

Hard exclusive production of vectormesons with CORE

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Motivation: Accessing gluon and sea-quark GPDs

Investigated channels:

$$\left. \begin{array}{l} \rho^0 \rightarrow \pi^+ \pi^- \\ \omega \rightarrow \pi^+ \pi^- \end{array} \right\} \text{u, d quarks}$$

$$\left. \begin{array}{l} \phi \rightarrow K^+ K^- \end{array} \right\} \text{s quarks, gluons}$$

$$\left. \begin{array}{l} J/\psi \rightarrow e^+ e^- \\ J/\psi \rightarrow \mu^+ \mu^- \end{array} \right\} \text{c quarks, gluons}$$

$$\left. \begin{array}{l} \Upsilon \rightarrow e^+ e^- \\ \Upsilon \rightarrow \mu^+ \mu^- \end{array} \right\} \text{b quarks, gluons}$$

generator: estarlight (hepmc3 output)

$Q^2 > 4.0 \text{ GeV}^2$ 1.000.000 events

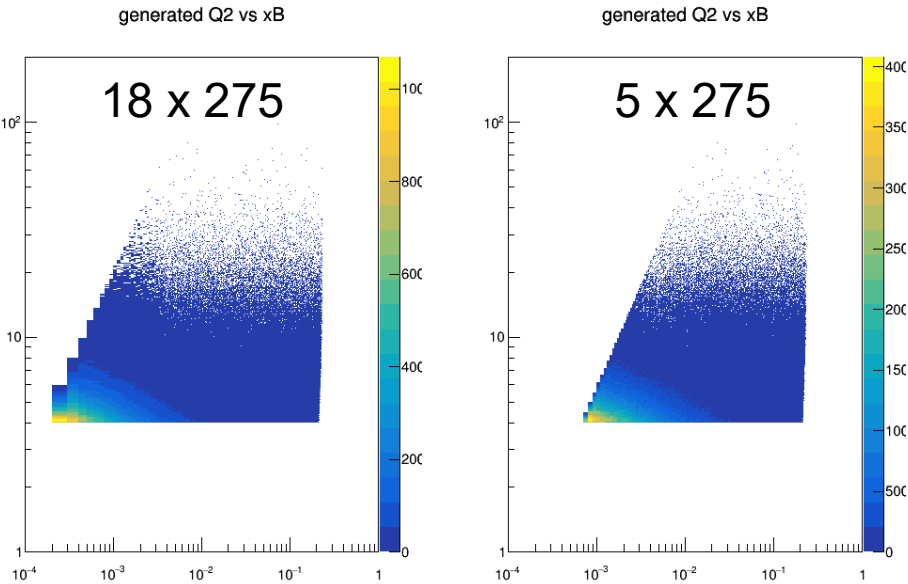
electrons x protons

18 x 275 (max energy, low luminosity)

10 x 275 (max luminosity)

5 x 275 (max luminosity, best PID)

5 x 100 (medium luminosity)



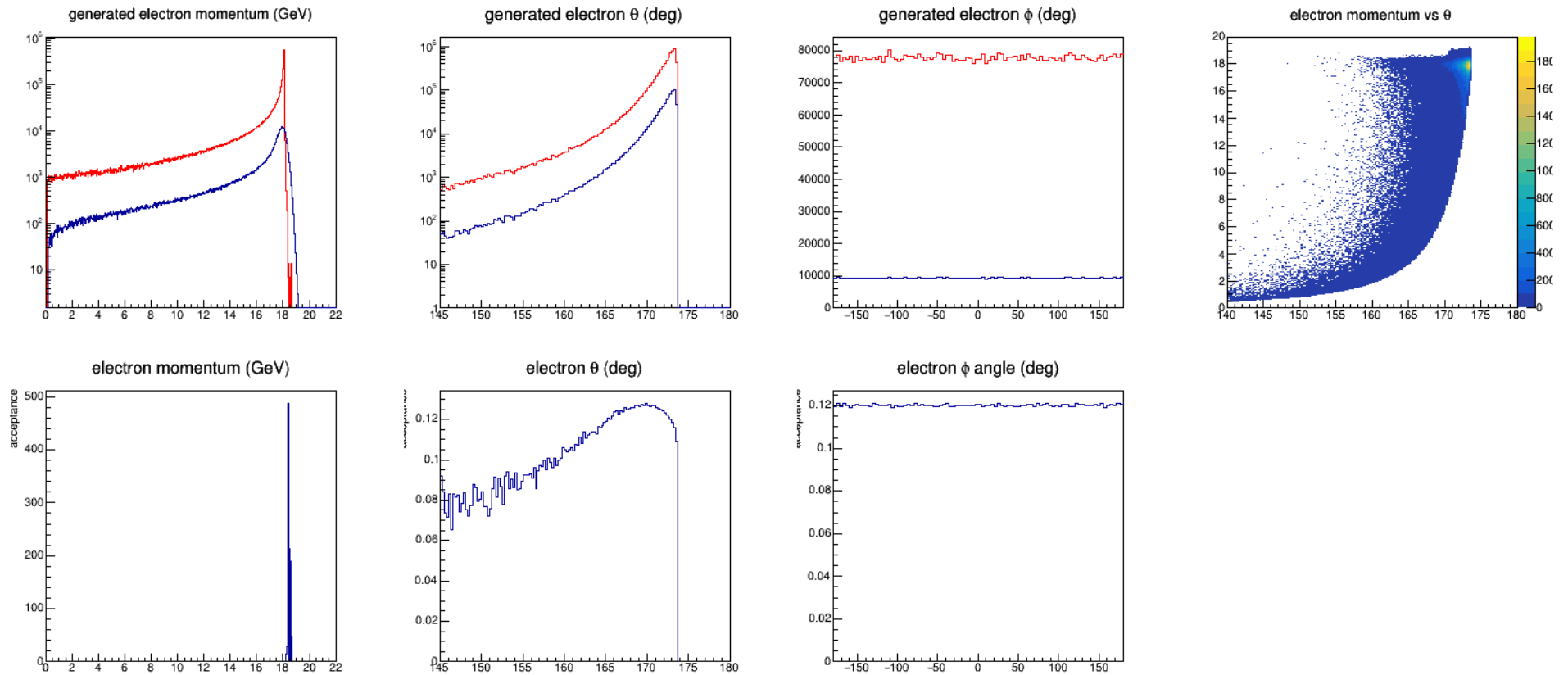
σ in pb:		$\pi^+ \pi^-$	$\pi^+ \pi^-$	$K^+ K^-$	$J/\psi \rightarrow e^+ e^-$	$J/\psi \rightarrow \mu^+ \mu^-$	$\Upsilon \rightarrow e^+ e^-$	$Q^2 > 1 \text{ GeV}^2$	$\Upsilon \rightarrow \mu^+ \mu^-$	$Q^2 > 1 \text{ GeV}^2$
e^-	p^+	ρ^0	ω	ϕ						
18	275	929,8	1,72	72,12	10,16	10,43	0,0321	0,0571	0,0334	0,0595
10	275	817,0	1,518	62,61	7,88	8,08	0,0226	0,0403	0,0236	0,0420
5	275	691,3	1,293	52,08	5,69	5,84	0,0140		0,0146	
5	100	515,7	0,979	37,57	3,21	3,29				

reconstruction: Delphes (Delphes_EIC_CORE_3T_v2.tcl)

$$\rho^0 \rightarrow \pi^+ \pi^-$$

18 x 275

electrons:

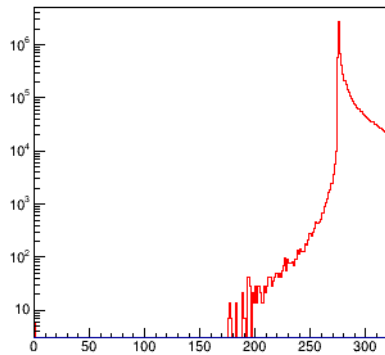


$$\rho^0 \rightarrow \pi^+ \pi^-$$

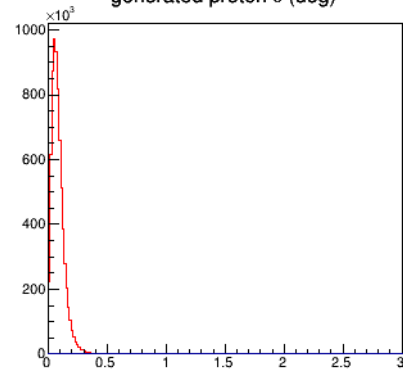
18 x 275

protons:

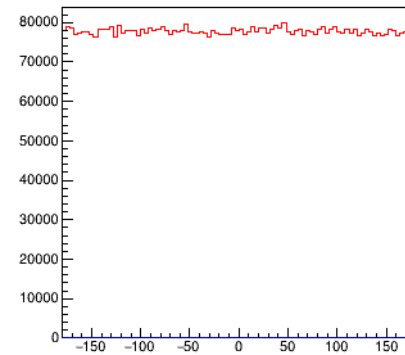
generated proton momentum (GeV)



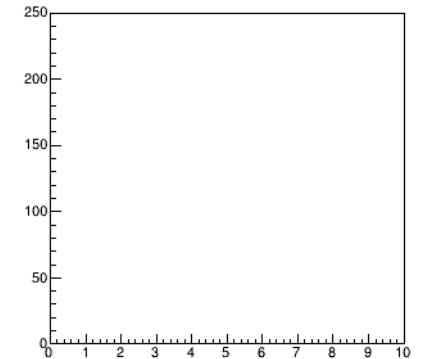
generated proton θ (deg)



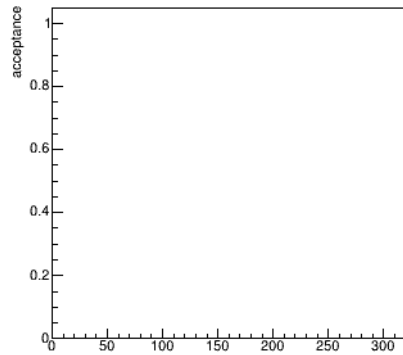
generated proton ϕ (deg)



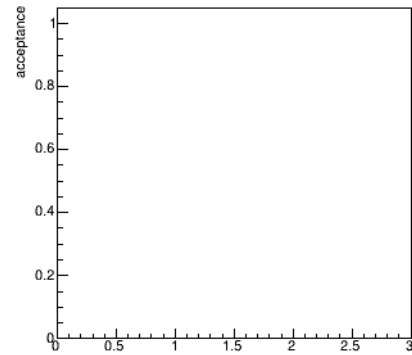
proton momentum vs θ



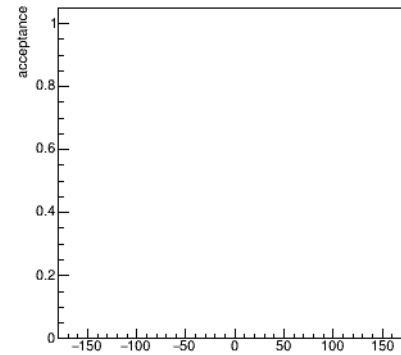
proton momentum (GeV)



proton θ (deg)



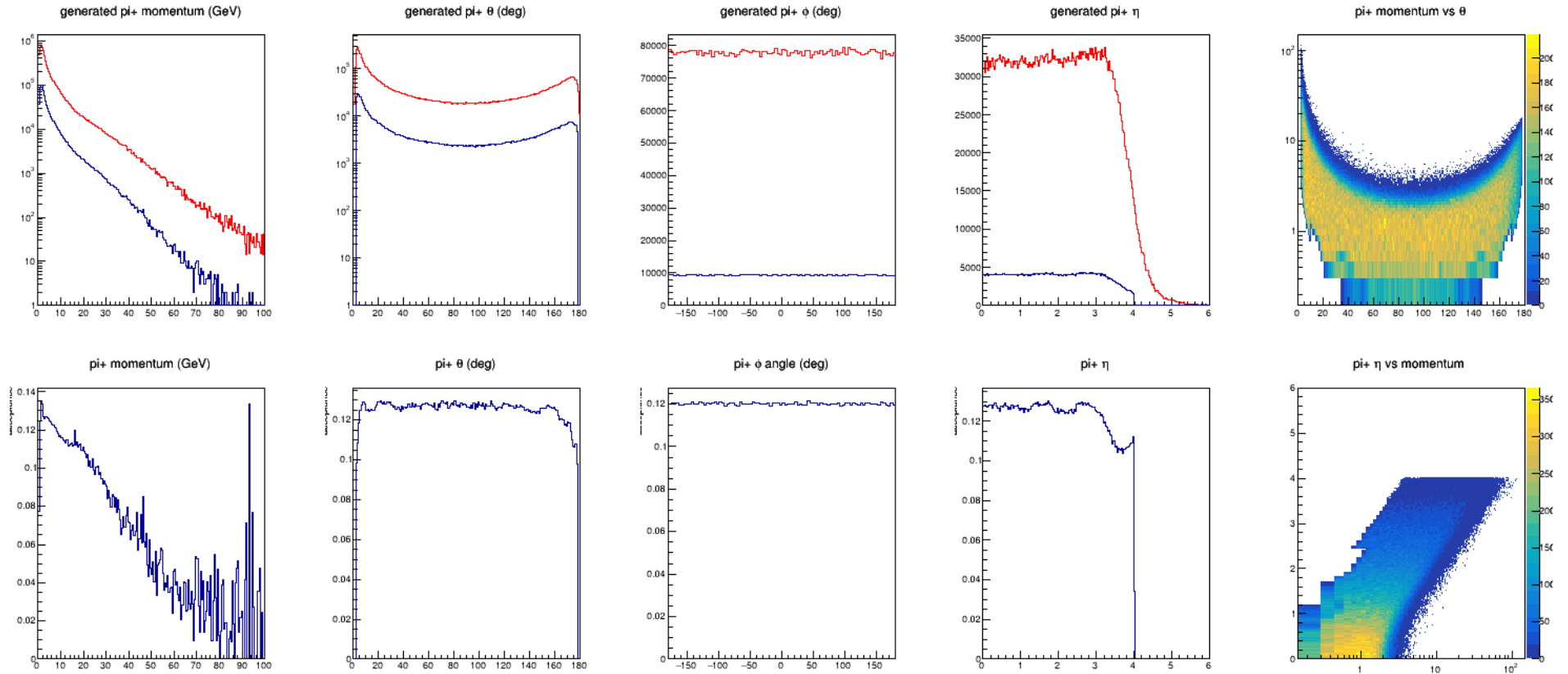
proton ϕ angle (deg)



$$\rho^0 \rightarrow \pi^+ \pi^-$$

18 x 275

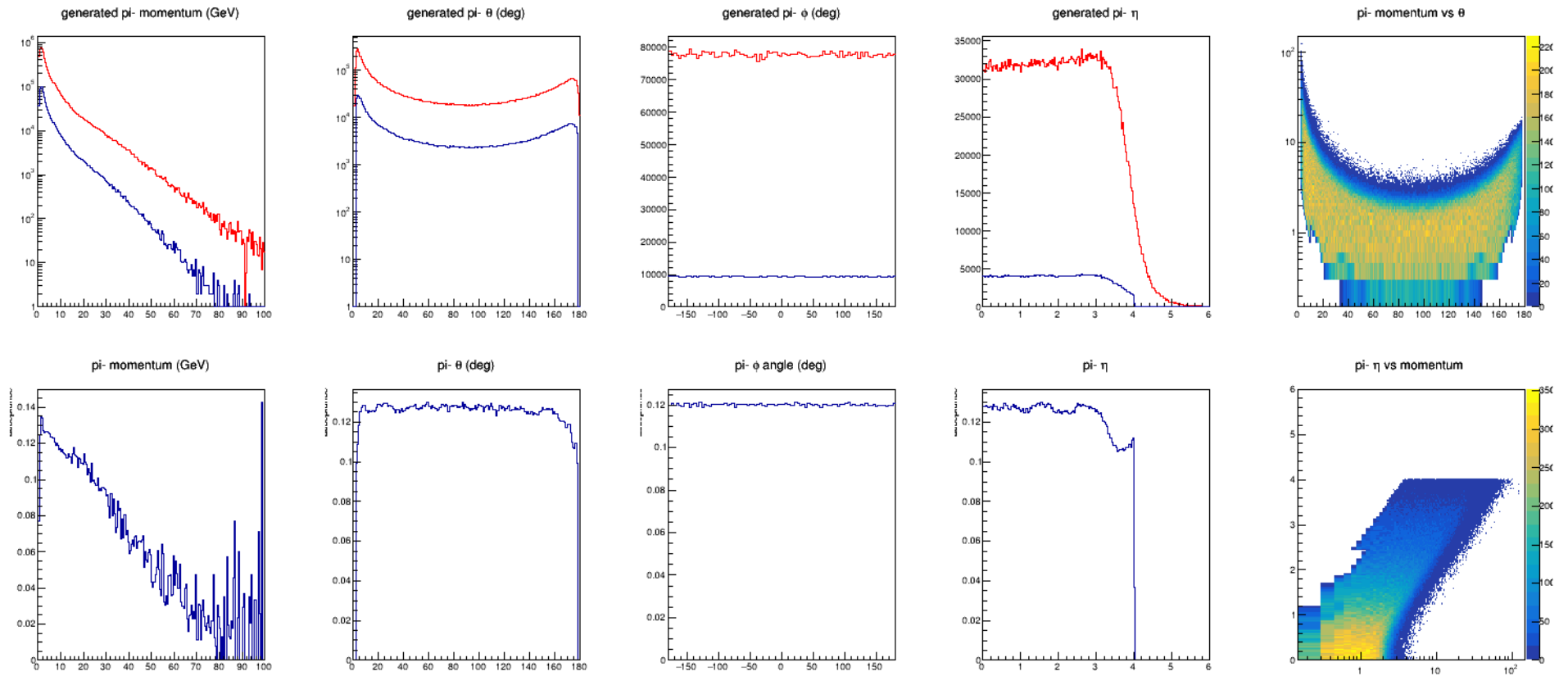
π^+ :



