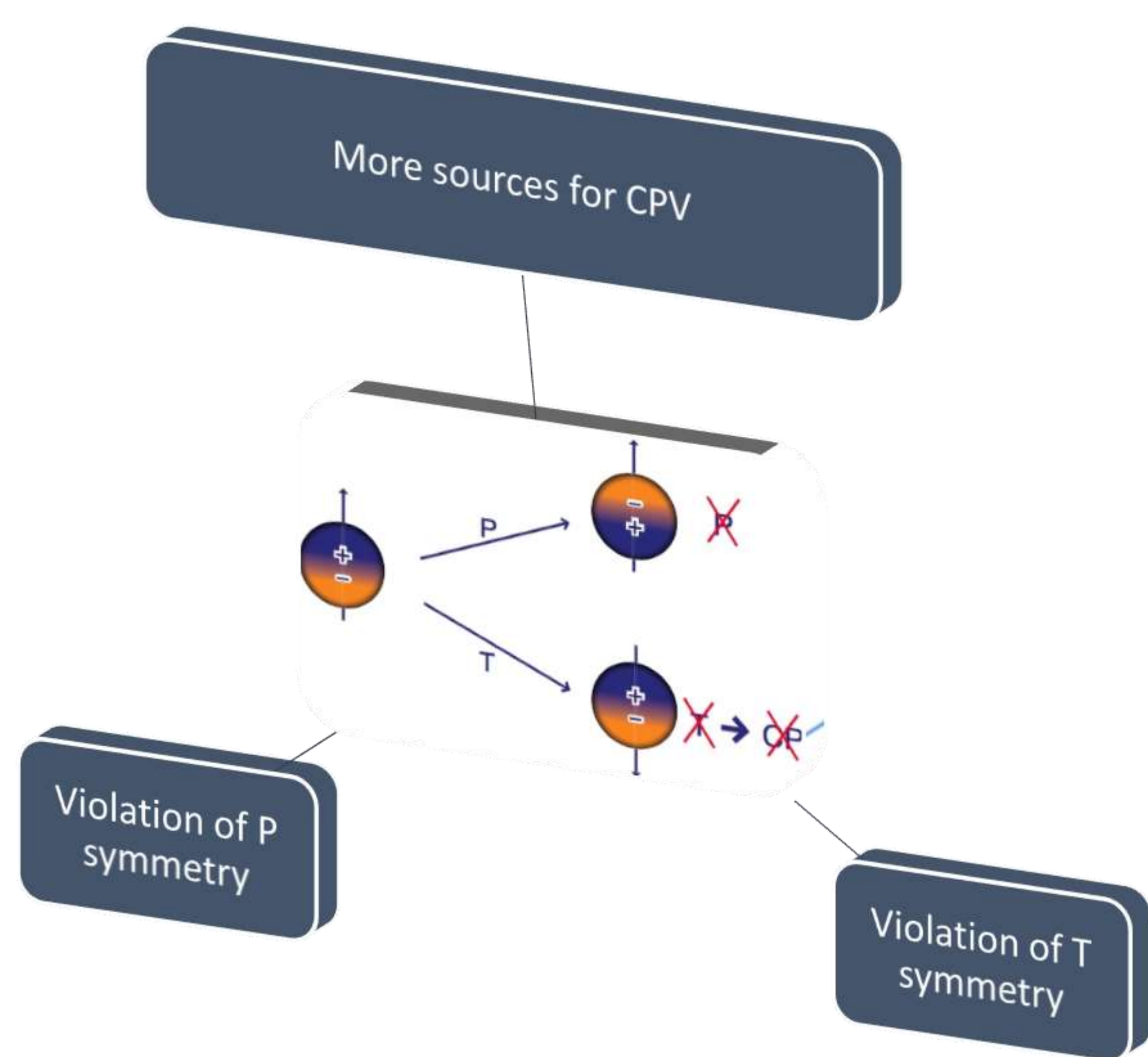


Motivation

