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on behalf of the AEgIS Collaboration

The AEgIS Experiment

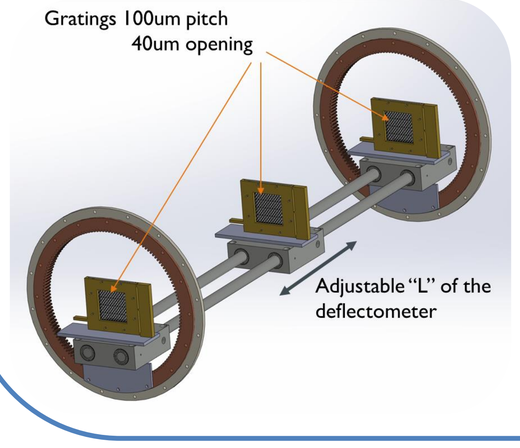
AEgIS (Antimatter Experiment: Gravity, Interferometry, and Spectroscopy) is hosted at the Antimatter Factory at CERN, and its main aim is to test the Weak Equivalence Principle by measuring the vertical displacement caused by Earth's gravitational field on a beam of neutral antihydrogen.

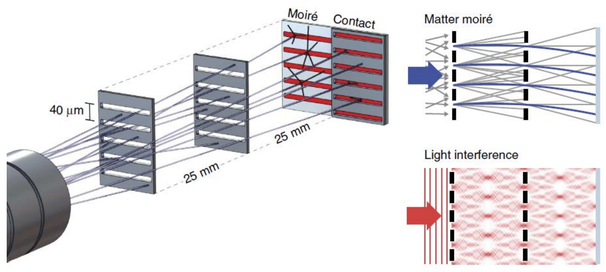
In the last years great efforts has been put through to increase the antihydrogen production rate higher than 1 $\bar{H}$/min, required in order to perform a gravity measurement.

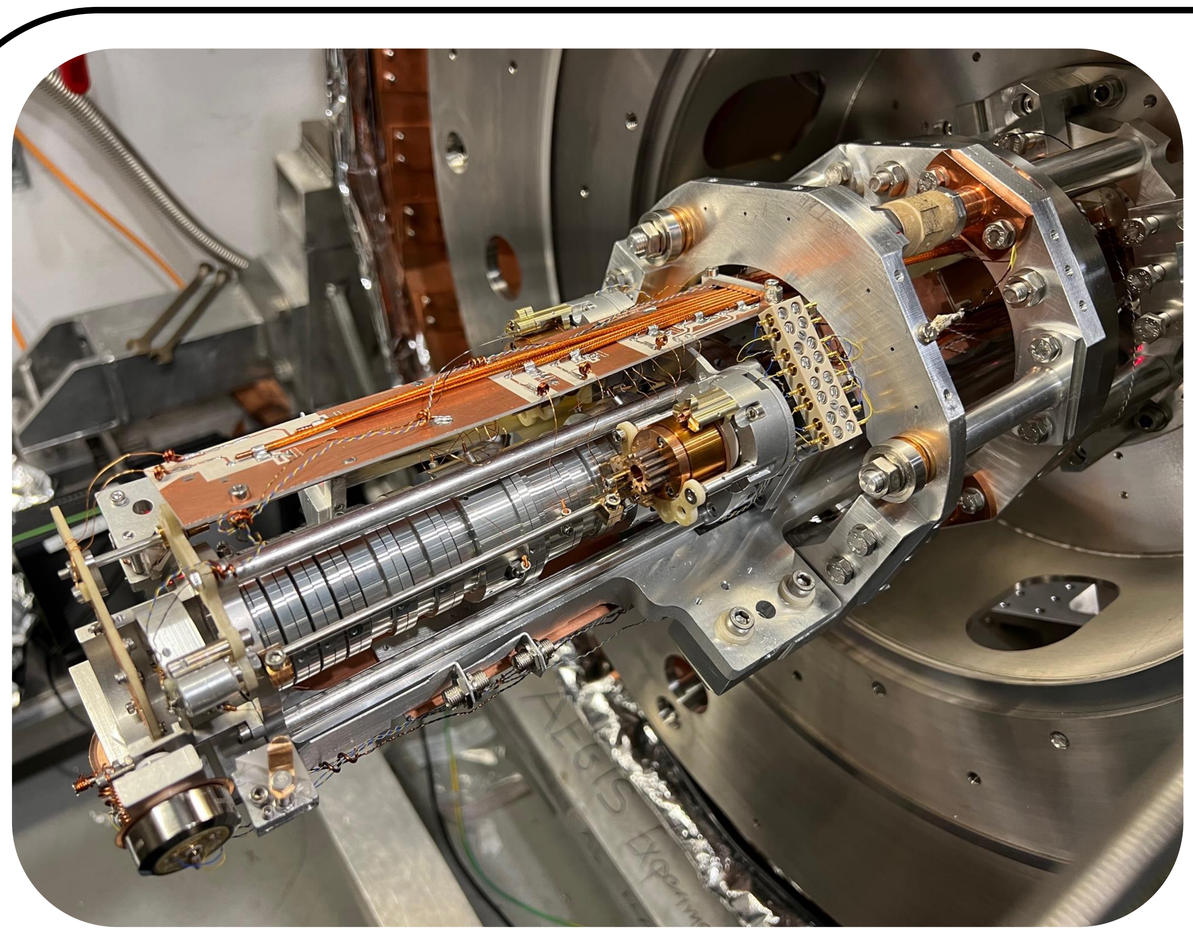
How to measure gravity on $\bar{H}$?

