Functionality analysis and Upgrade of the single stretched wire (SSW) bench for PERLE magnets

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Supervised by:

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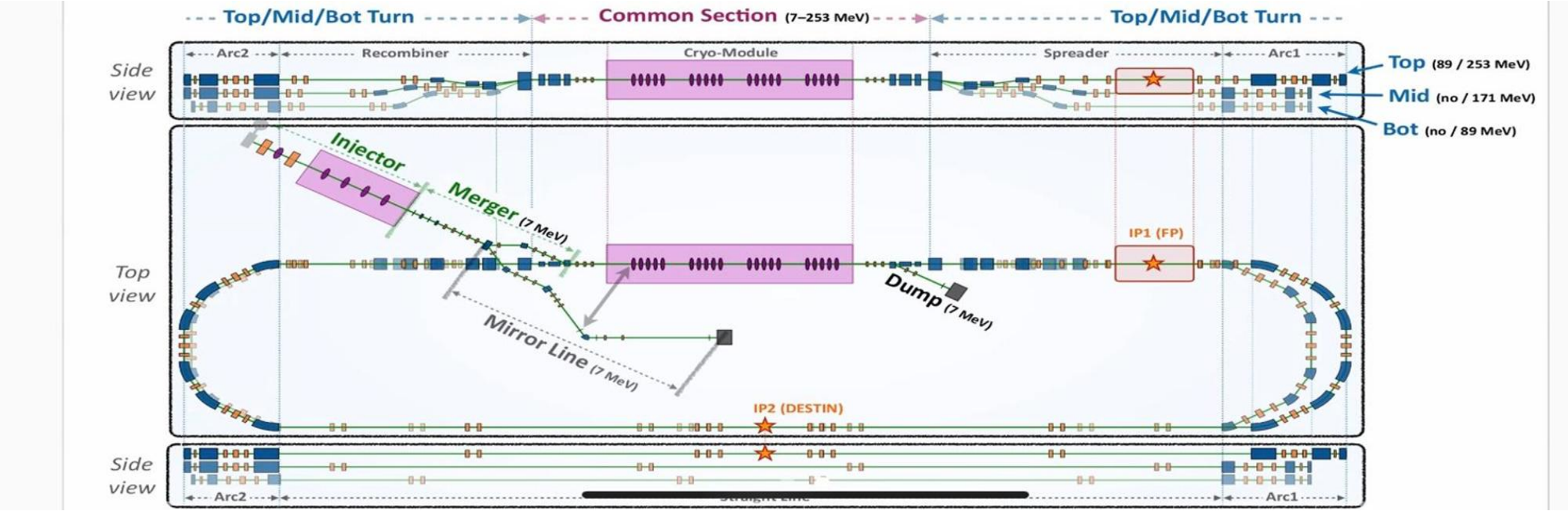
Introduction

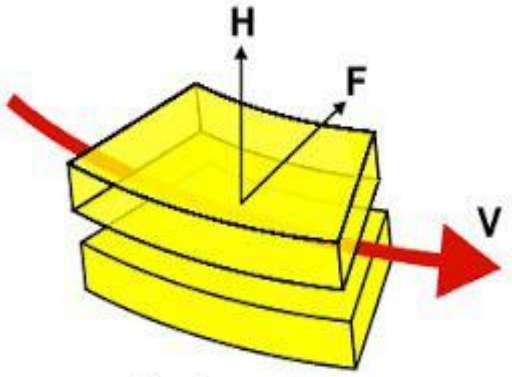
- I am working on performing measurements of the quadrupole magnet used in the **PERLE magnetic accelerator**, using the **SWM Bench**, which is controlled by the **Igor Pro** software.

- **PERLE project:** is a linear accelerator project using Energy Recovery Lin.ac (ERL) technology.

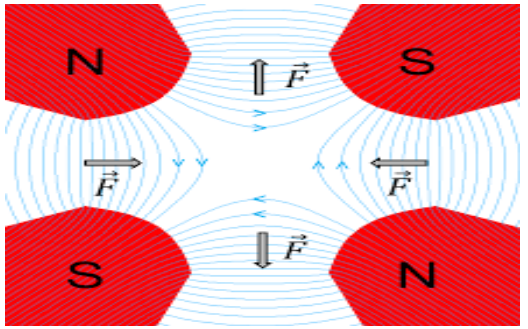
The Organisation of PERLE Collaboration is described in the COLLABORATION AGREEMENT of the following Instituts

Lattice of PERLE





dipole

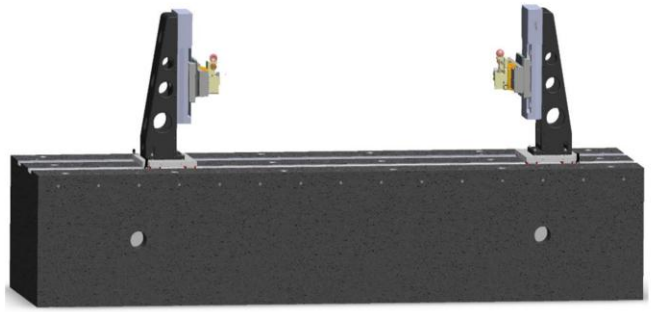


quadrupole

SWM Bench

SWM bench consist of:

Granite bench & Two Towers.



