Magnetic noise

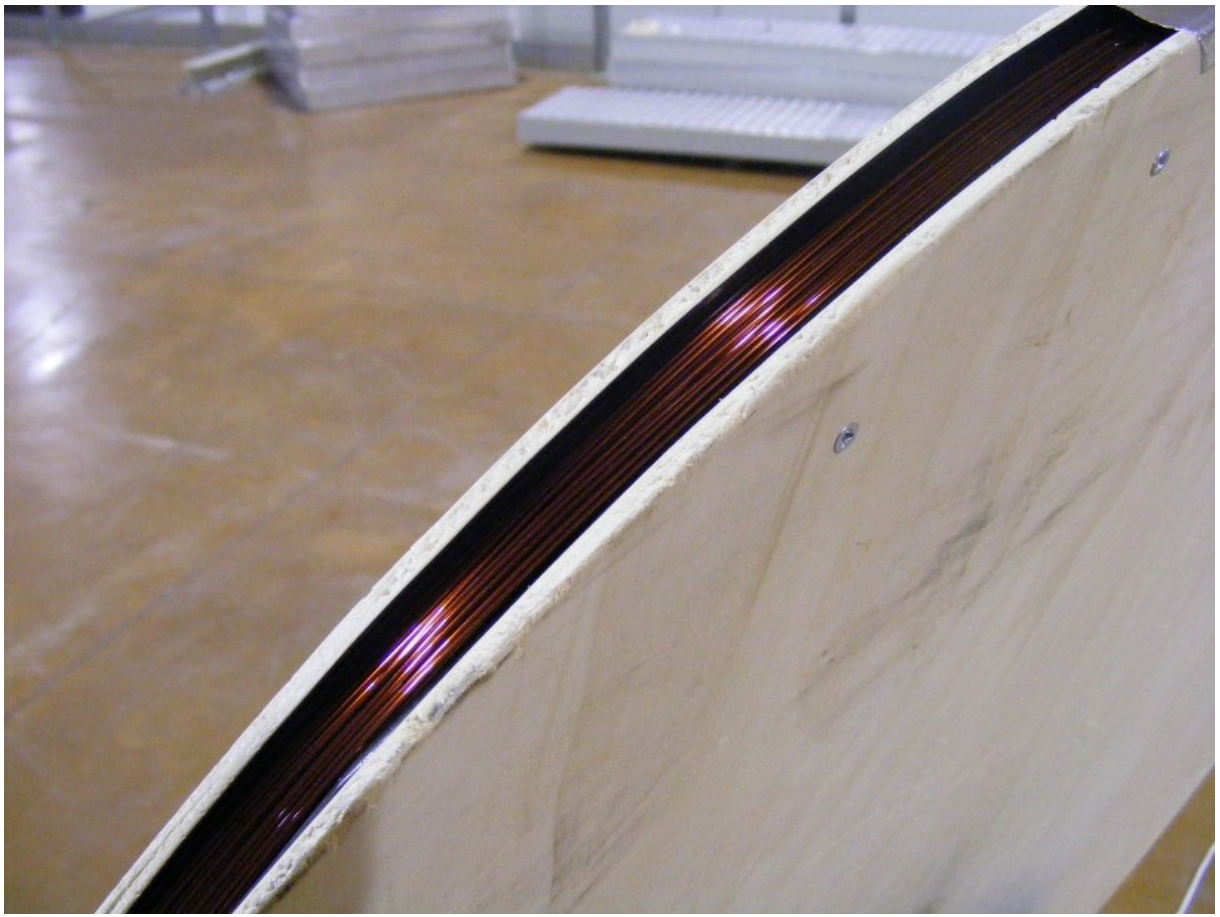
Bas Swinkels,

with help of I. Fiori, D. Huet, F. Paoletti, ...

