TOWARDS A REALISTIC MONTE CARLO SIMULATION OF THE MPD DETECTOR AT NICA

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ABSTRACT

For the correct development of any experiment in particle physics it is of utmost importance to simulate the conditions of the experiment in great detail, 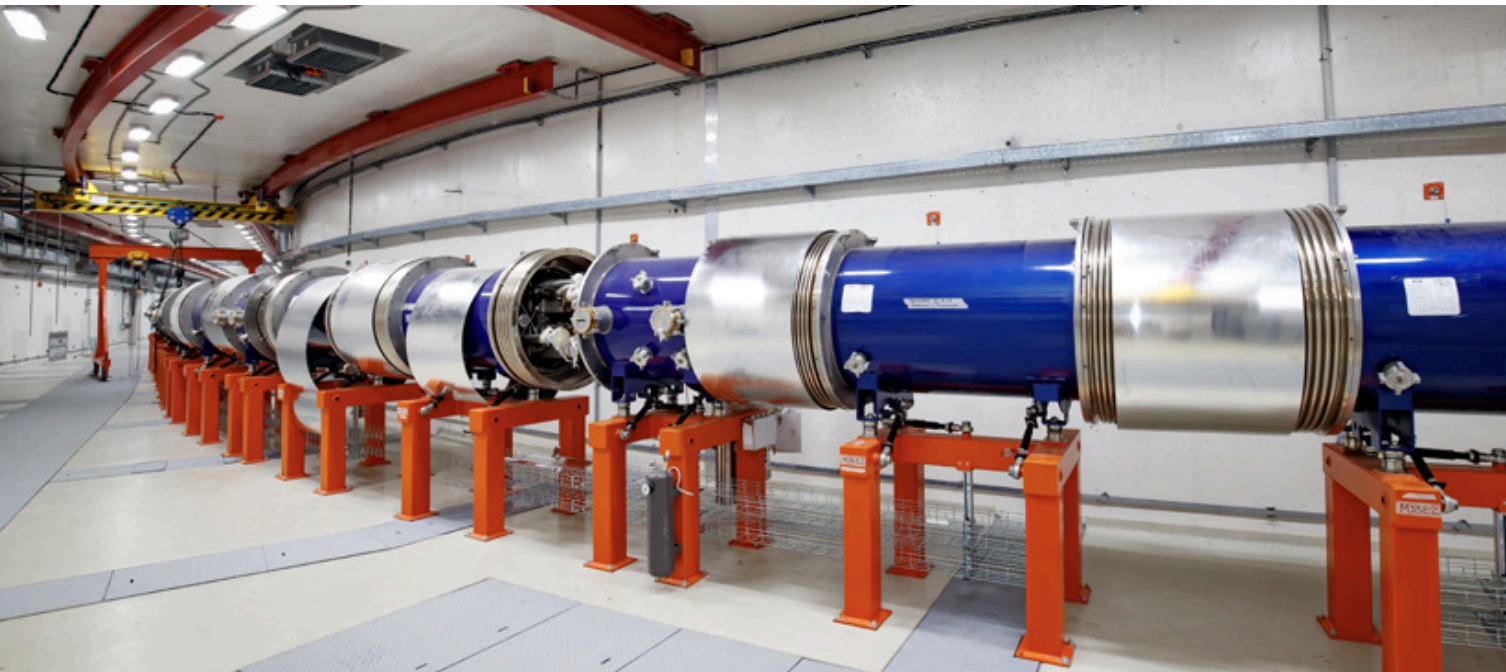for this the MPD TPC (time projecting camera) has been digitally re-constructed, this precentacion explains the progress of data reconstruction
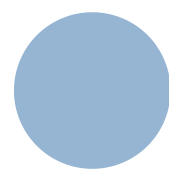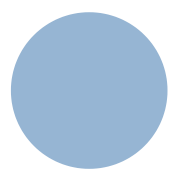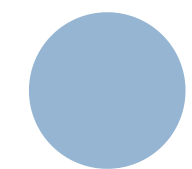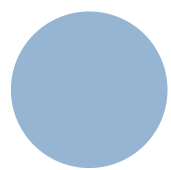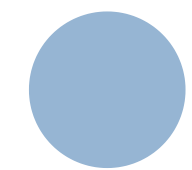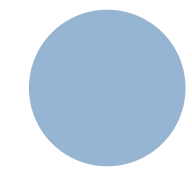
SHORT REVIEW OF NICA

NICA seeks to map the properties of the fireball through the mapping of its different thermodynamic properties in an energy range of 2 GeV to 12 GeV currently, since low energy is expected to find very different data between particulate species as opposed to high energy where it appears that properties tend to be the same

PARAMETERS

For realistic simulations a new simulation approach was developed with specific parameters

| Parameter	Value
Magnetic field	0.5 T
Drift gas	P10 (90% Argon + 10% Methane)
Drift velocity	5.45 cm/μs
Transverse diffusion (σ_T) at 0.5 T	185 μm/$\sqrt{\text{cm}}$
Longitudinal diffusion (σ_L)	320 μm/$\sqrt{\text{cm}}$
Pad size	5×12 mm^2 (27 rows) + 5×18 mm^2 (26 rows)
Electronics shaping time (FWHM)	180 ns
ADC dynamic range	12 bits
ADC sampling frequency	10 MHz

