

# 11T Dipole Task Force Meeting #19

Metrology of 5-m long collared coils (low grade)  
after recent collaring  
*Initial measurements*

Michela Semeraro (TE-MS-C-LMF)

Dariusz Pulikowski (TE-MS-C-LMF)

José Luis Rudeiros Fernández (TE-MS-C-LMF)\*



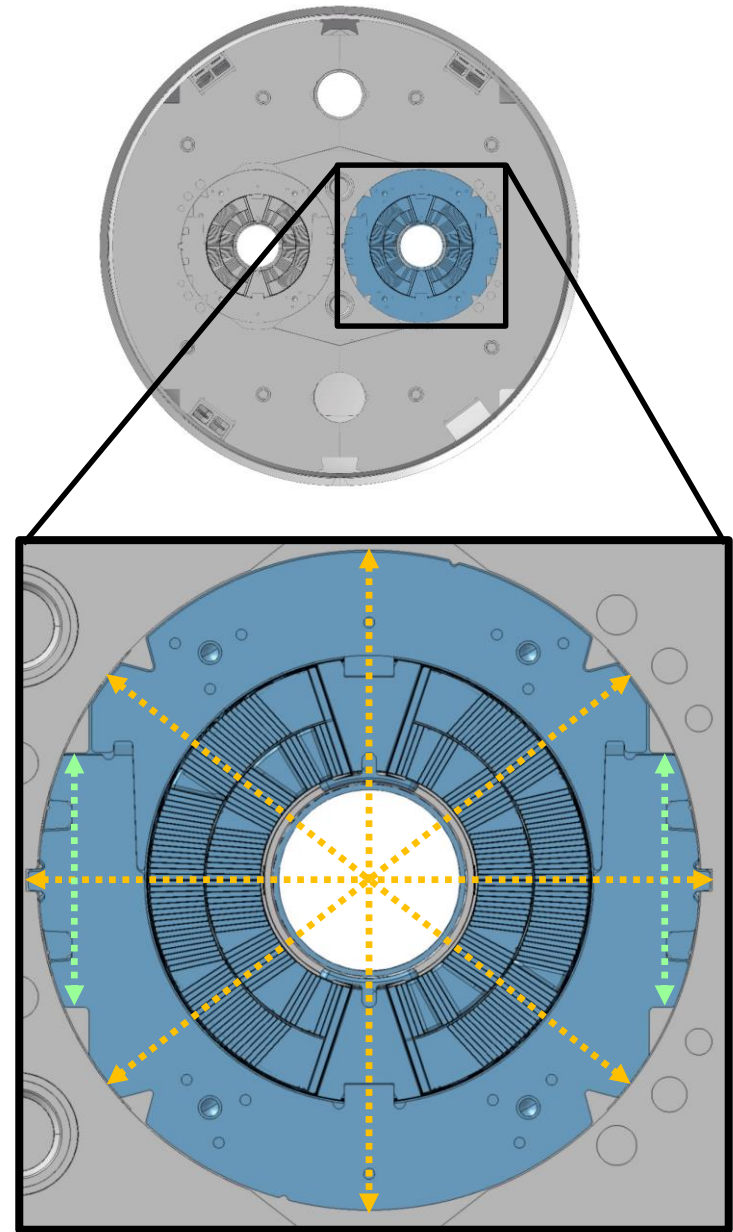
25-07-2018

# Contents

1. Introduction
2. Experimental
3. Initial results and discussion
4. Conclusions and future work

# 1. Introduction

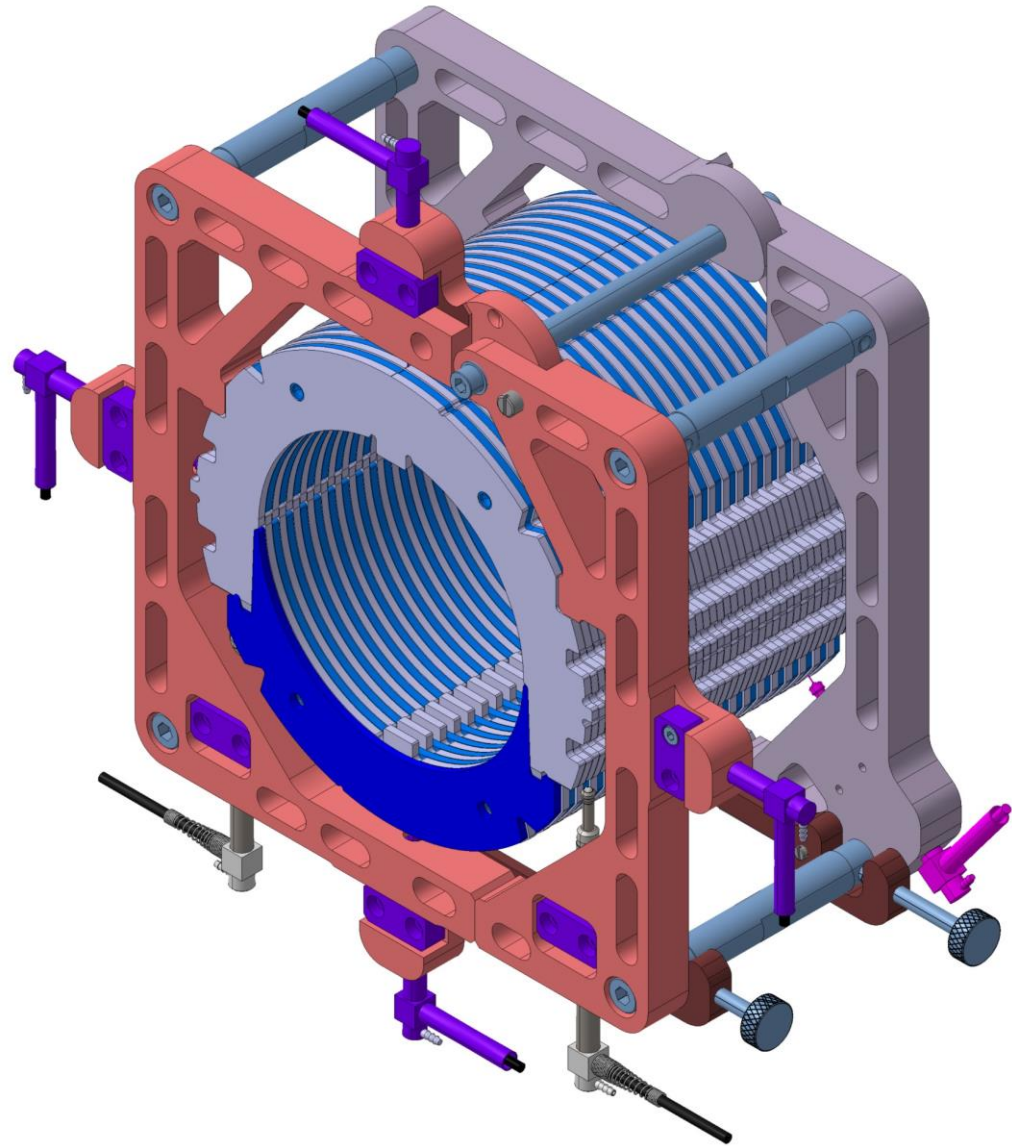
- The measurement system shall characterise the main dimensions of the cross section of the 11T collared coils along the longitudinal axis, after assembly.
- The measurement system shall be able to be easily assembled and disassembled around the collared coils, reliably and consistently.



## 2. Experimental

### Measurement system\*:

- 8 LVDT sensors with pneumatic actuation;
- Compressor and pneumatic system;
- Valve controlled with remote (automatic and manual mode);
- DAQ including Metro M400 terminal and LabVIEW and Matlab interfaces.



