

Cross Section He4(e,e'p\_backward)X

6-fold:  $(d\Omega_e) * (dE'_e) (d\Omega_p)*(d^2p_p)$

1. Theta and phi cut for electron
2. dE for electron
3. Theta and phi cut for proton
4. dp for proton

$N_A = 6.02e23$  atom/mol,  $A_z = 4$  g/mol, 1 barn =  $1e24$  cm<sup>2</sup>  
 electron charge :  $1.6e-19$  C/electron

	Parameter	Unit	Kin 3 value
1.	Target density d_loss at 4 uA = 1.2%	g/cm <sup>3</sup>	$33.834 * 10^{-3}$
2.	Target Length	cm	15
3.	Total Charge	C	2.48843
4.	d_theta_electron	rad	$2*0.040 = 0.08$
5.	d_phi_electron	rad	$2*0.020 = 0.04$
6.	sin(L_angle)		Sin(20.3) = 0.3469
7.	d_E'_electron	GeV	$3.75-3.45 = 0.3$
8.	d_theta_proton	rad	$0.4-(-0.2) = 0.6$
9.	d_phi_proton	rad	$2*0.1 = 0.2$
10.	sin(BB_angle)		Sin(92) = 0.99939
11.	d_momentum_proton	GeV/c	$1.2- 0.2 = 1.0$
12.	N_pass_cut	entries	(peak)-(bg) = 67788-39814 = 27974 entries

13	Target area number density = (Target density)*(target Length)*(N_A)/(A_z)	Atom/ cm <sup>2</sup> or atom/barn	$7.638e-2$ atom/barn
14	N_electron= (Total charge)/ (Electron charge)	electron	$1.555e+19$
15	N_electron_target_area_number_density	electron*atom/barn	$1.188e+18$
16	dOmega_electron	srad	$1.110e-03$

	$=\sin(L\_angle)*d\_theta*d\_phi$		
17	$d\Omega_{proton}$ $=\sin(BB\_angle)*d\_theta*d\_phi$	srad	0.1199
18.	Raw cross section = $\frac{N\_pass\_cut}{(d\Omega_e*dE_e*d\Omega_p*dmomentum_p)}$ ----- $N\_electron\_Target\_area\_number\_density$		27974 (proton) ----- $(1.110e-03\ srad)*(0.3\ GeV)*(0.1199\ srad)*(1\ GeV/c)*(1.188e18\ electron*atom/barn)$  = 27974/4.7433e+13 = 5.897e-10  proton *barn ----- $srad^2* GeV^2/c*electron*atom$
19	$(d\Omega_e*dE_e*d\Omega_p)*N\_electron\_Target\_area\_number\_density$		4.7433e+13 $srad^2*GeV*electron*atom/barn$
20	Raw cross section = $N/dp*[19]$ where dp is the width of the bin		Proton/[parameter] ----- $srad^2*GeV*electron*atom/barn$

Raw cross section

$$= \frac{N_{\text{pass\_cut}}/(d\Omega_e*dE_e*d\Omega_p*dmomentum_p)}{N_{\text{electron\_Target\_area\_number\_density}}}$$

where

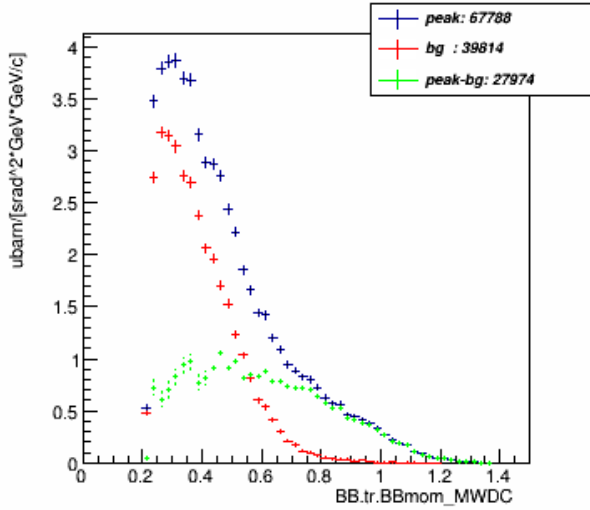
$$\text{Target\_area\_number\_density} = (\text{Target density}) * (\text{target Length}) * (N_A) / (A_z)$$

$$N_{\text{electron}} = (\text{Total charge}) / (\text{Electron charge})$$

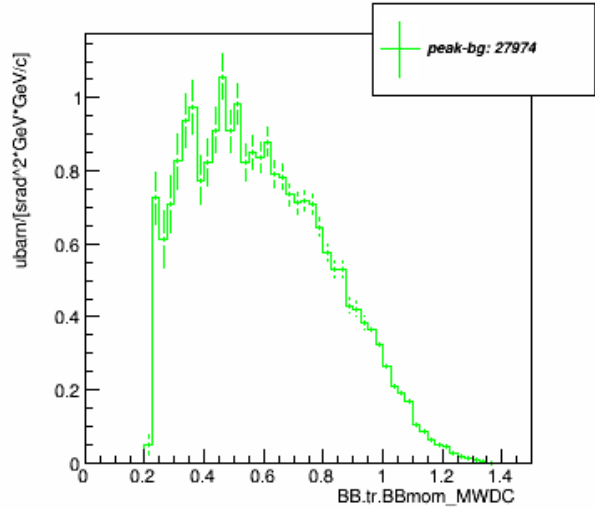
$$N_{\text{electron\_Target\_area\_number\_density}} = (\text{Target density}) * (\text{target Length}) * (N_A) / (A_z) * (\text{Total charge}) / (\text{Electron charge})$$

$$\begin{aligned} \text{Raw(Kin3)} &= \frac{[\text{proton}] / [(1.110e-03 \text{ srad}) * (0.3 \text{ GeV}) * (0.1199 \text{ srad}) * (d\_momentum)]}{[1.188e+18 \text{ electron*atom/barn }]} \\ &= \frac{[\text{proton}]}{[d\_momentum] * [4.7433e13 \text{ srad}^2 * \text{GeV/barn}]} \end{aligned}$$

p\_MWDC\_w\_pID\_N\_CT\_no\_xcut\_kin\_3

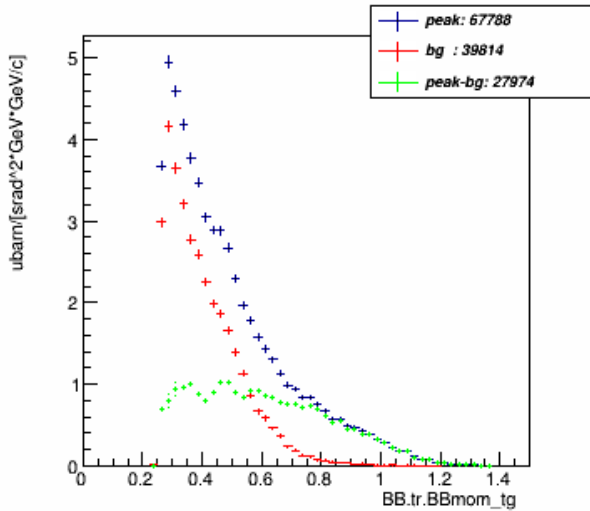


p\_MWDC\_w\_pID\_N\_CT\_sub\_bg\_kin\_3

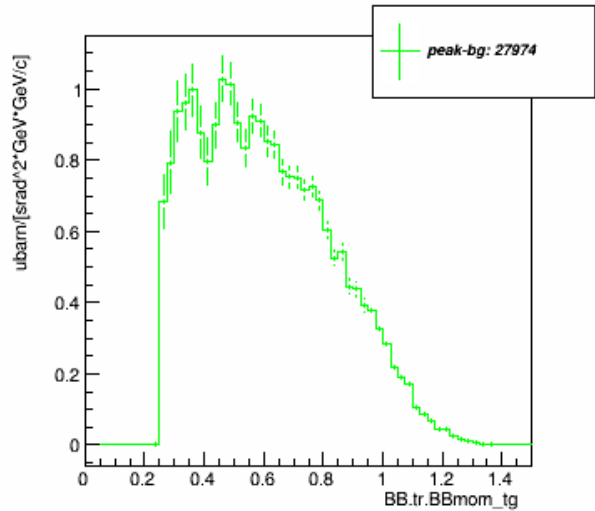


Kin3: p\_MWDC cross section

p\_tg\_w\_pID\_N\_CT\_no\_xcut\_kin\_3



p\_tg\_w\_pID\_N\_CT\_sub\_bg\_kin\_3

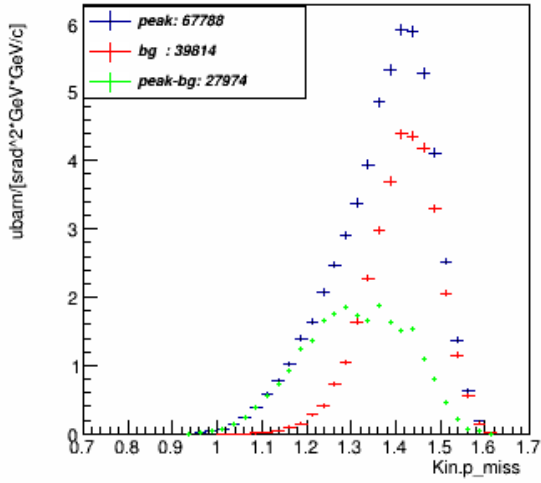


Kin3: p\_target cross section

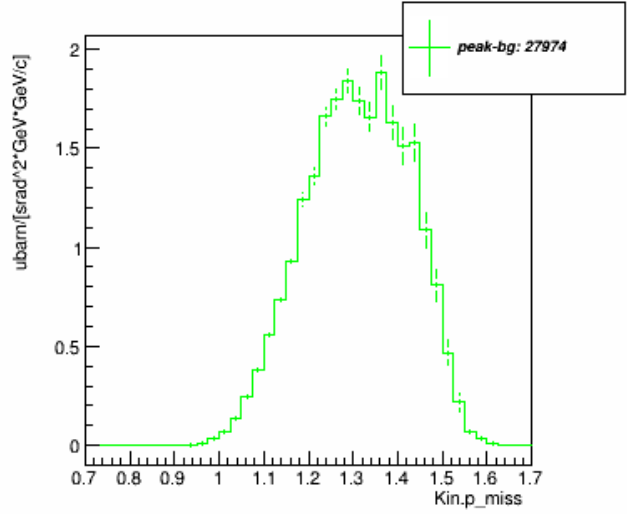
\*\* what is the dip at 0.4 ? whether it is the deep due to the inefficiency?

