

Alignment Procedure for Air Operating UME Kibble Balance

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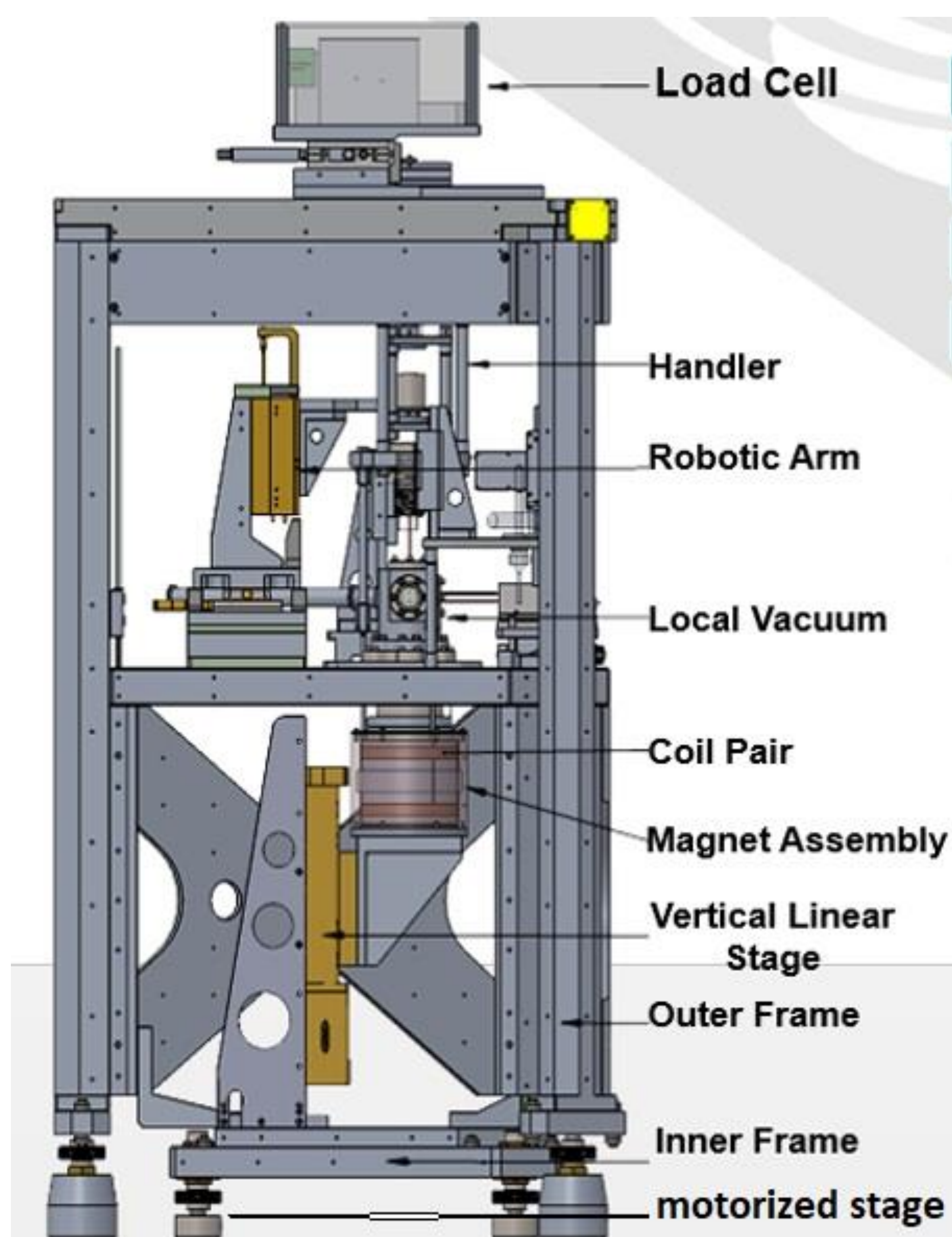
Abstract

Measurement procedure for magnetic flux in a coil caused by non vertical displacements of the magnet assembly is described.

