Mechanical design, analysis and integration of pre–alignment systems for CLIC

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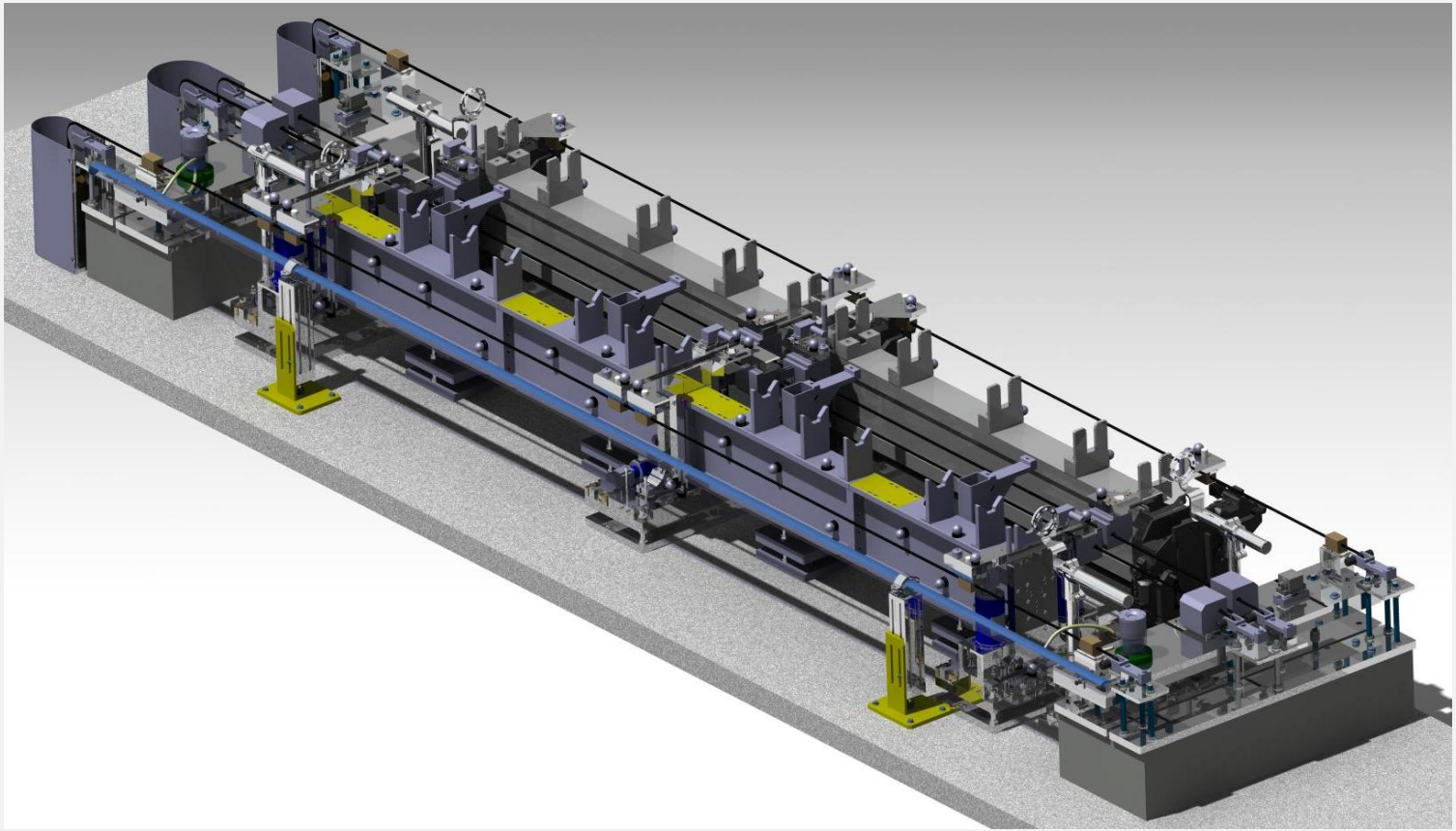


Contents

I. Introduction

CLIC Pre-alignment

- Components should be pre-aligned within a few microns over 200m
- Overlapping stretched wires will provide a stable and determined alignment reference
- cWPS sensors will perform measurements with respect to these wires
- Actuators will re-adjust the components to their theoretical positions

Challenges in the Test-Modules for the mechanical engineer

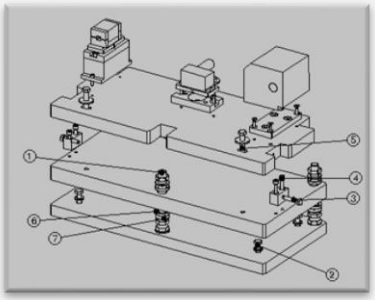
- Simultaneous existence of various systems: vacuum, RF, stabilization, pre-alignment
- Limited space for installation
- Access and maintenance issues
- Proper collaboration between systems designed by different people

