

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 = $1e24$ cm²
 electron charge : $1.6e-19$ C/electron

	Parameter	Unit	Kin 3 value
1.	Target density d_loss at 4 uA = 1.2%	g/cm ³	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 ² 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

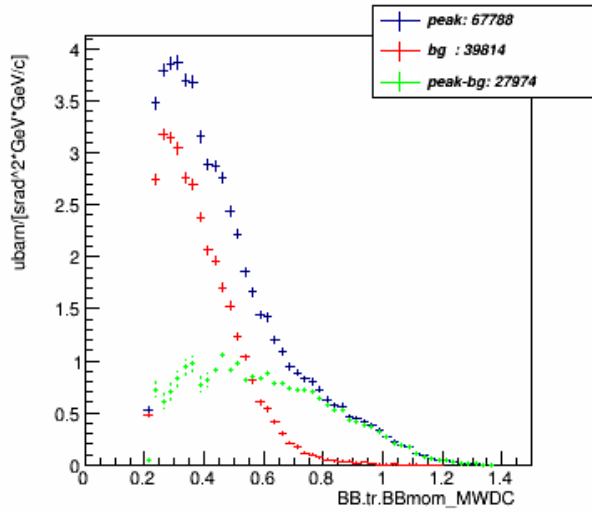
$$\text{Target_area_number_density} = (\text{Target density}) * (\text{target Length}) * (N_A) / (A_z)$$

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

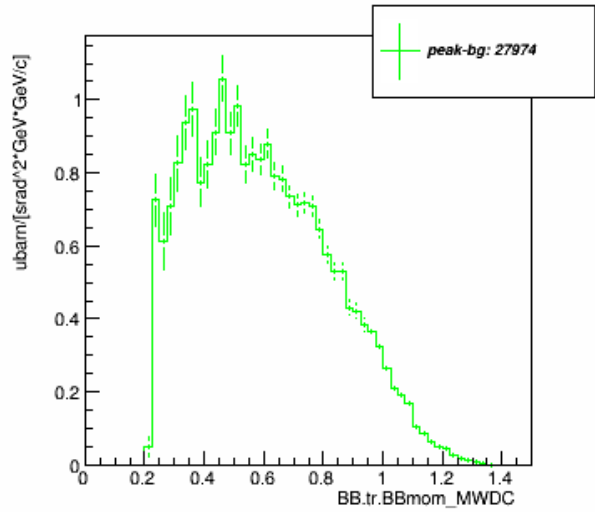
$$N_{\text{electron_Target_area_number_density}} = (\text{Target density}) * (\text{target Length}) * (N_A) / (A_z) * (\text{Total charge}) / (\text{Electron charge})$$

