HAM SAS Passive Seismic Attenuation System
Fabrication, Assembly, Installation

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California Institute of Technology
Massachusetts Institute of Technology

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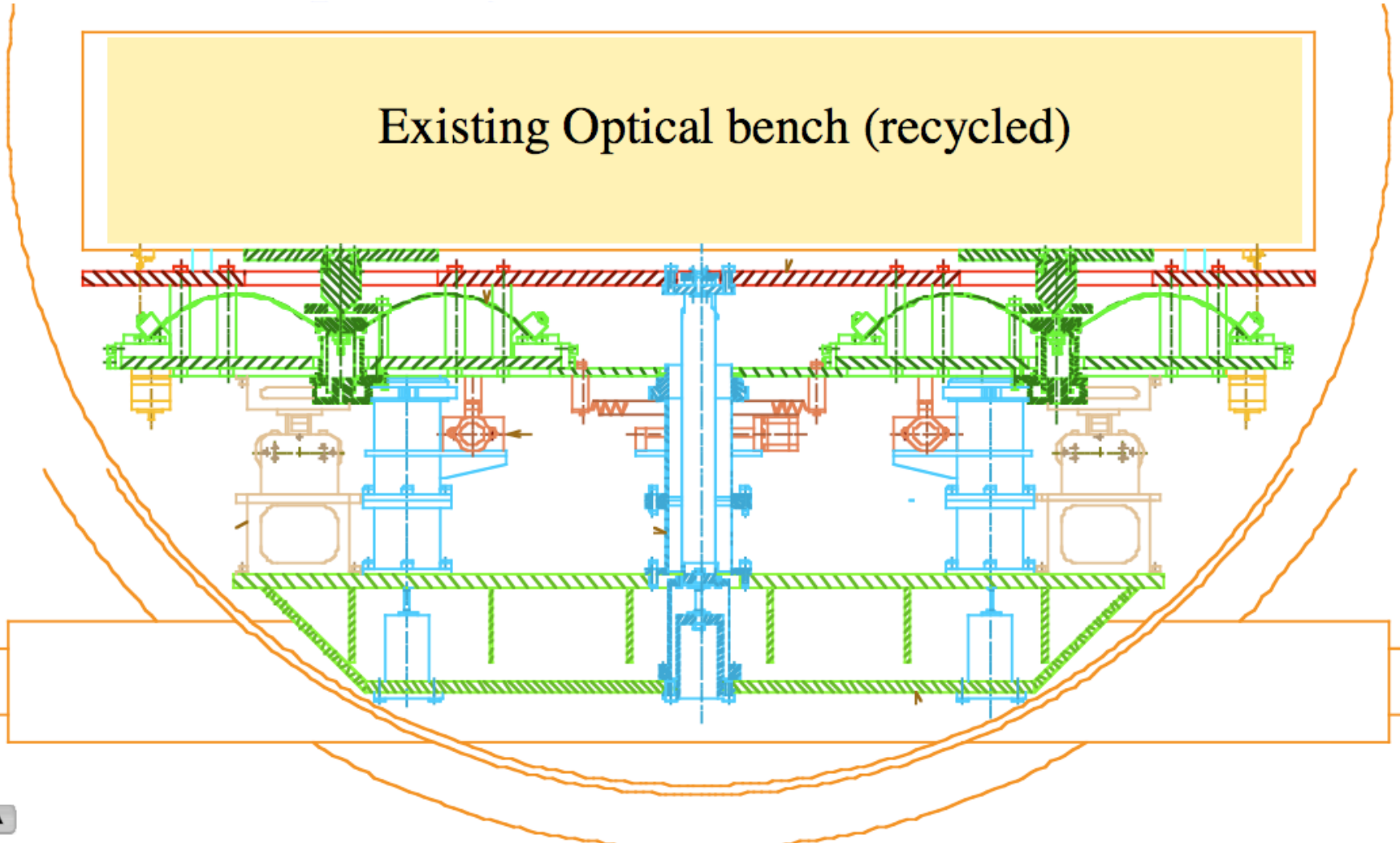
Building a seismically isolated optical bench for the HAM chambers (replacing both ISI and HEPI)



Construction status
a summary

- All SAS parts have been manufactured
- Problem encountered with welding,
  this generated substantial delay
- Dirty state assembly/testing ongoing @ G&M
- Built clean chamber for clean assembly
- Developing cleaning procedure
- Building oven for final clean gas bake-out
- Additional delay from complexity of task

Weldments

Substantial problems encountered in production of base structure

- Aluminum weldments shrunk MUCH more than expected
- Problems in producing UHV class welds
- Solutions:
- Honeycomb structure strain relaxed in oven
- New techniques for present and further productions
- Bottom plate of structure bolted instead of welded
- Now back on track