The metrological reference network of overlapping wires

II. Mechanical Design – Typical workflow

Concept

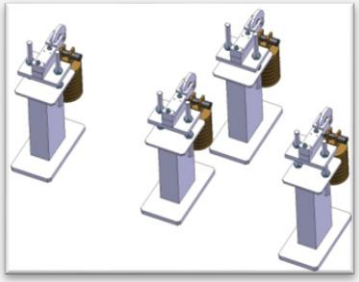
Integration

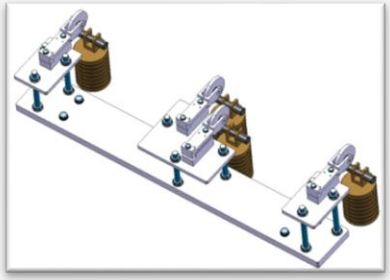


3D design

Re-design

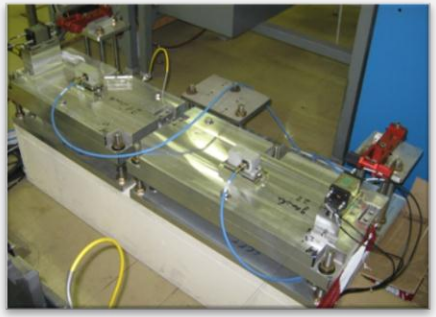
Fabrication





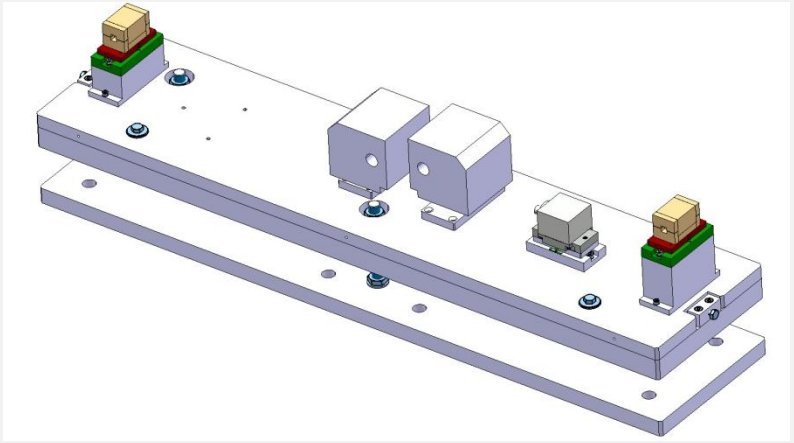
Installation

Previously used system that needs to be modified

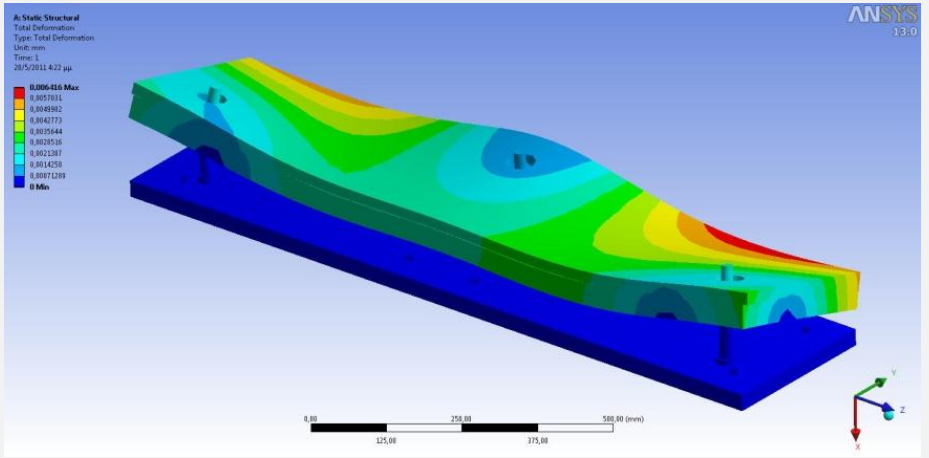


III. Completed and running projects

- Support extemities of WPS and HLS sensors for CLIC Test–Module

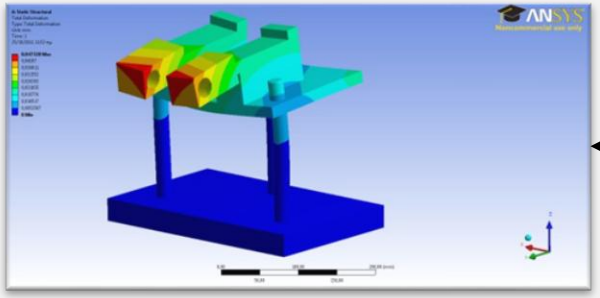


3D design of proposed solution

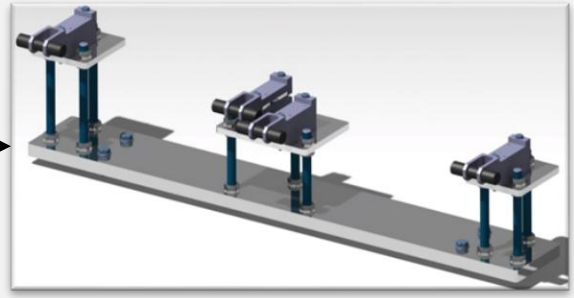


Simulation under working load
for design optimization

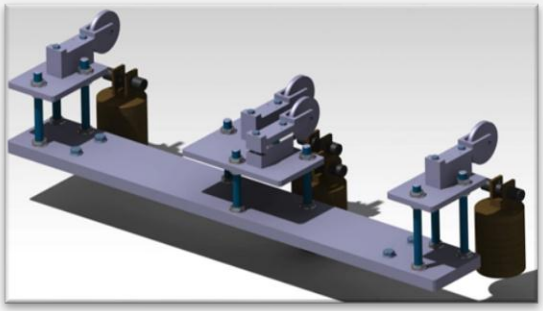
Design, analysis & integration of additional components



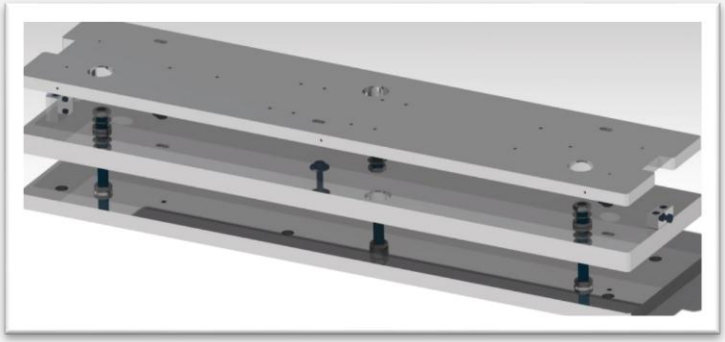
Deformation under working load (static)



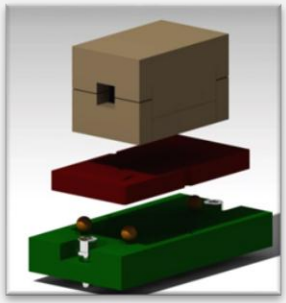
Stretching devices – fixed end



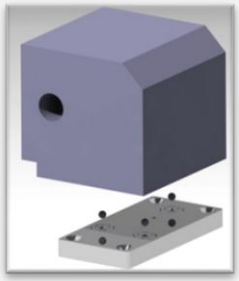
Stretching devices – weight end



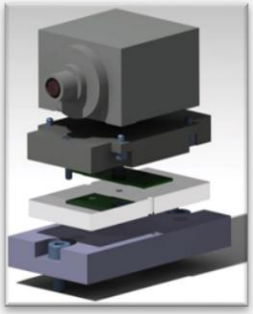
Basic supporting system



cWPS sensor with fixation

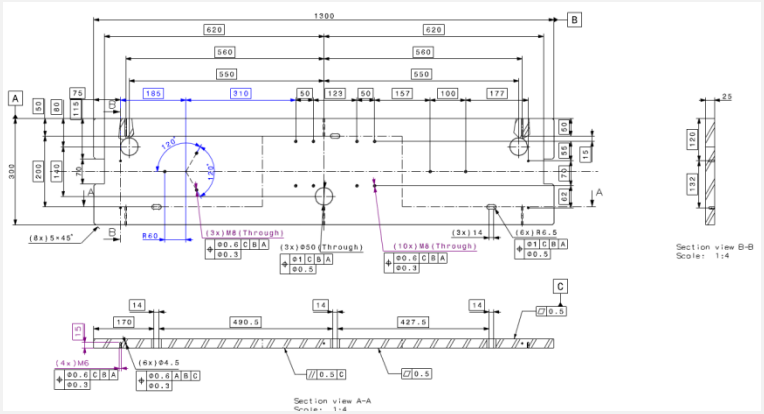


Optical WPS with fixation

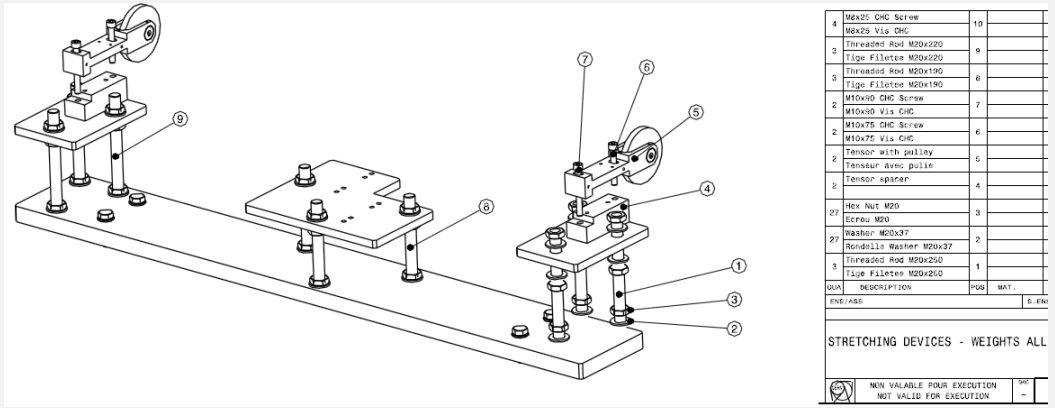


Servo Inclinometer with fixation

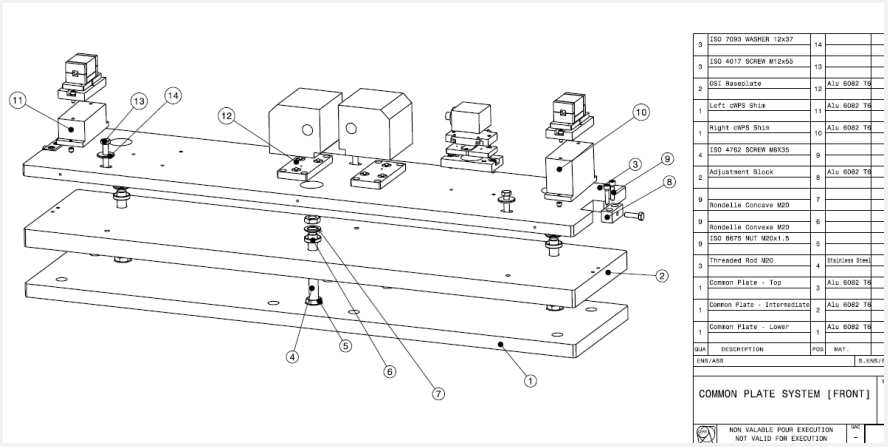
Fabrication drawings and installation plans



