

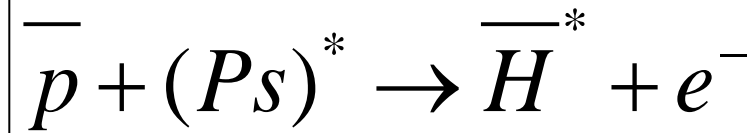
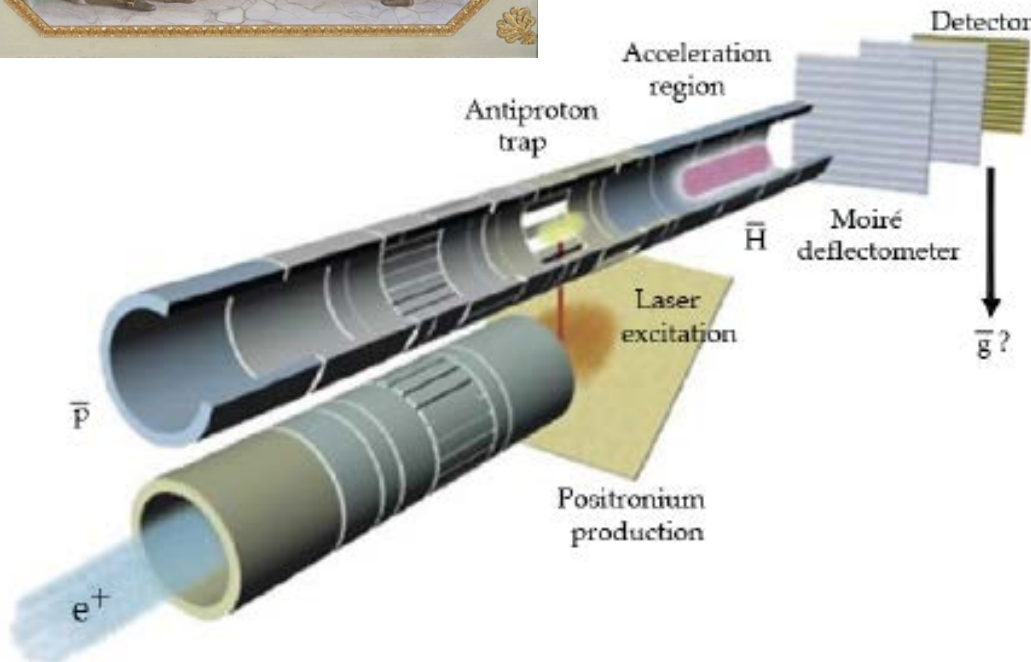
AEgIS (Antimatter Experiment: Gravity, Interferometry Spectroscopy)

Main scientific goal: **production of a Hbar beam** for direct measurement of the Earth's gravitational acceleration g on antihydrogen.



“cascai in opinione che se si levasse totalmente la resistenza del mezzo, tutte le materie discenderebbero con eguali velocità”.
Galileo Galilei (1564-1642)

Luigi Catani 1816- Firenze Palazzo Pitti

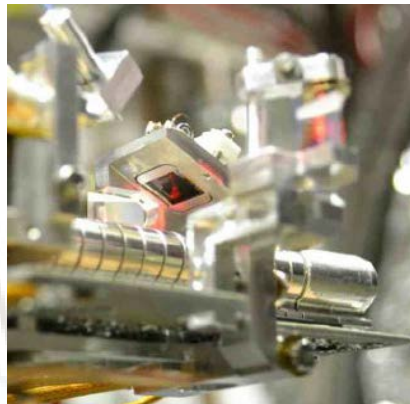


- Cold Ps
- Ps in Rydberg states

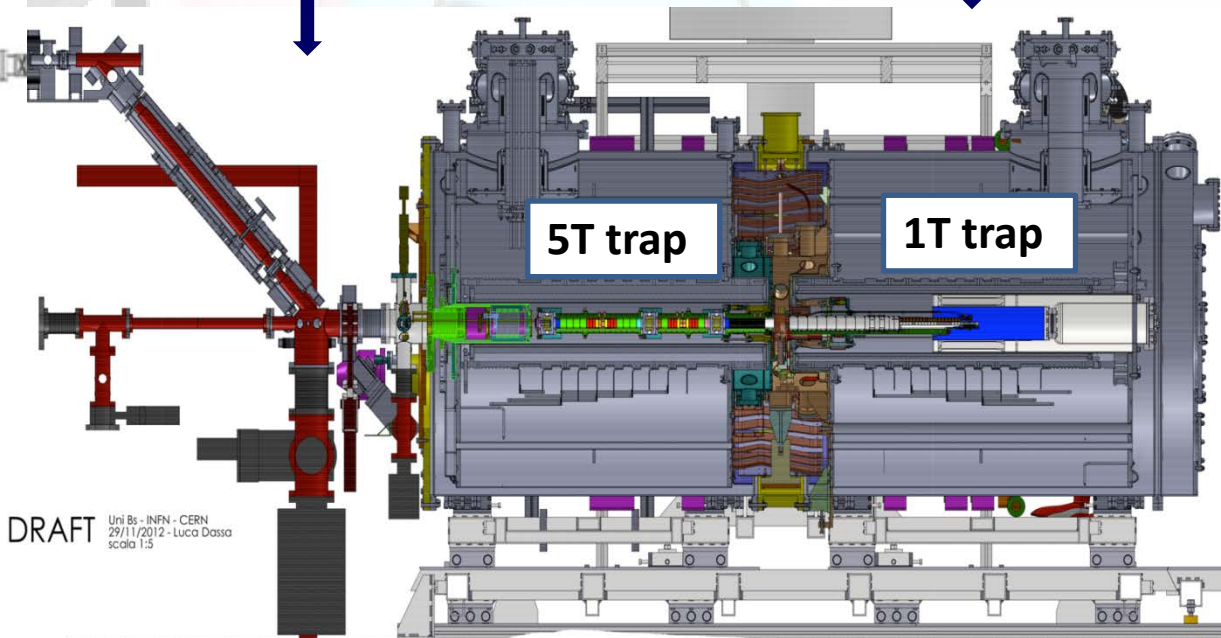
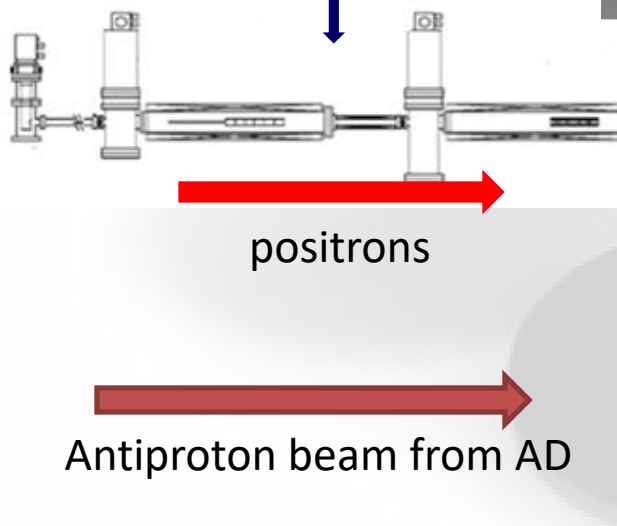
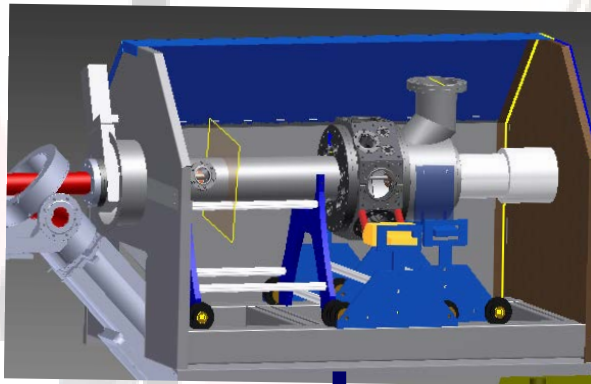
AEgIS apparatus

