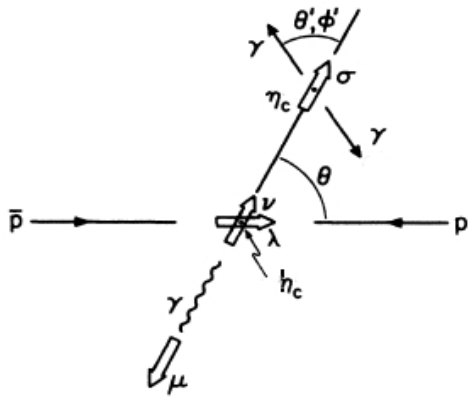
Status of the

$h_c \to \eta_c + \gamma$

benchmark channel

D.Melnychuk, SINS Warsaw, VRVS meeting, 18.06.2007

Description of the studied channel



$$p\bar{p} \to h_c \to \eta_c + \gamma, \qquad E_\gamma = 503\ MeV$$

$$\eta_c \to \gamma + \gamma, \quad BR = 0.43 \cdot 10^{-3}$$

$$E_{CM} = 3526\ MeV,\ p_z = 5609\ MeV$$

Cross-sections:

$$\sigma_{p\bar{p} \to h_c \to \eta_c + \gamma} = 16.8 \pm 2.7\ pb\ (E835)$$

$$\sigma_{\pi^0\pi^0} = 26\ nb\ at\ h_c\ energy$$

$$\sigma_{\pi^0\gamma} = 1\ nb\ at\ h_c\ energy$$

$$\sigma_{\pi^0\pi^0} : \sigma_{\pi^0\gamma} : \sigma_{h_c} = 4 \cdot 10^6 : 0.15 \cdot 10^6 : 1$$

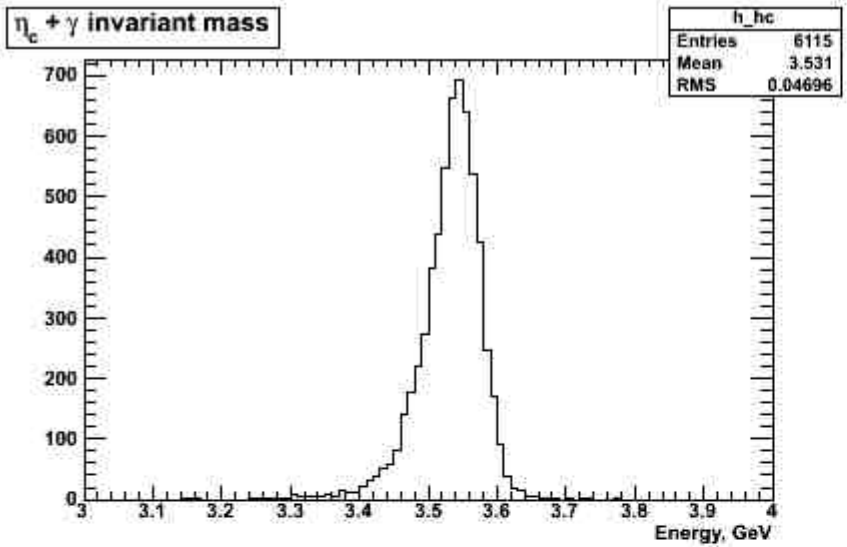
Event selection

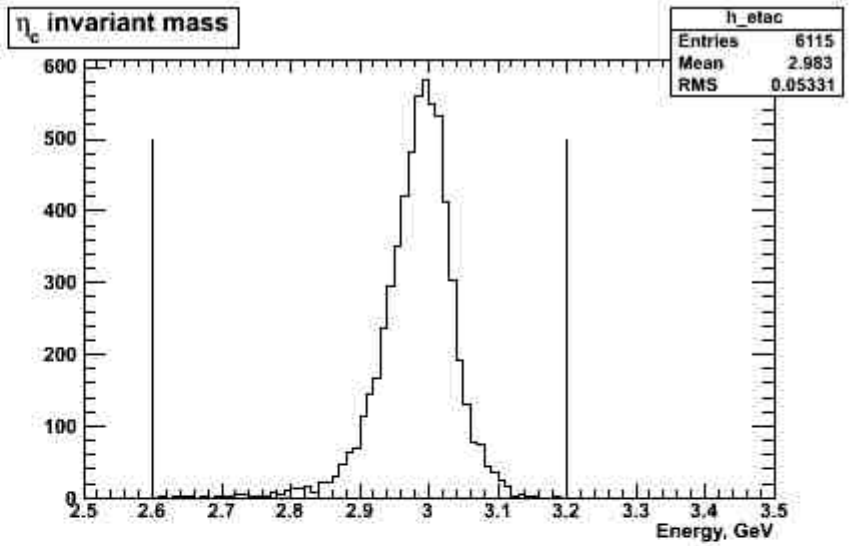
- 10k events ppbar->eta_c +gamma (E_{CMS}=3526 MeV)
- background
  - 10 M ppbar-> pi0+pi0
  - 10 M ppbar-> pi0+gamma

