European Organization for Nuclear Research

2nd WG5 Meeting

FF magnets pre-isolator & experimental set-up proposal

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Objective

Stabilize FF magnets to:

0.1 nm RMS @ 4 Hz

Using an integrated approach:

- passive pre-isolator

- active mechanical stabilization

- beam-based stabilization

Pre-isolator – How does it work?

Low dynamic stiffness mounts

(nat. frequency around 1 Hz)

Acts as a low-pass filter for the ground motion

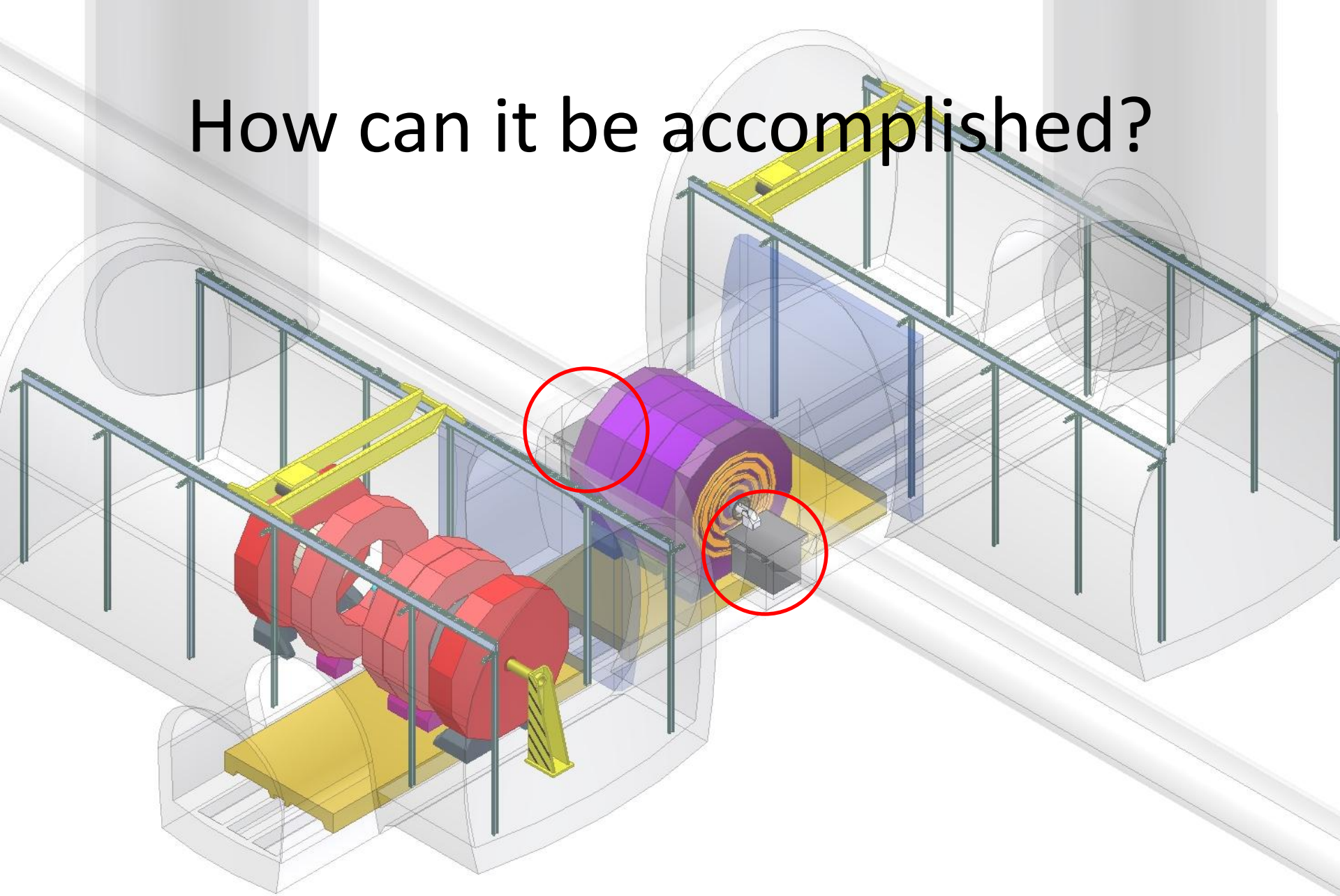
+

Large mass

(50 to 200 ton)

Provides the inertia necessary to withstand the external disturbances (air flow, acoustic pressure, etc.)