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

p_MWDC_w_pID_N_CT_no_xcut_kin_3

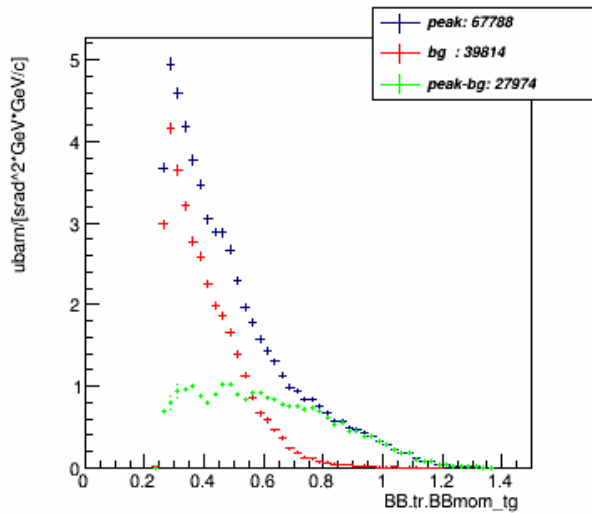


p_MWDC_w_pID_N_CT_sub_bg_kin_3

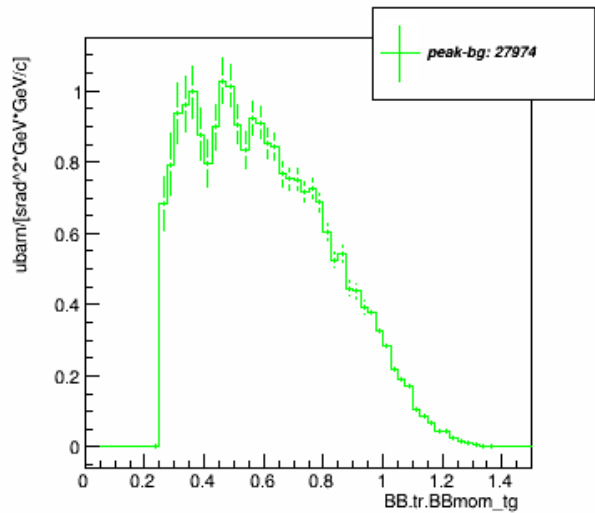


Kin3: p_MWDC cross section

p_tg_w_pID_N_CT_no_xcut_kin_3



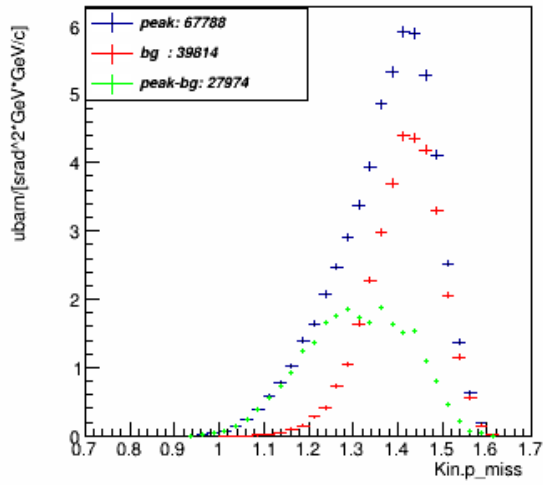
p_tg_w_pID_N_CT_sub_bg_kin_3



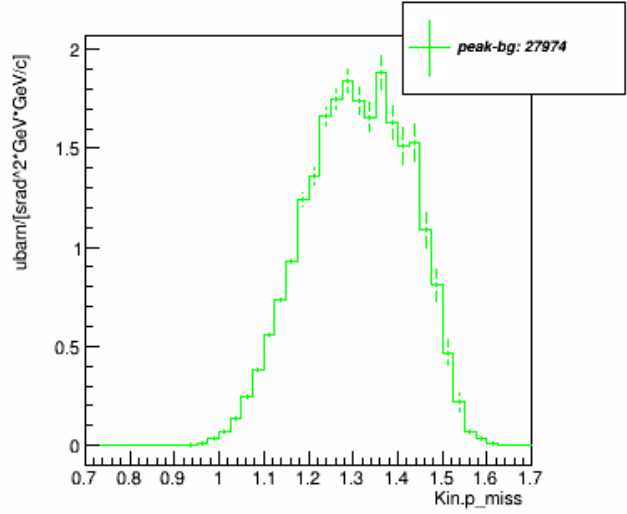
Kin3: p_target cross section

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

p_miss_w_pID_N_CT_no_xcut_kin_3

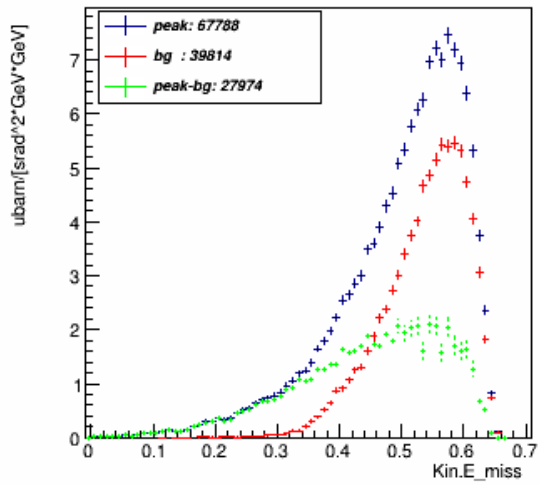


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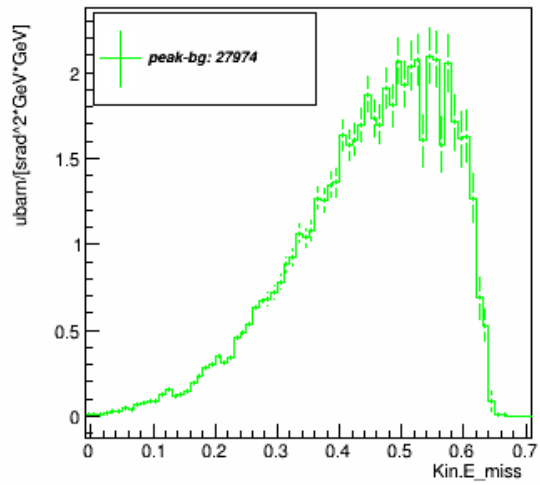


Kin3: P_miss cross section

E_miss_w_pID_N_CT_no_xcut_kin_3

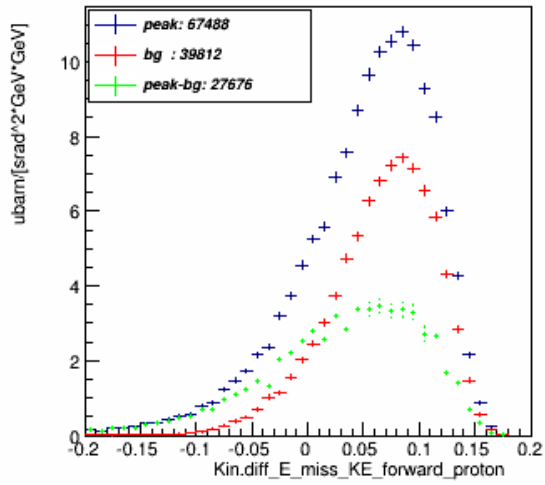


E_miss_w_pID_N_CT_sub_bg_kin_3

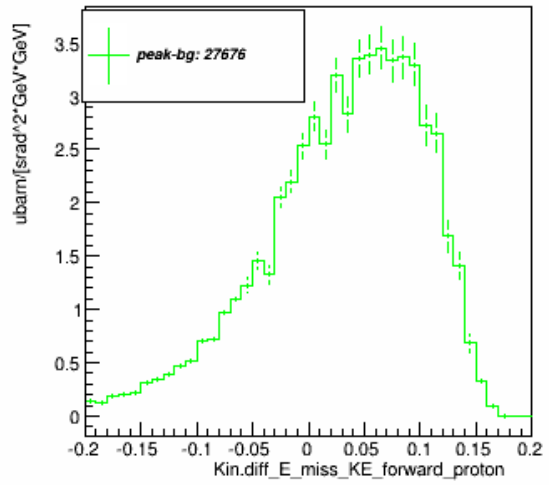


Kin3: E_miss cross section
 $E_{\text{miss}} = w - (T_{\text{recoil}}) - (T_{\text{proton}})$