Introduction

- Magnetic injections
  - far-field -> noise projection
  - near-field -> relative contribution of mirrors
- Magnetic probe
- Outlook

Far-field injections 1

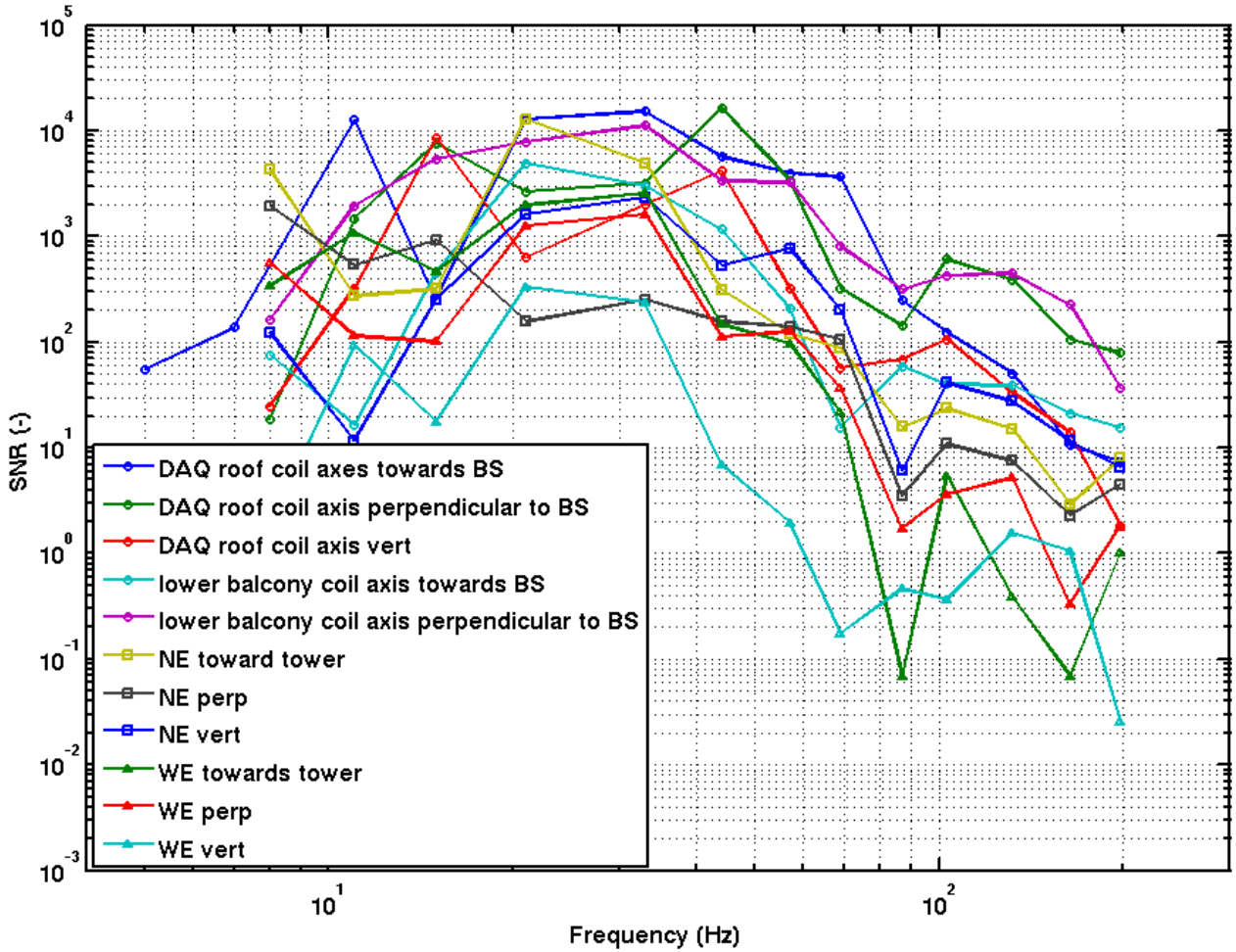


- Built a new coil, optimized for strongest field: 1m diameter, 50 turns
- Inject magnetic fields from a large distance
- Assume mirror and magnetometer see same field

