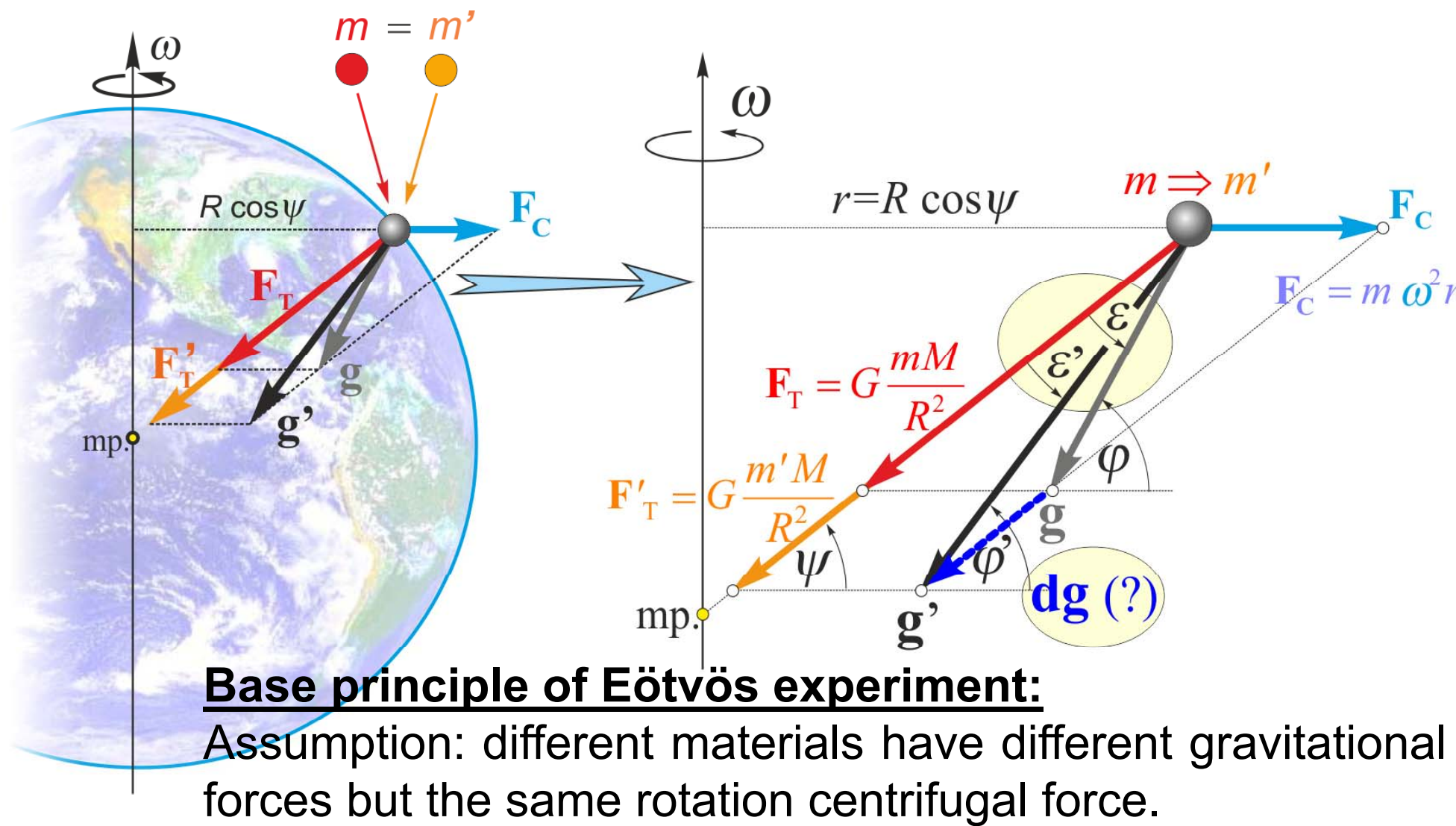


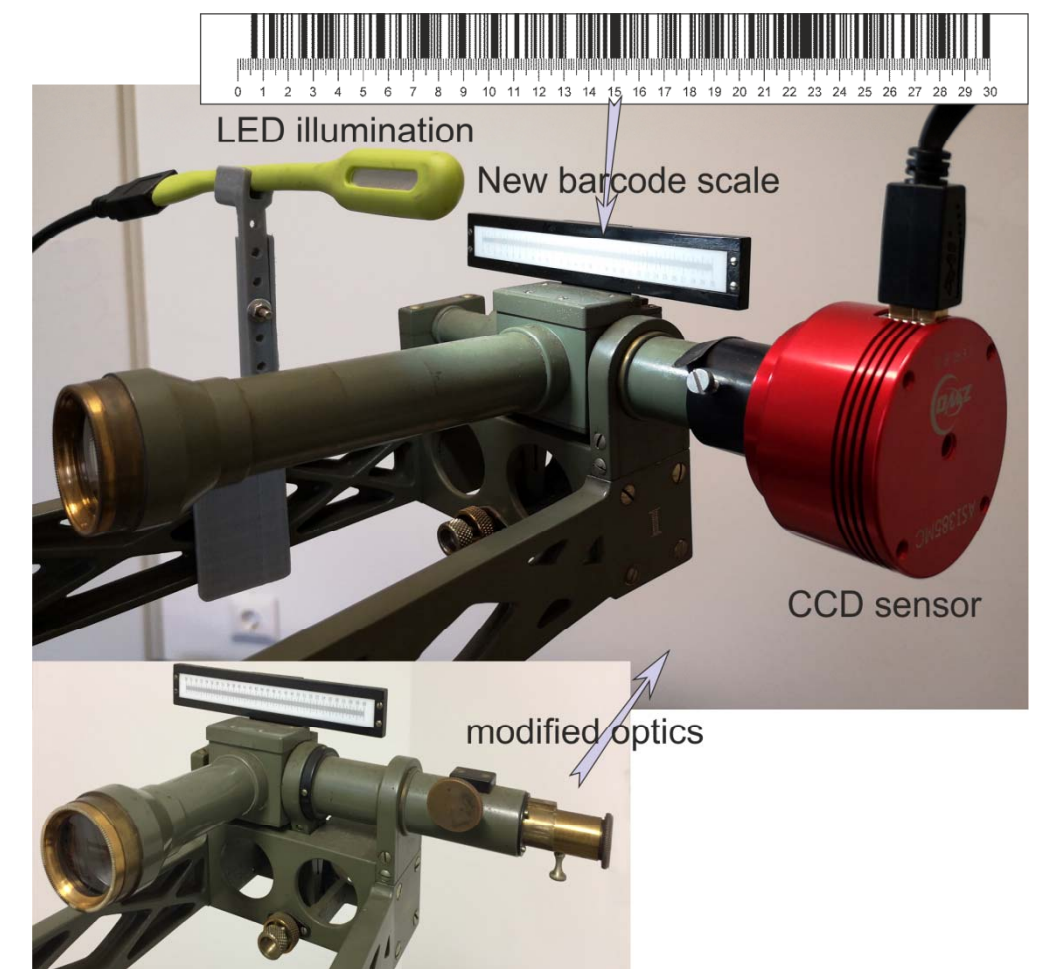
Remeasurement of the Eötvös equivalence experiment

Lajos VÖLGYESI (BME), György SZONDY (Independent researcher), Gyula TÓTH (BME), Gábor PÉTER (BME), Bálint KISS (BME), László DEÁK (Wigner), Csaba ÉGETŐ (BME), Gergely BARNAFÖLDI (Wigner), Edit FENYVESI (Wigner), Gyula GRÓF (BME), László SOMLAI (Wigner), Péter HARANGOZÓ (BME), Péter LÉVAI (Wigner), Péter VÁN (Wigner-BME)