E_miss_forward_w_pID_N_CT_no_xcut_kin_3



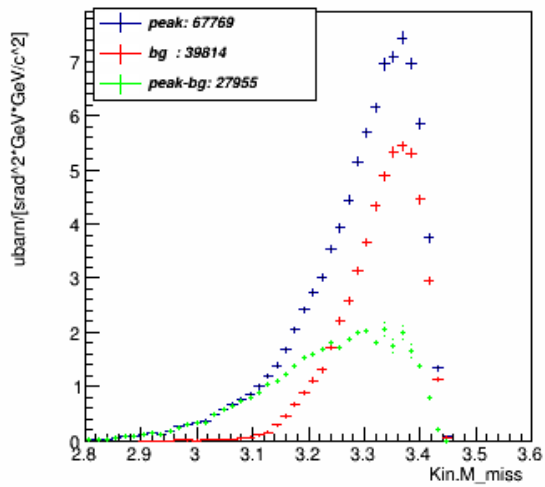
E_miss_forward_w_pID_N_CT_sub_bg_kin_3



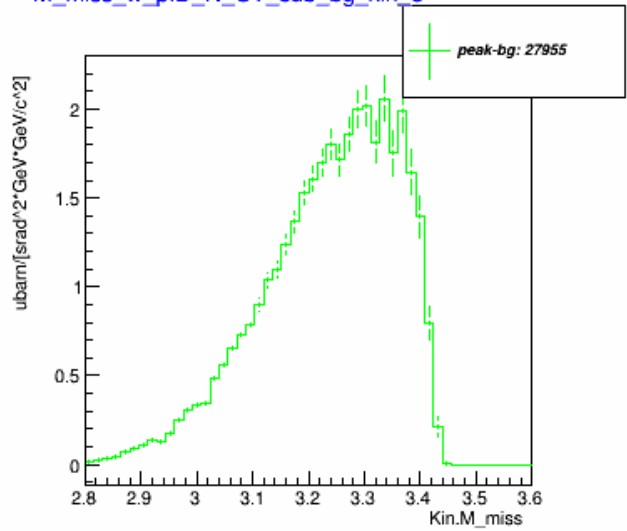
Kin3: E_miss_forward cross section

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

M_miss_w_pID_N_CT_no_xcut_kin_3



M_miss_w_pID_N_CT_sub_bg_kin_3

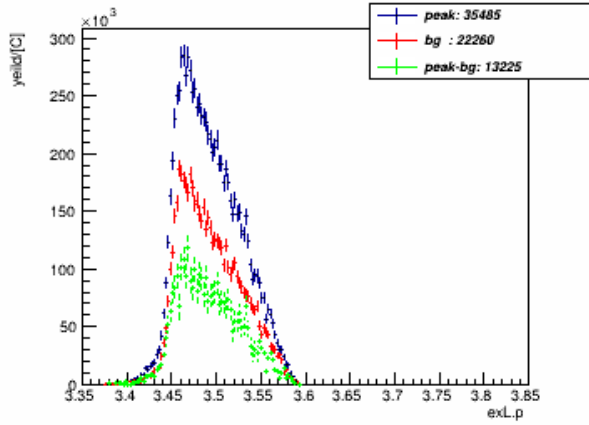


Kin3: M_miss cross section

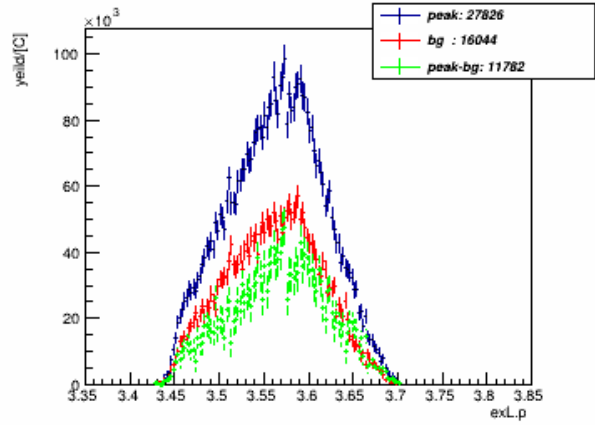
The Effect of Xcut on the Energy range in electron

	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

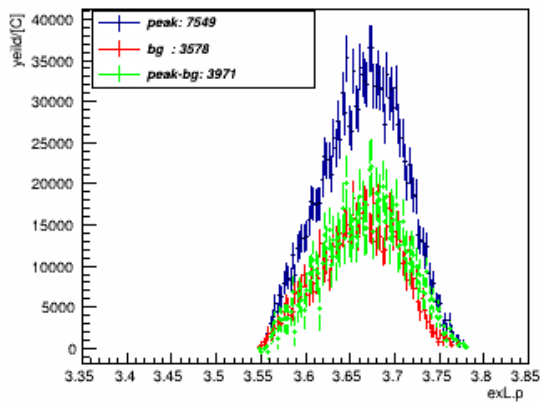
Ee_w_pID_N_CT_xcut_less_than_1.1_kin_3



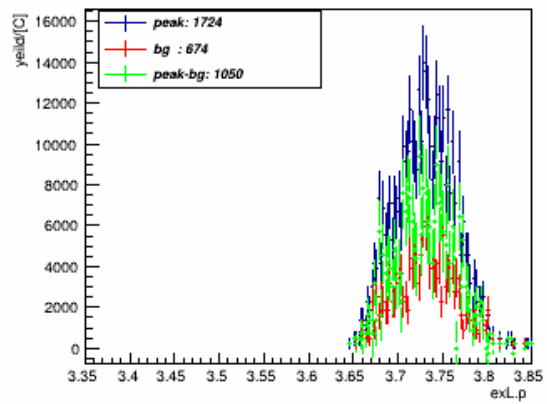
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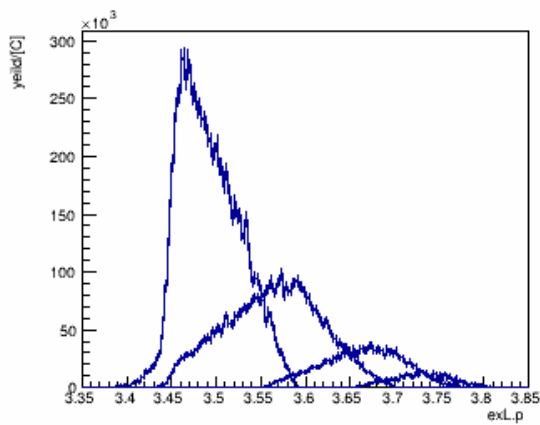
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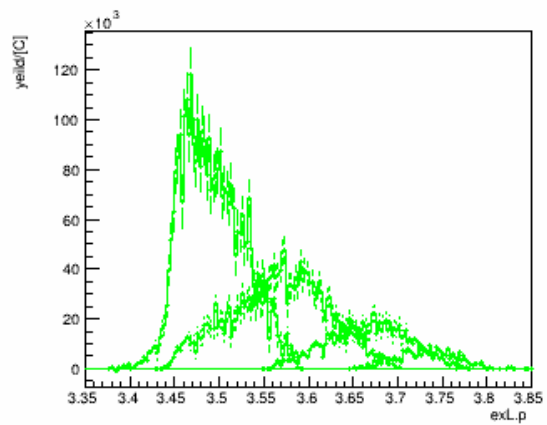
Ee_w_pID_N_CT_xcut_greater_than_1.5_kin_3



