**Chen DAC at NSLS-II**

**New Proposal**

**COMPRES Facilities Comments**

**Bin Chen**

I concur that the new facility has the potential to be a great asset to the high-pressure mineral physics community in the US. The NSLS DAC program had served the community extremely well, until it was decommissioned. I can foresee that the new facility will be a great success with adequate support from COMPRES and other institutions. The leveraged matching fund from HPSTAR will definitely help establish long-term collaboration between COMPRES and HPSTAR to support the facility. The COMPRES’s share of 1.1M (total is 2.2 M) is steep. Does COMPRES has the budget to support this or this should be supplemental request?

**Arianna Gleason**

-This new facility is positioning itself to be the East Coast version of APS- reviling the capabilities of APS-HPCAT, -GSECARS and Sector 3 to enable new access to the COMPRES user base. This sounds like an excellent scientific investment.

-It looks like the user community would be quite broad – focused quick a bit on East coast institutions – but has received letters of support more broadly. There isn’t too much international appeal listed, but I imagine that will come as the end-stations come on-line.

-It’s not so clear what the partnership between COMPRES and the PIs would look like, but again, it’s early in the development stages. Relationship between the host facility and COMPRES seems strong.

-If I had to pick between the $2.9M for LMAPF at ASU and the $2.2M for DAC@NSLS-II, I surely pick DAC@NSLS-II as serving the broader community needs.

**Anne Pommier**

*-Science:* This facility would allow conducting very exciting studies in Earth and planetary sciences, with leading-edge capabilities. It seems that this facility will develop DAC experiments in new directions (several beamlines included), suggesting that new and creative experiments would be conducted there. However, it is a bit difficult for me to identify what these directions will be (might be similar to the lack of “specialty techniques” that Mark is referring to in his letter).

Potential to become a unique DAC facility, but I have a naïve (non-user) question: what would it offer that other existing DAC facilities do not have?

*-User community:* It seems that the plan is to provide significant time to COMPRES users (though an estimate of the time allocated to COMPRES users is not specified).

Proposed to organize a workshop, with a proposal submitted to EOID: I agree with both the strengths and weaknesses pointed out by the EOID Committee. I would just add that the fact it is on **invite only** is understandable but not very inclusive in its approach.

*-Management team*: Totally qualified team but I agree with Mark that a clear management plan is needed. PI Chen has significant experience to conduct the experiments and manage the facility. Good point to have on-site staff; Beamline scientist Hong and Research specialist Yang both have the required expertise and skills.

*-Facility:* PreviousDAC program (NSLS I) was very successful, so it would be exciting to see it continued in some way as part of NSLS II.

Budget*:* $150k requested from COMPRES, huge leverage from other sources (HPSTAR, FIU) – however, how will it be included to the COMPRES IV budget? Does it imply cutting funds to other facilities? (situation unclear to me)

**Mark Rivers**

*-Science:* This proposal would provide both standard and cutting edge techniques. The new techniques (XPCS, nanoprobe) will open up new scientific areas. I have some questions about how they will actually implement some of the things they propose.

Multigrain. This is a technically challenging problem. HP-CAT has been working on this for a number of years, and as far as I know it is still not available to the general users. Who will develop this at NSLS-II? This uses single-crystal technology but with multiple grains. This means they need an accurate rotation stage, and software for single crystal data collection. There are no details on this.

PDF on melts. This is very challenging for several reasons. The amorphous scattering is weak and must be measured to high precision. This requires long acquisition times, but maintaining a stable melt in the DAC for those times is difficult. Because the scattering is weak it can be swamped by the scattering from the diamonds which are orders of magnitude thicker than the sample. For both of these reasons the melt scattering at the APS is being done in a Paris Edinburgh cell, not a DAC. The PE cell allows using a soller slit to remove the non-sample scattering, but this does not have the resolution for the smaller DAC samples. It is also much easier to maintain stable liquid with resistive rather than laser heating.

Sound velocities. What is the advantage of the IXS beamline for these sound velocity measurements compared to 3-ID and 30-ID at the APS which COMPRES is already supporting?

*-User community:* It is clear that the capacity of the high-performance beamlines at the APS is insufficient for the community demand. 13-ID-D and HP-CAT undulator beamlines are heavily oversubscribed. While the performance of the XPD station will not be at the same level as these stations because of the significantly lower brightness, there are many projects that could be done well at XPD. The problem with XPD is that there is also unlikely to be a large amount of time for DAC experiments there either because they will compete for COMPRES time with the multi-anvil program, and with a very large community of non-COMPRES users who do powder diffraction.

*-Management team*: The team has good experience. There will be 1 or 2 beamline scientists on site, no other management from the team. The success of the project will depend heavily on the beamline scientists.

*-Facility:*

They propose to use SRX for emission spectroscopy and for sub-micron imaging. SRX does not currently have a high-resolution analyzer for emission spectroscopy. It also does not yet have sub-micron focusing, and the mirrors they purchased for that purpose have been shown to be unable to achieve sub-micron focus.

They propose in the table to use HEX for full-field imaging. This beamline will not have the optics or brightness to do this in the DAC. It can do it in the multi-anvil.

They propose to use the side-branches of HEX for DAC work. However, the side branches are much poorer sources, because they are looking at the extended wiggler source from a non-zero angle. This makes the source size much larger than when looking on axis in the central end station, and means the source cannot be well focused in the DAC. This is exactly the problem that X-17-C had at the old NSLS. (I will make some quantitative estimates of this effect in the near future).

The list of existing equipment is interesting, but not too useful without information on what items are actually in-hand and available for use at NSLS-II.

The section on the KB mirrors in the budget justification indicates a misunderstanding. They imply that the reason the mirrors that XPD plans to buy can only reach 25x10 microns is because of the mirrors themselves, while if they use mirrors from HPCAP they can get a 5x7 micron spot size. This is completely incorrect. The reason for the larger spot size is the source, upstream optics, and beamline layout, not the mirrors themselves. Using a different set of mirrors will not help.

They say the MAR CCD detector at GSECARS is not in use, but in fact it is heavily used. It does belong to Stony Brook and GSECARS would return it if it is needed at NSLS-II.

They say they need purchase another laser heating system because the one that COMPRES previously purchased is in use at Stony Brook. I feel this is unacceptable. COMPRES purchased this for use on the COMPRES beamlines at NSLS. It should move to NSLS-II and not be lost to Stony Brook. COMPRES has leverage here, since Stony Brook is a partner on this proposal and wants it to be approved.

There is no description of how the system will be mounted in XPD. We heard at the workshop that another PUP has been approved with their own table in the upstream part of this station. Where will the DAC system be mounted. Does it need to purchase its own table, etc?

The cost of the GSECARS/COMPRES gas loading system is $300K from Univ. of Chicago, not $170K. I think it is unlikely anyone else can build it for $170K.

There is no explanation or justification provide for the $30K/year consultants in the budget.

The match from HPSTAR is very positive aspect of the proposal.

**Dan Shim**

* Multi-grain XRD
  + We probably need more support from software side than hardware side for this.
  + Can we do this in existing facilities?
* Pair distribution fuction
  + The same criticism also applies here.  It is important to show why NSLS-II can be better place to do this than other places.
* Nano-imaging
  + This is the type of experimental tool that could be unique for NSLS-II
* Will the beamlines be fully COMPRES?  If partial, does it justify full time staffs of 2?
* Coordination with IR Beamline would benefit the users