international linear collider

ILC-Americas
FY10 Work Package
Technical Progress Report

Laboratory: LLNL
Work Period: September 1, 2009 to March 31, 2010

Beam Delivery System R&D @ LLNL (WBS 1.6.1.7)

($200K + FY09 carryover)

We created a 1D model of the resonant enhancement cavity in Mathematica and used it to identify the key laser and cavity parameters. We determined that a cavity enhancement of 450 is feasible with expensive, but available optics of reflectivity 0.998. We then modeled degradations to the cavity enhancement caused by: group velocity dispersion in the cavity mirrors, phase and amplitude noise on the laser pulses, and longer-term phase variance over the pulse train caused by optic movement, pointing instability, and thermal effects in the amplifiers. Maintaining a constant, spatially-uniform phase over the pulse train will be the tightest constraint on the laser design. Phase variation will be caused mainly by heating of the main amplifier crystal. We have set up simulation tools in COMSOL to analyze heat deposition and thermal cycling in laser amplifier heads for the main amplifier. We have done initial simulations of gain energetics and heat deposition and removal for several different configurations. We have identified three configurations of possible amplifier mediums and have determined their pumping and amplification profile over a pulse trains matched to the ILC timing.

Positron Source R&D @ LLNL (WBS 1.3.1.2)

($300K + FY09 carry-over)

We continued to participate in the Daresbury rotating target eddy current experiment, providing analysis of the rotordynamics for the torque measurements and simulations of the eddy current behavior. The rotordynamic model generated at LLNL successfully predicted the resonances within the operating range for the simplified target wheel. Resonance issues should not be a significant issue for the operation of the rotating target although beam effects from the pulsed flux concentrator should still be studied. The eddy currents measured in the test setup show ~1.3kW for a 0.5T field at 2000RPM which is less than the expected heating from the beam and manageable. The simulations of the eddy current, including the spokes, overestimates the heating compared to the actual data.

Target Component Prototyping ($200K)

Funding for this activity was not available in Q1-Q2 FY10.

Flux Concentrator Studies ($100K + FY09 carryover)

We completed the baseline determination of magnetic fields, heat deposition, stress and strain, for a straight bore magnet and a flux concentrating configuration using carry-over funding from FY09. All of the parameters were workable for a single shot device, but comparison with capture efficiencies is needed to optimize for the best design for long term operation. Once we have capture efficiency calculations from ANL we will complete the parametric study and finalize a baseline, with the inclusion of safety margins. FY10 funding for lifetime studies and detailed engineering was not available in H1.