

Forward physics instrumentation at the FCC

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Introduction

Physics motivation

Forward measurements at the FCC

Introduction

- Forward measurements difficult at the LHC, limited running time
- Special β^* -runs for TOTEM and ALFA
- At LHC, all 4 IR's have optics layout designed for very high luminosity, β^* down to ~ 0.3 m
- Can low luminosity IR be designed at FCC with
 - ▶ $\mathcal{L} \sim 10^{31}\text{-}10^{32} \text{ cm}^{-2}\text{s}^{-1}$
 - ▶ optimized by design for $\beta^* \sim 300\text{-}1000$ m ($\beta^* \sim 1/\mathcal{L}$)
- brainstorming discussions with H. Burkhardt and D. Schulte
 - ▶ no arguments that such an option is not feasible, needs detailed studies
 - choice of l^*
 - design of magnets
 - design of beam optics
 - integration into the machine layout

Physics motivation for pp-collisions

- standalone measurements of forward instrumentation
 - ▶ measurement elastic scattering
 - cross section $\frac{d\sigma}{dt}$ up to $t \sim 8-10 \text{ GeV}^2$
 - ▶ measurement single/double diffractive dissociation
 - cross section $\frac{d^2\sigma}{dt d\xi}$ for values of t and ξ as low as possible
- measurements combined with central detector at mid-rapidity
 - ▶ measurement of central production at mid-rapidity
 - correlation of centrally produced state and t, ξ of proton
 - correlation of centrally produced state and diffractive dissociation of beam
 - ▶ measurement of proton scattering plane
 - information of helicity structure of central state

Physics motivation for γp -collisions

- exclusive γp processes
 - ▶ forward quarkonia production $J/\psi, \Upsilon$ measured by e^+e^- -decays
 - ▶ forward Z-boson production measured by e^+e^- -decay as test of DGLAP evolution
 - ▶ time-like Compton scattering, measure e^+e^- in the continuum

Forward Instrumentation at the FCC

- Roman Pot type detector stations for measuring t , ξ of very forward scattered protons
- segmentation of D1 dipole into 2-3 segments of increasing bending power ?
 - ▶ measurement of very forward e^+e^- -pairs of increasing longitudinal momenta of e^+ and e^-