Studying background subtraction methods

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Hybrid method

1. Subtract the combinatorics by using mixed event normalized in the minimum-correlation region
2. Subtract the correlated bckg by using like-sign from the same event

<u>Evaluate the procedure</u>:

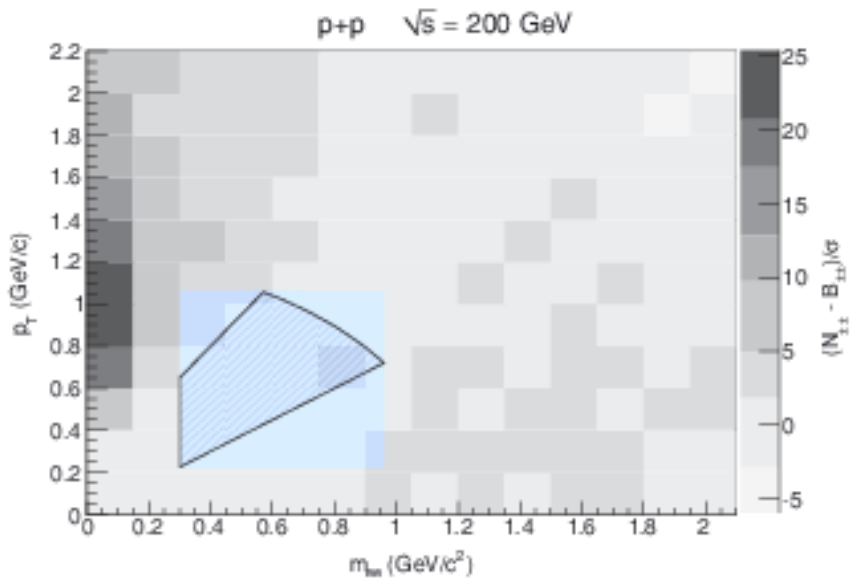
- Undersubtract in the first step to check the robustness of the procedure
- Evaluate the procedure with HIJING
- Remove jets by using opening angle cut and compare with these results

Hybrid method

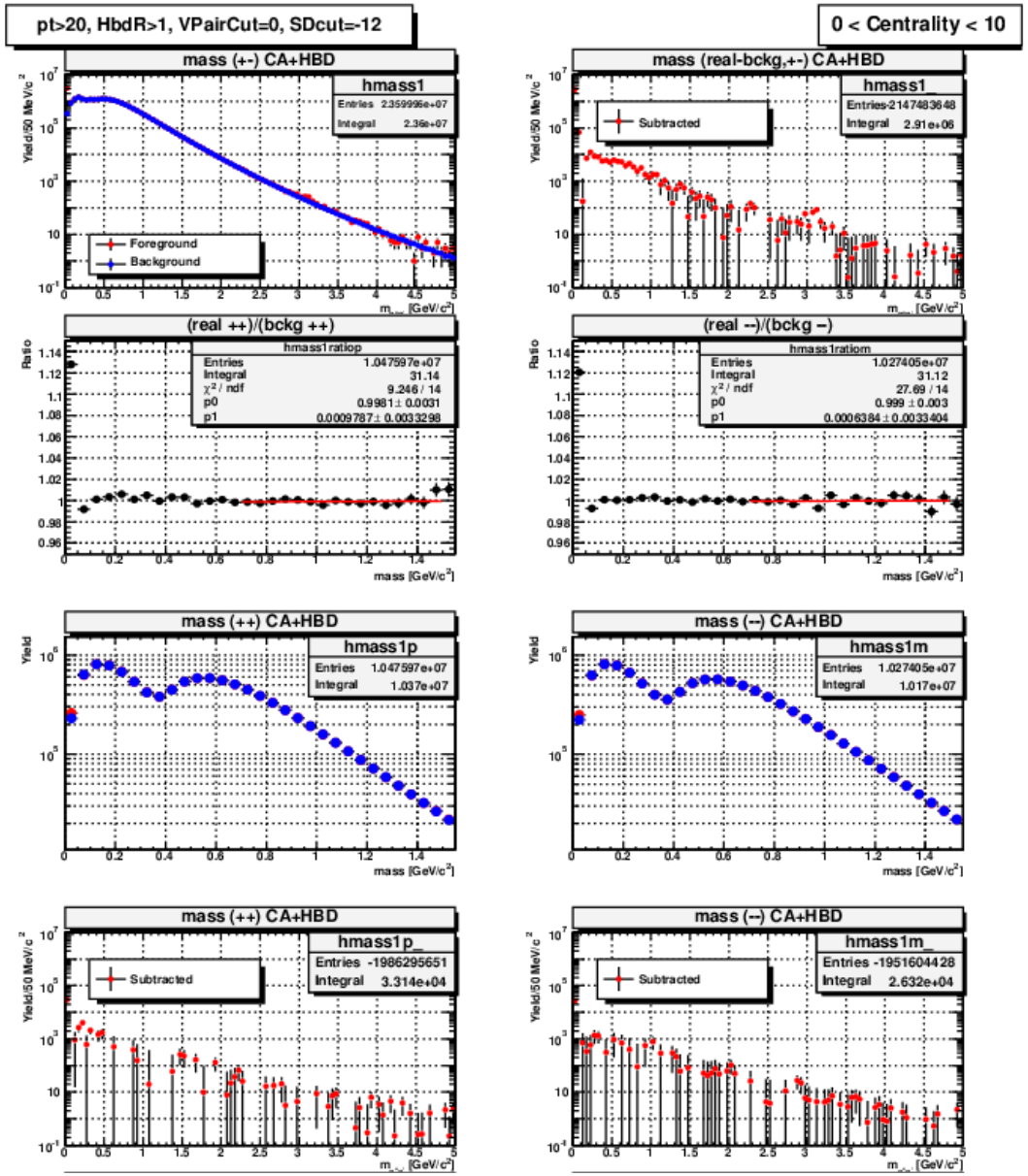
- Use the mixed background to estimate the combinatorics
- For normalization of the mixed background determine the region containing minumum correlations
- Using the region from ppg88:

  (derived for p+p)

$$
\begin{aligned}
m_{ee} &> 0.3\ \mathrm{GeV}/c^2 \\
m_T &< 1.2\ \mathrm{GeV}/c^2 \\
p_T/c - 1.5 m_{ee} &\leqslant 0.2\ \mathrm{GeV}/c^2 \\
p_T/c - 0.75 m_{ee} &\geqslant 0\ \mathrm{GeV}/c^2,
\end{aligned}
$$



