CLIC STABILITY STUDY

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Latest stabilization technology applied to the accelerator field

2001: Select/buy equipment *2002: Since 3/02 measure*

Buy advanced industrial solutions

- **Rigid system (rubber, piezos)**
- **Soft system (air)**
- **Platform with minimized structural resonances**

Test in normal working environment at CERN

Experimental set-up in the CERN-CLIC vibration test stand in Building 169.

Tolerances on mechanical stability:

Vertical plane is most demanding…

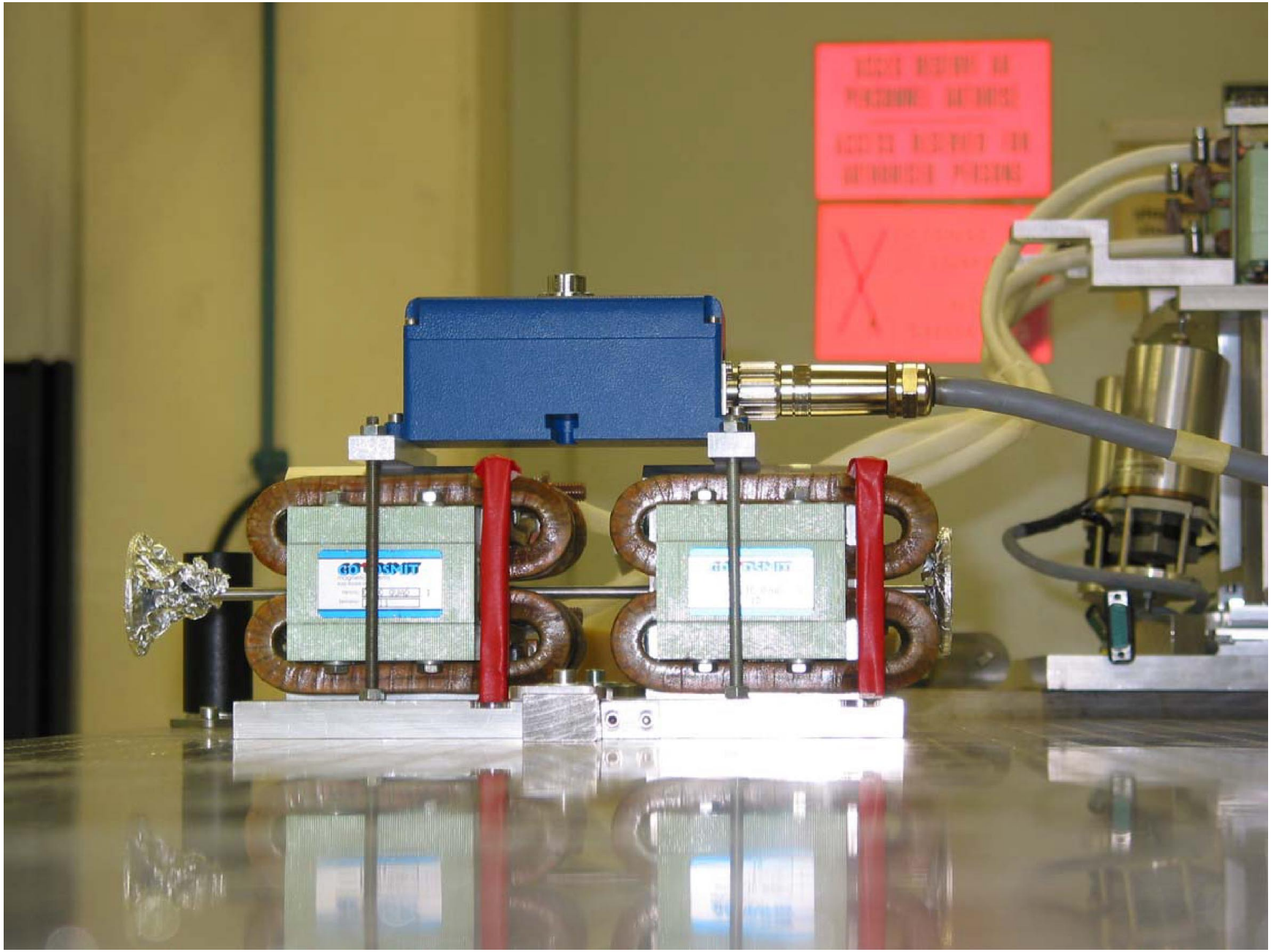
For CLIC:

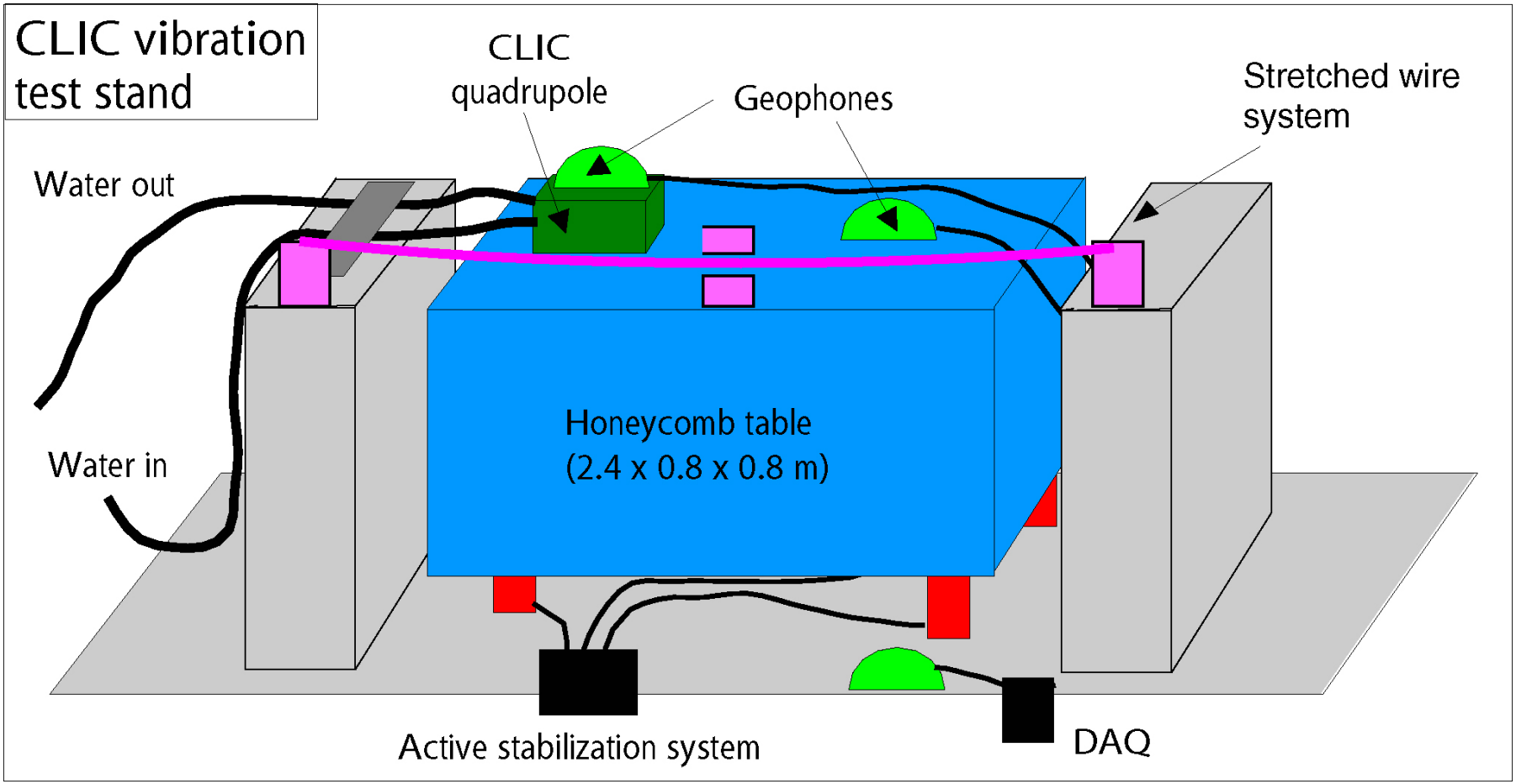
Linac quadrupoles (1300 times 2)	1.3 nm rms above 4 Hz
Final doublet (2)	0.2 nm rms above 4 Hz

Less severe in horizontal plane (4 nm rms above 4 Hz for doublet)

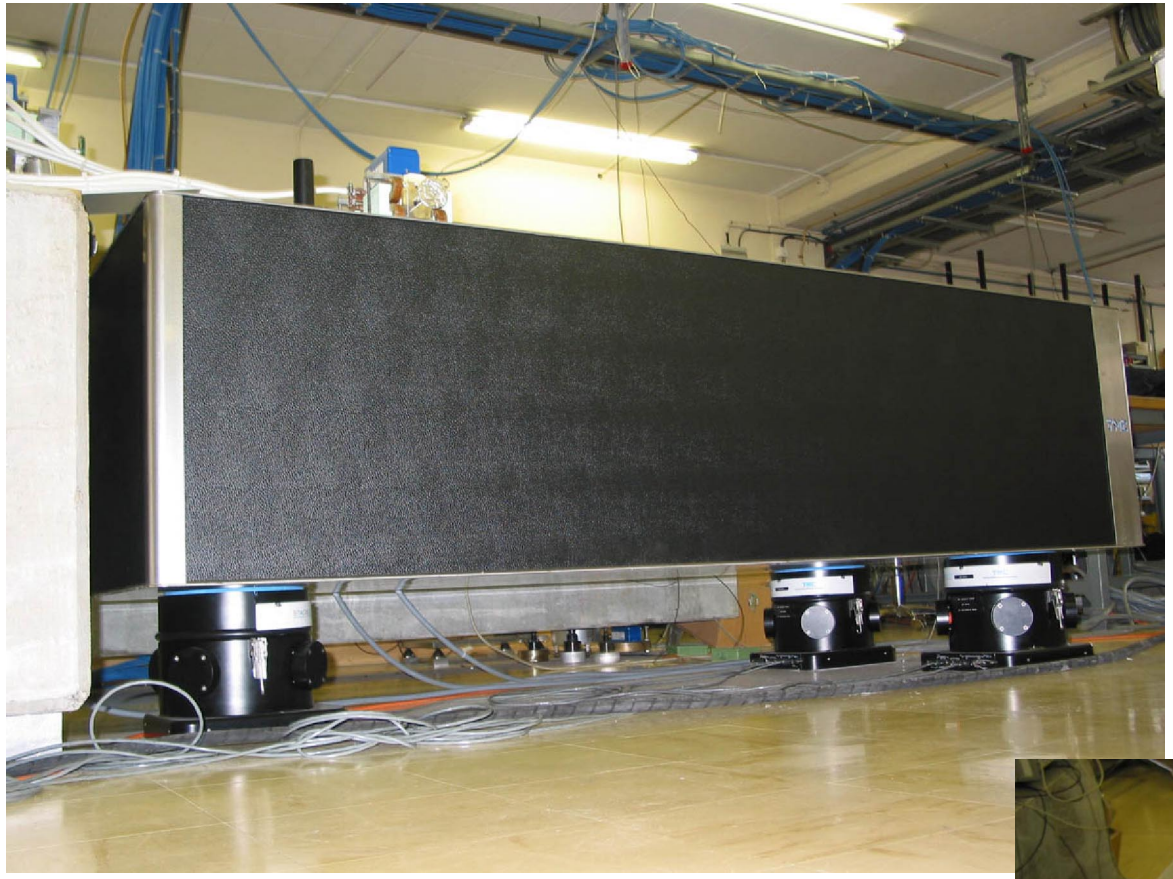
CLIC stability study:
Demonstrate feasibility of nano-metre size colliding beams!

