Polish participation in the Einstein Telescope

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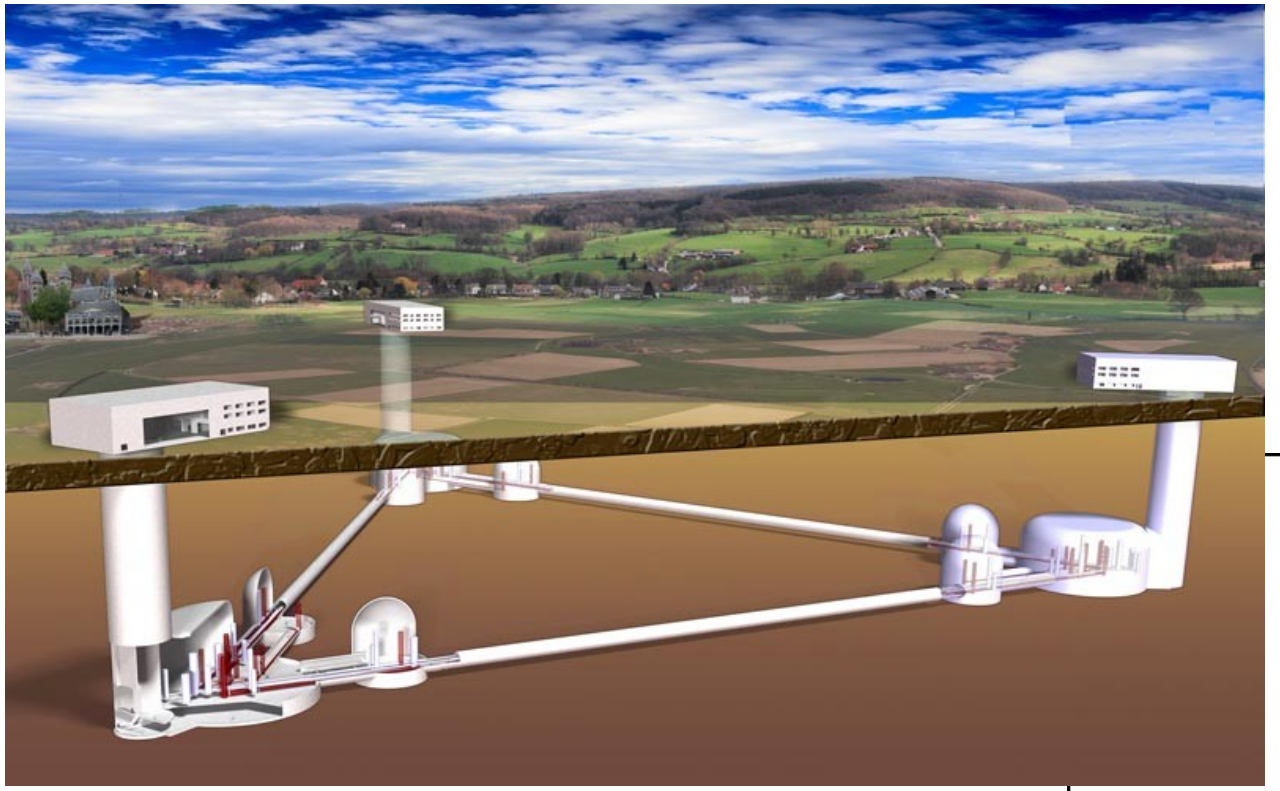
