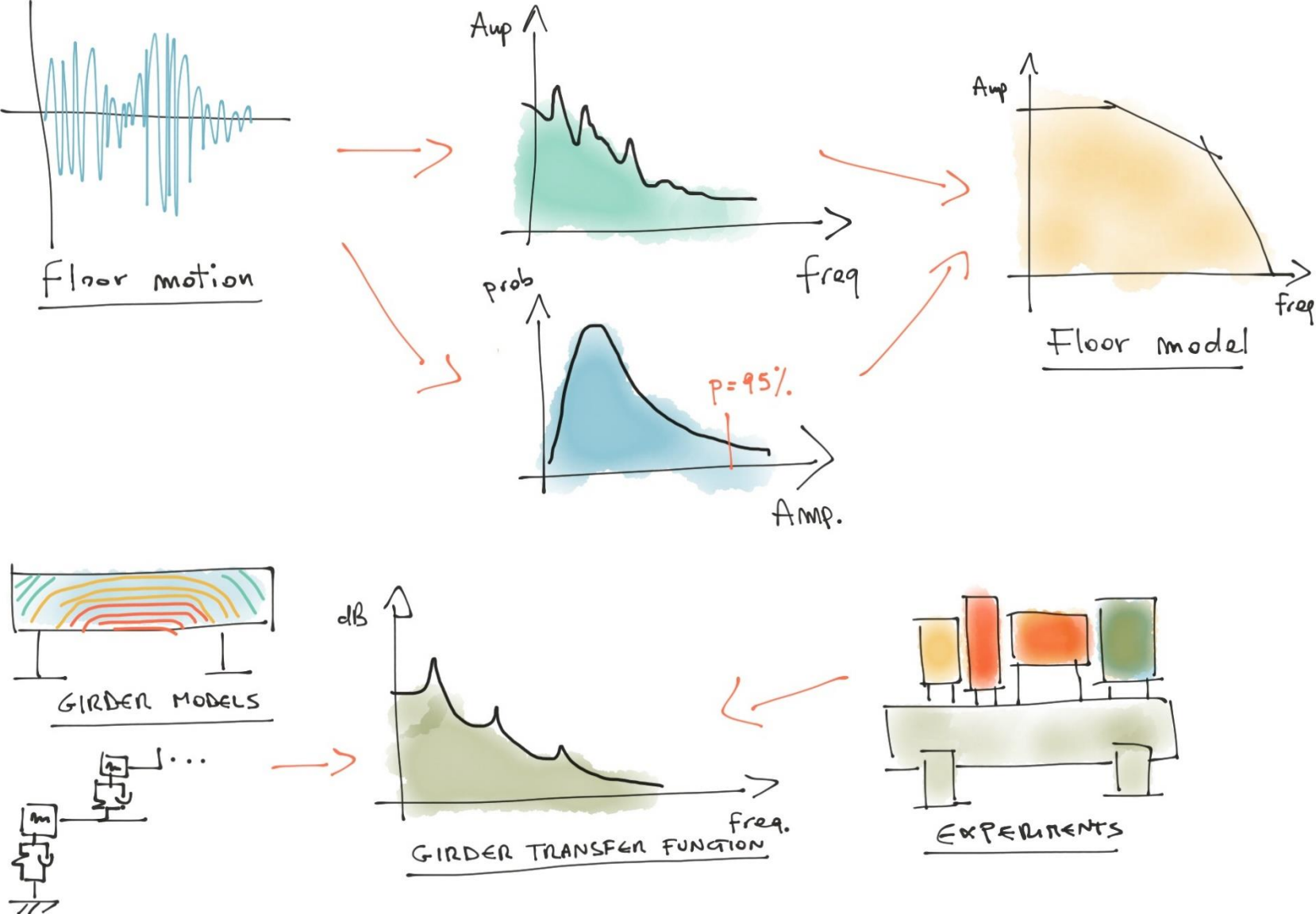


Diamond – II Vibration measurement and test plan

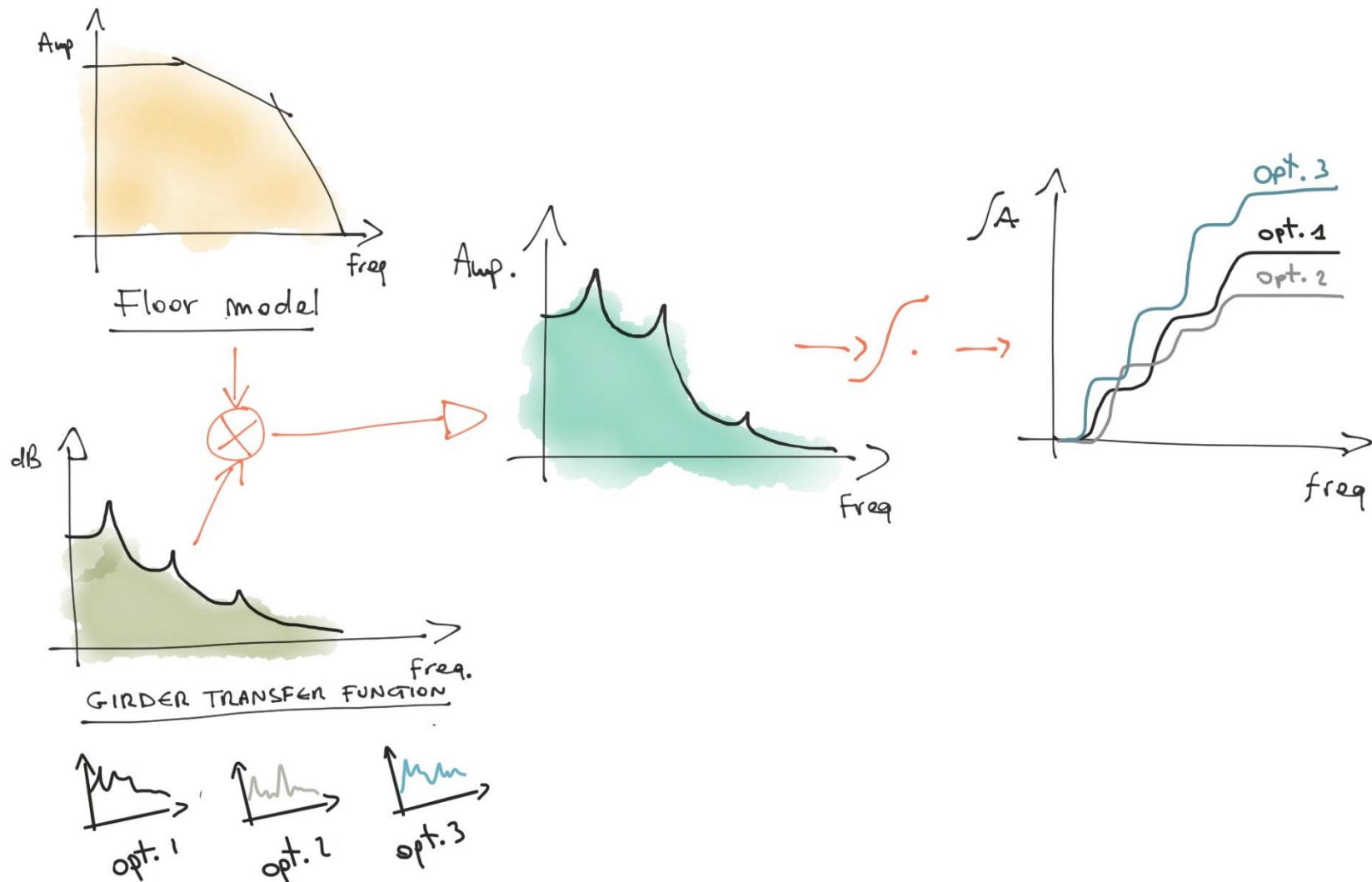
Davide Crivelli

davide.crivelli@diamond.ac.uk

Our approach



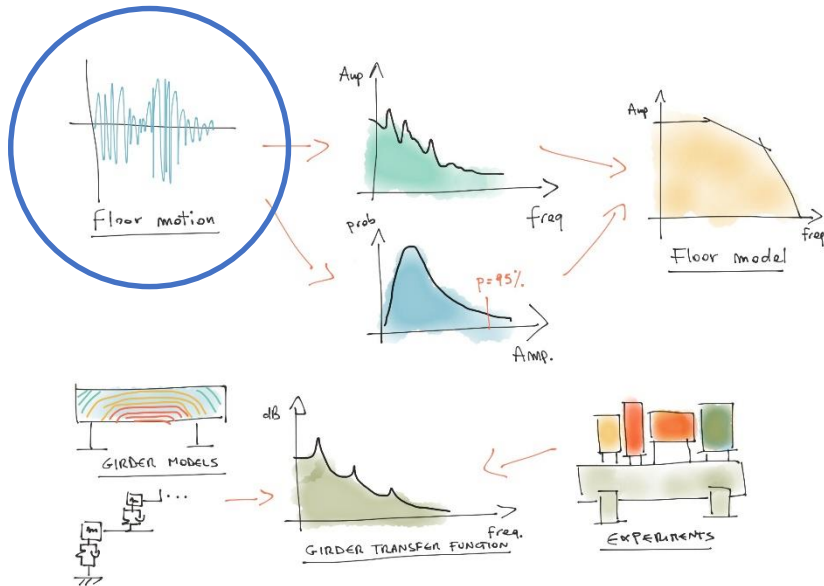
Our approach



