

Identified hadron spectra in high-statistics p+p collisions at 158 GeV/c

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Motivation

The detection of cosmic-ray antinuclei is a potential breakthrough approach for the identification of dark matter. The dominant source of antinuclei in the astrophysical background are proton-proton interactions. Typically, modelling the production of light antinuclei requires antiproton production cross sections as an input. Hence antiproton production needs to be measured with high precision.

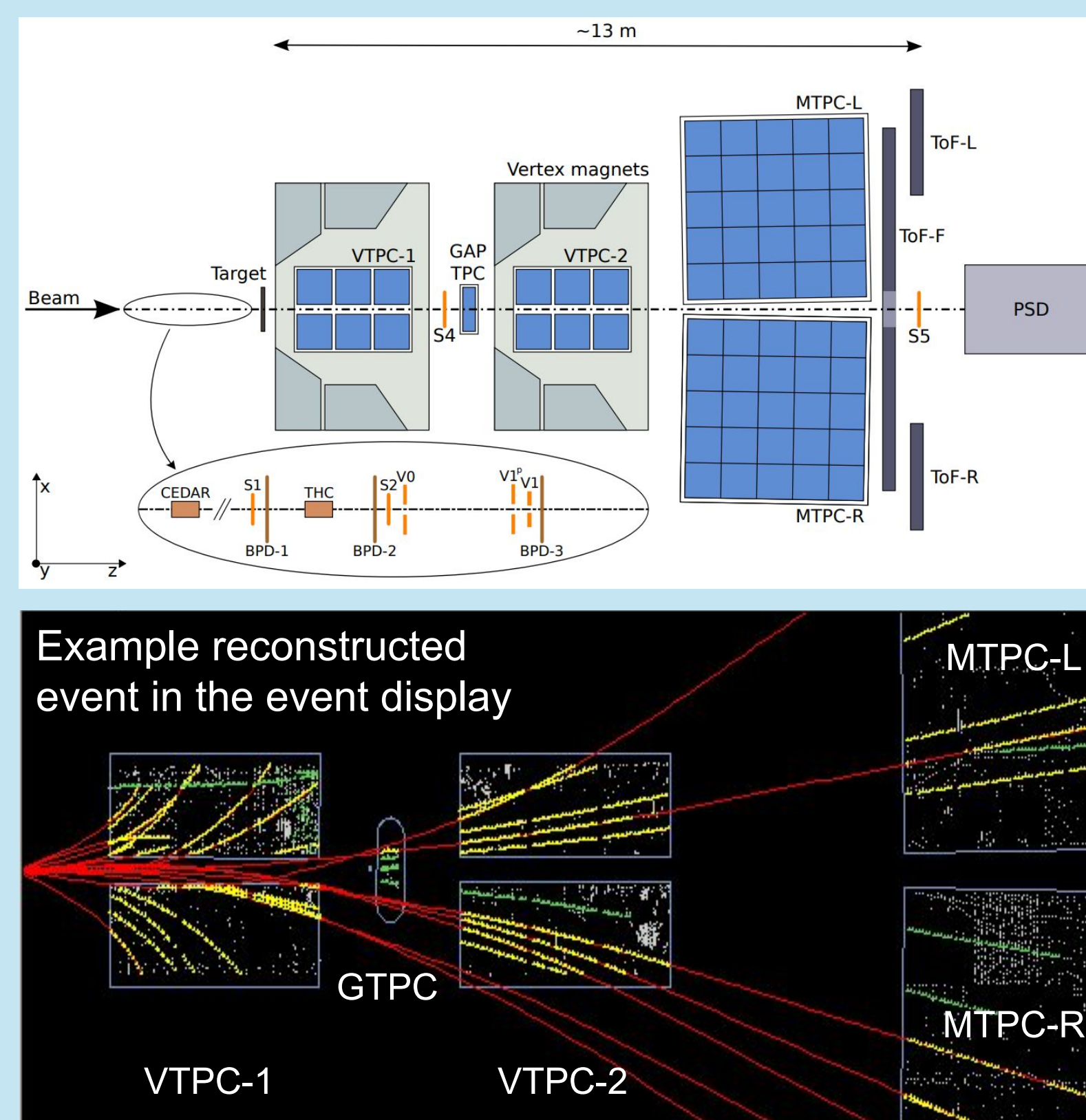
The two most popular models to describe antinuclei production are the coalescence and thermal model, but they are based on different underlying physics. A better understanding of antinuclei production mechanism is needed, which motivates the effort to analyze large data sets from fixed-target experiments.