Line injection

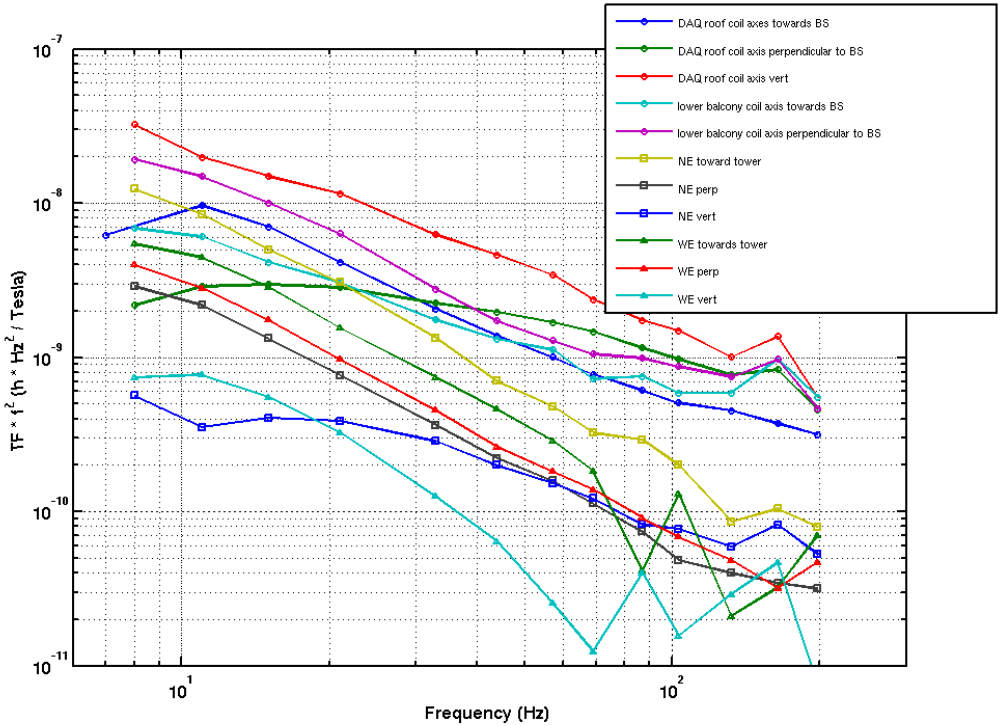
- Calibration server used as signal generator
  - injection is synchronous to DAQ
- DAC channel of NI/NE/WE suspensions
- Federico's stereo amplifier
- Inject series of lines from 8 to 198 Hz, driven by python script
- Retrieve line amplitudes in B1 and magnetometers
  - use fft, not averaged periodogram (pwelch)
  - all energy ends up in single bin if data length is integer number of cycles