NI Acquisition board

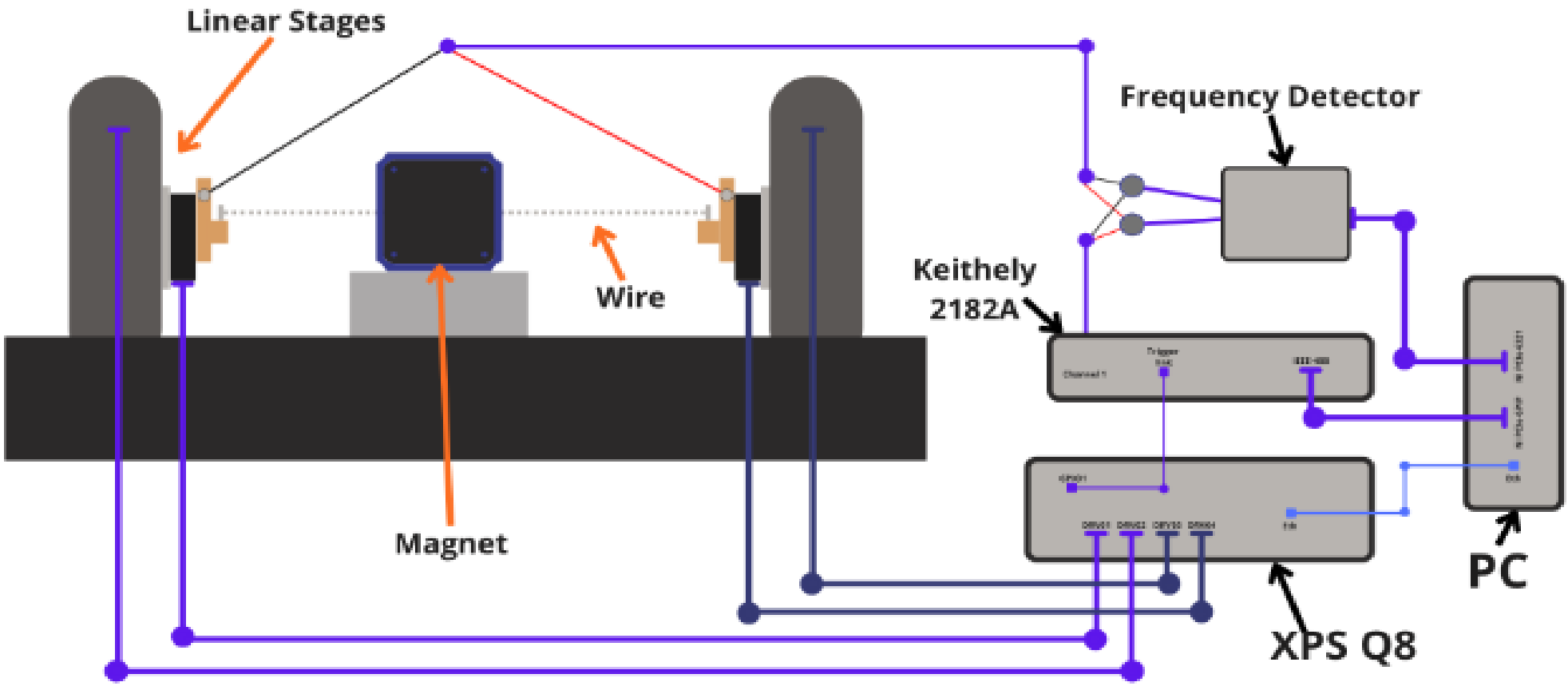
Keithley 2182 nanovoltmeter

Titanium wire

XPS controller

PC

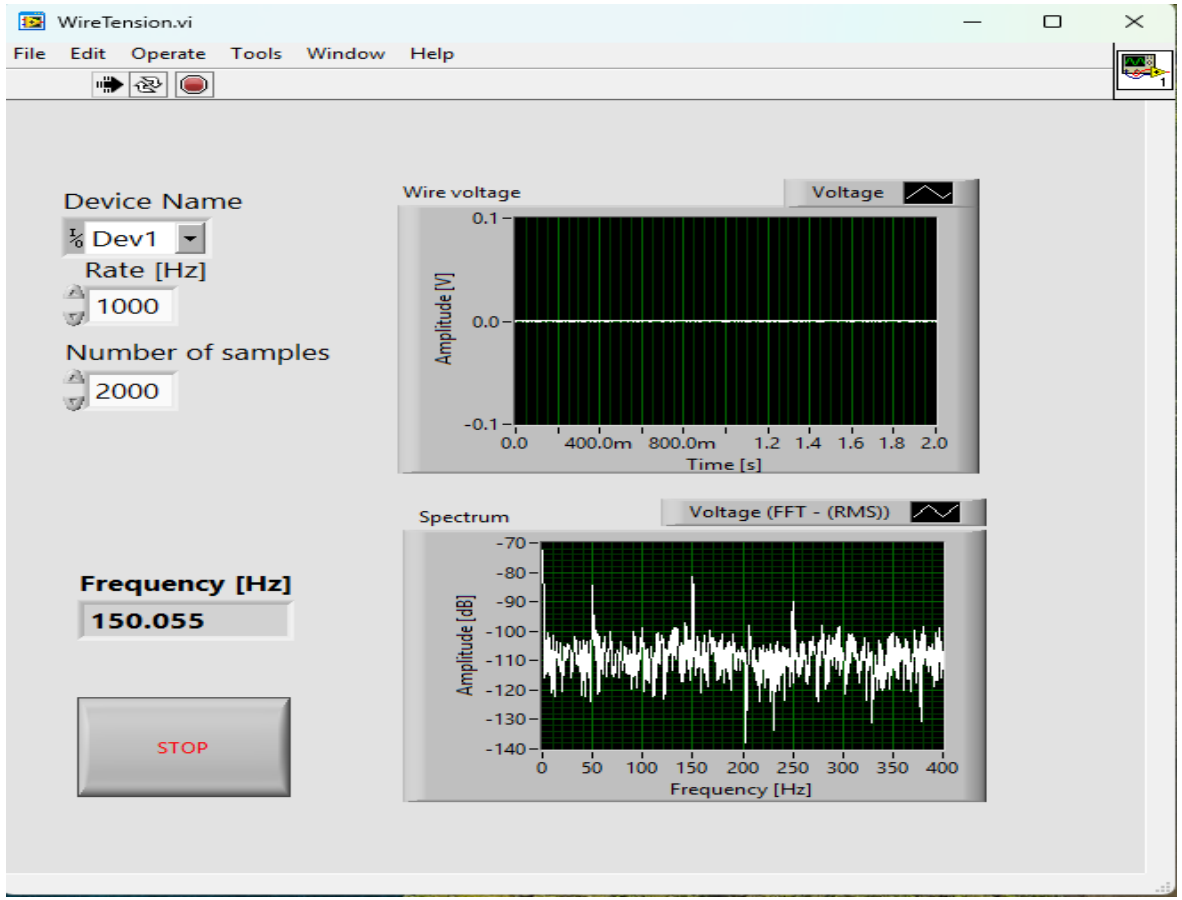
