Kinematics of the Panda decay channels

- Why
  - major task of the PID TAG group
    - common plots for separation power
    - open question: which quality for separation power do we really need for the different spatial regions?
    - kinematics of the individual decay channels helpful

- MC truth studies for the PID
  - distinction between the different partice IDs
  - distinction between different momenta regions
    - <1 GeV/c: PID via dE/dx and/or TOF
    - >1 GeV/c: PID via Cerenkov detectors
  - distinction between different spatial regions
    - θ: 0^0 - 5^0 : FS
    - θ: 5^0 - 20^0 : forward part of the TS
    - θ: 20^0 - 90^0 : forward part of the barrel region in the TS
    - θ: 90^0 - 170^0 : forward part of the barrel region in the TS
  - suitable decay channels

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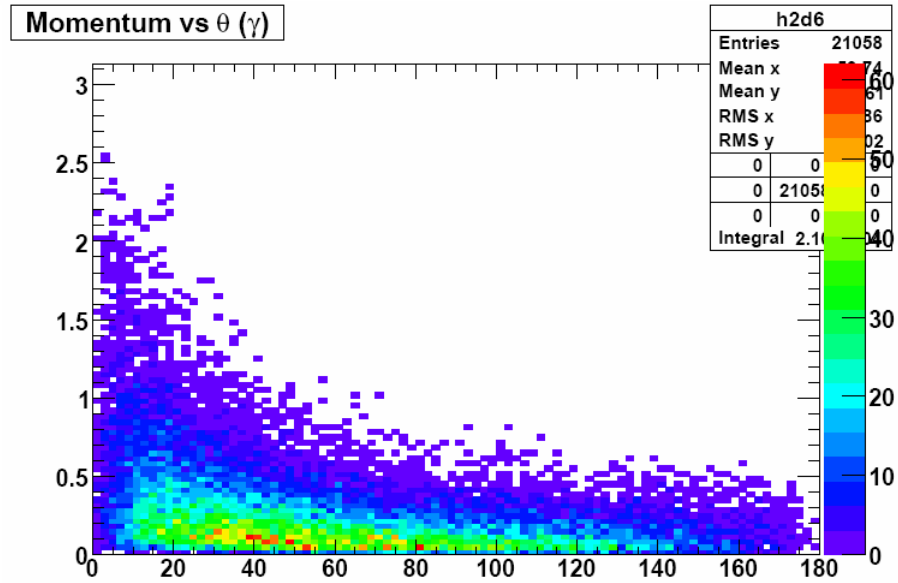
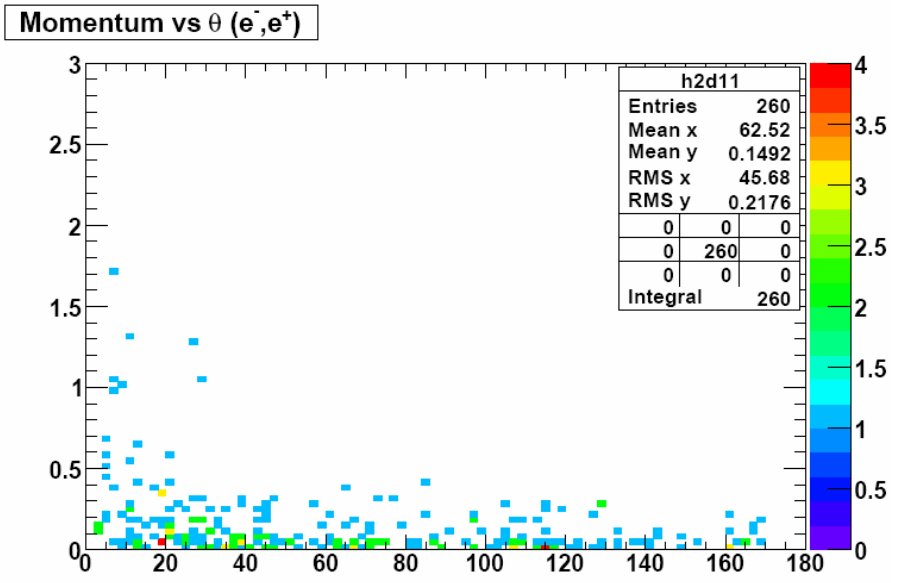
DPM @ 2.0 GeV/c