Floor measurements

Long term high frequency measurements inside storage ring tunnel

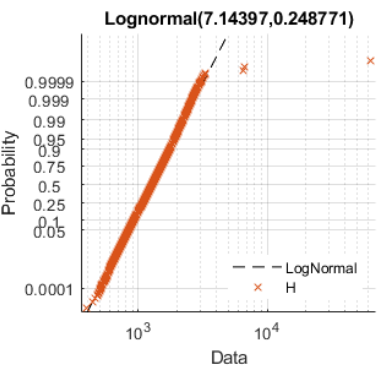
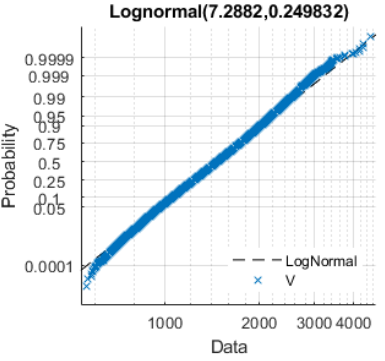
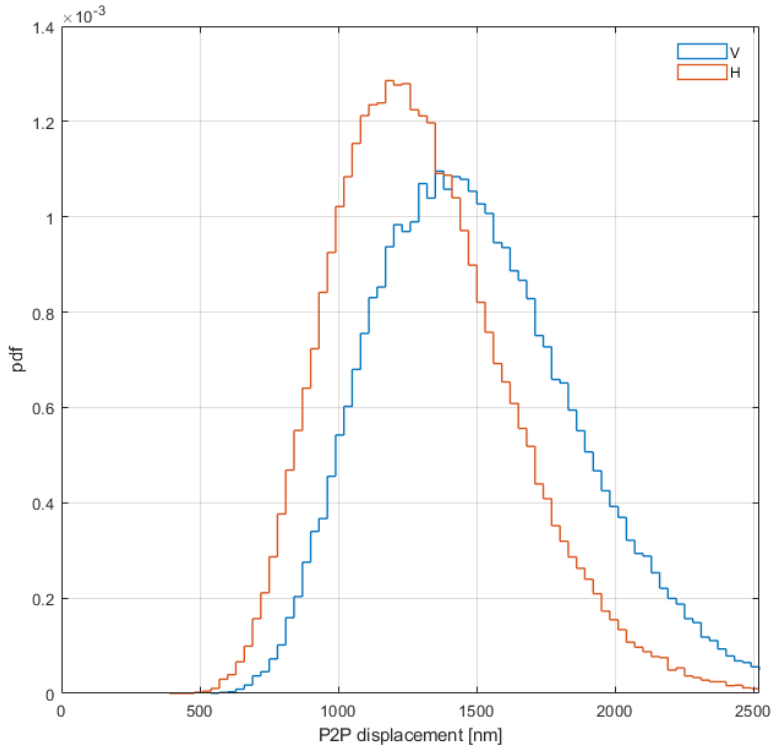
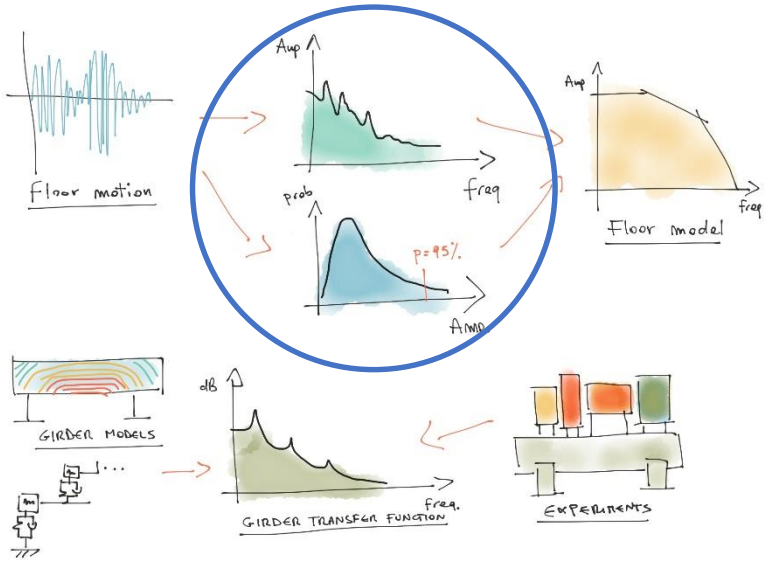
One week @ 2kHz