Schematic diagram of SWM bench



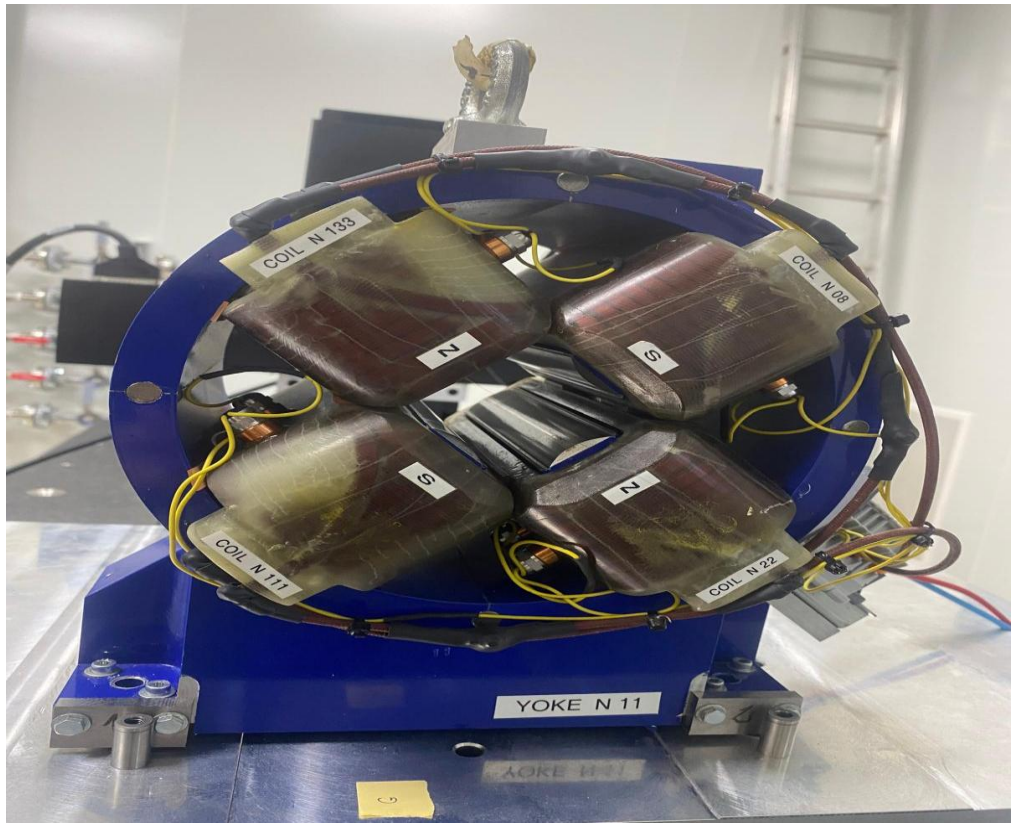
SWM bench Initialization

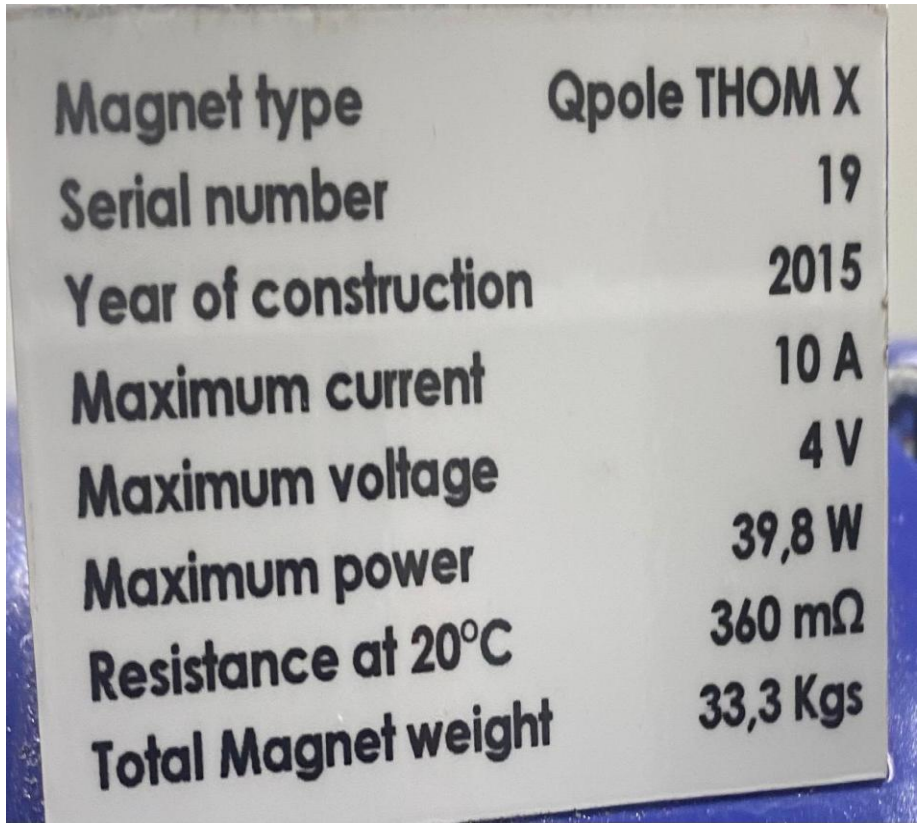
1)

2)



Quadrupole magnet





