Status of the METAS watt balance BWM II

Ali L. Eichenberger

kNOW workshop, Torino (2013)
BWM II: General view

- Driving stage
- Translation stage
- Mass comparator
- Magnet
- Mass exchanger
BWMII: Status

Key component

♦ Magnetic circuit & suspension
  Assembled, tests have started

♦ Driving & Translation stages
  Under test

♦ Mass exchanger
  Parts under construction

♦ Residual force measurement
  v2.0 (1.2 kg) available
  v3.0 (1.8 kg) damaged
  v3.1 (1.8 kg) under construction
BWMII: In the lab
BWMII: Load cell

- v3.0 (1.8 kg) was damaged during the mounting process
- Improved design (v3.1) less sensitive to handling
  1.8 kg / 4 g / <1 µg
- Under construction / tests @ MT
BWM II: Load cell alignment

- Mounted
  2000 x 2000 µrad resolution < 2 µrad
BWMII: The coil suspension

Macor ®

Last of 24 layers
BWMII: The coil suspension

Mirror

Corner-cube

Ceramic ball
BWM II: Magnetic circuit

- Cylindrical geometry (closed)
  - 2 SmCo rings
- Coil diameter: 200 mm
- Field: 0.63 T
- Compensation for thermal dependence
  \[ T_m < 1 \text{ ppm/K} \]
  (regular SmCo: ~360 ppm/K)
- Fine position adjustments
BWM II: Magnetic circuit
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- Alignment system

- Rotation

- Translation

- Pivots (ball)
BWMII: The coil suspension
BWMII: The coil suspension
BWM II: Mass exchanger

Suspension

Test mass

M1

M2

M3

M1

M2

M3

maxon motor

driven by precision
BWM II: Mass exchanger
BWM II: Mechanical Stop for static phase

- Force profile (with 0.5 mm steps)
BWM II: Schedule

- **Availability**
  - Load cell (new)  
    - November 2013
  - Mass exchanger  
    - November 2013

- **Dynamic phase (U/v)**  
  - till Dec. 2013

- **Static phase**  
  - early 2014

- **Measurement of h**  
  - later in 2014
BWM II: Team & Partners

♦ Team:

- Eichenberger Ali (100%) Project Leaders
- Baumann Henri (20%) PostDoc
- Cosandier Florent (100%) PhD student (CERN)
- TBD (100%)

♦ Partners:

- CERN
- Mettler-Toledo
- Prof. R. Clavel (ex-EPFL)
- Maxon Motor
Questions
BWM II: Magnetic circuit

- Cylindrical geometry

Temperature dependence

\[ \frac{dB}{dT} < 1 \text{ ppm/K} \]