

CLEANLINESS ISSUES FOR ADVANCED LIGO INSTALLATIONS

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LSC MEETING – MARCH 2006

The Following Advisories are
based on Experiences,
Improvements and Techniques
Learned and Developed from Initial
LIGO Installations.

- Recommendations are given with a “what's practical and reasonable” line of thinking.

Cleanliness

Requirements/Improvements for Advanced LIGO Installations

- ‘**Travelers**’ to control and record material processes like cleaning parts, vacuum baking and their RGA scans. Travelers should be maintained with the assembly procedures during builds. Travelers will then be filed with the DCC.
- **Lab Air Handling** - Increase the use of HEPA panels, soft wall enclosures and laminar flow benches with ion bars.
- HVAC system to maintain a positive pressure and flow. (No current controllable humidity on HVAC system).
- **Lab Maintenance** – Restrict access, use regular cleaning cycles (janitorial).
- Proper use of clean room garb, clean room practices and contamination controls.
- **Material Handling** - proper handling, transportation and storage of components waiting vacuum installation.

Cleanliness

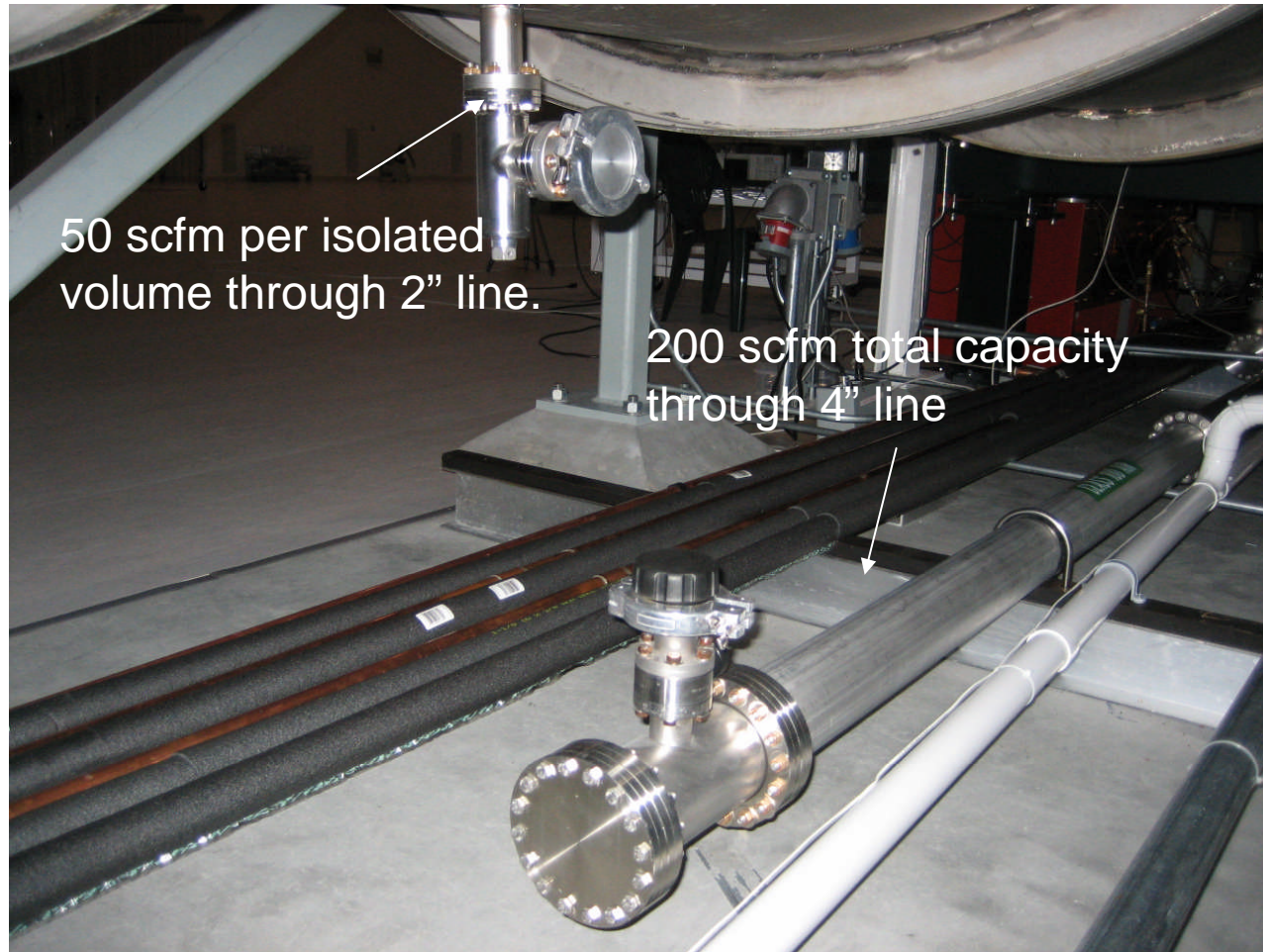
Requirements/Improvements for Advanced LIGO Installations