(magnet vibration, feedback, time-dependent luminosity)





Vibration damping:	Two systems (rigid or soft)
Cooling water:	on/off
Vibration:	Geophones
Alignment:	Stretched wire system
Support platform:	Lowest resonant frequency > 230 Hz



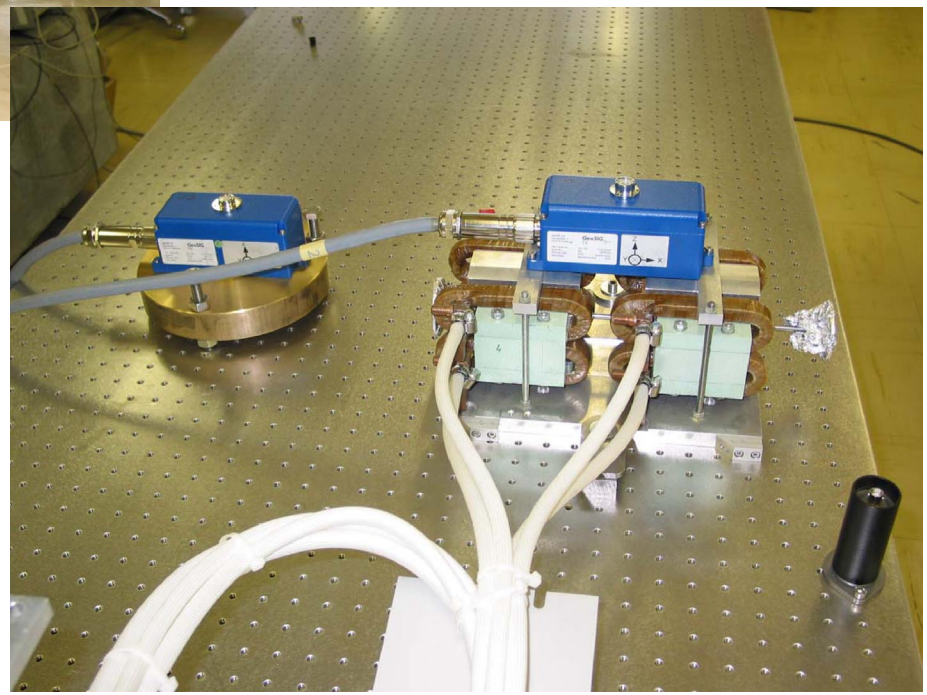
STACIS 2000 (TMC)

