LUMI Mechanical Design Details

Bill Ghiorso

Mechanical Design Personnel

- Bill Ghiorso – putting finishing touches on current design

past involvement:

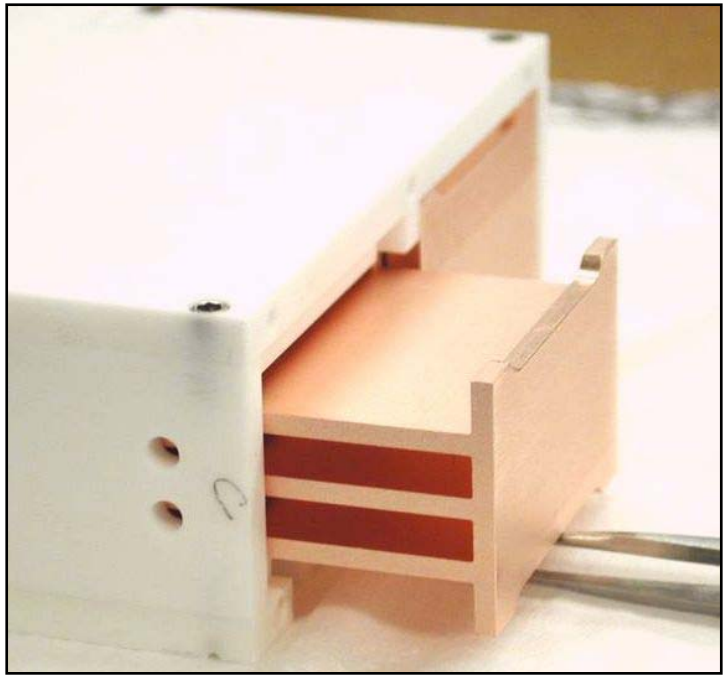
- Matt Hoff – container design
- Tim Loew – detector design

Detection Sensor

- High precision capacitor geometry
- Up to 1kV voltage biasing
- High-vacuum compatible materials permit contamination-free environment
- Compact size to fit in TAN