The radial field component Br equation as follows:

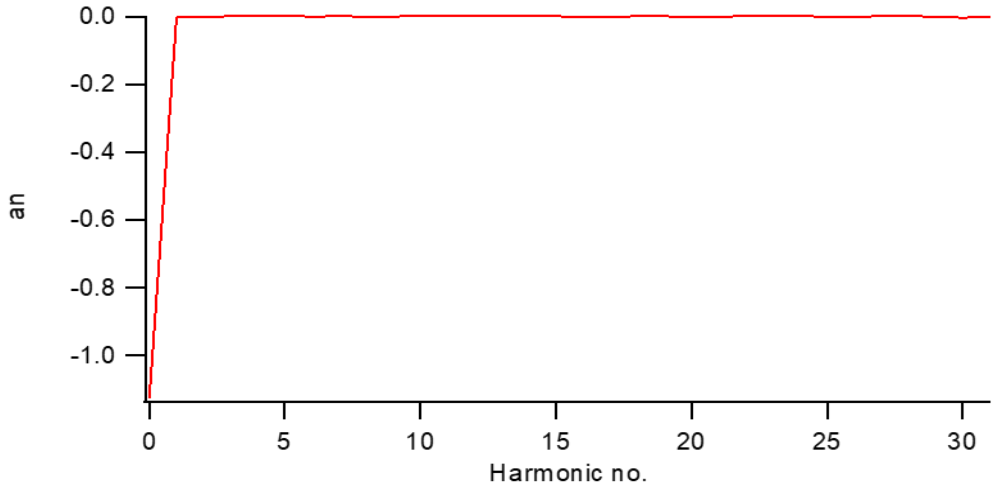
$$\mathbf{B}_r = \sum_n \left[a_n \cos(n\theta) + b_n \sin(n\theta)\right] r^{n-1}$$