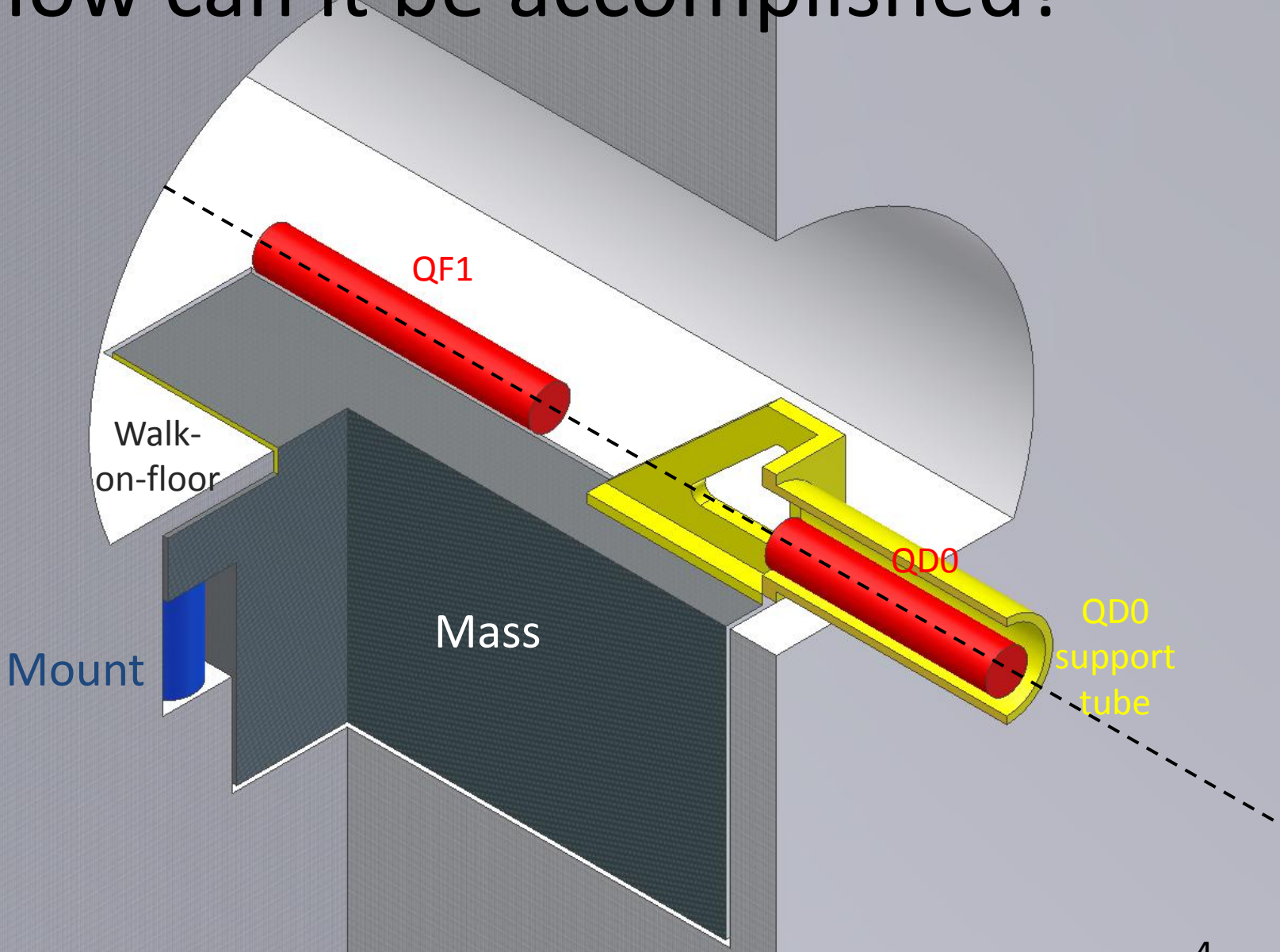
How can it be accomplished?