P_s converter & cooling

Chamber for P_s experiments

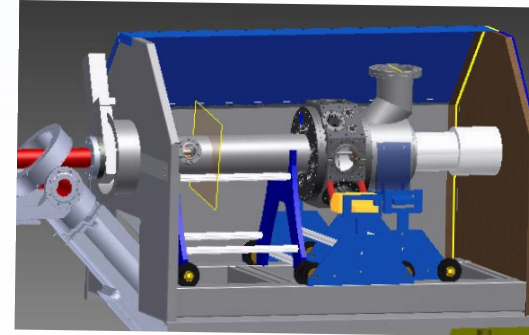


e⁺ bunched beam

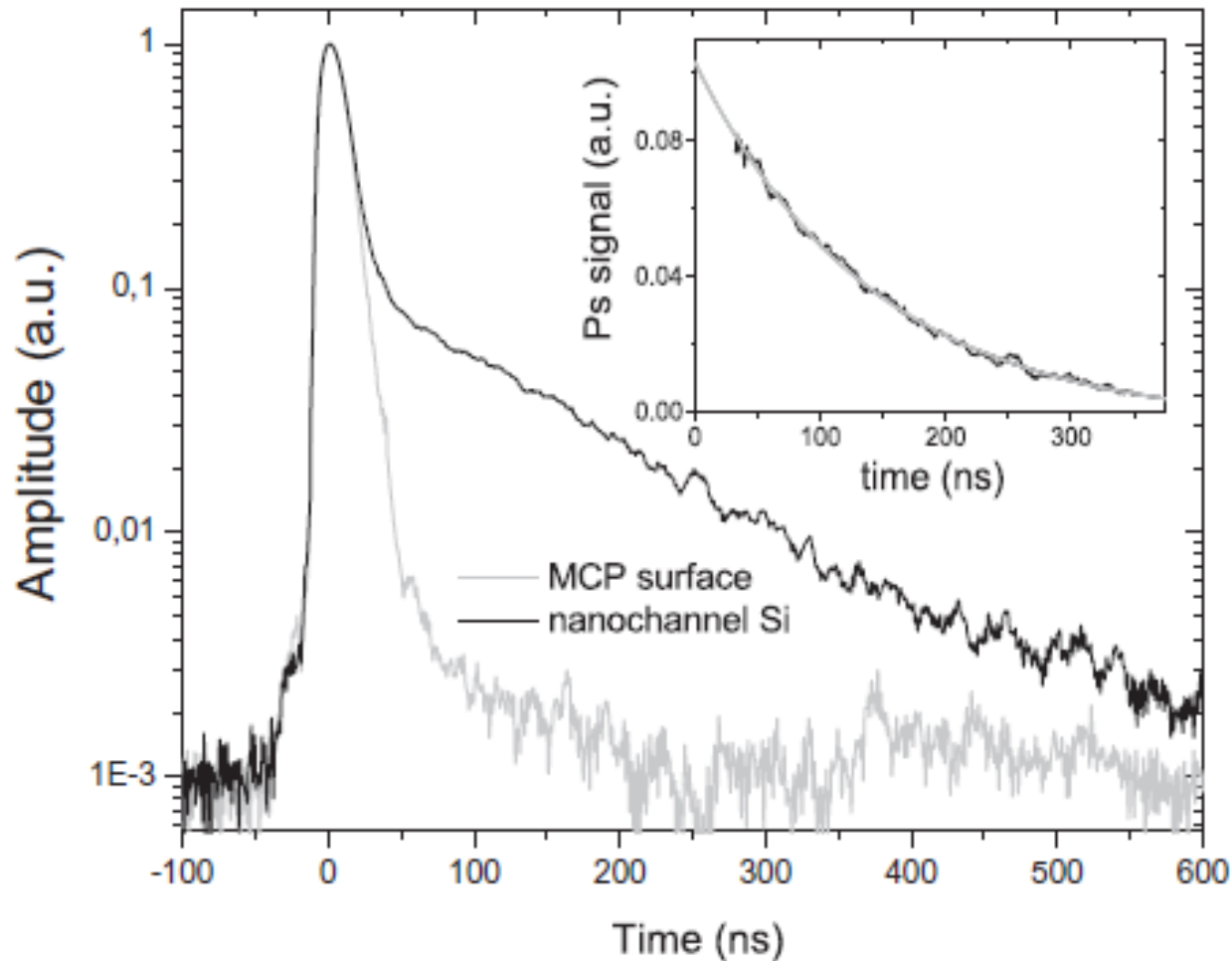


DRAFT Uni Bs - INFN - CERN
29/11/2012 - Luca Dasso
scala 1:5

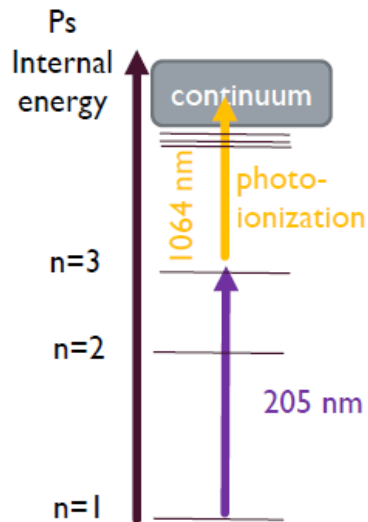
e⁺/Ps converters: Ps emitted into vacuum