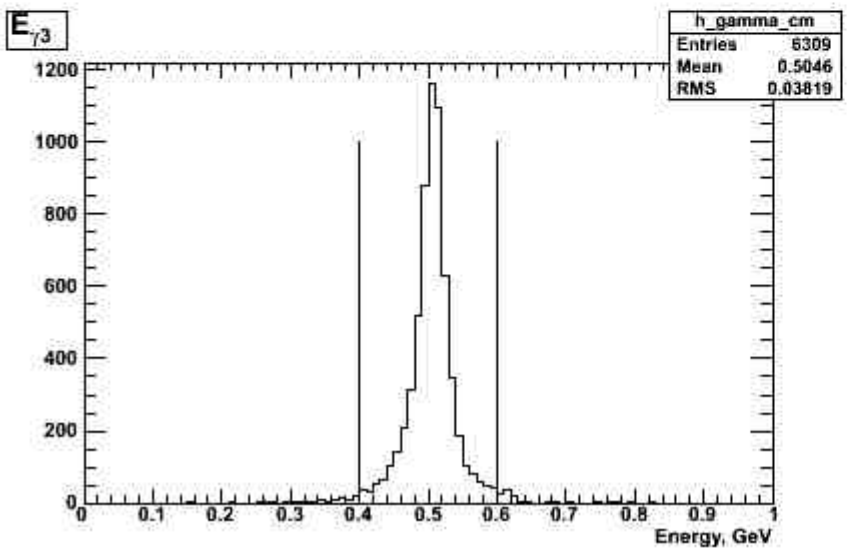
Selection cuts:

1. Only 3 neutrals in event
2. No pi0 signal
3. eta_c mass within [2.6:3.2] GeV
4. difference to beam momentum:
   $|p(\text{eta\_c+gamma})_z - p_{b,z}| < 0.2$ GeV,
   $|p(\text{eta\_c+gamma})_{x,y|} < 0.2$ GeV
5. E_gamma3 within [0.4:0.6] GeV

