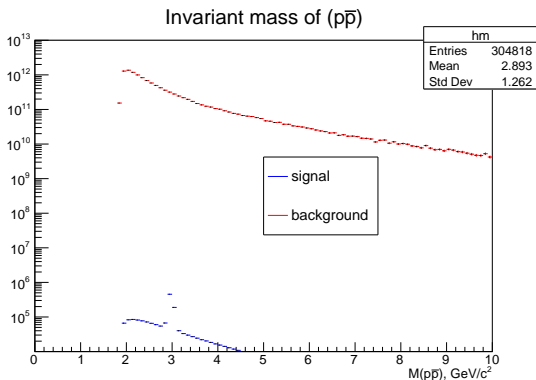# Reconstruction of $\eta_c \rightarrow p\bar{p}$ at SPD

Nikita Trunov
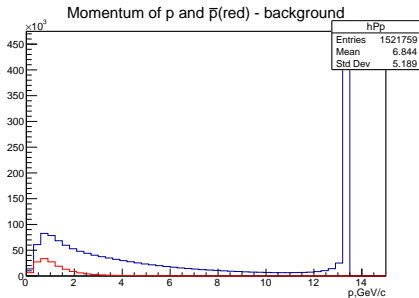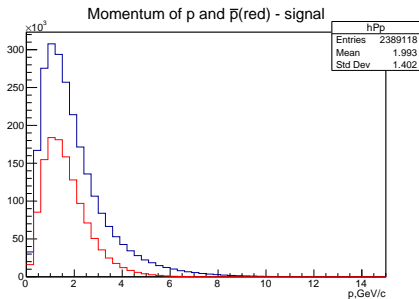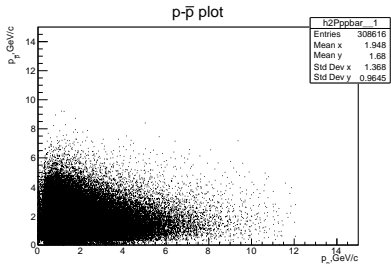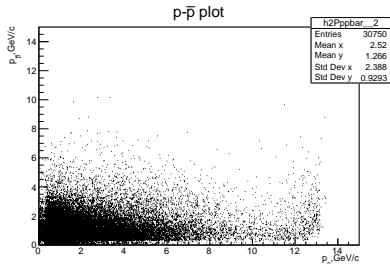
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31.03.2021, SPD meeting

- $p - p$ collision with $\sqrt{s} = 27\,GeV$
- $\sigma_{\eta_c \to p\bar{p}} = 400\,nb$
- $B = 1.45 * 10^{-3}$
- $\sigma_{MB} = 40\,mb$
- 5 orders of magnitude difference
- Can we reduce the background by imposing some cut(s)?

Momentum of p and p̄(red) - signal

Momentum of p and p̄(red) - background

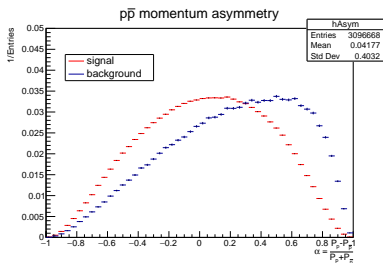Nikita Trunov   Reconstruction of $\eta_c \to p\bar{p}$ at SPD
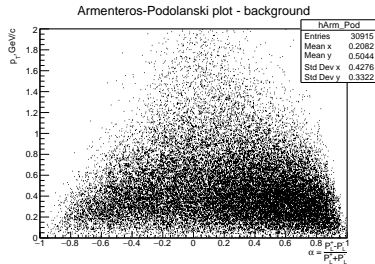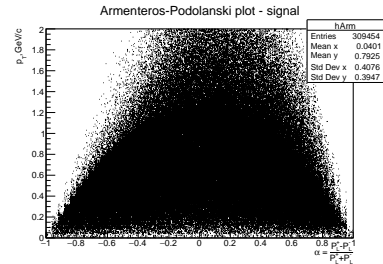
signal   background

1. In principle, the next cut suggests itself: $p_p < 9 GeV/c$
2. $\approx 1\%$ signal loss due to the cut

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Second option

Armenteros-Podolanski plot - signal

hArm	
Entries	309454
Mean x	0.0401
Mean y	0.7925
Std Dev x	0.4076
Std Dev y	0.3947

$\alpha = \dfrac{P_L^+ - P_L^-}{P_L^+ + P_L^-}$

Armenteros-Podolanski plot - background

hArm_Pod	
Entries	30915
Mean x	0.2082
Mean y	0.5044
Std Dev x	0.4276
Std Dev y	0.3322

$\alpha = \dfrac{P_L^+ - P_L^-}{P_L^+ + P_L^-}$

$p\bar{p}$ momentum asymmetry

hAsym	
Entries	3096668
Mean	0.04177
Std Dev	0.4032

— signal
— background
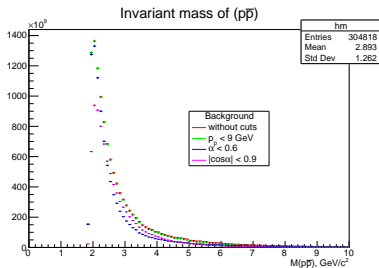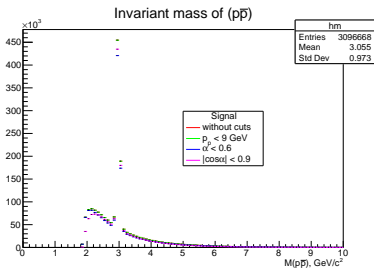
$\alpha = \dfrac{P_p - P_{\bar{p}}}{P_p + P_{\bar{p}}}$

1. The second obvious way to reduce the background is: $\alpha < 0.6$
2. $\approx 7\%$ signal loss due to the cut

Third option

cosine of the opening angle of p$\bar{p}$

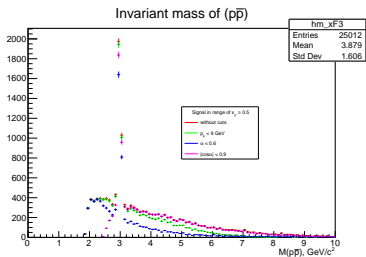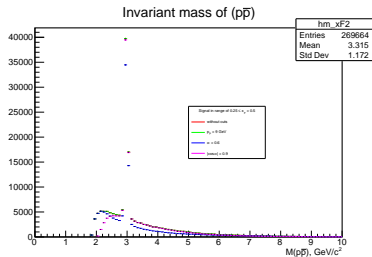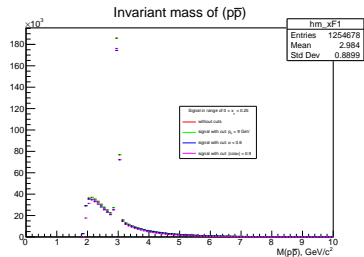| hCos	
Entries	3096668
Mean	−0.04478
Std Dev	0.5879

1. The third cut: $|\cos(\alpha)| < 0.9$
2. $\approx 5\%$ signal loss due to the cut

Invariant mass of (pp̄)

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signal

Invariant mass of (p p̄)

Invariant mass of (p p̄)

Invariant mass of (p p̄)

background

Summary

1. We cannot distinguish the signal among the contamination background (under such conditions)
2. Probably, we should impose multiple cuts
3. Anyway, the analysis should be continued