

Status of the SLAC/MSU SRF Gun Development Project*



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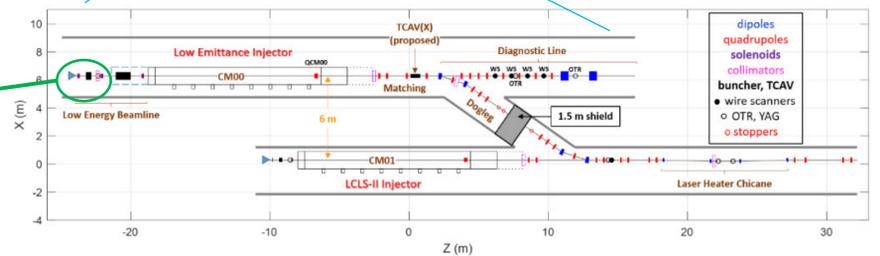
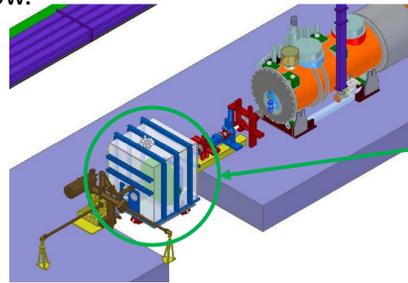


Introduction

The LCLS-II-HE Project will dramatically increase the photon energy reach of the LCLS-II X-ray FEL, to beyond 20 keV. This will be accomplished by ❶ increasing the LCLS-II linac energy to 8 GeV, ❷ upgrading the undulator system, and ❸ adding a new Low-Emittance Injector to the front end of the linac, with a superconducting quarterwave RF gun as the beam source. SLAC is partnering with the Facility for Rare Isotope Beams at Michigan State University to design, fabricate and test the prototype gun, with a “production” gun to follow.

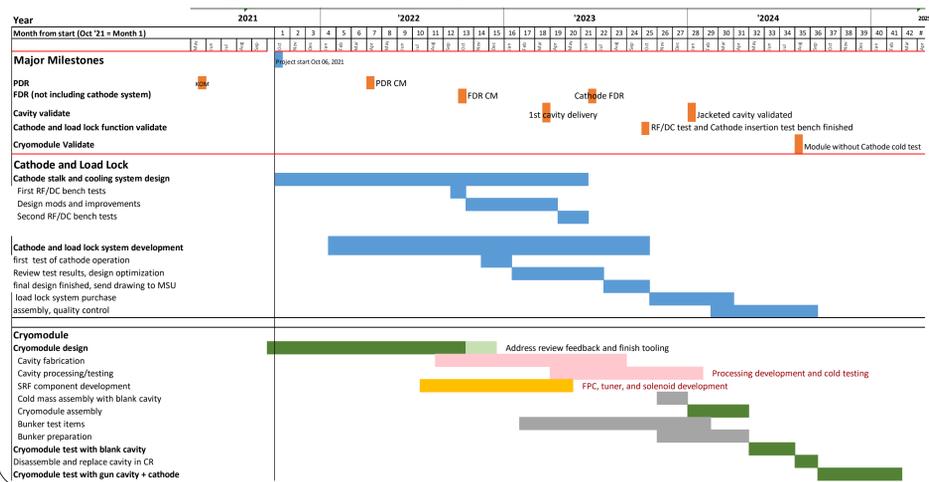
Design parameters for the gun include:

- 187.5 MHz (1.3 GHz / 7)
- Field on cathode > 30 MV/m
- Beam energy > 1.6 MeV (kinetic)
- Cathode lifetime > 1 week (> 1 month target)
- Field emission / dark current < 10 nA @ $E_{\text{cath}} = 30 \text{ MV/m}$



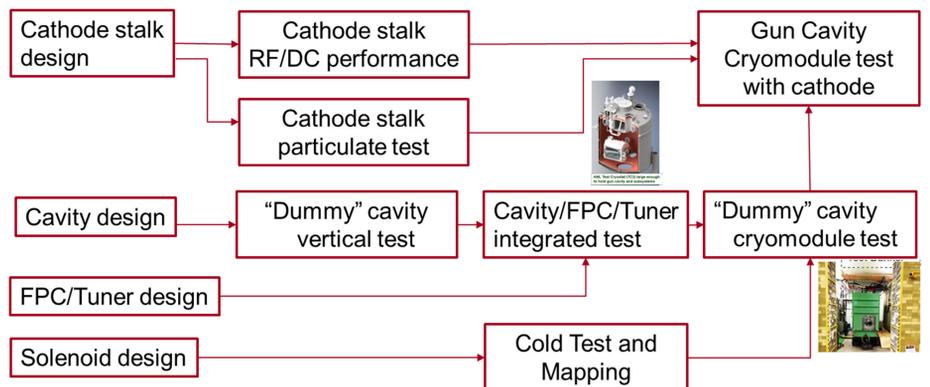
General Schedule

A synopsis of the gun prototype project schedule is shown below.