- **Vent Preparations:** LVEA and VEAs - Restrict access, increase regular cleaning cycles (janitorial).
- Minimal gowning of frocks, caps and shoe covers to enter LVEA and VEAs.
- Continuously monitor particle counts from 2 locations. Maintain cleanliness in LVEA to produce counts of less than 100 per average count of 5microns with activities (class 100).
- LVEA and VEA - HVAC should be producing a positive pressure and air flow.
- **Chamber Vents:** Single isolatable volume vents due to purge air limitations (200 scfm total capacity with 50 scfm available to each isolatable volume).
- Wipe down chambers from top to bottom prior to door removal.
- Install additional soft wall enclosure over chamber openings and seal.
- Wet mop floor under soft wall enclosure just prior to pulling door.
- Door remains mounted until particle counts under soft wall enclosures read “zero”.
- If possible only remove a single door per chamber and cover opening with fitted soft cover.
- When overhead crane is used for BSC dome removal or SUS installations utilize soft cover socks to seal crane shedding.
- Use additional HEPA soft wall enclosures for gowning.
- Use a laminar flow benches for staging Class ‘A’ & ‘B’ components.

Working inside the Vacuum Vessels

- Carefully plan vent and follow an approved Installation Specification.
- Minimize chamber tourism.
- Minimize non “Class” ‘A’ hardware in side.
- Minimize time spent inside.
- Adhere strictly to established contamination controls.
- Change garb frequently.