STEPS FOR SIMULATION

1. EVENT GENERATION;
2. PARTICLE TRANSPORT;
3. TPC RESPONSE SIMULATION;
4. CLUSTER/HIT FINDING;
5. TRACK RECONSTRUCTION INCLUDING ENERGY LOSS DE/DX DETERMINATION;
6. PHYSICS ANALYSIS: PID, SECONDARY VERTEX FINDER, ETC.
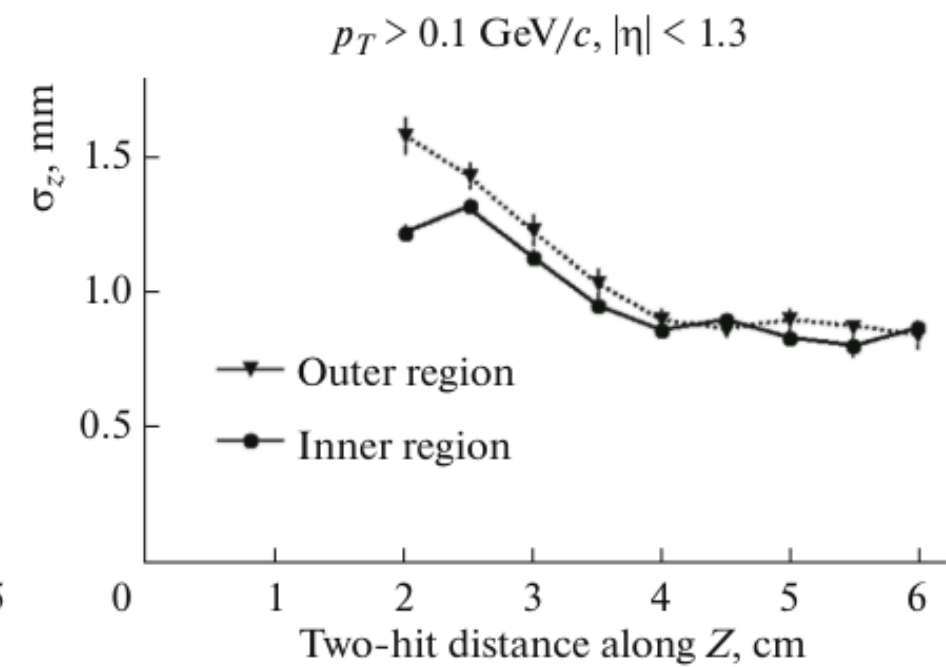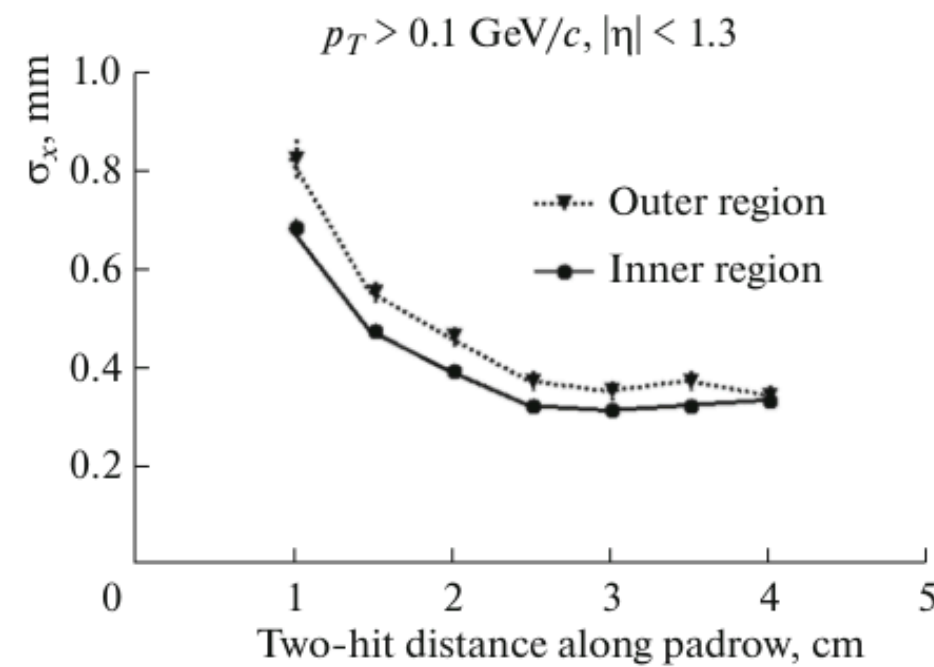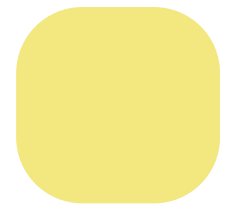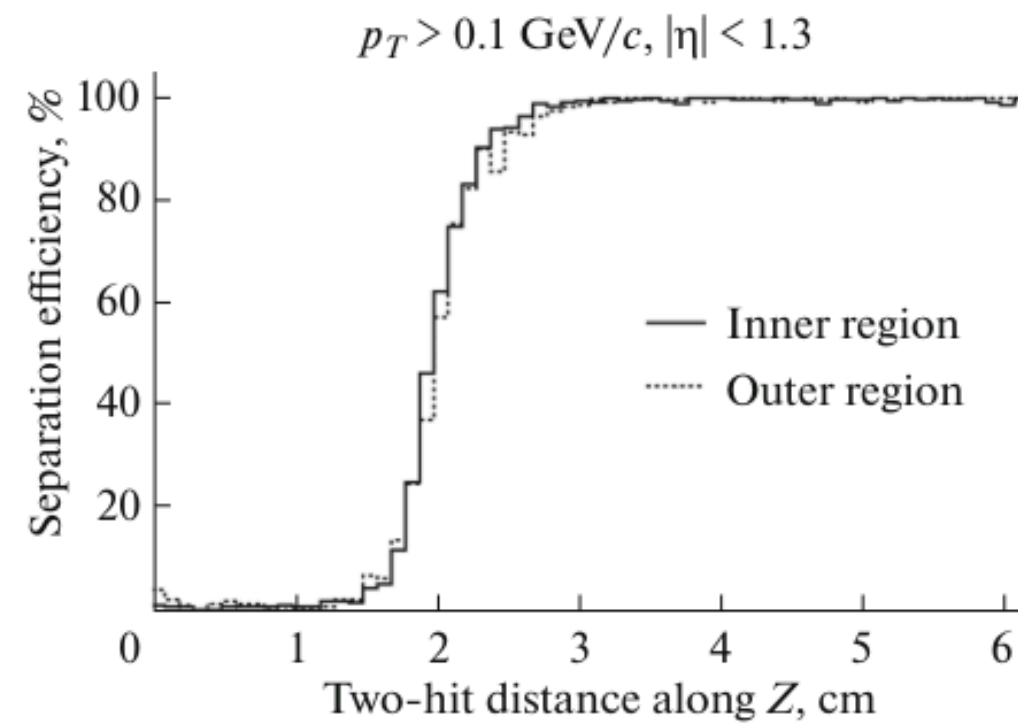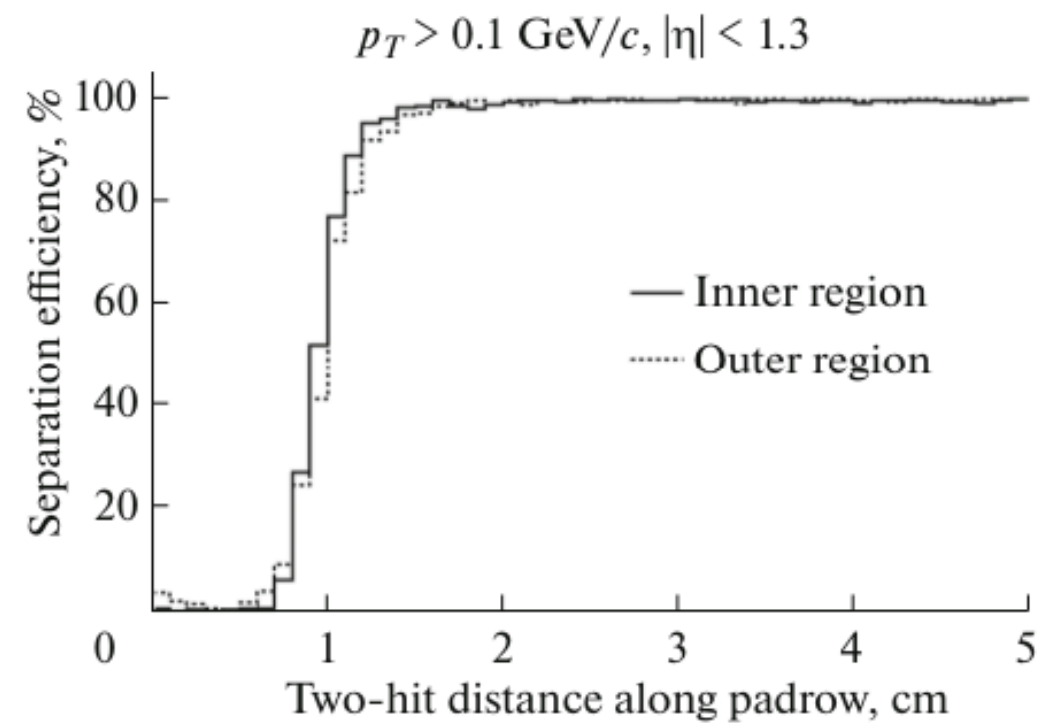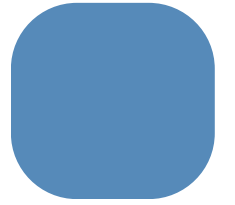
CLUSTER/HIT RECONSTRUCTION IN TPC

