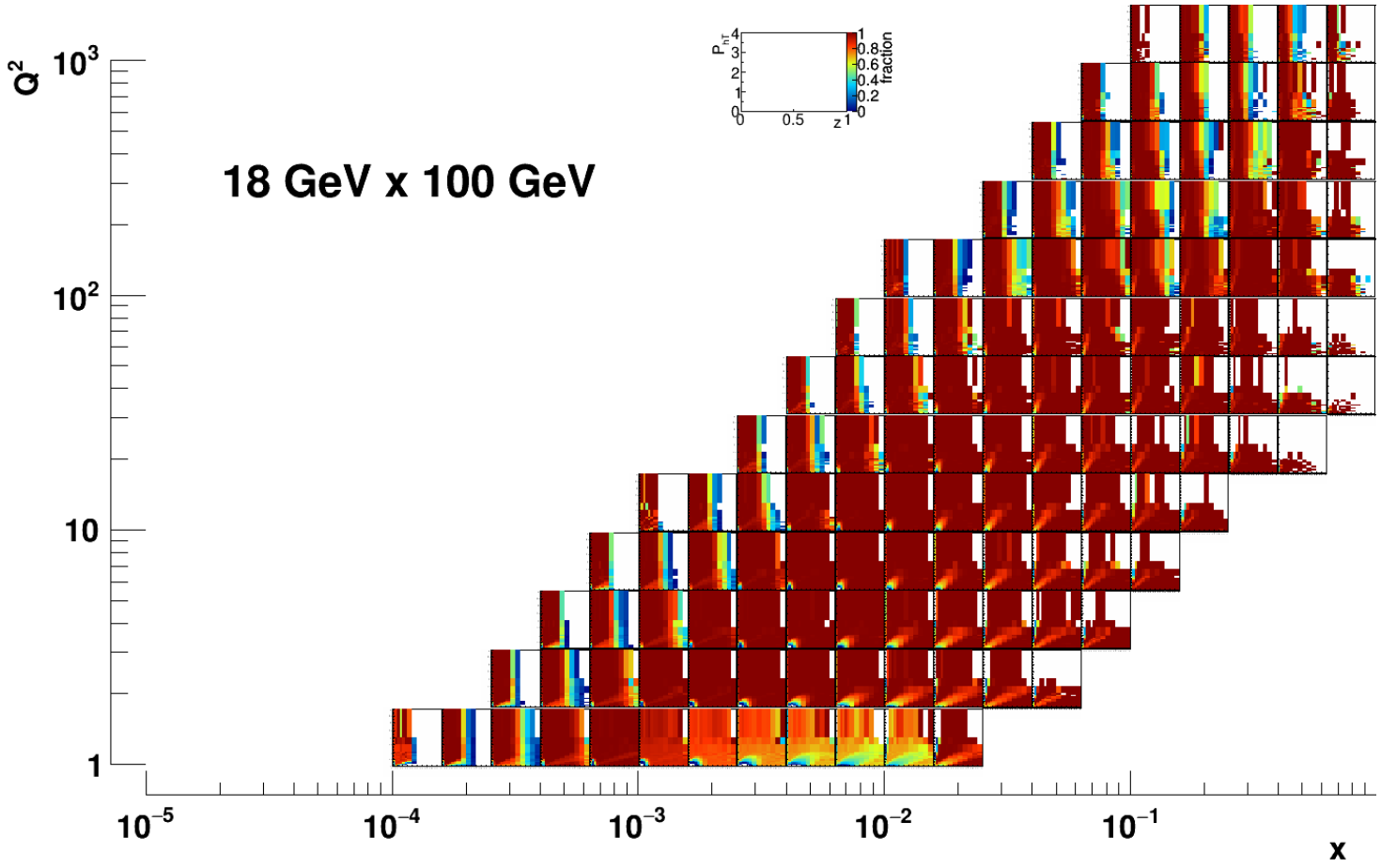
Very high p


18 GeV x 100 GeV
Q^2
10^3
10^2
10
1
10^{-5}
10^{-4}
10^{-3}
10^{-2}
10^{-1}
x
P_{hT}
z
fraction

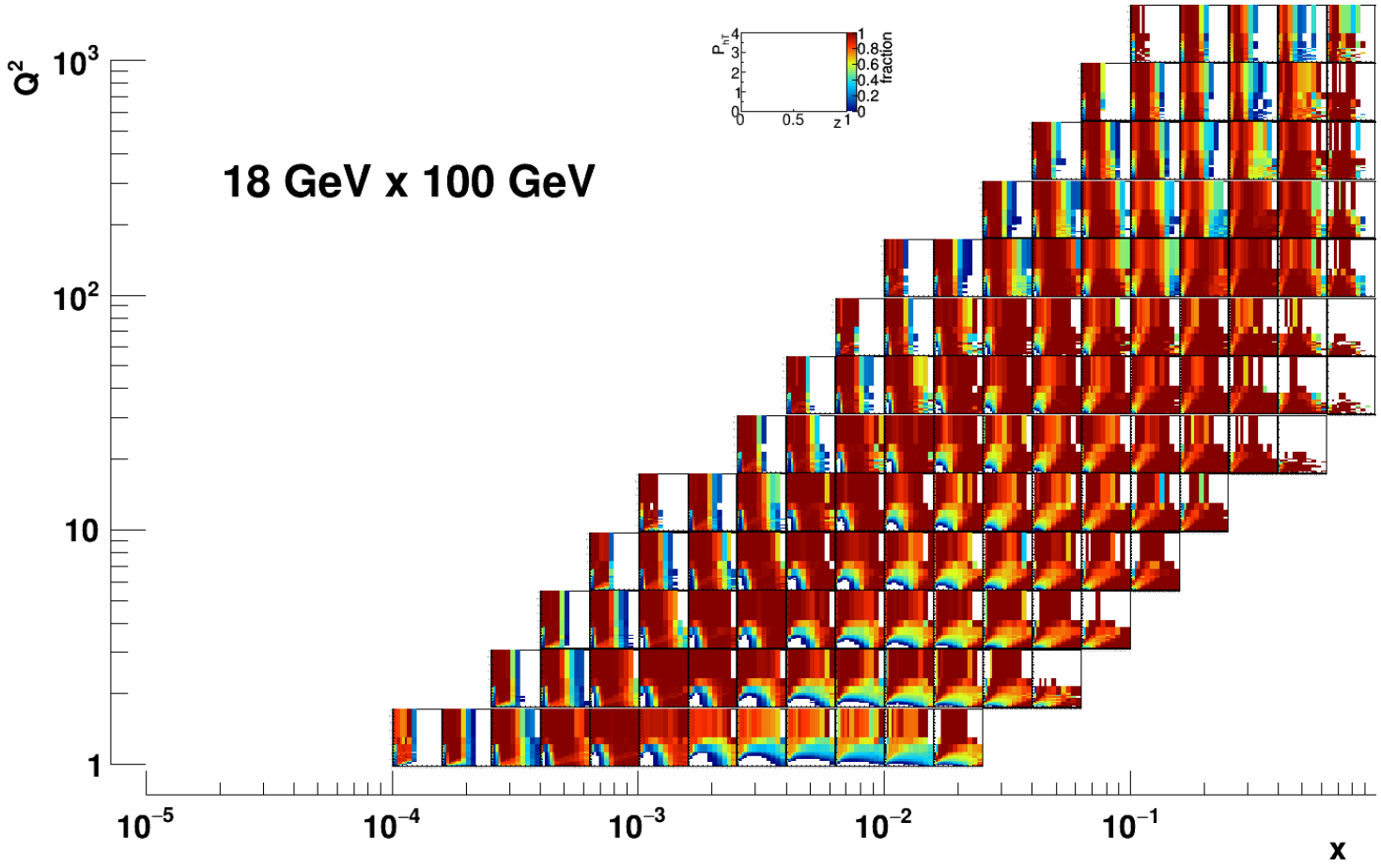
SIDIS request



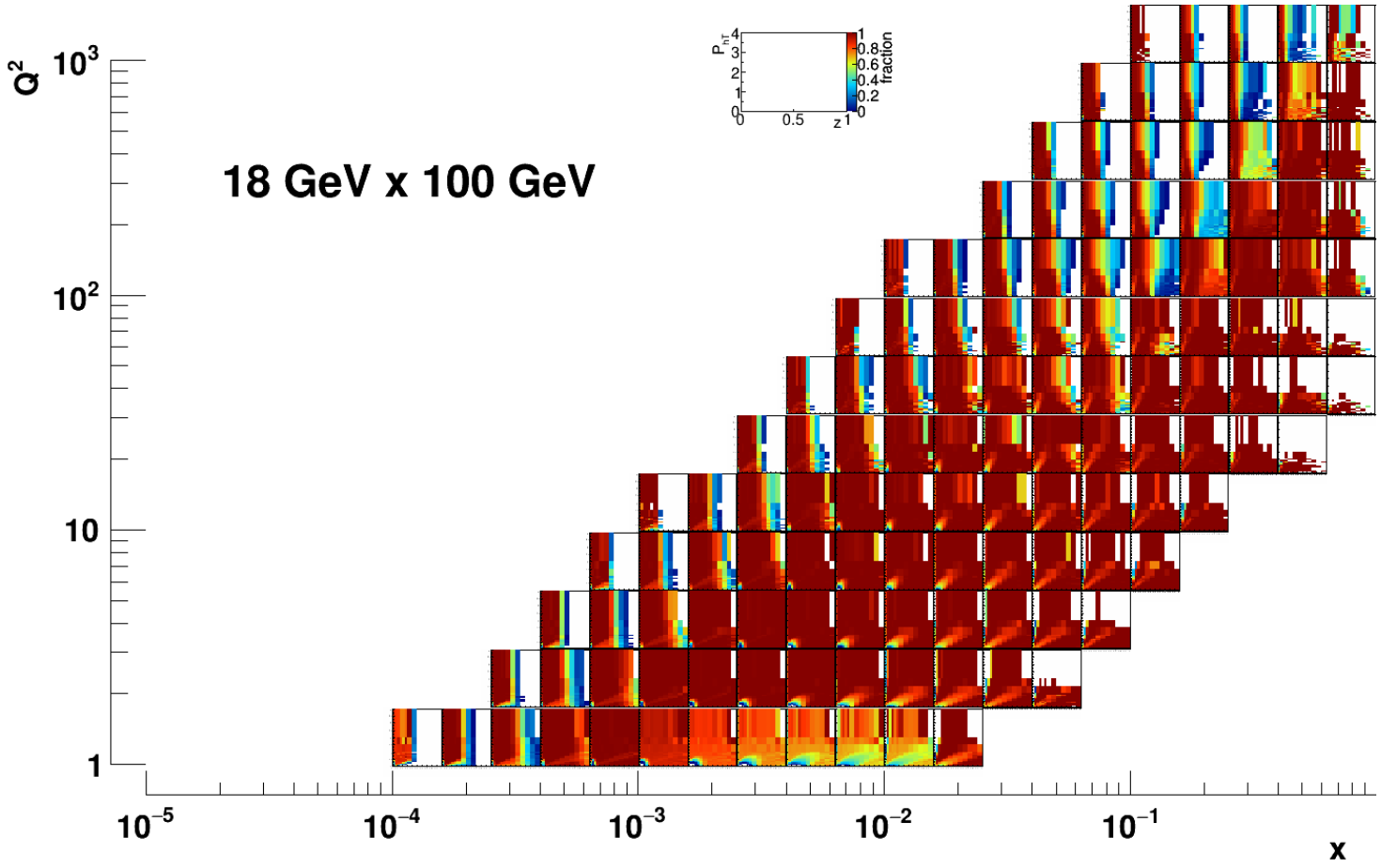
Anselm


18 GeV x 100 GeV
Q^2
10^3
10^2
10
1
10^{-5}
10^{-4}
10^{-3}
10^{-2}
10^{-1}
x
P_{hT}
z
fraction

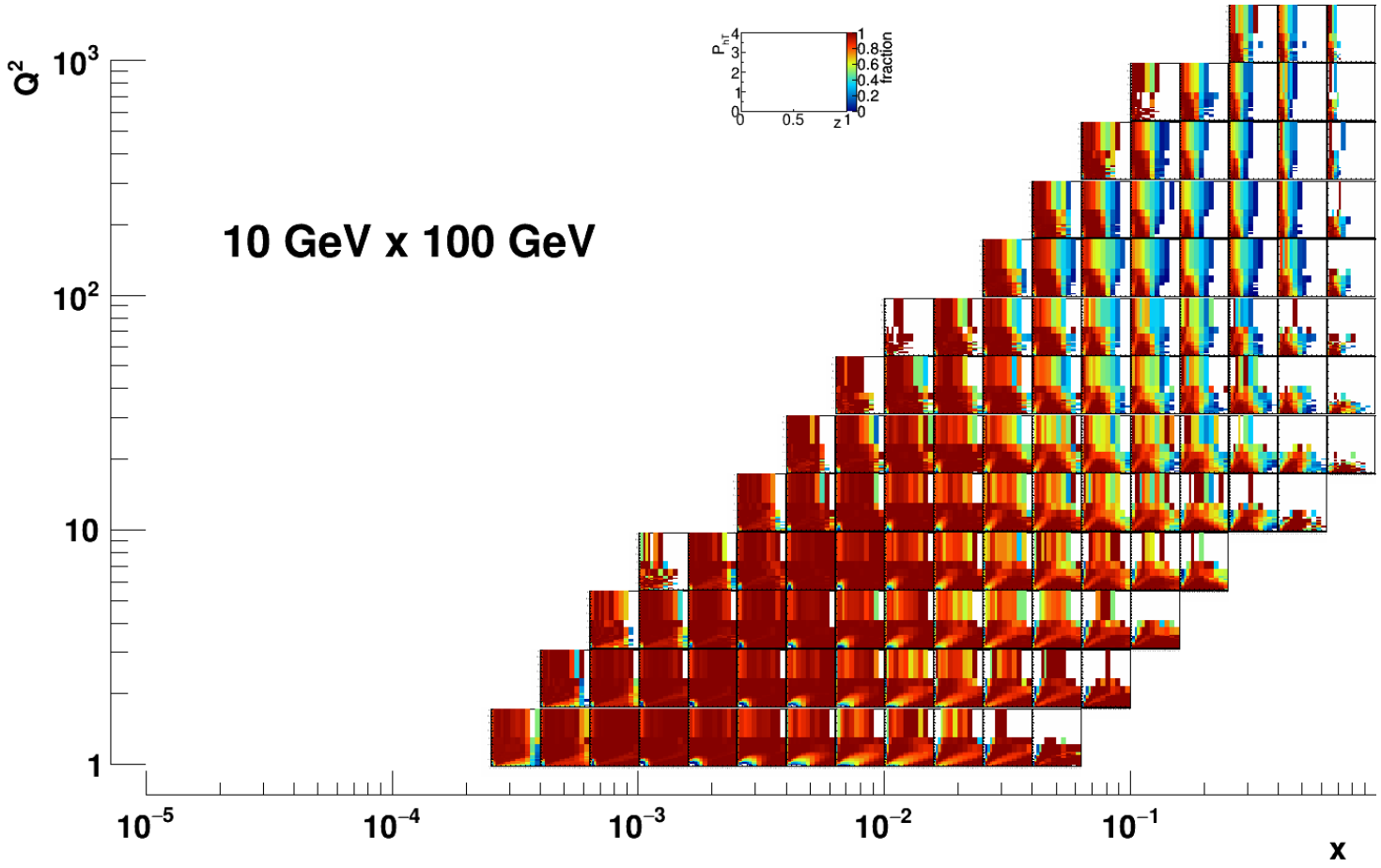
Low p cut


18 GeV x 100 GeV
Q^2
10^3
10^2
10
1
10^{-5}
10^{-4}
10^{-3}
10^{-2}
10^{-1}
x
P_{hT}
z
fraction

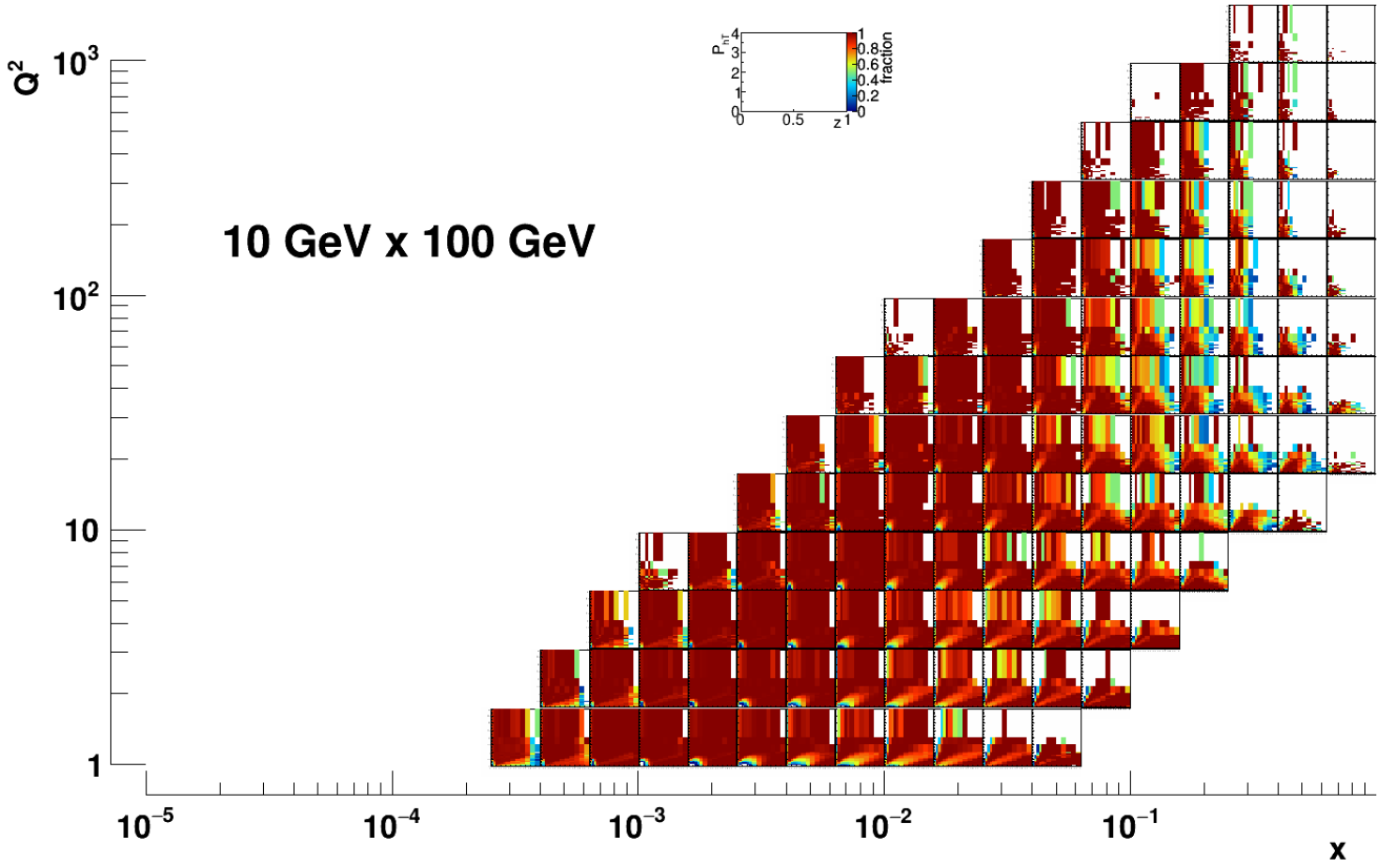
Final PID


18 GeV x 100 GeV
Q^2
10^3
10^2
10
1
10^{-5}
10^{-4}
10^{-3}
10^{-2}
10^{-1}
x
P_{hT}
