

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

6-fold:  $(d\Omega_e) * (dE'_e) (d\Omega_p)*(dp_p)$

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 12 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	2.27381
4.	d_theta_electron	rad	$2*0.040 = 0.08$
5.	d_phi_electron	rad	$2*0.020 = 0.04$
6.	sin(L_angle)		$\text{Sin}(20.3) = 0.3469$
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)		$\text{Sin}(97) = 0.9925$
11.	d_momentum_proton	GeV/c	$1.2- 0.2 = 1.0$
12.	N_pass_cut	entries	(peak)-(bg) = 54371-33406 = 20965 entries

13	Target area number density= (Target density)*(target Length)*(N_A)/(A_z)	Atom/ cm <sup>2</sup> or atom/ba rn	$7.638e22$ atom/cm <sup>2</sup>  $7.638e-2$ atom/barn
14	N_electron= (Total charge)/ (Electron charge)	electron	$1.421e+19$
15	N_electron_target_area _number_density	electron *atom/b arn	$1.085e+18$

16	dOmega_electron =sin(L_angle)*d_theta *d_phi	srad	1.110e-03
17	dOmega_proton =sin(BB_angle)*d_theta *d_phi	srad	0.1191
18.	Raw cross section = N_pass_cut/ (dOmega_e*dE_e*dO mega_p*dmomentum_ p) ----- N_electron_Target_are a_number_density		20965 (proton) ----- ( 1.110e-03 srad)*(0.3 GeV)*(0.1191 srad)*(1 GeV/c) *(1.085e18 electron*atom/barn)  =20965/4.3031e+13  = 4.872e-10  proton *barn ----- srad^2* GeV^2/c*electron*atom
19	(dOmega_e*dE_e*dO mega_p) *N_electron_Target_ar ea_number_density		4.3031e+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

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

where

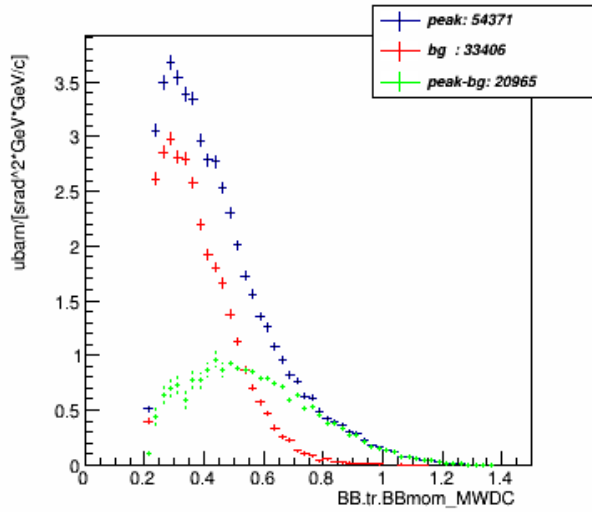
$$\text{Target\_area\_number\_density} = (\text{Target density}) * (\text{target Length}) * (N_A) / (A_z)$$

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

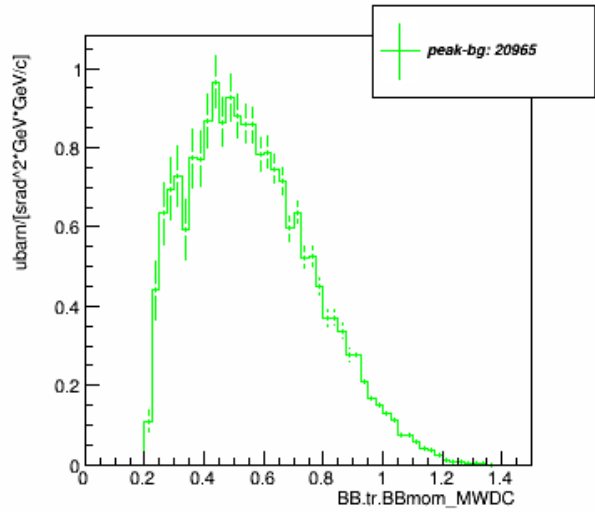
$$N_{\text{electron\_Target\_area\_number\_density}} = (\text{Target density}) * (\text{target Length}) * (N_A) / (A_z) * (\text{Total charge}) / (\text{Electron charge})$$

$$\begin{aligned} \text{Raw(Kin12)} &= \frac{[\text{proton}] / [(1.110e-03 \text{ srad}) * (0.3 \text{ GeV}) * (0.1191 \text{ srad}) * (d_{\text{momentum}})]}{[1.085e+18 \text{ electron*atom/barn }]} \\ &= \frac{[\text{proton}]}{[d_{\text{momentum}}] * [4.3031e13 \text{ srad}^2 * \text{GeV/barn}]} \end{aligned}$$

