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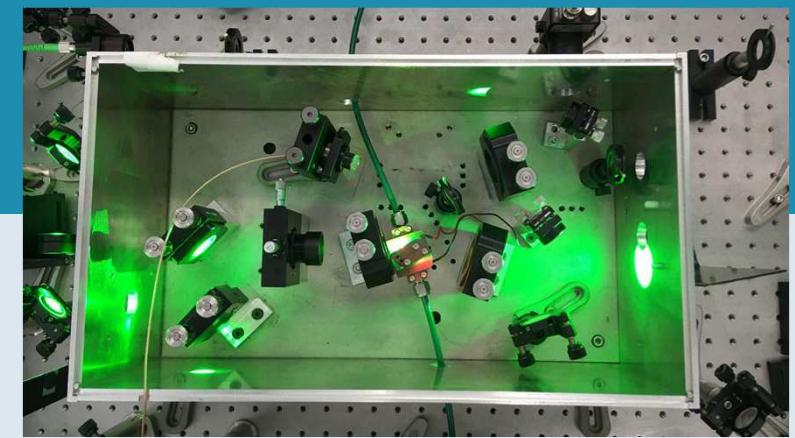
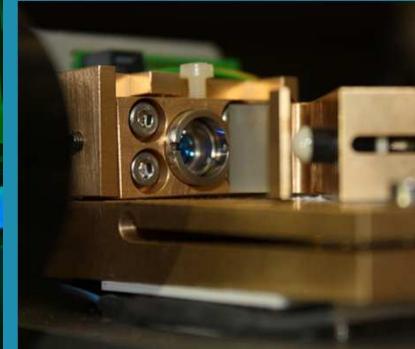
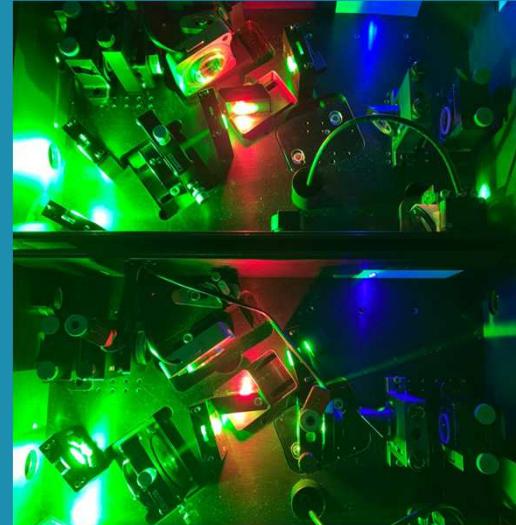
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# RIS measurements of stable erbium and tin at GISELE laboratory

ISOLFrance 2022 Workshop

Jekabs Romans

10/03/2022



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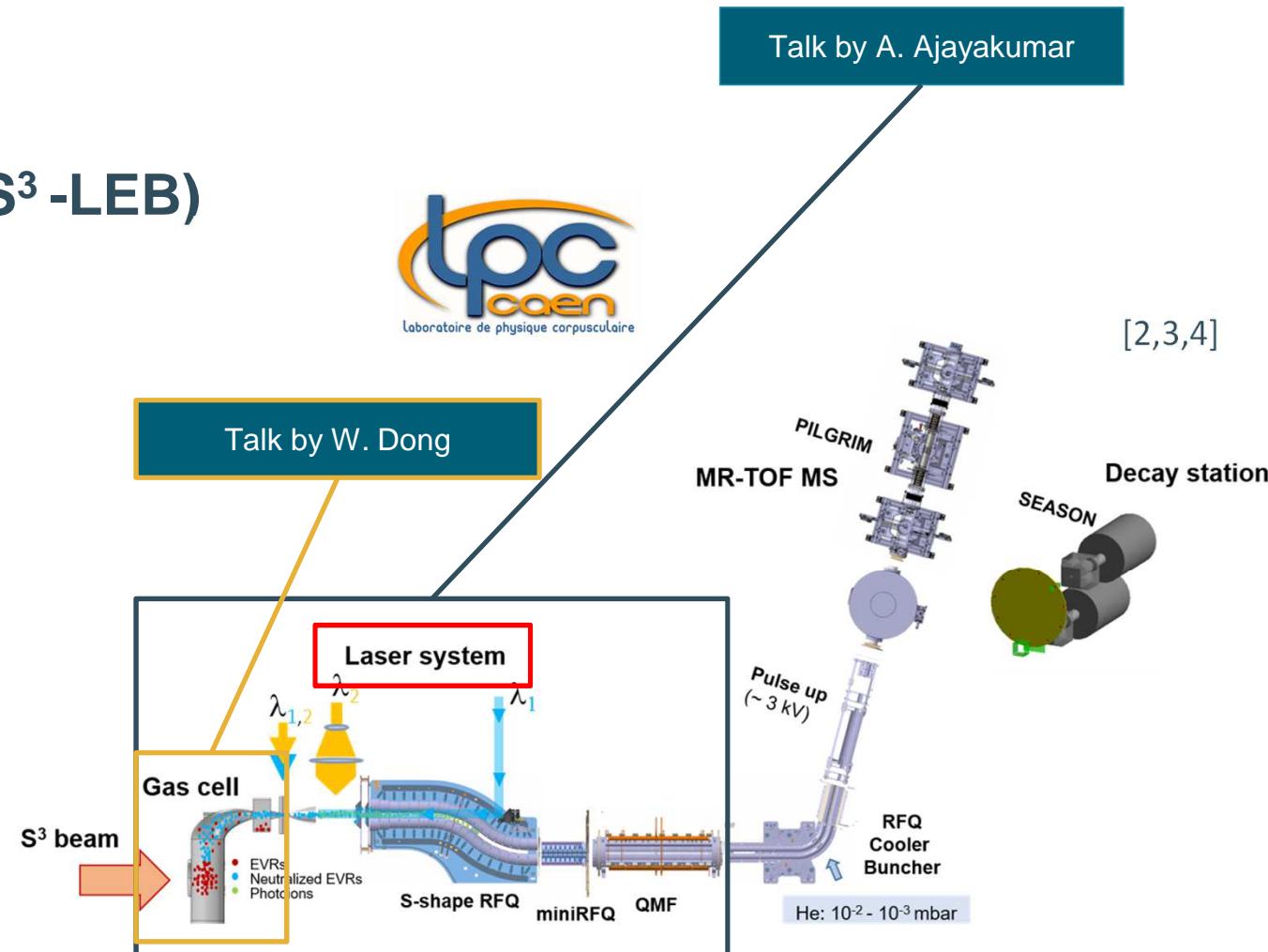
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# Motivation

