

# GlueX Physics Issues

For the last few years, the collaboration has been extremely focused on hardware issues:

- Summer 2003    Electronics Review
- Spring 2004    CD0
- Fall    2004        Detector Review
- Can we live with 11 GeV?
- Spring 2005     JLab Science Review
- Summer 2005    Lehman Review

# Where is the GlueX Science?

What has happened in the last few years?

What progress have we made in solving the science issues that we identified 5 years ago?

I think that a lot has happened!

Meeting at Carnegie Mellon University  
February 11 and 12, 2006

# The CMU Meeting

The purpose of this meeting is look at physics relevant to the GlueX Experiment and the analysis necessary to extract that physics from the data. This will be accomplished by covering several broad topics.

The attendance of the meeting is open to all interested parties.

# The CMU Meeting - Analysis Tools

The analysis tools used to extract physics from the data.  
What is the state of the art? What is actually extracted?  
What are the underlying model assumptions?

We currently have a recent coupled channel analysis on E852  $3\pi$  data. And

We have an ongoing photo production analysis at Carnegie Mellon focusing on Baryons, but dealing with s- t- and u-channel processes in one coherent picture.

# Physics Issues

The PWA formalism – based on earlier efforts from E852 and Crystal Barrel.

How do we handle baryon resonances without having to try and remove them from the data?

How do we put 100 million events into a PWA?

What is the best way to couple channels together?

Final state interactions?

Final state particles with non-zero spin?

# Advances on These Issues

The PWA formalism – based on earlier efforts from E852 and Crystal Barrel.

How do we handle baryon resonances without having to try and remove them from the data? CMU Photo-production/Covariant Formalism

How do we put 100 million events into a PWA?  
IU did ~10 million, CMU do ~15-20 million now

What is the best way to couple channels together?  
IU did Isospin coupling, CMU is doing multiple final states

Final state interactions? IU 3pi analysis/ Adam Szczepaniak

Final state particles with non-zero spin? Covariant Formalism

# CMU Meeting -- Phenomenology

The phenomenology associated with the PWA tools.  
What is this phenomenology? A lot of this was developed in the 70s and 80s and is described in language that may no longer be in vogue.

Can the problem be formulated in more modern language?  
Is this phenomenology the best way to attack things?

# CMU PWA Meeting

We held a meeting at CMU in May of 2002 to focus on PWA.

This meeting focused more almost solely on phenomenological issues of describing the data.

It dealt with both Mesons and Baryons.

The language always sounds arcane...



# CMU Meeting -- Phenomenology

The phenomenology of exotic hadrons. How do we connect this to the physics coming out of the data? What are the most compelling signals for hybrids?

Mapping of a nonet?

Multiple nonets?

Mapping decay modes?

Mixing of non-exotic hybrids with normal mesons?

What is the priority list on physics goals?

# The CMU Meeting – Lattice QCD

Lattice QCD and its impact on our understanding of exotic hadrons. Lattice has made and continues to make tremendous advances in its ability to explain observed phenomena. In addition, new lattice computers are currently being built up. What are the prospects of carrying out lattice calculations related to hybrid mesons. This would include good mass predictions as well as some initial work on decays. What resources would be needed for these calculations?

# Outcome of the Meeting

The primary outcome of the meeting should be a white paper that discusses the previous topics, how they are interrelated, and what work still needs to be done to assure a successful outcome of the program. A possible question driving this white paper could be:

What is the path forward (on all fronts) to make sure that the results from GlueX can be understood and the interpretation of these results has its largest impact?

In order to have a draft of this white paper shortly after the meeting, it will be necessary to begin sections of the material before the meeting.

# Outcome

A second outcome will be the start of a Physics Book that would collect relevant theory works, describe the physics and serve as a tutorial on getting started with GlueX physics. The ultimate book is clearly a much longer term goal, but this meeting will serve a starting point for putting this book together.

# Summary

The time is ripe to start looking seriously at physics issues again.

We need to reinvigorate our theory group.

If you want to help with organization or want to participate, please contact me.