University Research and Training of Accelerator Scientists and Engineers

William Barletta (MIT), John Cary (U Colorado Boulder), Richard Temkin (MIT),
Emanuela Barzi (FNAL)

In its summary report to P5, the previous Snowmass Accelerator Capabilities study found that advances in accelerator science had been handicapped for more than a decade by DOE/OHEP's excessive focus on project-driven R&D. That message was later echoed by the 2015 HEPAP subpanel review of the General Accelerator R&D (GARD) program. Since that review, substantial funds from the pre-review GARD budget were mortgaged to finance superconducting RF (SRF) R&D in support of PIP-II, and roughly 40% was committed to support facility operations at the national laboratories.

Hence one cannot be surprised that little "free energy" remains for developing innovative technology unrelated to identified projects or for broad, foundational research in accelerator theory and associated computational physics. The largest exception to that trend is R&D in established laboratory programs in laser- and beam-plasma wakefield acceleration. These areas of important new basic science are exciting, but they have very low chances of being relevant to TeV e^+e^- colliders on a realistic time scale. Although more efficient RF-power sources would have a sizeable cost impact on a future collider, R&D in that area has disappeared from university research programs. The research portfolio emerging from Snowmass 2020 and subsequent P5 process is unlikely to improve this unbalanced R&D environment. Even the expanded "stewardship program" in OHEP is directed more at technology transfer than to revitalizing transformational work in accelerator technology.

The dwindling opportunities for innovative accelerator research have deep implications for the education of the next generation of accelerator physicists and engineers. The present funding regime puts some of the historically most fruitful producers of U.S. accelerator PhDs in jeopardy of drastic reductions in their capacity to accept and train students. At least three notable university programs are moribund or dead. Post-Snowmass 2013, NSF had initiated a program (~$10M/yr) of transformational accelerator research at universities. That program is "on hold." NSF has issued no calls for proposals for the past few years. Happily, the NSF-funded, multi-university Center for Bright Beams led by Cornell is a large step in the right direction.

The Letter of Interest SNOWMASS21-AF7_AF4-064 makes a strong case for a more appropriate balance of research funding that 1) *grows with inflation*, 2) *is not a slave to laboratory priorities*, and 3) has a *vibrant university-based component*. OHEP's reduction of opportunities for innovative accelerator R&D, especially at universities, has serious implications for training accelerator physicists and engineers. It puts at grave risk the most successful university programs to educate and train a new generation of accelerator scientists and technologists and chokes nascent efforts at other universities.

Stemming from the same root cause of this decline, OHEP is increasing pressures on

America's regional accelerator school (USPAS), transforming it from a community-wide enterprise to a single laboratory program and simultaneously decreasing both the support for and flexibility of its director in both operations and communicating with DOE. Over the past decade, OHEP has also become increasingly unsupportive of the program of the collaboration of the regional accelerator schools [ref 1] to hold broad international sessions (Joint International Accelerator School–JAS). In the opposite direction, the organizers of previous JAS sessions have been moving to expand their collaboration of internationally organized teaching to include the many countries in Asia and the Americas that now have world-class accelerator facilities in a new International Accelerator School (IAS).

The SARS-Cov-2 has also damaged the regional schools (such as USPAS and the CERN School) and the JAS. Sessions in 2020 have been cancelled and at least some sessions in 2021 will be online. Online sessions will cost less, but that false "economy" comes at the expense of denying students the enormous benefit of intensive face-to-face interactions with an international body of expert lecturers and highly capable young professionals. We urge full support of in-person USPAS sessions as soon as public health concerns allow. Another casualty of covid-19 has been a variety of international exchanges of accelerator physics and engineering students such as the Fermilab International Student Program. The P5 process must strongly encourage OHEP to strengthen ties with and support of international accelerator schools and international student exchanges.

Educating and training a new generation of accelerator physicists and technologists requires that our field retain a vibrant level of intellectual excitement in an atmosphere of inquiry unconstrained by the time and budget pressures of construction projects or the limitations imposed by supporting user programs at lab facilities. As in the past, broad foundational research attracts the highest caliber students, who become intellectual leaders and can produce science that can grow into focused programs in their own right.

Of particular importance is the health of the university programs in accelerator physics where the predominant focus is on forefront accelerator research and where the majority of U.S. accelerator physicists have been trained during the last thirty years. In addition increased opportunities for experimental study on-campus also attract high quality, motivated undergraduates to our field.

Restricting the funding of accelerator research to work with immediate relevance to OHEP projects and directed research programs is both shortsighted and inconsistent with the accelerator stewardship mission of OHEP. A broader, less project-focused portfolio of research should aim to broaden the opportunities for new, tenure-track faculty and post-doctoral researchers who will pursue accelerator science. A reinvigorated, community-wide USPAS program as well as a well-supported and vibrant International Accelerator School are vital to the fruitful international personal collaborations of accelerator scientists and engineers. We urge the Accelerator Frontier study of Snowmass 2020 to make the strongest possible such recommendation.

Reference:

[1] “Educating and Training Accelerator Scientists and Technologists for Tomorrow,” W.A. Barletta, S. Chattopadhyay, A. Seryi, Reviews of Accelerator Science & Technology, Vol. 5 (2012) 313–331