p\_MWDC\_w\_pID\_N\_CT\_no\_xcut\_kin\_12

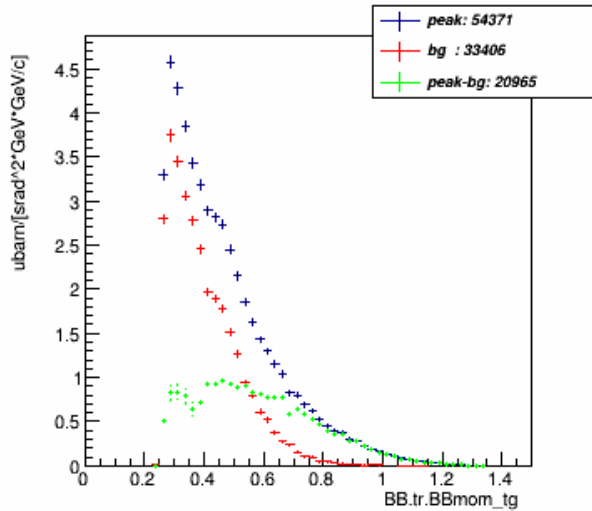


p\_MWDC\_w\_pID\_N\_CT\_sub\_bg\_kin\_12

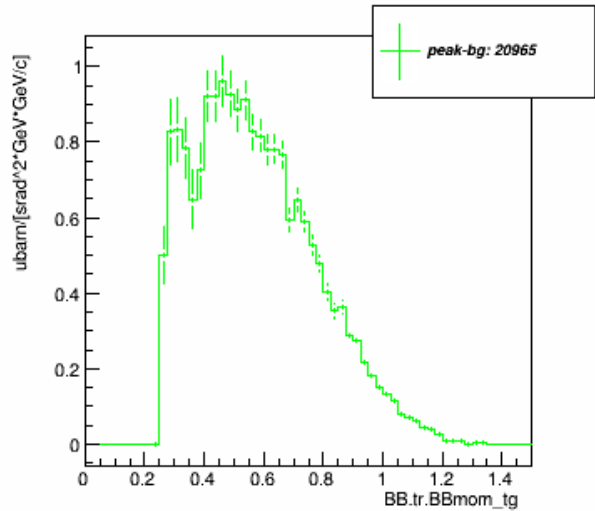


Kin12: p\_MWDC cross section

p\_tg\_w\_pID\_N\_CT\_no\_xcut\_kin\_12



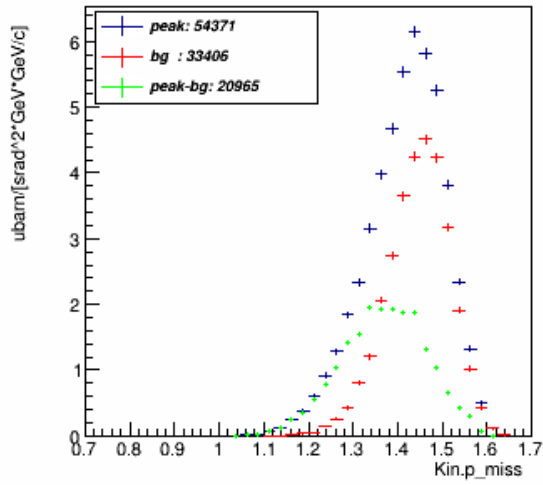
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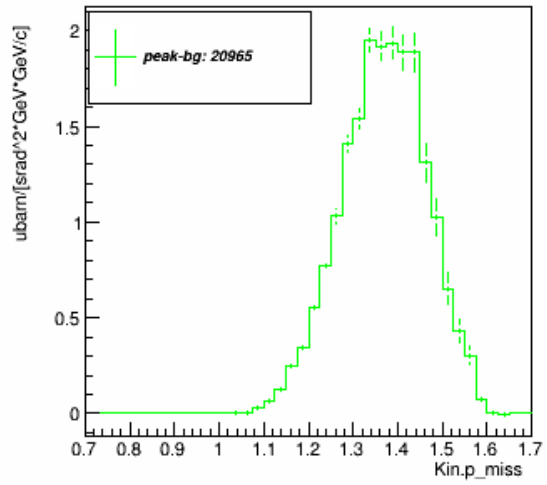
Kin12: p\_target cross section