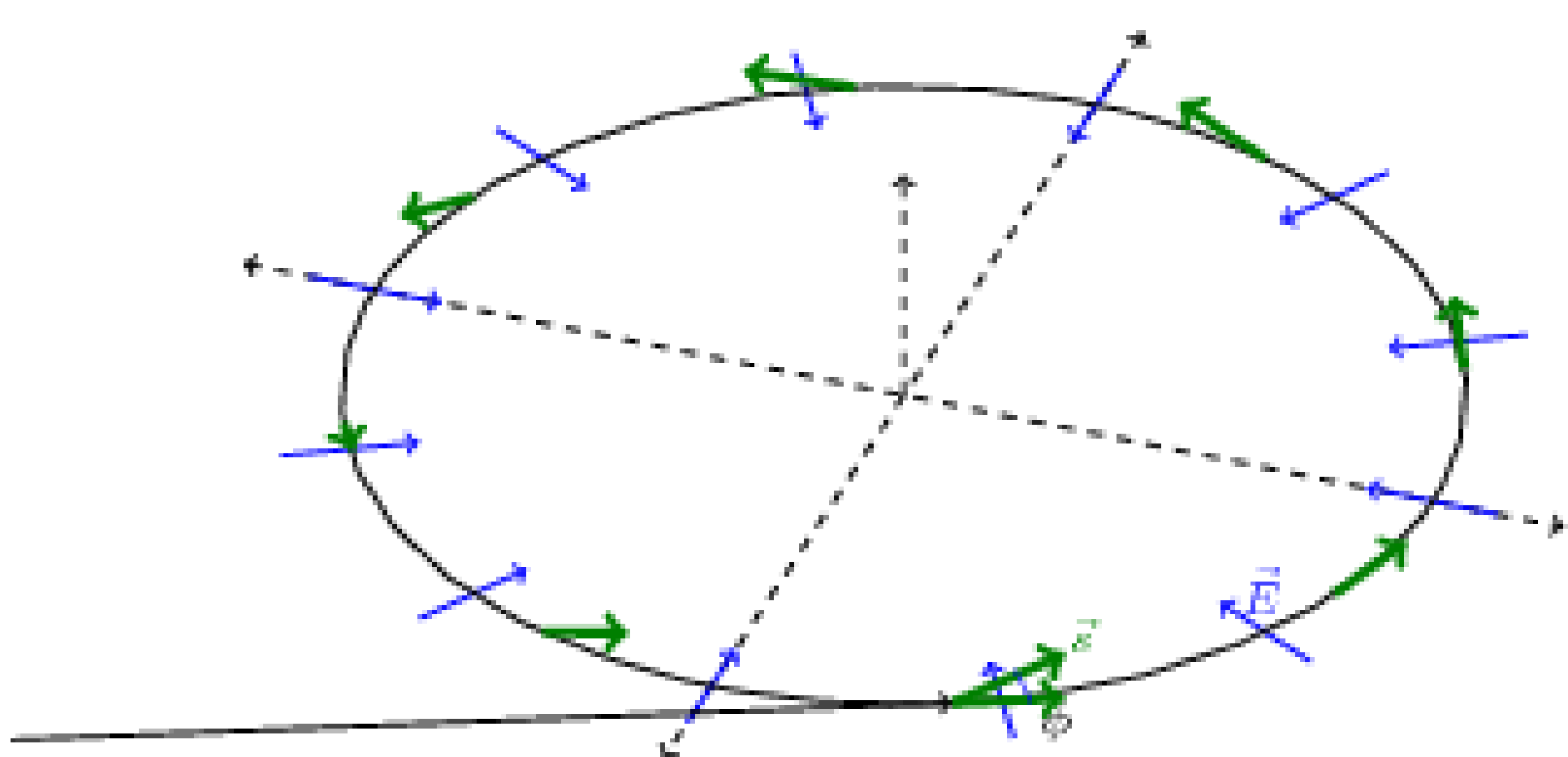


What makes the EDM so special?