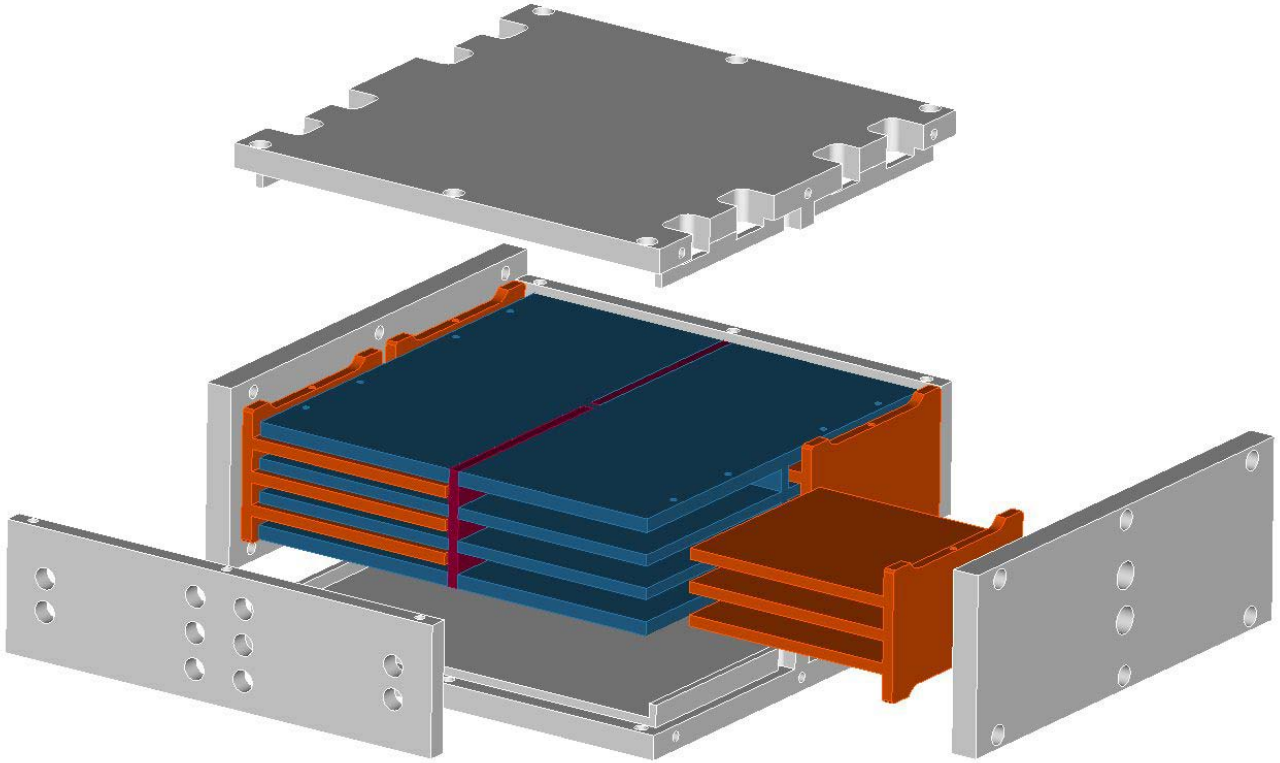
Sensor capacitive elements

- OFHC copper used for capacitor electrodes
  > high aspect ratio “fins” require using the Wire-EDM process (Electrical Discharge Machining)
  > common ground element is e-beam welded together



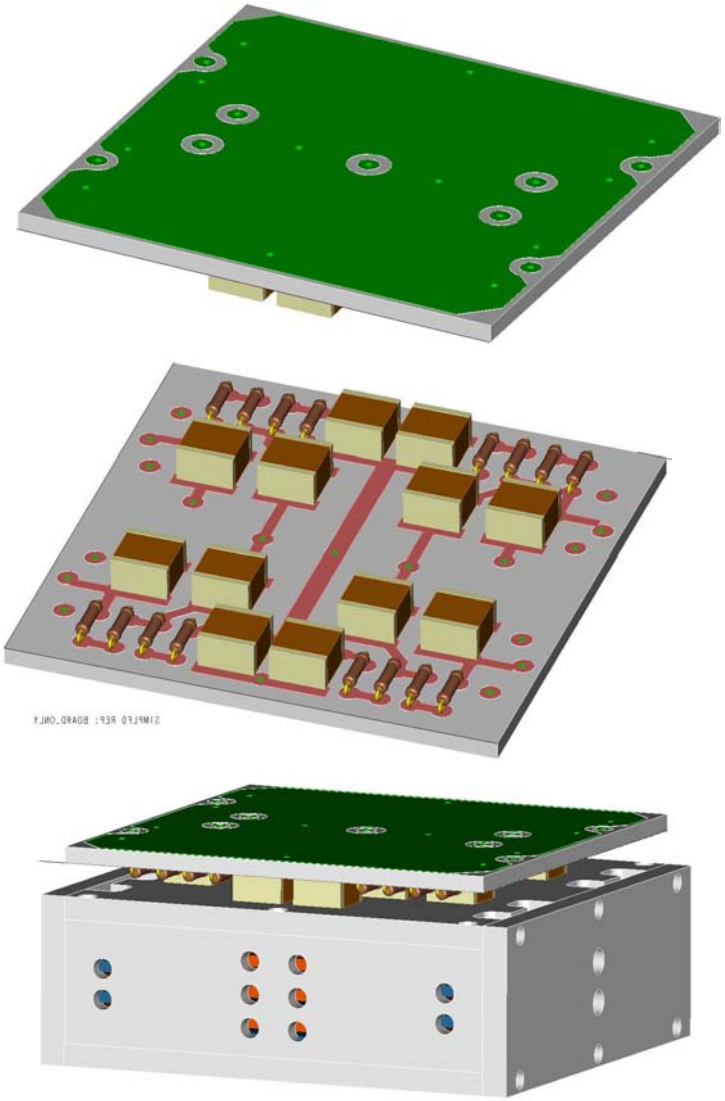
Sensor body

- MACOR machinable glass for structure
  - > zero porosity reduces chances of contamination
  - > use of conventional tooling eases creation of detailed geometry
  - > Fasteners used to hold self-aligning, over constrained assembly together (requires some craftsmanship to assemble)