Single Shot SSPALS measurements with
PbWO₄ scintillator + Hamamatsu R11265-100 PMT



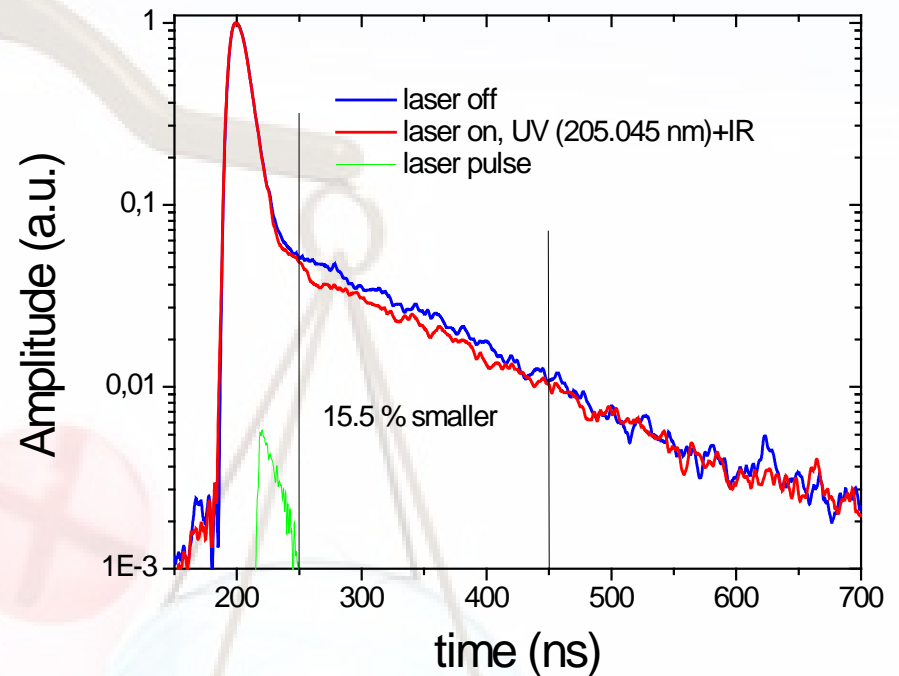
$1^3S \rightarrow 3^3P$ Ps excitation



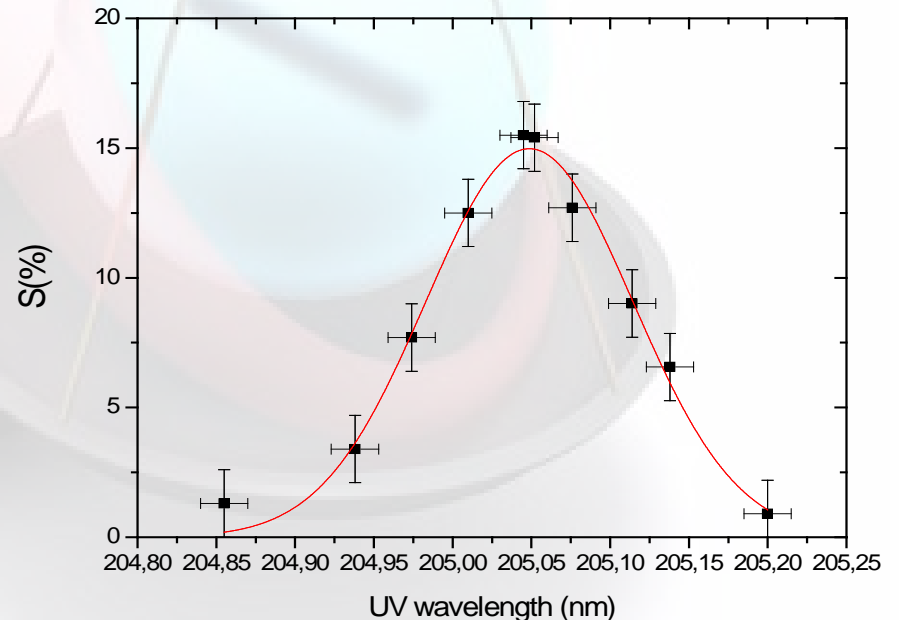
**-3P excitation line centered at
205.05±0.02 nm**