Ee_w_pID_N_CT_xcut_less_than_1.1_kin_3

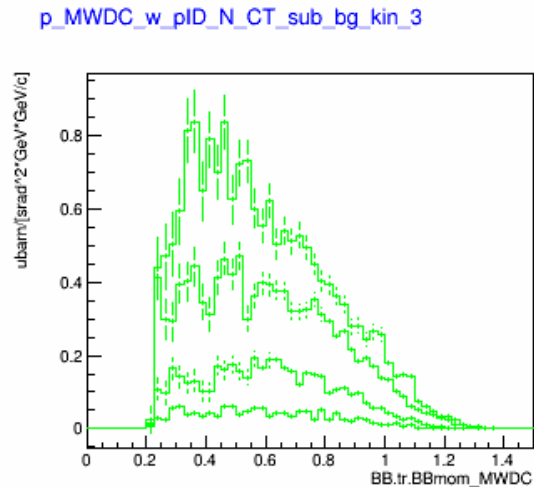
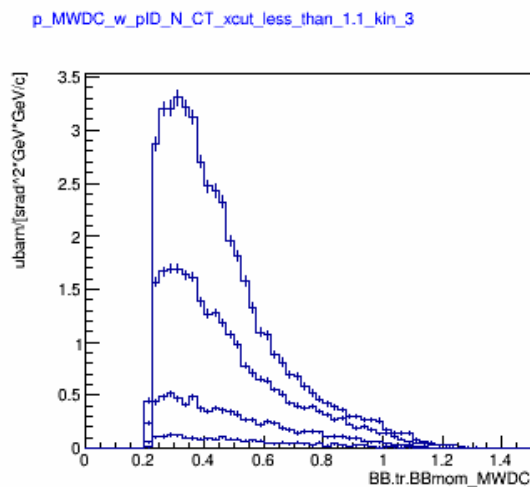
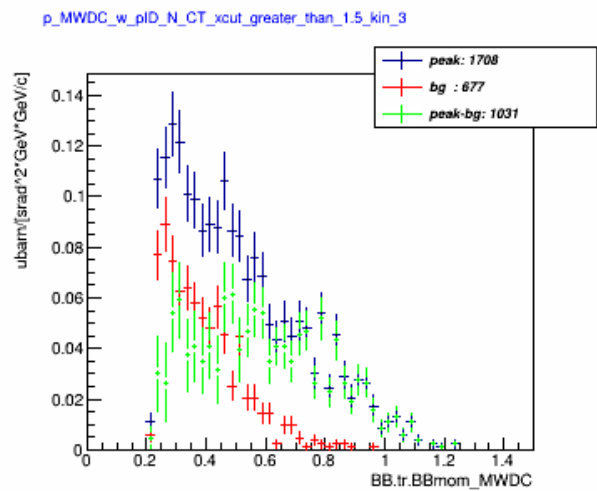
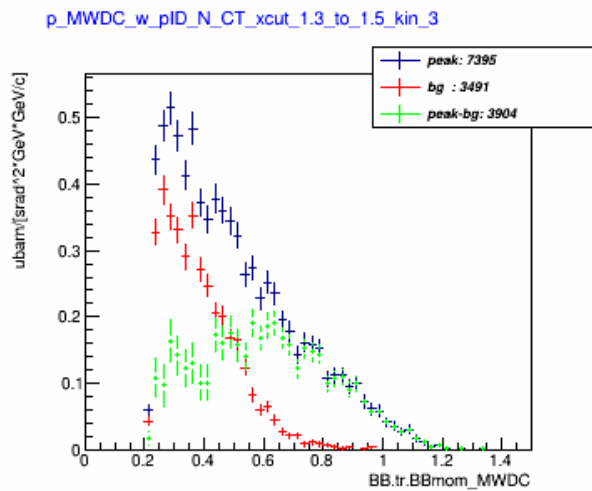
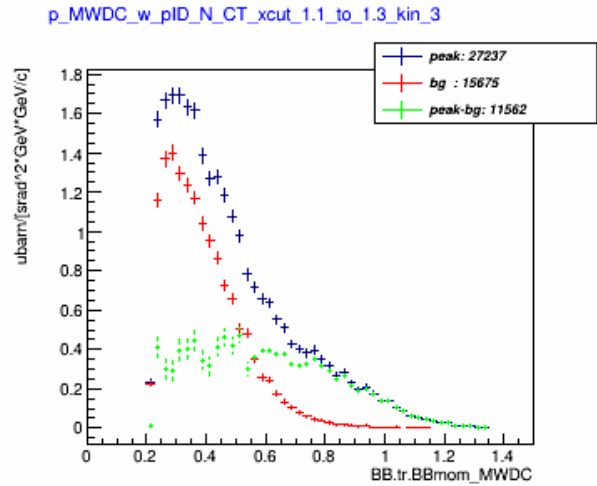
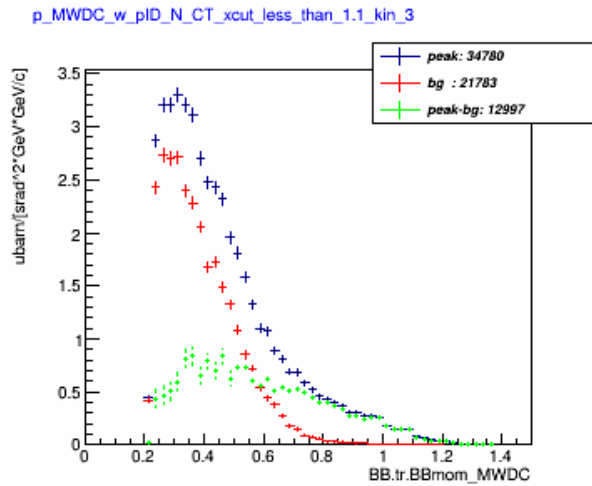