\*\* what also 0.7? 0.6?

p\_miss\_w\_pID\_N\_CT\_no\_xcut\_kin\_3

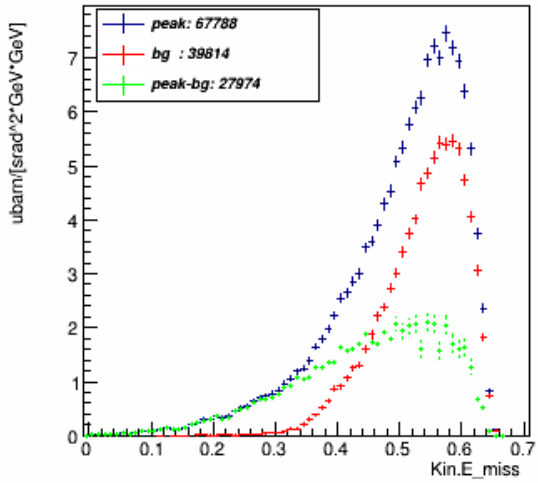


p\_miss\_w\_pID\_N\_CT\_sub\_bg\_kin\_3

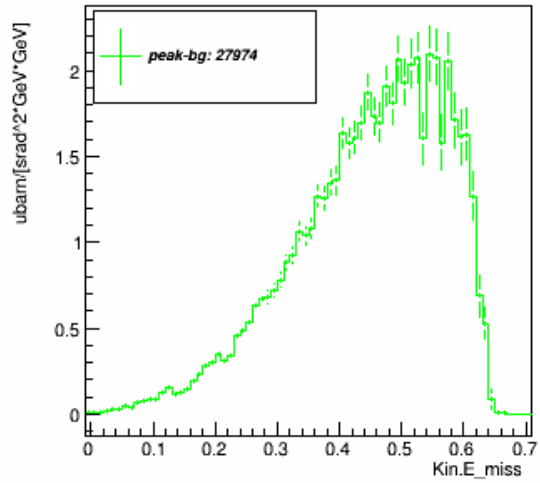


Kin3: P\_miss cross section

E\_miss\_w\_pID\_N\_CT\_no\_xcut\_kin\_3



E\_miss\_w\_pID\_N\_CT\_sub\_bg\_kin\_3

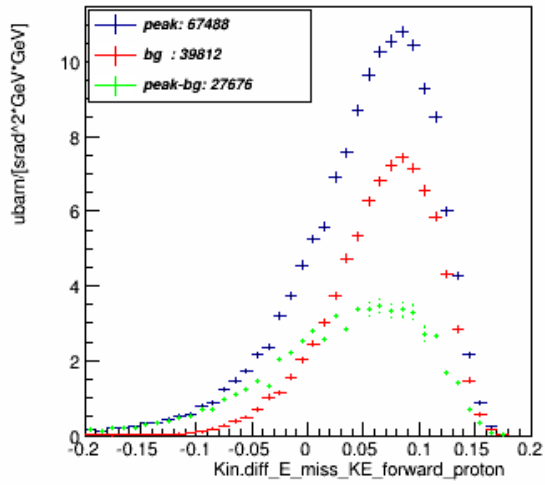


Kin3: E\_miss cross section

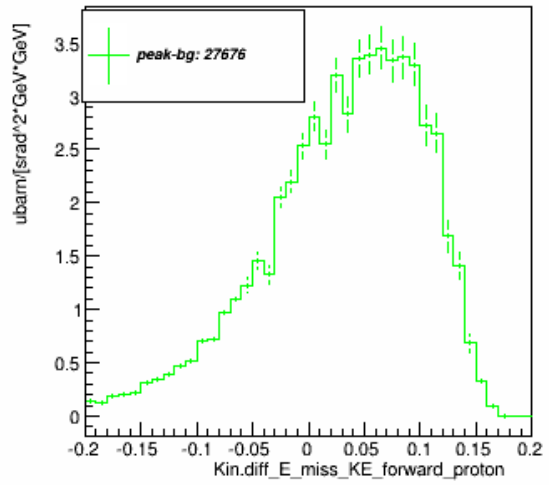
$$E_{\text{miss}} = w - (T_{\text{recoil}}) - (T_{\text{proton}})$$

**\*\*E\_miss vs p\_miss\*\***

E\_miss\_forward\_w\_pID\_N\_CT\_no\_xcut\_kin\_3



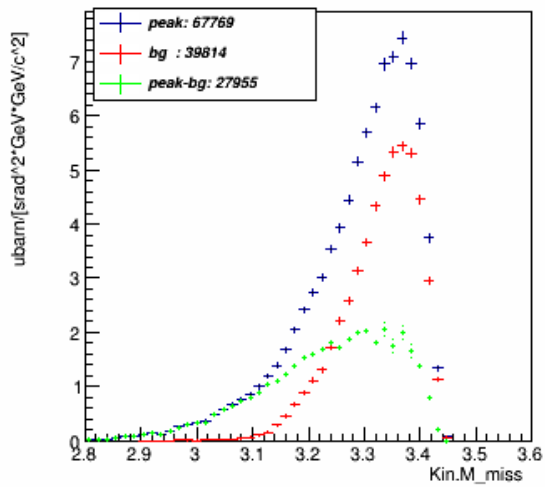
E\_miss\_forward\_w\_pID\_N\_CT\_sub\_bg\_kin\_3



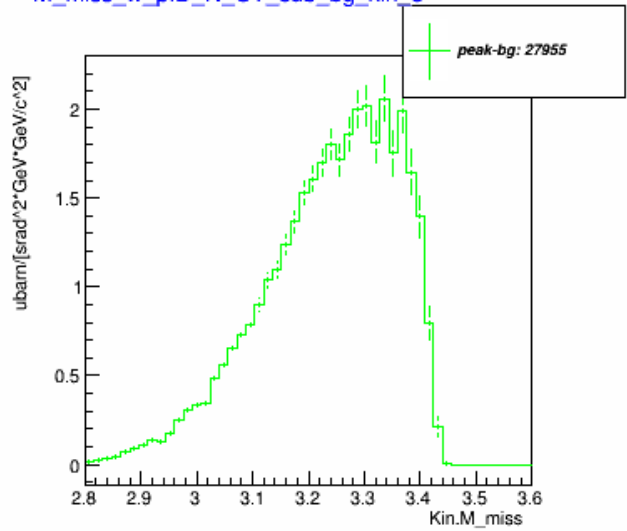
Kin3: E\_miss\_forward cross section

$$E_{\text{miss\_forward}} = w - (T_{\text{forward\_proton\_assuming\_all\_p\_miss}}) - (T_{\text{proton}})$$

M\_miss\_w\_pID\_N\_CT\_no\_xcut\_kin\_3



M\_miss\_w\_pID\_N\_CT\_sub\_bg\_kin\_3

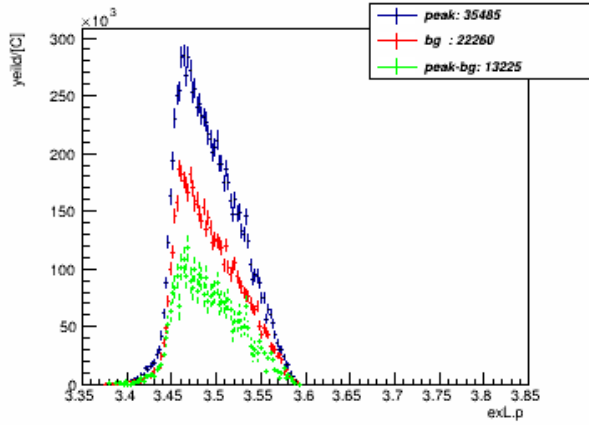


Kin3: M\_miss cross section

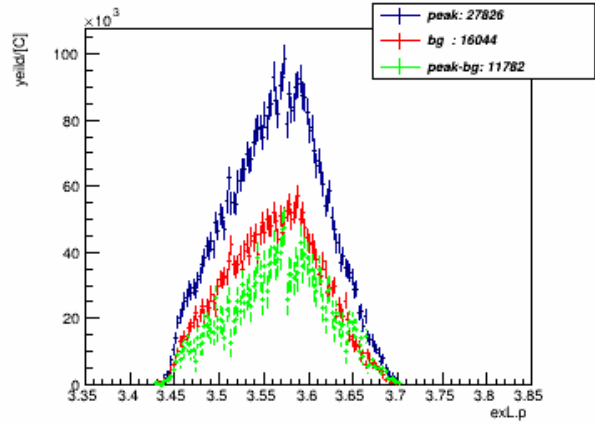
## The Effect of Xcut on the Energy range in electron

	X_range	E_electron [GeV]	DeltaE [GeV]
Pre vio us cut	~0.8-1.8	Cut: 3.45-3.75	0.3
1.	Cut :<=1.1	3.40-3.59	0.19
2.	Cut:1.1-1.3	3.43-3.70	0.27
3.	Cut:1.3-1.5	3.55-3.78	0.23
4.	Cut:>=1.5	3.65-3.84	0.21

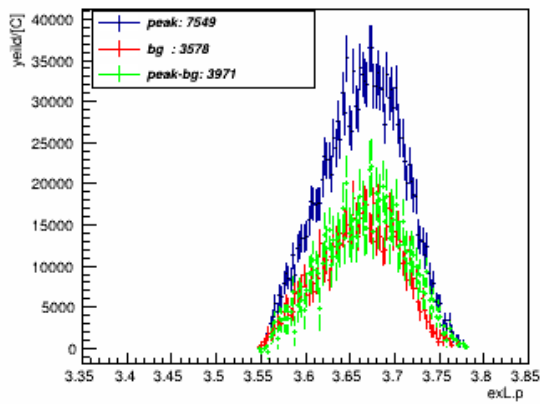
Ee\_w\_pID\_N\_CT\_xcut\_less\_than\_1.1\_kin\_3



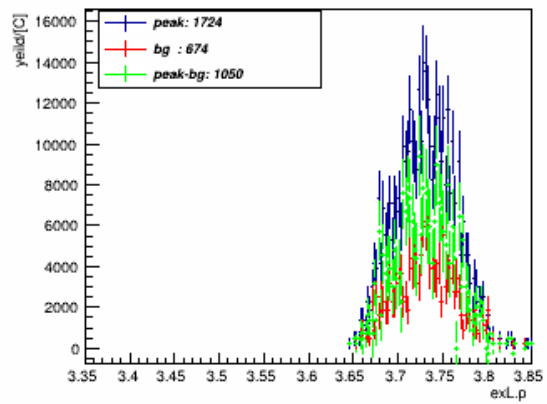
Ee\_w\_pID\_N\_CT\_xcut\_1.1\_to\_1.3\_kin\_3