Rubber damping

Active feedback circuit on ground motion

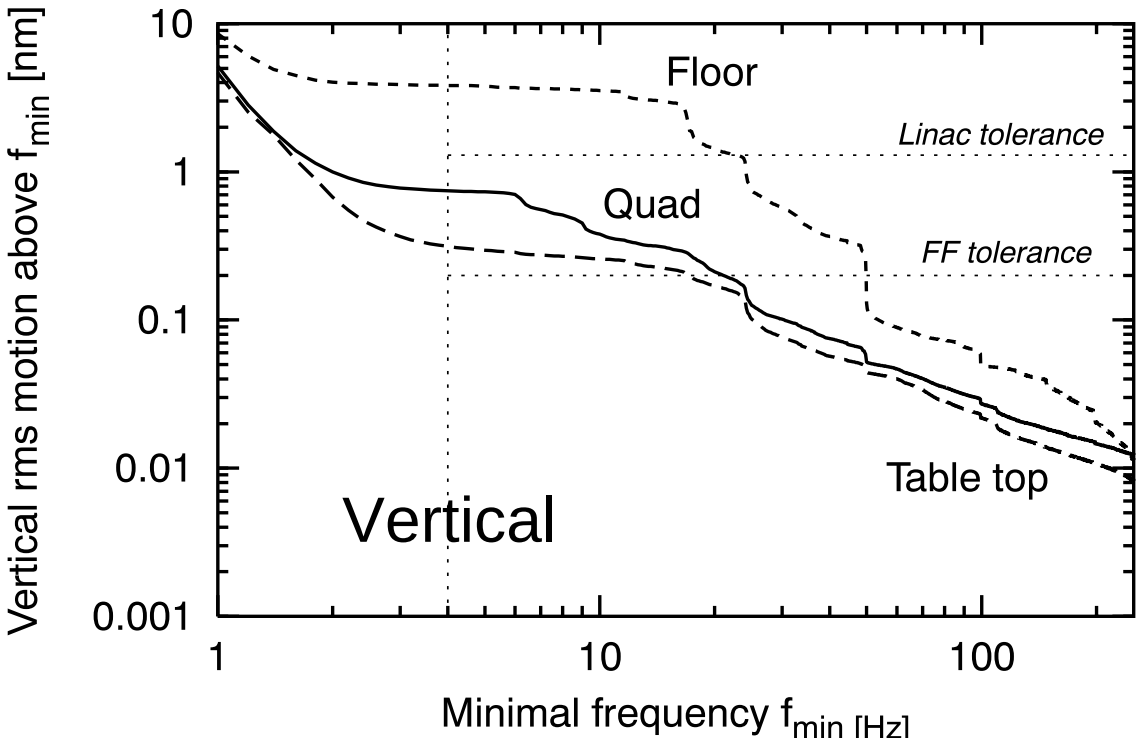
Measure ground motion

Actuators: piezos



Rigid system

Quadrupole vibration:



On magnet top:

X: (0.4 ± 0.1) nm

Y: (0.9 ± 0.1) nm
(0.3 nm on table top)

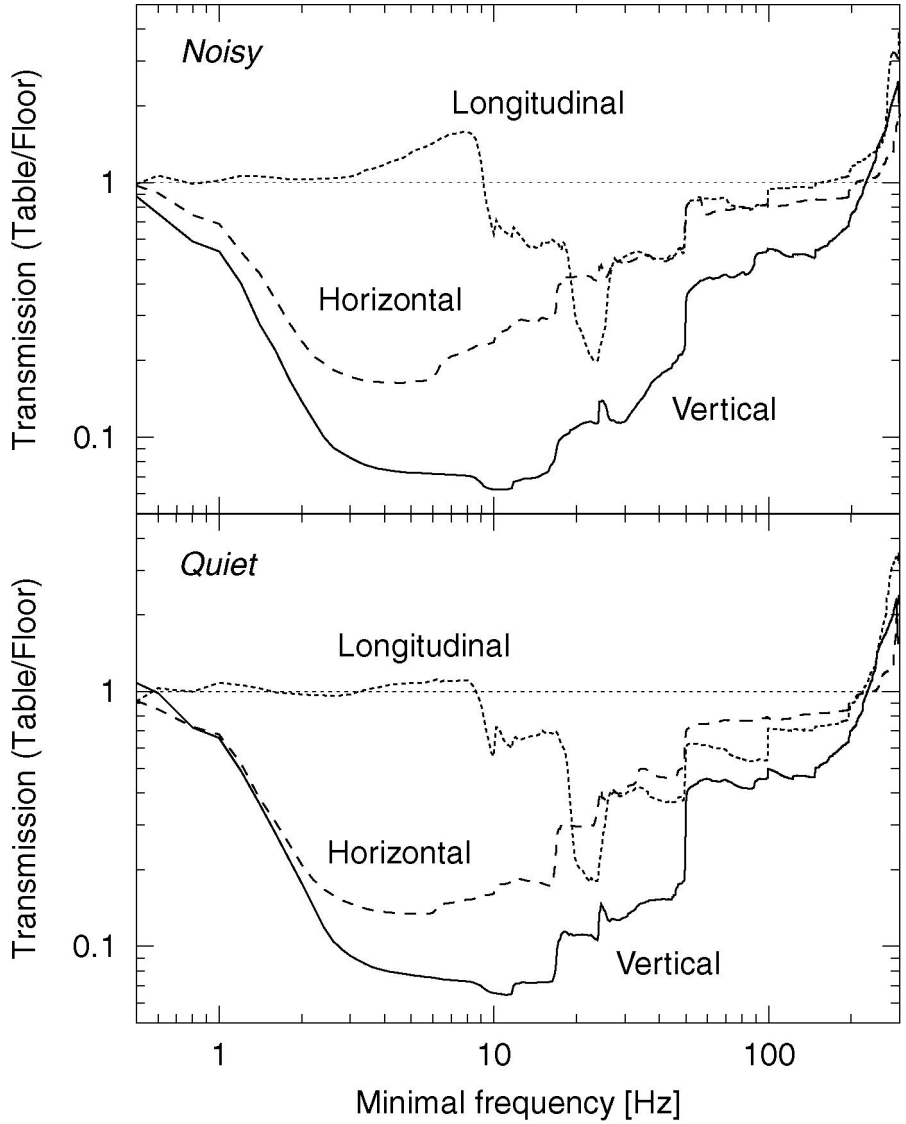
Z: (3.2 ± 0.4) nm

without cooling water.

With nominal flow of cooling water:

Y: (1.3 ± 0.2) nm

Tight vertical linac tolerance demonstrated!