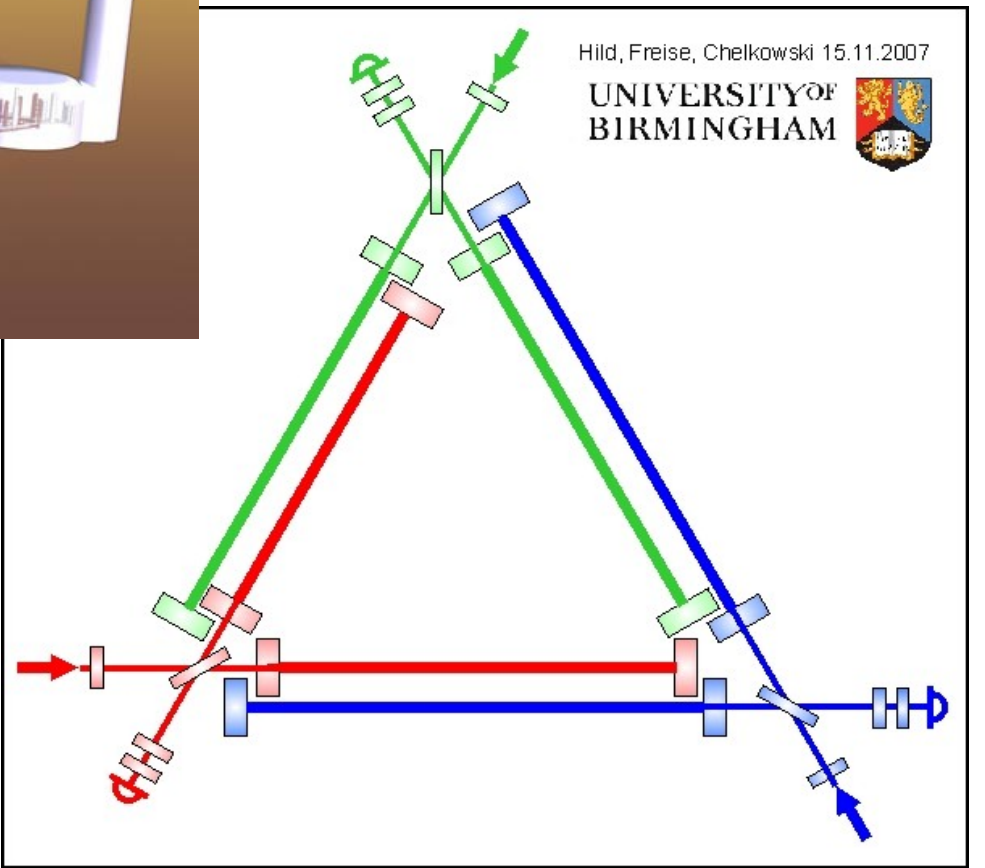
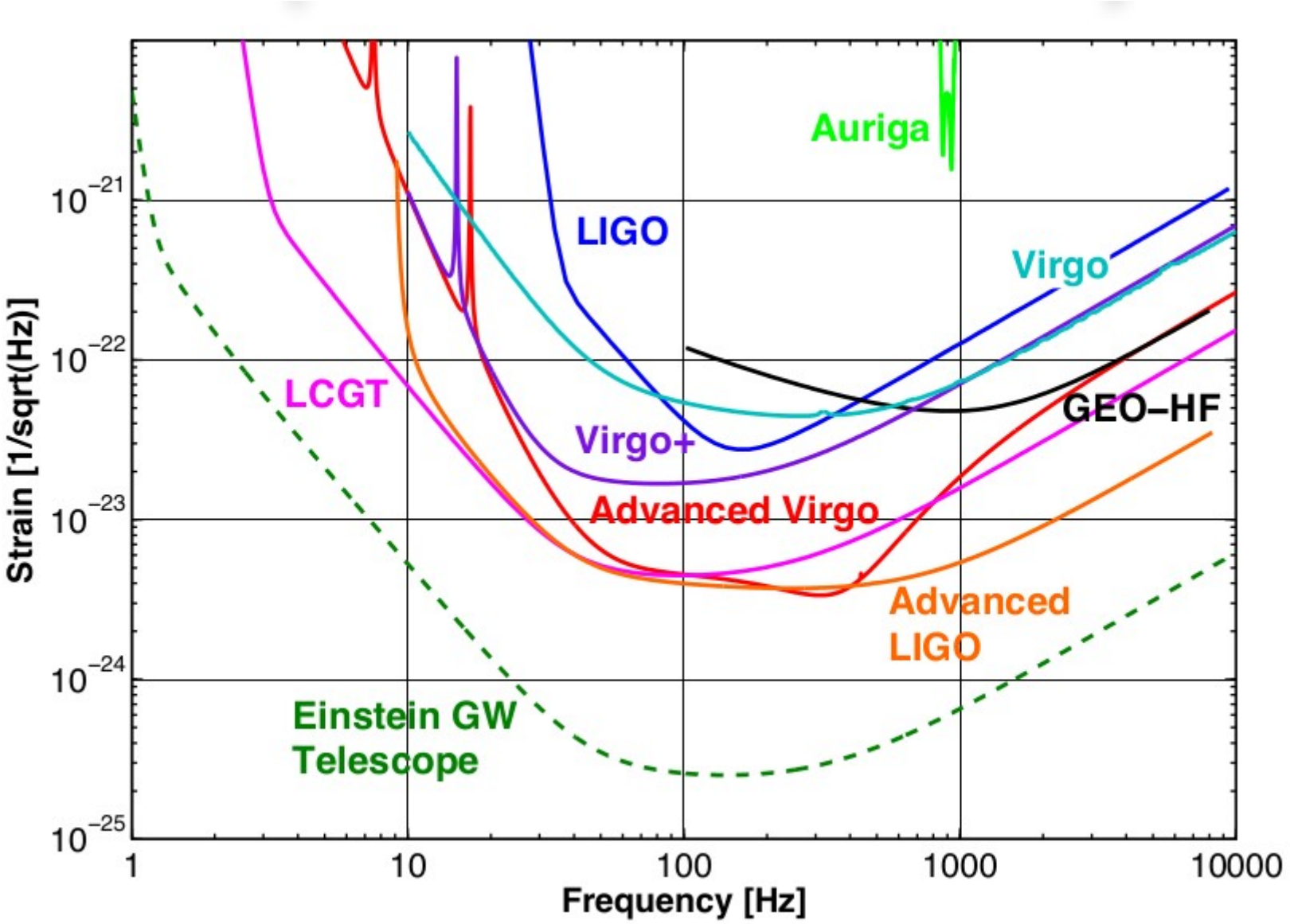
Einstein Telescope





