

Accelerating Structure Pre-alignment Support: Prototypes

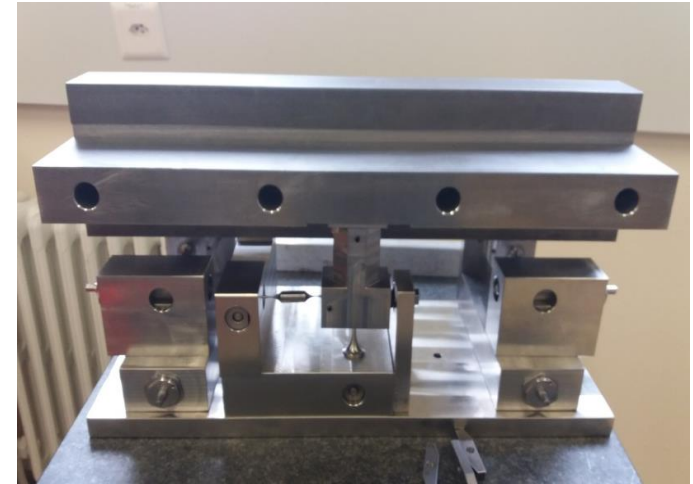
Two prototype Accelerating Structure (AS) pre-alignment adjustment stands have been manufactured and tested in collaboration with the CERN Engineering Survey, Mechatronics and Measurements (SMM) group.

Prototype Test Results:

- The Accelerating Structures can be positioned within $1\mu\text{m}$ when measured directly.
 - To less than the $15\mu\text{m}$ resolution of the AT401 laser tracker when measured from 2m.
- Performance of the Adjustment Supports is $90\mu\text{m}/\text{revolution}$, as designed.
- Backlash is less than $45\mu\text{m}$ (half a resolution).
- Stability is dependent on spring preload. Displacements of $50\mu\text{m}$ measured in several axes across multiple transportation tests.

Design Feedback:

- Clearances around the heat treated flexures should be considered and possibly relaxed.
 - Interference between sliding parts appears to be limiting range.
- Repositioning of adjustment points to one side is desirable to ease use.
- High strength steel required to prevent the lead-screws twisting under torsion.
- Spring forces need to be optimised.
 - High preload and stiffness increases stability and return performance, but is limited by flexure strength



Above: Prototype 1 (Including Dumb Test Mass)

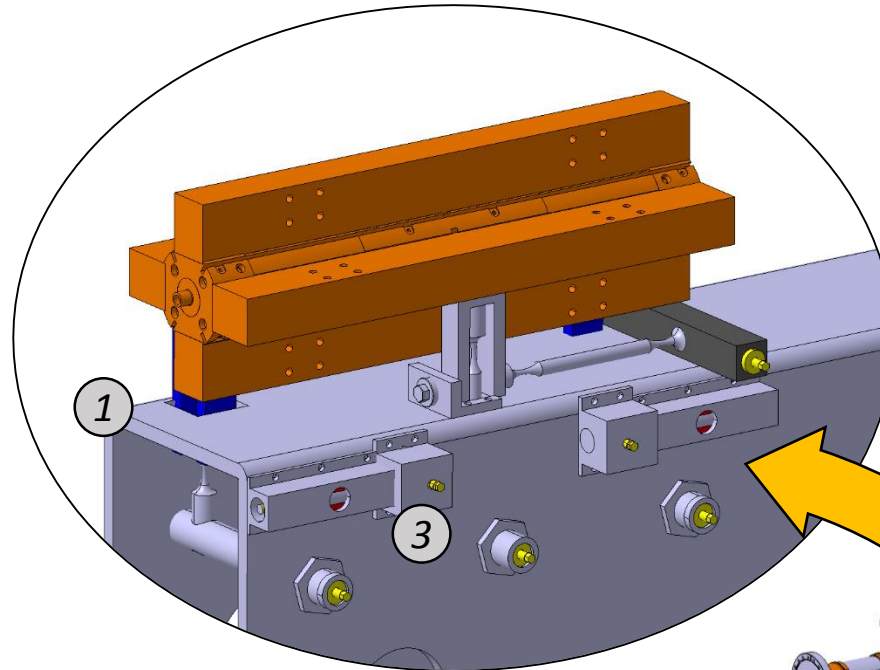


Above: Prototype 2 (Including Thermal Test AS)

