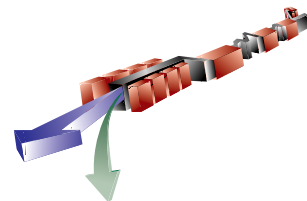


10 Conventional Facilities



TECHNICAL SYNOPSIS

The LCLS takes advantage of the existing infrastructure at SLAC. It uses the last third of the existing 3 km linac including the existing enclosure and utilities. A new injector will be installed at sector 20 in the Off-Axis Injector Tunnel. This branch tunnel was constructed as part of the original construction at SLAC in the 1960s for just such an injector. The existing linac equipment including the klystrons and modulators will be used. The injector tunnel will require some modifications to bring it to current safety standards and to accommodate the specific requirements of the LCLS injector.

Two short sections of linac will be removed to accommodate the magnets and vacuum chambers for the two pulse compressors. New systems to bring power and water to these elements will be required.

The beam transport, DL-2, from the end of the linac to the beginning of the undulator will be new but will require less power and water than the existing Final Focus Test Beam (FFTB). This is due to the fact that the maximum energy for the LCLS beam is 16 GeV while the FFTB is designed for a 50 GeV beam.

The LCLS Undulator is housed in the existing FFTB tunnel which will be renamed the Undulator Hall. The undulator is a permanent magnet device with very low power and cooling requirements. The existing capacity is adequate. In both the case of DL-2 and the undulator the power and water distribution systems will have to be reconfigured.

The Undulator has tight alignment requirements, which places stringent requirements on the foundations and on the temperature stability of the air and water in the tunnel. The existing tunnel has the stable supports required for the FFTB, which were characterized as part of that operation. The LCLS will require additional piers.

Two new experimental halls will be built. The near hall will begin 40 meters downstream of the exit of the undulator and extends for 55 meters in the direction of the beam. It will be 30 meters wide. The far hall will be constructed 322 meters downstream of the exit of the undulator, just outside of a relocated PEP ring road. It will be 57 meters in the direction of the beam and 35 meters wide. The two halls will be connected by a 3 meter by 3 meter tunnel that is 227 meters long. The experiment area on the first floor of the far hall will be below grade with the ceiling approximately at grade. An office and laboratory area will be constructed at grade on top of the far hall to accommodate LCLS users and scientific and support staff. Parking will be provided adjacent to the far hall.

10.1 Injector Housing

When the SLAC linac was originally constructed in 1962, two short tunnels were built on the north side of the main linac tunnel. One is at the 1/3-point (sector 10) and another at the 2/3-point (sector 20). These tunnels were included to house future injectors that would allow efficient use of segments of the linac. The tunnel at sector 20 is located in the right place for the LCLS injector (see **Figure 10.1**). The original construction included a surface building to support the injector (see **Figure 10.2**). Neither the tunnel nor the surface building has been used for this purpose in the 36 years of operation of the linac.

The shielding between the off-axis tunnel and the main tunnel will be reconfigured to accommodate the beam pipe, the waveguides, an alignment pipe and other utilities. There are three penetrations between the surface building and the injector tunnel to accommodate the laser beam transfer pipe, control signals, and power connections.

The support building will be modified to have a clean room for the laser. Personnel exclusion walls will be built with a pair of doors on the west side for personnel access to the tunnel. The interlock for these doors will be integrated into the existing linac Personnel Protection System.

The injector will be powered by existing klystrons in the klystron gallery. No new resources will be required. The klystron output power will be redirected to the off-axis tunnel with a new waveguide system described in the injector section.

Utilities will be provided for the magnet power supplies, controls, lasers, vacuum, and diagnostics. Cooling water will come from the main linac tunnel to cool the accelerator components. Cooling water will come from the klystron gallery for the laser and the equipment in the support building. In both cases, there is adequate capacity but new plumbing and wiring are required.

The costs to modify the existing utilities for the injector's use are included with the injector costs.