Introduction

The JEDI collaboration is currently preparing for measuring the Deuteron EDM in the COoler SYNchrotron (COSY). One of the major challenges that one needs to worry about is the precise knowledge about the beam position along the ring.



$$\frac{d\vec{s}}{dt} = \vec{s} \times (\vec{\Omega}_{MDM} + \vec{\Omega}_{EDM})$$

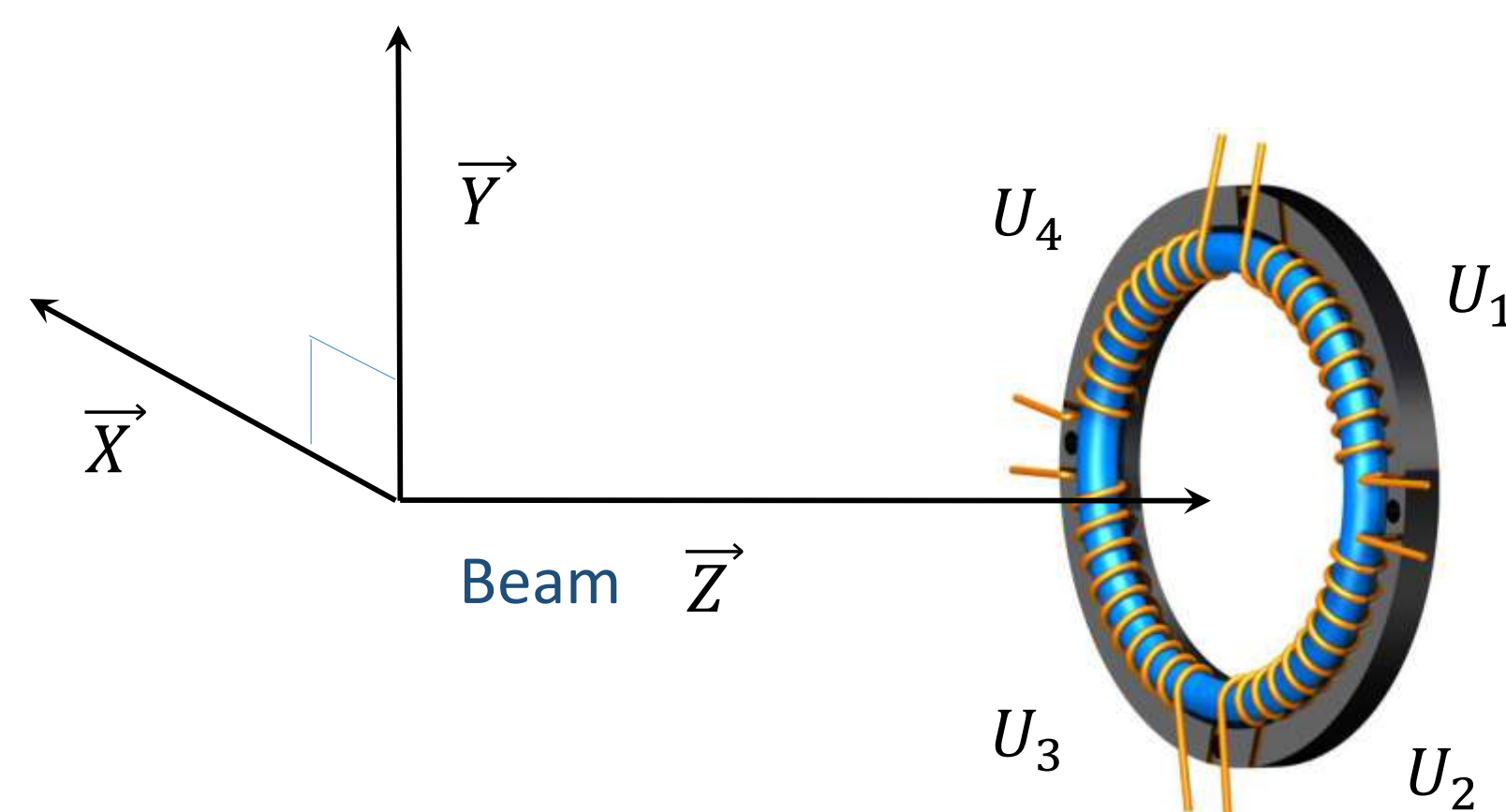
$$\frac{d\vec{s}}{dt} \propto d \cdot \vec{E} \times \vec{S}$$

Study polarization build-ups due to spin interactions with electric field

Beam position monitors along the ring

- Beam center of mass
- Longitudinal bunch shape
- Beam closed orbit
- True EDM signal