**-excitation-ionization
efficiency ~15%**

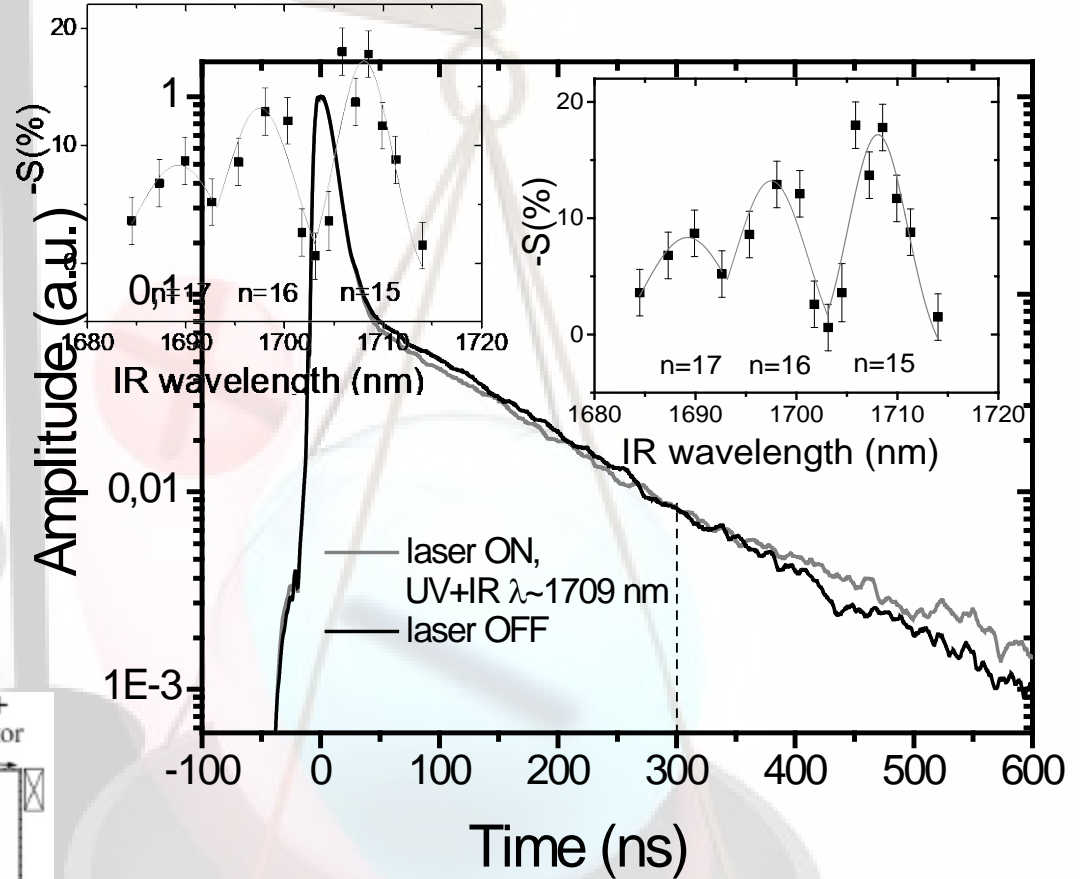
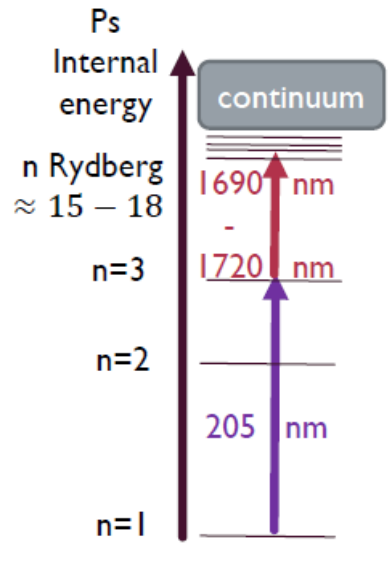
Energy : 54 μ J UV; 50 mJ IR



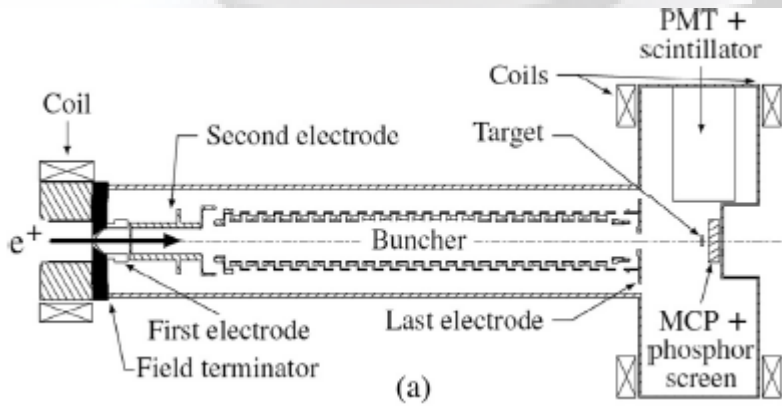
$$S(\%) = (\text{Area laser OFF} - \text{Area laser ON}) / \text{Area laser OFF}$$