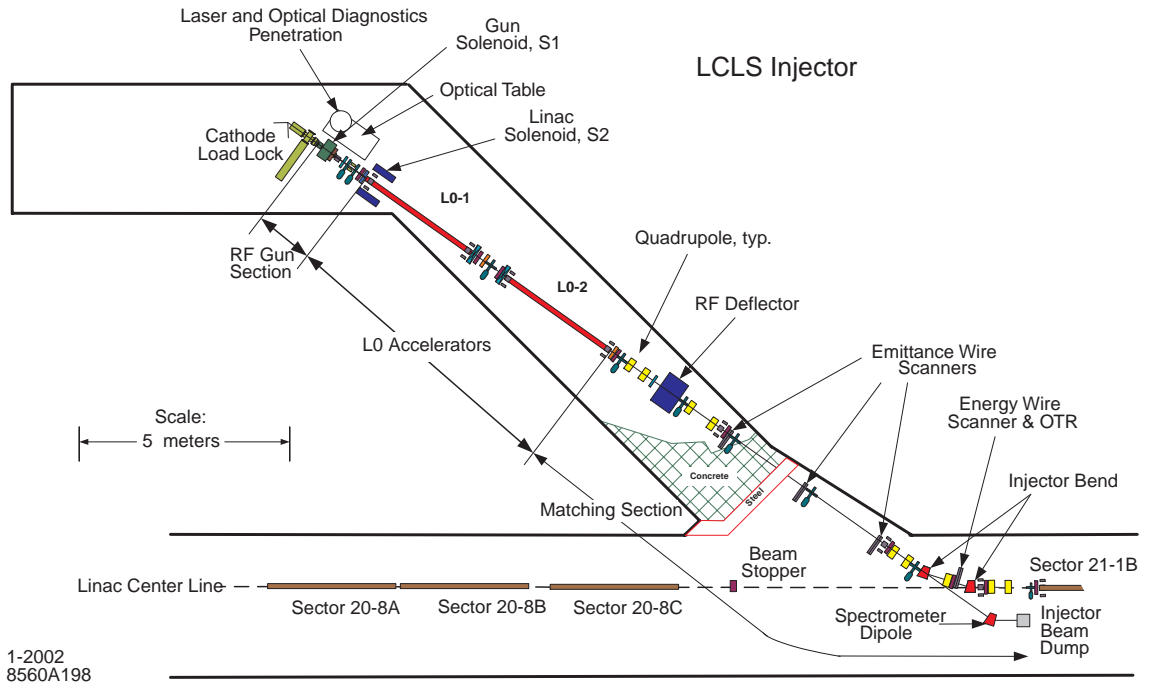


Figure 10.1 Layout of the injector tunnel

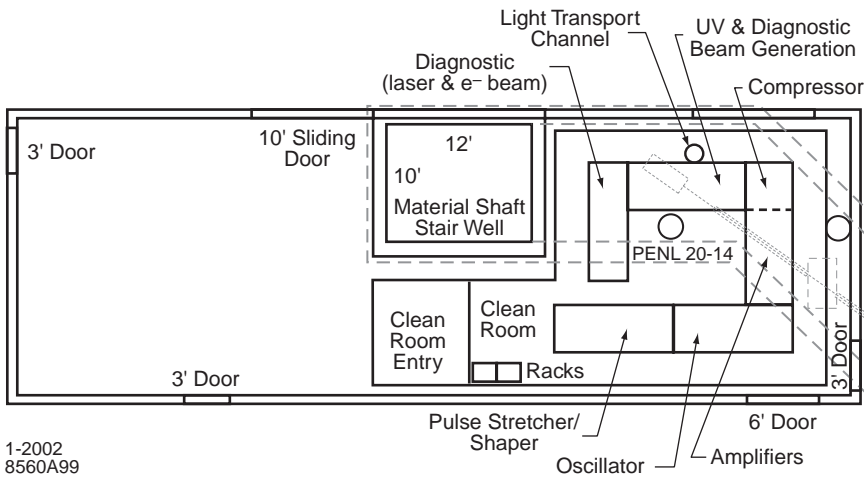


Figure 10.2 Layout of the injector support building

10.2 Linac Housing

The LCLS uses the last 1 km of the existing linac, from sector 20 through sector 30. The existing utilities will be adequate for the new operation. In two sectors, sector 20 and sector 25, sections of the linac will be removed and replaced with magnets and vacuum chambers for electron beam pulse compression. Rearrangement of some low conductivity water and electrical power distribution will be required at these locations but the total capacity is adequate for the new requirements. The costs for these changes are included with the linac costs.