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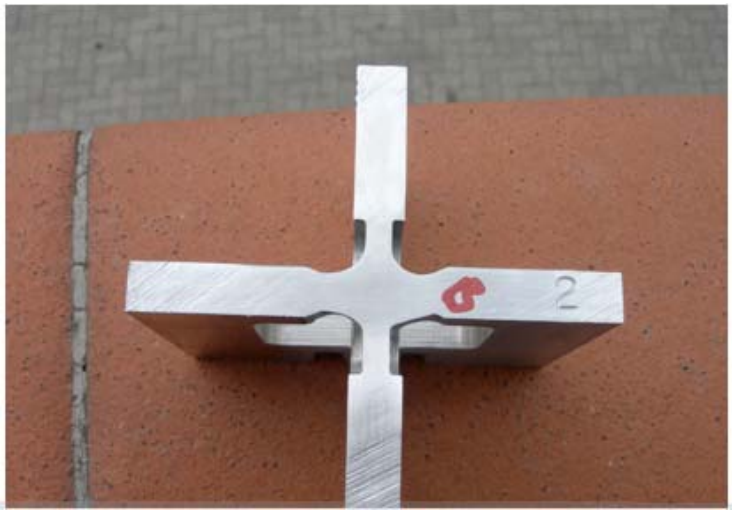
Base structure parts

Part shaping to reduce heat loss during welding => UHV class welds

Constraining honeycomb during final welding

Some weld quality control

shaping parts worked well



LIGO- T060095-00-E → LIGO → May 12th 2006

Procedure to expose possible cracks in aluminum welds

Riccardo DeSalvo, Yumei Huang

LIGO- LIGO-T060108-00-D → LIGO → 25th May 2006

T-Weld Tests performed May 25th 2006

Stefano Molesti, Marcello Berchiolli, Riccardo DeSalvo

LIGO- T060110-00-D → LIGO → 25th May 2006

Successful plug welds

Stefano Molesti, Marcello Berchiolli, Riccardo DeSalvo

LIGO- T060111-00-D → LIGO → 24th May 2006

Failed plug welds

Stefano Molesti, Marcello Berchiolli, Riccardo DeSalvo

LIGO- LIGO-T060109-00-D → LIGO →

Preliminary Weld Tests, mid May 2

Stefano Molesti, Marcello Berchiolli, Yumei Huang, Riccardo

LIGO- T060128-00-D → LIGO → 27th May 2006

Cross weld tests

Stefano Molesti, Marcello Berchiolli, Chiara Vanni, Riccardo DeSalvo

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Weldments details

Weld shrinkage effect

Cross pipe supports

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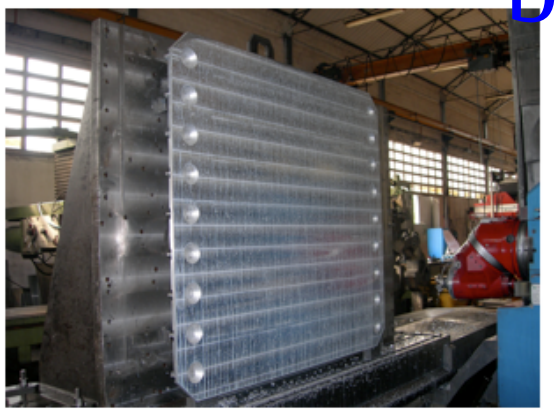
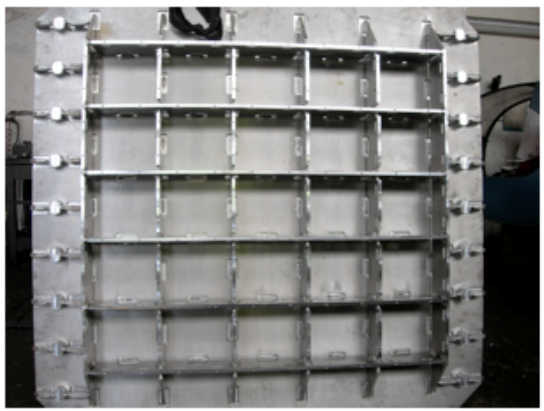
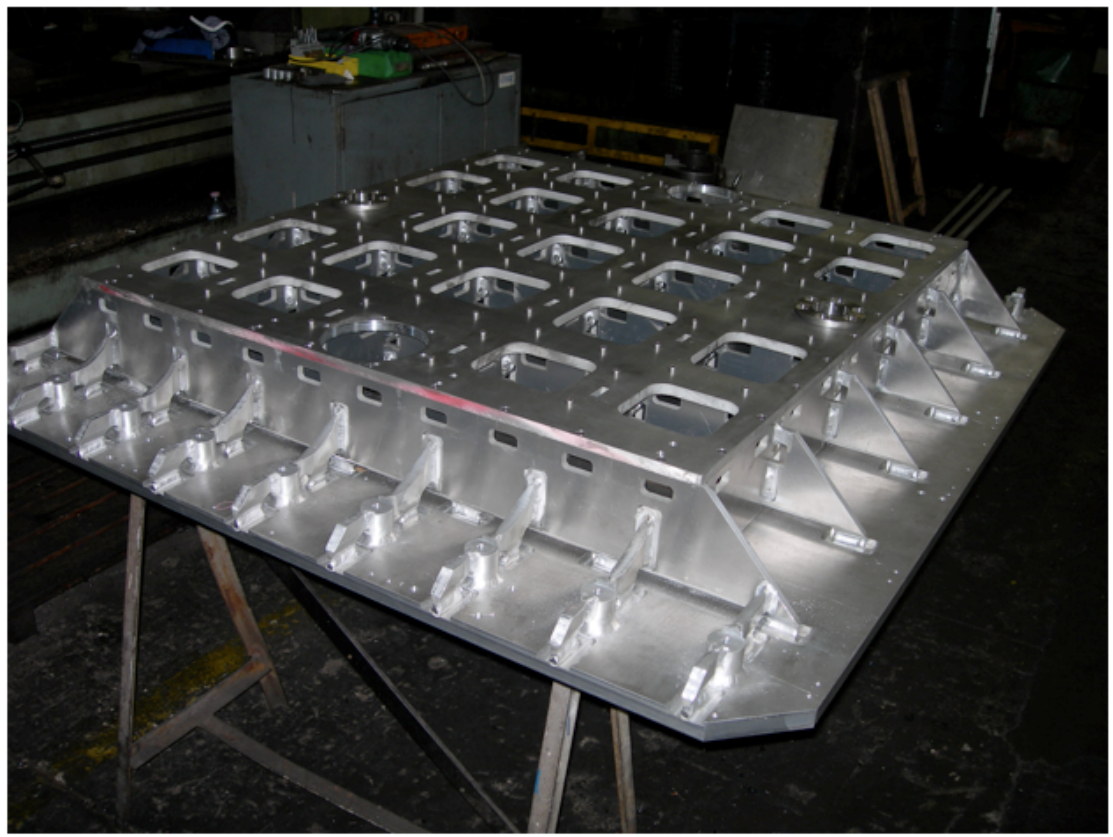
Base structure final machining and bottom plate assembly







