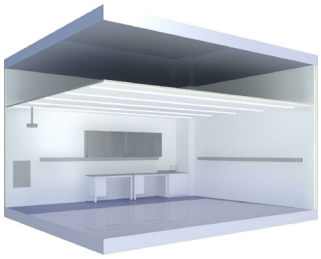
AMO Lab



CLN Lab

CMX Lab

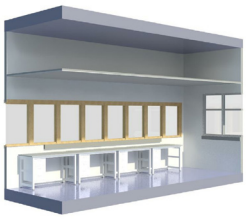
Dark Lab

UCSB

PROGRAM DOCUMENT

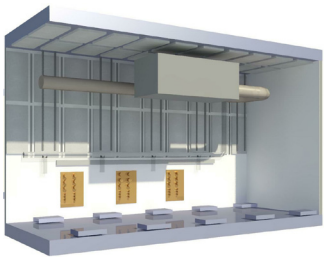
13 June 2016

Hybrid AMO CMX Lab

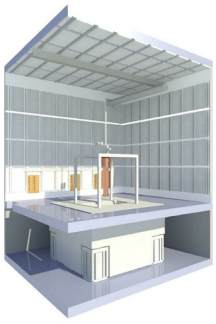


Control Lab

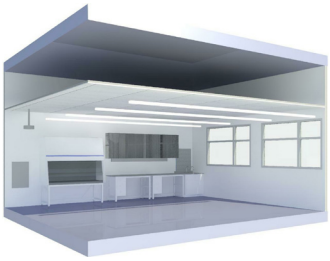
Dry Lab



PMP Closet



STM Lab



Wet Lab

lab
Life. Science. Architecture, Inc.

Table of Contents

Introduction

The UCSB physics department is highly renowned with many prize-winning faculty members, including several Nobel laureates, and many members of the National Academy of Sciences. The department has seen an explosion of growth in enrollment over the past decade that has placed it at the top of the list of US universities for undergraduate physics majors. The biggest concern for the continuing success of the department has been identified as the inadequacy of its spaces. The need for additional and substantially higher quality spaces, particularly for laboratory research and laboratory instruction, offices and interaction, has been an ongoing concern of the department for a very long time.

This document summarizes the results of first exercise to understand the space needs of the department that would allow it to maintain its high standing in research and also manage the expansion of majors and requisite growth of the department to a base of roughly 60 faculty members. The result of this exercise shows that all Physics department needs can be met with a new building having a surface area of 74,000 assignable square feet (ASF) and the refurbishment and use of the Broida physics building with 66,000 ASF. The bottom-up evaluation of new building space needs reported here are consistent, within a few percent, of the 70,000 ASF top-level guidance provided by the university.

The findings presented here are the result of a series of extended working meetings of the department's Physics Building Committee (PBC) with consultant Mark Reed of the Lab Life Science Architecture consulting firm in the Spring of 2016. The highest priority of these meetings was the specification of research laboratory spaces since these have special needs that must be called out in the subsequent stage of the design process involving a call for proposals and quotes for an architectural design of the new building. Modern experimental physics is probing nature at new extremes of temperature, energy and distance scales with the promise of unprecedented physical understanding of everything around us. This requires laboratory spaces with excellent environmental controls and services. Lab types, quantities and their detailed specifications are spelled out in in this document. Other aspects of the UCSB Physics department's mission such as instruction, administration, faculty and researcher offices, meeting and so on require different types of spaces that are also summarized in tabular form in this document.

It is understood that further development of the concepts for a new physics building and renovation of the existing Broida building will likely differ from the overall plan presented here. Nevertheless, the program contained here is a good first approximation to what is needed, and we believe it will be a valuable guide for the next phases of this project, particularly in regard to the specifications and requirements of research laboratory spaces.

Program Summary

Program Distribution

	Building	New	Broida	Total
Code	Space Category			
110	Classroom	3,800		3,800
125	Classroom Service	1,500		1,500
210	Research Lab	43,050	29,850	72,900
211	Research Office	4,750	10,250	15,000
225	Research Lab Service	1,580	1,570	3,150
250	Scholarly Activity	3,790	1,867	5,657
260	Class Lab		6,220	6,220
261	Special Class Lab		4,670	4,670
265	Class Lab Service		1,308	1,308
270	Open Laboratory		2,166	2,166
275	Open Lab Service		272	272
310	Academic Office	14,280		14,280
320	Administrative Office	750	4,650	5,400
335	Office Service		1,564	1,564
340	Conference Room		313	313
510	Central Computer		613	613
720	Storage	500	500	1,000
	Misc		187	187
		74,000	**66,000**	**140,000**

Broida

Broida Total	77,322
Demolish Lecture Hall	-3,813
Demolish Lecture Sevice	-1,729
Exclude Inst. Terahertz	-5,709
Subtotal	66,071
rounding	-71
	66,000

Complete renovation of Broida, including enclosing the exterior corridors for use as dust-free, climate controlled laboratory corridors

PSB

225	Research Lab Service	11,000	11,000
			151,000

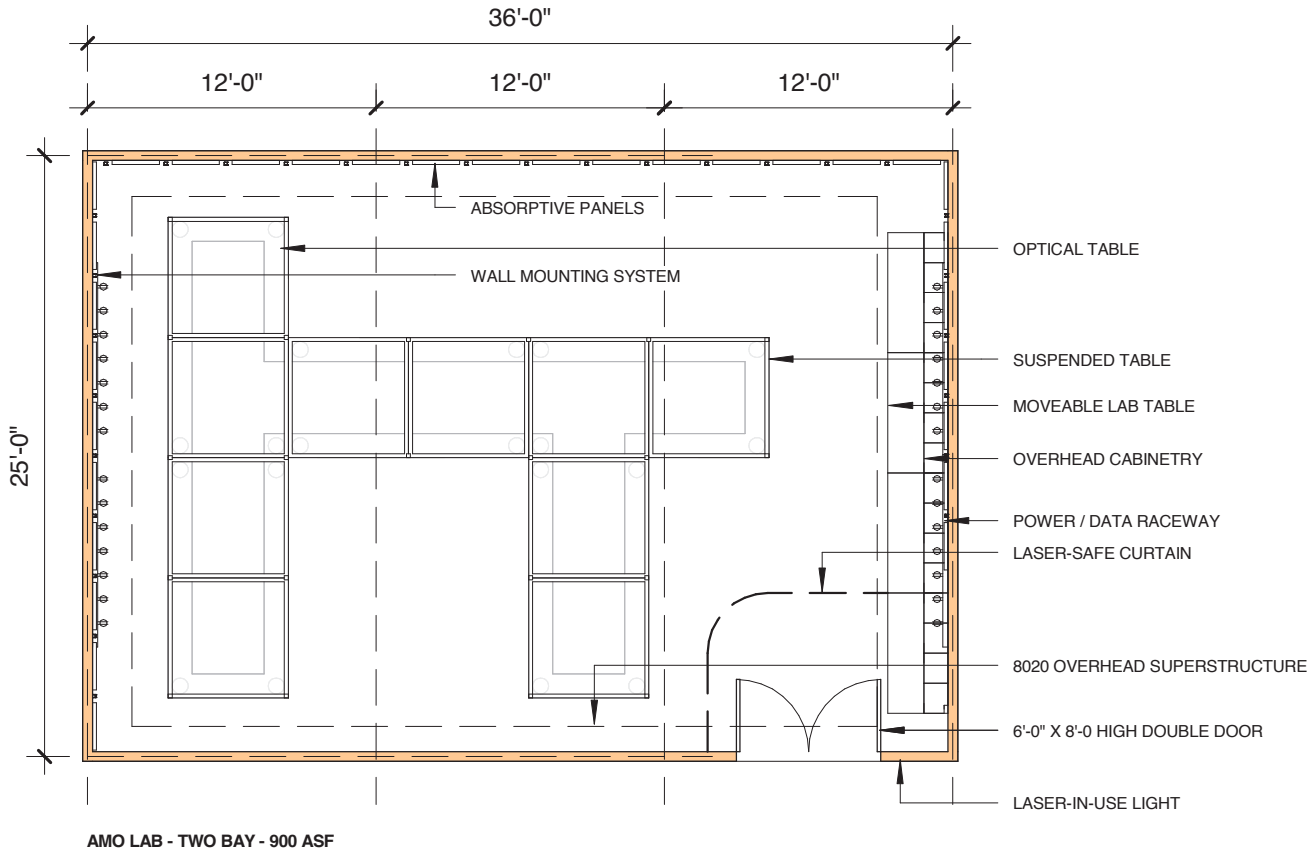
Research Lab Summary

Faculty	Lab Type	AMO	CMX	STM	HYB	CTL	PMP	CLN	DRY	WET	DRK	Bay Subtotal	Area Subtotal
	SF per Bay	300											
Astro X/O		0.0	4.0	0.0	0.0	0.0	0.0	7.0	18.0	0.0	0.0	29.0	8,700
BioPhysics X		0.0	0.0	0.0	0.0	0.0	0.0	0.0	1.0	18.5	13.5	33.0	9,900
CMX / AMO		30.0	39.5	8.0	11.0	8.5	21.5	7.5	20.0	7.0	1.0	154.0	46,200
HEX		0.0	2.0	0.0	0.0	0.0	3.0	4.0	15.0	3.0	0.0	27.0	8,100
		30.0	**45.5**	**8**	**11**	**8.5**	**24.5**	**18.5**	**54**	**28.5**	**14.5**	**243.0**	**72,900**

Labs in gold are assumed to be in new construction	42,600	Note: All above grade labs shall be capable of having laboratory sinks and plumbing installed for flexibility to convert to WET lab types in the future.
Other labs in new construction to be determined during programming phase	450	
Total of Lab Space in New Construction	43,050	
Total of Lab Space in Renovated Broida	29,850	Complete renovation of Broida, including enclosing the exterior corridors for use as dust-free, climate controlled laboratory corridors
	72,900	

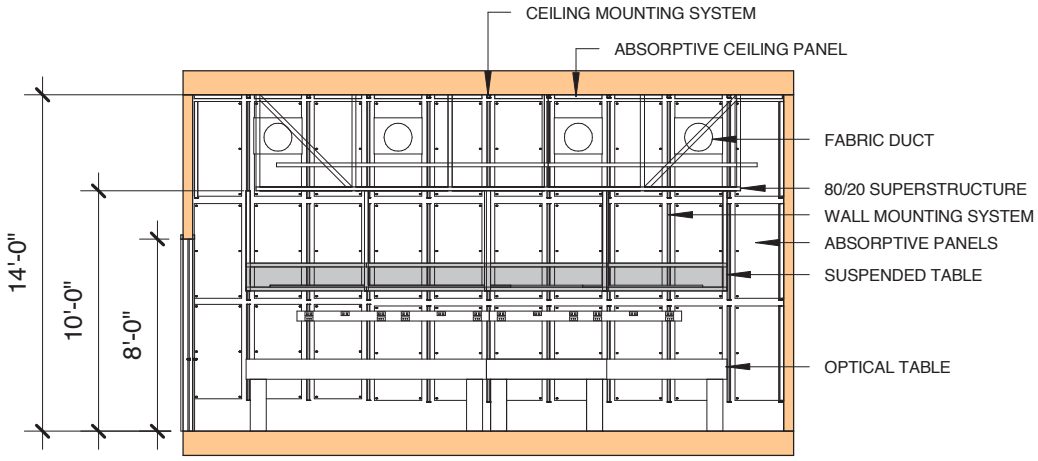
AMO Lab (Atomic/Molecular/Optical Experiment)

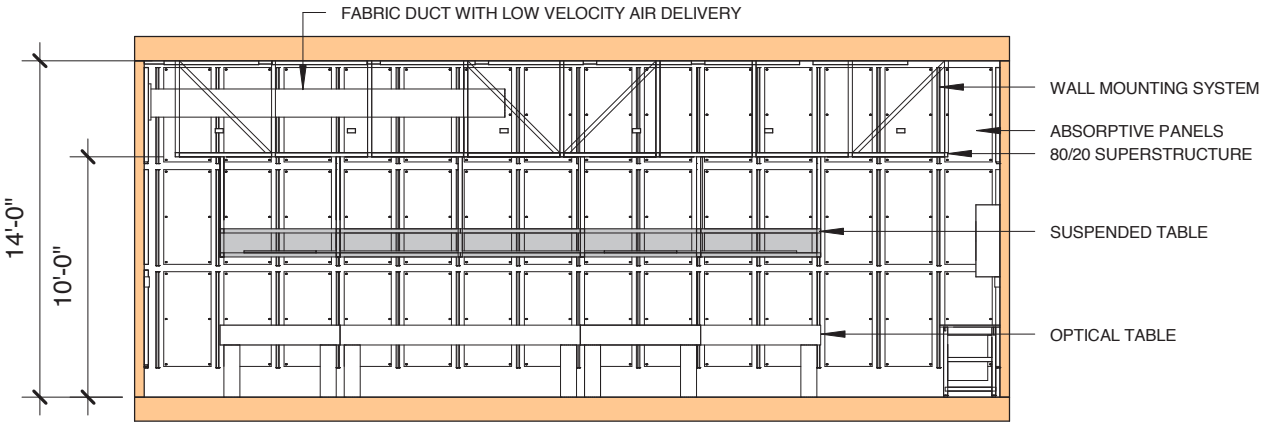
The interaction of light and matter underlies a variety of quantum technologies. Optical interactions are also a central tool for investigations of fundamental physics in diverse areas from gravitational wave detection to quantum simulation to ultra-precise quantum metrology. The technological driver of this field is the remarkable continuing advance in laser technology and the resulting array of transformative capabilities ranging from attosecond pulse trains to sub-hertz-linewidth sources. To take full advantage of these tools, modern optics laboratories require excellent temperature and humidity stability (often in multiple stages), dust control, a stable electromagnetic and acoustic environment, low floor vibration, provision for laser safety, gas handling, equipment cooling water, and plentiful electrical power.



AMO LAB - TWO BAY - 900 ASF

AMO Lab Plan



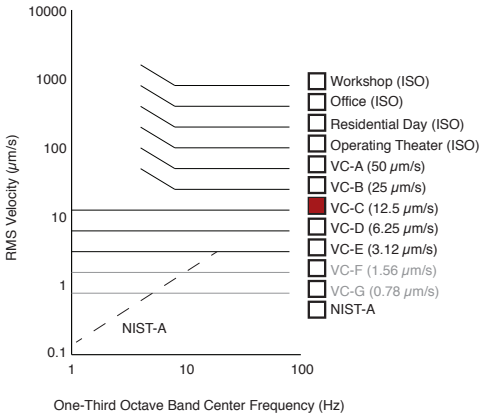


AMO Lab Sections

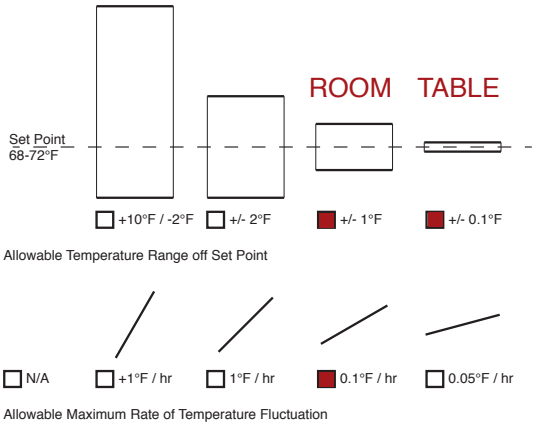
Laboratory Performance Criteria

Laboratory Type: Optics Lab (AMO)
Laboratory Function: Advanced laser optics
Description of Activities: Array of 12 x 5 optical tables with lenses and mirrors, with overhead suspended table

Vibration Control



Temperature Control



NOTE: Local Remote FCU to have 50% over-capacity, to be water based and controlled by user.