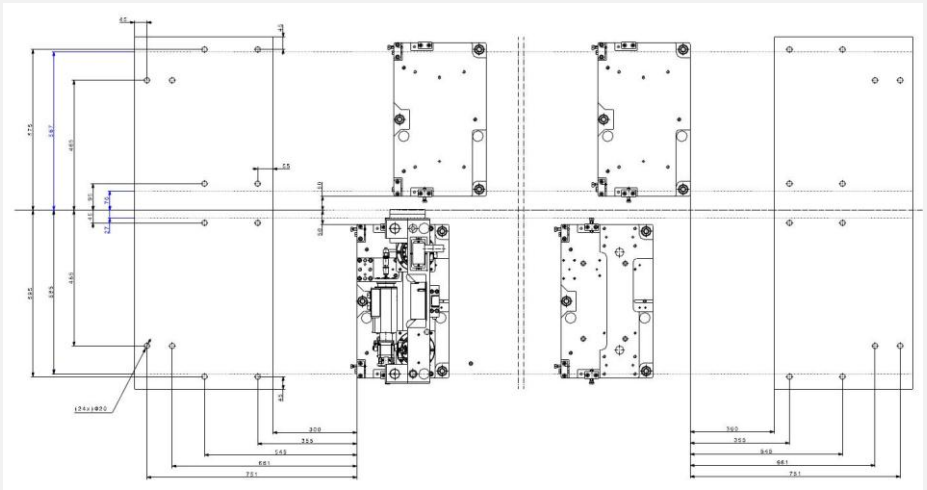
Top plate fabrication drawing



Stretching devices assembly plan

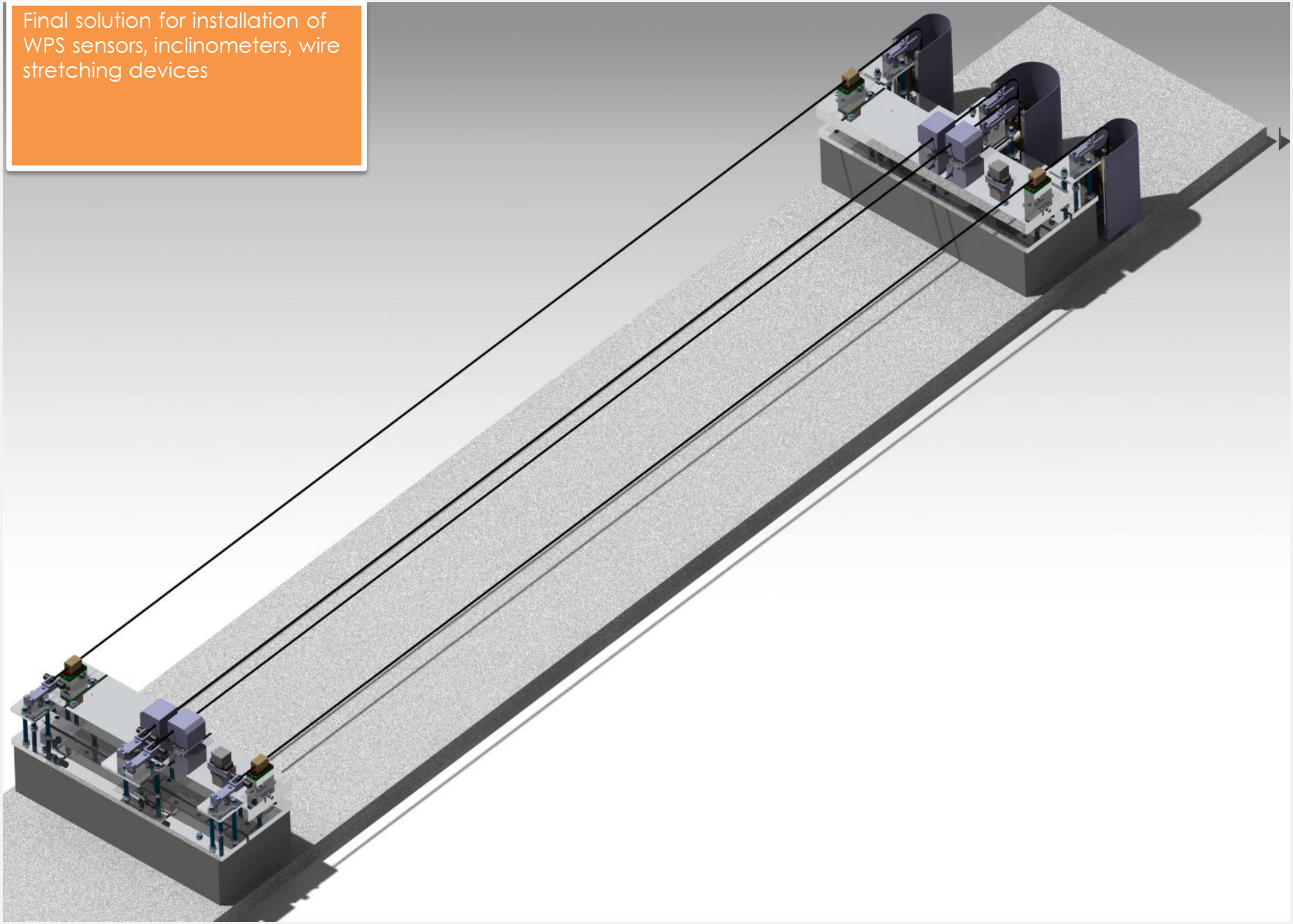


Complete system assembly plan



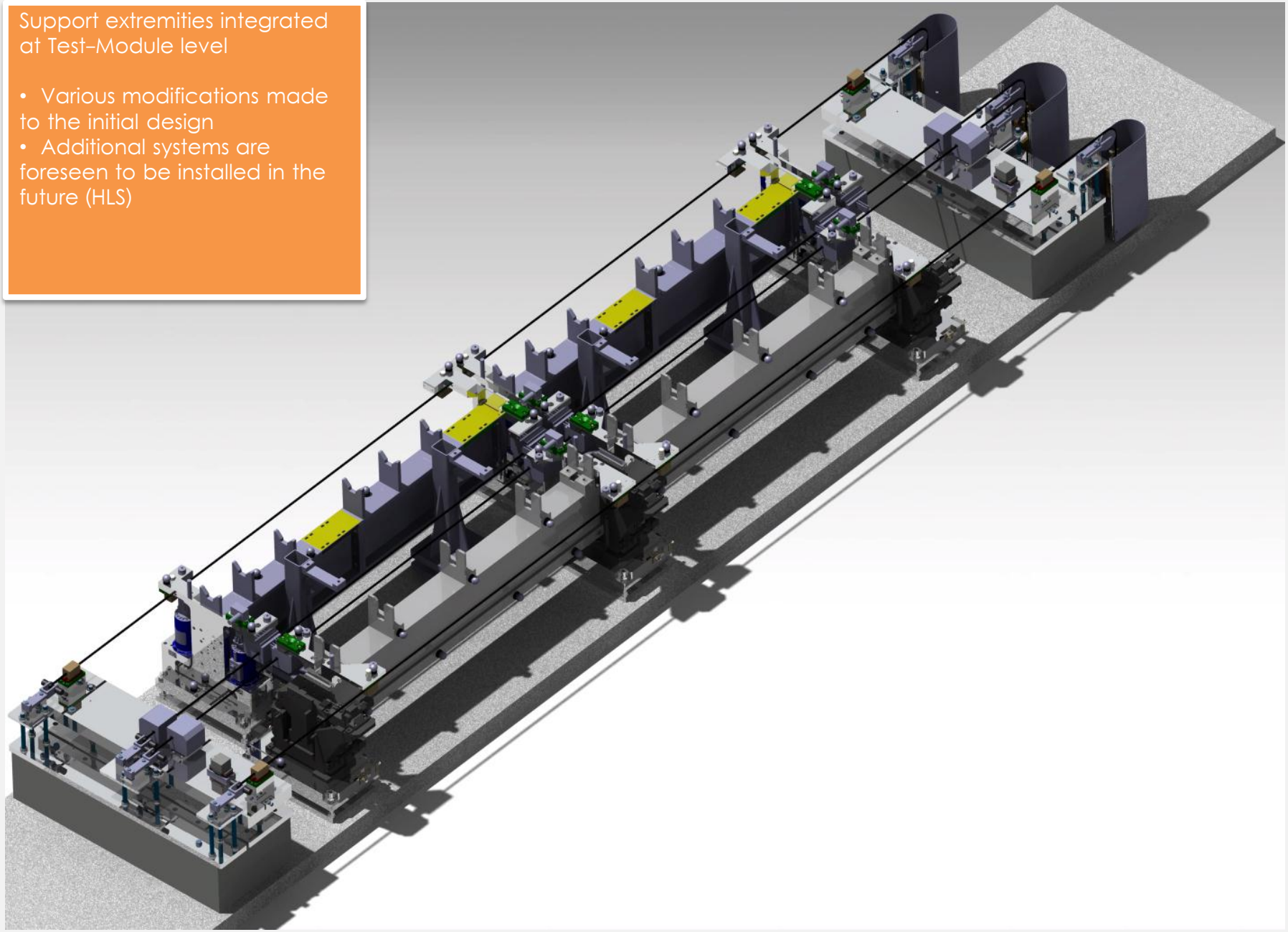
Supporting block installation plan

Final solution for installation of WPS sensors, inclinometers, wire stretching devices