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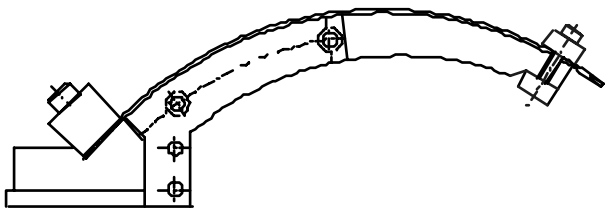
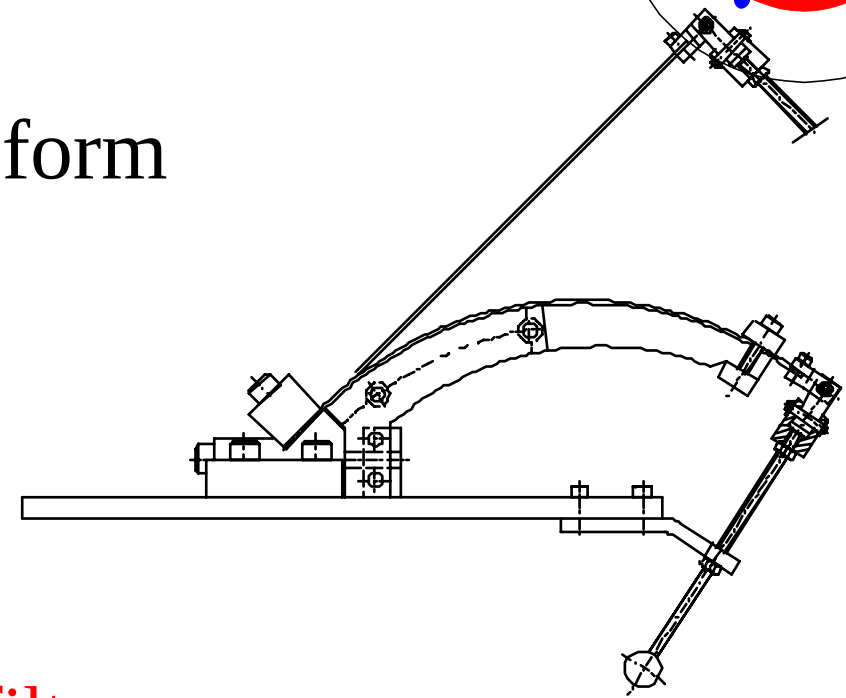
Assembly philosophy

- Dirty assembly and some testing
- Disassemble and UHV cleaning
- Clean room assembly and factory tuning
  - Minimize use of LIGO manpower
- Shipping clean assembly
- Install in HAM as a unit