Hybrid method-subtract the mixed background



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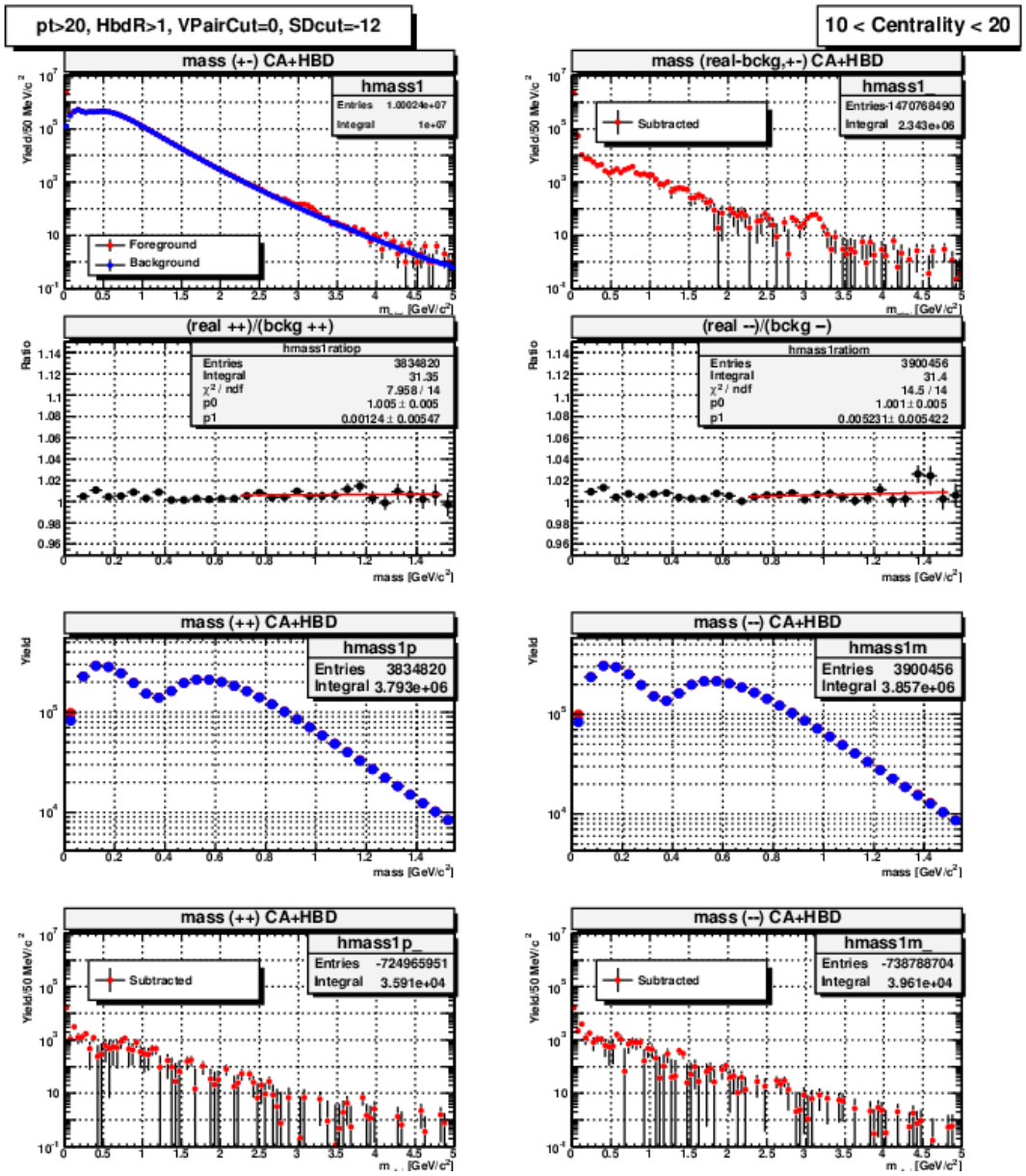
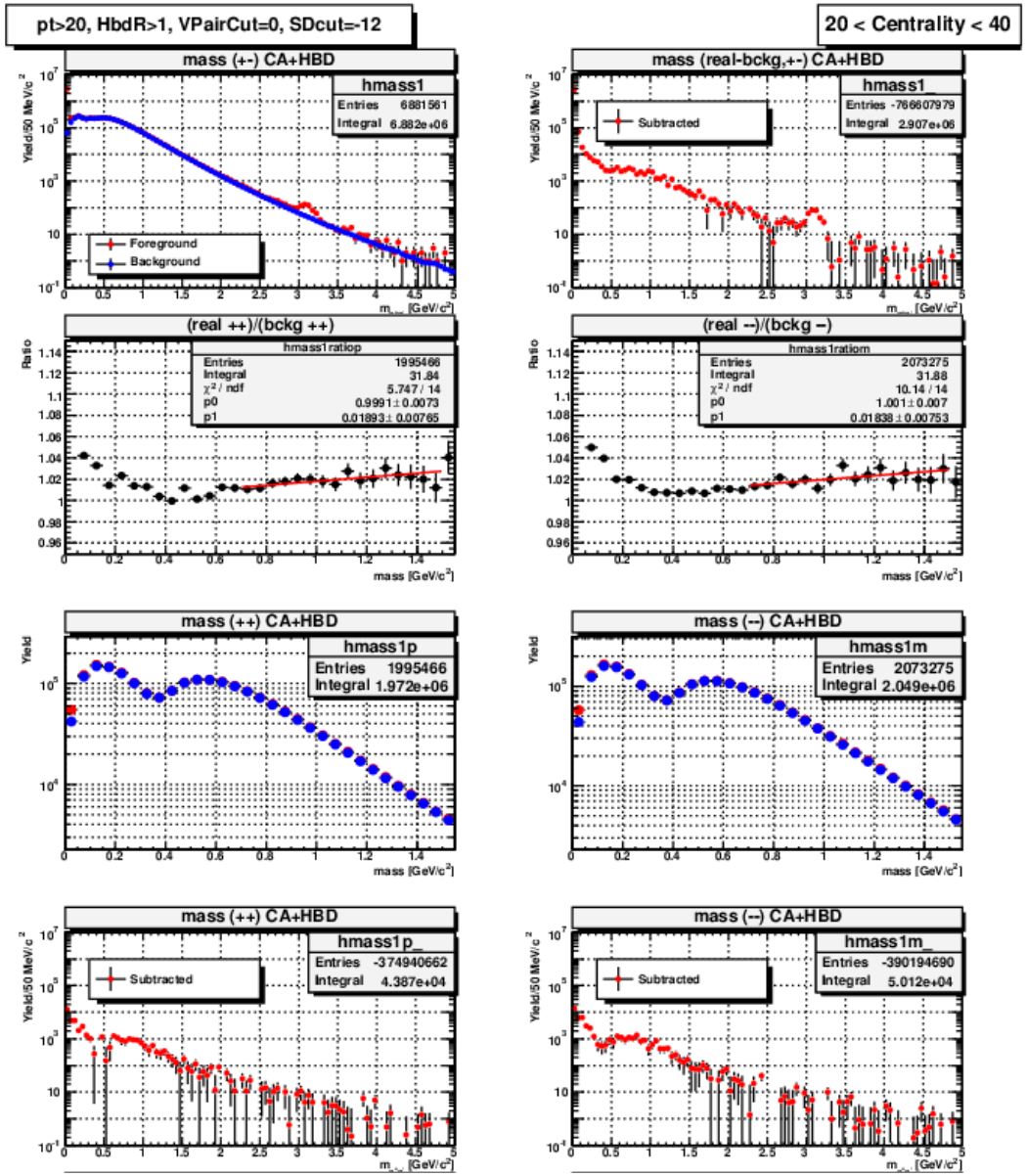
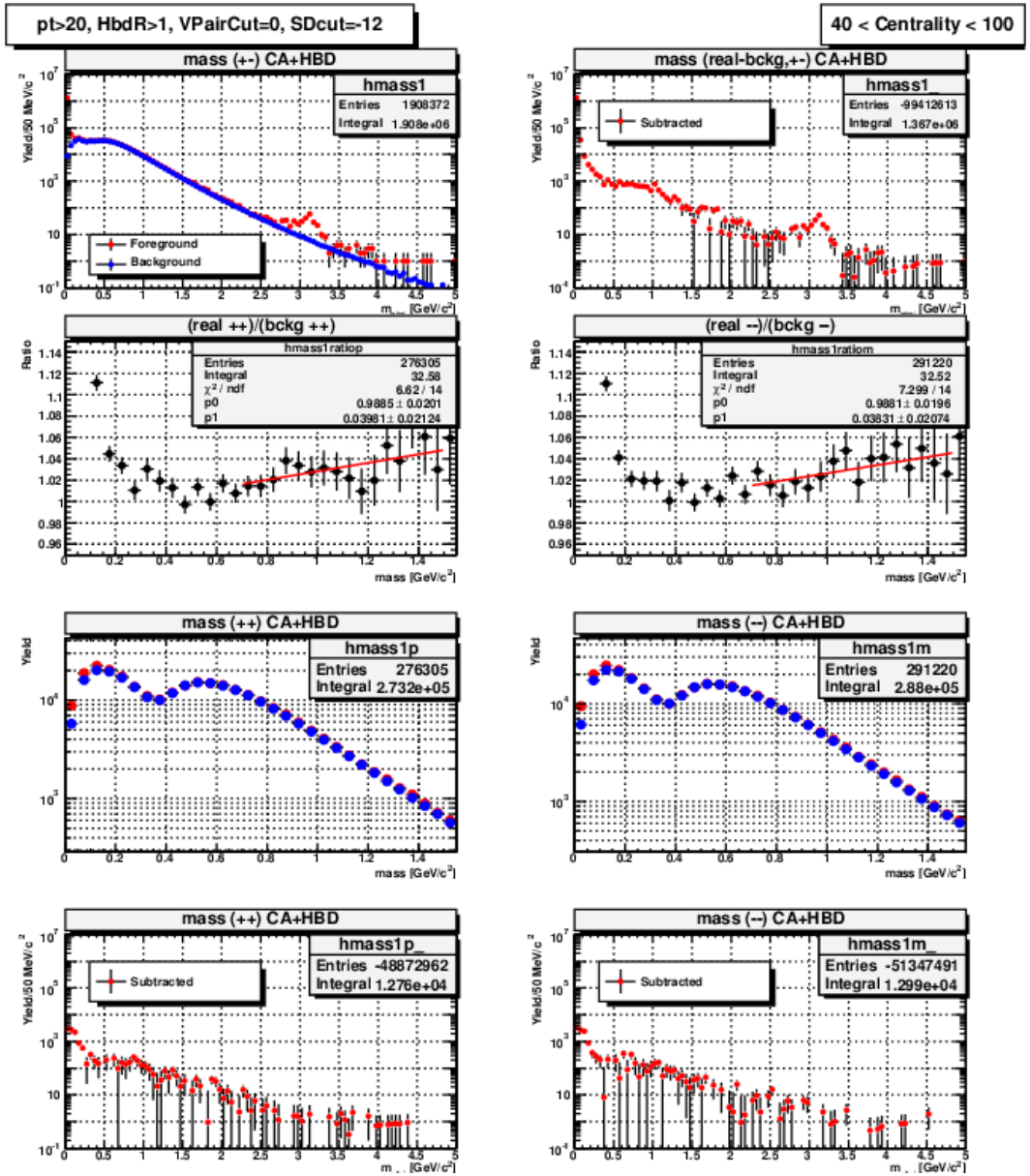