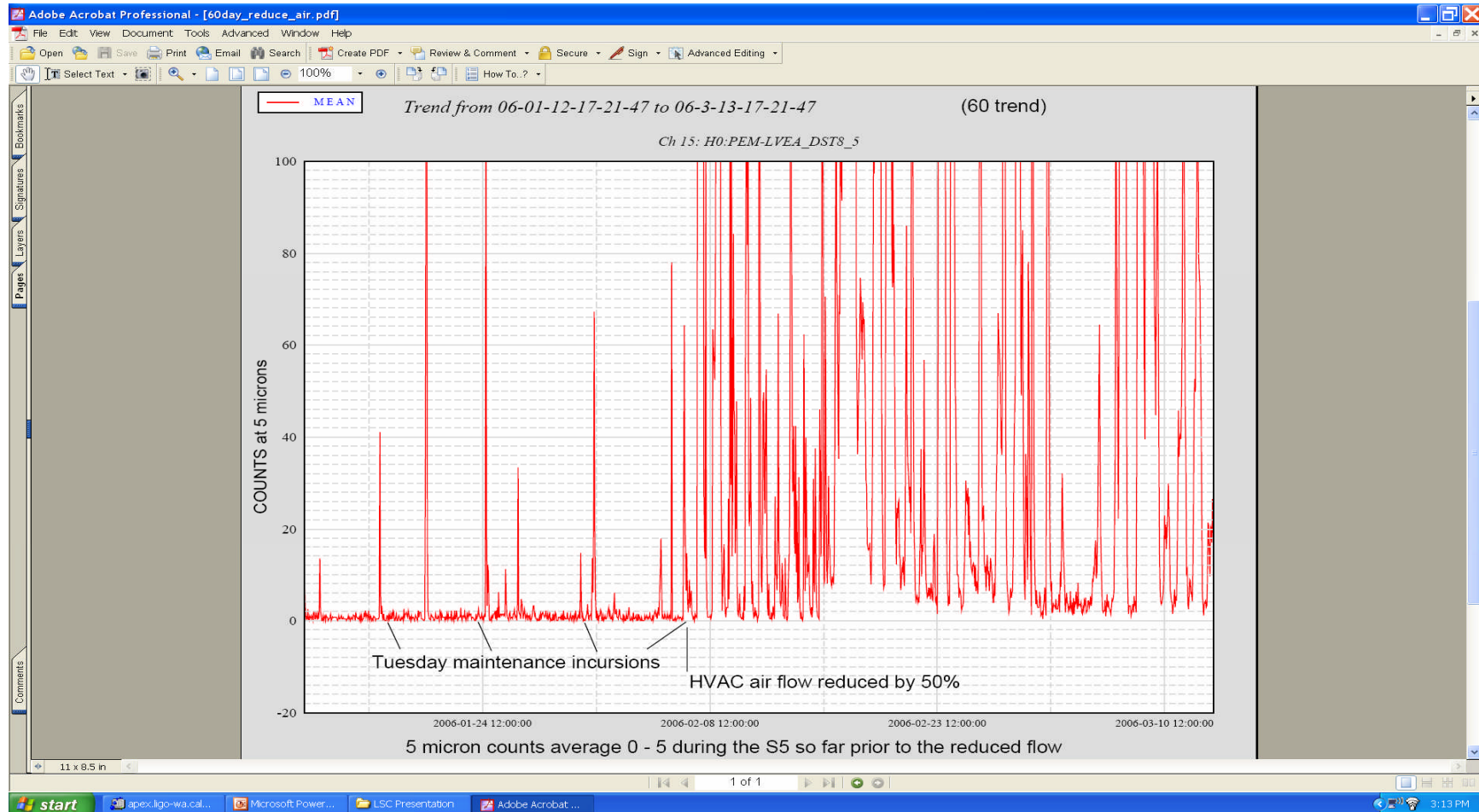
Purge Lines



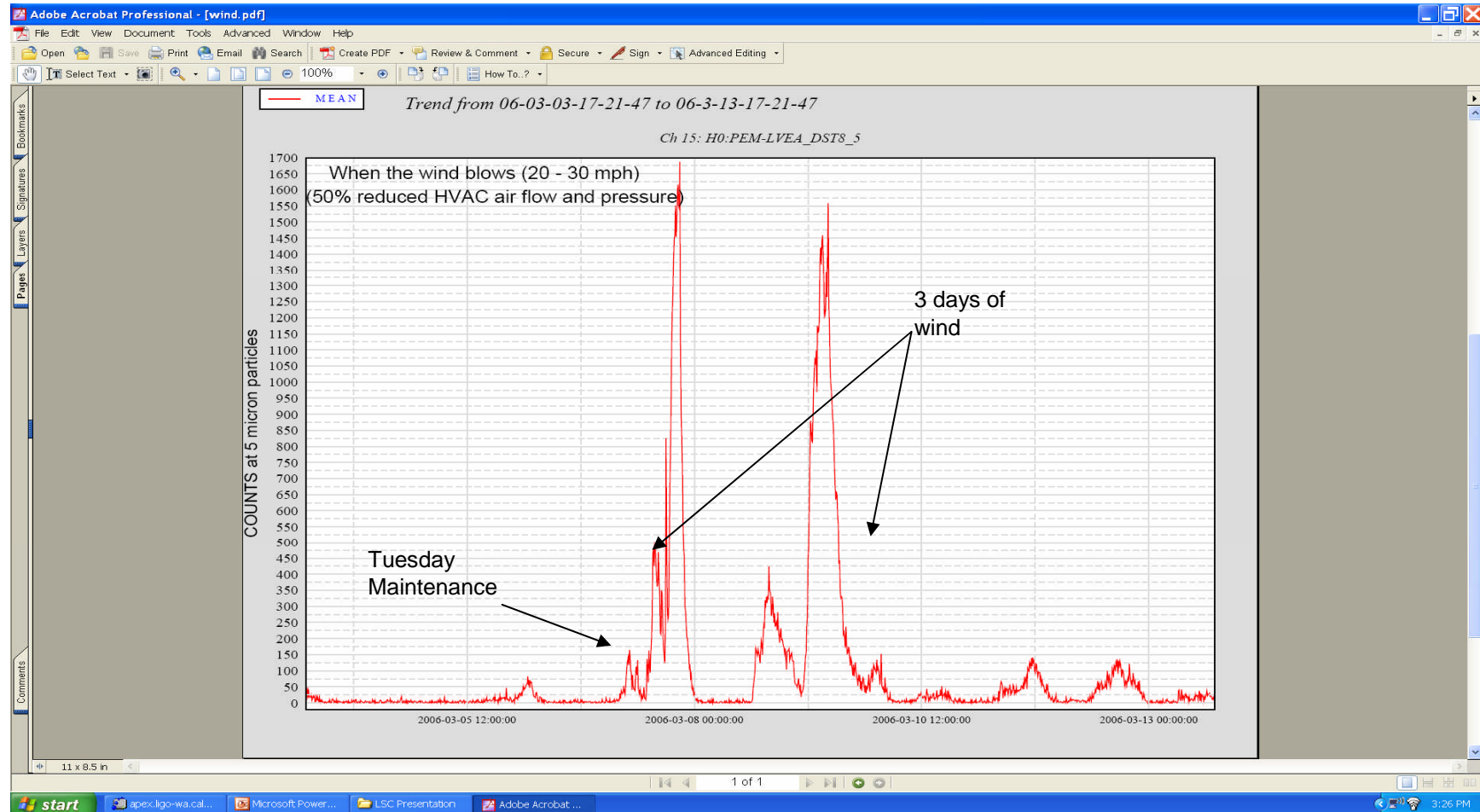
Nomenclature for Airborne Particle Concentration

- “Class 10” (at 0.5 μ m) describes air with not more than 10 particles / cu. ft. of size 0.5 μ m and larger.
- “Class 100” (at 0.5 μ m) describes air with not more than 100 particles / cu. ft. of size 0.5 μ m and larger.