- UrQMD Au-Au at $\sqrt{s_{NN}} = 9$ GeV
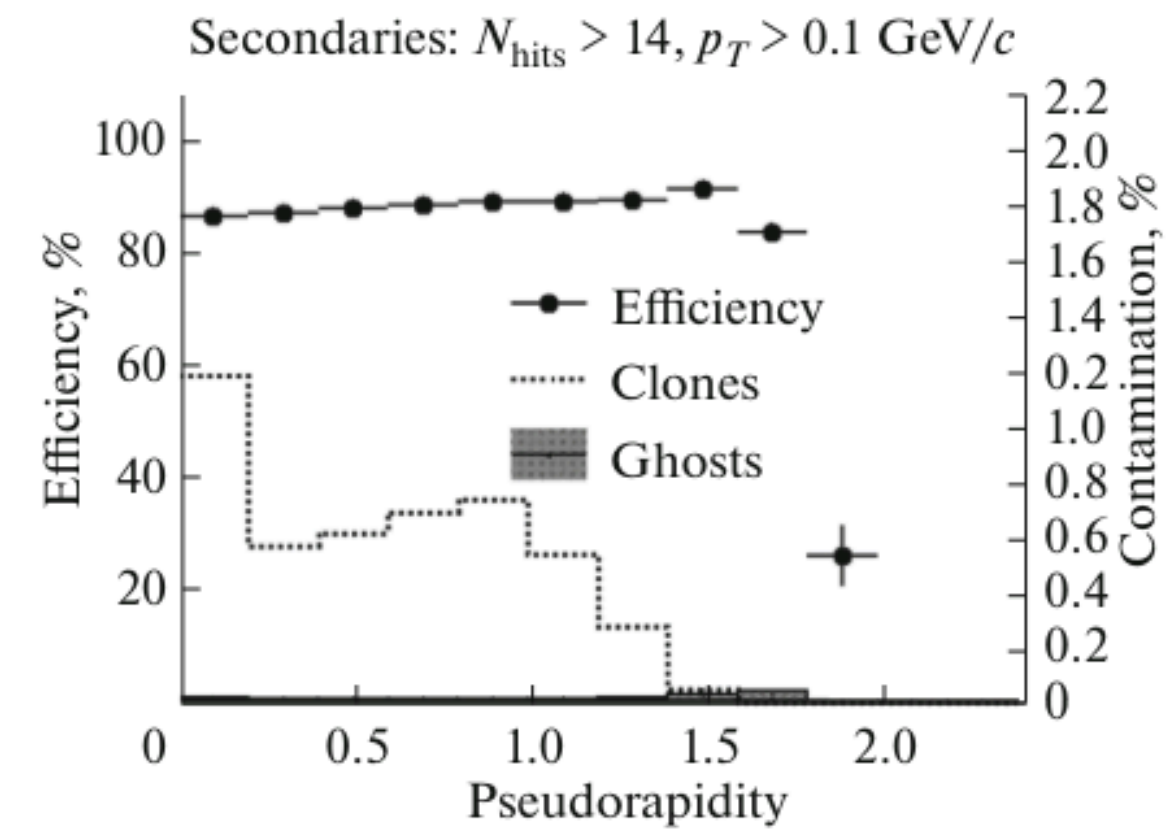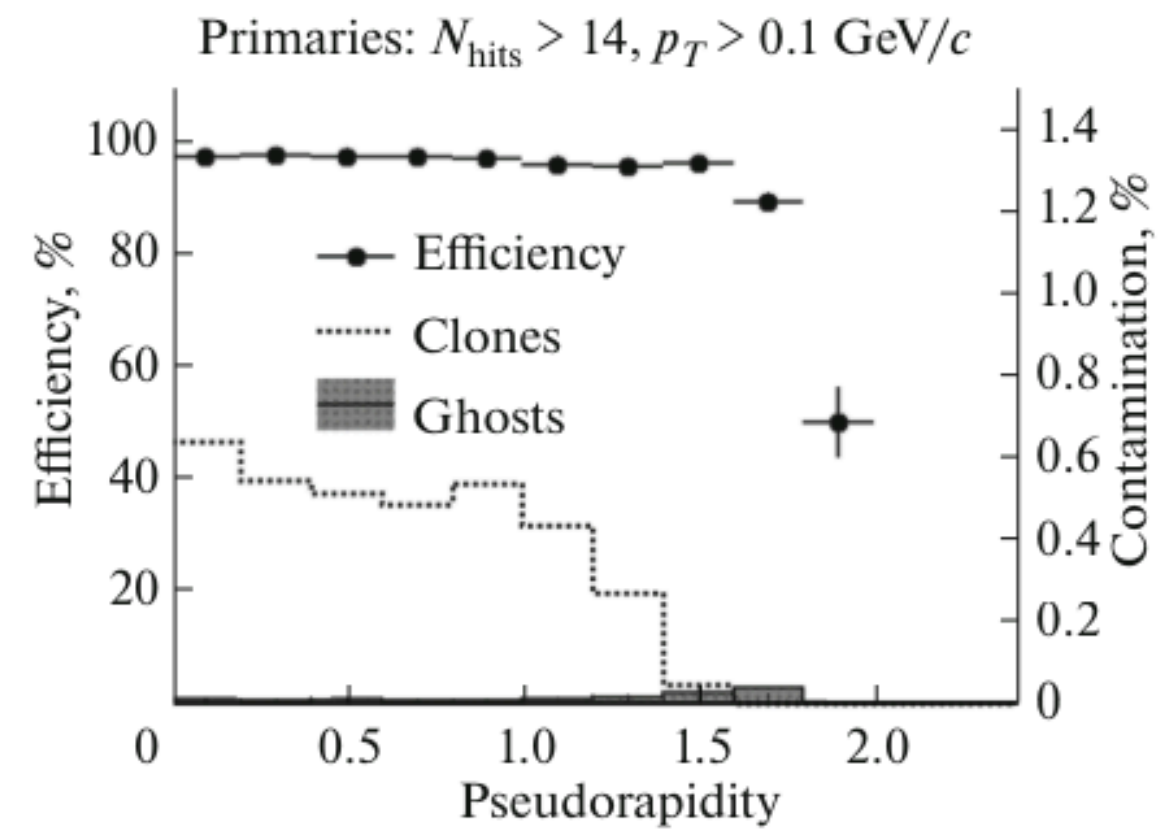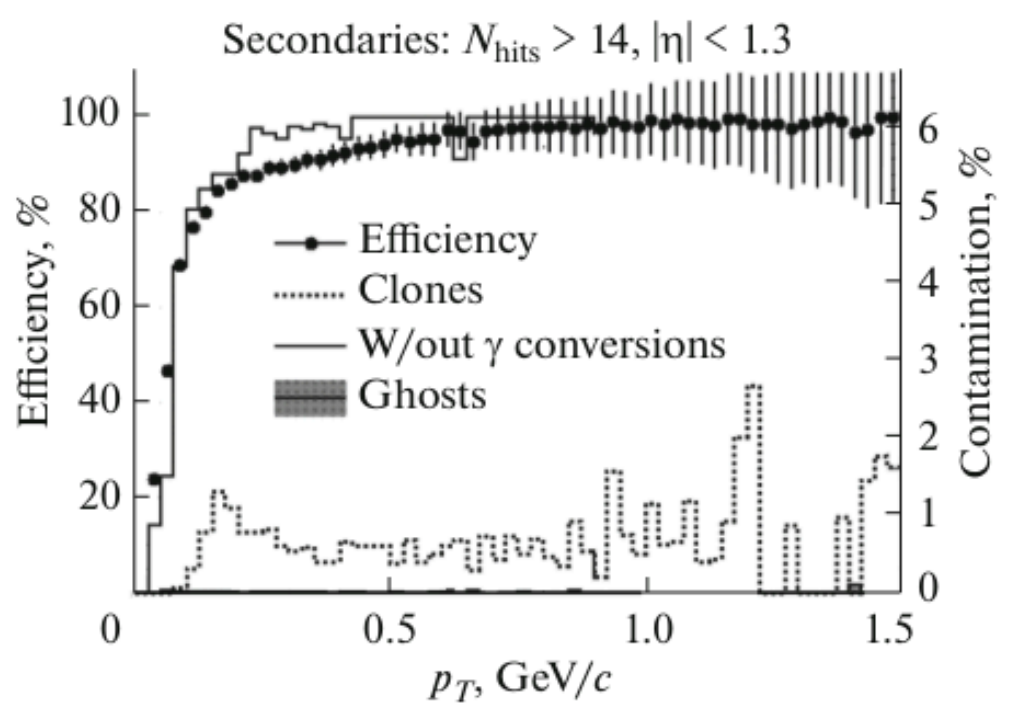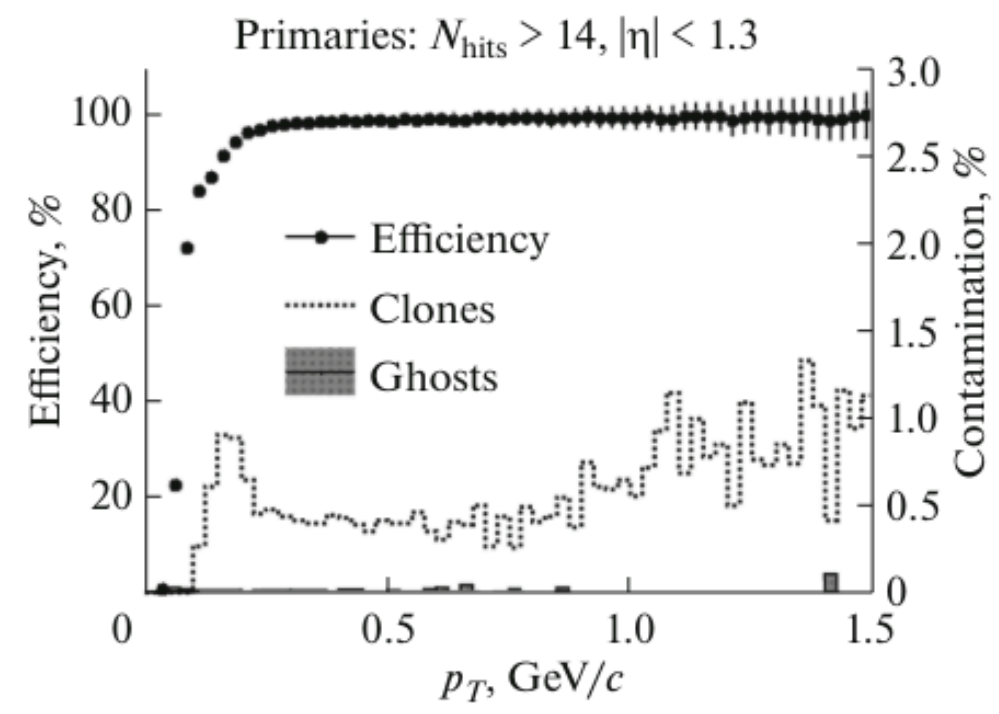
Isolated hits, dip angle = 5−15 deg