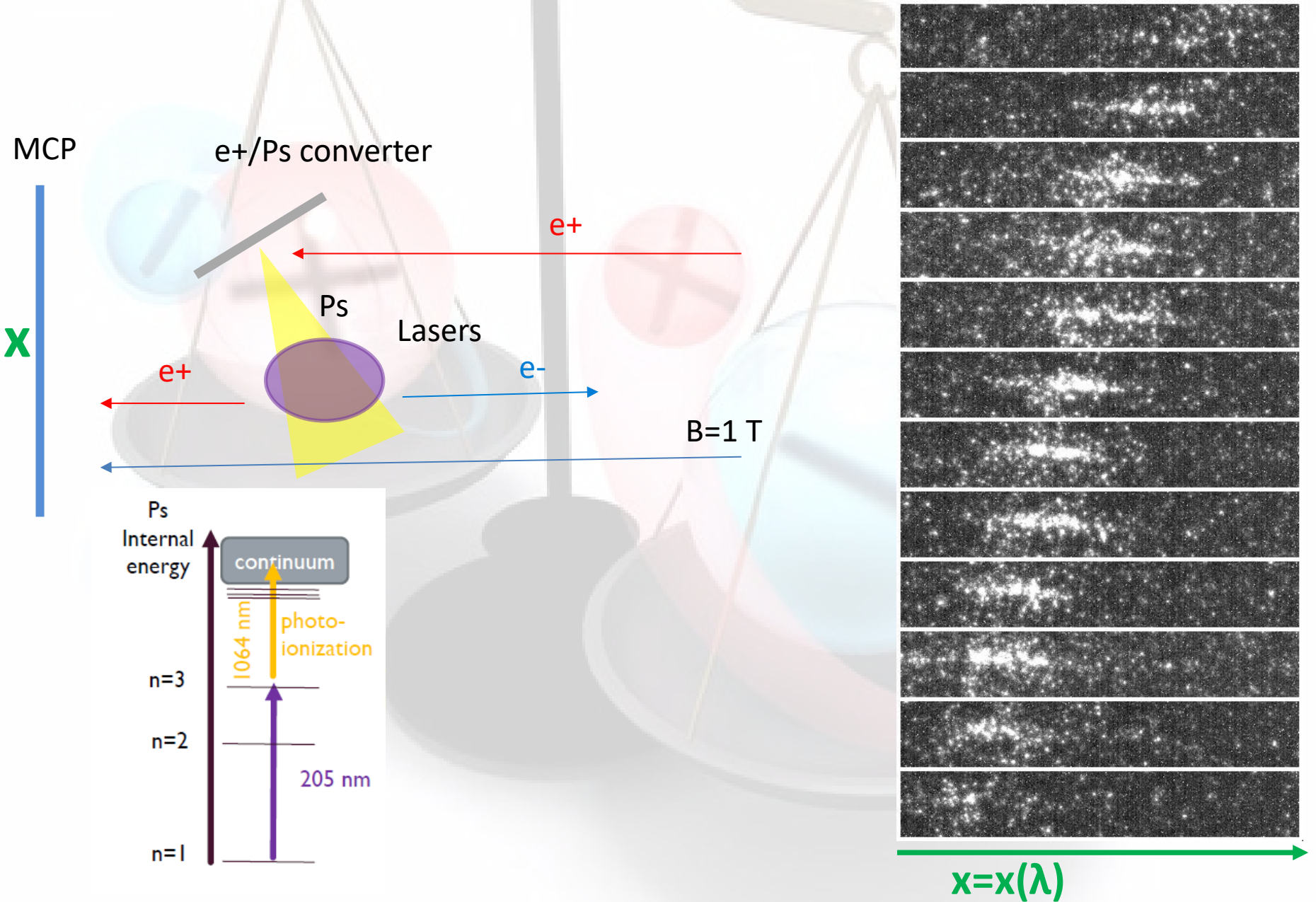
$3^3\text{P} \rightarrow$ Rydberg Ps excitation



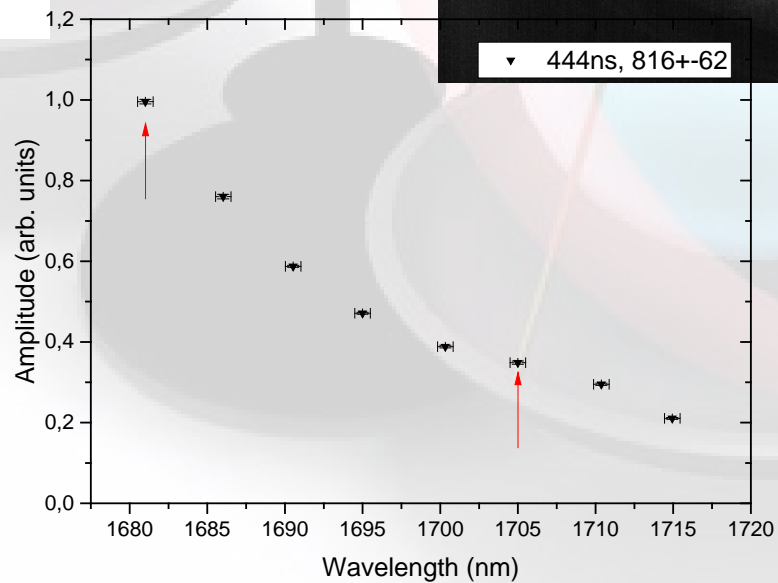
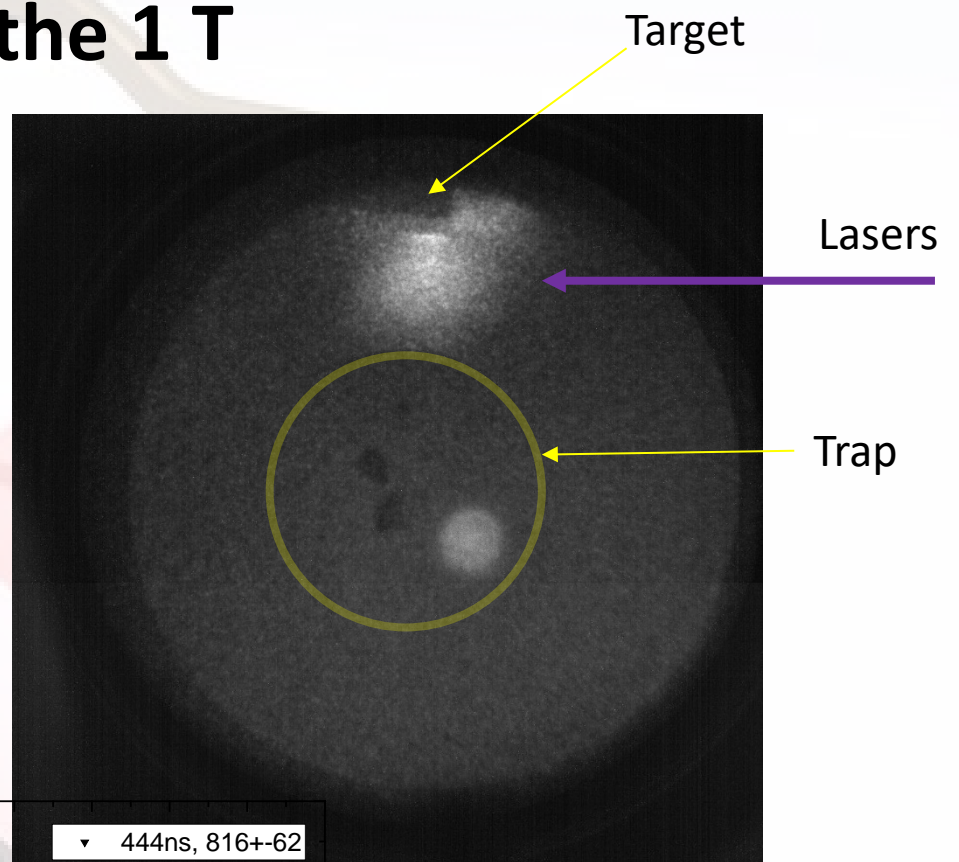
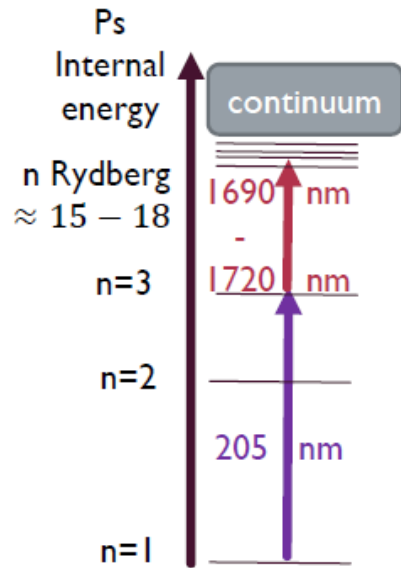
$$S(\%) = (\text{Area laser OFF} - \text{Area laser ON}) / \text{Area laser OFF}$$