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

p\_miss\_w\_pID\_N\_CT\_no\_xcut\_kin\_12

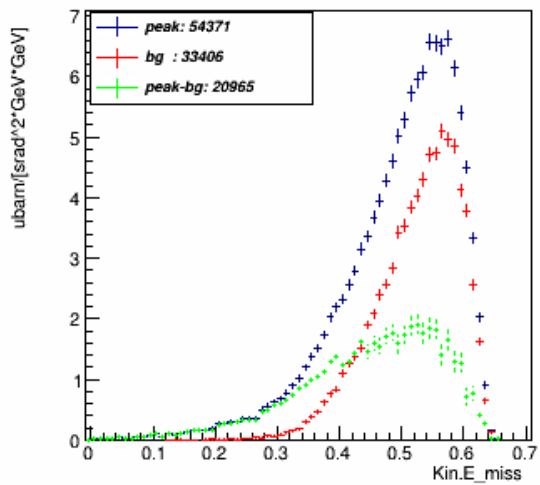


p\_miss\_w\_pID\_N\_CT\_sub\_bg\_kin\_12

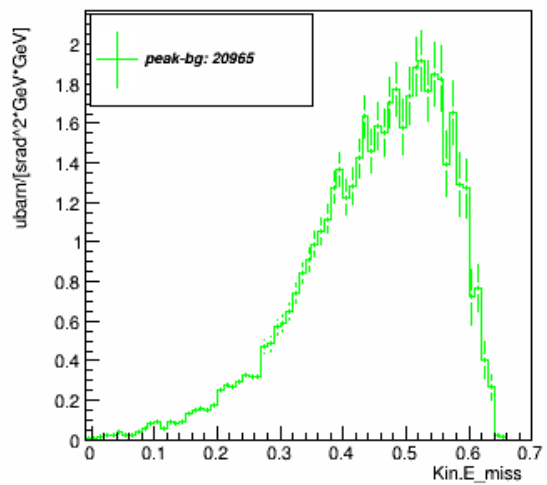


Kin12: P\_miss cross section

E\_miss\_w\_pID\_N\_CT\_no\_xcut\_kin\_12

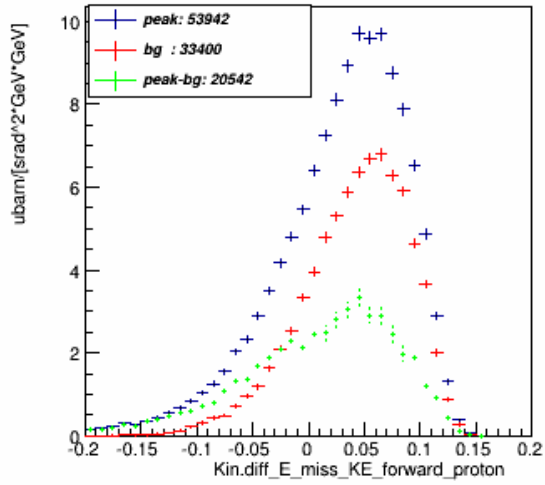


E\_miss\_w\_pID\_N\_CT\_sub\_bg\_kin\_12

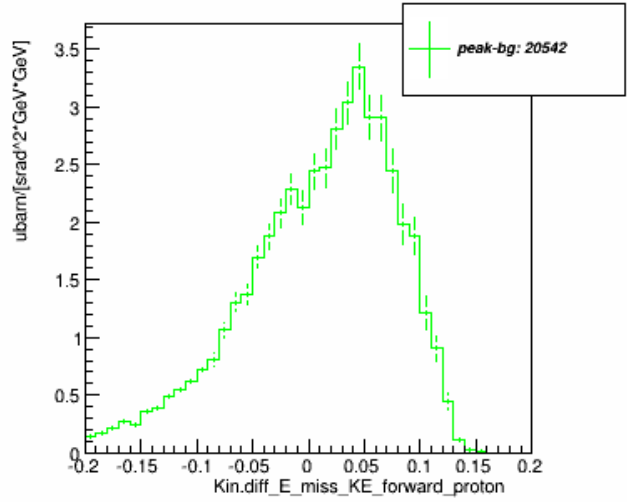


Kin12: E\_miss cross section

E\_miss\_forward\_w\_pID\_N\_CT\_no\_xcut\_kin\_12

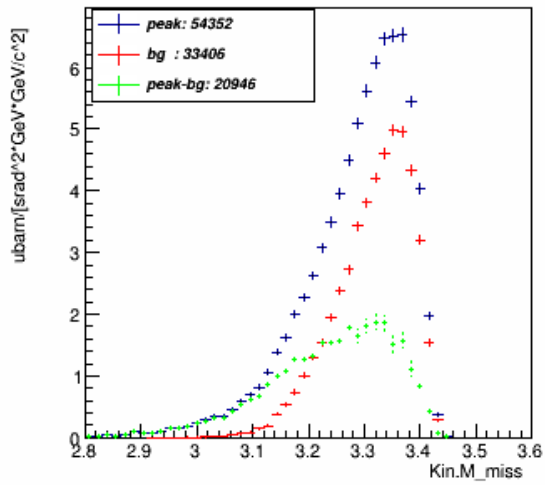


E\_miss\_forward\_w\_pID\_N\_CT\_sub\_bg\_kin\_12

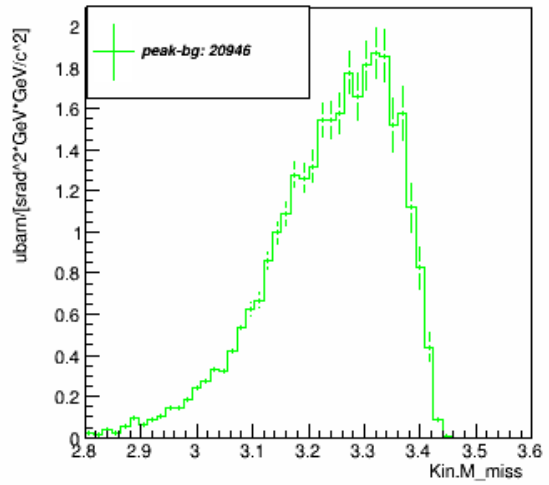


Kin12: E\_miss\_forward cross section  
\*\*add definition\*\*

M\_miss\_w\_pID\_N\_CT\_no\_xcut\_kin\_12



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

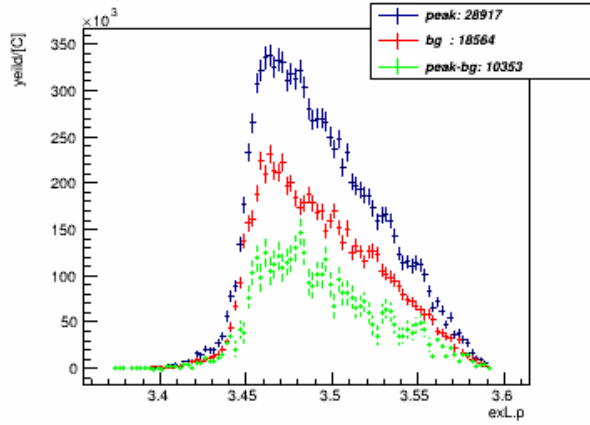


Kin12: M\_miss cross section

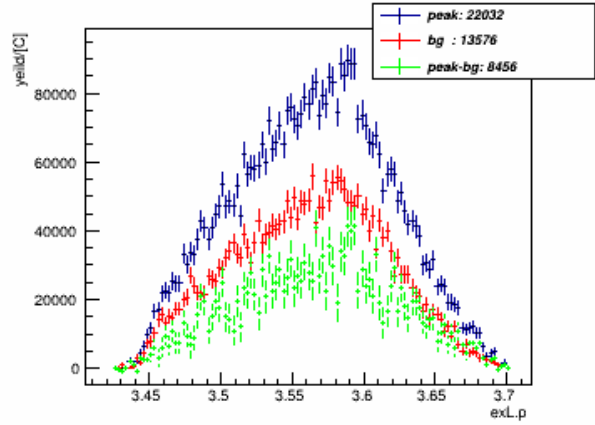
## The Effect of Xcut on the Energy range in electron

	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

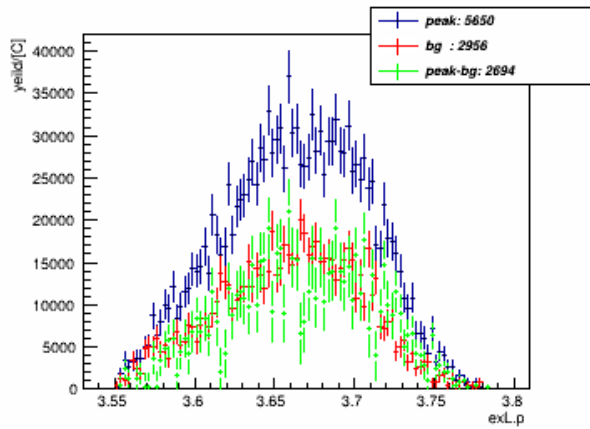
Ee\_w\_pID\_N\_CT\_xcut\_less\_than\_1.1\_kin\_12



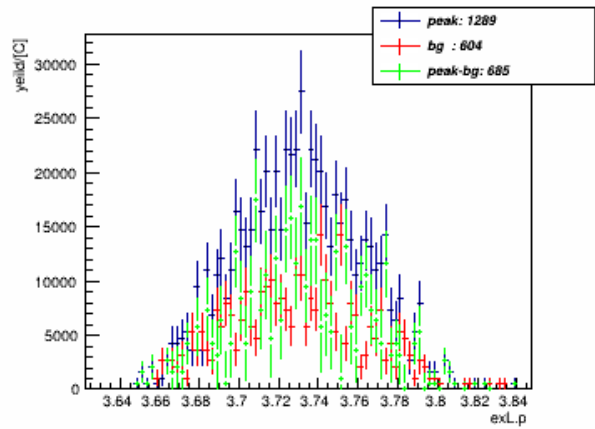
Ee\_w\_pID\_N\_CT\_xcut\_1.1\_to\_1.3\_kin\_12