$$\rho^0 \rightarrow \pi^+ \pi^-$$

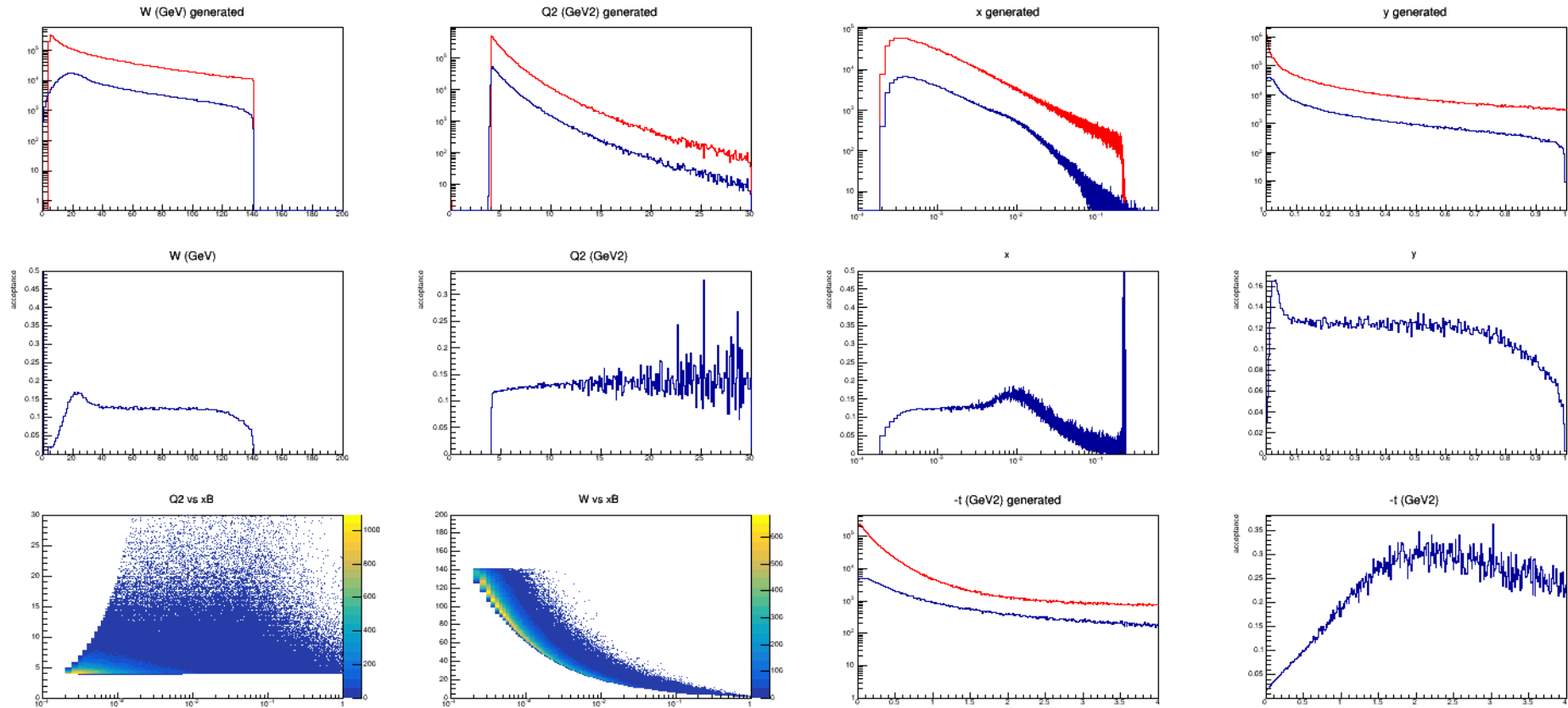
18 x 275

pi-:



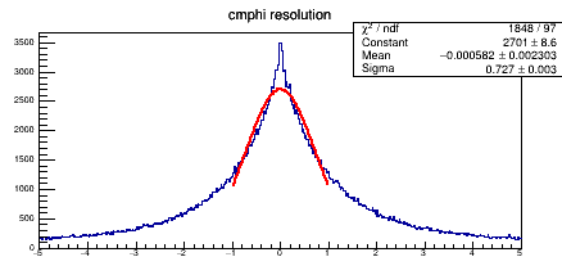
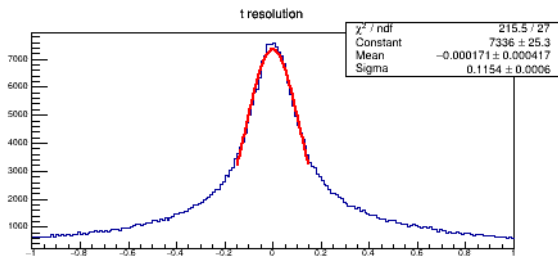
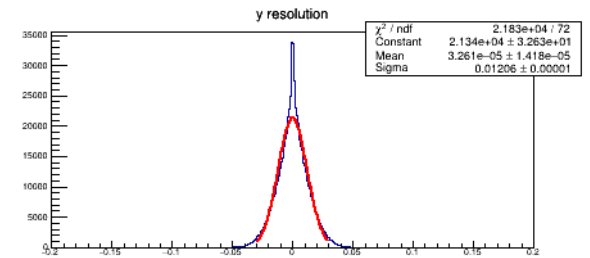
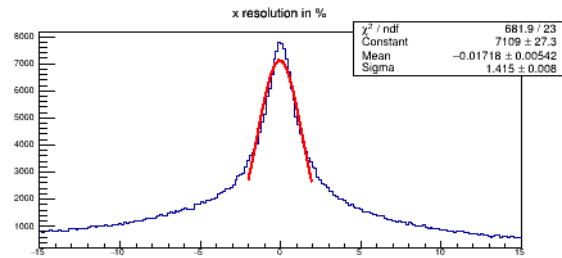
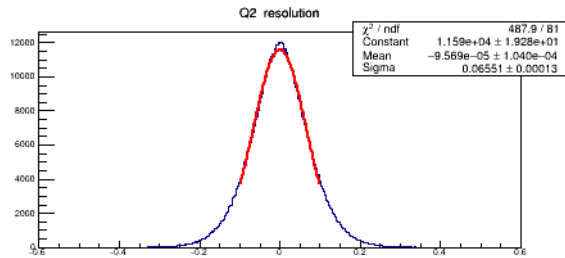
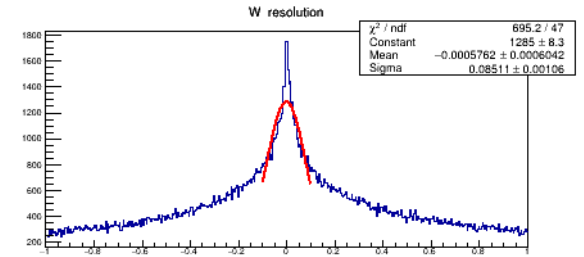
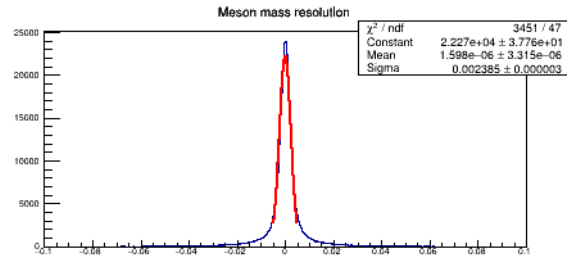
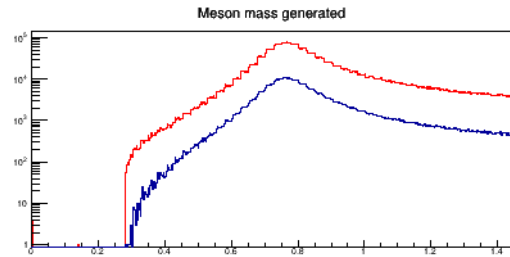
$$\rho^0 \rightarrow \pi^+ \pi^-$$

18 x 275



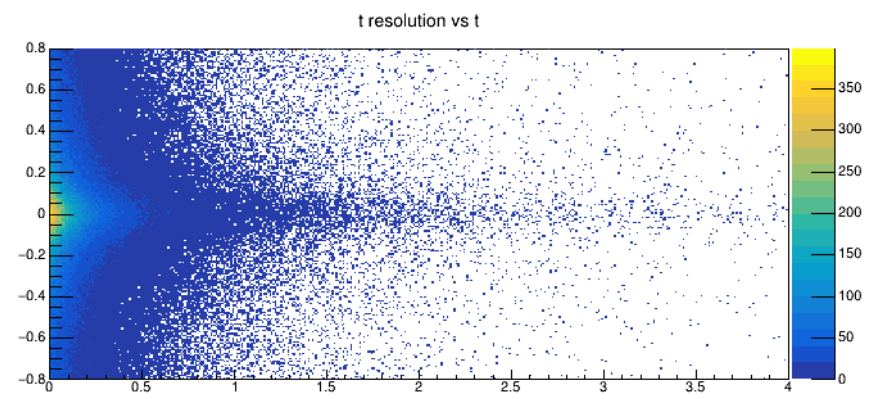
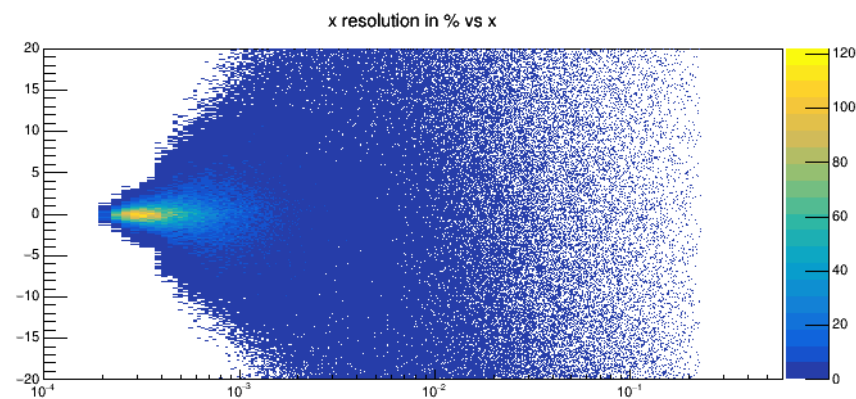
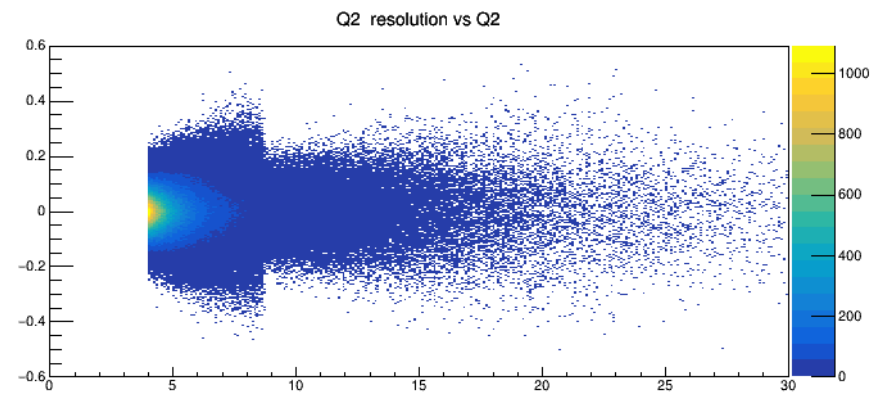
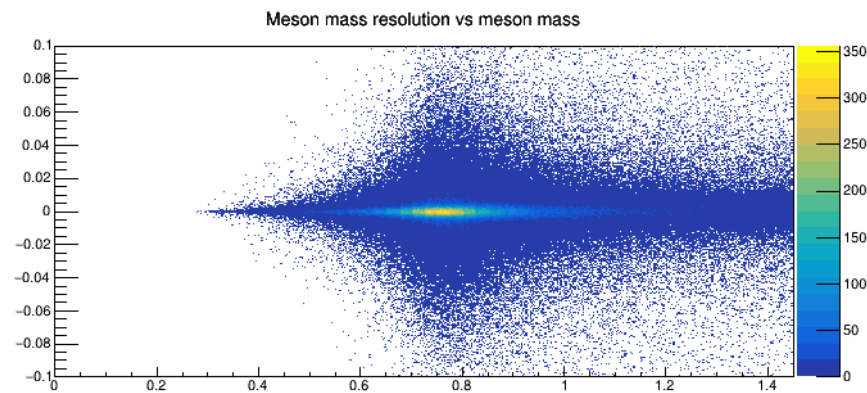
$$\rho^0 \rightarrow \pi^+ \pi^-$$