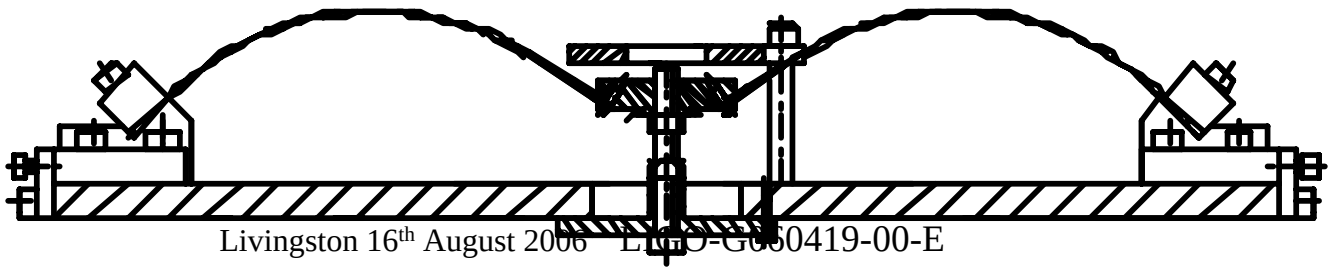
GAS filter assembly theory

- Pull the blade over a form





- Mount the base in the filter
- Transfer the load and tune



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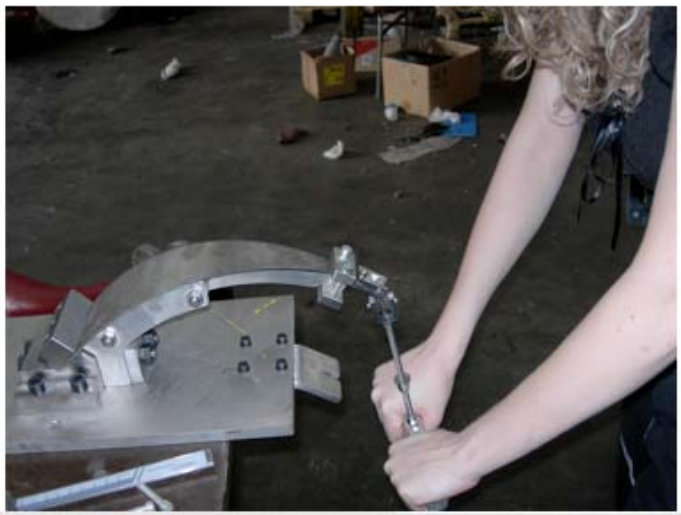
Actual GAS filter assembly



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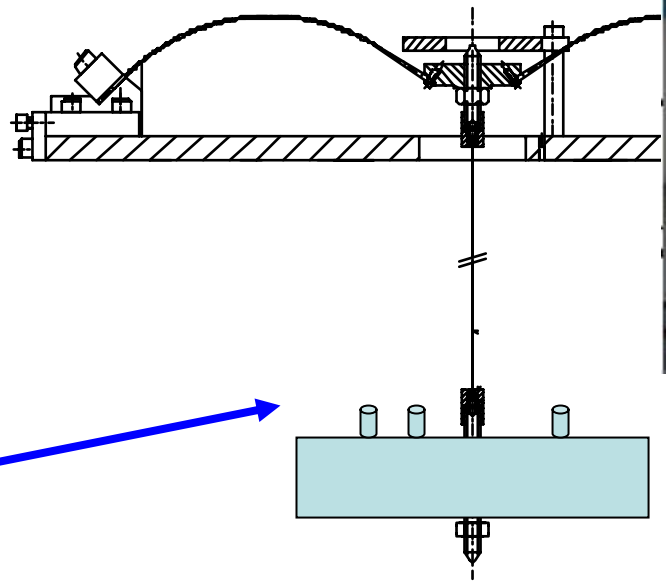
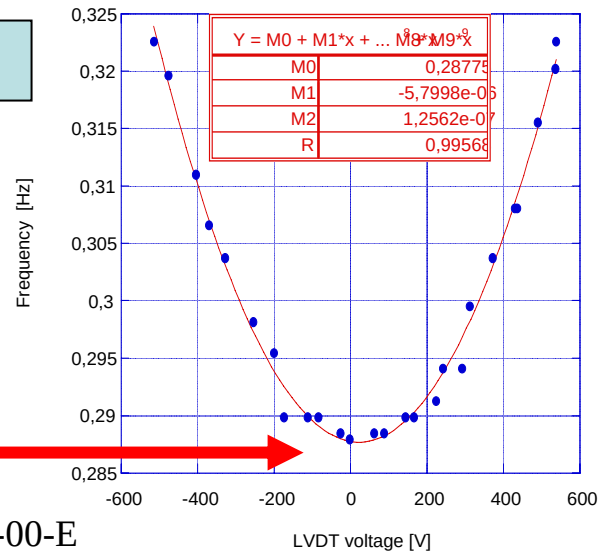
Assemblying GAS filters

Tuning the GAS filter

- Use screws for radial compression tuning
- Add mass to change working point





- Best mechanical working point

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Mounting the spring box

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Mounting the IP flex joints

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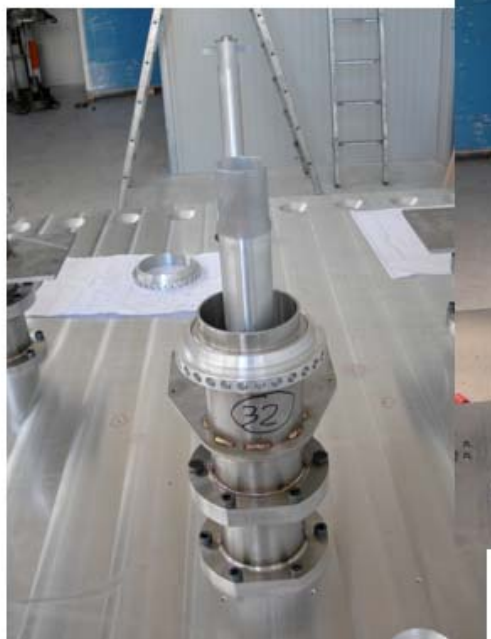
Assemblying the IP legs



