Effects of beam-induced backgrounds in Higgs boson invisible decay

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Samples

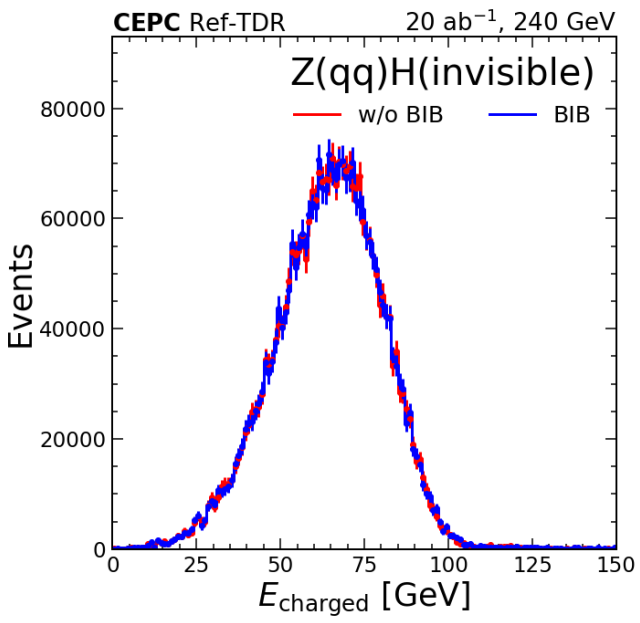
Samples without BIB

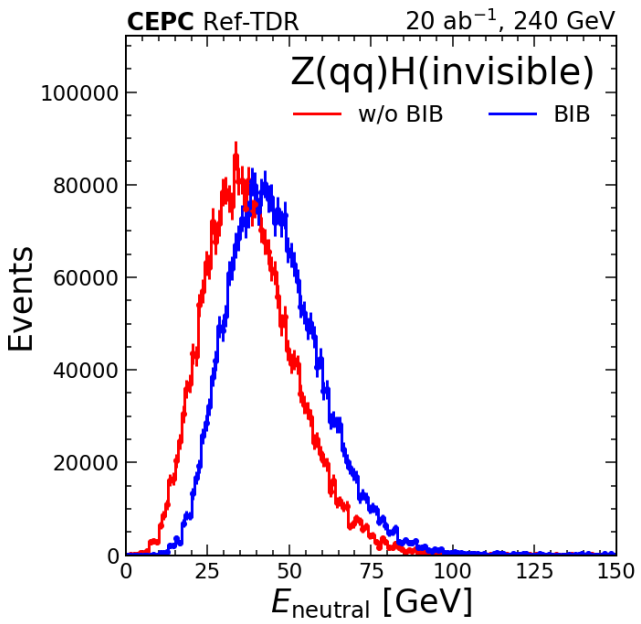
- /cefs/higgs/zhangkl/Production/2505/E240_qqHinvi/Reco/rec_E240_qqHinvi_00001-00499.root