*Conceptual design

Drawings by N. Siegrist

How can it be accomplished?

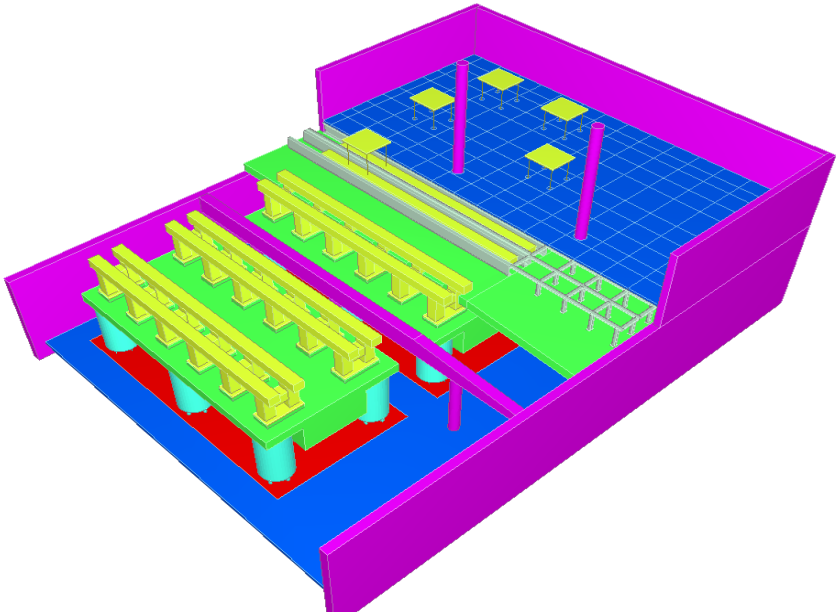


*Conceptual design

“State of the art” example

Vibration isolation system at the Centre for Metrology and Accreditation – Helsinki, Finland

4 independent seismic masses
(3x70 ton + 1x140 ton)



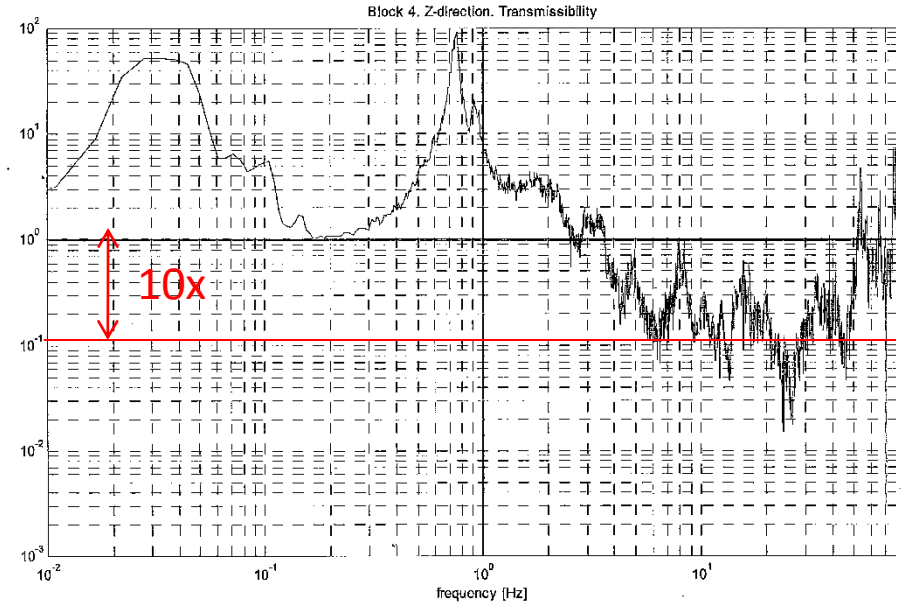
0.8 Hz pneumatic vibration isolators
(“air springs”)