Isolated hits, crossing angle <5 deg
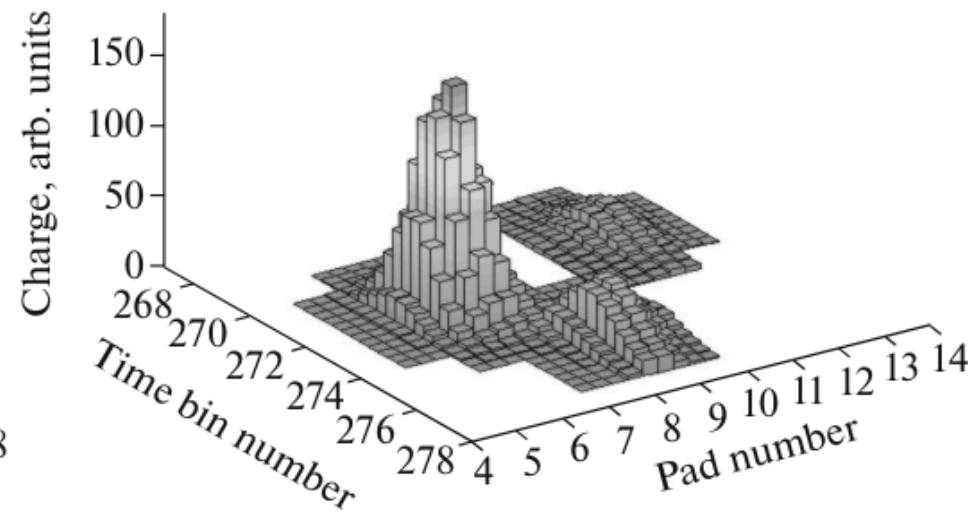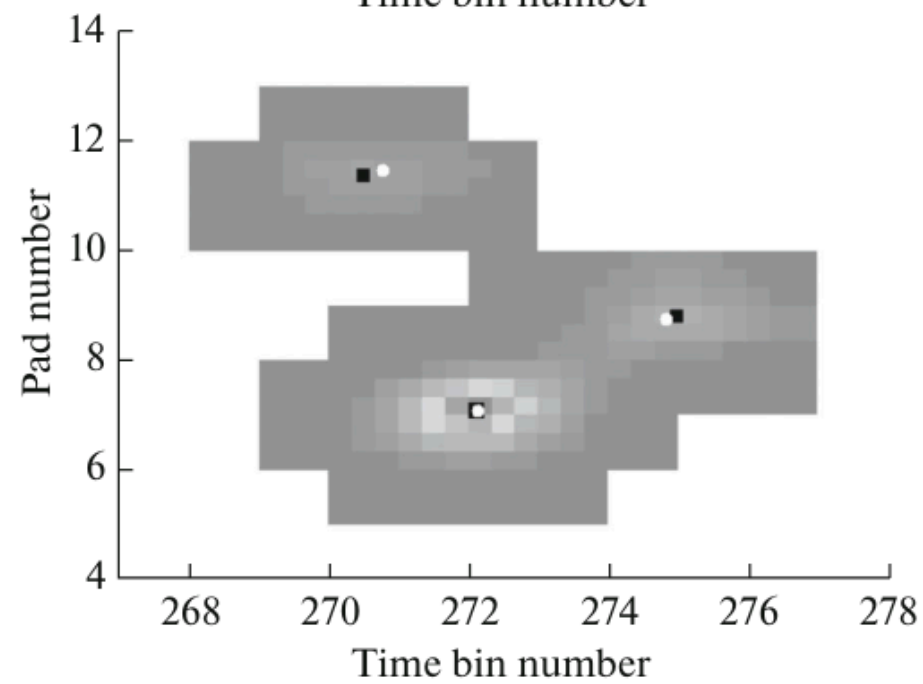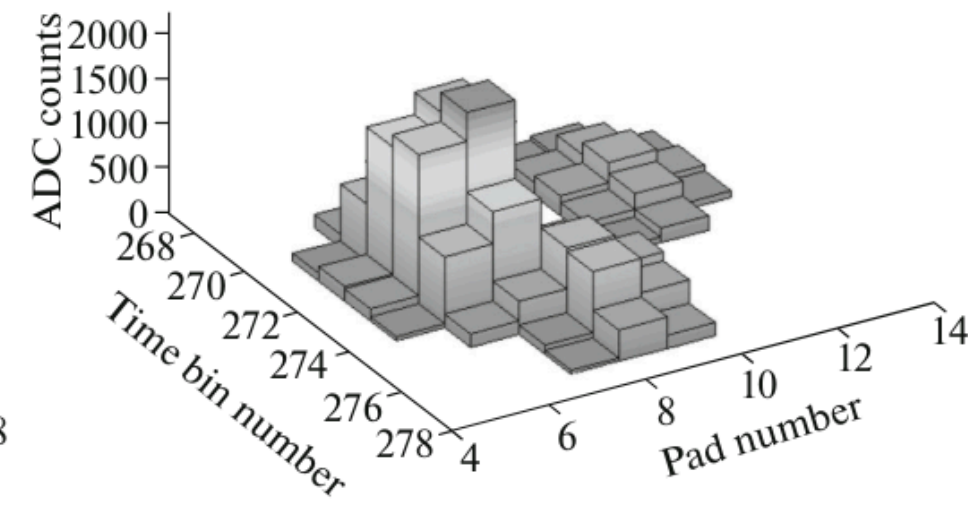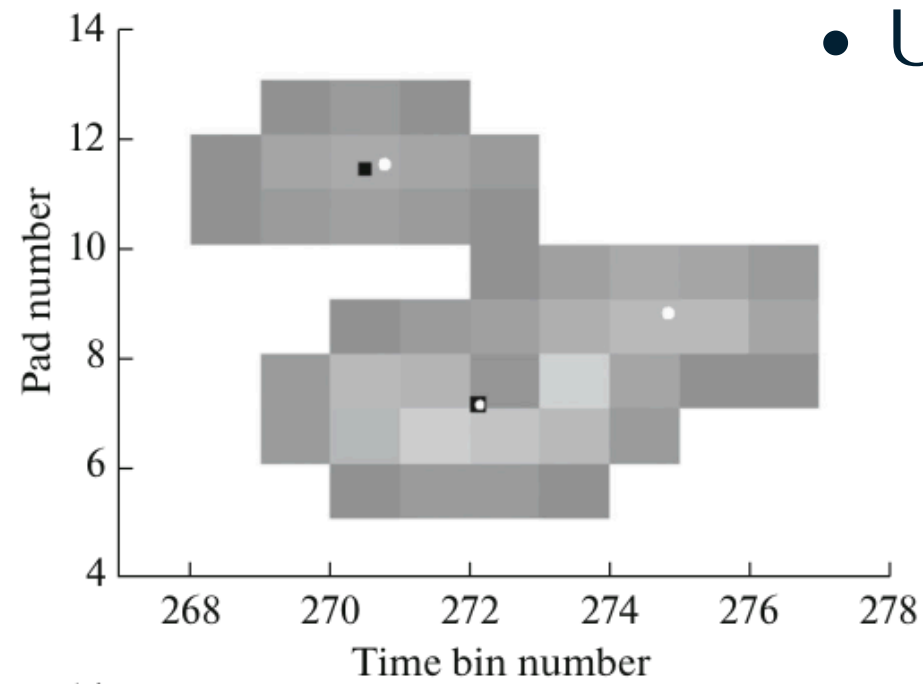