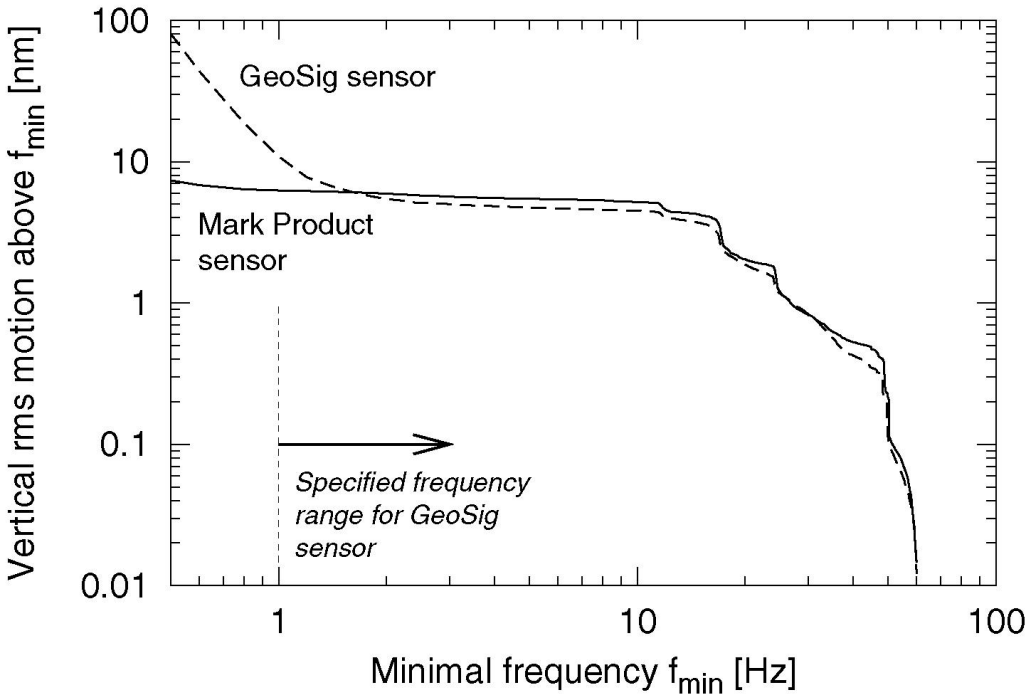
System limited by:

Electronic noise in feedback circuit

Amplification of high frequency motion!

Transfer function depends on signal/noise ratio!

Transfer function depends on level of ground motion!