Acoustic Control

- ☐ NC-15 TEM / Recording
- ☐ NC-20 SEM
- ■ NC-25 Dil Fridge
- ☐ NC-30 High Perf Lab
- ☐ NC-35 Conference
- ☐ NC-40 Private Office
- ☐ NC-45 Open Office
- ☐ NC-50 Laboratory
- ☐ No Requirement

Air Quality

- ☐ ISO 3 1
- ☐ ISO 4 10
- ☐ ISO 5 100
- ☐ ISO 6 1,000
- ☐ ISO 7 10,000
- ☐ ISO 8 100,000
- ■ No Classification
- ■ Laminar Flow
- ■ Moveable T-stat

Humidity Control

- ■ 30%-50% RH
- ☐ 30%-50% RH Settable
- ☐ No Humidification

- ■ Return Air Allowed
- ■ Local FCU (Remote)
- ■ Positive Pressure
- ☐ Negative Pressure
- ■ +/- 2% RH

Power Density

- ☐ 5 W/sf (2W/sf demand)
- ☐ 10 W/sf (5W/sf demand)
- ☐ 20 W/sf (10W/sf demand)
- ☐ 30 W/sf (15W/sf demand)
- ☐ 50 W/sf (25W/sf demand)
- ■ 80 W/sf (40 W/sf demand)
- ☐ 100 W/sf (50W/sf demand)
- ■ Pump Power
- ■ Instrument Power
- ■ Clean Ground
- ■ Emergency Power

Electromagnetic Interference (EMI) Control

- ☐ 100 nT RMS (300 nTp-p): General High Performance Lab
- ■ 35 nT RMS (100 nTp-p): Dilution Refrigerator Lab
- ☐ 18 nT RMS (50 nTp-p): E Beam / FIB
- ☐ 11 nT RMS (30 nTp-p): SEM / TEM
- ☐ 4 nT RMS (10nTp-p): FEI Titan / JEOL 2100F

Architectural

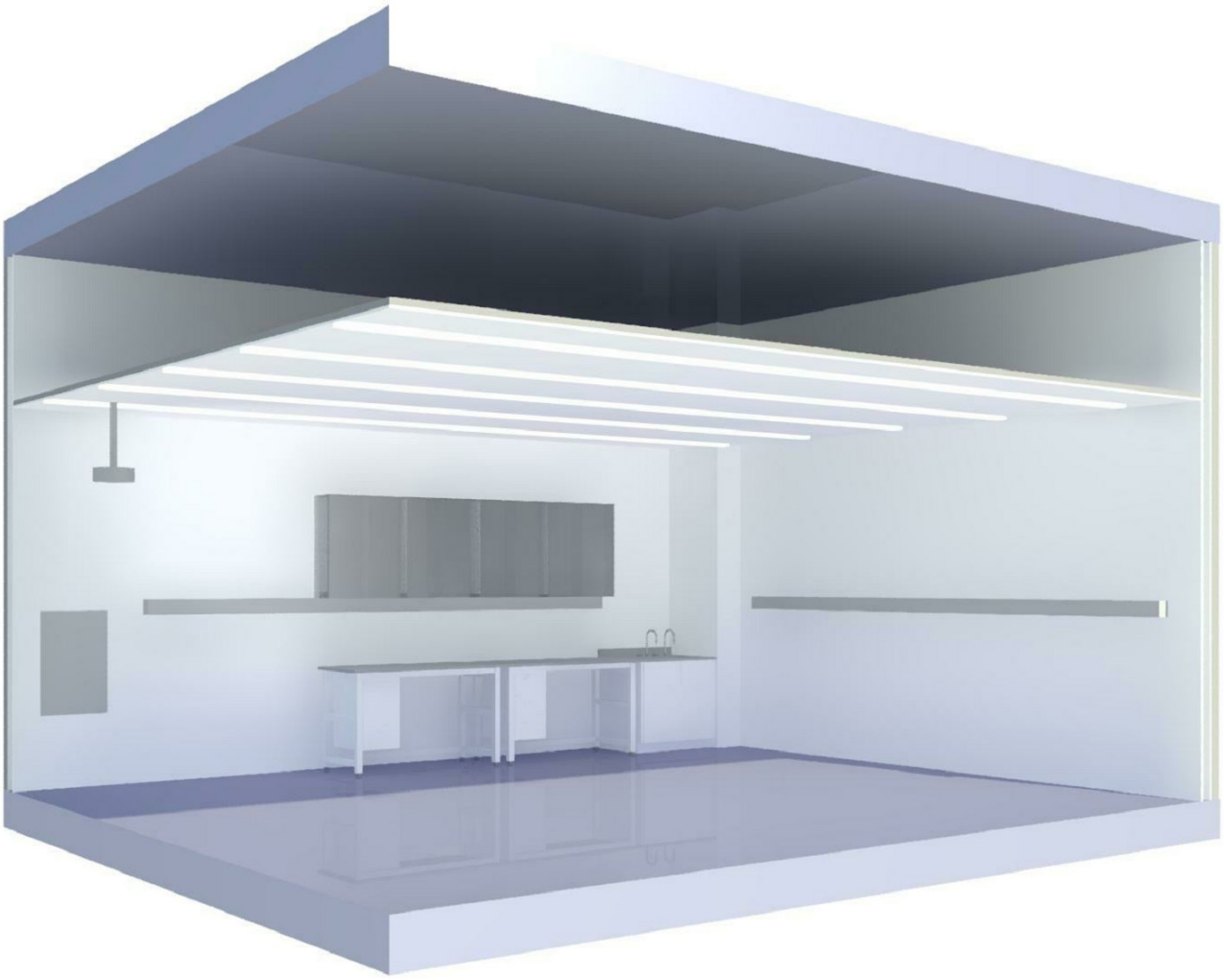
- ■ ESD Flooring
- ☐ Seamless Flooring
- ☐ Cryo Safe Flooring
- ☐ Chemical Resistant Flooring
- ■ Wall Mounts
- ■ Ceiling Mounts
- ■ Double Door
- ☐ Windows Allowed

Infrastructure

- ■ Clean Dry Air
- ☐ House Vacuum
- ■ House Nitrogen (gas)
- ☐ House Helium (gas)
- ■ Cylinder Gas Manifolds Qty 2
- ■ Helium Recovery (Vertical)
- ■ Other Pump exhaust
- ■ 480V 3p Required

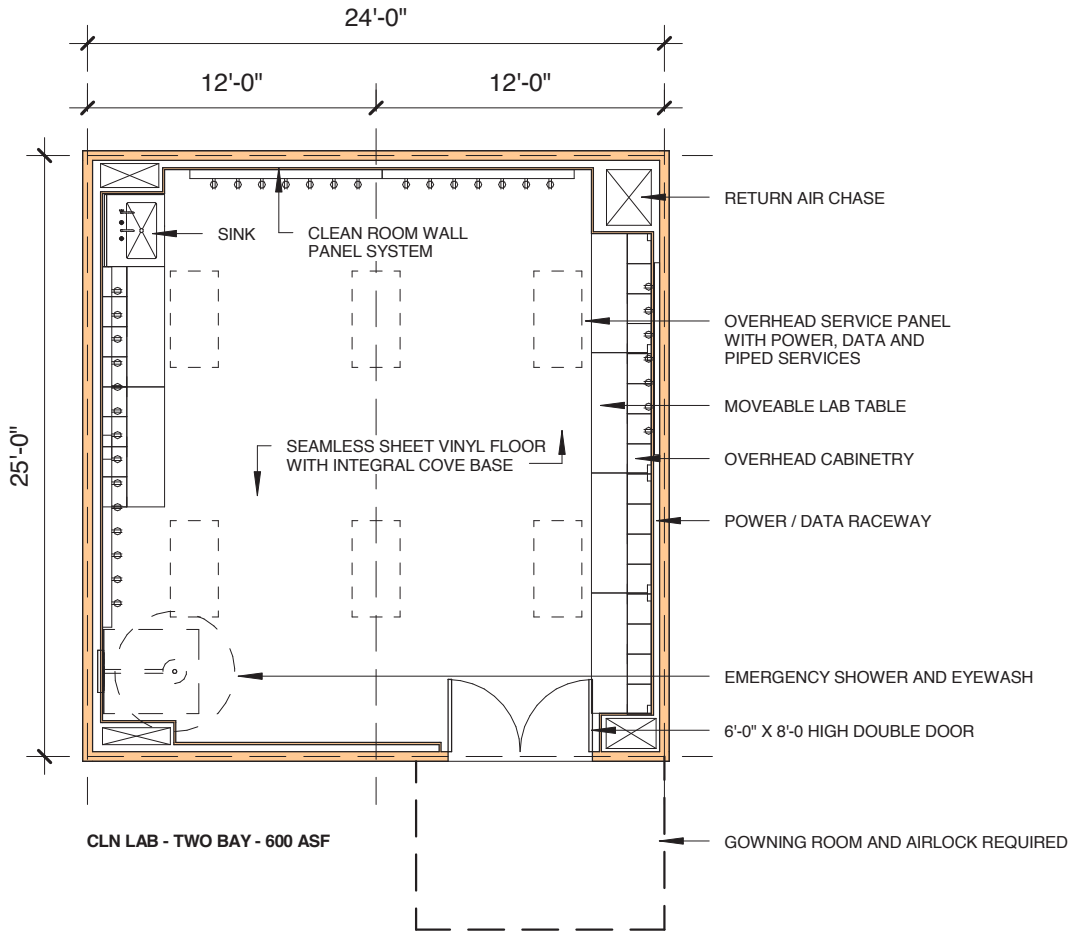
- ☐ Hot Water
- ☐ Cold Water
- ☐ RODI
- ☐ Eyewash (Tempered Water)
- ☐ Safety Shower (Tempered Water)
- ■ Other Laser in use light
- ■ Data (Fiber)
- ■ Data (Copper)

- ☐ Fume Hood
- ☐ Snorkel Exhaust
- ☐ Biological Safety Cabinet
- ■ HEPA Filter
- ■ ULPA Filter
- ■ Process Chilled Water
  75% Percent of Power Demand
- ■ 12V DC LED Lighting
- ☐ Standard LED Lighting

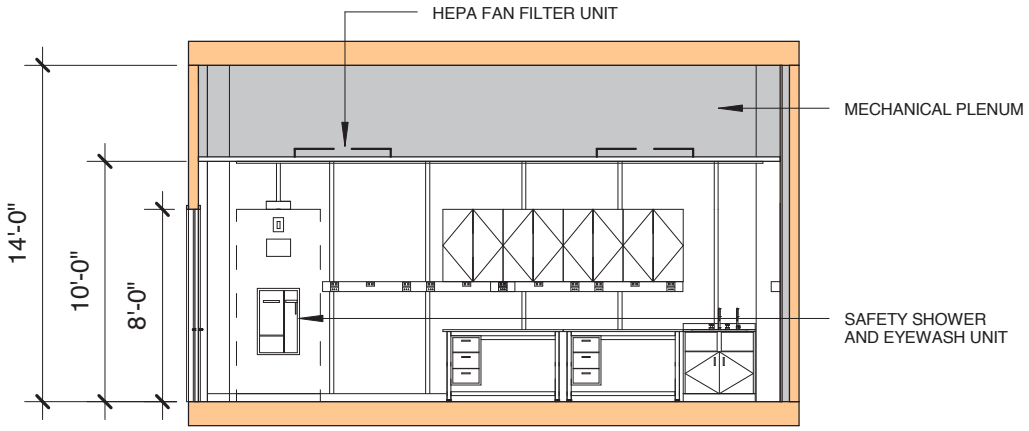


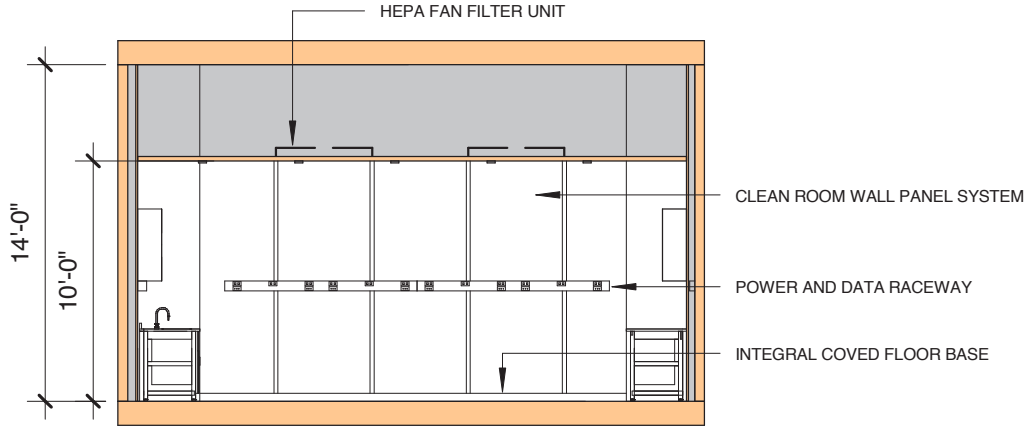
CLN Lab (Clean Assembly Experiment)

To probe the vacuum of space-time, particle and astroparticle physics experiments now involve extremely large-scale detectors. Construction of detector subsystems thus requires the capability for high precision, automated assembly of large quantities of components in a clean, access-controlled environment. Sensor module processing can also involve wirebonding, electronic testing, and burn-in with thermal cycling for particle tracking and calorimeter systems carried out in a space contiguous with that of the automated assembly. Clean dry air, vacuum and power are the main needs. Chillers are also needed operated to values as low as -40C. Climate control isn't critical but humidity should not be too low.


24'-0"
12'-0"
12'-0"
25'-0"
SINK
CLEAN ROOM WALL PANEL SYSTEM
SEAMLESS SHEET VINYL FLOOR WITH INTEGRAL COVE BASE
RETURN AIR CHASE
OVERHEAD SERVICE PANEL WITH POWER, DATA AND PIPED SERVICES
MOVEABLE LAB TABLE
OVERHEAD CABINETRY
POWER / DATA RACEWAY
EMERGENCY SHOWER AND EYEWASH
6'-0" X 8'-0 HIGH DOUBLE DOOR
GOWNING ROOM AND AIRLOCK REQUIRED
CLN LAB - TWO BAY - 600 ASF

CLN Lab Plan



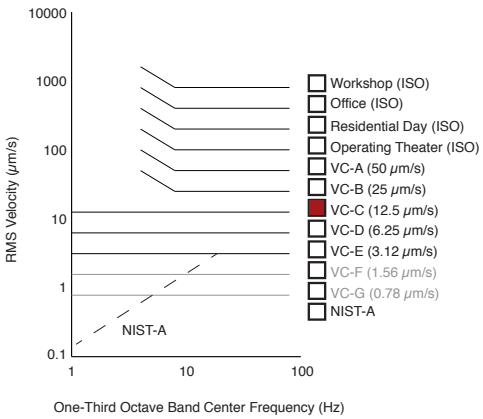


CLN Lab Sections

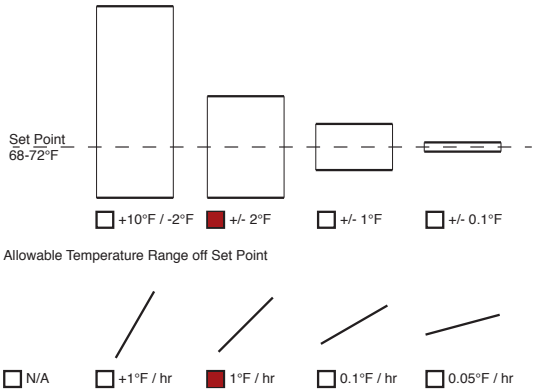
Laboratory Performance Criteria

Laboratory Type: CLN Lab
Laboratory Function: Clean Assembly for Astro/HEP
Description of Activities: Construction of electronic devices for use in Astro and HEP experiments

Vibration Control



Temperature Control



Acoustic Control

- ☐ NC-15 TEM / Recording
- ☐ NC-20 SEM
- ☐ NC-25 Dil Fridge
- ☐ NC-30 High Perf Lab
- ☐ NC-35 Conference
- ☐ NC-40 Private Office
- ☐ NC-45 Open Office
- ■ NC-50 Laboratory
- ☐ No Requirement

Air Quality

- ☐ ISO 3 1
- ☐ ISO 4 10
- ☐ ISO 5 100
- ☐ ISO 6 1,000
- ■ ISO 7 10,000
- ☐ ISO 8 100,000
- ☐ No Classification
- ■ Laminar Flow
- ☐ Moveable T-stat

Humidity Control

- ■ 30%-50% RH
- ☐ 30%-50% RH Settable
- ☐ No Humidification

- ■ Return Air Allowed
- ■ Local FCU (Remote)
- ■ Positive Pressure
- ☐ Negative Pressure
- ■ +/- 2% RH

Power Density

- ☐ 5 W/sf (2W/sf demand)
- ☐ 10 W/sf (5W/sf demand)
- ☐ 20 W/sf (10W/sf demand)
- ■ 30 W/sf (15W/sf demand)
- ☐ 50 W/sf (25W/sf demand)
- ☐ 80 W/sf (40 W/sf demand)
- ☐ 100 W/sf (50W/sf demand)
- ☐ Pump Power
- ■ Instrument Power
- ■ Clean Ground
- ■ Emergency Power

Electromagnetic Interference (EMI) Control

- ■ 100 nT RMS (300 nTp-p): General High Performance Lab
- ☐ 35 nT RMS (100 nTp-p): Dilution Refrigerator Lab
- ☐ 18 nT RMS (50 nTp-p): E Beam / FIB
- ☐ 11 nT RMS (30 nTp-p): SEM / TEM
- ☐ 4 nT RMS (10nTp-p): FEI Titan / JEOL 2100F

Architectural

- ■ ESD Flooring
- ■ Seamless Flooring
- ☐ Cryo Safe Flooring
- ■ Chemical Resistant Flooring
- ☐ Wall Mounts
- ☐ Ceiling Mounts
- ■ Double Door
- ☐ Windows Allowed

Infrastructure

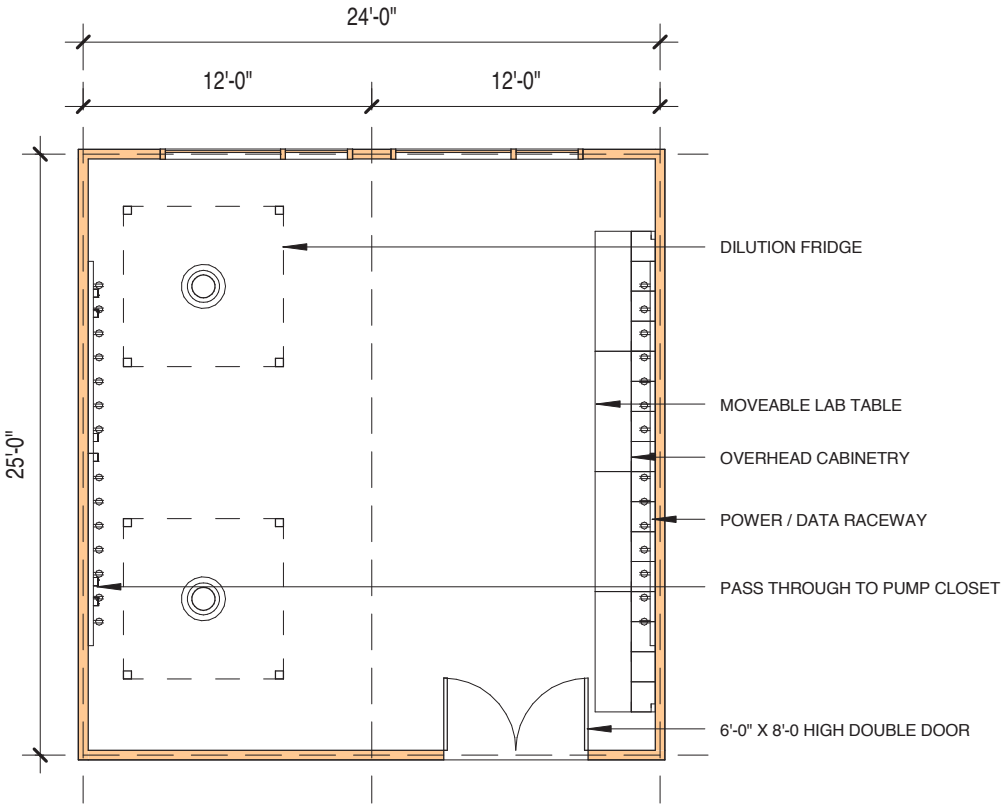
- ■ Clean Dry Air
- ☐ House Vacuum
- ■ House Nitrogen (gas)
- ☐ House Helium (gas)
- ■ Cylinder Gas Manifolds Qty 2
- ■ Helium Recovery (Vertical)
- ■ Other Adjacent gowning room
- ☐ 480V 3p Required