Ps Rydberg excitation in the 1 T: $n=3$

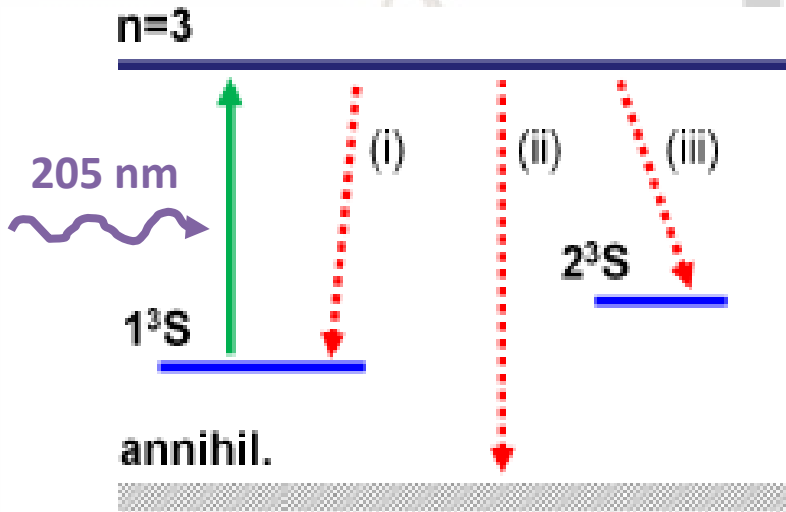


Ps Rydberg excitation in the 1 T

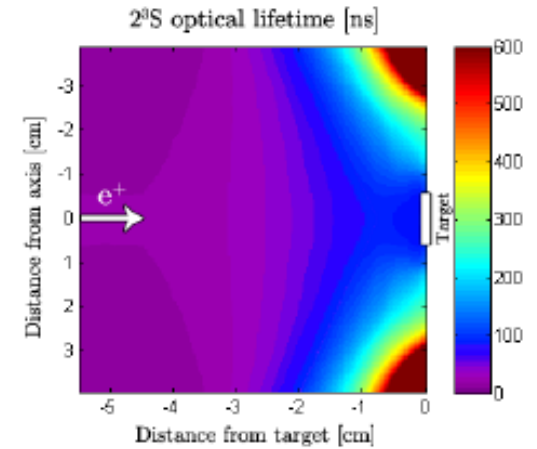


2^3S Ps production

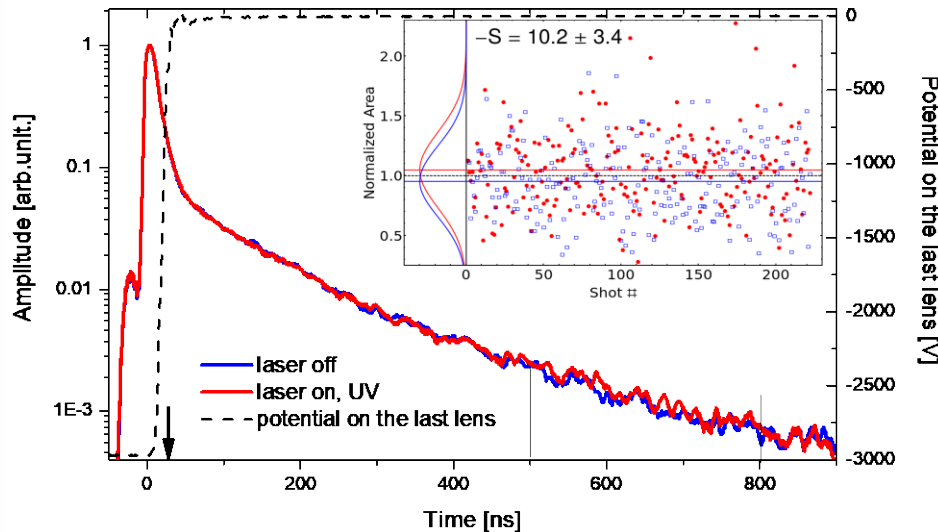
Aghion S. *et al.*, PRA 98, 013402 (2018)



