# SPS TEST-BEAM INFRASTRUCTURE EXTENSION FOR LOW TEMPERATURE, FAST TRIGGERING APPLICATIONS

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## Project Scope

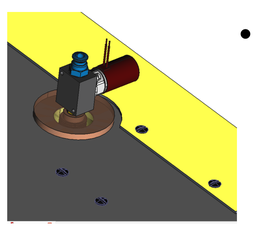
Low temperature environment for leakage current mitigation at high fluences (>$10^{15}$ $n_{eq}/cm^2$) & charge carrier mobility for impact ionization-based sensors. 20% $^0X$ for SPS pions (80 GeV) with operating range from -60°C to +60°C, 5 independent DUT planes with X-Y and up to 30° rotation per sensor, with fully remote operation.

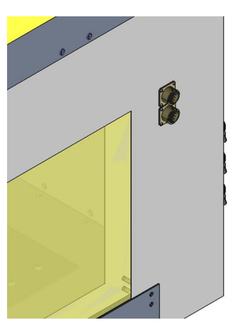
- **XPS-based Cold Box with removable DUT assembly**
- **Hubert P815W 1.2 kW, water-cooled chiller, -60 °C**
- **34.2 kN dynamic load, 5mm pitch, 1m travel stages**

**Mass, Coolant & DUT Planes**

| Design Variant | Total weight ex. Coolant (kg) | | | Estimated Coolant Volume (l) | Max. No. of DUT Planes |
|---|---|---|---|---|---|
| | Box Mass | Stage Mass | Total | | |
| CERN | 37.51 | 3.71 | 50.64 | 1.65 | 5 |
| DESY | 22.5 | 1.5 | 31.2 | 0.85 | 2 |
| Climate Chamber | 38.91 | 3.71 | 42.62 | 1.65 | 5 |

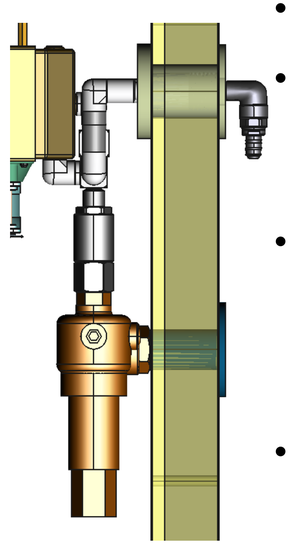
## Operational Design Features





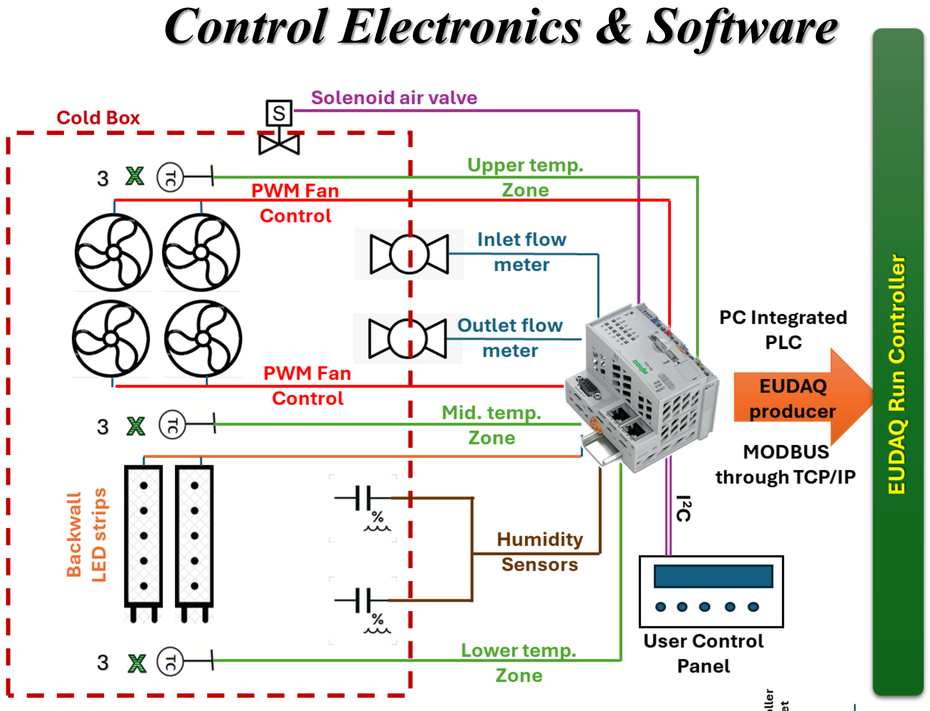
- Top-side regulated air intake valve, 100 l/min max flow, 10% hysteresis, 2M cycles, < 1MPa
- 2 x 16 Cannon gold plated passthrough connector
- 250 x 300 mm beam window aligned with DUT, no Al cladding
- 3 x 50 mm steel pipe clamps for cooling circuit