Explore the possibilities provided by detection by three colocated interferometers

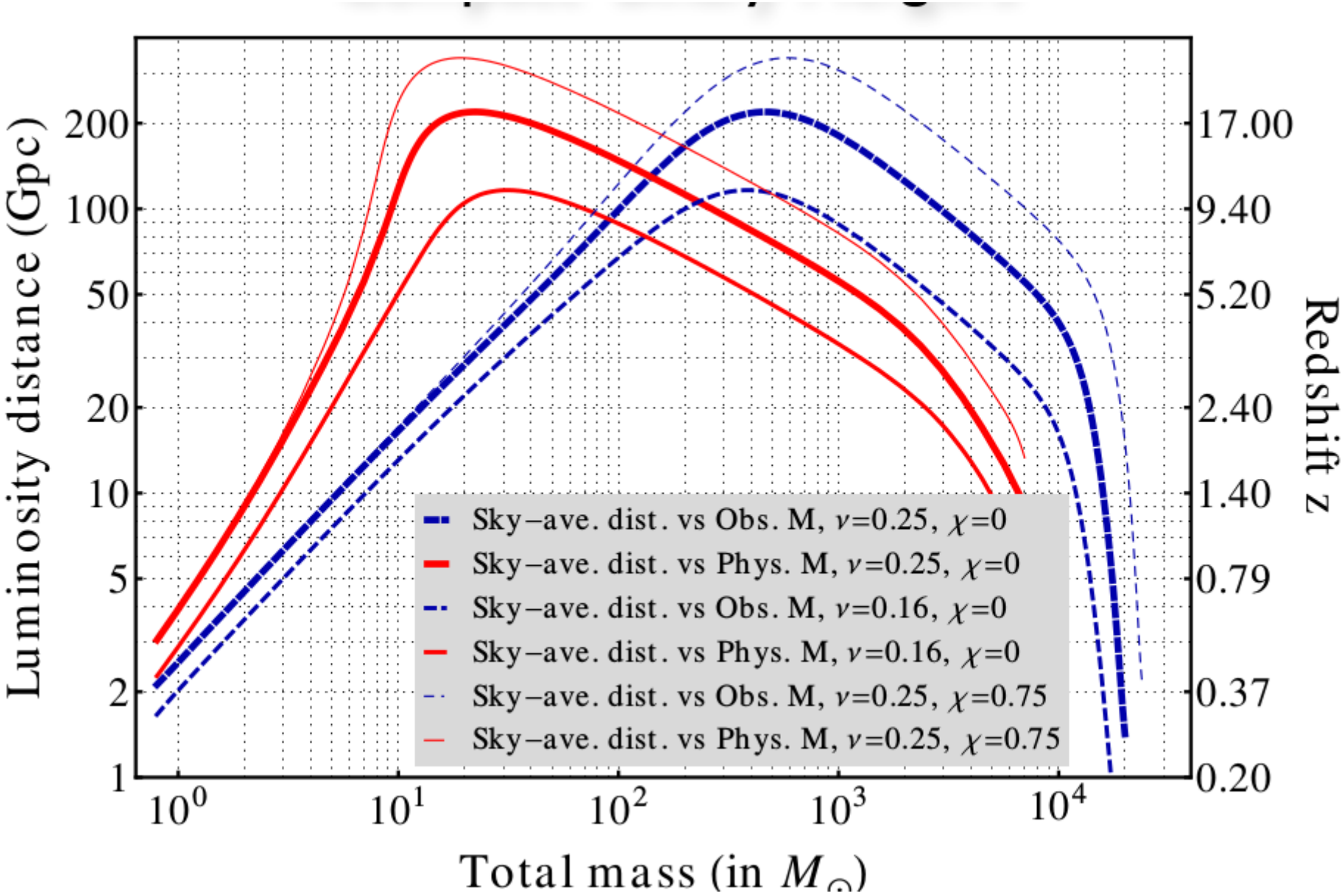
ET Sensitivity



What does it mean?