Floor measurements

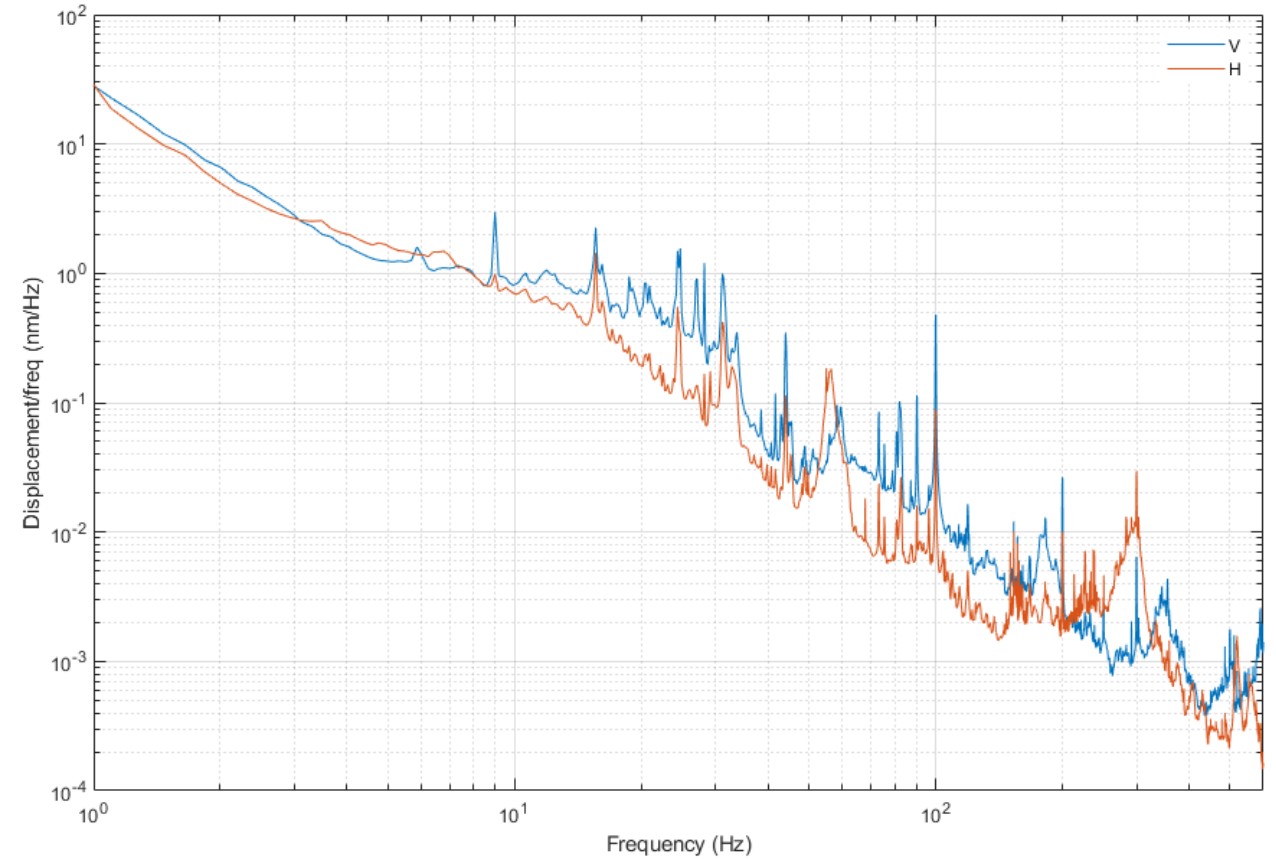
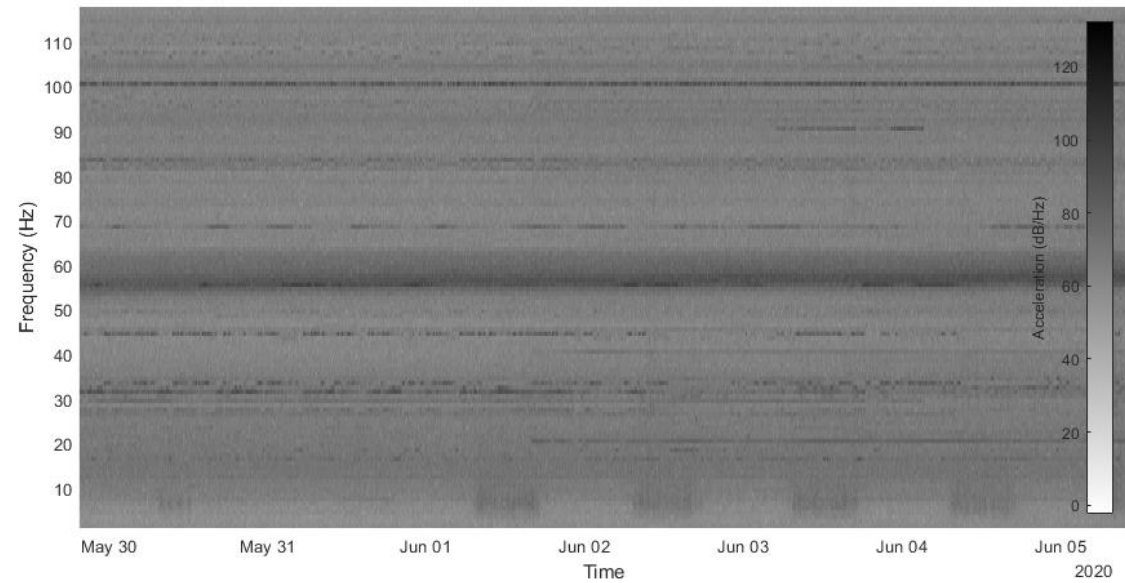
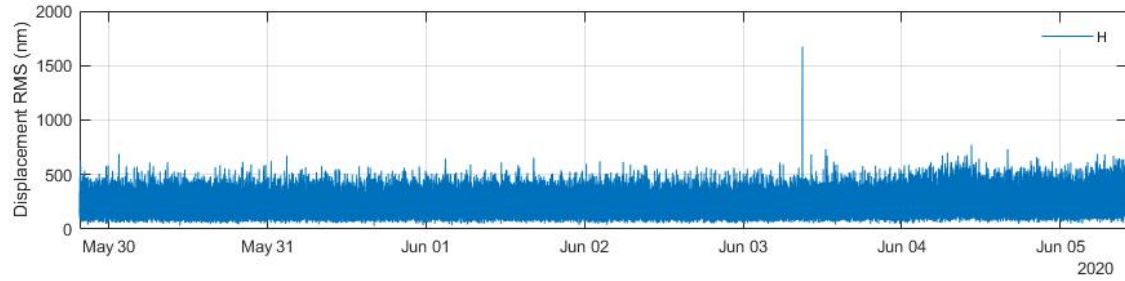