z
fraction

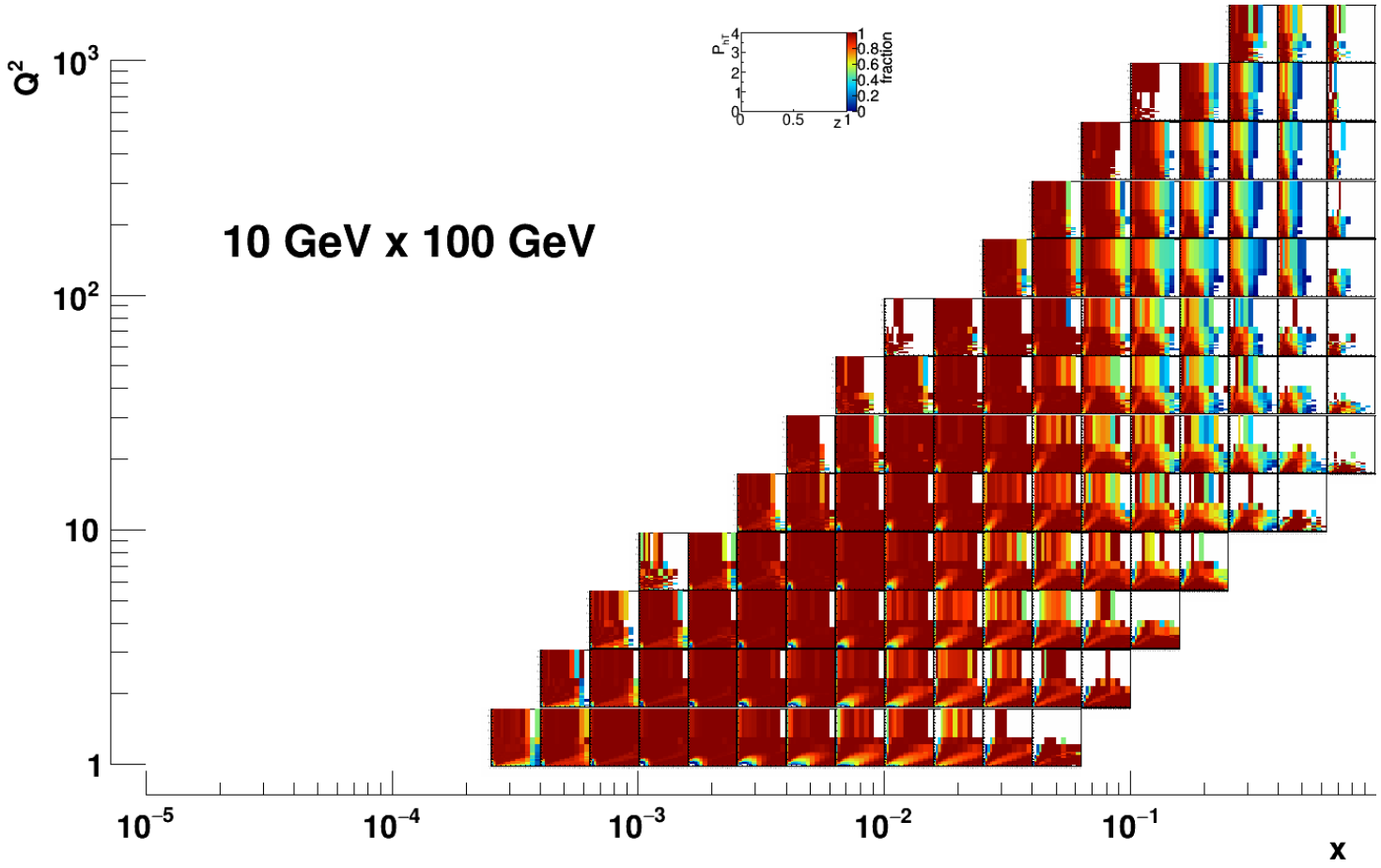
Matrix


10 GeV x 100 GeV
Q^2
10^3
10^2
10
1
10^{-5}
10^{-4}
10^{-3}
10^{-2}
10^{-1}
x
P_{hT}
z
fraction

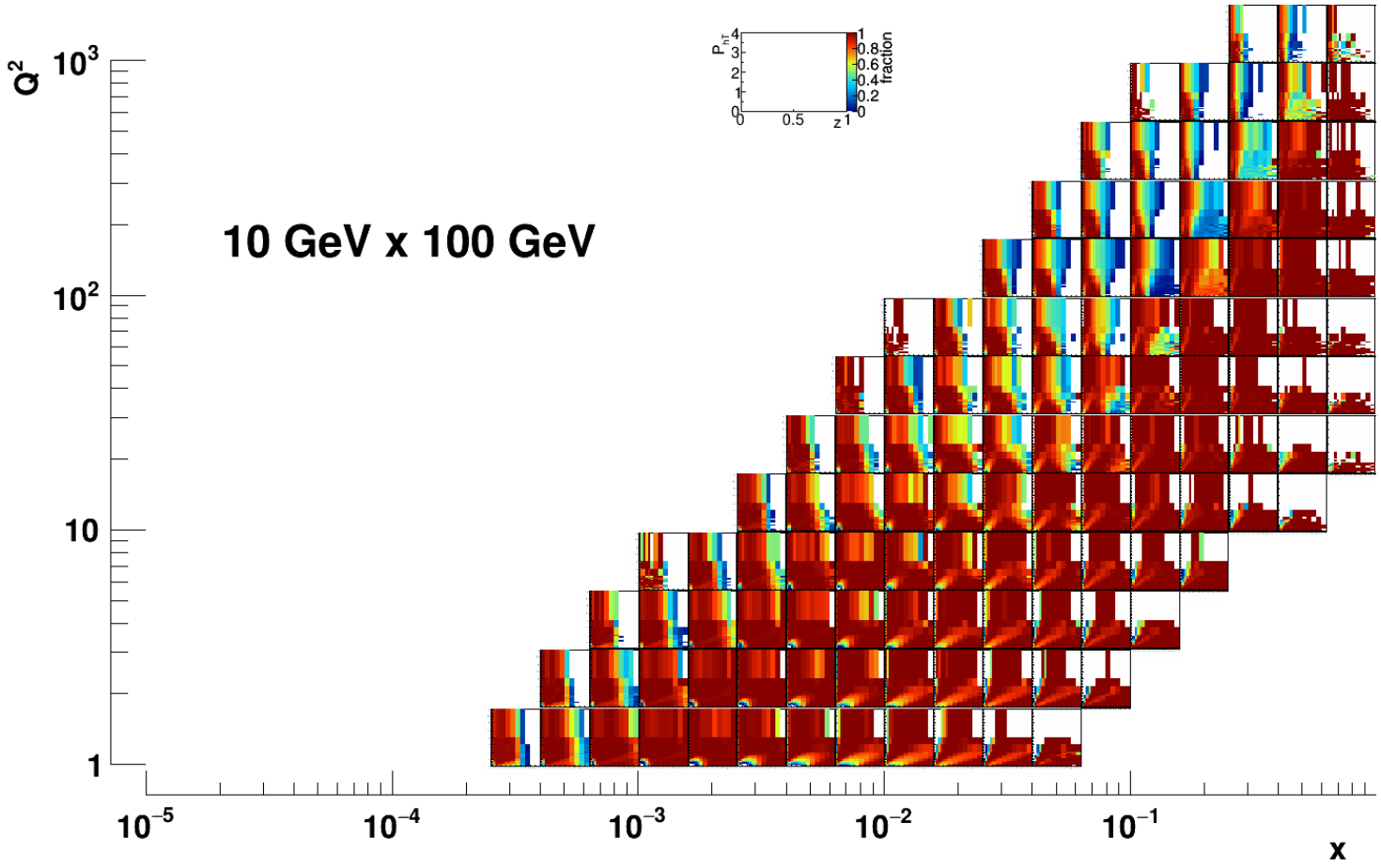
SIDIS


10 GeV x 100 GeV
Q^2
10^3
10^2
10
1
10^{-5}
10^{-4}
10^{-3}
10^{-2}
10^{-1}
x
P_{hT}
fraction
z

old


10 GeV x 100 GeV
Q^2
10^3
10^2
10
1
10^{-5}
10^{-4}
10^{-3}
10^{-2}
10^{-1}
x
P_{hT}
z
fraction

Very high p


10 GeV x 100 GeV
Q^2
10^3
10^2
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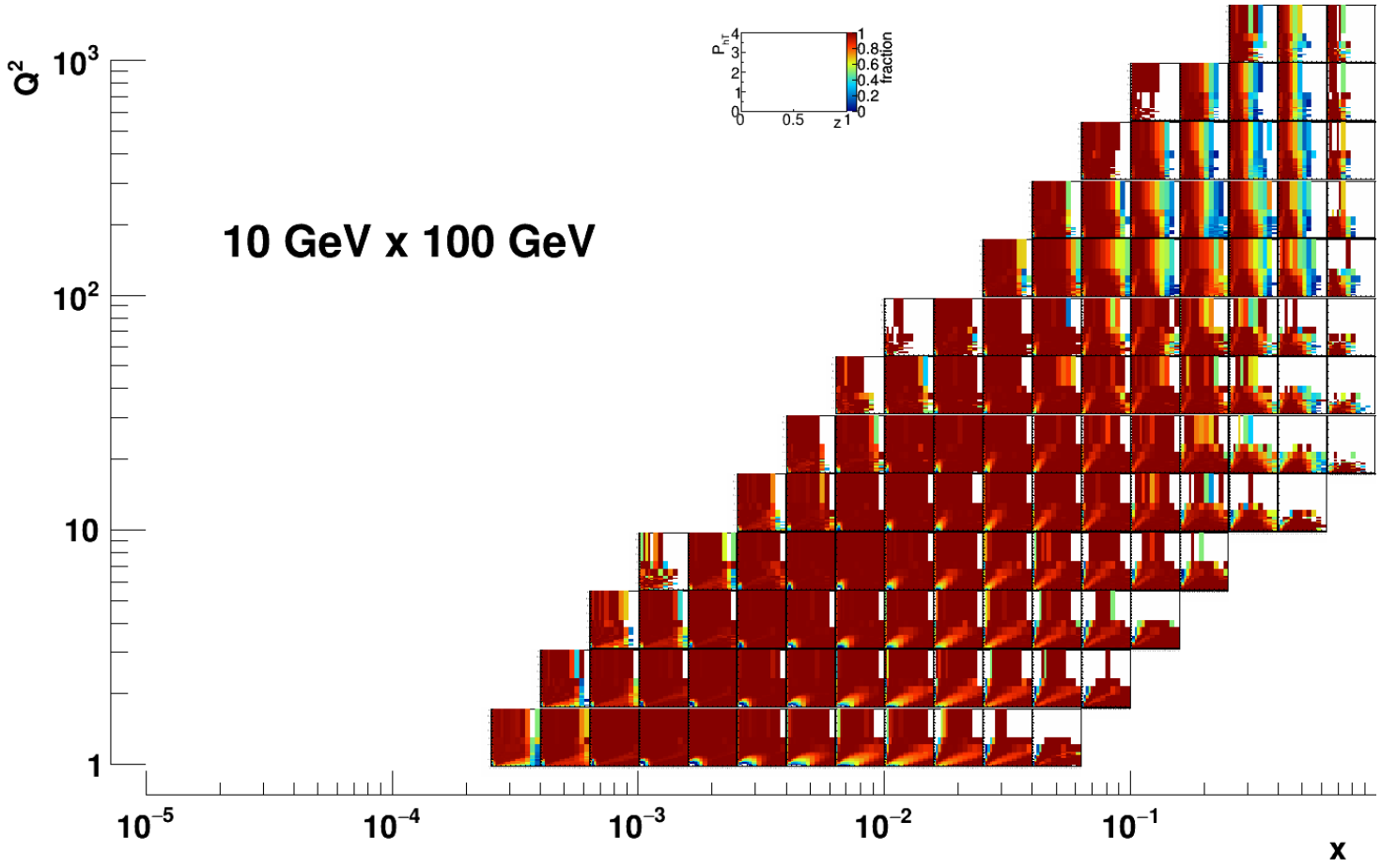
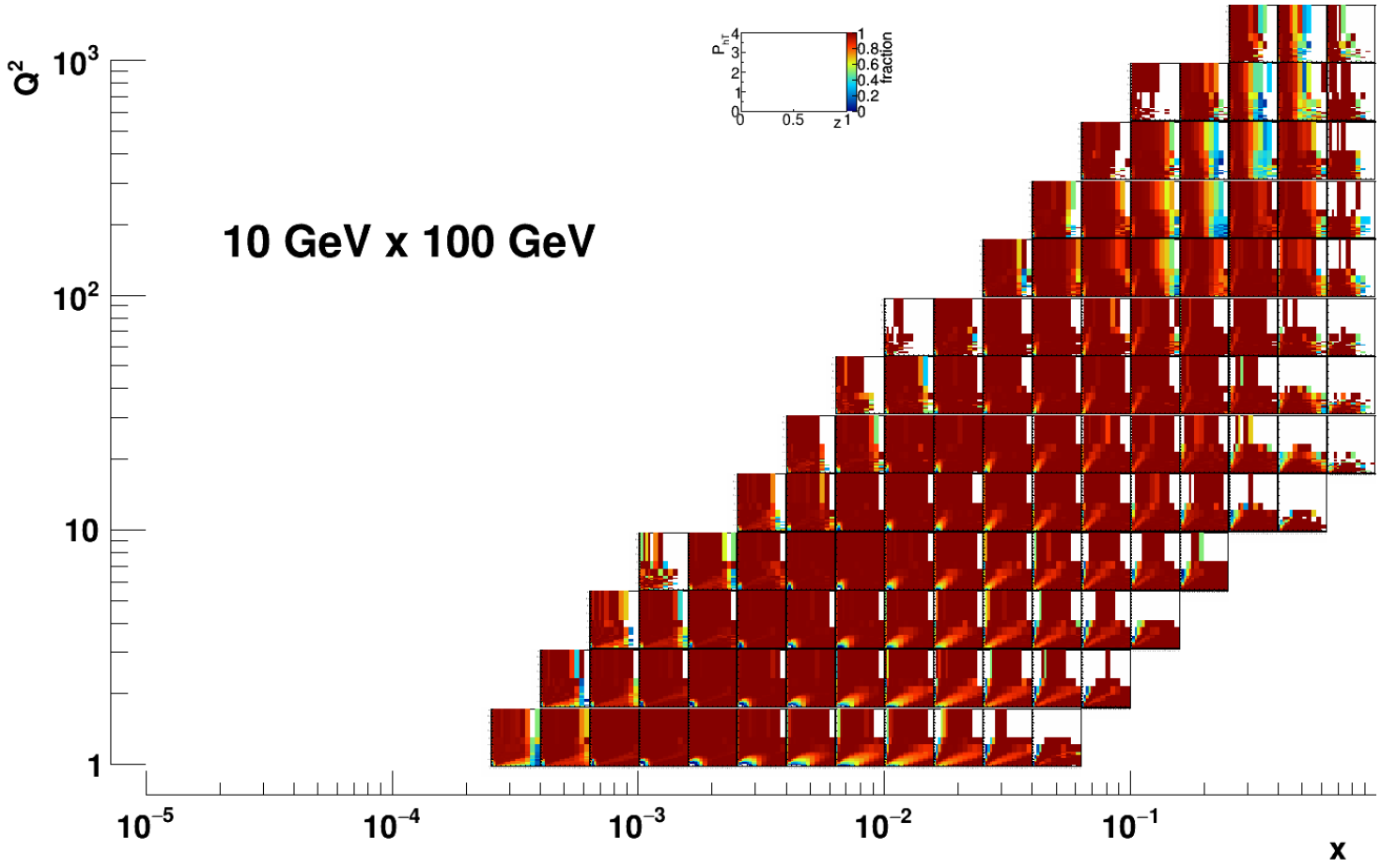
10^{-4}
10^{-3}
10^{-2}
10^{-1}
x
P_{hT}
z
fraction