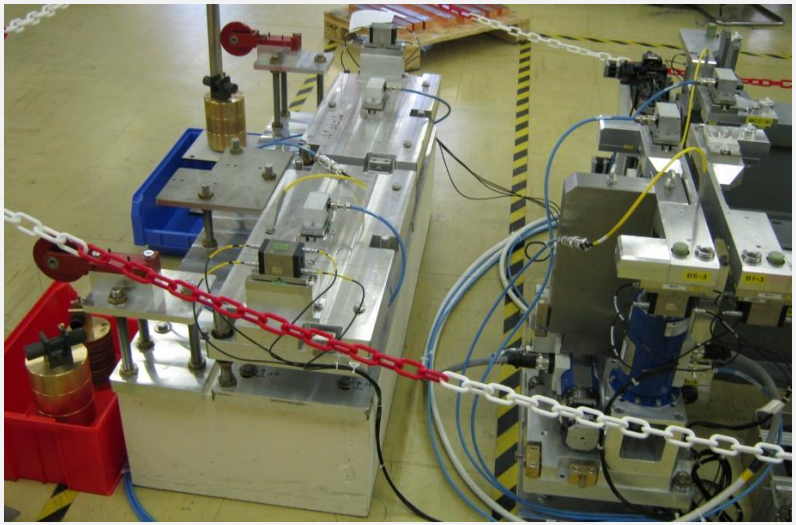


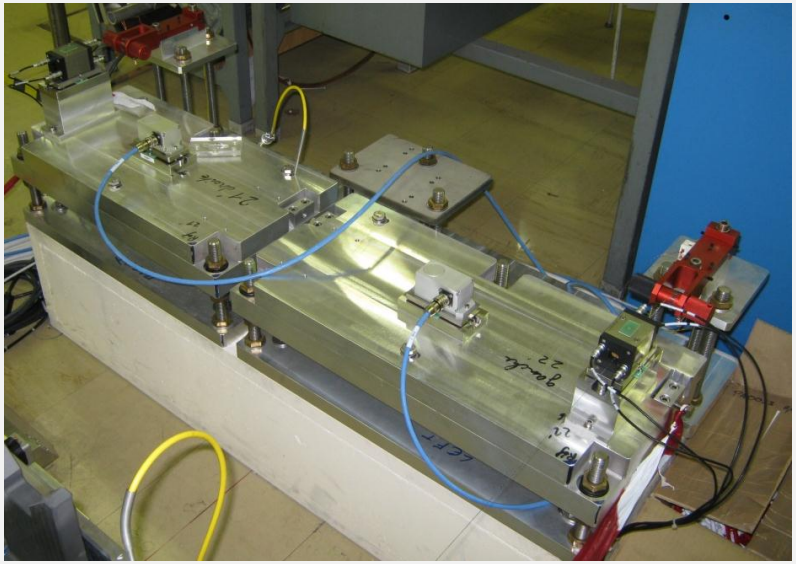
Support extremities integrated at Test–Module level

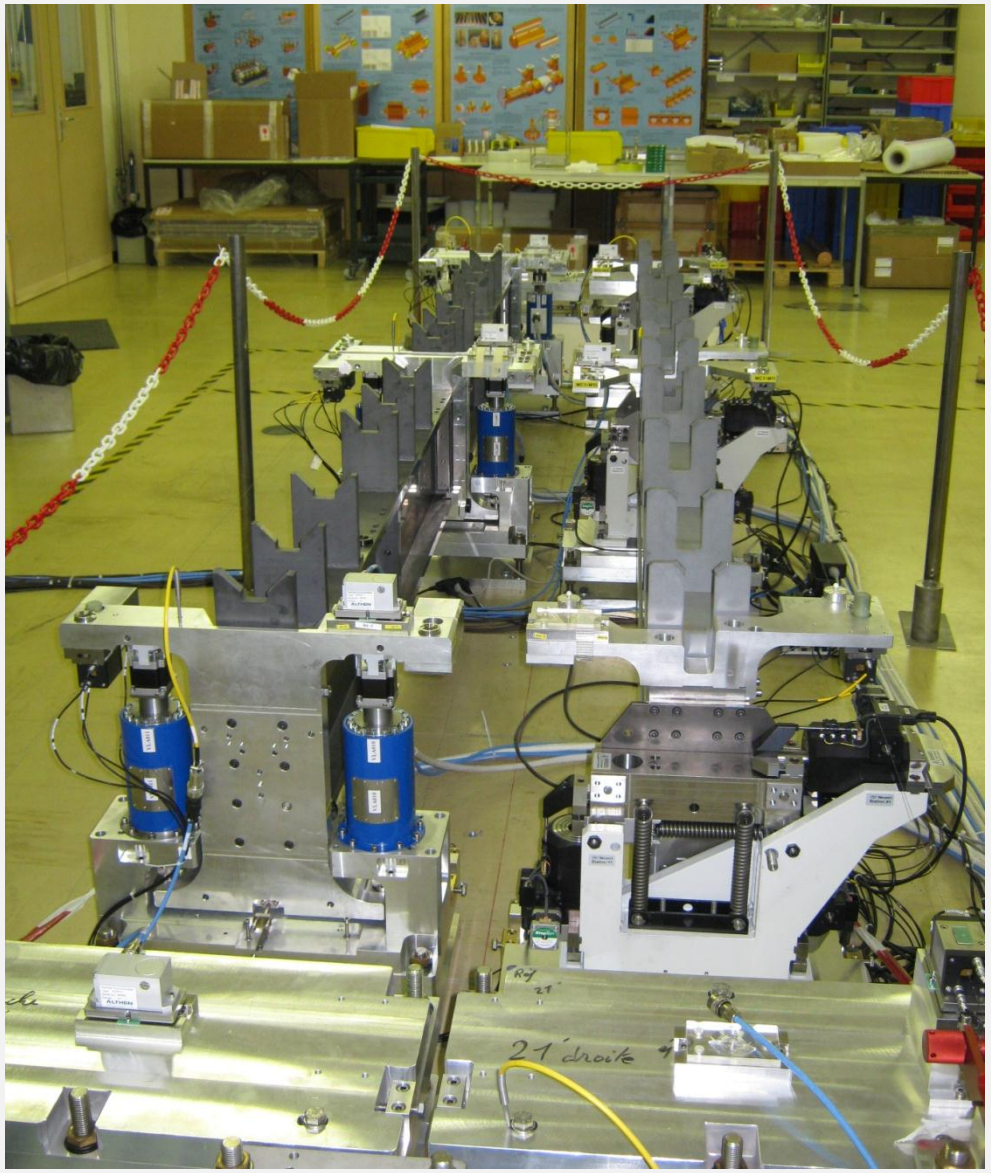
- Various modifications made to the initial design
- Additional systems are foreseen to be installed in the future (HLS)