- 1Hz - 50Hz
- 50Hz - 100Hz
- 100Hz - 150Hz
- 150Hz - 200Hz
- 200Hz - 250Hz
- 250Hz - 300Hz
- 300Hz - 350Hz
- 350Hz - 400Hz
- 400Hz - 450Hz
- 450Hz - 500Hz

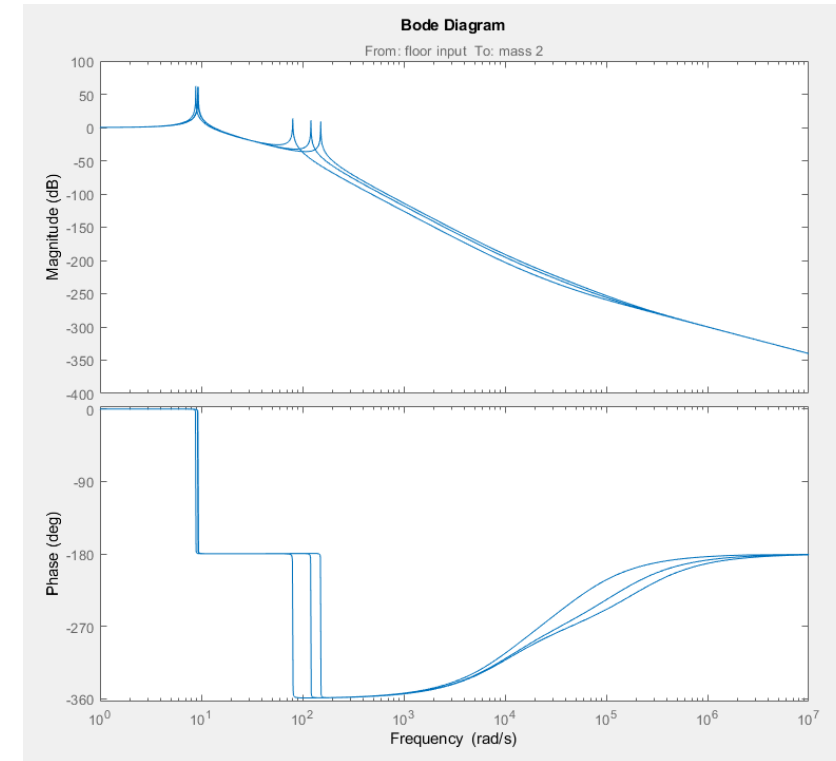
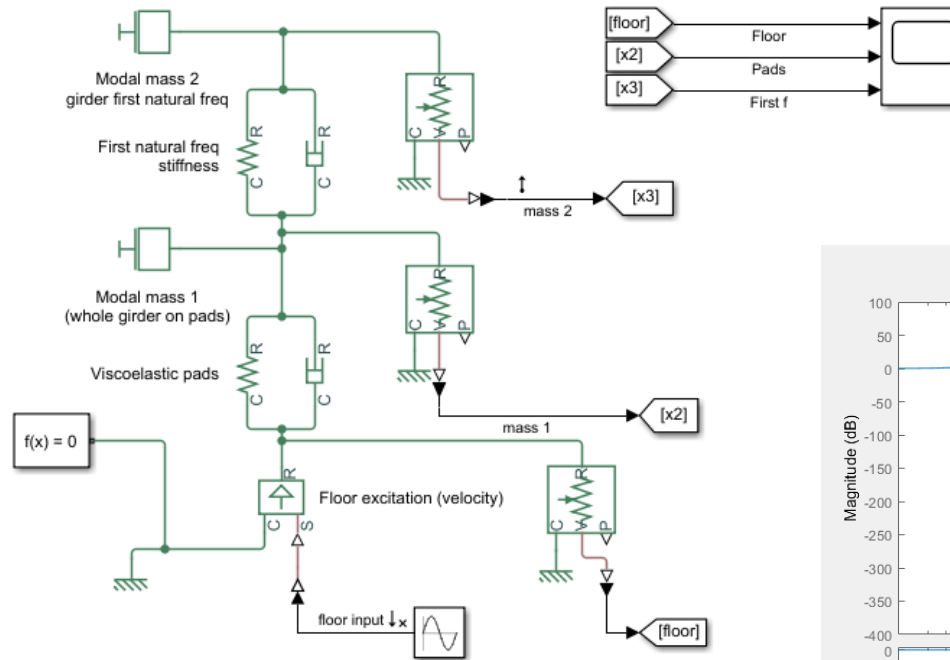
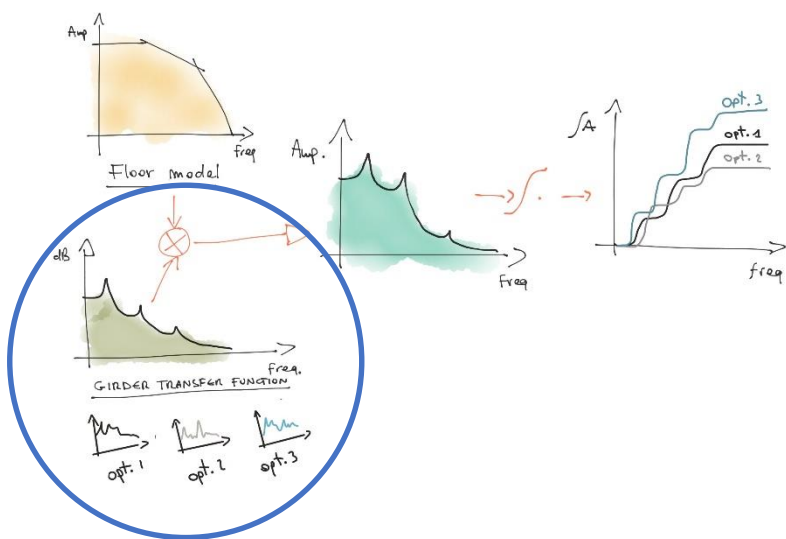


(Data from outside of storage ring)

Floor measurements (outside storage ring)



Simulink model (design exploration)