Hybrid method-subtract the mixed background



Hybrid method-subtract the mixed background



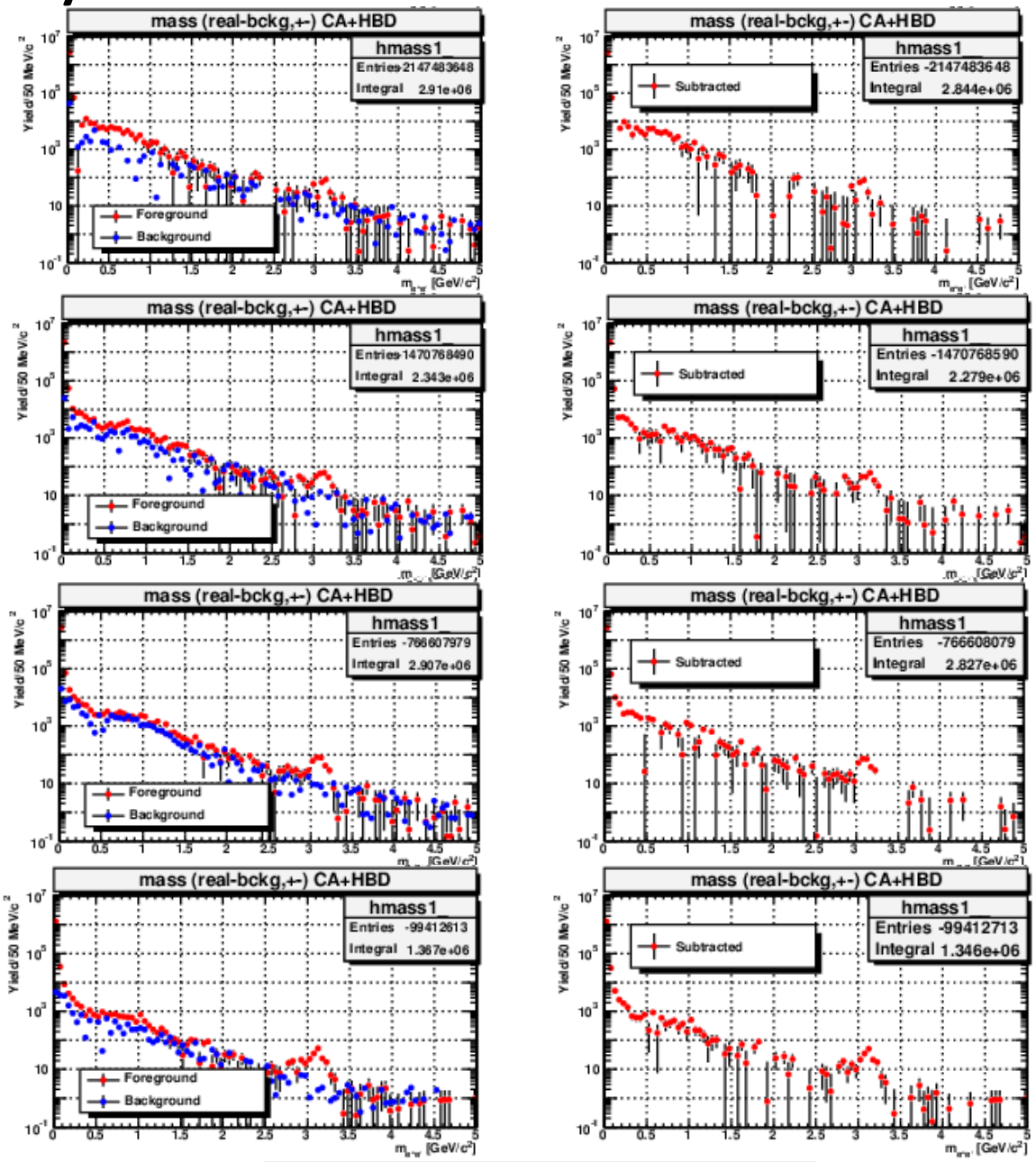
Hybrid method - like-sign subtraction

The signal for each **dm (1D)** bin is obtained according to:

$S_{+-} = N_{+-} - 2\sqrt{N_{++}N_{--}}\,\dfrac{B_{+-}^{mix}}{2\sqrt{B_{++}^{mix}B_{--}^{mix}}}$	$N_{++} > 0$ $N_{--} > 0$
$S_{+-} = N_{+-} - N_{++}$	$N_{++} > 0$ $N_{--} = 0$
$S_{+-} = N_{+-} - N_{--}$	$N_{++} = 0$ $N_{--} > 0$

<u>Using the following binning</u>:
$0 < m_{ee} < 5$ GeV/c^2, bin 0.05 GeV/c^2

Hybrid method-subtract the correlated backgr.