The beam of neutral antihydrogen is let falling inside a moiré deflectometer, with adjustable gratings and light interference reference, and the passing particles are detected thanks to a high resolution vertexing detector. From the vertical displacement, the value of g can be calculated:

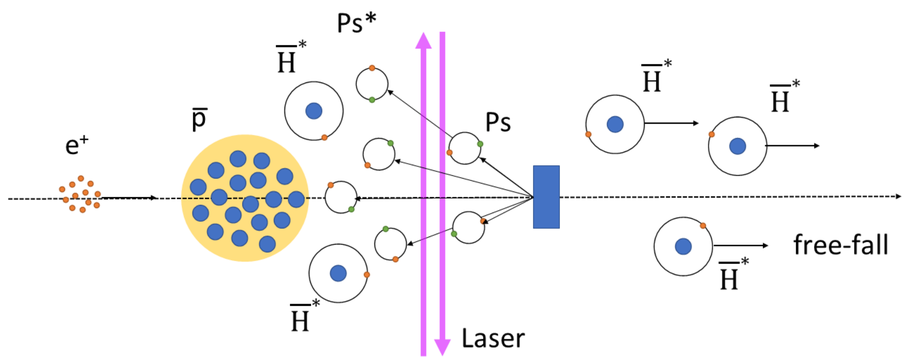
$$g = \frac{\Delta y}{t^2}$$







Pulsed antihydrogen formation



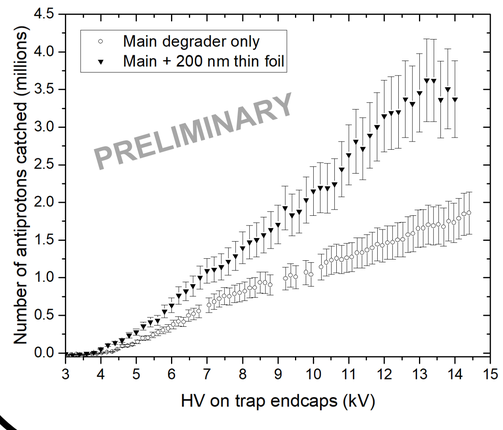
In AEgIS a charge-exchange reaction between antiproton and Rydberg positronium atoms is employed to form antihydrogen:

