On estimation of statistical uncertainties for asymmetry measurements

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Method 1

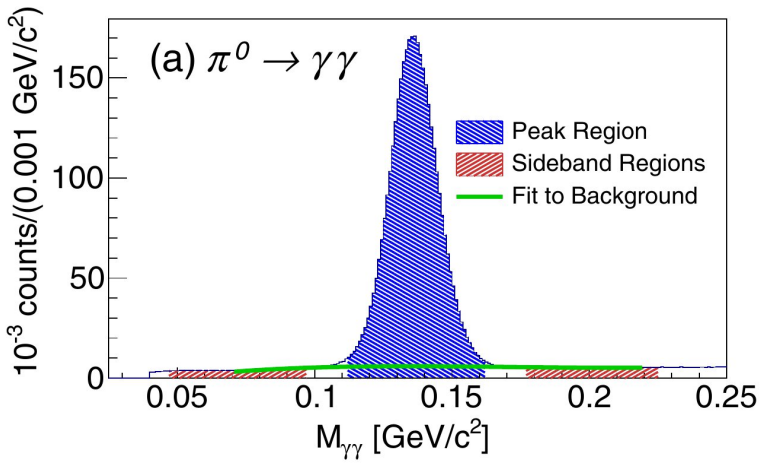
- At the last P&MC meeting Amaresh presented estimation of statistical uncertainty for A_N based on the **subtraction of the background contribution from the "raw" asymmetry**:

$$A_N^{Sig}(\phi) = \frac{A_N^{Raw}(\phi) - r.A_N^{Bkg}(\phi)}{1-r}$$

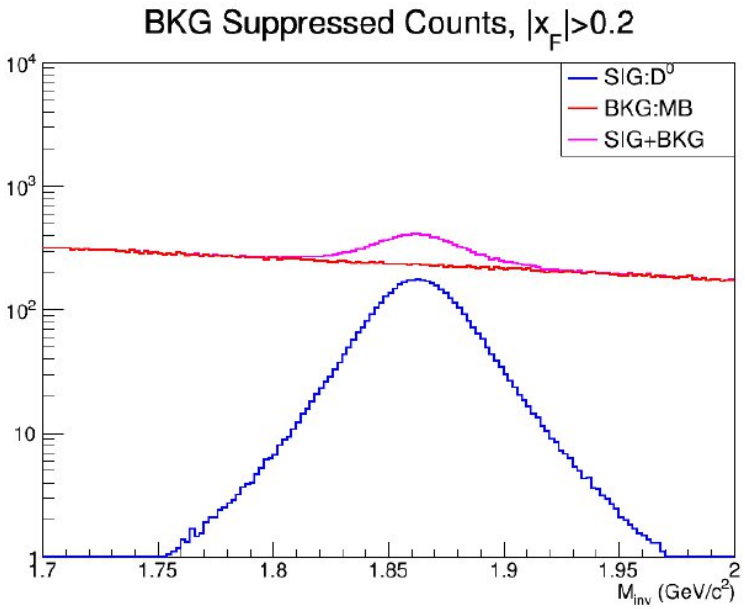
- This method was used by PHENIX and STAR collaborations. The ϕ –acceptance is divided to pairs of opposite bins, subtractions is performed, and results for different bins are combined.

- The explicit expression is $\sigma^2 = \left[\frac{1}{2P(1-r)}\right]^2 \frac{2N_\phi}{\sum_i <\cos\phi>_i^2}\left(\frac{1}{N_{raw}} + r^2\frac{1}{N_{bg}}\right)$. Here r~8/9 is fraction of the background in the signal region.

- Assuming 360M produced D^0 -> $K\pi^0$ mesons, the following errors were obtained (uncertainty of r is **neglected**, $N_{bg} \sim N_{bg}$ in the signal region):



PHENIX: TSSA for π^0



Amresh at the last CM

Method 2

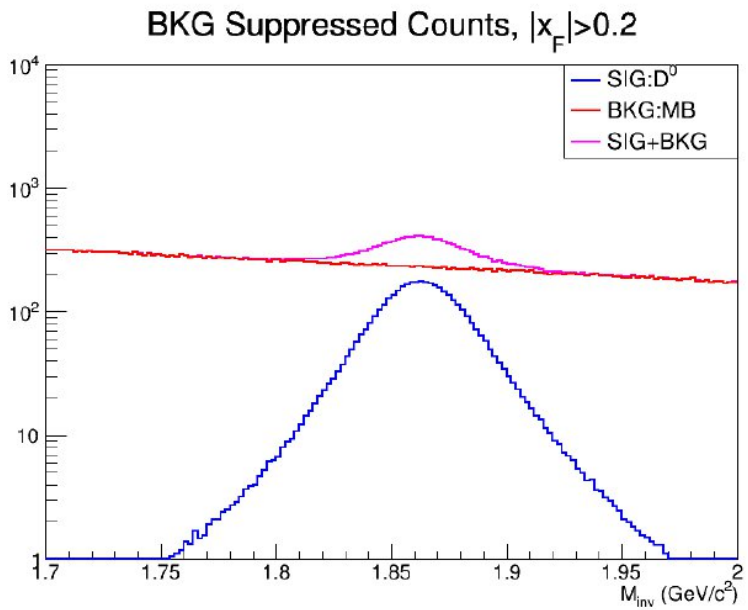
- **Linear fit** of pseudodata with two shapes: signal and background. The linear fit is applied **twice**:

  1) to determine the signal number uncertainty in φ bins (Kπ invariant mass fit)

  2) to determine the uncertainty of A_N (fit of the signal φ dependence)

- The uncertainty in the linear is given by shapes and expected uncertainties (see PDG note on LSM linear fit): $V_{ii} = \sum_k \frac{h_i(x_k) h_i(x_k)}{\sigma_k^2}$.

- The background ratio is assumed to same in all bins (see figure)



Amresh at the last CM

- The results are

	0.2 < xF < 0.3	0.3 < xF < 0.4	0.5 < xF < 0.6
σA_N (Amresh)	0.0156	0.0265	0.1640
σA_N (This talk)	0.009	0.015	0.094

On differences

- Two methods use **different input**.
- The **Method 1**:
  - does not account for uncertainty of *r* (usually treated as systematic uncertainty);
  - varying mass window for D-meson the better r values can be obtained resulting in small uncertainty ~ 0.010;
  - sidebands for A_N^{bg} can be increased.
- The **Method 2** assumes exact knowledge on the signal and background shapes (idealized case). One may test also a fit with “unknown” shapes.