This poster presents the preliminary measurements of proton and antiproton spectra using the high-statistics proton-proton data sets from NA61/SHINE. The high-statistics data allows to significantly extend the phase space coverage in rapidity and transverse momentum, as compared to previous results from NA61/SHINE.

Moreover, π^\pm and K^\pm spectra were also obtained as a by product of this analysis.

NA61/SHINE (SPS Heavy Ion and Neutrino Experiment) at CERN

- Fixed-target, large acceptance hadron spectrometer, with coverage of the full forward hemisphere, down to $p_T = 0$.
- TPCs are main tracking detectors. TOF also placed downstream.
- Momentum resolution: $\sim 1\%$, dE/dx energy resolution: $\sim 4\%$.
- Particle identification using energy deposition (dE/dx) in the TPCs.
- 10% of the data were taken with empty target to estimate background corrections.



Proton-proton collisions

- More than 60 million recorded collisions over multiple years.
 - 30 million events after selection.
 - 750 million particle tracks \rightarrow 65 million after event & track selection cuts.

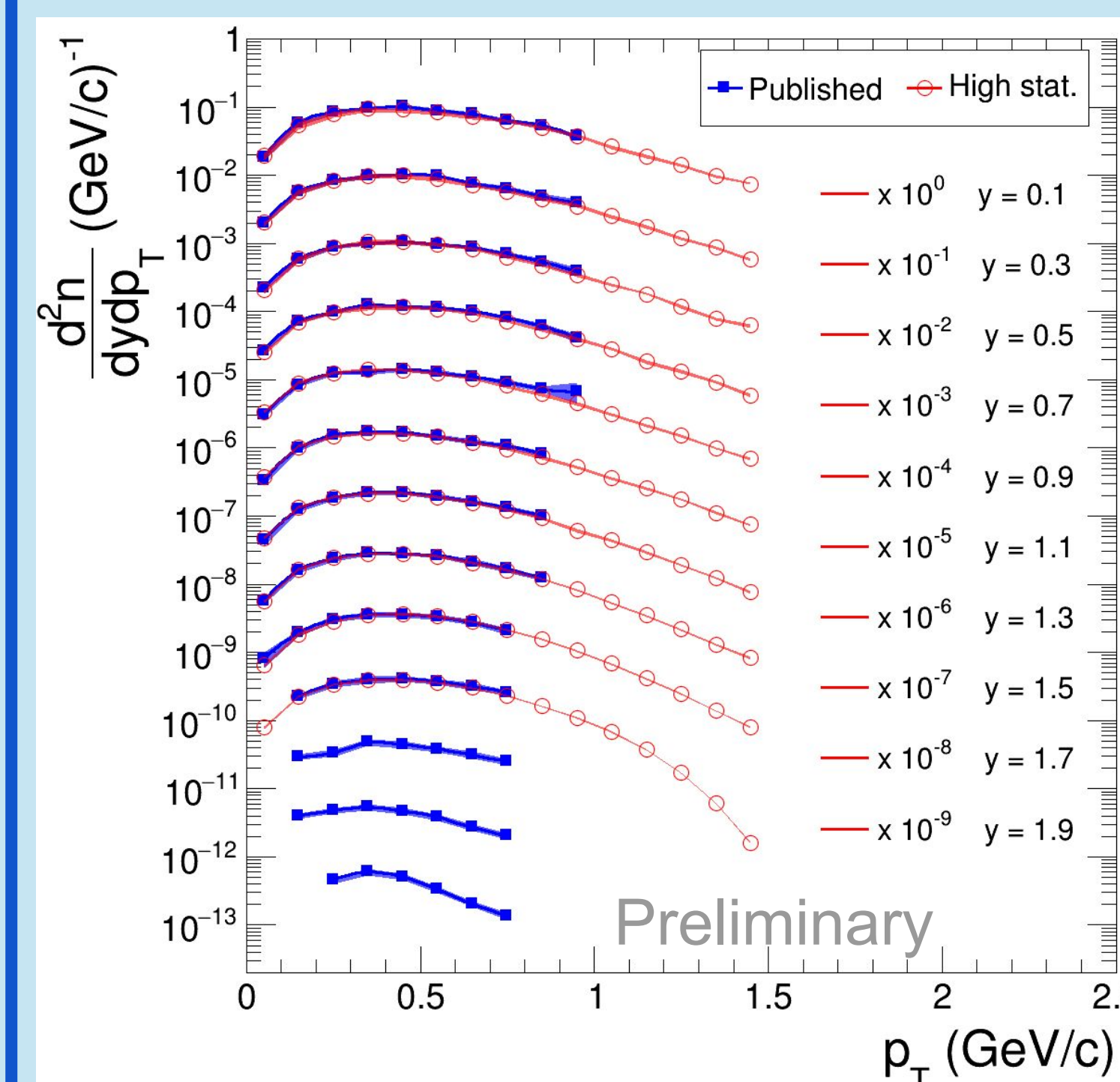
Run	Total p+p events (millions)	After event selection (millions)
2009	4	1
2010	44	16
2011	14	4