- ☐ Hot Water
- ☐ Cold Water
- ☐ RODI
- ■ Eyewash (Tempered Water)
- ■ Safety Shower (Tempered Water)
- ■ Other Room in use light
- ■ Data (Fiber)
- ■ Data (Copper)

- ■ Fume Hood
- ■ Snorkel Exhaust
- ☐ Biological Safety Cabinet
- ■ HEPA Filter
- ☐ ULPA Filter
- ■ Process Chilled Water
  75% Percent of Power Demand
- ■ 12V DC LED Lighting
- ☐ Standard LED Lighting

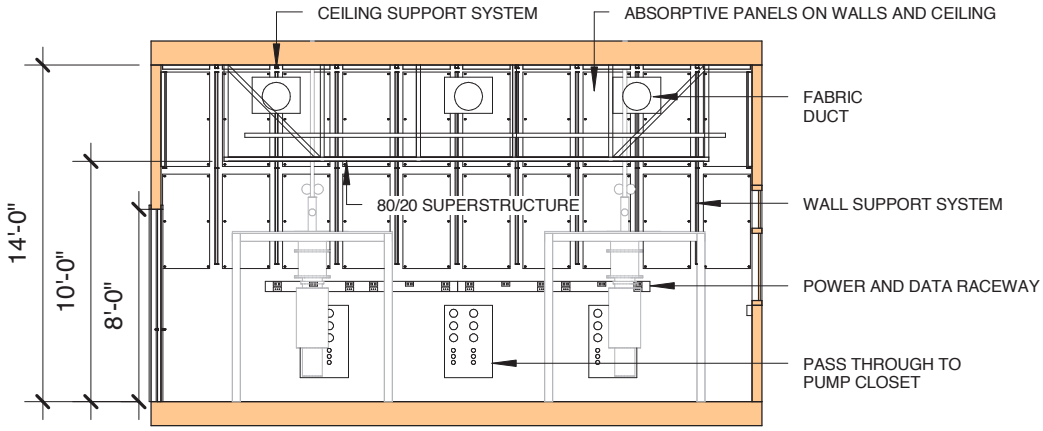
CMX Lab (Condensed Matter Experiment)

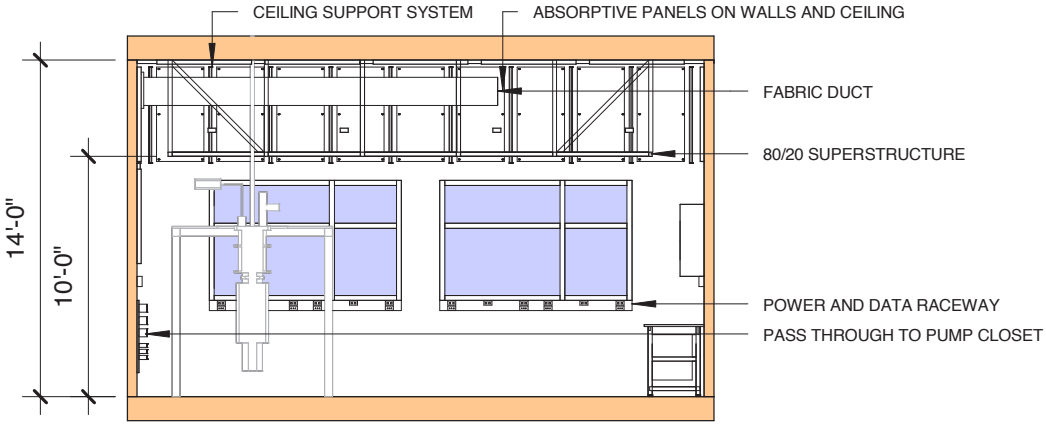
Condensed matter experimentalists study materials and the physical properties of their various phases, with the goal of gaining a fundamental understanding of how the various constituents of matter (e.g. electrons and nuclei) interact to produce exciting and often technologically useful phenomena with applications in next-generation electronic devices, lasers, quantum computers and more. These experiments commonly involve ultra-low noise electronic and magnetic measurements, helium cryostats (both wet and closed-cycle), and clean spaces for sample assembly. They may also contain add-on optics and commercial or homebuilt atomic force microscopes. A subset of CMX labs is especially sensitive to fluctuating magnet fields (e.g. superconducting qubit and nitrogen vacancy magnetometry labs) and will need 11nT RMS magnetic field specifications.



CMX LAB - TWO BAY - 600 ASF

CMX Lab Plan



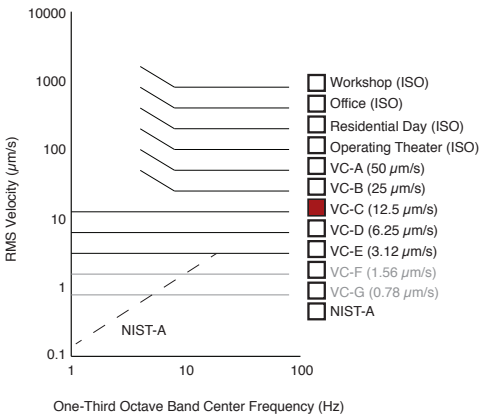


CMX Lab Sections

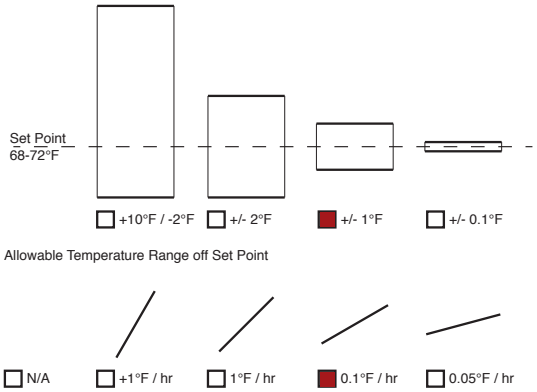
Laboratory Performance Criteria

Laboratory Type: CMX Lab
Laboratory Function: Condensed Matter Physics
Description of Activities: Dilution refrigerator

Vibration Control



Temperature Control



Acoustic Control

- ☐ NC-15 TEM / Recording
- ☐ NC-20 SEM
- ☐ NC-25 Dil Fridge
- ■ NC-30 High Perf Lab
- ☐ NC-35 Conference
- ☐ NC-40 Private Office
- ☐ NC-45 Open Office
- ☐ NC-50 Laboratory
- ☐ No Requirement

Air Quality

- ☐ ISO 3 1
- ☐ ISO 4 10
- ☐ ISO 5 100
- ☐ ISO 6 1,000
- ☐ ISO 7 10,000
- ☐ ISO 8 100,000
- ■ No Classification
- ☐ Laminar Flow
- ■ Moveable T-stat

Humidity Control

- ■ 30%-50% RH
- ☐ 30%-50% RH Settable
- ☐ No Humidification

- ■ Return Air Allowed
- ■ Local FCU (Remote)
- ■ Positive Pressure
- ☐ Negative Pressure
- ■ +/-5% RH

Power Density

- ☐ 5 W/sf (2W/sf demand)
- ☐ 10 W/sf (5W/sf demand)
- ☐ 20 W/sf (10W/sf demand)
- ☐ 30 W/sf (15W/sf demand)
- ☐ 50 W/sf (25W/sf demand)
- ■ 80 W/sf (40 W/sf demand)
- ☐ 100 W/sf (50W/sf demand)
- ■ Pump Power
- ■ Instrument Power
- ■ Clean Ground
- ■ Emergency Power

Electromagnetic Interference (EMI) Control

- ☐ 100 nT RMS (300 nTp-p): General High Performance Lab
- ■ 35 nT RMS (100 nTp-p): Dilution Refrigerator Lab
- ☐ 18 nT RMS (50 nTp-p): E Beam / FIB
- * ■ 11 nT RMS (30 nTp-p): SEM / TEM
- ☐ 4 nT RMS (10nTp-p): FEI Titan / JEOL 2100F

* Lower EMI Control for NV magnetometry/ scanning squid.

Architectural

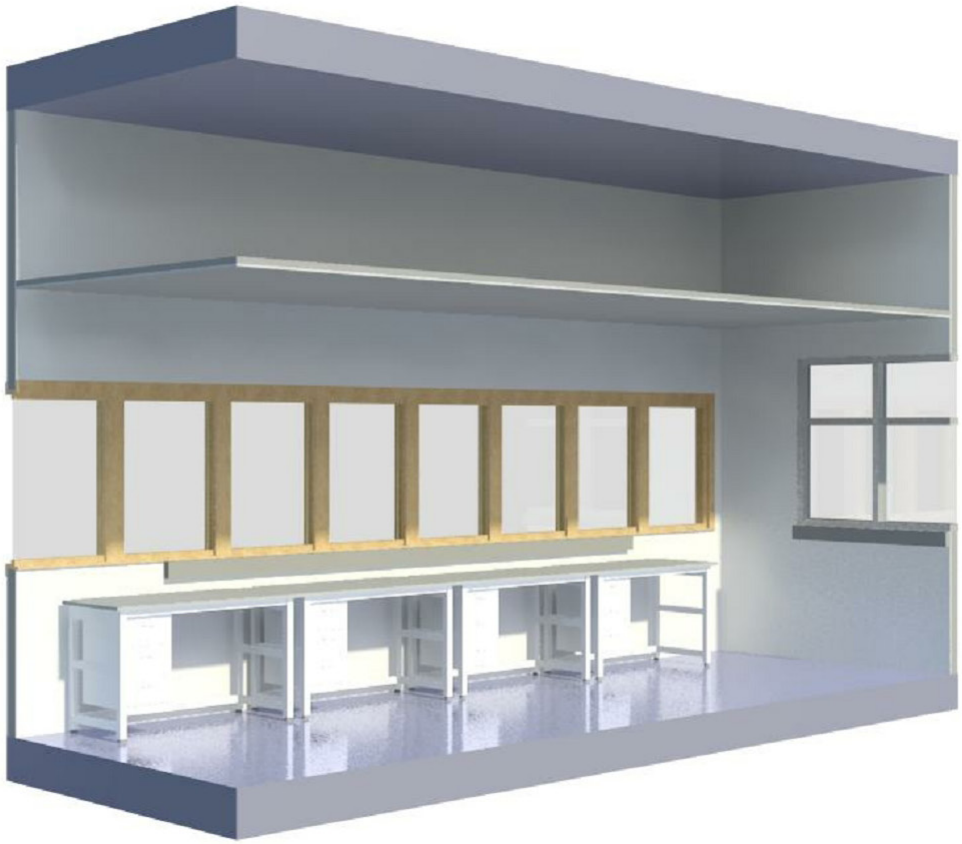
- ■ ESD Flooring
- ■ Seamless Flooring
- ■ Cryo Safe Flooring
- ☐ Chemical Resistant Flooring
- ■ Wall Mounts
- ■ Ceiling Mounts
- ■ Double Door
- ■ Windows Allowed

Infrastructure

- ■ Clean Dry Air
- ☐ House Vacuum
- ■ House Nitrogen (gas)
- ☐ House Helium (gas)
- ■ Cylinder Gas Manifolds Qty 2
- ■ Helium Recovery (Vertical)
- ☐ Other _____
- ☐ 480V 3p Required

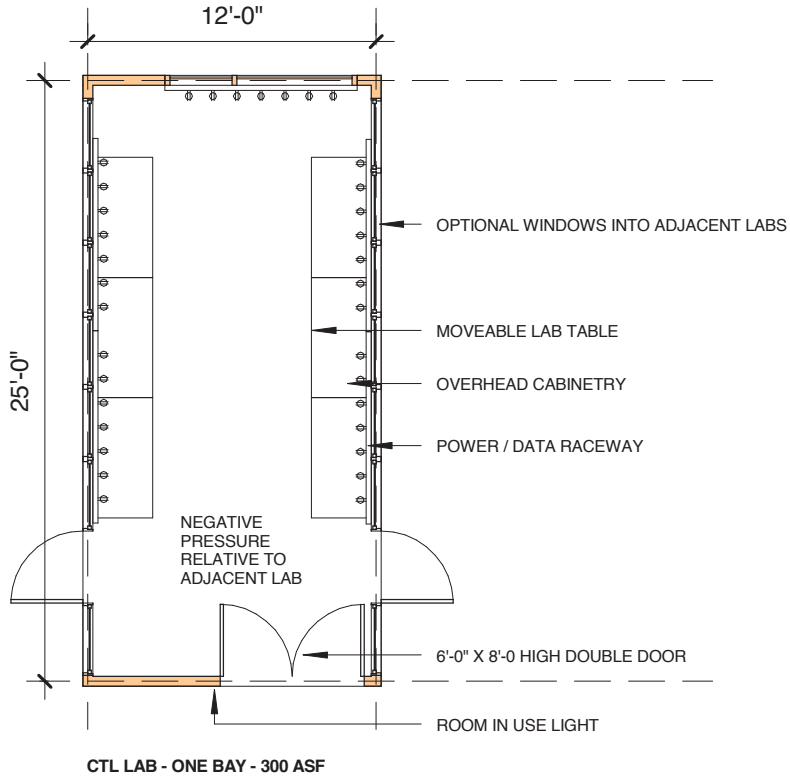
- ☐ Hot Water
- ☐ Cold Water
- ☐ RODI
- ☐ Eyewash (Tempered Water)
- ☐ Safety Shower (Tempered Water)
- ■ Other Room in use light
- ■ Data (Fiber)
- ■ Data (Copper)

- ☐ Fume Hood
- ■ Snorkel Exhaust
- ☐ Biological Safety Cabinet
- ■ HEPA Filter
- ☐ ULPA Filter
- ■ Process Chilled Water
  75% Percent of Power Demand
- ■ 12V DC LED Lighting
- ☐ Standard LED Lighting



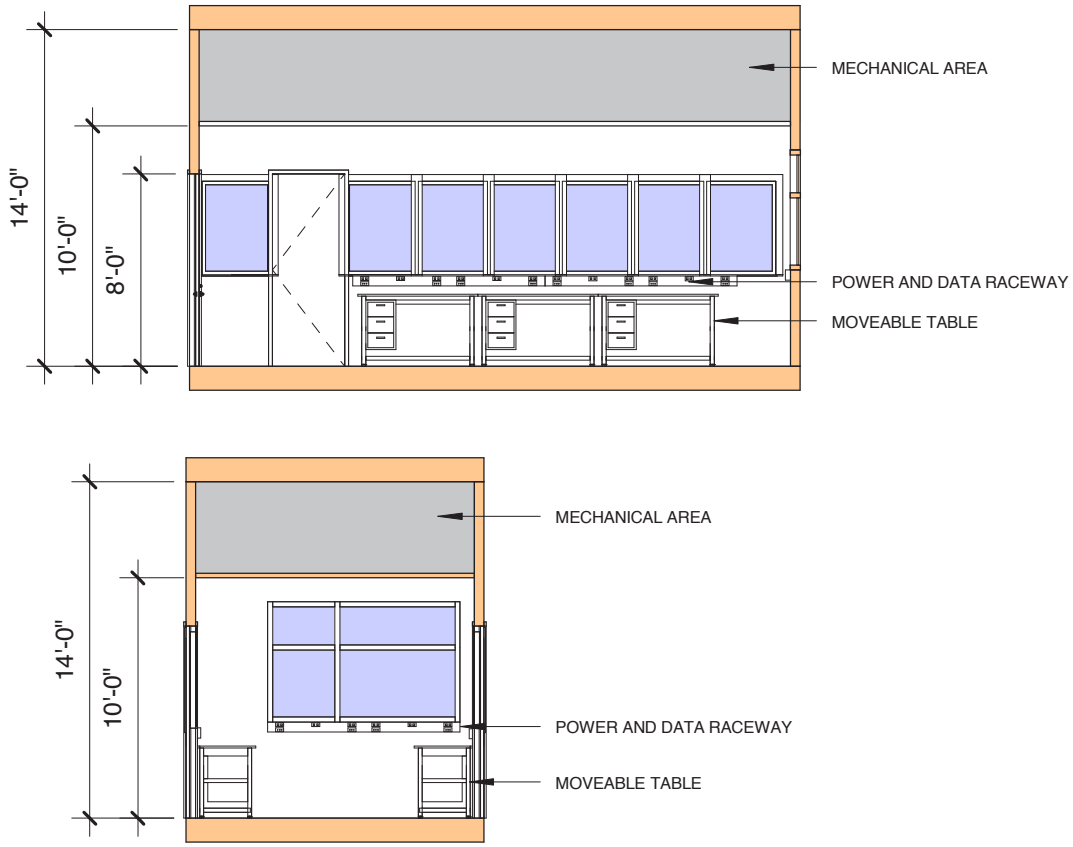
CTL Lab (Control)

This lab type sits adjacent to and supports the AMO, CMX and STM labs with ultrasensitive temperature/acoustic/vibrational requirements. The control lab houses the personnel, computers, power supplies, and other equipment that run the experiment. Segregated space for noisy peripheral equipment and people enables superior environmental control in adjacent high performance labs.



