

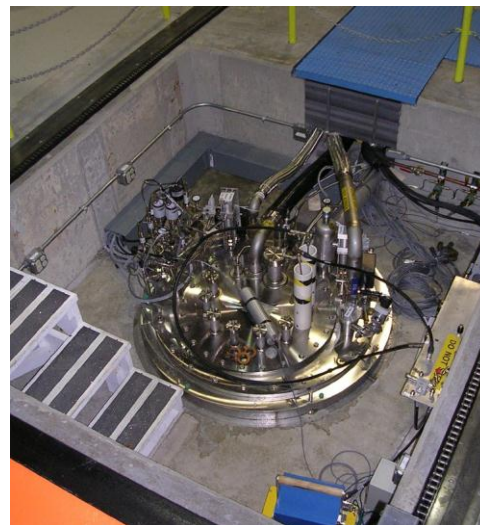
## SRF at Fermilab: Vertical Test Stands

Fermilab scientists use the vertical test stand, located in Industrial Building 1 (IB1), to test 1.3 GHz SRF niobium cavities for ILC R&D as well as other cavities of different types and frequencies for Project X. During a vertical test, physicists apply a low power CW (continuous wave) RF voltage to a superconducting cavity and measure the Q (or quality) factor – a measure of the rate of energy loss. A high Q factor means that the cavity will better retain the energy pumped into it – a desirable outcome from the vertical test stand process. Both Project X and the ILC are interested in cavities with high Q. The vertical test stand is part of the qualification process for determining that the cavities meet all of the extraordinary needs of the projects. Vertical tests also serve to verify whether the cavity preparation procedures are correct.

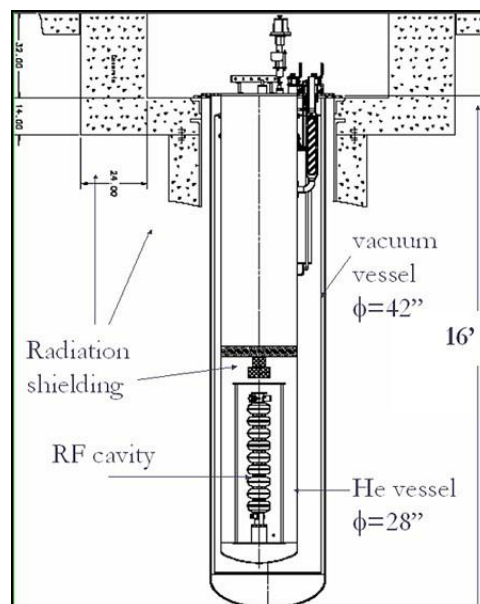
In the test stand, a cavity is immersed in liquid helium and tested inside a vertical dewar to characterize its accelerating properties. Cooled down to a temperature of  $\sim 2$  K, physicists will be able to determine how high a gradient the cavity will be able to reach – the key to accelerating particles to their highest possible energies. The goal for the ILC cavities is an impressive accelerating field of 35 million volts per meter with a Q factor of  $10^{10}$ . Project X cavities will require a lower gradient but higher Q. Typically, each cavity will spend a few days inside the vertical test stand, including the cool-down and warm-up period, but a test may require more time if the cavity appears to have a problem. Once the cavity completes the vertical test process, it will be dressed inside a helium vessel and continue on to the next qualification test.

The first vertical test stand (VTS1) is fully operational and has produced world class test results as part of the ILC R&D program. For RF power, the group selected a 500-watt amplifier and an RF system based on a design for similar test stands at Jefferson Lab. Throughout the design process, Fermilab worked closely with physicists and engineers from DESY, Cornell University and Jefferson Lab.

A total of 184 vertical tests have been completed and the throughput of VTS1 has exceeded its design specification. Fermilab is well underway in constructing two additional vertical test stands to allow for additional throughput and to accommodate lower frequency cavities. These test stands should be operational in late 2012.

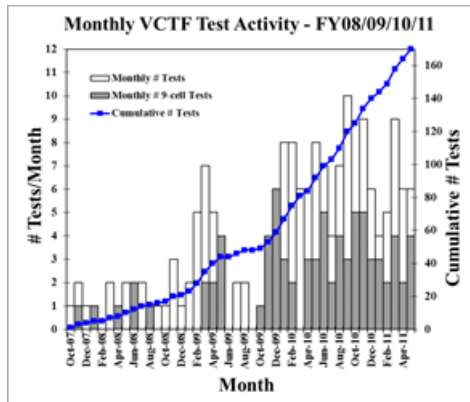


The vertical test stand in the floor of IB1



A schematic engineering drawing of VTS1

## Fermilab Vertical Test Stand Tests



## Americas 9-cell Cavities

### Last test

