
The value of small experiments for training early career scientists

Austin Schneider

Request for support

Recommend strong support for small intensity-frontier experiments

Short time-scale of experiments

- More compatible with length of PhD and postdoc
- Faster turnaround for fundamental physics questions
- Incremental progress on detector technologies
- Lower cost
- Lower programmatic risk

Fewer barriers for impactful individual contribution

- Students and postdocs can see an experiment through from design to results
- Early career scientists (ECS) are more readily engaged in leadership
- ECS have a chance to develop a broader skill-set

I have been a graduate student on a large experiment (>300 people), where I obtained experience mostly on high-level analysis, and am fortunate to now be a postdoc on a smaller experiment (CCM with <30 people) where I had the opportunity to

- work directly on the detector
- pursue phenomenology
- develop simulation and analysis tools
- perform low-level analysis
- perform high-level analysis
- be an integral part of experimental leadership

The long time-scale of large experiments

- Large experiments are not compatible with grad-student and postdoc timescales
 - Design → construction → data-taking → analysis:
several times the length of a typical PhD
 - Possible, but challenging to give students the necessary experience
- [AIP study](#) cites difficulties for students and postdocs on “large” experiments (~40 collaborators)
 - Voiced concern for students spending “too much time on too few stages” of an experiment
 - Situation is more challenging now with even larger experiments
- Early career scientists must gain experience by working on several different projects
 - **Small experiments provide these opportunities**

Success of small experiments

- Motivation, design, detector R&D, simulation, construction, data-taking, analysis, and publication
 - ECS can contribute to every stage of the experiment
 - Beneficial for building the skills necessary for long term career in HEP
- Experimental engagement
 - Easier for ECS to become engaged with experiment leadership
 - Fewer barriers for impactful individual contribution
- Low cost per student or postdoc
 - Small experiments can train a larger number of postdocs and students for lower cost
 - Provide supplemental opportunities for ECS working on larger experiments
- Impactful results from small-medium size experiments
 - MiniBooNE, Minerva, COHERENT, CCM, and many more
- Many small experimental opportunities exist now, often outside of FNAL
 - But they need continued support!

I am asking P5 to please recommend **"a thriving program of small experiments within the intensity frontier. These experiments provide great physics opportunity, and, at the same time, train early-career scientists at a level that cannot easily be obtained within the structure of large experimental collaborations"**.