Introduction

~30 proton-proton collisions per filled LHC bunch crossing in 2012 – called “pile-up”. More pile-up expected in the future, up to 400 in some Super-LHC projections.

Overlay on real data

Uses a single data event, recorded with a special zero-bias trigger, to model all pile-up. Trigger event from hard-scatter process is simulated using Geant4 and overlaid. Simulated event must use data geometry, alignments, magnetic field, and beam-spot corresponding to the selected zero-bias data event. Automatically includes cavern background, detector noise, full bunch structure, non-uniform bunch luminosity, and detector conditions (dead channels, etc.)

Simulated Pile-up

Minimum-bias pp events are generated with Pythia (6 or 8) and simulated with Geant4. “Cavern background” also simulated using special generators and Geant4.

Performance

Data from calibration samples are compared to simulation, for various amounts of pile-up. Data is also compared to simulation as a function of position in the bunch structure, to test the modeling of in-time vs. out-of-time pile-up.

Overall good agreement of simulated pile-up and data, up to ~20 pp/crossing.