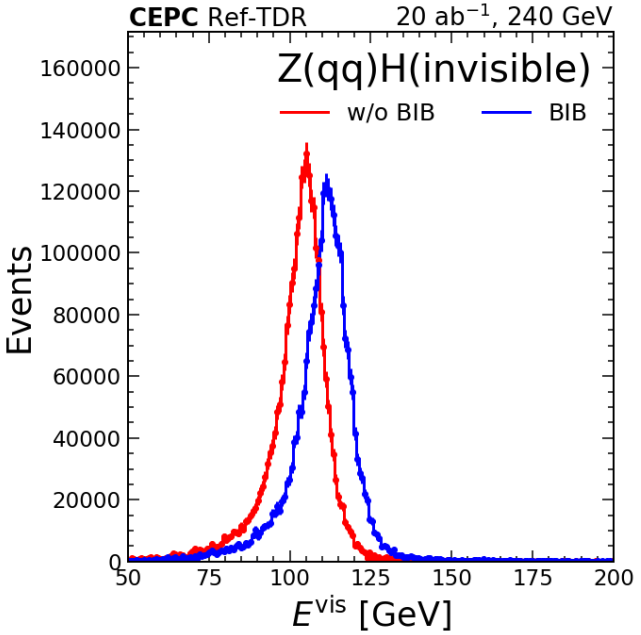
Samples with BIB

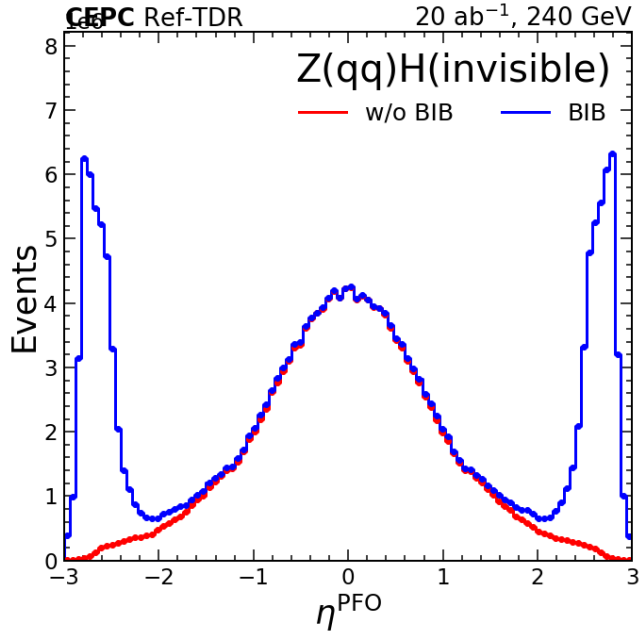
- /cefs/higgs/zhangcg/cepc/tdr25.5.0/CEPCSW/tupleformixedqqHnn/mixed_rec_E240_qqHinvi_00001-00499.root
- Issues due to mixing different CEPCSW versions fixed.