Actual installation at 169/S-039

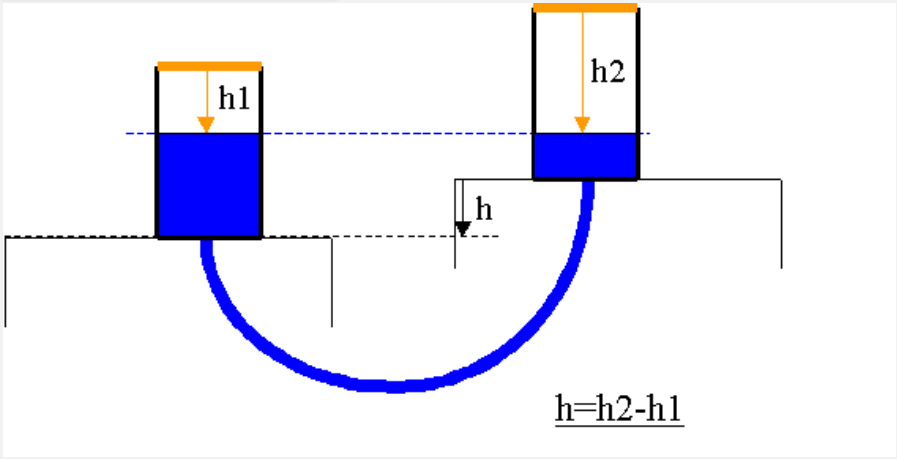






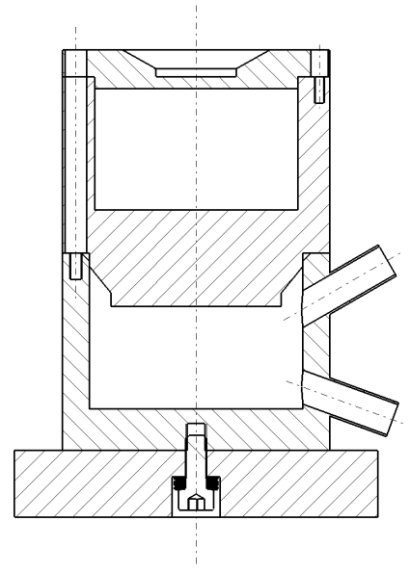
❑ Adaptation of Hydrostatic Leveling System (HLS) and water network for CLIC Test–Module

HLS schematic

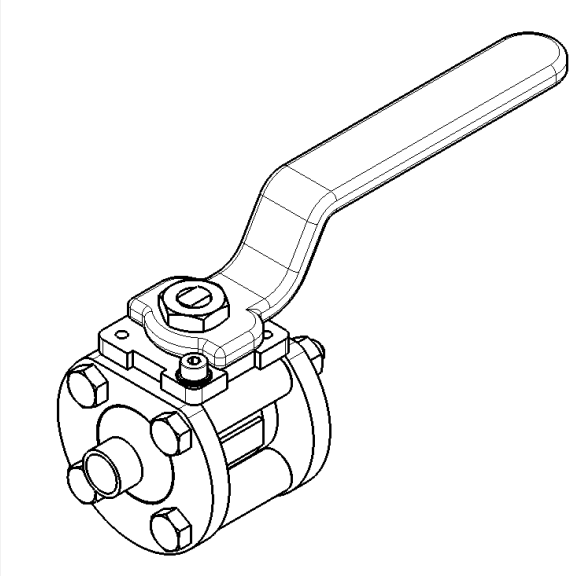


- Used to determine height differences
- Based on communicating vessels principle
- Air linkage between the stations for achieving the same pressure

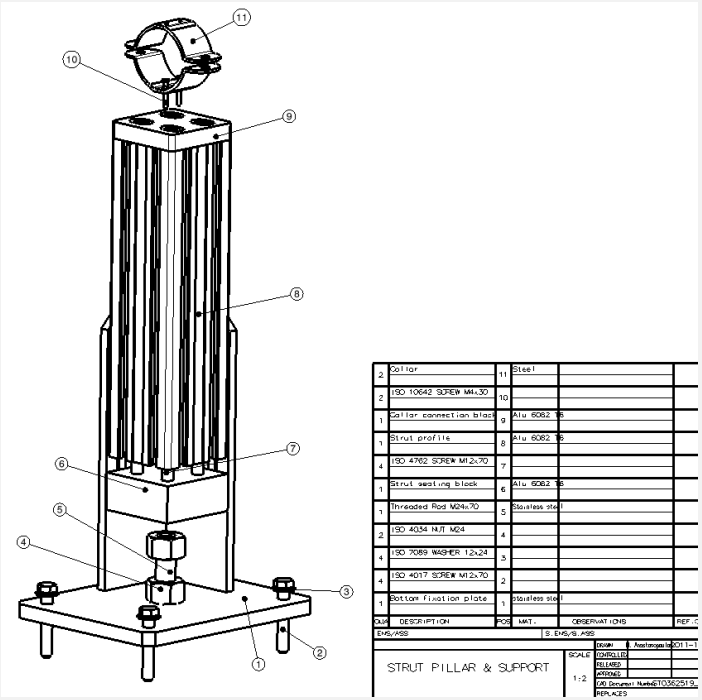
Typical HLS Pot and a previous installation