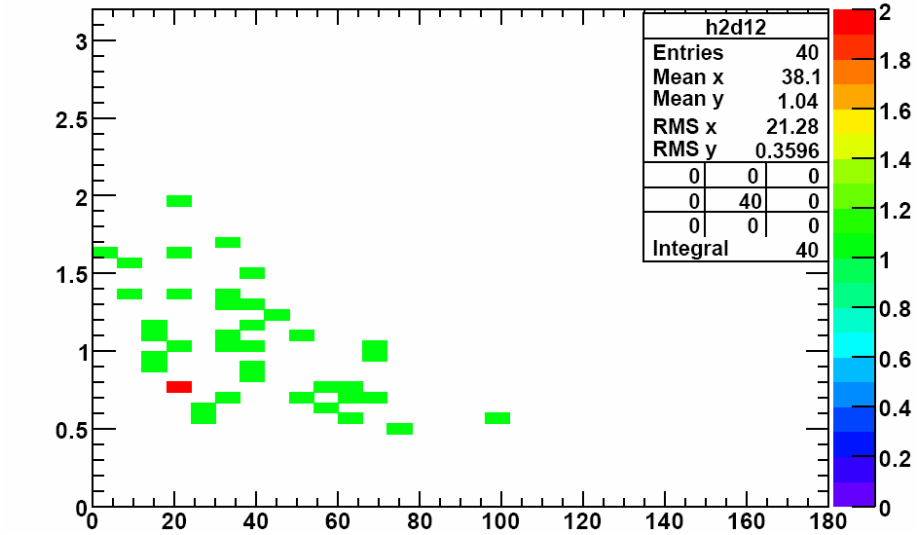
Momentum vs θ (γ)



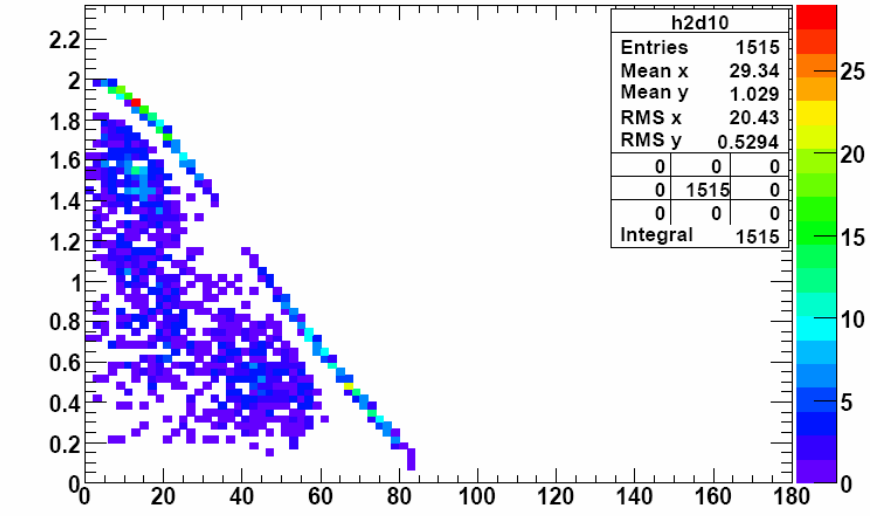
Momentum vs θ (e^-,e^+)



Momentum vs θ (K_L)

