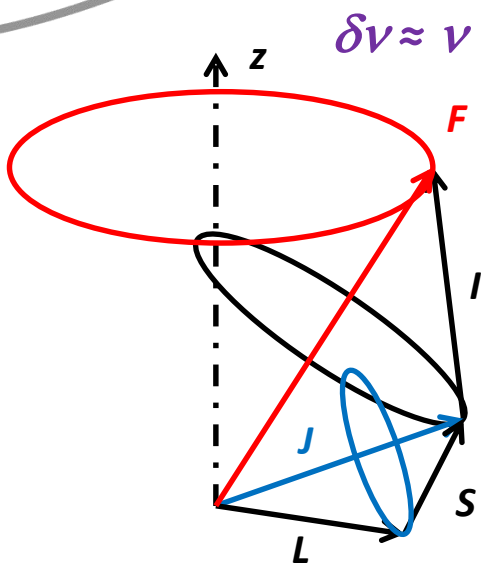
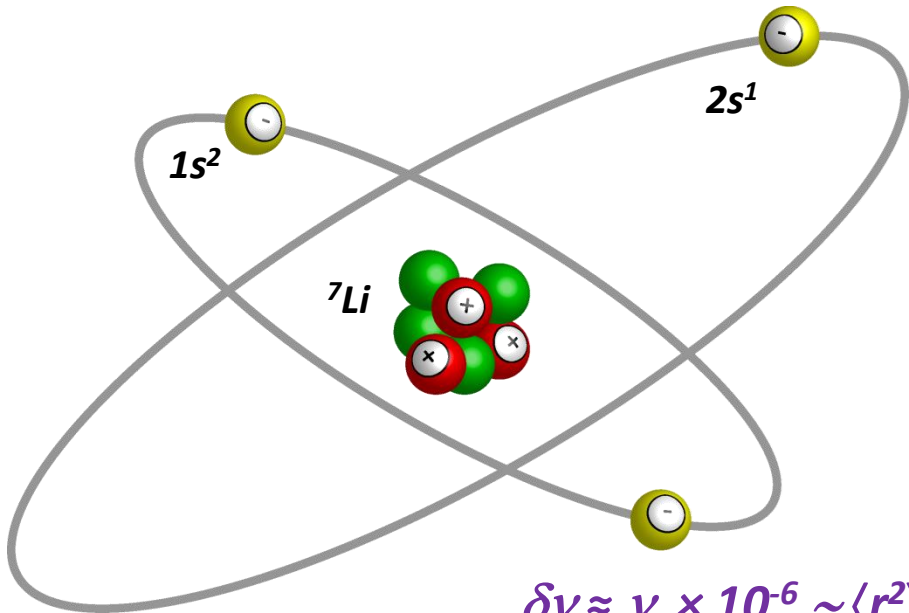


*Project for
Collinear Laser Spectroscopy
at ALTO*

Outlook

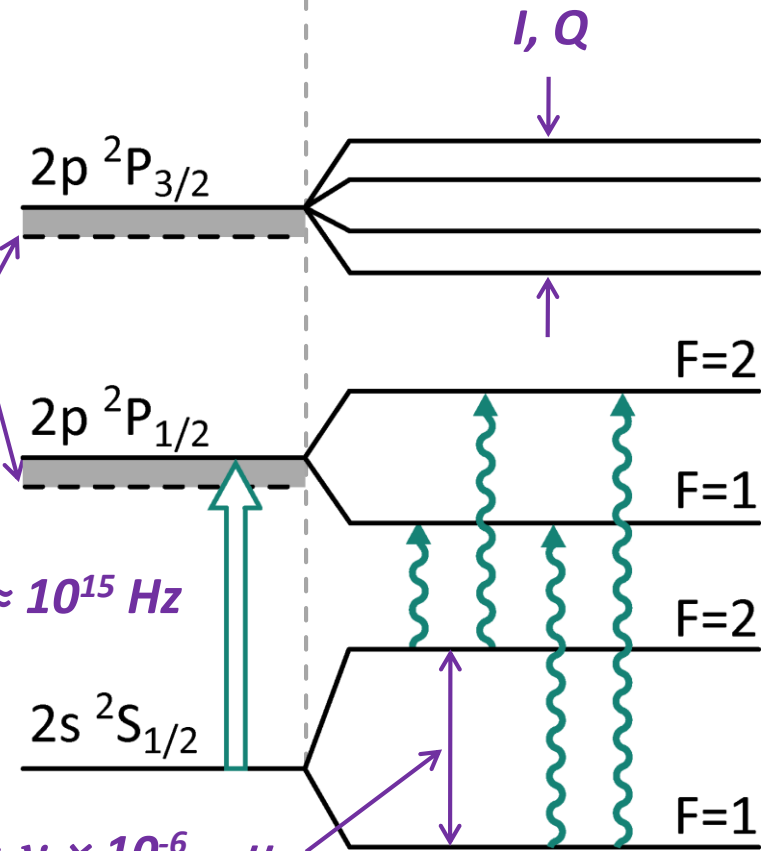
- **Concept of laser spectroscopy**
 - **Hyperfine structure**
 - **Isotope shifts**
 - **Examples**
- **The ALTO facility**
- **Physics case for laser spectroscopy at ALTO**
 - **Conceptual design of LINO**
- **Decay spectroscopy of polarized beam**

Hyperfine structure (HFS) → Laser Spectroscopy →
 Model Independent: $I, \mu, Q, \delta\langle r^2 \rangle$