CTL LAB - ONE BAY - 300 ASF

CTL Lab Plan

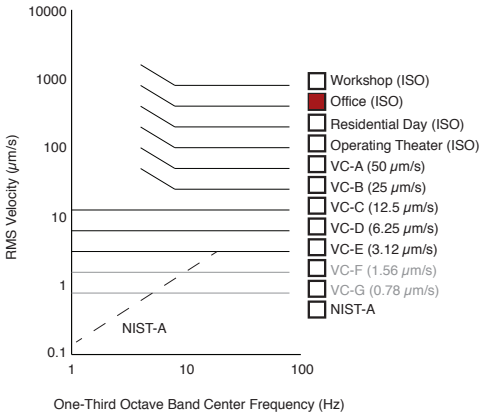


CTL Lab Sections

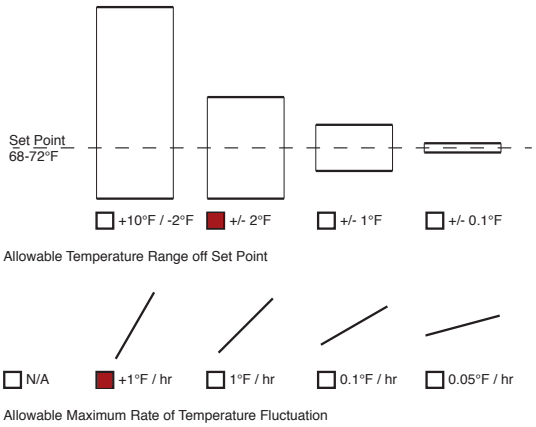
Laboratory Performance Criteria

Laboratory Type: CTL Lab (Control Room)
Laboratory Function:
Description of Activities: Data Analysis, measurement, computing adjacent to high performance spaces.

Vibration Control



Temperature Control



Acoustic Control

- ☐ NC-15 TEM / Recording
- ☐ NC-20 SEM
- ☐ NC-25 Dil Fridge
- ☐ NC-30 High Perf Lab
- ☐ NC-35 Conference
- ■ NC-40 Private Office
- ☐ NC-45 Open Office
- ☐ NC-50 Laboratory
- ☐ No Requirement

Air Quality

- ☐ ISO 3 1
- ☐ ISO 4 10
- ☐ ISO 5 100
- ☐ ISO 6 1,000
- ☐ ISO 7 10,000
- ☐ ISO 8 100,000
- ■ No Classification
- ☐ Laminar Flow
- ☐ Moveable T-stat

Humidity Control

- ☐ 30%-50% RH
- ☐ 30%-50% RH Settable
- ■ No Humidification

- ■ Return Air Allowed
- ☐ Local FCU (Remote)
- ■ Positive Pressure
- ☐ Negative Pressure
- ☐ +/- 2% RH

Power Density

- ☐ 5 W/sf (2W/sf demand)
- ☐ 10 W/sf (5W/sf demand)
- ☐ 20 W/sf (10W/sf demand)
- ■ 30 W/sf (15W/sf demand)
- ☐ 50 W/sf (25W/sf demand)
- ☐ 80 W/sf (40 W/sf demand)
- ☐ 100 W/sf (50W/sf demand)
- ☐ Pump Power
- ■ Instrument Power
- ☐ Clean Ground
- ■ Emergency Power

Electromagnetic Interference (EMI) Control

- ■ 100 nT RMS (300 nTp-p): General High Performance Lab
- ☐ 35 nT RMS (100 nTp-p): Dilution Refrigerator Lab
- ☐ 18 nT RMS (50 nTp-p): E Beam / FIB
- ☐ 11 nT RMS (30 nTp-p): SEM / TEM
- ☐ 4 nT RMS (10nTp-p): FEI Titan / JEOL 2100F

Architectural

- ☐ ESD Flooring
- ☐ Seamless Flooring
- ☐ Cryo Safe Flooring
- ☐ Chemical Resistant Flooring
- ☐ Wall Mounts
- ☐ Ceiling Mounts
- ☐ Double Door
- ■ Windows Allowed

Infrastructure

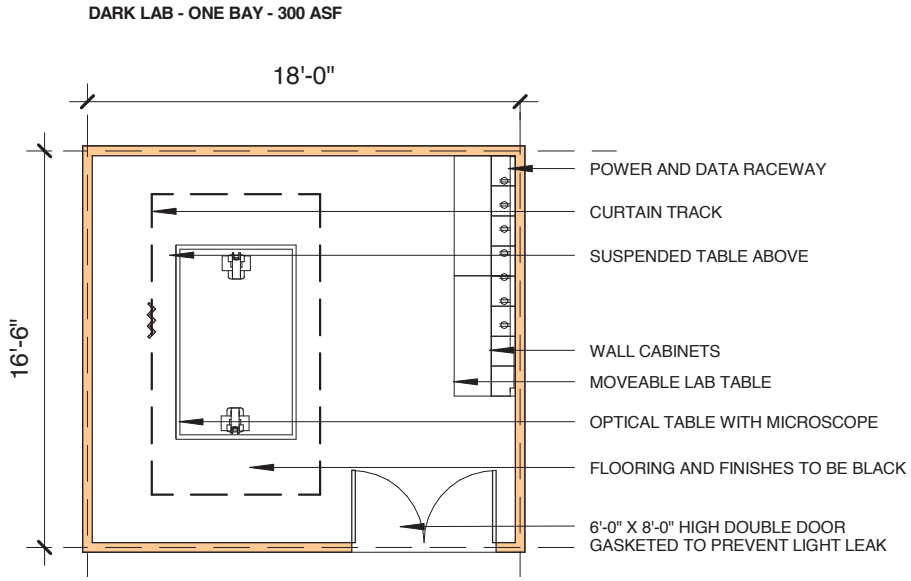
- ☐ Clean Dry Air
- ☐ House Vacuum
- ☐ House Nitrogen (gas)
- ☐ House Helium (gas)
- ☐ Cylinder Gas Manifolds Qty___
- ☐ Helium Recovery (Vertical)
- ☐ Other _____
- ☐ 480V 3p Required

- ☐ Hot Water
- ☐ Cold Water
- ☐ RODI
- ☐ Eyewash (Tempered Water)
- ☐ Safety Shower (Tempered Water)
- ☐ Other _____
- ■ Data (Fiber)
- ■ Data (Copper)

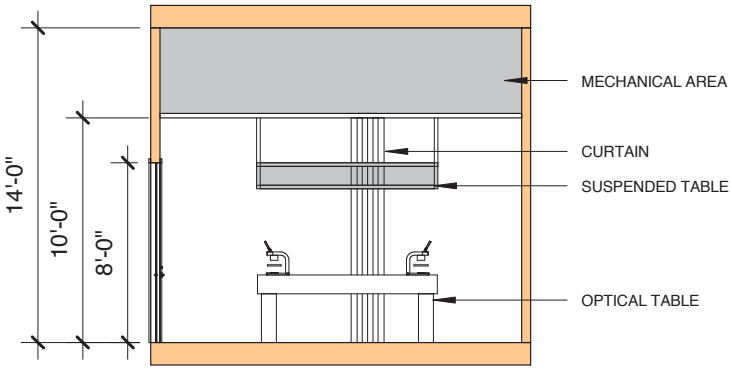
- ☐ Fume Hood
- ☐ Snorkel Exhaust
- ☐ Biological Safety Cabinet
- ☐ HEPA Filter
- ☐ ULPA Filter
- ☐ Process Chilled Water
  ____Percent of Power Demand
- ■ 12V DC LED Lighting
- ☐ Standard LED Lighting

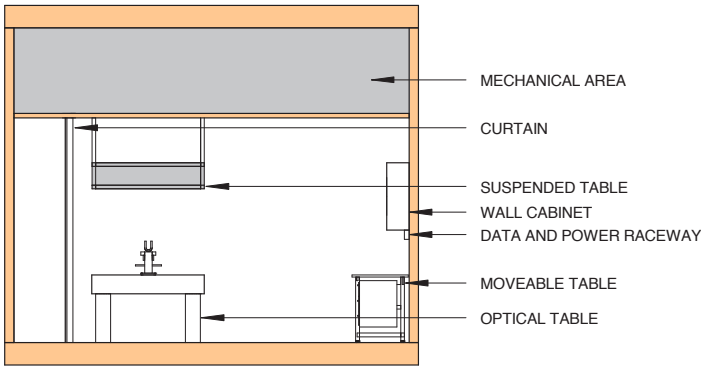
DRK Lab (Dark Lab for Microscopy)

Experimental biophysicists develop and carry out precise measurements of biological systems spanning the range from single molecules to collections of cells. Regardless of the nature of the sample or the specific technique, these measurements tend to involve some type of microscopy, and rely on weak optical signals. To succeed, one must maximize what is under the best of circumstances a very low signal to noise ratio. Biophysicists therefore require laboratory space from which stray external light can be completely excluded, with precise climate control and filtered air for maintaining the viability of high-purity samples.



DRK Lab Plans



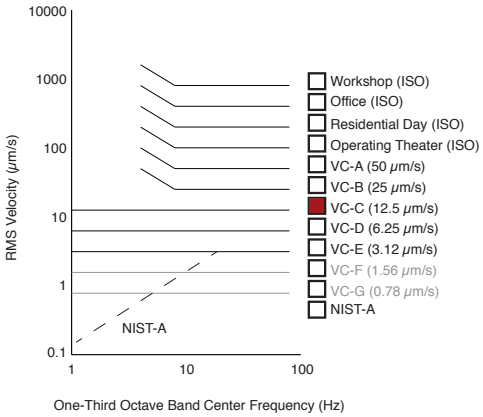


DRK Lab Sections

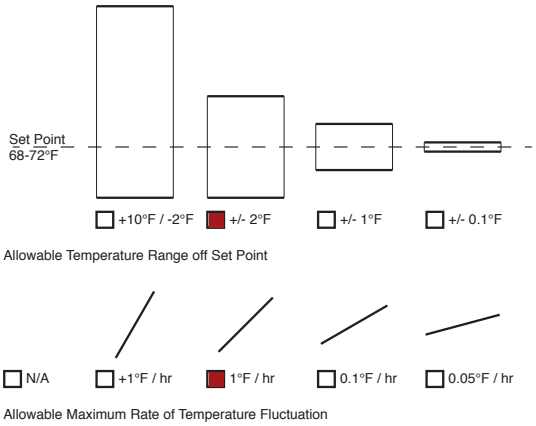
Laboratory Performance Criteria

Laboratory Type: Dark Lab
Laboratory Function: Microscopy
Description of Activities: Biophysics microscopy labs, with light control

Vibration Control



Temperature Control



Acoustic Control

- ☐ NC-15 TEM / Recording
- ☐ NC-20 SEM
- ☐ NC-25 Dil Fridge
- ■ NC-30 High Perf Lab
- ☐ NC-35 Conference
- ☐ NC-40 Private Office
- ☐ NC-45 Open Office
- ☐ NC-50 Laboratory
- ☐ No Requirement

Air Quality

- ☐ ISO 3 1
- ☐ ISO 4 10
- ☐ ISO 5 100
- ☐ ISO 6 1,000
- ☐ ISO 7 10,000
- ☐ ISO 8 100,000
- ■ No Classification
- ☐ Laminar Flow
- ☐ Moveable T-stat

Humidity Control

- ☐ 30%-50% RH
- ☐ 30%-50% RH Settable
- ■ No Humidification

- ☐ Return Air Allowed
- ☐ Local FCU (Remote)
- ■ Positive Pressure
- ☐ Negative Pressure
- ☐ +/- 2% RH

Power Density

- ☐ 5 W/sf (2W/sf demand)
- ☐ 10 W/sf (5W/sf demand)
- ■ 20 W/sf (10W/sf demand)
- ☐ 30 W/sf (15W/sf demand)
- ☐ 50 W/sf (25W/sf demand)
- ☐ 80 W/sf (40 W/sf demand)
- ☐ 100 W/sf (50W/sf demand)
- ☐ Pump Power
- ■ Instrument Power
- ■ Clean Ground
- ■ Emergency Power

Electromagnetic Interference (EMI) Control

- ■ 100 nT RMS (300 nTp-p): General High Performance Lab
- ☐ 35 nT RMS (100 nTp-p): Dilution Refrigerator Lab
- ☐ 18 nT RMS (50 nTp-p): E Beam / FIB
- ☐ 11 nT RMS (30 nTp-p): SEM / TEM
- ☐ 4 nT RMS (10nTp-p): FEI Titan / JEOL 2100F

Architectural

- ☐ ESD Flooring
- ☐ Seamless Flooring
- ☐ Cryo Safe Flooring
- ☐ Chemical Resistant Flooring
- ☐ Wall Mounts
- ☐ Ceiling Mounts
- ■ Double Door
- ■ Windows Allowed with complete blackout

Infrastructure

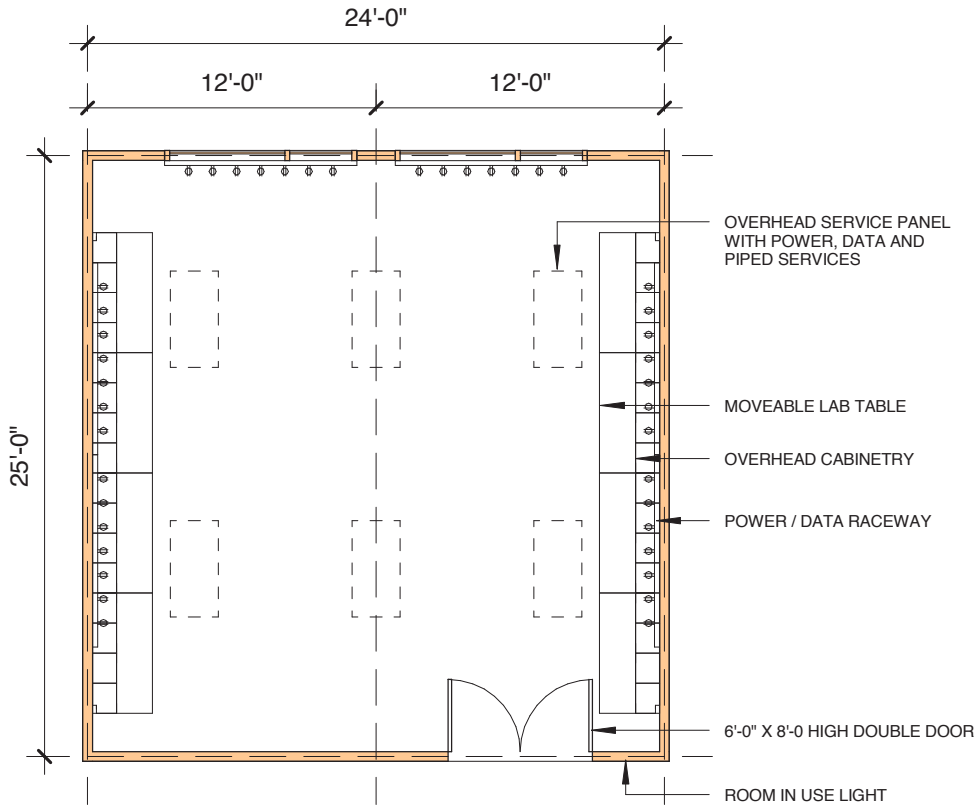
- ■ Clean Dry Air
- ■ House Vacuum
- ■ House Nitrogen (gas)
- ☐ House Helium (gas)
- ☐ Cylinder Gas Manifolds Qty___
- ☐ Helium Recovery (Vertical)
- ☐ Other _____
- ☐ 480V 3p Required

- ☐ Hot Water
- ☐ Cold Water
- ☐ RODI
- ☐ Eyewash (Tempered Water)
- ☐ Safety Shower (Tempered Water)
- ☐ Other _____
- ■ Data (Fiber) 20 ports
- ■ Data (Copper)

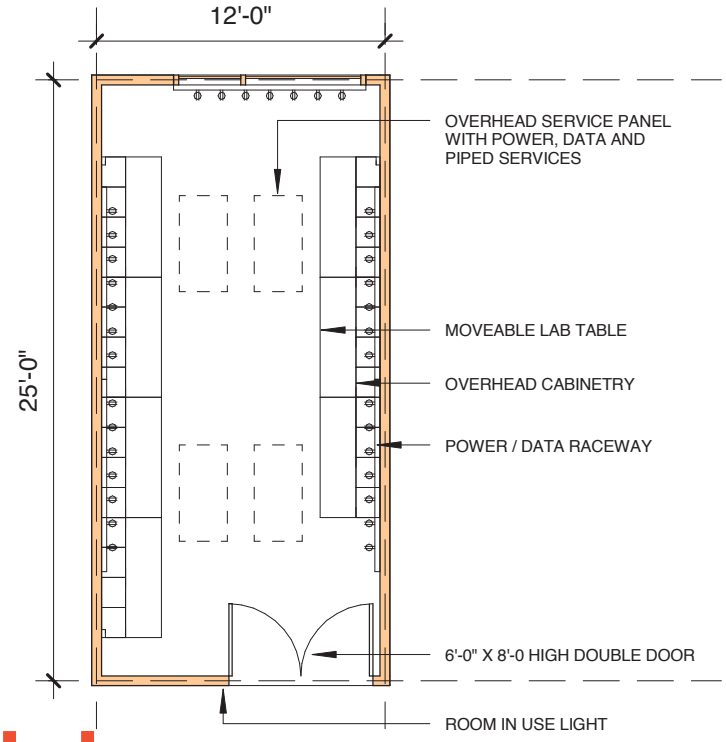
- ☐ Fume Hood
- ☐ Snorkel Exhaust
- ☐ Biological Safety Cabinet
- ■ HEPA Filter
- ☐ ULPA Filter
- ☐ Process Chilled Water
  ____Percent of Power Demand
- ■ 12V DC LED Lighting 3 color dimming
- ☐ Standard LED Lighting

Dry Lab (Standard Lab for Astro, Assembly, HEP)

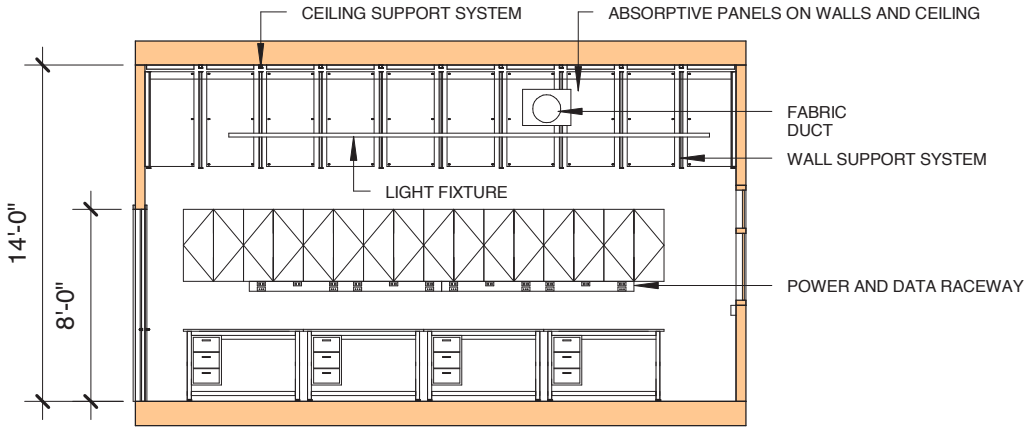
Cutting edge experimentation often requires the development of new devices for detection and measurement. The Dry Lab is used for detector research and development and electronics development, assembly and testing. It should be equipped with a wet bench and various rolling and fixed workbenches and cabinets for maximum flexibility. General activities include electronics assembly, operation of vacuum systems, magnets, gas-filled detectors, low-impact chemical work (e.g. isopropyl and acetone for part cleaning, epoxies, vacuum grease etc.). Low-rate venting of gases such as CH4 requires fume ports. Chilled water is required for magnets and pump cooling could reach 20 l/min. Liquid nitrogen for use in cold traps may be present, and occasional liquid helium fills may also be performed.