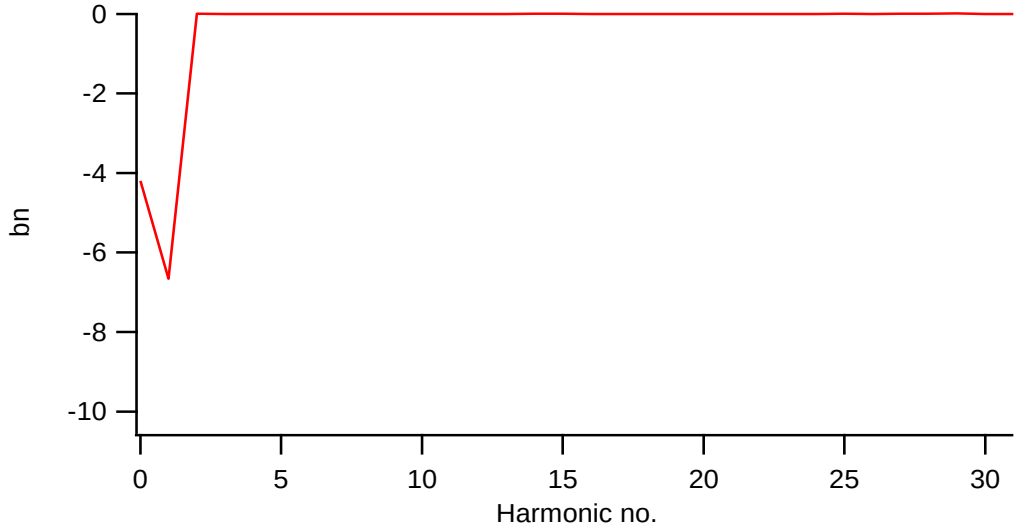
Where an , bn on T and n=1refers to a dipole field, n=2 quadrupole, n=3sextupole etc.

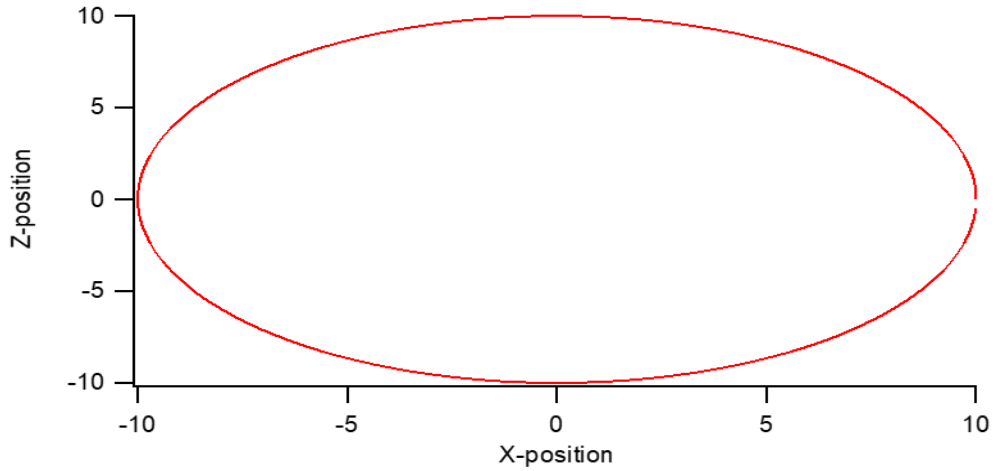
Results of Manual measurements

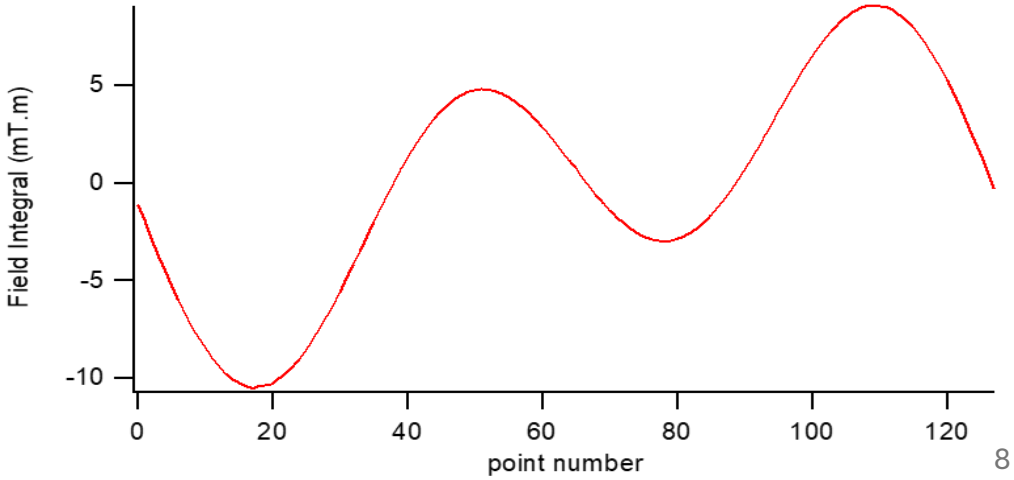
- **Manual: do each measurement individual**

