

Very-forward π^o production cross section in proton-proton collisions at $\sqrt{s} = 13$ TeV measured with the LHCf experiment

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Integrated luminosity The LHCf experiment Data set ◆ LHC fill #3855 (p-p at √13 TeV) Type | π⁰: 2.1 nb⁻¹ Two independent detectors. placed ~140 m from (dedicated trigger without prescaling) the Interaction Point 1 (IP1) along the beam line on Arm₂ ~14 hours of data taking with luminosity: 0.3-1.6 x 10^{29} cm⁻² s⁻¹ opposite sides: Arm1 and Arm2 [1] * Type II π⁰: 0.8 nb⁻¹ Each detector is made of two sampling and position sensitive calorimeters with thickness ~44 X_a (~1.6 λ) and different transverse dimensions **Results** Transverse position measurement: 0.20 < X_c < 0.25 0.25 < X_e < 0.30 0.30 < X_c < 0.35 Arm1 Type I GeV [GeV GeV preliminary preliminary Arm2: silicon microstrip detectors Arm1 Type II (email cal Arm1 $\frac{\sigma}{dp^3}$ r Arm1 Type II (large cal $\frac{d^3 \sigma}{3}$ ы. E^{d^3} Ер Ъ. - Arm2 Type Arm2 Type II (small cal Ē $\sigma_{_{inel}}$ σ_{inel}^{1} Arm2 Type II (large cal) preliminar p_T [GeV] p_{τ} [GeV] p_{τ} [GeV] 0.35 < X_r < 0.40 0.40 < X_r < 0.50 $0.50 < X_r < 0.60$ π^0 reconstruction GeV preliminary GeV preliminary [GeV preliminary $0.20 < X_{-} < 0.25$ $\frac{d^3 \sigma}{dp^3}$ $\frac{d^3 \sigma}{dp^3}$ $E \frac{d^3 \sigma}{2}$ Е^д 8000 one photon in each calorimeter ("Type I") щ Ē 10 $\frac{1}{2}$ U 10 7000 two photons in the same calorimeter ("Type II") Arm₂ 6000F Type I 10-4 transverse hit position for the two photons and their 06 08 5000E p_T [GeV] p_T [GeV] p_{τ} [GeV] enerav 0.60 < X_c < 0.70 0.70 < X_e < 0.80 0.80 < X_E < 0.90 4000F Signal fitted with an asymmetric Gaussian, GeV-2 $\frac{d^3}{dp^3}$ [GeV⁻¹ preliminary preliminary GeV preliminary 3000 background with a 3rd order polynomial 2000 $E\frac{d^3}{dp^3}$ $E^{\frac{d^3}{E}}c$ Е^д 1000 Background p,-dependence estimated within 4-7 σ Ē 1 inel $\frac{1}{\sigma_{nel}}$ from the peak on both sides ("sideband method") 140 200 bkg bkg signal and energy/position resolution effects p_ [GeV] p_ [GeV] p_{τ} [GeV] Good agreement between Arm1 and Arm2 data and between "Type I" and "Type II" events [6] O. Adriani et al., JHEP 2018 (2018) 1

Arm2 acceptance covers the gaps in Arm1 data for $X_r < 0.6$ and extends the low- p_τ coverage for $X_r > 0.6$, while Arm1 extends the acceptance to higher p.

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- Arm1: GSO bars [2]
- Measurement of verv forward neutral particles (photons [3,4], neutrons [5-7], π⁰ [8-10])
- Experimental data in the very forward region are fundamental for the tuning of hadronic interaction models used to simulate the interaction of cosmic ravs with the atmosphere
- Two typologies of π⁰ events detected:
- Invariant mass measured from the reconstructed
- Signal window within 3 σ from the peak
- Unfolding procedure to correct selection efficiency

References

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[7] O. Adriani et al., JHEP 2020 (2020) 1. [8] O. Adriani et al., PRD 86 (2012) 092001. [9] O. Adriani et al., PRC 89 (2014) 065209. [10] O. Adriani et al., PRD 94 (2016) 032007.