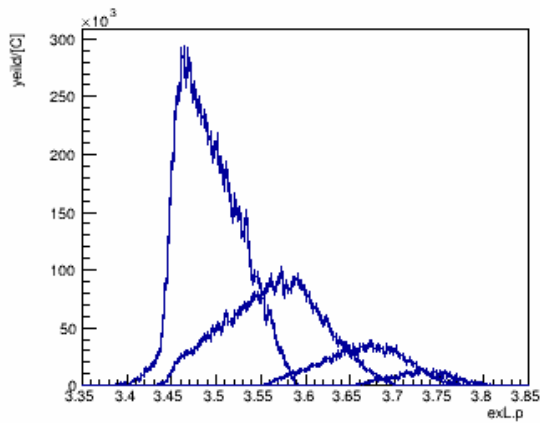
Ee\_w\_pID\_N\_CT\_xcut\_1.3\_to\_1.5\_kin\_3



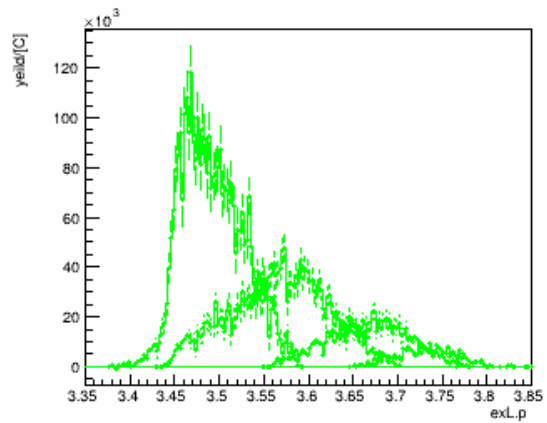
Ee\_w\_pID\_N\_CT\_xcut\_greater\_than\_1.5\_kin\_3



Ee\_w\_pID\_N\_CT\_xcut\_less\_than\_1.1\_kin\_3



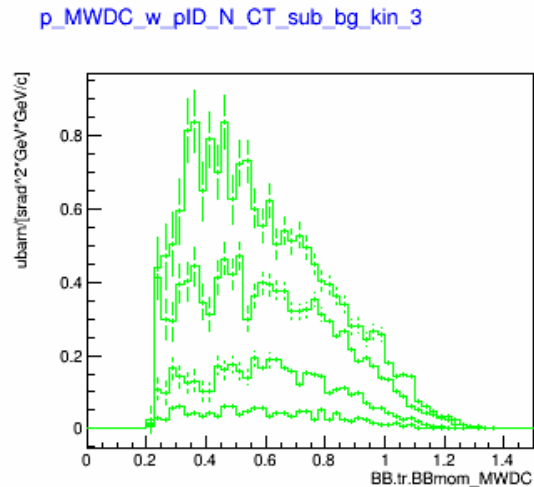
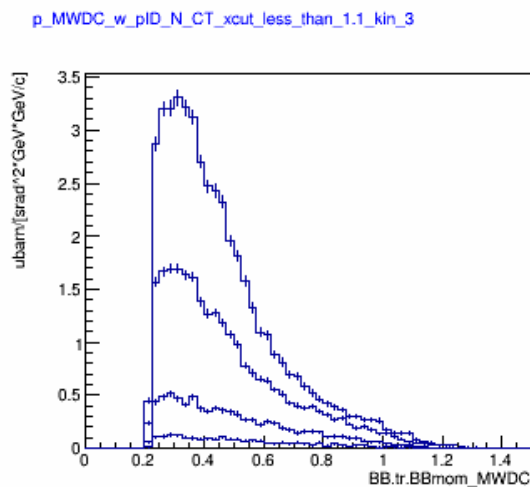
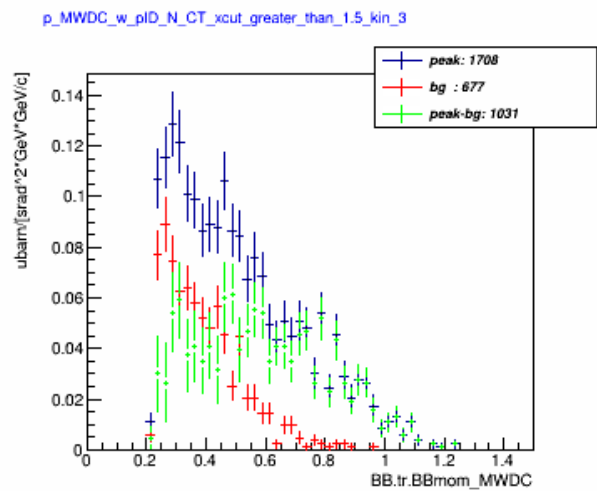
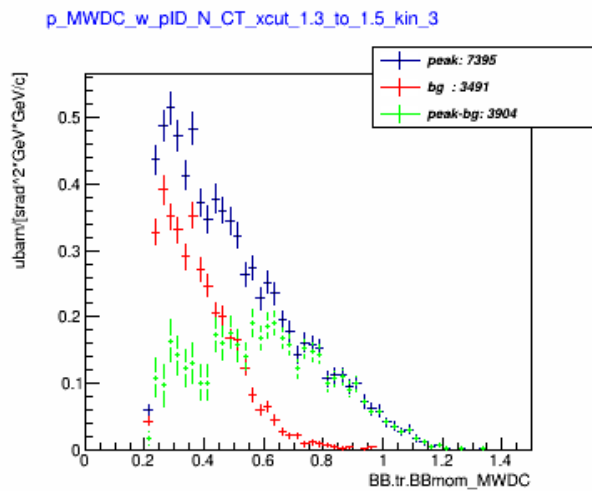
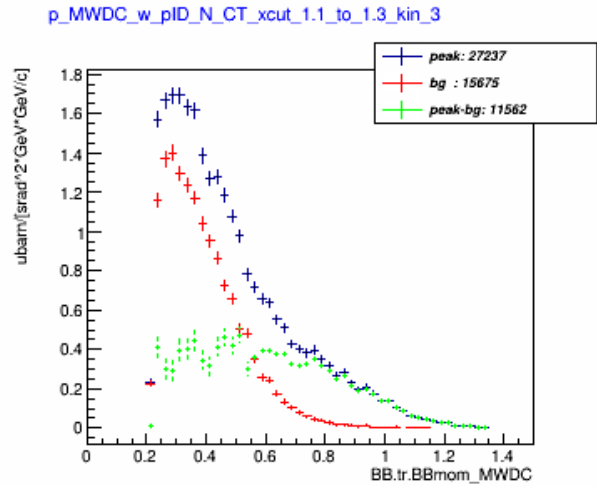
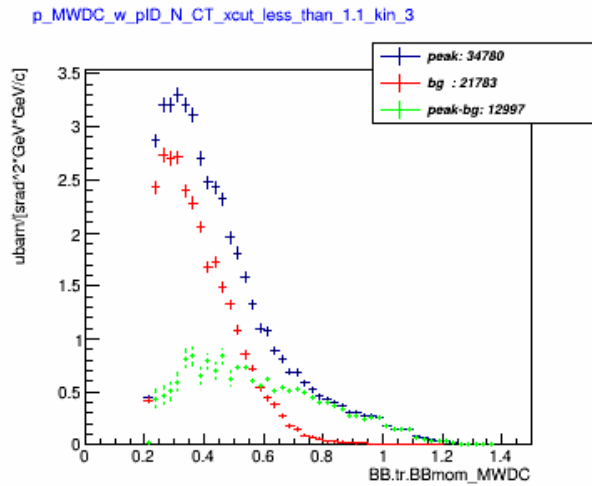
Ee\_w\_pID\_N\_CT\_sub\_bg\_kin\_3



Kin12: Energy electron with varius Xcut

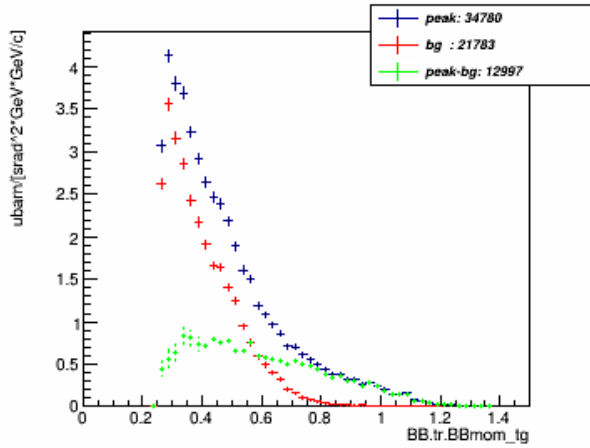


The modification of the range of  $E_{\text{electron}}$  is adjust to each Xcut range.

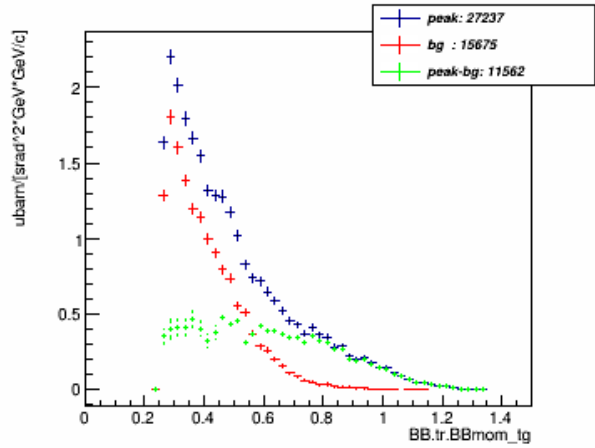


Kin 3: p\_MWDC cross section per each Xcut

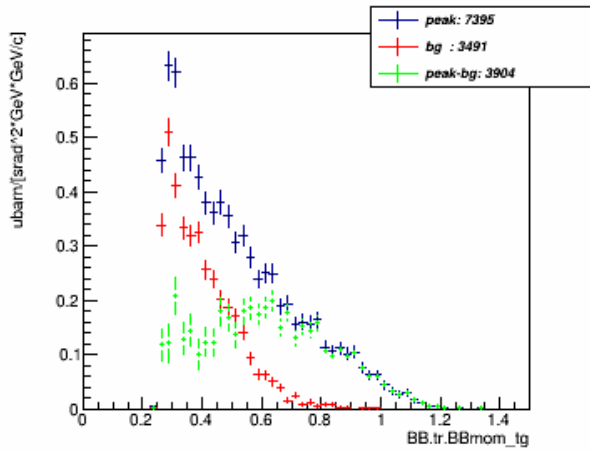
p\_tg\_w\_pID\_N\_CT\_xcut\_less\_than\_1.1\_kin\_3



