



Determination of σ_{eff} with DPS-sensitive observables

Paolo Gunnellini, Hannes Jung, Panos Katsas

Deutsches Elektronen-Synchrotron

MPI@LHC 2013

Universiteit Antwerpen

December, 2013

How to estimate σ_{eff} from available measurements?

- TEMPLATE METHOD: Fit with templates for background (SPS) and signal (DPS) to the data and extraction of σ_{eff} from their relative fraction

Really time consuming and difficult!

This presentation wants to:

- illustrate an alternative idea how to estimate the effective cross section from the available CMS data (currently at an early stage)

→ Outline:

- Introduction of the method we would like to use
- Very preliminary results:
 - W+jets analysis (→ do we get sth compatible with the CMS result?)
 - Four-jets analysis (→ which order of magnitude do we get for σ_{eff} ?)
- Issues that still need to be addressed (and are missing in our results)

What about an alternative method for σ_{eff} extraction?

IDEA: tune the parameters corresponding to the amount of DPS contribution in the available MCs

TOOL: RIVET routines and Professor

HOW TO: generate samples with different choice of the parameter and fit the data to get the best description

WHICH GENERATOR: PYTHIA8, HERWIG++, MADGRAPH+PYTHIA8...

WHICH PARAMETER: MultipleInteraction:expPow \rightarrow it is the exponent of the matter distribution function of the two protons in PYTHIA8 4C

\uparrow expPow \rightarrow overlap decreases faster \rightarrow less MPI contribution \rightarrow higher σ_{eff}

\downarrow expPow \rightarrow overlap decreases slower \rightarrow more MPI contribution \rightarrow lower σ_{eff}

\rightarrow ..After the tune (ca. 2 days!):

- plug-in the obtained parameter to see if the agreement improves
- extract from the PYTHIA8 output the effective cross section corresponding to the choice of the parameter

\rightarrow At this stage, the uncertainty in σ_{eff} is just the one coming from the fit with Professor!

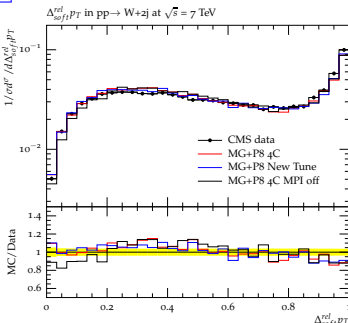
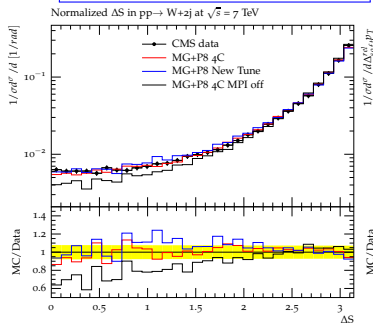
Effective cross section in the W-jets channel

Tuning the W-jet distributions in the tuning range [0.8,2.5]

Parameter	New Tune	4C
MultipleInteractions:expPow	1.523371	2.0
+Unc	1.7466189	-
-Unc	1.3001231	-
Goodness of fit	0.118	-

$$\sigma_{eff} = 25.9^{+2.4}_{-2.9} \text{ mb}$$

→ CMS result $\sigma_{eff} = 20.7 \pm 0.8 \pm 6.5 \text{ mb}$



Compatible results
obtained with
four-jet analysis

→ CMS talk
Thursd. afternoon

LEFT: ΔS
RIGHT: $\Delta_{soft}^{rel} p_T$

- We are thinking of an alternative method for σ_{eff} extraction
- A preliminary cross-check with W +jets result has been extracted
- A preliminary value for four-jets has been obtained

OPEN ISSUES

- When tuning, need not to spoil the description of other observables
- Evaluation of the systematics:
 - Dependence on the generator
 - Dependence on the matching scale and scheme
 - Dependence on the parton shower model
 - What else?

Thanks for your attention