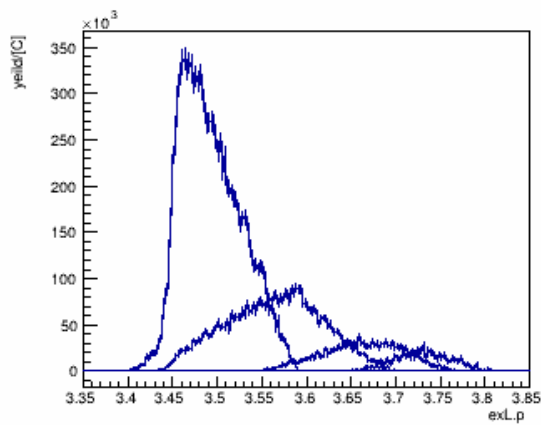
Ee\_w\_pID\_N\_CT\_xcut\_1.3\_to\_1.5\_kin\_12



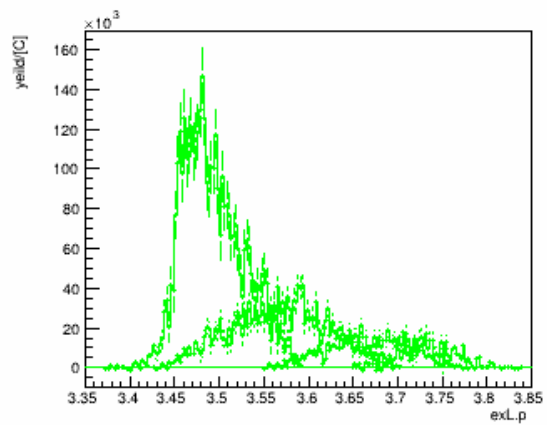
Ee\_w\_pID\_N\_CT\_xcut\_greater\_than\_1.5\_kin\_12



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



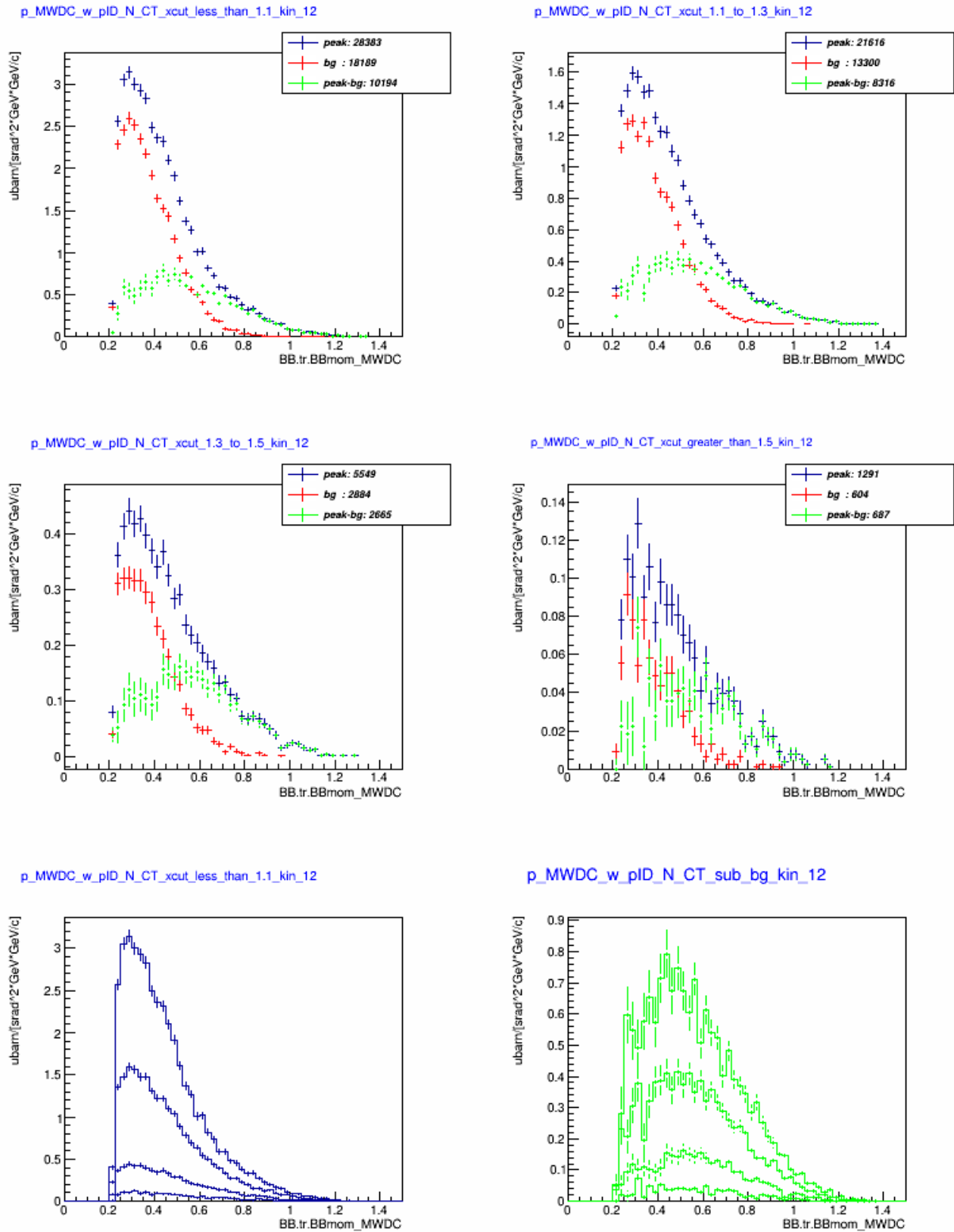
Ee\_w\_pID\_N\_CT\_sub\_bg\_kin\_12



Kin12:Energy electron with varius Xcut

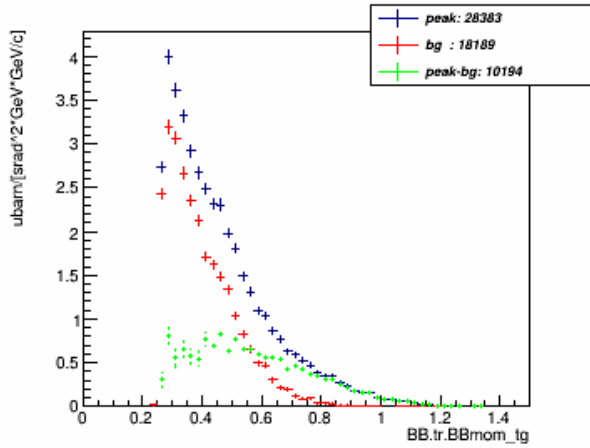


The modification of the range of  $E_{\text{electron}}$  is adjust to each Xcut range.