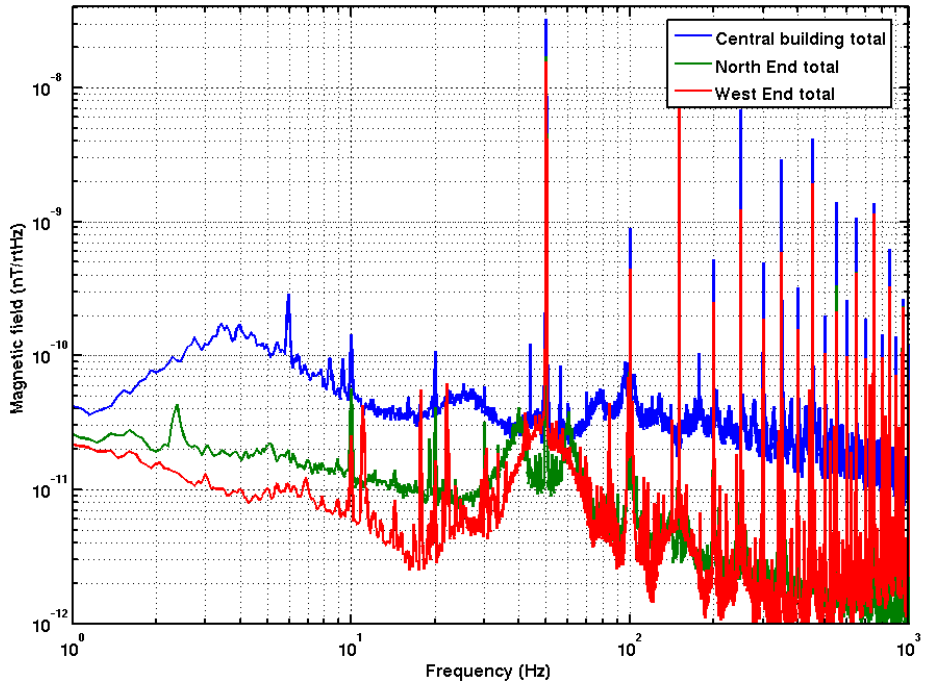
Far-field injection 2



- High SNR in B1 for relevant frequencies

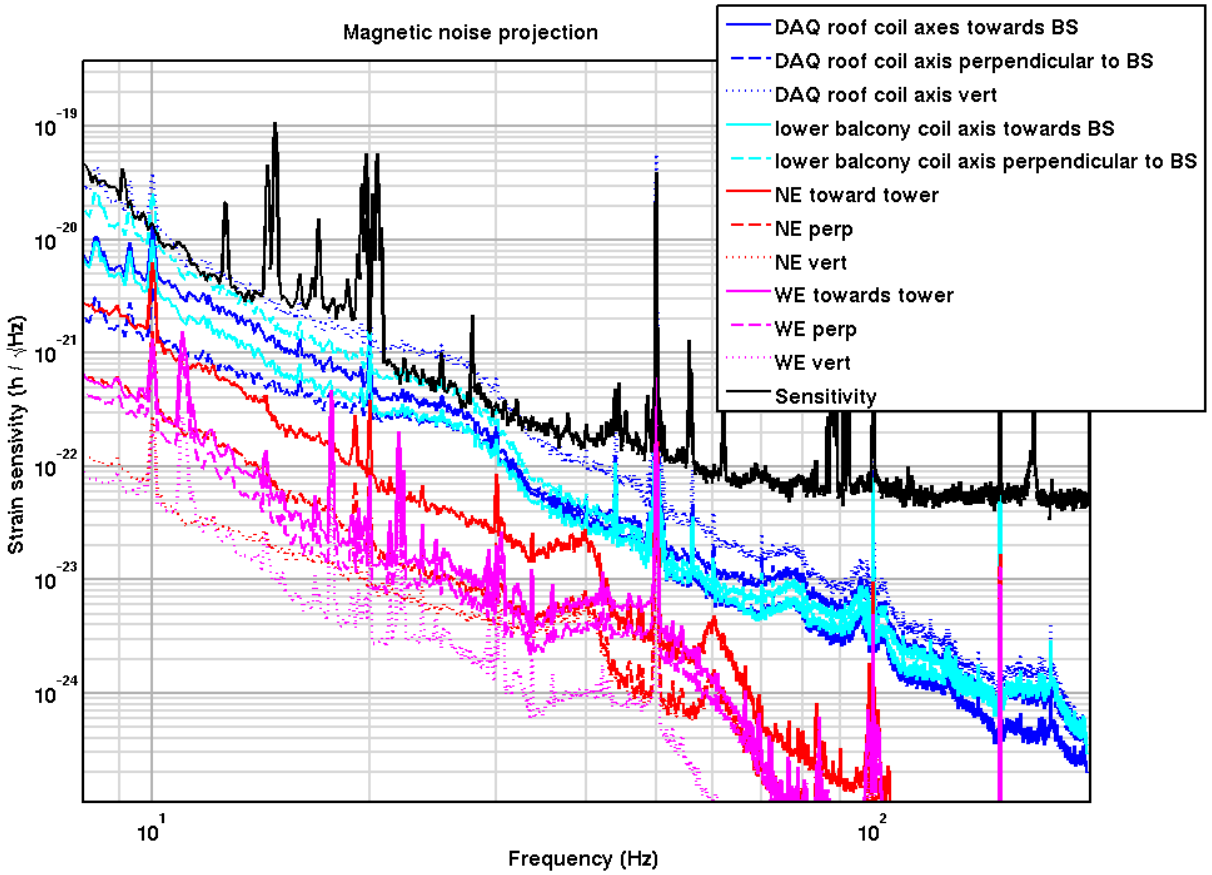
Far-field noise projection 1