Circuit board attachment to sensor

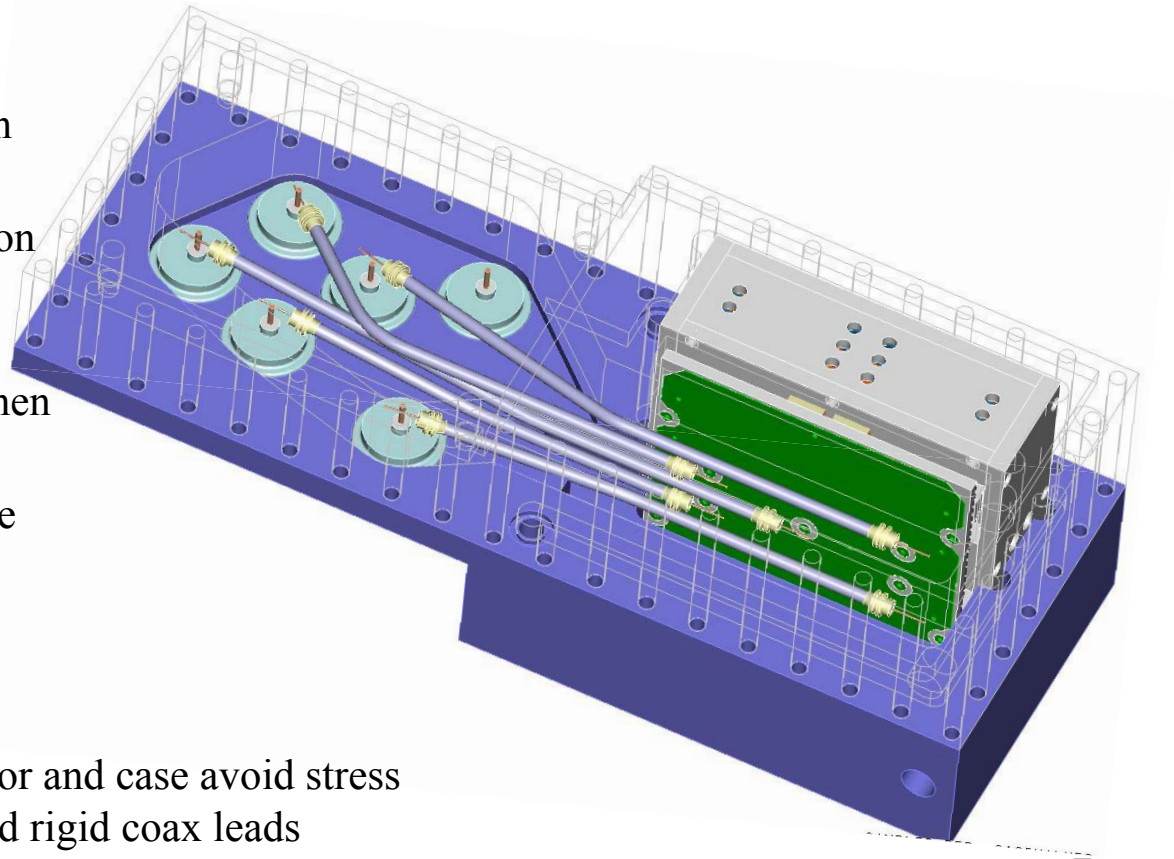
- Not integrated with sensor housing
  - Problems with trace adherence using MACOR substrate
  - More flexibility of fabrication with commercial vender solution
  - Components can be mounted on the side away from the leads for protection to prevent voltage breakdown problems
  - Rigid lead attachment more secure when attaching to ground plane side of board (no small pads)
  - Leads to detector elements changed from strips with screw clamps to soldered round wires



Case design & fabrication

- Stainless steel CNC milled construction
  - Stainless steel allows extra thin wall to optimize detector size
  - Permits welded-in isolated-ground coax feedthroughs
  - Gas is directed across sensor by channel milled in case half