## Cooling & Safety Features

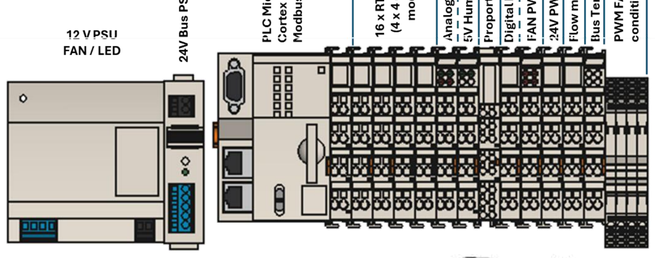


- Ethanol Cooling Circuit
- Low temperature spill-less quick disconnect, clean-cut (-60°C)
- Conductive carbon fiber reinforced PEEK, 2-part pass- throughs to avoid static electricity build-up
- 15 psi calibrated expansion valve certified for -200°C to 215°C range

## Control Electronics & Software




- Modular PLC control with LAN and integrated PID controller
- Integrated touch front panel with Local/Remote mode
- Combined "Infrastructure" EUDAQ producer integrating chiller, stages & pico-motors

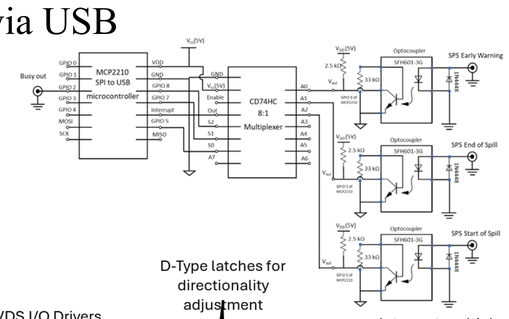


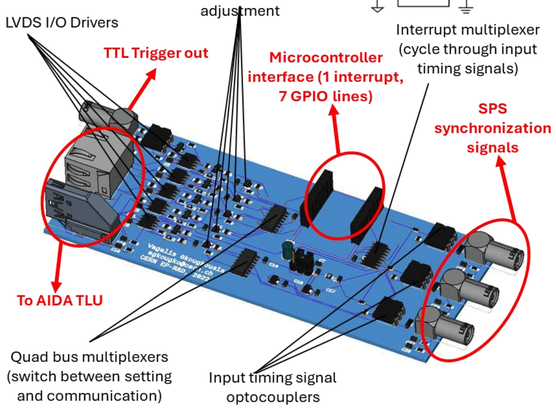

**Sensors**

| | | |
|---|---|---|
| Cooling loop | Flow (In / Out) | 2 |
| | Pressure (In/out) | 2 |
| | Temperature (In/out) | 2 |
| Water Loop | Flow (In / Out) | 2 |
| | Pressure (In/out) | 2 |
| | Temperature (In/out) | 2 |
| Box Interior | Temperature | 3 x 3 zones |
| | Humidity with in. heater | 2 |

## Trigger Board

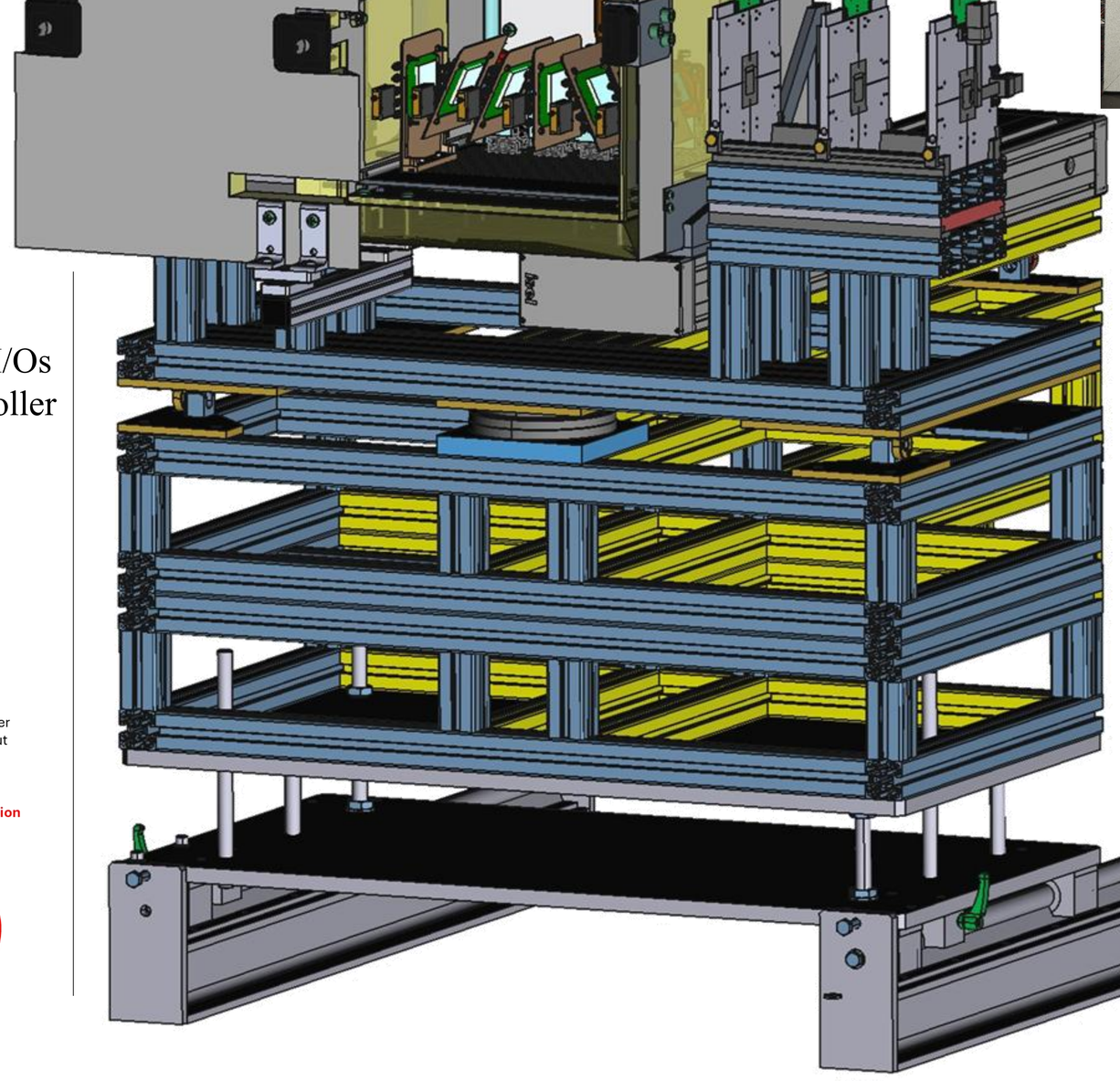
- TLU Synchronization by vetoing trigger during read-out
- RJ-45 / HDMI for TLU interface
- Versatile design, Reconfigurable I/Os & PIC programmable microcontroller via USB