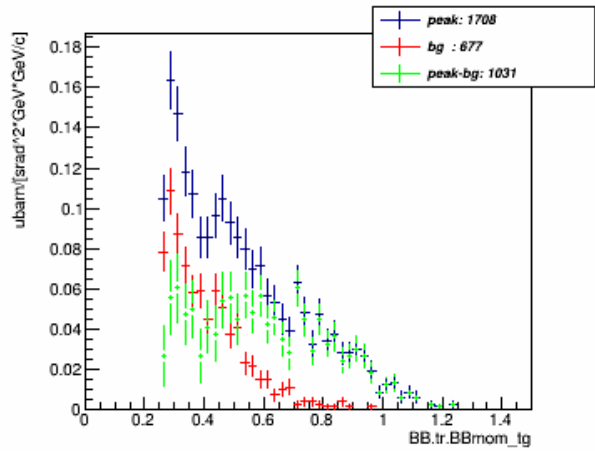
p\_tg\_w\_pID\_N\_CT\_xcut\_1.1\_to\_1.3\_kin\_3



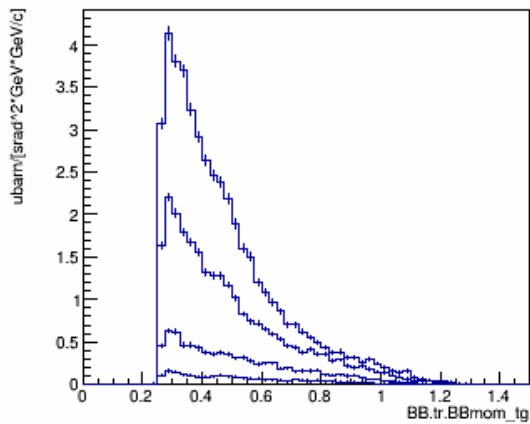
p\_tg\_w\_pID\_N\_CT\_xcut\_1.3\_to\_1.5\_kin\_3



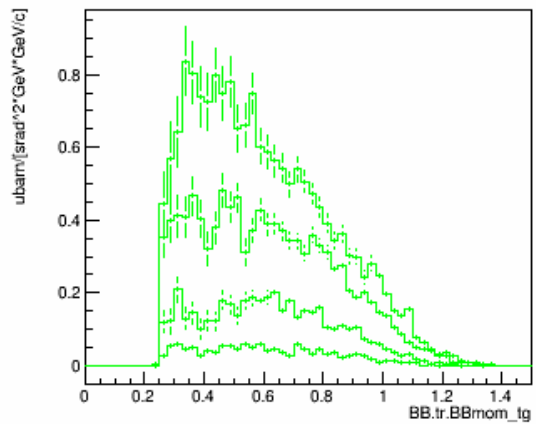
p\_tg\_w\_pID\_N\_CT\_xcut\_greater\_than\_1.5\_kin\_3



p\_tg\_w\_pID\_N\_CT\_xcut\_less\_than\_1.1\_kin\_3

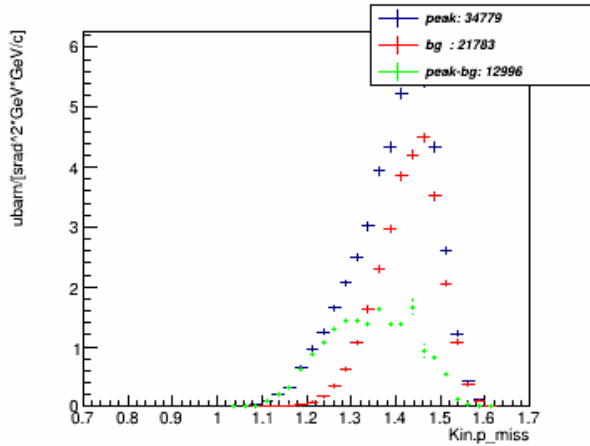


p\_tg\_w\_pID\_N\_CT\_sub\_bg\_kin\_3

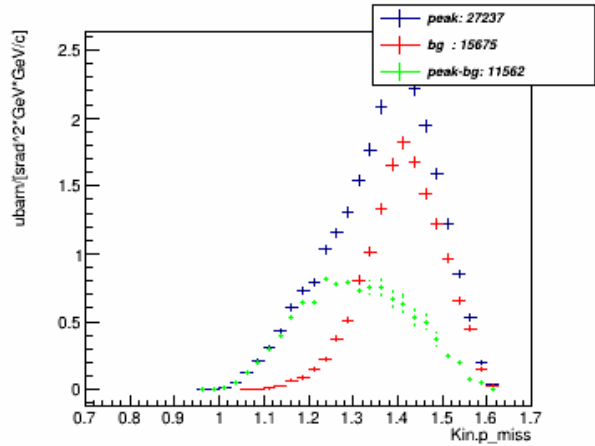


Kin 3: p\_target cross section per each Xcut

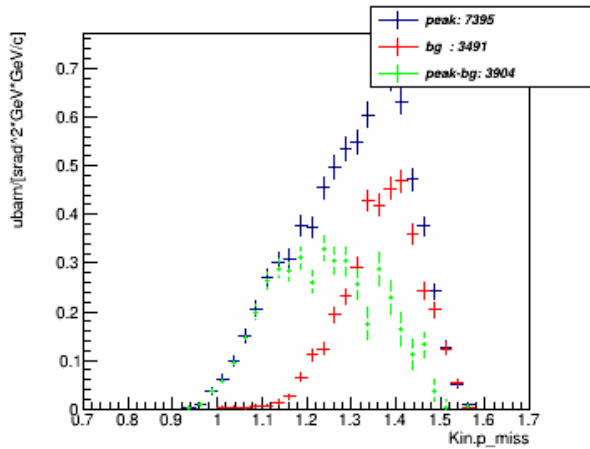
p\_miss\_w\_pID\_N\_CT\_xcut\_less\_than\_1.1\_kin\_3



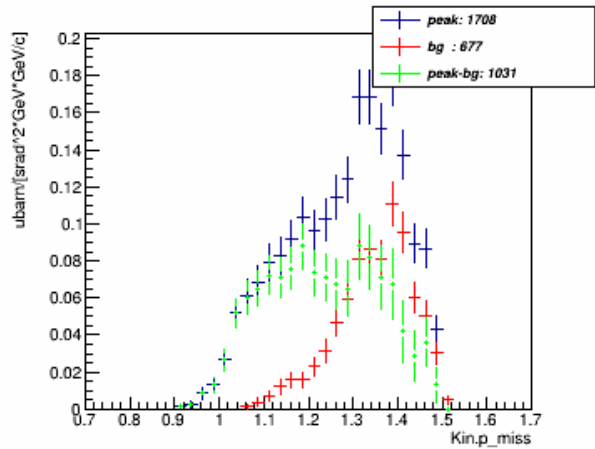
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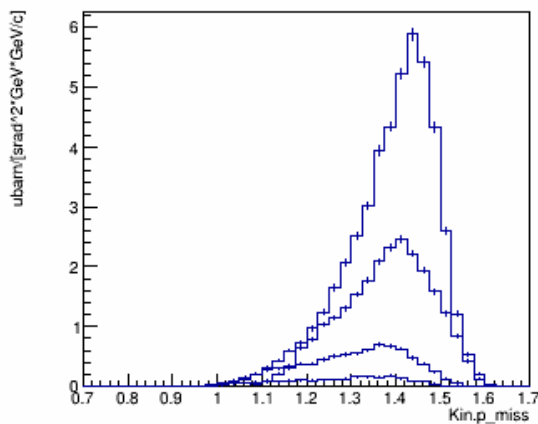
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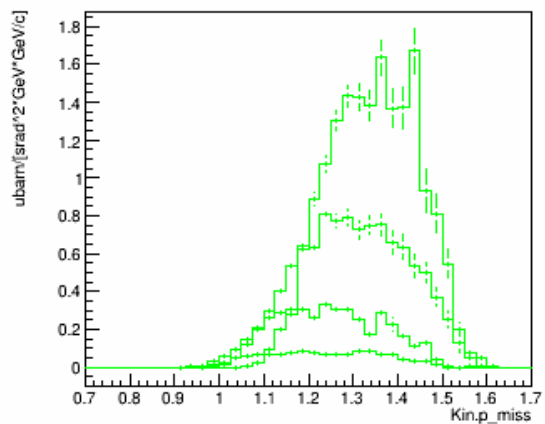
p\_miss\_w\_pID\_N\_CT\_xcut\_greater\_than\_1.5\_kin\_3



p\_miss\_w\_pID\_N\_CT\_xcut\_less\_than\_1.1\_kin\_3

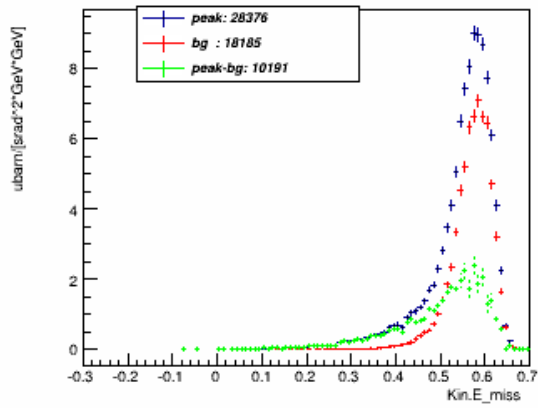


p\_miss\_w\_pID\_N\_CT\_sub\_bg\_kin\_3

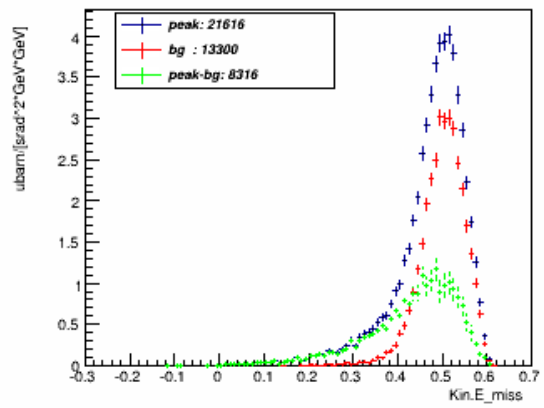


Kin 3: P\_miss cross section per each Xcut

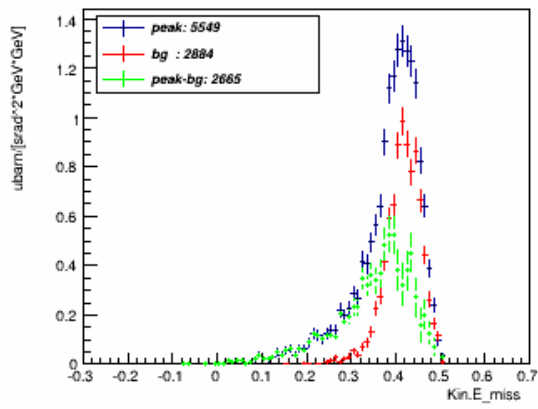
E\_miss\_w\_pID\_N\_CT\_xcut\_less\_than\_1.1\_kin\_12