*Infos provided by FABREEKA VIBRATION & SHOCK CONTROL

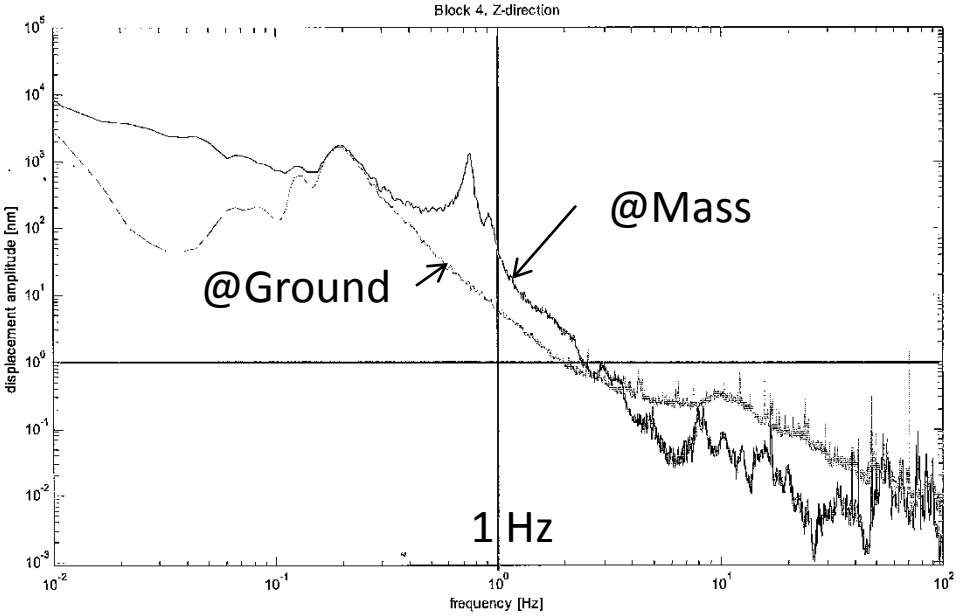
“State of the art” example

Provided measurement data

Transmissibility



Vertical displacements

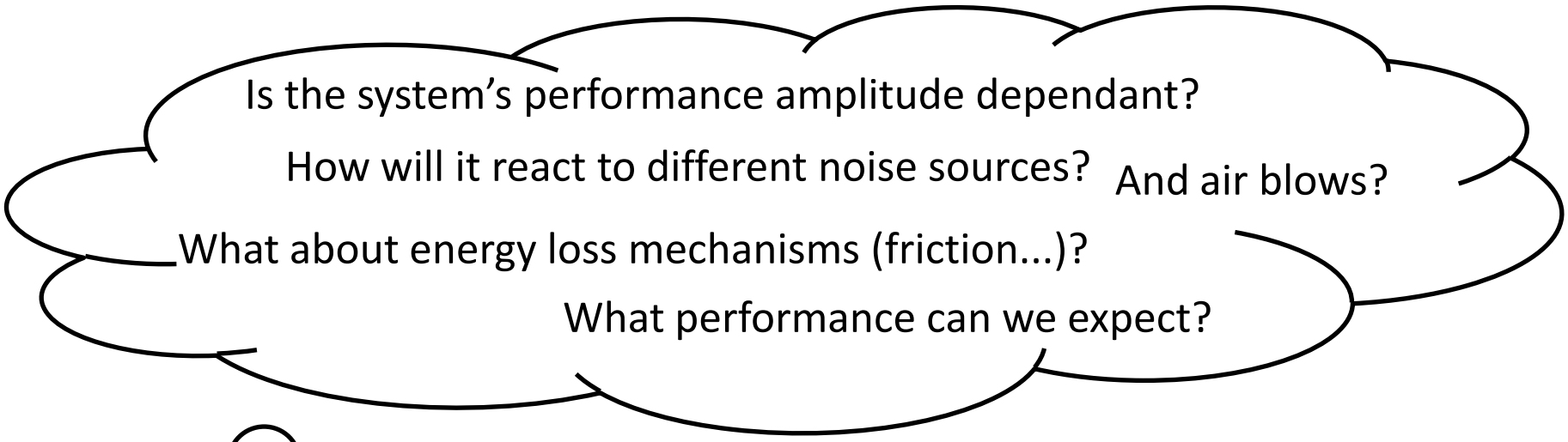


Note: Ground motion noise level <u>below</u> CMS measurements (A. Kuzmin – EDMS 1027459)

*Infos provided by FABREEKA VIBRATION & SHOCK CONTROL

Experimental set-up – Why?

The previous example is promising, but...