Model validation

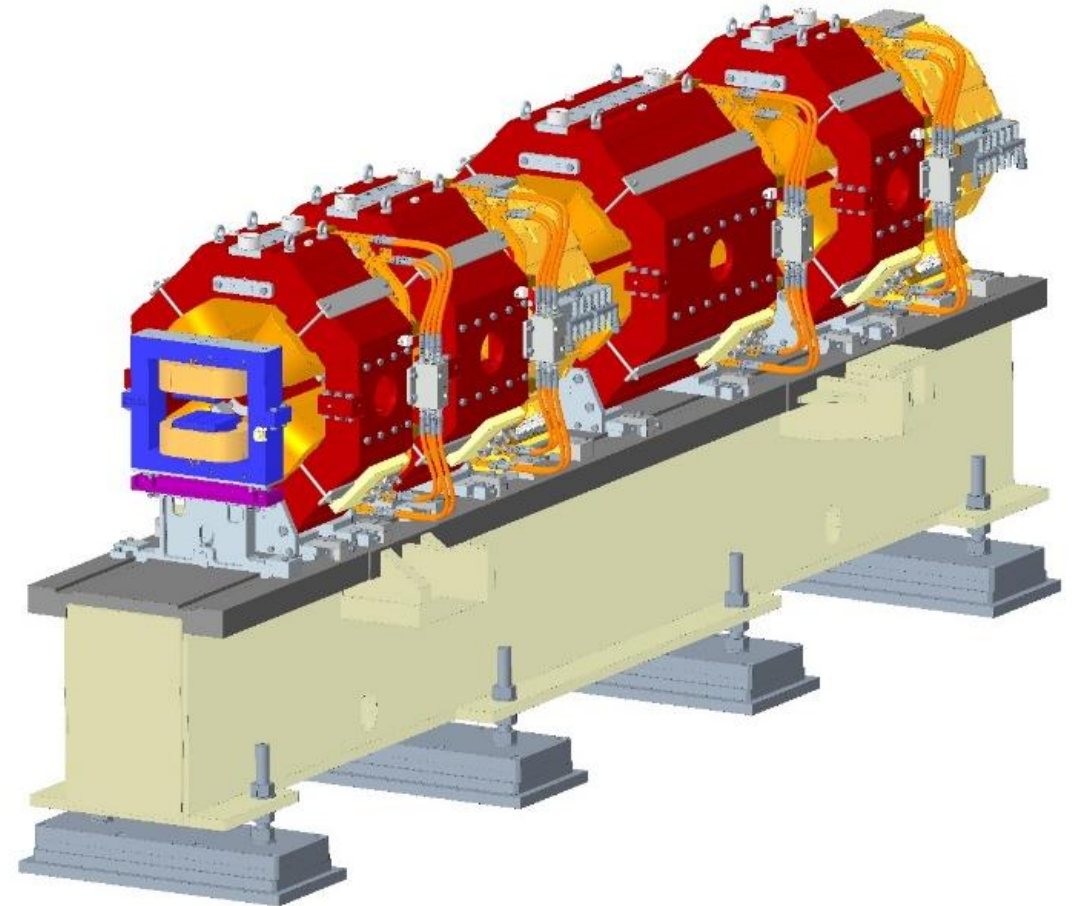
Testing!

- Experimental Modal Analysis
- Random Vibration testing

What does this tell us?

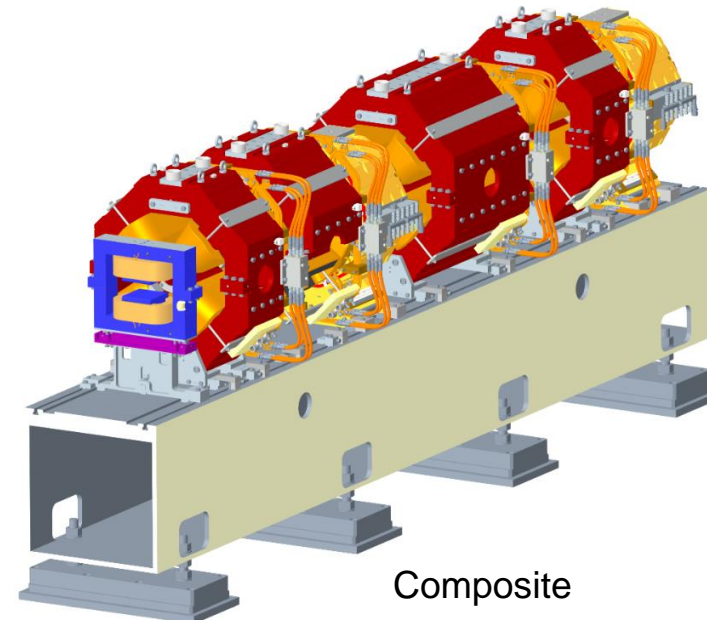
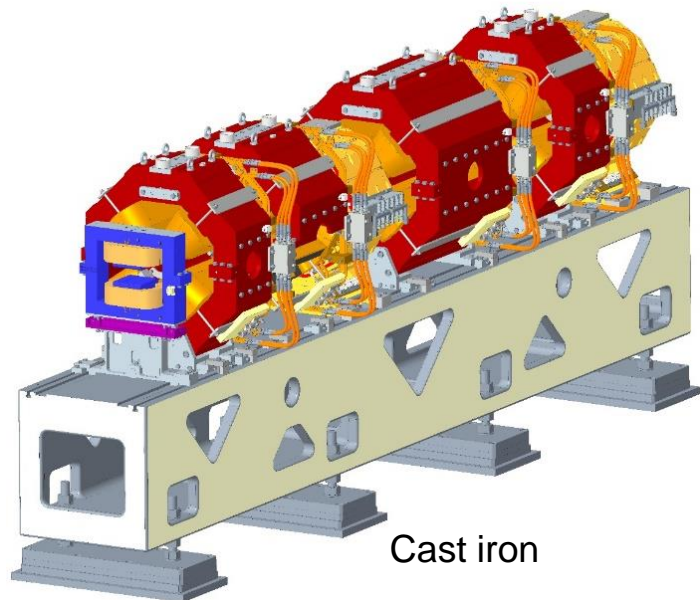
- Natural Frequencies and mode shapes of our girders
- How our girders perform on a representative floor