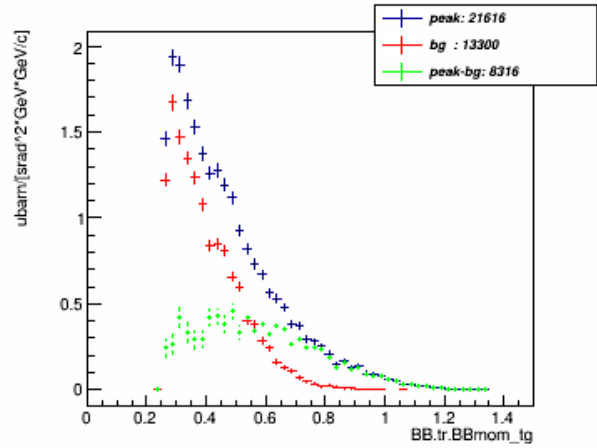


Kin 12:  $p\_MWDC$  cross section per each Xcut

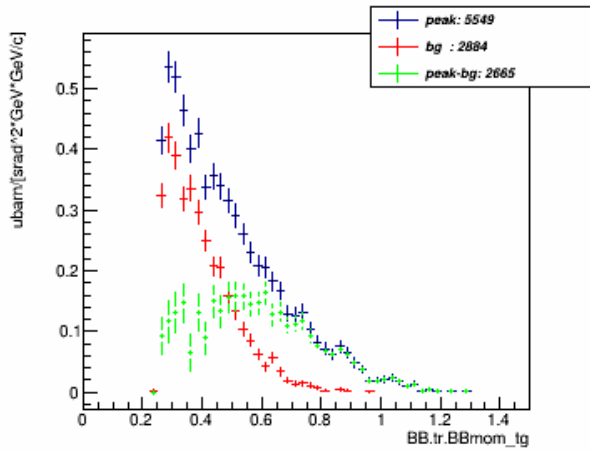
p\_tg\_w\_pID\_N\_CT\_xcut\_less\_than\_1.1\_kin\_12



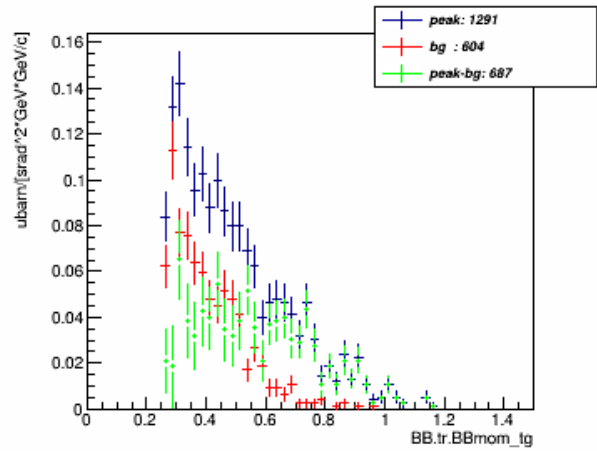
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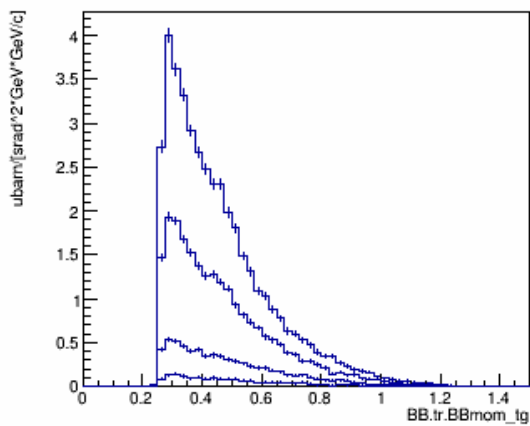
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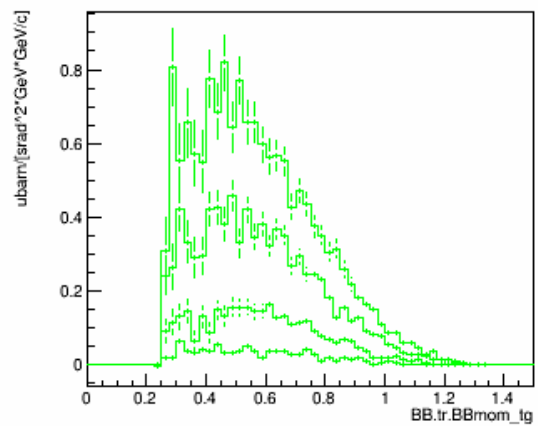
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p\_tg\_w\_pID\_N\_CT\_xcut\_less\_than\_1.1\_kin\_12