SIDIS request



Anselm


10 GeV x 100 GeV
Q^2
10^3
10^2
10
1
10^{-5}
10^{-4}
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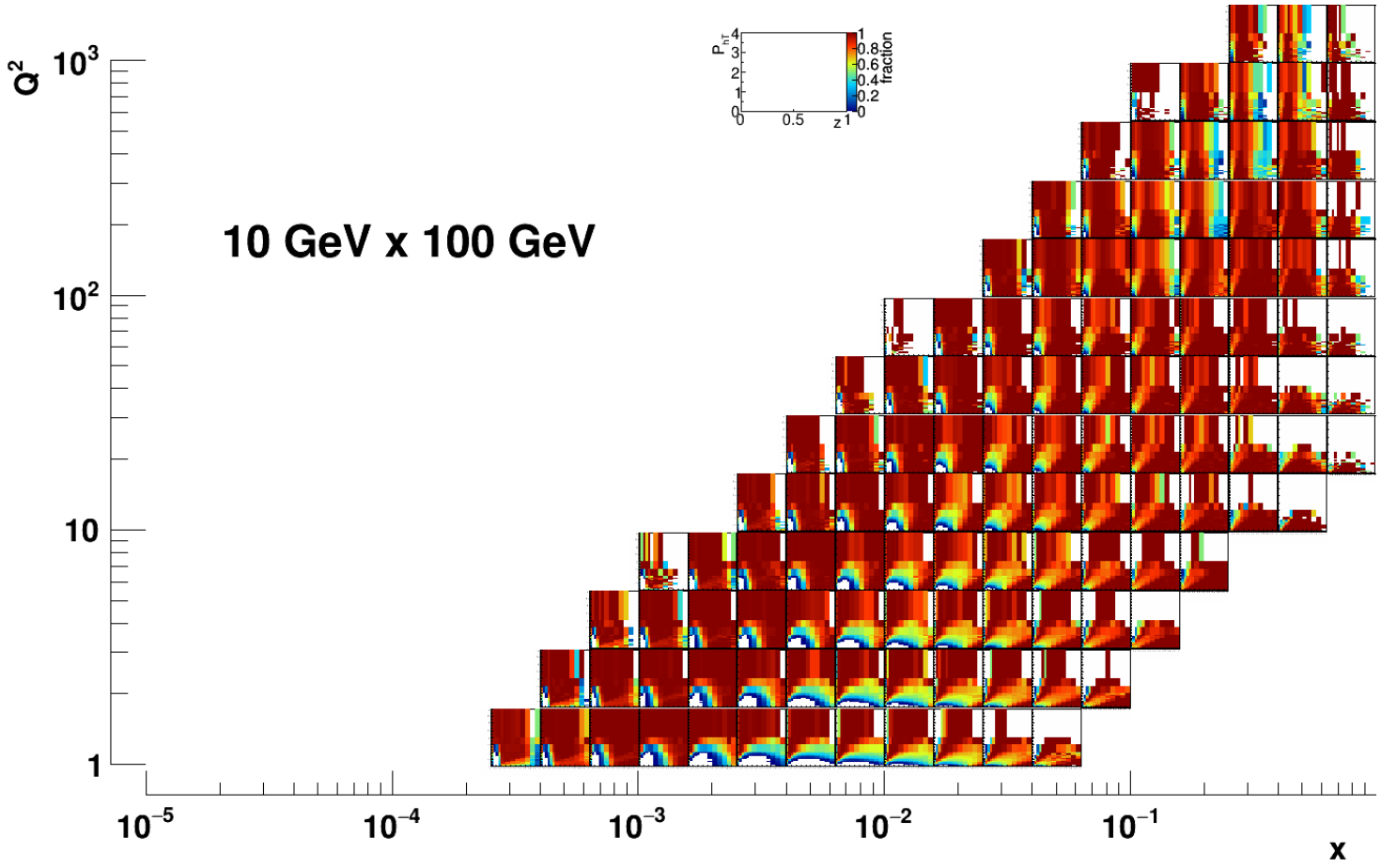
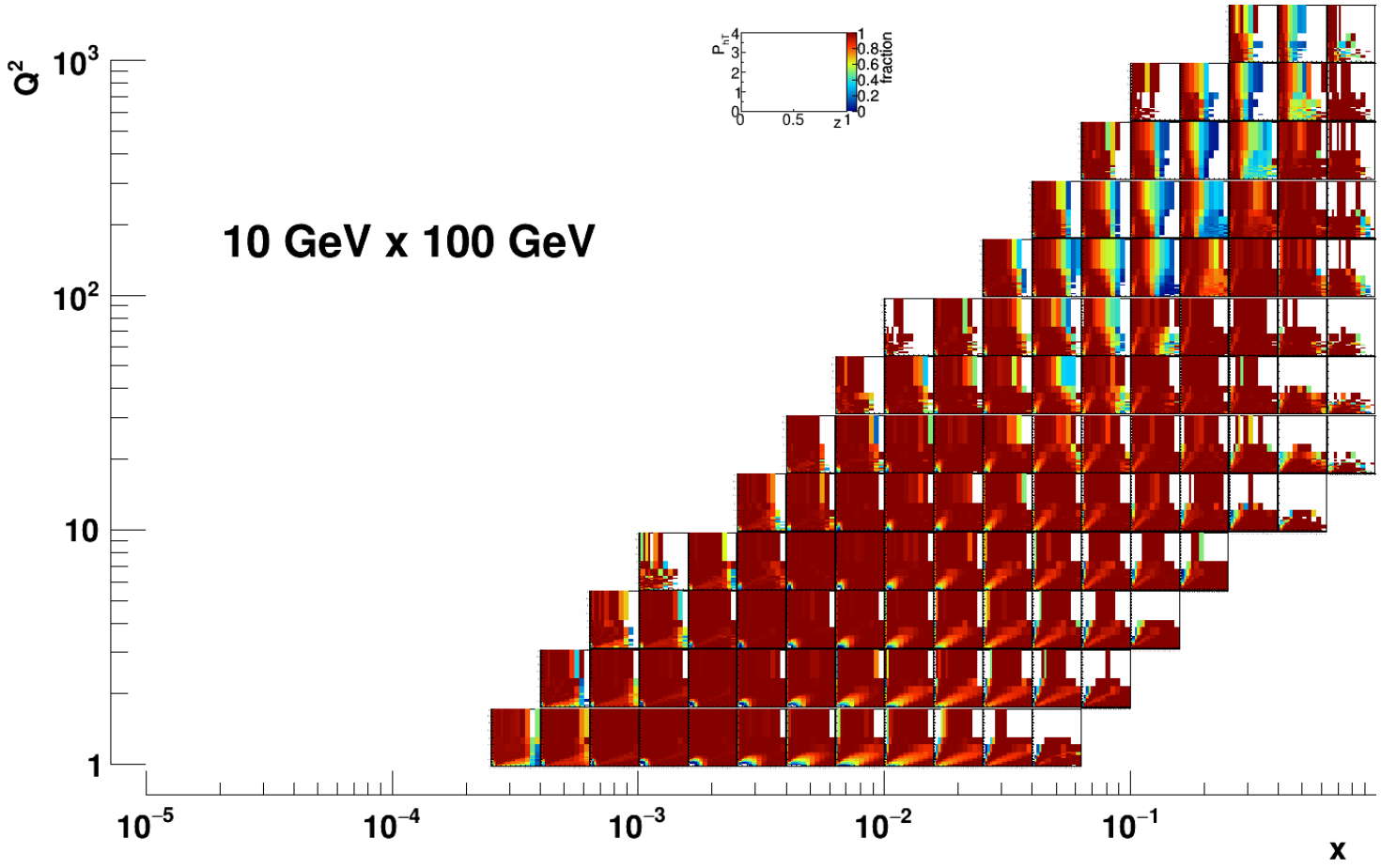
fraction