$\delta v \approx \nu \times 10^{-6} \sim \langle r^2 \rangle$

$FS \rightarrow \vec{F} = \vec{I} + \vec{J} \rightarrow HFS$



$\nu \approx 10^{15} \text{ Hz}$

$\Delta E \approx \nu \times 10^{-6} \sim \mu$

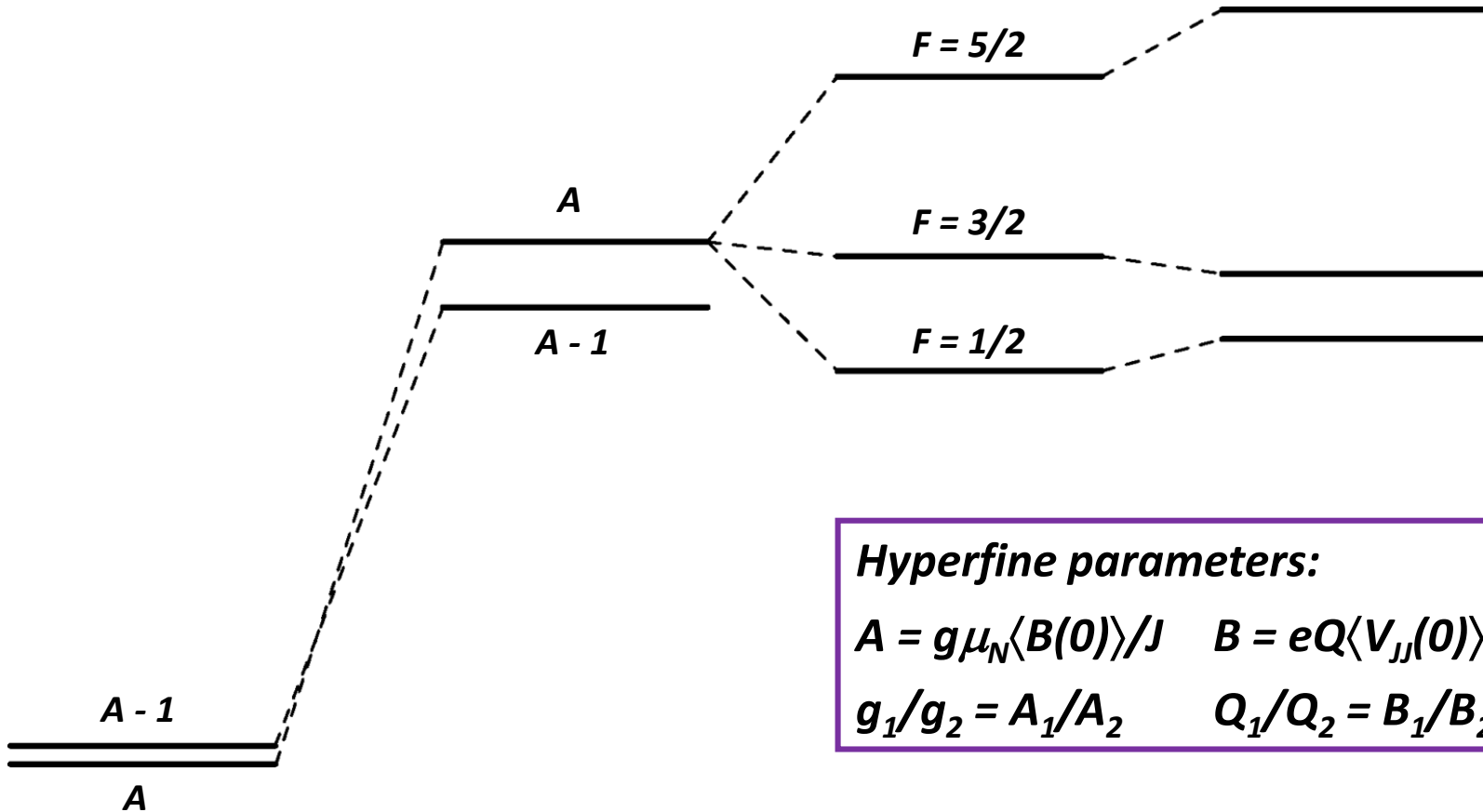
Example: $J = 1, I = 3/2$

Point charge

+ nuclear size

+ magnetic moment

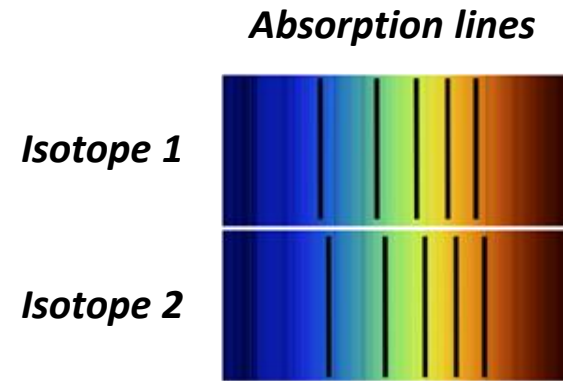
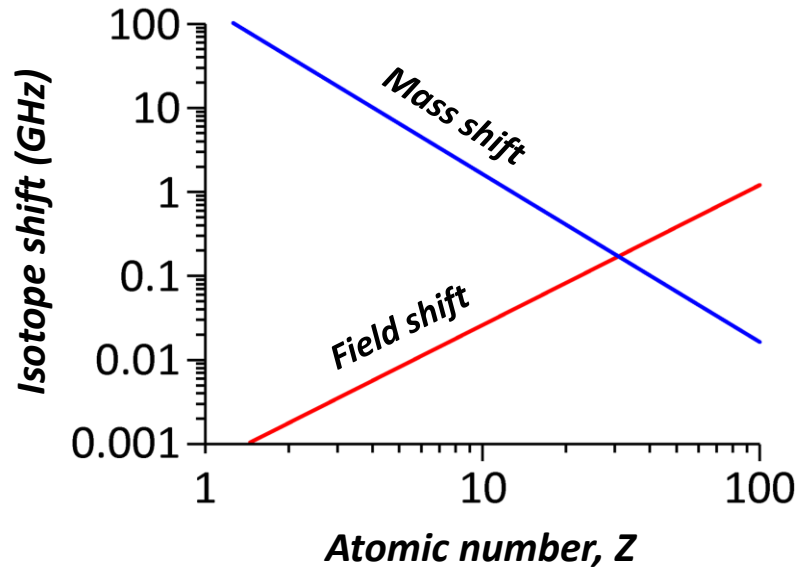
+ quadrupole moment


Hyperfine parameters:

$$A = g\mu_N \langle B(0) \rangle / J \quad B = eQ \langle V_{JJ}(0) \rangle$$

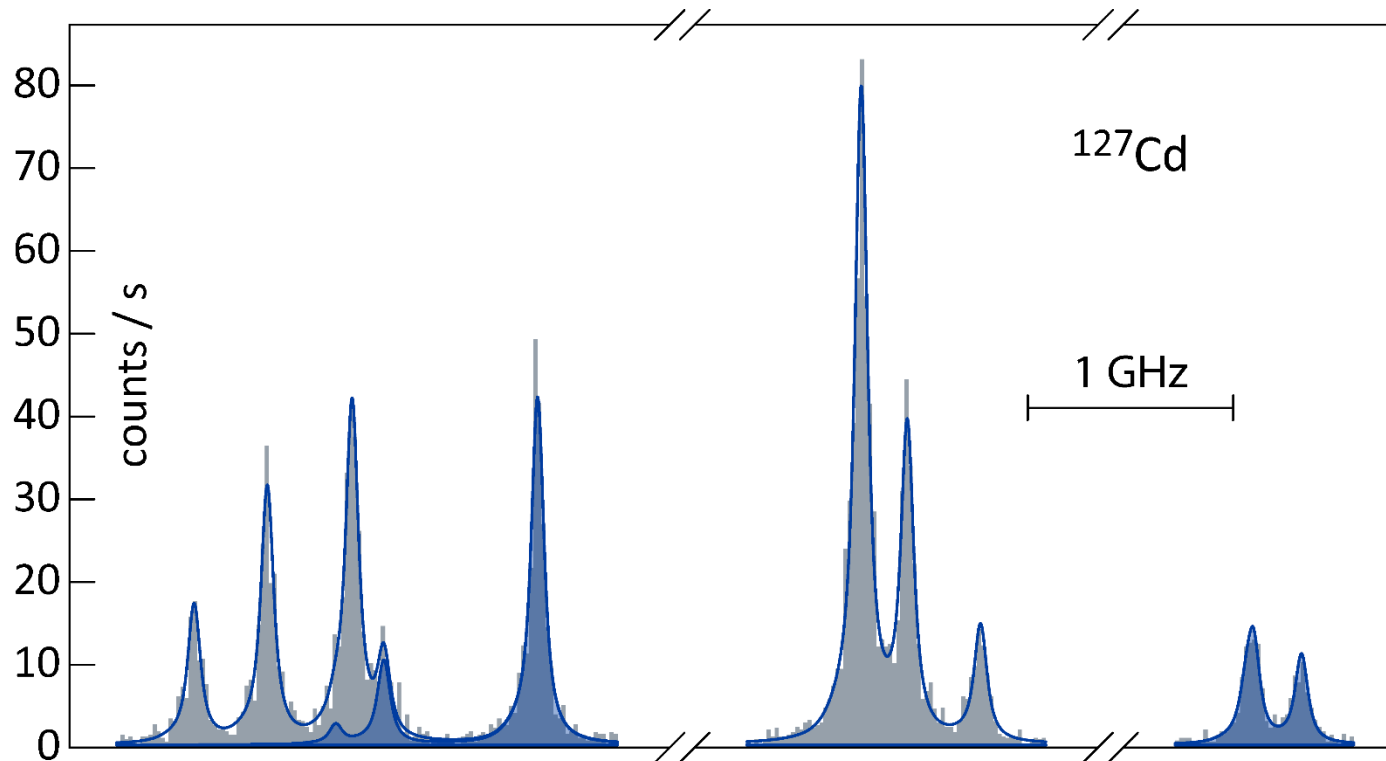
$$g_1/g_2 = A_1/A_2 \quad Q_1/Q_2 = B_1/B_2$$