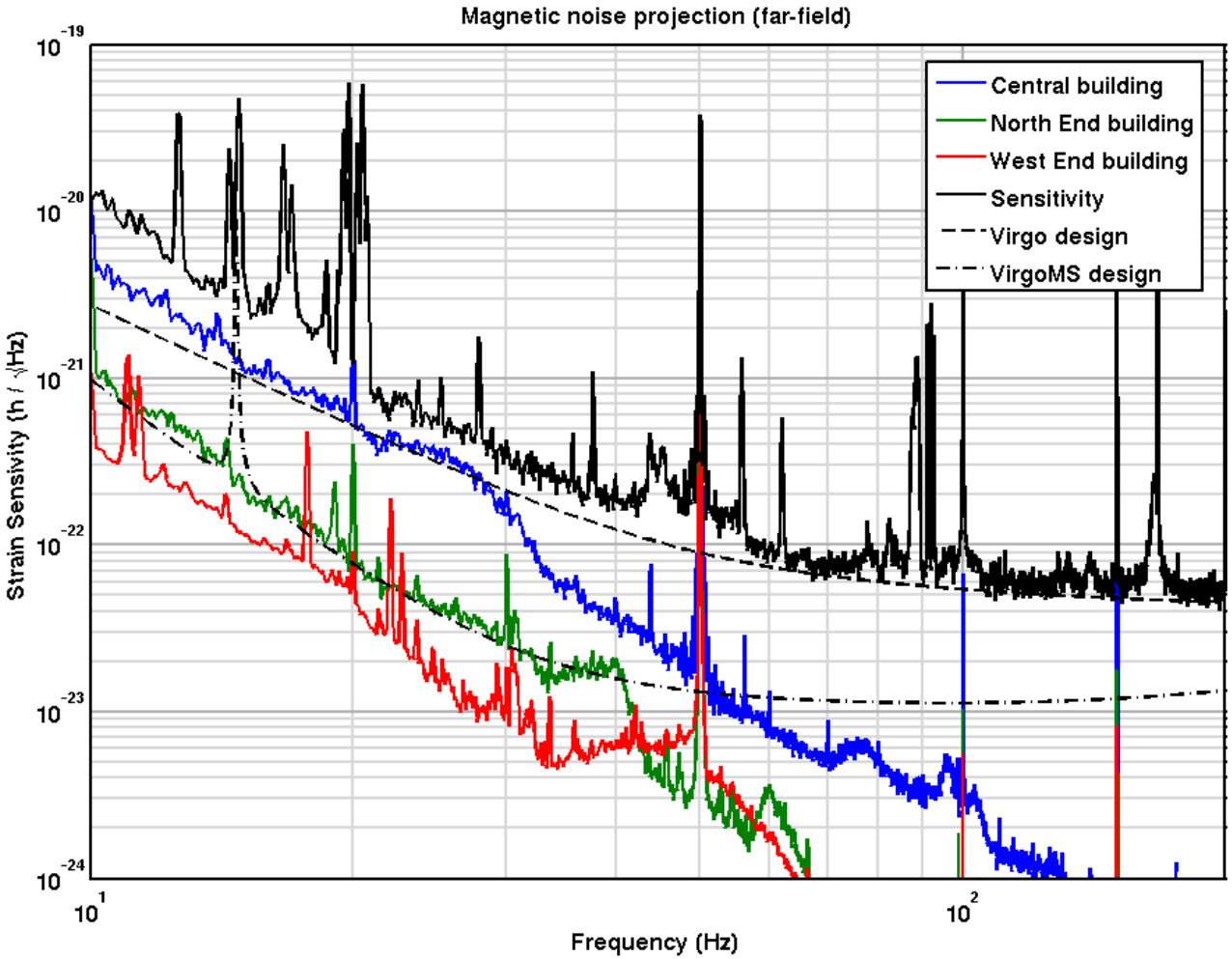
- Measure transfer-functions from magnetometers to B1*calibration
- Combine with magnetic field in quiet conditions