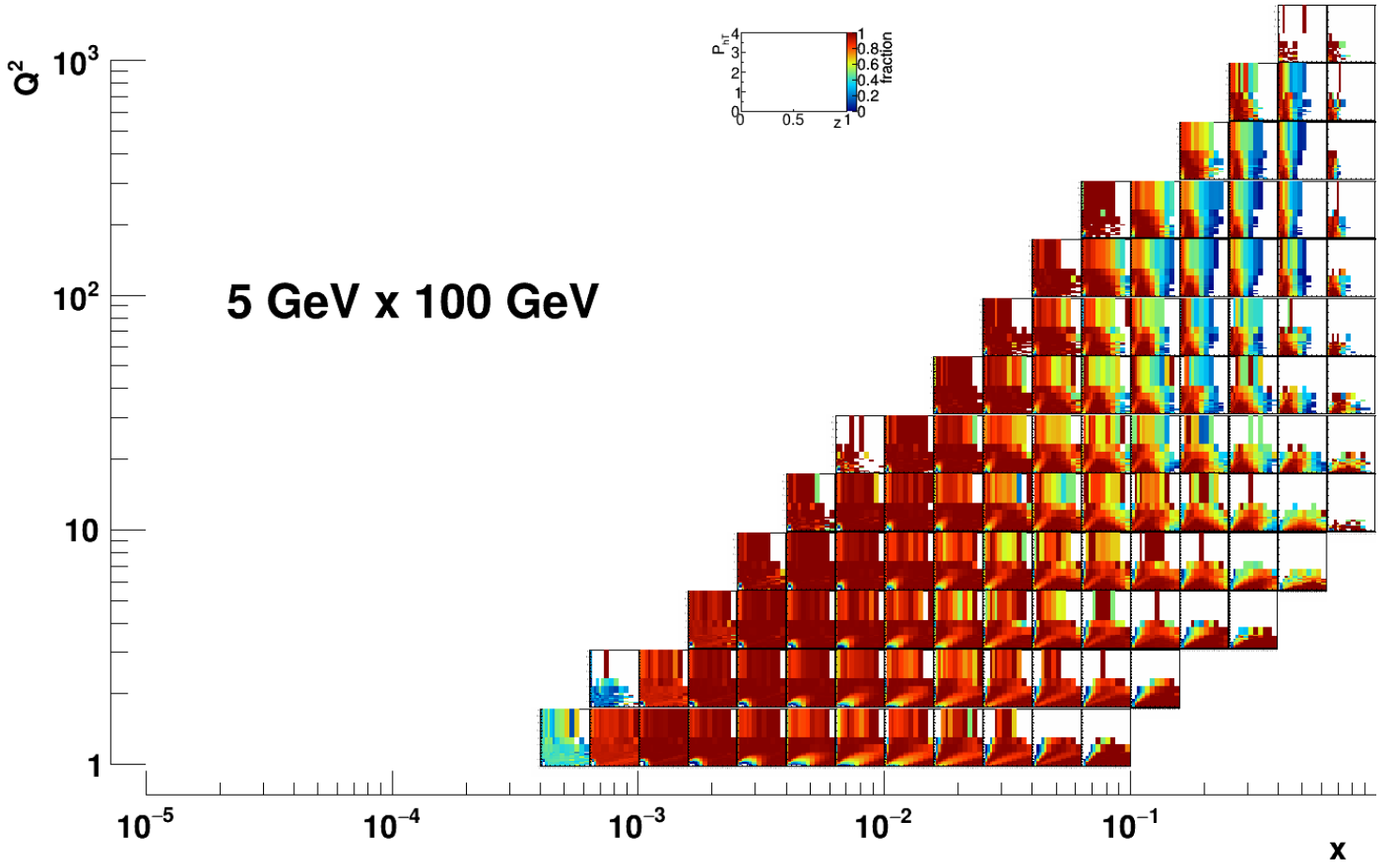
Low p cut


10 GeV x 100 GeV
Q^2
10^3
10^2
10
1
10^{-5}
10^{-4}
10^{-3}
10^{-2}
10^{-1}
x
P_{hT}
z
fraction

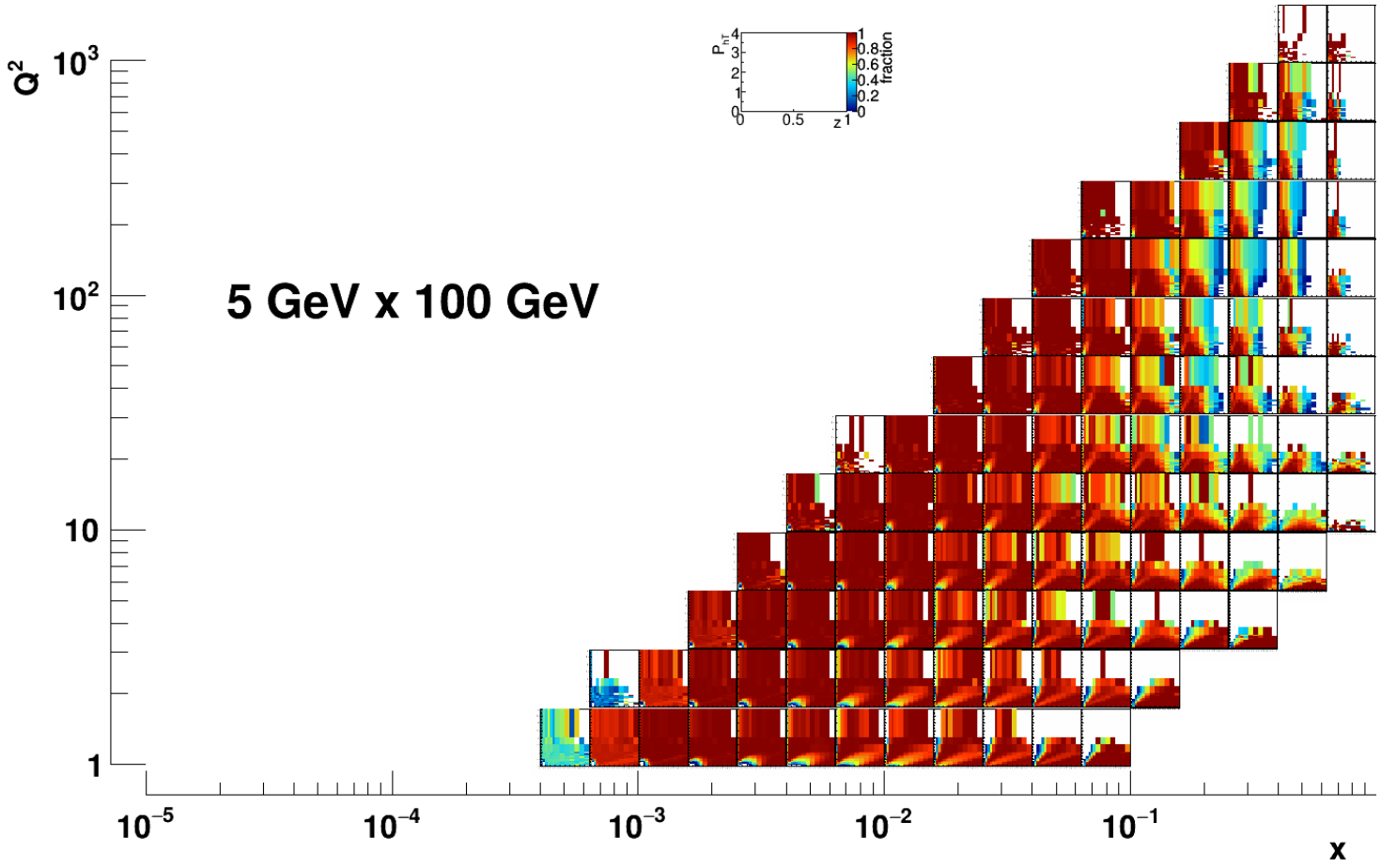
Final PID


10 GeV x 100 GeV
Q^2
10^3
10^2
10
1
10^{-5}
10^{-4}
10^{-3}
10^{-2}
10^{-1}
x
P_{hT}
z
fraction

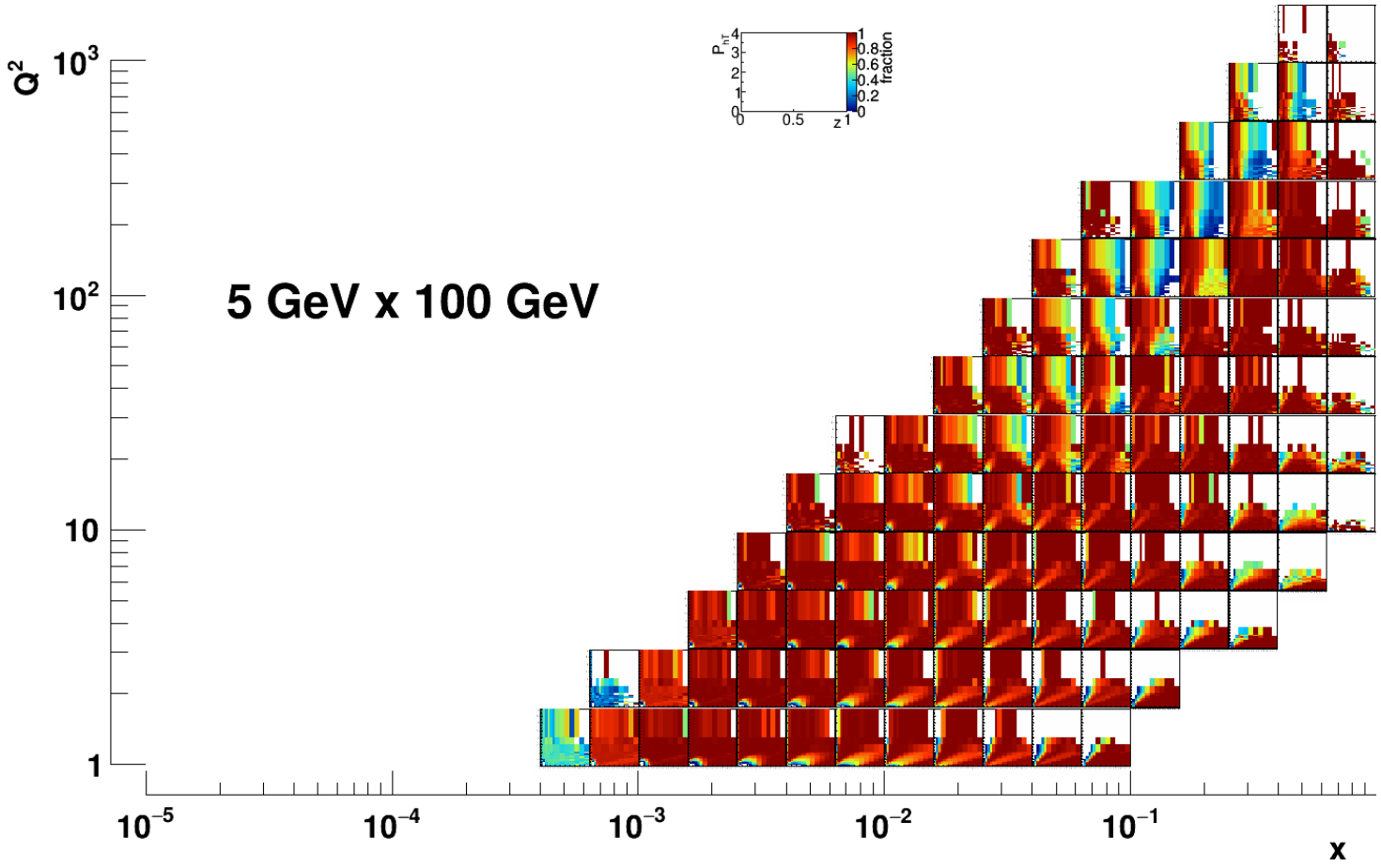
Matrix


5 GeV x 100 GeV
Q^2
10^3
10^2
10
1
10^{-5}
10^{-4}
10^{-3}
10^{-2}
10^{-1}
x
P_{hT}
z
fraction

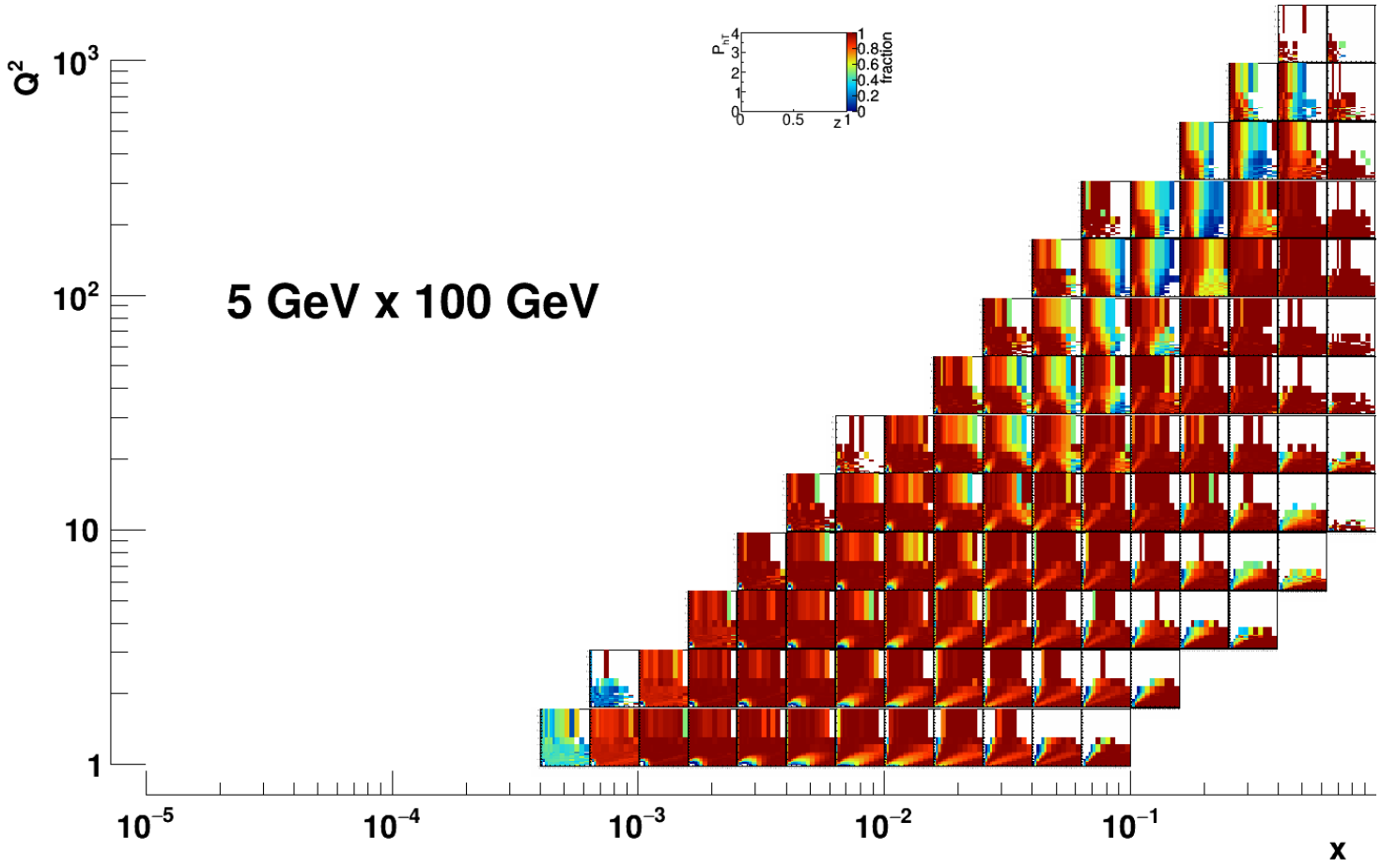
SIDIS


5 GeV x 100 GeV
Q^2
10^3
10^2
10
1
10^{-5}
10^{-4}
10^{-3}
10^{-2}
10^{-1}
x
P_{hT}
z
fraction

