**Facility Members Comments on 6BMB Proposal**

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**Compiled by Mark Rivers**

**Ben Chin**

The proposal prepared by PI Donald J. Weidner and Co-PI Matthew Whitaker is to request an additional one-year support or continuous support for the next few years for Beamline 6BMB at the APS, in response to the decision of the closure of the facility from the COMPRES central office. The proposal laid out the unique technical capabilities and the cutting-edge research that can be enabled by the existing and planned technical development effort from the prolific and productive team led by Prof. Weidner. The developed techniques for rock deformation research in the beamlines at NSLS and now at 6BMB at APS is on the frontier of the field. Those capabilities include DDIA and RDA combined with a variety of techniques such as imaging the sample with Strain Markers, in situ stress measurements with a conical slit detection system, the newly developed DIASCoPE ultrasonic system, steady state flow experiments, and sine pump. The 6BMB beamline offers unique techniques that are complementary to those to be available at XPD of NSLS-II.

In the proposal, the table on user statistics demonstrated the rock deformation facility at 6BMB is used by 40–60 distinct research groups each year. Each year, around 16 to more than 20 papers are published as a result of the work conducted using the facility. I would say the beamline is productive.

One thing I would suggest for the 6BMB beamline proposal is to include a career development plan for the beamline scientist. It would be nice if the beamline scientist can be involved in proposal writing to secure extramural funding.

It is understandable the community would have to make hard decisions when money is tight. However, it would be a pity to see all the effort wasted by the closure of the beamline with a short notice. For the time being, I would suggest continuing to support 6BMB for an additional year.

**Arianna Gleason**

(Abby’s rules are in italics.)

*•Science: What are the scientific drivers motivating the facility/infrastructure investment? What are the science outcomes from previous investment?*

 🡪 Science drivers: Measure of rock deformation and rheology of Earth relevant materials

🡪 outcomes: New technology; important scientific studies for Earth and planetary science to moderately high pressure

*•User Community: Who are the users of the facility? Do COMPRES investments provide a resource that is open for the community? Is the user group inclusive, representing a diversity of practitioners, and with opportunities for new users?*

🡪 Users are fairly diverse coming mostly from academic institutions. Facilities appear widely accessible to the whole community and available to new users/students.

*•Management Team: What is the nature of the partnership between COMPRES and the PI(s)? Are COMPRES beamline scientists provided with high-quality support, supervision, mentoring, and professional development?*

🡪The partnership looks healthy and strong. I’m not so clear how much PD and mentoring Chen is getting – unless we are assuming it comes from this ’10 trips between NY and IL to support APS operation’. What is the definition of ‘support APS operation’ – like help build diagnostics and fix broken parts, or mentorship of staff? I guess 10 trips are fine – but it might benefit the beamline scientist more if there were specific science endeavors where it was clear he/she had ownership. It might be nice to build in a little more in the budget for another conference for Chen and more for shop support – 4k seems low.

*•Facility: How does the facility help match the needs of the COMPRES community?  Does the facility provide state of the art equipment? What is the nature of the partnership between COMPRES and the host facility, both on paper (e.g. MOUs/Partner User Agreements) and in practice? To what extent does COMPRES leverage additional support from the host facility (e.g. equipment, shared facilities, and/or staffing)?*

🡪 I’m really excited about the capabilities presented here for the COMPRES community. In particular, the DIASCoPE initiative looks like a great addition for time-resolved /transient phenomena studies in line with their existing investigations of deformation mechanisms. Partnership with host institutions looks fine. However, the Budget justification made it sound like APS needs to pony up more support for hutch related work.

**Ann Pommier**

*1) Science:*

This facility has allowed the development of rheological measurements and techniques that were previously intractable. This proposal would keep promoting new rheological investigations that are needed to understand the physics and chemistry of terrestrial interiors. The science highlights included in the proposal point out the diversity and the quality of the science performed at this facility in a very convincing way. It is clear that excellent research is conducted at 6BMB at APS. Also, having another APS beamline for multi-anvil experiments would be a great addition and lead to very exciting Earth and planetary science investigations.

*2) Management team:*

Users come from several institutions and involve students (several PhD dissertations and a few MS theses benefitted from experiments performed at this facility, as listed in the proposal).

It is unclear how much beam time the four PIs from the Grand Rheology Challenge are getting compared to other external users; it would have been good to highlight this point, as there might be a risk of having a huge discrepancy regarding the facility access (“first and second-class users” feeling).