Talk by A. Ajayakumar

## S<sup>3</sup> – Low Energy Branch (S<sup>3</sup> -LEB)

- Development of **laser system** for resonant ionization spectroscopy (RIS) is crucial part of S<sup>3</sup>-LEB commissioning



[2] R. Ferrer et al. Nucl. Instrum. Meth. Phys. Res. B 317 (Dec. 2013), pp. 570-581. doi: 10.1016/J.NIMB.2013.07.028

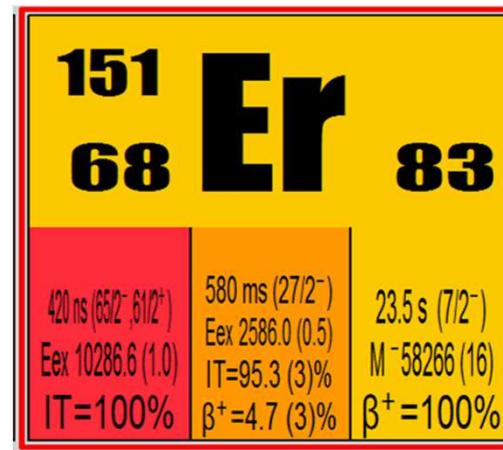
[3] N. Lecesne. S<sup>3</sup> Workshop talk (June 2018)

[4] J. Romans et al. Atoms, 10, 21 (Feb 2022). doi:10.3390/atoms10010021

# Motivation (Er I RIS)

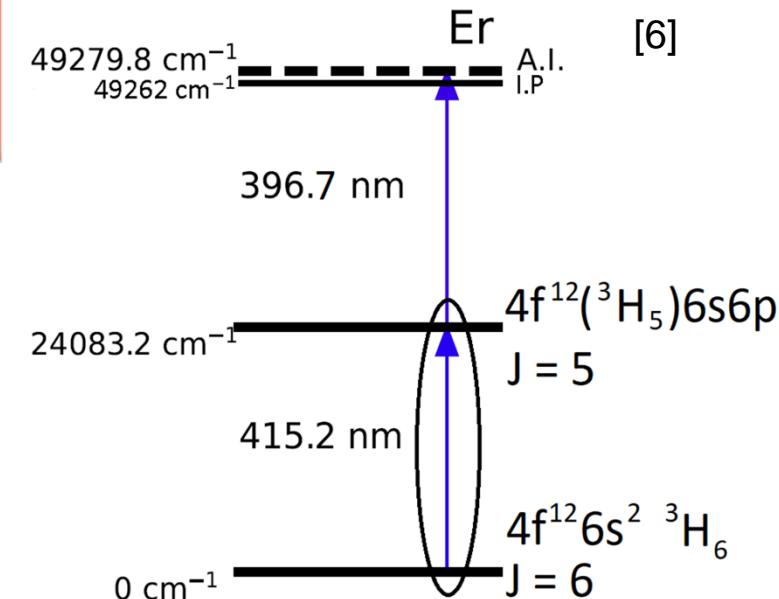
$^{151}\text{Er}$

- Sufficient expected **production rates** during the commissioning run of  $^{152}\text{Er}$
- One step closer to proton drip line and  $N = 82$  shell closure
- High **nuclear spin**
- **State lifetimes** compatible with S<sup>3</sup>-LEB
- Existing **RIS schemes** of very high efficiency