Accelerating Structure Pre-alignment Support: Future Version

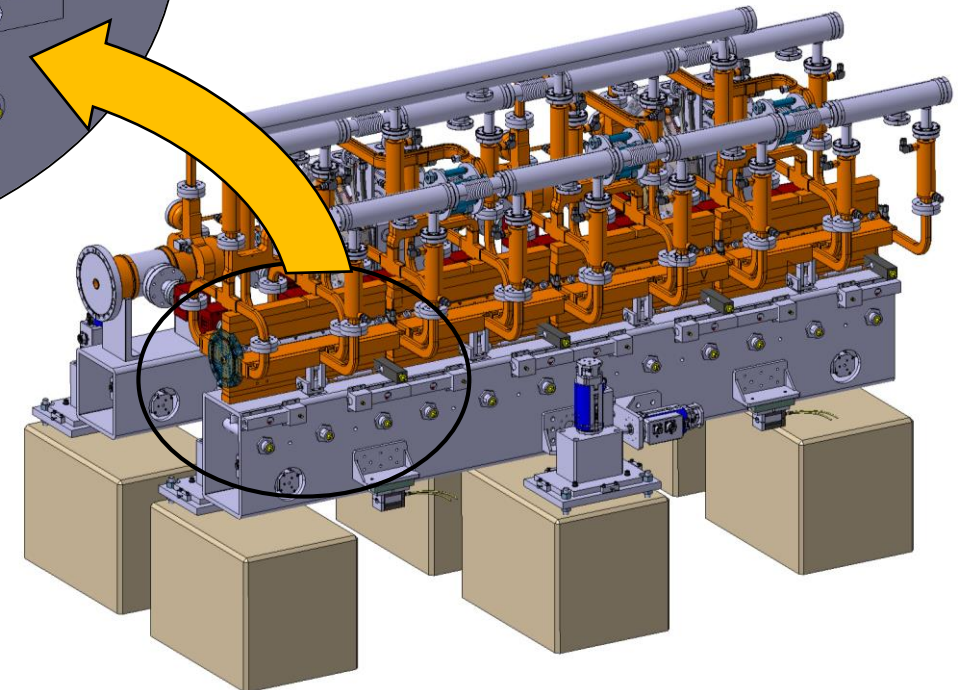
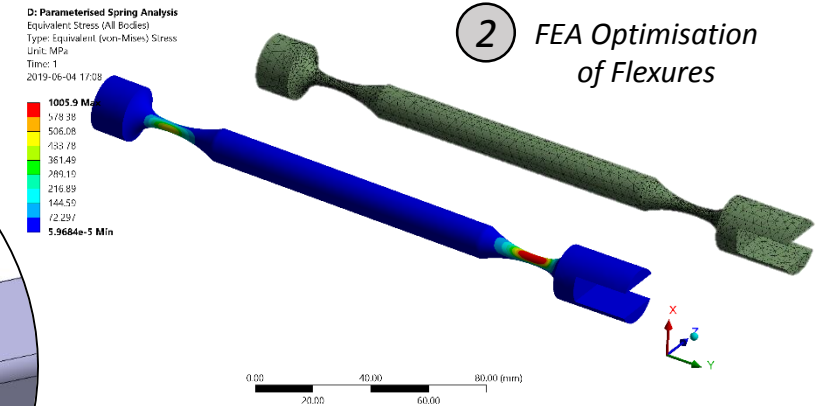
Future Version Design:

1. Integration with the rest of the TBM assembly.
2. Optimisation of flexure designs to allow $\pm 1.5\text{mm}$ of adjustment in each axis.
 - Both individual axis and in combination.
3. Repositioning of adjustment points to one side to facilitate automated adjustment.
 - Achieved by including a gearbox before the lead screw for the lateral adjustment axes.



Current Challenges:

- Optimisation of return spring selection.
 - Increasing the spring preload and stiffness is desirable to increase stability and return performance, but is limited by flexure strength.
- Further stability testing.
 - Current stability tests were inconclusive, showing an increasing displacement across multiple tests, rather than a 'settling'.
- Disassembly and inspection of prototypes.
 - The Y-axis range of Prototype 2 is limited, possibly due to interference between heat-treated parts. This must be verified.



T0 - Two Beam Module