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Professor Takashi Nakano
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Dear Professor Nakano:

This comes to thank you for your interesting oral presentation to the BNL Program Advisory Committee (PAC) at their Meeting of September 8-10, 2004 and convey to you the outcome of the consideration by the PAC of your Letter of Intent (LoI), "Search for the Pentaquark". The LoI did not identify a spokesperson in communications to BNL, so I send this letter to you as the oral presenter to the PAC. Of course, you may distribute this letter freely within the pentaquark collaboration. The Committee examined the LoI, heard the oral presentation and discussed your ideas in executive session at that meeting. They then provided me with the following written advice:

> *"The PAC encourages the preparation and submission of a proposal that could be carried out in a timely fashion and achieve a meaningful upper bound on the Θ^+ width (significantly less than the present bound of about 1 MeV)."*

I append to this letter, the full text of the PAC's written comments, which delineates their views on how this measurement could clarify the present confusion about the existence of the Θ^+ and its particle properties. They also note the possibility of determining the spin and parity of this possible new exotic particle as a result of the formation process used to create it in your detector. In the PAC discussion about your LoI, a number of questions about the efficacy of the method arose, many of them related to the role of the carbon nucleus, with its attendant Fermi motion, on the formation method proposed for the Θ^+ production.

As I explained to several members of the collaboration, BNL does not grant approval to LoIs, but I try to communicate in my letter to the collaboration, the response of the PAC to the proposed physics and their recommendation for the submission of a full proposal. In the case of the Θ^+ experiment, we are fully aware of the desire of all parties to move ahead as rapidly as possible with the next stage of proposal development and will act to remove potential delays generated by the infrequency of PAC meetings, if such action is needed to keep the scientific approval process on-track.

As you know, the awarding of scientific approval by BNL for experiments intended to be run at the Brookhaven AGS must then be followed by a process to obtain funding for construction and operation of the experiment, this because the AGS is no longer a baseline facility of the U.S. DOE HENP program. In the case of the pentaquark search, the existence of a fully functional detector (the E949 Experiment) renders the construction aspect moot, but the question of operating funding remains. If your full proposal achieves strongly positive scientific approval, the next step would be for the Laboratory to submit it to the DOE Office of Nuclear Physics, DOE Landlord for the AGS-RHIC facility, for approval to include the experiment in the AGS fixed-target physics program. We have previously succeeded in obtaining all the necessary DOE and NSF agency agreements in the case of the upcoming RSVP experiments sponsored by the NSF, and we anticipate funding for RSVP construction to commence in the near future. I am, therefore, optimistic that we could succeed in obtaining agency approval and funding for your experiment if it sustains a high level of scientific approbation.

Next, let me take this opportunity to congratulate you and your entire Collaboration on an interesting presentation of the case for carrying out a definitive experiment at the AGS to confirm (or debunk) the existence of the Θ^+ pentaquark. I also note the ingenuity and quite low cost of your proposed experiment through its use of the existing E949 detector and the relatively short number of running weeks needed to achieve a good physics result. All these considerations will act to your benefit, assuming the proposal fully documents the open questions that were identified by the PAC.

Finally, I offer the help of the Laboratory for the preparation of the full proposal, especially as it relates to the aspects of the proposal that relate to resources needed for the preparation and operation of the pentaquark search in the E949 detector.

Sincerely,

(Original signed by T. Kirk)

Thomas B.W. Kirk
Associate Laboratory Director
High Energy and Nuclear Physics

Attachment (1)

Cc: PAC Members
A. Byon-Wagner, DOE-OHEP
B. Tippens, DOE-ONP
L. Littenberg

BNL PAC Recommendations
Meeting of September 8-10, 2004

LoI: Search for the Pentaquark

The LOI proposes a search for the Θ^+ resonance by means of a "production experiment", in which the Θ^+ - assuming it exists - is produced through one of its known main decay channels, K^+n. Such experiments can be "definitive" in the sense that their ability to confirm or refute the existence of the Y^+ is only limited by the achieved energy resolution, but not subject untestable assumptions. The PAC encourages the preparation and submission of a proposal that could be carried out in a timely fashion and achieve a meaningful upper bound on the Θ^+ width (significantly less than the present bound of about 1 MeV).

The proposed experiment makes use of an existing detector (E949) and an existing K^+ beam line (LESB3). It plans to use a beam with a wide energy spread (due to energy loss in the target) and measures the invariant mass of the produced state by observation of the decay products. Since the mass resolution is larger than the anticipated width of the Θ^+, the observed signal will be proportional to the intrinsic width of the resonance. In principle, the experiment could also be able to determine the spin, and maybe even the parity, of the Θ^+, if it exists.

The simulations of the expected signal, given the detector response and acceptance, are in an early stage. It is important to demonstrate the achievable upper limit on the resonance width and the accuracy with which the width could be measured if a signal is observed. In particular, it will be important to understand how the reachable limit depends on the spin and parity of the Θ^+ and on the relative phase between the background and the resonance. A critical limitation may derive from the ability to measure the energy and angle of the "recoil" proton. The proposal should also spell out the commitment of members of the E949 detector collaboration to the successful operation of the detector and clarify how a timely analysis of the data to be taken can be assured.