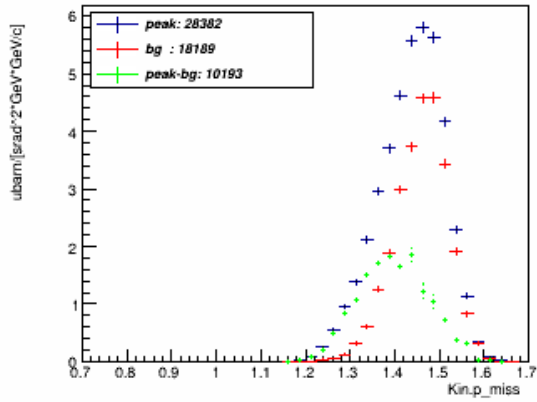


p\_tg\_w\_pID\_N\_CT\_sub\_bg\_kin\_12

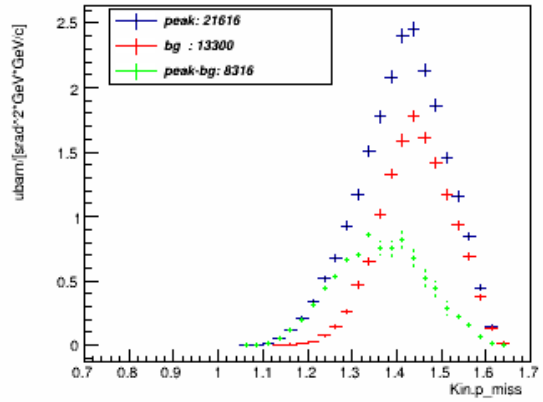


Kin 12: p\_target cross section per each Xcut

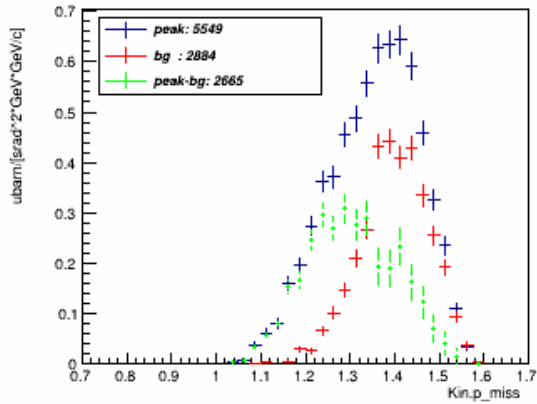
p\_miss\_w\_pID\_N\_CT\_xcut\_less\_than\_1.1\_kin\_12



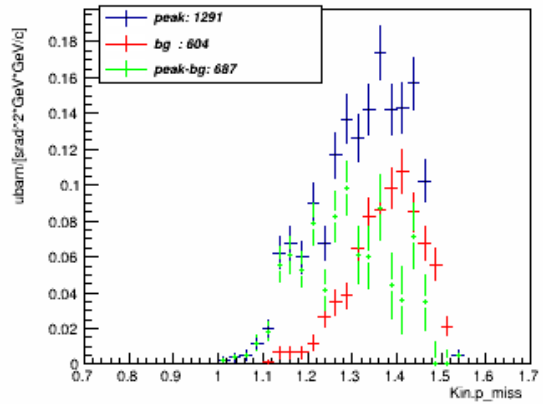
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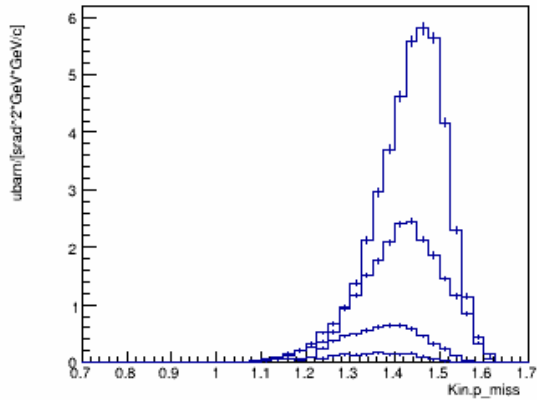
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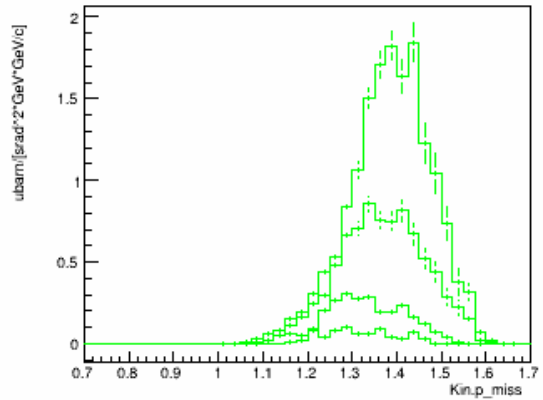
p\_miss\_w\_pID\_N\_CT\_xcut\_greater\_than\_1.5\_kin\_12



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

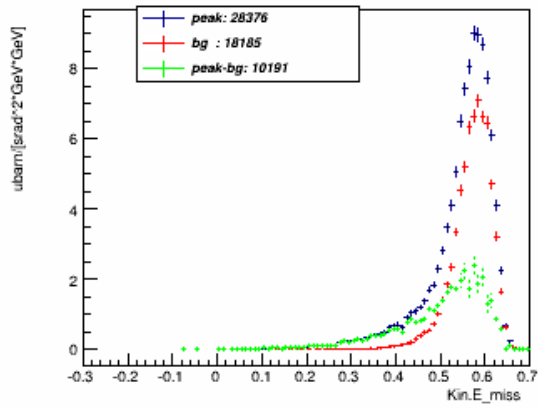


p\_miss\_w\_pID\_N\_CT\_sub\_bg\_kin\_12

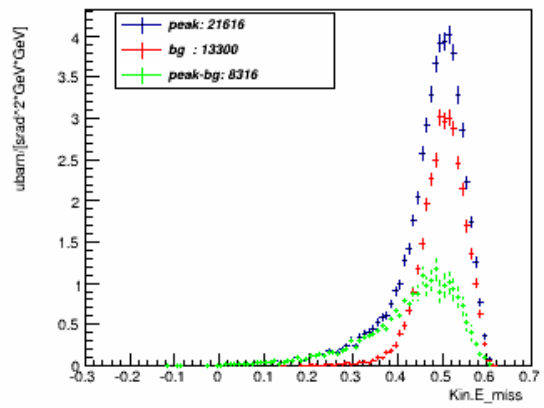


Kin 12: P\_miss cross section per each Xcut

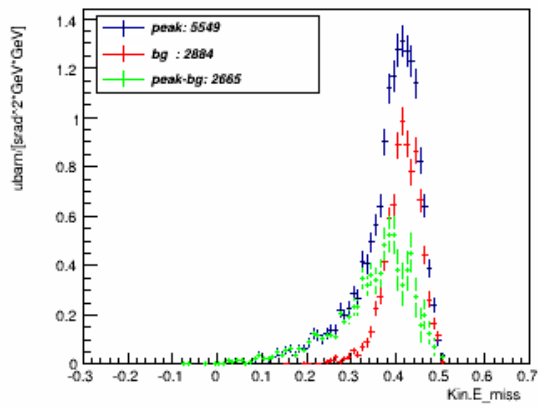
E\_miss\_w\_pID\_N\_CT\_xcut\_less\_than\_1.1\_kin\_12