18 x 275



$$\rho^0 \rightarrow \pi^+ \pi^-$$

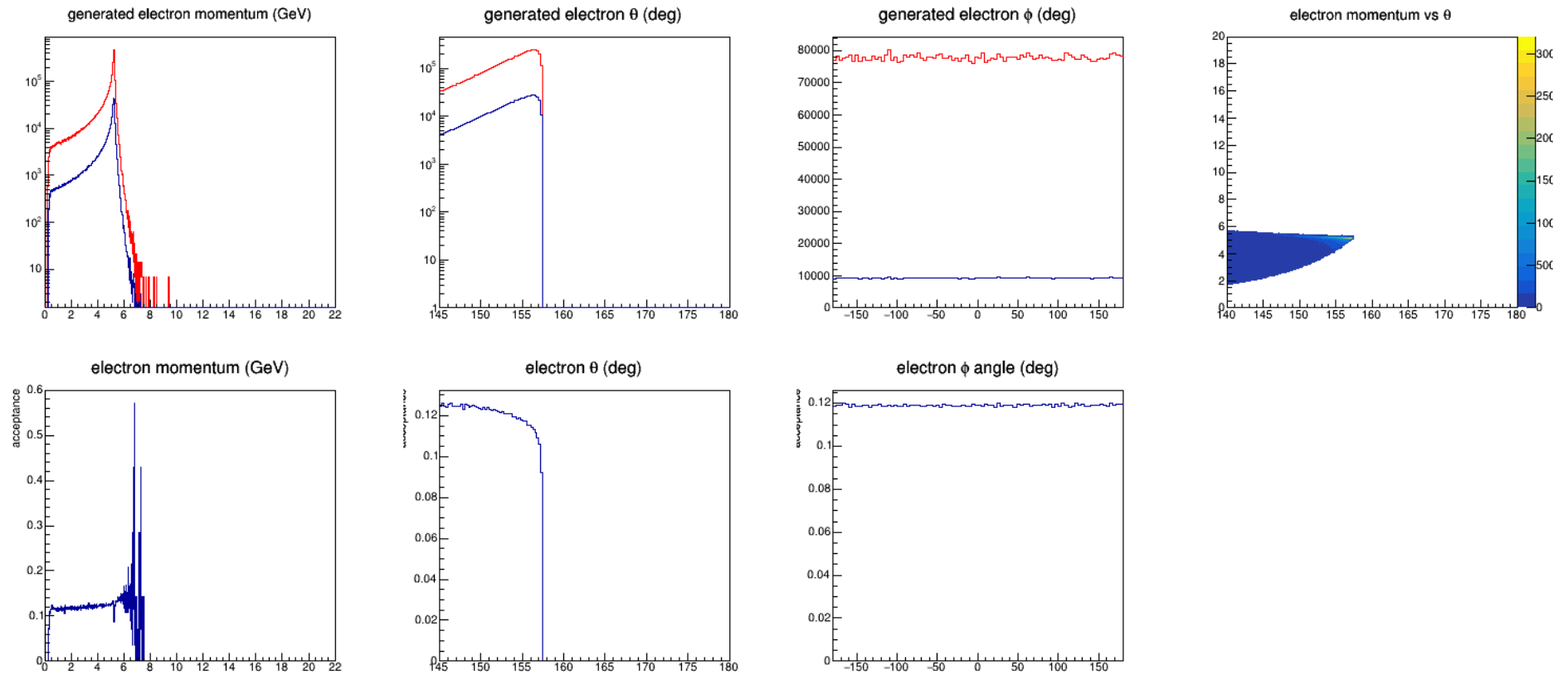
18 x 275



$$\rho^0 \rightarrow \pi^+ \pi^-$$

5 x 275

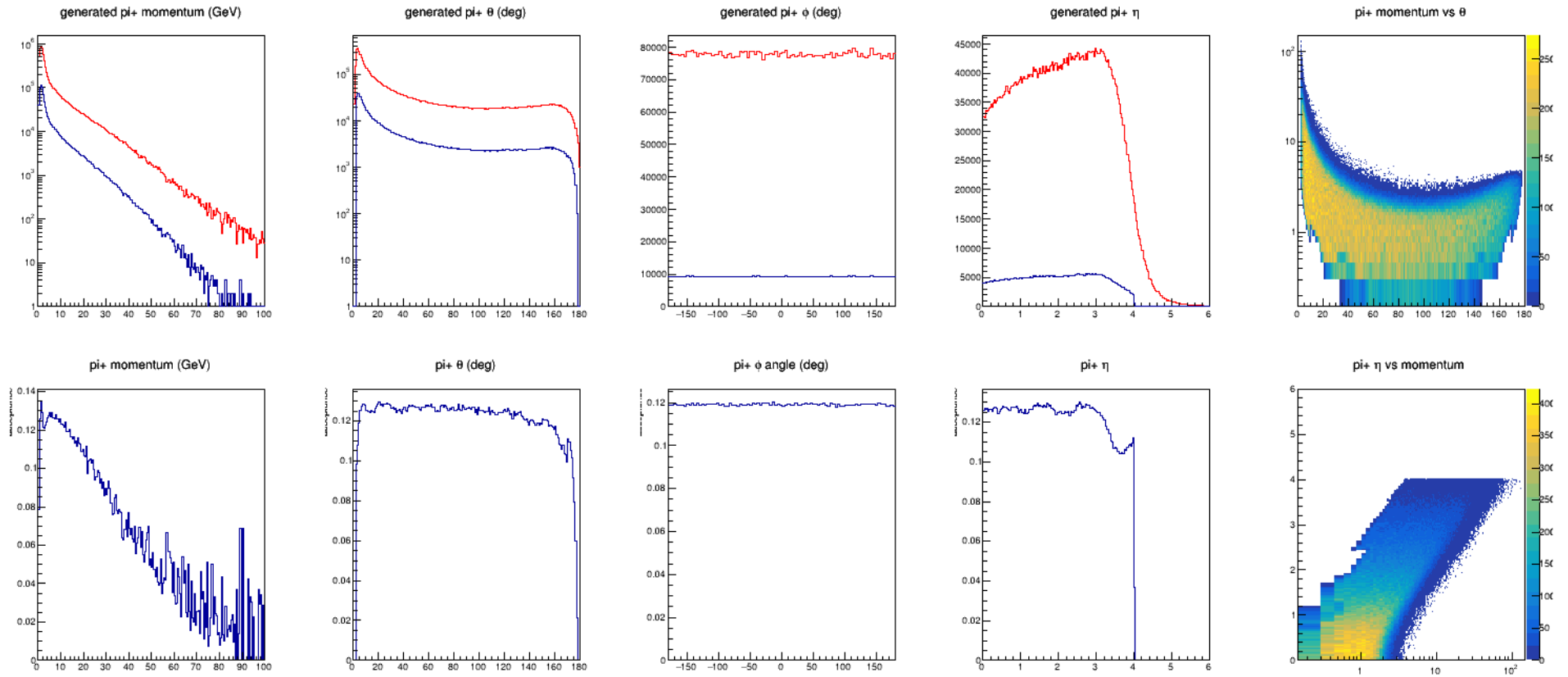
electrons:



$$\rho^0 \rightarrow \pi^+ \pi^-$$

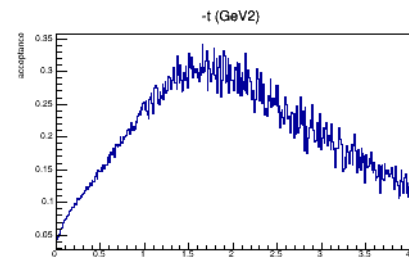
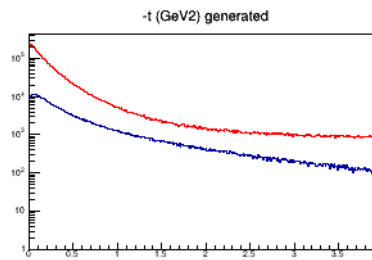
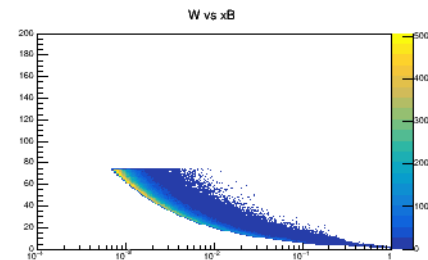
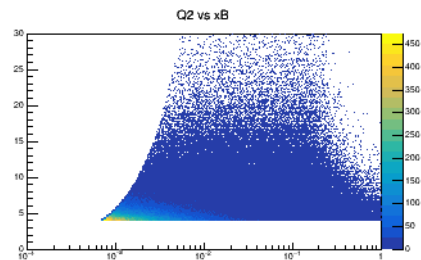
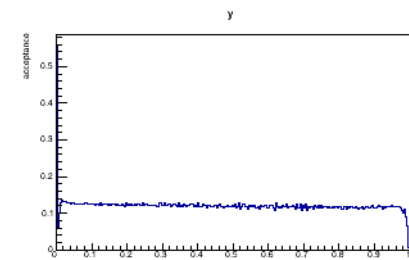
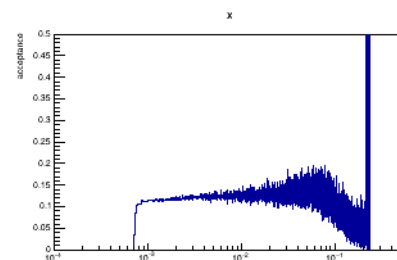
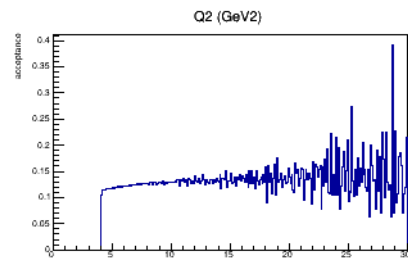
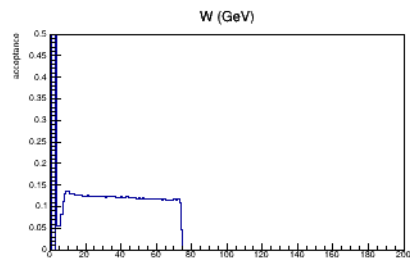
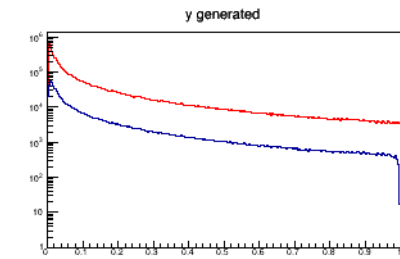
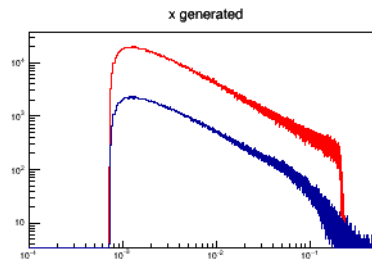
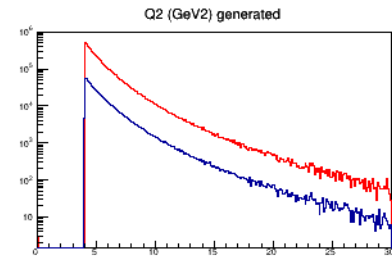
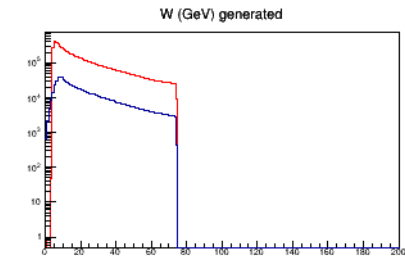
5 x 275

π^+ :



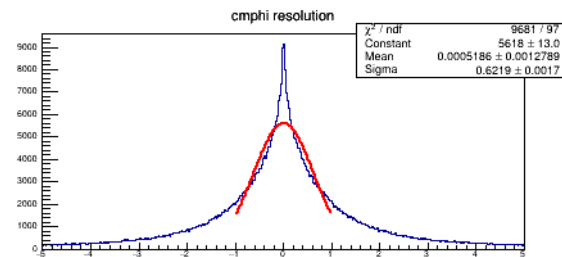
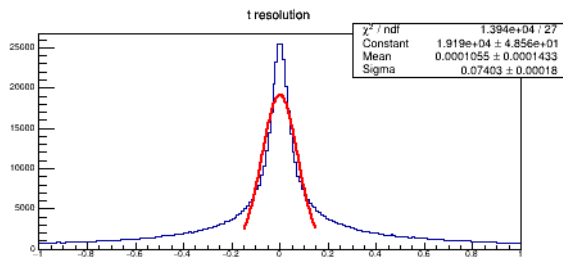
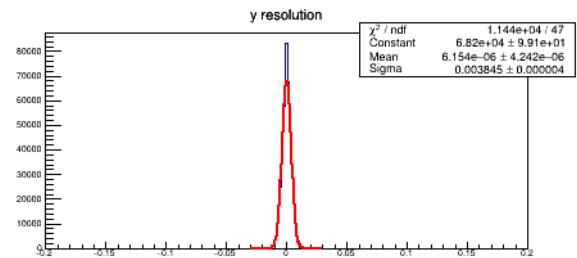
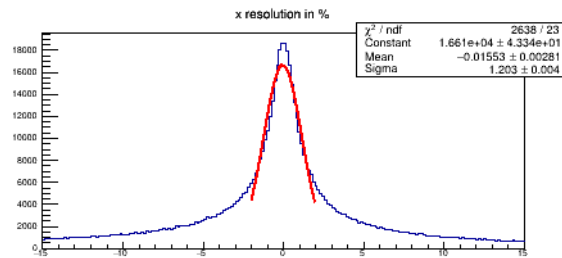
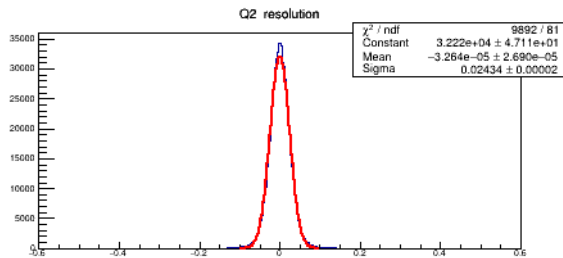
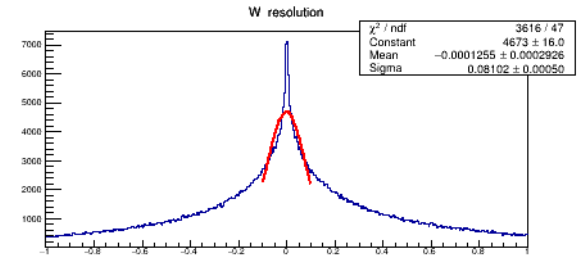
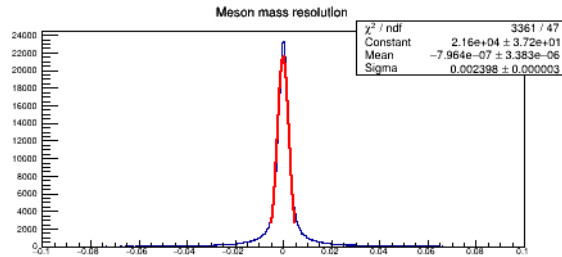
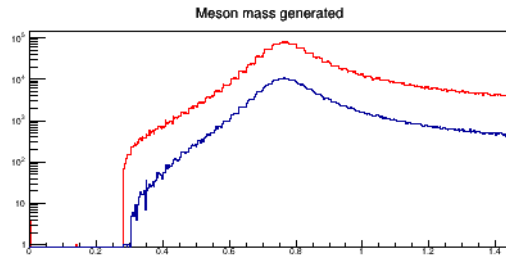
$$\rho^0 \rightarrow \pi^+ \pi^-$$

5 x 275



$$\rho^0 \rightarrow \pi^+ \pi^-$$

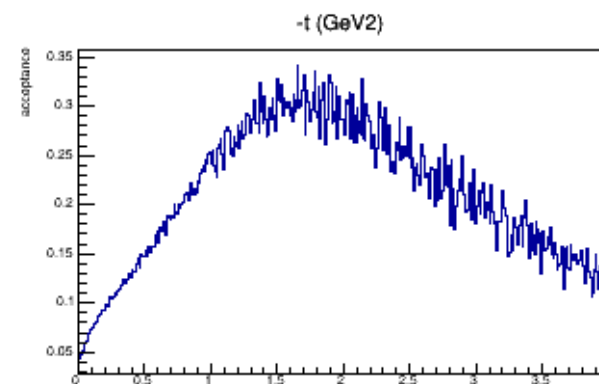
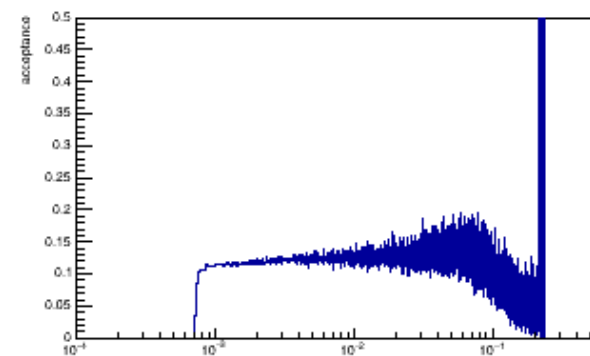
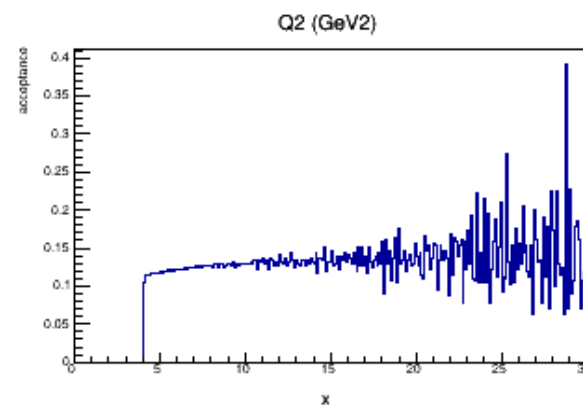
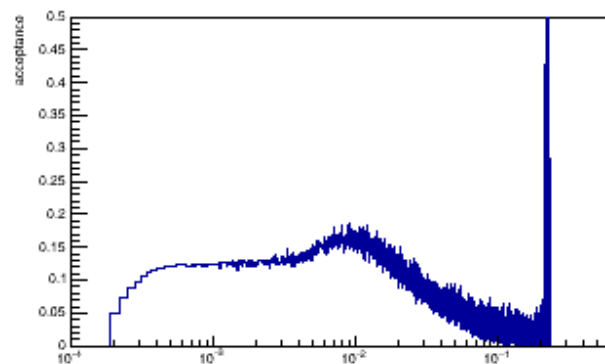
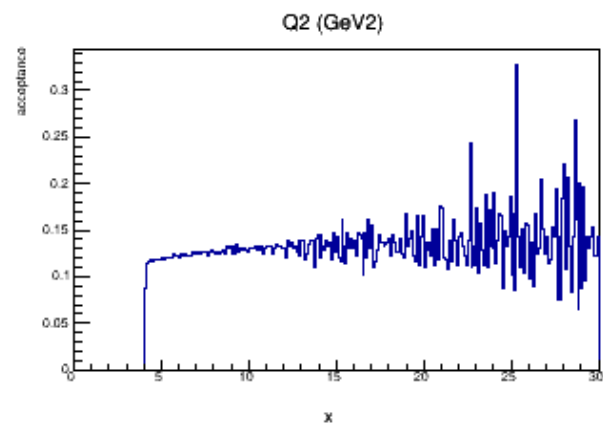
5 x 275