Theoretical background



- A current-carrying wire (to mimic COSY beam)
- Faraday's law
- Induced voltages

$$\frac{\Delta U_{hor}}{\sum_{i=1}^4 U_i} = \frac{(U_1 + U_2) - (U_3 + U_4)}{\sum_{i=1}^4 U_i}$$

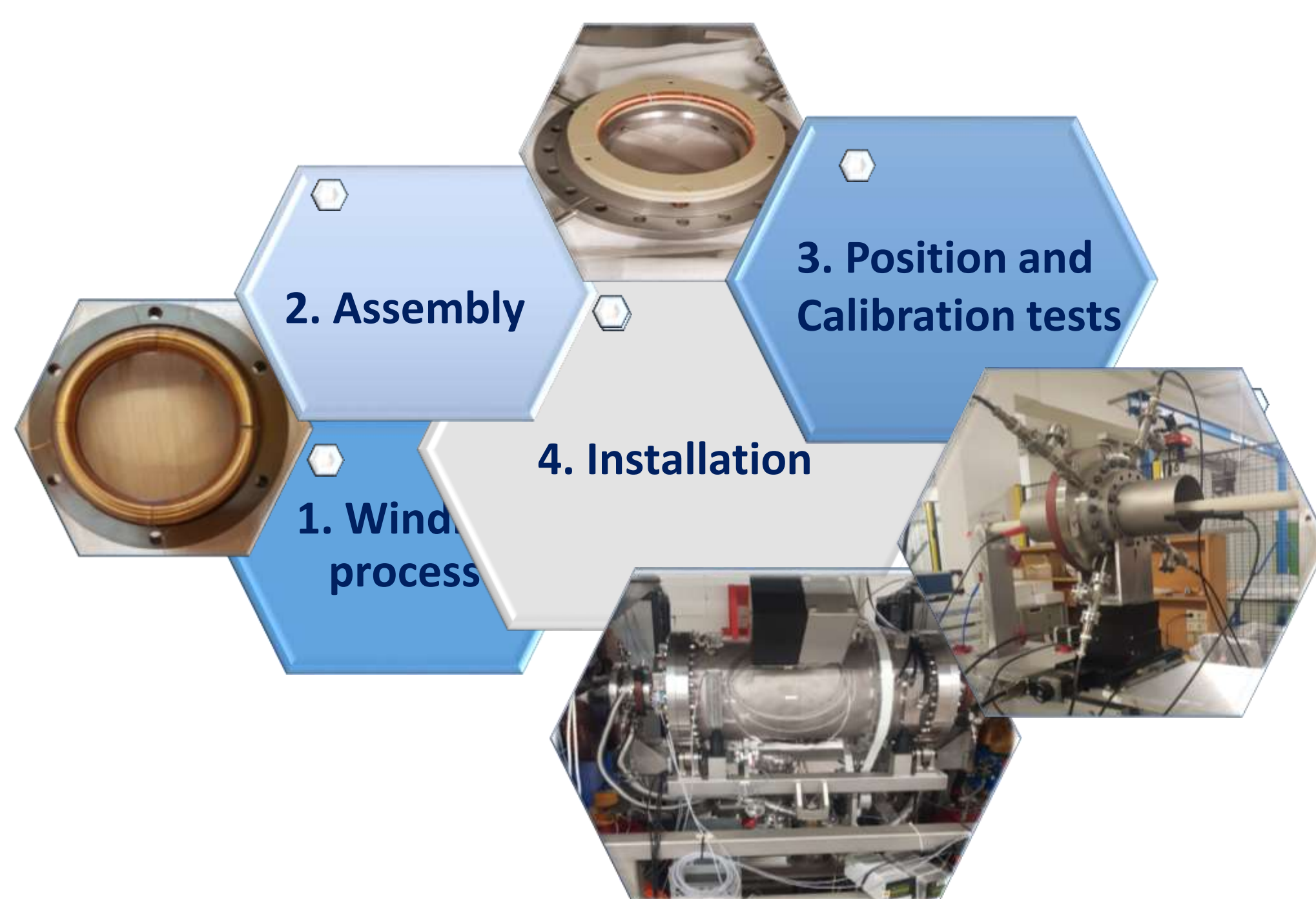
$$= c_1 x - c_2 (x^3 - 3y^2 x) + c_3 (x^5 - 10y^2 x^3 + 5y^4 x) + \dots$$