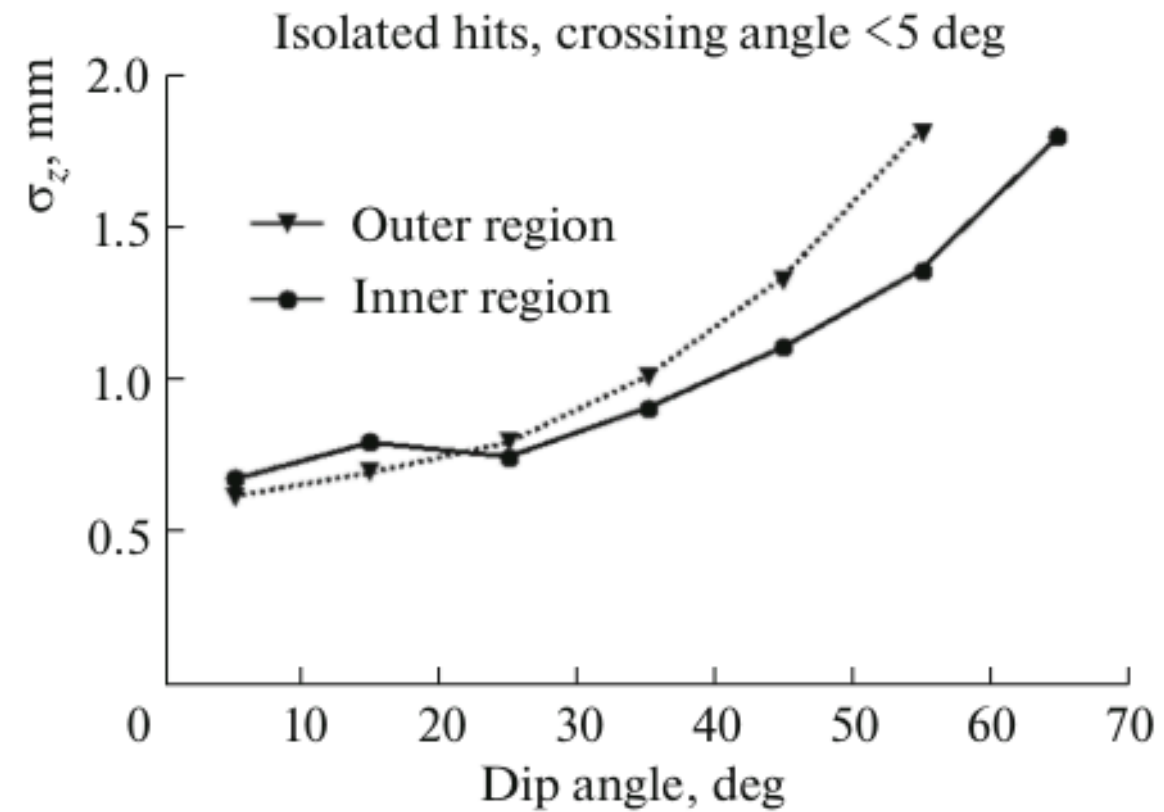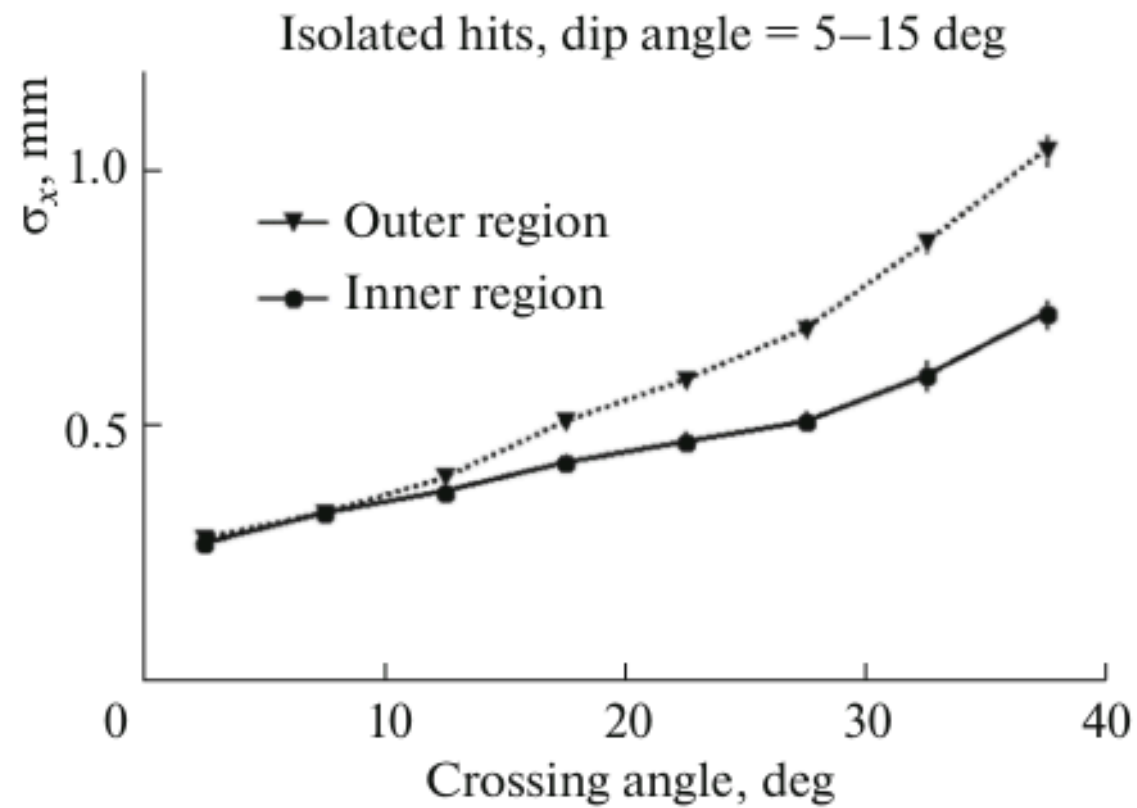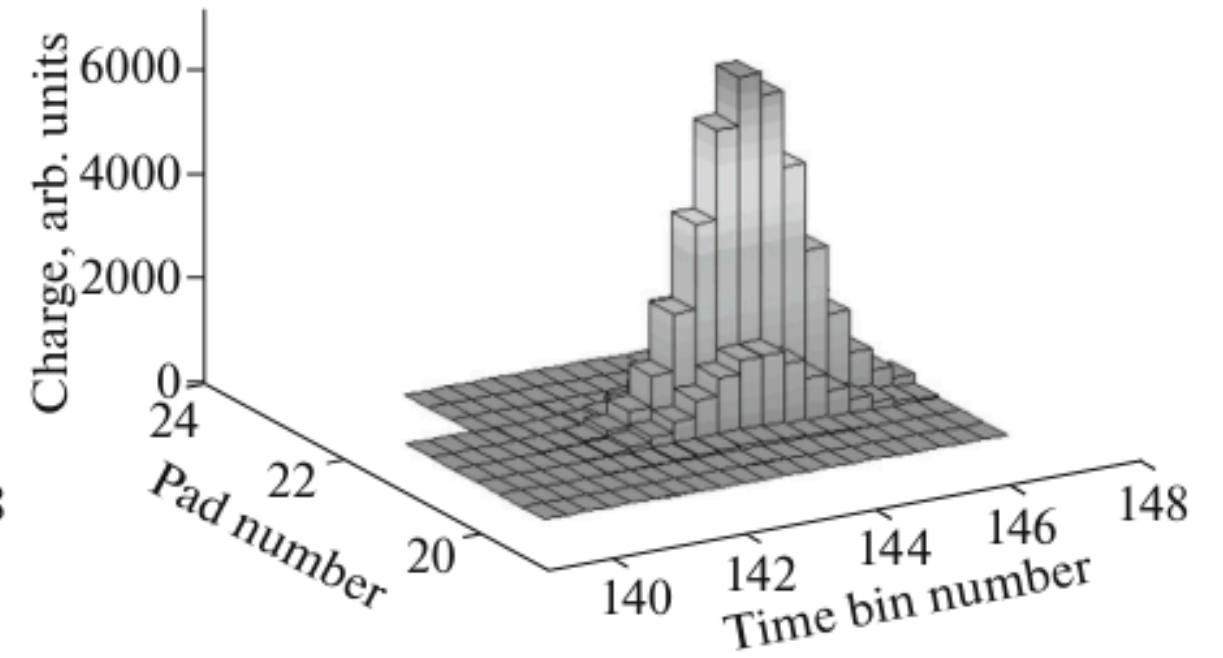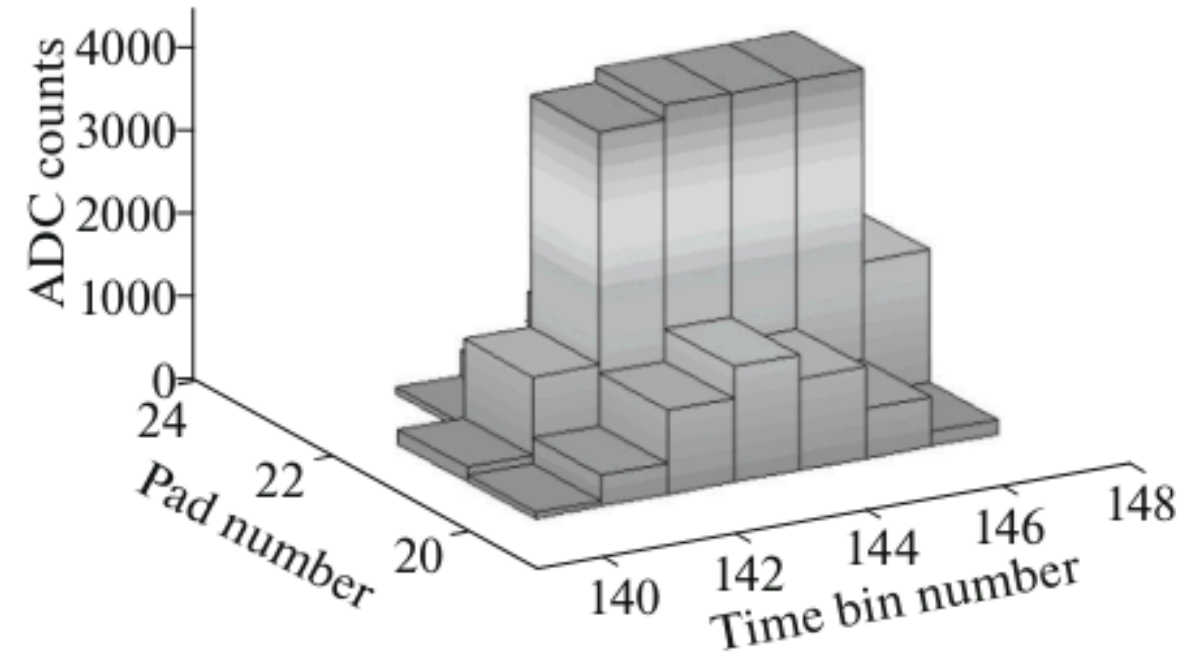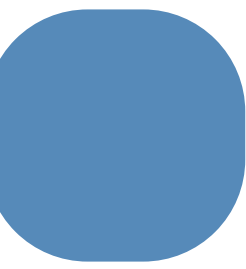
COORDINATE RECONSTRUCTION