- Sensitivity ~100 times better than current detectors
- Volume roughly 10^6 times larger
- 30 seconds of ET time is equivalent to 1 year of LIGO/VIRGO data

ET range for coalescences



ET prospects

- Possibility of funding depends on the success of LIGO/VIRGO
- ET design summarized in the Design Study document http://www.et-gw.eu/etdsdocument
- Currently financed through ASPERA in several countries including Poland

Polish ET Consortium

- University of Warsaw
- Warsaw Technical University
- Institute of Mathemathics, PAS
- Nicolaus Copernicus Astronomical Center, PAS
- University of Białystok
- University of Zielona Góra
- Silesian University

ET activities in Poland

- Theoretical studies:
  - Objects
  - Mock Data Challenge
- Site characterisation
  - Precise seismometers
  - Investigation of sites

Studies of astrophysical sources

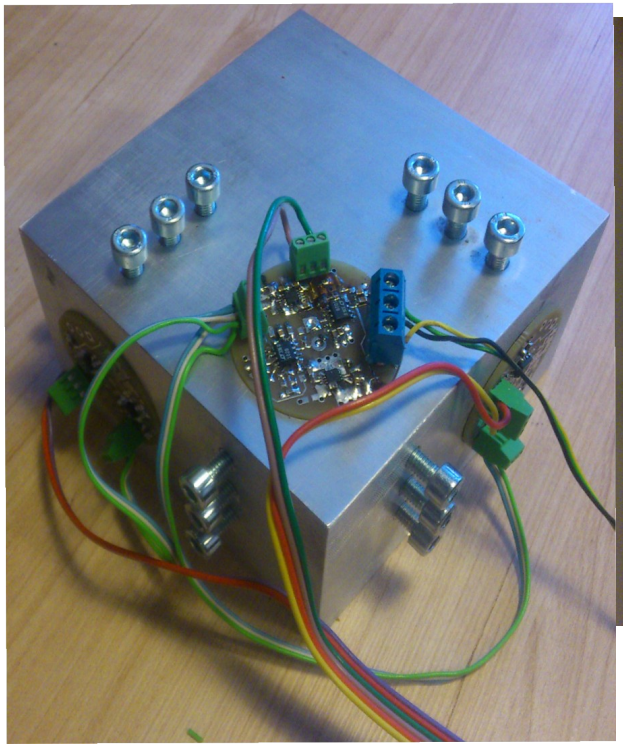
- Binaries - DNS, BBH, BHNS formation
- Pulsars and instabilities
- Unresolved backgrounds – from binaries, pulsars.
- Mock data challenge
  - Injection of sources
  - Data analysis pipelines

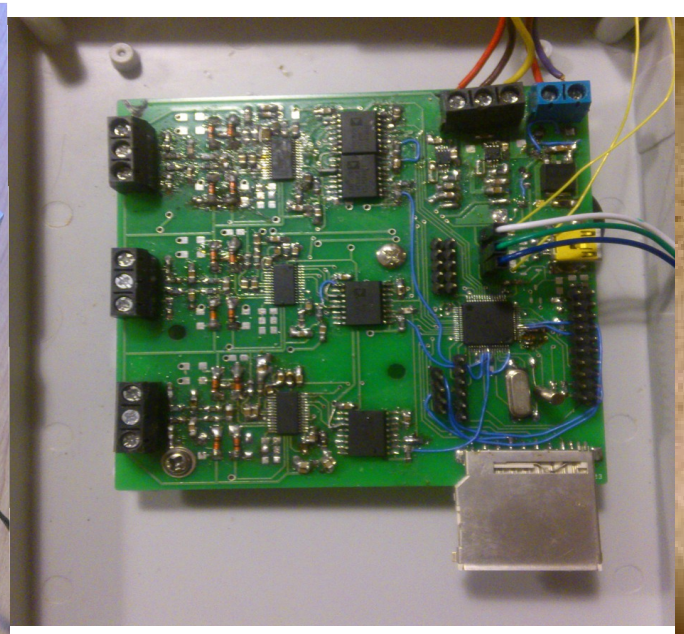
Seismic sensors

- Use geophone based sensors
- Develop custom electronics – amplifier, analog to digital converter, and data logger.
- Test, improve
- Mass produce sensors, and deploy at sites.