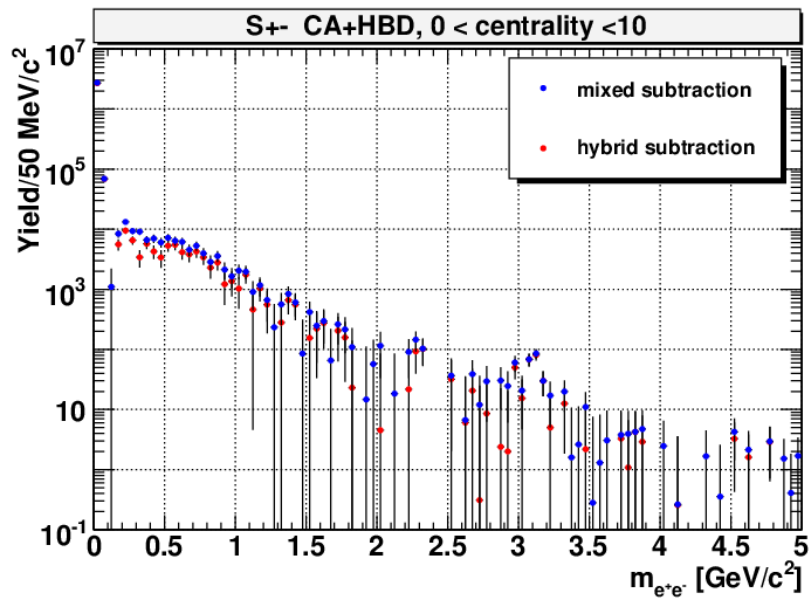
0 < centrality < 10

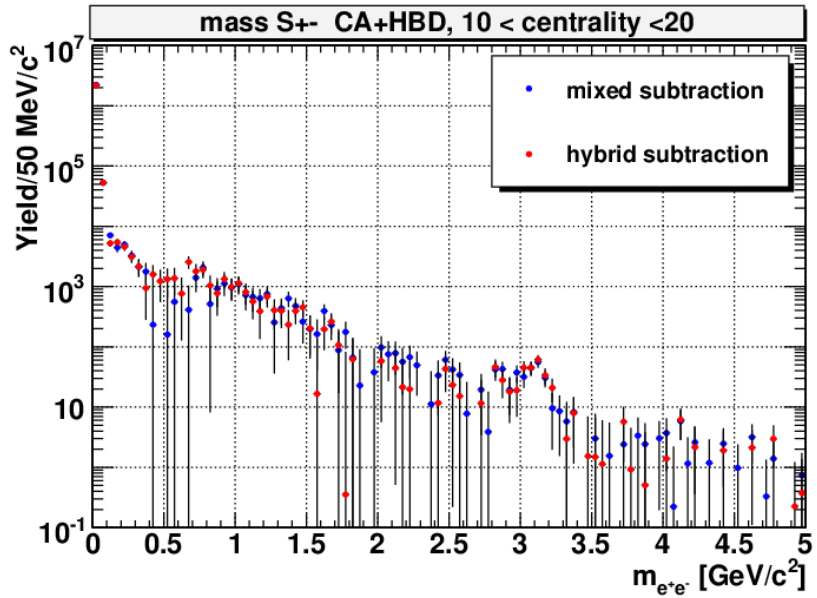
10 < centrality < 20

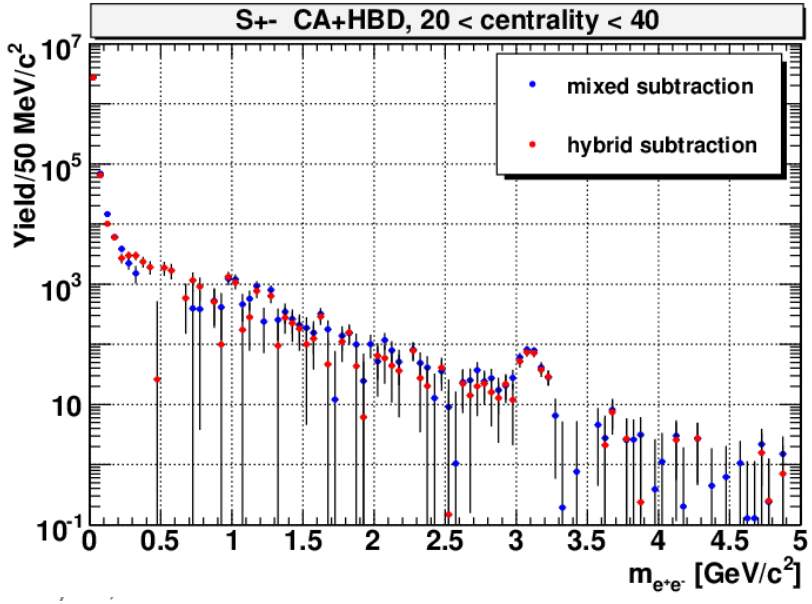
20 < centrality < 40

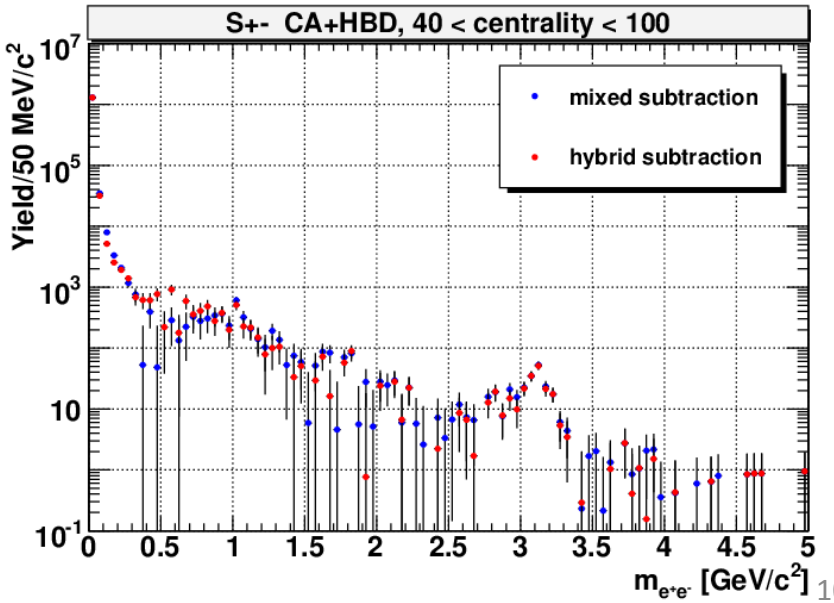
40 < centrality < 100

Compare mixed vs. hybrid subtraction







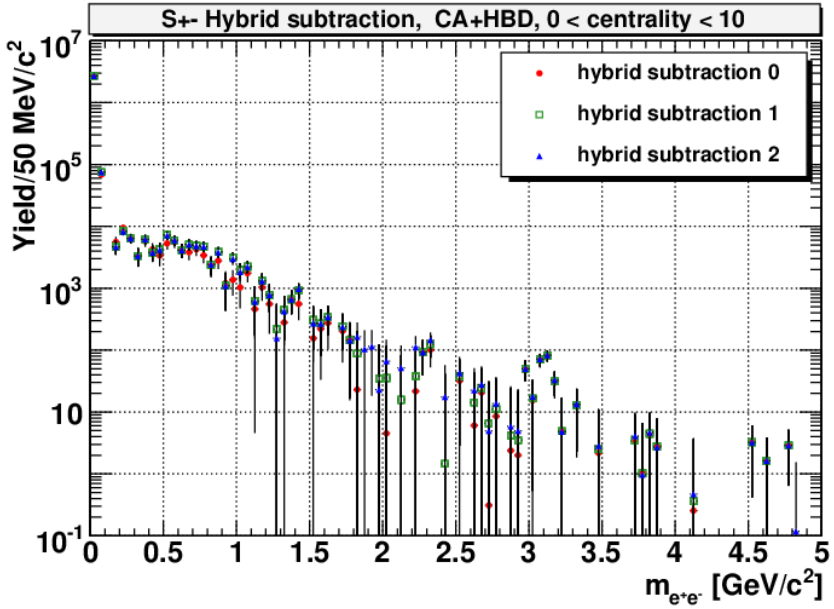


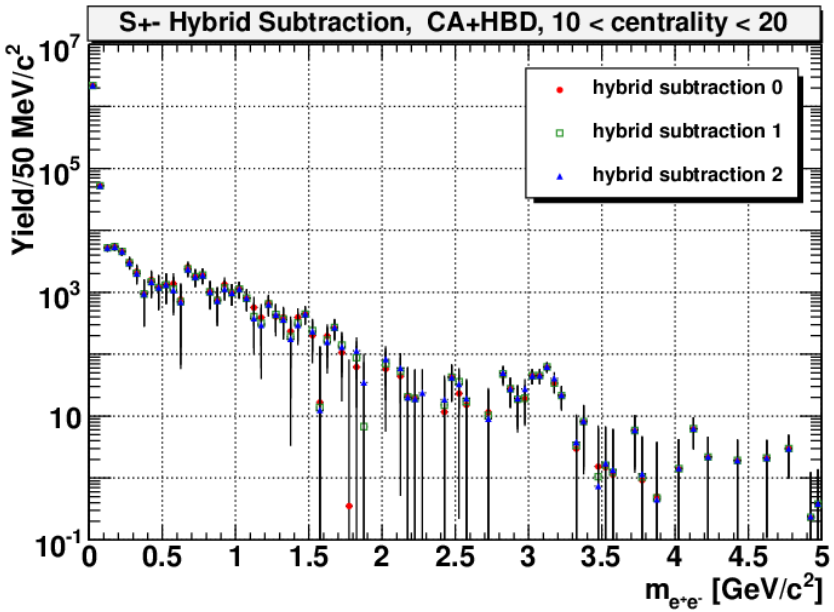
Hybrid subtraction – cross check 1

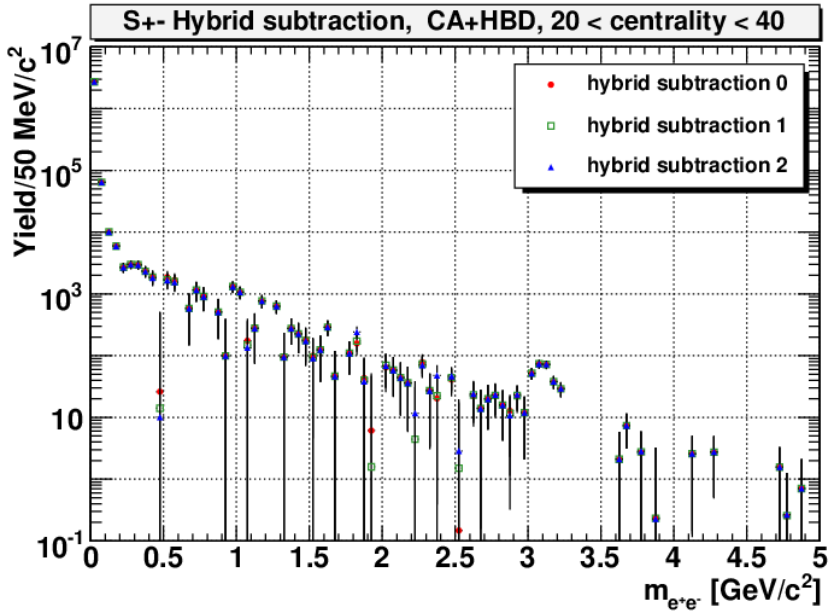
