Question 1.1: No

Question 1.2: No

Question 1.3: No

Question 2.1: No

Question 2.2: Yes

Description of the experiment:

IEN has started the development of an optical frequency standard based on laser cooled neutral ytterbium. The extremely narrow transitions $^1S_0$-$^3P_0$ of the fermionic isotopes at 578 nm have relevant metrological features: they have a Q factor of $5x10^{16}$ and the analysis of the possible frequency shifts shows the possibility to reach an accuracy well below $10^{-16}$ [1,2].

When it is trapped in an optical lattice, Yb offers the possibility of a Lamb-Dicke scheme for atomic interrogation, allowing to reach both high accuracy and high stability of the standard [1]. In fact, using an appropriate laser wavelength for the optical lattice, it has been predicted the possibility of the observation of the transition without the AC Stark shift [1].

Yb atomic structure allows the laser cooling of the sample by use of commercial laser devices; on the other hand the rich Yb isotope variety allows a wide investigation of frequency standards based both on fermionic and on bosonic atoms [3, 4].

Finally, physical interest for this atom arises from the possibility of fundamental physic tests and Bose-Einstein condensation [5].

[1] S. Porsev et alterim, Phys. Rev. A, 69, 021403 (2004)

[2] C. W. Hoyt et alterim, Phys. Rev. A,

[3] R. Maruyama et alterim, Phys. Rev. A, 68, 011403 (2003)

[4] T. Hong et alterim, Phys. Rev. Lett., 94, 050801 (2005)

[5] Y. Takasu et alterim, Phys. Rev. Lett., 91, 040404, (2003)