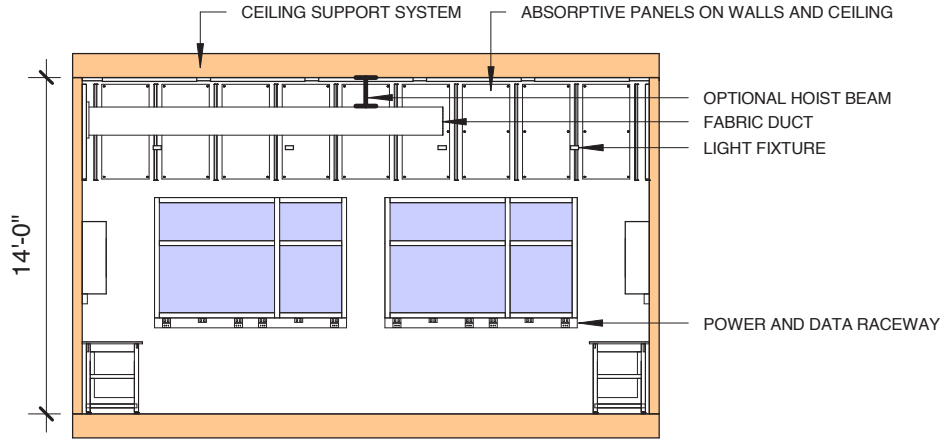


DRY LAB - TWO BAY - 600 ASF



Dry Lab Plans



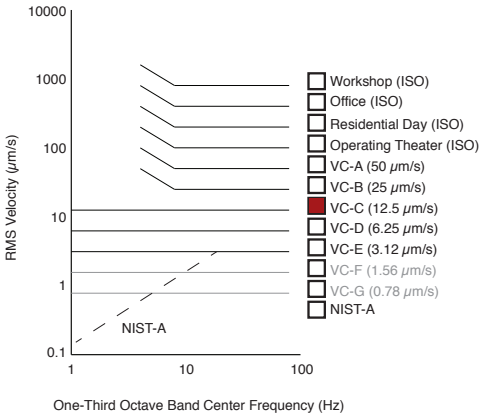


Dry Lab Sections

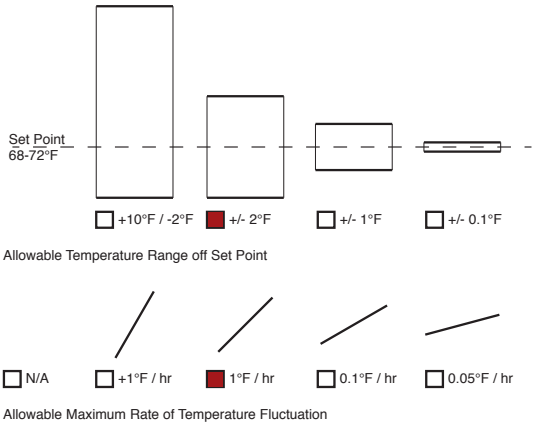
Laboratory Performance Criteria

Laboratory Type: Dry Lab
Laboratory Function: General Purpose Physics Lab with no wet functions
Description of Activities: Relatively stable experiments - base line lab, convertible to other types

Vibration Control



Temperature Control



Acoustic Control

- ☐ NC-15 TEM / Recording
- ☐ NC-20 SEM
- ☐ NC-25 Dil Fridge
- ☐ NC-30 High Perf Lab
- ☐ NC-35 Conference
- ☐ NC-40 Private Office
- ☐ NC-45 Open Office
- ■ NC-50 Laboratory
- ☐ No Requirement

Air Quality

- ☐ ISO 3 1
- ☐ ISO 4 10
- ☐ ISO 5 100
- ☐ ISO 6 1,000
- ☐ ISO 7 10,000
- ☐ ISO 8 100,000
- ■ No Classification
- ☐ Laminar Flow
- ☐ Moveable T-stat

Humidity Control

- ■ 30%-50% RH
- ☐ 30%-50% RH Settable
- ☐ No Humidification

- ☐ Return Air Allowed
- ☐ Local FCU (Remote)
- ■ Positive Pressure
- ☐ Negative Pressure
- ☐ +/- 2% RH

Power Density

- ☐ 5 W/sf (2W/sf demand)
- ☐ 10 W/sf (5W/sf demand)
- ■ 20 W/sf (10W/sf demand)
- ☐ 30 W/sf (15W/sf demand)
- ☐ 50 W/sf (25W/sf demand)
- ☐ 80 W/sf (40 W/sf demand)
- ☐ 100 W/sf (50W/sf demand)
- ■ Pump Power
- ■ Instrument Power
- ☐ Clean Ground
- ■ Emergency Power

Electromagnetic Interference (EMI) Control

- ■ 100 nT RMS (300 nTp-p): General High Performance Lab
- ☐ 35 nT RMS (100 nTp-p): Dilution Refrigerator Lab
- ☐ 18 nT RMS (50 nTp-p): E Beam / FIB
- ☐ 11 nT RMS (30 nTp-p): SEM / TEM
- ☐ 4 nT RMS (10nTp-p): FEI Titan / JEOL 2100F

Architectural

- ☐ ESD Flooring
- ☐ Seamless Flooring
- ☐ Cryo Safe Flooring
- ☐ Chemical Resistant Flooring
- ■ Wall Mounts
- ■ Ceiling Mounts
- ■ Double Door
- ■ Windows Allowed

Infrastructure

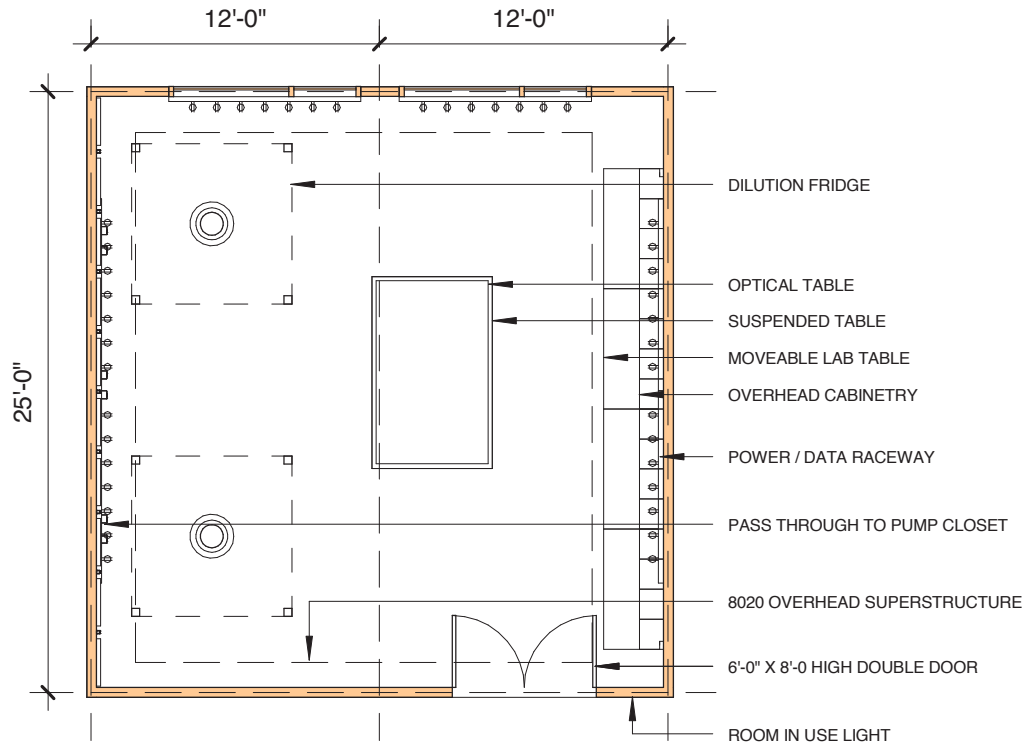
- ■ Clean Dry Air
- ☐ House Vacuum
- ■ House Nitrogen (gas)
- ☐ House Helium (gas)
- ■ Cylinder Gas Manifolds Qty 2
- ■ Helium Recovery (Vertical)
- ☐ Other _____
- ☐ 480V 3p Required

- ☐ Hot Water
- ☐ Cold Water
- ☐ RODI
- ☐ Eyewash (Tempered Water)
- ☐ Safety Shower (Tempered Water)
- ☐ Other _____
- ■ Data (Fiber)
- ■ Data (Copper)

- ☐ Fume Hood
- ☐ Snorkel Exhaust
- ☐ Biological Safety Cabinet
- ☐ HEPA Filter
- ☐ ULPA Filter
- ■ Process Chilled Water
  75 Percent of Power Demand
- ■ 12V DC LED Lighting
- ☐ Standard LED Lighting

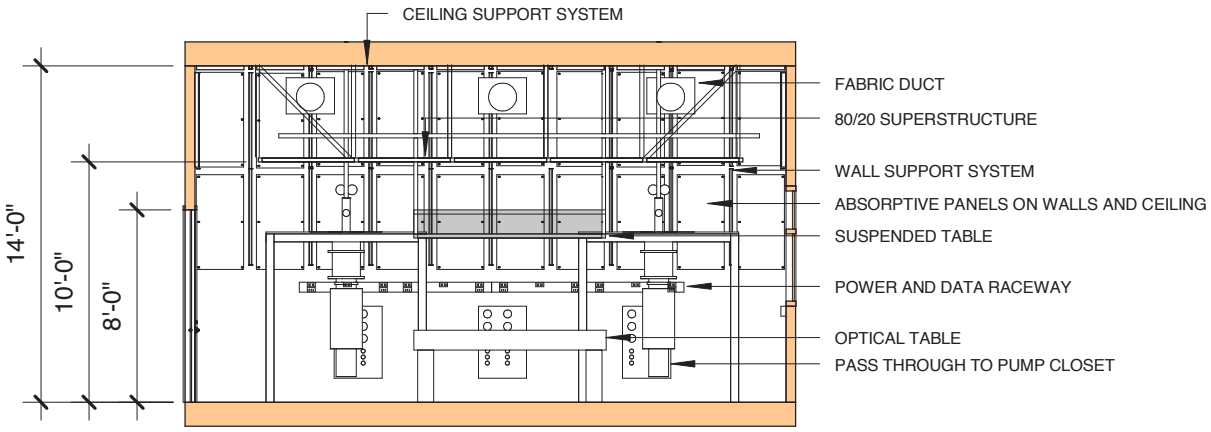
HYB Lab (Hybrid)

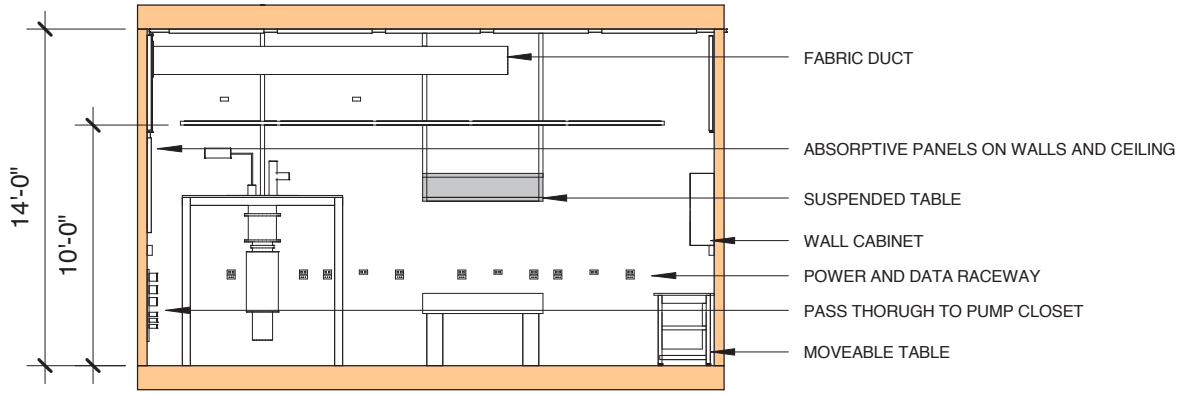
Research at the interface of solid-state, atomic, and optical physics has been growing steadily over recent years. For example, atoms and atomic-like systems can be used as very sensitive, nanoscale, optical probes of condensed matter systems. In another example, the field of optomechanics studies highly controlled interfaces between light and mechanical objects, with the ultimate goals of fundamental tests of quantum mechanics, hybrid quantum networks, and enhancing the sensitivity of mechanical detectors. For these types of experiments, lasers, optical components, helium cryostats (often closed cycle), and low vibration platforms are employed. Lab requirements include excellent temperature and humidity control, low dust environments, low acoustic noise, low vibrational noise, low electromagnetic noise, provision for laser safety, and several utilities such as gas handling, nitrogen gas, compressed air, DI water, equipment cooling water, and plentiful electrical power.nitrogen gas, compressed air, DI water, equipment cooling water, and plentiful electrical power).



HYB LAB - TWO BAY - 600 ASF

HYB Lab PLan



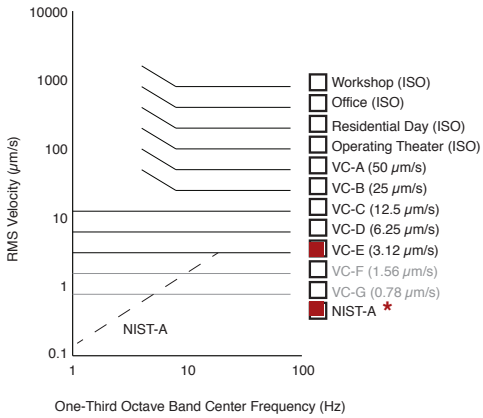


HYB Lab Sections

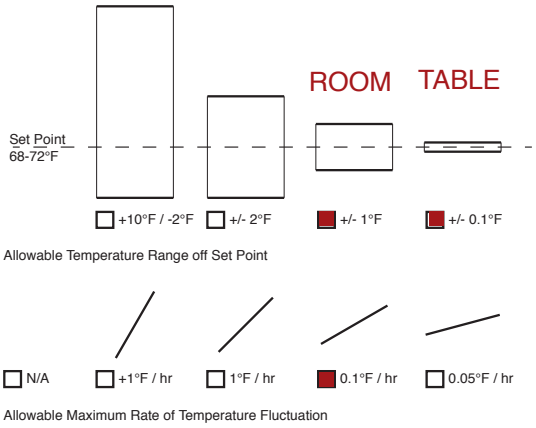
Laboratory Performance Criteria

Laboratory Type: HYB (Hybrid AMO/CMX)
Laboratory Function:
Description of Activities:

Vibration Control



Temperature Control



*Basement lab with isolated plinth

NOTE: Local Remote FCU to have 50% over-capacity, to be water based and controlled by user.

