

Asymmetry Measurement in the Elastic π^+p Scattering at 0.8 GeV/c.

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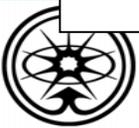
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- New data on polarization (asymmetry) in π^+p
- Backward angles, 0.80 GeV/c
- The **latest** and the **last** experiment in the series of the polarization parameter measurements by ITEP-PNPI collaboration in the last decade (A $^\pm$ at 1.00, 1.43 and 1.62 GeV/c, P $^-$ at 1.43, 1.78 and 2.07 GeV/c, P $^+$ at 1.94 and 2.07 GeV/c)
- Beam momentum range (0.8-2.1) GeV/c ideal for resonance spectroscopy: 65 % of light quark resonances in 3 clusters

MAIN GOAL:

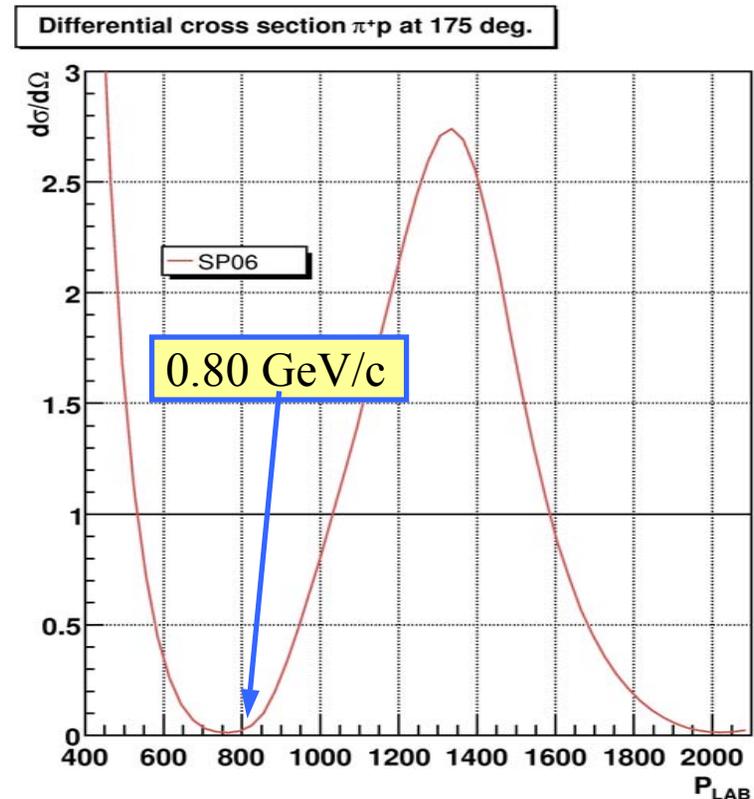
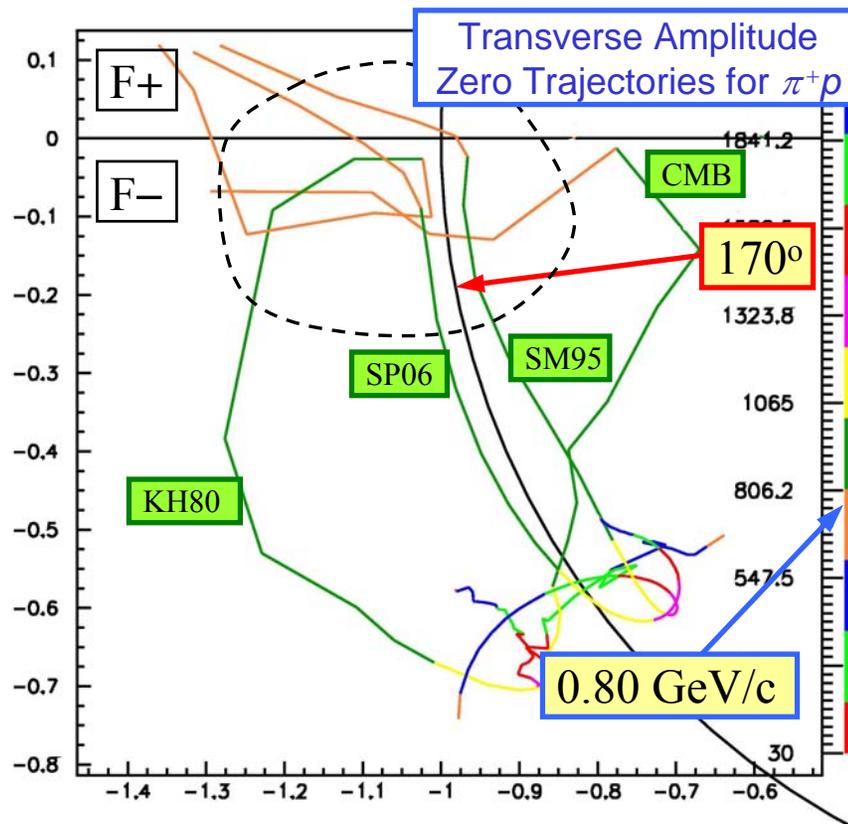
- Data for the *UNAMBIGUOUS RECONSTRUCTION* of the elastic πp scattering amplitudes by PWA to resolve problems in LIGHT BARYON SPECTROSCOPY