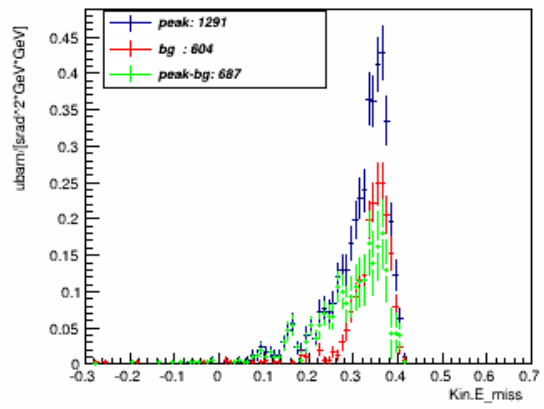
E\_miss\_w\_pID\_N\_CT\_xcut\_1.1\_to\_1.3\_kin\_12



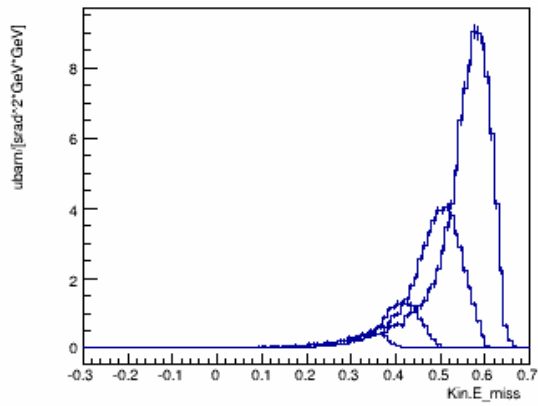
E\_miss\_w\_pID\_N\_CT\_xcut\_1.3\_to\_1.5\_kin\_12



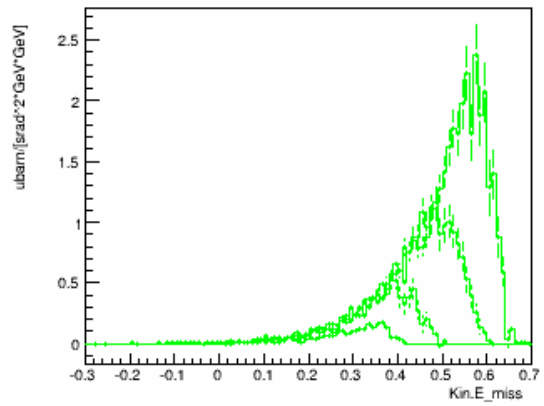
E\_miss\_w\_pID\_N\_CT\_xcut\_greater\_than\_1.5\_kin\_12



E\_miss\_w\_pID\_N\_CT\_xcut\_less\_than\_1.1\_kin\_12

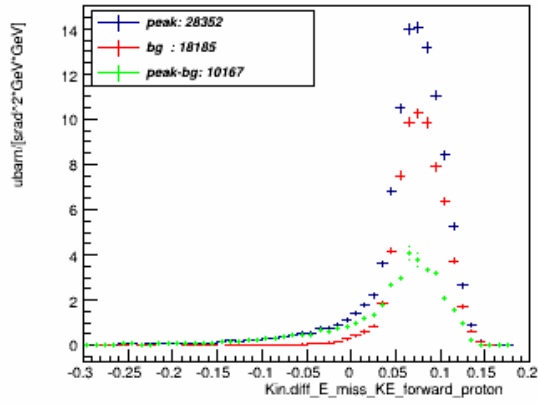


E\_miss\_w\_pID\_N\_CT\_sub\_bg\_kin\_12

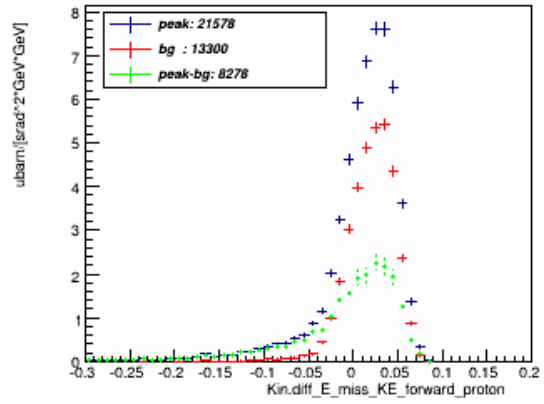


Kin 3: E\_miss cross section per each Xcut

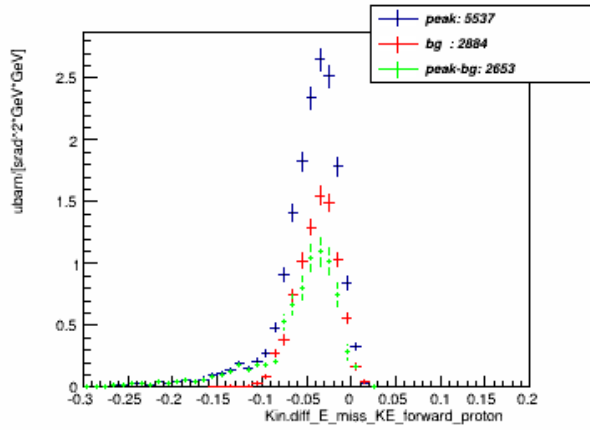
E\_miss\_forward\_w\_pID\_N\_CT\_xcut\_less\_than\_1.1\_kin\_12



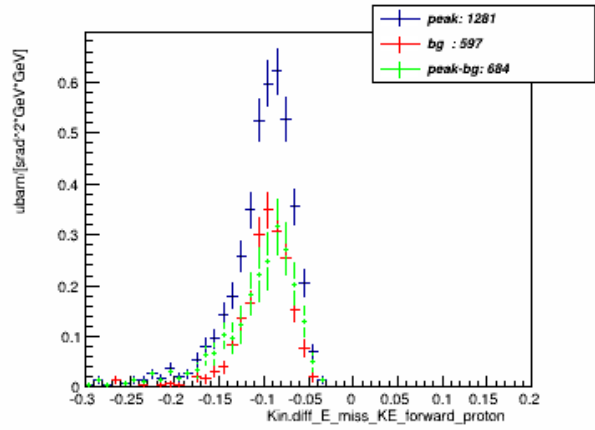
E\_miss\_forward\_w\_pID\_N\_CT\_xcut\_1.1\_to\_1.3\_kin\_12



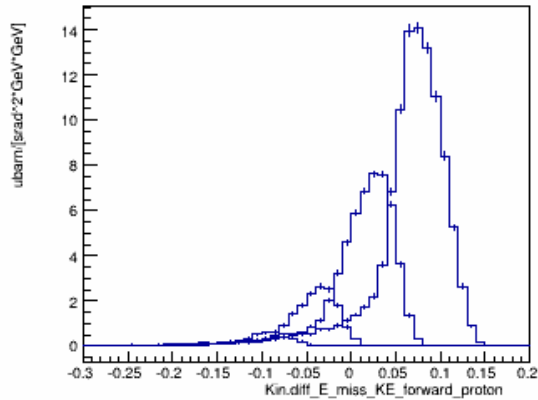
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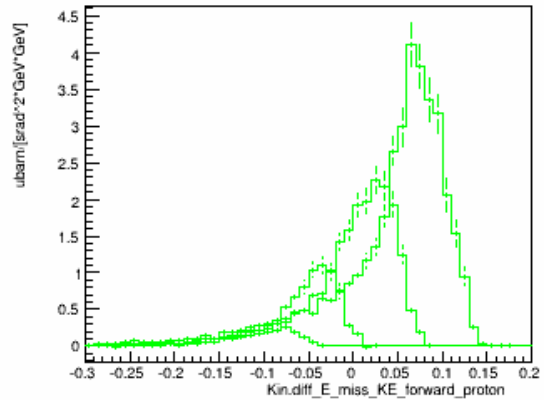
E\_miss\_forward\_w\_pID\_N\_CT\_xcut\_greater\_than\_1.5\_kin\_12



E\_miss\_forward\_w\_pID\_N\_CT\_xcut\_less\_than\_1.1\_kin\_12

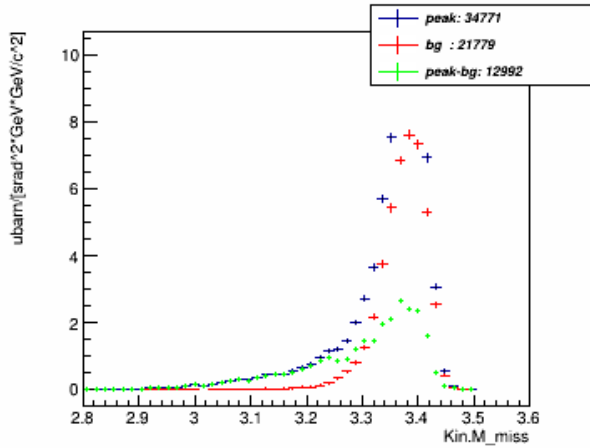


E\_miss\_forward\_w\_pID\_N\_CT\_sub\_bg\_kin\_12

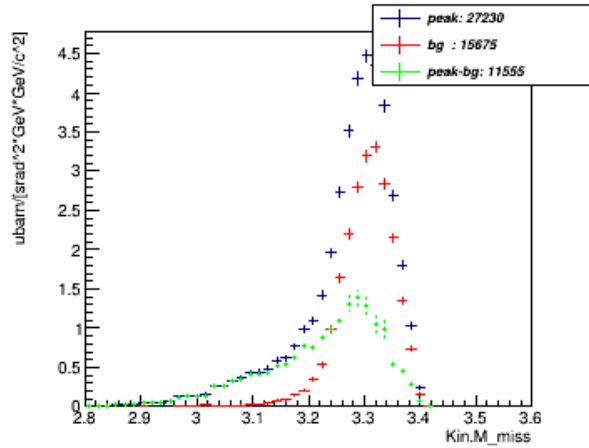


Kin 3: E\_miss forward cross section per each Xcut

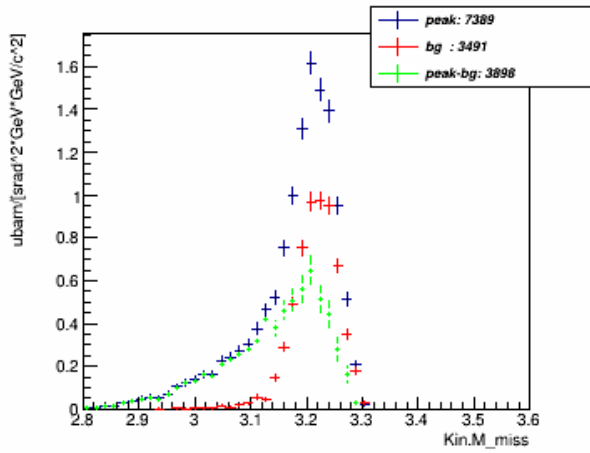
M\_miss\_w\_pID\_N\_CT\_xcut\_less\_than\_1.1\_kin\_3