Far-field noise projection 2



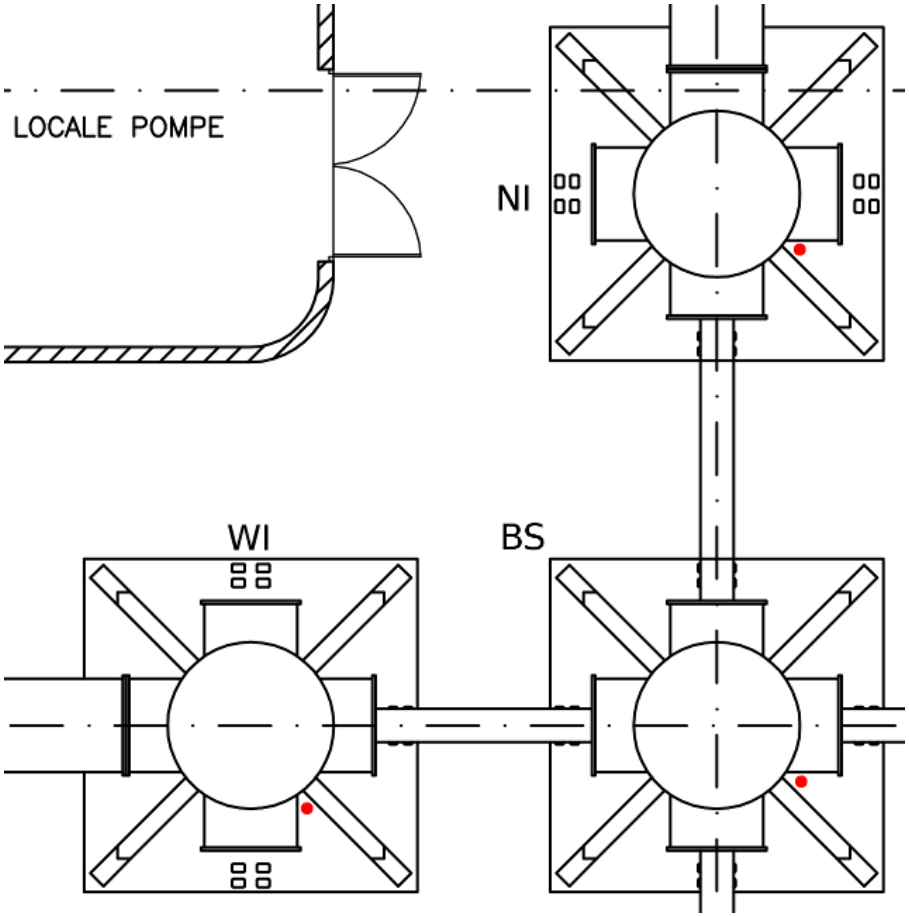
- Some inherent limitations of projections: relatively large errors
- Some projections clearly too high
- Only valid for noise sources in the far-field

Far-field noise projection 3



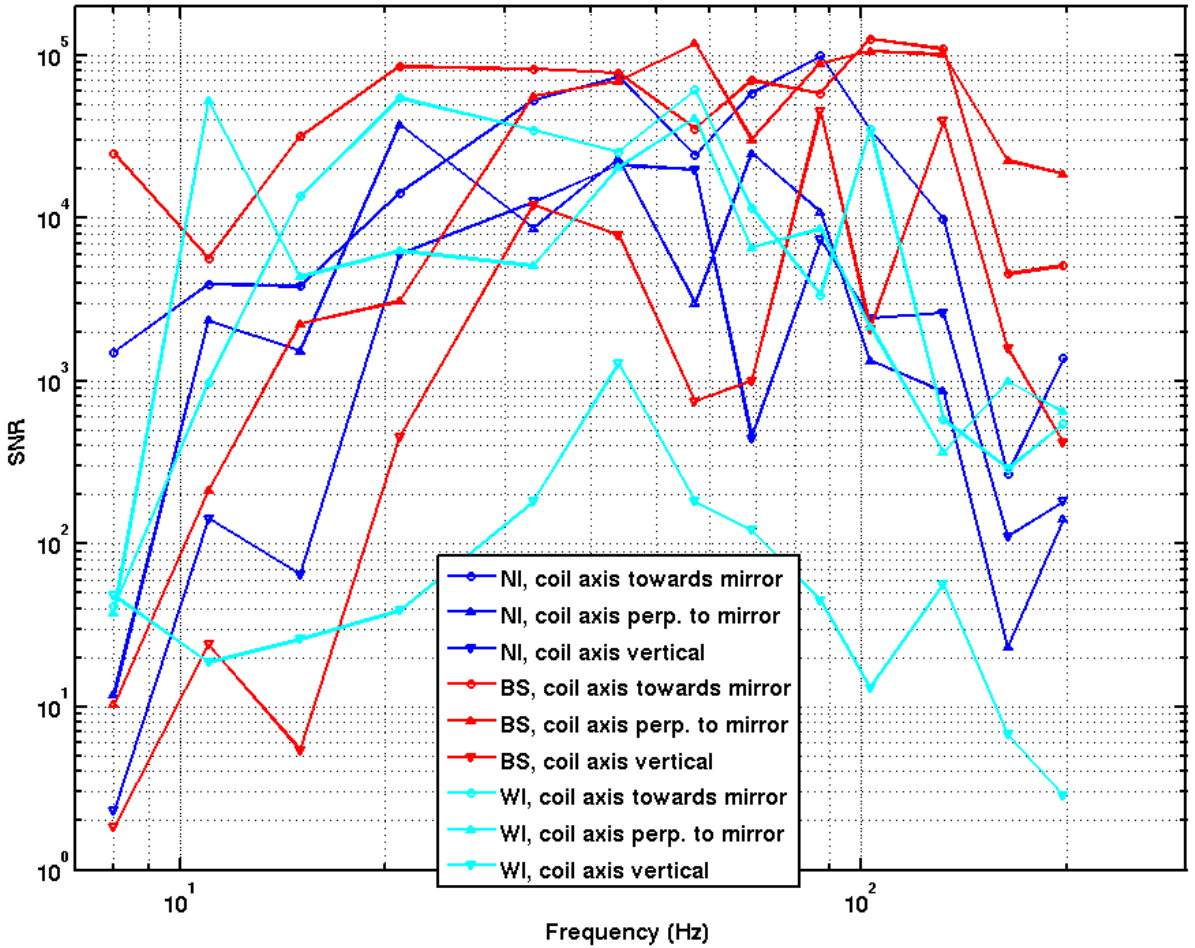
- Pick maximum curves for buildings that are not above current sensitivity
- Above Virgo+MS design, mainly for CB