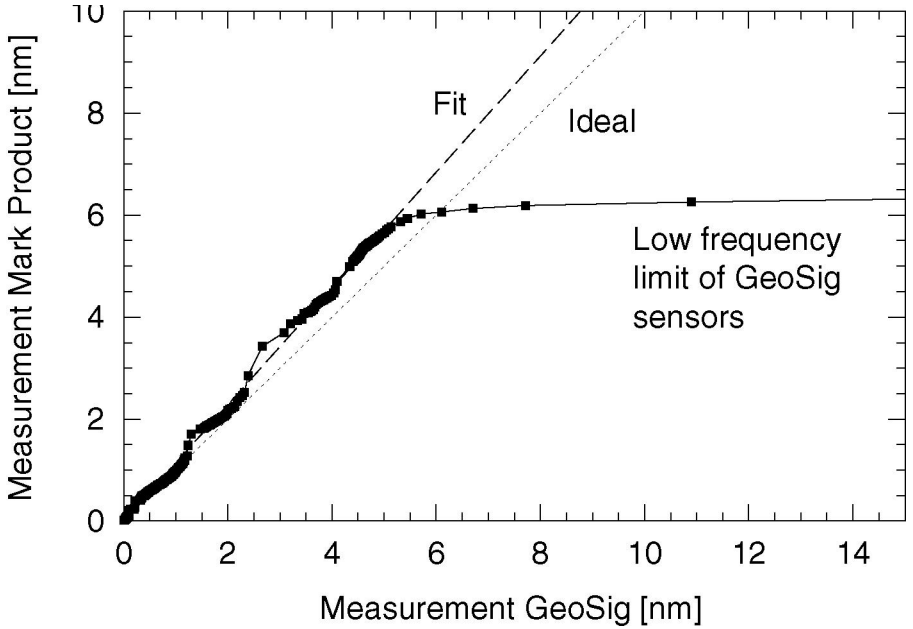


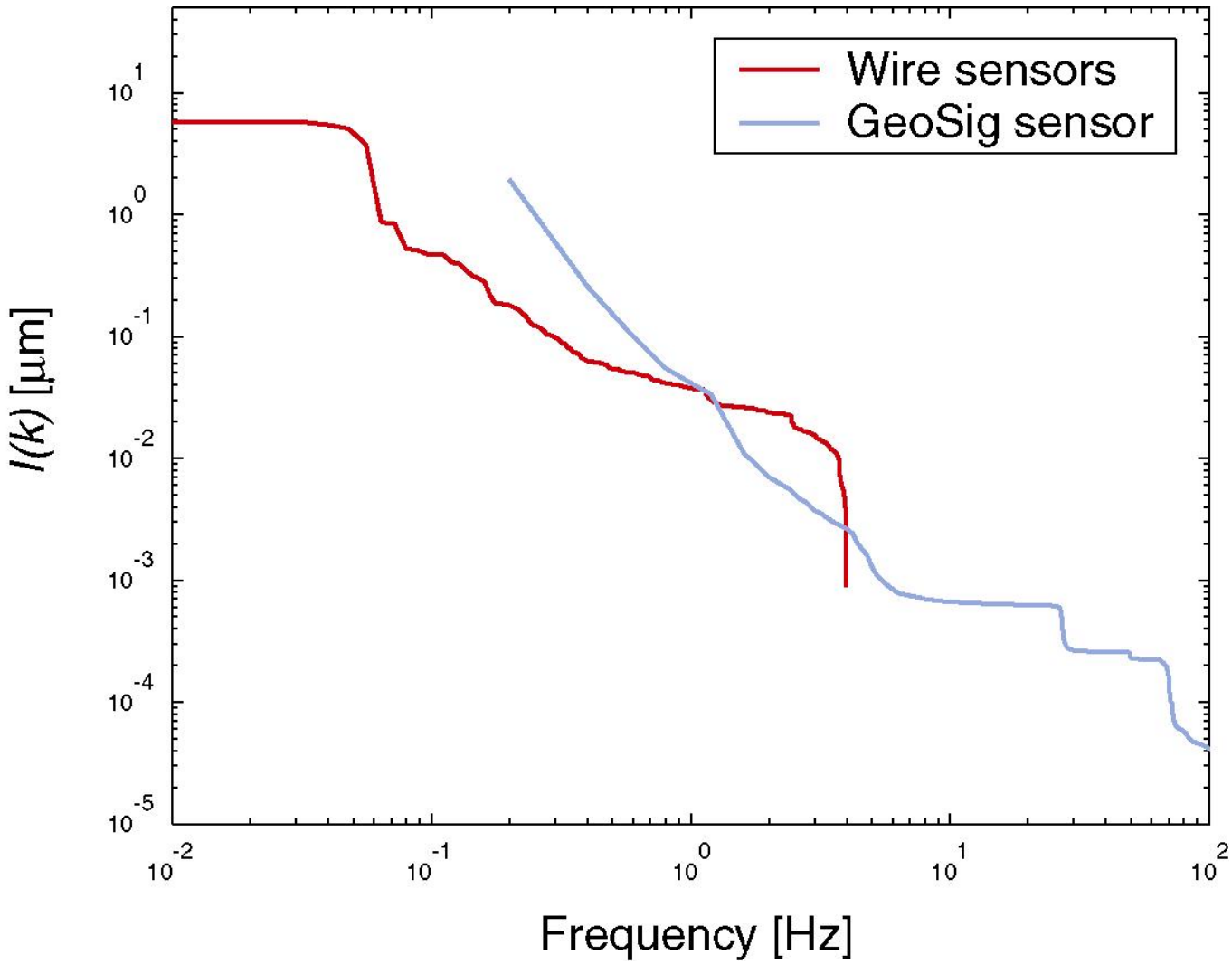
How do we know our absolute scale?