\*Developed by M. Semeraro

# 2. Experimental

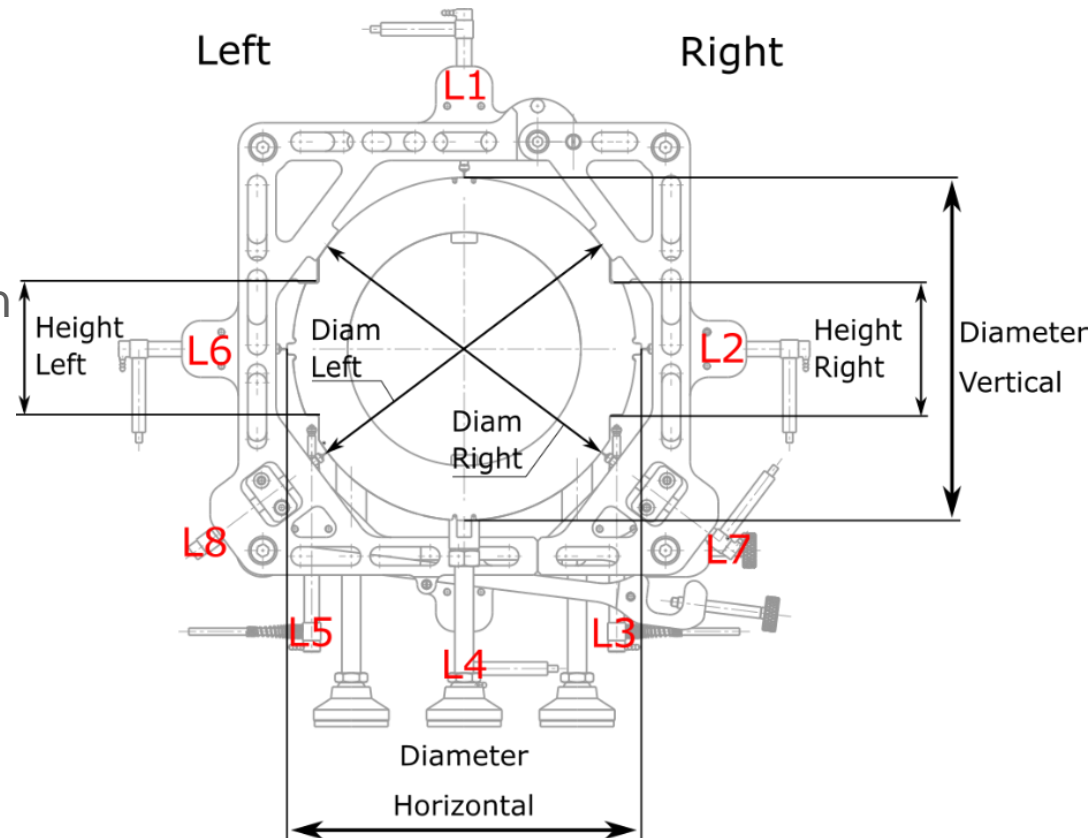
## Measurement system\*:

### Diameters:

- **Vertical** (measured between 2 LVDTs).
- **Horizontal** (measured between 2 LVDTs).
- **37° Right** (measured between 1 LVDT & Reference surface).
- **37° Left** (measured between 1 LVDT & Reference surface).

### Heights:

- **Right** (measured between 1 LVDT & Reference surface).
- **Left** (measured between 1 LVDT & Reference surface).