There are lot of unanswered questions.

We need to

unequivocally demonstrate that the concept can work

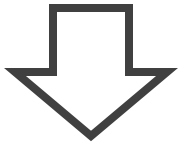
Experimental set-up – How?

It needs to be:

Simple to design/build/assemble

Easy to “debug” & tune

Cheap



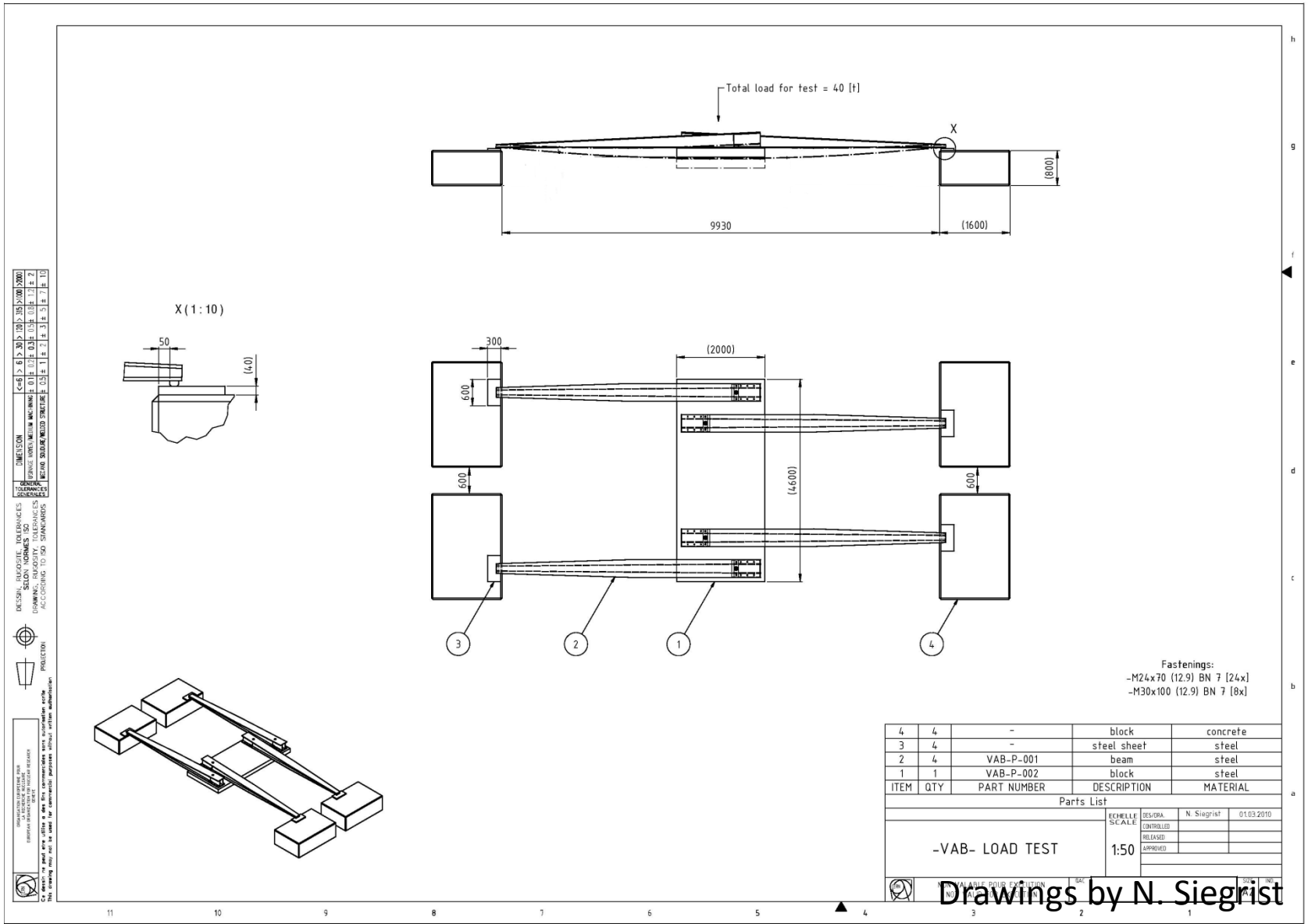
Proposal:

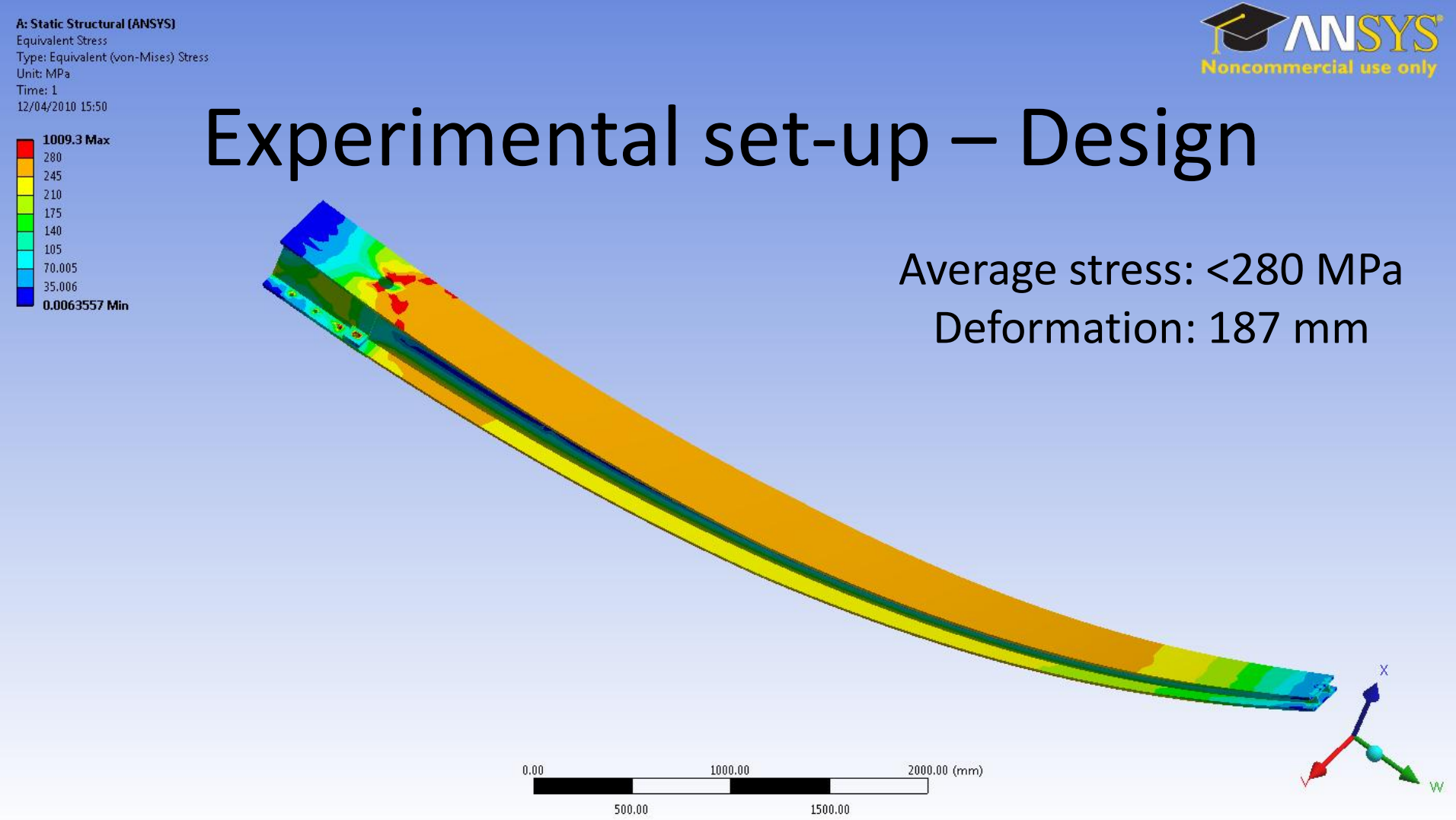
40 ton mass

supported by

4 structural beams

Experimental set-up – How?