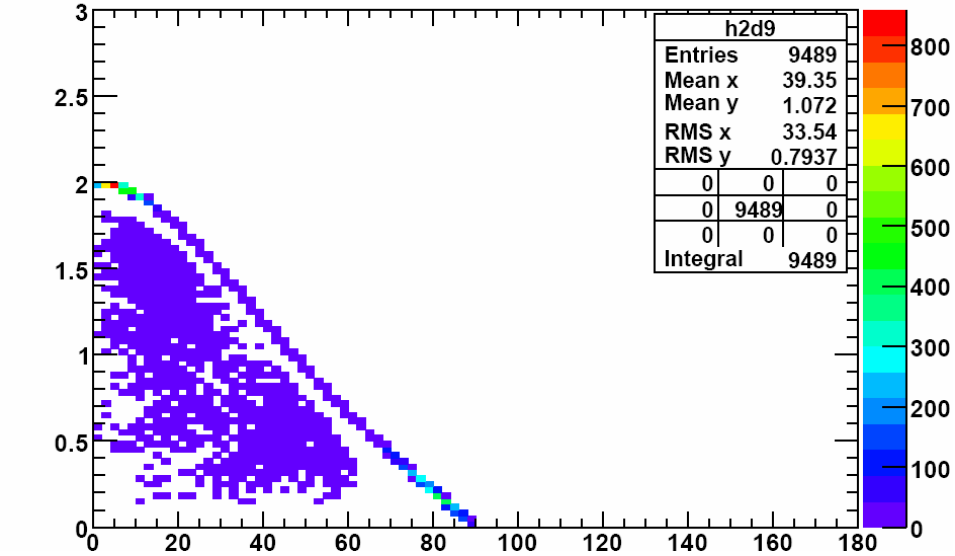


Momentum vs θ (n,$\bar{n}$)

