

Director's Corner

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Project X at Fermilab

*"What's in a name? That which we call a rose
By any other name would smell as sweet."*
(William Shakespeare (1564-1616), Romeo and Juliet II, ii, 1-2)

These days it seems that the questions I am asked most frequently are not about what gradient we will achieve for the ILC, not who will be the ILC Research Director, the next SLAC Director or the CERN Director General. Instead, I receive both genuine and rhetorical questions about Fermilab's proposed Project X. People ask me: Why is it being proposed? What is Project X? What are the science goals and opportunities? How will Project X impact the GDE and ILC? What are the technological challenges and issues?

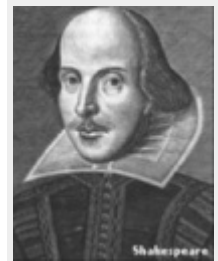
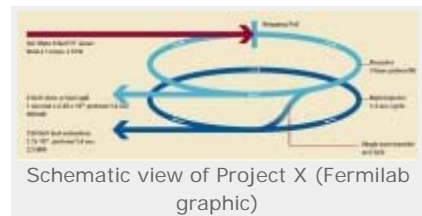
And so forth. These represent a very complex set of questions, and I would like to share some of my personal responses to them, not necessarily representing the official views of the GDE.

Why is Project X being proposed? Laboratories must plan their futures by balancing such factors as the science opportunities, long- term objectives, expected resources, and other laboratories' programmes. CERN is finishing construction of the Large Hadron Collider and planning an upgrade; KEK is finishing construction of JPARC and considering whether to build a Super B Factory; SLAC and DESY are building major light source facilities. Fermilab is also in a period of transition with the impending end of the Tevatron collider programme. The lab has clearly stated its priority and long-term commitment to the ILC. This ambition, however, must be balanced with a viable programme during the inevitable gap between the closure of the Tevatron and construction of the ILC.

What is Project X? Fermilab Director Pier Oddone has told me on several occasions that the laboratory needs to map out its program following Run II. This need was reinforced by the observation from Ray Orbach, Under Secretary for Science of the US Department of Energy, that processes to get funding, international agreements and a site for the ILC could stretch the completion date to well beyond our technically driven time scale. Orbach also expressed concern that without interim accelerator projects core competency may deteriorate in this field.

Last spring, Pier picked up this challenge and appointed a "steering committee" of Fermilab staff and outsiders to recommend possible interim accelerator projects for Fermilab, aligned as much as possible with the longer-term ILC objective. After considering a broad range of possible projects, the steering group [recommended](#) that Fermilab undertake a design programme, temporarily dubbed as Project X.

Project X is an intense 8 GeV linear proton machine, using ILC-like superconducting RF technology for the "high beta" or relativistic portion of the machine. The top level parameters are $5.6 \cdot 10^{13}$ protons per pulse, 5 Hz and 200 kW beam power at 8 GeV. The protons could be injected into the Main Injector, accelerated to 120 GeV and fast extracted to make an intense neutrino beam. The 8-GeV beam and the 120-GeV beams could also be slow-extracted to support a broad based precision physics programme.



In Romeo and Juliet, William Shakespeare dramatised the lack of significance of the actual name given to something.

What are the science goals and opportunities? I may return to this subject in a future column after the science case has been fully presented and discussed. For now, let me just say that the general goals are a future generation of neutrino

physics and a varied programme of precision measurements. The arguments have not been made yet for the detailed science opportunities and how they compare with other facilities. In my opinion, which I am sure is shared by most of my colleagues, the evaluation of the science opportunities is the most important consideration as to whether Project X should go forward.

What impact will Project X have on the GDE and ILC? All major commitments made in particle physics will take momentum away from the ILC, whether they be an LHC upgrade, a dark energy mission or Project X. That said, the ILC needs to fit into the realities of such ongoing global projects and the priority and urgency for the ILC should be determined by the scientific imperatives. The GDE wants to be ready to propose construction of the ILC within about three years, when LHC results could be in hand that strongly support the science goals.

Initiating Project X could affect the readiness and timescale of the ILC. The fact that ILC main linac technologies account for maybe 25 percent of Project X means that it would represent a significant scale model of the ILC, a welcome feature of this project. Project X could also help with the industrialisation process for cryomodules in the US. On the other hand, Project X does not address our most pressing technical issue of achieving high gradient, and it could even detract from that goal at Fermilab. I am also concerned that the few superconducting RF experts at Fermilab will need to be shared between the two projects. Balancing all these factors will be a challenge, but I am optimistic that this can be accomplished with close collaboration and good will between the GDE and Fermilab.

In conclusion, I would like to emphasise that whether Project X furthers the ILC should not be the main question before us. These two projects could be balanced, as long as sufficient flexibility is taken in the approach toward Project X to accommodate all the uncertainties of the ILC, including timescale. The crucial question then is simply whether Project X offers sufficiently compelling science to warrant a new major commitment in our field.

My Caltech colleague and friend Richard Feynman once talked about a lesson he had learned from his father about the significance of knowing the names of birds. He succinctly and insightfully concluded that *"there is a difference between knowing the name of something and knowing something."* We now need to find out what's really in the name Project X.

-- Barry Barish