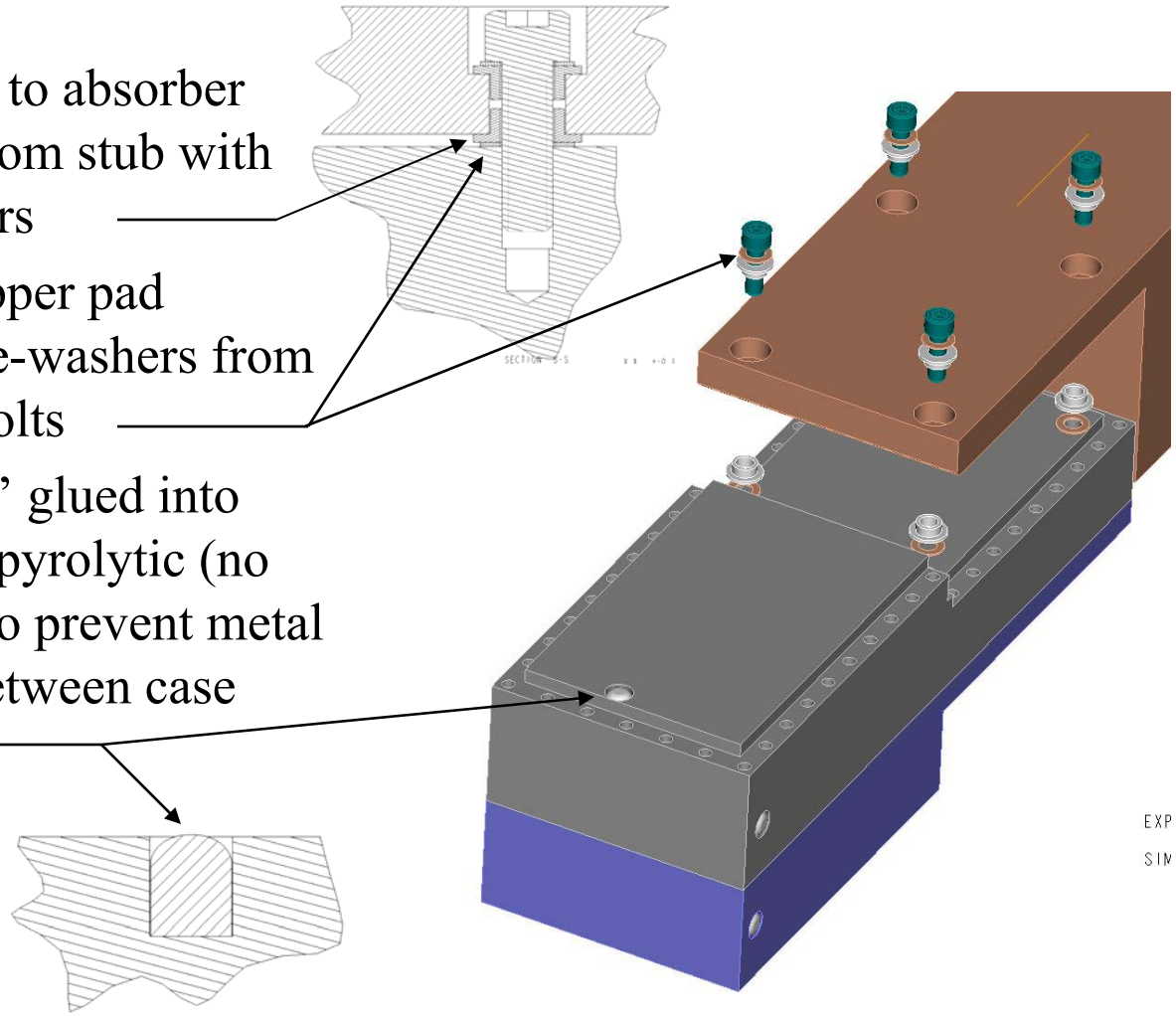
- No-weld, bolt-together design with sheet tin gasket
  - Disassembly before installation possible for engineering updates, QA issues
  - No heating of components when final weld-up is performed
  - Uniformity between prototype and production units



- Sensor mounting
  - Fits milled pocket in case
  - Wave washers between sensor and case avoid stress buildup on MACOR case and rigid coax leads