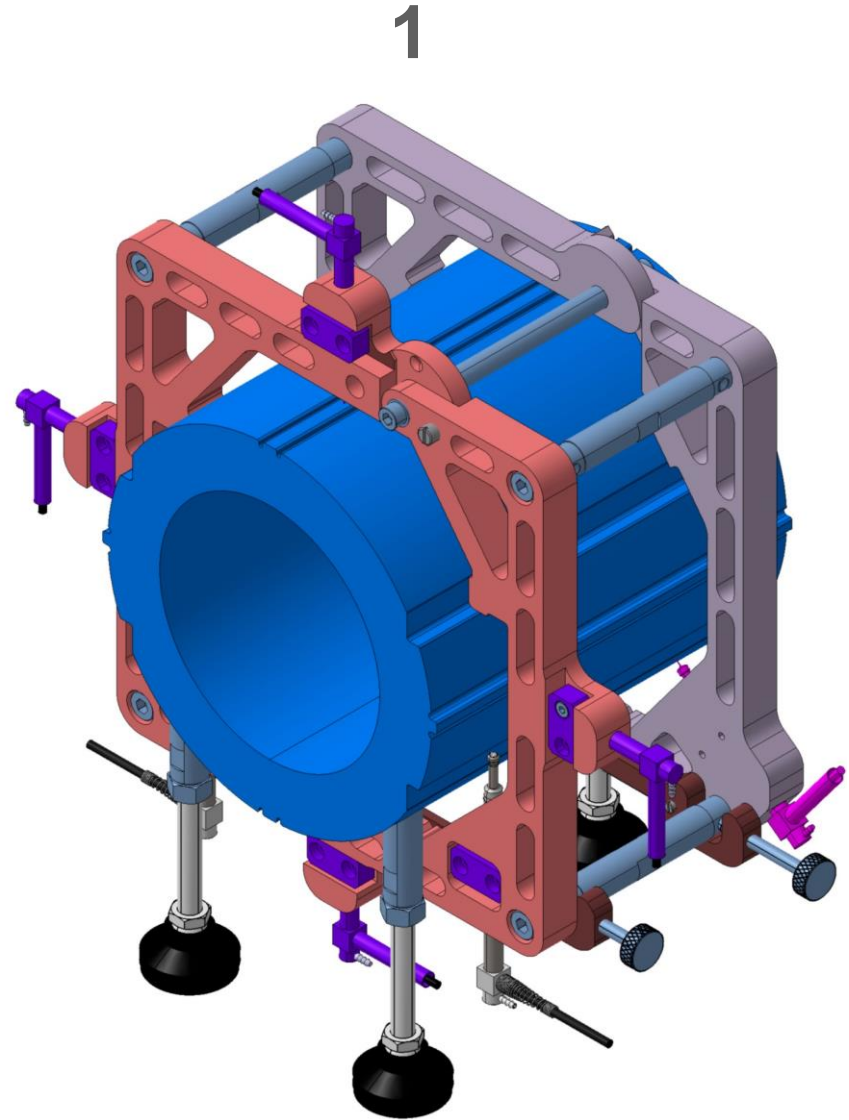


\*Developed by M. Semeraro

# 2. Experimental

## Measurement procedure:

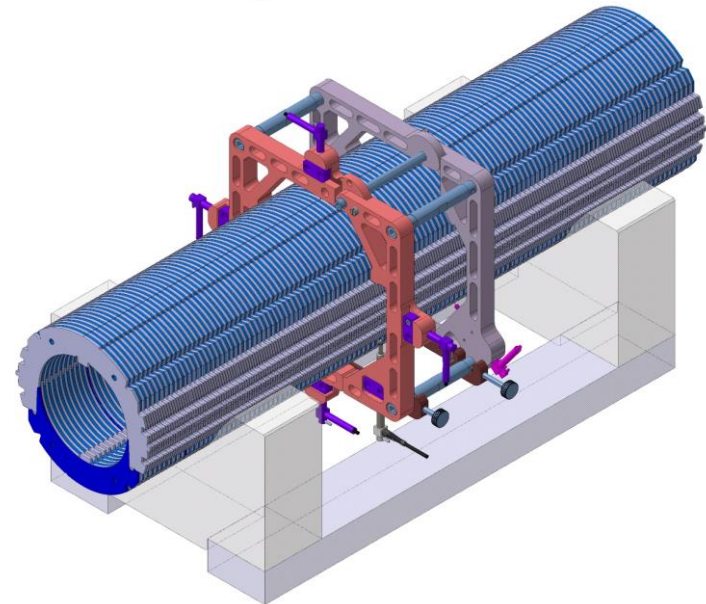
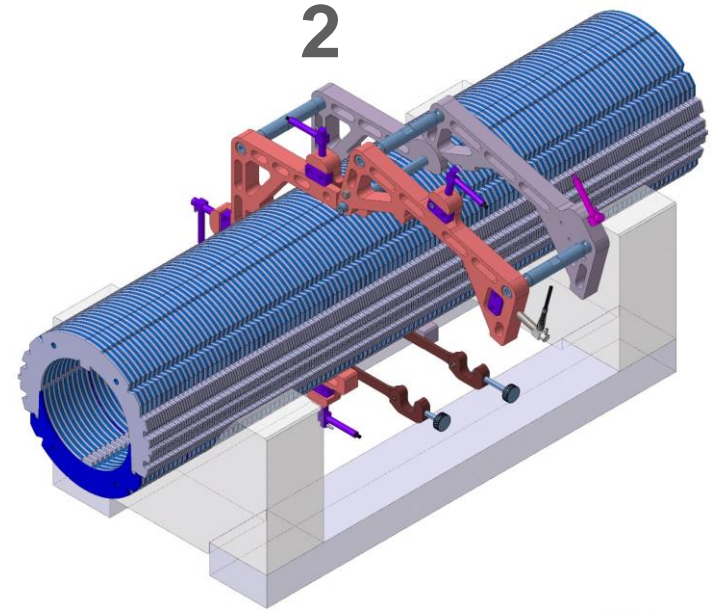
1. LVDT sensors are set to the nominal reference value (zero) by using a calibration piece.