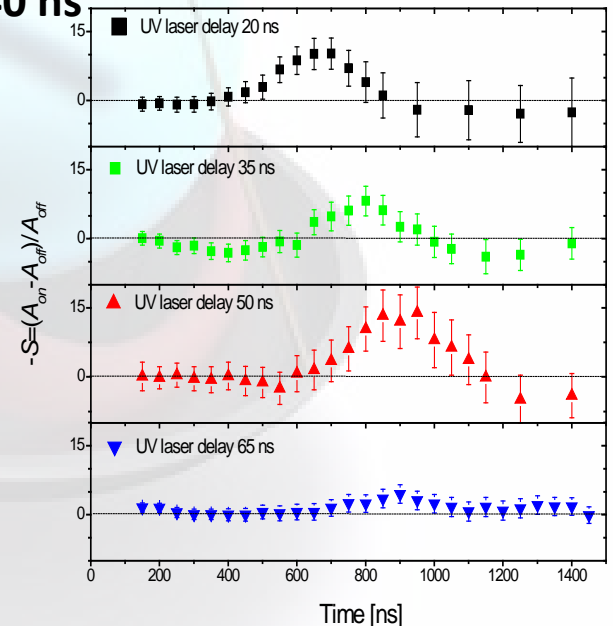
In electric field



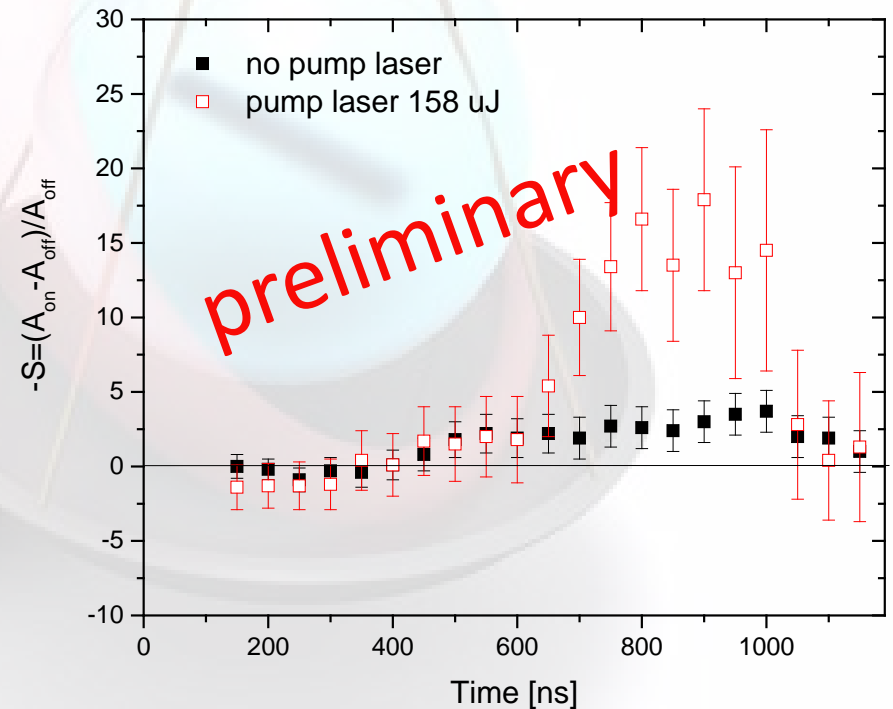
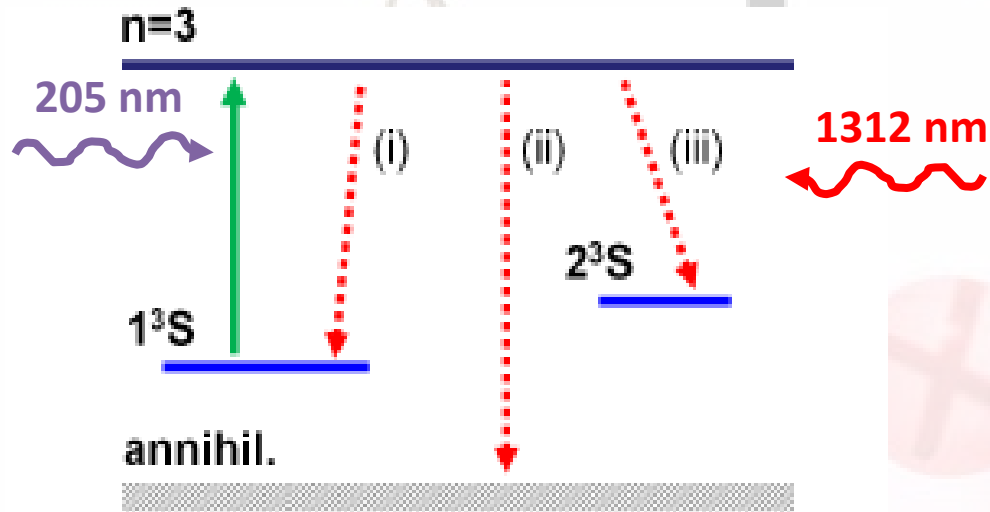
In free field \rightarrow lifetime 1140 ns



Potential on the last lens [V]