A new x-band accelerating structure will be added at sector 20. This will require a new modulator and klystron in the gallery. This new installation will require power and water connections.

10.3 Undulator Hall

The Undulator Hall will house the electron beam dogleg, the undulator and the electron beam dump. The upstream end of this tunnel is underground and in line with the linac. The downstream part is constructed in the Research Yard from shielding blocks.

Prior to the construction of the LCLS, this hall houses the technical equipment associated with the FFTB. This equipment will be removed to make room for the LCLS equipment, primarily the undulator. The piers in the tunnel and the general soil stability were characterized during the earlier operation of the FFTB. Stability was important to the FFTB operation and the existing piers in the tunnel were constructed to tight stability specifications.

The LCLS undulator requires exceptional mechanical and environmental stability. New stable supports will be installed in the tunnel for the undulator. The air handling in the tunnel will be improved to reduce the tunnel temperature variation.

The utilities required in the tunnel for the LCLS are more modest than those required during FFTB operation. The energy is lower, 16 GeV vs. 50 GeV, and the undulator uses permanent magnets. No new utility resources are required but new plumbing, wiring, cable trays, etc. will be required. The costs for these elements are included in the Linac and Undulator sections.

10.4 Experimental Halls

The LCLS requires two experimental halls, one 40 meters downstream of the end of the undulator and the other 322 meters downstream of the end of the undulator (see **Figure 10.3**). A tunnel for the beam line, utilities and access connects the halls.