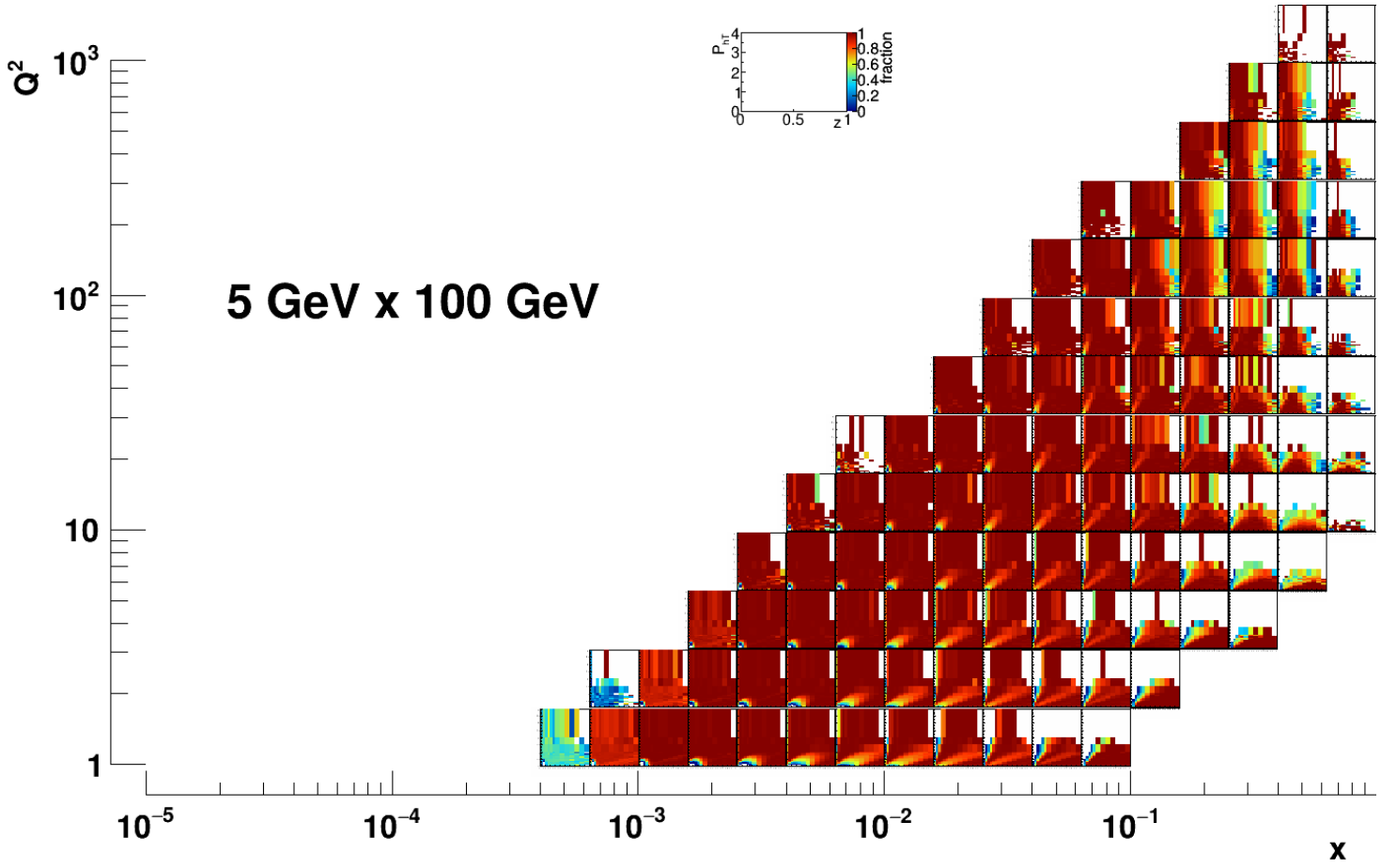
old


5 GeV x 100 GeV
Q^2
10^3
10^2
10
1
10^{-5}
10^{-4}
10^{-3}
10^{-2}
10^{-1}
x
P_{hT}
z
fraction

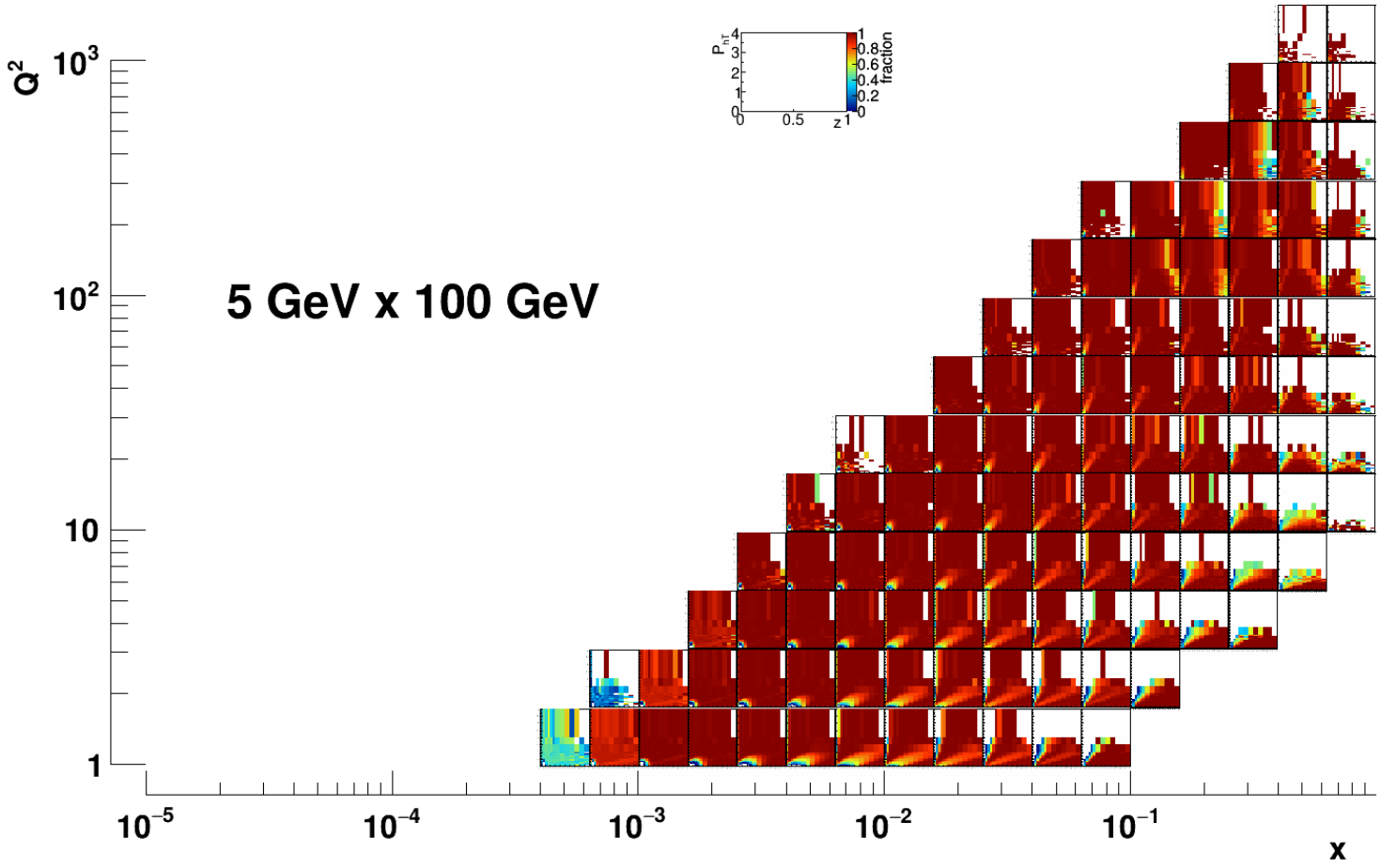
Very high p


5 GeV x 100 GeV
Q^2
10^3
10^2
10
1
10^{-5}
10^{-4}
10^{-3}
10^{-2}
10^{-1}
x
P_{hT}
z
fraction

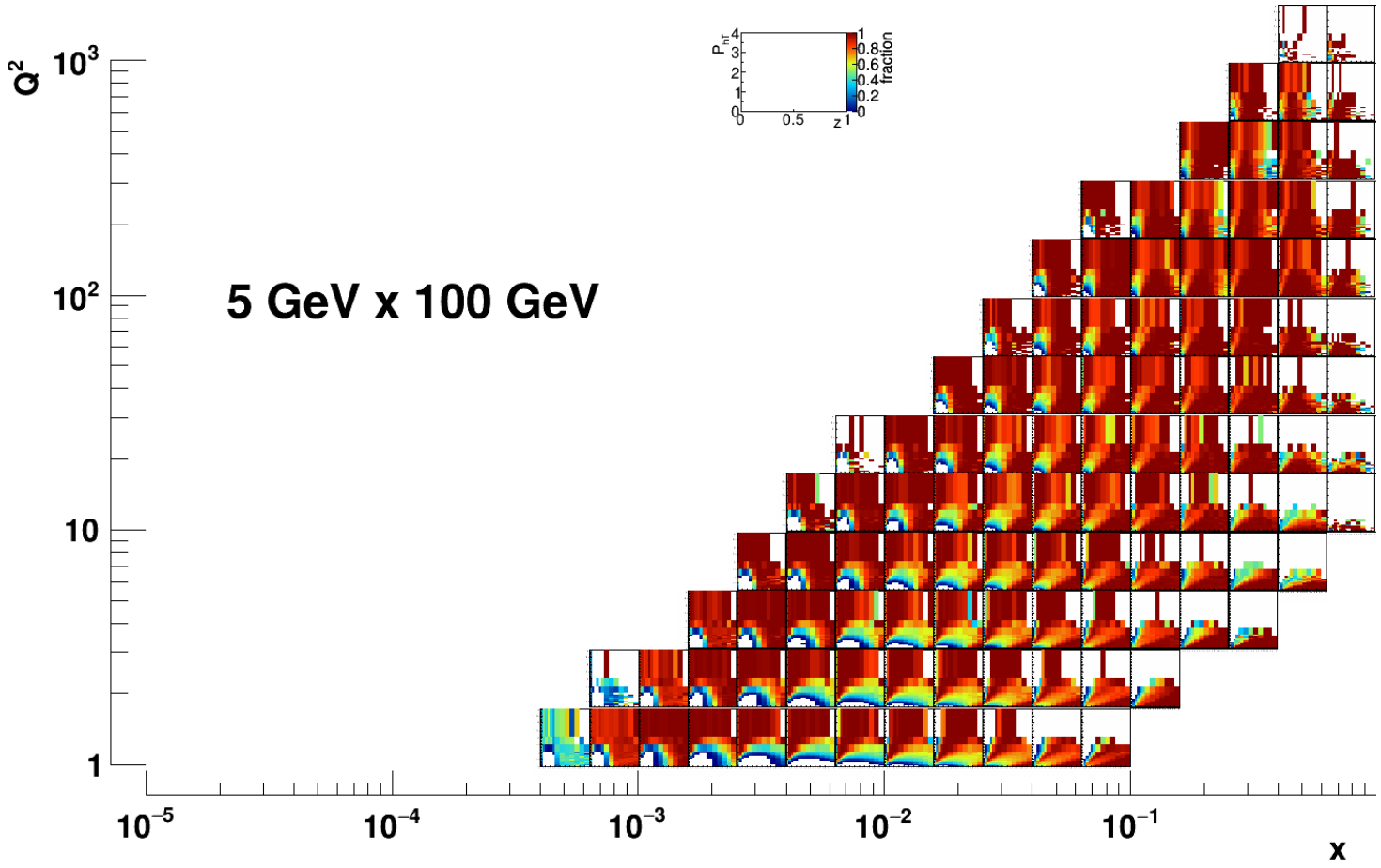
SIDIS Request



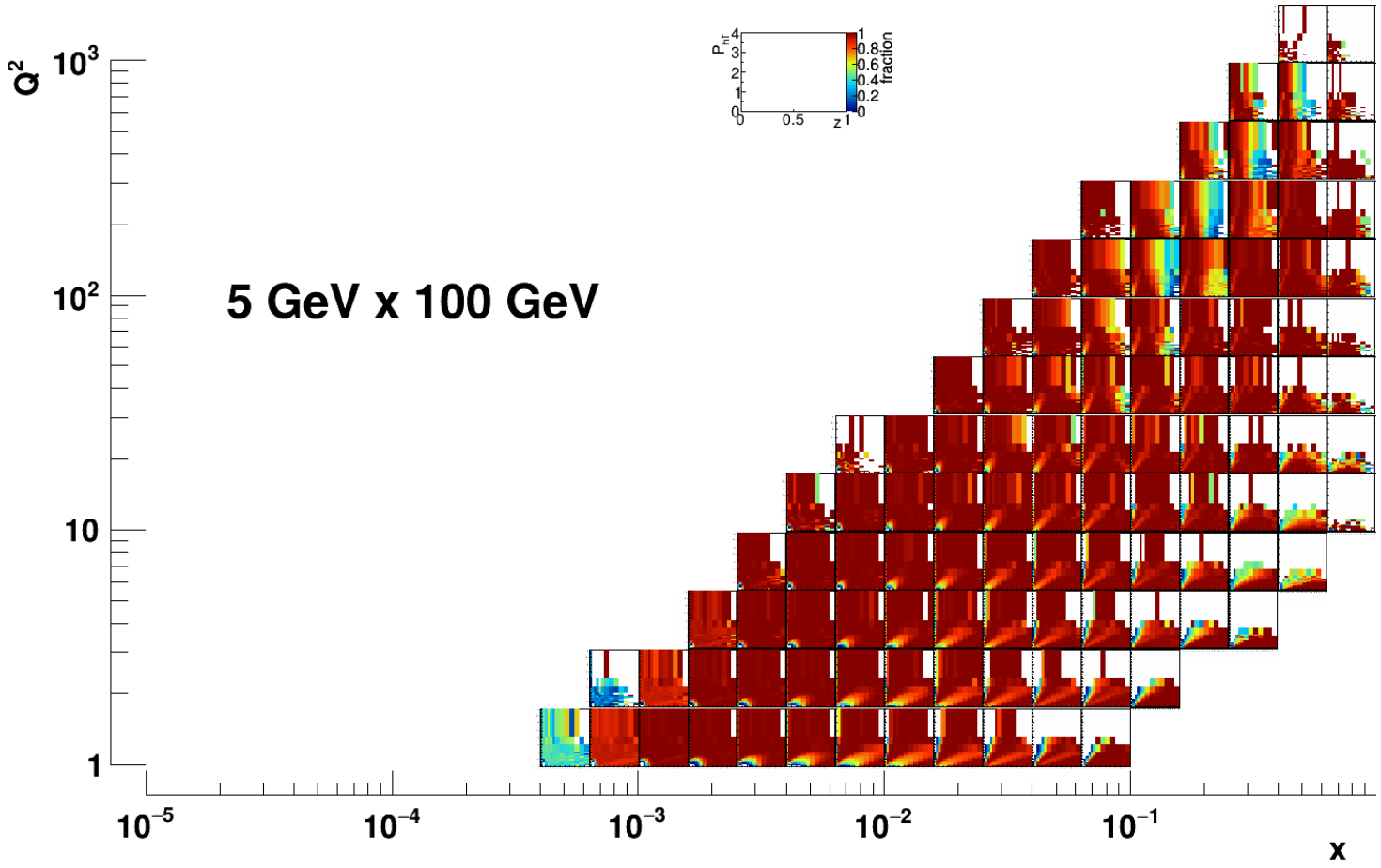
Anselm


5 GeV x 100 GeV
Q^2
10^3
10^2
10
1
10^{-5}
10^{-4}
10^{-3}
10^{-2}
10^{-1}
x
P_{hT}
z
fraction

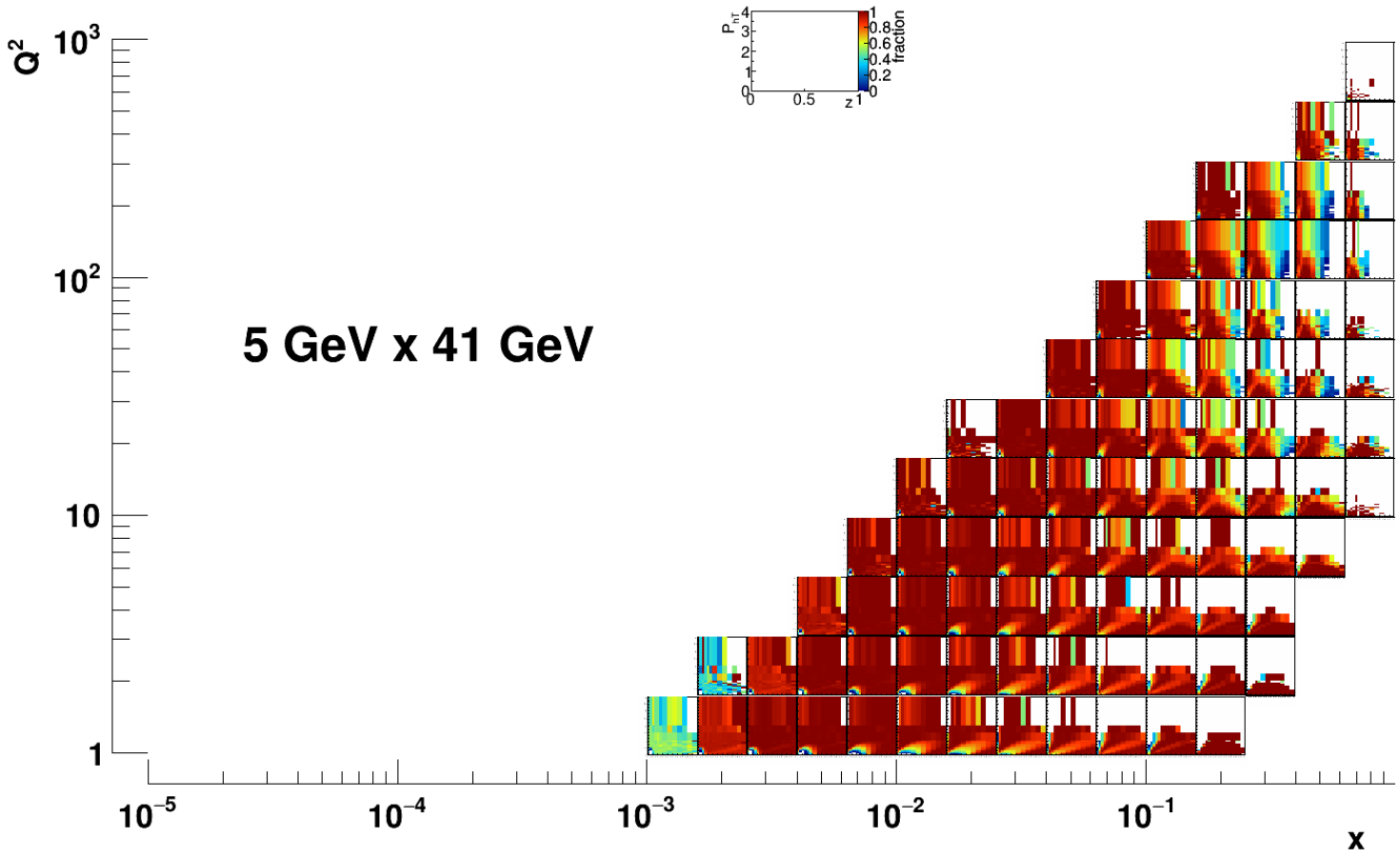
Low p cut


5 GeV x 100 GeV
Q^2
10^3
10^2
10
1
10^{-5}
10^{-4}
10^{-3}
10^{-2}
10^{-1}