TRACK RECONSTRUCTION PROCEDURE

PRIMARY AND SECONDARY PARTICULATE REBUILDING EFFICIENCY

SYSTEM ERRORS AND RECONSTRUCTIONS

Primaries, $N_{\mathrm{hits}} > 14$, $|\eta| < 1.3$

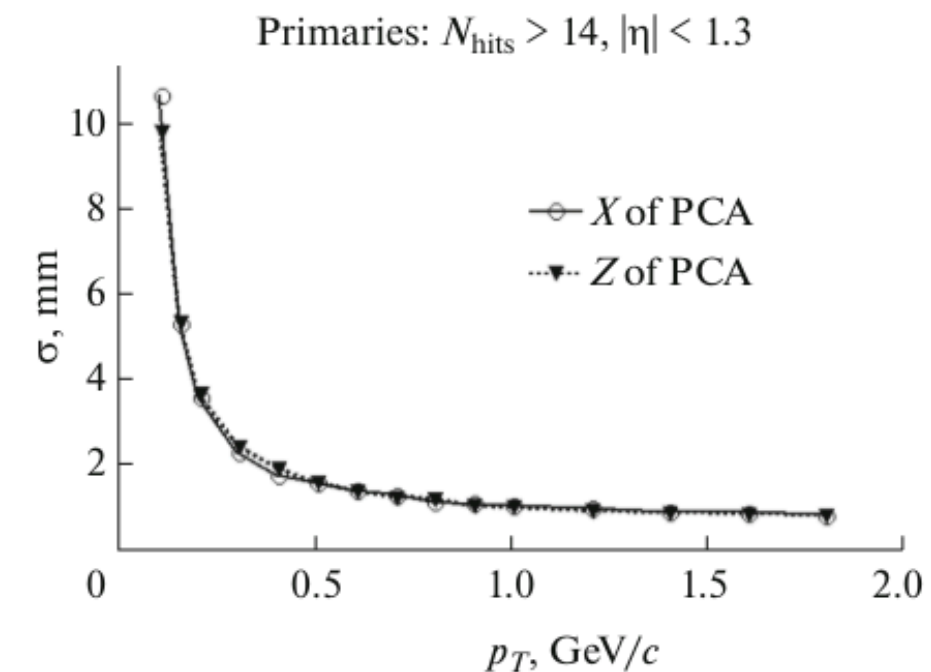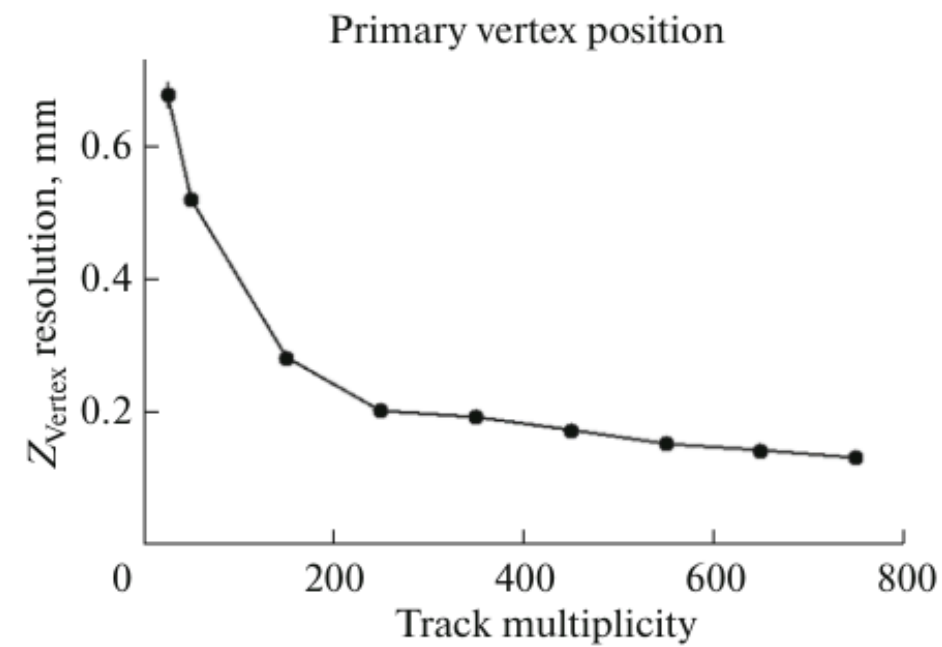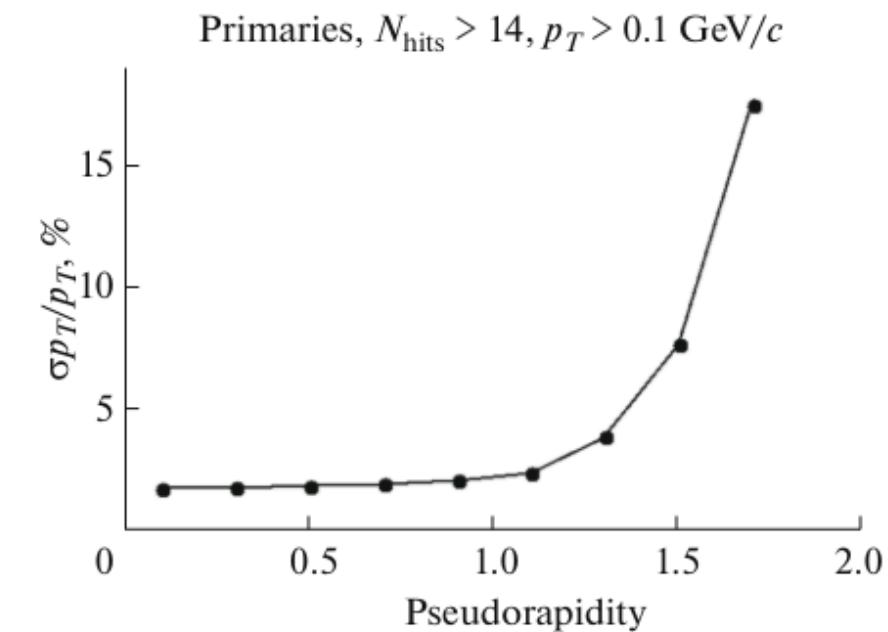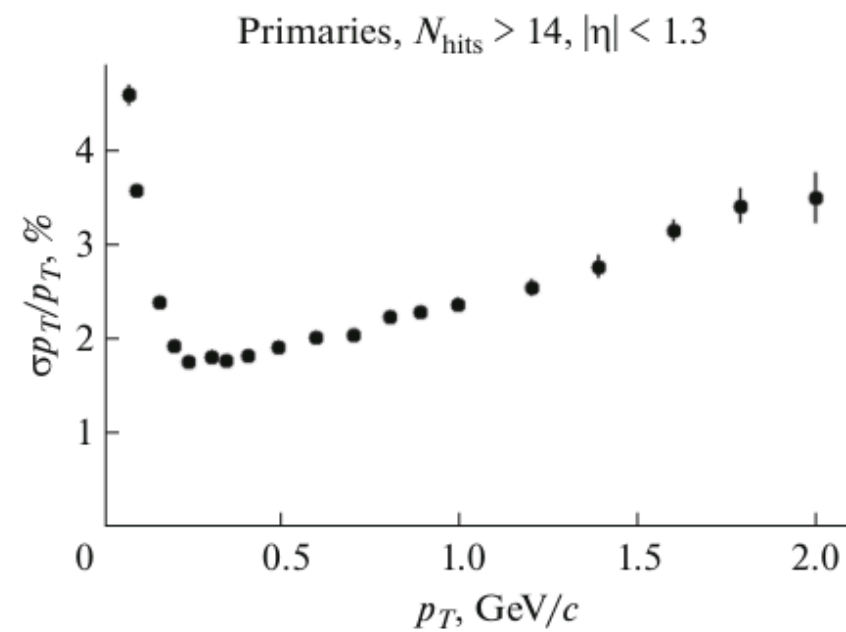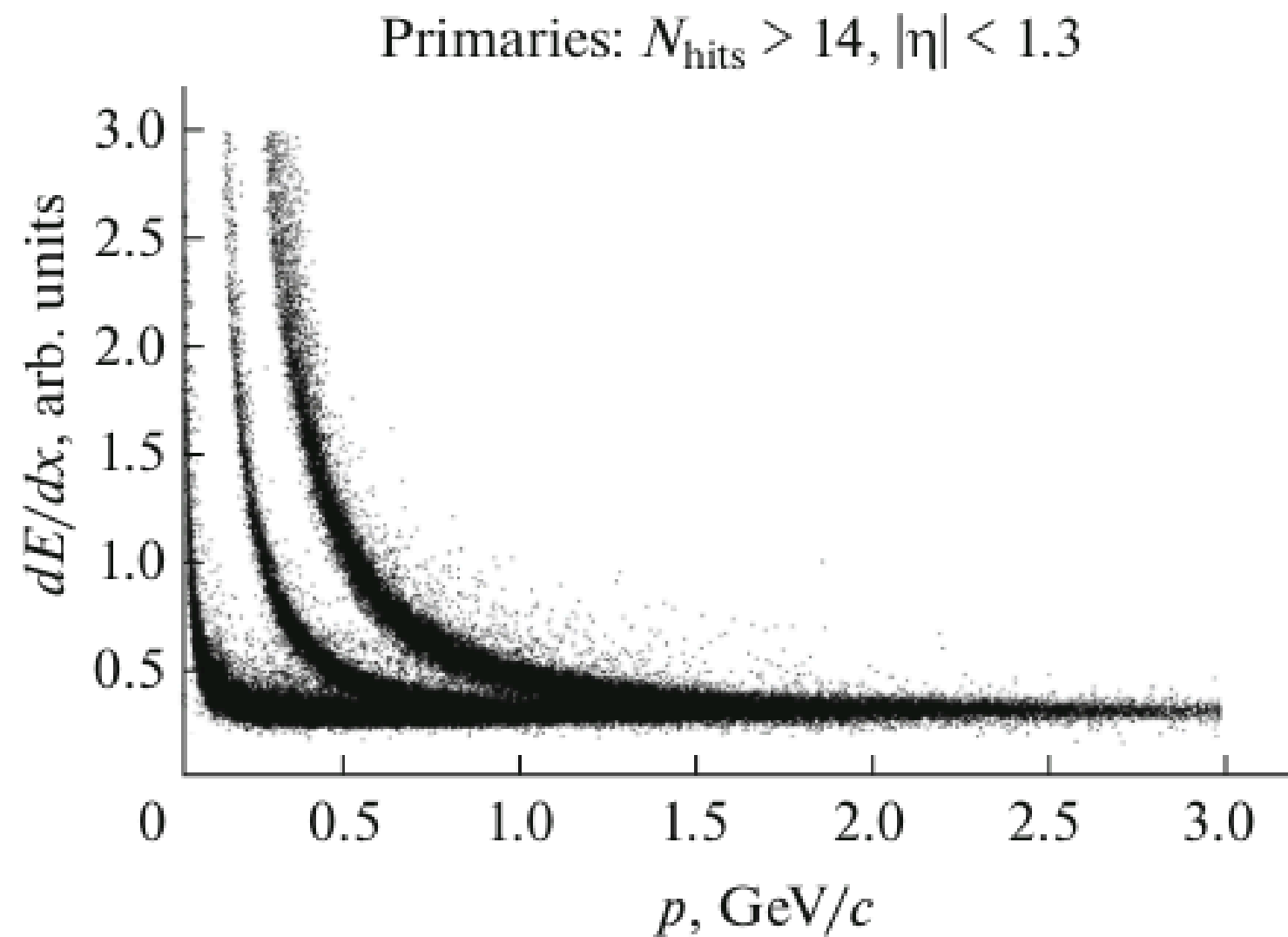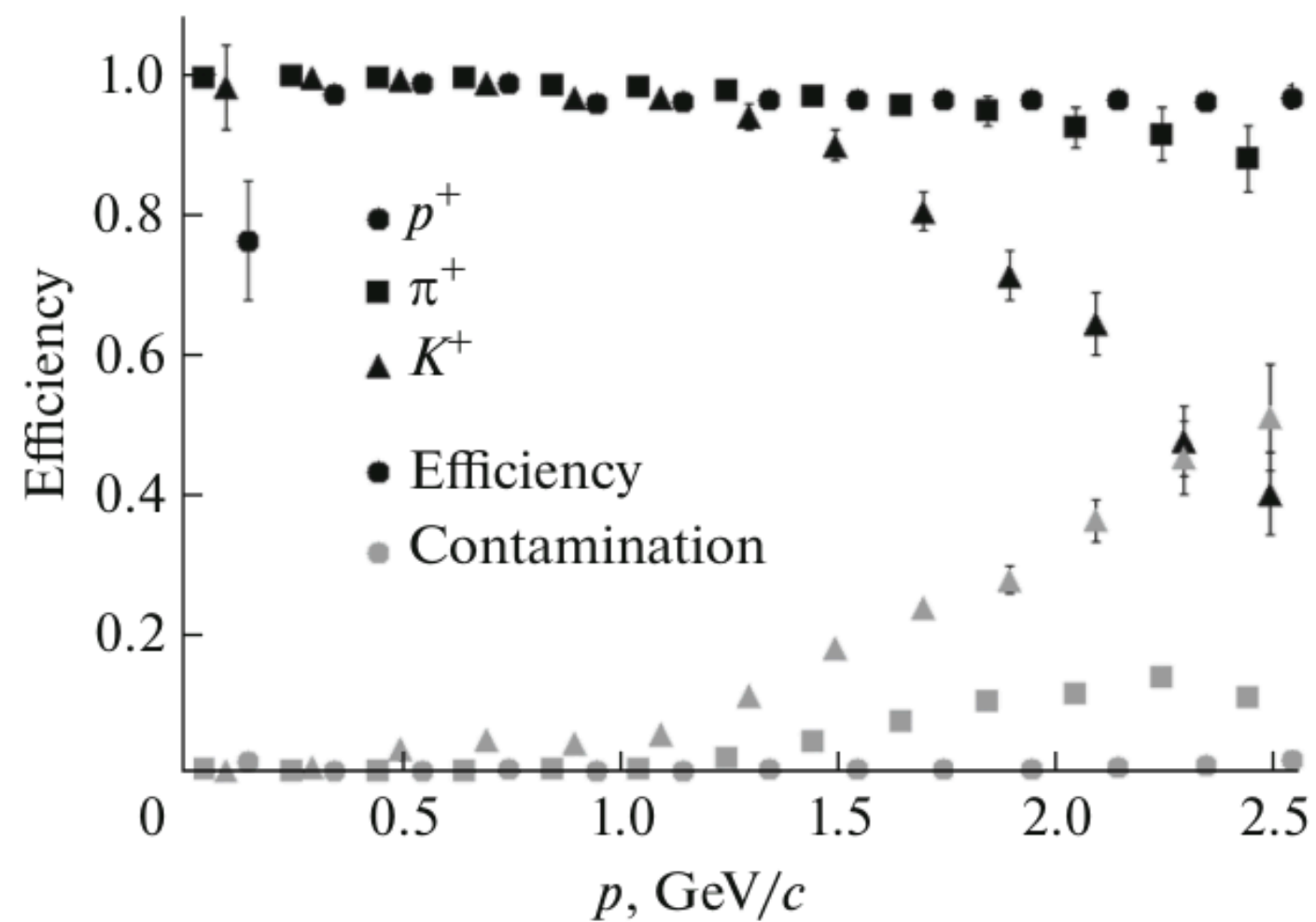Primaries, $N_{\mathrm{hits}} > 14$, $p_T > 0.1$ GeV/c