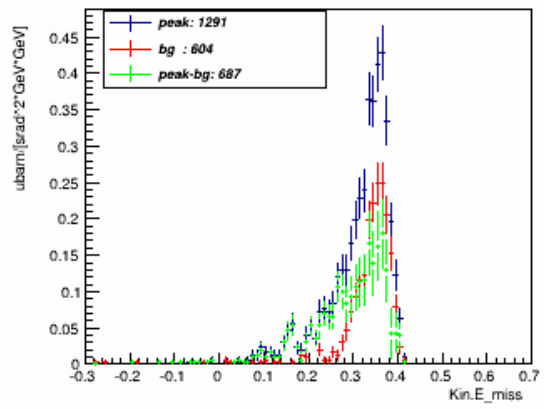
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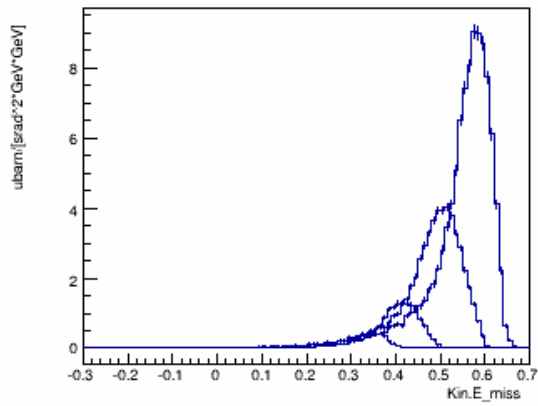
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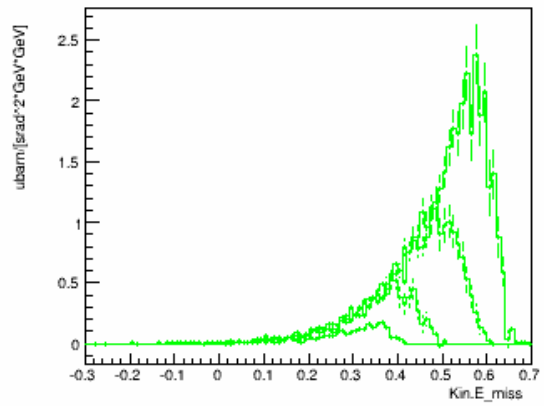
E\_miss\_w\_pID\_N\_CT\_xcut\_greater\_than\_1.5\_kin\_12



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

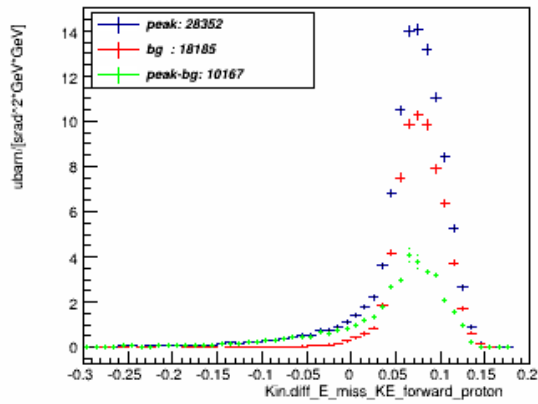


E\_miss\_w\_pID\_N\_CT\_sub\_bg\_kin\_12

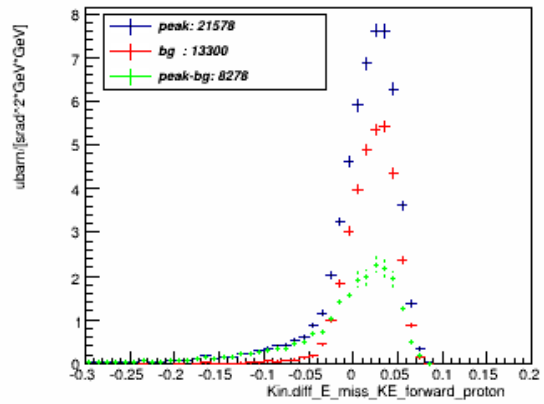


Kin 12: E\_miss cross section per each Xcut

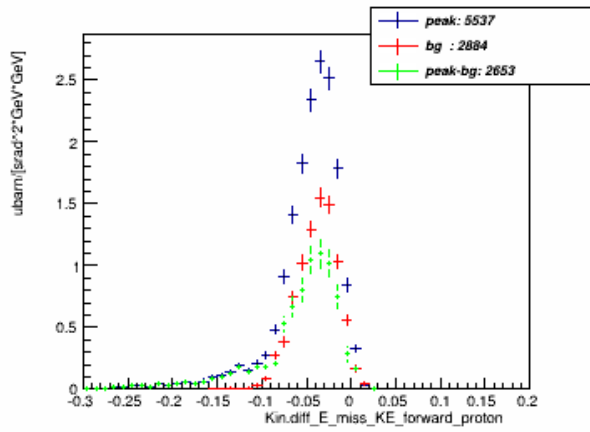
E\_miss\_forward\_w\_pID\_N\_CT\_xcut\_less\_than\_1.1\_kin\_12



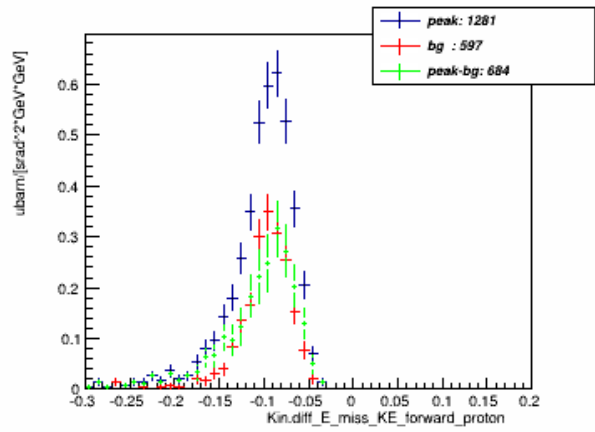
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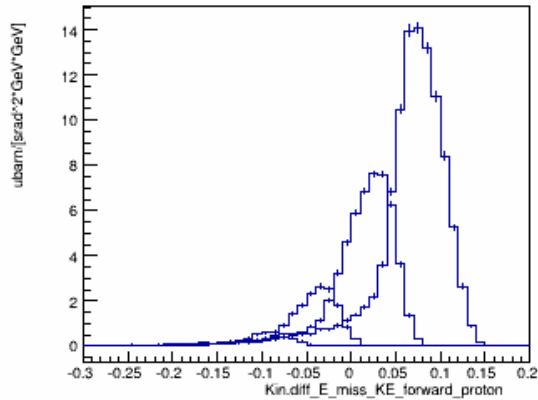
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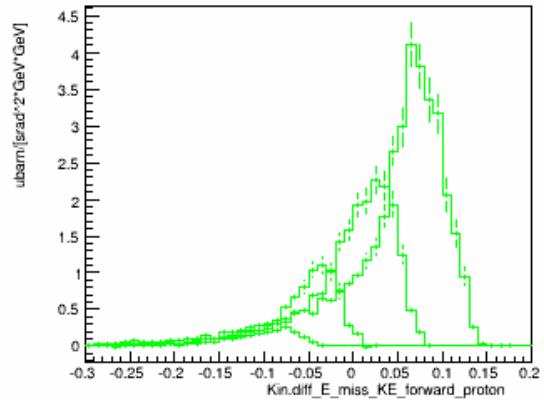
E\_miss\_forward\_w\_pID\_N\_CT\_xcut\_greater\_than\_1.5\_kin\_12