Ee_w_pID_N_CT_sub_bg_kin_3



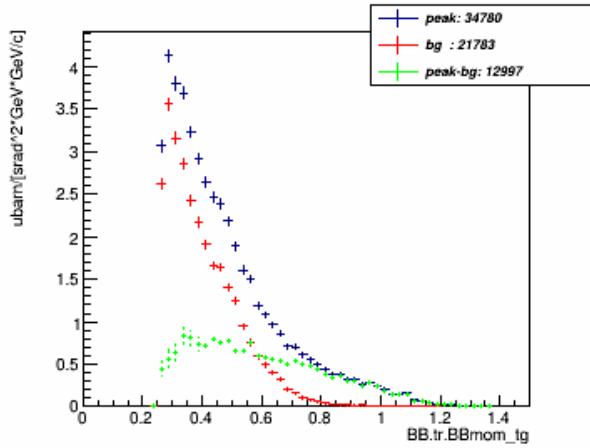
Kin12: Energy electron with varius Xcut

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

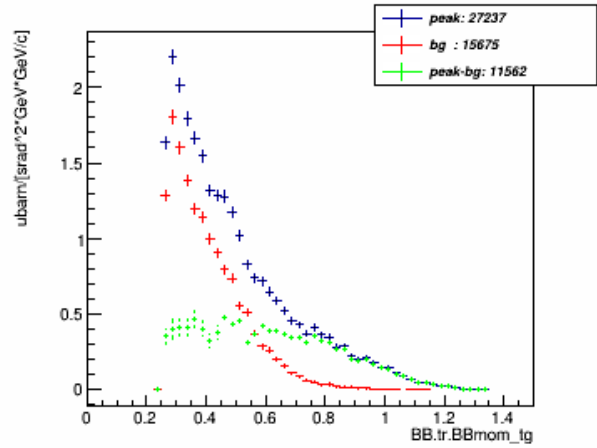


Kin 3: p_MWDC cross section per each Xcut

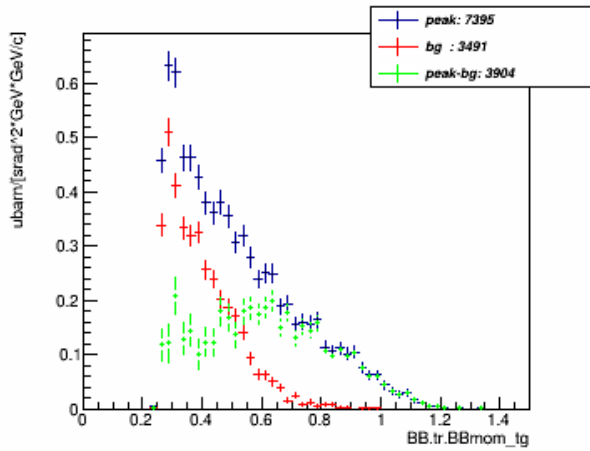
p_tg_w_pID_N_CT_xcut_less_than_1.1_kin_3



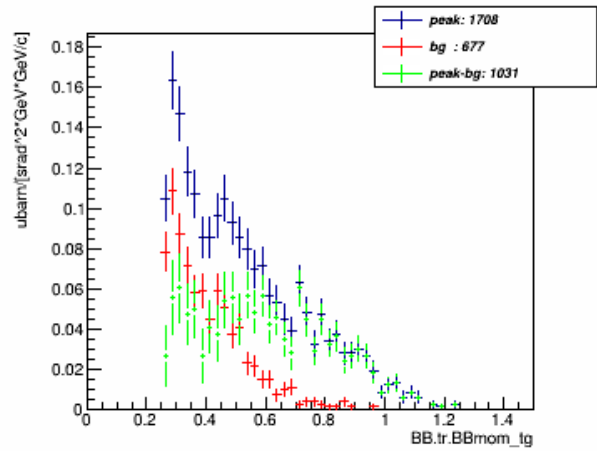
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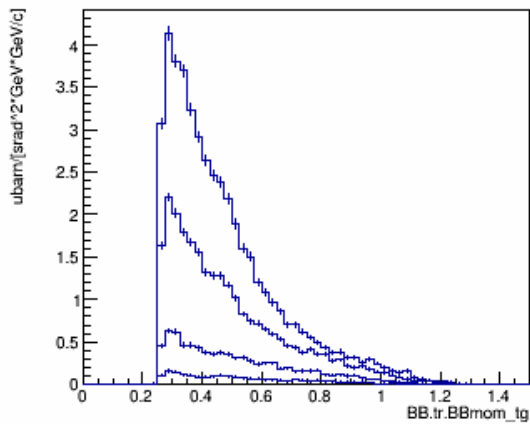
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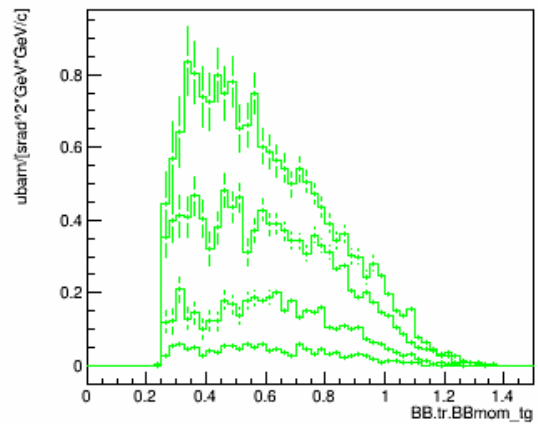
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p_tg_w_pID_N_CT_xcut_less_than_1.1_kin_3

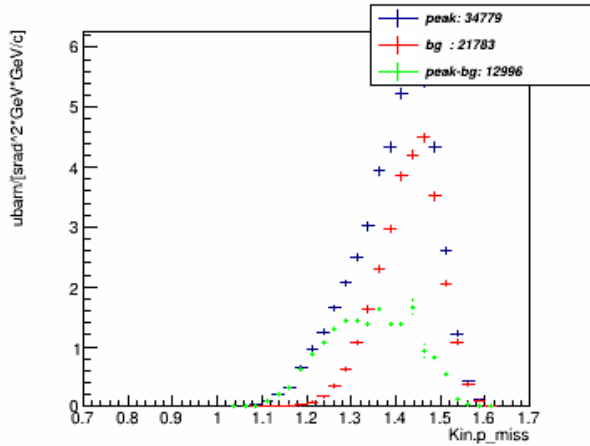


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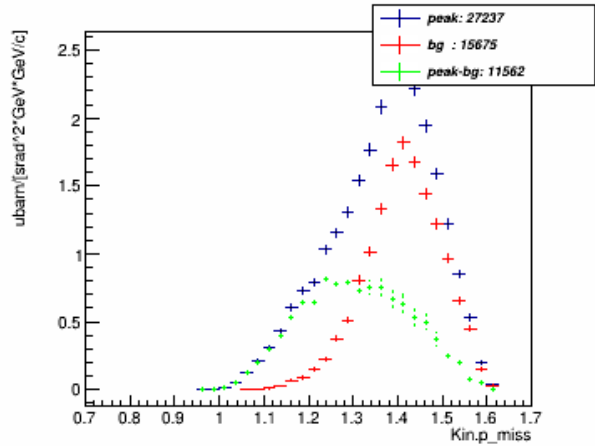


