Ch. #3 Soft Diffraction Update

Tim Martin, Valentina Avati
(editors)

University of Warwick, CERN

September 23, 2014

Chapter 3 - Soft Diffraction & Total Cross Section

Since last time:

→ Iteration on the text, addition of some glue paragraphs.

→ Inclusion of TOTEM low-mass double dissociation capabilities.

→ Inclusion of discussion and figures supplied by CASTOR (CMS).

Still outstanding:

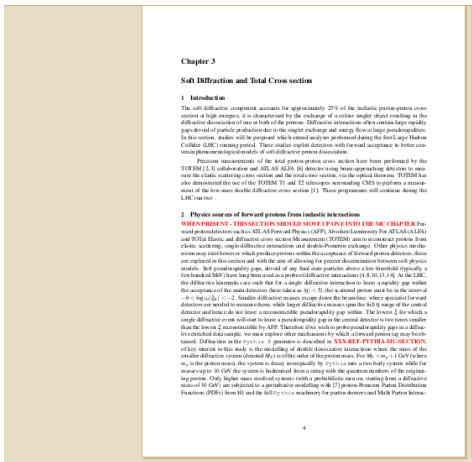
→ MC section giving details for studies in Ch 3 and Ch 7. Can be integrated into MC chapter now.

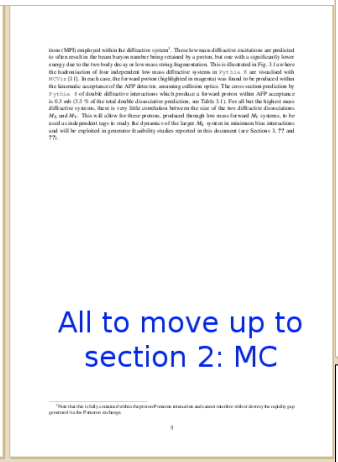
→ Outlook for ALFA and TOTEM in run 2.

→ Running conditions - link in part to similar info in Ch 7

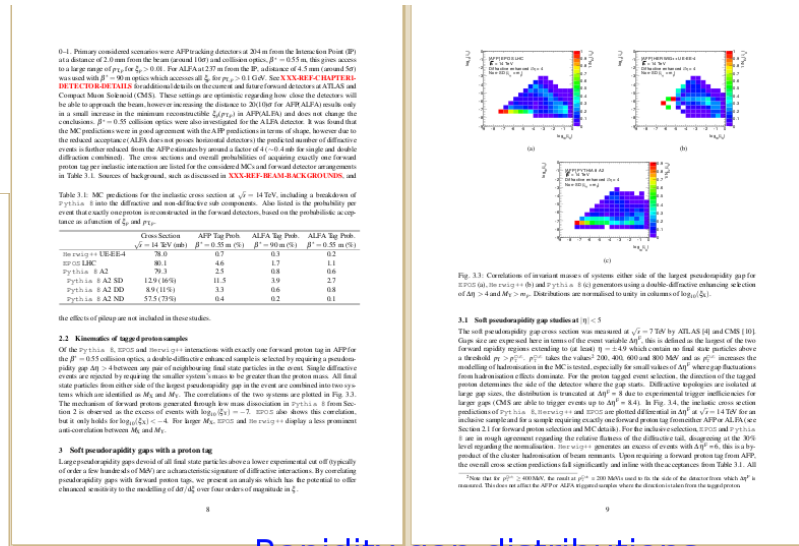
→ Conclusion.

Chapter 3:

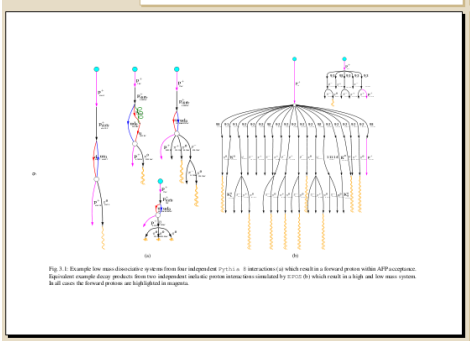


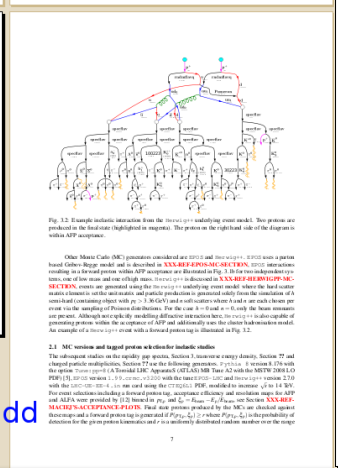


All to move up to section 2: MC

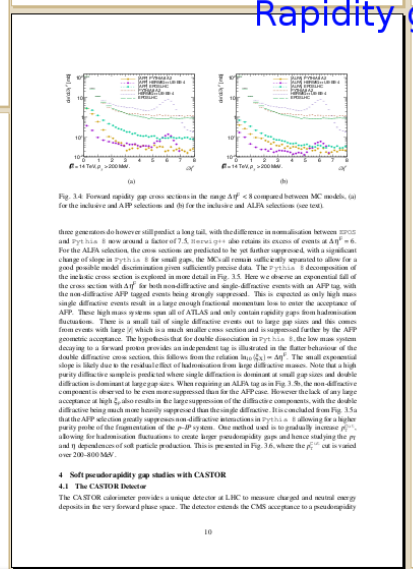


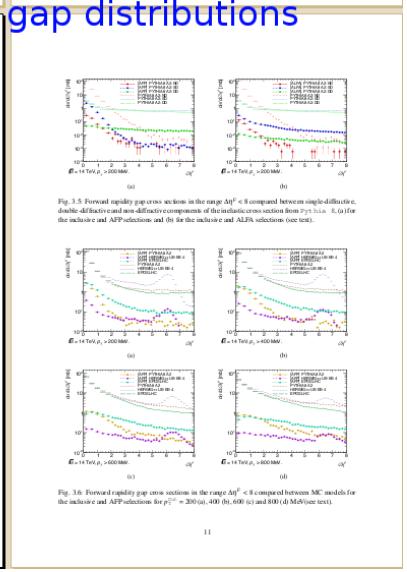
Rapidity gap distributions





Internal links to add





Chapter 3:

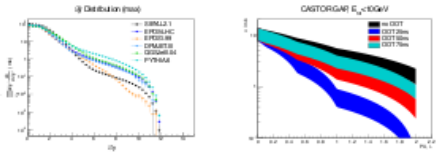


Fig. 3.7: (a) Distribution of rapidity gaps sizes in 13 TeV proton-proton collisions. The transition to low-mass diffraction for rapidity gaps larger then 10 is only accessible with the CASTOR detector and T2. (b) Dependence of detection efficiency of rapidity gaps ($E_{CASTOR} < 10$ GeV) on pileup for different bunch spacing scenarios.

of -6.6. In this location of phase space CASTOR is very sensitive to the production of medium- and low-mass excited states and can thus be used to study diffractive dissociation. It was shown that CASTOR is well suited to distinguish double diffraction from single diffraction, and that it can contribute to studies soft diffraction [9]. The RMS noise level per calorimeter cell is on the order of 100–300 MeV, which provides a very good environment to search for rapidity gaps under the condition that the luminosity and subsequently pileup levels are not high. Since CASTOR has no segmentation in pseudorapidity, only gaps larger than the acceptance of CASTOR can be observed.

4.2 Pseudorapidity gaps in CASTOR

The use of CASTOR allows for the soft pseudorapidity gap spectrum to be investigated over a larger range. As seen in Fig. 3.7a, very little integrated luminosity is required, around 10 nb^{-1} with low pileup ($\mu < 0.05$) is sufficient for many studies. Here rapidity gaps in CASTOR are defined as being events for which there was less than 10 GeV total energy deposit in the acceptance of CASTOR. The impact of out-of-time pileup events destroying any gap is highlighted for different bunch configurations in Fig. 3.7b. Such data will contribute complementary information to other soft diffractive measurements that will be performed e.g. by the TOTEM Collaboration. The CASTOR data can be studied together with the TOTEM T2 tracking station data. In this way, rapidity gaps within the acceptance of CASTOR are resolved and correlation measurements of M_X vs. $\Delta\eta$ in this very forward phase space interval can be performed. These are unique measurement opportunities at LHC in respect to soft diffraction. Firstly, to measure soft diffractive cross sections in differential bins of mass as well as rapidity gaps and, secondly, to measure single diffractive mass distributions, if possible correlated to the momentum loss of the surviving proton.

4.3 Soft pseudorapidity gaps conclusion

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5 The total cross section

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6 Running scenarios for elastic and soft diffraction

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7 Conclusions

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References

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Contributions from CMS CASTOR

Missing: Plans of TOTEM & ALFA for sigma tot. Chapter wrap up.