x
P_{hT}
z
fraction

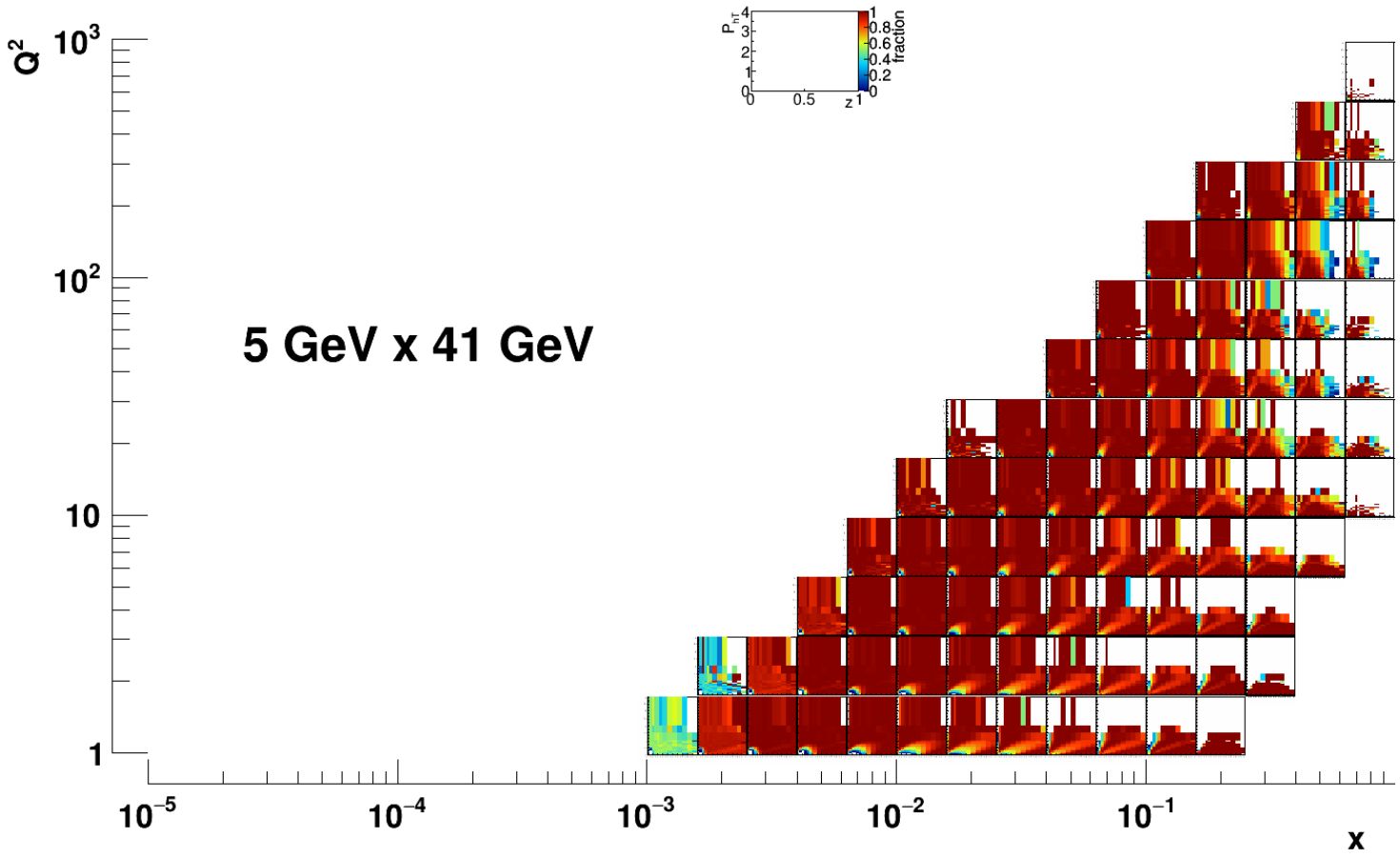
Final PID


5 GeV x 100 GeV
Q^2
10^3
10^2
10
1
10^{-5}
10^{-4}
10^{-3}
10^{-2}
10^{-1}
x
P_{hT}
z
fraction

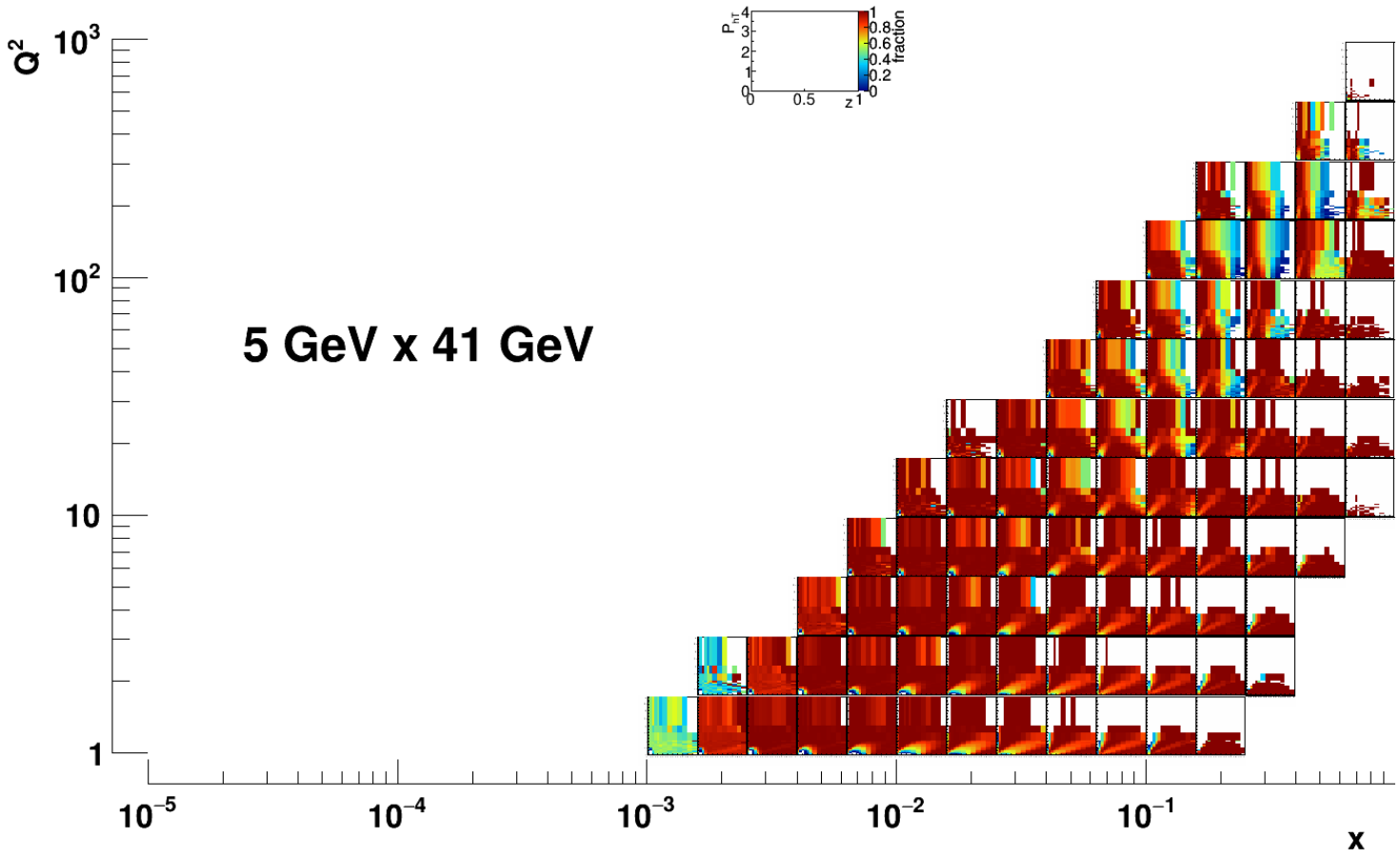
Matrix



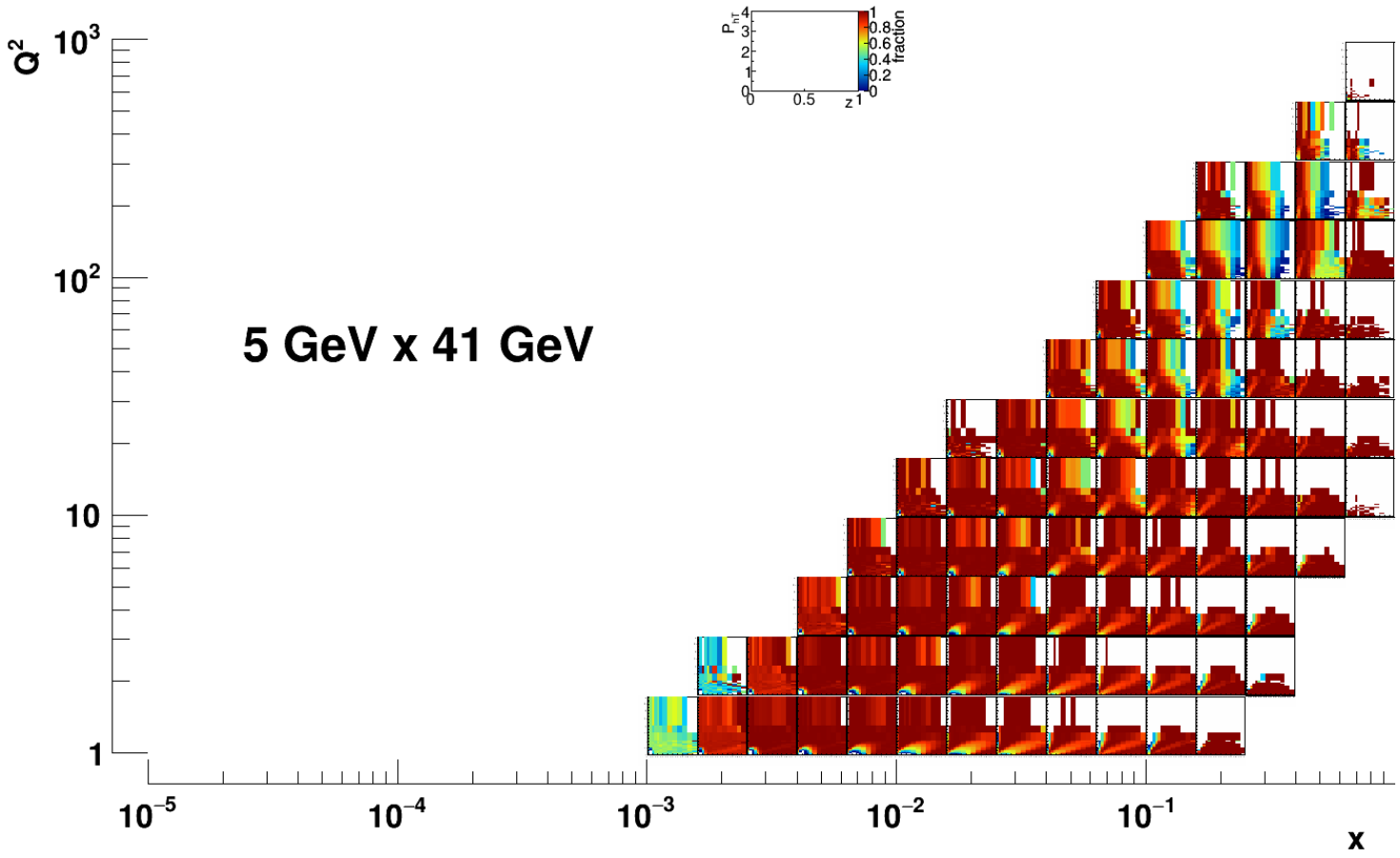
SIDIS



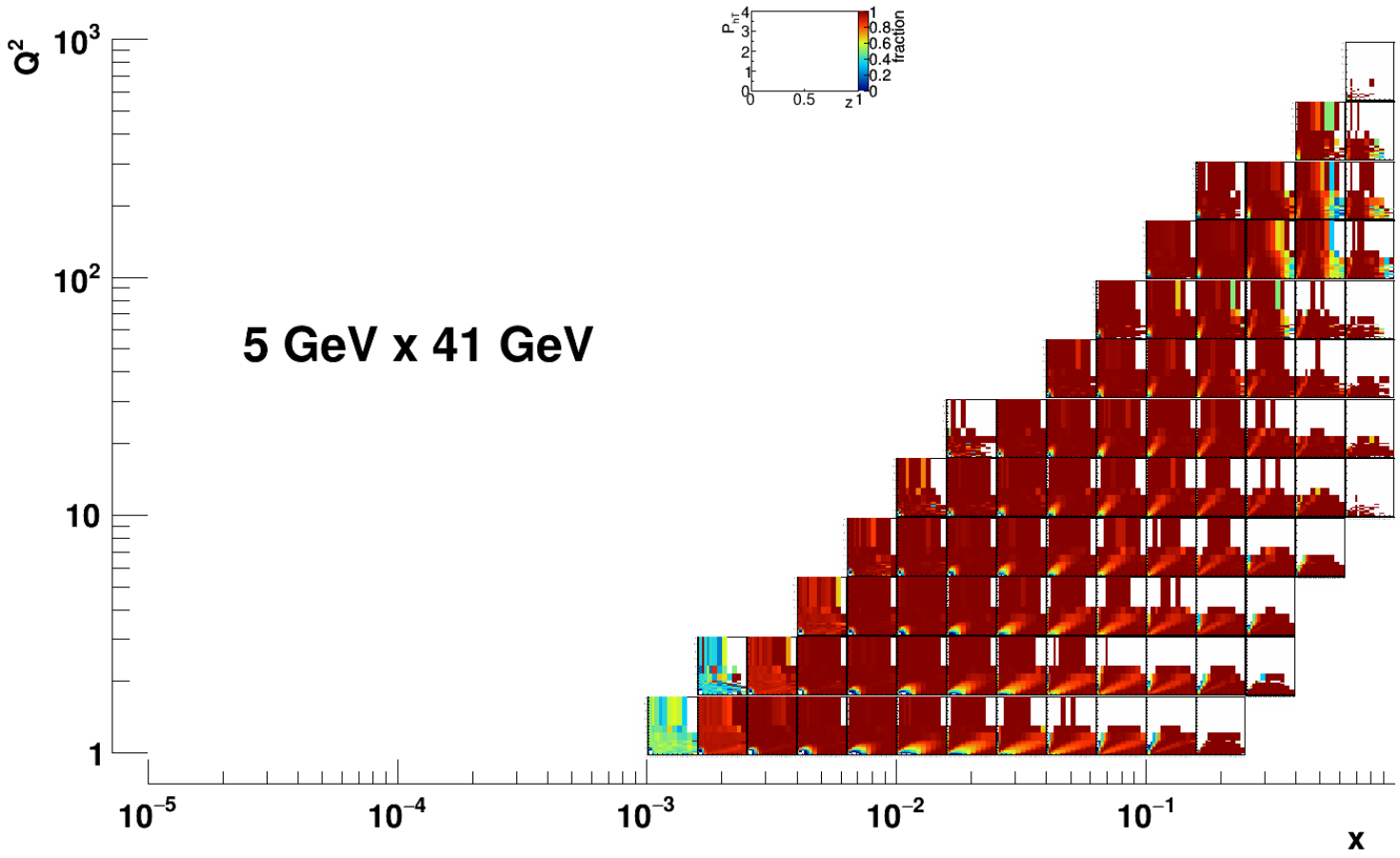
old



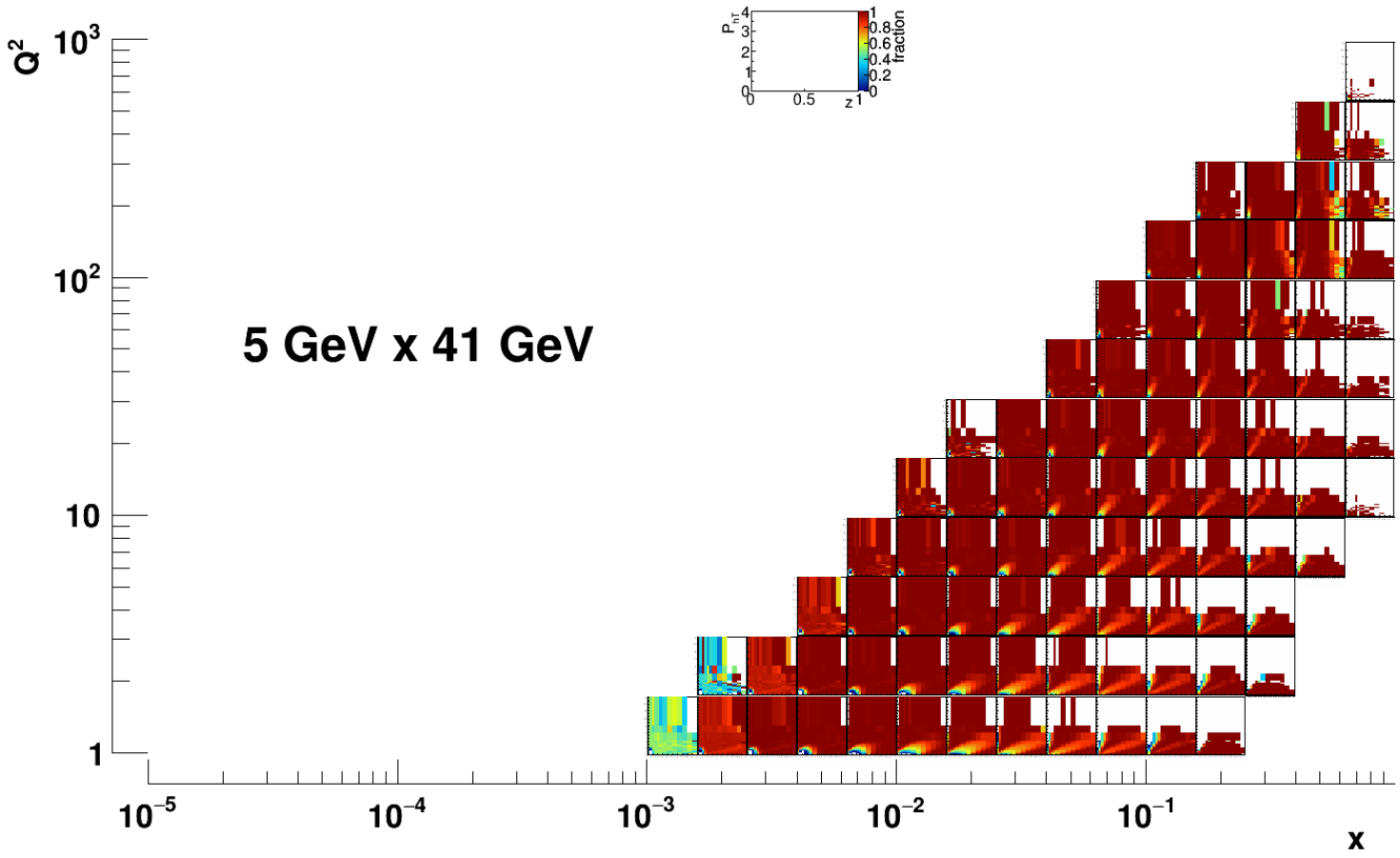
High p



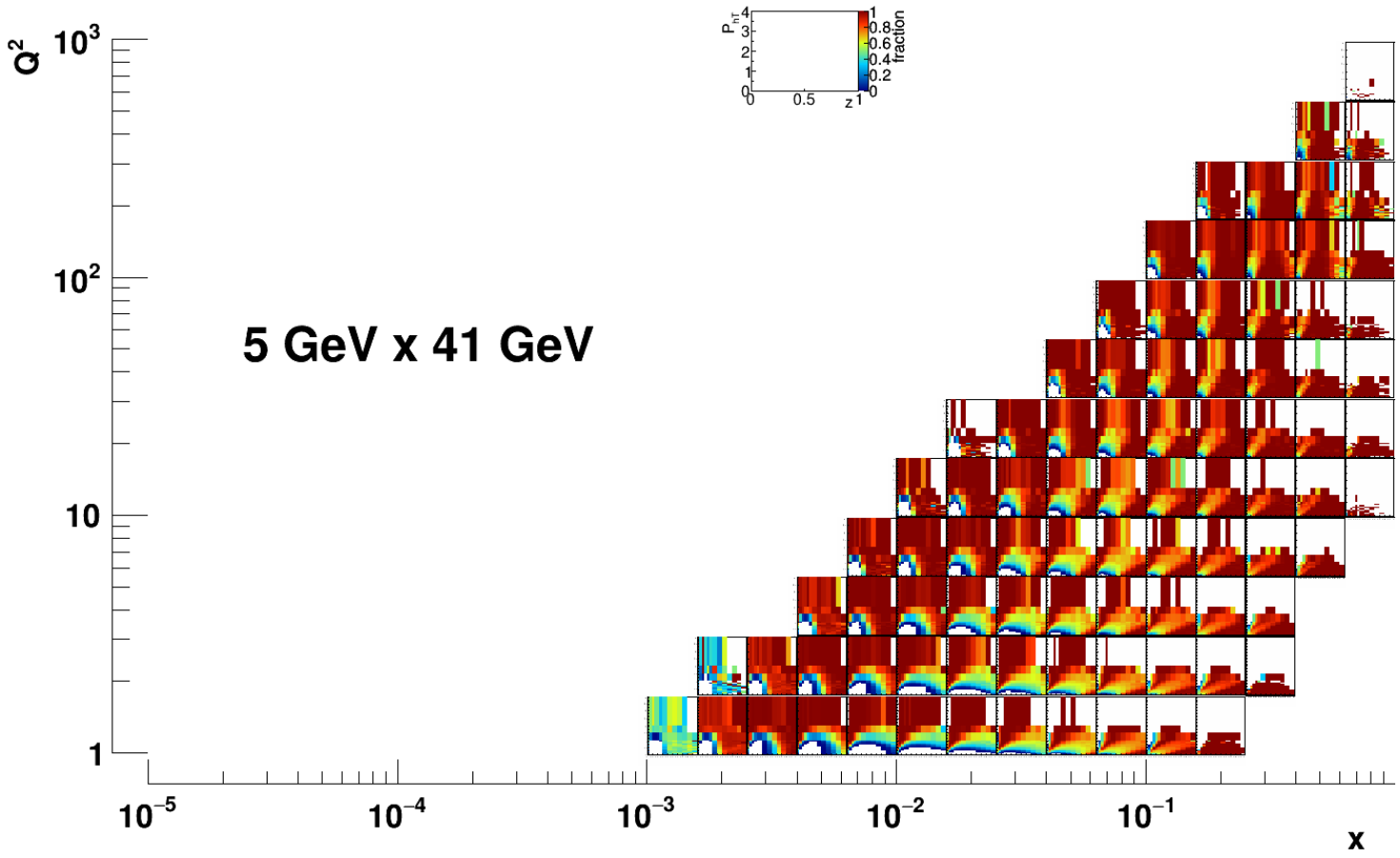
SIDIS request



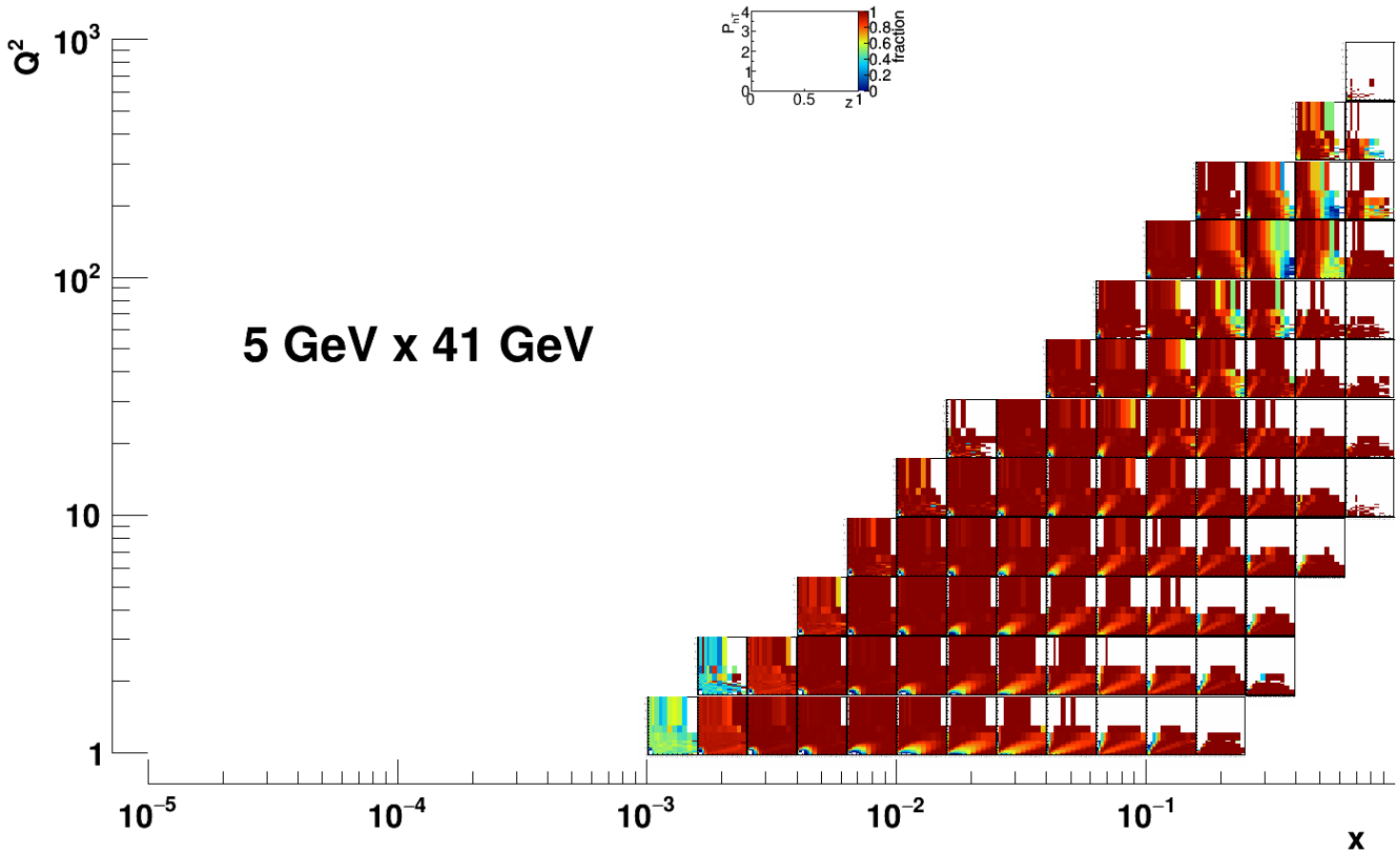
Anselm



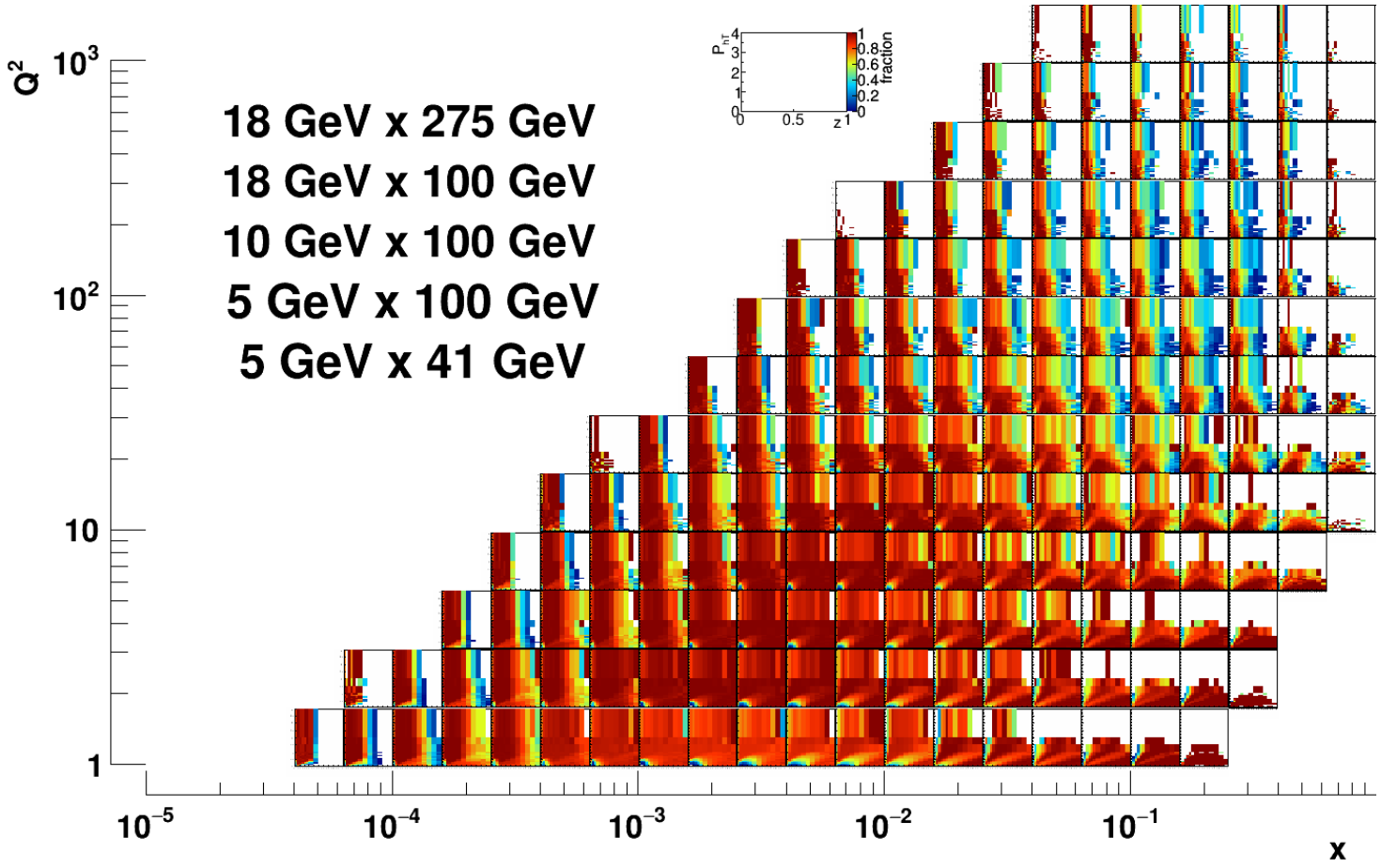
Low p cut



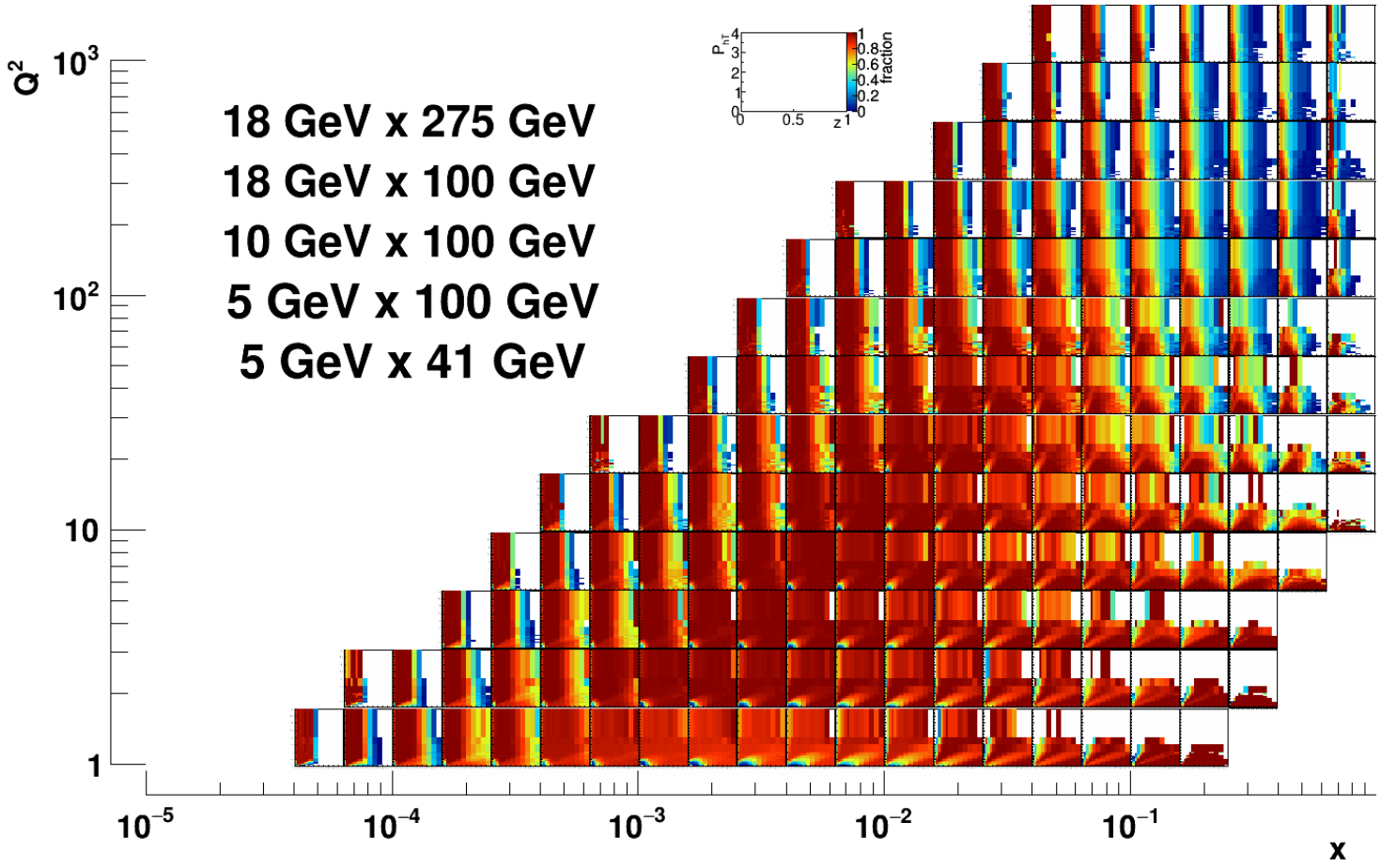
Final PID



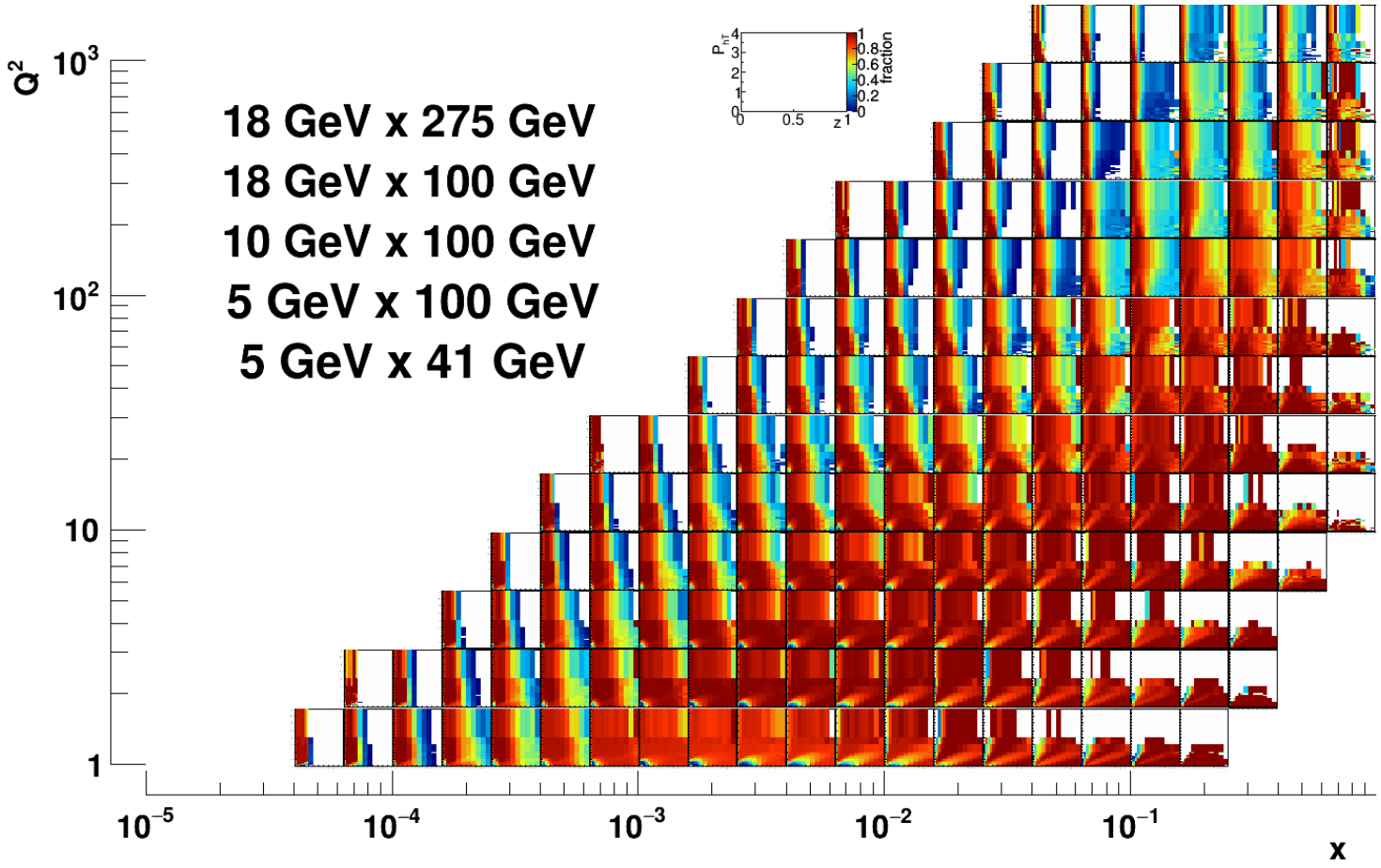