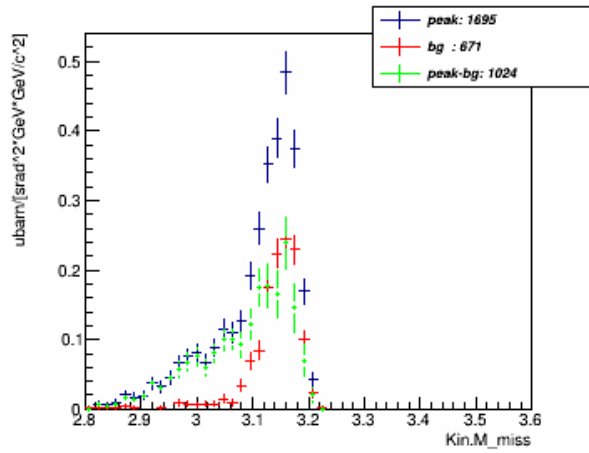
M\_miss\_w\_pID\_N\_CT\_xcut\_1.1\_to\_1.3\_kin\_3



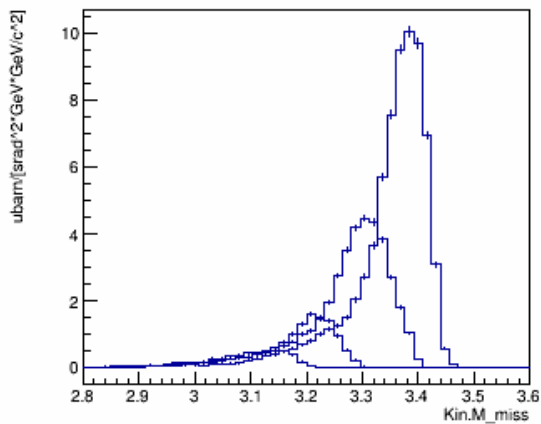
M\_miss\_w\_pID\_N\_CT\_xcut\_1.3\_to\_1.5\_kin\_3



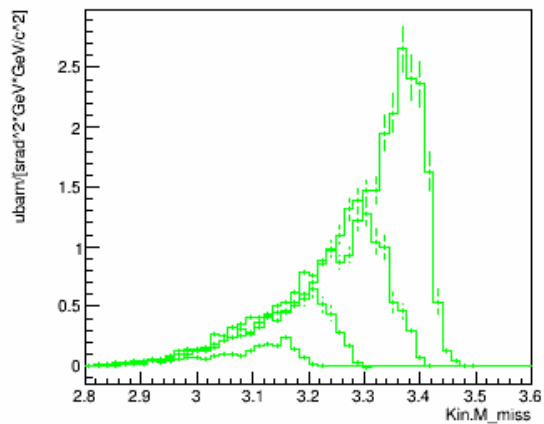
M\_miss\_w\_pID\_N\_CT\_xcut\_greater\_than\_1.5\_kin\_3



M\_miss\_w\_pID\_N\_CT\_xcut\_less\_than\_1.1\_kin\_3

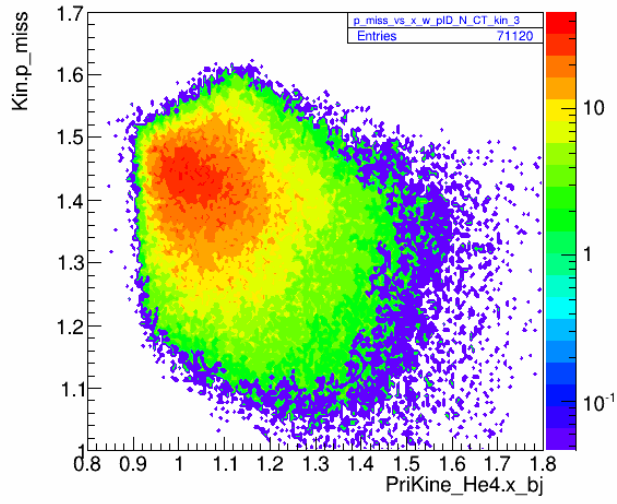


M\_miss\_w\_pID\_N\_CT\_sub\_bg\_kin\_3

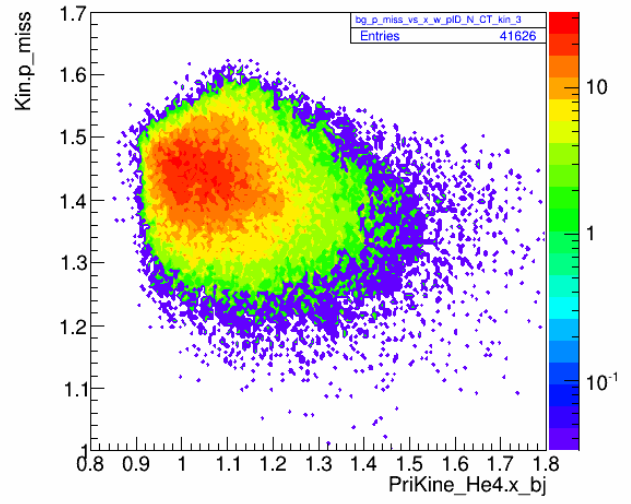


Kin 3:  $M_{\text{miss}}$  cross section per each Xcut

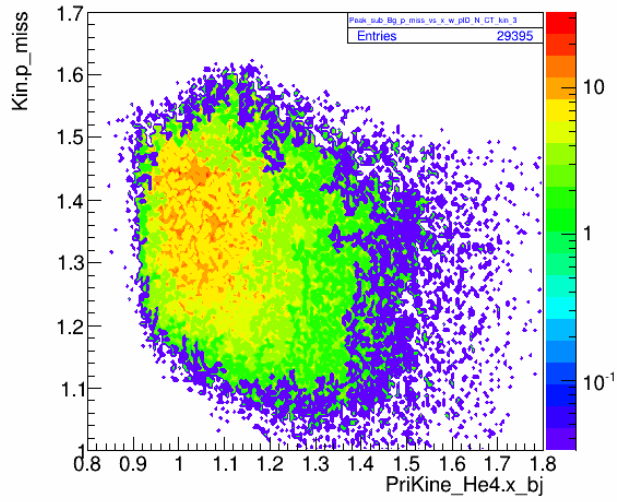
p\_miss\_vs\_x\_w\_pID\_N\_CT\_kin\_3



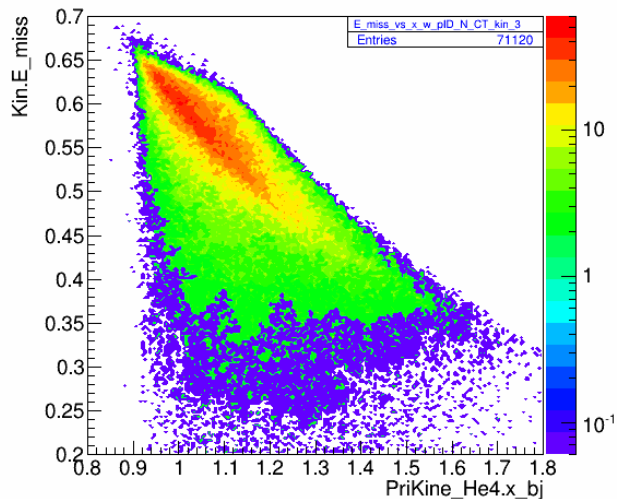
bg\_p\_miss\_vs\_x\_w\_pID\_N\_CT\_kin\_3



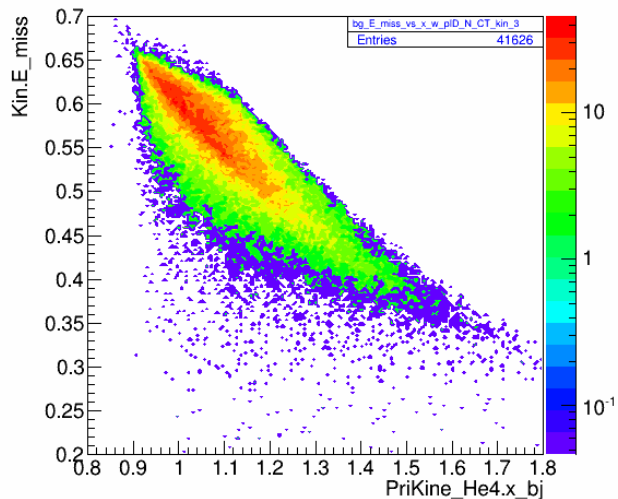
Peak\_sub\_Bg\_p\_miss\_vs\_x\_w\_pID\_N\_CT\_kin\_3



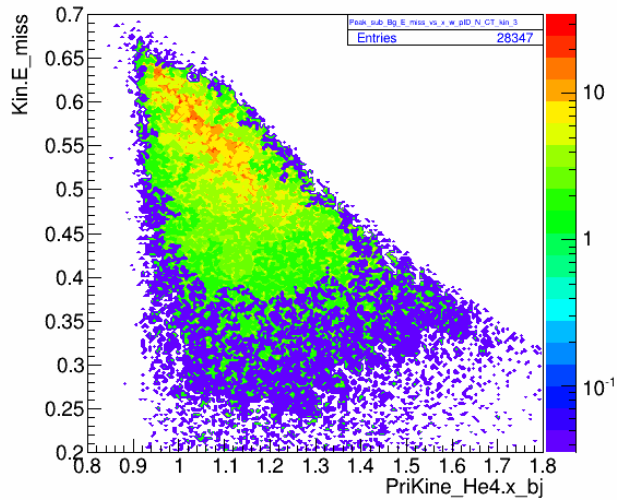
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bg\_E\_miss\_vs\_x\_w\_pID\_N\_CT\_kin\_3