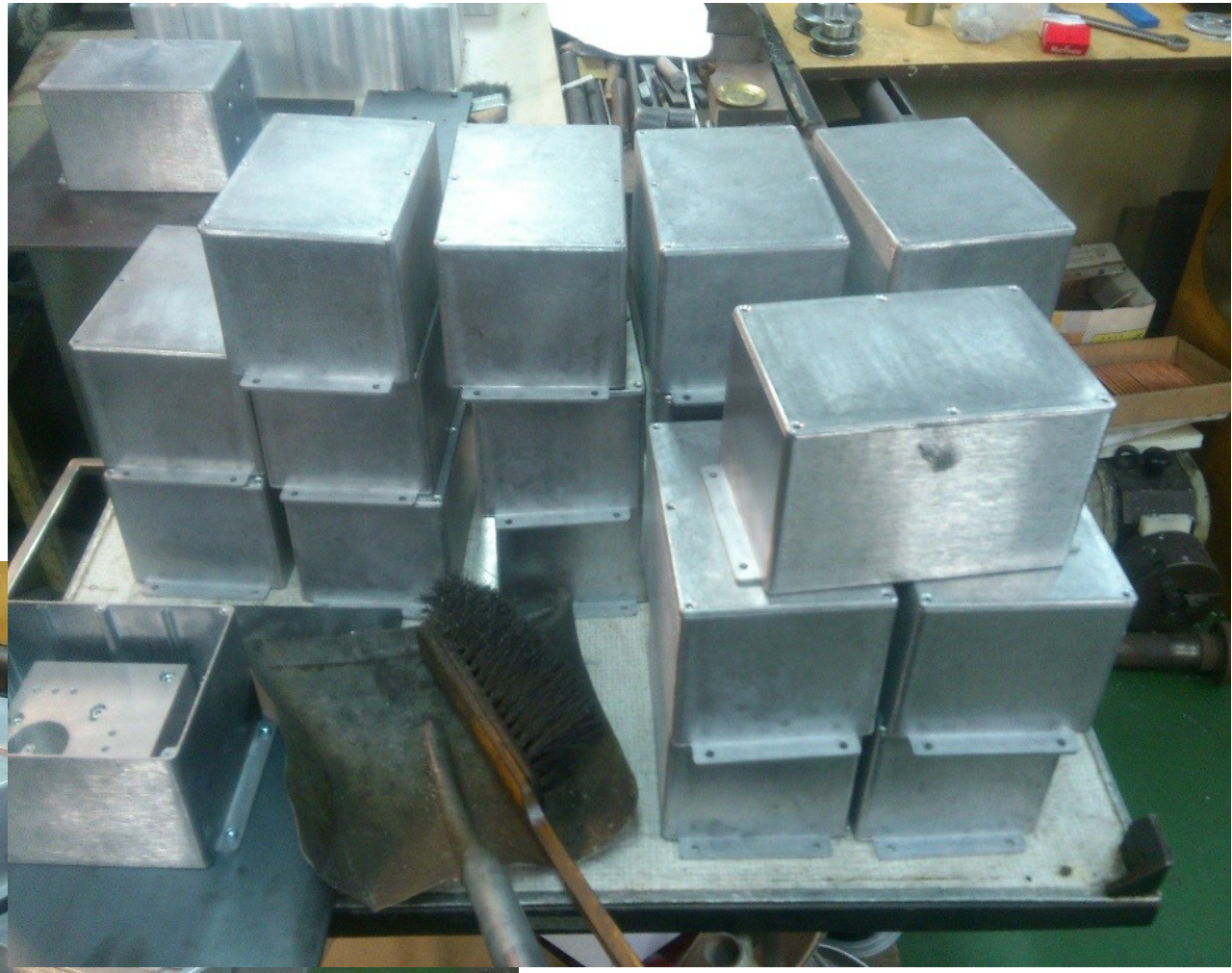
System properties

- 3x ADC, X Y Z axis
- sampling frequency 200 Hz, resolution 32 bit
- Data stored to SD card (~4 Gb per month), 32 Gb will last for 8 months