Isotope shifts and nuclear rms charge radii

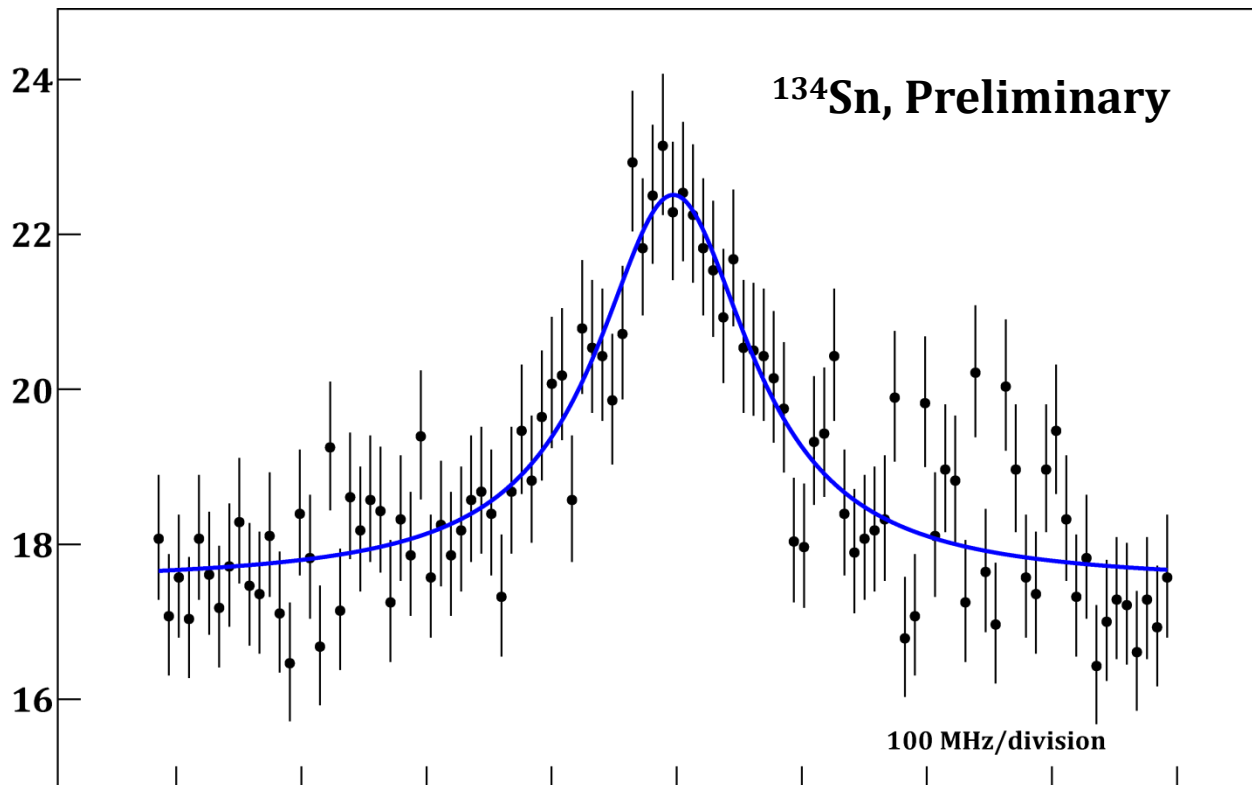


$$\text{Isotope shift: } \delta\nu^{AA'} = \underbrace{K \frac{m_A - m_{A'}}{m_A m_{A'}}}_{\text{Mass shift}} + \overbrace{F \delta \langle r^2 \rangle^{AA'}}^{\text{Field shift}}$$

Discovery of long-lived isomeric states



PRL, 110, 192501 (2013)