$h_c \to \eta_c + \gamma$ channel

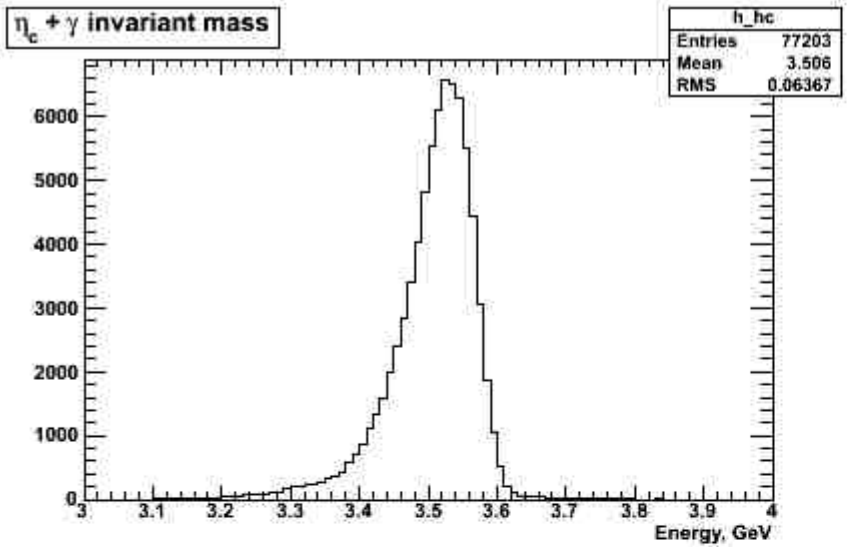


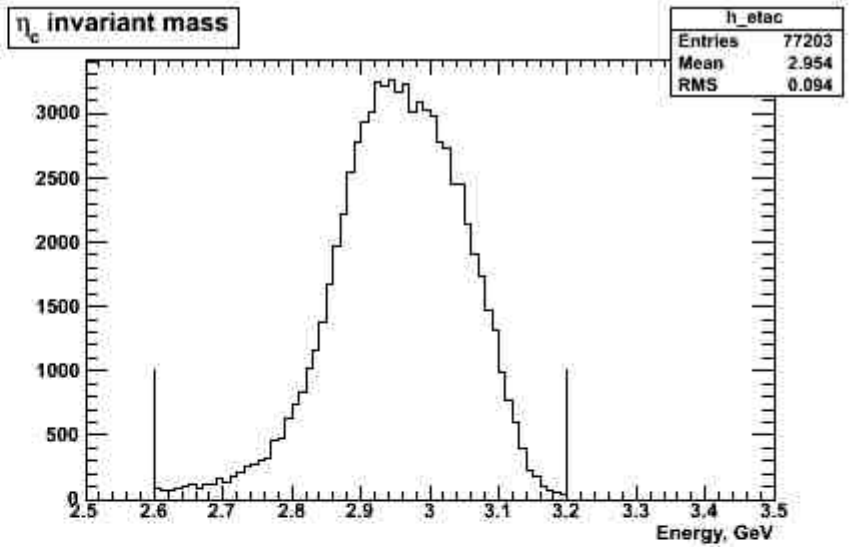


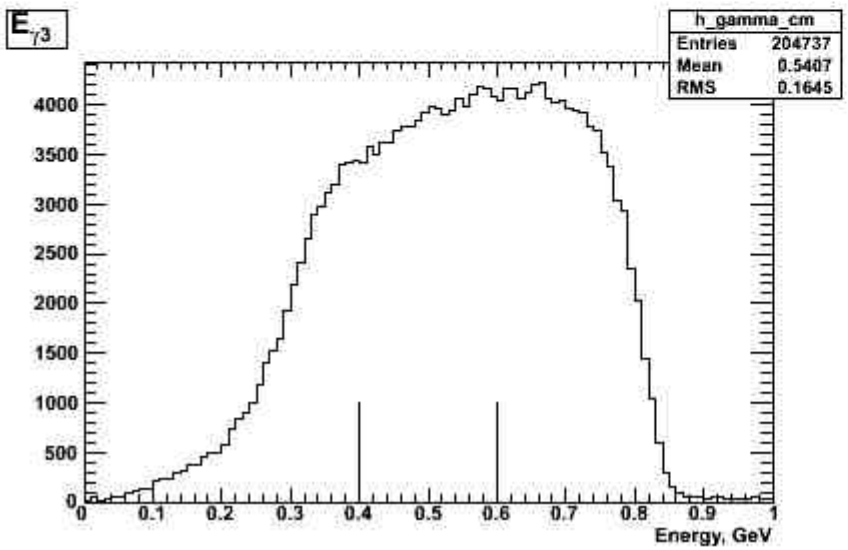


cut	efficiency
3 neutral	70.5 %
no pi0	70.1 %
eta_c mass	67.0 %
beam momentum	63.1 %
E_gamma 3	61.1 %