Calibration manufacturer

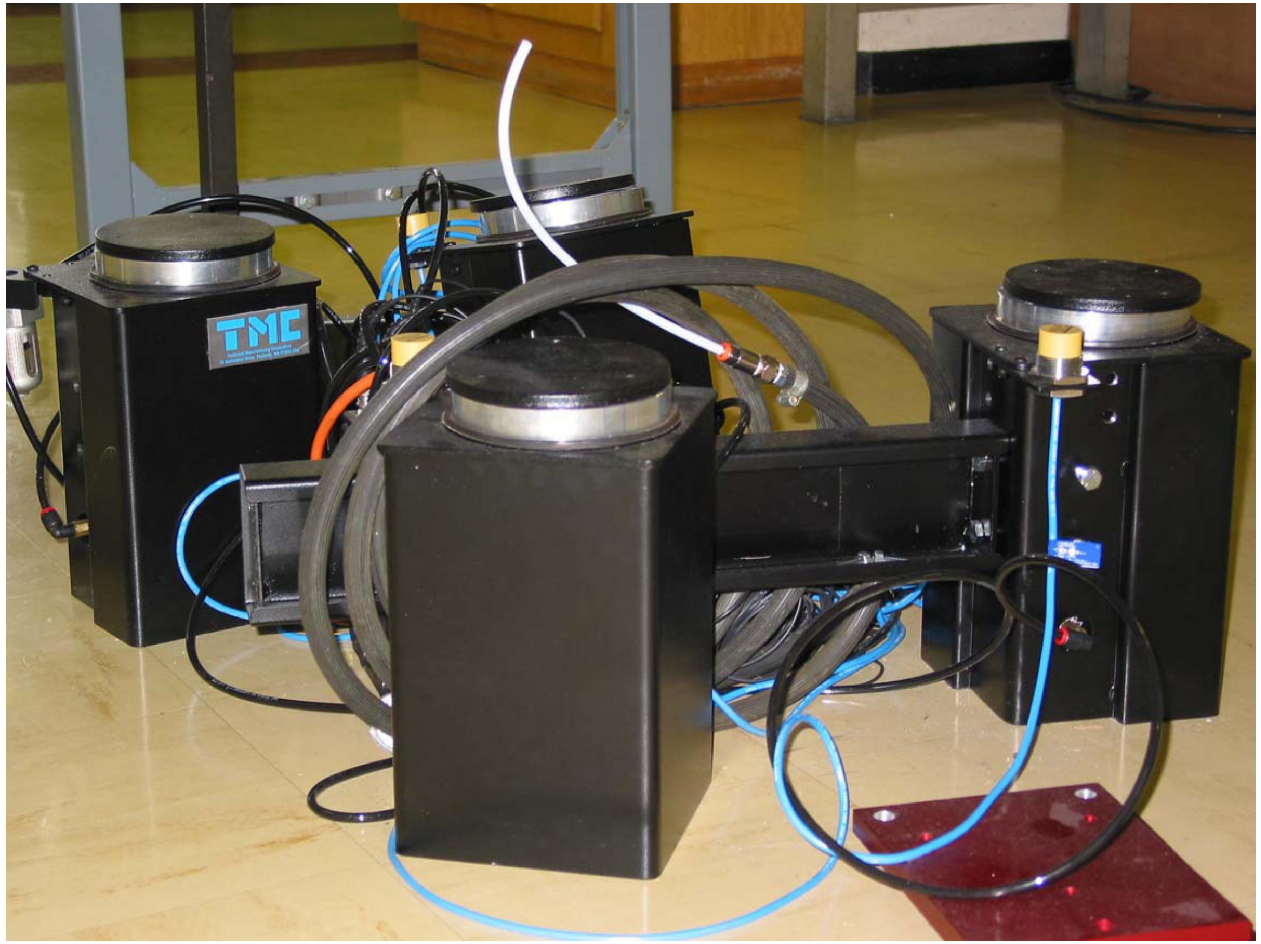
Comparison GeoSig / Mark Product

~ 15 % discrepancy





Low frequencies: Stretched wire
High frequencies: Geophones Geosig
Intermediate: Collaboration with ESRF (Gueralp)