# 2. Experimental

## Measurement procedure:

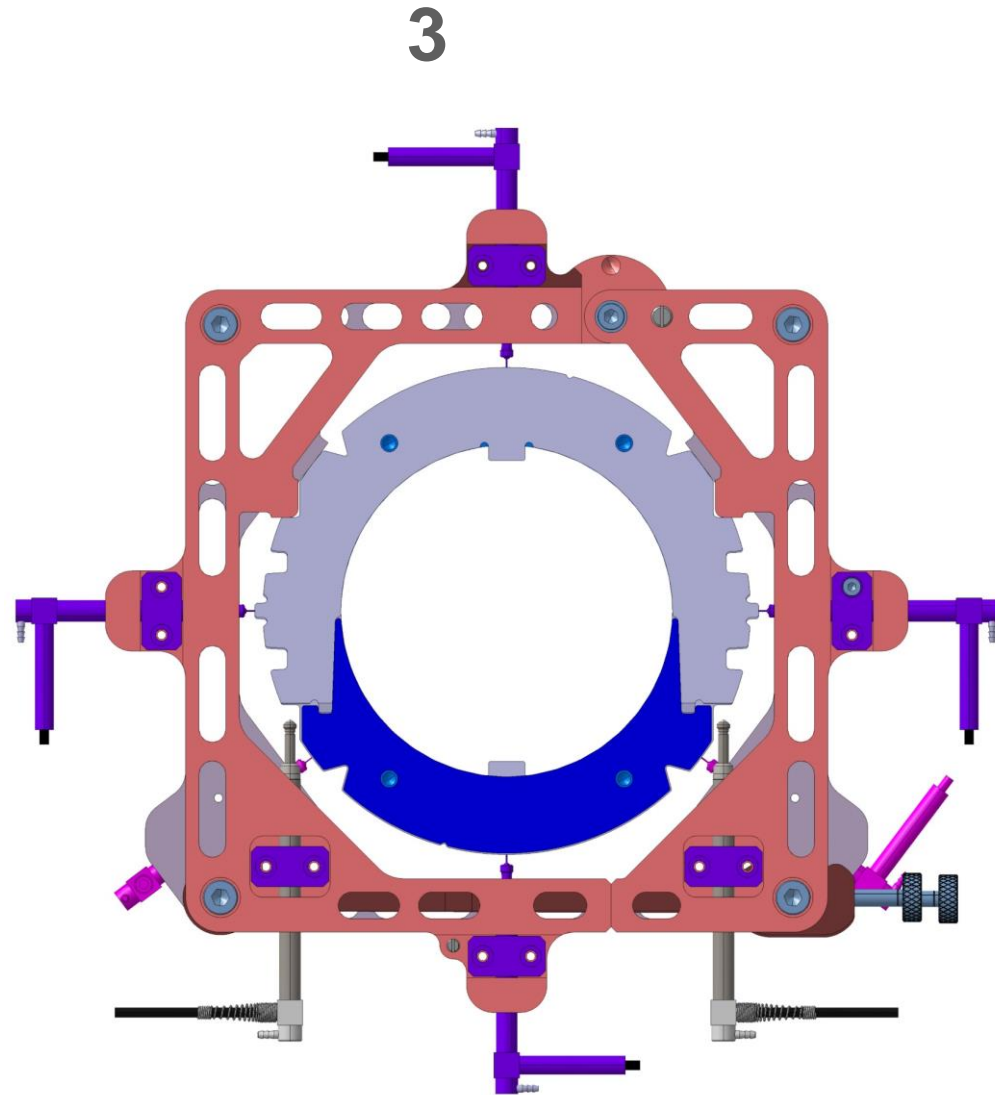
1. LVDT sensors are set to the nominal reference value by using a calibration piece.
2. The measurement system is placed at certain position along the longitudinal axis of the collared coil, making sure it is consistently aligned using the same reference surfaces.



## 2. Experimental

### Measurement procedure:

1. LVDT sensors are set to the nominal reference value by using a calibration piece.
2. The measurement system is placed at certain position along the longitudinal axis of the collared coil, making sure it is consistently aligned using the same reference surfaces.
3. The pneumatic system is activated bringing all LVDTs in contact with the collars, and the value of all sensors is recorded.
4. Operations 2 & 3 are repeated along the length of the collared coils.