Background

- * Light baryon resonances in the latest PDG are based mainly on PWA's KH80 and CMB80, both performed more than two decades ago.
- * More recent analyses by VPI/GWU group did not revealed 4 of 13 resonances
- * Latest data on the asymmetry and spin rotation parameters in πp do not confirm KH80 and CMB80 in the backward scattering region, while the agreement with GWU is far from perfect either



- ❖ Zero trajectories approach real surface close to 180°
 - \Rightarrow Both transverse amplitudes are very small: $|F_+| \sim 0, |F_-| \sim 0$
 - \Rightarrow Very low cross-section
- ❖ Trajectory behavior different in PWAs due to very poor experimental data and possible discrete ambiguity
- ❖ Potential sensitivity to the high momentum resonances

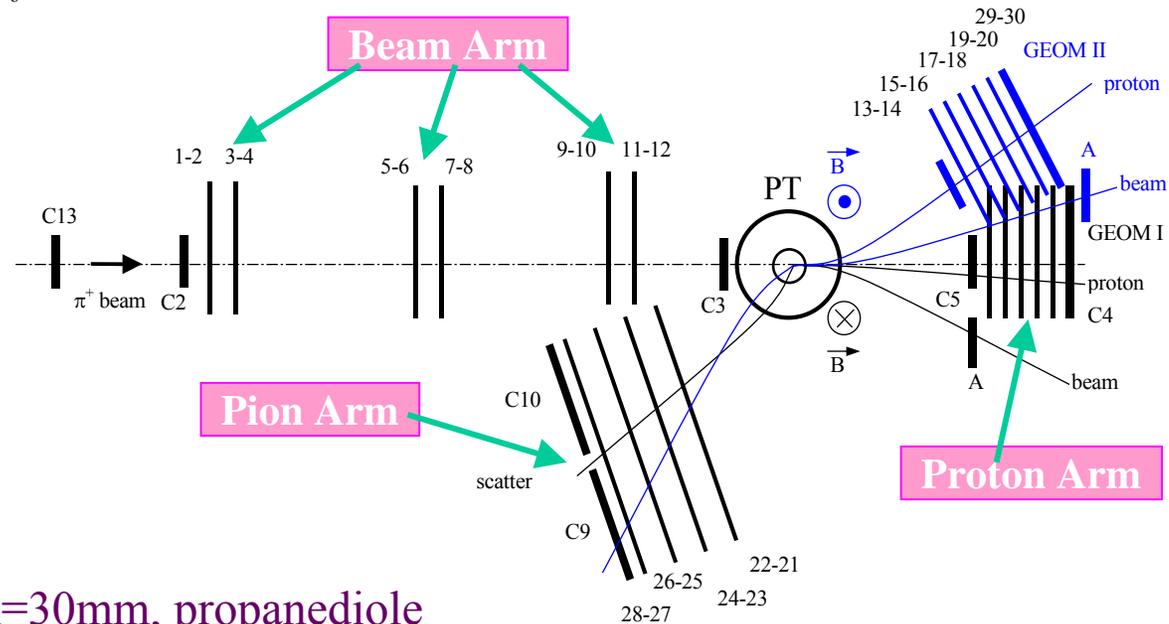


MAIN ELEMENTS:

- * Vertically polarized proton target PT
- * 3 sets of wire chambers for tracking
- * Trigger scintillation counters

TARGET:

- * Cylinder $\varnothing 30\text{mm}$, $h=30\text{mm}$, propanediol $\text{C}_3\text{H}_8\text{O}_2$, free proton density $\approx 10\%$
- * Magnetic field 2.5 T
- * ^3He evaporation type cryostat at 0.5 K
- * Dynamic nuclear orientation
- * Polarization (70-75) %, measurement accuracy 3 %
- * Sign reverse every 12 hours



GEOMETRY I:

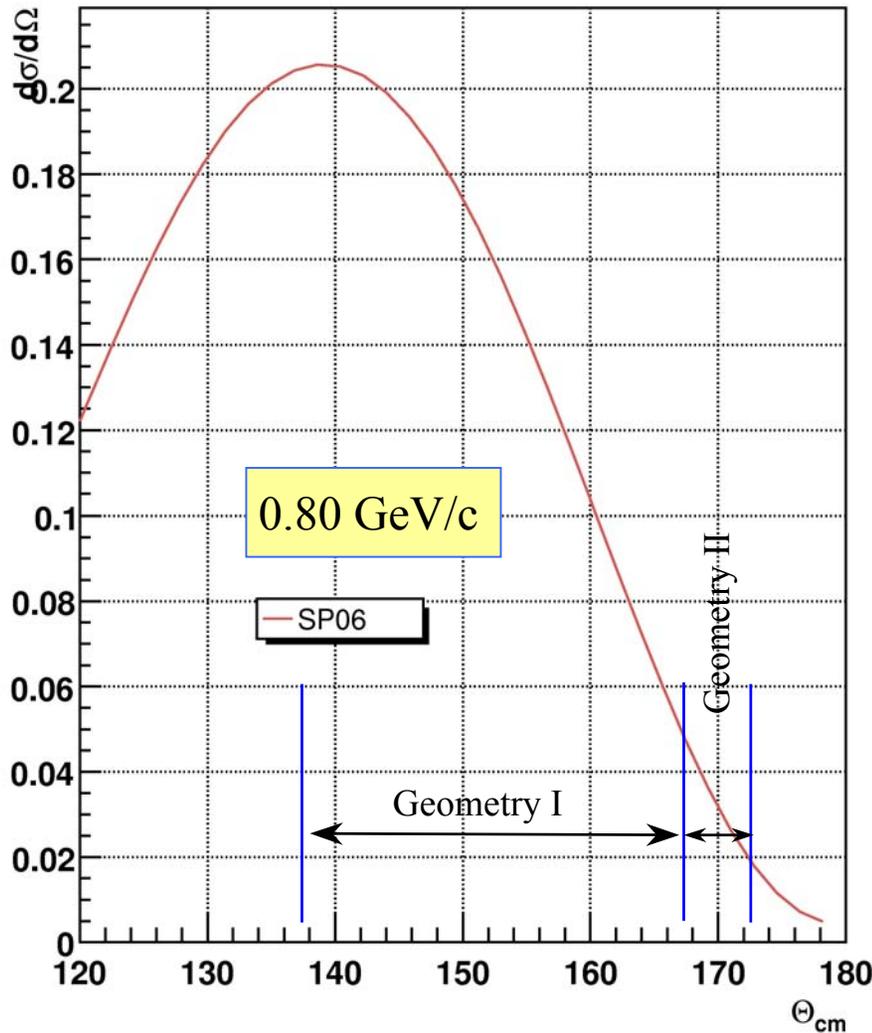
$\theta_{\text{cm}} = 137-167^\circ$, magnetic field DOWN

GEOMETRY II:

$\theta_{\text{cm}} = 167-173^\circ$, magnetic field UP



Differential cross section π^+p at 0.80 GeV/c



MAIN DIFFICULTY:

➤ Low cross section in Geometry II: 2--4 times less events than in each of 4 intervals in Geometry I

ELASTIC EVENT SELECTION:

☑ Coplanarity and kinematic correlation

$\Delta\phi$, $\Delta\theta$ – deviations from the elastic kinematics

NORMALIZATION:

✧ Using “unpolarized” event counts – quasi-elastic 2-particle events in the vicinity of the elastic peak, but not under it