Already published in [Aduszkiewicz et al. Eur. Phys. J. C \(2017\) 77: 671](#)

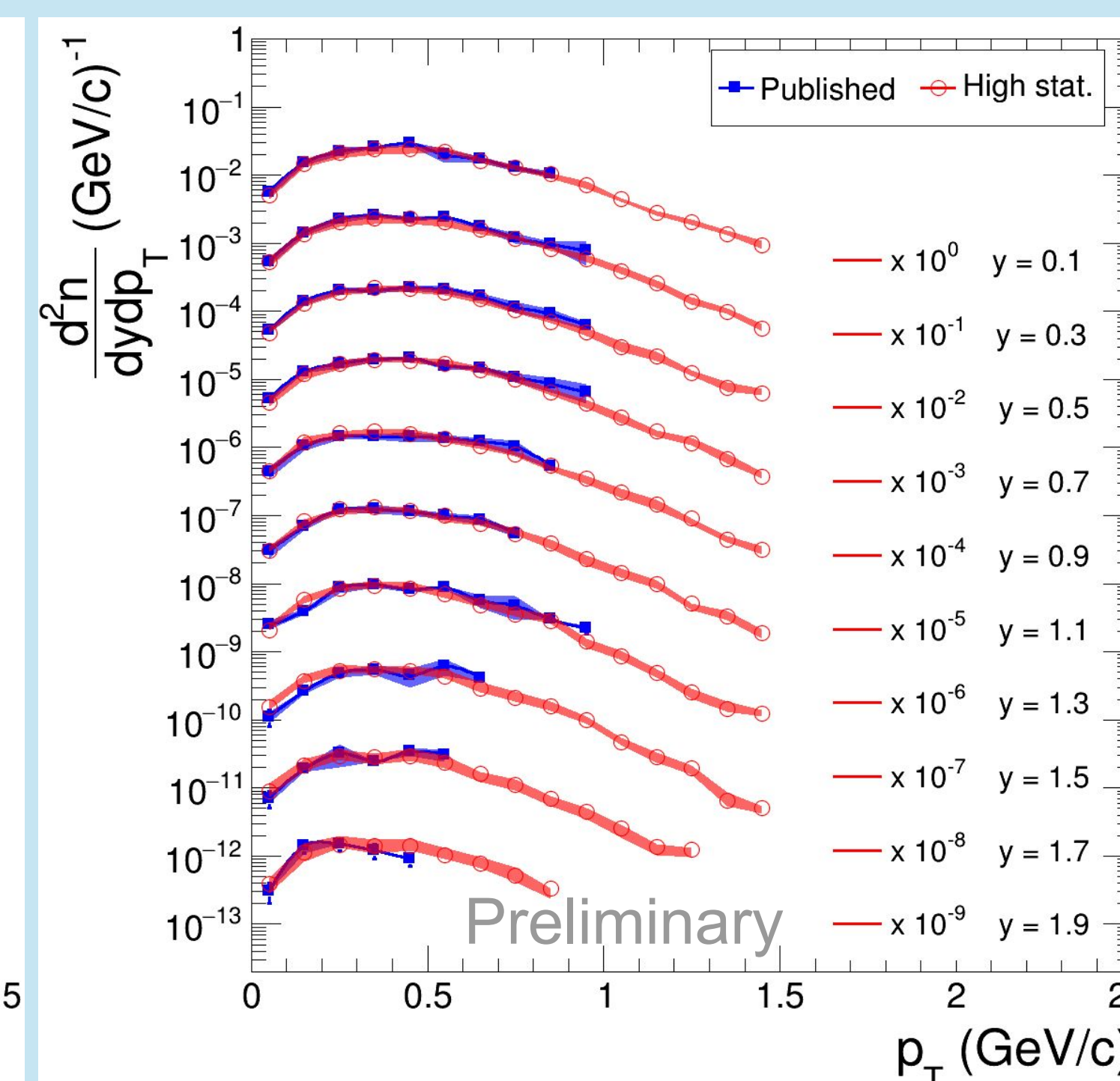
New results for (anti)protons

Charged hadrons produced by strong interaction processes and in electromagnetic decays of produced hadrons in inelastic p+p interactions at 158 GeV/c ($\sqrt{s} = 17.3$ GeV).

- Statistical uncertainties are smaller than the symbol sizes.
- Systematic uncertainties are shown as color bands.