Features





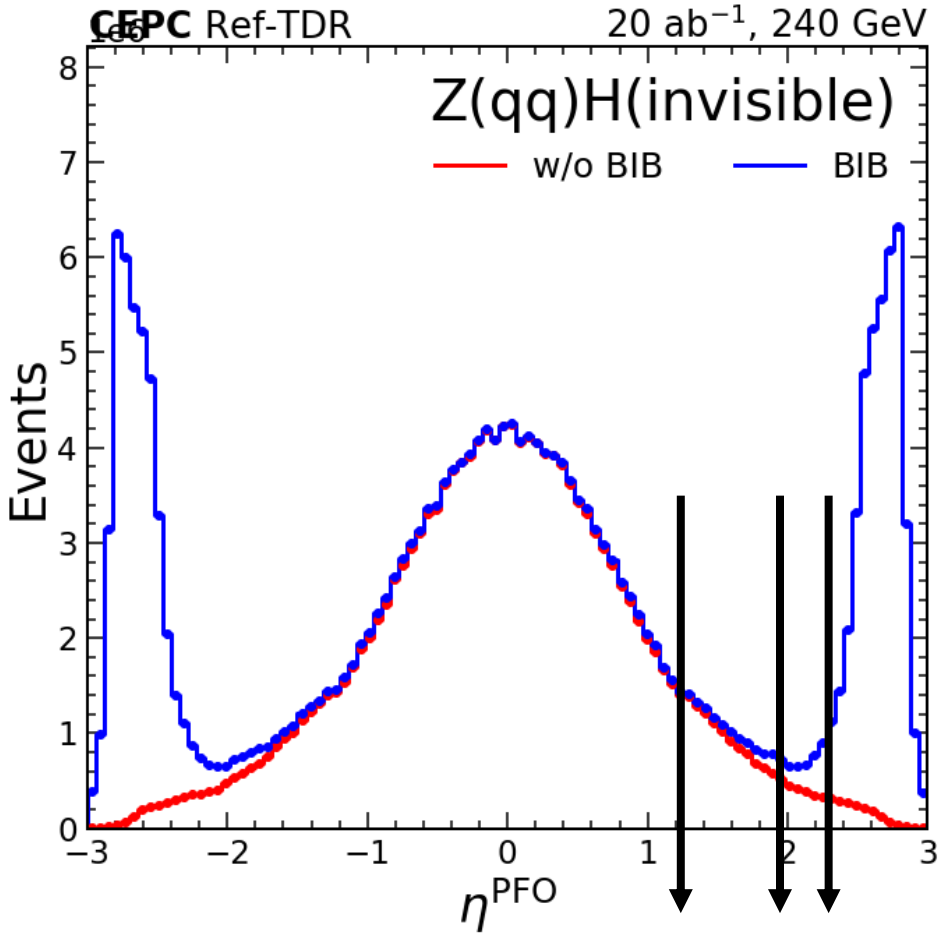




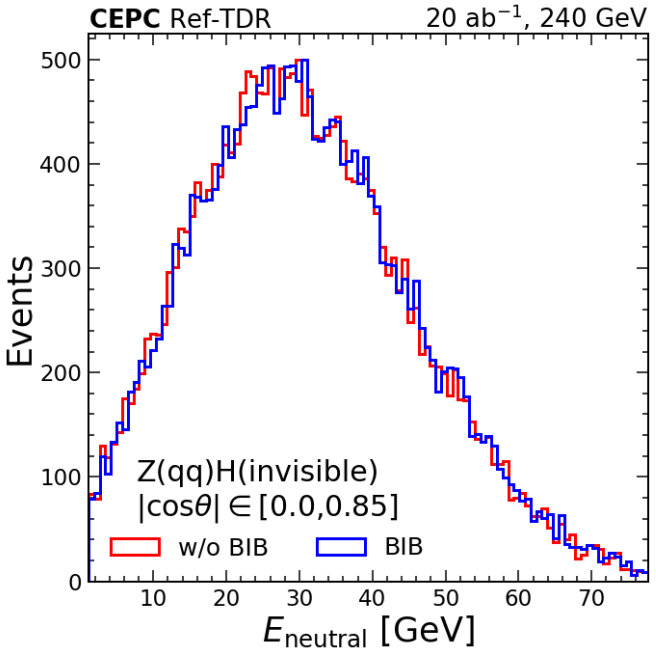
Key features

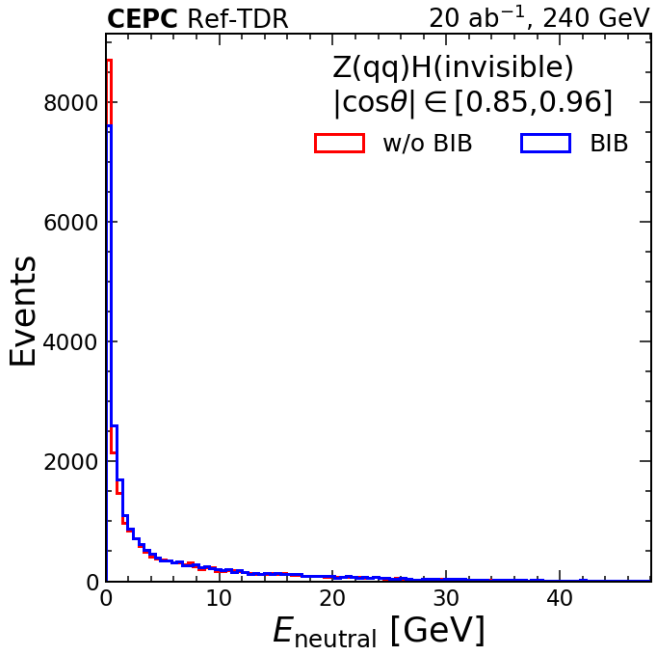
- Negligible effects on charged PFOs.
- More neutral PFOs induced, with an extra energy of ~ 7 GeV.
- Most extra PFOs lie in forward regions.