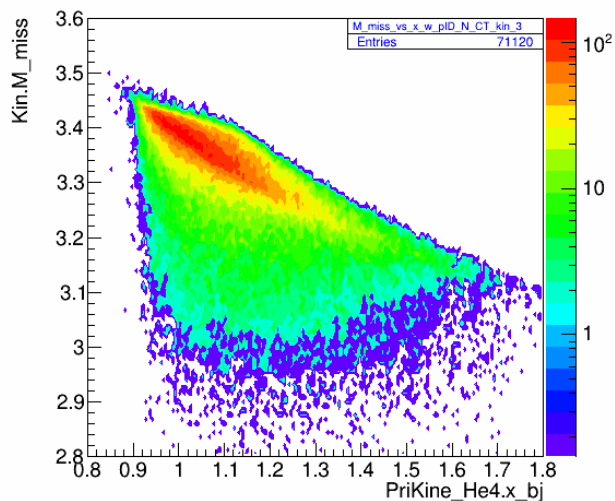


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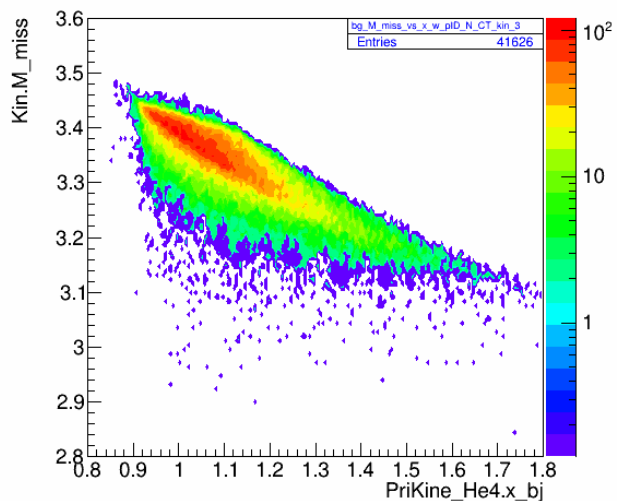