- check the robustness of the method by slightly undersubtracting in the first step:

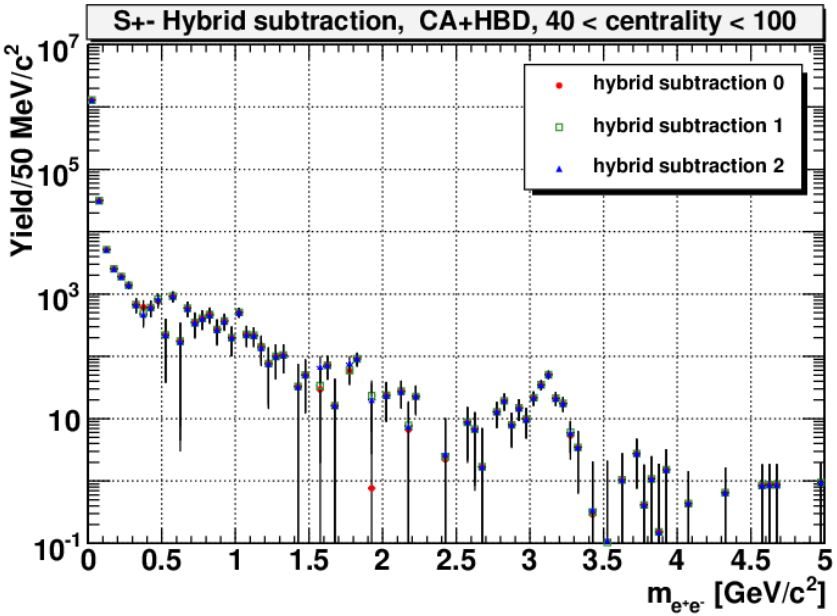
a) Subtract the mixed event according to obtained normalization 100% (“hybrid subtraction 0”)
b) Subtract the mixed event by 99% (“hybrid subtraction 1”)
c) Subtract the mixed event by 98% (“hybrid subtraction 2”)

Hybrid subtraction – cross check 1









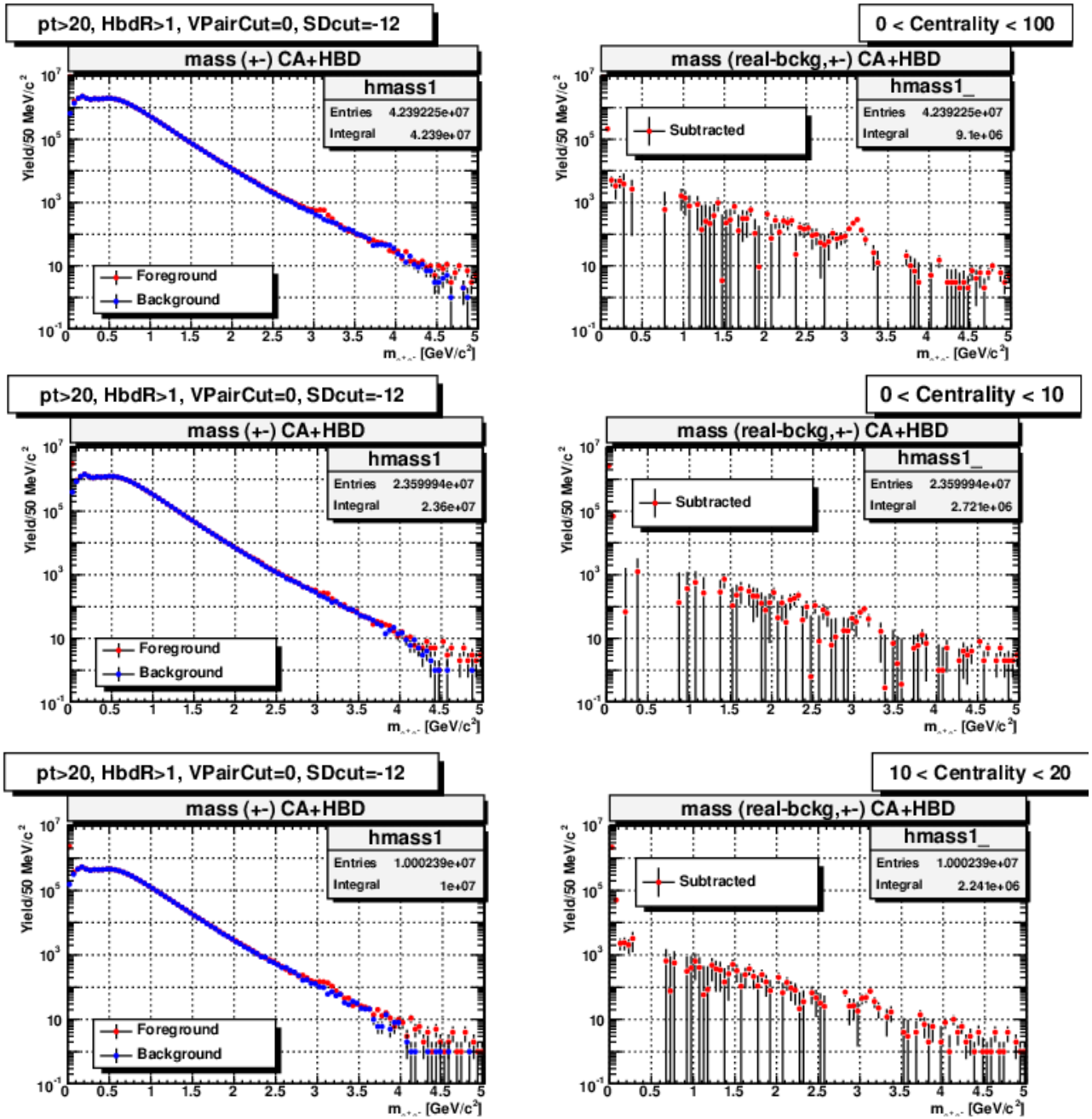
Like-sign subtraction

The signal for each **dm** x **dp$_T$** x **dz** bin is obtained according to:

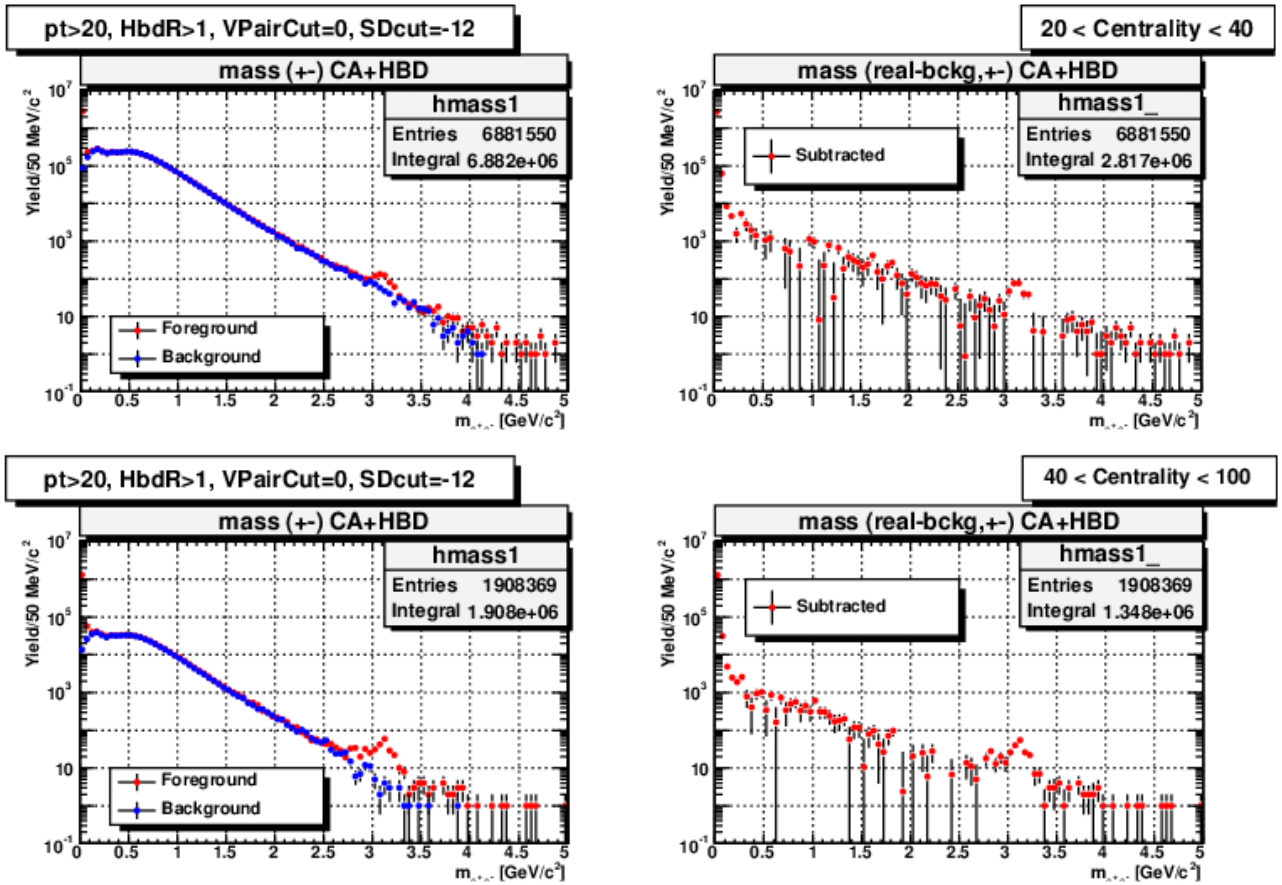
$S_{+-} = N_{+-} - 2\sqrt{N_{++}N_{--}}\,\dfrac{B^{mix}_{+-}}{2\sqrt{B^{mix}_{++}B^{mix}_{--}}}$	$N_{++} > 0$ $N_{--} > 0$
$S_{+-} = N_{+-} - N_{++}$	$N_{++} > 0$ $N_{--} = 0$
$S_{+-} = N_{+-} - N_{--}$	$N_{++} = 0$ $N_{--} > 0$

<u>Using the following binning</u>:
$0 < m_{ee} < 5$ GeV/c^2, bin 0.05 GeV/c^2
$0 < p_T < 20$ GeV/c, bin 0.05 Gev/c
$-20 < z < 20$ cm, bin 5 cm