4.9 MeV/nucl  $^{40}\text{Ar} + ^{116}\text{Sn} \rightarrow ^{151}\text{Er} + + 5\text{n}$   
1E+14 pps

A	Rate/pps	[5]
TOTAL	2,11E+6	
$^{152}\text{Er}$	1,12E+03	
$^{151}\text{Er}$	3,99E+04	



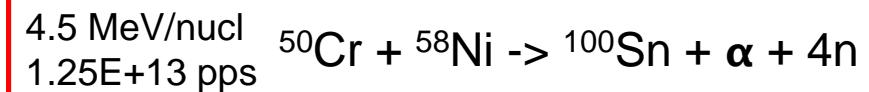
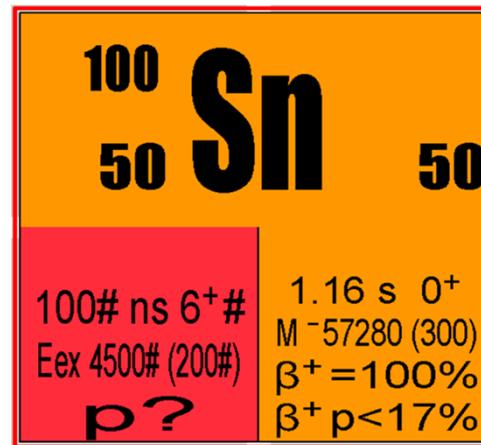
[5] H. Savajols. Expected Day-one experiment productions (2019)

[6] D. Studer. PhD thesis. Johannes Gutenberg-Universitaet Mainz (2015)

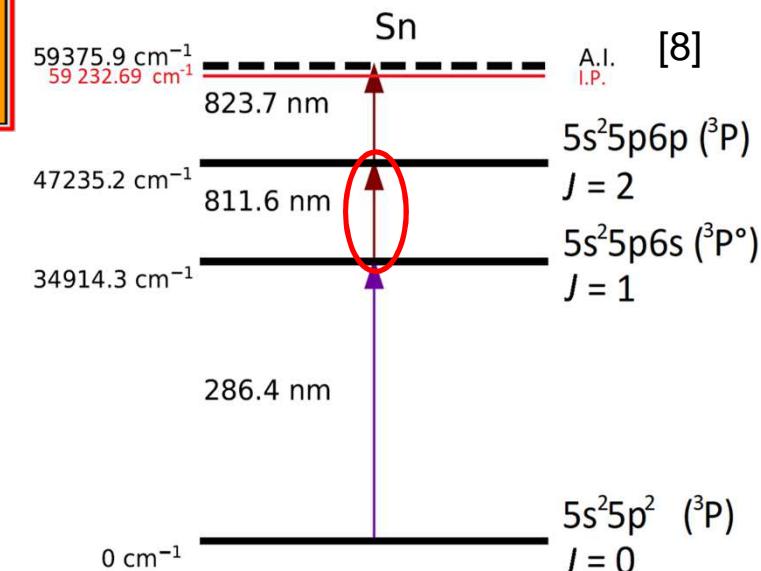
# Motivation (Sn I RIS)

$^{100}\text{Sn}$

- Double shell-closure at  $N = 50$  and  $Z = 50$
- Ground-state lifetime is compatible with S<sup>3</sup>-LEB setup
- Existing **RIS schemes** of very high efficiency