Near-field injections 1



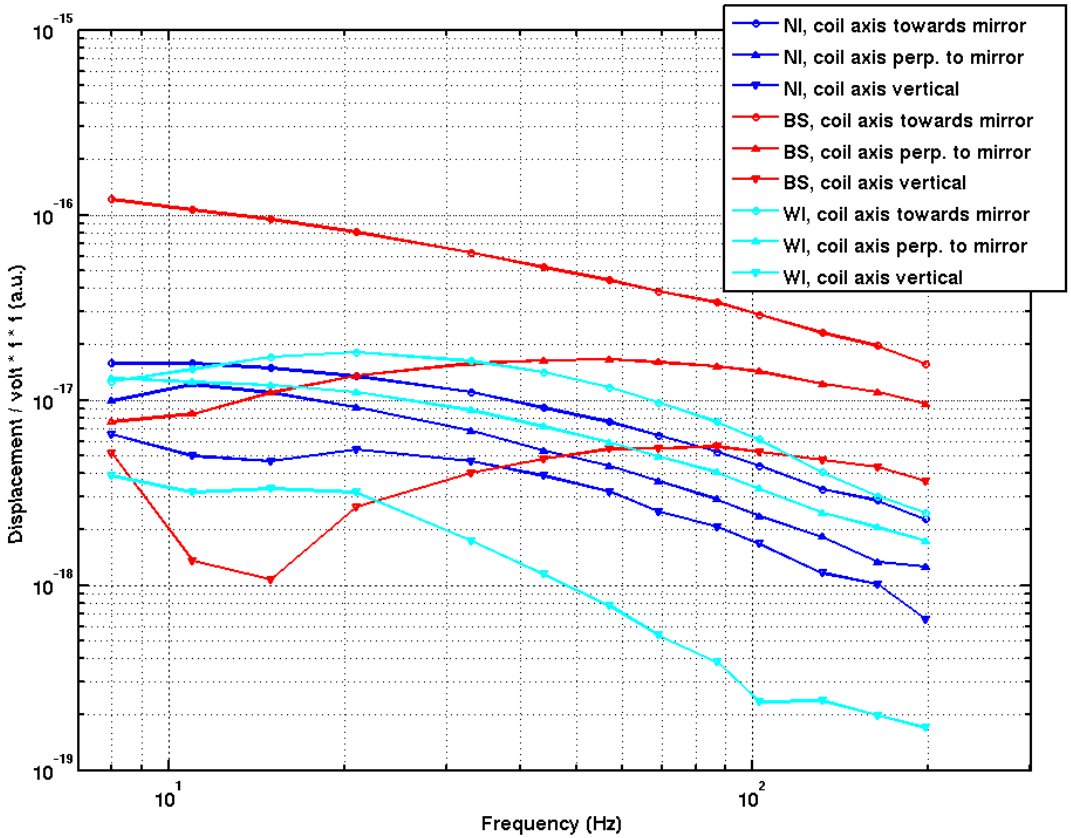
- Use small coil inside ovens, see red dots
- 10 cm diameter, 35 turns, 5 Ohm series resistor, current monitor
- Mainly used for relative comparison of towers in CB