$$\frac{\Delta U_{ver}}{\sum_{i=1}^4 U_i} = \frac{(U_1 + U_4) - (U_3 + U_2)}{\sum_{i=1}^4 U_i}$$

$$= c_1 y - c_2 (y^3 - 3x^2 y) + c_3 (y^5 - 10x^2 y^3 + 5x^4 y) + \dots$$

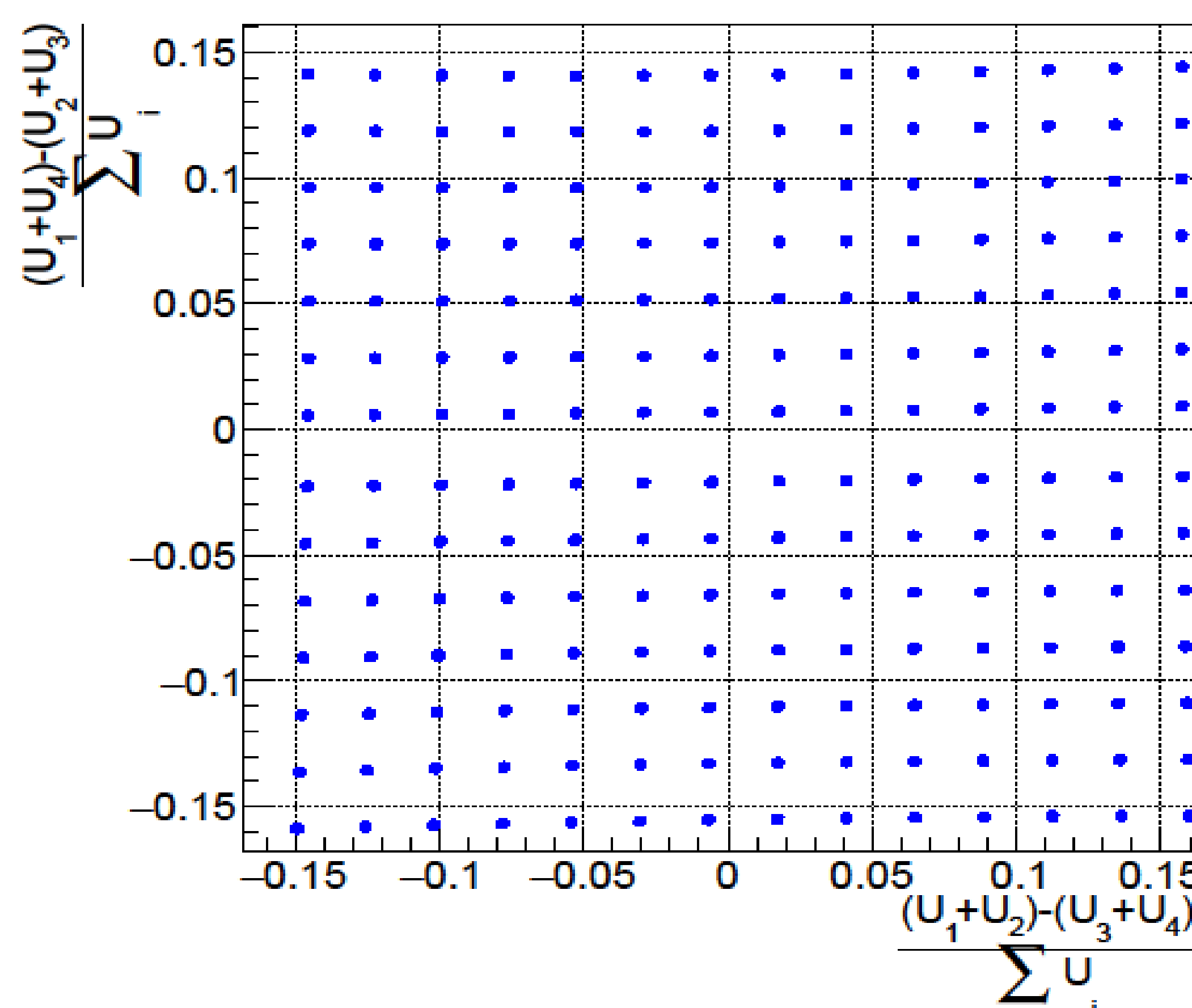
* C_i : Constants depend on coil parameters

