Training the Next Generation of Physicists and Engineers at Universities

- When the famous bank robber, Willie Sutton, was asked "Why do you rob banks" he replied, "because that's where the money is."
- If P5 is to advise the DoE and NSF on where to invest in infrastructure that supports workforce development, the answer is obvious: Universities, because that's where the students are.
- I have a bit of perspective on this, having been continuously funded by DoE at the University of Michigan for 37 years to participate in some of the largest Cosmic Frontier experiments ever built.
  - Monopole, Astrophysics and Cosmic Ray Observatory (MACRO) - 600 tonnes of liquid scintillator, ADC, TDC, trigger system
  - Dark Energy Survey (DES) - Filter Changer Mechanism
  - Dark Energy Spectroscopic Instrument (DESI) – >7500 Fiber Positioning Robots and control system. At peak production > 25 students were involved in some aspect of this.

- Undergraduate and graduate students, postdocs and research scientists developed their skills in experimental physics on these projects. Many are now critical to the successful operation of large projects and will be the scientific leaders of tomorrow.
- Nearly everyone here, once "cut their teeth" on research projects at Universities.

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- Four decades developing novel instruments for HEP and cosmology experiments has taught me that great science comes from great scientific instruments!
- Many experimental physicists today are not familiar with the working end of a screwdriver or of an oscilloscope.
- Who will design and build the next generation of experiments?
- University research and the training of young scientists works best when there is a strong partnership between Universities and the National Labs. Some National Labs are better than others at promoting such partnerships.
- Continuity of funding at Universities is critical to maintaining the facilities and human infrastructure necessary to train the next generation of experimentalists.
- In recent decades, gaps between the end of one construction project and the beginning of another have made it difficult or impossible for many university groups to maintain capability to continue their participation in large scientific construction projects.
- We urge P5 to recommend that the agencies place a priority on sustaining vital infrastructure at our Universities to preserve capability to train our future experimental physicists and engineers.