Plot approval for HCP

Pile-up effect on muon isolation variables in 2011 data

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The Z → μμ sample

- Selections:
  - GRL: Higgs to tau tau V28
  - Trigger: EF_mu18_MG_medium
  - At least 2 μ MCP recommended and Combined with $P_T > 20$ GeV
  - Opposite charge muons
  - $|M_{μμ} - M_Z| < 15$ GeV
The Z → μμ sample

Corrections:

• Pile-up reweighting -00-00-13

• Muon efficiency correction -03.15 as described in: MCPAnalysisGuidelinesEPS2011

• Muon momentum correction -03.05 as in: MCPAnalysisGuidelinesEPS2011

• Trigger efficiency scale factor -SF_for_J-K.root as in: MuonTriggerPhysicsTriggerRecommendations2011
Z → μμ Sample

- Dataset: Susy D3PD Rel16
- Data 2011:
  - All runs period J and K
- Simulation MC10b:
  - mc10_7TeV.106047.PythiaZmumu_no_filter
  - AlpgenJimmyWmunuNp*_pt20
  - AlpgenJimmyZtautauNp*_pt20
  - mc10_7TeV.105200.T1_McAtNlo_Jimmy
  - mc10_7TeV.105757.PythiaB_mu10mu10X
$E_T$ and $\Sigma P_T$ distributions

**ATLAS** Preliminary

\[ \int L dt = 730 \text{ pb}^{-1} \quad \sqrt{s} = 7 \text{ TeV} \]

- Data 2011
- Pythia $Z \rightarrow \mu\mu$
- QCD

$|M_{\mu\mu} - M_Z| < 15 \text{ GeV}$

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$E_T$ and $\Sigma P_T$ distributions

\begin{align*}
\int L dt &= 730 \text{ pb}^{-1} \quad s = 7 \text{ TeV} \\
\rightarrow & \text{ Data 2011} \\
\rightarrow & \text{ Pythia } Z \rightarrow \mu\mu \\
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\end{align*}

11/09/11

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$E_T$ and $\Sigma P_T$ distributions
$E_T$ and $\Sigma P_T$ distributions

- **Left plot:** distribution of the calorimeter transverse energy in a cone around the muon of $\Delta R < 0.4$, 0.3 and 0.2 respectively. Cell energy belonging to a narrow core cone is subtracted for take into account muon energy deposit. Only cell with signal $3.6 \sigma$ above noise are taken into account. The MC distribution is shifted and wider respect to data.

- **Right plot:** distribution of the sum of the track $P_T$ around the muon in a cone of $\Delta R < 0.4$, 0.3 and 0.2 respectively. Tracks are required to came from the same vertex as the muon by a Z0 cut and to have $P_T > 1$ GeV. MC tend to be more isolated than data. This is probably due to mismodeling of the underlying event.
Out of time pile-up contribution

\[ \langle E_T^{(\Delta R < 0.4)} \rangle \text{ [GeV]} \]

\[ \int Ldt = 730 \text{ pb}^{-1} \quad \sqrt{s} = 7 \text{ TeV} \]

\[ |M_{\mu\mu} - M_Z| < 15 \text{ GeV} \]

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\[ \langle \sum \text{Track } P_T^{(\Delta R < 0.4)} \rangle \text{ [GeV]} \]

\[ \int Ldt = 730 \text{ pb}^{-1} \quad \sqrt{s} = 7 \text{ TeV} \]

Data 2011

Simulation

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Out of time pile-up contribution

**Number of previous filled bunch:** is the number of previous filled bunches with respect to the analyzed one, retrieved using TrigBunchTool-00-02-01 tanking into account the 600 ns calorimeter pulse time length and the 50 ns bunch spacing, so in 600 ns 12 out of time pile-up signals can add up.

- **Left Plot:** mean value of $E_{T \Delta R < 0.4}$ distribution versus the number of previous filled bunch. The calorimeter pulse has a long negative tail so signals from previous bunches gives a negative contribution.

- **Right Plot:** mean value of $P_{T \Delta R < 0.4}$ distribution versus the number of previous filled bunch. This variable is independent from out of time pile-up. MC deviation for 3 and 6 previous bunches.
In time pile-up contribution

\[
\langle E_T(\Delta R < 0.7) \rangle \text{ [GeV]}
\]

\[
\int L dt = 730 \text{ pb}^{-1} \quad \sqrt{s} = 7 \text{ TeV}
\]

\[
|L_{\mu\mu} - M_Z| < 15 \text{ GeV}
\]

\[
|M_{\mu\mu} - M_Z| < 15 \text{ GeV}
\]

\[
\langle \Sigma \text{Track } P_T(\Delta R < 0.7) \rangle \text{ [GeV]}
\]

\[
\int L dt = 730 \text{ pb}^{-1} \quad \sqrt{s} = 7 \text{ TeV}
\]

\[
|L_{\mu\mu} - \Sigma P_T \Delta R < 0.4\rangle
\]

\[
\Sigma_{\mu\mu} \Delta R < 0.4
\]

\[
|L_{\mu\mu} - \Sigma P_T \Delta R < 0.2\rangle
\]

\[
\Sigma_{\mu\mu} \Delta R < 0.2
\]

\[
|M_{\mu\mu} - M_Z| < 15 \text{ GeV}
\]

\[
|M_{\mu\mu} - M_Z| < 15 \text{ GeV}
\]
In time pile-up contribution

**Number of vertices:** is the number of reconstructed vertex in the event with more than two associated tracks.

- **Left plot:** mean value of muon $E_{T \Delta R < 0.2}$ distribution for cone size 0.2 and 0.4 versus number of vertices, a cut at 20 GeV on this variables is applied to avoid MC-data tail disagreement.

- **Right plot:** mean value of muon $P_{T \Delta R < 0.2}$ distribution for cone size 0.2 and 0.4 versus number of vertices, a cut at 20 GeV on this variables is applied to avoid MC-data tail disagreement.
Fit of $E_T$ with a CrystallBall function

$$\int L dt = 730 \text{ pb}^{-1}, \sqrt{s} = 7 \text{ TeV}$$

$|M_{\mu\mu} - M_Z| < 15 \text{ GeV}$
Fit of $E_T$ with a CrystallBall function

- The $E_{T, \Delta R < 0.4}$ distribution has been fitted with a CrystallBall function, the width $\sigma$ is reported here in function of the number of vertices.
Comparison between different number of vertices

ATLAS Preliminary

\[ \int L dt = 730 \text{ pb}^{-1}, \ \sqrt{s} = 7 \text{ TeV} \]

- Data 2011 - # of vertex = 4
- Simulation - # of vertex = 4
- Data 2011 - # of vertex = 8
- Simulation - # of vertex = 8

\[ |M_{\mu\mu} - M_Z| < 15 \text{ GeV} \]
Comparison between different number of vertices

- Muon $E_T^{\Delta R < 0.4}$ distribution for number of vertices equal to 4 and 8, data and MC are compared.