Methodology

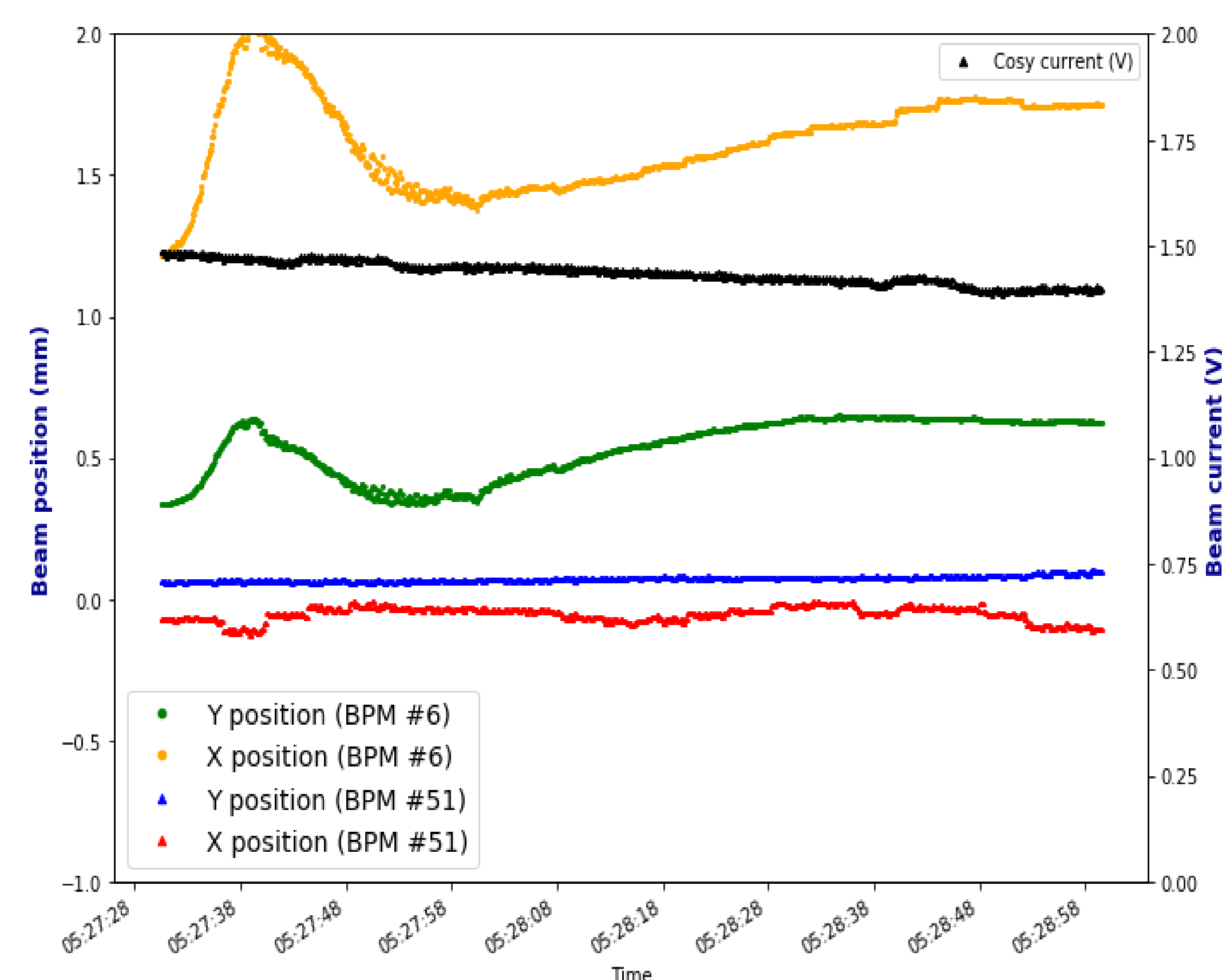


Grid map

In a calibration test :
The coil is moved in a step size of (some range mm) with the help of the stepping motors in both the horizontal and vertical directions. The map yielded should be symmetric .