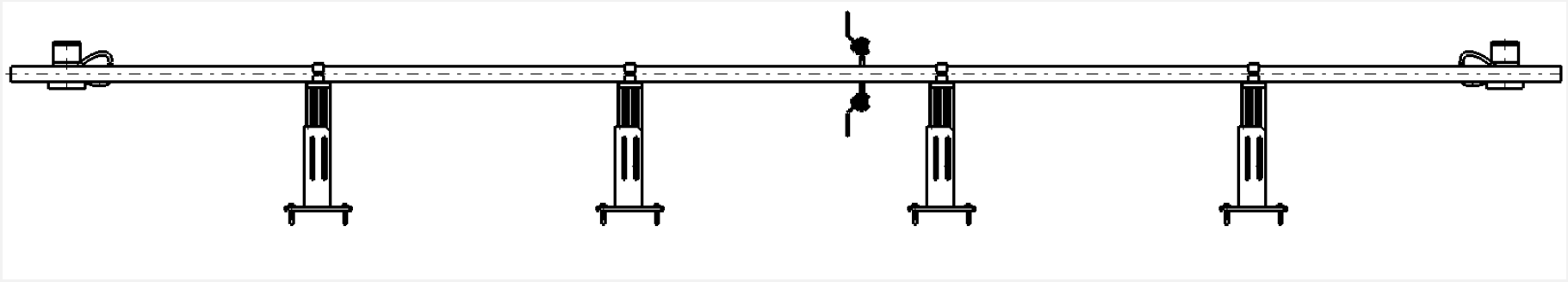
HLS Pot assembly



PS4 Valve

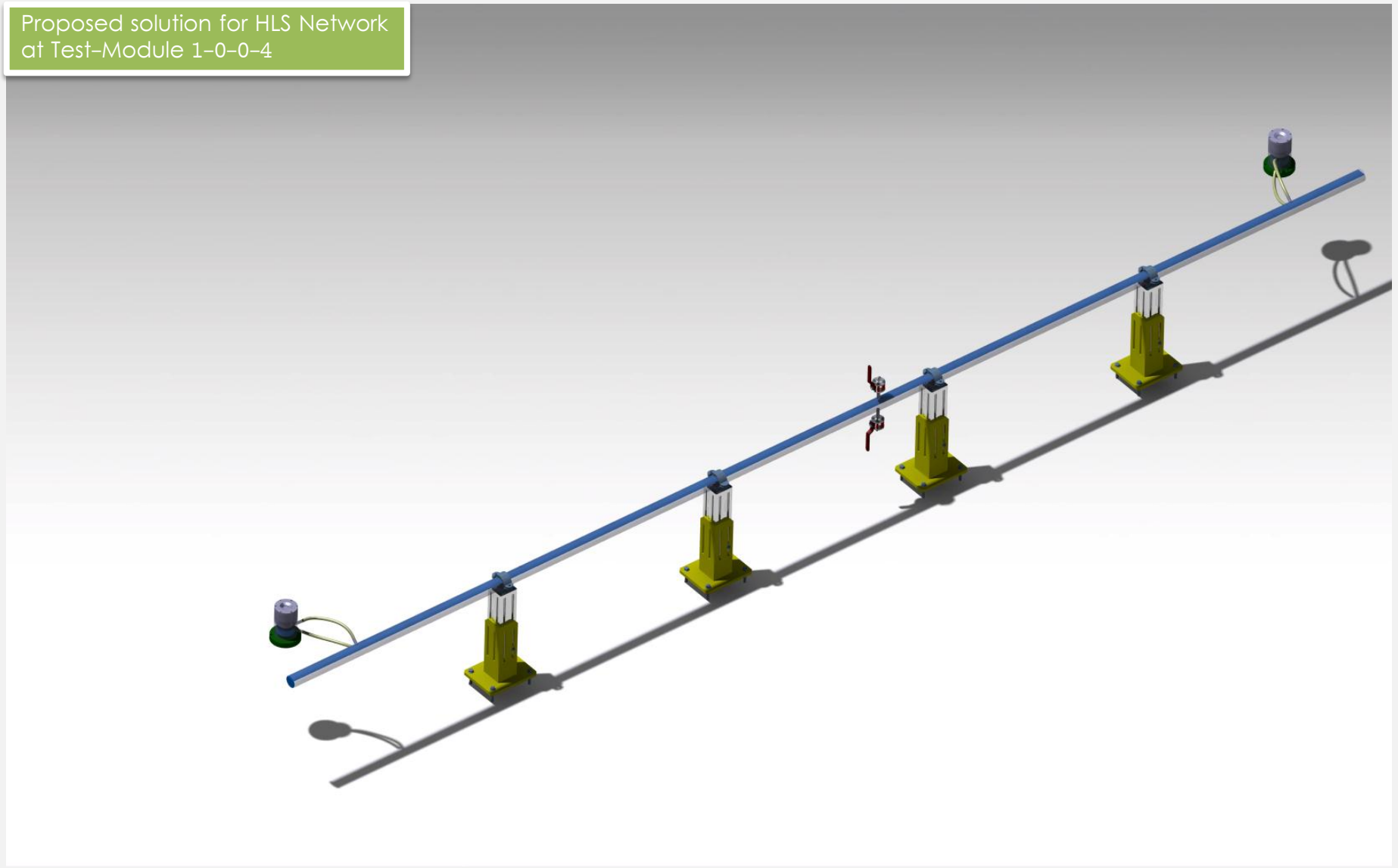


Support assembly plan



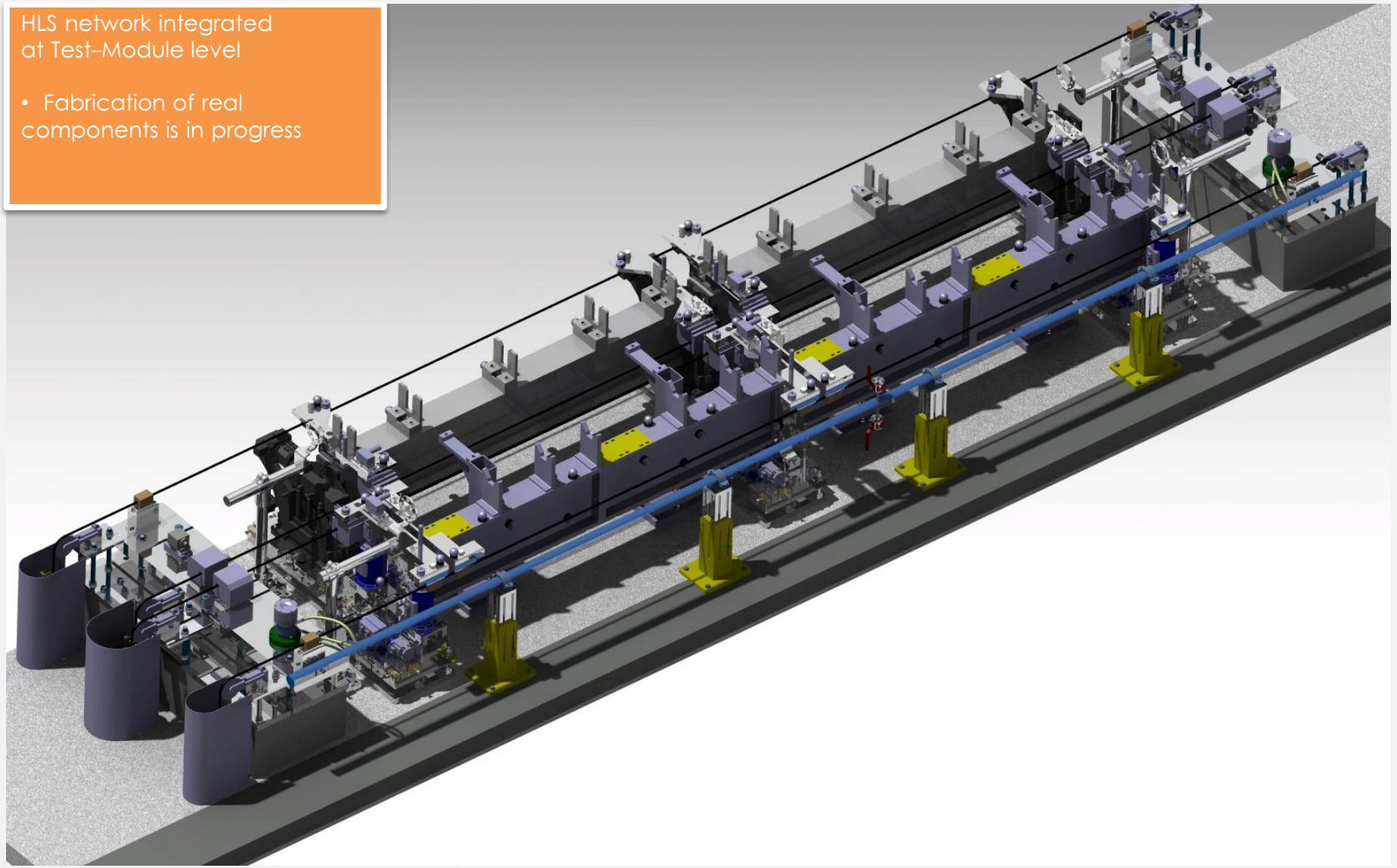
HLS Network installation plan

Proposed solution for HLS Network at Test-Module 1-0-0-4



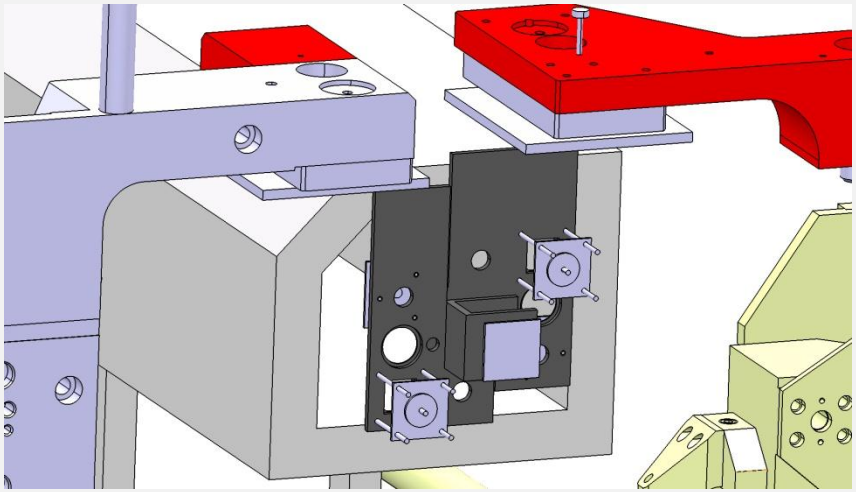
HLS network integrated at Test–Module level

- Fabrication of real components is in progress

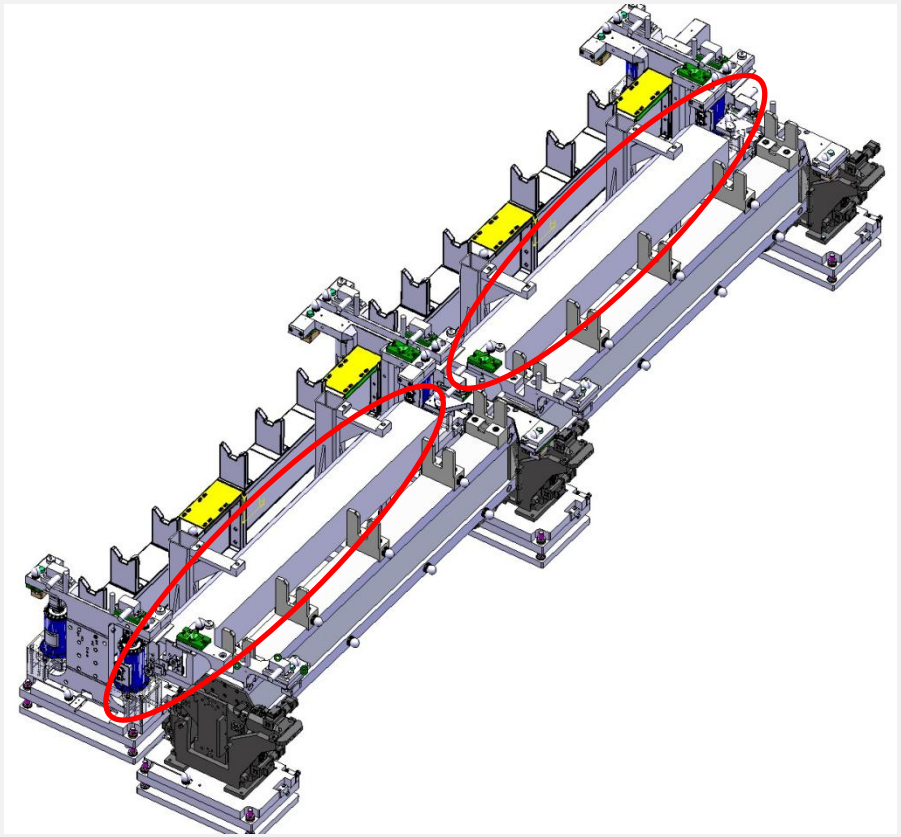


