Minutes of Informal Meeting of Concerned BRAG Members, July 14-15, 2000

Abstract

These minutes summarize the discussion that took place at The George Washington University Northern Virginia Campus on Friday, July 14, and Saturday, July 15, 2000. Attendees present were Dick Arndt (GW), Cornelius Bennhold (GW), Bill Briscoe (GW), Simon Capstick (FSU), Steve Dytman (Pitt), Helmut Haberzettl (GW), T.-S. Harry Lee (ANL), Mark Manley (KSU), Winston Roberts (NSF), Igor Strakovsky (GW), Dennis Weygand (JLab), and Ron Workman (GW). The meeting was called by Steve Dytman and Cornelius Bennhold after many people (including the BRAG steering committee and the working group organizers) expressed dismay at the direction the organization was moving (or not moving). All agreed that it is hard to sort out strategy among 50 people, the way the two full BRAG meetings were set up; however, there was no agreement about the exact reason for the lack of success to date. The purpose of this meeting was to air issues among a small group obviously committed to the BRAG cause and to suggest ways BRAG can move ahead successfully.

Friday Morning

- Discussion focussed on the "ultimate" objective (4–5 years) of BRAG.
  - It was generally agreed that the long term goal should be to map out the baryon spectrum (composed of u, d, s quarks) and all of its properties.
  - This should be done for baryons with masses up to 2.1 or 2.2 GeV in order to investigate the missing resonance region (all $N = 2$ and some $N = 3$ baryons). This range should also permit a search for hybrid baryons, for which the lightest are expected to start at $\sim$1.9 GeV.
- It was noted that we should decide on a standardized method of extracting resonance parameters. Ultimately we need to develop a relativistic theory of scattering. The formalism for this exists but it is a horrendous problem to solve and make the necessary connection to scattering amplitudes. More manpower is needed.
- There was discussion about what do we need to measure and with what probes to obtain the experimental observables needed to extract resonance parameters.
  - Dennis noted that he is analyzing both $\gamma N \to \pi\pi N$ and $\gamma N \to \omega N$ data with the goal to study baryon resonances. His analysis starts at a diagrammatic level.
  - It was noted that a manpower problem exists for the $\gamma N \to \pi N$ analysis. This work will anchor the analysis for $eN \to e'\pi N$.
  - Everyone agreed that a priority should be to extract amplitudes for $\gamma N \to \pi\pi N$.

– It was pointed out that the electromagnetic transition amplitudes should be extracted for as many resonances as possible up to 2.1 or 2.2 GeV.

Friday Afternoon

An overview was presented of the Crystal Ball (CB) program at the AGS using both pion and kaon beams. Everyone agreed on the importance of moving the CB detector into the AGS D-line.

The main discussion focussed on physics issues:

- What is a resonance?
  - T-matrix pole
  - Breit-Wigner peak
  - speed plot peak

The main question was is it always necessary to search for the poles in the T-matrix. The consensus emerged that when anything else is quoted (*e.g.*, B-W parameters), the exact definitions must be provided. (The important thing is that sufficient information be provided for a reader to be able to reconstruct the amplitude in the vicinity of the state using the resonance parameters given and the definitions.) It was emphasized that coupled-channel analyses should find the *same pole* in all channels for true resonances. At the present time, it may still be helpful to quote both B-W parameters and T-matrix pole.

- Most of the time focussed on the $\pi\pi N$ issue. The following points emerged:

  a. No formalism exists for a multipole decomposition of $\gamma N \to \pi\pi N$. While tedious, *this must be done.* It is not clear, however, how to identify properly a resonance in a "three-body" multipole.

  b. How does one go beyond tree level and include final-state interactions (FSI)? All present models only do tree level. FSI *can* be included in quasi-two-body reactions.

  c. It is unrealistic (and probably unnecessary) to include full three-body unitarity.

  d. The validity of the quasi-two-body approach was debated.

  e. To satisfy unitarity, one will always need some dummy channel to absorb inelasticity due to unobserved processes such as three-pion final states.