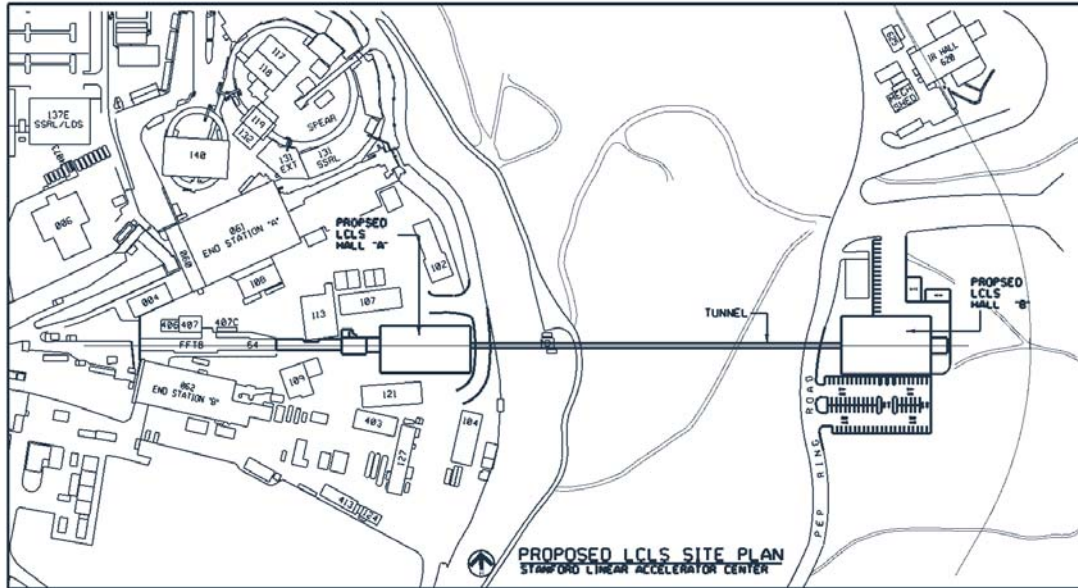


Figure 10.3 Site plan of the experimental halls

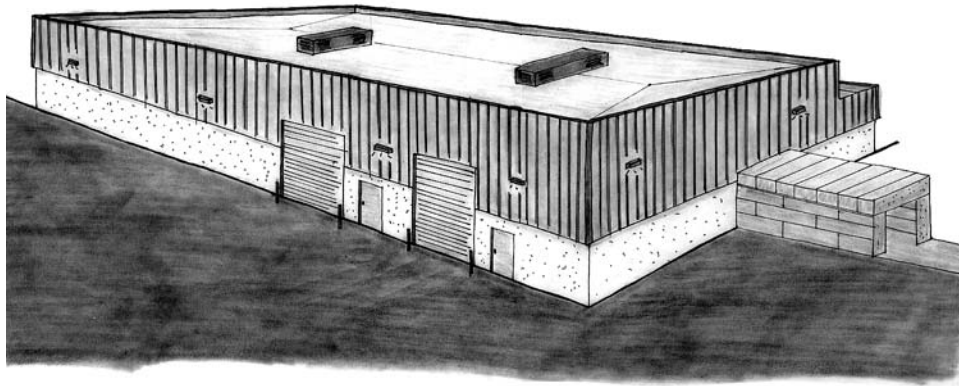
10.1.1 Near Experimental Hall

The near experimental hall will be constructed immediately downstream of the electron beam dump. This hall will be 30 meters wide by 55 meters in the direction of the x-ray beam.

The near hall will have 10 offices for LCLS users and on-site operations staff. This hall will include three enclosures for x-ray diagnostic equipment.

The interior distribution of the utilities will be covered in the section on x-ray optics. Adequate water and power for the near hall experiments is available in the Research Yard.

Figure 10.4 shows an architectural rendering of the near hall in the Research Yard, **Figure 10.5** shows a cross section of that hall and **Figure 10.6** shows the initial layout of the interior.



LCLS Near Hall "A"