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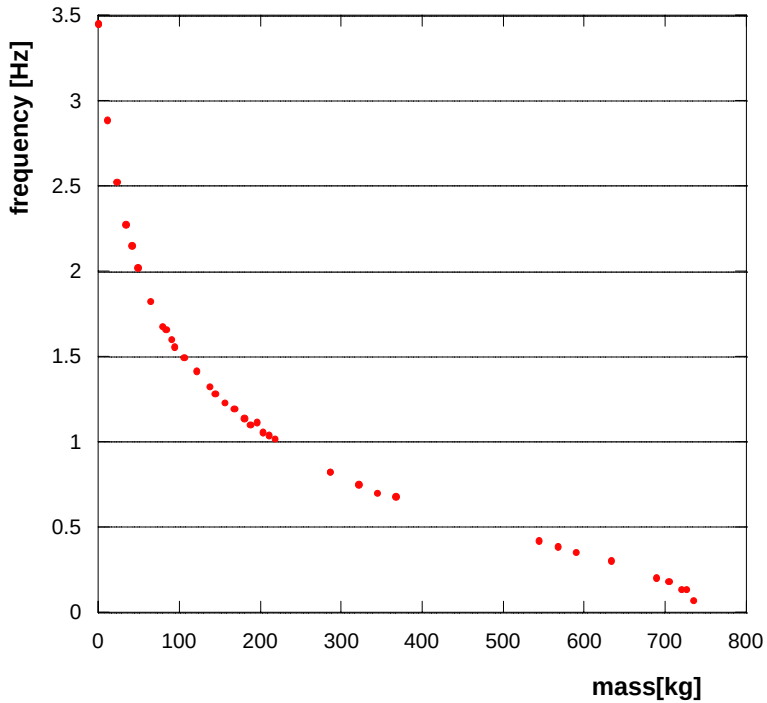
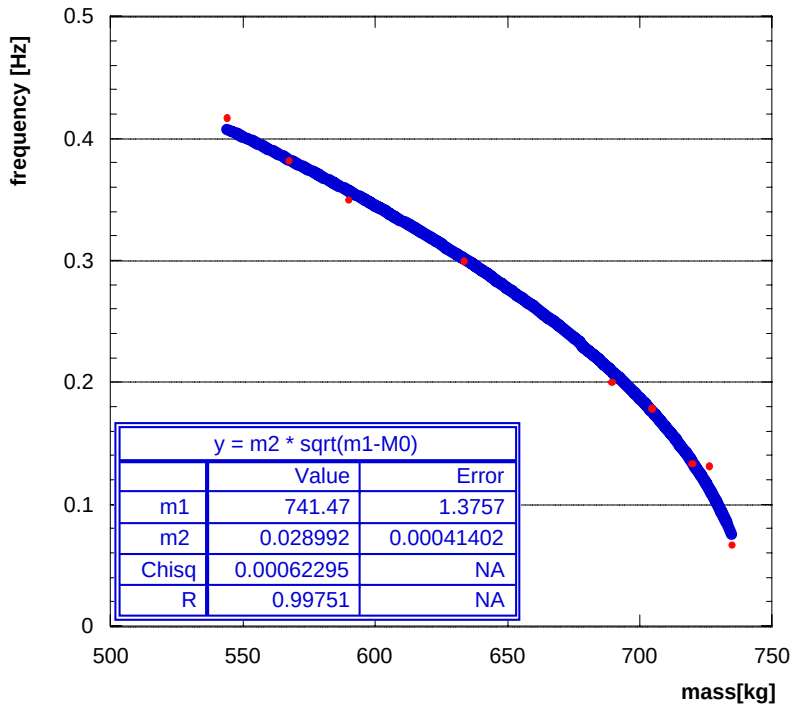
Dirty state assembly ongoing @ G&M