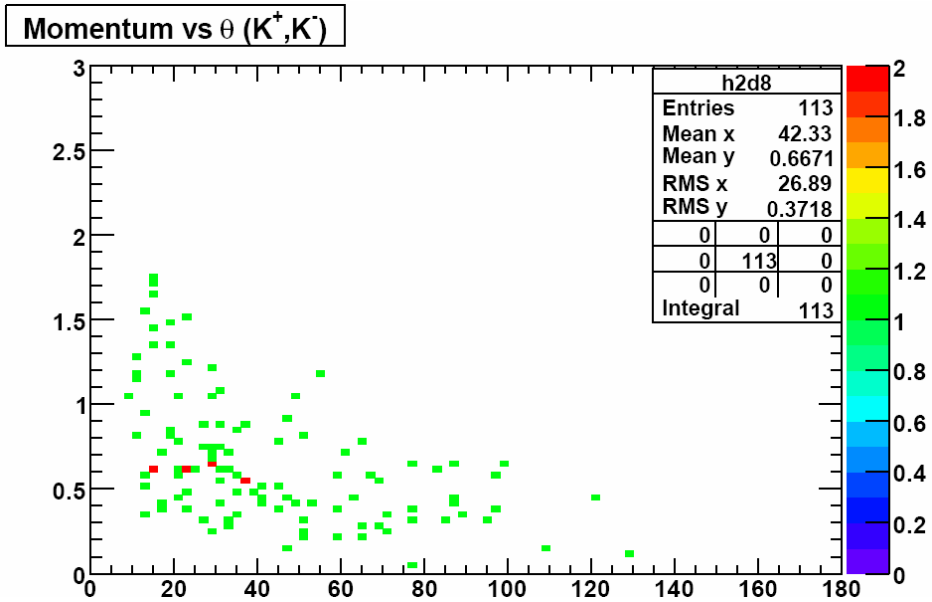


DPM @ 2.0 GeV/c

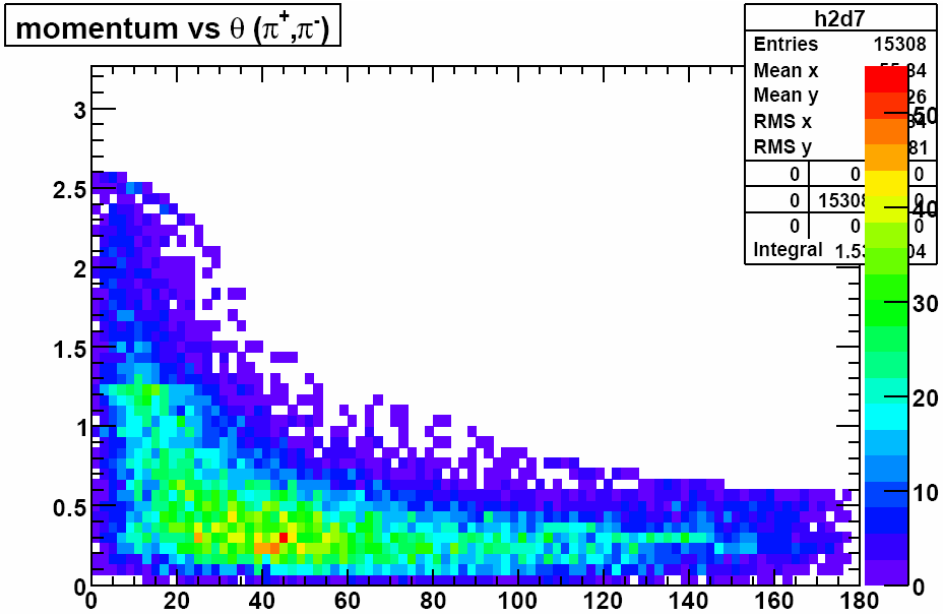
Momentum vs θ (p,$\bar{p}$)



Momentum vs θ (K^+,K^-)



momentum vs θ (π^+,π^-)

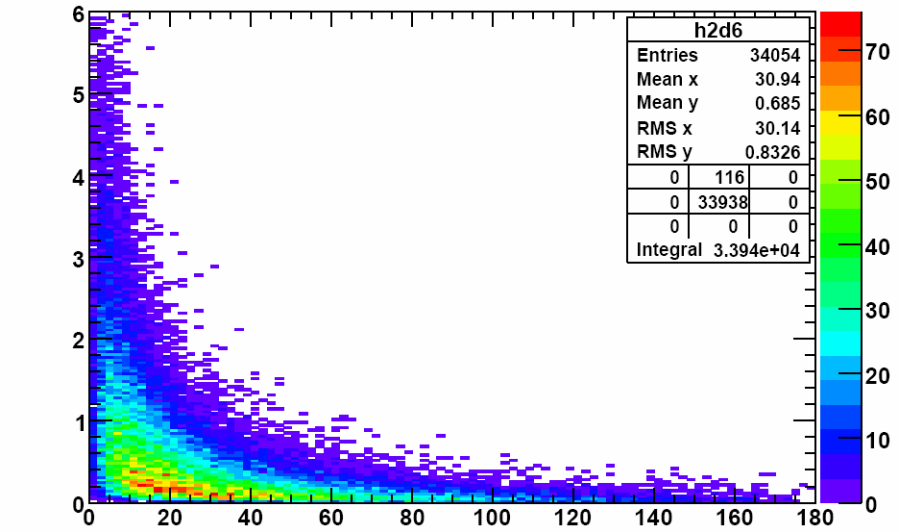


DPM @ 2.0 GeV/c

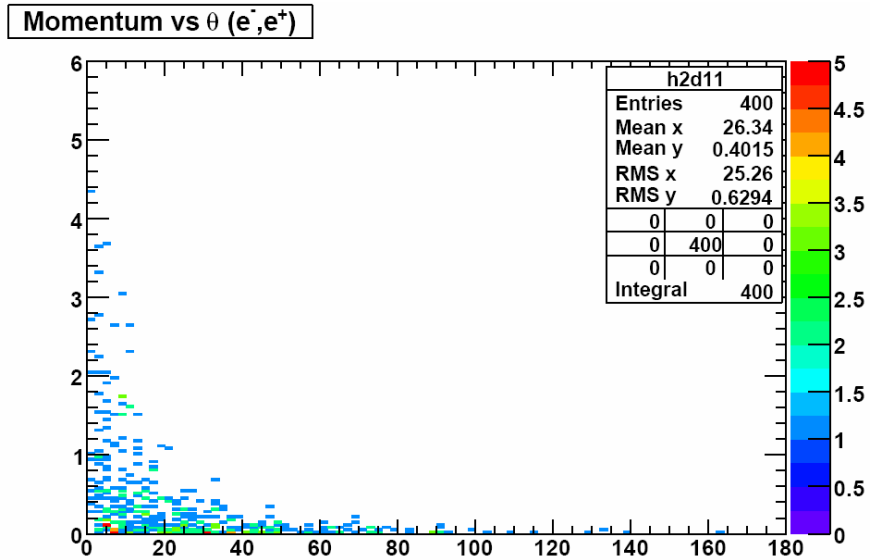
	momentum range in GeV/c for different Θ regions			
particle	**0^0 - 5^0**	**5^0 - 20^0**	**20^0 - 90^0**	**90^0 - 180^0**
e^+, e^-	0 - 2.0	0 – 1.5	< 1.0	< 0.5
γ	0 - 2.6	0 - 2.4	0 – 1.8	0 – 1.0
K_L	0 - 2.5	0 - 2.5	0 - 2.0	< 1.0
n, $\bar{n}$	0 - 2.0	0 - 2.0	0 – 1.7	-
p, $\bar{p}$	0 - 2.0	0 - 2.0	0 – 1.7	-
K^+, K^-	0 - 2.0	0 - 2.0	0 – 1.5	< 0.8
π^+, π^-	0 - 2.6	0 - 2.6	0 – 2.4	< 1.0