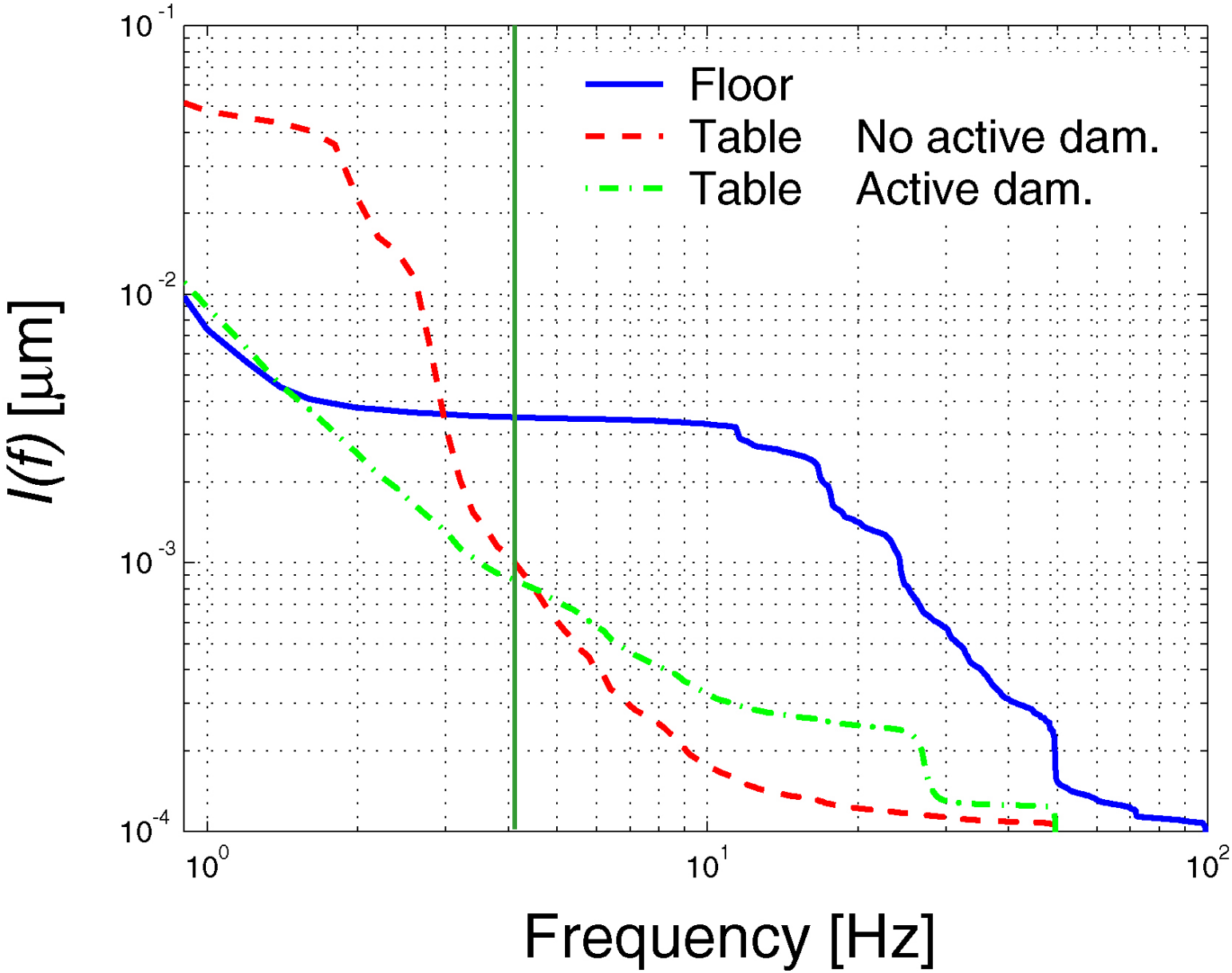
Air piston supports

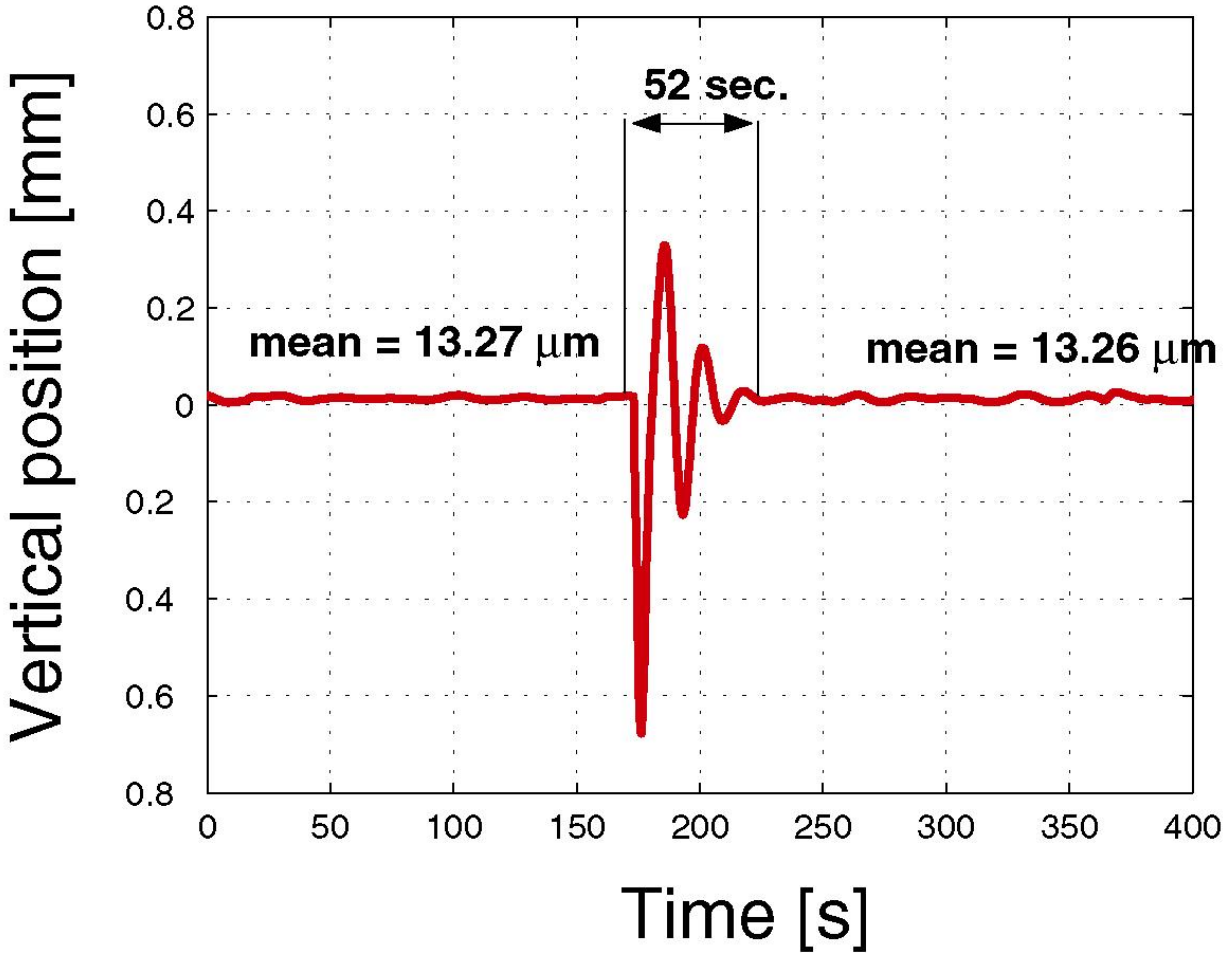
Micrometer alignment system

Geophones measure load vibration

Active feedback circuit on air pressure

Soft system


Floor
Table No active dam.
Table Active dam.
I(f) [µm]
Frequency [Hz]
10^-1
10^-2
10^-3
10^-4
10^0
10^1
10^2



Automatic realignment seems to work very well for soft system…

Best achieved:

On magnet top:

X: (0.4 ± 0.1) nm

Y: (0.9 ± 0.1) nm
(0.3 nm on table top)

Z: (3.2 ± 0.4) nm

without cooling water.

With nominal flow of cooling water:

Y: (1.3 ± 0.2) nm

Tight vertical linac tolerance demonstrated!

Rigid system seems more performing than soft system.
Soft system has a good short-term alignment stability.