

# **Review of the Joint Physics Analysis Center Indiana University & Jefferson laboratory**

## **Committee Members:**

Abhay Deshpande , Curtis Meyer, Stephan Paul,  
Jonathan Rosner, Stephen Sharpe & Eric Swanson

## **Committee Charge:**

We wish to solicit your opinion on the scope and quality of the work performed under the JPAC umbrella, its relevance and importance to the JLab physics program, as well as to the wider hadron community, and your advice on research directions for the future.

## **Review Dates:**

The review of the Joint Physics Analysis Center (JPAC) was held at Jefferson Lab on May 3 and 4, 2016. All committee members were present locally or through a video connection for the duration of the review.

## **Summary**

The Joint Physics Analysis Center (JPAC) was established to effectively extract maximal benefit from the data about to be realized from the 12-GeV CEBAF upgrade. Of particular interest are data from the new GlueX Experiment and the upgraded CLAS-12 experiment. The original concept for the Center was formulated by M. Pennington, while its implementation has been carried out by A. Szczepaniak. These two scientists have done an exemplary job of implementing this center with the very effective day-to-day management by A. Szczepaniak, which has also expanded the original idea to interactions with experiments beyond Jefferson Lab. Over the past three years, JPAC has attracted an enthusiastic and energetic group of researchers including graduate students, postdocs and faculty, from around the world. The researchers in JPAC are all uniformly appreciative of the intellectual environment provided by JPAC leadership. As Jefferson Lab moves to new leadership in the roles of lab director and theory group leader it is important that Szccepaniak's guidance of JPAC is maintained. Without this, the future of the Center and with it a timely extraction of upcoming Jefferson Lab physics results could be endangered.

## **Findings:**

- JPAC's overall organization is working well, with Adam Szczepaniak being an effective leader, and Michael Pennington serving both as an important member of JPAC's research effort and supporting the effort in the management hierarchy at JLAB and DOE.
- Adam Szczepaniak is providing exemplary and enthusiastic scientific and intellectual leadership to JPAC.
- Approximately seven years remain on JPAC's planned ten year effort. This is an appropriate timescale to match both with the timelines of JLab experiments and the breadth of tasks to be undertaken.
- JPAC members are highly productive with the group delivering, on average, one paper per month and one talk per week.
- JPAC communication is excellent. In particular, the group maintains a high quality website that explains its research, and provides access to code and online tools for generating amplitudes and other quantities. The group also maintains a wiki page for internal communication and is working on a site to host educational videos concerning amplitude analysis.
- JPAC has hosted a number of international workshops and schools to both collect and disseminate information relevant to the interpretation of spectroscopic data.
- The junior members of the Center highly appreciated opportunities to meet with each other in person to discuss scientific issues and review progress. However, this does not seem to happen too often amongst this group (perhaps due to funding issues). Many members of the Center, especially the new ones, would welcome more frequent and longer duration collective activities. Currently, the group meets approximately weekly via video or other such links. However, the value of such broader and personal gatherings was very highly emphasized by all members of the Center, in private and semi-private conversations.
- The first cycle of postdoc changes appears to have gone successfully, with the second round well integrated into the effort. JPAC has also succeeded in establishing theory faculty positions.
- We observed an "esprit de corps" among the postdocs and students: they displayed enthusiasm for the research and a desire to help each other. Individual projects appear well-defined and attuned to the needs of the experiments. The interactions with advisors/mentors appear constructive, with postdocs/students feeling that they had substantial input into the choice of methodology.
- We find that JPAC is able to attract excellent students and postdocs. The visibility of JPAC is such that it is also able to attract visiting students. Training is excellent, with weekly project meetings, regular discussion groups, and biennial workshops all supported by the group.