A	Rate/pps	[1]
$^{101}\text{Sn}$	6.7E+00	
$^{100}\text{Sn}$	4.6E-01	

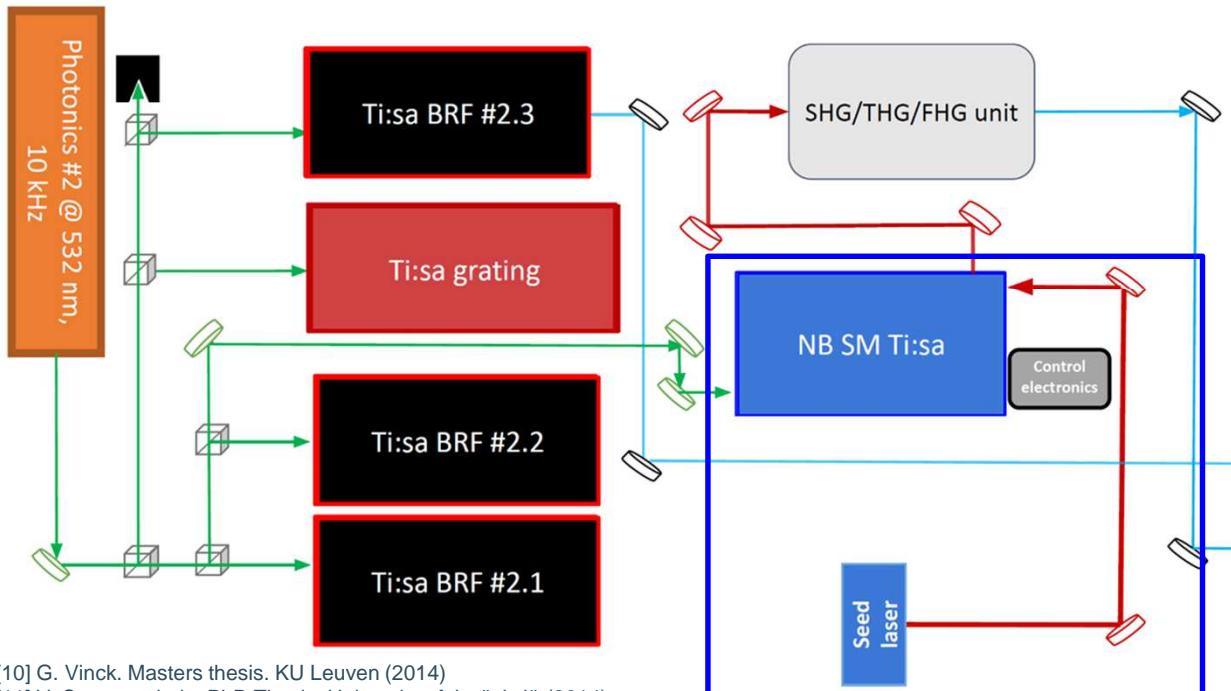


[8] RILIS DB. URL: <https://riliselements.web.cern.ch/index.php>

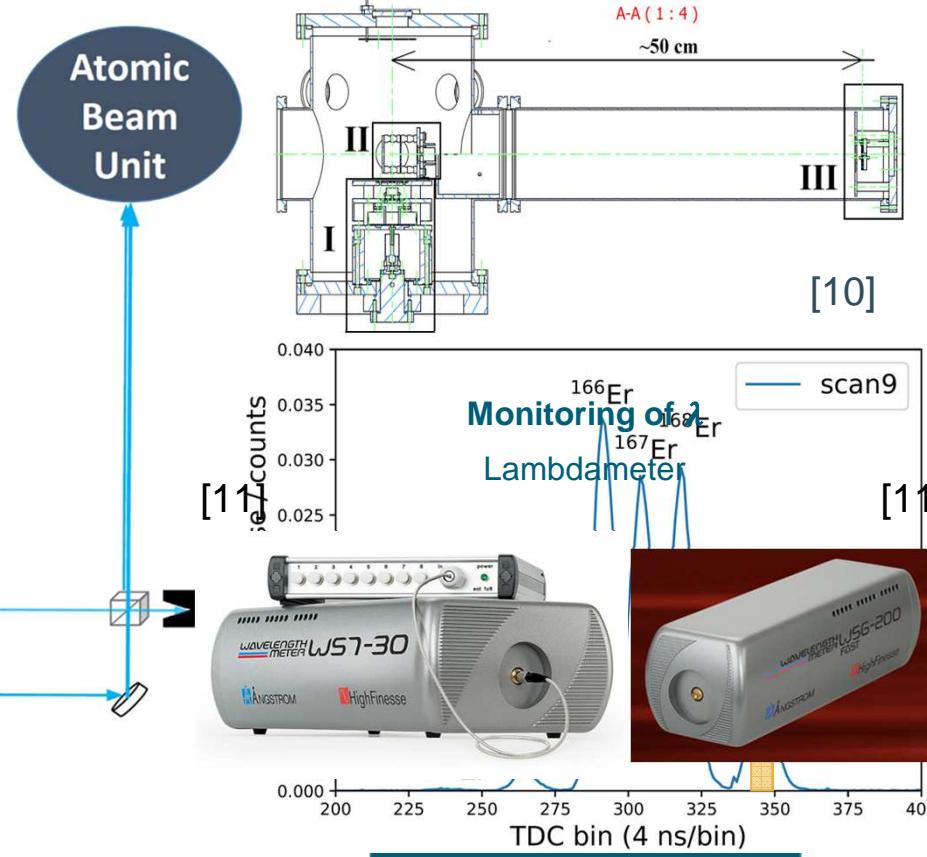
# GISELE offline laser laboratory

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- Novelty - Narrow-bandwidth Ti:sa laser system ( $\Delta\lambda < 50 \text{ MHz}$ ) [11]