NEXT: IP Frequency/Load tuning





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Next steps

- Mounting the LVDT sensor/coil actuator units
- Test cabling

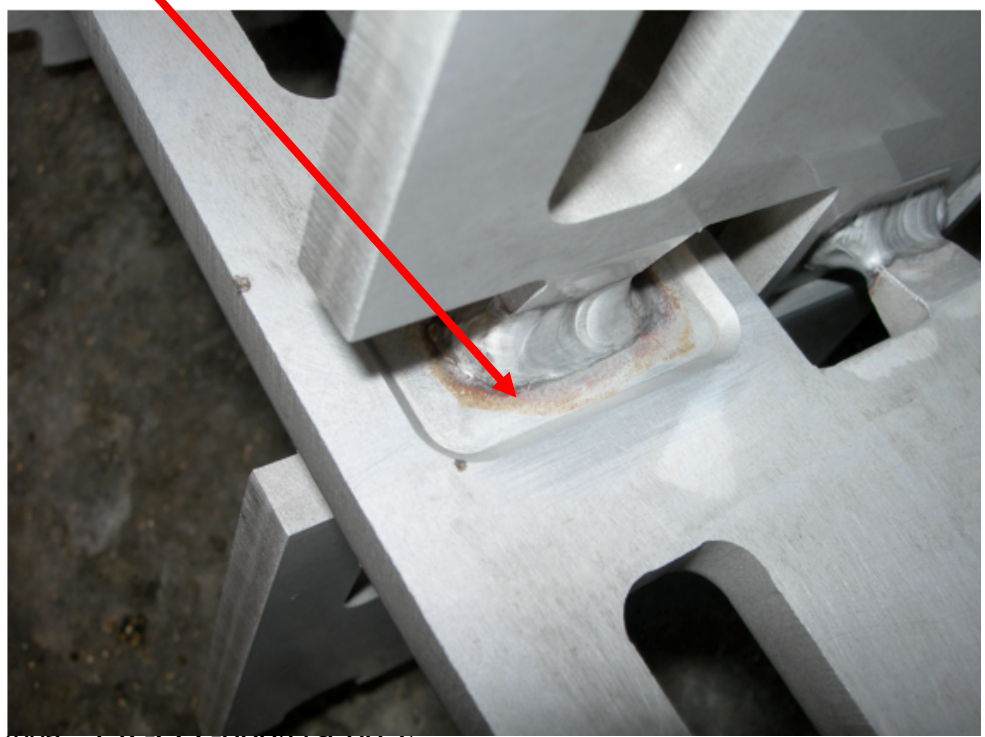
- Disassemble for cleaning
- Clean assembly

Clean room construction

- Clean room filters being installed, clean ass.y stands, crane, shelving in fabrication

Cleaning tests

- Basic (NaOH) etch cleans surface and exposes weld residues (probably organic)



Cleaning tests

- Acid etch and rinsing eliminate residues

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Cleaned test structure

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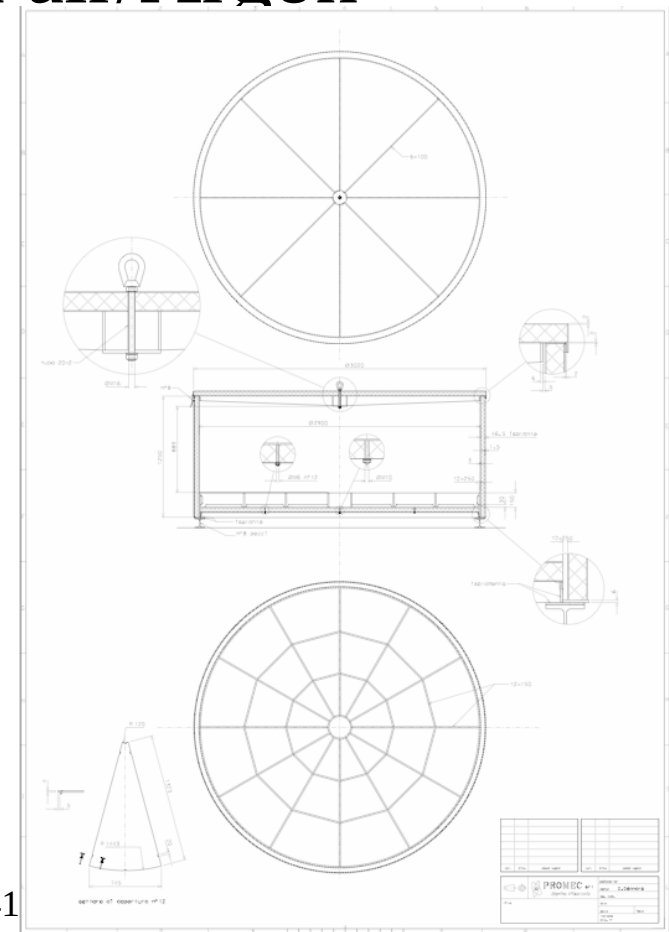
Cleaning plant

- now finished, being commissioned

Further UHV processing

- Building 3 m diameter clean air/Argon atmosphere bakeout oven
  - for individual part bakeout
  - for final assembly bakeout