- A number of the presentations showed direct connections to extracting physics from both current and upcoming Jefferson Lab data. In particular, there has been a very close tie to the spectroscopy program in CLAS-6 at several levels. This included single meson photoproduction, meson decays and amplitude analysis. This has moved into the first GlueX analyses, where JPAC participation is crucial for interpretation of the first results. The work of JPAC will remain essential to the success of both GlueX and CLAS-12.
- Results and work relevant to other experimental efforts were presented and JPAC appears to be coupled into spectroscopy programs and heavy flavor decay groups in both Europe and Asia.
- The nature of JPAC activities includes a very high level of communication with experimental collaborations. Different collaborations are structured differently, and have different methods of internal evaluation, review and publication policies. It was pointed out that some of the analyses that the JPAC center theorists and phenomenologists got involved in and spent significant time on, unfortunately did not result in publications, because of delays in publication by the corresponding experimental collaborations. This is clearly a very unfortunate and somewhat demotivating situation for young theorists in the Center, which affects directly their career prospects in the immediate and long-term future.

### **Comments:**

- JPAC is performing essential work relevant across the full range of JLab's experimental effort; this effort requires substantial JPAC manpower. Current support comes from JLab, IU and GWU, while additional postdoc support for JPAC from the JLab theory pool is merited.
- The effectiveness of JPAC could be enhanced by building up a teaching resource for new members consisting of written materials and videos of lectures. This is partly done, but could be improved and extended.
- The postdocs and students expressed the desire for semiannual JPAC meetings of 1-2 weeks duration. This would allow for educational lectures, presentations of ongoing research, and most importantly, the opportunity for sharing experiences and brainstorming on future projects. In addition, members of CLAS-12, GlueX, and other relevant experimental collaborations could be invited.
- The summer school on reaction physics was very successful and should be continued, perhaps biennially. This is a vehicle for integrating new members into JPAC, for spreading the expertise more widely, and for building connections with experimentalists.
- Efforts to expand the funding base of JPAC beyond its current distributed sources are encouraged. Given the international nature of the effort, this could include non-US sources.
- Efforts to expand JPAC contributions from other universities are encouraged.

- The integration of JPAC expertise and formalism with those of the HadSpec lattice QCD collaboration is encouraged. It is likely that a combined effort will be required to relate upcoming experimental data on resonances to ab-initio QCD computations. This is particularly essential for resonances with decays to more than two stable particles (e.g., most exotics).
- It would be advantageous if JPAC were recognized more widely as a collaboration, e.g., by being listed as such in INSPIRE.
- During the review, some center members expressed a long-term vision to include Transverse Momentum Distributions (TMDs) in JPAC. This would require significant additional manpower and possibly a dilution of current efforts. We suggest that, in the near term, JPAC focus on amplitude analyses.
- The tight collaboration between JPAC members and experimental groups is a crucial aspect of JPAC. In order to minimize cases where issues on the experimental side prevent completion of projects, we suggest close scrutiny by senior JPAC members could help in choosing projects to minimize this risk.
- JPAC should consider publishing tutorial materials concerning amplitude analysis. Although this is not the purpose of the group, JPAC members have developed substantial expertise in this rather poorly documented area. Writing tutorial and educational material would provide a strong benefit to the field and assist in educating future junior members of the group.
- Raise the visibility of JPAC on the JLab theory site. Currently links to EBAC are more prominent than those to JPAC. Place a link on the research page: [https://www.jlab.org/div\\_dept/theory/highlight/index.html](https://www.jlab.org/div_dept/theory/highlight/index.html)
- If JPAC were to cease, it is not clear how long the knowledge and expertise it has developed would continue to be useable for data analysis. It would be useful to review if the current method of dissemination of information is viable should funding for JPAC end.

## **Recommendations:**

- We recommend continued funding and support for the joint faculty position between JLAB and IU, for the leadership of the Center in general, and for Adam Szczepaniak in particular. We strongly support the continuation of Adam Szczepaniak as the director of JPAC. In view of the impending departure of Mike Pennington from Jefferson Lab, we recommend that as soon as his replacement is known, Prof. Szczepaniak discuss the status & the future of the JPAC with him/her.
- The Lab management and the experimental collaborations work closely with the Center's leadership in preparing future proposals, and supporting them with "what might be lost" scenarios if the center does not get a sustained long term budget consistent with their mission.
- As noted above, frustration was expressed by JPAC members about collaborations with experimental groups not leading to timely publications. We recommend JPAC management to look for ways to mitigate this issue. A good starting point might be to contact the CTEQ collaboration, which has long dealt with these issues, and more formal connections for advice. Further, regular meetings at a monthly or bi-monthly frequency between JPAC and experimental groups should be considered.