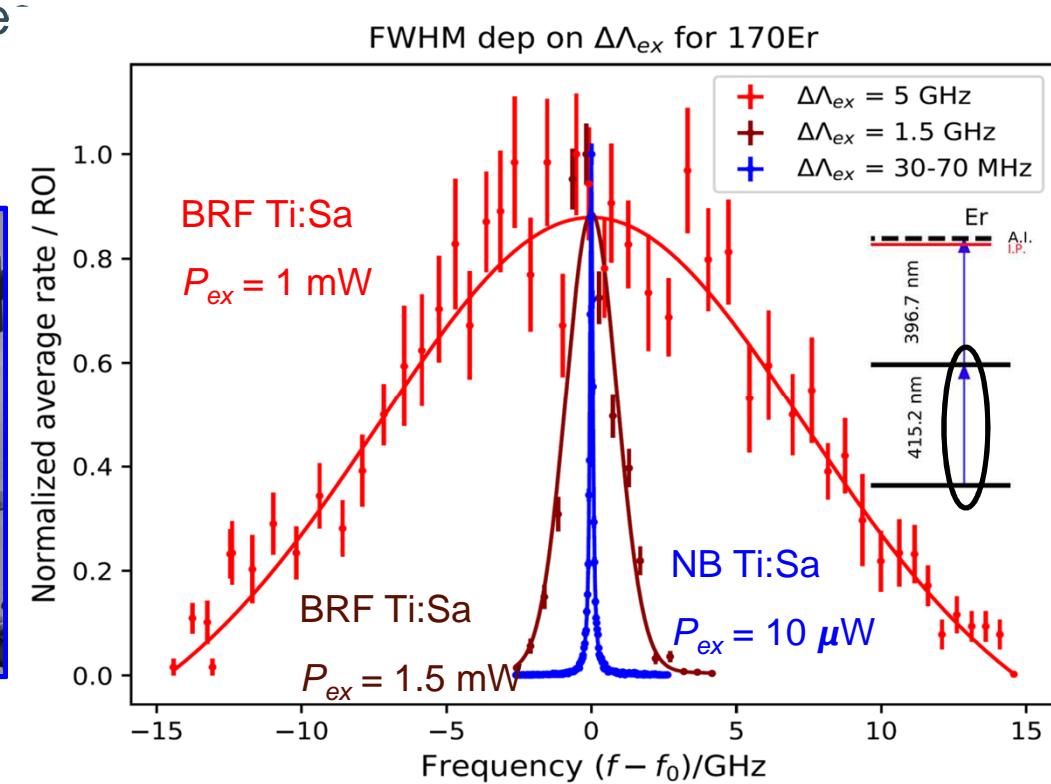
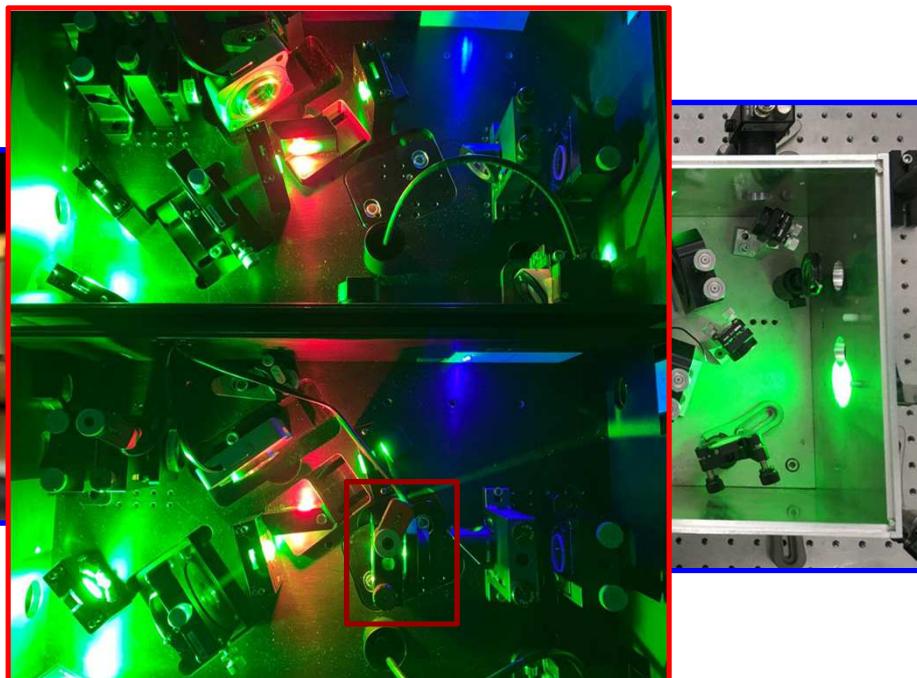
[10] G. Vinck. Masters thesis. KU Leuven (2014)  
[11] V. Sonnenschein. PhD Thesis. University of Jyväskylä (2014)  
[12] HighFinesse. URL: <https://www.highfinesse.com/en/>