Acoustic Control

- ☐ NC-15 TEM / Recording
- ☐ NC-20 SEM
- ■ NC-25 Dil Fridge
- ☐ NC-30 High Perf Lab
- ☐ NC-35 Conference
- ☐ NC-40 Private Office
- ☐ NC-45 Open Office
- ☐ NC-50 Laboratory
- ☐ No Requirement

Air Quality

- ☐ ISO 3 1
- ☐ ISO 4 10
- ☐ ISO 5 100
- ☐ ISO 6 1,000
- ☐ ISO 7 10,000
- ☐ ISO 8 100,000
- ■ No Classification
- ■ Laminar Flow
- ■ Moveable T-stat

Humidity Control

- ■ 30%-50% RH
- ☐ 30%-50% RH Settable
- ☐ No Humidification

- ■ Return Air Allowed
- ■ Local FCU (Remote)
- ■ Positive Pressure
- ☐ Negative Pressure
- ■ +/- 2% RH

Power Density

- ☐ 5 W/sf (2W/sf demand)
- ☐ 10 W/sf (5W/sf demand)
- ☐ 20 W/sf (10W/sf demand)
- ☐ 30 W/sf (15W/sf demand)
- ☐ 50 W/sf (25W/sf demand)
- ■ 80 W/sf (40 W/sf demand)
- ☐ 100 W/sf (50W/sf demand)
- ■ Pump Power
- ■ Instrument Power
- ■ Clean Ground
- ■ Emergency Power

Electromagnetic Interference (EMI) Control

- ☐ 100 nT RMS (300 nTp-p): General High Performance Lab
- ☐ 35 nT RMS (100 nTp-p): Dilution Refrigerator Lab
- ☐ 18 nT RMS (50 nTp-p): E Beam / FIB
- ■ 11 nT RMS (30 nTp-p): SEM / TEM
- ☐ 4 nT RMS (10nTp-p): FEI Titan / JEOL 2100F

Architectural

- ■ ESD Flooring
- ☐ Seamless Flooring
- ☐ Cryo Safe Flooring
- ☐ Chemical Resistant Flooring
- ■ Wall Mounts
- ■ Ceiling Mounts
- ■ Double Door
- ☐ Windows Allowed

Infrastructure

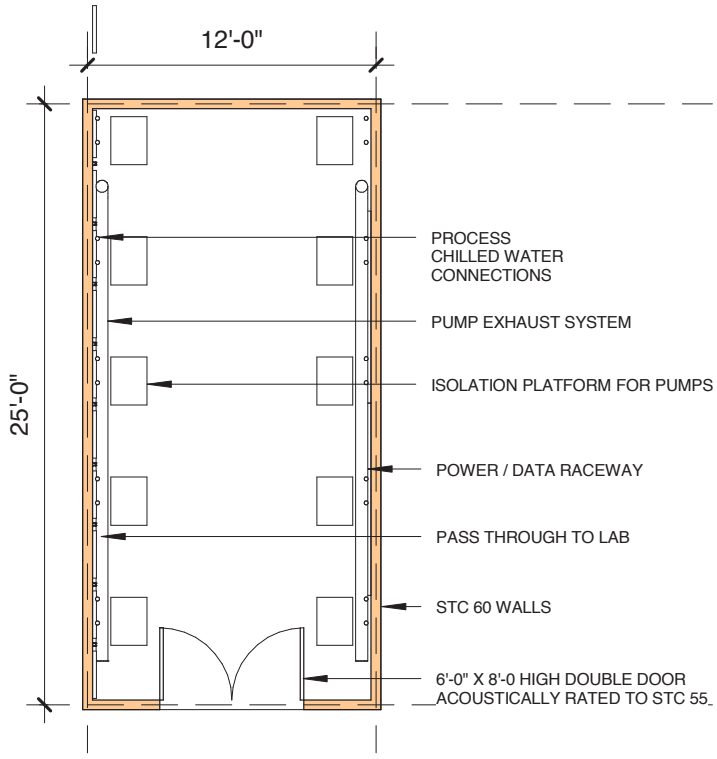
- ■ Clean Dry Air
- ☐ House Vacuum
- ■ House Nitrogen (gas)
- ☐ House Helium (gas)
- ■ Cylinder Gas Manifolds Qty 2
- ■ Helium Recovery (Vertical)
- ■ Other Pump Exhaust
- ■ 480V 3p Required

- ☐ Hot Water
- ☐ Cold Water
- ☐ RODI
- ☐ Eyewash (Tempered Water)
- ☐ Safety Shower (Tempered Water)
- ■ Other Laser in Use Light
- ■ Data (Fiber)
- ■ Data (Copper)

- ☐ Fume Hood
- ☐ Snorkel Exhaust
- ☐ Biological Safety Cabinet
- ■ HEPA Filter
- ■ ULPA Filter
- ■ Process Chilled Water
  75% Percent of Power Demand
- ■ 12V DC LED Lighting
- ☐ Standard LED Lighting

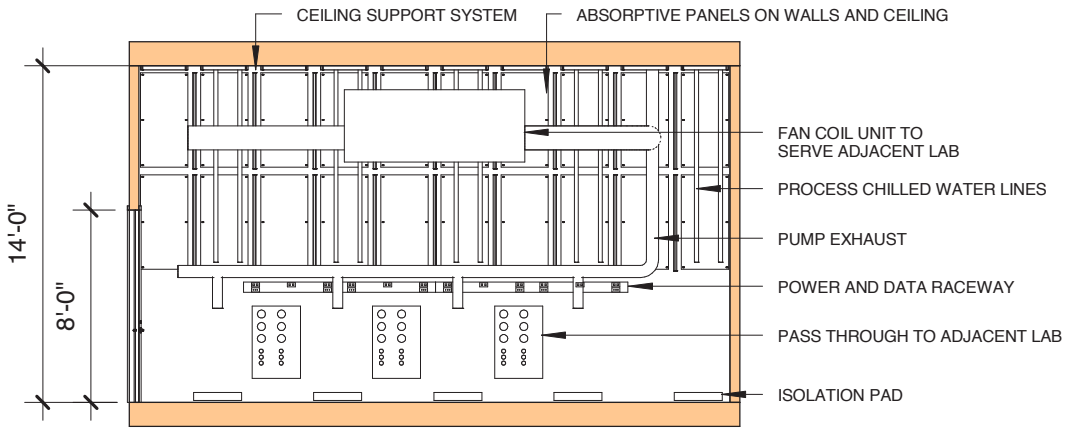
PMP Closet (Standard Support Lab for Pump and Chiller Systems)

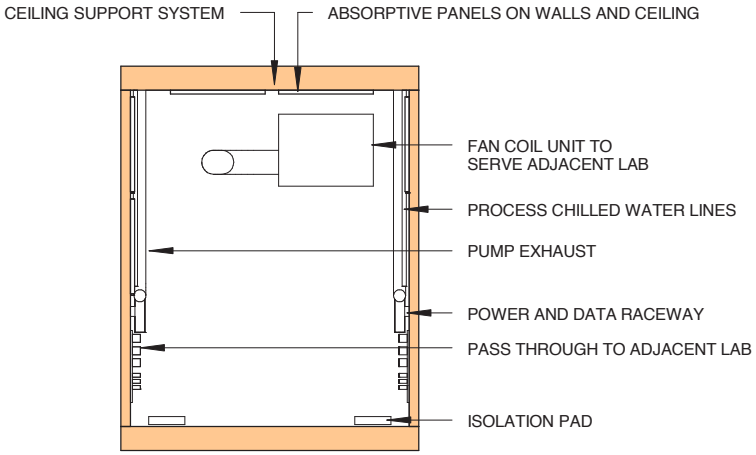
The pump closet supports many types of labs by providing segregated space for placement of noisy peripheral equipment.



PUMP CLOSET - ONE BAY - 300 ASF

Pump Closet Plans



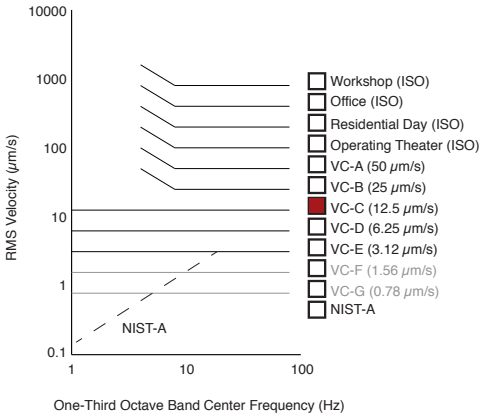


Pump Closet Sections

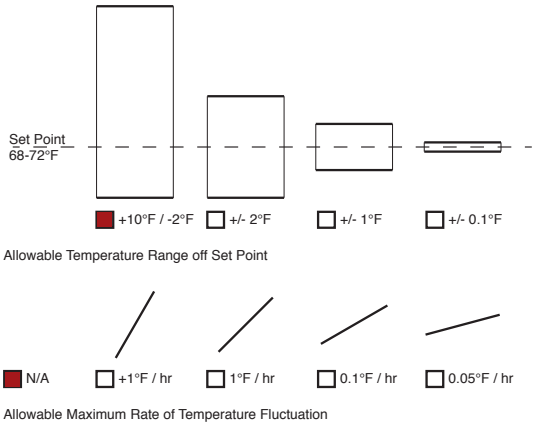
Laboratory Performance Criteria

Laboratory Type: Pump Closet
Laboratory Function: Support room for CMS, AMO, and other lab types
Description of Activities: Vibration and acoustically isolated room for pumps and chillers and local FCU

Vibration Control



Temperature Control



Acoustic Control

- ☐ NC-15 TEM / Recording
- ☐ NC-20 SEM
- ☐ NC-25 Dil Fridge
- ☐ NC-30 High Perf Lab
- ☐ NC-35 Conference
- ☐ NC-40 Private Office
- ☐ NC-45 Open Office
- ■ NC-50 Laboratory
- ☐ No Requirement

Air Quality

- ☐ ISO 3 1
- ☐ ISO 4 10
- ☐ ISO 5 100
- ☐ ISO 6 1,000
- ☐ ISO 7 10,000
- ☐ ISO 8 100,000
- ■ No Classification
- ☐ Laminar Flow
- ☐ Moveable T-stat
- ■ Pump Exhaust

Humidity Control

- ☐ 30%-50% RH
- ☐ 30%-50% RH Settable
- ■ No Humidification

- ■ Return Air Allowed
- ■ Local FCU (Remote)
- ☐ Positive Pressure
- ■ Negative Pressure
- ☐ +/- 2% RH

Power Density

- ☐ 5 W/sf (2W/sf demand)
- ☐ 10 W/sf (5W/sf demand)
- ☐ 20 W/sf (10W/sf demand)
- ☐ 30 W/sf (15W/sf demand)
- ☐ 50 W/sf (25W/sf demand)
- ☐ 80 W/sf (40 W/sf demand)
- ■ 100 W/sf (50W/sf demand)
- ■ Pump Power
- ☐ Instrument Power
- ☐ Clean Ground
- ■ Emergency Power

Electromagnetic Interference (EMI) Control

- ■ 100 nT RMS (300 nTp-p): General High Performance Lab
- ☐ 35 nT RMS (100 nTp-p): Dilution Refrigerator Lab
- ☐ 18 nT RMS (50 nTp-p): E Beam / FIB
- ☐ 11 nT RMS (30 nTp-p): SEM / TEM
- ☐ 4 nT RMS (10nTp-p): FEI Titan / JEOL 2100F

Architectural

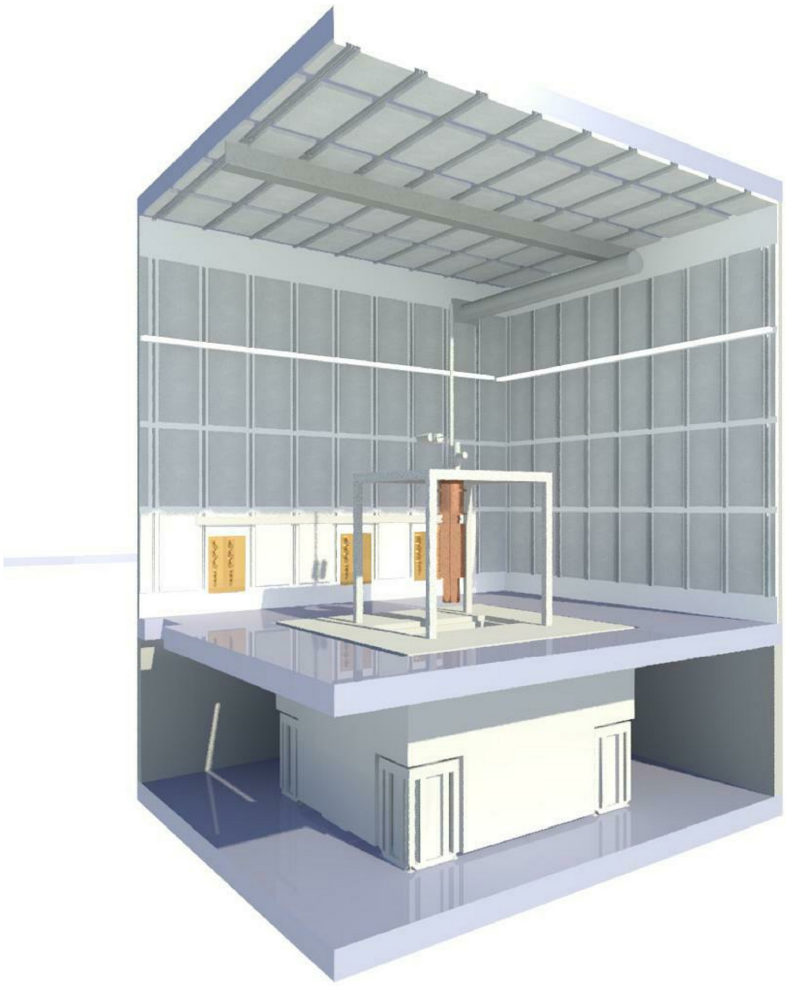
- ☐ ESD Flooring
- ☐ Seamless Flooring
- ☐ Cryo Safe Flooring
- ☐ Chemical Resistant Flooring
- ■ Wall Mounts
- ■ Ceiling Mounts
- ■ Double Door
- ■ Windows Allowed

Infrastructure

- ■ Clean Dry Air
- ☐ House Vacuum
- ■ House Nitrogen (gas)
- ☐ House Helium (gas)
- ■ Cylinder Gas Manifolds Qty 2
- ■ Helium Recovery (Vertical)
- ■ Other Pump Exhaust
- ■ 480V 3p Required

- ☐ Hot Water
- ☐ Cold Water
- ☐ RODI
- ☐ Eyewash (Tempered Water)
- ☐ Safety Shower (Tempered Water)
- ☐ Other _____
- ■ Data (Fiber)
- ■ Data (Copper)

- ☐ Fume Hood
- ☐ Snorkel Exhaust
- ☐ Biological Safety Cabinet
- ☐ HEPA Filter
- ☐ ULPA Filter
- ■ Process Chilled Water
  75% Percent of Power Demand
- ■ 12V DC LED Lighting
- ☐ Standard LED Lighting



STM Lab (Scanning /Transport /Microscopy / High Stability Lab)

Nanoscale scanning probe microscopy allows microscopic imaging of diverse material and device properties under extreme conditions, providing a central tool both for materials science and for the fundamental physics of solid-state systems. Nanoscale probes require a unique, ultra-stable and quiet environment that allows sensors and target materials to be positioned within angstroms of each other, often for periods as long as months. To create the requisite conditions, scanning probe labs require ultra-low vibration, often accomplished with multiple stages of passive and active isolation, as well as good acoustic insulation extending to low frequencies. High sensitivity experiments are typically conducted in liquid Helium cryostats, and provisions must be made for helium recovery and recondensation systems. Such systems, which require cooling water and considerable electrical power, must be well isolated to protect sensitive experiments while being connected via leak tight gas lines. The wide array of scanning probe technologies includes laser and magnetic probes that may require provisions for laser safety or a low noise electromagnetic environment.