18 x 275

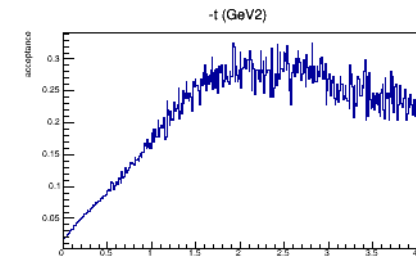
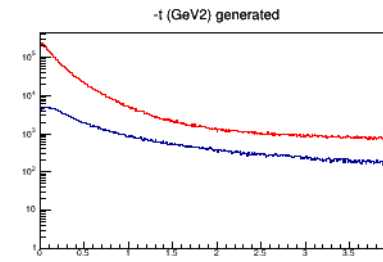
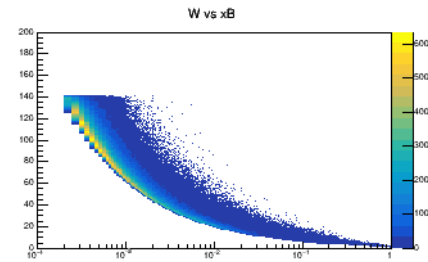
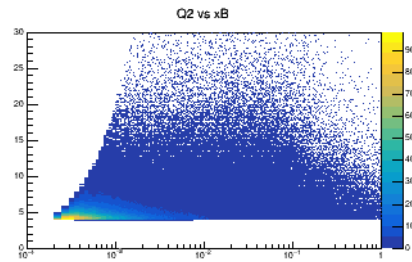
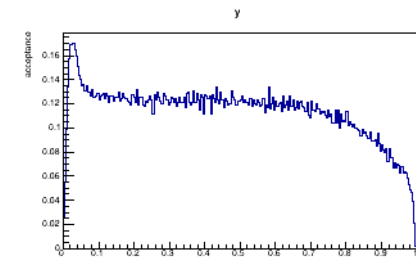
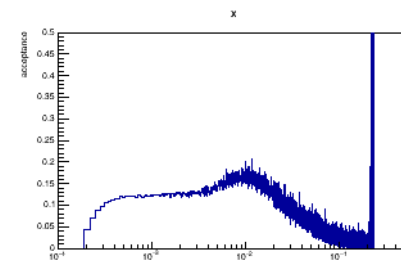
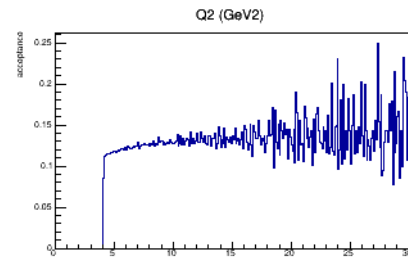
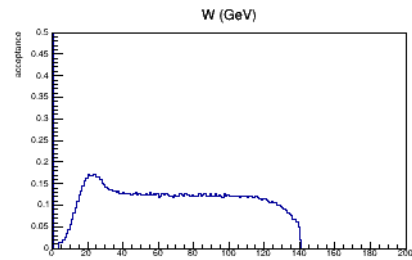
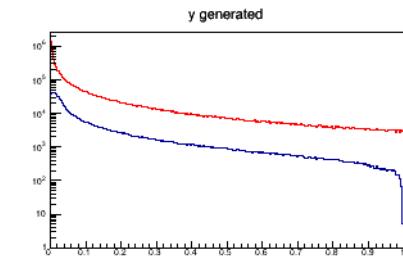
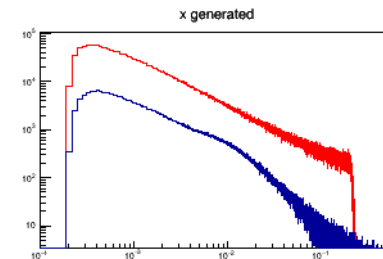
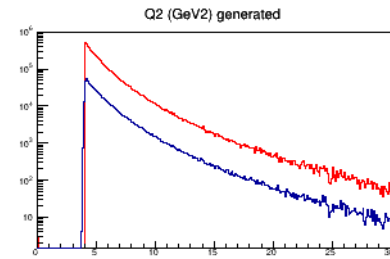
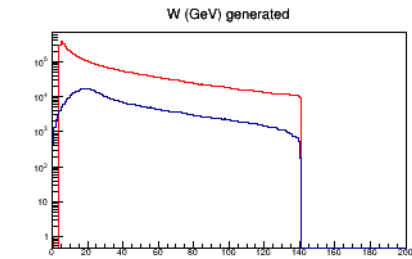
$$\rho^0 \rightarrow \pi^+ \pi^-$$

5 x 275



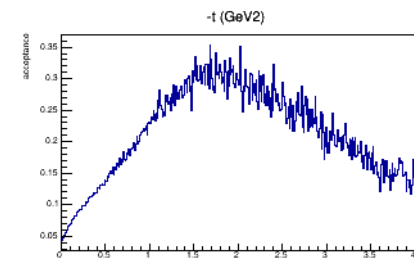
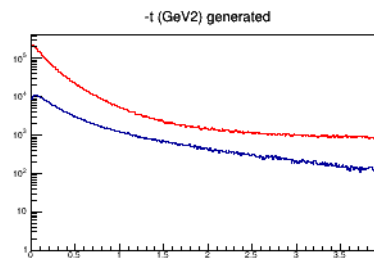
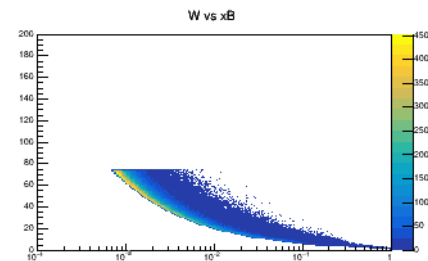
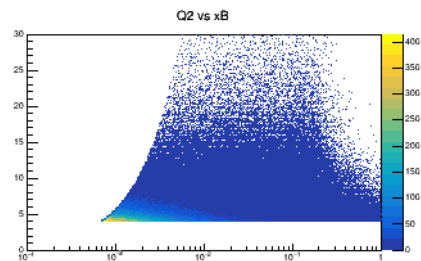
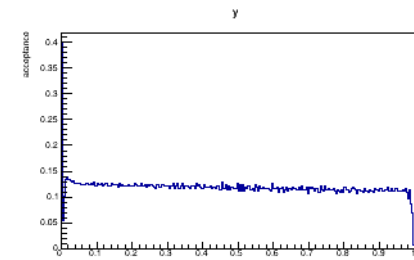
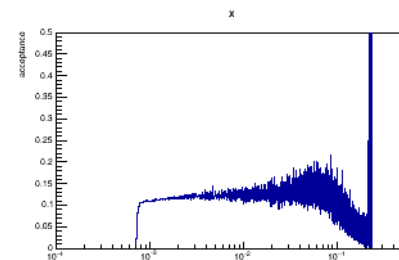
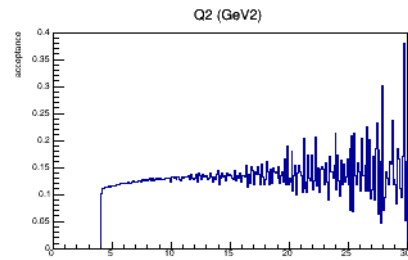
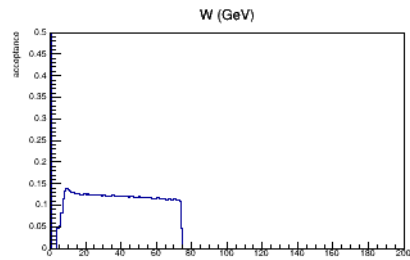
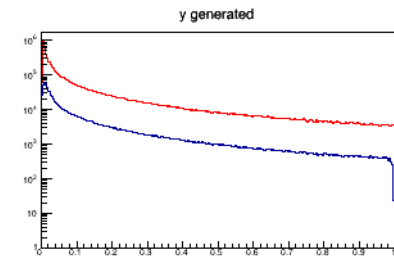
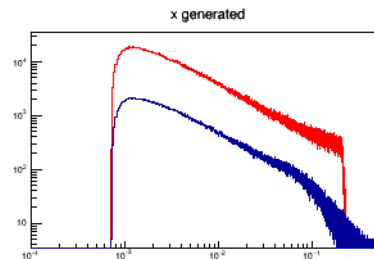
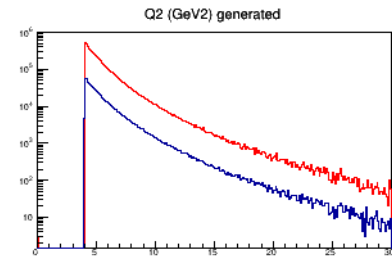
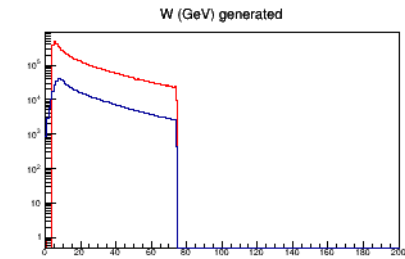
$$\omega \rightarrow \pi^+ \pi^-$$

18 x 275



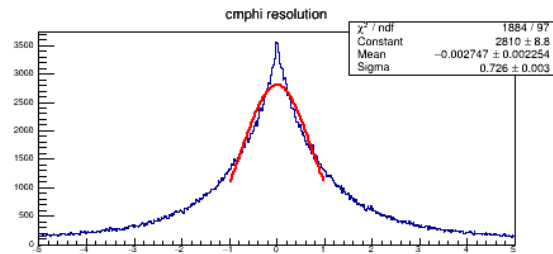
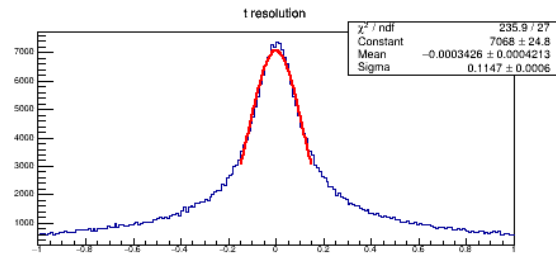
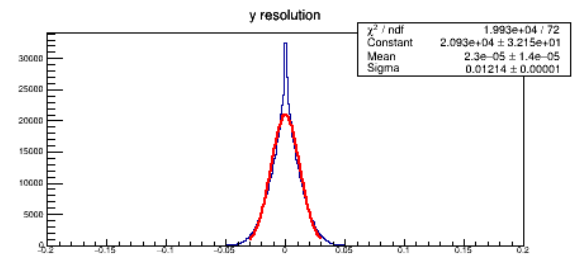
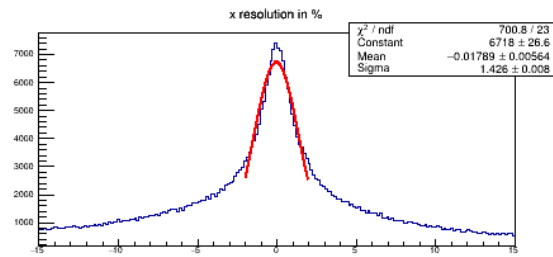
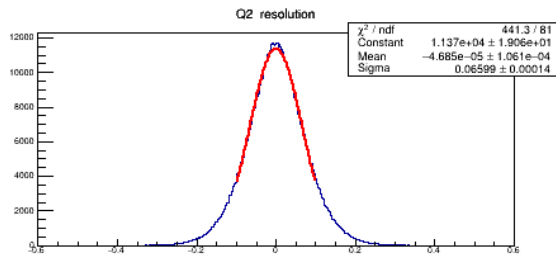
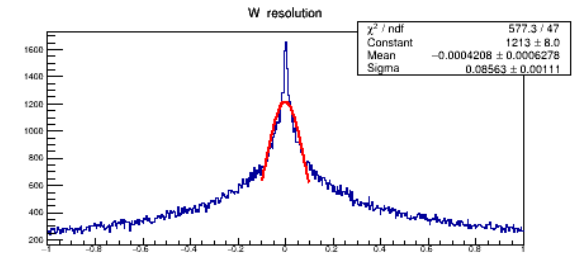
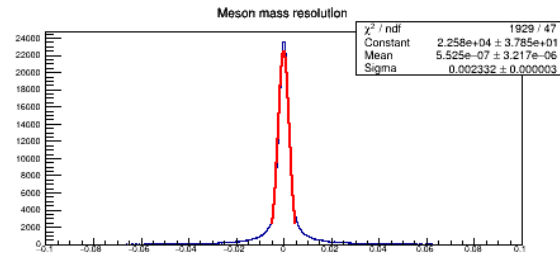
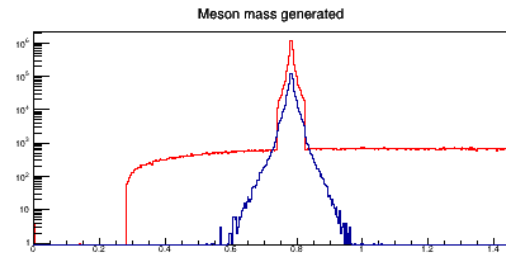
$$\omega \rightarrow \pi^+ \pi^-$$

5 x 275



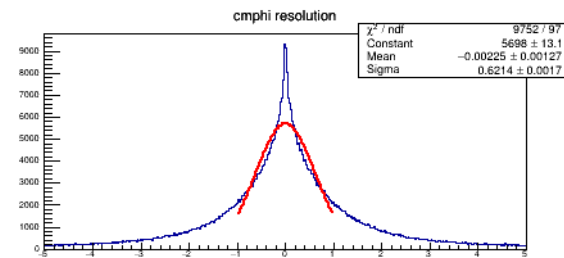
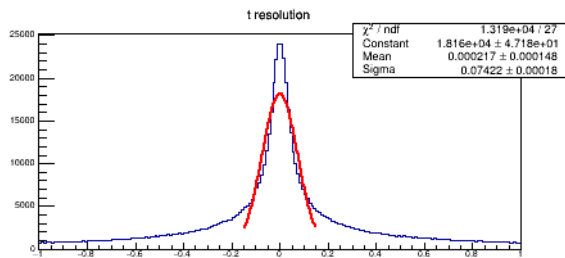
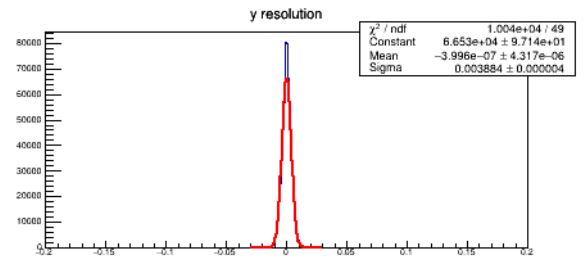
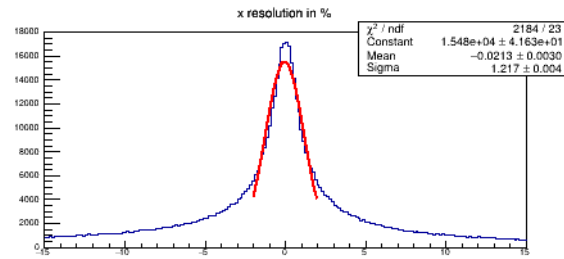
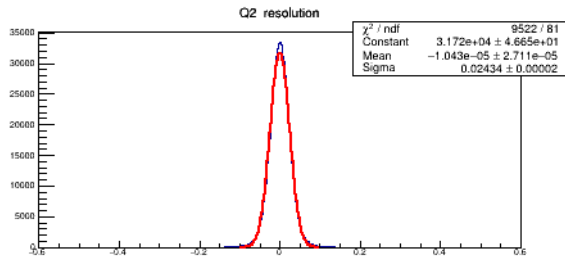
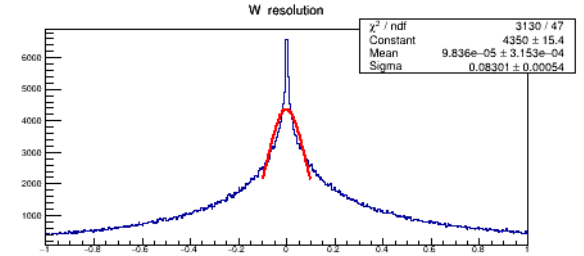
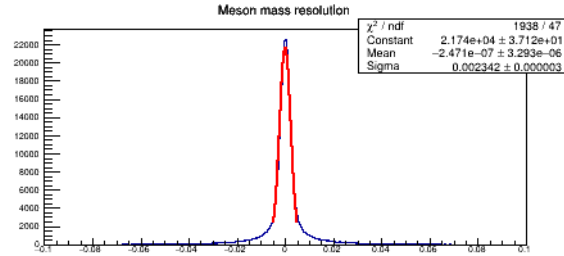
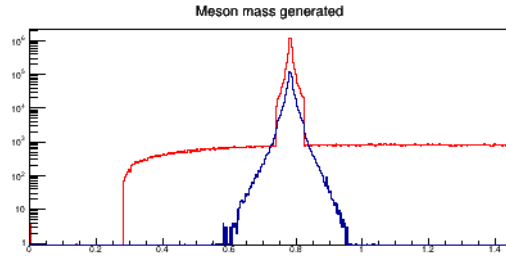
$$\omega \rightarrow \pi^+ \pi^-$$