$\pi^0\pi^0$ channel

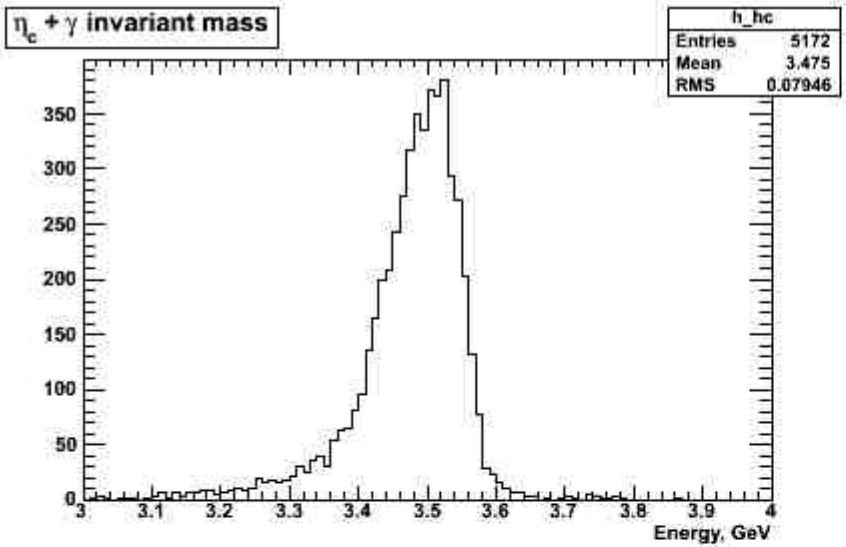


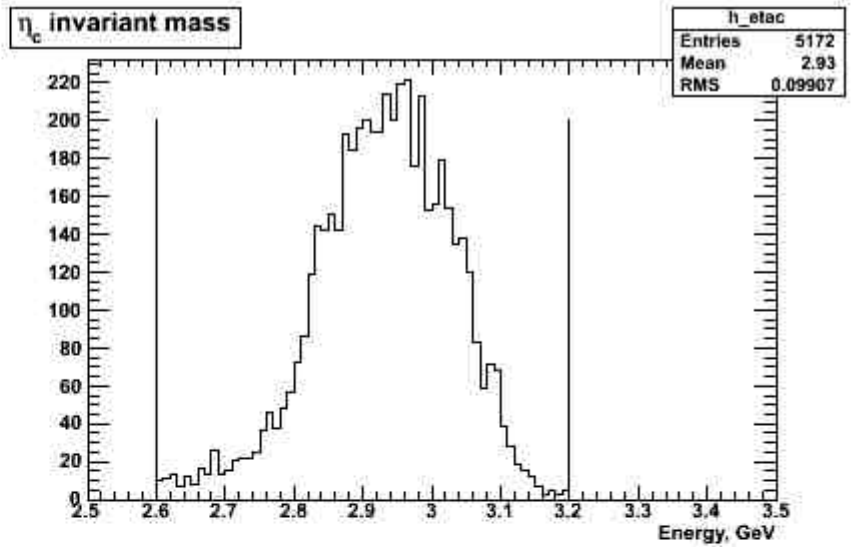


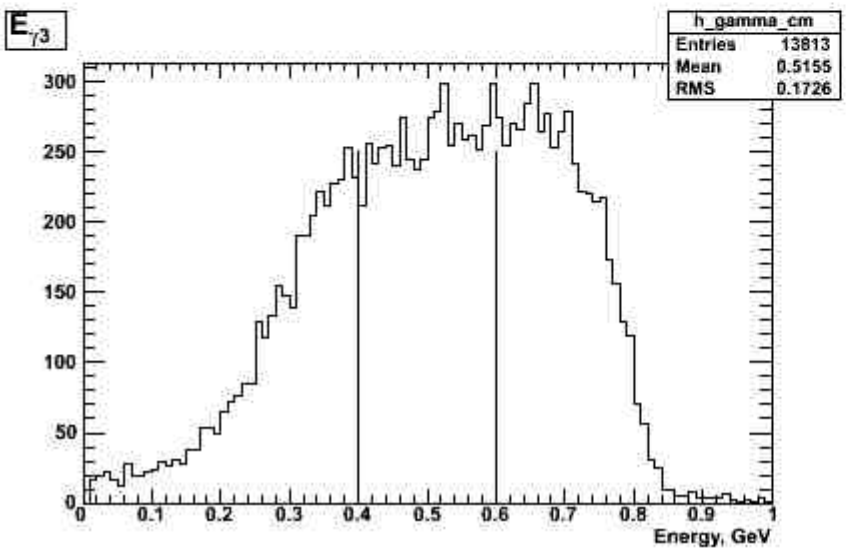


cut	efficiency
3 neutral	69.9%
no pi0	5.8%
eta_c mass	2.7 %
beam momentum	2.0 %
E_gamma 3	7.7 e-3

