

Whitepaper: A proposal for establishing DAC experimental station at NSLS-II

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We would like to propose a project to establish and operate a DAC experimental station at the X-ray Powder Diffraction (XPD) beamline of NSLS-II.

Rationale: The COMPRES DAC program at NSLS was a workhorse for synchrotron based experimental high-pressure research in the COMPRES community and the most productive COMPRES facility based on the data in COMPRES 2017-2022 renewal proposal to NSF (see table below). It will be beneficial to the community to resume such a program if it is financially possible.

Table 1. COMPRES Facilities Publication Statistics (2012-2016)

	2012	2013	2014	2015	2016*	Total
12.2.2 DAC ALS	32	31	22	20	11	116
U2A IR DAC NSLS	16	12	20	11	10	69
X17B2 Multi-anvil NSLS	12	13	14	5	6	50
X17C/B3 DAC NSLS	34	34	51	27	20	166
Sector 3 IXS DAC + Mössbauer APS	10	3	13	9	6	41
Gas Loading APS	17	23	24	40	24	128
ASU Multi-anvil	3	9	9	7	3	31
PX ² APS	N/A	N/A	N/A	N/A	3	3
6BM-B Multi-anvil APS	N/A	N/A	N/A	N/A	0	0
EOID other	4	4	0	0	0	8
Central Office	2	8	0	0	0	10
Total	130	137	153	119	83	622

Peer-reviewed publications and theses.

* Through July 2016

Technologies to be enabled: 2-D angel dispersive powder x-ray diffraction; high Q coverage (photon energy up to 70 keV) pair distribution function x-ray scattering; multi-grain x-ray diffraction. High pressure up to multi-megabar and wide range temperature with cryostat or laser heating.

Beamtime allocation: Regain the 20% of total beamtime allocation at the beamline to share with COMPRES multianvil program. Beamtime allocation will be used by COMPRES community through general user proposal.

Broader Impacts beyond XPD beamline: Integrating with existing COMPRES FIS DAC facility, this project will serve as a hub for studies using DACs in conjunction with other hard x-ray

beamlines, such as CHX, HXN, SRX and IXS, at NSLS-II. Staff of this project will offer essential technical support to COMPRES community taking advantages of the high quality light source at these beamlines.

Project personnel: PI: Jiuhua Chen, a professor of FIU with two decade experience conducting experiments and managing operations at both multianvil and DAC beamlines. Beamline Scientist: Xinguo Hong, the beamline scientist of the previous COMPRES DAC project at NSLS and the major contributor for making COMPRES DAC beamline the most productive project. Research specialist: Wenge Yang, the manger of HPSynC at APS who will engage in this project half-time to promote the hub function of the project and successful integration of DAC with other x-ray techniques (CHX, HXN, SRX, IXS etc.). Postdoctoral research associate: to be recruited for user support, technical development and research.

Annual budget request:

Personnel cost: \$206k

Beamline scientist: \$70k;

Research specialist (half-time): \$40k;

Postdoc: \$40k;

PI: \$5k.

Fringe benefit rate: 33.22%

Equipment + materials cost: \$85k

Off-campus IDC rate: 26%

Total project cost: \$367k.

Budget requested from COMPRES: \$150k

Budget support from partner institution HPSTAR*: \$150k

Cost sharing by FIU: \$67k

*HPSTAR is interested in the collaborative effort to enable frontier DAC/x-ray techniques, and its users will apply beamtime through general user proposal.