

# Closeout

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# Did we achieve what we wanted from this workshop?

We have addressed many important questions.

- How strong is the **experimental evidence** for pentaquark states?
  - New evidence has been presented, and new experiments are being planned
  
- What are the most promising **interpretations** of the experiments in terms of the underlying degrees of freedom?
  - We have seen heated discussions about this.
  
- What are the important **production mechanisms**?
  - Theoretical calculations have started and will continue. These are of particular importance for experimentalists planning new experiments



- What are the **most important topics** to be addressed by the planned and proposed experiments?
  - Quantum numbers spin & parity remain at the top of the list.
  - Isospin and natural widths remain important issues.
  
- Is the **right equipment** available to do this well?
  - New experimental concepts were presented.
  - Ideas to measure hadronic phase shifts in KN scattering.
  
- Is there a **need for new detector** system?
  - Vertex detectors may be needed to provide better tools in the search for cascade states with secondary vertices.

# Was there anything that was missed?

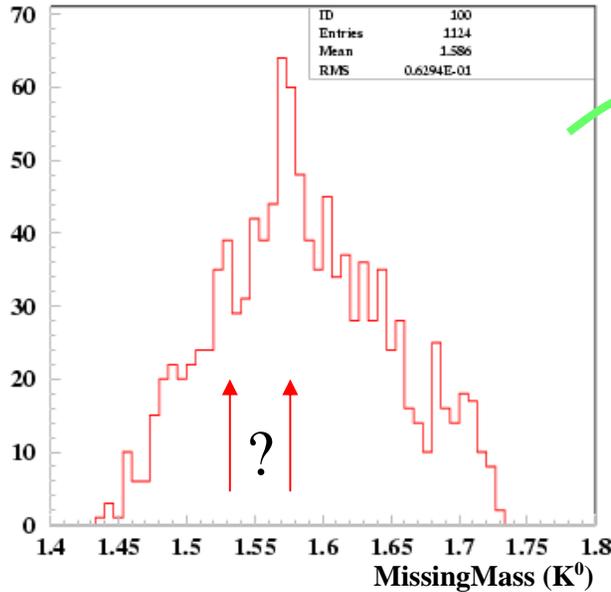
Here are 2 topics that didn't make it to the plenary sessions:

- 1) Are there two states close by in mass?
  - There is VERY preliminary evidence from CLAS for two states, one at  $\sim 1530$  MeV, one at  $\sim 1572$  MeV.
  - There are VERY preliminary results from neutrino scattering showing two peaks at 1533 MeV and 1577 MeV (+ one at 1470 MeV). Maybe the result of experimental problem?
  
- 2) Did hadron scattering experiments really NOT see the  $\Theta^+(1540)$  ?
  - some evidence suggests they did see it, but didn't notice it!

# CLAS data on Hydrogen



All angles

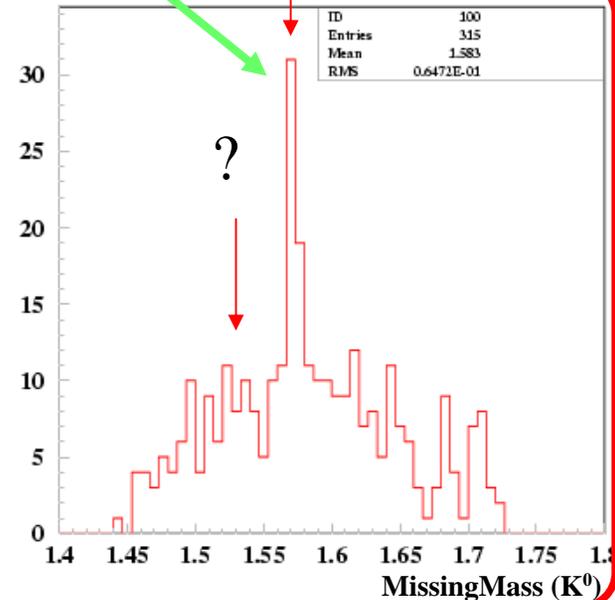


$M(nK^+)$

$K^0$  at large angles

$\sim 1572\text{MeV}$  ?

