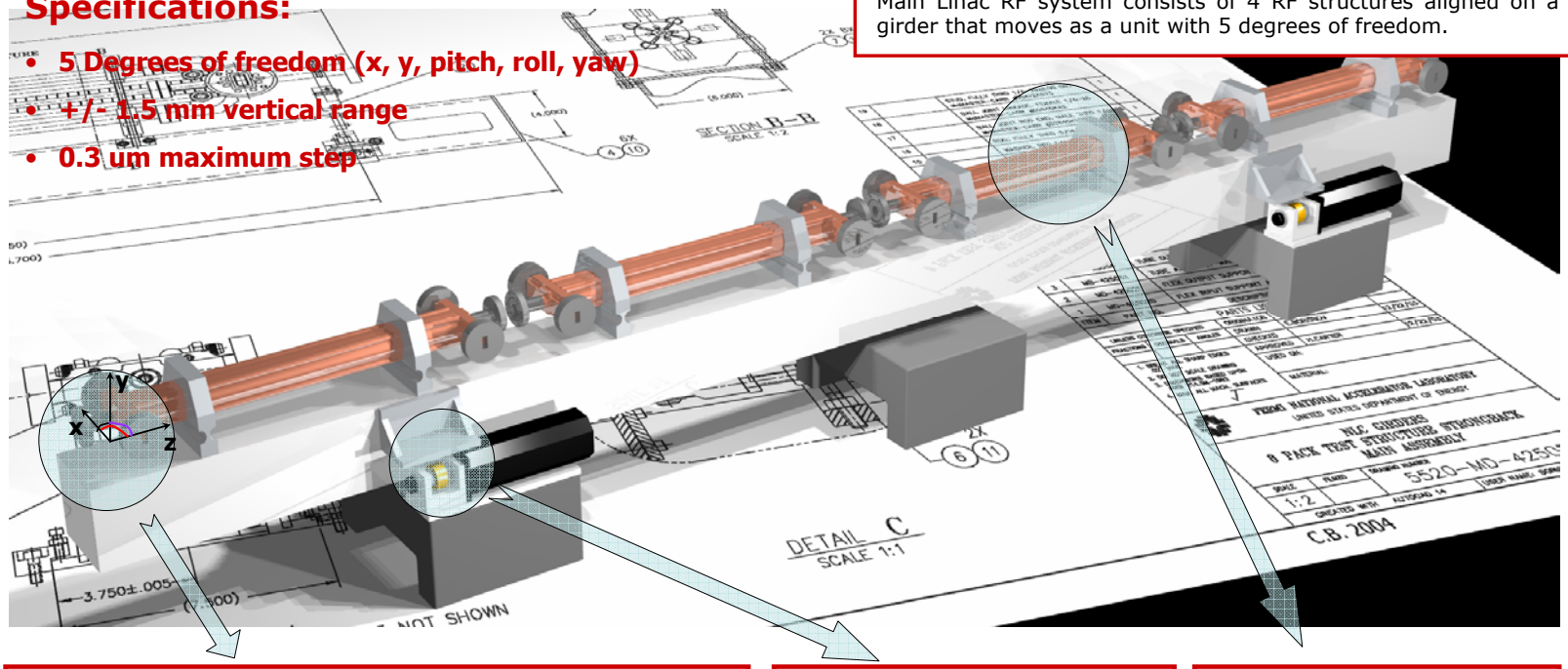
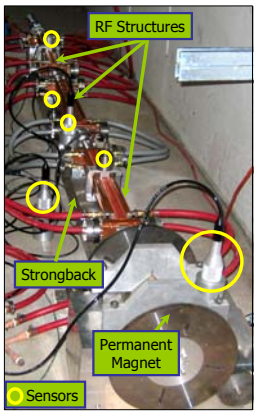
Main Linac RF Girders

In order to apply beam based alignment, both the quads and the RF system must be supported by movers. The basic cell for the Main Linac RF system consists of 4 RF structures aligned on a girder that moves as a unit with 5 degrees of freedom.