Measurement Setup and Measurement Procedure

Three leg's inner frame supporting the magnet assembly is equipped with three linear motorized stages which provide vertical displacements for each leg in independent way. Such a design allows to reach two goals:

- to reach optimal alignment of the magnet assembly when horizontal displacements of the magnet assembly are minimal
- to measure magnetic flux caused by non vertical displacements by generating five independent motions of the magnet assembly via three motorized stages



$$\vec{O} = \left(\frac{\vec{H}}{|\vec{H}|}, \frac{\vec{\theta}}{|\vec{\theta}|} \right)$$

horizontal displacement

angular displacement

$$\vec{O} = \sum_{a=1}^5 c_a \vec{O}_a$$

displacement in alignment experiment

$$\Phi = \sum_{a=1}^5 c_a (\Phi_a - G Z_a)$$

magnetic flux

measurement uncertainty

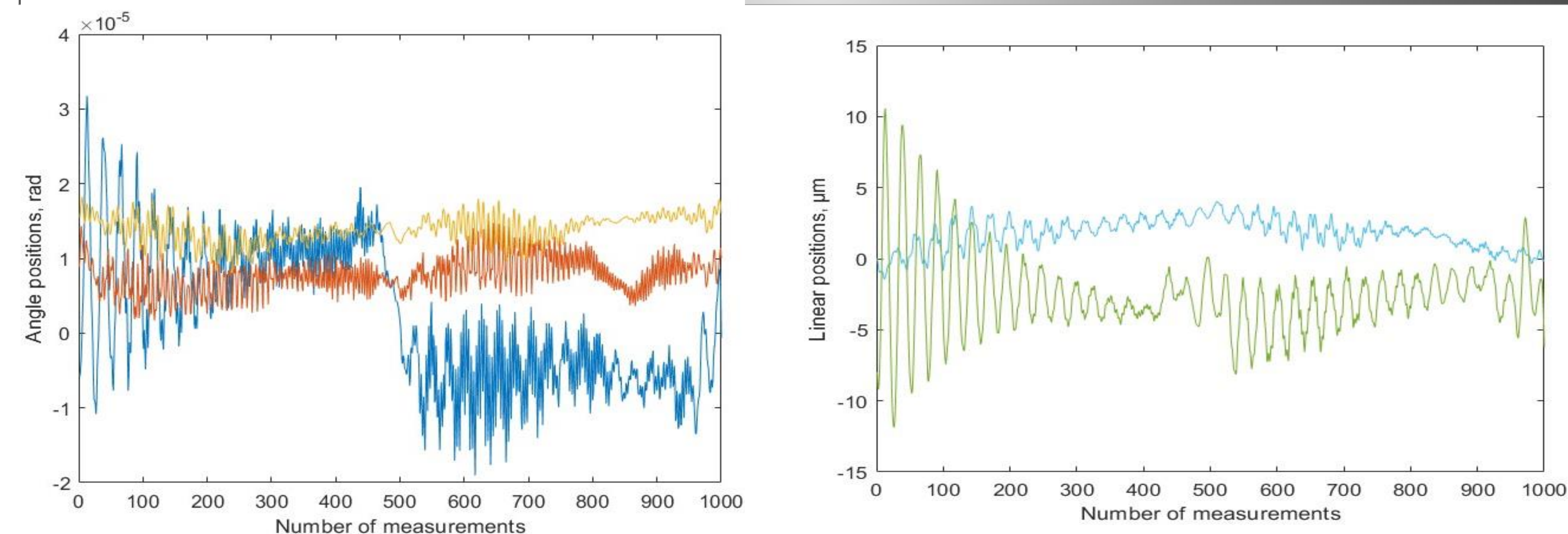
vertical displacement

geometric factor

$$\sigma = |\vec{c}| \sigma_\Phi$$

magnetic flux measurement uncertainty

Measurement Results



O	O_1	O_2	O_3	O_4	O_5	C
0,1720	68,9145	-0,4496	69,3904	-42,2970	-68,3656	0,0393
-0,9850	-39,2672	85,4469	46,4734	-54,9003	-9,8425	0,0342
-0,2610	40,8501	-57,3876	-17,3933	61,3097	35,8356	-0,0586
0,9460	74,4402	-18,6775	58,8495	-62,8937	-92,4840	-0,0027
0,1930	8,1253	13,7117	17,1955	-18,6399	-17,2406	-0,0210

$$|\vec{c}| = 0.0812$$

Conclusion

Measurement procedure and measurement setup for magnetic flux caused by non vertical displacements of the magnet assembly is discussed for a moving magnet KB. Instead of measuring each component of horizontal force and torque on a coil the proposed method measure the magnetic flux which is of the direct interest. The advantage of such approach is that even if the alignment is far from being ideal low measurement uncertainty may be achieved y selecting appropriate five independent motions in the alignment experiment which model the motion of magnet assembly in the main KB experiment.

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