$\pi^0\gamma$ channel





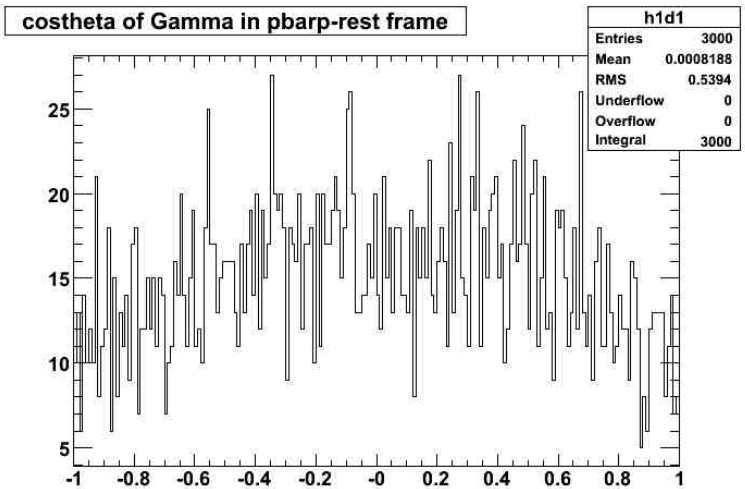


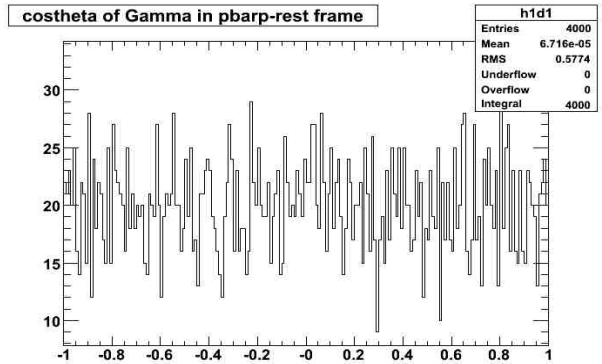
cut	efficiency
3 neutral	12.7%
no pi0	0.9 %
eta_c mass	2.9 e-3
beam momentum	1.3 e-3
E_gamma 3	5.0 e-4

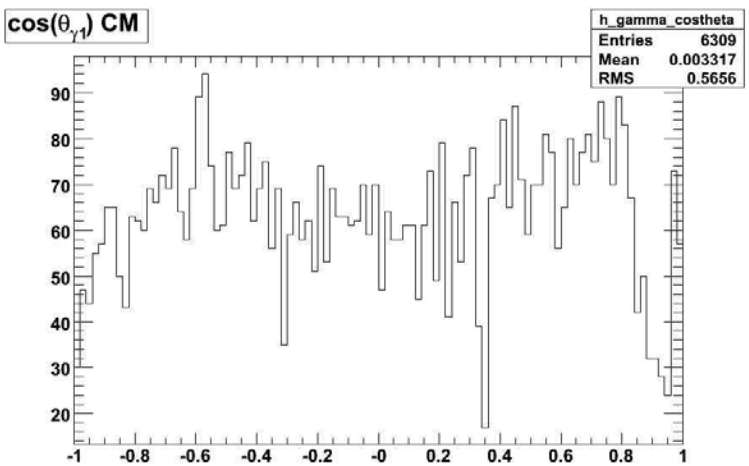
$\cos(\theta_\gamma^*)$

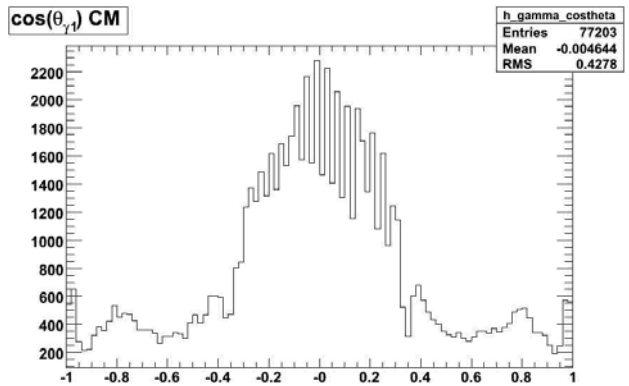
$\pi^0\pi^0$

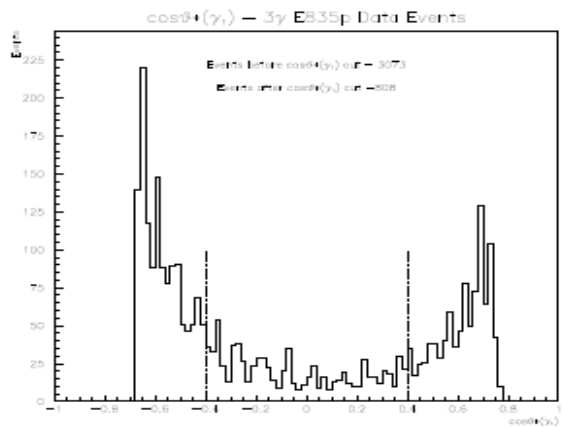
$h_c \rightarrow \eta_c + \gamma$











Summary

1. Signal to background ratio at the moment is 1:125:51000 (h_c:pi0+gamma:pi0+pi0)
2. Problem with cos(theta) should be resolved
3. Additional background studies with DPM generator should be done