Figure 10.4 Near hall architectural rendering

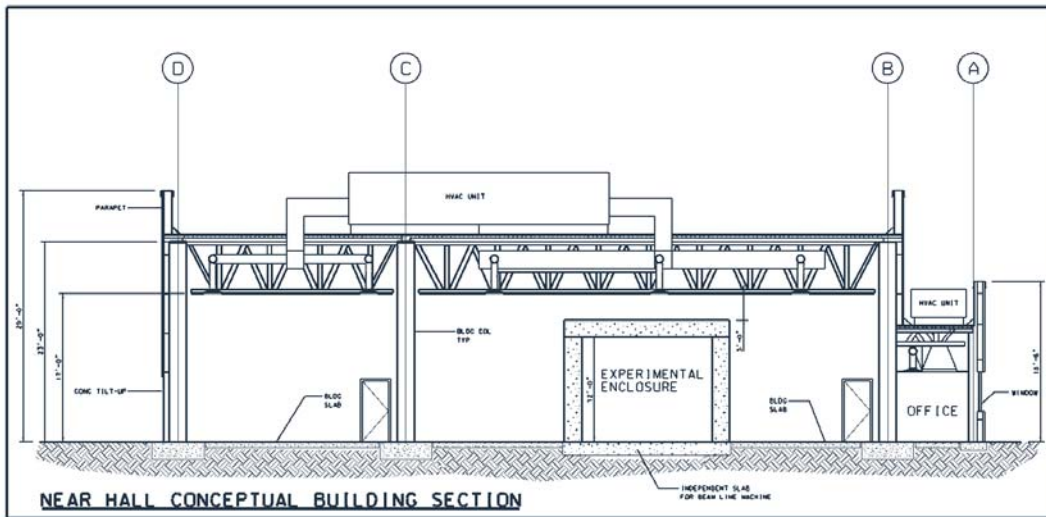


Figure 10.5 Cross section of near hall

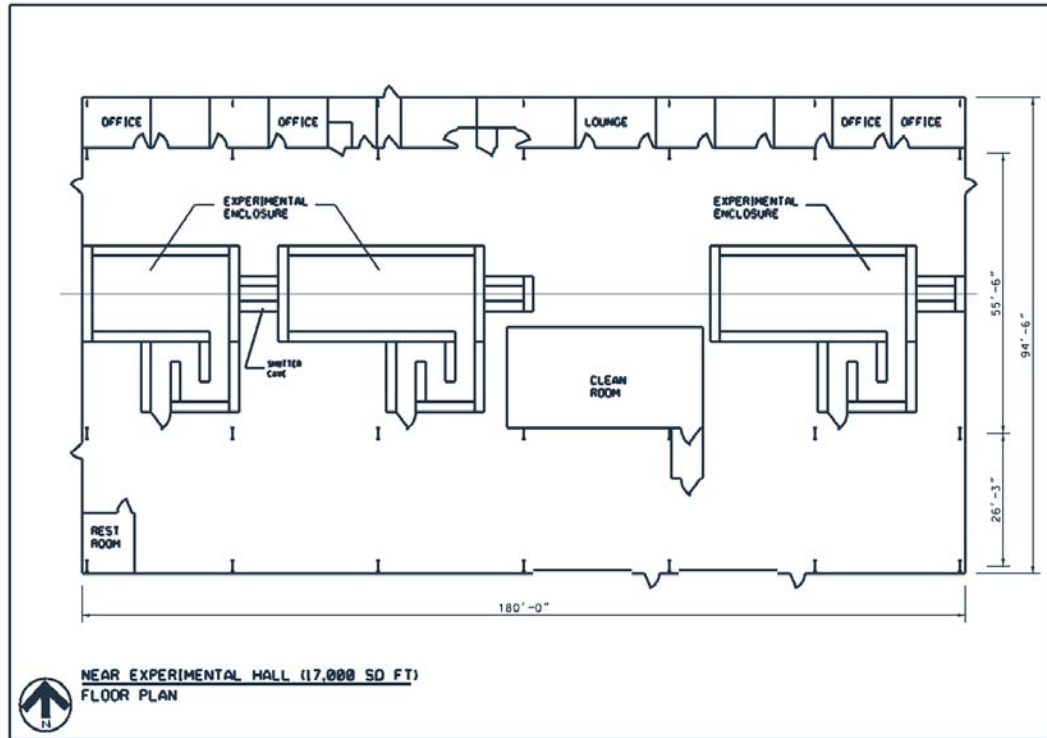


Figure 10.6 Near hall floor plan

10.1.2 Far Experimental Hall

The far experimental hall is located east of the PEP ring road. It is 57 meters in the beam direction and 35 meters wide. The floor is 6 meters below grade with the x-ray beam line 1.25 meter above the floor. The ceiling of the experimental hall is at grade level. A laboratory and office structure, **Figure 10.7**, will be constructed on top of this hall with 95 offices and 18 laboratory and support areas. **Figure 10.8** shows the floor plan for this office and laboratory structure. **Figure 10.9** shows a cross section of the building. There is a service ramp from the ring road to the floor of the experimental hall to allow bringing equipment directly to the experiments. Parking is provided for 70 cars.