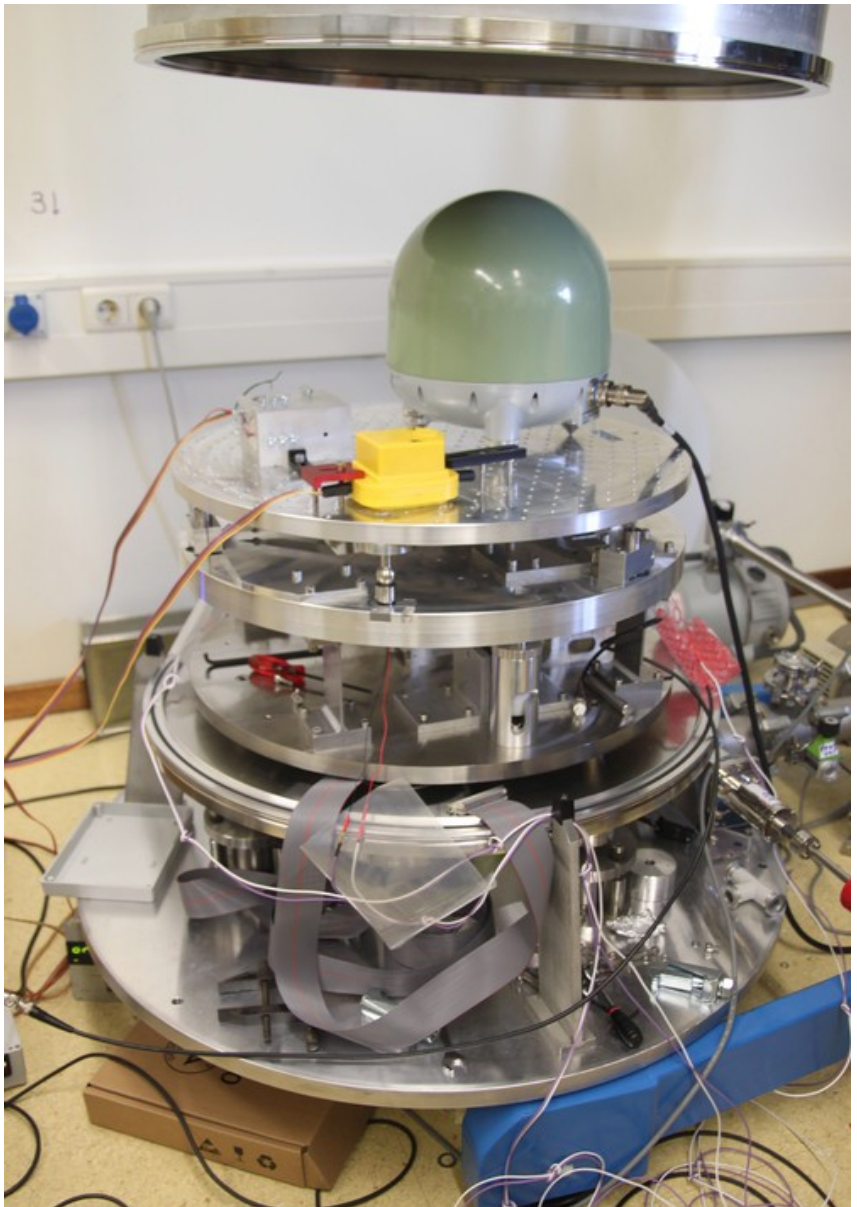


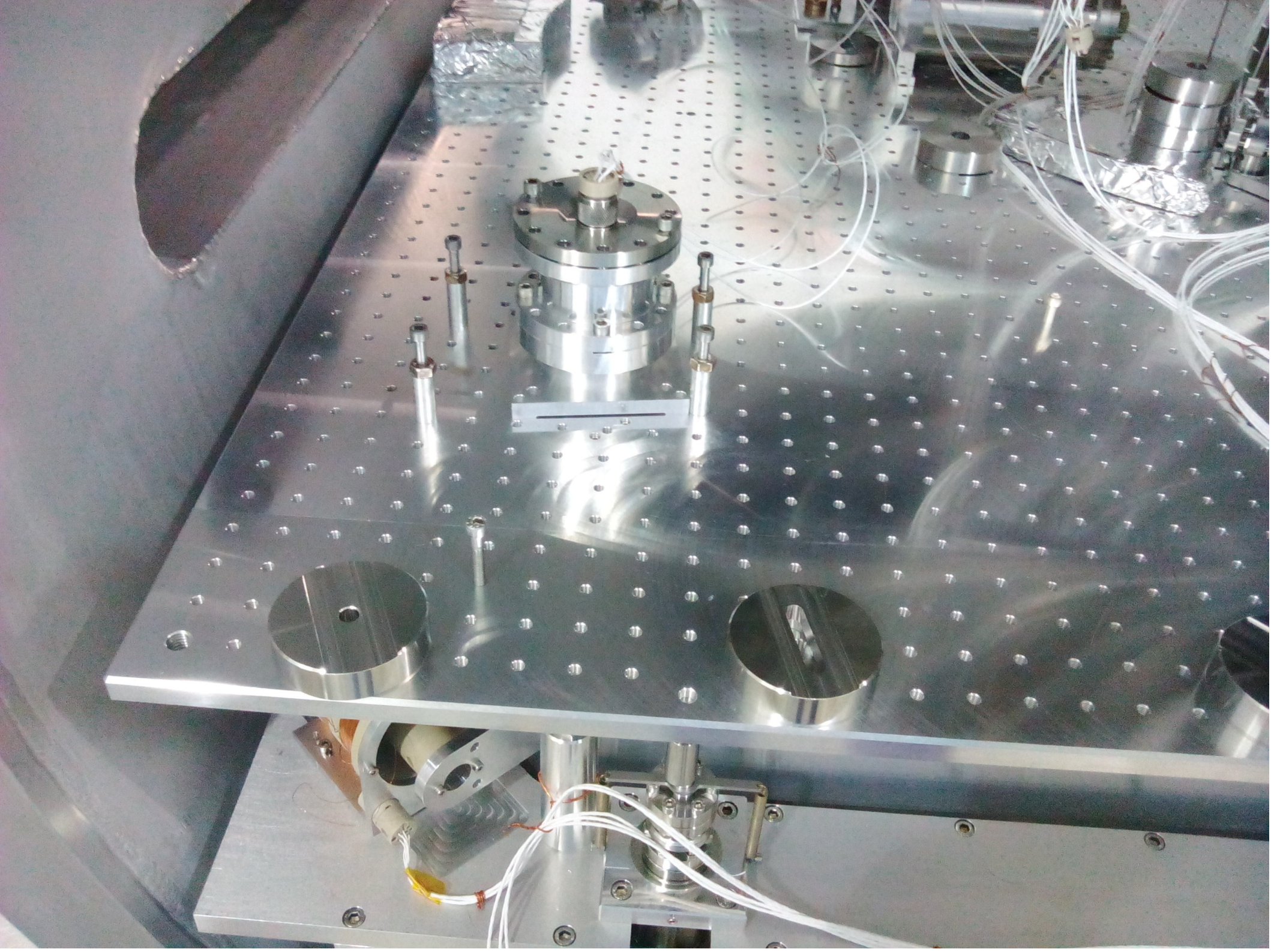
Mass production



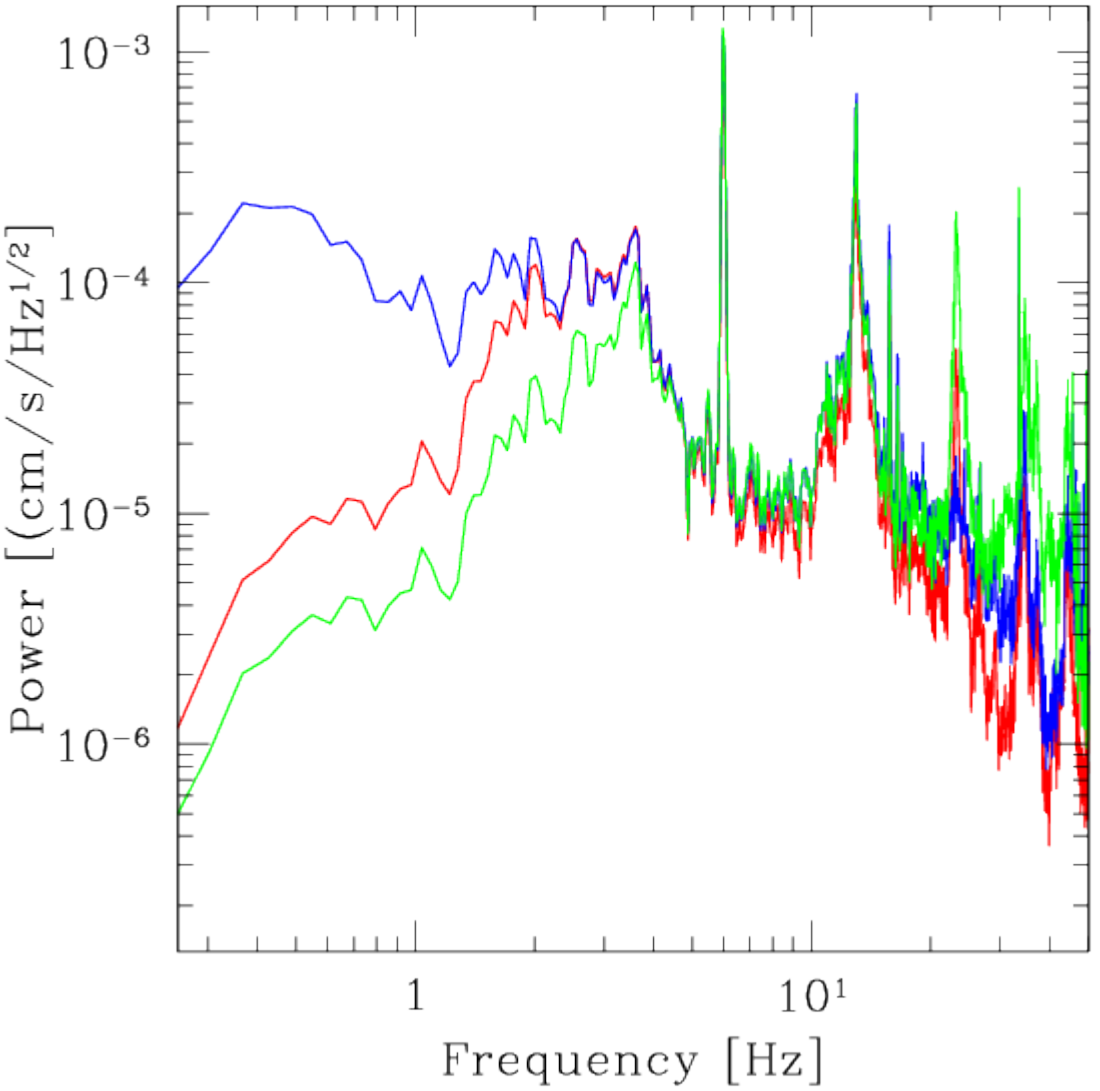
Tests and results

- Performed at NIKHEF, in Amsterdam
- Compared the sensors to Trillium 360.
- Noise tests in seismically isolated vacuum chamber.