❑ Integration of NIKHEF RasChain system

- Alternative alignment solution
- Based on optical WPS sensors (laser)
- Needs thermal insulation



NIKHEF optical alignment system
(current design under modifications)

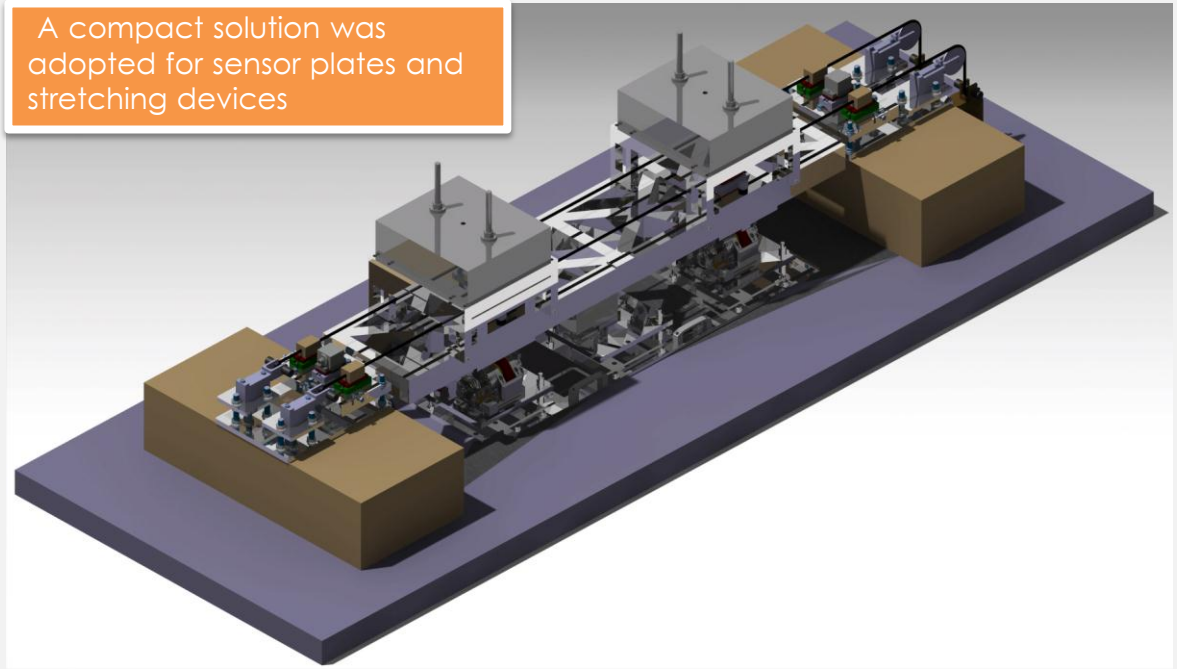


Integration of current version of the system
(Laser sensors & thermal insulation)

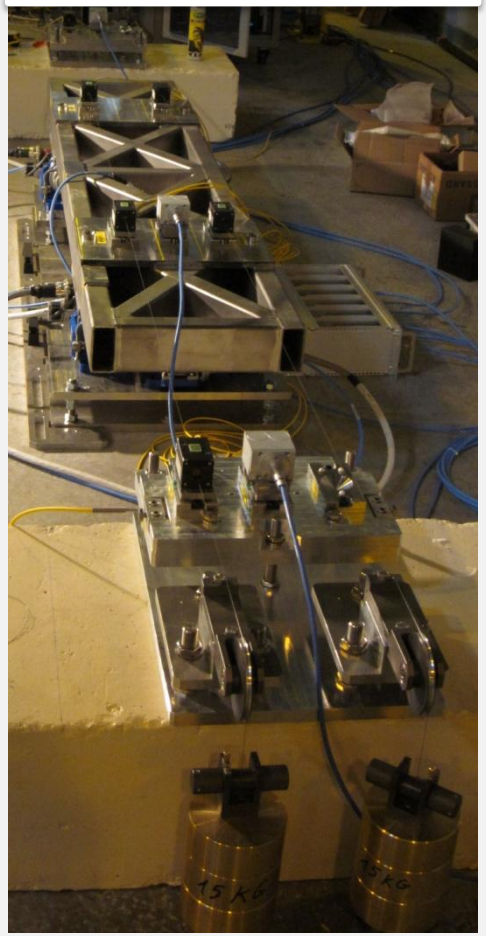
❑ Integration of an alignment system in a 5 DoF Mockup