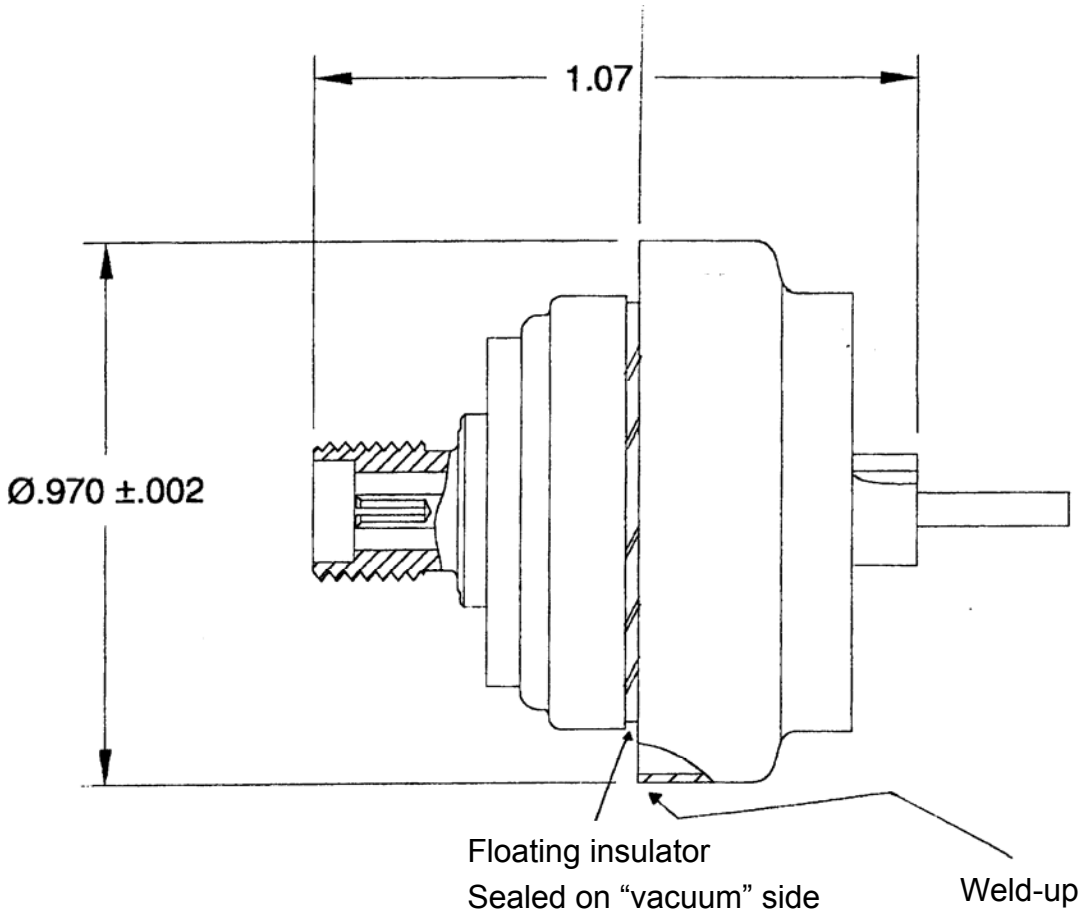
Case Isolation from TAN

- Bolts holding case to absorber stub are isolated from stub with ceramic tee-washers
- Fully annealed copper pad washers protect tee-washers from overstressing by bolts
- Ceramic ‘bumpers’ glued into holes in case with pyrolytic (no organics) cement to prevent metal to metal contact between case halves and TAN



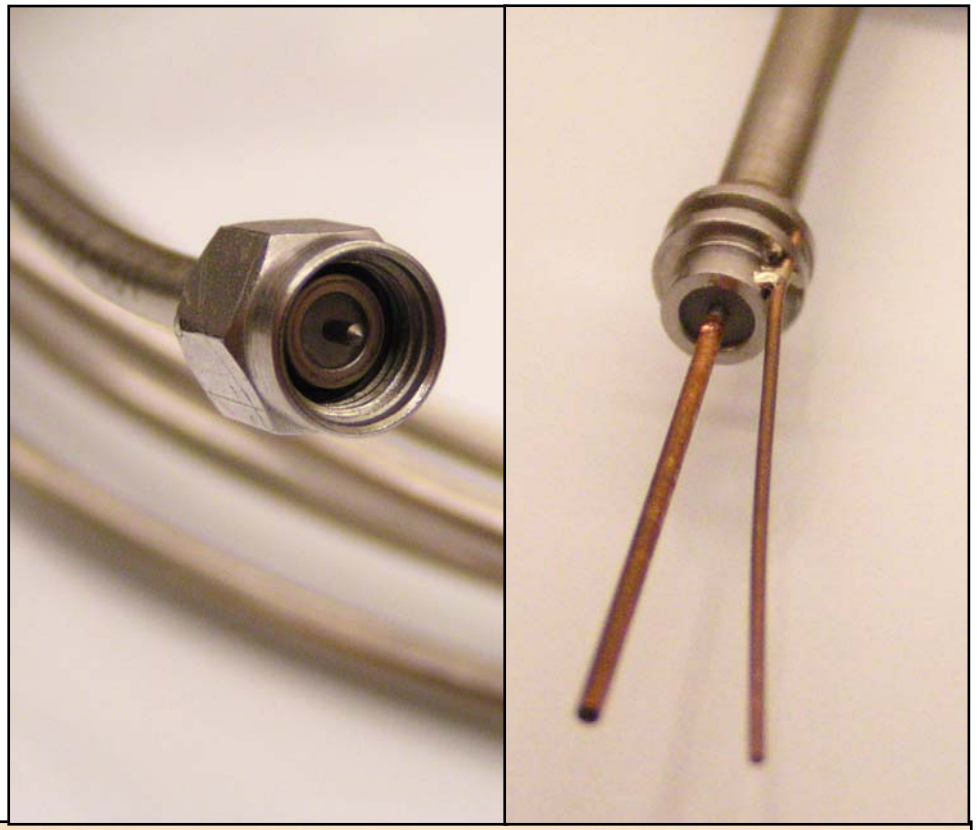
Signal line handling Electrical feedthroughs