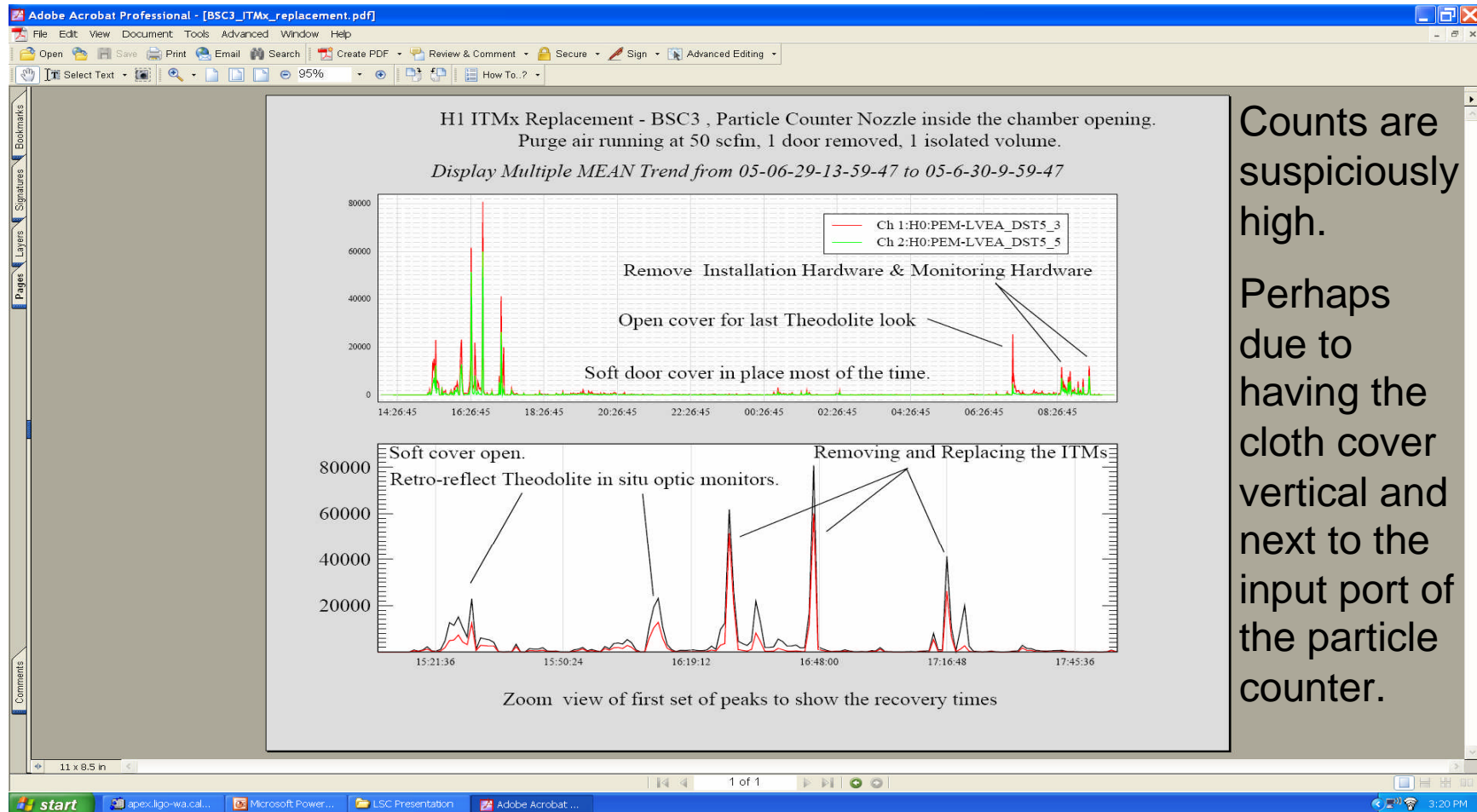
LVEA Particle Counts with HVAC Air Flow Reduced by 50%