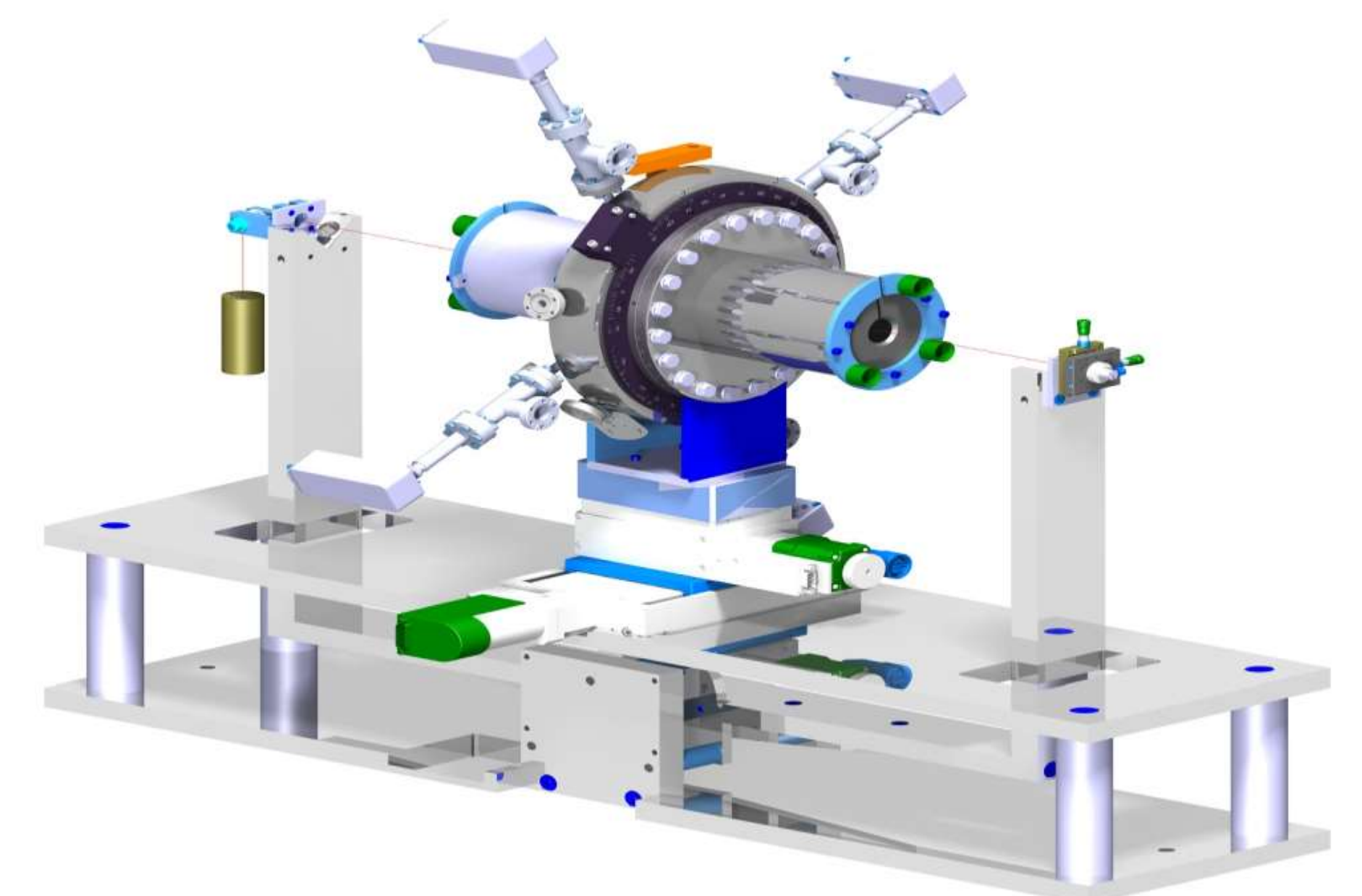


Last beam time Jan/Feb 2018



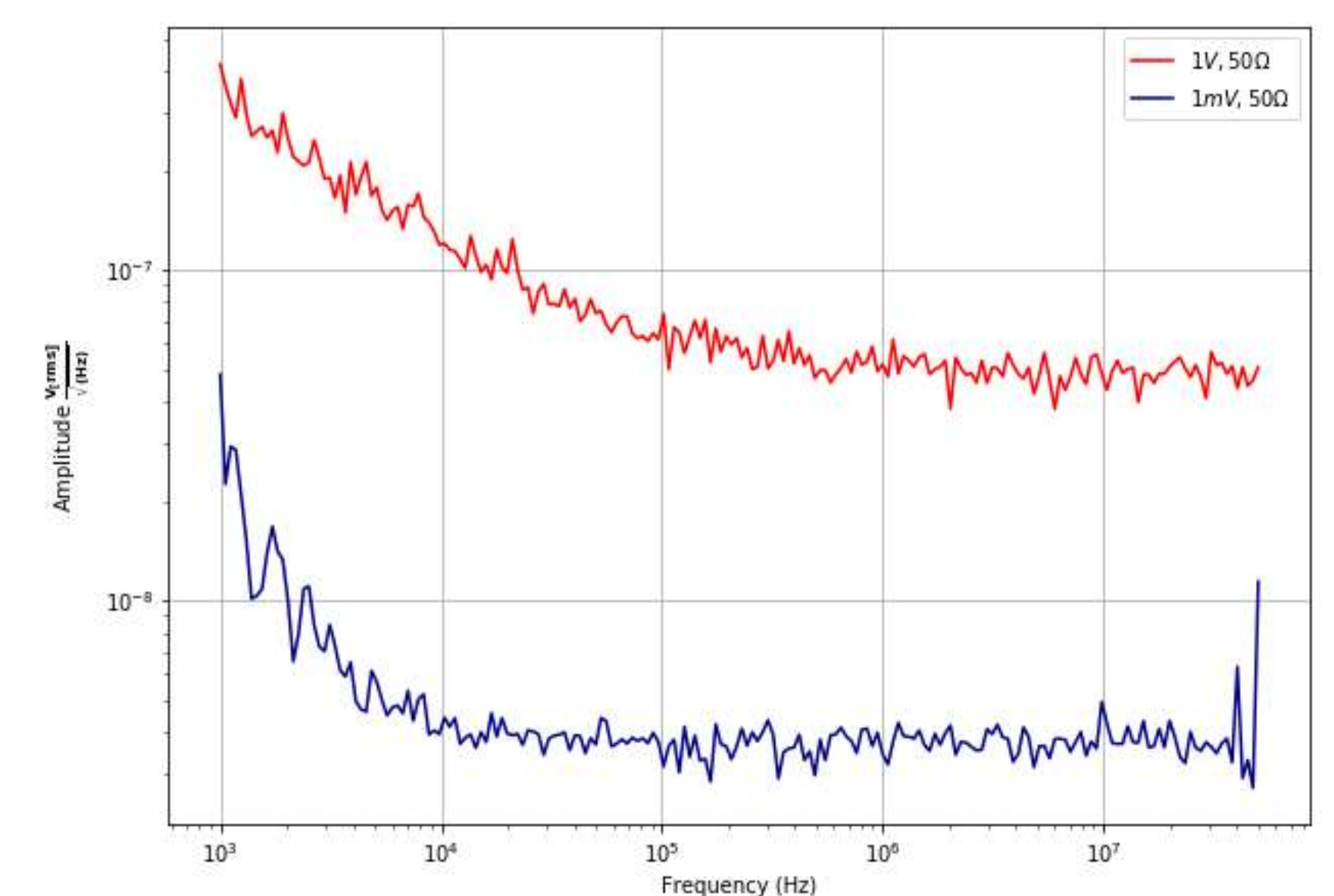
Future upgrades

- Precise positions: With knife edge around the wire to electrically determine the wire positions



- Controlling potential noise sources

Noise at the input of the lock-in amplifier



- Use the proper signal pre-amplifier depending on improved SNR values.
- Control the current strength at the test-stand (0.1 – 1.0 mA)

Summary

- Rogowski coil BPM's are highly sensitive and compact devices
- Currently, the greatest goal is to have a perfectly produced, tested, and calibrated coils with zero issues
- In the final prototype ring, we would have several of such monitors for distinct experimental purposes