18 x 275



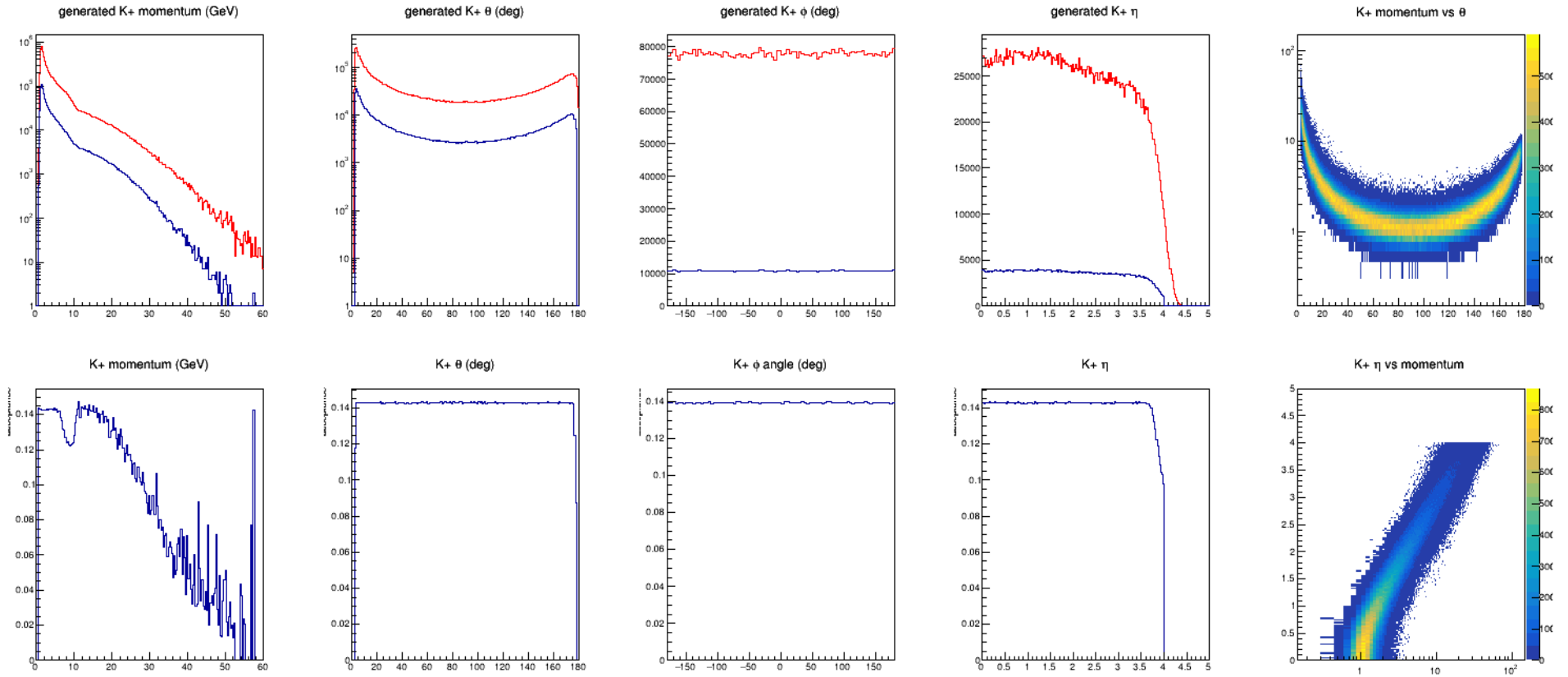
$$\omega \rightarrow \pi^+ \pi^-$$

5 x 275



$$\phi \rightarrow K^+ K^-$$

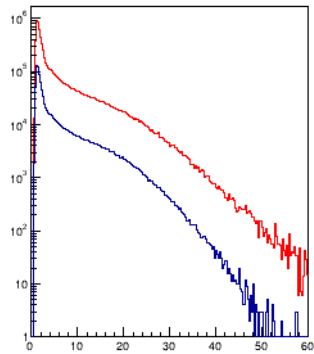
18 x 275



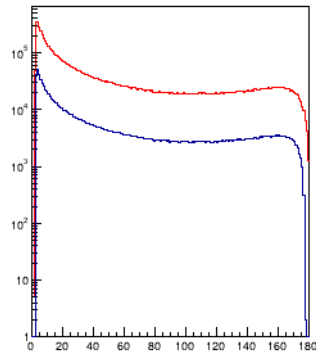
$$\phi \rightarrow K^+ K^-$$

5 x 275

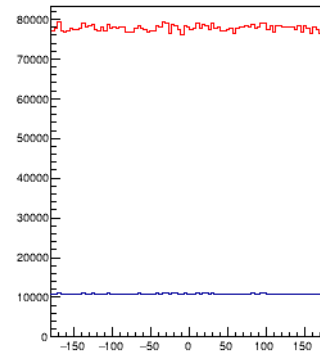
generated K+ momentum (GeV)



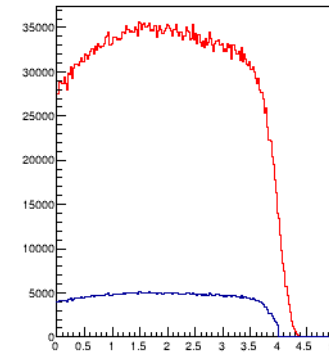
generated K+ θ (deg)



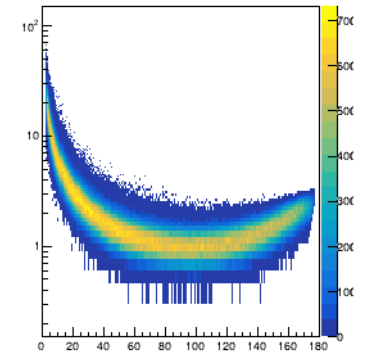
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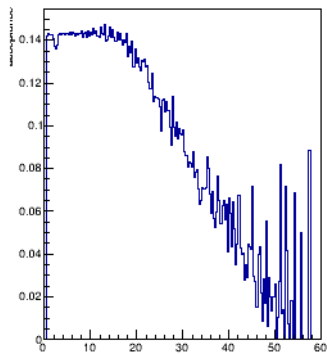
generated K+ η



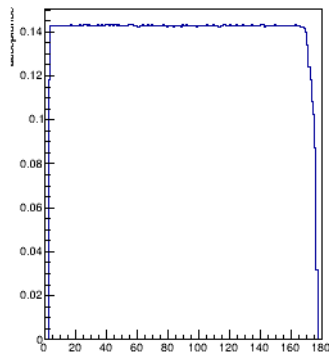
K+ momentum vs θ



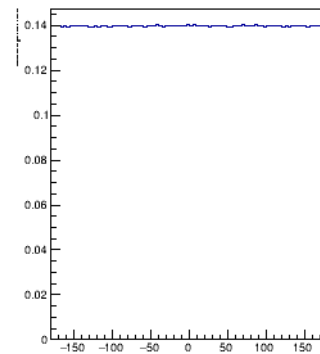
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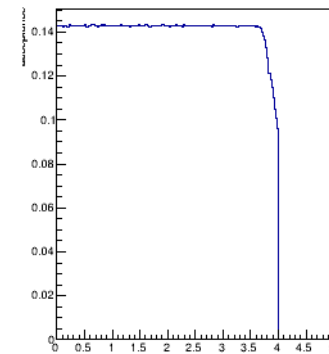
K+ θ (deg)



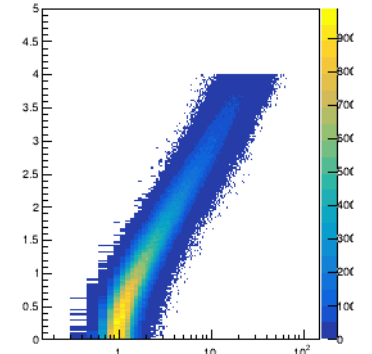
K+ ϕ angle (deg)



K+ η

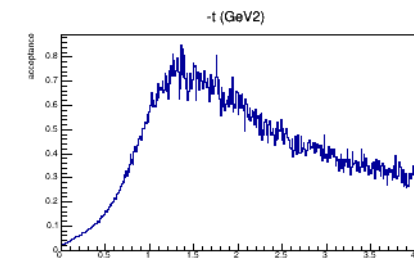
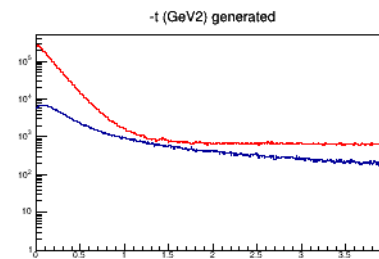
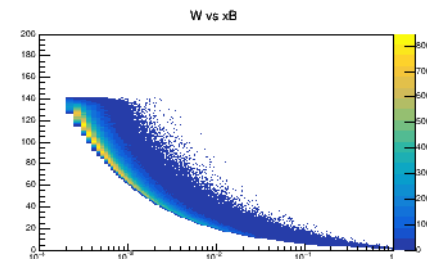
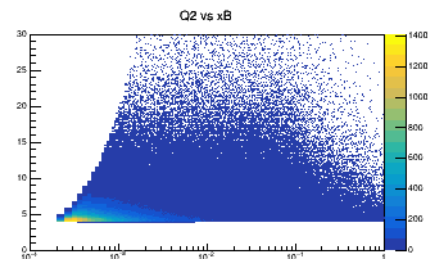
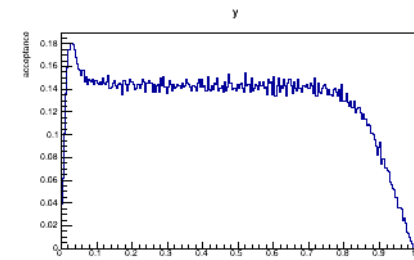
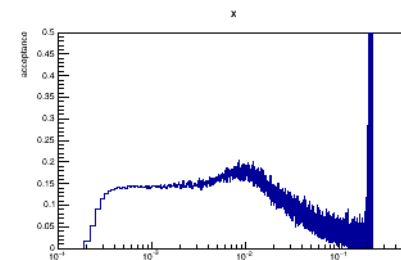
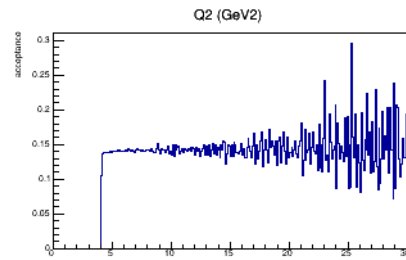
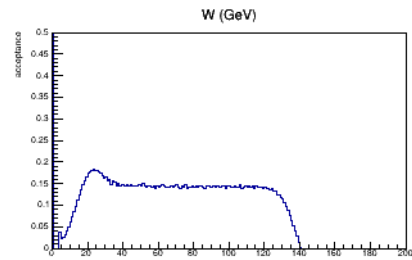
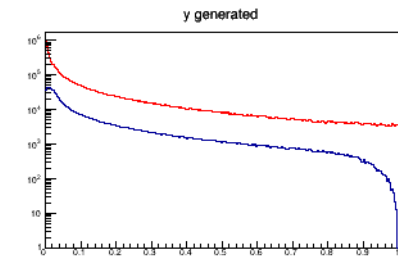
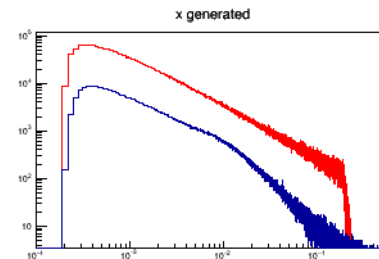
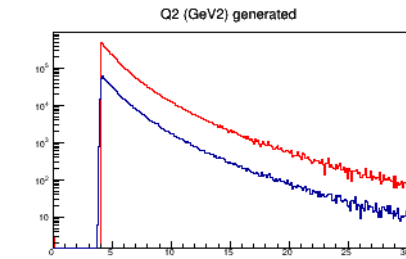
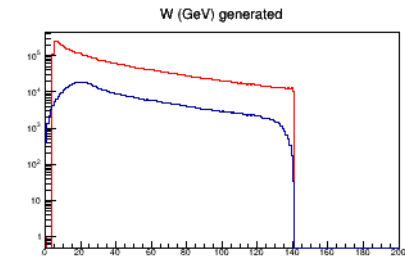