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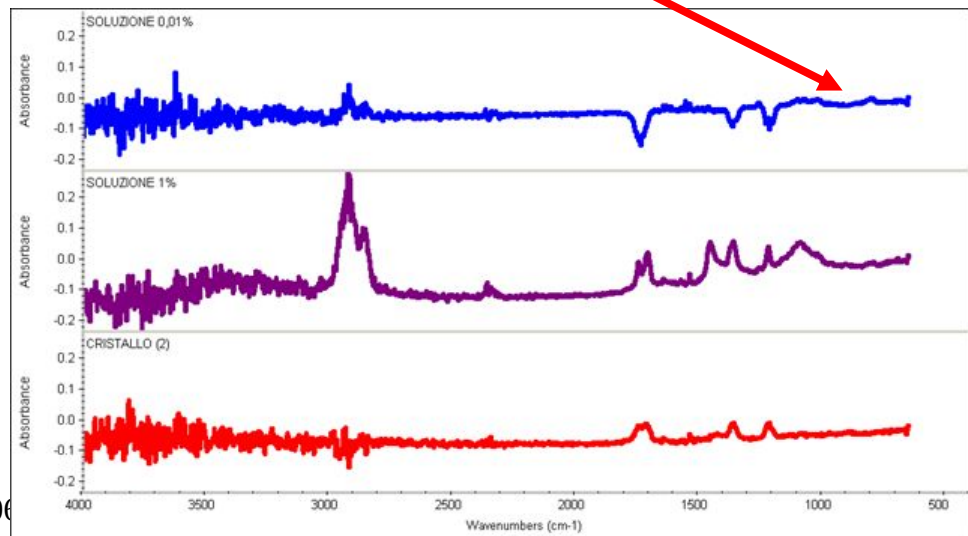
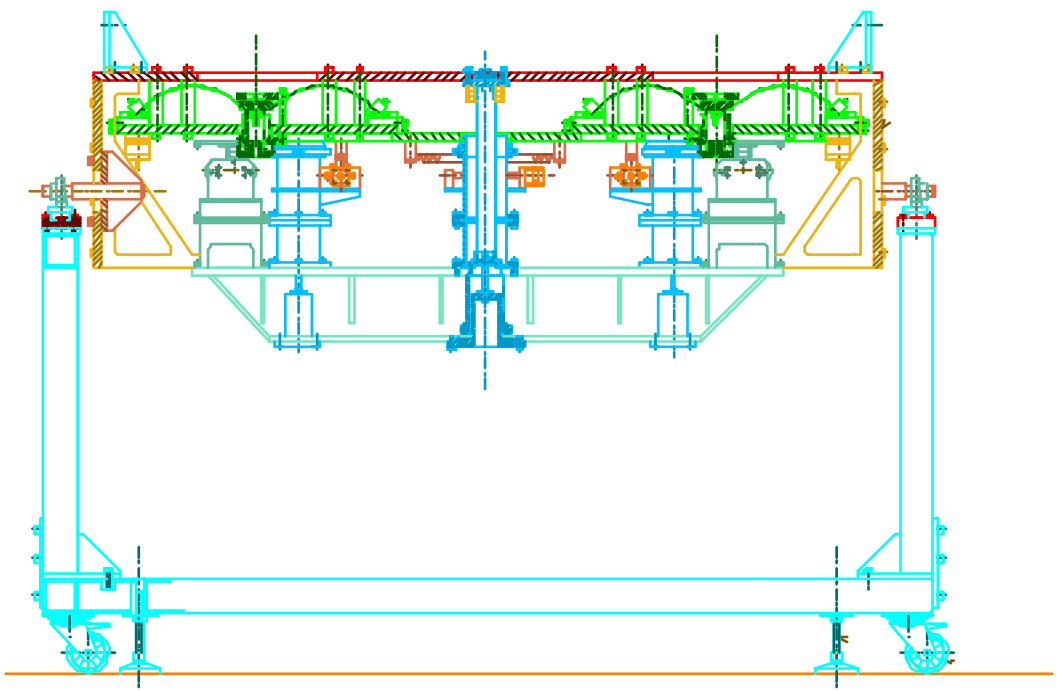
Cleaning quality control

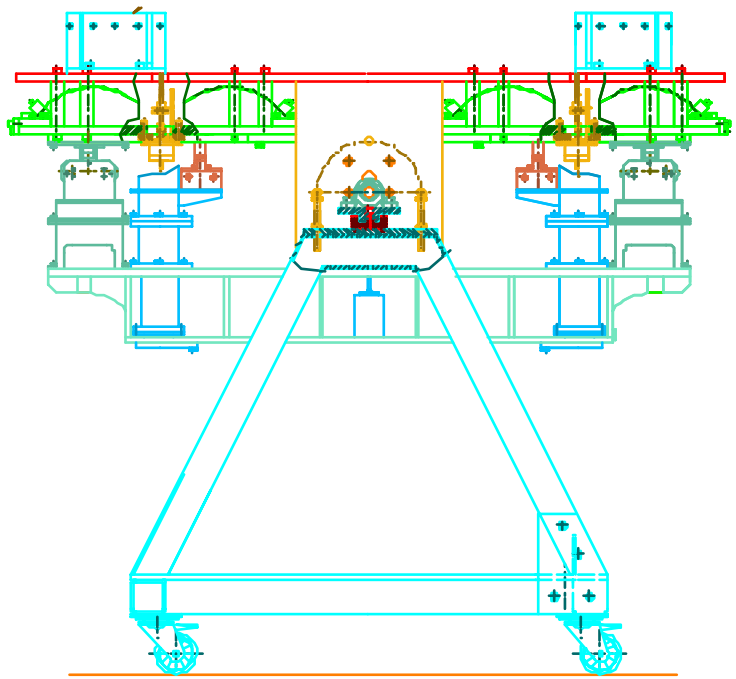
- Provided in house FTIR testing
  - Better control
  - Faster turn around
  - Direct monitoring of absorption @1064 of possible contaminants