New data on ^{134}Sn 

Electron linac - 10 μ A, 50 MeV

^{238}U -carbide target & ion source
 5×10^{11} photofissions / s

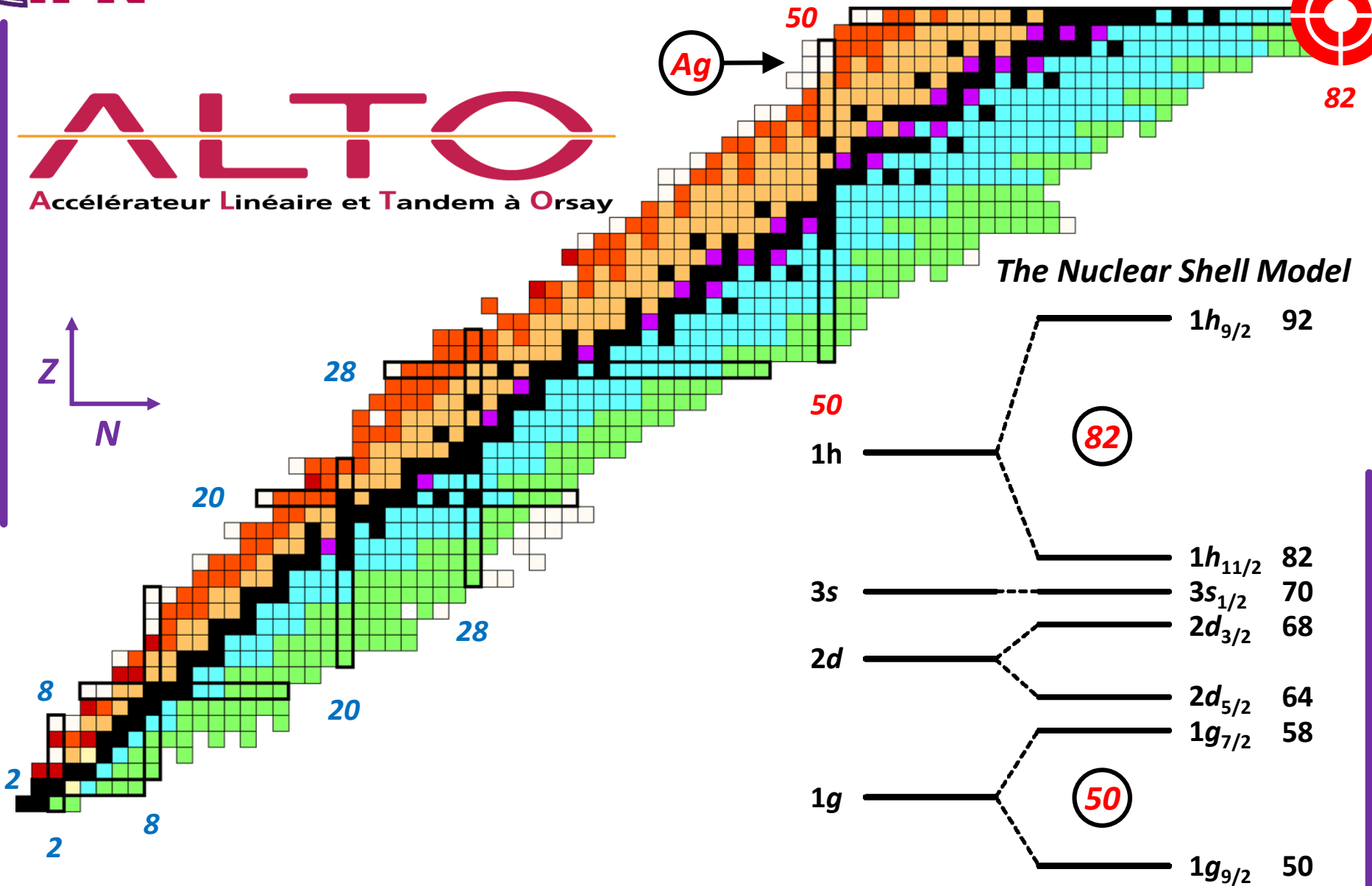
Mass separator

LINO

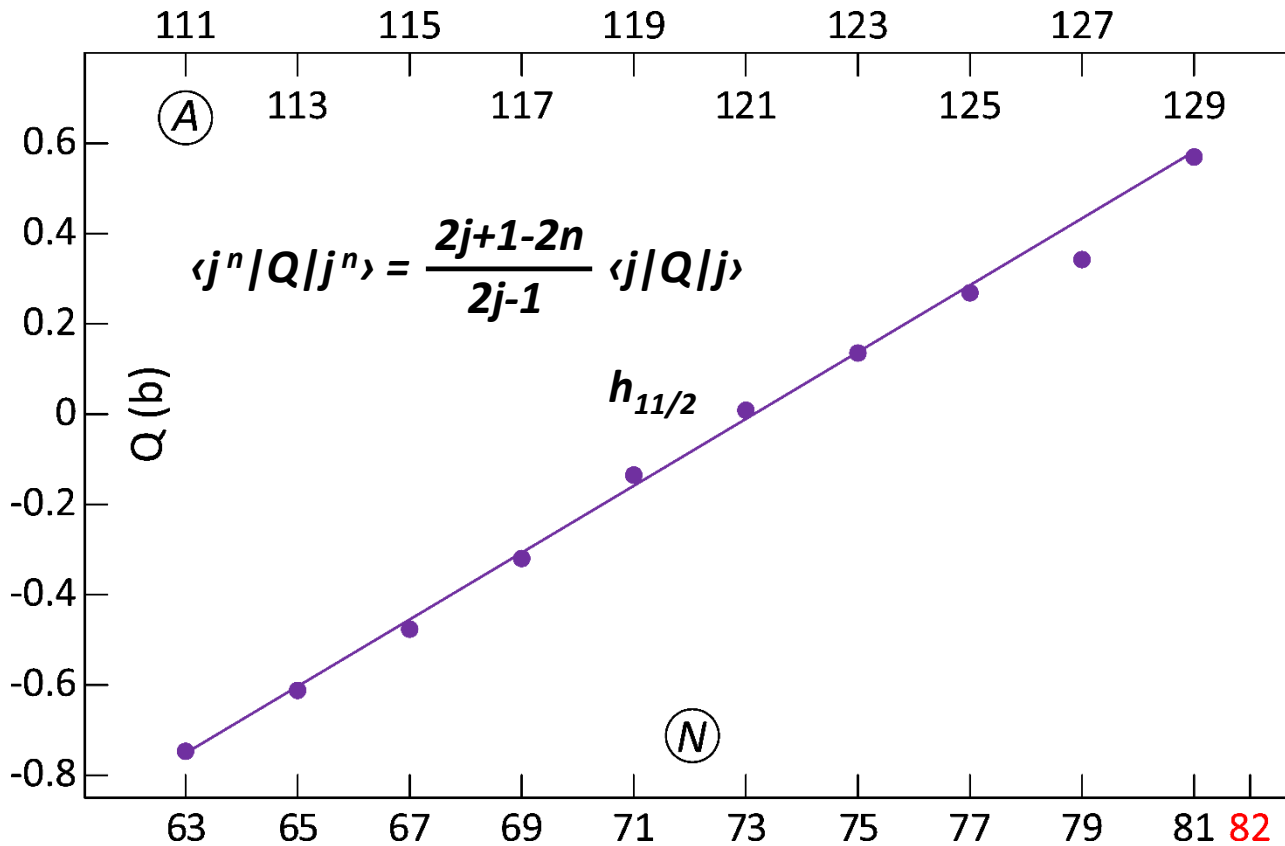