Like-sign subtraction

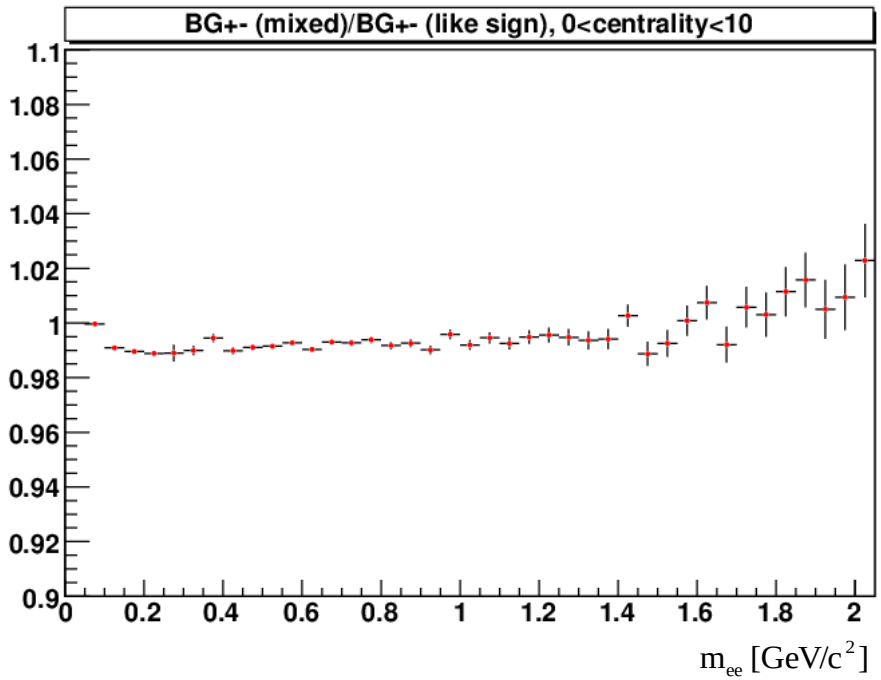


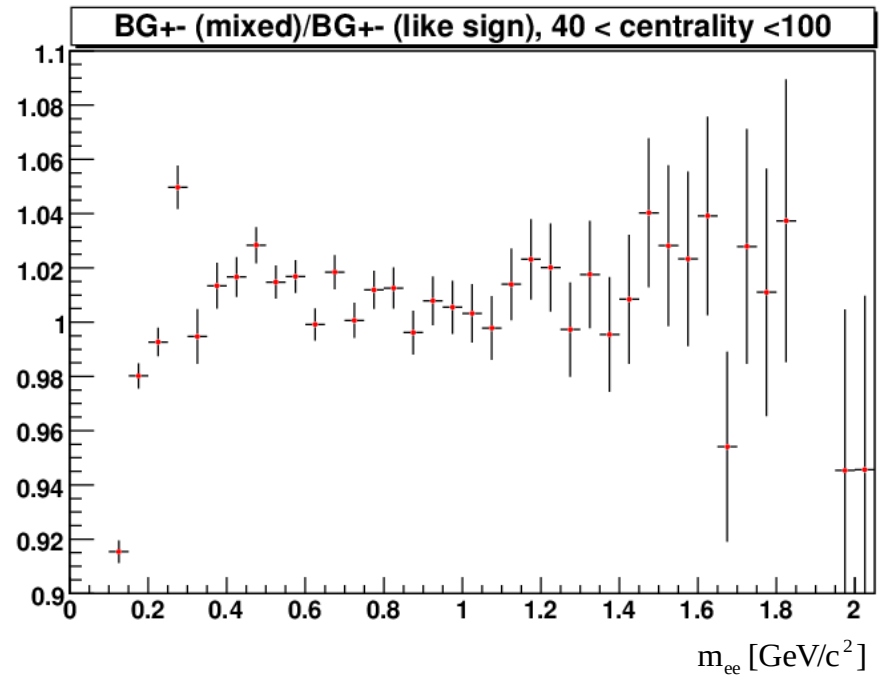
Like-sign subtraction



Like-sign subtraction

Ratio of B_{+-} in mixed event and same event

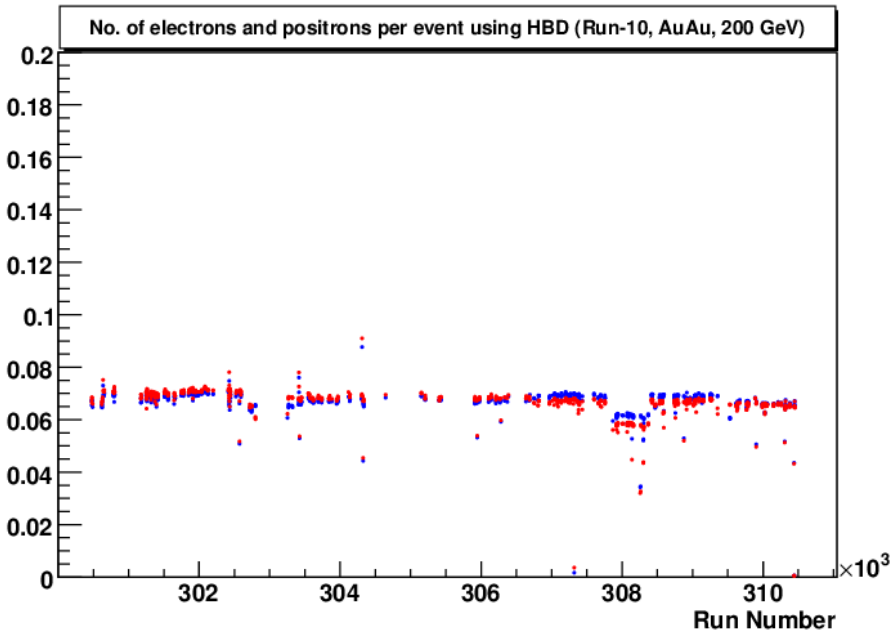




BACKUP SLIDES

Data set, event cuts, track cuts

- **Run-10 – 200 GeV Au+Au data**
  - Events 4.5B out of 7.0B in +/-20 cm vertex
- Event cuts:
  - abs(bbcz) < 20 cm
- Track selection:
  - track quality = 31, 51, 63
- eID cuts:
  - n0 > 2
  - E/p>0.6
  - EMCal ~3 sigma matching
  - chi2/npe0 < 10
  - disp < 5
  - prob > 0.01
  - |zed| < 75 cm



- HBD matching:
  - 0 < centrality < 10, Rejection*=3, efficiency(single)~0.8
  - 10 < centrality < 20, Rejection*=6, efficiency(single)~0.8
  - 20 < centrality < 40, Rejection*=11, efficiency(single)~0.8
  - 40 < centrality < 92, Rejection*=20, efficiency(single)~0.8

  *Rejection defined for HBD backplane conversions

Normalization

a) Get the normalization factors for the like sign spectra:

$$nf_{++} = \int_{0.6GeV}^{\infty} N_{++} \Big/ \int_{0.6GeV}^{\infty} B_{++} \qquad nf_{--} = \int_{0.6GeV}^{\infty} N_{--} \Big/ \int_{0.6GeV}^{\infty} B_{--}$$

b) Get in integrals of the normalized like sign spectra:

$$B_{++}^{N} = \int_{0}^{\infty} B_{++} \times nf_{++} \qquad B_{--}^{N} = \int_{0}^{\infty} B_{--} \times nf_{--}$$

c) Get the normalization factor for the unlike sign spectrum:

$$nf_{+-} = \frac{2\sqrt{B_{++}^{N} \times B_{--}^{N}}}{\int_{0}^{\infty} B_{+-}} = \underbrace{\frac{2\sqrt{B_{++} \times B_{--}}}{\int_{0}^{\infty} B_{+-}}}_{\text{acc. correction}} \sqrt{nf_{++} nf_{--}} = \sqrt{nf_{++} nf_{--}}$$

Normalization I. **Normalization II.**

Normalization I. and II. are equivalent if the acceptance for e^+ and e^- is the same.