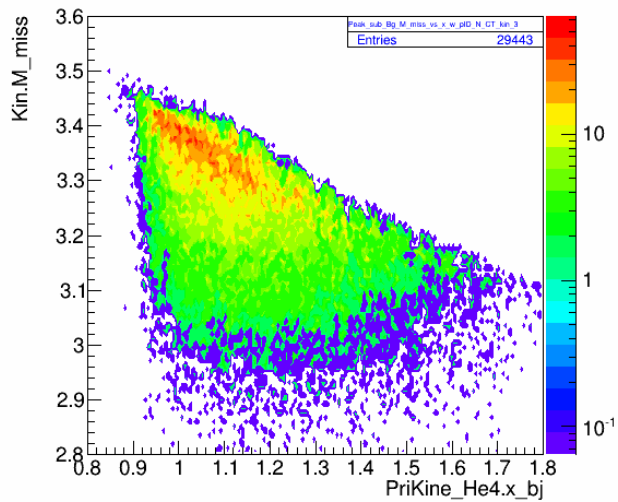
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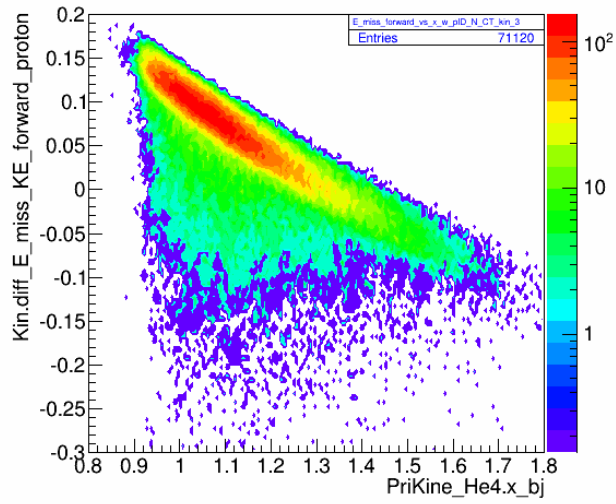
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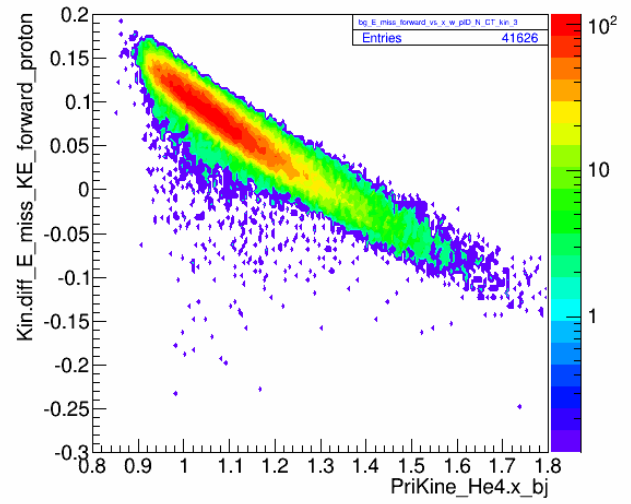
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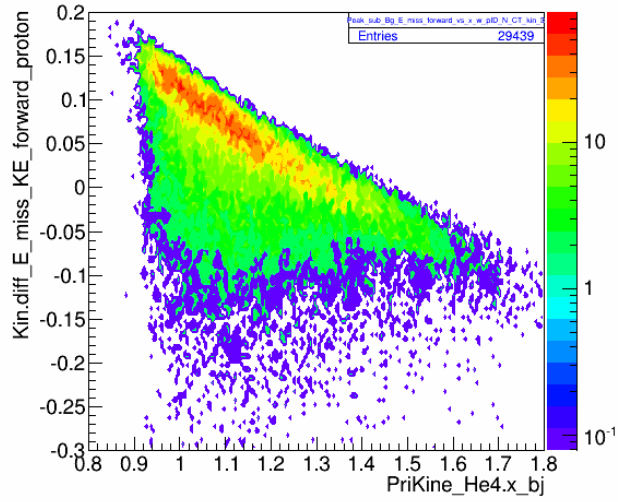
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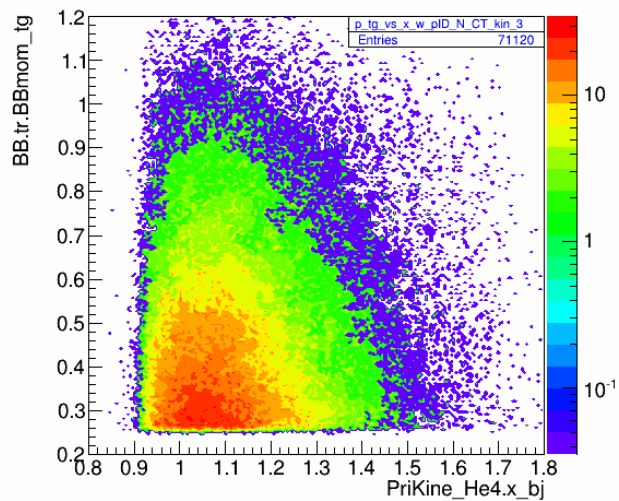
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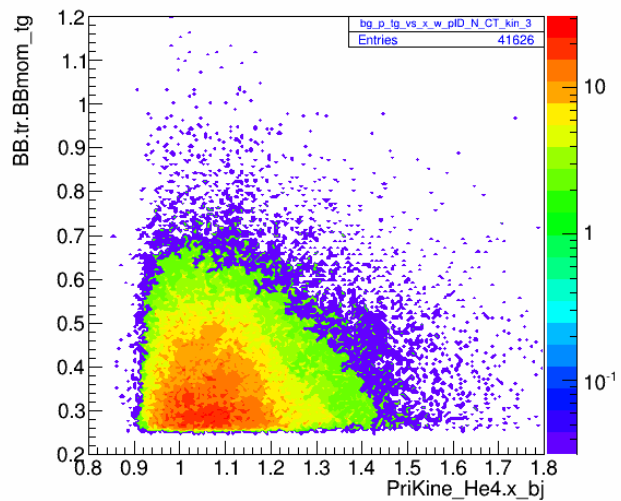
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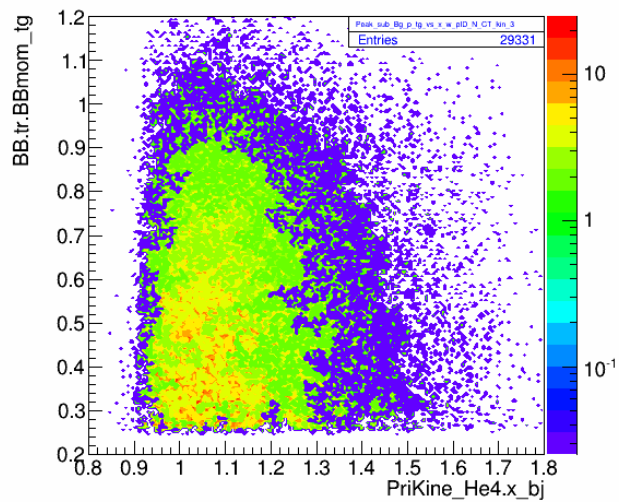
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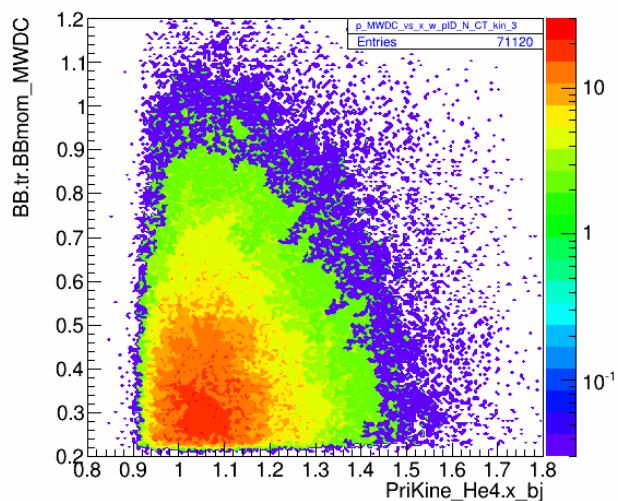
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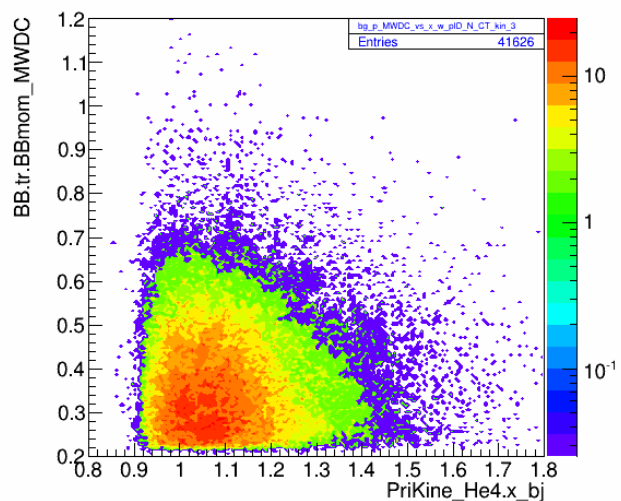
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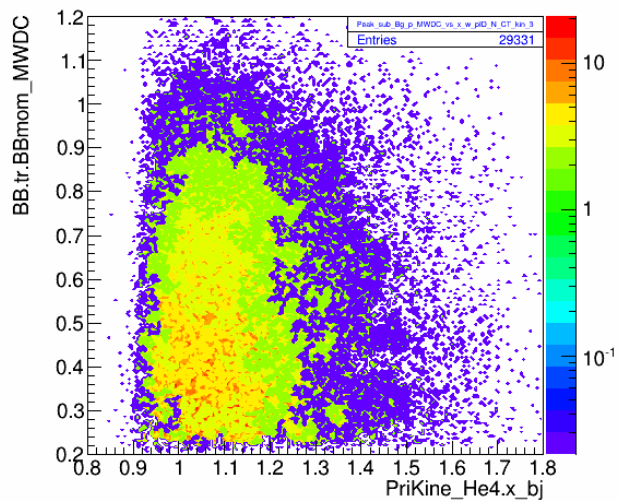
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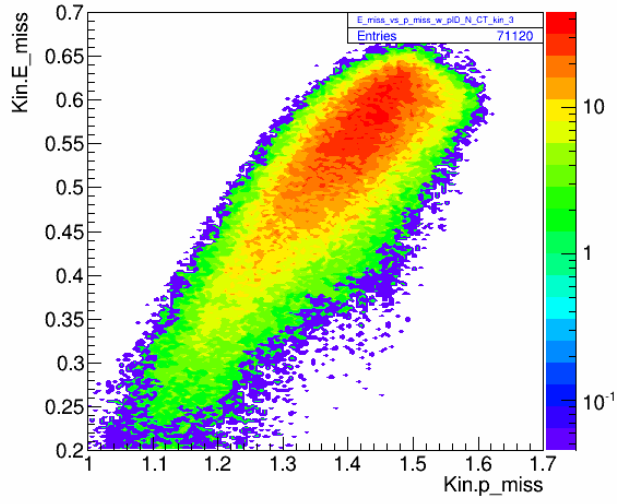
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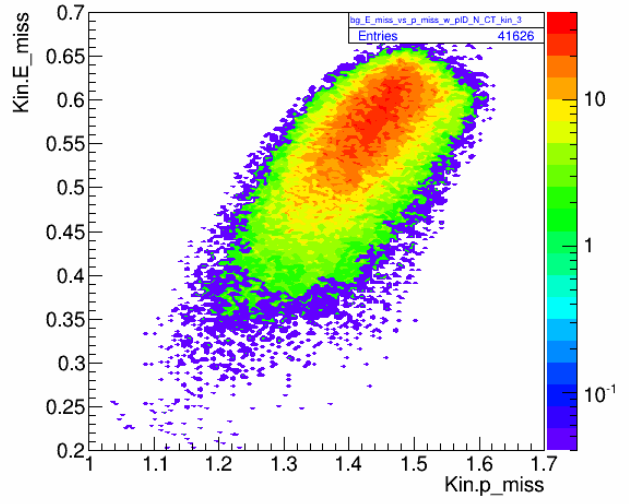
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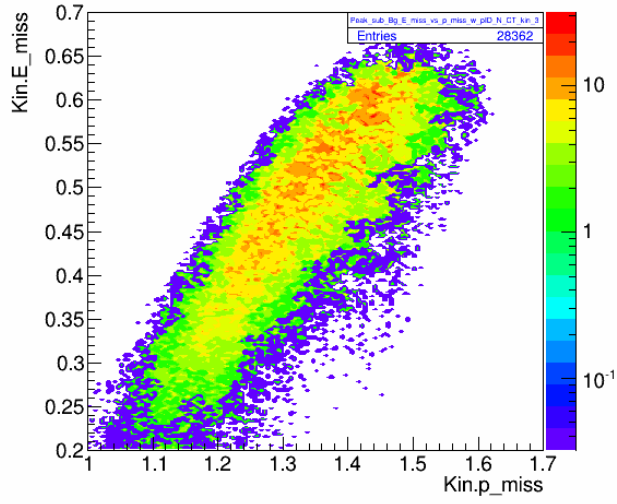
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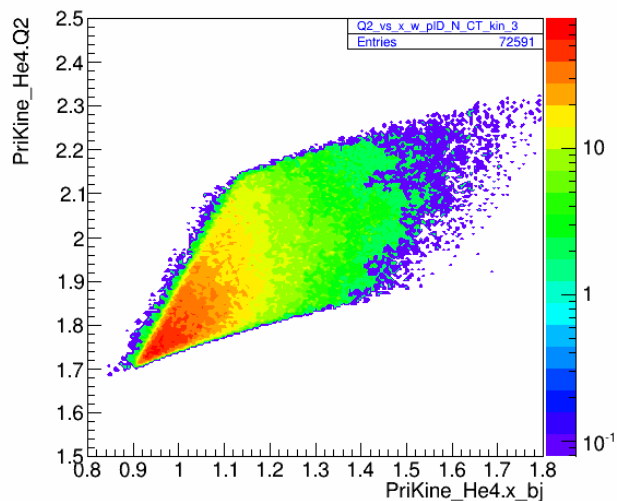
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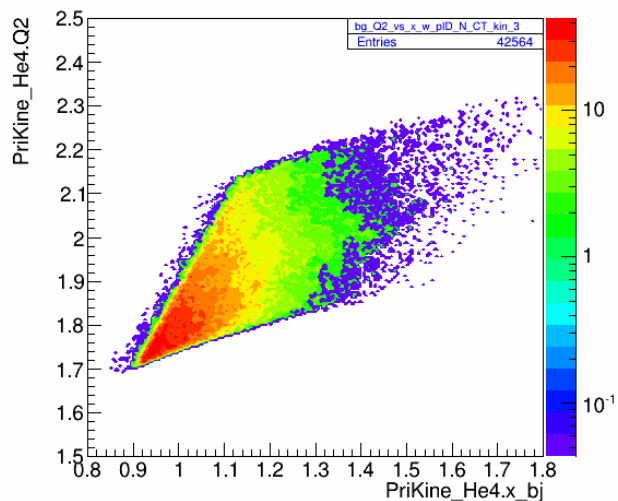
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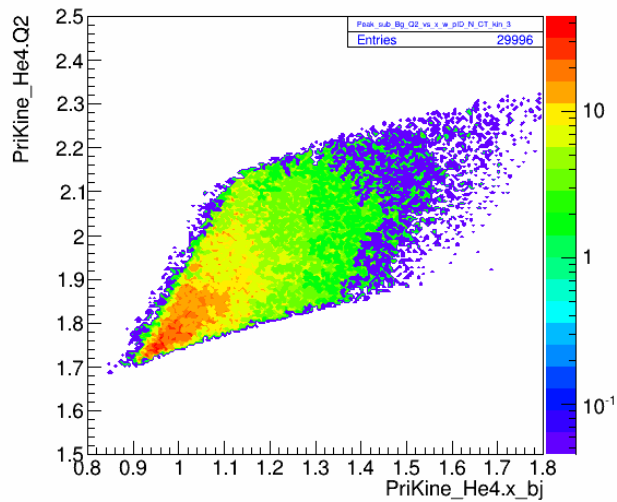
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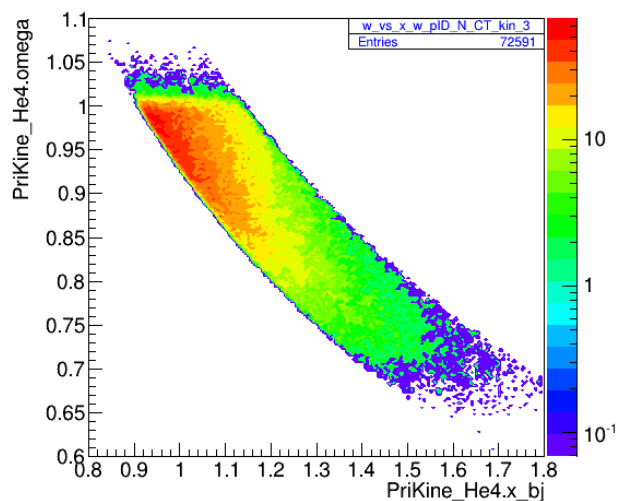
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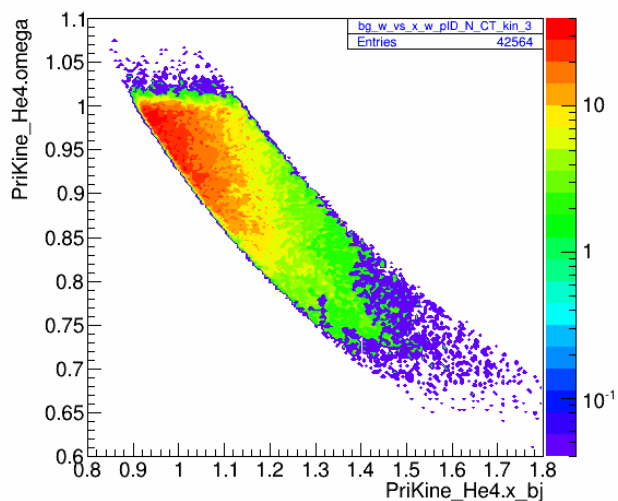
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w\_vs\_x\_w\_pID\_N\_CT\_kin\_3



bg\_w\_vs\_x\_w\_pID\_N\_CT\_kin\_3



Peak\_sub\_Bg\_w\_vs\_x\_w\_pID\_N\_CT\_kin\_3