Experimental set-up – Design

Average stress: <280 MPa

Deformation: 187 mm

Design criterias:

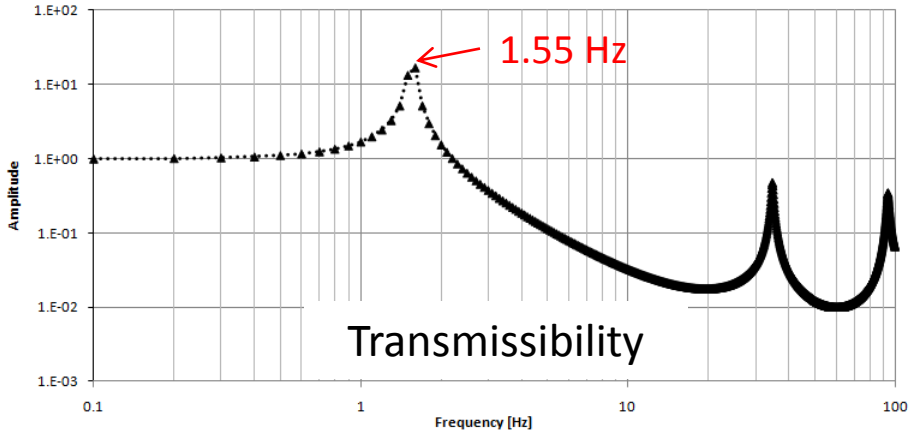
High deformations (i.e. low bending stiffness)