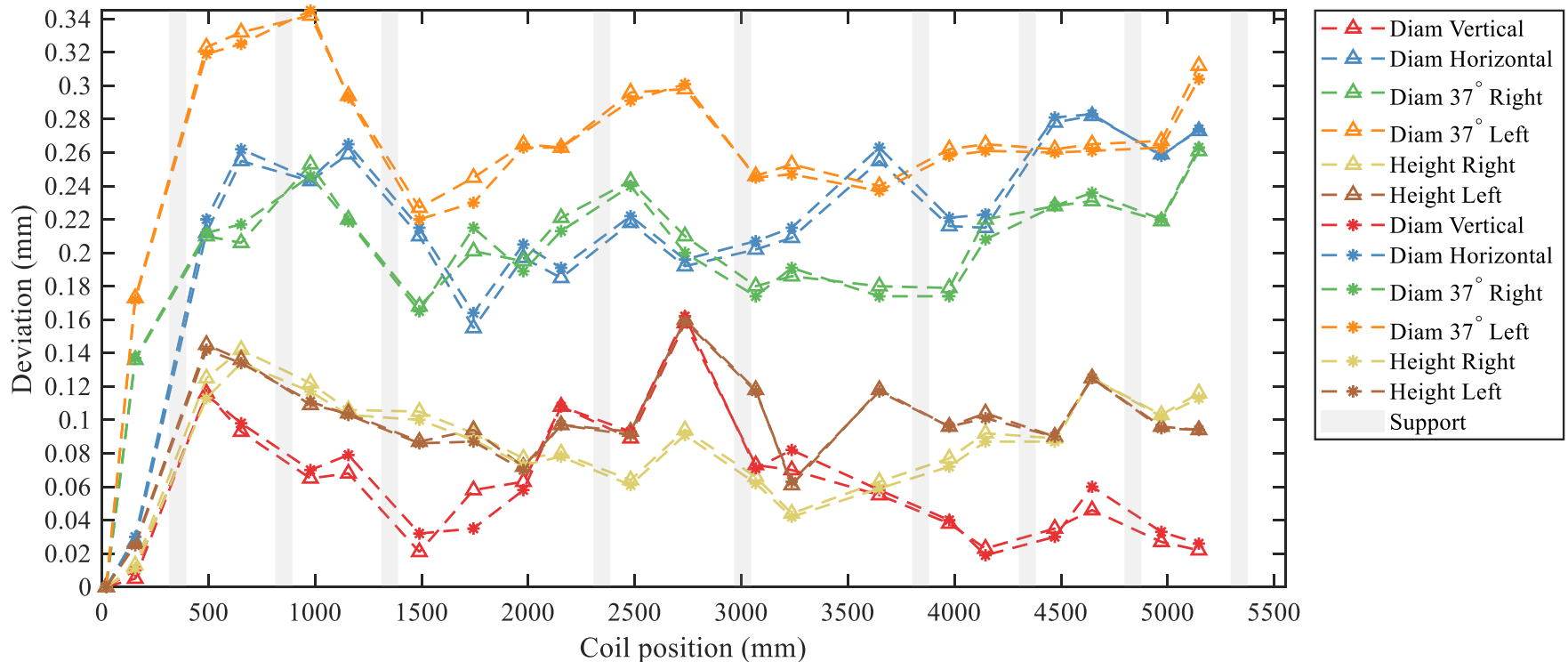




# 3. Initial results and discussion

## Measurements on CC low grade (CR01 & CR02):

- 22 positions measured along the collared coil length;
- Deviations are referred (in these initial measurements) to the first measured collars (i.e. Coil position ~ 0 mm);
- Two full sets of measurements by two different operators (i.e.  $-\Delta-$  and  $-*-$ ) on two different days.