Saturday Morning

The main discussion focussed on organization issues.

- Funding issues.
  - Do we want to ask funding agencies (NSF,DOE) for money to support BRAG? Such monies could be used to support travel for BRAG-related collaborative efforts. To obtain funding, it will be necessary to demonstrate that BRAG is more than the sum of the individuals that make it up. Funding agencies are unlikely to provide extra support for "incremental progress". It was noted that a proposal to support BRAG should specify *concrete goals* that can be met in the three- or five-year duration of the proposal.
- Three suggestions were offered:
  - A concerted theoretical effort to make sense of the huge bank of data coming especially from the N^* physics program at JLab, and the complementary CB program at the AGS.
  - Collaborative efforts to define and compare results for quoted resonance parameters. There is a need for a more substantive rating system than provided in the PDG's *Review of Particle Physics.*
  - Development of new theoretical procedures to deal with the $\pi\pi N$ issue and gauge invariance.
- The new NSF program to support Physics Frontiers Centers was discussed. This program will help university-based centers and large research groups make transformational advances in the most promising research areas. It was noted that this program invites proposals from *all* areas of physics, not just nuclear/particle physics. (Helmut volunteered to investigate possible ideas of how BRAG could take advantage of this program. It was generally agreed that a preproposal from BRAG by the Sept. 18 deadline would be premature.)
- We discussed reorganizing the working groups around five common seeds of interest:
  - Coupled Channel Analyses
  - Theoretical Descriptions of Reaction Dynamics
  - Extraction of Partial-Wave/Multipole Amplitudes from Scattering Data
  - Quark Model Calculations of Resonance Properties
  - Experimental and Data Base Issues (including preliminary theoretical interpretations of data, for example, using simple Breit-Wigner or tree-level methods)

  It was agreed that the working groups are key to BRAG's success. Furthermore, it was noted that the best way to contribute to the Mainz N^* workshop is through reports of people doing critical assessment of different approaches in each topic. We welcome contributions from all BRAG members.

- Recommendation for liaisons with broader hadron community:
  - Lattice calculations (Eric Swanson?)
  - Mesons (Dennis Weygand)
  - Heavy-quark baryons (Winston Roberts)
- We discussed the possibility of creating a BRAG Review of Baryon Resonances, which would supersede the baryon review section in the PDG's *Review of Particle Physics* (RPP). Ultimately, if such a BRAG review article were successful, BRAG might request that the baryon section be removed from the RPP. (A suggestion to remove baryons from the RPP was discussed by the PDG some years ago.)
- Possible dates for the next full BRAG meeting were discussed. The group recommends that the next full BRAG meeting be held at the N^* meeting at Mainz (March 7-11, 2001).
- Possible avenues for a BRAG Workshop were discussed. Some felt that JLab would not be a good location because of the many distractions there. One possibility would be to have a one-week INT (Institute of Nuclear Theory) Workshop, funded by JLab. (Helmut, Cornelius, Simon, and Winston agreed to investigate details of organizing such a workshop.)

Saturday Afternoon

- Possible short-term goals of BRAG were summarized:
  - BRAG web site (Mark and Simon volunteered)
  - Regular review article on baryon resonances (Bill, Steve, Mark, and Ron will discuss this and make a proposal to BRAG at a later date)
  - *Physics Today* article (later)
- Possible time frames for the next Working Group meetings were discussed.
- Proposed changes to the BRAG Charter were discussed:
  - Restructuring of Working Groups and removal of their description from the Charter. (The group felt that Working Groups should be a formation of natural collaborations between groups who are working on related topics.)
  - Revision of the Charter to be more flexible.

  A formal proposal to revise the Charter will be made at the next full BRAG meeting.

Summary

All present felt the discussions were valuable, but the true goal of the meeting was to provide an avenue for BRAG to move forward. Those present agreed that the working groups are the best way to proceed. They also agreed to try to pull the working groups together. We will try to do it with smaller groups (mostly subgroups of the present working groups) that have much in common. A useful theme might be “critical assessment of results”. Comments on these thoughts are requested from the full BRAG membership.