Kin 3: p_target cross section per each Xcut

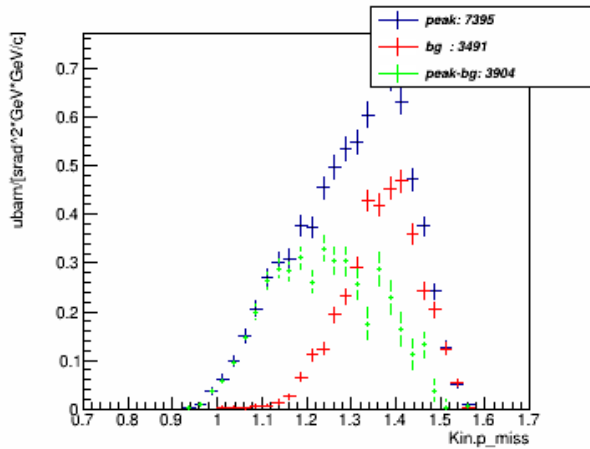
p_miss_w_pID_N_CT_xcut_less_than_1.1_kin_3



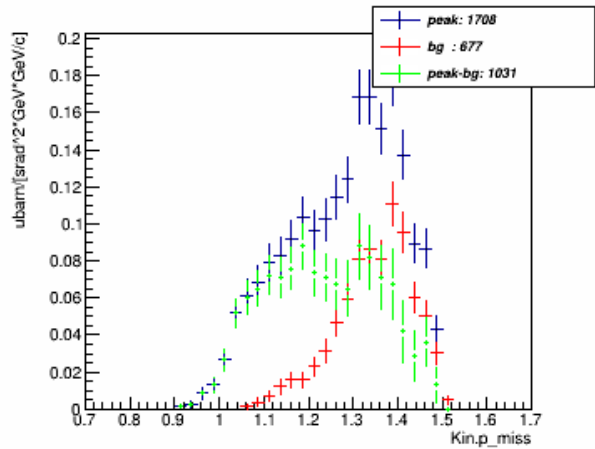
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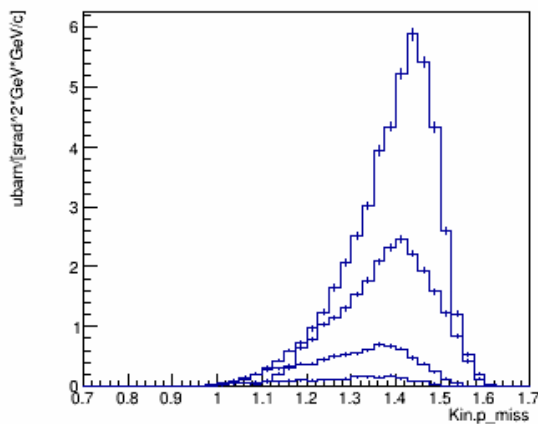
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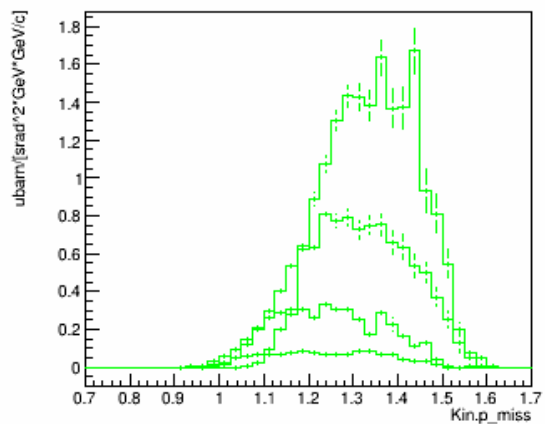
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p_miss_w_pID_N_CT_xcut_less_than_1.1_kin_3

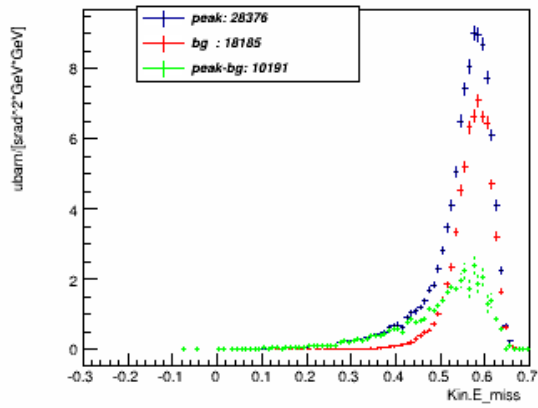


p_miss_w_pID_N_CT_sub_bg_kin_3

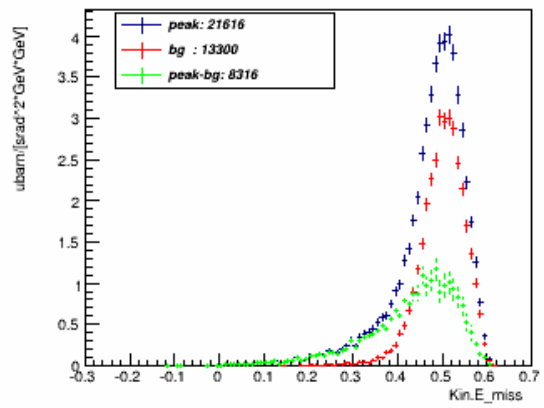


Kin 3: P_miss cross section per each Xcut

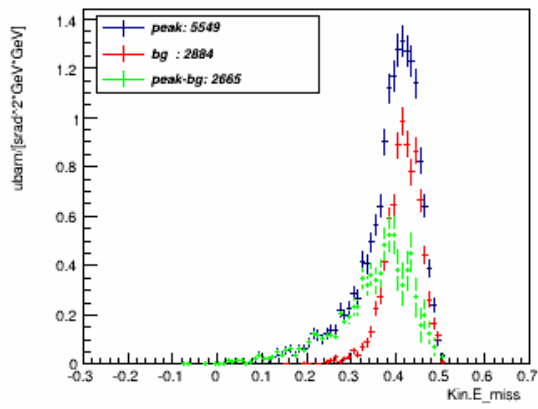
E_miss_w_pID_N_CT_xcut_less_than_1.1_kin_12