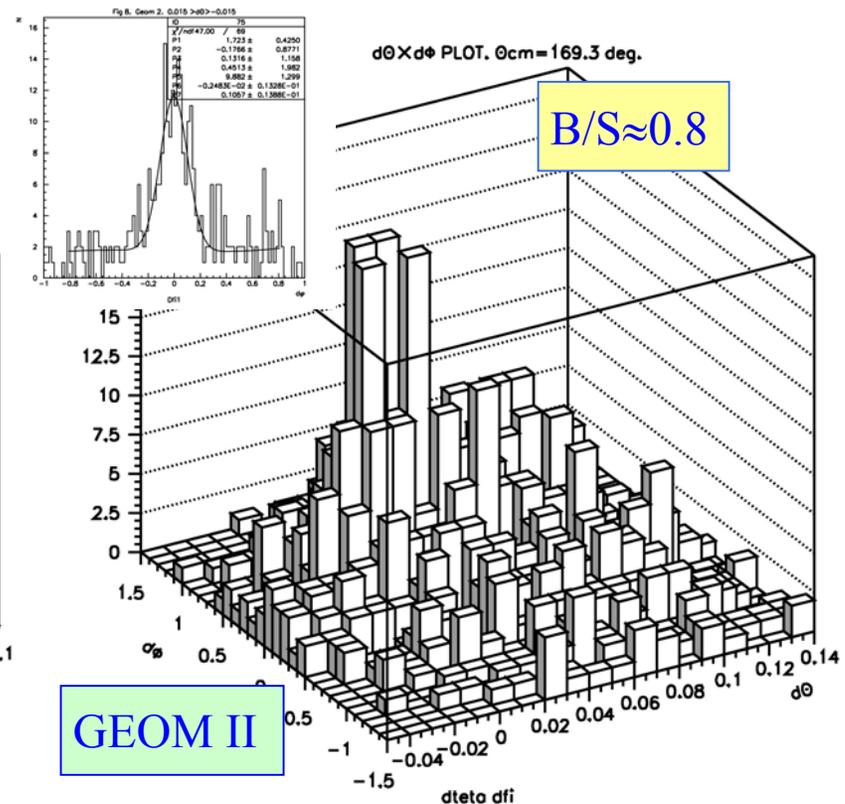
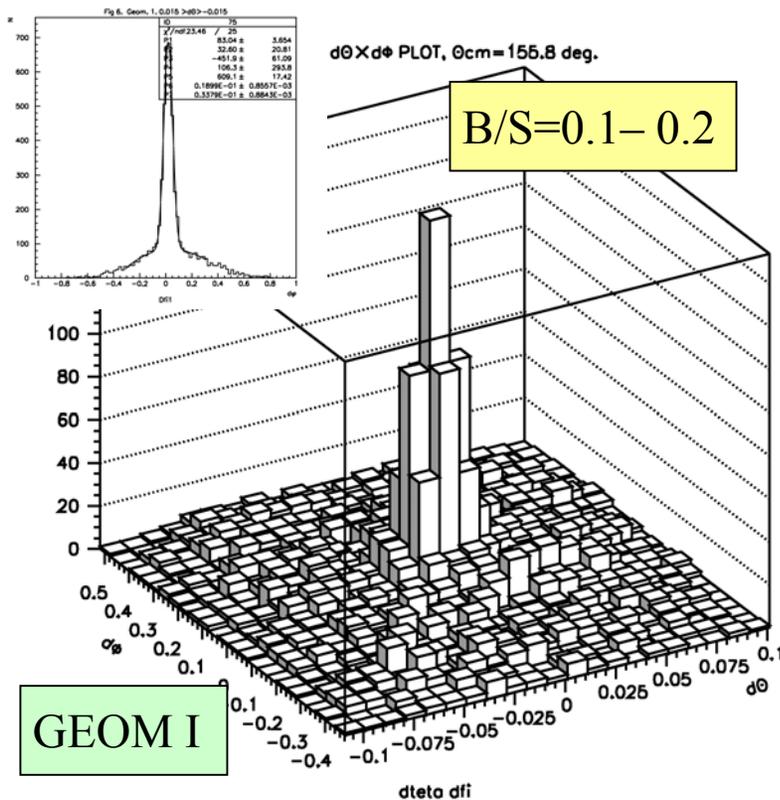