ALTO

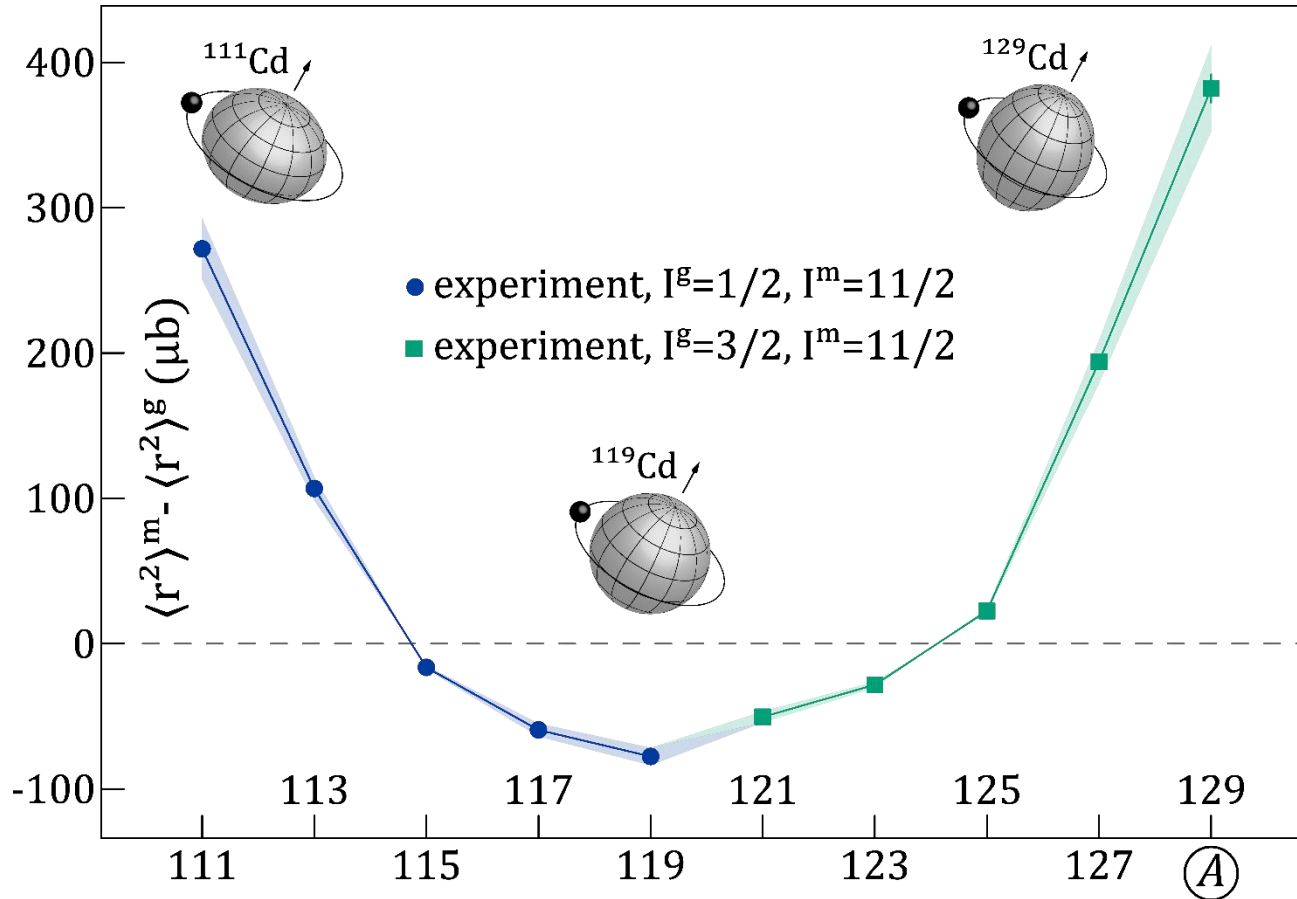
Accélérateur Linéaire et Tandem à Orsay



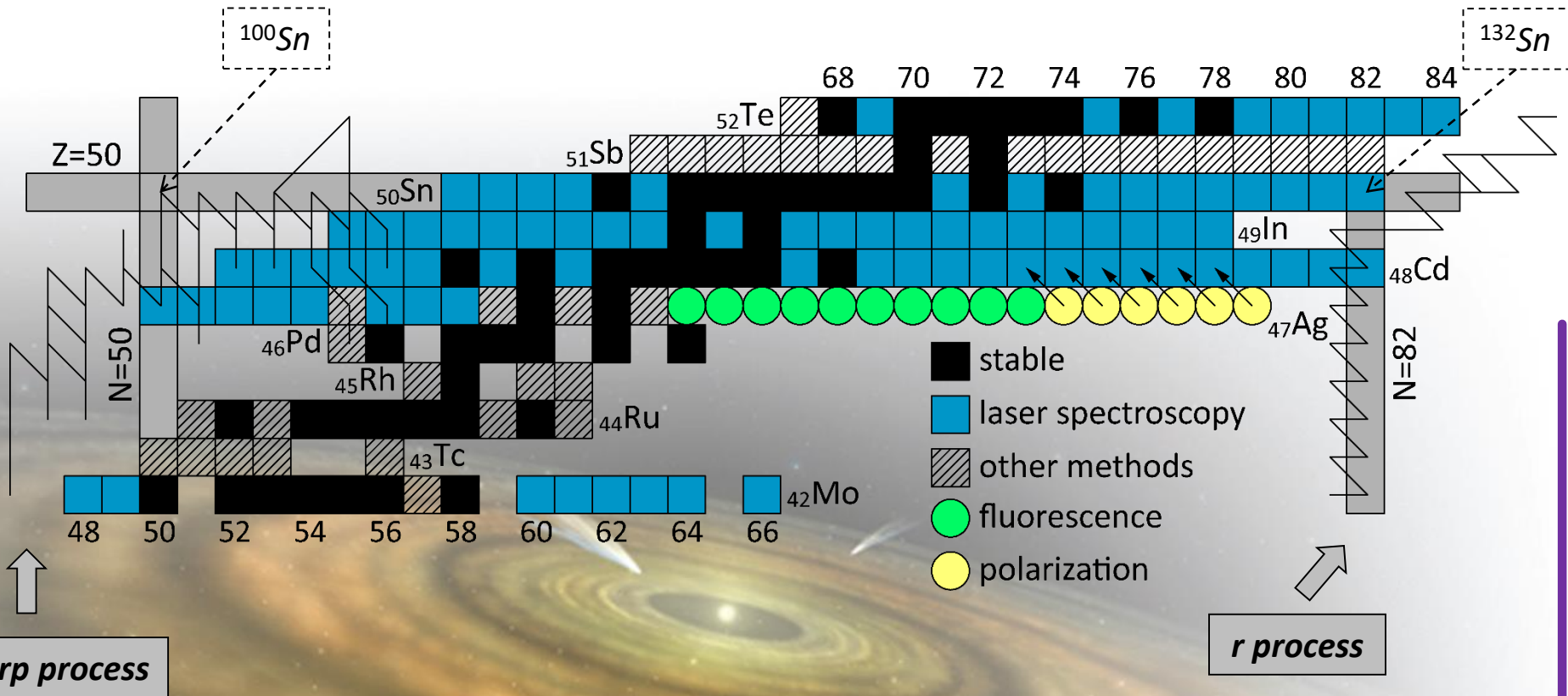
11/2⁻ quadrupole moments in Cd

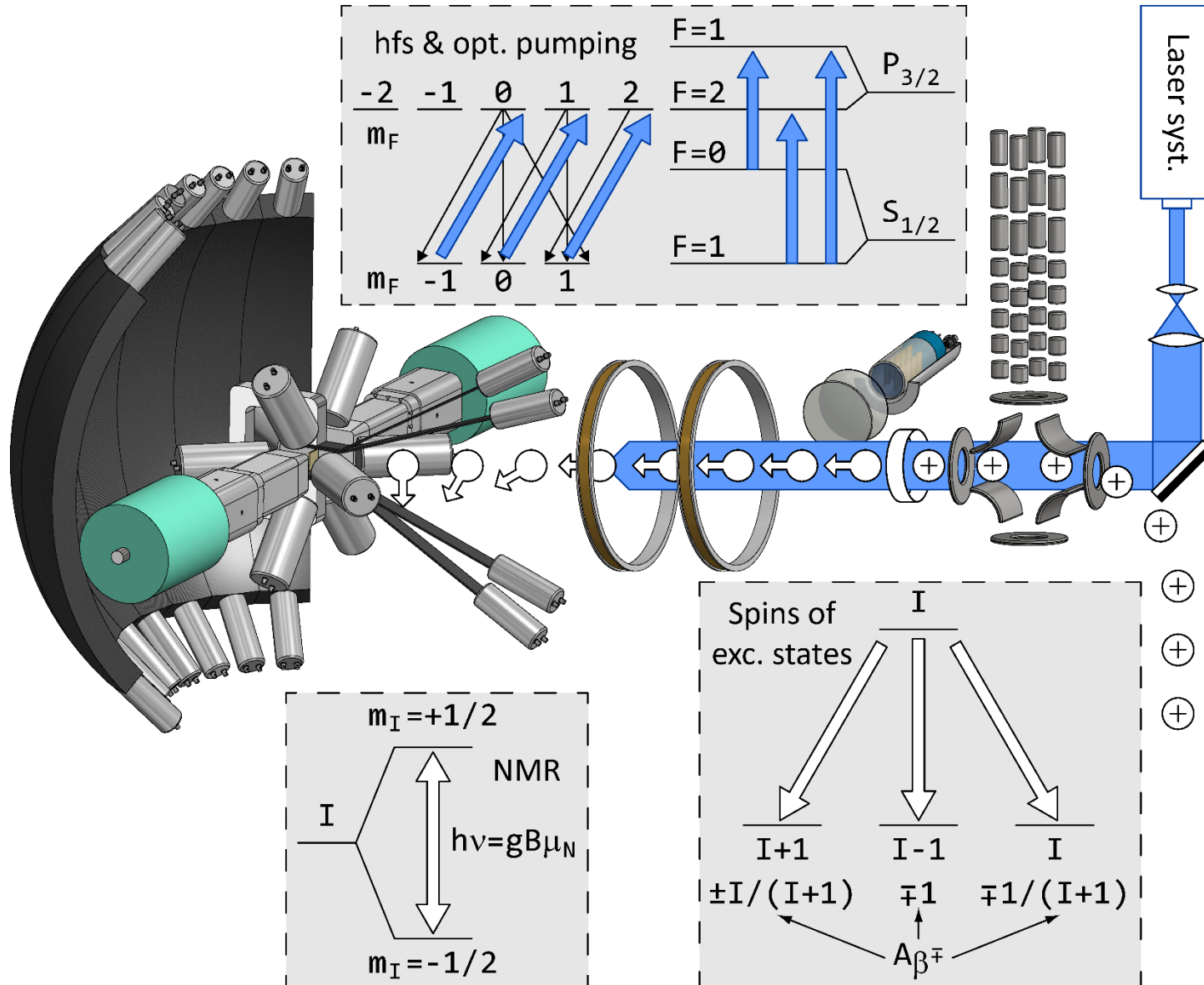