# Results (Development)

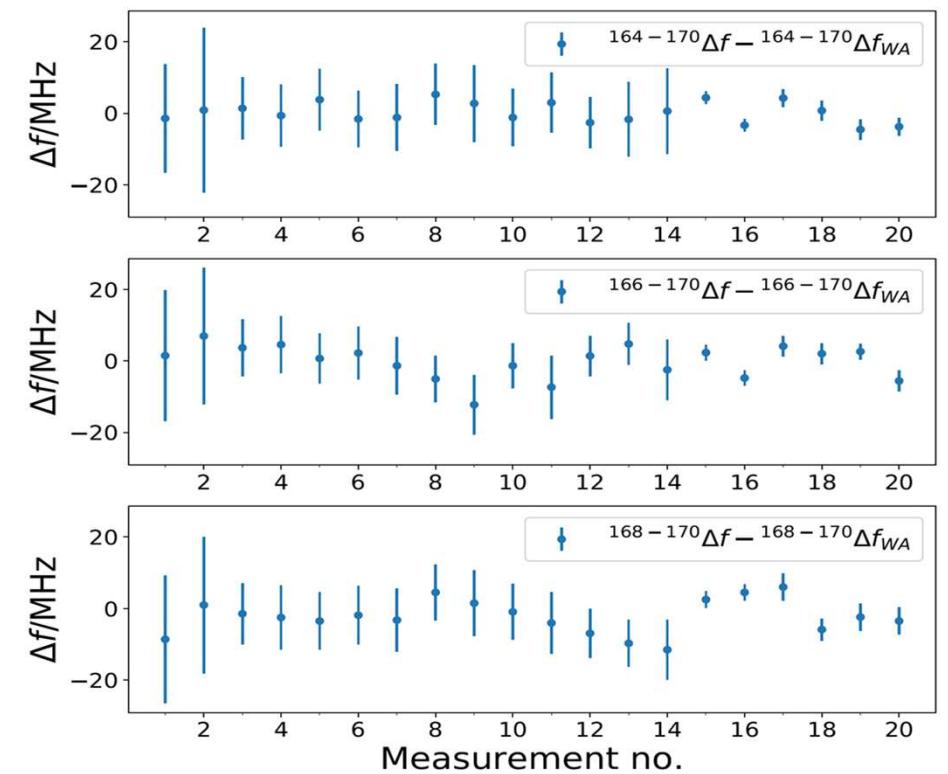
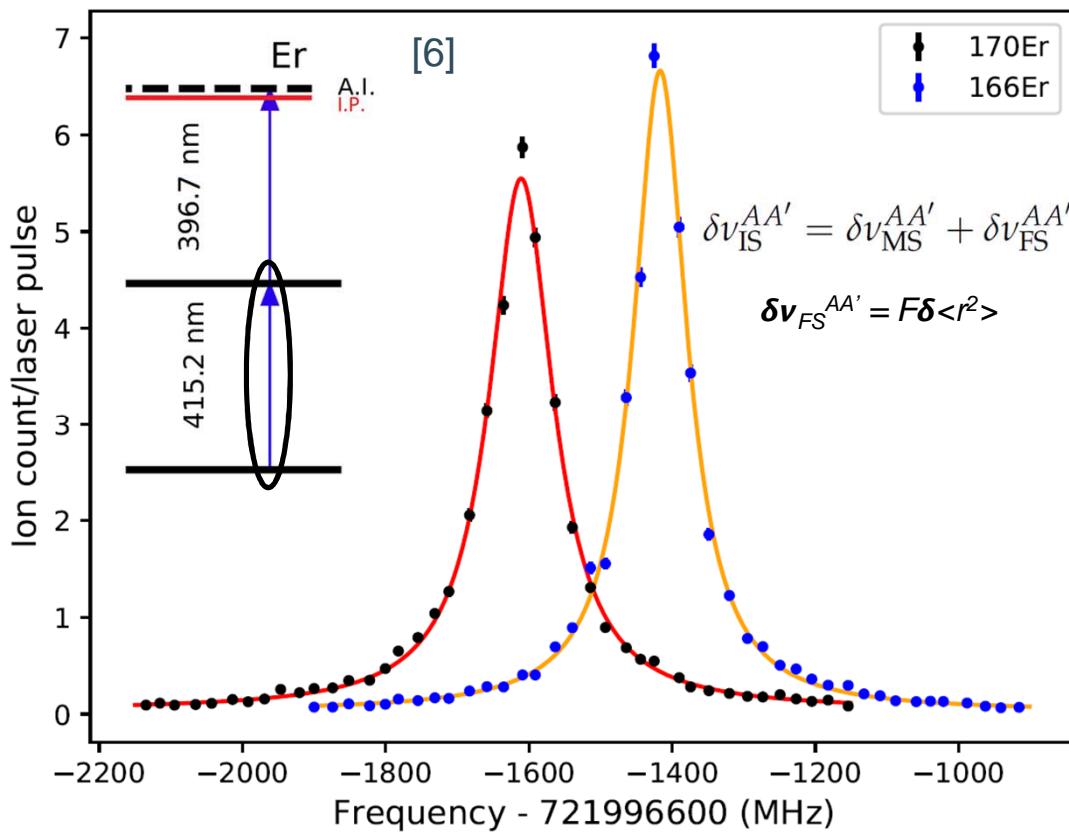
## Minimization of $\Delta\lambda$