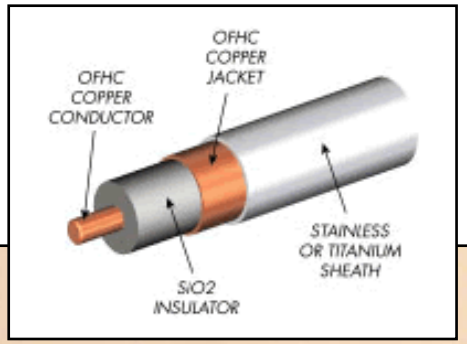
- Ceramic and stainless steel construction
- Standard SMA feedthrough welded into a second insulator for ground isolation (Ceramaseal)
- SMA connector on air side, pin terminals on pressure side

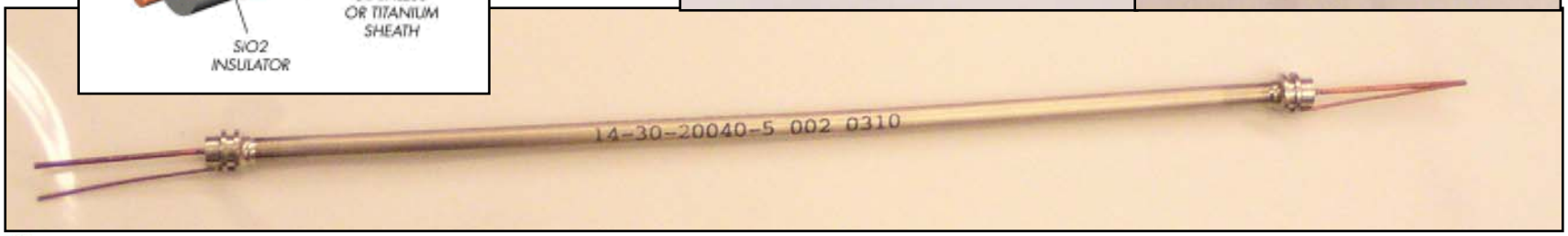


Signal line handling - SMA cable detail

- Radiation hardened coax with 9013 high radiation resistant glass insulation
- Hermetically sealed at both ends protects insulation characteristics
- Interior lines pin terminated, exterior lines SMA terminated
- Vender has pre-bent external lines for sharp turning radius out of case to clear the TAN