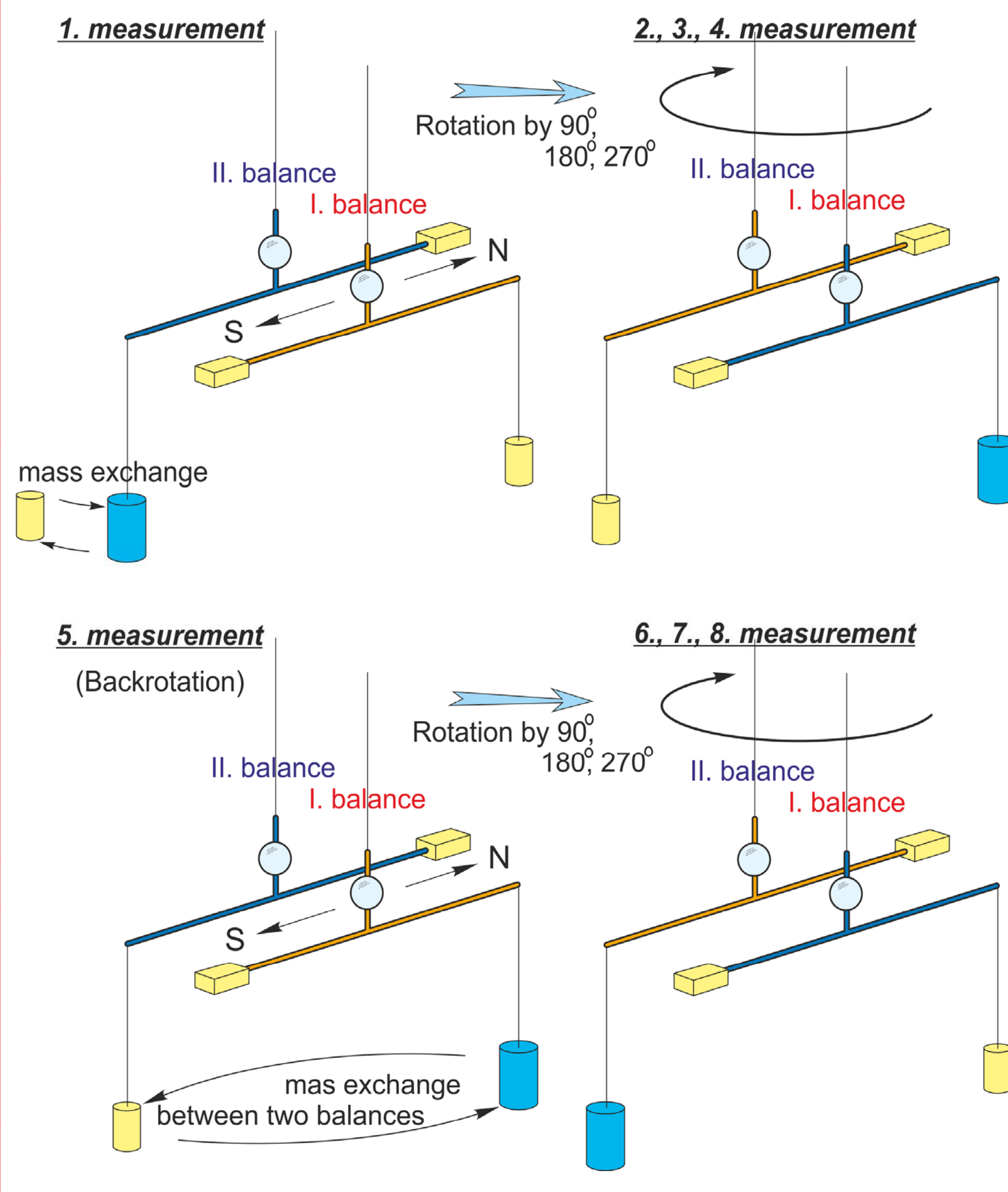
Loránd Eötvös with his colleagues D. Pekár and J. Fekete made a revolutionary precision measurement (**Eötvös experiment**) checking the equivalence of gravitational and inertial mass. In 1986, Fischbach and his colleagues discovered a systematic matter dependence in the EPF measurement results, which they were finally unable to conform experimentally. Analysis of the Eötvös experiment revealed a possible bias that confirm repeating the measurements under better conditions and using modern technology. Preparations for the measurements started at July of 2017 by the Wigner Research Centre for Physics, Department of Geodesy and Surveying, Department of Control Engineering and Information Technology of Budapest University of Technology and Economics (BME), and the Society for the Unity of Science and Technology in cooperation with other organizations, departments and experts. In December 2018, after more than one year of careful preparation preliminary tests have been started at 30 m below ground level in a controlled and undisturbed environment of the Jánossy Underground Laboratory at KFKI. The Eötvös year in 2019 is the 100th anniversary of Eötvös's death, which provides another good reason for repeating the Eötvös experiment.