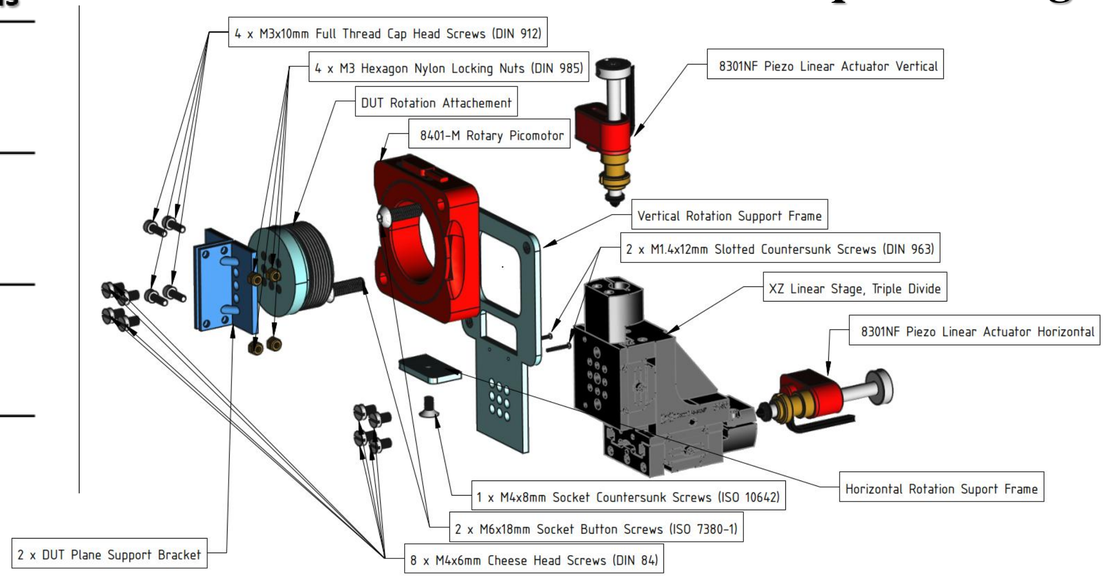




**Usable internal Dimensions**

| | | |
|---|---|---|
| CERN | Height (mm) | 314 |
| | Width (mm) | 375 |
| | Length (mm) | 320 |
| DESY | Height (mm) | 314 |
| | Width (mm) | 185 |
| | Length (mm) | 320 |
| Climate Chamber | Height (mm) | 644 |
| | Width (mm) | 375 |
| | Length (mm) | 320 |

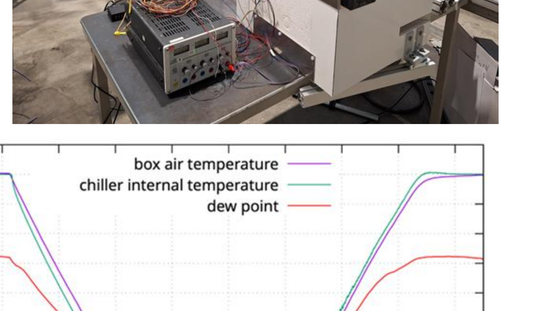


## DUT Plane Mechanics &Micro-positioning










## Commissioning & Installation

Tested July 2025




***Diagrams instructions & Assemblies available at:***