

Snowmass2021 Letter of Interest: Early-career Needs in Instrumentation

Katherine Dunne for the Early Career Instrumentation Group

Thematic Areas:

- CommF1: Applications & Industry
- CommF2: Career Pipeline & Development
- CommF3: Diversity & Inclusion
- CommF4: Physics Education
- CommF5: Public Education & Outreach
- CommF6: Public Policy & Government Engagement

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Introduction

Developing and retaining instrumentation physicists in HEP was identified as a challenge in the Snowmass 2013 Community Summer Study. Among all of the Frontiers of Snowmass, Instrumentation (including overlap with Underground and Accelerator Frontiers) has unique and specific needs when it comes to education and career pipeline development for early career members. The purpose of this LoI is to invite potential co-authors for a white paper on the status of these needs, and a set of strategies to address gaps between needs and resources. As a community-driven process, Snowmass provides a unique opportunity to focus efforts on defining recommendations for issues within the US instrumentation workforce identified in previous reviews [1, 2, 3]. The following topics have grown from conversations between early career members of the Instrumentation Frontier. We will expand upon these topics over the next year as a group, and we invite any new ideas.

Need for inter-frontier/cross-disciplinary mobility

Instrumentation has broad overlap across all Snowmass Frontiers. Multidisciplinary learning opportunities would strengthen the field by highlighting cross-cutting technology and methods. Not only does this provide greater career mobility, it also fosters innovation through identifying complementary needs and skills. We have identified the following as opportunities to facilitate cross-disciplinary work:

- Education in detector physics with a broad contextual basis at PhD level
- Re-training opportunities for post-graduates in emerging technologies
- Partnerships between universities/industry for internships in both directions: towards industry/towards HEP

Education opportunities for hardware work through US based detector school

There are several detector schools that provide hands-on experiences with different technologies. The only US-based school is the US Particle Accelerator School, which is focused on accelerator technology. There are prohibitive costs in travelling overseas that can reduce US student participation. ISOTDAQ is one of the largest and most well-known schools and has a competitive selection process due to the high application rate. Thus, there is a large demand for hands-on hardware schools, and a US-based program would benefit students unable to attend European schools due to funding. The ESHEP and the CERN/FNAL collider summer school could be used as a model of complementarity, with staggered schools to allow more opportunities each year.

New strategies for the evaluation/promotion of instrumentation based work

Doctorate degrees in the US are awarded in instrumentation very rarely, and the general outlook of early career members and hiring committees may be that faculty positions are unobtainable with instrumentation focused work. To attract/maintain people within the field requires a change in cultural perceptions of detector and hardware work. We plan to investigate the availability and need of PhD programs that focus heavily/entirely on detector development, instrumentation focused fellowships and awards in HEP, and how tracking of hirings of faculty/staff scientist positions from mainly hardware work could engage more interest in instrumentation for early career members.

Increasing diversity of the field

The field may benefit from directly addressing barriers that are specific to instrumentation as a career path for people of all intersecting identities that fall under what are typically termed ‘under-represented minorities.’ A separate LOI has been submitted with a proposal for promoting research experiences for Community College students as an avenue for increasing diversity. We welcome further conversations on this topic.

References

- [1] DPF Report, “Instrumentation in Particle Physics,” , 2011.
- [2] Instrumentation Frontier Conveners, “Report of Snowmass Community Summer Study,” 2013.
- [3] CPAD Report, “Quantum Sensing for High Energy Physics,” 2018.