We can use this experience to feed the design of our D-II system



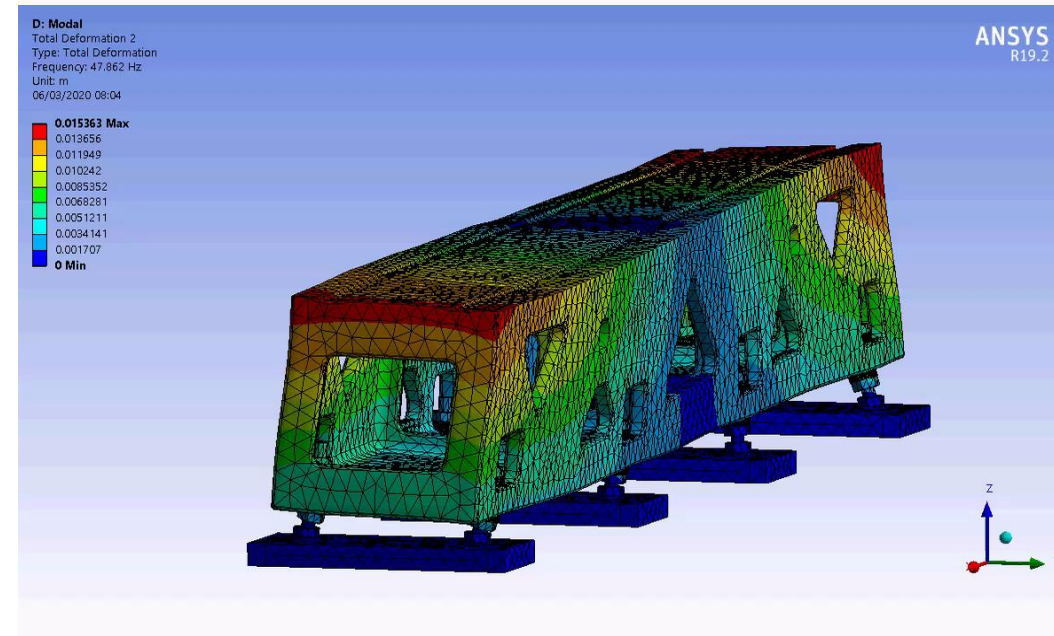
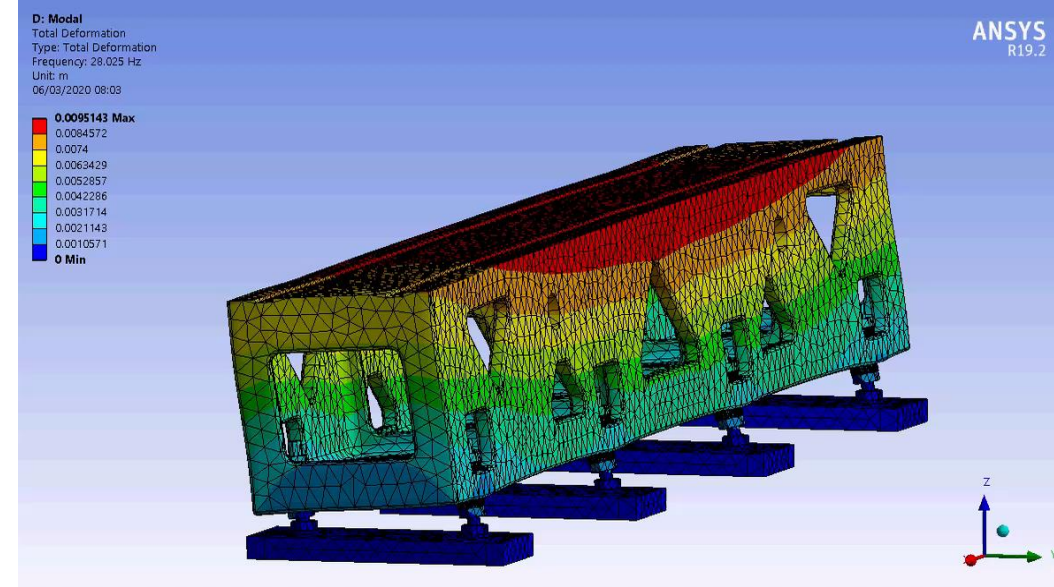
Model validation / tests

Girder Configuration	Support System	1 st Mode	2 nd Mode	Mass (Kg)
Girder 1 plate steel	Cam Rollers	16 Hz Rocking	30 Hz Twist	3300
Girder 1 plate steel	NSLS-II Manual	28 Hz Rocking	56 Hz Twist	3300
Girder 1 cast iron	NSLS-II Manual	28 Hz Rocking	47 Hz Twist	4100
Girder 1 composite	NSLS-II Manual	55 + Hz rocking	100 + Hz Twist	1900



Can't we just rely on simulation?

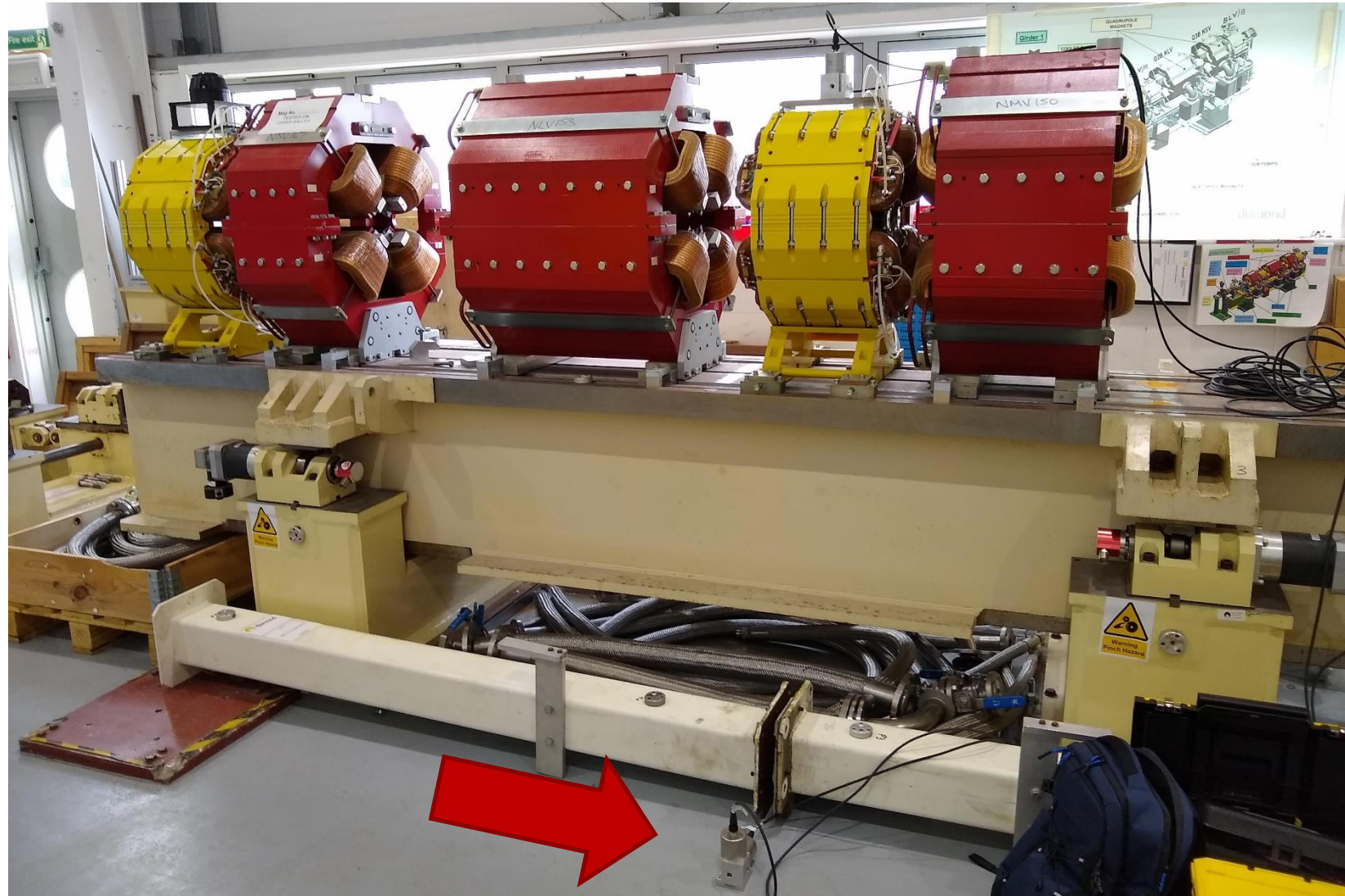
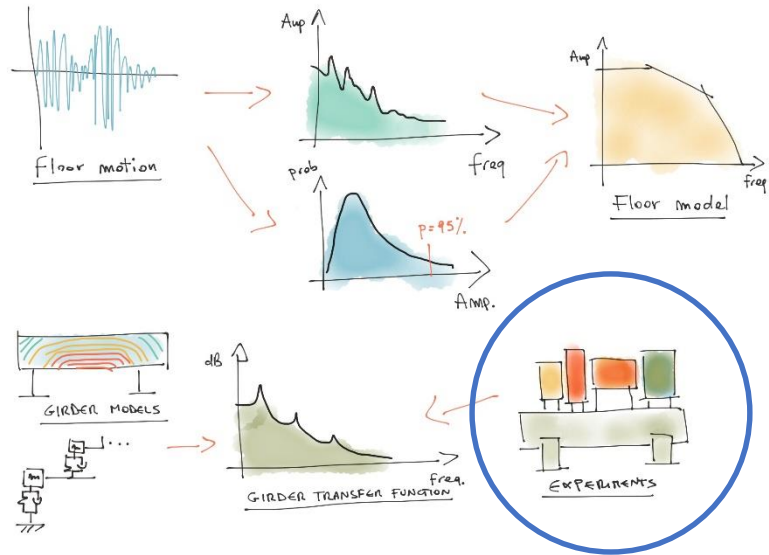
- FEA Modal simulation is good for predicting mode shapes and frequencies
 - Correct model set up is key
 - Typically this involves physical measurement of the stiffness of complex components (adjusters)
- Response spectrum & time dependent analyses are not considered accurate enough for our use case