The results were as follows:





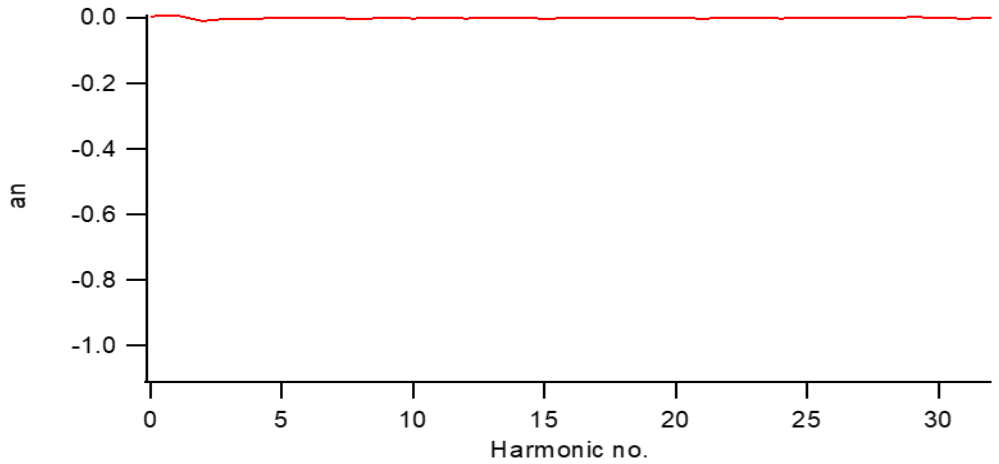


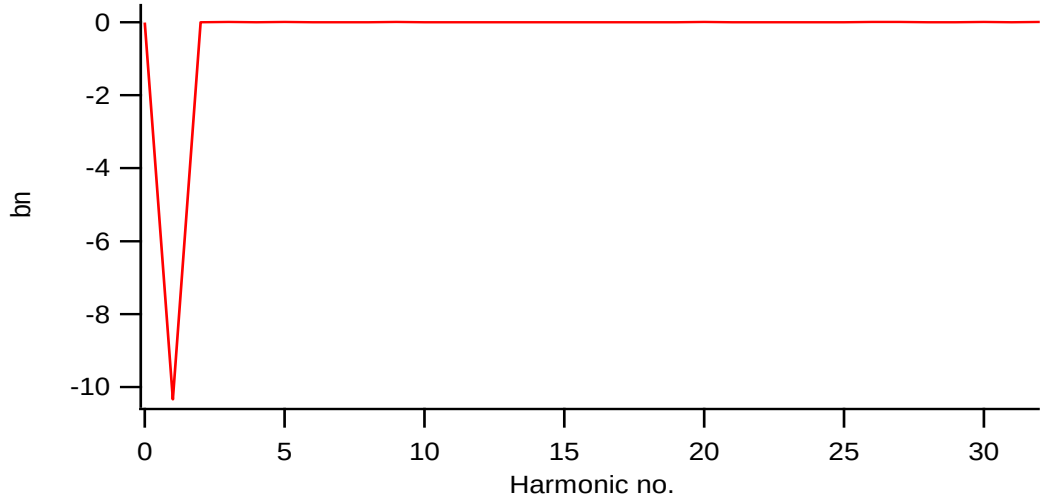


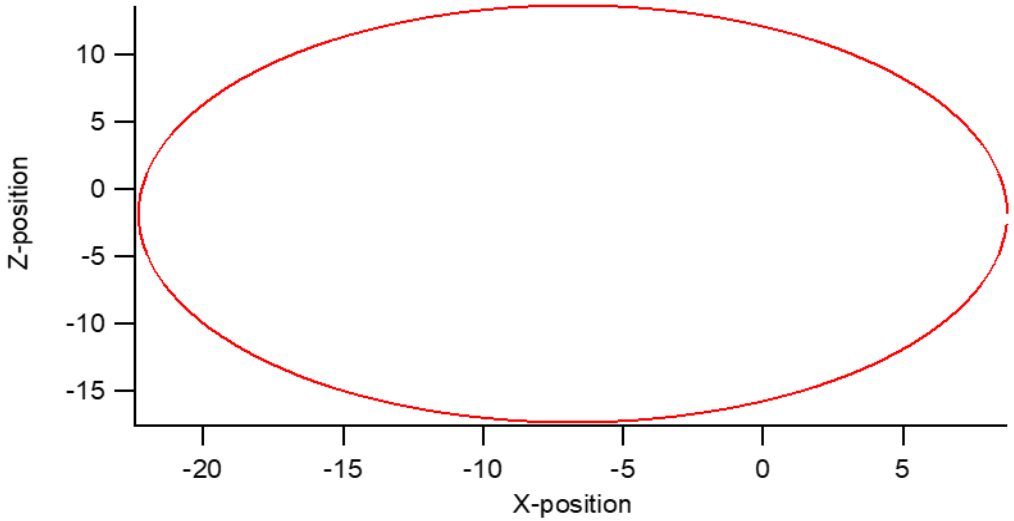
Results of Automatic measurements

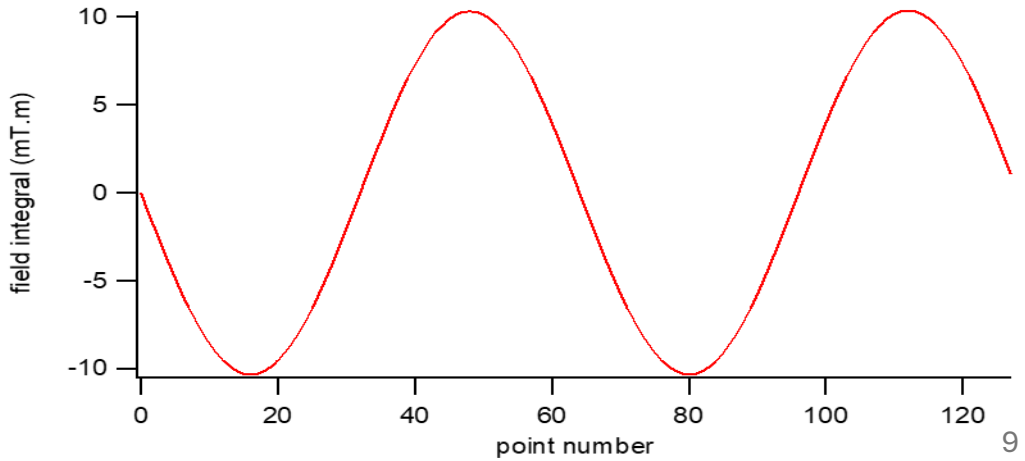
- **Automatic: code do all measurements**

The results were as follows:









Results

Type	b1 (mT)	b2 (mT)	b3 (mT)	b4 (mT)	b5 (mT)
Value	5.309	10000	1.757	-3.061	0.960
ratio	0.53*10^-3	1	0.17*10^-3	0.3*10^-3	0.09*10^-3

X0	Z0	Gradient (T)	Mag. Length (mm)	Field gradient (T/m)	Roll Angle (mrad)
-6.435	-2.024	-0.668	237.720	2.809	-0.366