K+ η vs momentum



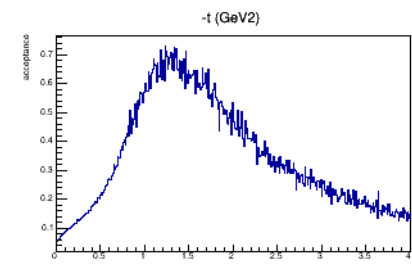
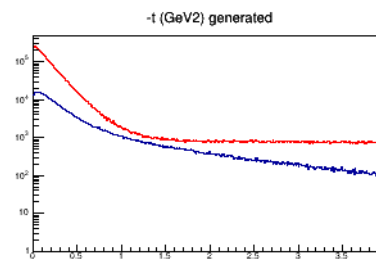
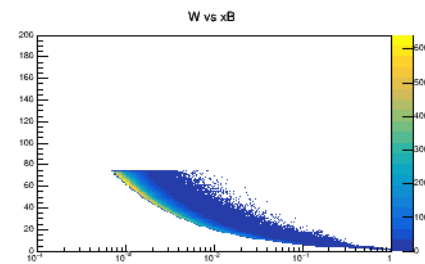
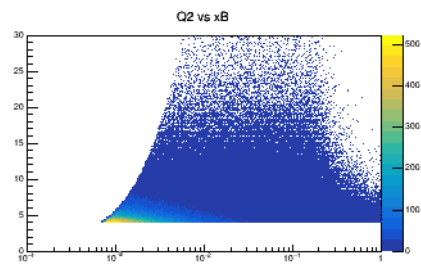
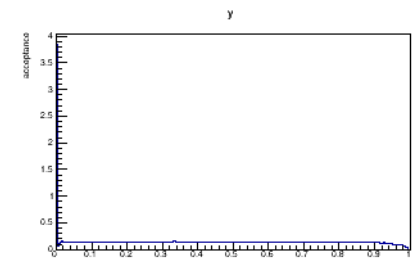
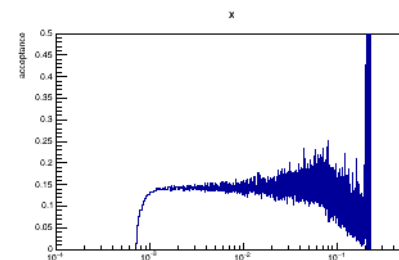
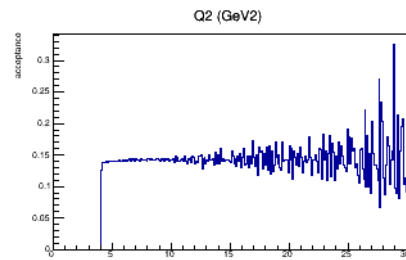
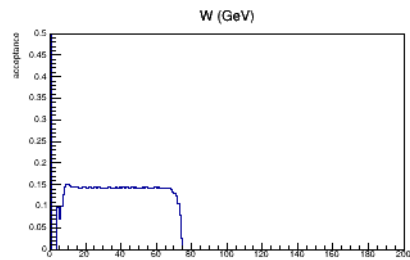
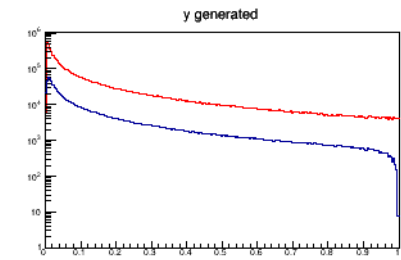
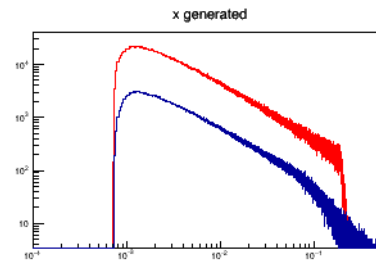
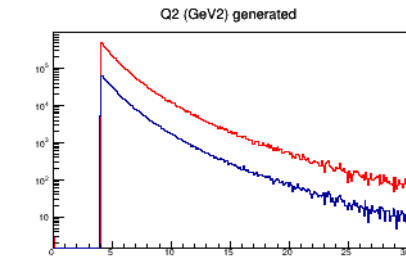
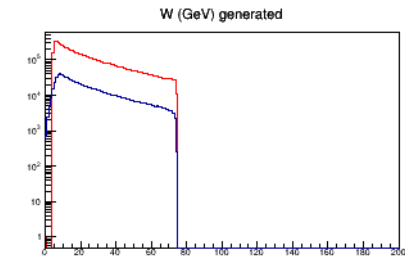
$$\phi \rightarrow K^+ K^-$$

18 x 275



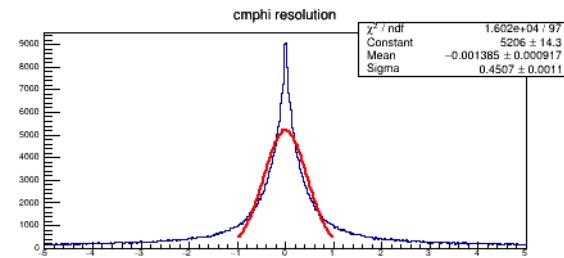
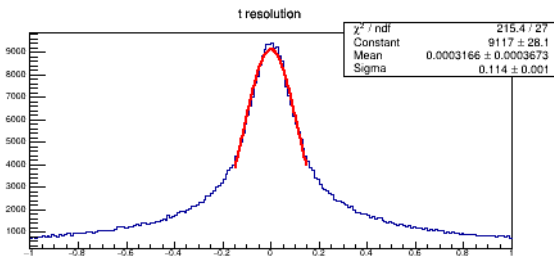
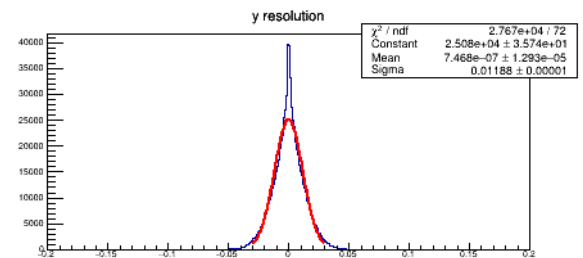
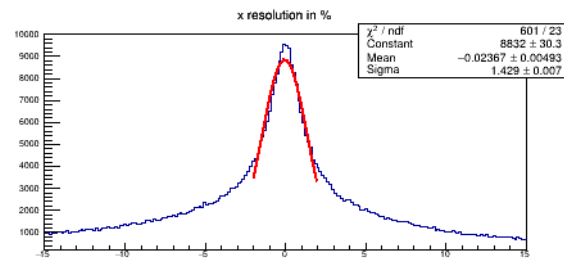
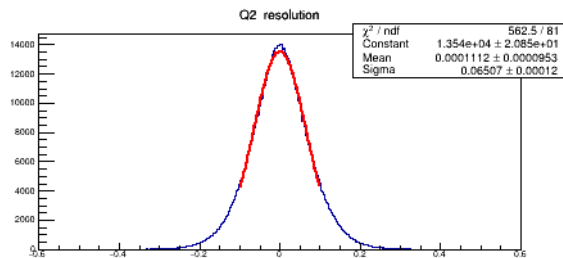
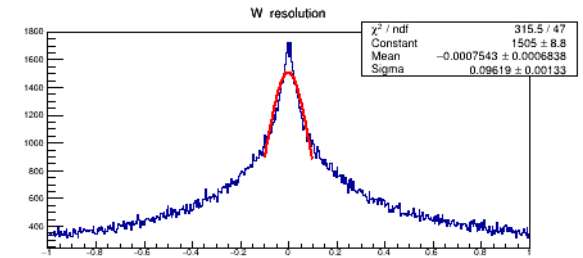
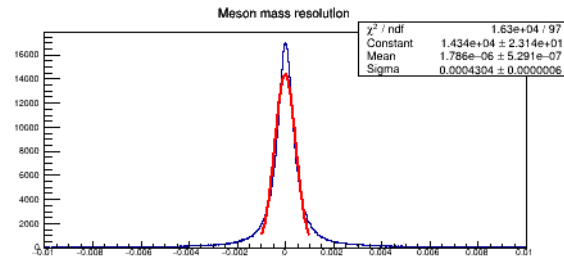
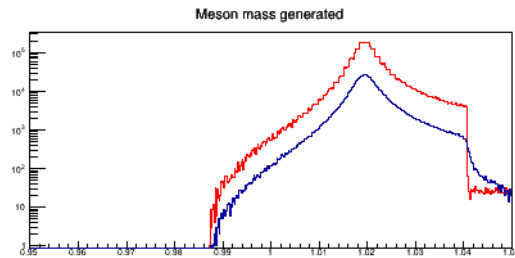
$$\phi \rightarrow K^+ K^-$$

5 x 275



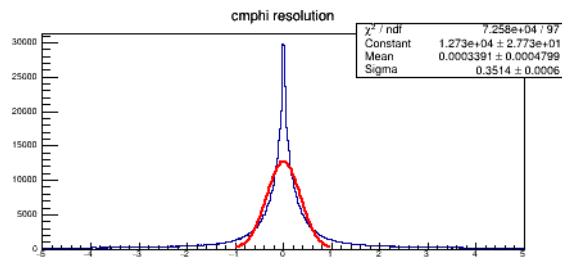
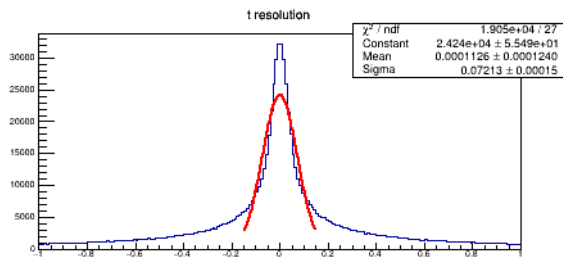
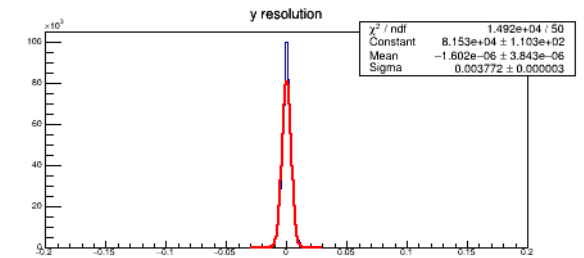
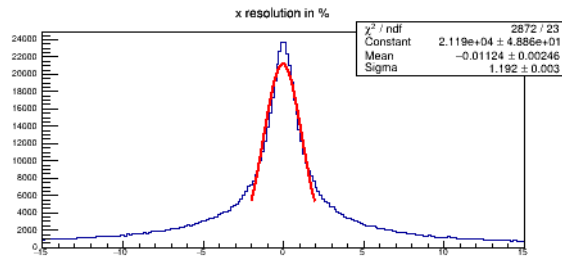
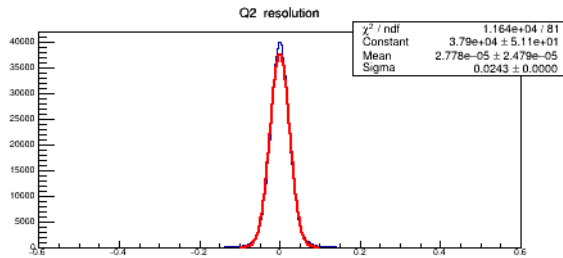
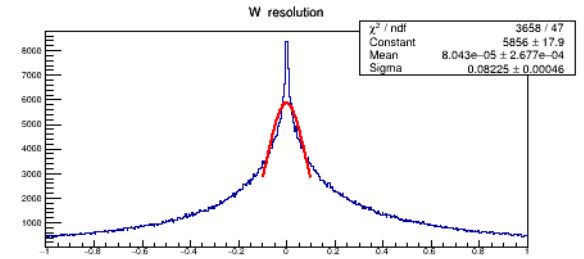
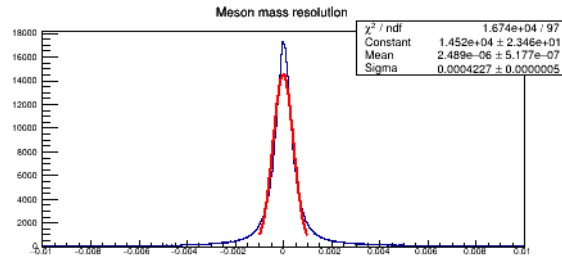
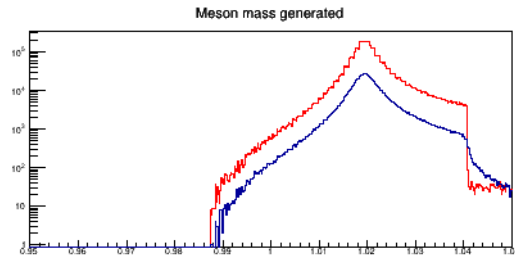
$$\phi \rightarrow K^+ K^-$$

