Electroweak production of a Z boson in association with forward/backward jets

Tom Cornelis for the CMS collaboration

In proton-proton collisions at the LHC, the dominant source of events with the HZjj final state is through mixed electroweak and strong processes of order $\mathcal{O}(\alpha_{\text{EW}}M^2_{\text{GG}}\alpha_s^2)$, also known as Drell-Yan plus two jets. Pure electroweak production of a Z boson in association with two jets is a rare process. Different classes of pure electroweak processes $\mathcal{O}(\alpha_{\text{EW}}^2)$: HZjj processes are possible: vector boson fusion (VBF), bremsstrahlung and multi-peripheral.

- Central $Z$ decay associated with two energetic forward-backward light-quark jets
- A large $\eta$ separation between the jets and large invariant dijet mass
- Colour exchange suppression between the tagging quark jets.

The results of our analysis pave the road for the more general study of vector boson fusion processes and for measurements of electroweak gauge couplings and vector boson scattering.

Two alternative background models for the Drell-Yan plus jets background have been developed.

- Simulation-based
  The simulation for Drell-Yan plus jets is based on MadGraph and lacks higher order virtual corrections. Predictions from NNLO are used to derive LO to NLO correction factors based on the dijet invariant mass $M_{jj}$ and on the rapidity of the Z boson in the dijet rest frame ($y_Z$).

- Data-based
  The production of $\gamma$ plus two jets is expected to resemble Drell-Yan processes and can therefore be used to model the shape of the tagging jets. A $\gamma$ plus 2 jets sample is selected in data in a similar way as the Z plus 2 jets selection. The photon py is reassigned to the Z boson py in order to mitigate the differences induced by the specific $\gamma$ or Z sample.

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