Matrix


18 GeV x 275 GeV
18 GeV x 100 GeV
10 GeV x 100 GeV
5 GeV x 100 GeV
5 GeV x 41 GeV
Q^2
10^3
10^2
10
1
10^{-5}
10^{-4}
10^{-3}
10^{-2}
10^{-1}
x
P_{hT}
z
fraction

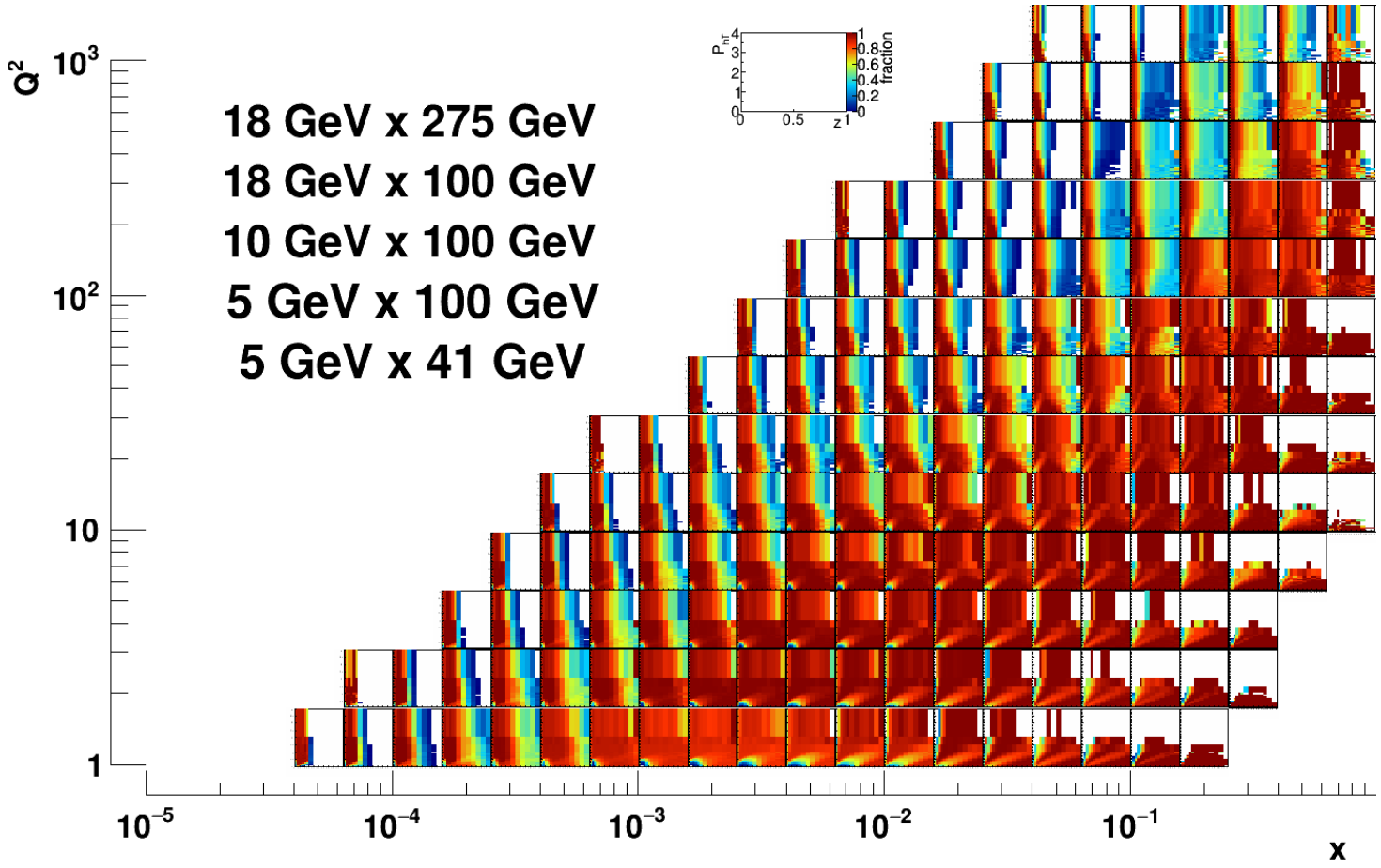
SIDIS


18 GeV x 275 GeV
18 GeV x 100 GeV
10 GeV x 100 GeV
5 GeV x 100 GeV
5 GeV x 41 GeV
Q^2
10^3
10^2
10
1
10^{-5}
10^{-4}
10^{-3}
10^{-2}
10^{-1}
x
P_{hT}
z
fraction

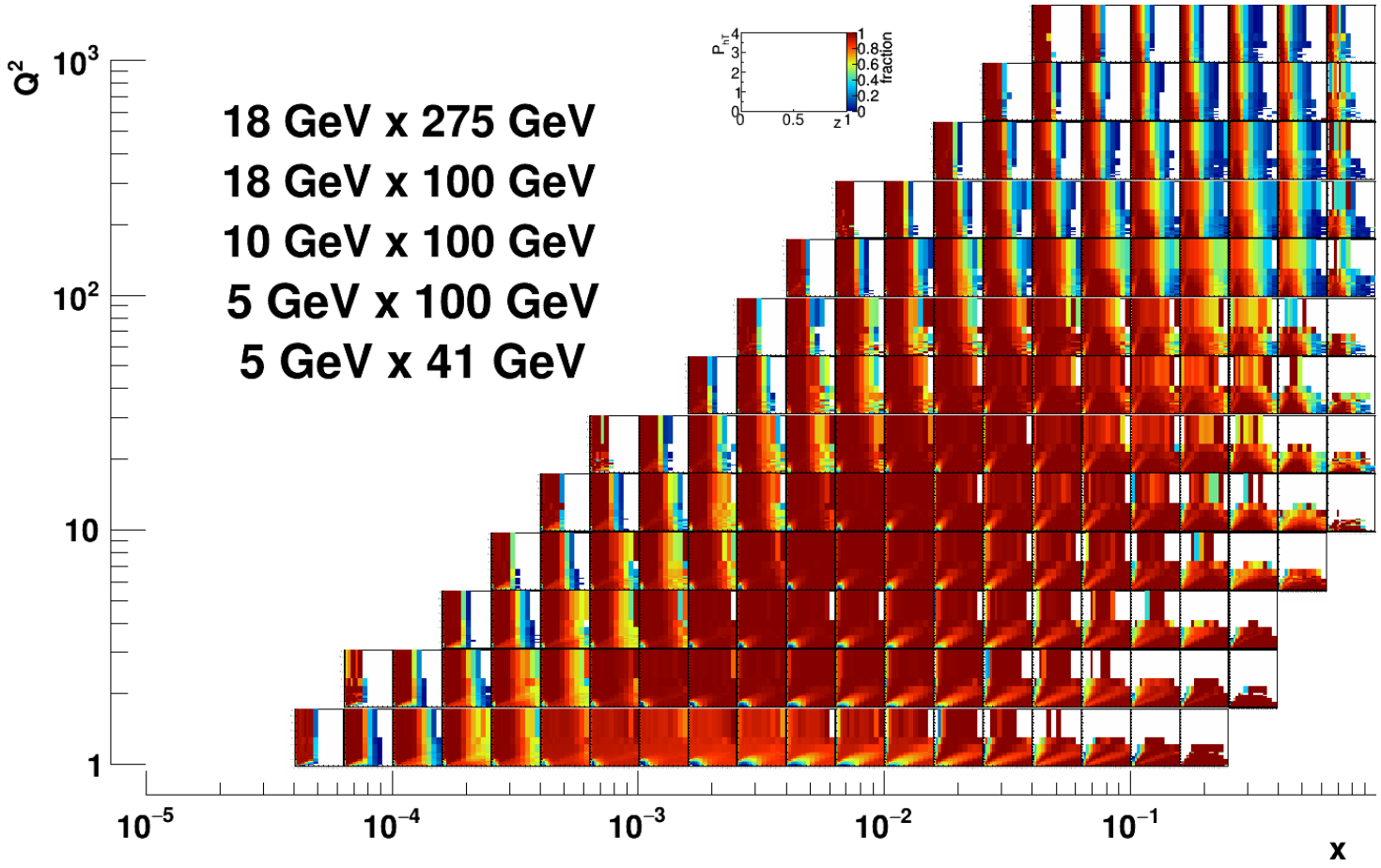
old


18 GeV x 275 GeV
18 GeV x 100 GeV
10 GeV x 100 GeV
5 GeV x 100 GeV
5 GeV x 41 GeV
Q^2
10^3
10^2
10
1
10^{-5}
10^{-4}
10^{-3}
10^{-2}
10^{-1}
x
P_{hT}
z
fraction

