Director's Corner

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The ILC Engineering Design Phase – Towards the production of an Engineering Design Report

Today's issue features a Director's Corner from Marc Ross, Project Manager for the Global Design Effort.

In August 2007, the Global Design Effort for the International Linear Collider published a Reference Design Report that contains a description of the design of the linear collider and a 'value' cost estimate. The design described in the RDR and its associated estimate allow the GDE to plan and prioritise the next phase of the ILC, the creation of an engineering design and the production, by mid 2010, of an Engineering Design Report.

In addition to a more mature design and an updated value estimate, the EDR will contain a plan for executing the ILC Project. The purpose of the EDR is to facilitate formal international negotiations at a government level on siting, funding, organisation and execution of the ILC project, with a timescale that is consistent with the start of construction in 2012. Upon completion, the GDE leadership will be able to seek approval of the ILC project from governmental agencies.

The RDR 'value estimate' methodology is based on experience with large multi-lateral international scientific projects such as the International Tokamak Experimental Reactor (ITER) and experiments at the Large Hadron Collider. The value of a component is defined as its lowest reasonable estimate of the procurement cost. Value is a particularly convenient concept for dealing with 'in-kind' contributions, where project participants provide equipment rather than directly providing funds.

The RDR value estimate and the ongoing ILC R&D effort allow a quantitative assessment of the leverage that engineering design phase efforts will have on the ILC. A good example is the R&D aimed at justifying the superconducting radiofrequency (SCRF) linac cavity design gradient choice of 31.5 MV/m (megavolts per metre). This R&D task, which involves a coordinated effort in all regions participating in ILC work, consists of repeated processing and testing of superconducting cavities in order to demonstrate the expected yield and to prove the effectiveness of the chosen 'baseline' cavity preparation procedure. In this example, a 10 percent reduction in the design gradient would raise the estimated cost of the ILC by about seven percent. Each ongoing R&D effort can be ranked in this way, resulting in a cost and risk mitigation priority assessment.

The GDE is now in the process of restructuring itself and making plans for the engineering design phase, leading to the completion of the ILC Engineering Design Report in 2010. The scope of the EDR necessitates a robust management and an appropriate organisation with resources sufficient to accomplish its aims. The engineering design phase organisation must have clear lines of authority and responsibility and must effectively connect tasks with human and financial resources (often from multiple resources across the regions). This must be accomplished while maintaining a strong international collaboration in the absence, at least initially, of centralised funding.

The engineering design phase organisational alignment highlights the cost drivers identified in the RDR. Production of high-technology SCRF components and Conventional Facilities and Siting (CFS) together account for 70 percent of the RDR value estimate. Accordingly, each has its own branch in the top level EDR Work Breakdown Structure. The third branch is allocated to Accelerator Systems.

A fundamental management principle of the engineering design phase will be the containment of the RDR value estimate. Areas of potential cost reduction via good engineering practices have been clearly identified in the RDR. While the RDR conceptual design is sound and complete, the overall engineering design remains immature, and this next phase will bring the application of accelerator systems engineering, industrial development investment and value engineering processes. Value Engineering is an iterative process whereby the cost / 'worth' ratio, assuming 'worth' is the lowest possible cost satisfying nominal criteria, is minimised. Similar terms are 'trade studies' and 'cost benefit analysis.'

One of the greatest challenges for the ILC is to maintain effective communication paths between co-workers who are separated by great distances. A great strength of the ILC GDE collaboration is the diverse technical expertise and wide ranging laboratory infrastructure that can be applied to any given problem. The strengths of this virtual organisation result from years of hard work and preparation. In the engineering design phase, the community will continue to rely on remote teleconferencing tools, such as the 'Webex' product. In addition, due to the need to iterate through the value engineering process and maintain a strong project management, we will also rely on multi-day technically focused, face-to-face meetings. These more internal meetings - which are crucial to building a strong foundation for effective communication -- will be summarised at the Global Design Effort meeting to be held at Fermilab in October.

-- *Marc Ross*

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