DPM @ 15.0 GeV/c

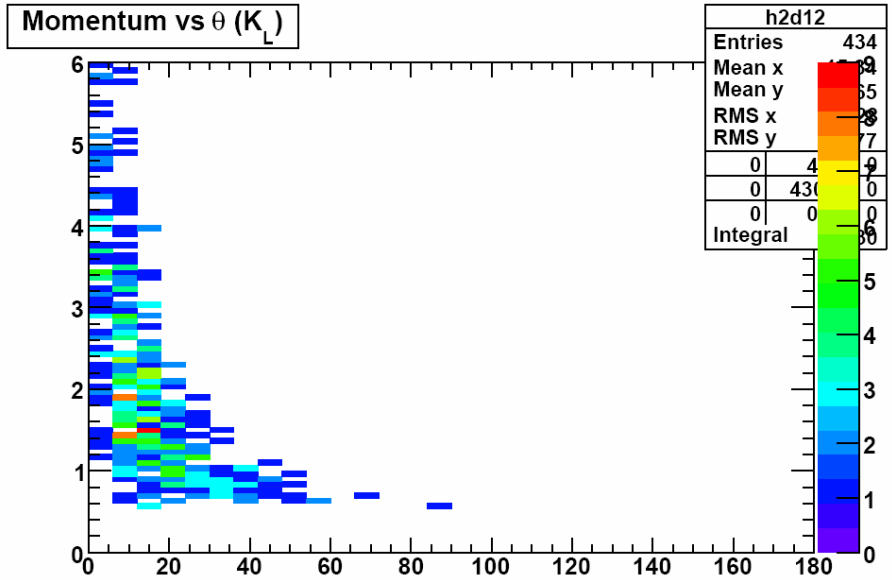
Momentum vs θ (γ)



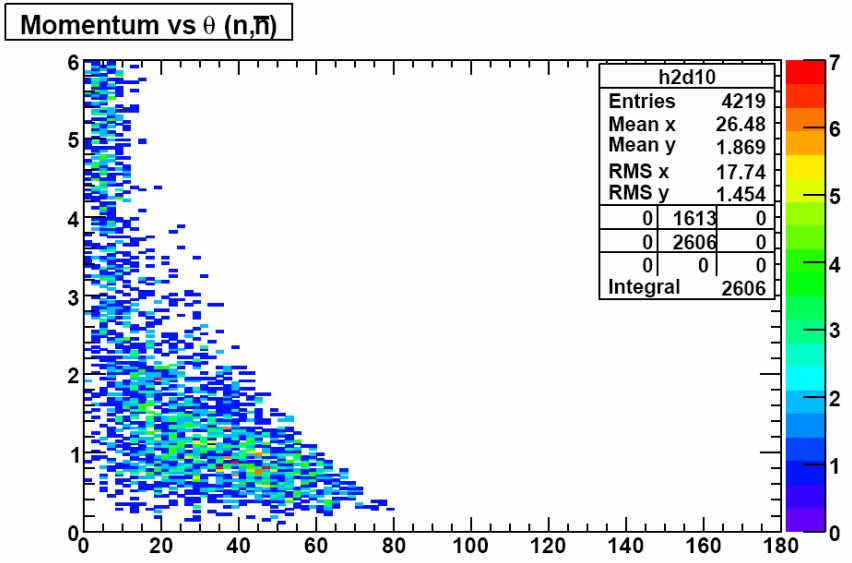
Momentum vs θ (e^-,e^+)