- Hyperfine structure resolving capabilities



# Results (Er I RIS)

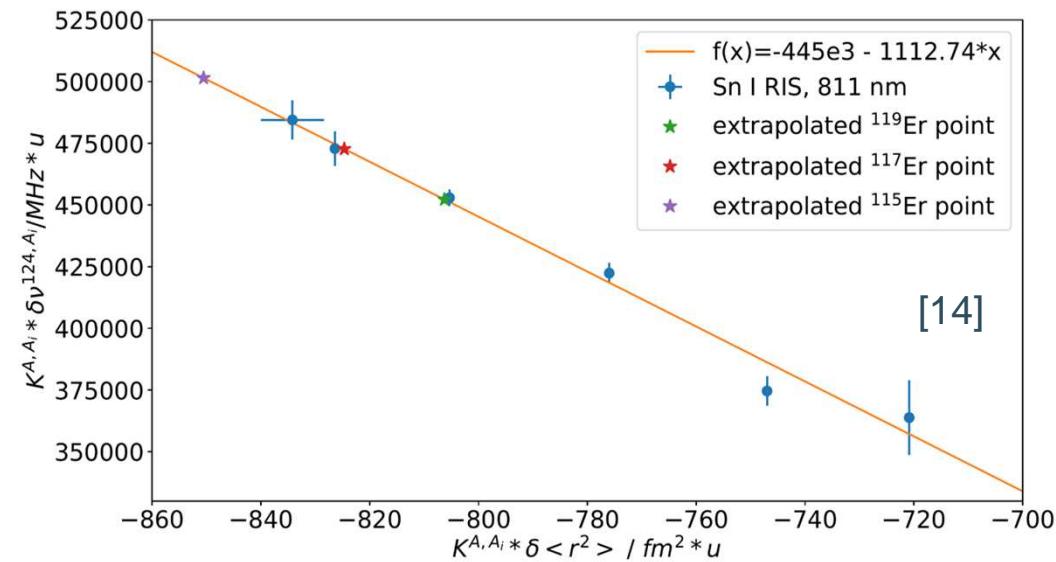
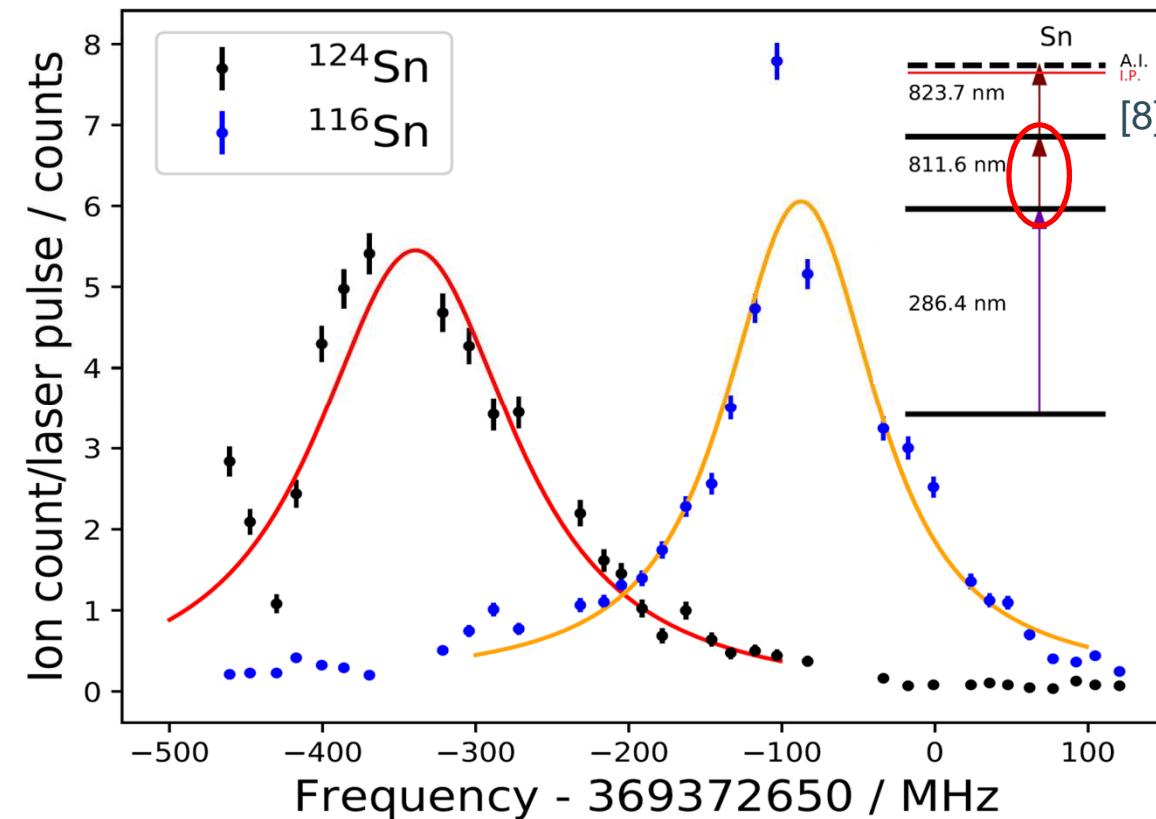
## Even-even $^{164,166,168-170}\text{Er}$ IS





# Results (Sn I RIS)

Even-even  $^{112,114,116,118,120,122-124}\text{Sn}$  IS



[14] I. Angelis & K. P. Marinova. At. Data Nucl. Data Tables 99.1 (2013)