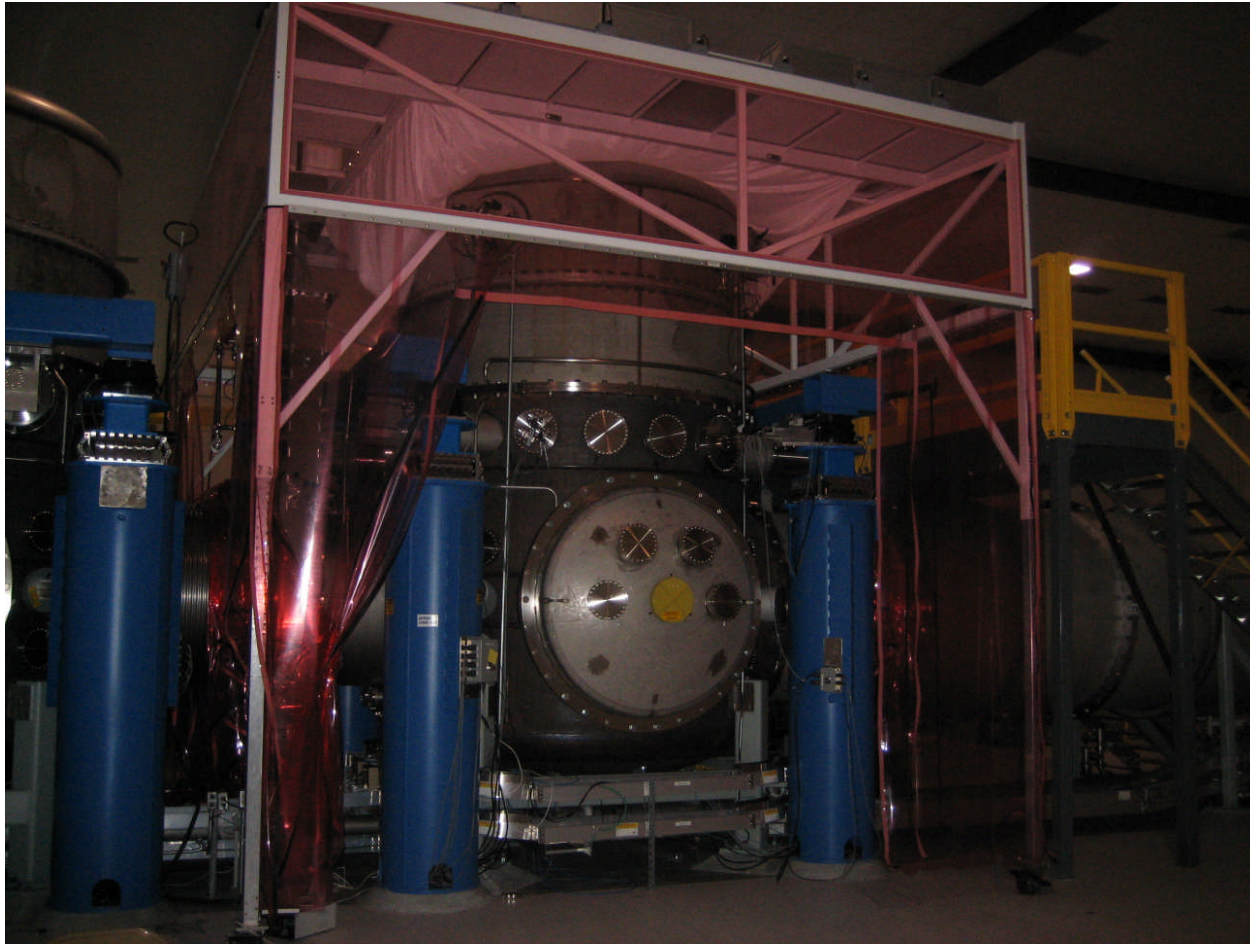
With the HVAC Flow Reduced 50% the Wind has Substantial Effects



H1-ITMx Replacement Particle Counts In situ



BSC Soft Wall Enclosure with Crane “Sock”



14 HEPA Filters.

Fans with variable speeds.

Approximate
16,800 scfm max.

Started up 3 days
before vent.

HAM Soft Wall Enclosure



20 HEPA Filters.

Fans with variable speeds.

Approximate
20,000 scfm max.

Started up 3 days
before vent.

Auxiliary Clean Room



Used to cover
BSC door
openings.

Also used as
change rooms
for gowning up.

Used over work
benches and for
clean staging
areas.

4,800 scfm
capacity

Improvements to Investigate

- Possible use of “Air Showers” (R. DeSalvo).
- Add more HEPA filtered panels to clean air near to vented volume.
- Breathing and body temperature controls.
(Hard to work with)
- Establish a more user friendly vacuum cleaner for in situ work.
- Establish better static controls.
- Test Burlington C3 fitted covers for particles.
- Omit (Al) wrapping much of the installation hardware by using cleanable hardware.
- Better understanding of particle counter installations and calibrations. Maximize their use.