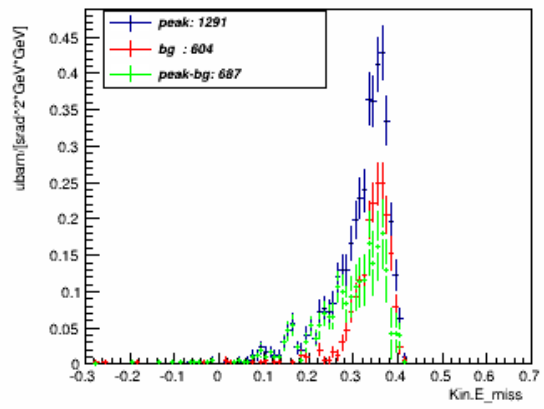
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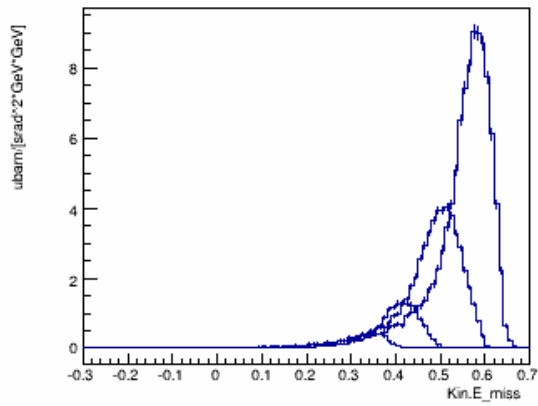
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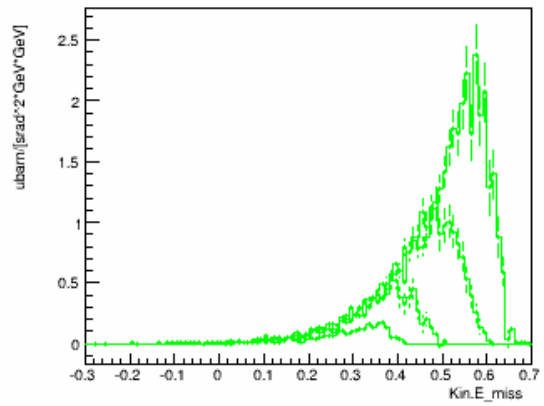
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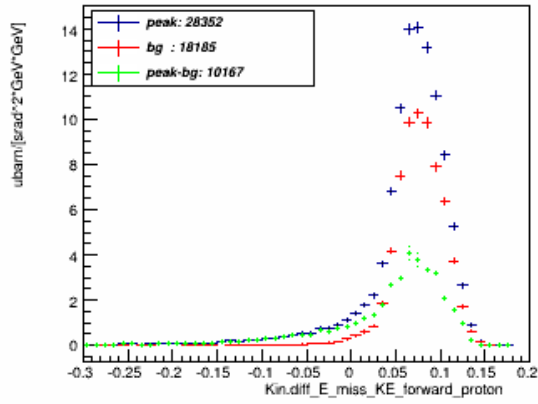


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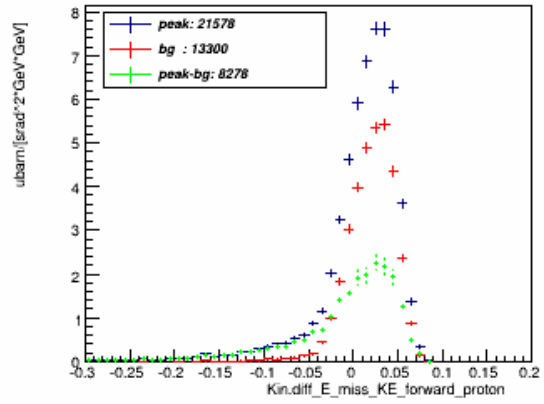


Kin 3: E_miss cross section per each Xcut

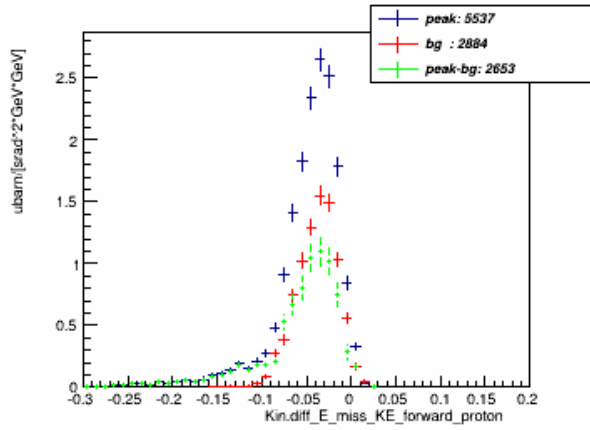
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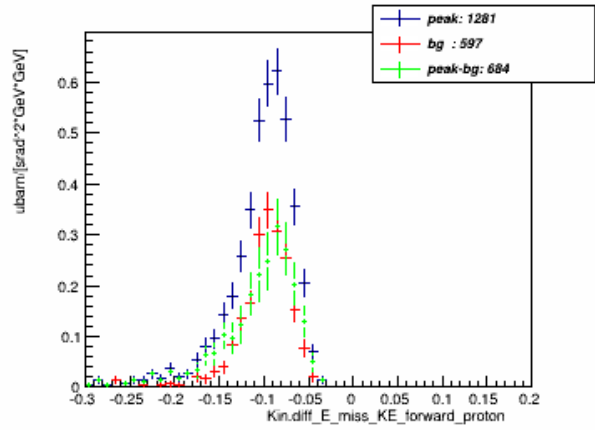
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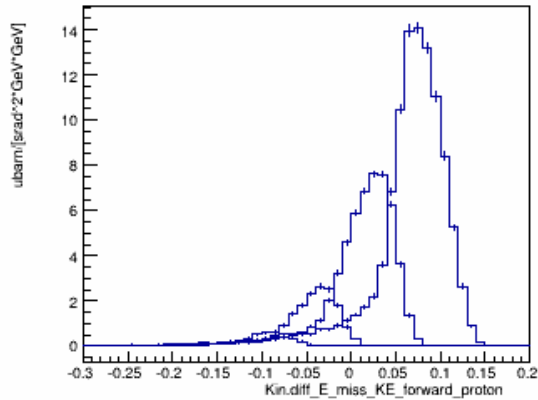
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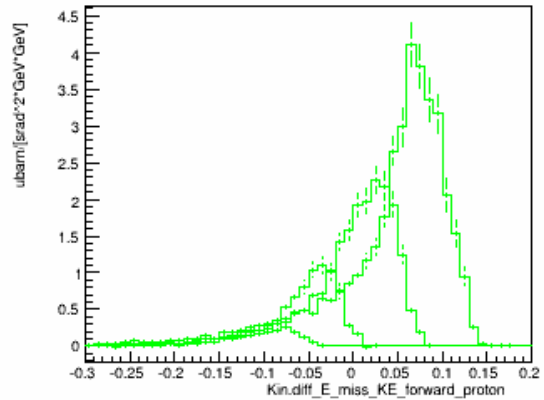
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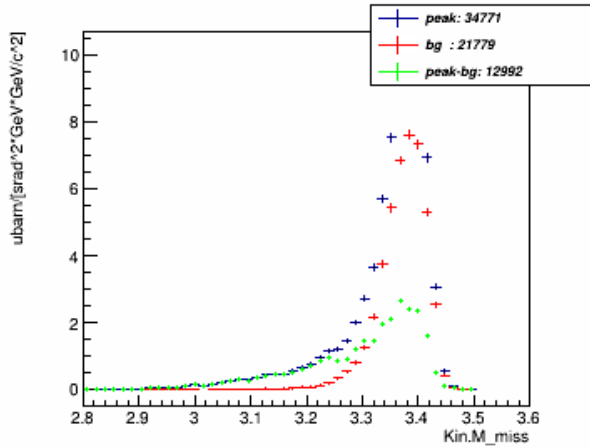