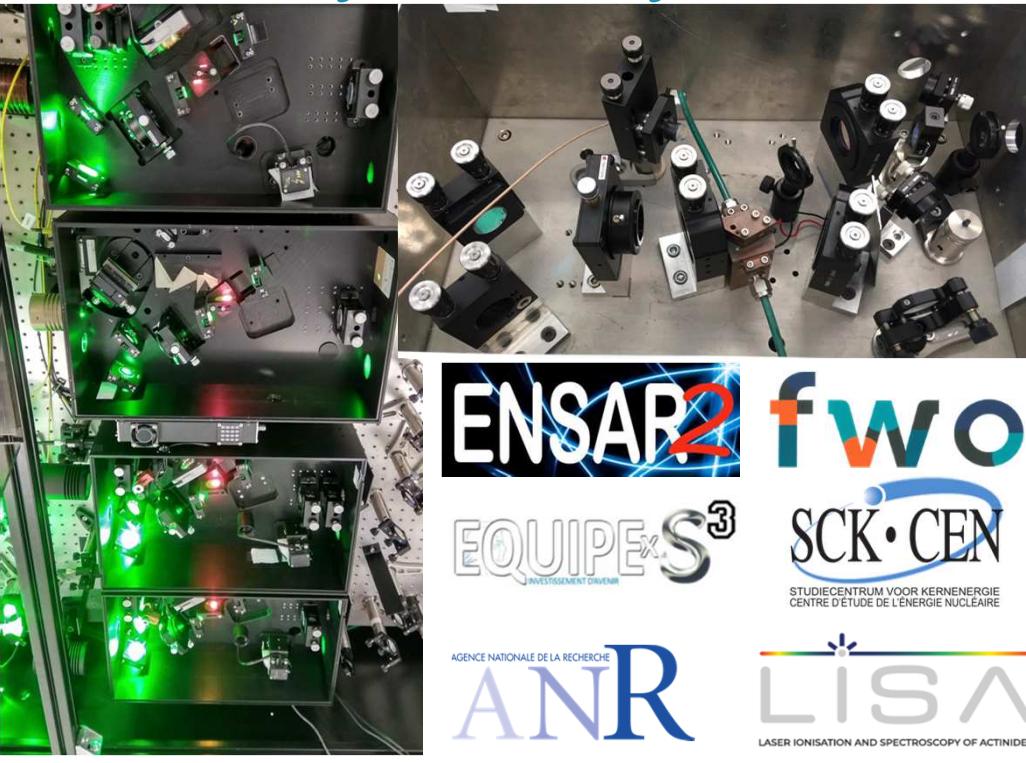
# Conclusions & outlook

- Laser system has been successfully developed for Day1 experiments of Er I and is currently developed for Sn I RIS in high resolution capabilities
- First ions in gas cell (A. Ajayakumar's talk)
- 2<sup>nd</sup> NB Ti:sa cavity for S<sup>3</sup>-LEB (A. Ortiz-Cortes work based on D. Studer's design [16])
- Continuous wave seed laser for wide scanning ranges (A. Ajayakumar, based on V. Sonnenschein's design [17])
- Day1 isotopes: laser scheme developments and optimisations (Pd, Th, Ac, Zr, ...)

[16] Larissa. URL: <https://www.larissa.physik.uni-mainz.de/>

[17] Sonnenschein, V., Tomita, H., Kotaro, K. et al. *Hyperfine Interact* **241**, 32 (2020). <https://doi.org/10.1007/s10751-020-1706-4>

# Thank you for your attention!



## Acknowledgements

### GANIL:

Anjali Ajayakumar; Dieter Ackermann; Lucia Caceres; Samuel Damoy; Pierre Delahaye; Patrice Gangnant; Nathalie Lecesne; Thierry Lefrou; Renan Leroy; Franck Lutton; Alejandro Ortiz;

Benoit Osmond; Julien Piot; Blaise-Maël Retailleau; Hervé Savajols; Gilles Sénécal

### LPC:

Frédéric Boumard; Jean-François Cam; Philippe Desrues; Xavier Fléchard; Julien Lory ; Yvan Merrer ; Christophe Vandamme

### IJC Lab:

Patricia Duchesne; Serge Franchoo; Vladimir Manea; Olivier Pochon

### KU Leuven:

Arno Claessens; Rafael Ferrer; Mark Huyse; Sandro Kraemer ; Yuri Kudriavtsev; Vaila Leask;

Jekabs Romans; Paul Van Denbergh; Piet Van Duppen; Matthias Verlinde ; Elise Verstraelen

### JGU:

Sebastian Raeder; Dominik Studer; Klaus Wendt

### JYU:

Ruben de Groote; Iain David Moore; Michael Reponen; Juha Uusitalo

### IPHC:

Emil Traykov

### IRFU:

Martial Authier; Olivier Cloue; Antoine Drouard; Thomas Goigoux; Emmanuel Rey-Herme; Marine Vandebrouck