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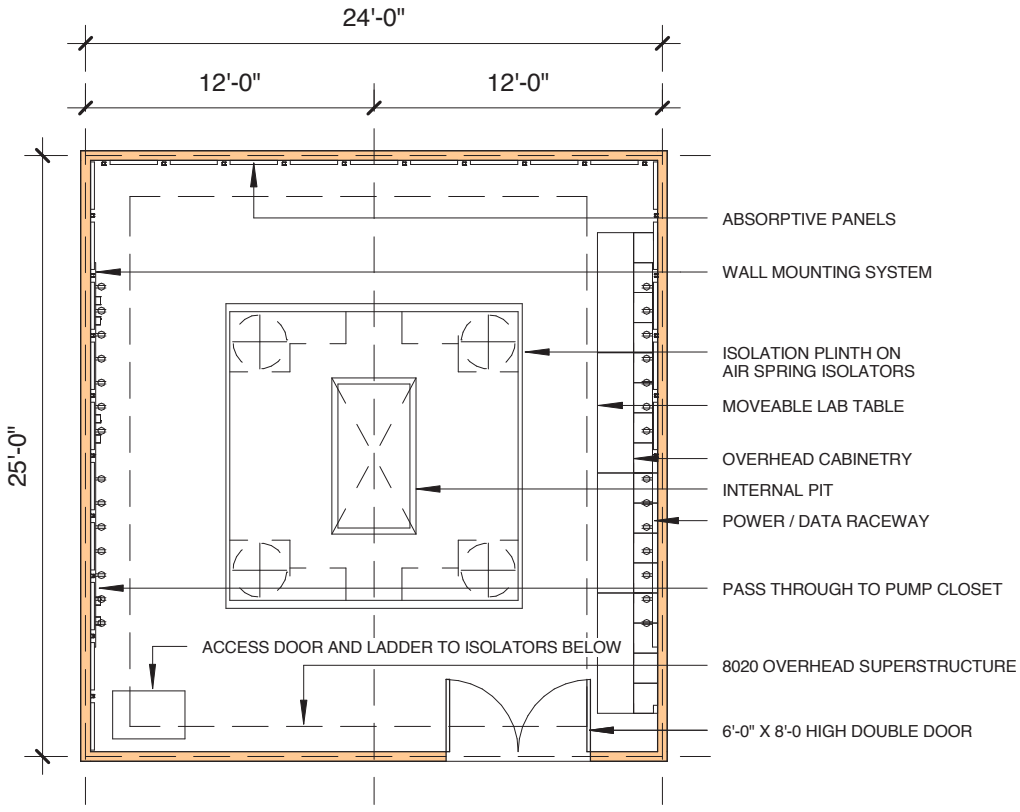
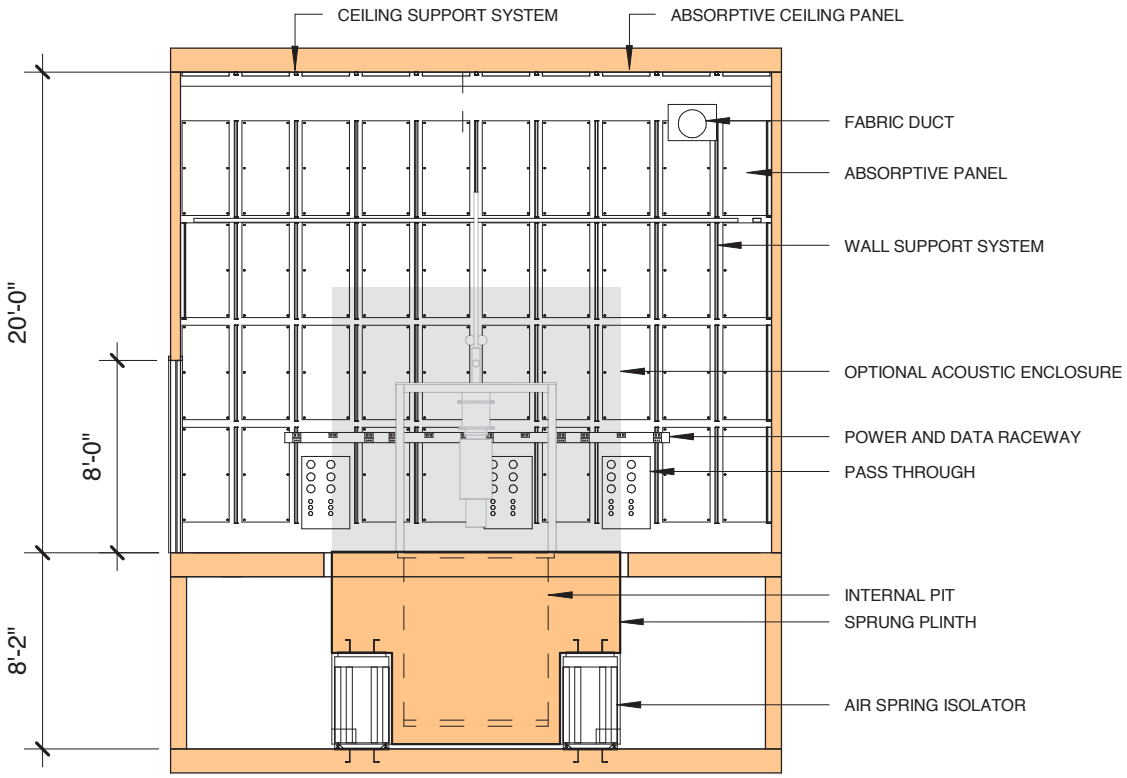
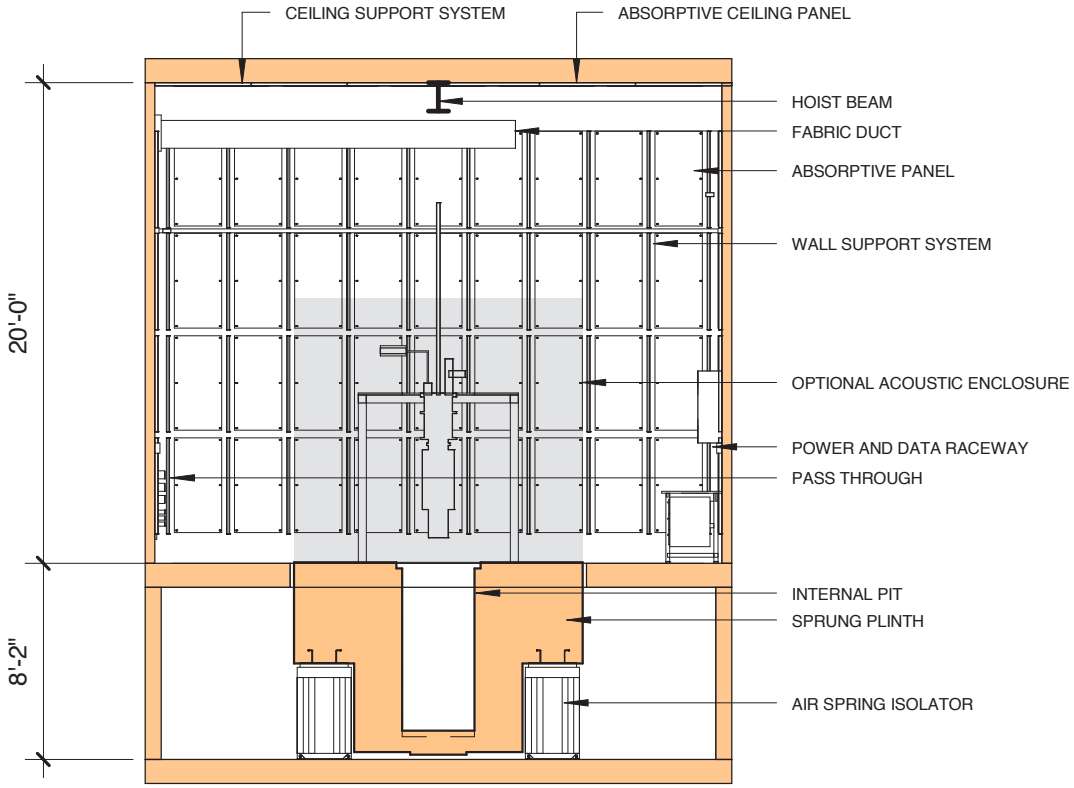


STM LAB - TWO BAY - 600 ASF

STM Lab Section



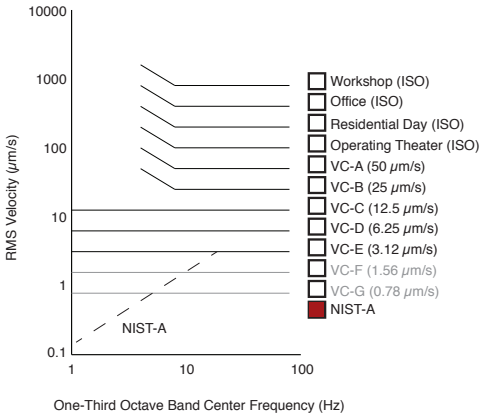


STM Lab Sections

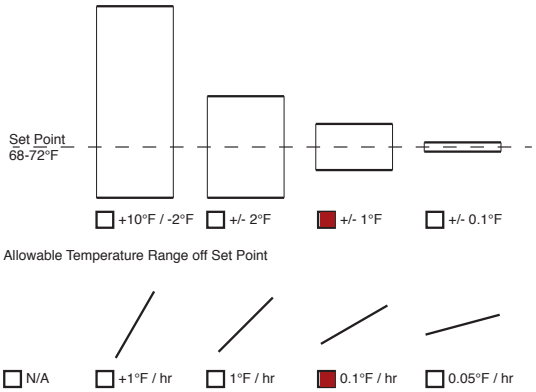
Laboratory Performance Criteria

Laboratory Type: STM Lab
Laboratory Function: High stability lab
Description of Activities: Scanning transport microscopy

Vibration Control



Temperature Control



Acoustic Control

- ■ NC-15 TEM / Recording
- ☐ NC-20 SEM
- ☐ NC-25 Dil Fridge
- ☐ NC-30 High Perf Lab
- ☐ NC-35 Conference
- ☐ NC-40 Private Office
- ☐ NC-45 Open Office
- ☐ NC-50 Laboratory
- ☐ No Requirement
- ■ Optional Acoustic Enclosure

Air Quality

- ☐ ISO 3 1
- ☐ ISO 4 10
- ☐ ISO 5 100
- ☐ ISO 6 1,000
- ☐ ISO 7 10,000
- ☐ ISO 8 100,000
- ■ No Classification
- ■ Laminar Flow
- ■ Moveable T-stat

Humidity Control

- ■ 30%-50% RH
- ☐ 30%-50% RH Settable
- ☐ No Humidification

- ■ Return Air Allowed
- ■ Local FCU (Remote)
- ■ Positive Pressure
- ☐ Negative Pressure
- ■ +/- 5% RH

Power Density

- ☐ 5 W/sf (2W/sf demand)
- ☐ 10 W/sf (5W/sf demand)
- ☐ 20 W/sf (10W/sf demand)
- ☐ 30 W/sf (15W/sf demand)
- ☐ 50 W/sf (25W/sf demand)
- ■ 80 W/sf (40 W/sf demand)
- ☐ 100 W/sf (50W/sf demand)
- ■ Pump Power
- ■ Instrument Power
- ■ Clean Ground
- ■ Emergency Power

Electromagnetic Interference (EMI) Control

- ☐ 100 nT RMS (300 nTp-p): General High Performance Lab
- ☐ 35 nT RMS (100 nTp-p): Dilution Refrigerator Lab
- ■ 18 nT RMS (50 nTp-p): E Beam / FIB
- ☐ 11 nT RMS (30 nTp-p): SEM / TEM
- ☐ 4 nT RMS (10nTp-p): FEI Titan / JEOL 2100F

Architectural

- ■ ESD Flooring
- ■ Seamless Flooring
- ■ Cryo Safe Flooring
- ☐ Chemical Resistant Flooring
- ■ Wall Mounts
- ■ Ceiling Mounts
- ■ Double Door
- ☐ Windows Allowed

Infrastructure

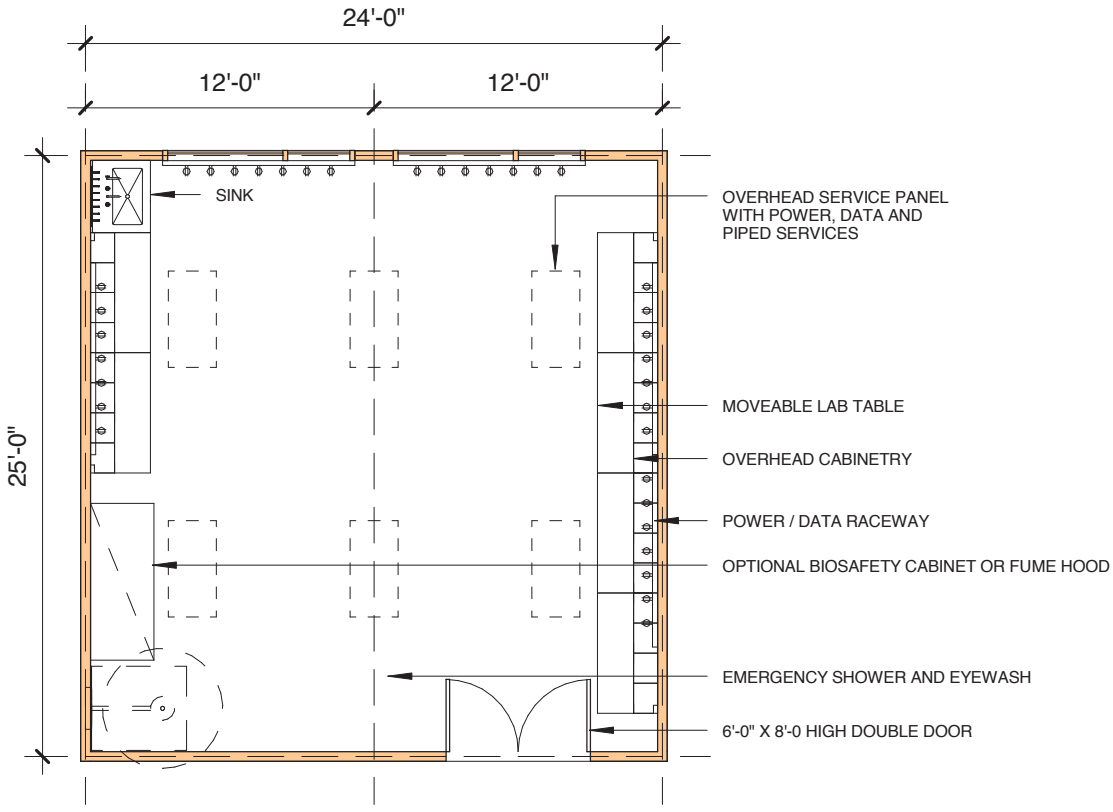
- ■ Clean Dry Air
- ☐ House Vacuum
- ■ House Nitrogen (gas)
- ☐ House Helium (gas)
- ■ Cylinder Gas Manifolds Qty 2
- ■ Helium Recovery (Vertical)
- ■ Other Pump exhaust
- ☐ 480V 3p Required

- ☐ Hot Water
- ☐ Cold Water
- ☐ RODI
- ☐ Eyewash (Tempered Water)
- ☐ Safety Shower (Tempered Water)
- ■ Other Room in use light
- ■ Data (Fiber)
- ■ Data (Copper)

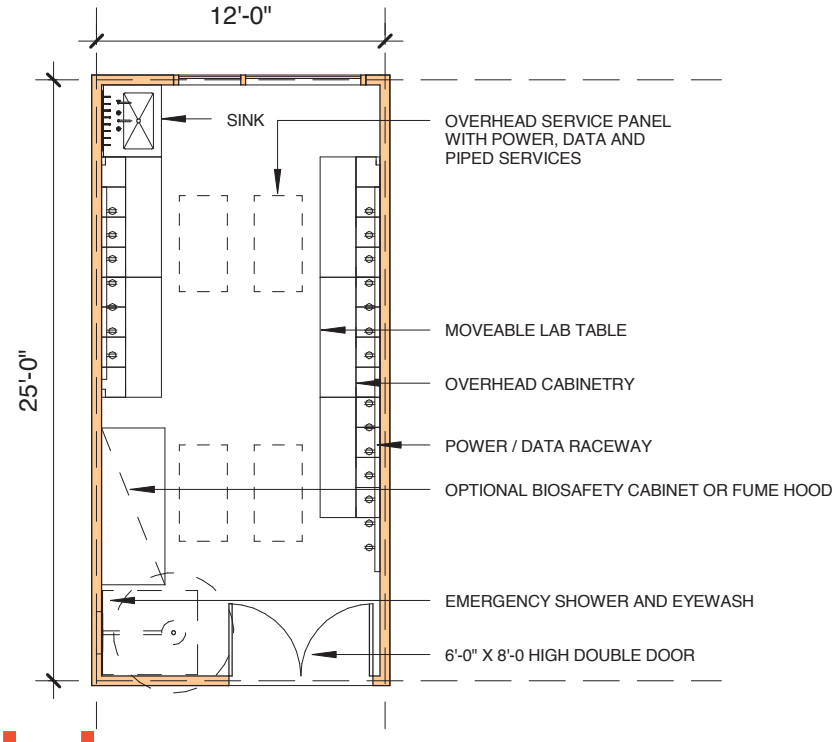
- ☐ Fume Hood
- ☐ Snorkel Exhaust
- ☐ Biological Safety Cabinet
- ■ HEPA Filter
- ☐ ULPA Filter
- ■ Process Chilled Water
  75%Percent of Power Demand
- ■ 12V DC LED Lighting
- ☐ Standard LED Lighting

Wet Lab (Wet Laboratory for BioPhysics)

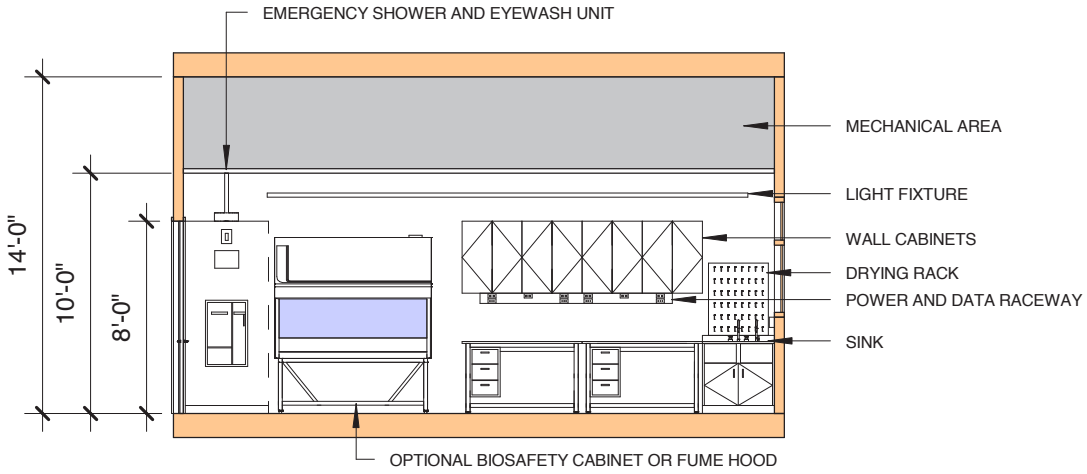
Biophysics experiments require high-quality standard wet lab space, similar to what one would find in a modern biology or chemistry department, for the preparation of chemical, biochemical, and biological samples. To support cell culture and preparation of ultra-pure samples, these labs should also provide precise climate control and filtered air.