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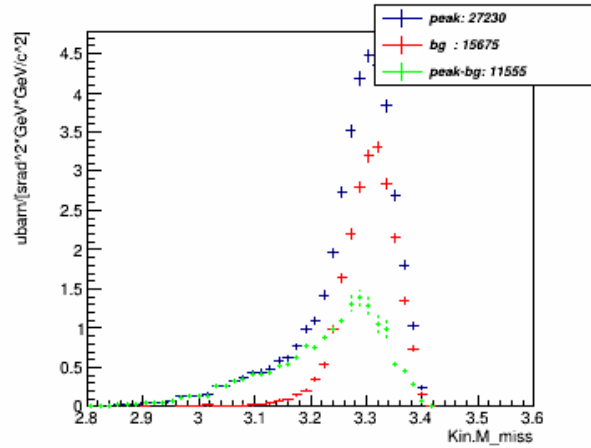


Kin 3: E_miss forward cross section per each Xcut

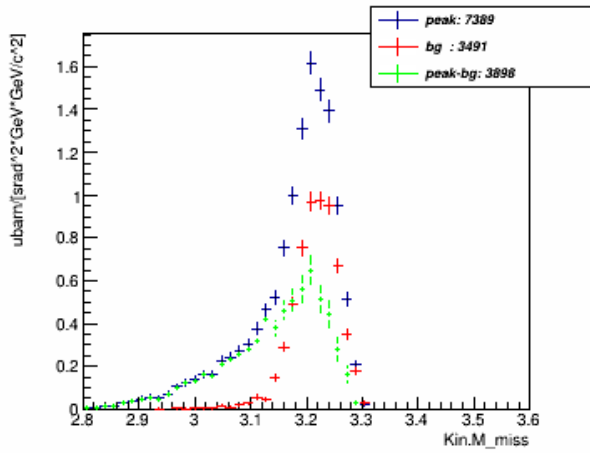
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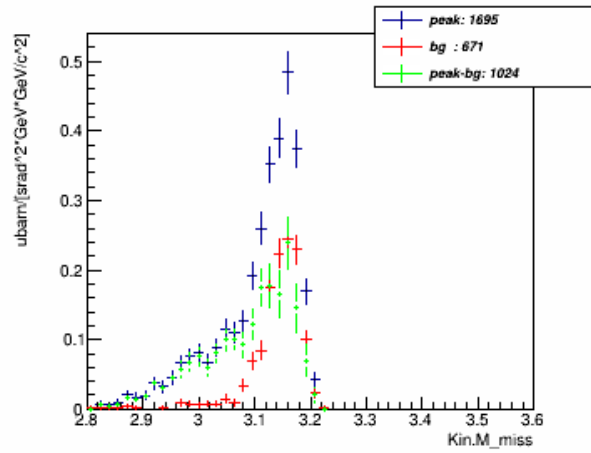
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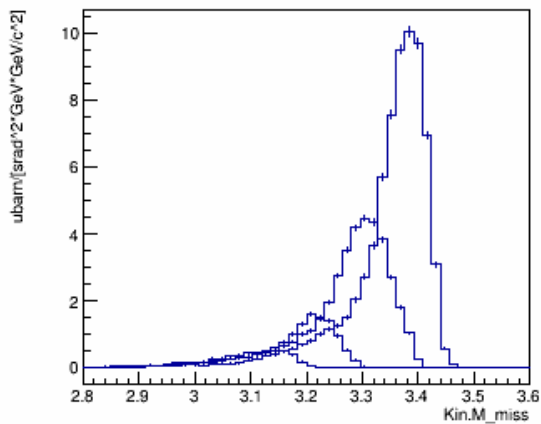
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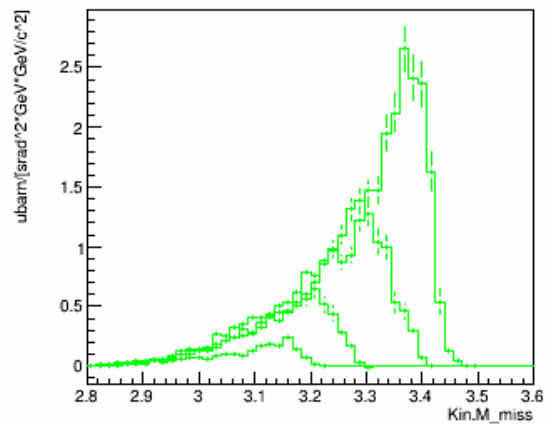
M_miss_w_pID_N_CT_xcut_greater_than_1.5_kin_3



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_miss cross section per each Xcut