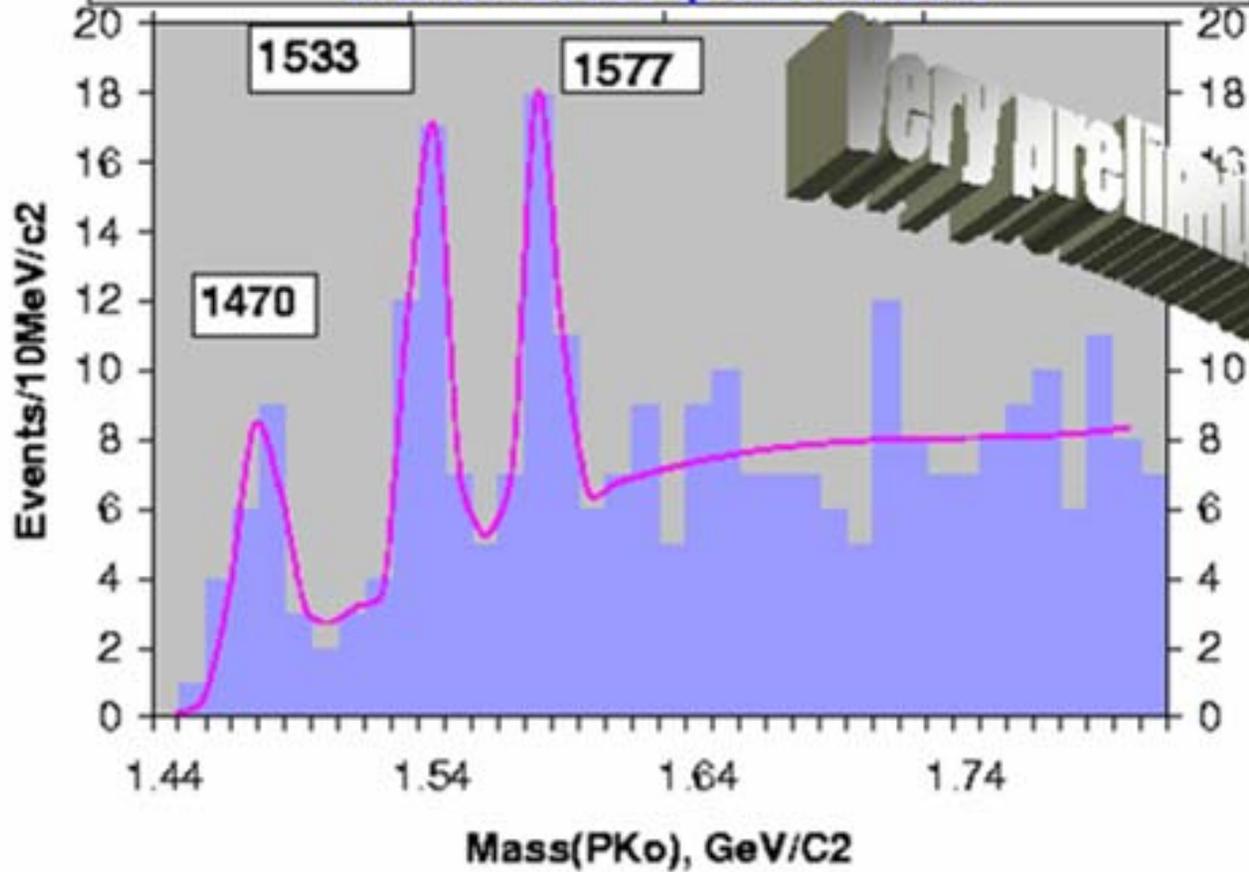
$\cos_{CM}(K^0) < -0.5$



$M(nK^+)$

V. Koubarovsky

Neutrino Interactions on H<sub>2</sub>+D<sub>2</sub>+Neon: Proton momenta:  $300 < p < 1200$  MeV/c