Specifications:

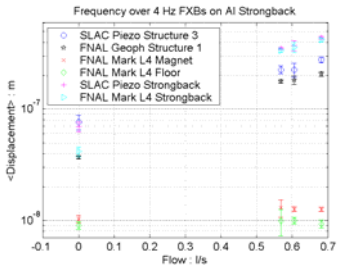
- 5 Degrees of freedom (x, y, pitch, roll, yaw)
- +/- 1.5 mm vertical range
- 0.3 um maximum step

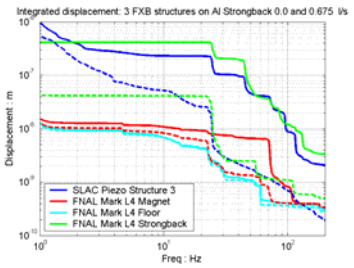




Vibration studies

The effect of cooling water flow in the RF cavities on the vibration stability of the girder-RF system and the coupling to the quad magnet has been extensively studied. Low coupling between the magnet and the structures through the beam pipe connection has been measured and FEA confirms a good agreement between model and experimental results.

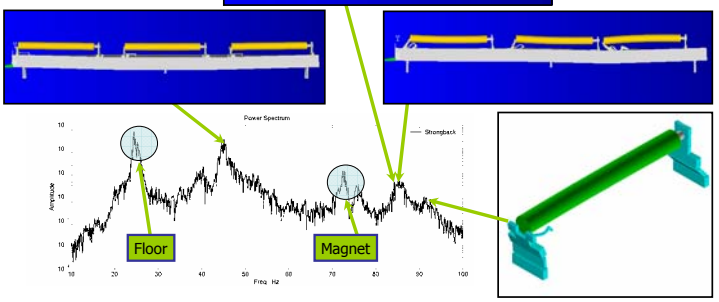




Displacement for frequencies above 4 Hz at different cooling water flow

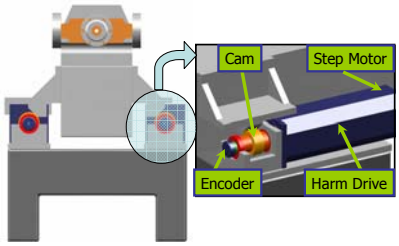
Integrated displacement

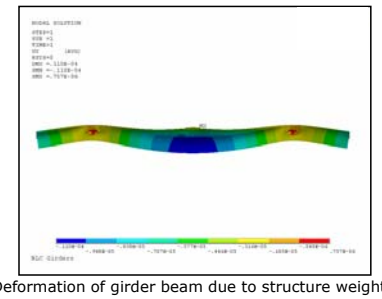
Dashed 0.00 l/s
Solid 6.75 l/s



Mechanical studies

The girder mover is a kinematic support where the number of points of contact (5) equals the number of spatial degrees of freedom. The beam direction is not constrained in order to allow for thermal expansion. This design was proven by the FFTB at SLAC and the SLS at PSI.

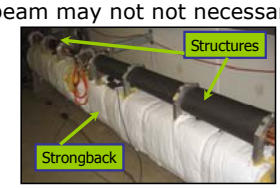




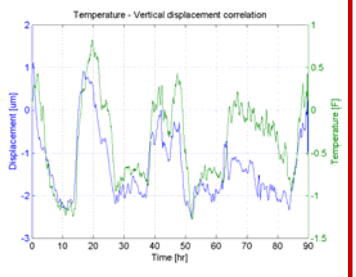
Deformation of girder beam due to structure weight

Thermal stability

In order to maintain a stable alignment of the RF structures within a girder, it is necessary to design a proper support system. These supports should allow for precise alignment and thermal expansion along the beam axis. Thermal stabilization of the girder beam may not not necessary.



Thermal stability test setup



RF structure y-displacement
Versus temperature

Conclusions:

No major technical problem was discovered so far. The design is almost finalized.