2^3S Ps production: stimulated production



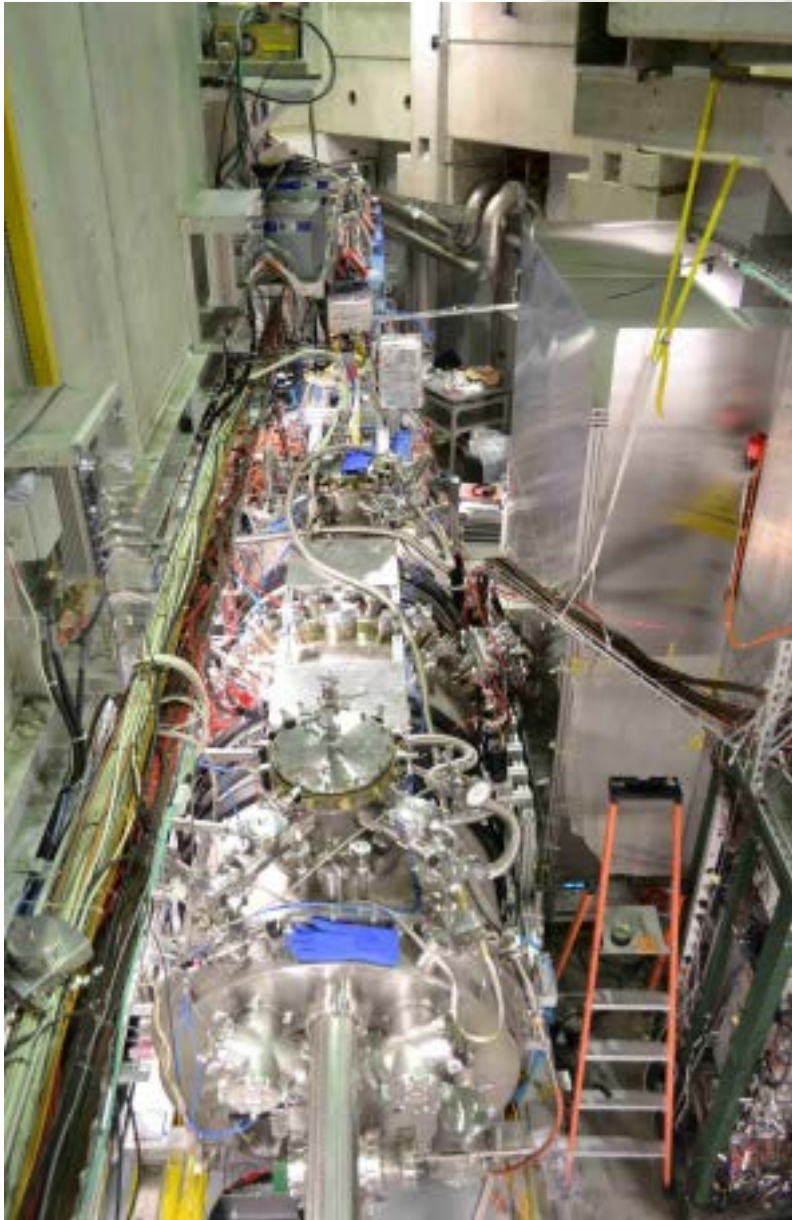
Conclusion

- Rydberg Ps production demonstrated and characterized in the Ps chamber
- Rydberg Ps production demonstrated and undercharacterization in the 1 T

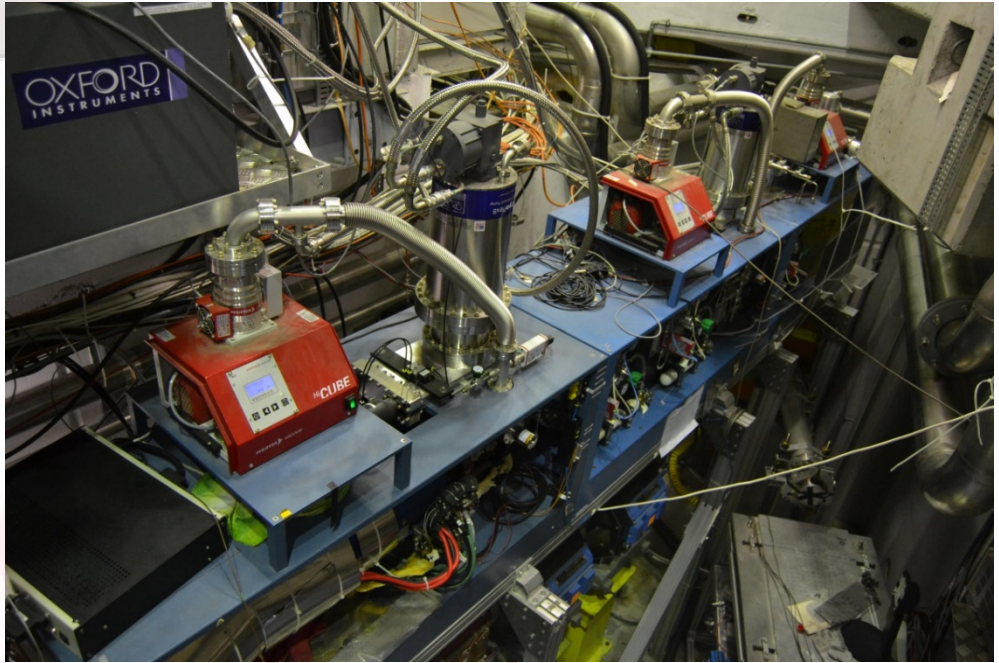
2019 plans

- tests of Ps laser cooling
 - a) production of monocromatic 2^3S Ps already demonstrated
 - b) optimization of the production of monocromatic 2^3S Ps
 - c) production of monocromatic 2^3S Ps beam
 - d) use of the monocromatic 2^3S Ps beam as diagnostic for laser cooling
- tests of Ps production efficiency in transmission targets

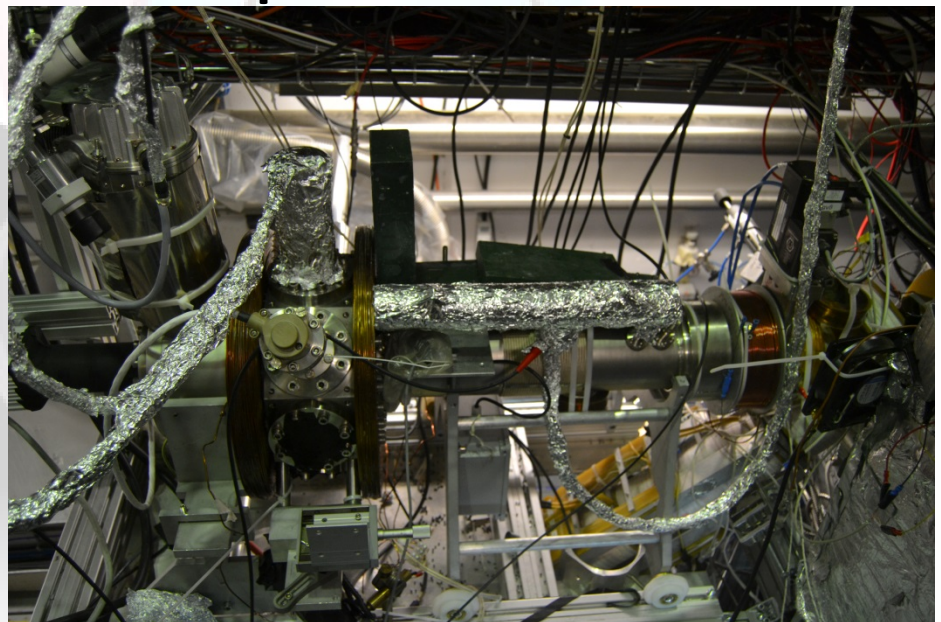
Padova → G. Nebbia 40% richiesta missione :3 kEuro



AEGIS set-up



Surko trap+accumulator



Chamber for Ps exp