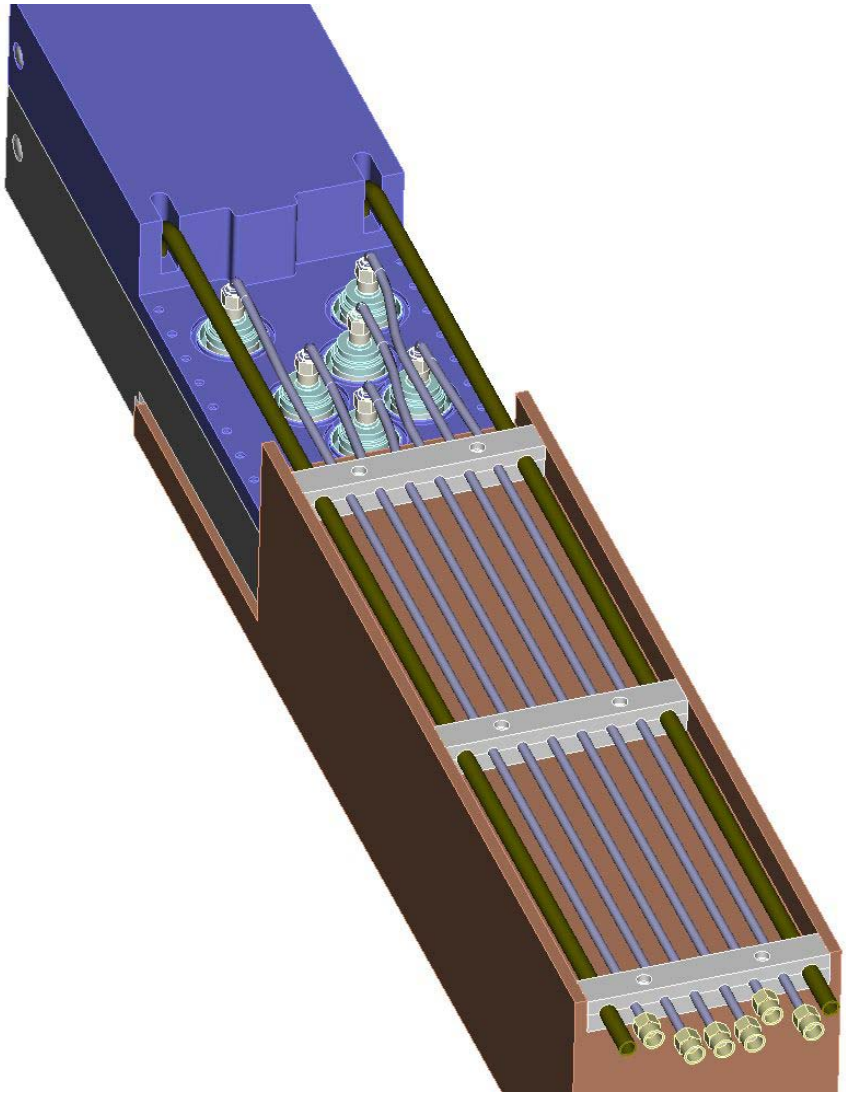




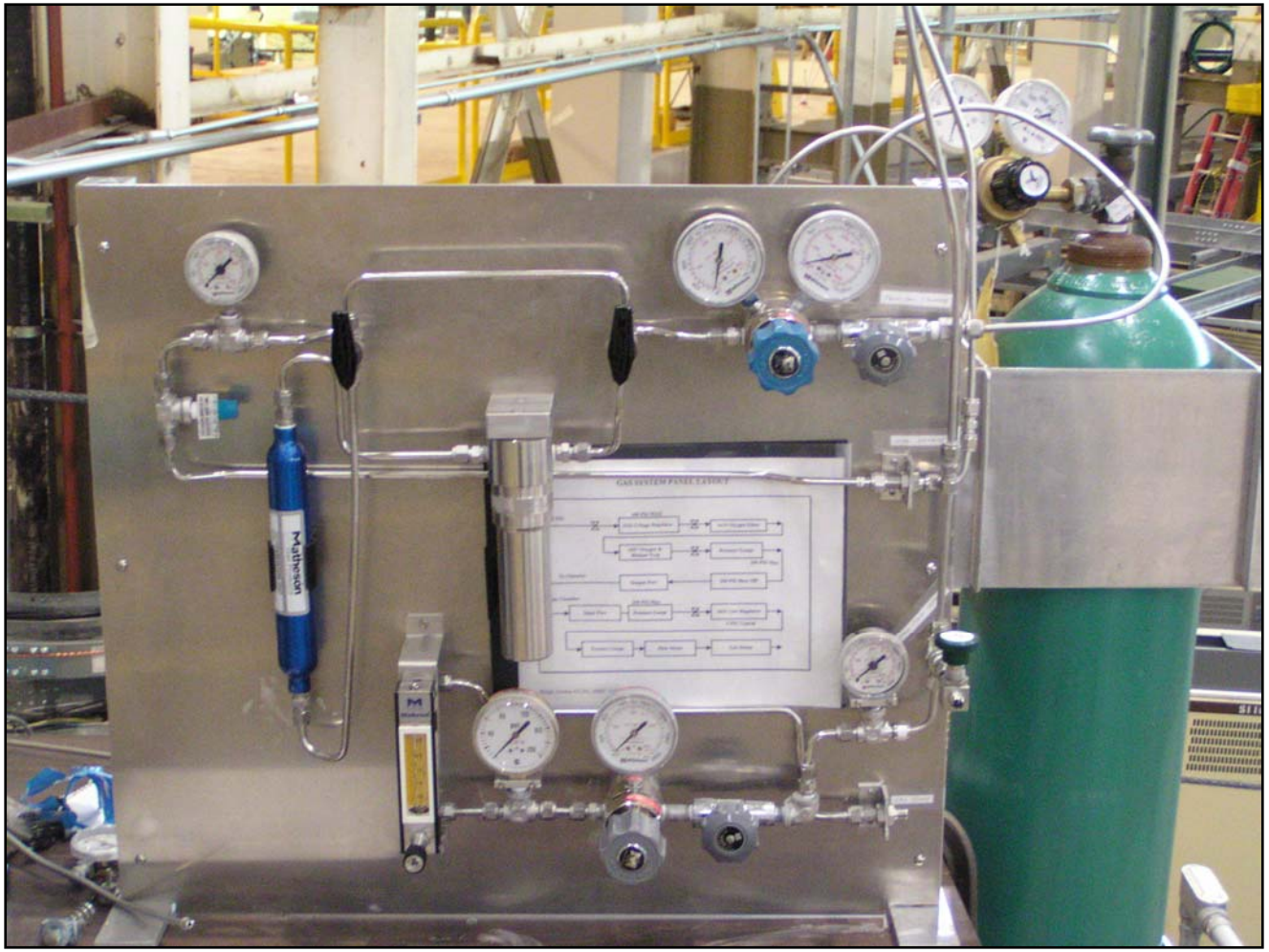


Signal line handling Line lead-out

- Note sharp vender-supplied bend of signal lines to avoid touching TAN for ground isolation
- Signal and gas lines pass through channel in absorber stub
- Comb guides in channel maintain ground isolation

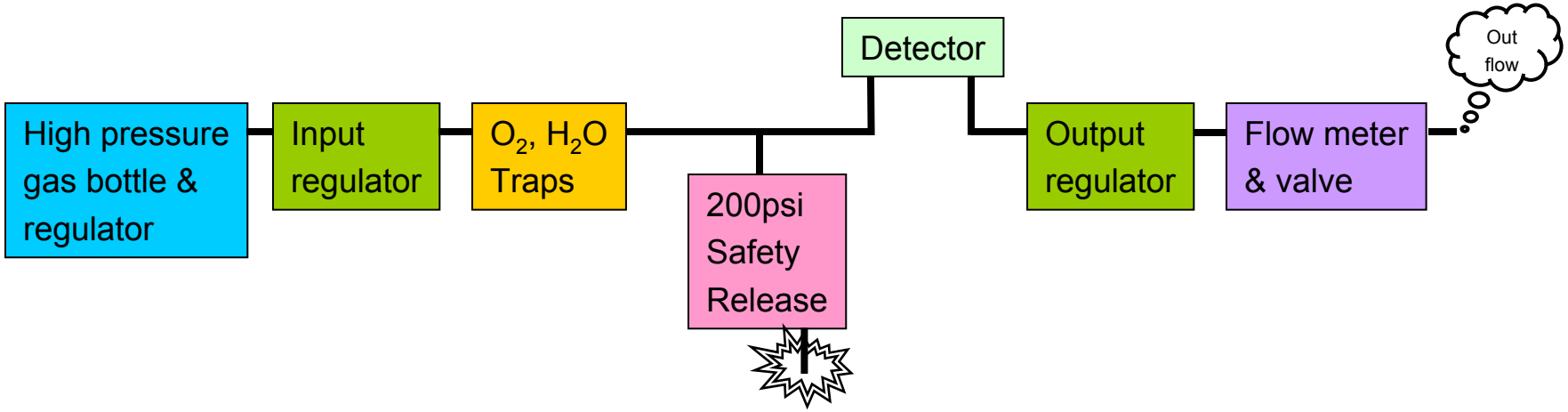


Gas delivery system



Gas Delivery System

- Constructed from high purity stainless steel components
- Simplified process:
  - Input regulator sets detector gas pressure (up to 10 atm.)
  - Oxygen & moisture trapping elements preserve clean environment
  - 200 psi pressure safety limit valve protects against overpressure
  - Gas circulates through detector
  - Output regulator sets low pressure (3psi typical) into flow meter
  - Flow meter controls circulation through detector
  - Outflow gas released to atmosphere



Simplified block diagram

Gas delivery system