Installing SAS in the HAMs

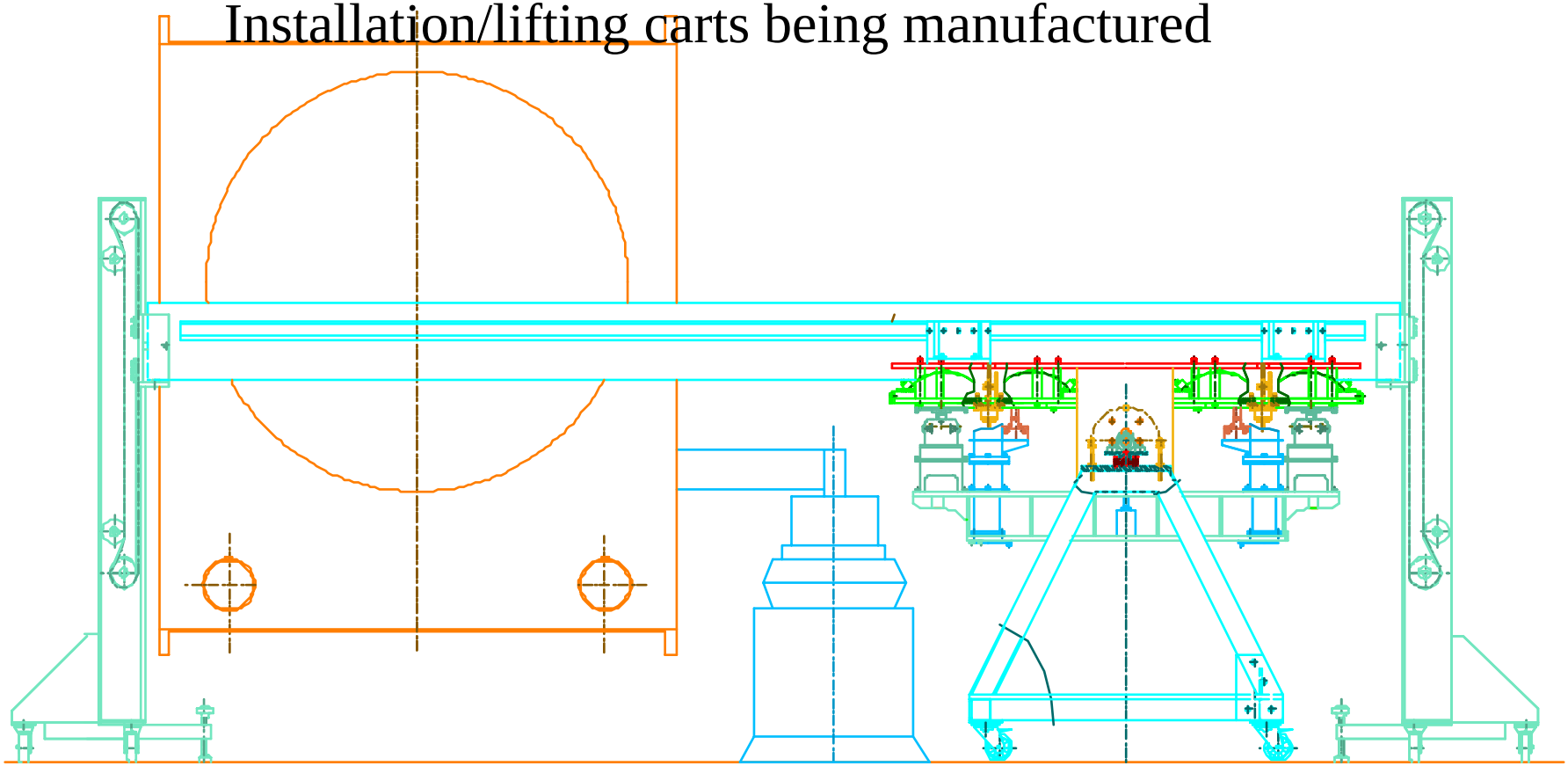
- Movement carts ready





Installing SAS in the HAMs

Installation/lifting carts being manufactured



Summary

- **We are going slower that we expected but**

  by next Hanford LSC meeting
  we will have a first class seismic attenuator:

1. Single stage including the functionality of HEPI
2. Passive attenuation:
   - No active components in vacuum (only coils)
     - No chance of electronics failures in vacuum ! ! !
     - Virtually no power dissipation under vacuum ! !
       - (From elimination of active components and from Low Frequency mechanics)
   - No sealed gas volumes in vacuum
     - No chance of crippling virtual leaks ! ! !
   - Immunity from power failures
   - Earthquake protection ! !