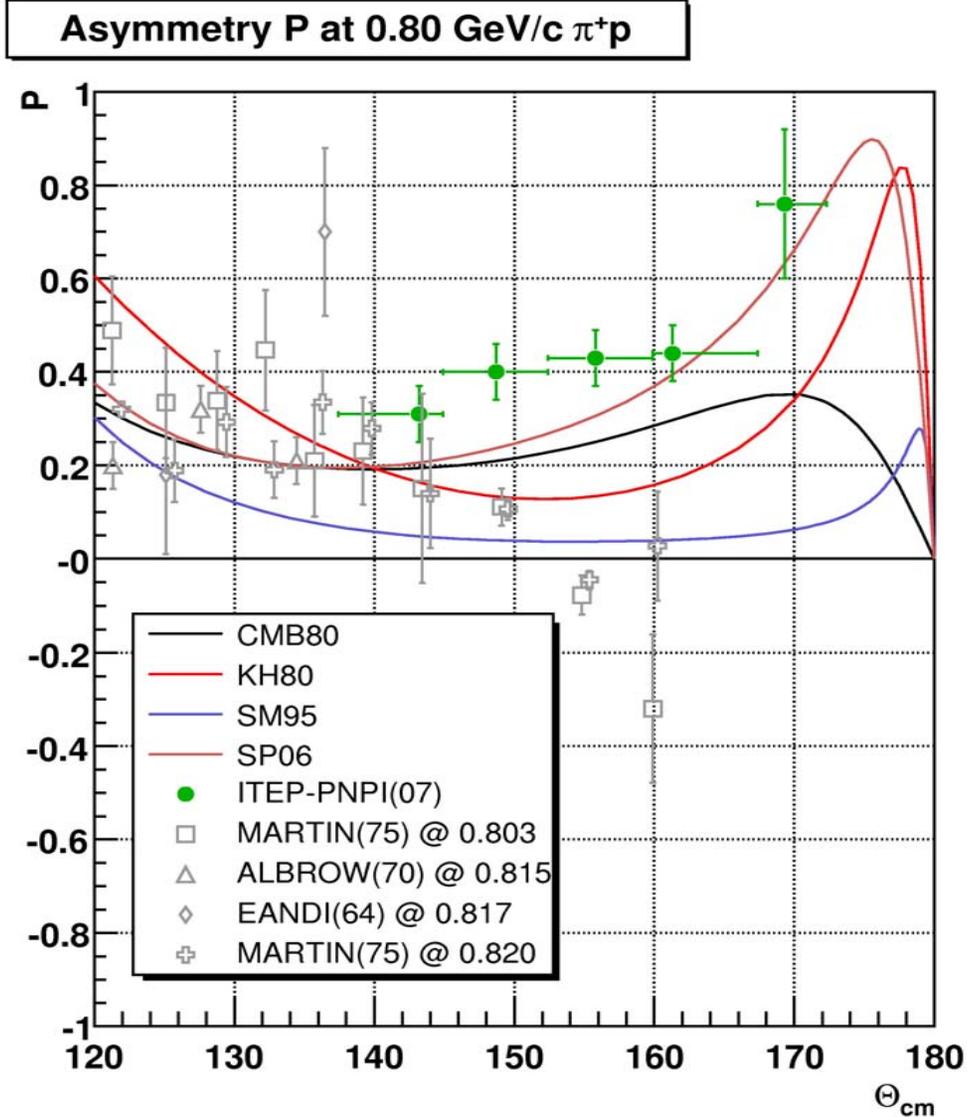
BACKGROUND SUBTRACTION:

- ❖ 2-dim 12-parameter polynomial fit for the background

SYSTEMATIC ERROR ESTIMATES:

- ❖ Various cuts on the elastic locus region





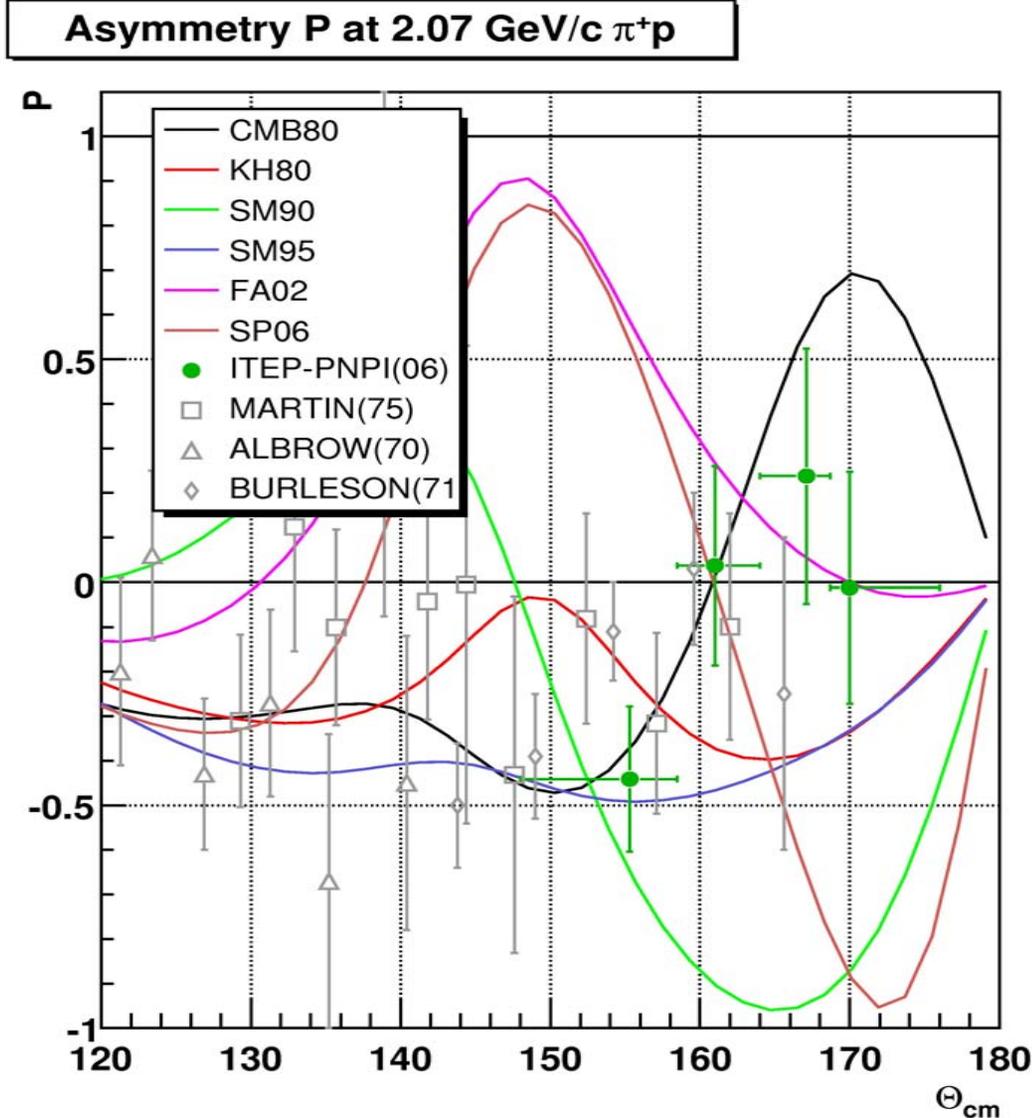
ERRORS include:

- Elastic event numbers
- Background calculations
- Intensity and efficiency normalization
- Overall normalization error due to target polarization uncertainty is $\sim 3\%$ and are not included

FEATURES:

- Best correspondence to the *latest* VPI/GWU SP06 analysis
- Agreement with the old data in the leftmost point
- Contradiction to MARTIN(75) at $\Theta_{cm} > 145^\circ$





- Best resemblance to **CMB80**
- Angular dependence looks contradictory to all other analyses
- **Obvious contradiction to the latest VPI/GWU solution**
- No disagreement with existing data



Conclusion

DSPIN-07



- GWU group significantly improved their analysis in the recent years, yet our data doesn't always confirm it
- New polarization parameter data require NEW GLOBAL TYPE PWA
- We extremely welcome the recent efforts of the Helsinki group on resurrection of KH80 analysis

Acknowledgements

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Dima Svirida (ITEP)