18 x 275



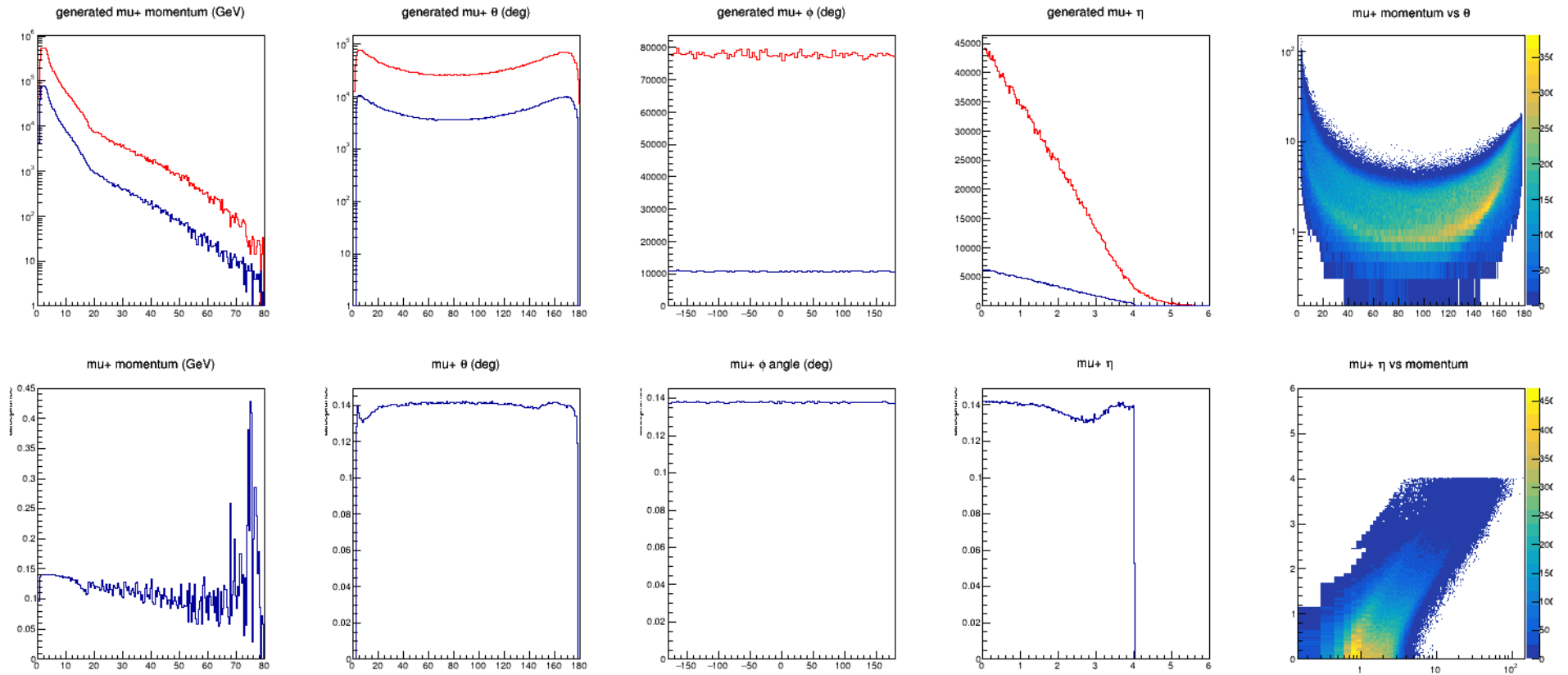
$$\phi \rightarrow K^+ K^-$$

5 x 275



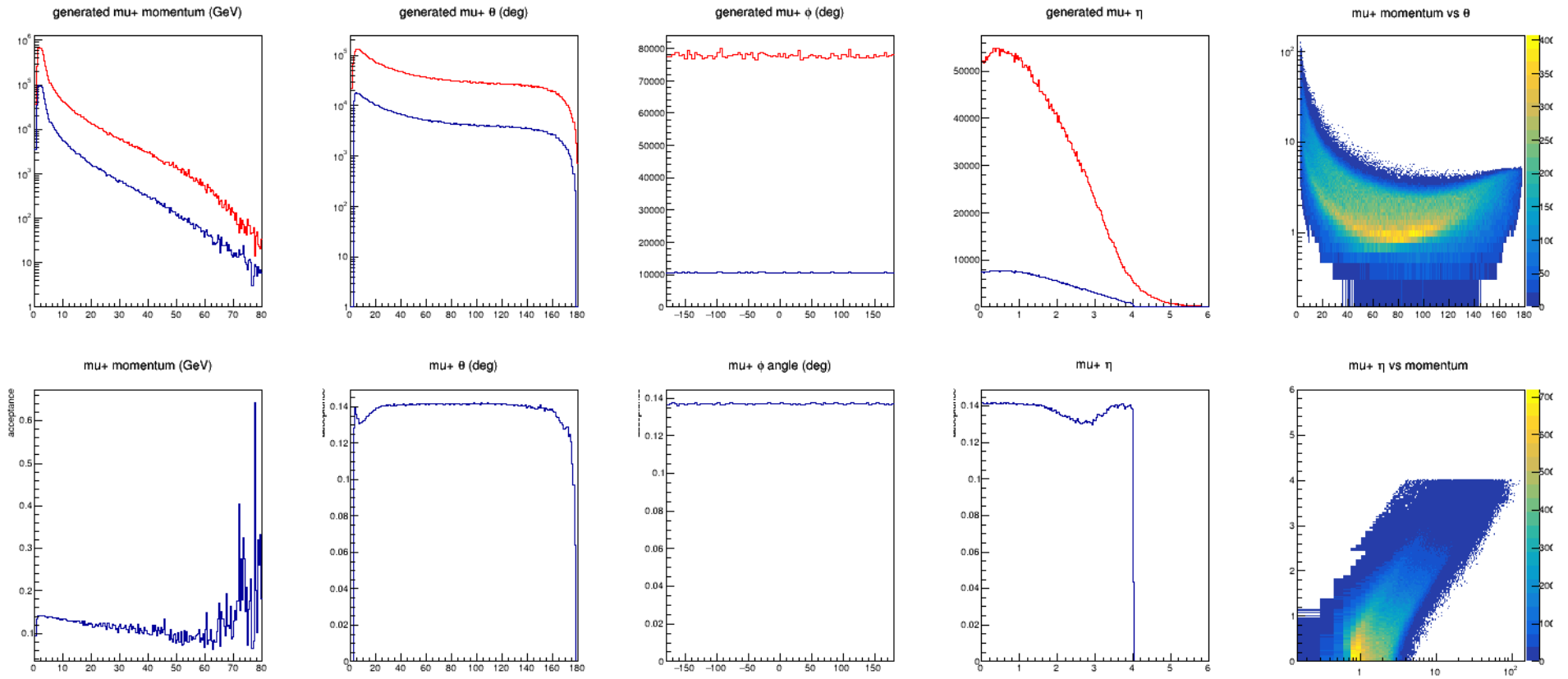
$$J/\Psi \rightarrow \mu^+\mu^-$$

18 x 275



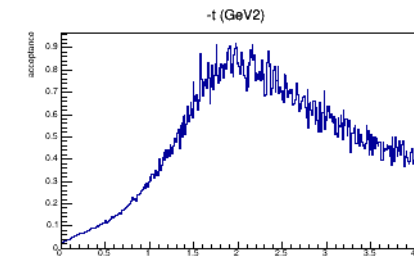
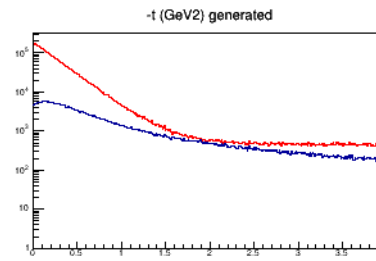
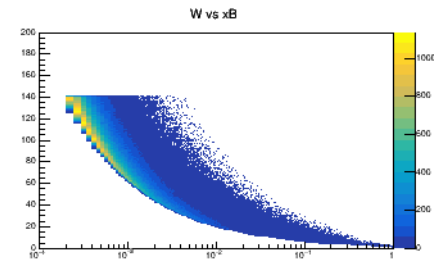
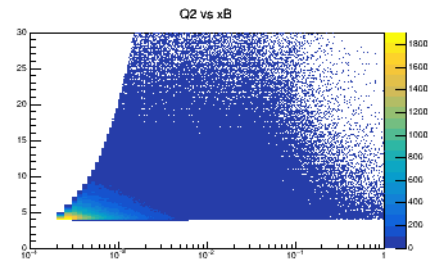
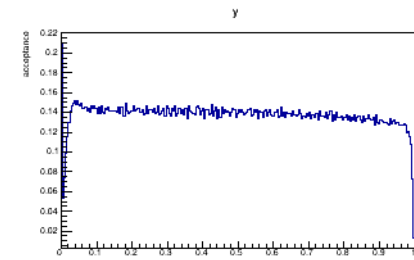
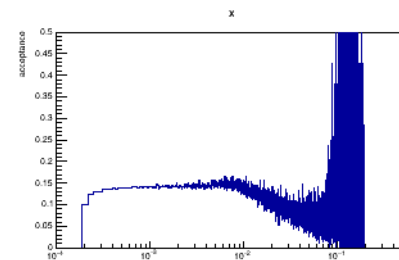
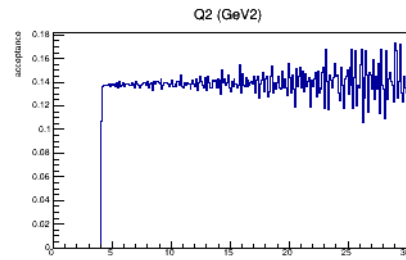
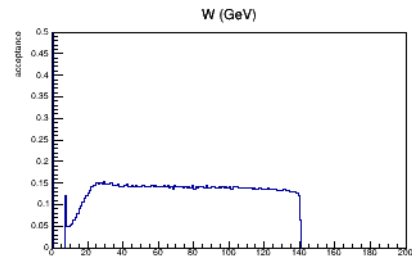
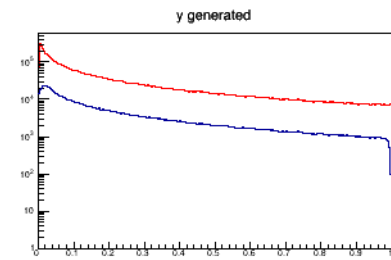
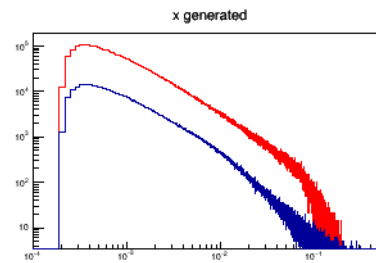
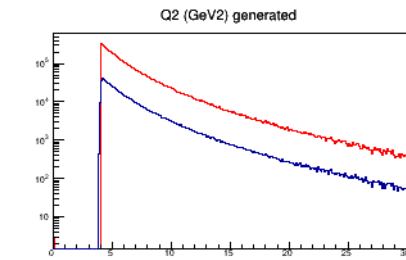
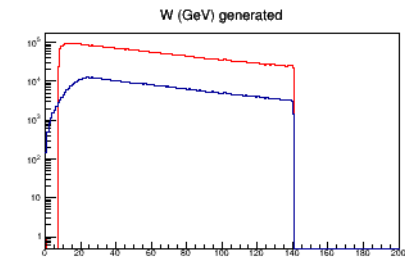
$$J/\Psi \rightarrow \mu^+\mu^-$$

5 x 275



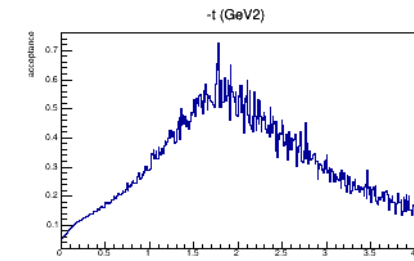
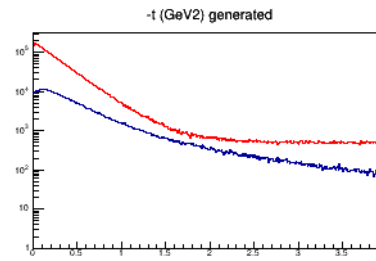
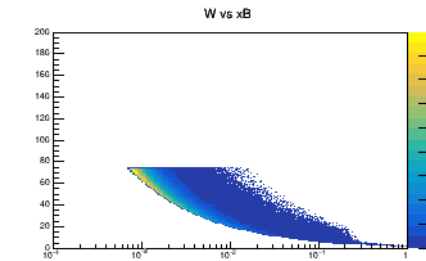
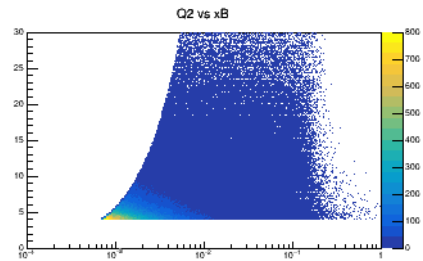
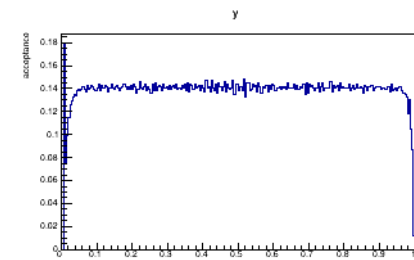
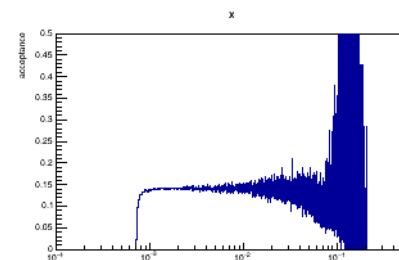
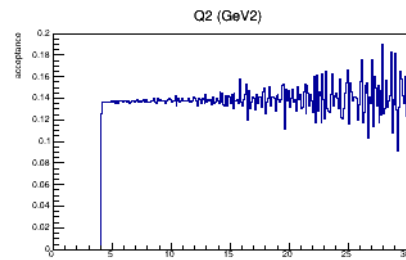
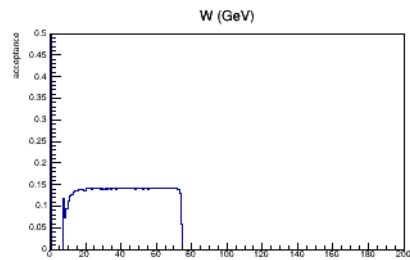
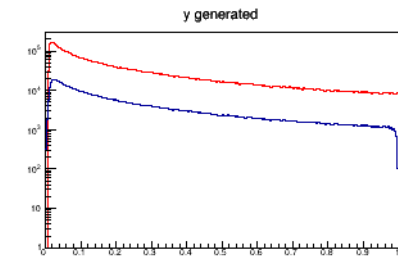
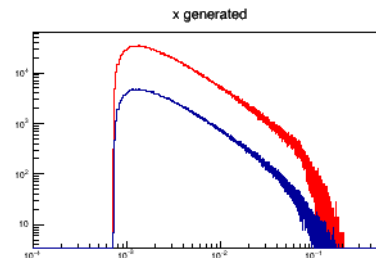
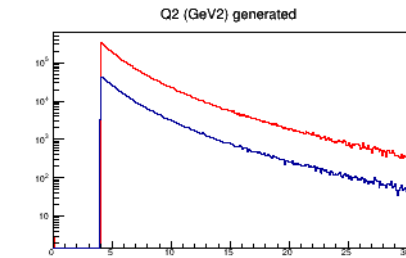
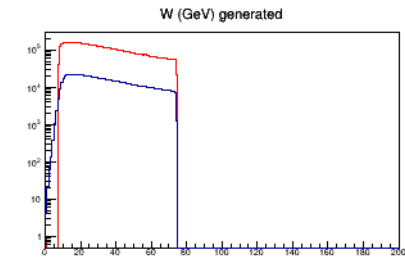
$$J/\Psi \rightarrow \mu^+\mu^-$$

18 x 275



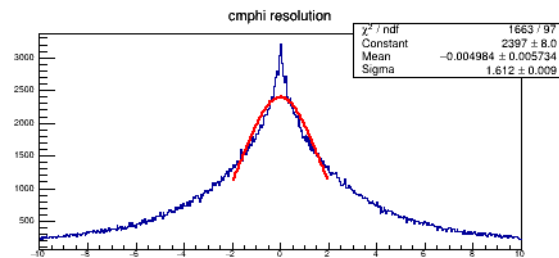
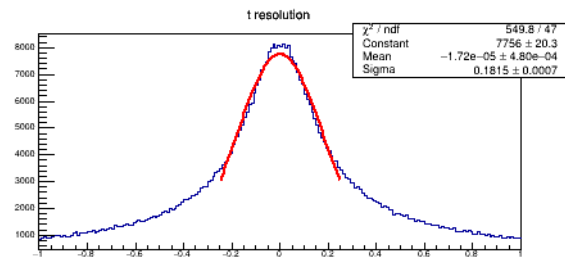
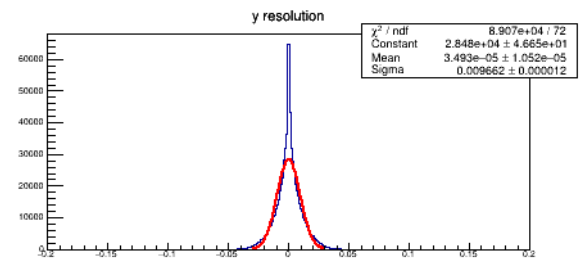
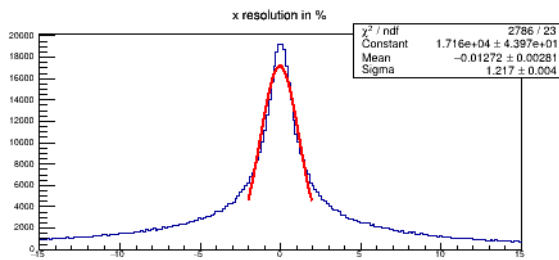
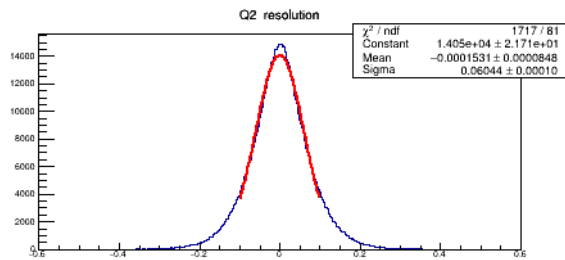
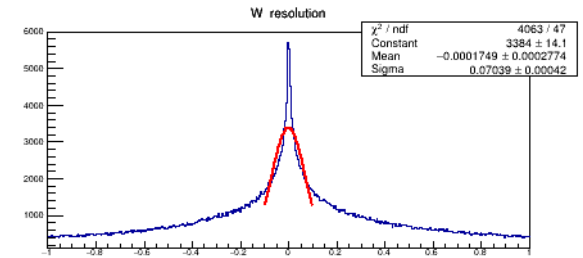
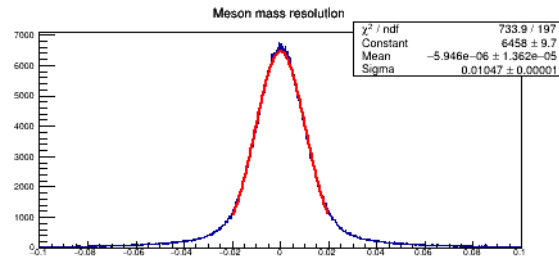
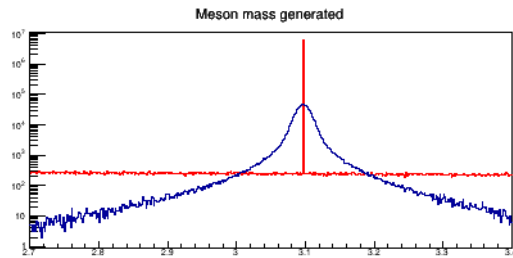
$$J/\Psi \rightarrow \mu^+\mu^-$$