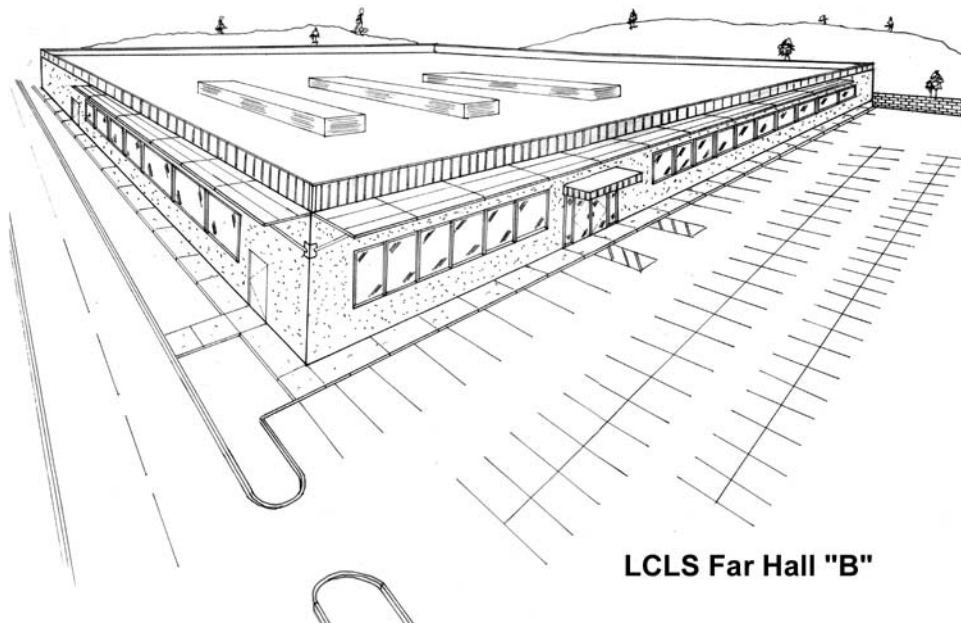


Figure 10.7 Far hall architectural rendering

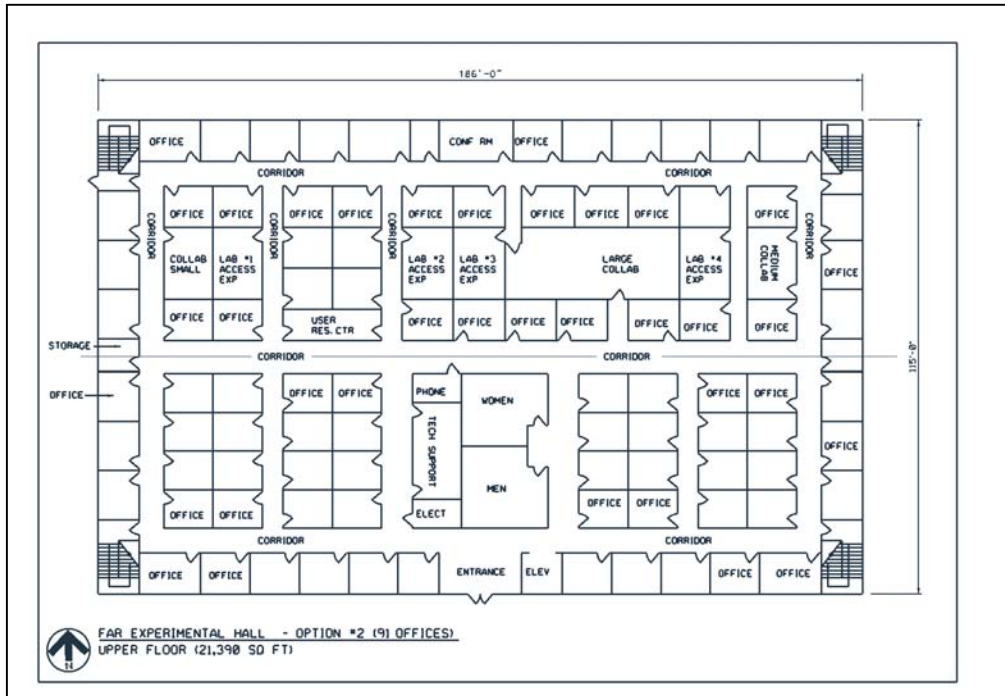


Figure 10.8 Floor plan for Far Hall second floor

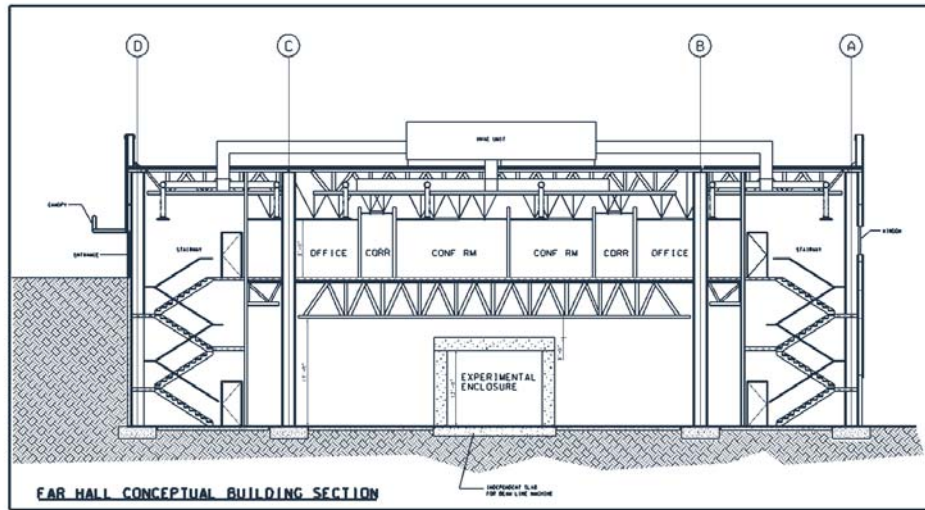


Figure 10.9 Cross section of the Far Hall

The interior of the experiment hall will be open, allowing flexible configuration of experiments. **Figure 10.10** shows the initial floor plan for this hall. It will have a 15-ton capacity bridge crane with a 15-foot hook height covering the experimental areas. Low conductivity water and power will be available at the walls of the