Accelerator Science Strategic Priorities

Accelerator Science is one of the six strategic thematic areas of focus for the laboratory in its long-range planning exercise (aside from neutrinos; LHC long-range plan; projects and facilities; exploring the unknown; and the cosmic program). The five highest priority strategic institutional objectives in the accelerator science theme are: (i) **Use and advance accelerator science to extend the scientific reach of existing facilities.** Improved performance of Fermilab accelerators with intense beams and low losses are critical to achieving the muon and neutrino programmatic goals. Developing comprehensive theoretical, computational and experimental tools as our core competencies will position us to assist other laboratories with similar challenges. This will ensure robust development of PIP-II and a strong international neutrino program; (ii) **Establish an advanced beam test facility using protons and electrons to address key questions related to intense yet affordable future accelerators (e.g. PIP-III) and enable a transformative accelerator science program.** Fermilab must complete the construction of the Integrable Optics Test Accelerator, **IOTA**, including its injector, define its science program and build community interest via university-lab partnership in a timely fashion; (iii) **Explore the scientific limits to achievable acceleration and quality factor for future superconducting accelerators**. Continuously operating accelerators, for example LCLS-II and PIP-II in the immediate future and 1- to 100-TeV-scale particle colliders in the far future will need enhanced acceleration capabilities and reduced losses to enable energy efficiency, cost-effectiveness and technology translation to affordable compact industrial accelerators; (iv) **Position Fermilab to be an essential contributor to future large accelerators under consideration.** Advanced capabilities in high-field magnets, high-performance superconducting linear accelerators and beam dynamics will position the laboratory to be a major player in future high-energy facilities; (v) **Show relevance of our science to U.S. competitiveness via the Illinois Accelerator and Research Center platform as an enabler of technology transfer to address industrial and societal grand challenges of health, security, energy and environment.** We need a timely launch of projects with joint partnership of university, industry and laboratory.

There is also the emerging recognition to enhance the academic profile of the laboratory accelerator personnel and establish preferred partnerships with local academic institutions such as Univ. of Chicago and Northern Illinois University (NIU). Synergistic partnership with Northern Illinois University in establishing a FNAL-NIU research cluster of excellence is already in progress. Transformative developments stemming from Fermilab accelerator research in developing accelerators at the intensity frontier for particle physics are expected to emerge in such areas as microwave and applied superconductivity, nonlinear dynamics, precision optical control of single particles in circulating beams and structured nanomaterials as particle sources.