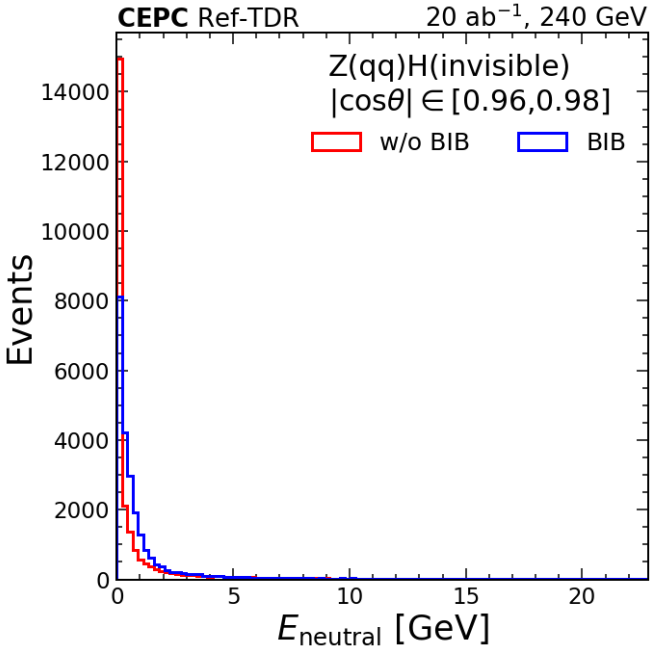
Energy in bins of cosθ

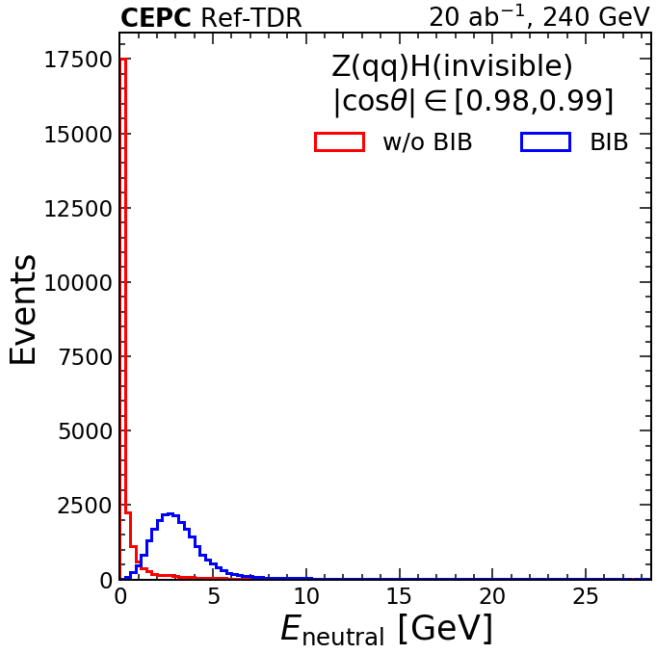


cosθ=0.85, 0.96, 0.98





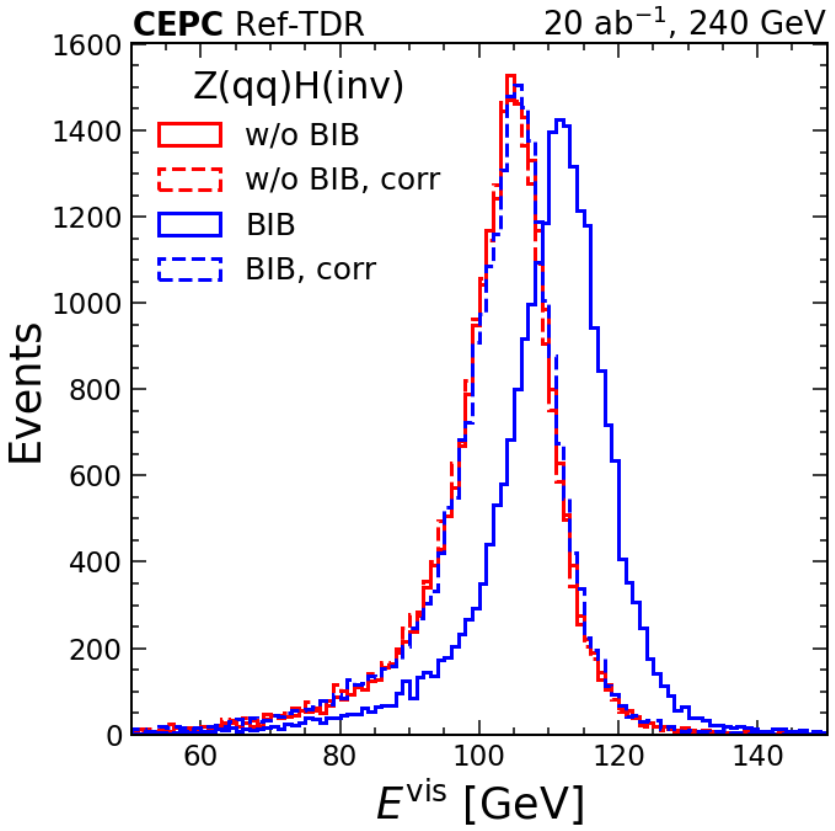


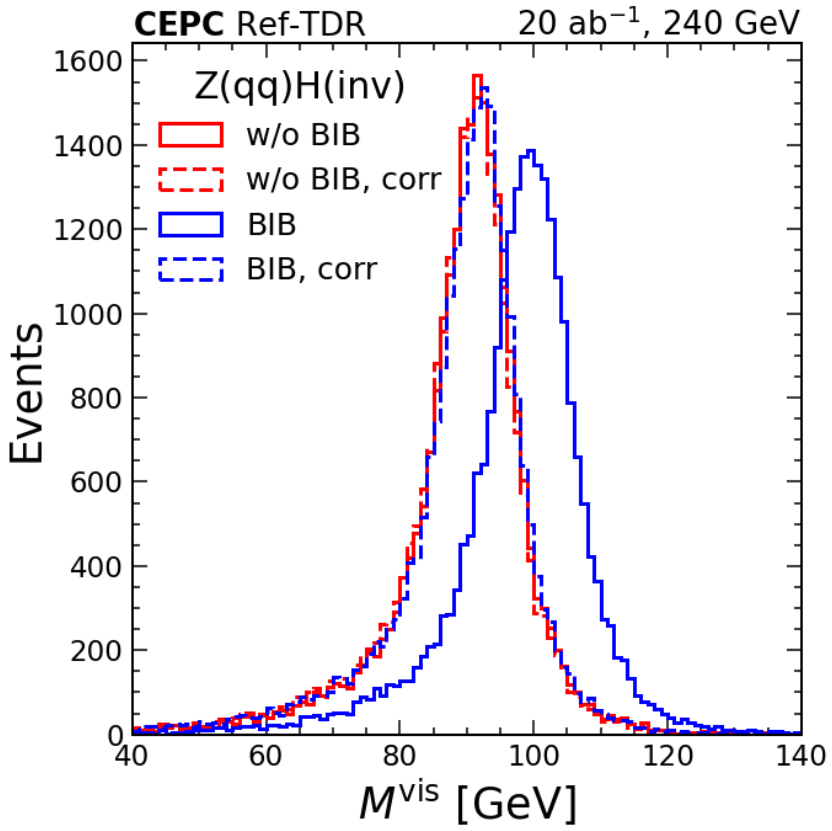


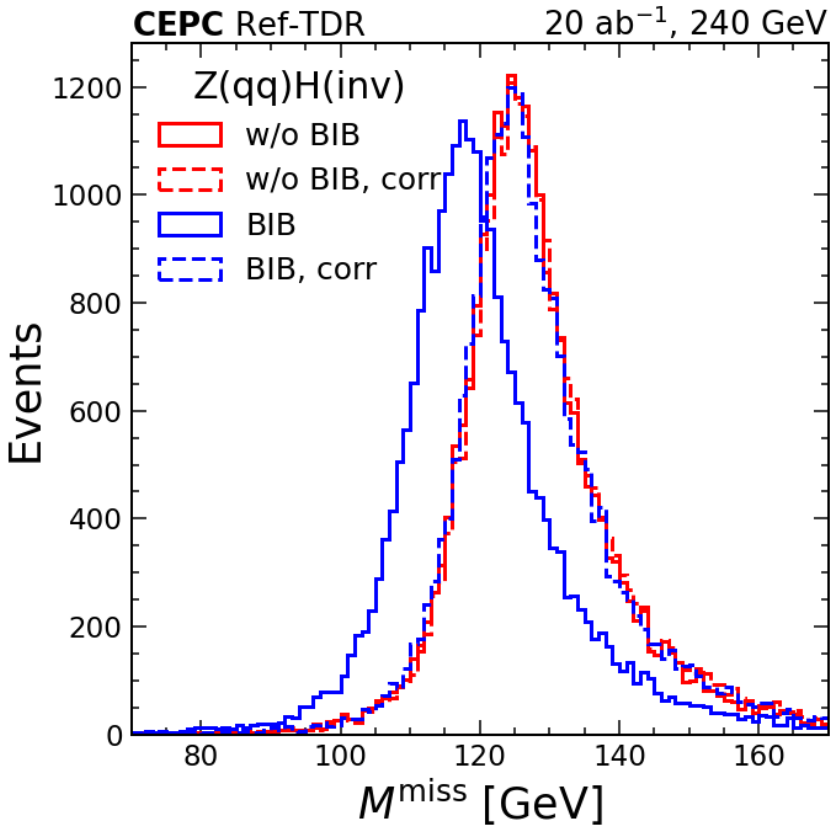
Preliminary BIB mitigation

Method