Isomer shifts in Cd

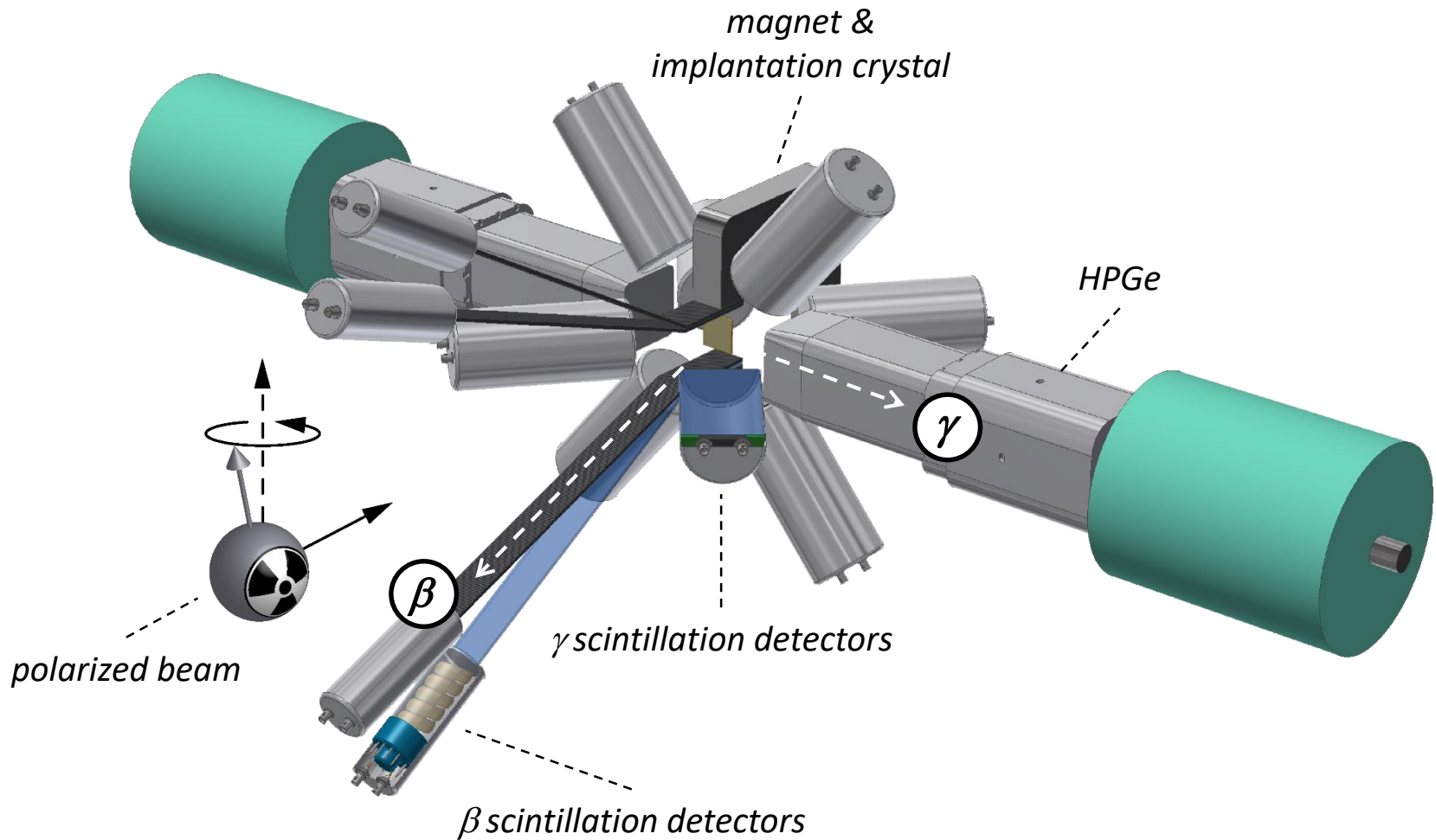


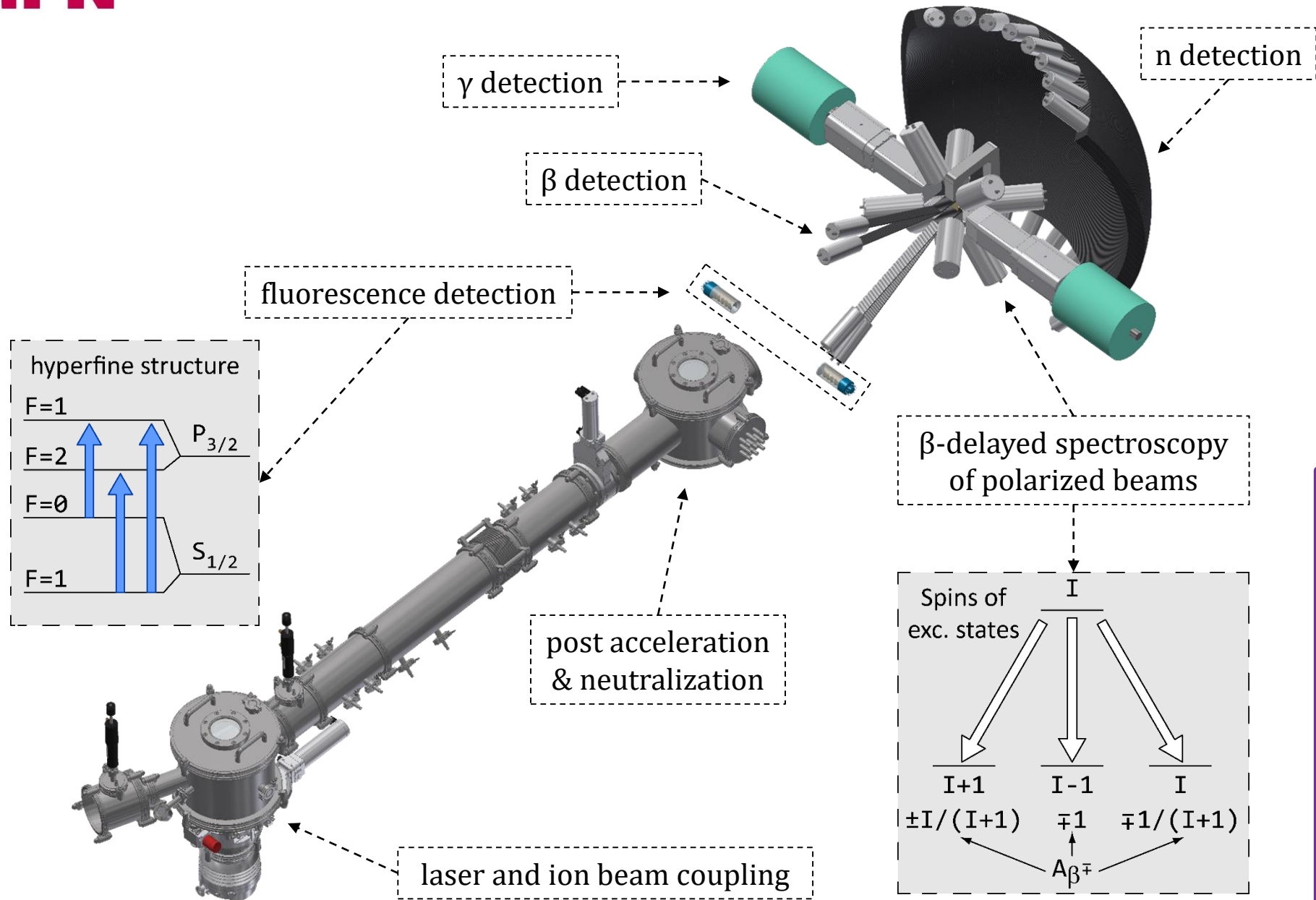
Survey of ground-state properties in the Sn region Possibility for $^{111-126}\text{Ag}$ at ALTO