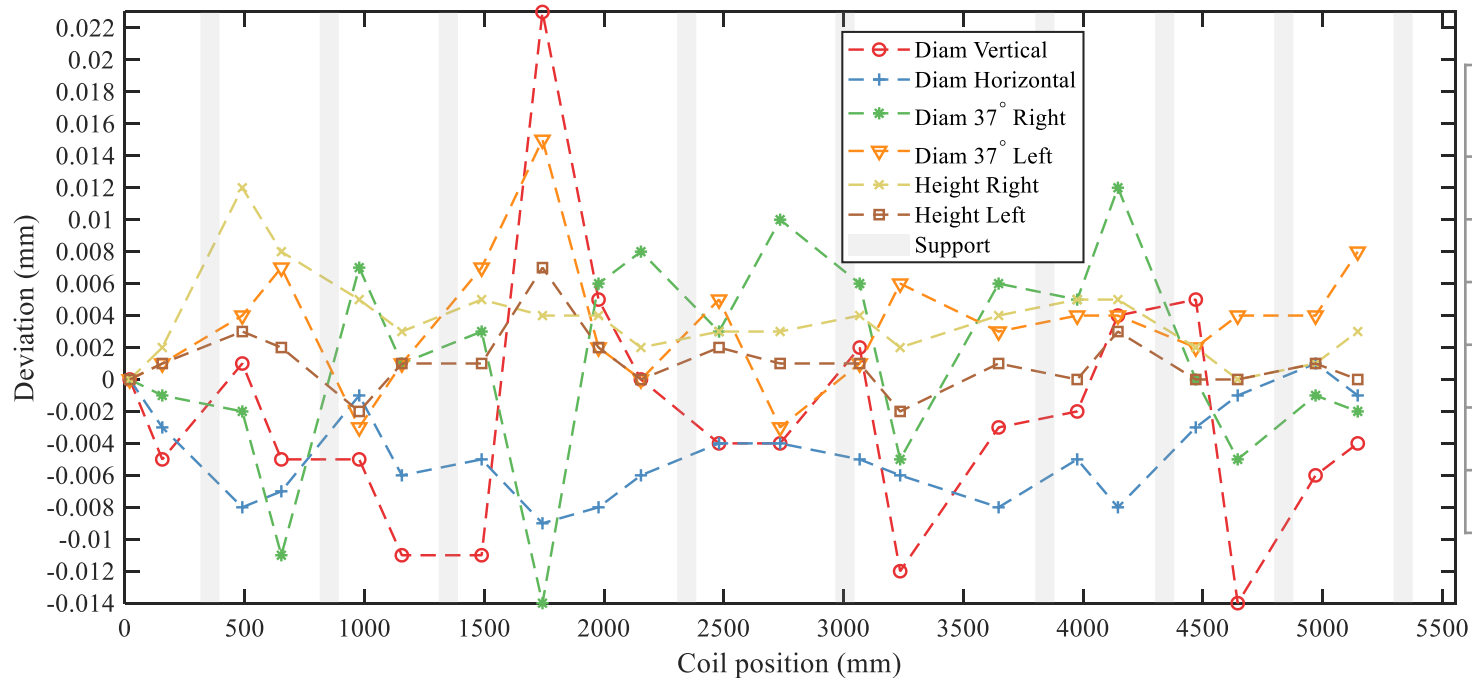


# 3. Initial results and discussion

## Measurements on CC low grade (CR01 & CR02):

- 22 positions measured along the collared coil length;
- Deviations are referred (in these initial measurements) to the first measured collars (i.e. Coil position ~ 0 mm);
- Two full sets of measurements by two different operators (i.e.  $-\Delta-$  and  $-*-$ ) on two different days.

### Deviation functions between the first and the second measurement



	<b>Average</b> ( $\mu\text{m}$ )	<b>SD</b> ( $\mu\text{m}$ )
<i>D. Vert.</i>	-2	8
<i>D. Horiz.</i>	-5	3
<i>D. Right</i>	1	7
<i>D. Left</i>	3	4
<i>H. Right</i>	4	3
<i>H. Left</i>	1	2

## 4. Conclusions and future work

- The measurement system is capable of measuring the collared coils, showing a **high degree of repeatability** between different measurements and operators.
- Before results could be shown in terms of absolute values with respect to nominal, the calibration piece has to be precisely measured (e.g. CMM).
- **Comparison** of the measurement system with respect to the vertical tower used in MSC/MDT will be carried out by using CC SP106 (planned for 30/07/2018).
- Final validation of the system to be done on the full size collared coils (low grade) planned for 15/08/2018.

# Thanks!



[www.cern.ch](http://www.cern.ch)