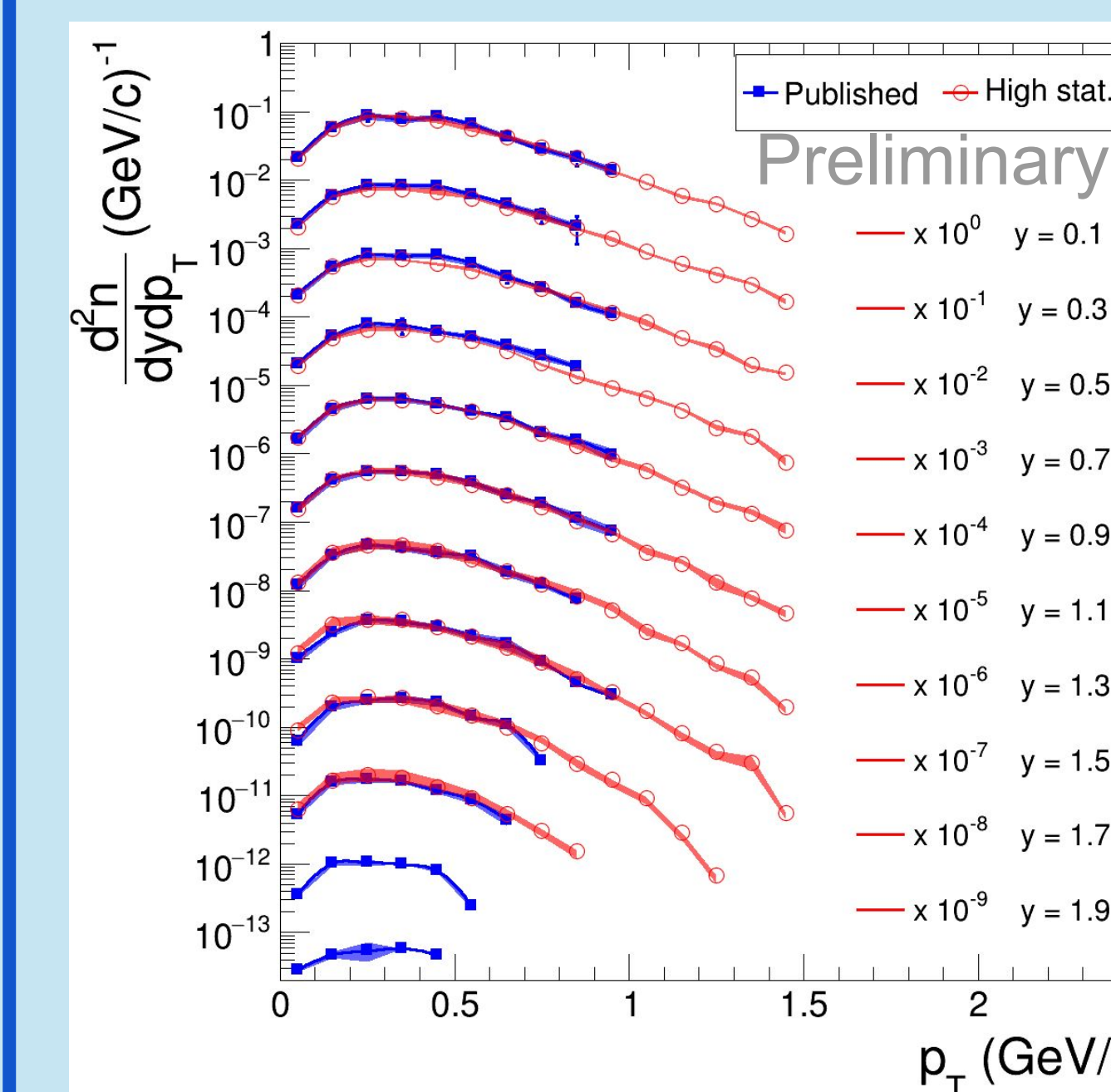


Protons

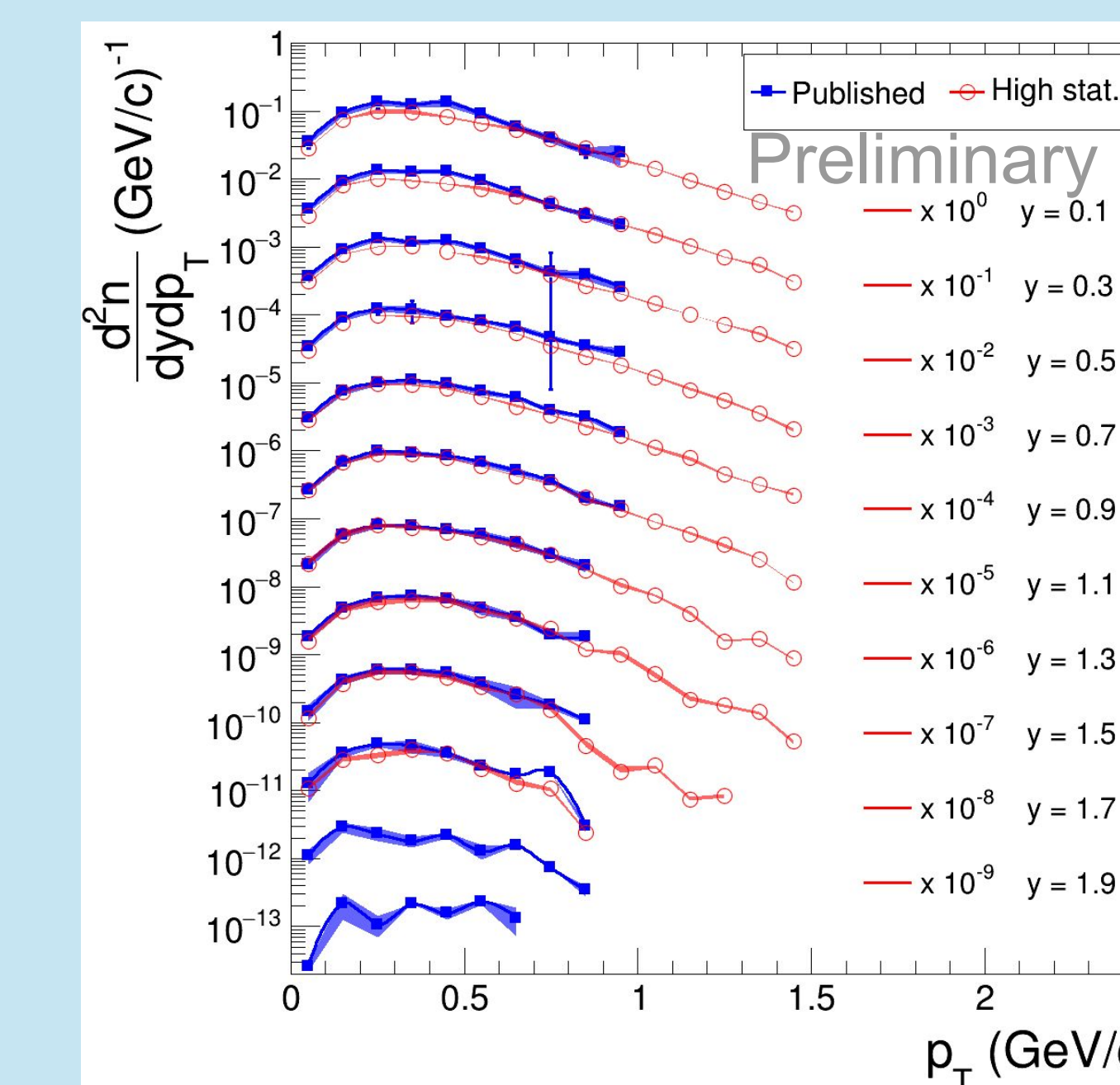


Antiprotons