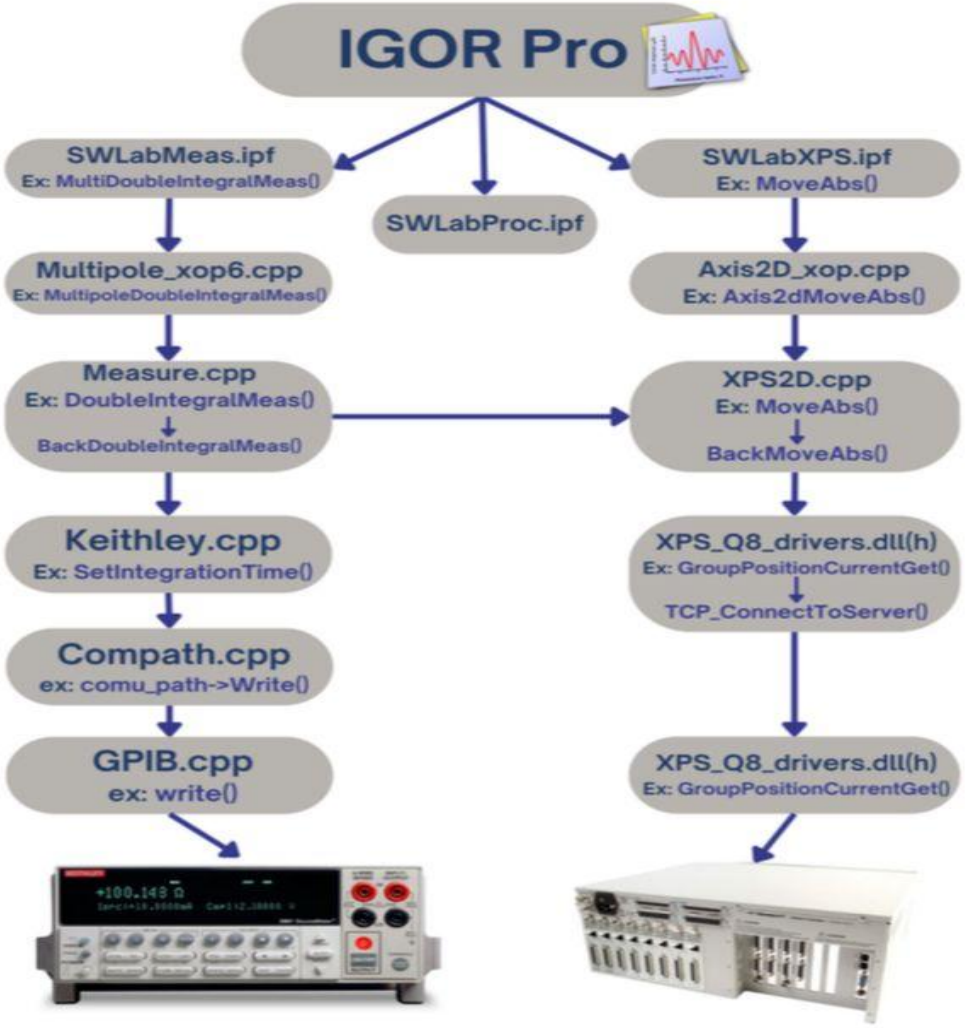
Conclusion

- In comparing the manual and automatic methods, the automatic one proved better as it saves time and effort by performing all measurements sequentially and providing clear and complete results.