“Separation-of-Problems” Approach

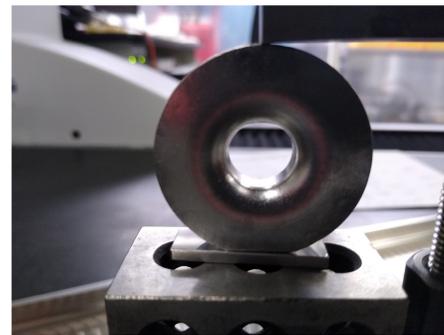
The project draws heavily upon experience from previous SRF gun development efforts. Extensive testing throughout the project is designed to allow early identification and remediation of problems.



Current Status

The preliminary design review for the cavity and cryomodule was held in April '22. Since then, detailed design, prototyping, and tool-and-die development has commenced; to the right are a test aperture for the cathode well (1.1 cm aperture), and a copper hydroforming test piece for the “short plate” (about 60 cm in diameter). Procurements have started for the first cathode stalk DC/RF bench tests.

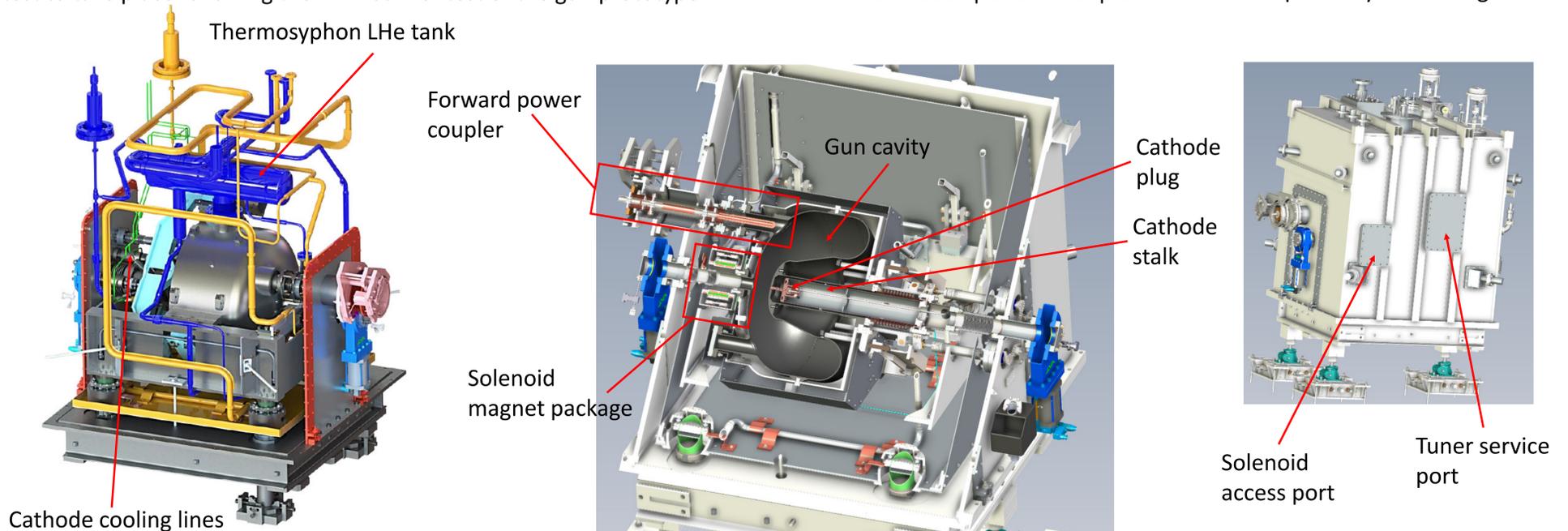
We are also pursuing cathode development and characterization, and a beam test to take place following the “RF” bunker test of the gun prototype.



Cathode aperture test piece



“short plate” hydroforming test



* Work supported by the Department of Energy Contract DE-AC02-76SF00515
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