

## Set For Success: How to Accelerate Early Career Accelerator Scientists

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Any scientific field that aims to be successful in the long term requires a constant supply of young, motivated, and skilled people. Accelerators are particularly big and complex machines; they can only be developed by a passionate community with a wide area of expertise and interest in maintaining a long career in the field. Today's early-career (EC) scientists will be needed to execute the plans discussed in the current Snowmass effort. EC scientists can energize the community by providing fresh and creative ideas to overcome technical limitations and operate current accelerators.

Ideally, young people have the opportunity to learn from the current experts and grow to be experts themselves. We develop best when we have access to the tools that we need, and many of us will mentor new colleagues, some will teach the incoming generation, and some will manage programs. We acknowledge that scientific excellence in combination with continuous personal development of organizational, social and pedagogical skills are needed for inclusive and effective leadership positions. Accelerator research is a long-term, global effort with a complex funding structure, and connectivity between facilities, disciplines and career levels is challenging to build and maintain. Investing in early career scientists and engineers is essential to the long-term development of accelerator science but if done strategically, can facilitate the growth of the community.

In this letter we want to advocate discussions about topics that concern the recruitment, training and development of the Early-Career generation of the Snowmass Accelerator Frontier. There are issues related to family life and work-life balance that affect the accelerator physics pipeline but are not unique to it, so we will defer discussions of it to the DEI LOIs entitled "Building the Pipeline," "Recruitment Evaluation and Recognition," and "Lifestyle and Personal Wellness". In this discussion, we are also interested in getting feedback from DoE/HEP concerning Early Career support goals, i.e. on how many additional members of the workforce are needed to match up to funding profiles and how early career members are distributed amongst the HEP/Accelerator physics collaborations. We hope that the Snowmass strategy will recommend dedicating appropriate funding for projects and programs that support development of Early-Career scientists.

### What Challenges Do Early Career People Face In The Accelerator Frontier?

**Getting into Established Communities:** This is an important time to examine who has access to a career in this field and what practices are limiting access and success in the field. Care must be taken to ensure that those with nontraditional career paths are not locked out of early career opportunities. Limited funds to attend workshops, schools, or conferences should not restrict network building for EC scientists.

**Opportunities to Publish:** Opportunities to produce peer-reviewed publications are essential for EC scientists to advance yet they remain limited. Accelerator research often requires a lengthy technical preparation stage before collecting results and a sustained effort to maintain apparatus which can result in long periods without career development opportunities. Furthermore, work that is critical for the success of user facilities does not rise to the high levels of novelty demanded by high-impact journals, meaning useful work done in a national laboratory setting is documented in conference proceedings.

### What Scientific Opportunities Do Early Career People Need To Be Successful?

**Visibility:** We encourage strong community support for Early-Career Scientists to present their major technical advances and scientific results in a high visibility environment, e.g. plenary and invited talks, seminars, newspaper articles, etc. We also support scheduling Early-Career talks and award ceremonies at times when many people are known to attend and for award opportunities to support diversity.

**Learning:** Progress in the accelerator frontier requires that knowledge be transferred to EC individuals from current experts. To encourage this, we suggest that senior community members are rewarded for teaching and creating an environment in which outreach, tutoring, and knowledge transfer is gaining as much recognition as personal achievements.

**Funding:** Adequate funding for Early-Career research and ensuring opportunities to identify with and directly engage with DoE program managers is needed. Current funding profiles could be improved by allowing for small to medium size projects where there are 'holes'. This can be accomplished either by expanding the scope of Lab Directed Research and Development (LDRD) projects to include work at other labs both in the US and overseas, or through a more directed program, for projects smaller than a DOE Early Career Award.

**Leadership:** Accelerator projects are full-career activities, with the time from first conception to turning the accelerator on spanning potentially decades. Involving Early-Career members of the community, who will be the senior members by the time the project comes on-line, gives them a stake in the projects they will be responsible for completing. Snowmass gives opportunities for leadership to those of us who are involved. We advocate that the community create more opportunities for leadership and interfacing after this effort ceases. Additionally, leadership roles should have well-defined goals and dedicated resources allocated to ensure that leaders can work independently.

## What Can Be Done To Get Early Career People Interested In Accelerator Science?

**Advertisement:** We advocate for sincere investment in the advertisement and running of accelerator schools (e.g. USPAS), university-level courses and high school lessons. Expansion of the number of universities with accelerator programs and facilitated navigation for interested students through explicit collaboration programs with advertised liaisons. This requires steady funding for dissertation-worthy accelerator research for early-career faculty as well.

At the undergraduate level, we support broad advertisement of the USPAS to increase awareness of the field. We also encourage adding outreach and mentorship to funding agency requirements and roadmaps. An important relationship between public awareness and creating opportunities to publish exists as the accelerator workforce is not only made up of scientists but of engineers and technicians who dedicate their careers to making accelerators run around the clock enabling our research. They are a critical part of the workforce and outreach efforts should extend beyond those who have an academic background.

**Broadening Access:** Students, early career scientists, and educators alike would benefit from improved cohesion between universities and accelerator laboratories. Existing programs rely significantly on individual collaborations between students and laboratory scientists, often through part-time mentorship. As a result, recruitment and retention of students and postdocs is heavily reliant upon individual practices in lieu of longstanding department structures, unlike in other fields. A concerted effort from Universities and labs to coordinate education and recruitment of new scientists would foster the stable, consistent influx of talent. There is also concern that evaluations at national labs emphasize personal achievement at the expense of mentoring junior scientists and supervising students.

To further broaden access, programs can also make hiring postings for post-doctoral positions open to growth opportunities so that talented accelerator physicists who might not have the perfect credentials for a specific project can learn on the job, enthusiasm to fund exploratory science and the development of new technologies benefits potential newcomers. An expansion beyond big machines to smaller proof of principle, and physical analogue machines can help provide opportunities for young professionals, as well as hands on experience for students.

Snowmass is a community planning process. Early-Career Scientists will play a key role in realizing its outcome. They express passion for their work, a willingness to execute ideas and a readiness for action where possible. Given opportunities, we are ready to contribute to the outcome of the Snowmass Planning Process. We therefore hope that there is interest in the broader community to ensure the scientific growth and development of Early-Career scientists and to ensure that also the next generation is interested in accelerator physics careers.