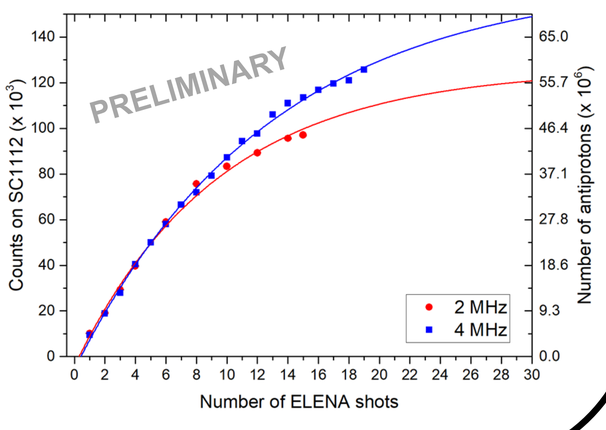
$$\bar{p} + Ps^* \rightarrow \bar{H}^* + e^-$$

Advantages:
- Cold formation
- Cross-section $\propto n_{Ps}^4$
- Pulsed formation -> knowledge of the time of flight

Record number of cold antiprotons in traps

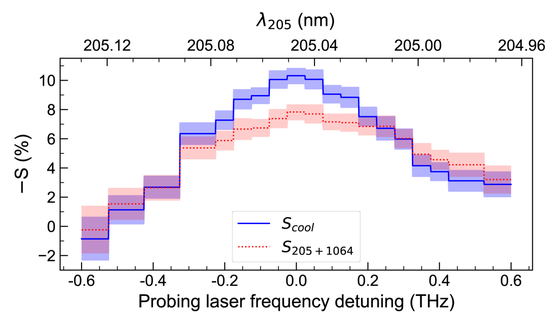
The number of antihydrogen atoms produced is directly proportional to the number of antiprotons employed, therefore an efficient catching is mandatory.
The AEgIS Experiment has set the record in AD of $\bar{p}$ trapping efficiency (~70 %, ~3.7 10^6 $\bar{p}$ every 2 minutes), and the world record of cold stored $\bar{p}$ (up to about 100 millions!).

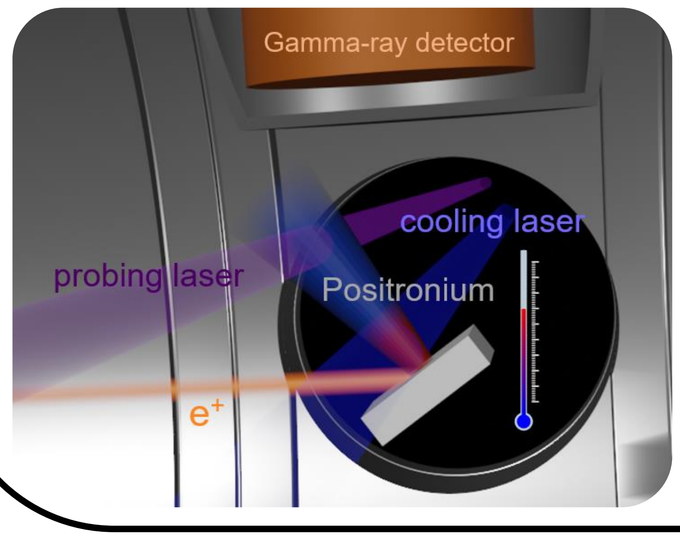


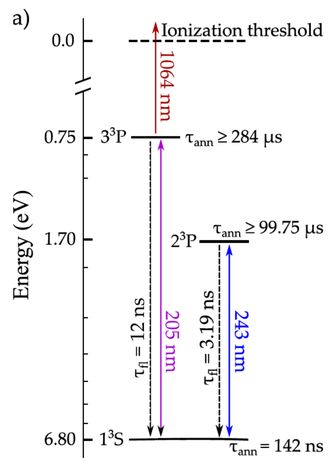


World-first Ps laser cooling

In AEgIS we have performed the first laser cooling of positronium atoms from 380(20) K to 170(20) K, the maximum cooling allowed by Doppler laser cooling. A cold source of Ps is instrumental to increase further $\bar{H}$ formation.







SCAN ME!