

Measurement of the Forward-Backward Asymmetry in $Z \rightarrow \mu\mu$ Events in CMS at 7 TeV

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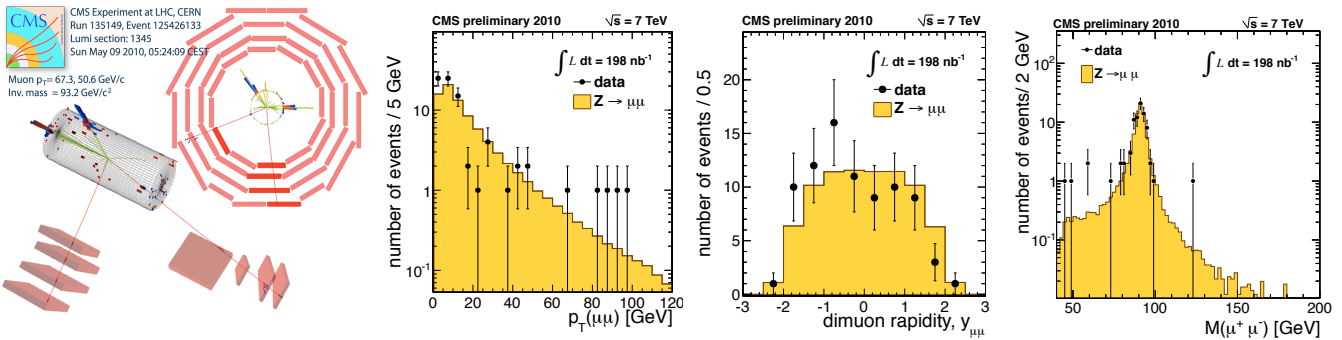
FORWARD-BACKWARD ASYMMETRY

In the process $pp \rightarrow q\bar{q} \rightarrow Z/\gamma^* \rightarrow l^+l^-$ both vector and axial-vector couplings of electroweak bosons to fermions are present. This results in a forward-backward asymmetry (A_{FB}) in the emission angle (θ) of the lepton (anti-lepton) relative to the incident quark (anti-quark) direction in the di-lepton center of mass reference frame. This asymmetry depends on the di-lepton invariant mass and deviations from the Standard Model prediction may indicate the existence of a new neutral gauge boson.

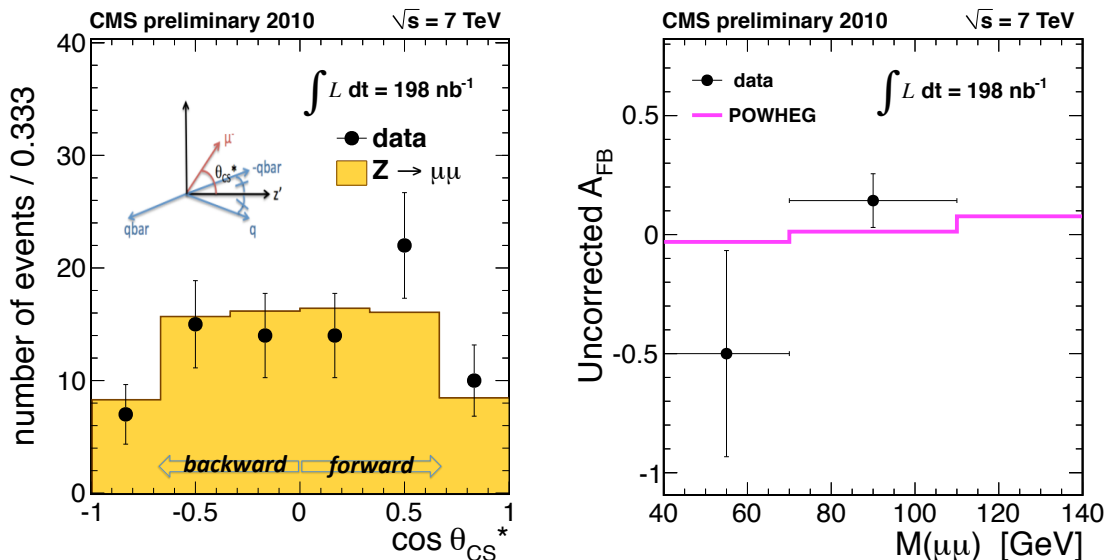
$$\frac{d\sigma}{d(\cos\theta)} = A(1 + \cos^2\theta) + B\cos\theta \quad A_{FB} = \frac{\sigma_F - \sigma_B}{\sigma_F + \sigma_B} = \frac{N_F - N_B}{N_F + N_B} = \frac{3B}{8A}$$

A and B are proportional to weak isospin and charge of the incoming fermions.

DI-MUON KINEMATICS



UNCORRECTED FORWARD-BACKWARD ASYMMETRY



θ_{CS}^* is defined in the Collins-Soper frame [1].

Mass bin [GeV]	[40-70]	[70-110]	[110-140]
# forward events	1	44	1
# backward events	3	33	0
Total # events	4	77	1

The uncorrected forward-backward asymmetry is measured to be -0.50 ± 0.43 in the mass range 40-70 GeV, and 0.14 ± 0.11 in the mass range 70-110 GeV using 198 nb^{-1} of data. The measured values are consistent with POWHEG + full CMS simulation predictions of -0.03 and 0.01 in these two mass bins [2].

REFERENCES

- [1] J.C. Collins and D. E. Soper, "Angular Distribution of Dileptons in High-Energy Hadron Collisions", Phys. Rev. D 16, (1977) 2219.
- [2] The CMS Collaboration, "Measurements of Inclusive W and Z Cross Sections in pp Collisions at $\sqrt{s}=7 \text{ TeV}$ ", CMS PAS EWK-10-002.