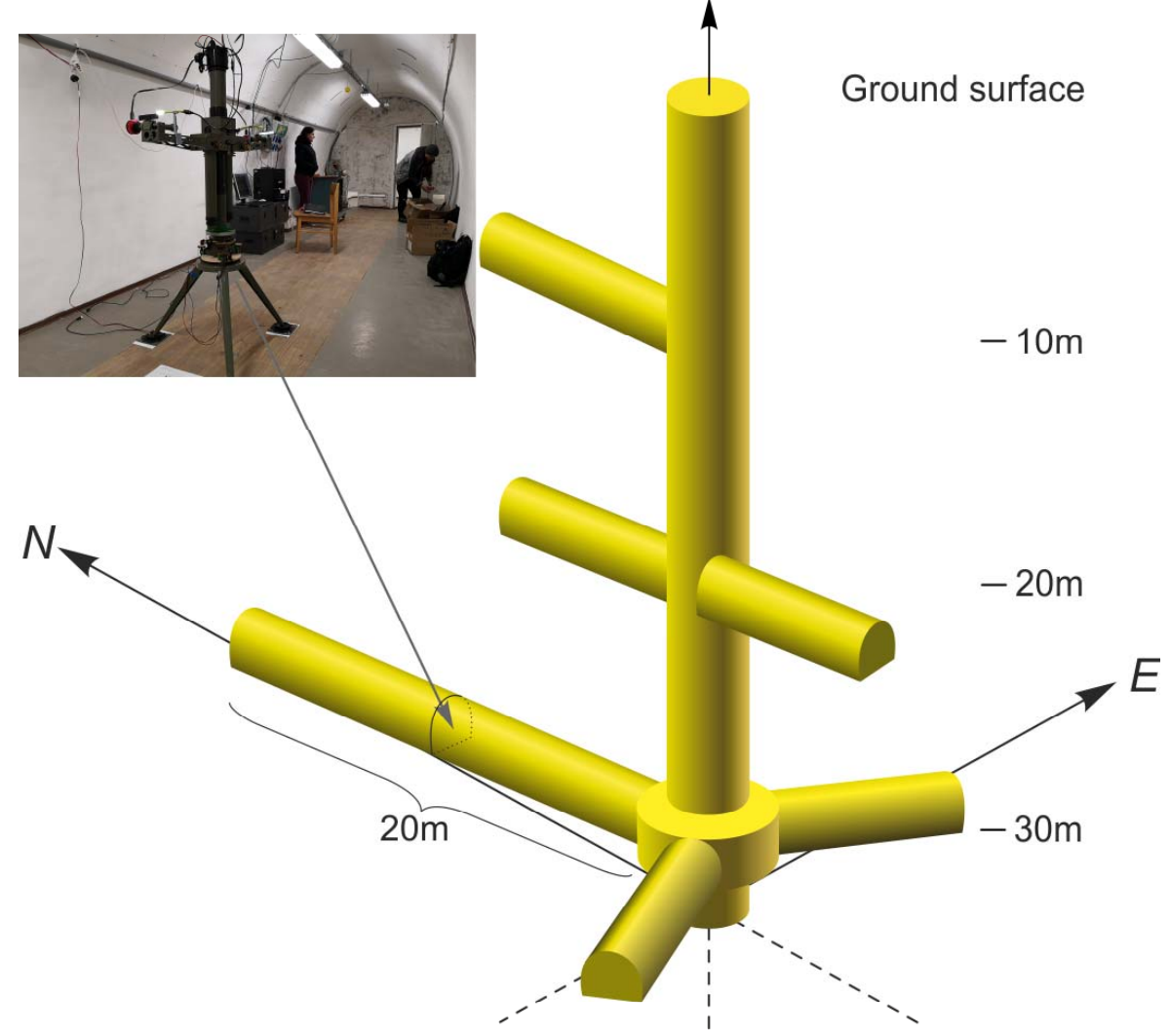
Modifying the instrument:
Automatic reading with CCD sensors:



Mass exchanging measurement strategy:



Location of measurements: Jánossy Underground Laboratory of KFKI (Wigner FK)



First (preliminary) results:

Eötvös: 10^{-9}

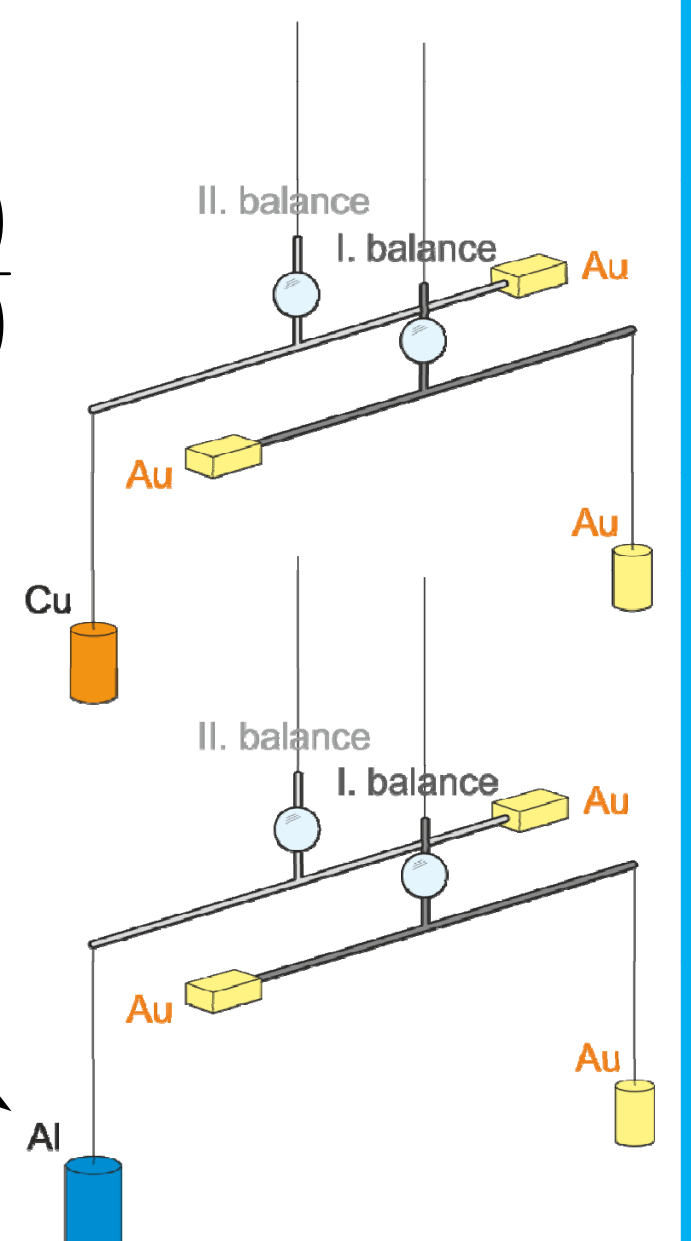
Present state: 10^{-10}

$$\text{Eötvös parameter: } \eta = 2 \frac{(m_g/m_i) - (m'_g/m'_i)}{(m_g/m_i) + (m'_g/m'_i)}$$

measurement period	material	η
05.15-05.20.	Au-Au	0.12×10^{-10}
05.15-05.20.	Au-Cu	0.02×10^{-10}
05.21-06.04.	Au-Au	0.15×10^{-10}
05.21-06.04.	Au-Cu	-0.76×10^{-10}
06.17-06.24.	Au-Au	-0.33×10^{-10}
06.17-06.24.	Au-Al	1.74×10^{-10}
06.26-07.03.	Au-Au	0.09×10^{-10}
06.26-07.03.	Au-Al	0.91×10^{-10}

η for the identical masses (Au-Au) should be 0,
 η for Au-Cu and Au-Al should be 0 if WEP is valid.

The same order of magnitude of errors can be seen for all pairs of masses!



Test measurement site in the underground laboratory

The preparatory work of the measurements took place for two years. The Eötvös-Pekár torsion balance has been prepared for Eötvös experiment, remote-controlled rotation mechanics and the automatic reading by CCD sensors are working well, required software have been written and tested. Calibration and test measurements have been made, the accuracy of our measurements exceeds the original by nearly two orders of magnitude. **Up to now we did not detect any deviation from the WEP (weak equivalence principle) with accuracy of 10^{-10} considering the estimated measurement error.**