building. The interior distribution of the utilities will be covered in the section on x-ray optics. The Far Hall will have its own low conductivity water plant. It will exchange heat with the cooling tower water from the MCC cooling tower.

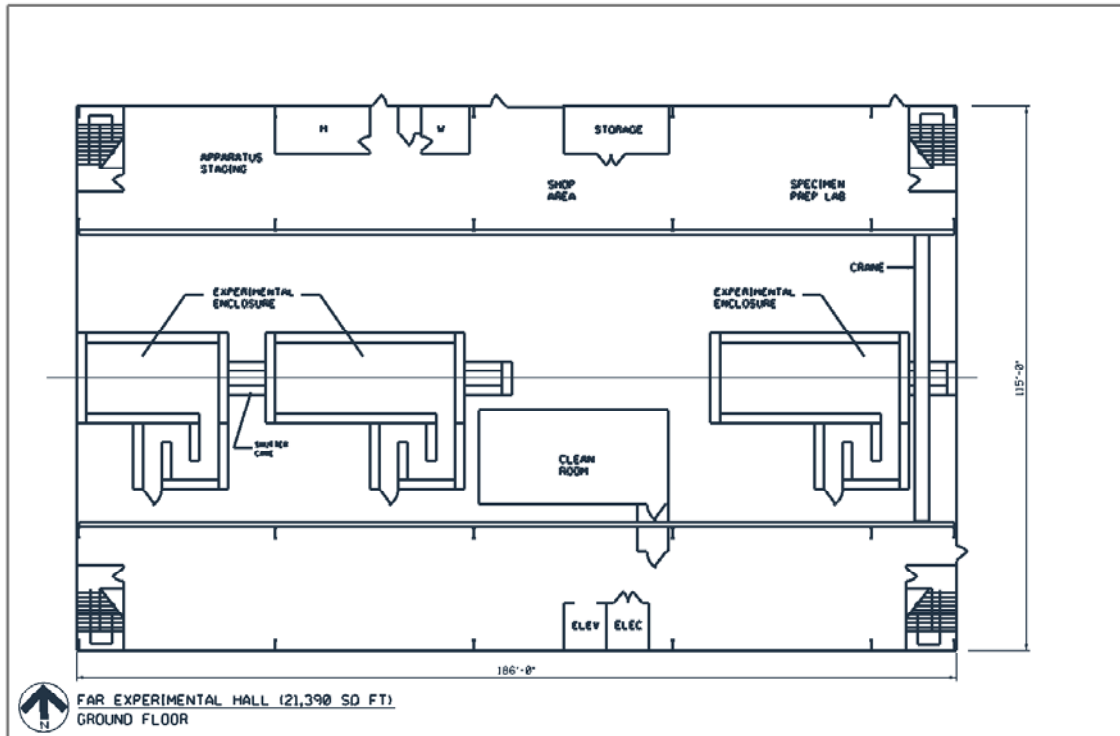


Figure 10.10 Floor plan for far hall experimental floor

10.5 Beam Tunnel

The two experimental halls are connected by a 3 by 3 meter enclosure that is 227 meters long. The x-ray beam will be transferred in a vacuum pipe in this tunnel, and control and timing cables required between the halls also will be carried in this tunnel.