Near-field injections 2



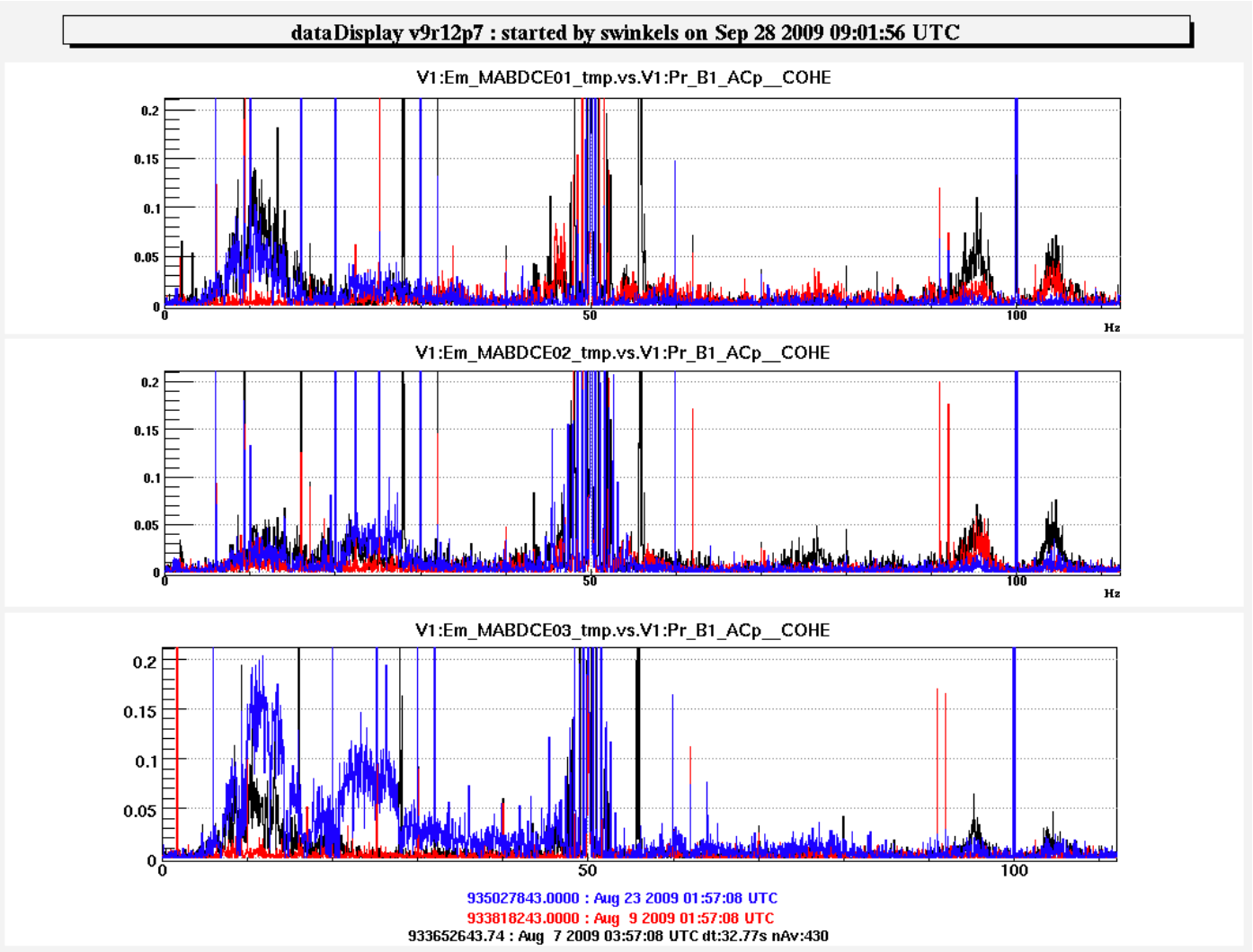
- Lines retrieved with very high SNR

Near-field injections 3



- BS clearly highest contributor, factor 4-8 higher than NI/WI
- Possible mechanism: ty rotation + large mis-centering in x (> 1cm)
- To do: calculate projection using dipole model and check for consistency with far-field projection

Coherence with magnetic probe



- Portable magnetic probe left overnight in BS/NI/WI ovens
- Hard to draw conclusions, but there might be source close to WI

Outlook

- More noise hunting, especially 20 Hz bump
- Repeat near-field injections for PR, NE and WE?
- Reduce sensitivity of magnetometers at NE/WE
- For Virgo+MS:
  - Magnets on BS will be changed
  - Same magnets for test masses
  - Dielectric reference mass should help

End