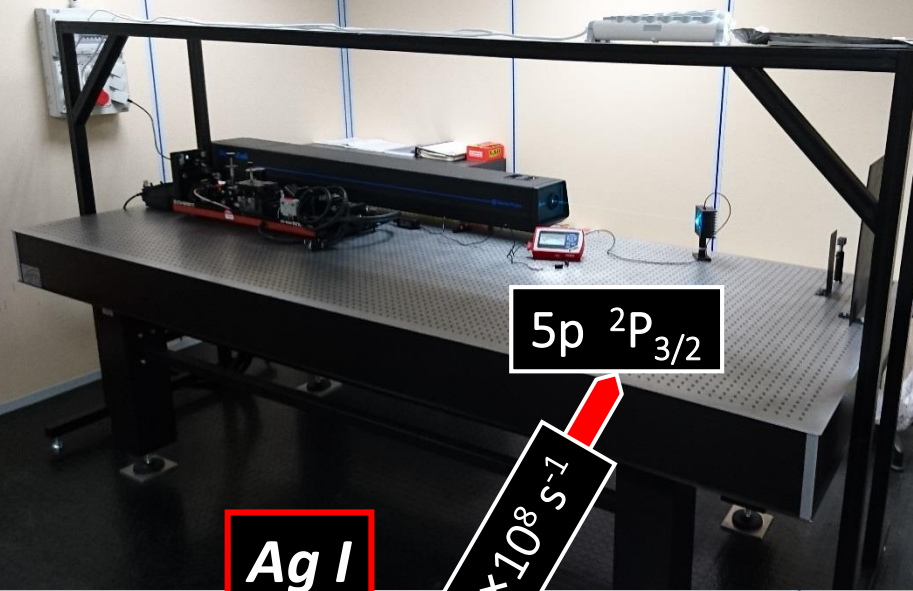




Sketch of a possible layout for β -delayed γ detection



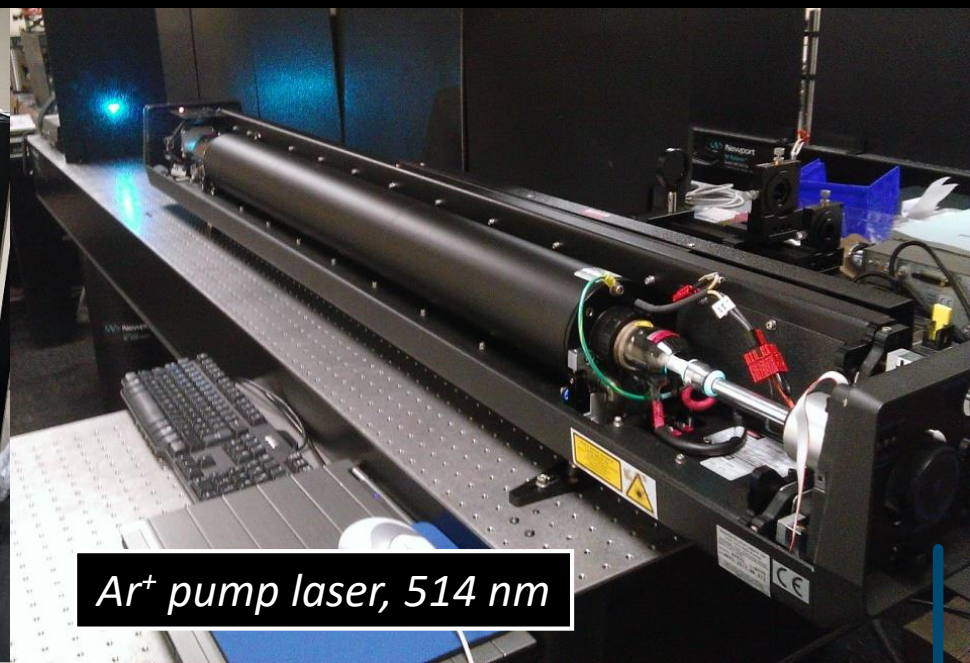




$5p \ 2P_{3/2}$

Ag I

328 nm, $1.4 \times 10^8 \text{ s}^{-1}$

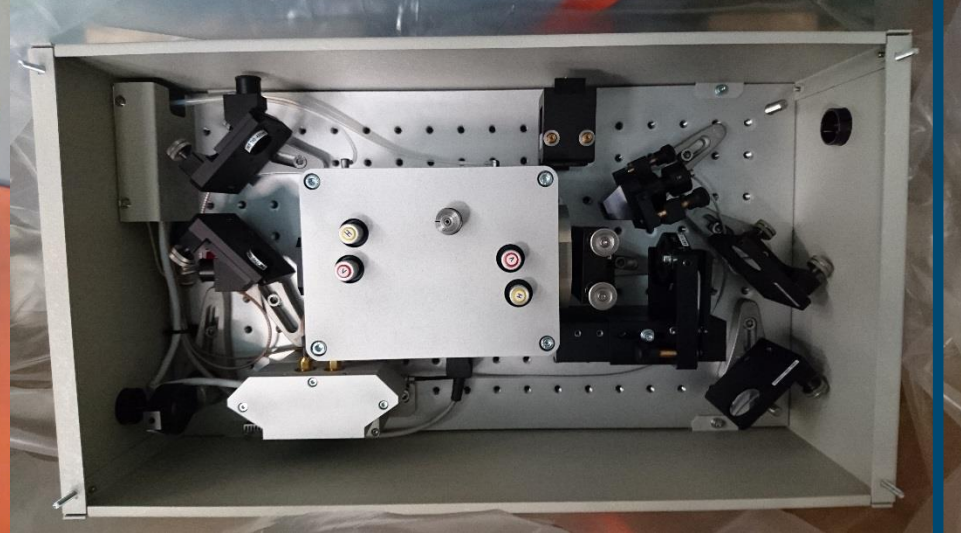


Ar^+ pump laser, 514 nm



$5s \ 2S_{1/2}$

Tunable Dye laser (656 nm for Ag)



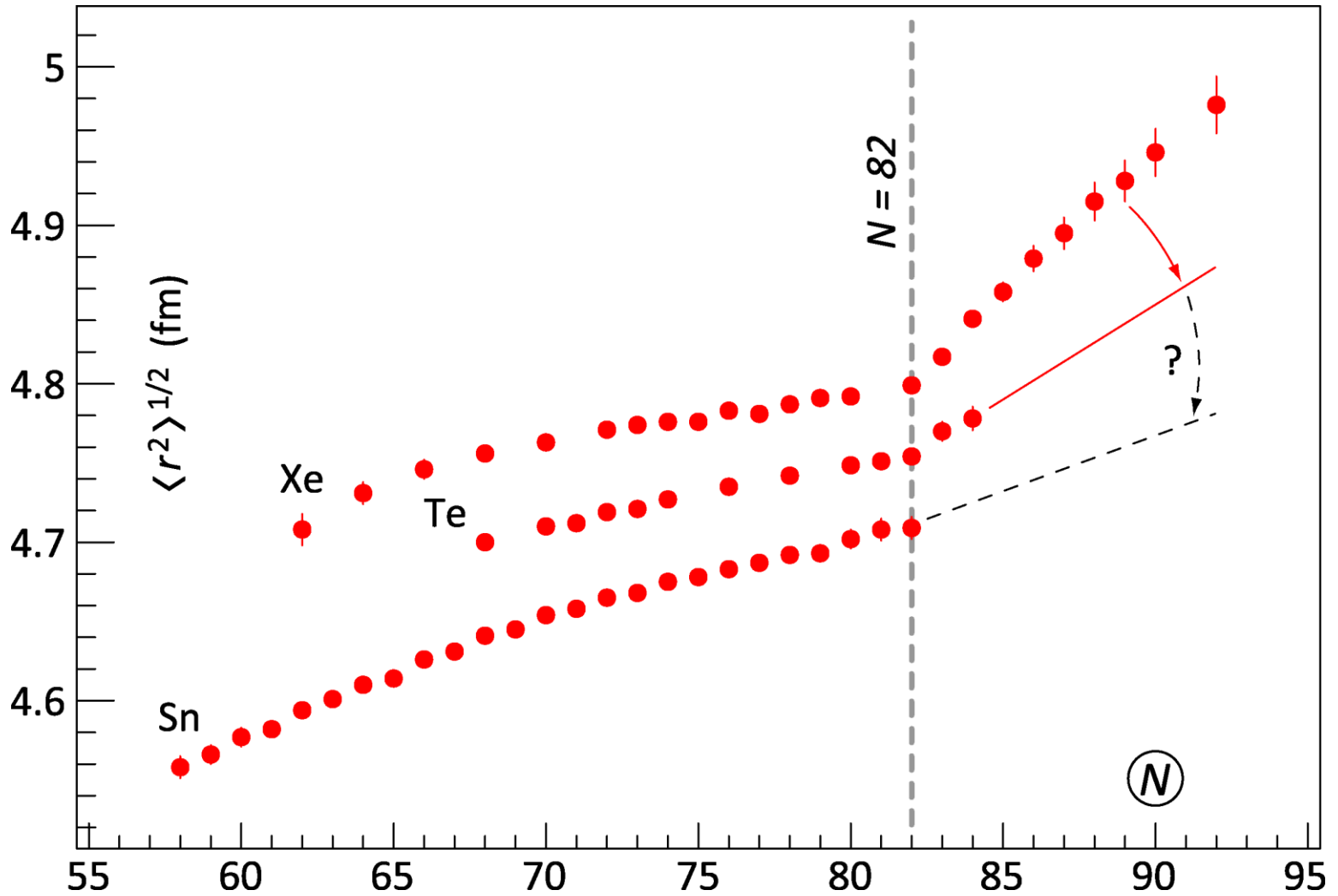
SHG (328 nm for Ag)