- Get rid of neutral PFOs with $|\cos\theta| > 0.98$
- From Weizheng

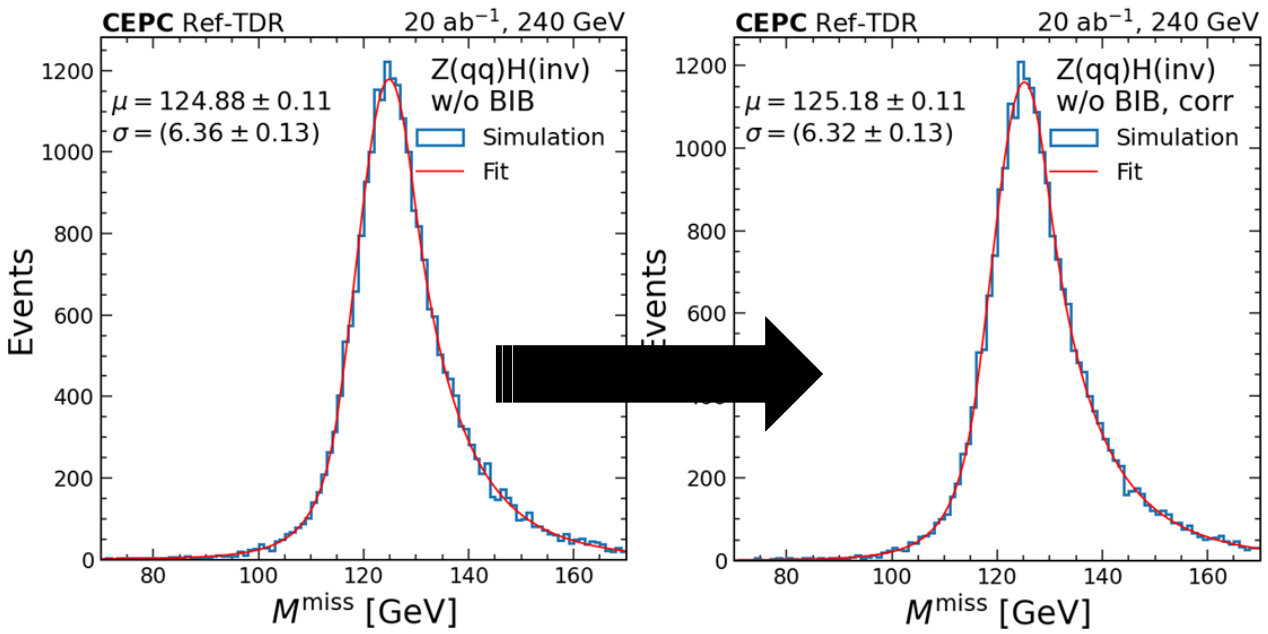






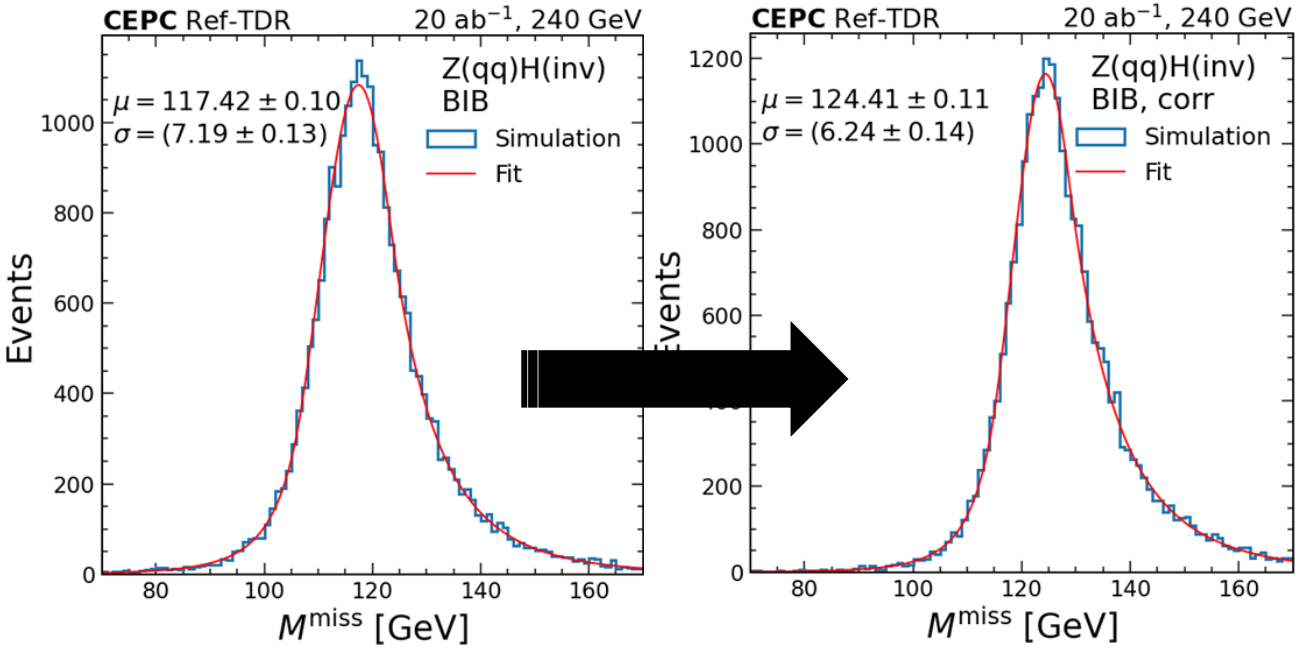
Missing mass resolution

No BIB



- Mean value increased.
- Resolution seems to be better? But the same within uncertainties.

With BIB



- Mean value shifted back to around 125 GeV.
- Resolution improved to the level of the situation without BIB.

Conclusion

- **We are confident that BIB effects on invisible decays can be properly treated.**
  - With a simple cut on cosθ, the missing mass resolution is improved to the same level of no BIB, with negligible effects on signals.
  - The same conclusion is expected for BMR.

- **Further steps**
  - Check the effects for Z(invisible)H(qq)

- **Discussions**
  - For studies involving neutral PFOs, it could be better to require $|\cos\theta| < 0.98$ instead of 0.99.