Primary vertex position

Primaries: $N_{\mathrm{hits}} > 14$, $|\eta| < 1.3$

Primaries: $N_{\mathrm{hits}} > 14$, $|\eta| < 1.3$

Primaries: $N_{\mathrm{hits}} > 14$, $p_T > 0.1$ GeV/c

TPC-TOF MATCHING

Primaries: $N_{hits} > 14$, $|\eta| < 1.3$

Primaries: $N_{hits} > 14$, $|\eta| < 1.3$, $p = 0.28-0.32$ GeV/c

Mean 0.3018
Sigma 0.0197

$\sigma/\langle dE/dx \rangle = 6.5\%$
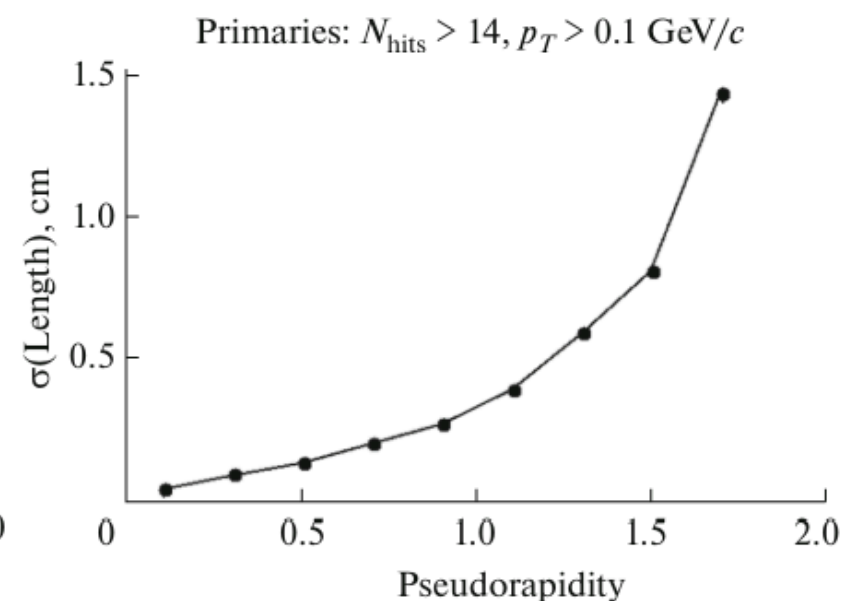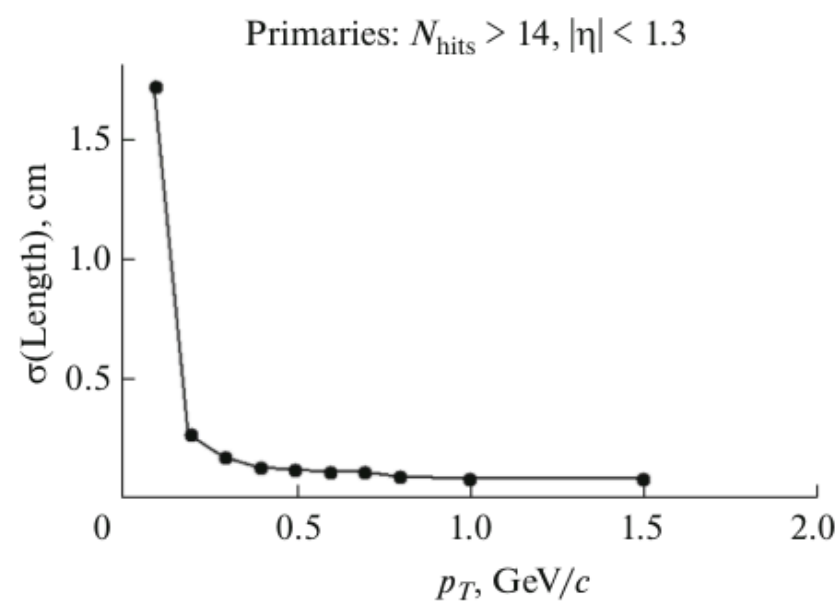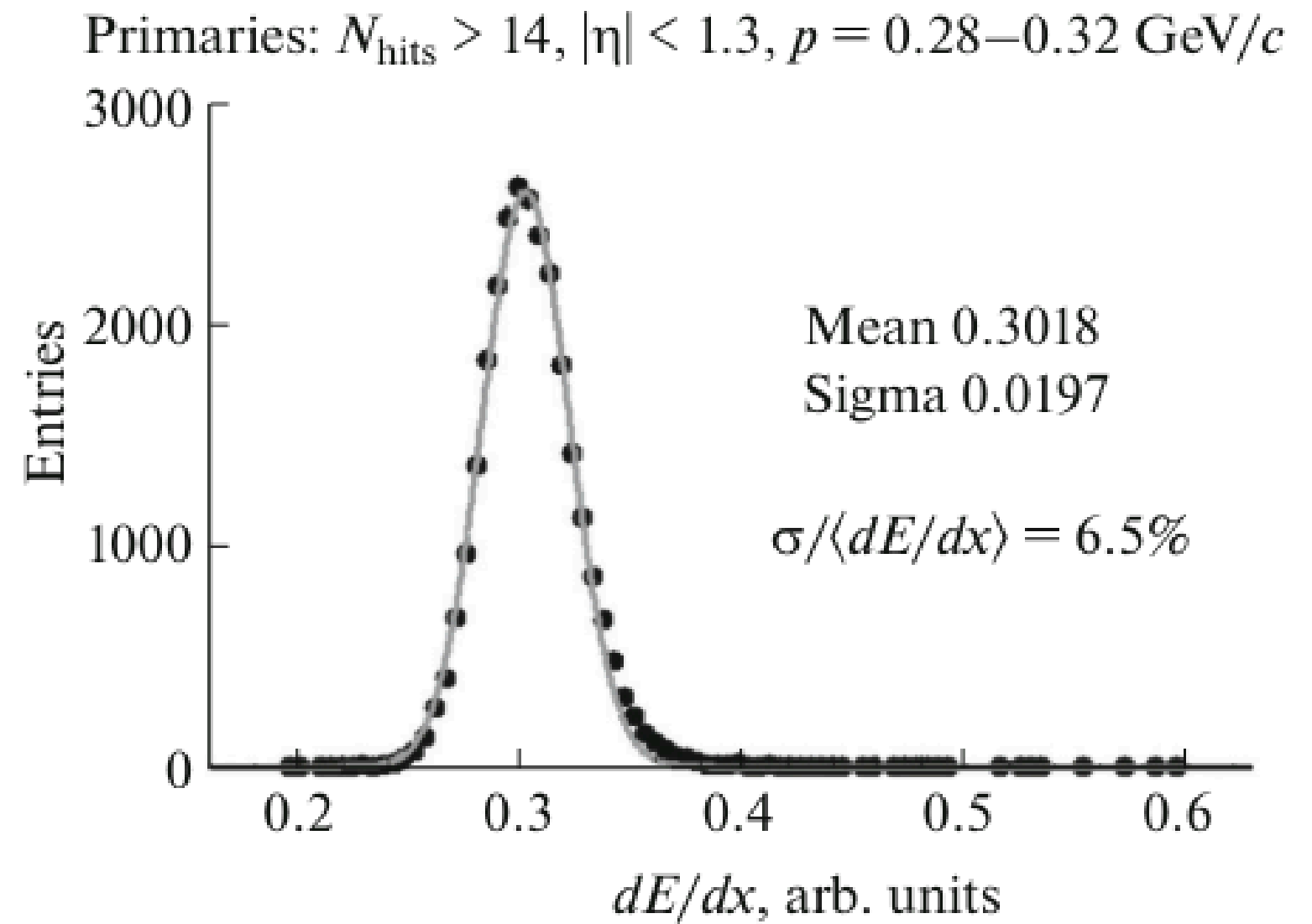