The partnership with COMPRES looks strong. In particular, the interactions with GSECARS are clearly highlighted though it seems that there is still room for improvement (increased scientific and technical interactions). In particular, the idea of sharing a technical staff person with GSECARS (as suggested p.12) is relevant, and this should have been added to the budget of the proposal (as it would be reasonable/fair to split costs between 6BMB and GSECARS).

Information is missing regarding the situation of beamline scientist Chen. Chen seems to be a key component of the success of 6BMB and is part of the budget, but it is unclear how the facility enhances this scientist’s professional development, involvement in science, and career in general.

*3) Facility:*

The proposed development for this beam line facility is well justified, and the need to stabilize 6BMB as well as the negative impact on the scientific community in case it closes is clearly highlighted. This program is currently in a transition state (since the shutdown of NSLS) and this proposal offers a relevant path forward.

However, the budget and its justification are very succinct and thus, unclear. The detail of the costs for shop support and supplies is missing. It seems small; does it mean there is complementary source of funding for it? This needs to be clarified.

“This support is required for moving heavy objects such as the press and the RDA when Karato comes”: this reads as a privilege made for a specific PI. It is awkward to have in the budget of a facility some funding dedicated to one specific *user*. Hopefully this is just a phrasing issue.

I recommend funding if possible.

**Mark Rivers**

This proposal is much stronger than previous versions we have seen for this facility. It discussed in depth the technology and techniques that they have developed, the science they have done in the past, and propose to do going forward. Historically this group has indeed been a leading force in the field of high-pressure deformation experiments, (though I think they have underplayed the role that Yanbin Wang and GSECARS have played). They have demonstrated an excellent record of developing innovative techniques and applying them to important Earth science problems.

Some impressive science has been done at 6BMB. Only a small amount has been published, but some is close to publication and 2 years lag between experiment and publication is not unusual.

They make the case that 6BMB is needed until HEX comes on line. For me this raises concerns. First, there are some encouraging signs mentioned in the proposal that high-pressure may be part of 6BMB, but there is nothing in writing or guaranteed at this point. HEX is at least 5 years away from being operational. This leads to a several questions in my mind:

Can COMPRES afford to fund 6BMB and XPD during this period?

Is 6BMB the best place to be doing white beam experiments at the APS? 6BMB lacks focusing mirrors, so its intensity is less than X-17-B2 which is adversely impacting some experiments, particularly Karato’s very high pressure experiments. One possibility would be to move this program to a beamline which has focusing optics. This could be 13-BM-D, but that would lead to an oversubscription problem. A better solution would be to develop the 14-BM-D beamline which might be available 100% of the time, and could have 1:1 focusing mirror to increase the intensity by a factor of 10.

Note that the proposal makes this statement about focusing:

As the Facilities Committee indicated, a mirror can increase the flux density by an order of magnitude. Of course this comes with a decrease of the vertical dimension of the beam by at least an order of magnitude. Thus, most imaging would require that the mirror be inserted and removed as one switched between diffraction and imaging. The beam will move up or down with this action. It is not clear whether or not this can be automated and kept to a time loss of no more than a few seconds. In addition, we need to have the range of motion of the press to make the change as the mirror is removed.

This statement is incorrect. In fact the mirror at 13-BM-D is dynamically bendable, and can be rapidly changed between focusing the beam (to 20 microns at the smallest) to defocusing the beam, to 5 mm or more in height. This can be done with no vertical motion of the beam. There is thus no need to insert and remove the mirror; one simply changes the bending from focused to defocussed, and this can be done in a few seconds in a very reproducible manner.

I recommend that this program be continued for 1 more year, at which point a decision may be needed on whether to continue 6BMB and/or XPD, and whether to try to raise the money to move the program to 14-BM-D.

**Dan Shim**It is very impressive report.  I found that they have been very successful.  I also learned that there are much uncertainties at NSLS-II.

I have a few questions.

- They have a list of achievements which are impressive.  It would have been nice if there are supporting letters from the groups who have used this facility.  How important it is to continue the facility without interruption during the transitional period?

- It appears that there has been discussion on moving the facility to GSECARS.  Although they said it will increase the load dramatically at GSECARS, there is no clear data I can find to support the argument.  I am not sure it is good idea to move to GSECARS, though.  Could there be other reasons why this may not be a good idea?

- Appendix III is confusing to me.  I do not want to mis-interpret, but does the table indicates decline of users by the move from NSLS to APS 3 years ago?  It is not clear how to interpret the table.

- I feel I have to hear from the users about how the different transitions plans would impact their research and what are the better solutions.