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

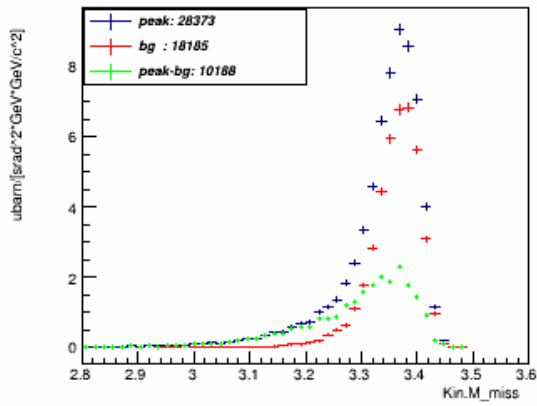


E\_miss\_forward\_w\_pID\_N\_CT\_sub\_bg\_kin\_12

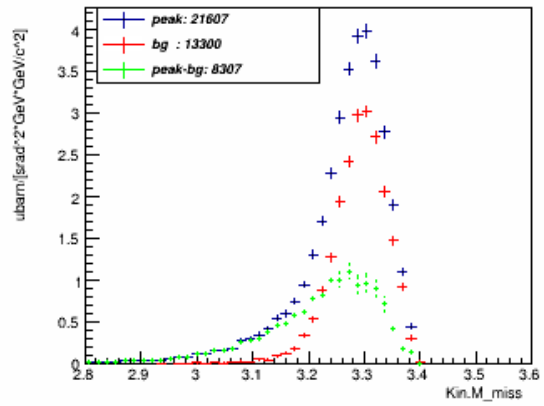


Kin 12: E\_miss forward cross section per each Xcut

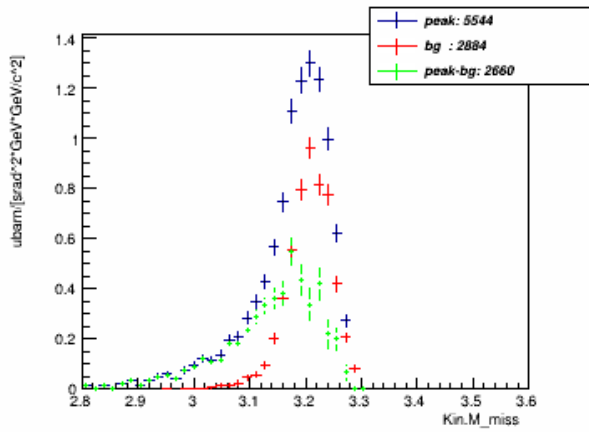
M\_miss\_w\_pID\_N\_CT\_xcut\_less\_than\_1.1\_kin\_12



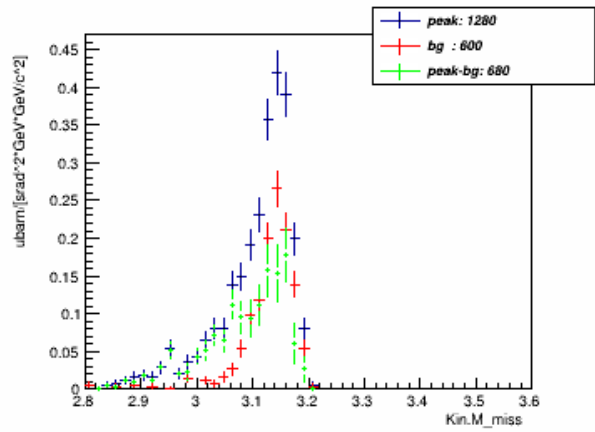
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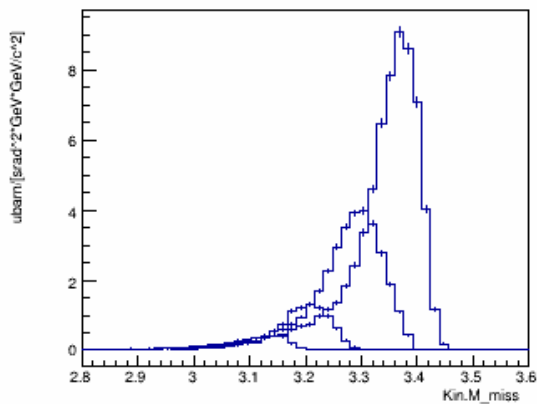
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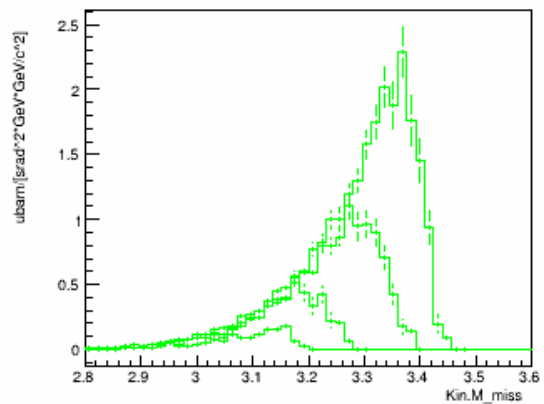
M\_miss\_w\_pID\_N\_CT\_xcut\_greater\_than\_1.5\_kin\_12



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



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



Kin 12: M\_miss cross section per each Xcut