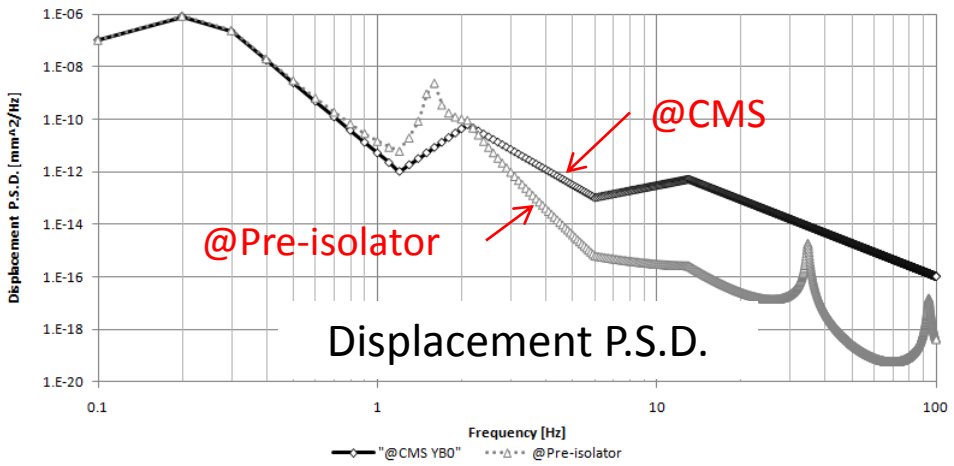
Acceptable stresses

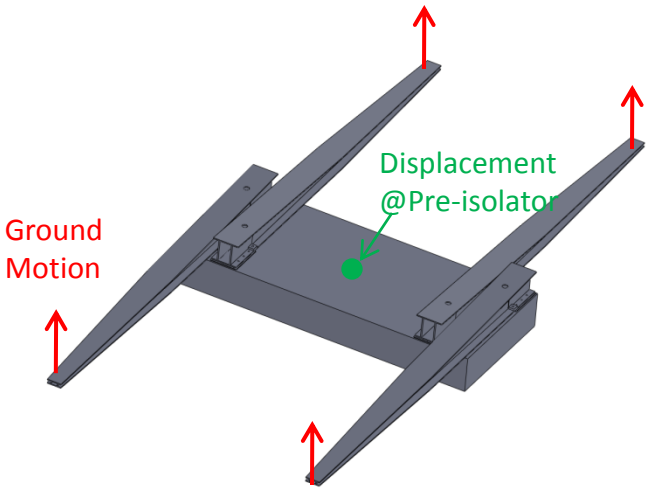
⇨ **Shape optimization**

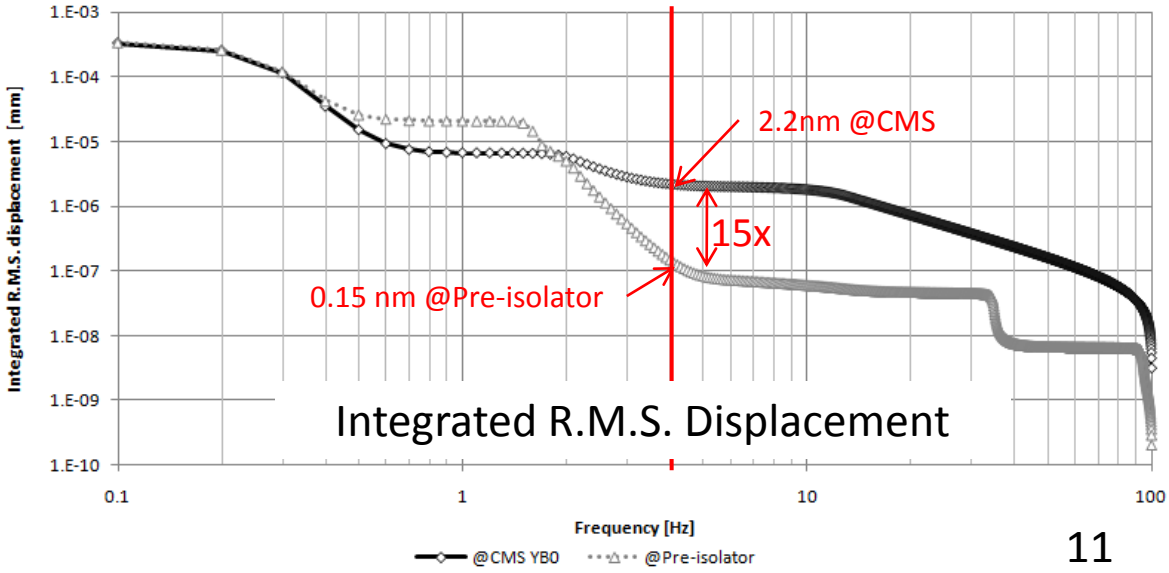
Experimental set-up – Performance

Performance in ideal conditions (ground motion only)



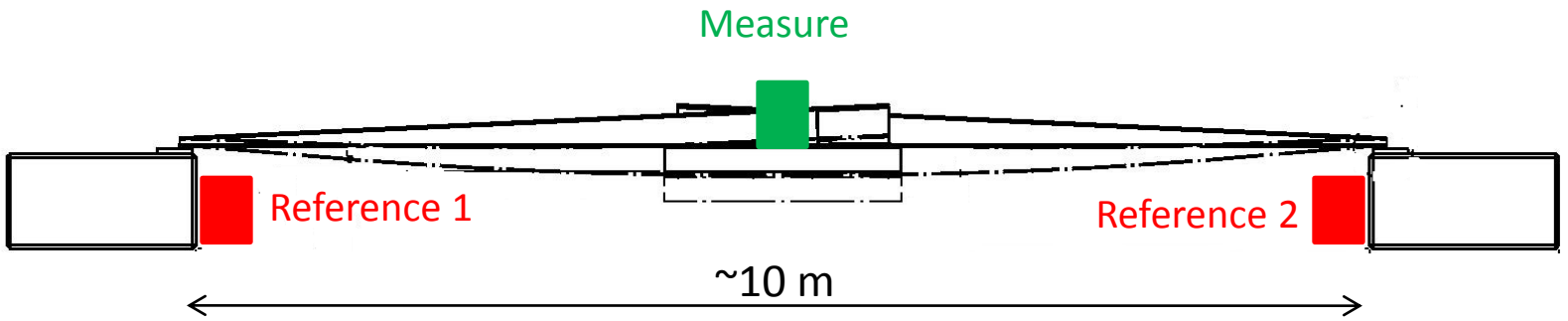






Experimental set-up – Measurements

A set-up like the one below is foreseen



At least 3 seismometers/geophones

Synchronous measurements

Help needed for the measurements

Summary

- A passive low-frequency pre-isolator has been proposed as a support for the FF magnets;

- This pre-isolator will constitute the first “layer” of the stabilization chain;

- This concept has already been used in other facilities;

- Experimental tests should be performed to understand how the system behaves in “real life” conditions (no simulation can, accurately, take into account all these effects);

- A simple and relatively inexpensive experimental set-up has been conceived and proposed.