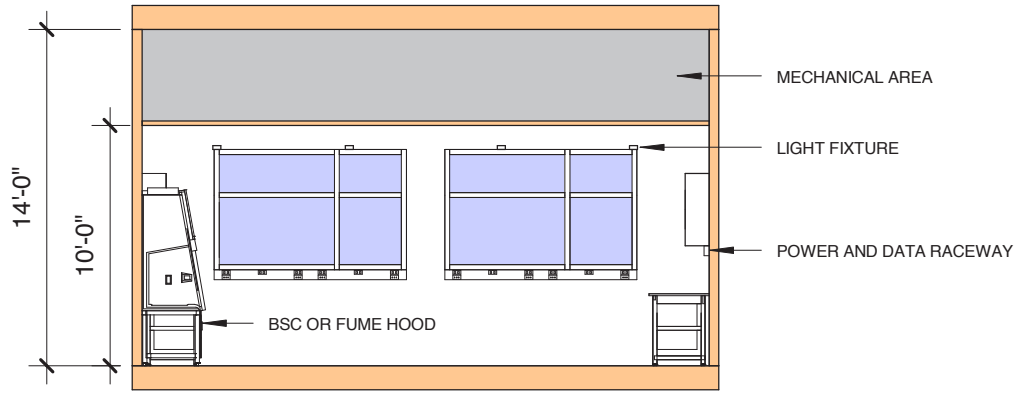


WET LAB - TWO BAY - 600 ASF



Wet Lab Plan



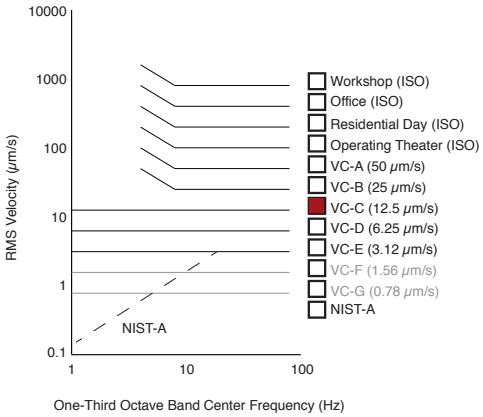


Wet Lab Sections

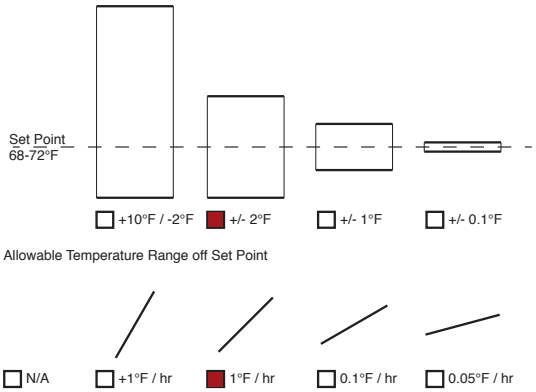
Laboratory Performance Criteria

Laboratory Type: Wet Lab
Laboratory Function: General Purpose lab with wet functions
Description of Activities: Biophysics, tissue culture, sample preparation

Vibration Control



Temperature Control



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- ☐ NC-15 TEM / Recording
- ☐ NC-20 SEM
- ☐ NC-25 Dil Fridge
- ☐ NC-30 High Perf Lab
- ☐ NC-35 Conference
- ☐ NC-40 Private Office
- ☐ NC-45 Open Office
- ■ NC-50 Laboratory
- ☐ No Requirement

Air Quality

- ☐ ISO 3 1
- ☐ ISO 4 10
- ☐ ISO 5 100
- ☐ ISO 6 1,000
- ☐ ISO 7 10,000
- ☐ ISO 8 100,000
- ■ No Classification
- ☐ Laminar Flow
- ☐ Moveable T-stat

Humidity Control

- ☐ 30%-50% RH
- ☐ 30%-50% RH Settable
- ■ No Humidification

- ☐ Return Air Allowed
- ☐ Local FCU (Remote)
- ■ Positive Pressure
- ☐ Negative Pressure
- ☐ +/- 2% RH

Power Density

- ☐ 5 W/sf (2W/sf demand)
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- ☐ 80 W/sf (40 W/sf demand)
- ☐ 100 W/sf (50W/sf demand)
- ☐ Pump Power
- ■ Instrument Power
- ☐ Clean Ground
- ■ Emergency Power

Electromagnetic Interference (EMI) Control

- ■ No Requirement
- ☐ 100 nT RMS (300 nTp-p): General High Performance Lab
- ☐ 35 nT RMS (100 nTp-p): Dilution Refrigerator Lab
- ☐ 18 nT RMS (50 nTp-p): E Beam / FIB
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Architectural

- ☐ ESD Flooring
- ■ Seamless Flooring
- ☐ Cryo Safe Flooring
- ■ Chemical Resistant Flooring
- ☐ Wall Mounts
- ☐ Ceiling Mounts
- ■ Double Door
- ■ Windows Allowed

Infrastructure

- ■ Clean Dry Air
- ■ House Vacuum
- ■ House Nitrogen (gas)
- ☐ House Helium (gas)
- ■ Cylinder Gas Manifolds Qty CO2
- ☐ Helium Recovery (Vertical)
- ☐ Other _____
- ☐ 480V 3p Required

- ■ Hot Water
- ■ Cold Water both Lab and Potable
- ■ RODI
- ■ Eyewash (Tempered Water)
- ■ Safety Shower (Tempered Water)
- ☐ Other _____
- ■ Data (Fiber) 20 ports
- ■ Data (Copper)

- ■ Fume Hood
- ☐ Snorkel Exhaust
- ■ Biological Safety Cabinet
- ■ HEPA Filter
- ☐ ULPA Filter
- ☐ Process Chilled Water
  ____Percent of Power Demand
- ☐ 12V DC LED Lighting
- ■ Standard LED Lighting

UCSB

PROGRAM DOCUMENT

13 June 2016

APPENDIX A: CATEGORIZED PROGRAM

lab
Life. Science. Architecture, Inc.

Table of Contents

110 Classroom

	Building	New Space Needs				Current Broida Space		
Code	Space Category	Room Name	Quantity	Unit Area (ASF)	Area Subtotal	Room Name	Area Subtotal	
110	**Classroom**	Large Lecture	1.0	2800	2,800	Large Lecture	2,813	
		Small Lecture	1.0	1000	1,000	Small Lecture	1,000	
						Demolish Large Lecture	-2,813	
						Demolish Small Lecture	-1,000	
110	**Classroom**		2		3,800			**3,800**

TOTAL REQUIREMENT

Program area assumed to be in new construction	3,800
Total of Program area in Renovated Broida	0
	3,800

125 Classroom Service

	Building	New Space Needs				Current Broida Space		
Code	**Space Category**	Room Name	Quantity	Unit Area (ASF)	Area Subtotal	Room Name	Area Subtotal	
125	**Classroom Service**	Lecture Prep	5.0	300	1,500	Lecture Prep	1,500	
						Lecture Prep	229	
						Demolish Lecture Prep	-1,500	
						Demolish Lecture Prep	-229	
125	**Classroom Service**		5		1,500			**1,500**

TOTAL REQUIREMENT

Program area assumed to be in new construction	1,500
Total of Program area in Renovated Broida	0
	1,500

210 Research Lab

	Building	New Space Needs				Current Broida Space		
Code	**Space Category**	Room Name	Quantity	Unit Area (ASF)	Area Subtotal	Room Name	Area Subtotal	
210	**Research Lab**	AMO	30.0	300	9,000	Research Lab (L1)	13,783	
		CMX	45.5	300	13,650	Research Lab (L2)	3,776	
		STM	8.0	300	2,400	Research Lab (L3)	2,755	
		HYB	11.0	300	3,300	Research Lab (L4)	6,716	
		CTL	8.5	300	2,550	Research Lab (L5)	2,465	
		PMP	24.5	300	7,350	Research Lab (L6)	2,449	
		CLN	18.5	300	5,550			
		DRY	54.0	300	16,200			
		WET	28.5	300	8,550	Exclude Inst. Terahertz	-2,855	
		DRK	14.5	300	4,350			
		subtotal	243.0		72,900			
		Less Broida			-29,089			
210	**Research Lab**				43,811		29,089	**72,900**

TOTAL REQUIREMENT

Labs in gold are assumed to be in new construction	42,600
Other labs in new construction to be determined during programming phase	450
Total of Lab Space in New Construction	43,050
Total of Lab Space in Renovated Broida	29,850
	72,900

Note: All above grade labs shall be capable of having laboratory sinks and plumbing installed for flexibility to convert to WET lab types in the future.

Complete renovation of Broida, including enclosing the exterior corridors for use as dust-free, climate controlled laboratory

211 Research Office

	Building	New Space Needs				Current Broida Space		
Code	**Space Category**	Room Name	Quantity	Unit Area (ASF)	Area Subtotal	Room Name	Area Subtotal	
211	**Research Office**					Research Office (L1)	2,031	
		Research Office _PD	100.0	70	7,000	Research Office (L2)	2,183	
		Research Office_Grad	200.0	40	8,000	Research Office (L3)	129	
						Research Office (L4)	2,586	
						Research Office (L5)	1,156	
						Research Office (L6)	1,403	
		Less Broida			-9,488			
211	**Research Office**				5,512		9,488	**15,000**

TOTAL REQUIREMENT

Research Offices assumed to be in new construction	4,750
Total of Research Offices in Renovated Broida	10,250
	15,000

225 Research Lab Services

	Building	New Space Needs				Current Broida Space		
Code	**Space Category**	Room Name	Quantity	Unit Area (ASF)	Area Subtotal	Room Name	Area Subtotal	
225	**Research Lab Service**	Cold Room (Bio)	0.5	300	150	Res. Lab. Srvc. (L1)	3,705	
		Freezer Room (Bio)	1.0	300	300	Res. Lab. Srvc. (L2)	0	
		Chem Prep (Bio)	3.0	300	900	Res. Lab. Srvc. (L3)	0	
		High Bay Assembly Lab (in PSB)	1.0		0	Res. Lab. Srvc. (L4)	100	
		Autoclave (Bio)	0.5	300	150	Res. Lab. Srvc. (L5)	666	
		Tissue Culture (Bio)	1.0	300	300	Res. Lab. Srvc. (L6)	0	
		Frogs / Fish Transfer Room	0.5	300	150			
		Shared Prep (CMX)	2.0	300	600	Exclude Inst. Terahertz	-2,855	
		Remote Observing Room	2.0	300	600			
		subtotal	11.5		3,150			
		Less Broida			-1,617			
225	**Research Lab Service**				1,533		1,617	**3,150**

TOTAL REQUIREMENT

Research Lab Service assumed to be in new construction	1,580
Total of Research Lab Service in Renovated Broida	1,570
	3,150

250 Scholarly Activity

	Building	New Space Needs				Current Broida Space		
Code	Space Category	Room Name	Quantity	Unit Area (ASF)	Area Subtotal	Room Name	Area Subtotal	
250	**Scholarly Activity**					Scholarly Activity (L3)	935	
						Scholarly Activity (L6)	522	
		Theorist Commons	2.0	150	300			
		Commons (1 per floor)	7.0	300	2,100			
		Faculty Commons	1.0	900	900			
		Video Conference	1.0	300	300			
		Small Mtg	4.0	150	600			
250	**Scholarly Activity**				4,200		1,457	**5,657**

TOTAL REQUIREMENT

Scholarly Activity assumed to be in new construction	3,790
Total of Scholarly Activity in Renovated Broida	1,867
	5,657

260 Class Lab

	Building	New Space Needs				Current Broida Space		
Code	**Space Category**	Room Name	Quantity	Unit Area (ASF)	Area Subtotal	Room Name	Area Subtotal	
260	**Class Lab**	Electronics (Phys 127)	1.0	600	600	Class Lab (L2)	1,915	
		Phys 134 /150	1.0	600	600	Class Lab (L3)	1,905	
		Phys 25	2.0	600	1200			
260	**Class Lab**				2,400		3,820	**6,220**

TOTAL REQUIREMENT

Program area assumed to be in new construction	0
Total of Program area in Renovated Broida	6,220
	6,220

261 Special Class Lab

	Building	New Space Needs				Current Broida Space		
Code	**Space Category**	Room Name	Quantity	Unit Area (ASF)	Area Subtotal	Room Name	Area Subtotal	
261	**Special Class Lab**	Special Class Lab	3.0	300	900.0		0.0	
		Senior Lab (Phys 128)	3.0	300	900.0	Special Class Lab (L3)	2,570.0	
		Honors (Phys 13)	1.0	300	300.0		0.0	
							0.0	
							0.0	
							0.0	
261	**Special Class Lab**				2,100		2,570	**4,670**

TOTAL REQUIREMENT

Program area assumed to be in new construction	0
Total of Program area in Renovated Broida	4,670
	4,670

265 Class Lab Service

	Building	New Space Needs				Current Broida Space		
Code	**Space Category**	Room Name	Quantity	Unit Area (ASF)	Area Subtotal	Room Name	Area Subtotal	
265	**Class Lab Service**	Class Lab Service	1.0	600	600.0	Class Lab Service (L2)	615.0	
						Class Lab Service(L3)	93.0	
265	**Class Lab Service**				600		708	**1,308**

TOTAL REQUIREMENT

Program area assumed to be in new construction	0
Total of Program area in Renovated Broida	1,308
	1,308

270 Open Laboratory

	Building	New Space Needs				Current Broida Space		
Code	**Space Category**	Room Name	Quantity	Unit Area (ASF)	Area Subtotal	Room Name	Area Subtotal	
270	**Open Laboratory**	Undergraduate TA Study	1.0	1000	1,000.0	Open Laboratory (L1)	857.0	
						Open Laboratory (L2)	0.0	
						Open Laboratory (L3)	0.0	
						Open Laboratory (L4)	0.0	
						Open Laboratory (L5)	309.0	
						Open Laboratory (L6)	0.0	
270	**Open Laboratory**				1,000		1,166	**2,166**

TOTAL REQUIREMENT

Program area assumed to be in new construction	0
Total of Program area in Renovated Broida	2,166
	2,166

275 Open Lab Service

	Building	New Space Needs				Current Broida Space		
Code	Space Category	Room Name	Quantity	Unit Area (ASF)	Area Subtotal	Room Name	Area Subtotal	
275	Open Lab Service	Open Lab Srvc.	0.5	300	150.0	Open Lab Srvc. (L1)	122.0	
275	Open Lab Service				150		122	272

TOTAL REQUIREMENT

Program area assumed to be in new construction	0
Total of Program area in Renovated Broida	272
	272

310 Academic Office

	Building	New Space Needs				Current Broida Space		
Code	**Space Category**	Room Name	Quantity	Unit Area (ASF)	Area Subtotal	Room Name	Area Subtotal	
310	**Academic Office**	Acad. Office _Faculty	60.0	170	10,200	Academic Office (L1)	238	
		Visitor	5.0	170	850	Academic Office (L2)	2,753	
		Emeriti	10.0	170	1,700	Academic Office (L3)	587	
		Lecturer	6.0	170	1,020	Academic Office (L4)	1,695	
		Temp Lecturer	3.0	170	510	Academic Office (L5)	1,194	
						Academic Office (L6)	3,224	
		Less Broida			-9,691			
310	**Academic Office**		84		4,589		9,691	**14,280**

TOTAL REQUIREMENT

Program area assumed to be in new construction	14,280
Total of Program area in Renovated Broida	0
	14,280

320 Administrative Office

	Building	New Space Needs				Current Broida Space		
Code	**Space Category**	Room Name	Quantity	Unit Area (ASF)	Area Subtotal	Room Name	Area Subtotal	
320	**Administrative Office**	Administrative Office	40.0	120	4,800	Administrative Office (L1)	170	
		Physics Computing Services	2.0	300	600	Administrative Office (L2)	0	
						Administrative Office (L3)	2,600	
						Administrative Office (L4)	270	
						Administrative Office (L5)	1,471	
						Administrative Office (L6)	141	
		Less Broida			-4,652			
320	**Administrative Office**		42		748		4,652	**5,400**

TOTAL REQUIREMENT

Program area assumed to be in new construction	750
Total of Program area in Renovated Broida	4,650
	5,400

335 Office Service

	Building	New Space Needs				Current Broida Space		
Code	**Space Category**	Room Name	Quantity	Unit Area (ASF)	Area Subtotal	Room Name	Area Subtotal	
335	**Office Service**	Office Service	2.0	300	600	Office Service (L1)	0	
						Office Service (L2)	689	
						Office Service (L3)	241	
						Office Service (L4)	0	
						Office Service (L5)	0	
						Office Service (L6)	34	
335	**Office Service**				600		964	**1,564**

TOTAL REQUIREMENT

Program area assumed to be in new construction	0
Total of Program area in Renovated Broida	1,564
	1,564

340 Conference Room

	Building	New Space Needs				Current Broida Space		
Code	**Space Category**	Room Name	Quantity	Unit Area (ASF)	Area Subtotal	Room Name	Area Subtotal	
340	**Conference Room**	Conference Room	0.0	300	0			
						Conference Room (L5)	313	
340	**Conference Room**						313	**313**

TOTAL REQUIREMENT

Program area assumed to be in new construction	0
Total of Program area in Renovated Broida	313
	313

510 Central Computer

	Building	New Space Needs				Current Broida Space		
Code	**Space Category**	Room Name	Quantity	Unit Area (ASF)	Area Subtotal	Room Name	Area Subtotal	
510	**Central Computer**	Central Computer	1.0	300	300.0			
						Central Computer (L5)	313.0	
510	**Central Computer**		1		300		313	**613**

TOTAL REQUIREMENT

Program area assumed to be in new construction	0
Total of Program area in Renovated Broida	613
	613

720 Storage

	Building	New Space Needs				Current Broida Space		
Code	**Space Category**	Room Name	Quantity	Unit Area (ASF)	Area Subtotal	Room Name	Area Subtotal	
720	**Storage**	Storage	3.0	300	900	Storage (L1)	100	
720	**Storage**		3		900		100	**1,000**

TOTAL REQUIREMENT

Program area assumed to be in new construction	500
Total of Program area in Renovated Broida	500
	1,000