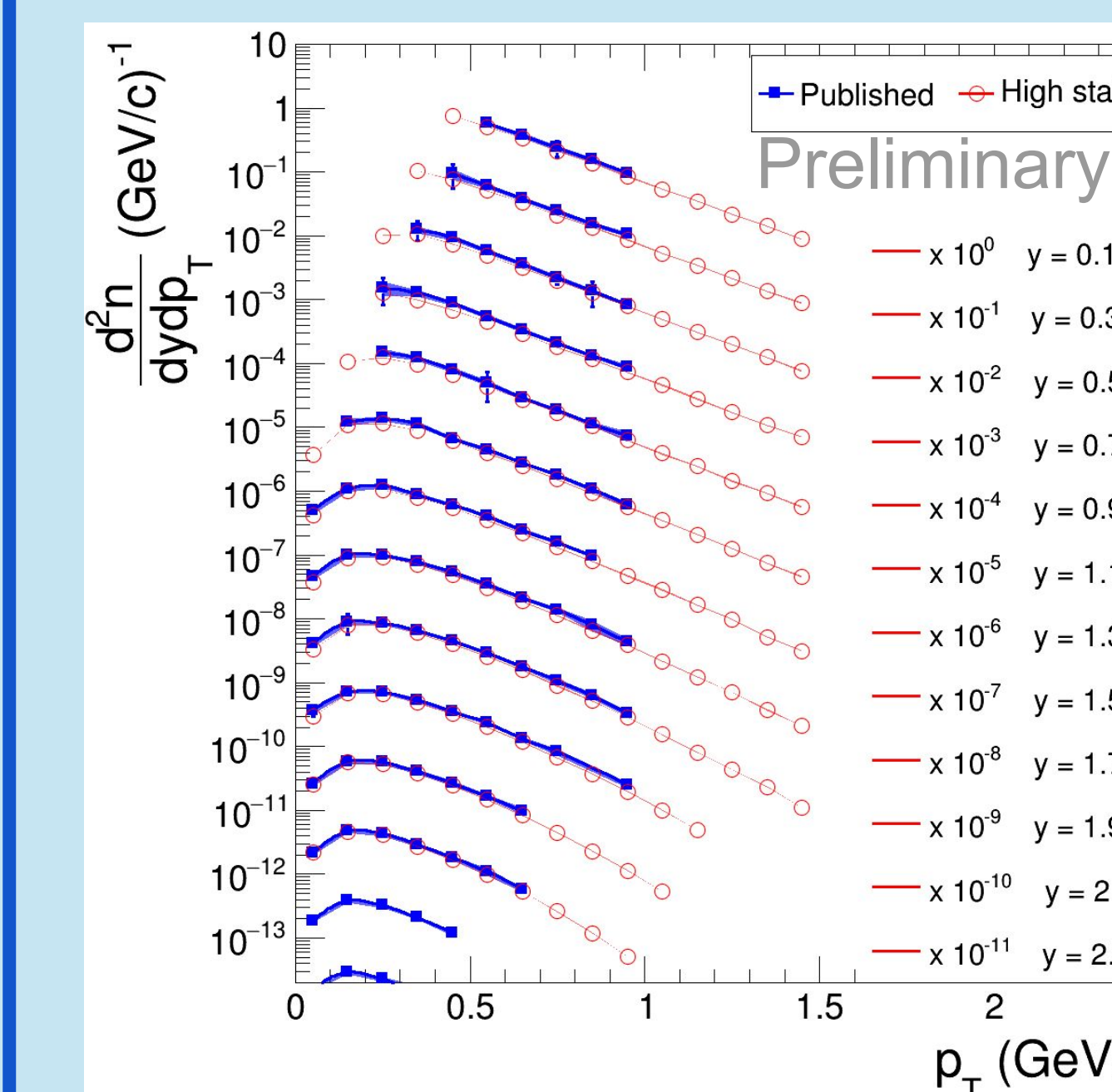
Pions and kaons



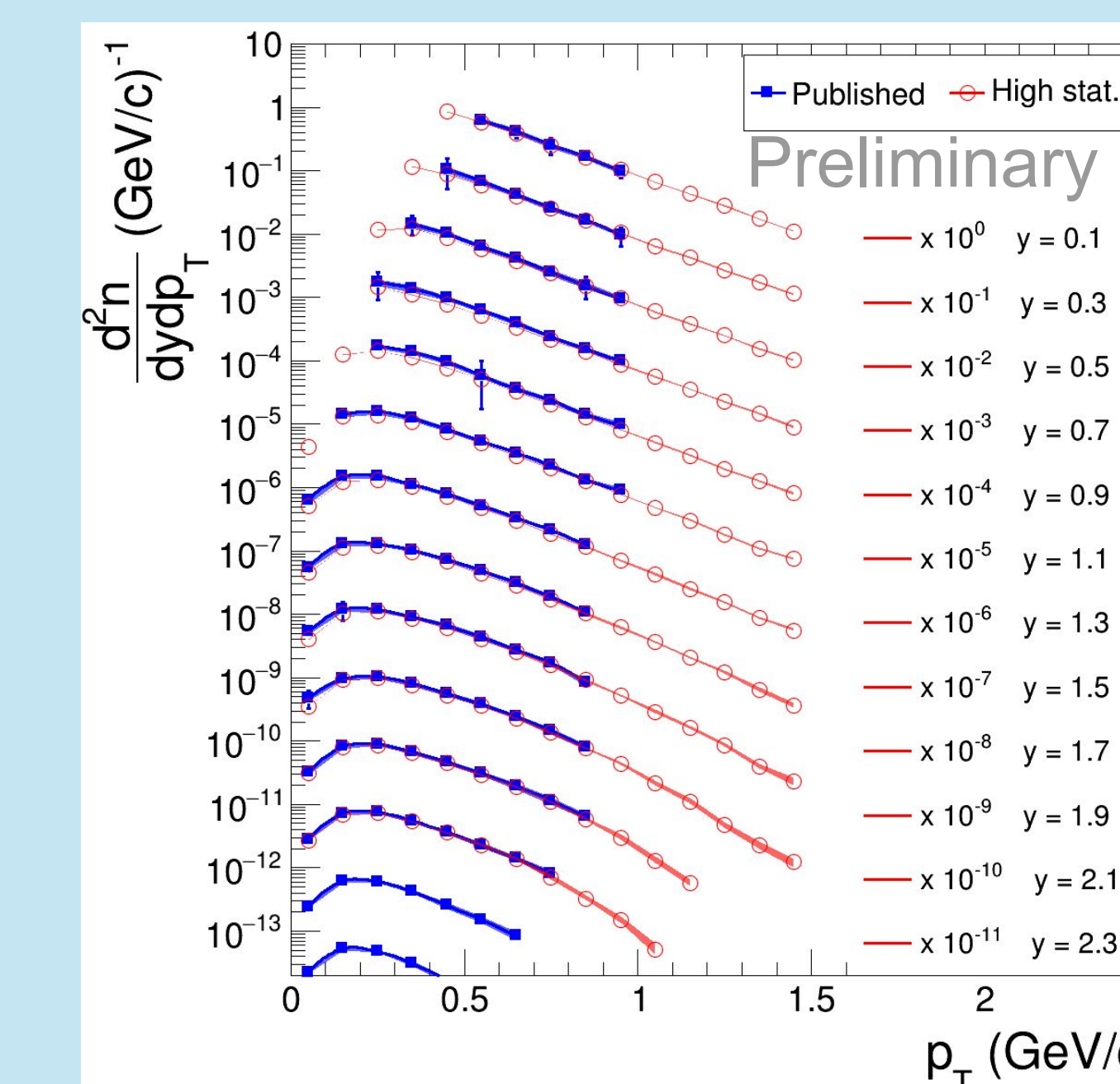
K^-



K^+



π^-



π^+

Outlook

- **Final release and publication coming soon.**
- Time-of-flight-based analysis is ongoing.
- Angular correlation measurements have been started.

Acknowledgements

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