- Will provide an evaluation platform for a 5 DoF system, based on cam movers

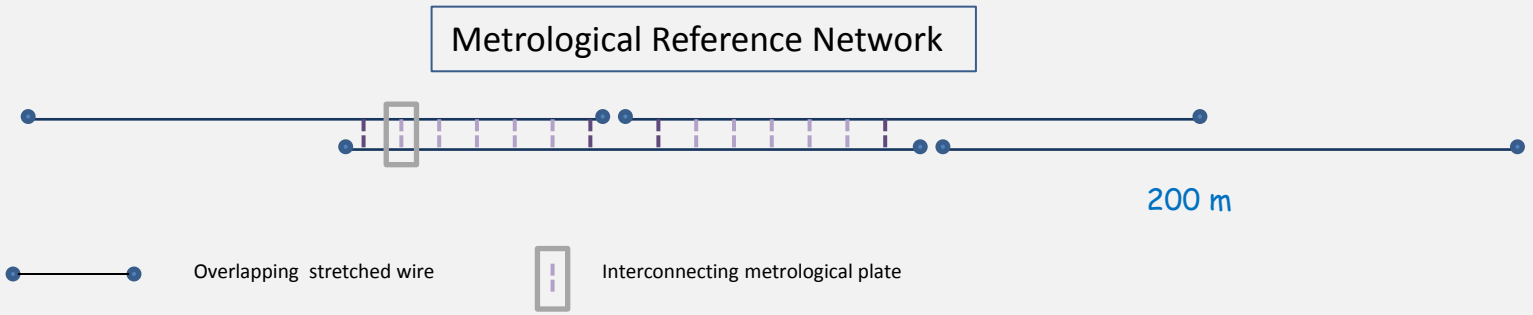
A compact solution was adopted for sensor plates and stretching devices



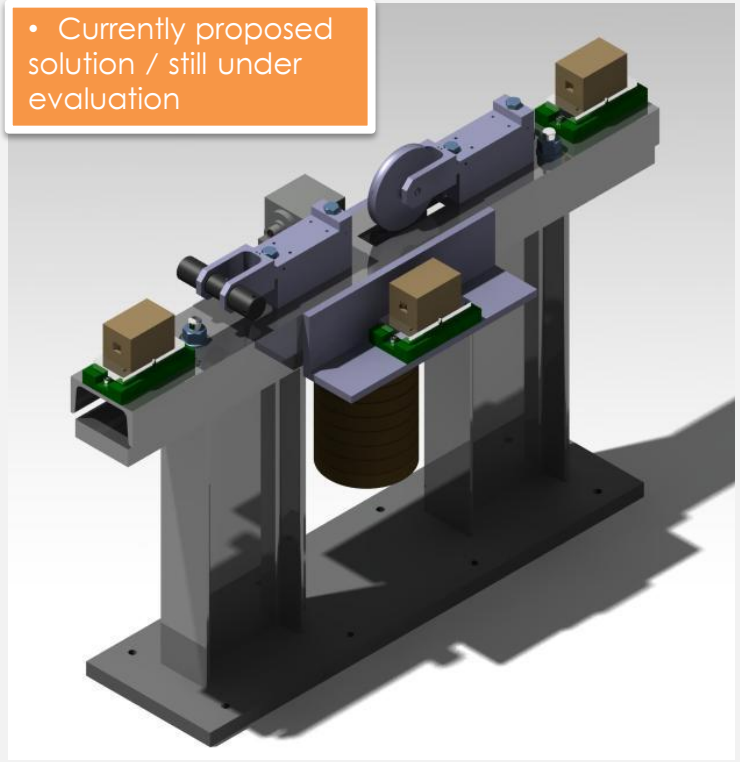
Actual installation at 927–TAP



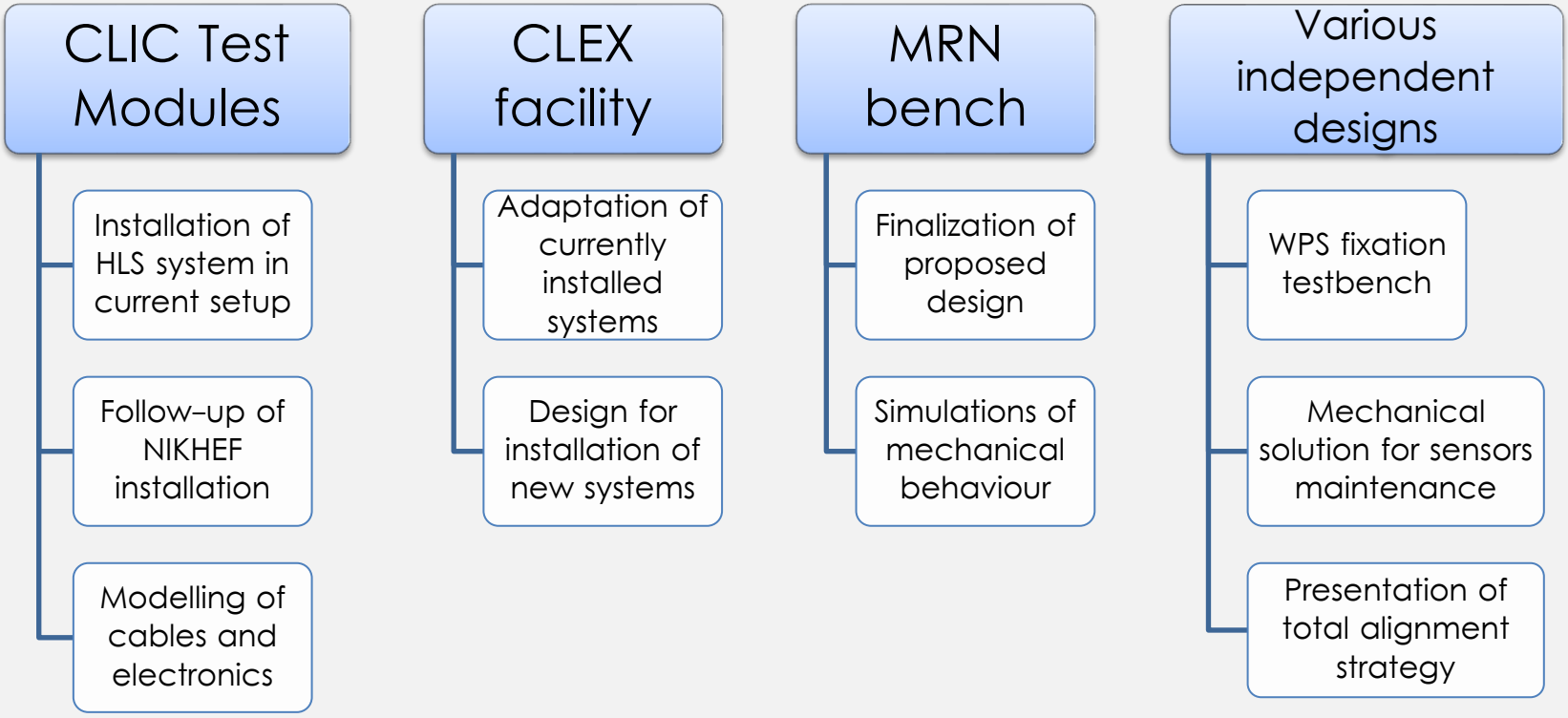
❑ Metrological Reference Network (MRN) Interconnecting bench



- Limited space (~ 50 cm. width allowance inbetween the module's girders)
- Access for sensors and stretching devices maintenance
- Minimum deformation of supporting plate



IV. Future tasks



Thanks for your attention!