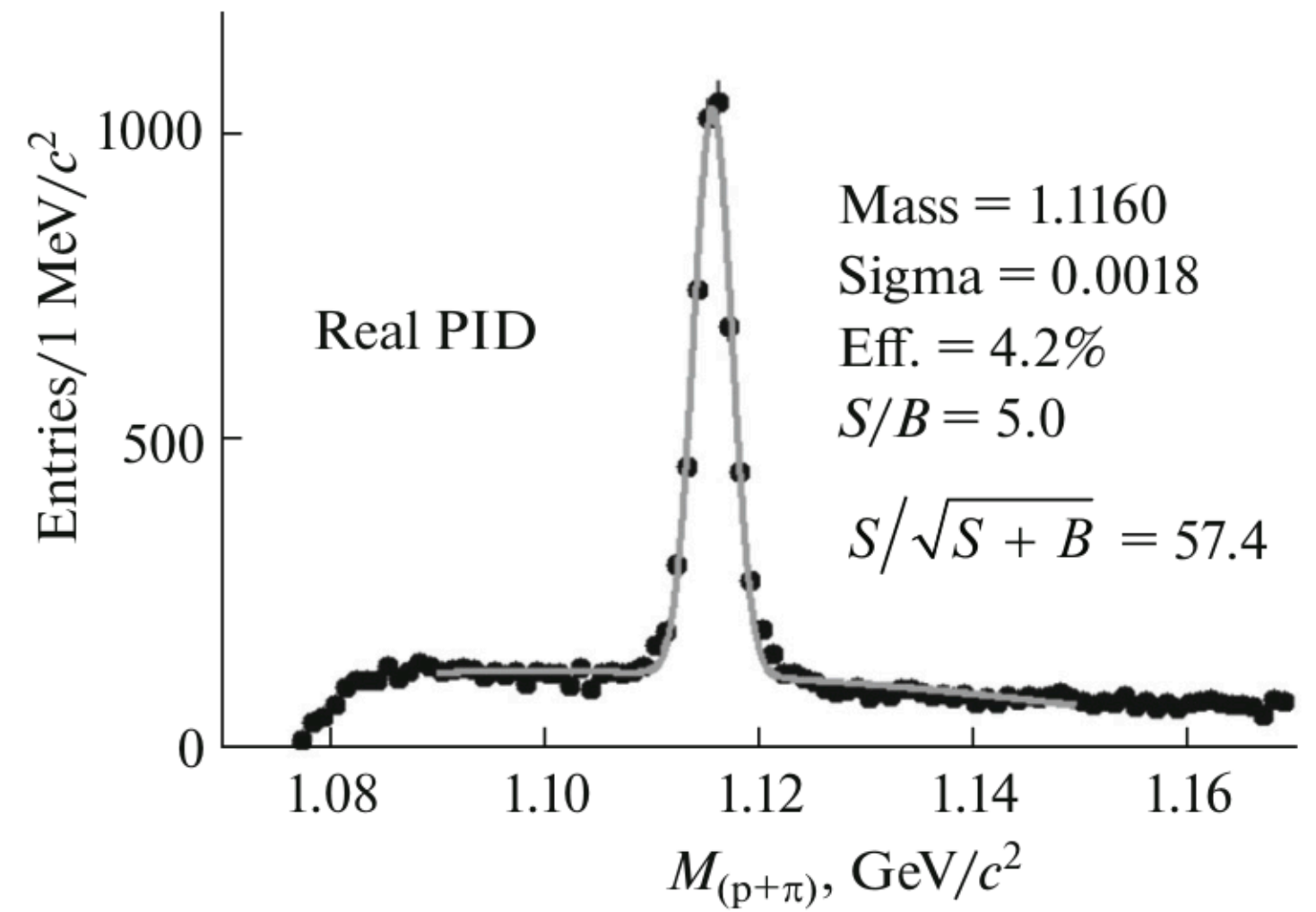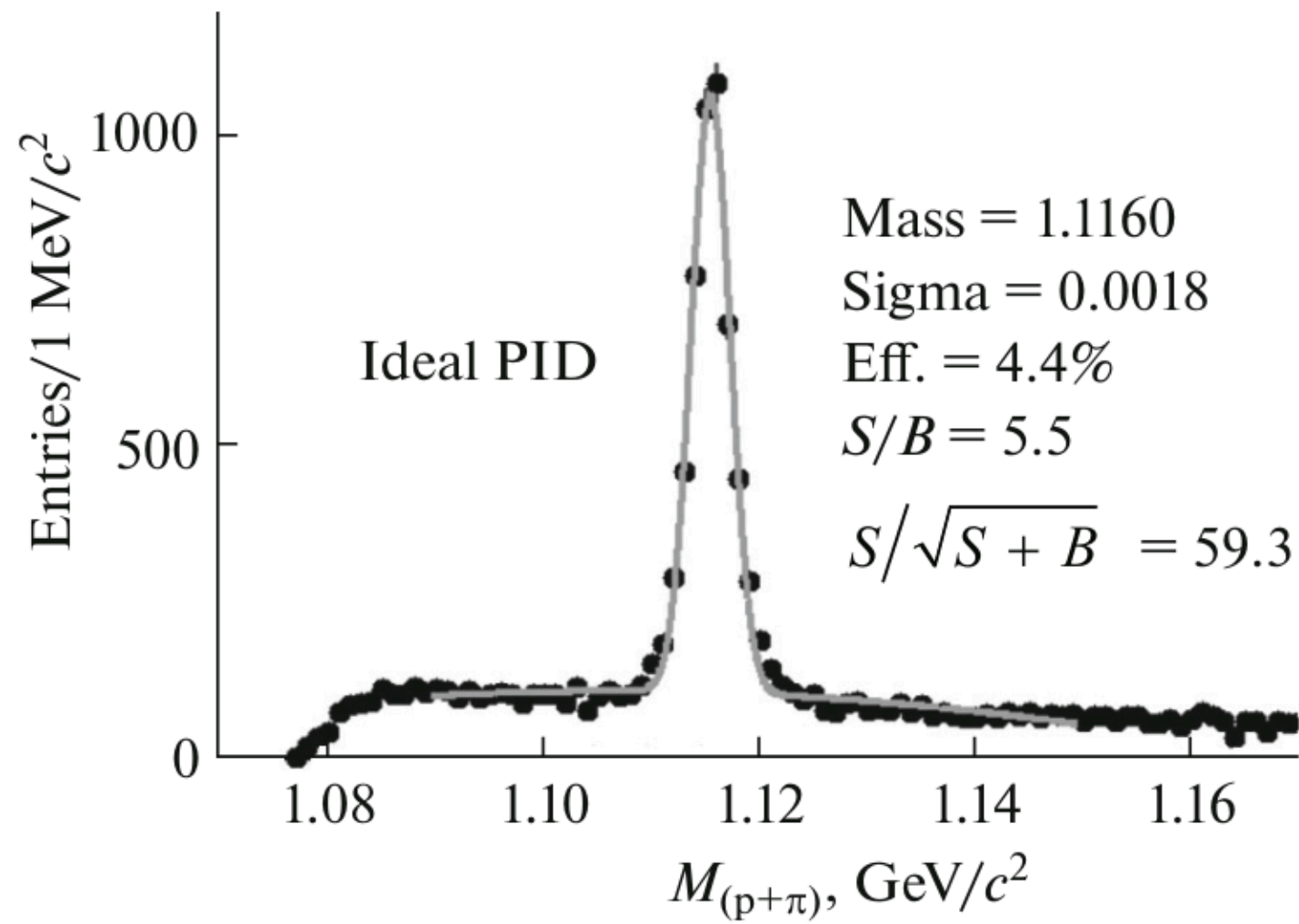# PARTICLE IDENTIFICATION
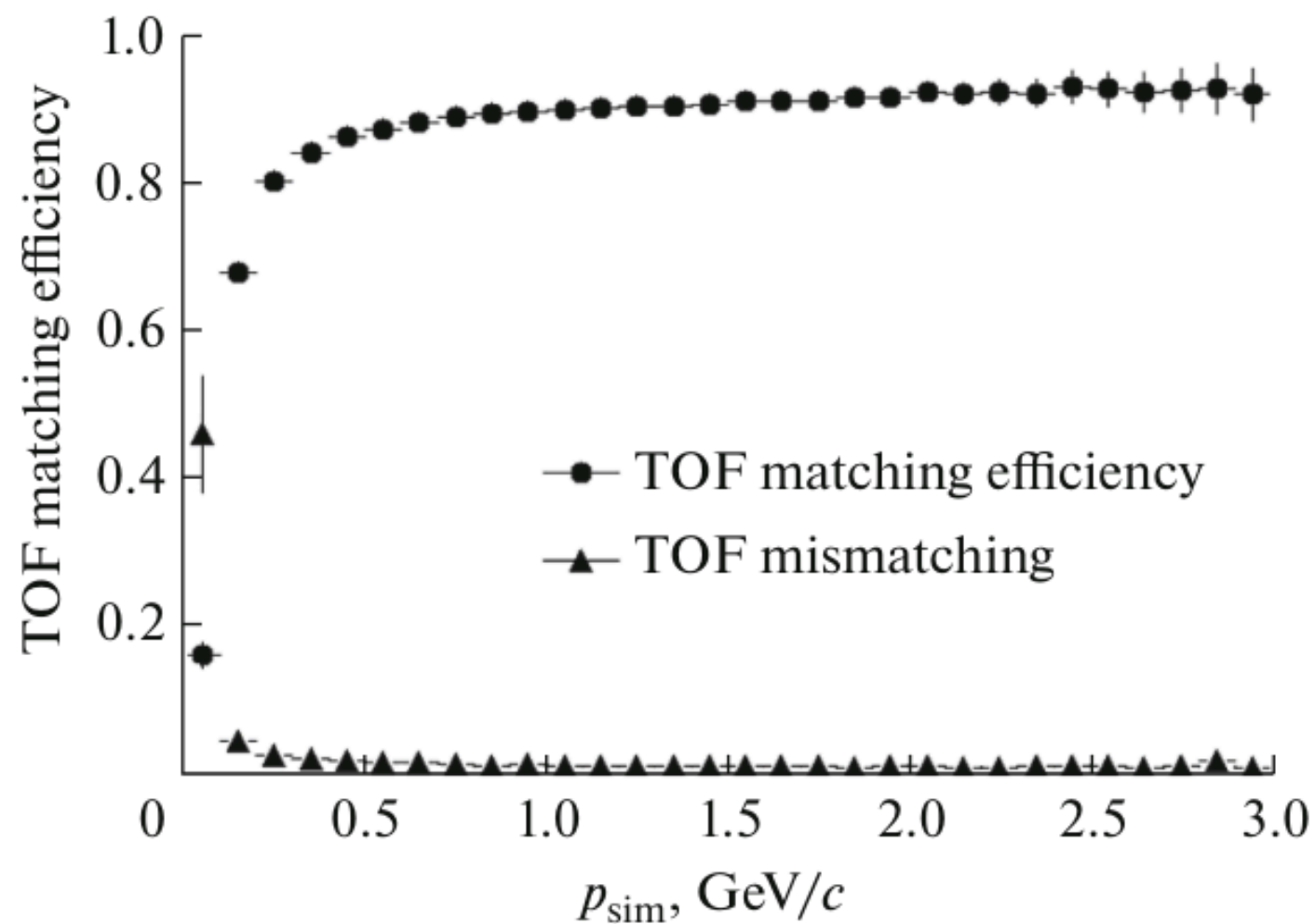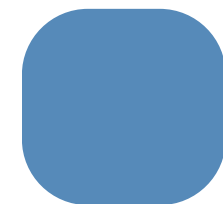
FINALLY DATA WERE RECONSTRUCTED USING THE DIFFERENT STEPS THUS TAKING, RECONSTRUCTED INVARIANT MASS OF PROTON AND PION(–) AND PERFECT CHARGED PARTICLE IDENTIFICATION

TASK 1

- For task 1, the method described for the reconstruction of multiple data will be used and the results will be analyzed.