Bakeout Control and Heater Systems

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ALPHA Collaboration

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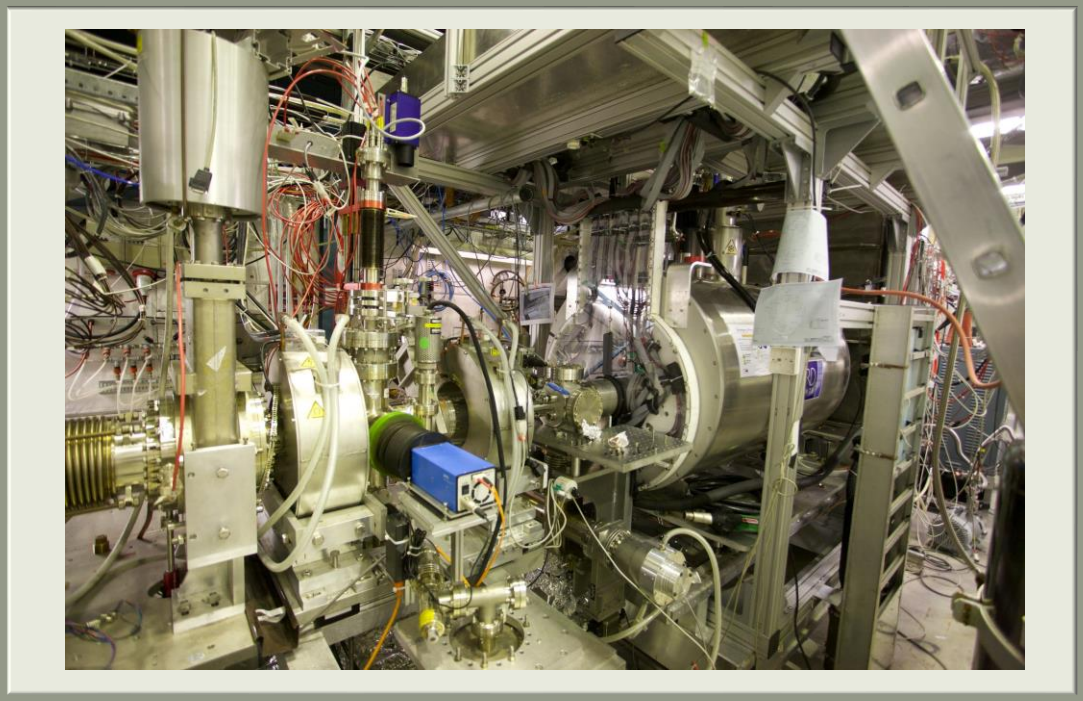
ALPHA
Antihydrogen Laser Physics Apparatus

Goals:

- Create and trap antihydrogen
- Perform spectroscopy on antihydrogen
- Explore antisymmetries in matter and antimatter
- Test CPT violation



Antimatter and Vacuums

Antimatter and Annihilations:

$$e^- + e^+ \rightarrow \gamma + \gamma$$

Need low pressure to in order to effectively trap antiprotons and positrons

$$\sigma = 3\sqrt{2}\pi a_0^2 \sqrt{\frac{27.2\text{eV}}{E}}$$

$$\Gamma = \frac{1}{\tau} = n_{gas} v \sigma$$

$$P = \left(3\sqrt{2}\pi a_0^2 \sqrt{\frac{27.2\text{eV}}{m_{\bar{p}}}} \right)^{-1} \frac{k_B T}{\tau}$$

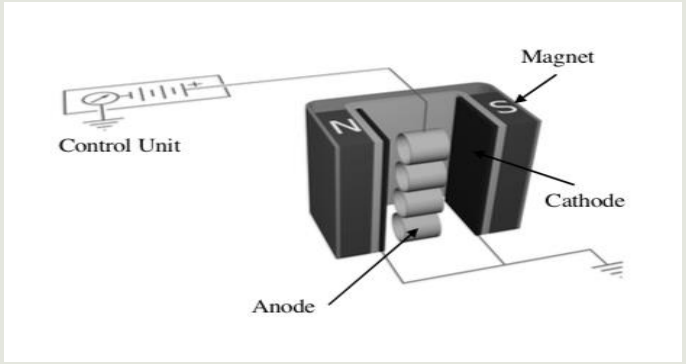
Given an estimated gas temperature of 10K and the length of of the experiment at 15 minutes, a pressure of better than 8e-13 mbar is needed.

Pumps

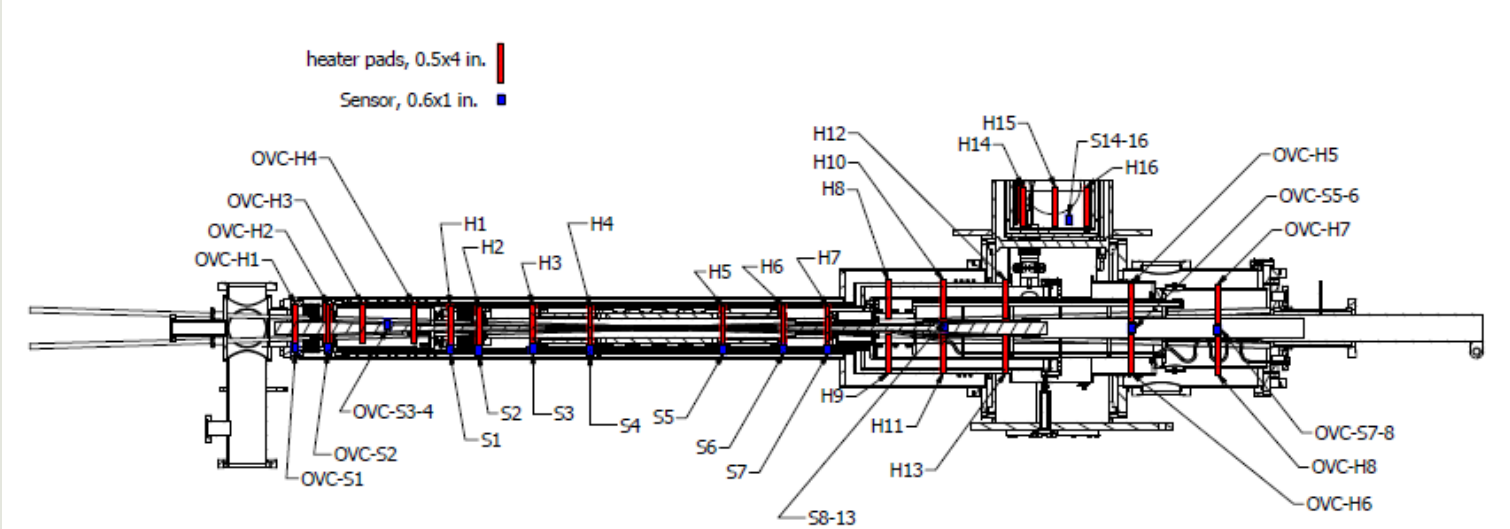
Scroll Pump

Turbo Pump

Ion Pump



Bakeout and Heater Control



Heater and sensor placements.

Cultural Experiences

Geneva

Bern

Sources

Slide 2:

CERN

Slide 3:

E. Butler, Antihydrogen formation, dynamics and trapping, Ph. D. thesis, Swansea University (2011).

Slide 4:

Turbo Pump
By User:Liquidat (Own work) [GFDL (http://www.gnu.org/copyleft/fdl.html), CC-BY-SA-via Wikimedia Commons

Ion Pump
Schulz, L Sputter-ion pumps 10.5170/CERN-1999-005.37 1999.

Slide 6:

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