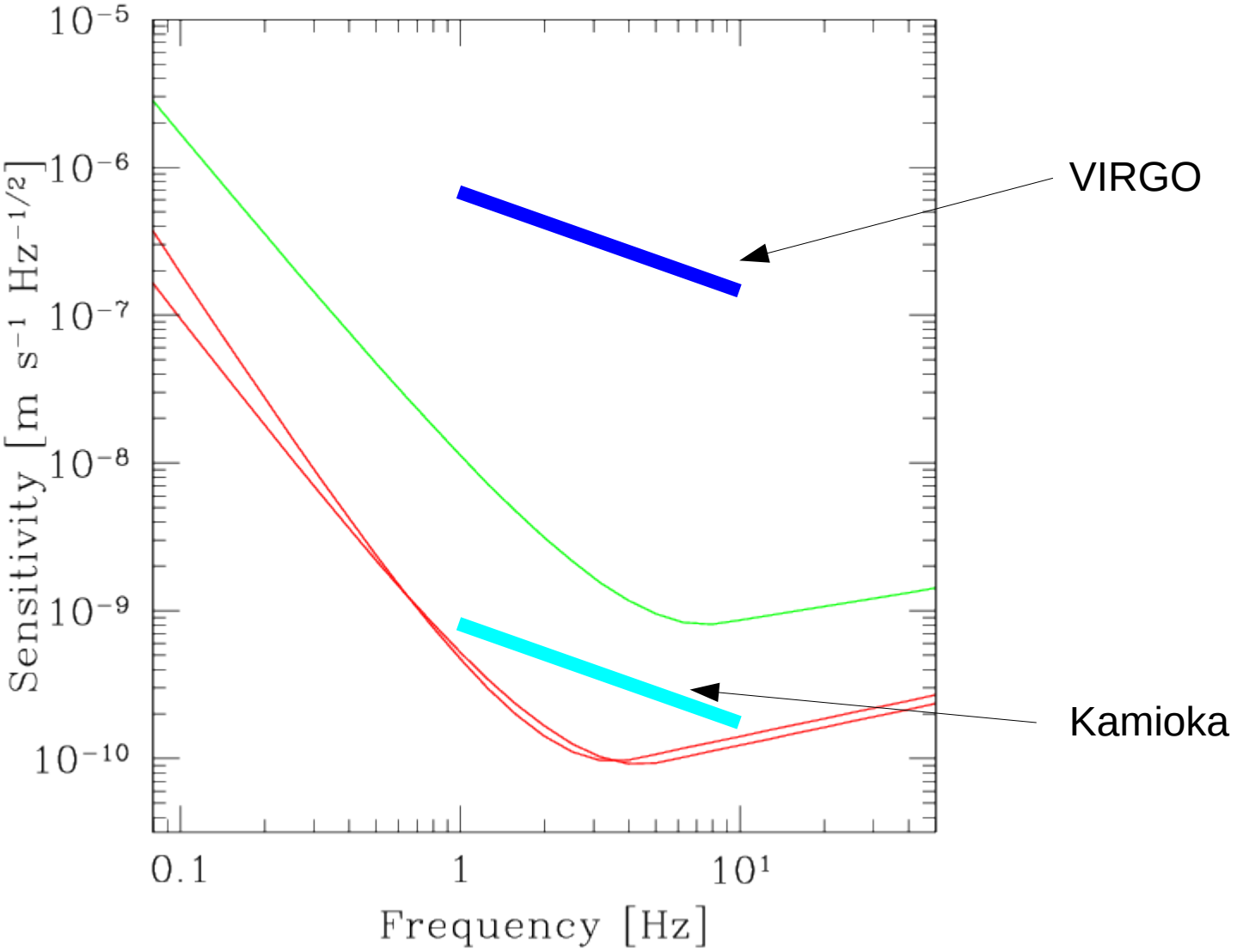
Signal measured



Sensitivity estimate

- Assume that noise is at the electronic level
- Trillium response is used as reference
- Calculate the sensitivity using the measured ratios.

Sensitivity



Current status

- Finishing assembly of 27 sensors
- Initial visit in a mine near Olkusz next week
- Plan deployment within two months

- Further steps:
  - Deployment in Hungary, Sardinia, Spain, Finland
  - Aim at gathering more than a year of data at each location

Next steps

- The project depends on LIGO/VIRGO success in the coming years
- Current finacing runs out next year
- Very long term project