Summary

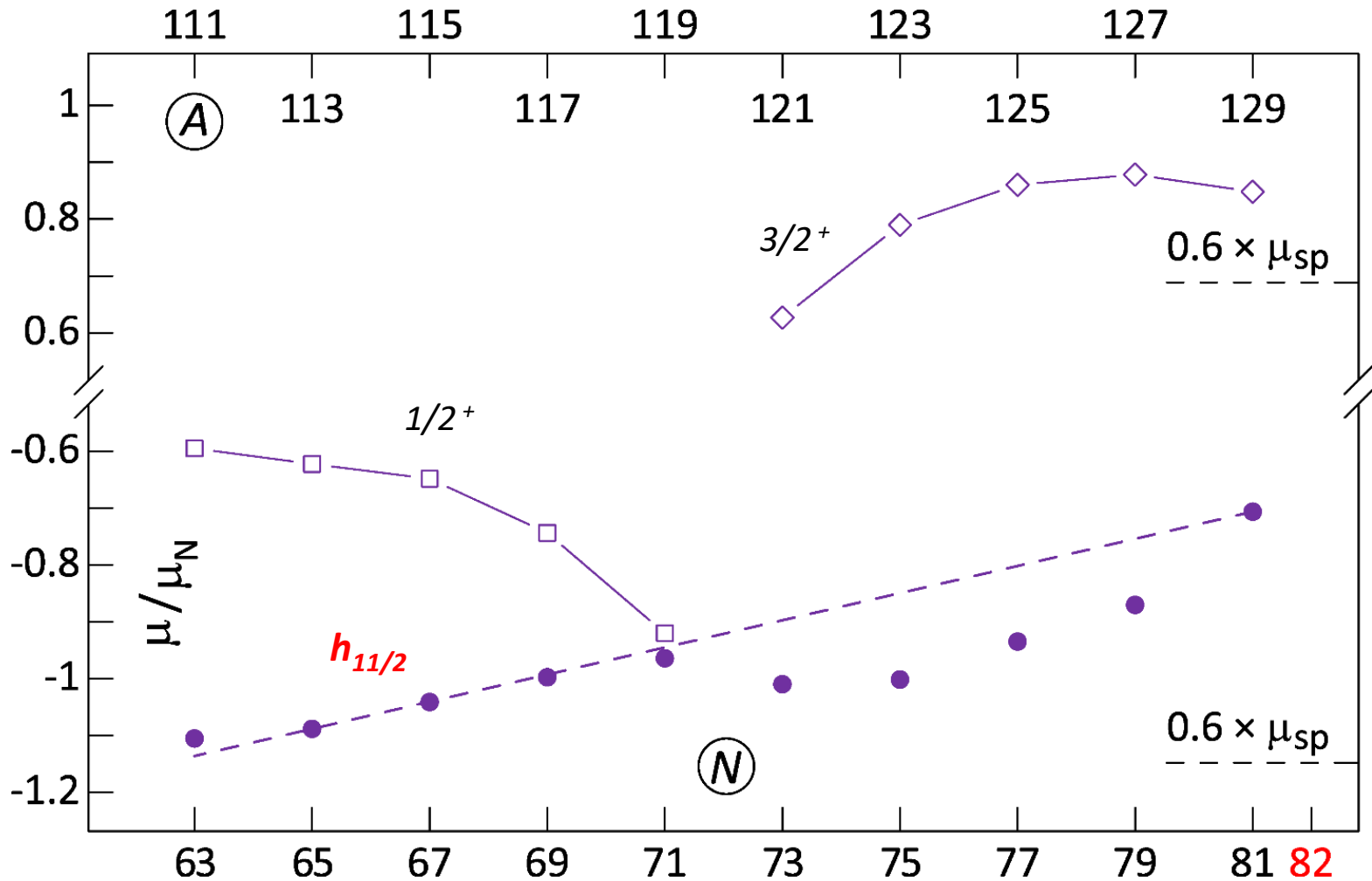
Commissioning and online work foreseen for 2017-2018



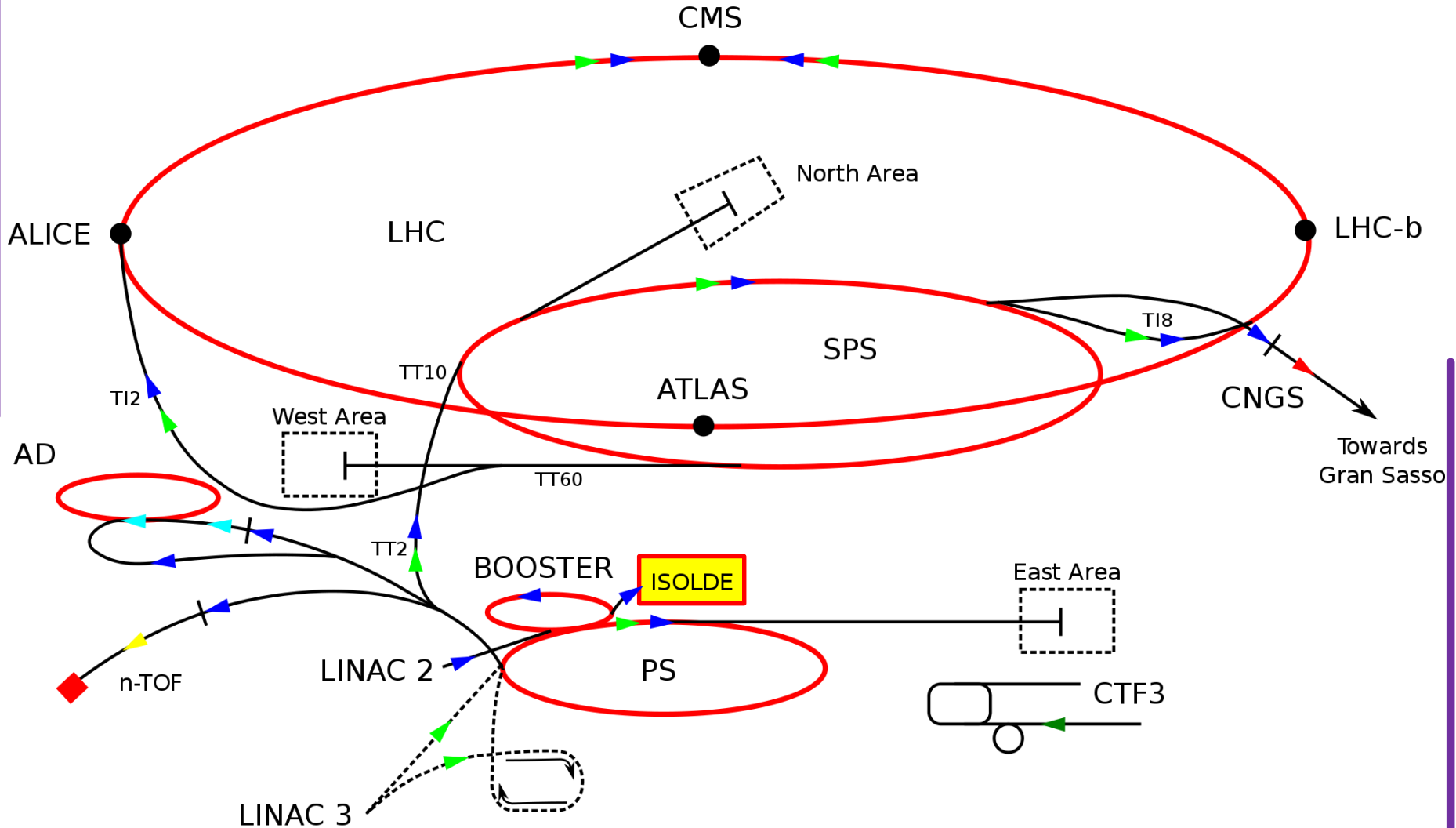
Charge radii across $N = 82$



Magnetic moments of the $11/2^-$ states



CERN accelerator complex



ISOLDE

REX Isolde

RILIS

HRS

p_x

ISCOOL

GPS

COLLAPS