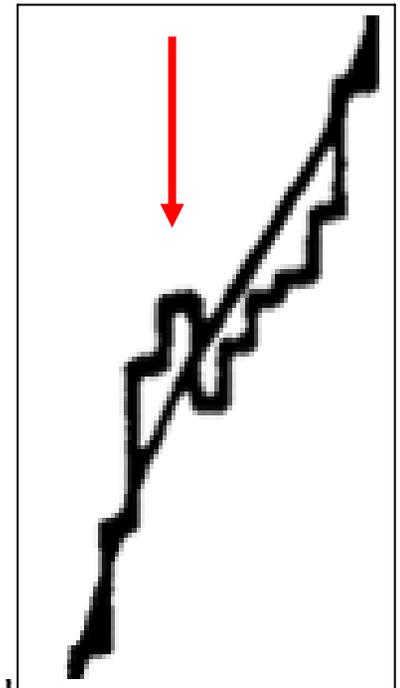
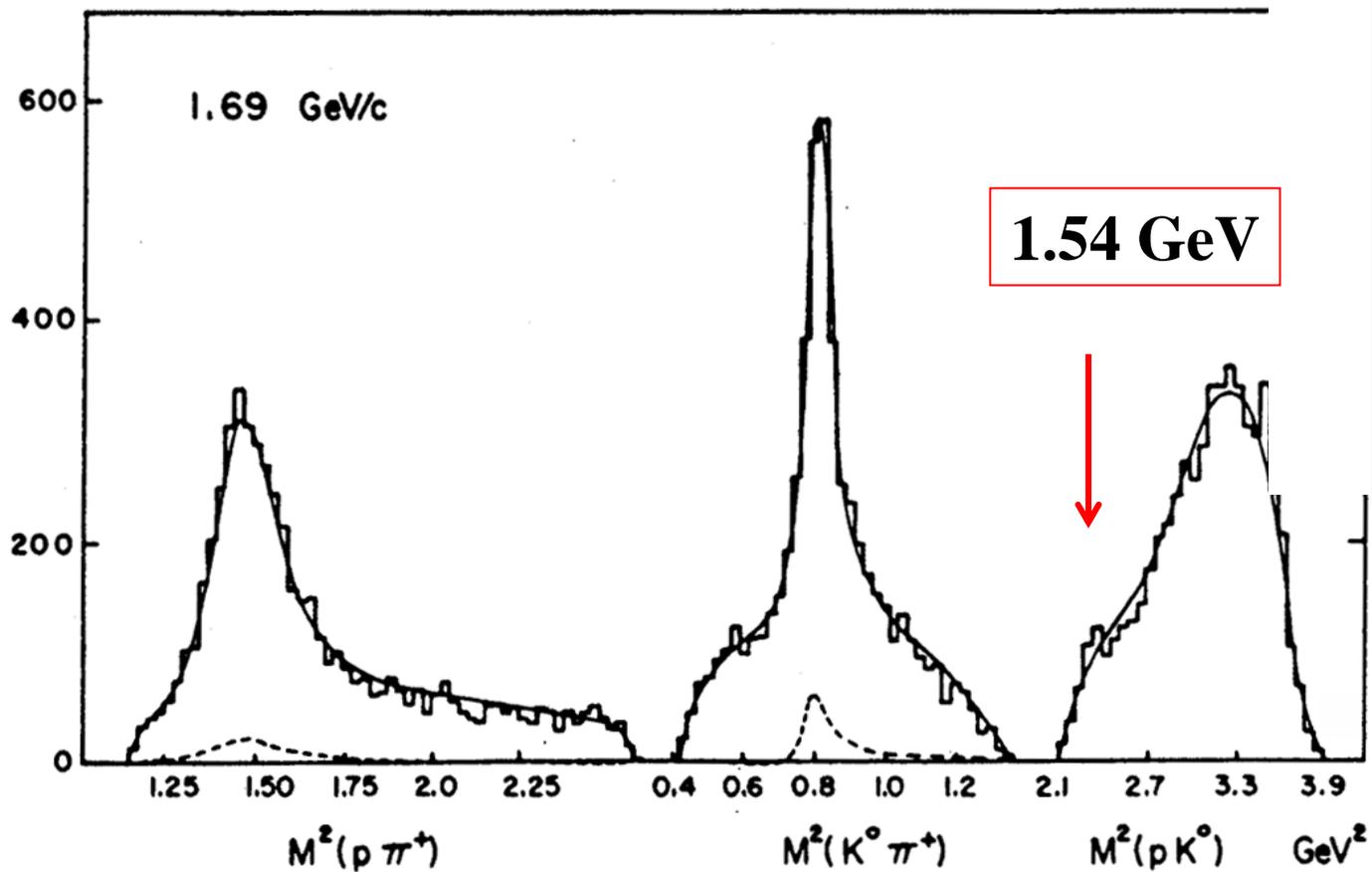


M. Kubantsev

# The unclaimed $\Theta^+(1540)$ ?

CERN:  $K^+p \longrightarrow pK^0X$  Bubble Chamber Data

A. Berthon, et al., NPB63, 54 (1973)



Thank you, to:

the **Conveners** for organizing the focus sessions

the **Chairs** of the plenary sessions

all **Speakers** (I hope everyone who wanted to speak had the opportunity to do so)

all **Participants** for the many lively discussions

my **Colleagues** from the Organizing Committee

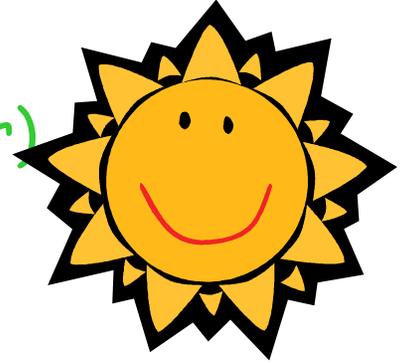
**Jefferson Lab** for supporting this workshop

Very Special THANKS to

**Linda Ceraul**

# 2003 - Dawn of the Pentaquark

Spring-8: LEPS (Carbon)  
ITEP: DIANA (Xenon bubble chamber)  
JLab: CLAS (Deuterium & proton)  
ELSA: SAPHIR (Proton)  
ITEP: World Neutrino scattering  
CERN SPS: NA49 (pp scattering)  
HERA: HERMES  
Searching in RHIC Data  
CERN WA89  
COSY  
GRAAL



The unclaimed  $\Theta^+(1540)$

... and enough to keep us busy for a while...



Goodbye until

Penta-Quark 2004

OSAKA  
or Spring-8