Momentum vs θ (K_L)

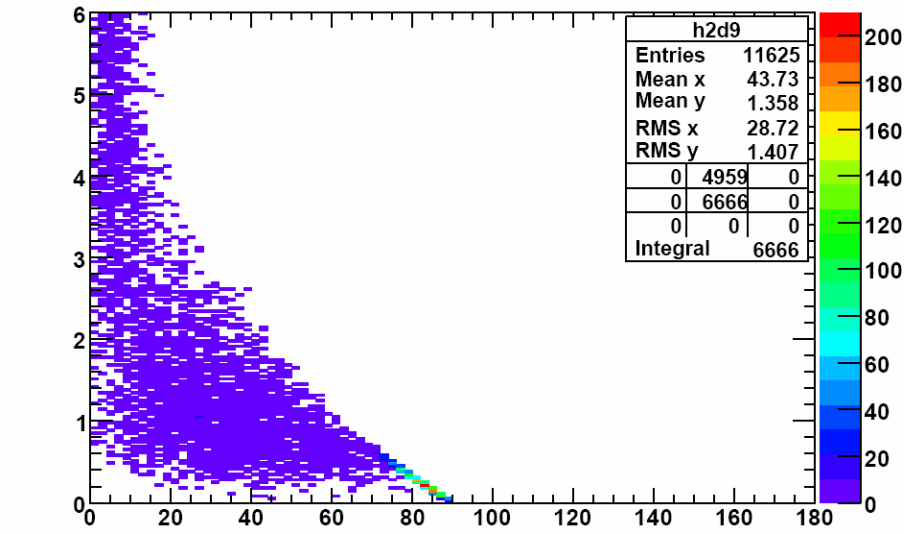


Momentum vs θ (n,$\bar{n}$)