- As a result, it is necessary to write an auto dipole measurement code to ensure accuracy and save time.

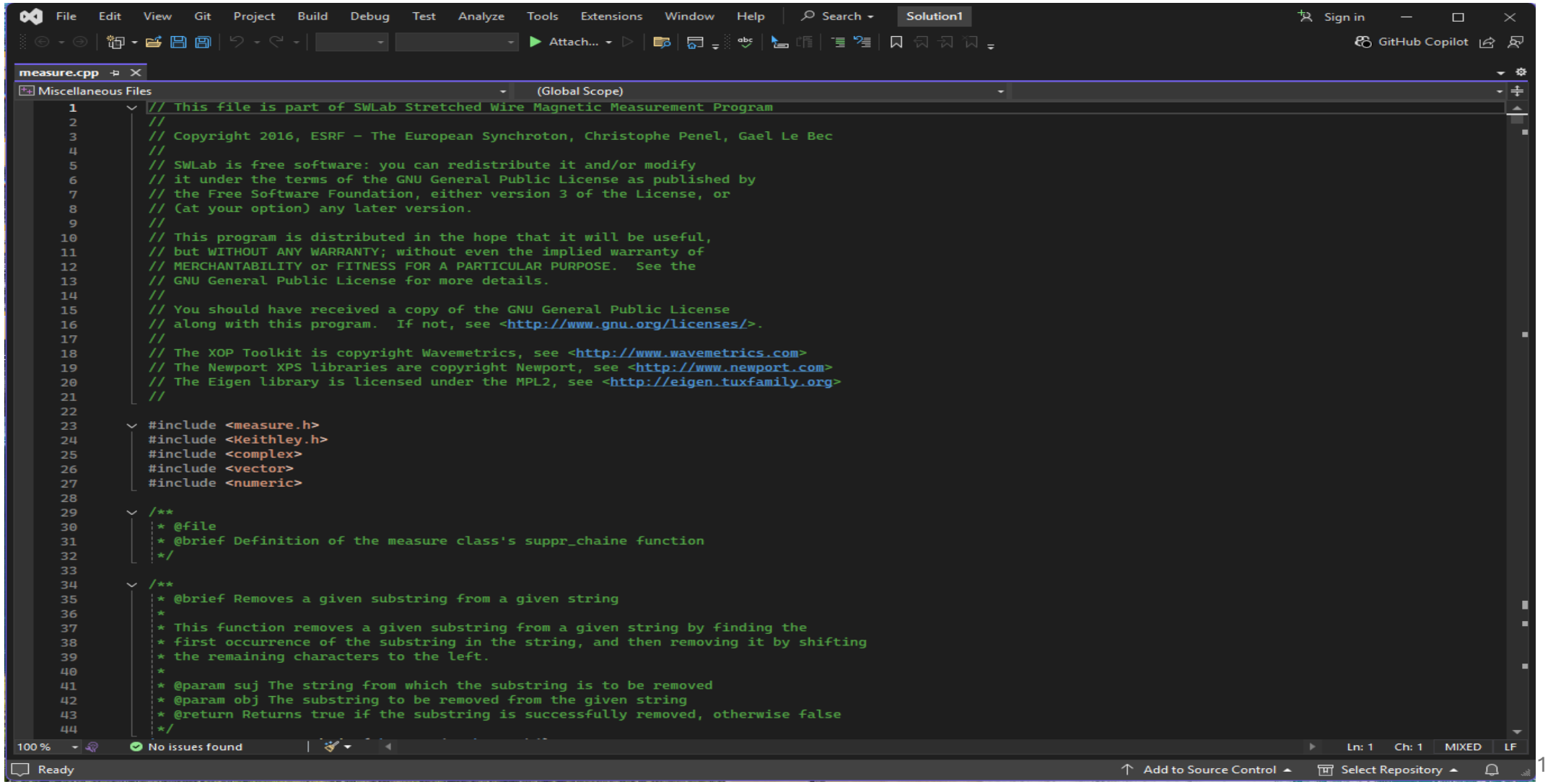
Required now

- Study stretch wire bench code hierarchy



Required now

- Study quadrupole magnet auto code as classes to write dipole magnet auto code.



Thank you
Any question