Model validation

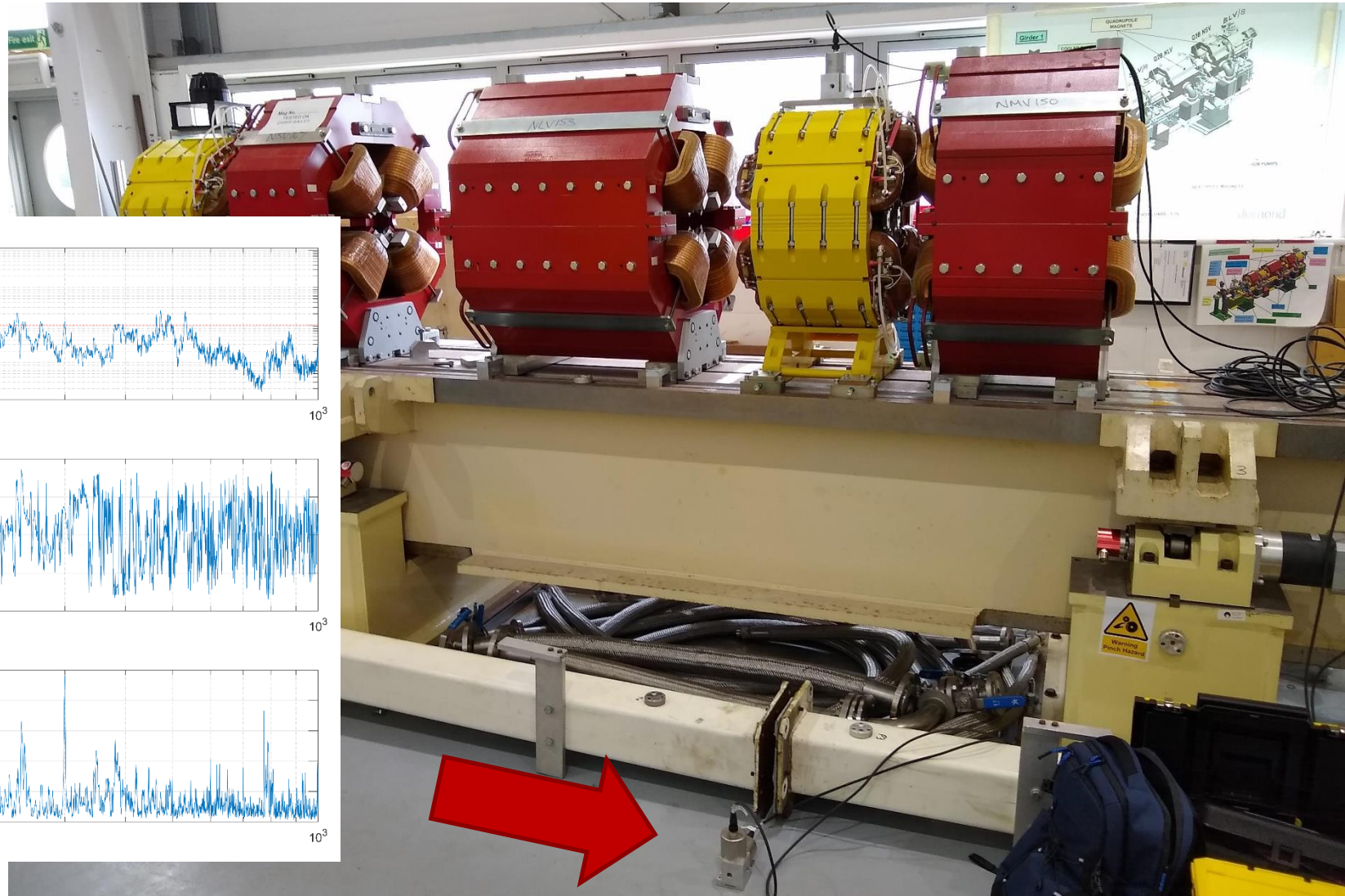
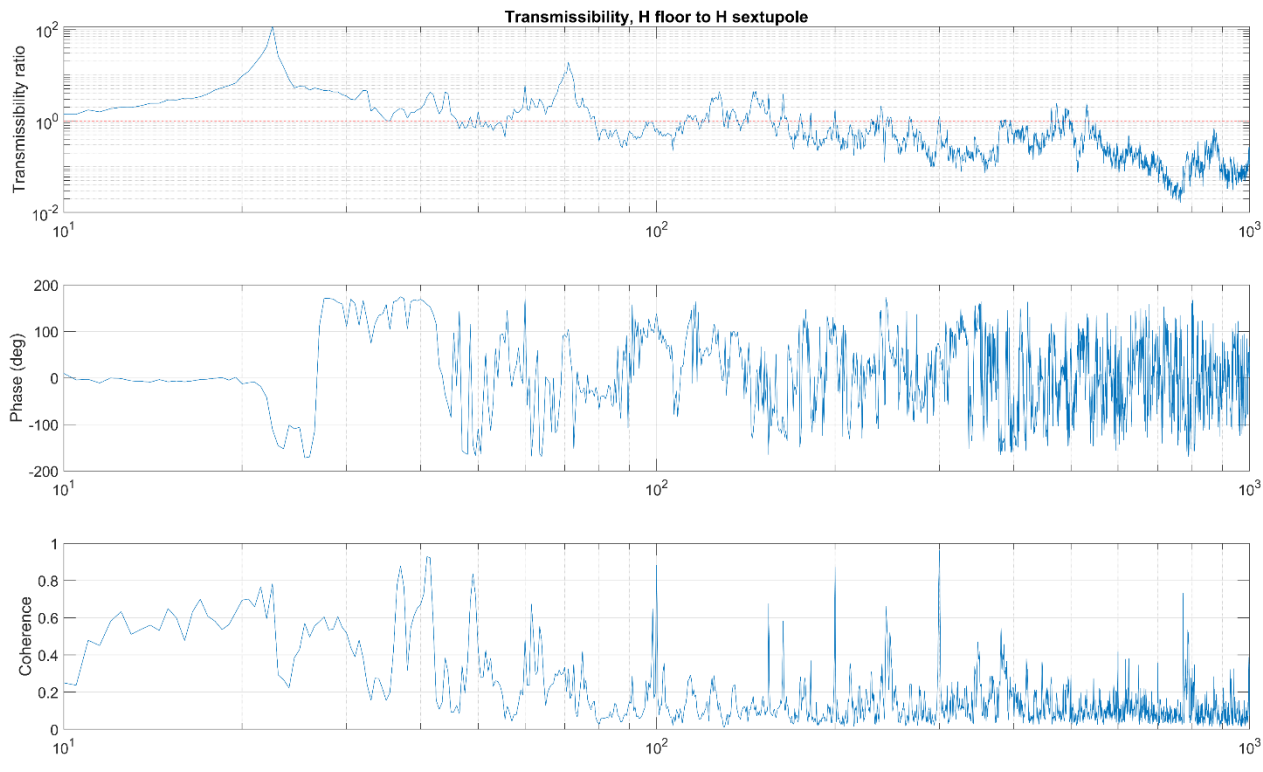
Mockup “Diamond I” girder:
transmissibility tests