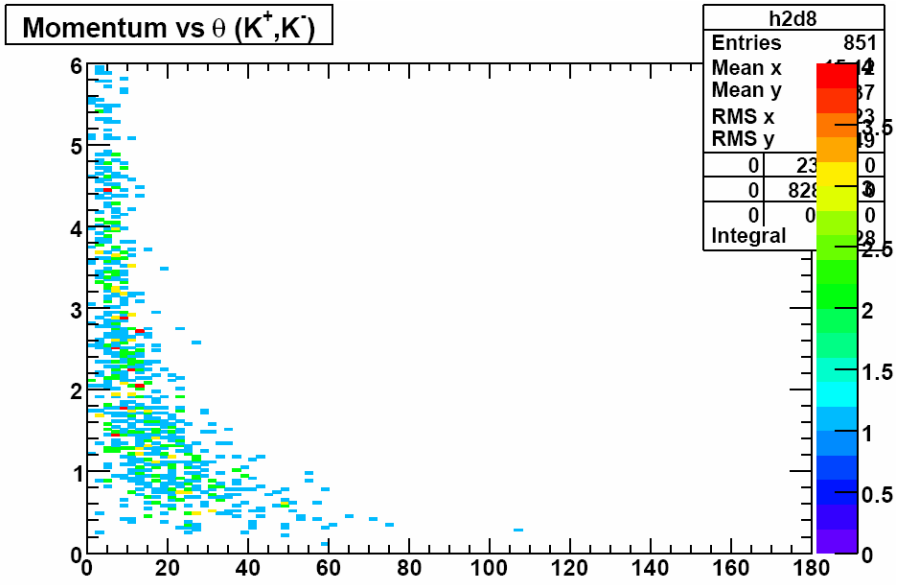


DPM @ 15.0 GeV/c

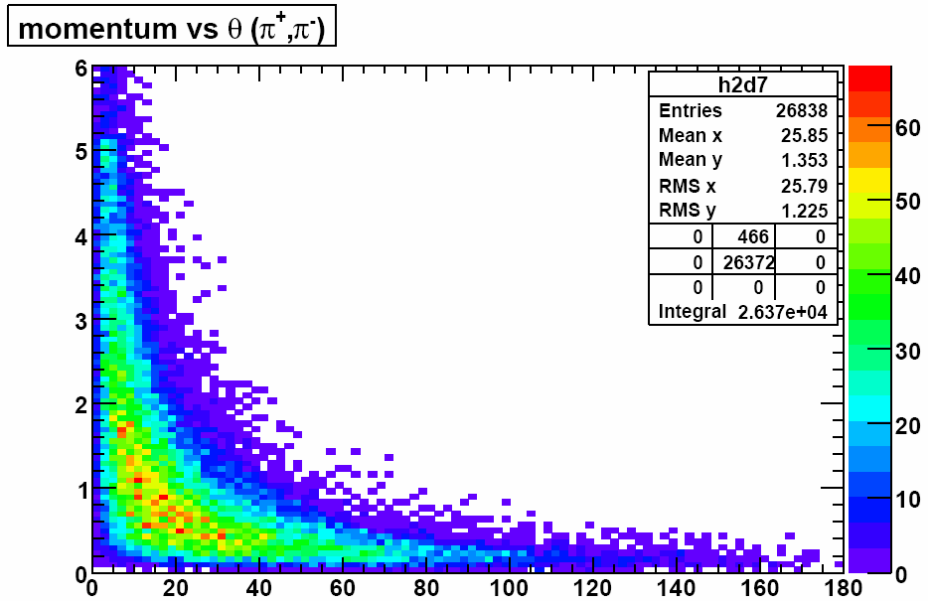
Momentum vs θ (p,$\bar{p}$)



Momentum vs θ (K^+,K^-)



momentum vs θ (π^+,π^-)