5 x 275



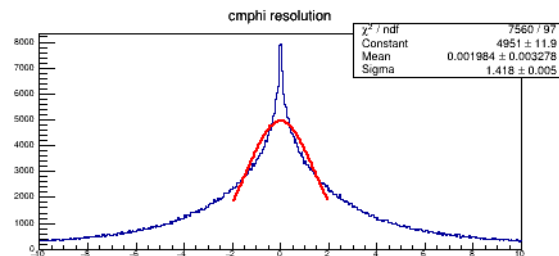
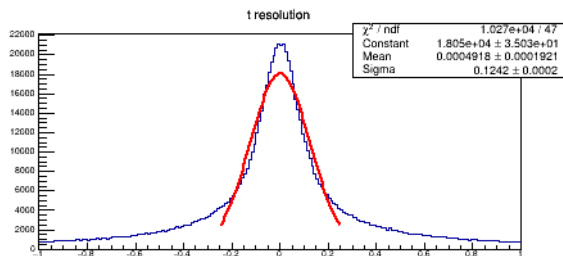
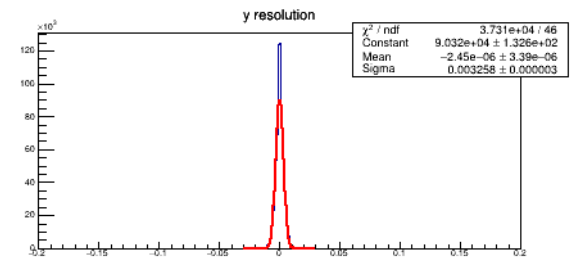
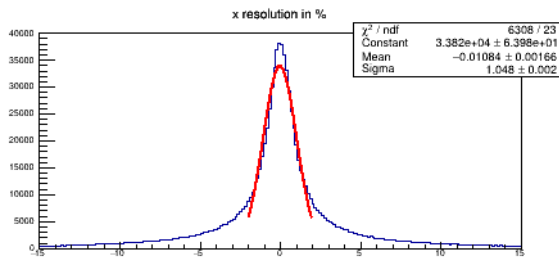
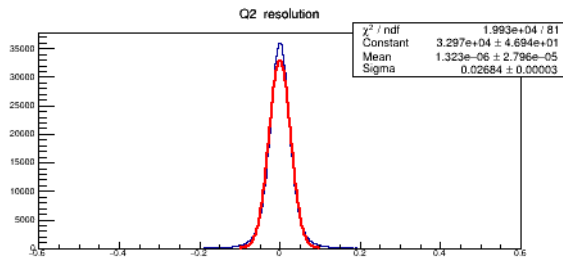
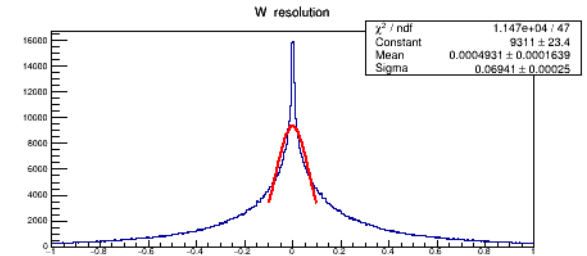
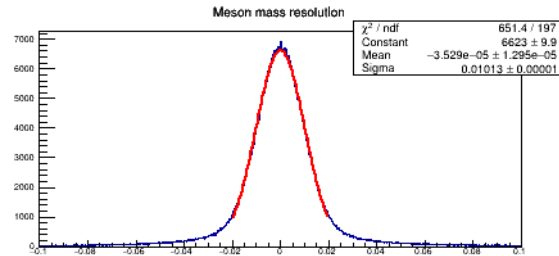
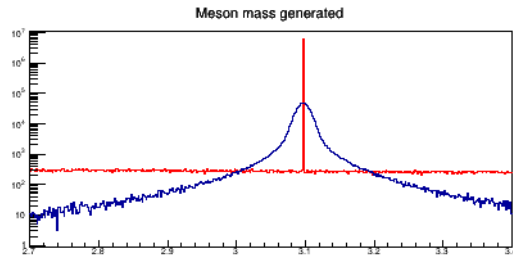
$J/\Psi \rightarrow \mu^+\mu^-$

18 x 275



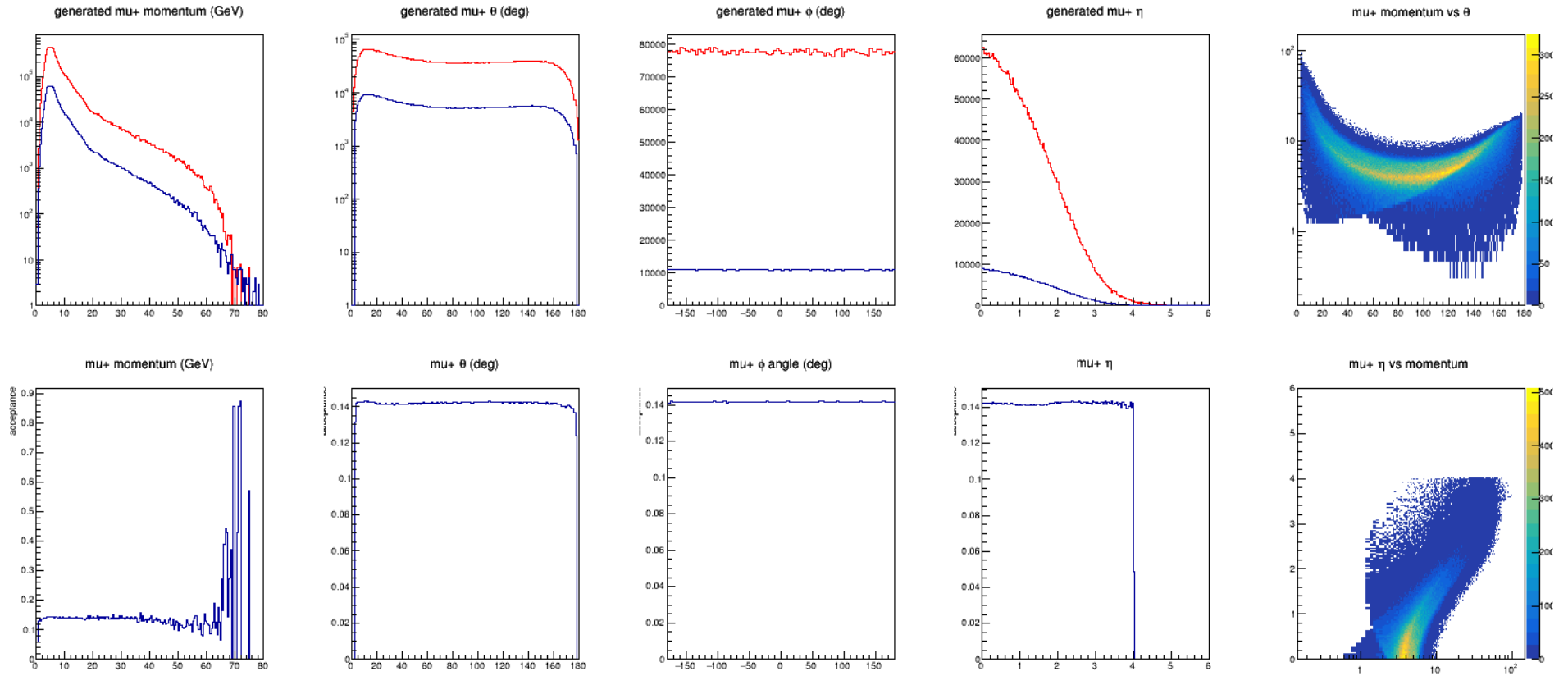
$J/\Psi \rightarrow \mu^+\mu^-$

5 x 275



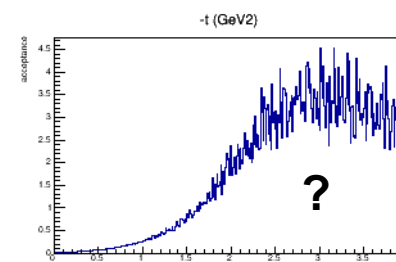
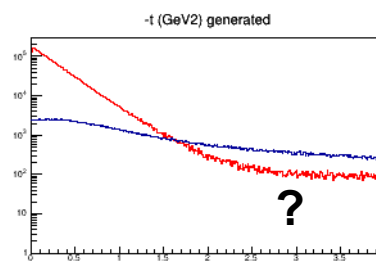
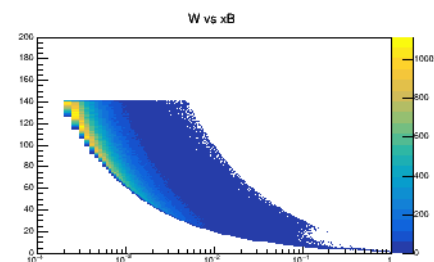
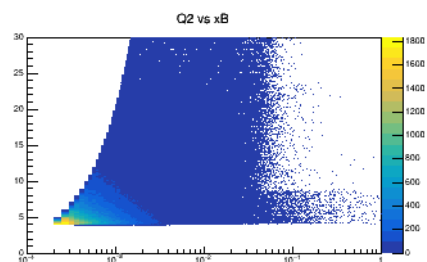
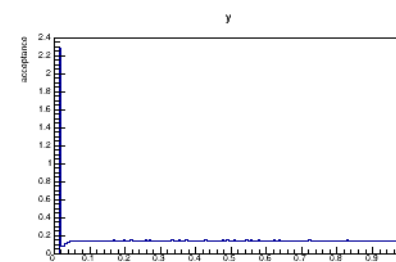
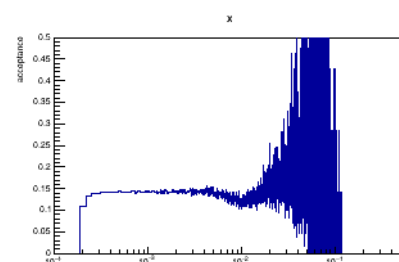
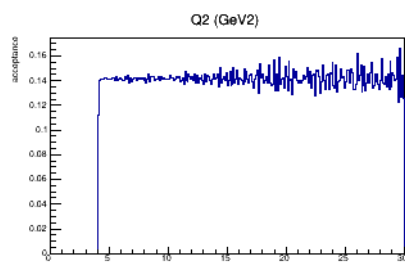
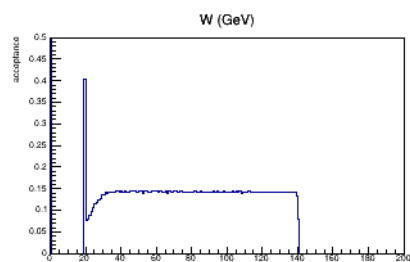
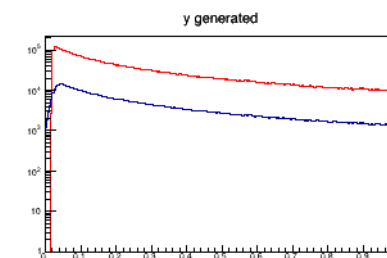
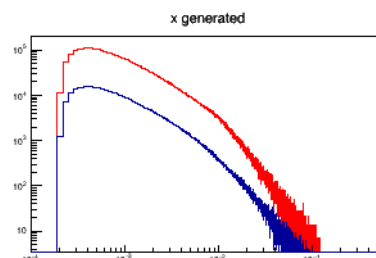
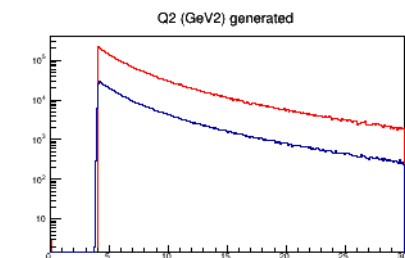
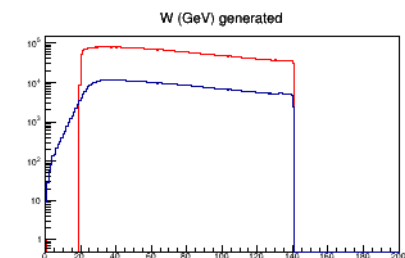
$$\Upsilon \rightarrow \mu^+ \mu^-$$

18 x 275



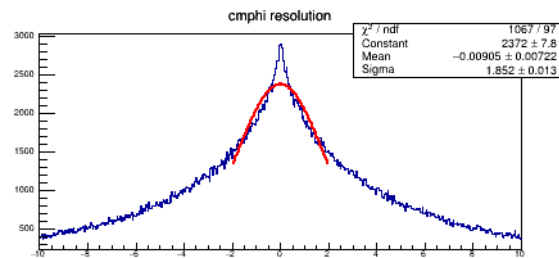
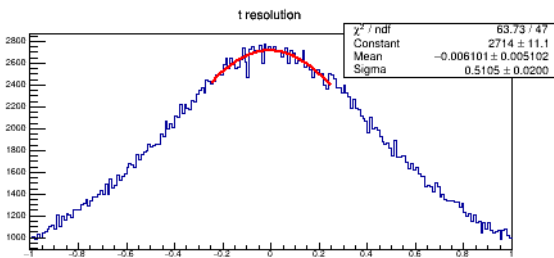
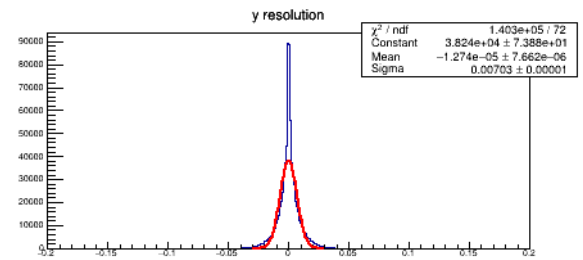
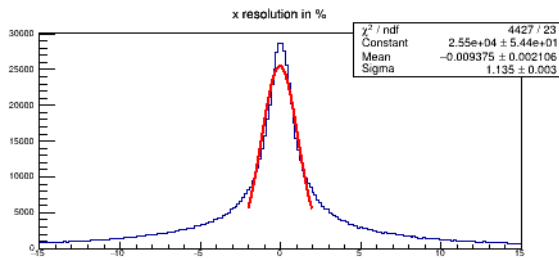
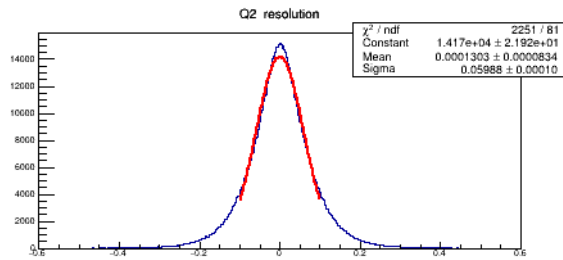
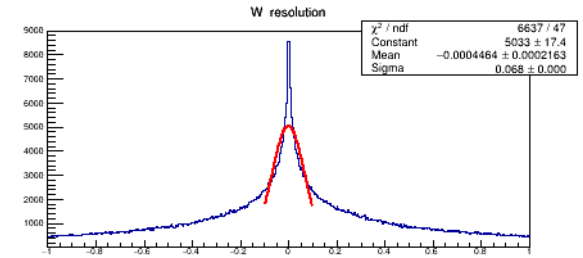
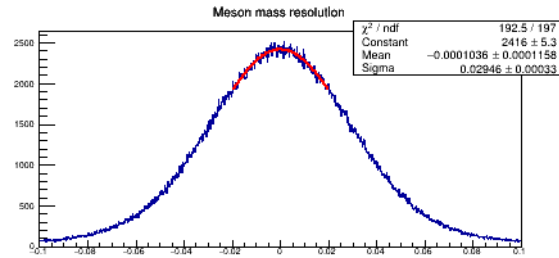
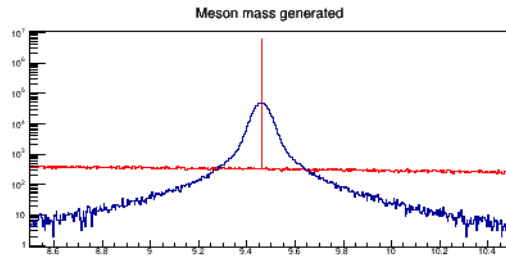
$$\Upsilon \rightarrow \mu^+ \mu^-$$

18 x 275



$$\Upsilon \rightarrow \mu^+\mu^-$$

18 x 275



$\rho^0 \rightarrow \pi^+ \pi^-$	accept.	M resolution	-t resolution	Q ² resolution
18 x 275	0,12	0,002385	0,1154	0,06551
10 x 275	0,12	0,002375	0,08323	0,0356
5 x 275	0,12	0,002398	0,07403	0,02434
5 x 100	0,12	0,002318	0,07443	0,02402
$\omega \rightarrow \pi^+ \pi^-$				
18 x 275	0,12	0,00233	0,1147	0,06599
10 x 275	0,12	0,00232	0,08311	0,03569
5 x 275	0,12	0,00234	0,07422	0,02434
5 x 100	0,12	0,00229	0,07546	0,02396
$\phi \rightarrow K^+ K^-$				
18 x 275	0,14	0,00043	0,114	0,0651
10 x 275	0,14	0,00043	0,08133	0,0354
5 x 275	0,14	0,00042	0,07213	0,0243
5 x 100	0,14	0,00041	0,07144	0,024

J/Ψ → μ⁺μ⁻				
	acceptance	M resolution	-t resolution	Q² resolution
18 x 275	0,14	0,0105	0,1815	0,0604
10 x 275	0,14	0,0102	0,1392	0,0358
5 x 275	0,14	0,0101	0,1242	0,0268
5 x 100	0,14	0,0098	0,1216	0,0266
Υ → μ⁺μ⁻				
18 x 275	0,14	0,02946	0,5105	0,05988
10 x 275	0,14	0,0294	0,4678	0,0378
5 x 275	0,14	0,0304	0,4344	0,0309

$$\rho^0 \rightarrow \pi^+ \pi^-$$

$$\phi \rightarrow K^+ K^-$$

$$J/\psi \rightarrow \mu^+ \mu^-$$

mu+ η vs momentum

$$\Upsilon \rightarrow \mu^+ \mu^-$$

-3.5 < eta < -1.7 K/pi separation up to p = 2.0 GeV/c
 -1.56 < eta < 1.56 K/pi separation up to p = 6.0 GeV/c
 1.56 < eta < 3.5 K/pi separation up to p = 50 GeV/c