Planning to also use as
baseline against carbon / cast
iron prototypes



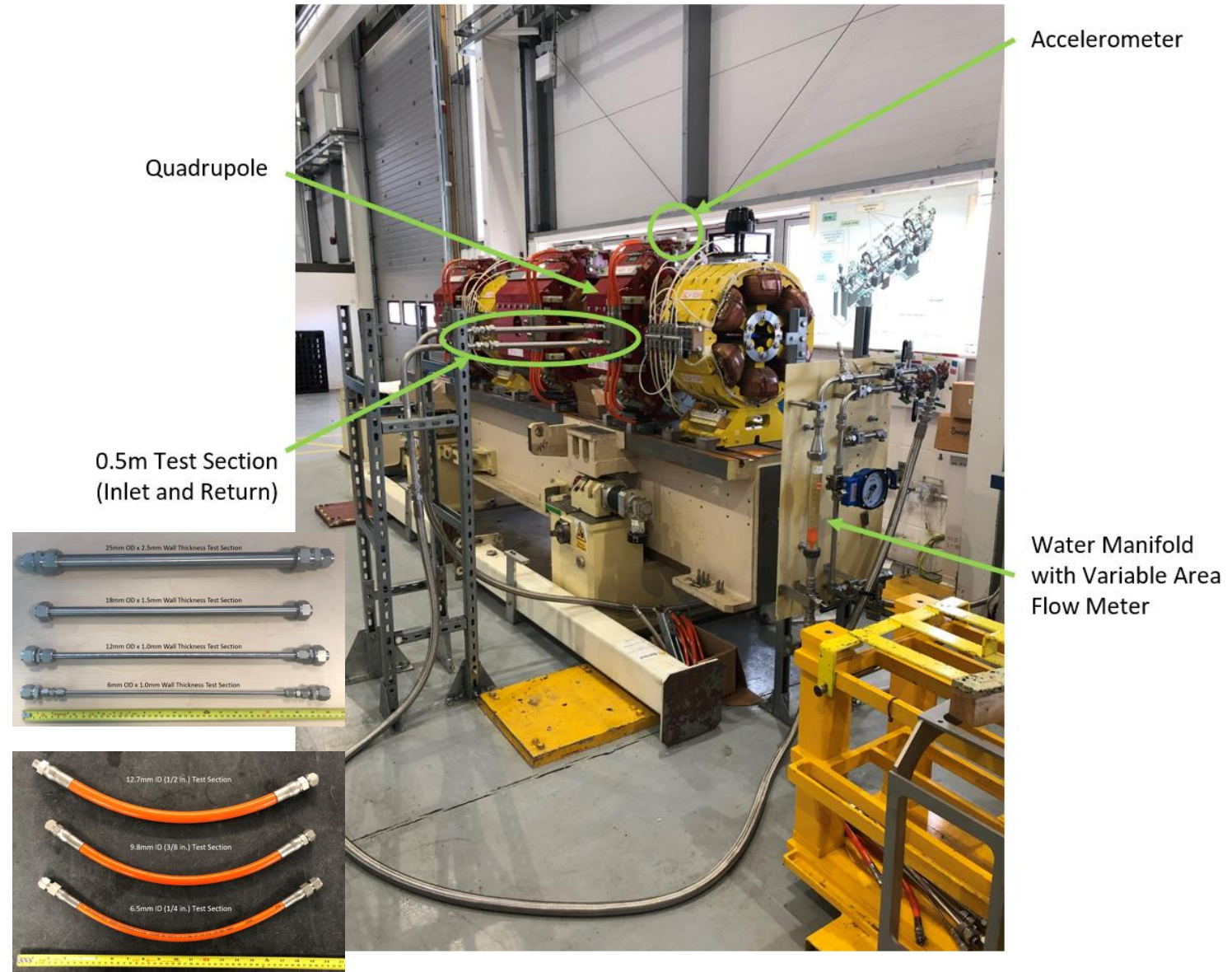
Model validation

Mockup “Diamond I” girder:
transmissibility tests



Test plan for girders

- Comparing cast iron vs carbon fibre vs steel
- Evaluating effect of
 - Damping pads
 - Number of supports
 - Girder height
- Water flow tests
 - Water cooling and layout of services
 - On-magnet manifold vs girder manifold
 - Orifice plates vs no flow regulation



Thanks for listening!