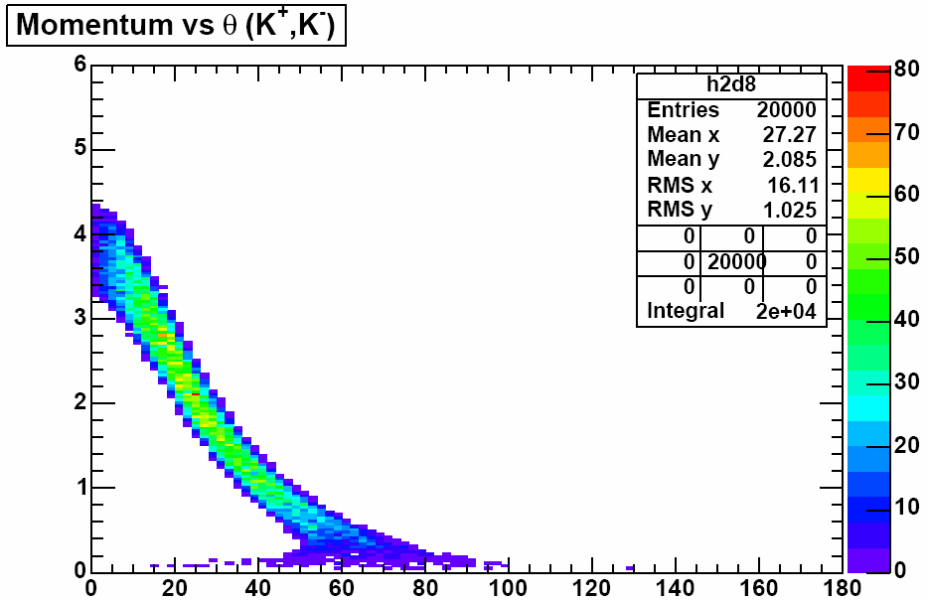


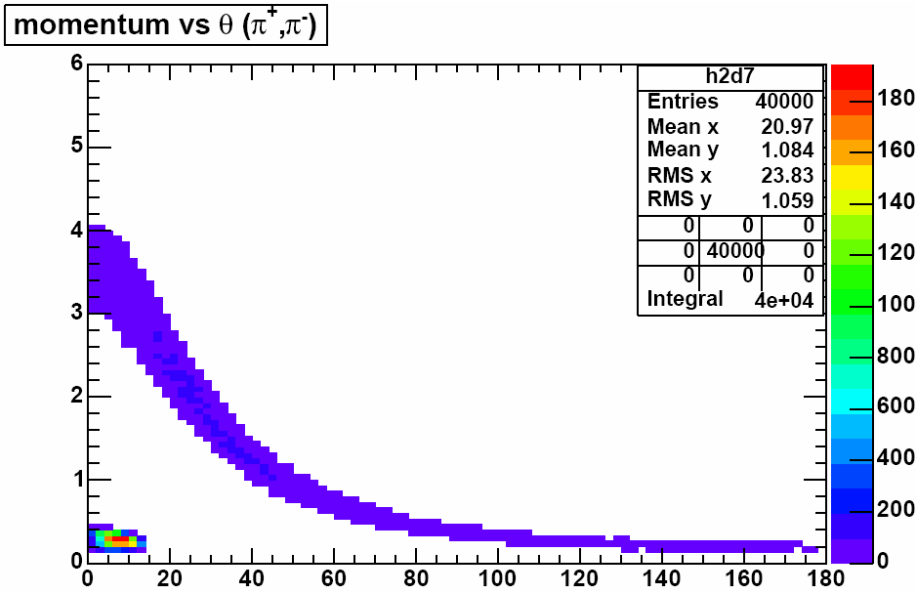
DPM @ 15.0 GeV/c

	momentum range in GeV/c for different Θ regions			
particle	**0^0 - 5^0**	**5^0 - 20^0**	**20^0 - 90^0**	**90^0 - 180^0**
e^+, e^-	0 - 5.0	0 – 3.5	< 1.0	< 0.3
γ	0 - >6.0	0 - >6.0	0 – 2.5	< 1.0
K_L	0 - >6.0	0 - >6.0	0 - 2.5	< 1.0
n, $\bar{n}$	0 - >6.0	0 - >6.0	0 – 4.0	-
p, $\bar{p}$	0 - >6.0	0 - >6.0	0 – 4.0	-
K^+, K^-	0 - >6.0	0 - >6.0	0 – 2.5	< 0.8
π^+, π^-	0 - >6.0	0 - >6.0	0 – 4.0	< 1.0

$\bar{p}p \rightarrow \Psi(4040) \rightarrow D^*\bar{D}^*$

- D^*, $\bar{D}^*$ decay modes:
  - $D^* \rightarrow D^0 \pi^+ \rightarrow (K^- \pi^+) \pi^+$
  - $\bar{D}^* \rightarrow \bar{D}^0 \pi^- \rightarrow (K^+ \pi^-) \pi^-$
- $\bar{p}$ momentum: 7.7 GeV/c





$\bar{p}p \rightarrow \Psi(4040) \rightarrow D^*\bar{D}^*$

	momentum range in GeV/c for different Θ regions			
particle	0^0 - 5^0	5^0 - 20^0	20^0 - 90^0	90^0 - 180^0
K^+, K^-	3.0 - 4.5	0 – 4.2	0 – 3.0	< 0.5
π^+, π^-	0 – 4.2	0 - 4.0	0.7 – 3.0	< 0.5

summary

- kinematcs of DPM @ 2.0 &15.0 GeV/c and $\Psi(4040)$ -> $D^*\bar{D}^*$
  - FS: PID via dE/dx (and/or TOF) and via Cherenkov detectors
  - forward region of the TS: PID via dE/dx (and/or TOF) and via Cherenkov detectors
  - barrel part of the TS
    - forward region: PID via dE/dx (and/or TOF) PID via Cherenkov detectors for $\Theta < 75^0$
    - backward region: PID via dE/dx (and/or TOF)

- do we need a DIRC detector for the barrel part?

- further channels
  - UrQMD (which materials)?
  - Drell Yan?
  - which benchmark channels?