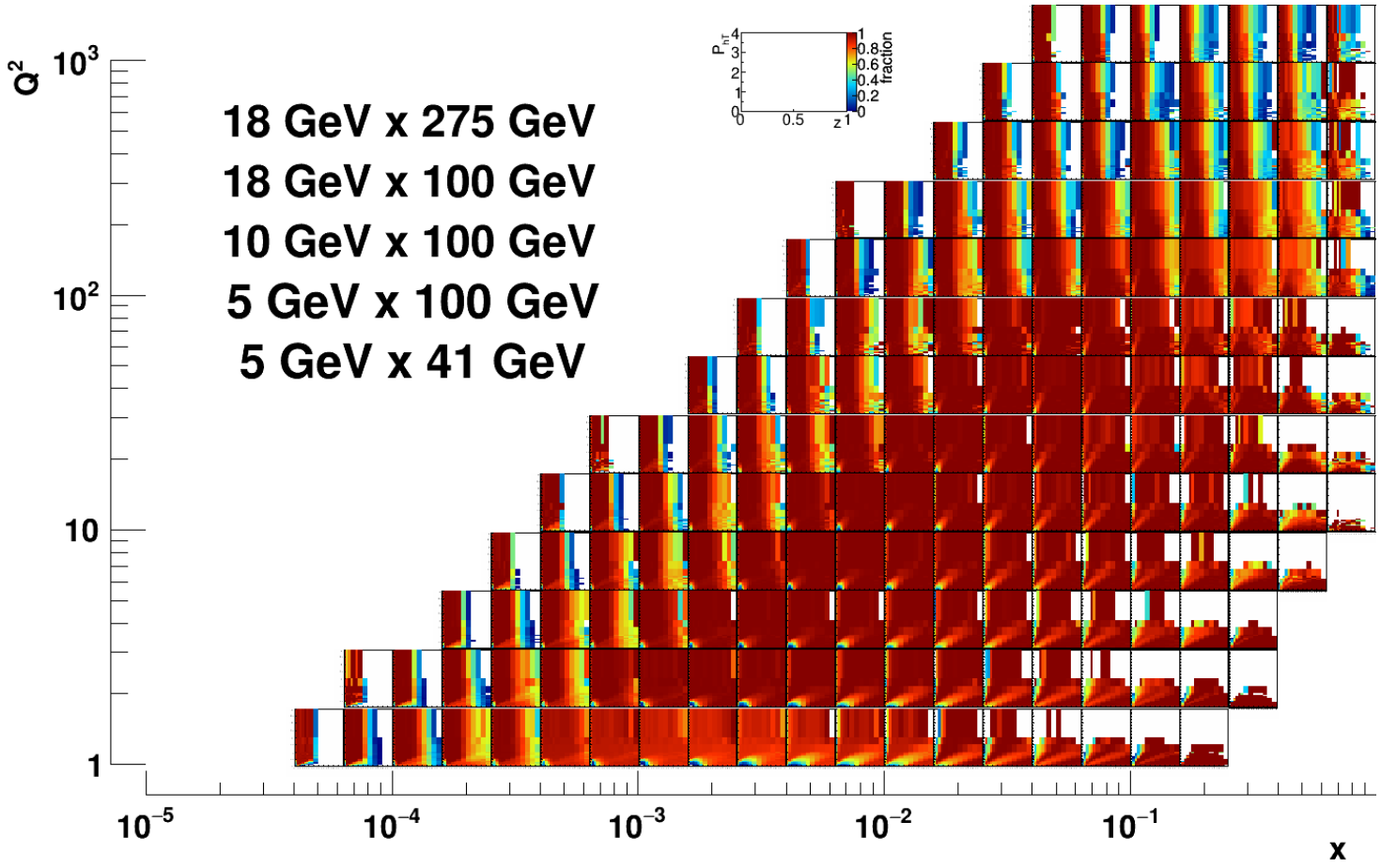
Very high P


18 GeV x 275 GeV
18 GeV x 100 GeV
10 GeV x 100 GeV
5 GeV x 100 GeV
5 GeV x 41 GeV
Q^2
10^3
10^2
10
1
10^{-5}
10^{-4}
10^{-3}
10^{-2}
10^{-1}
x
P_{hT}
z
fraction

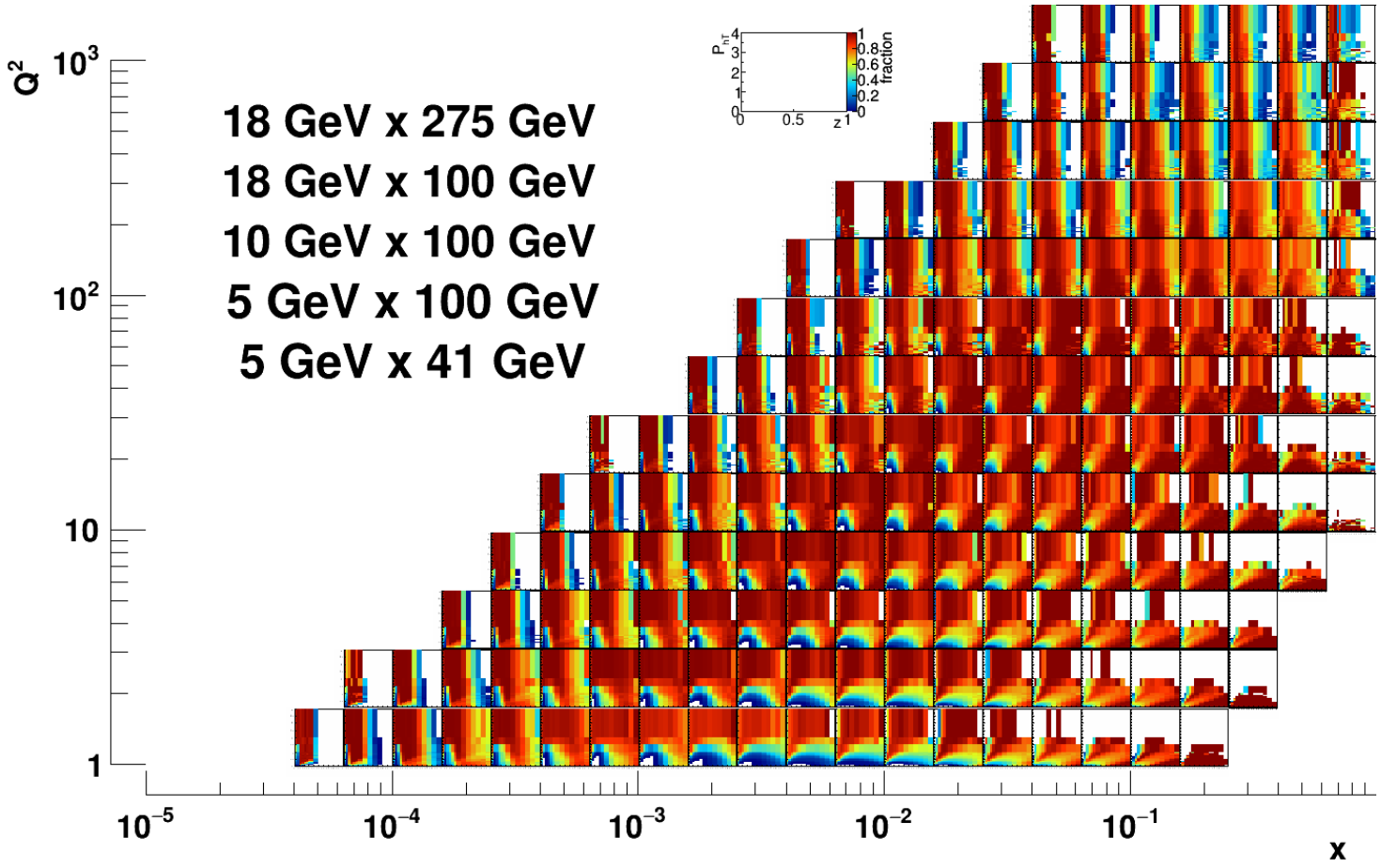
SIDIS request



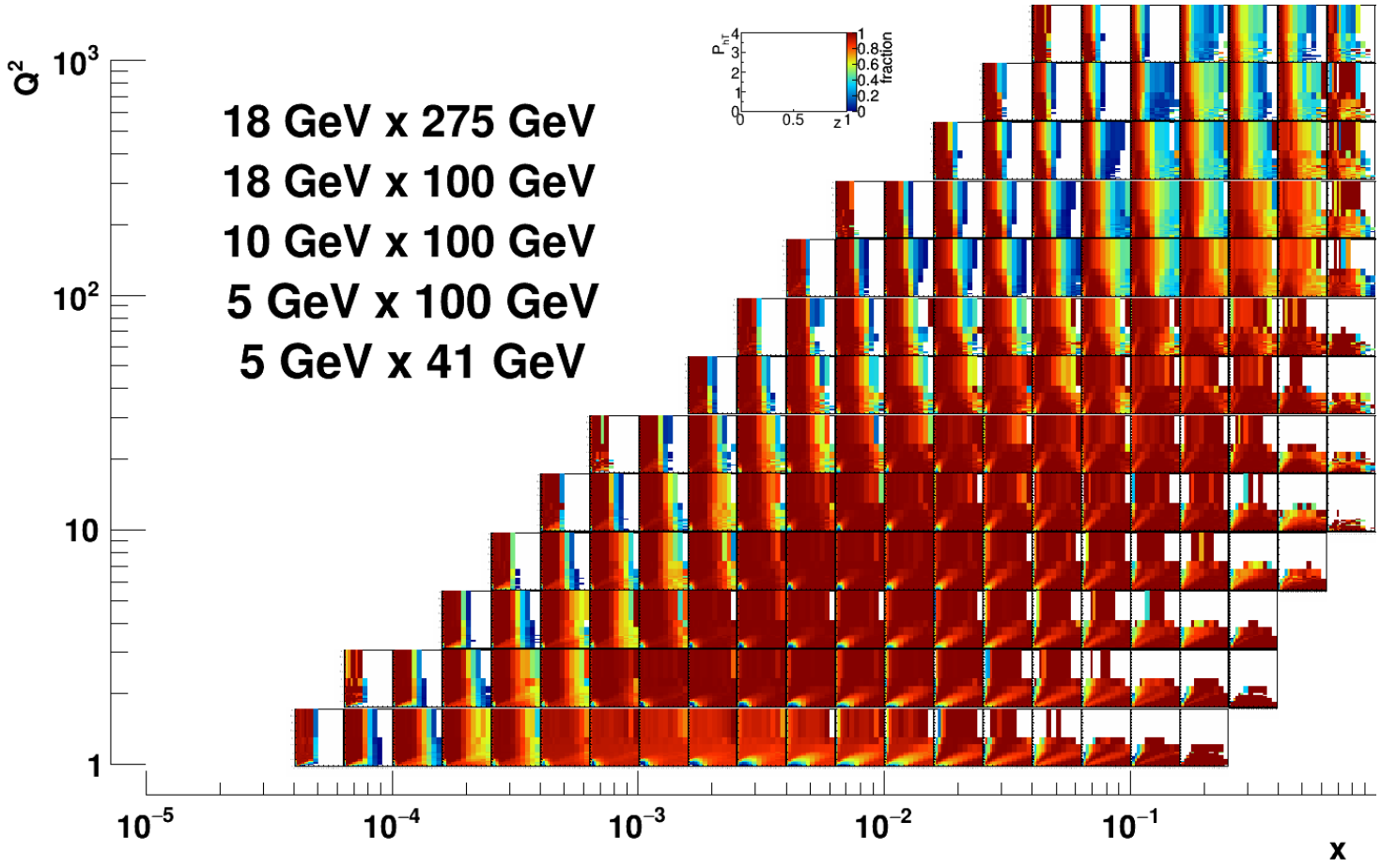
Anselm


18 GeV x 275 GeV
18 GeV x 100 GeV
10 GeV x 100 GeV
5 GeV x 100 GeV
5 GeV x 41 GeV
Q^2
10^3
10^2
10
1
10^{-5}
10^{-4}
10^{-3}
10^{-2}
10^{-1}
x
P_{hT}
z
fraction

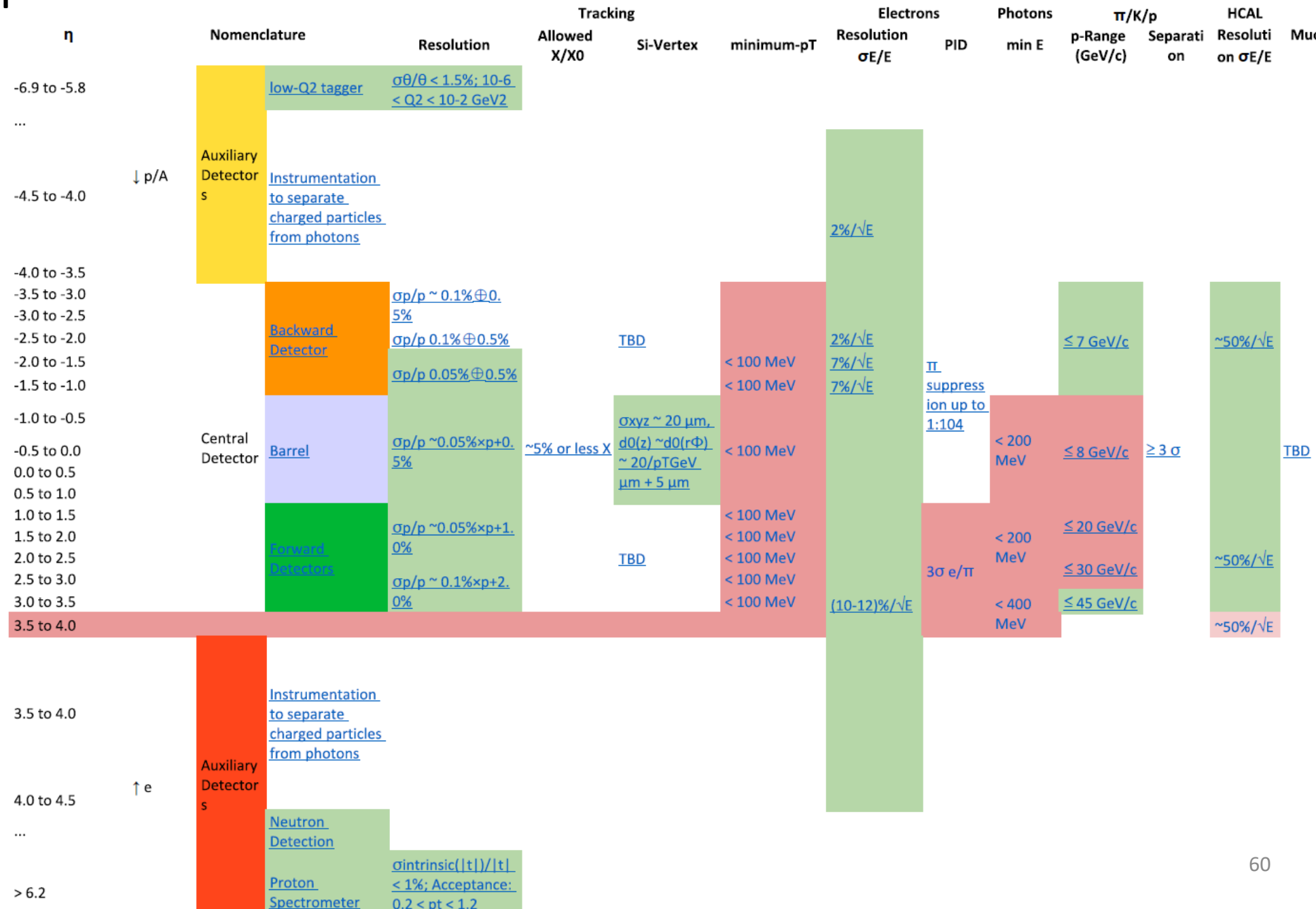
Low p cut


18 GeV x 275 GeV
18 GeV x 100 GeV
10 GeV x 100 GeV
5 GeV x 100 GeV
5 GeV x 41 GeV
Q^2
10^3
10^2
10
1
10^{-5}
10^{-4}
10^{-3}
10^{-2}
10^{-1}
x
P_{hT}
z
fraction

Final PID ranges



SIDIS group's detector matrix



Summary

- SIDIS preferences help at intermediate x, z and Q^2 ranges for all transverse momenta over official detector matrix
- Old setting particularly helpful for larger z, x and Q^2, but 50 GeV PID acceptance already at rapidities from 2 very unlikely → try to push as much as is possible: 20/30/45 GeV
- Very high momentum for pi0 would help at the highest x and z but would require expensive pre-shower

- Conclusion:
  - higher P ranges help – forward (η>1) may be even more important as harder to cover by different energies
  - No need to cover more than 8 GeV at central rapidities

MC simulations status

	1< Q2< 100		100<Q2	
ep 18x275	60M	68 pb^{-1}	4M	1.3 fb^{-1}
ep 18x100	40M	59 pb^{-1}	4M	2.3 fb^{-1}
ep 10x100	40M	69 pb^{-1}	2M	1.7 fb^{-1}
ep 5x100	40M	84 pb^{-1}	1M	1.5 fb^{-1}
ep 5x41	40M	125 pb^{-1}	1M	6.2 fb^{-1}

Part of the data is already copied to shared EICDATA/YR-SIDIS/ directory