

First laser measurements on radioactive beams using ISCOOL

A summary of tests made on 02-15 Nov 2007



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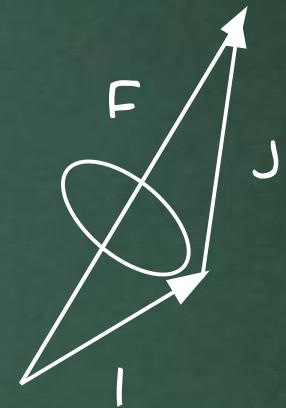
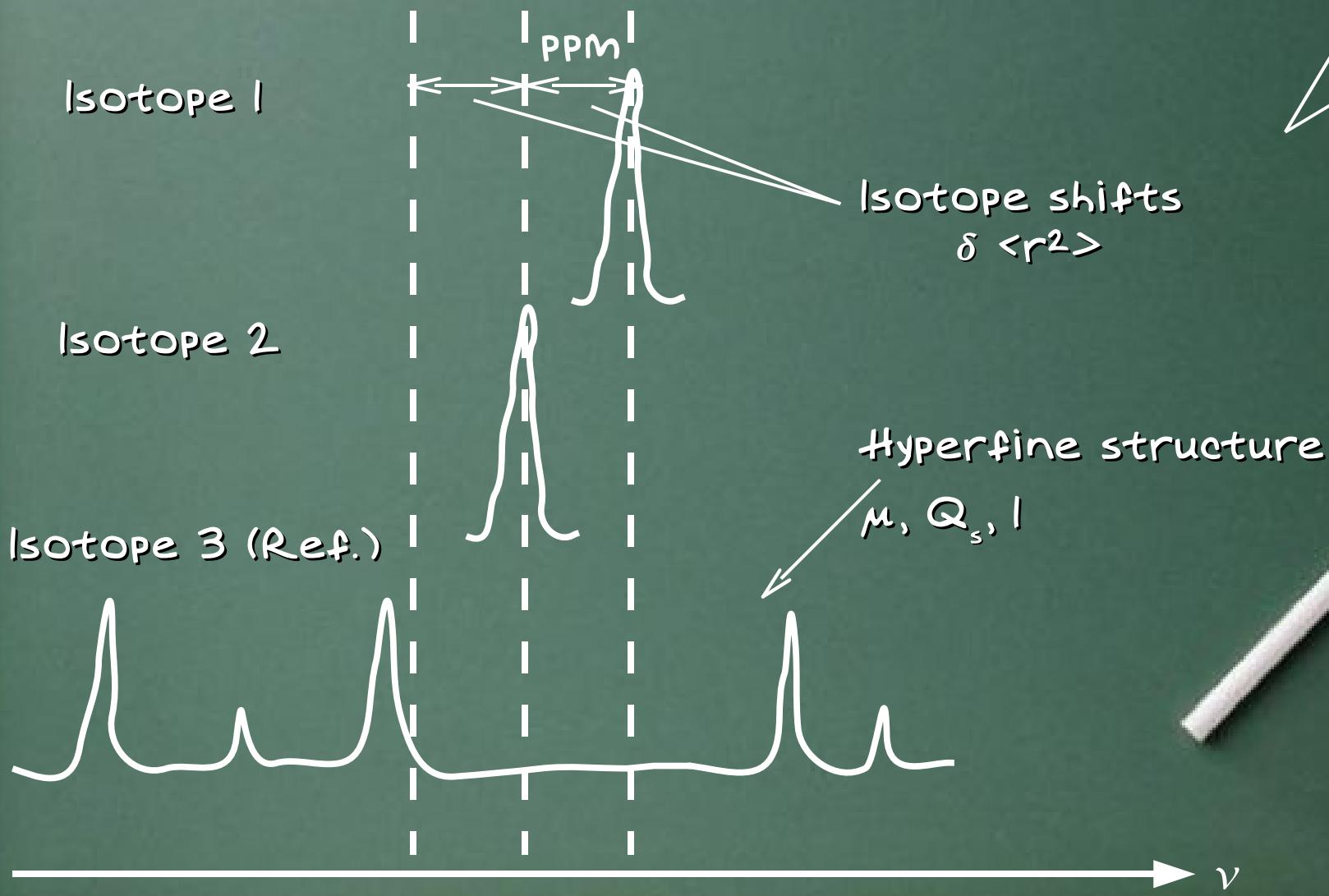
Motivation

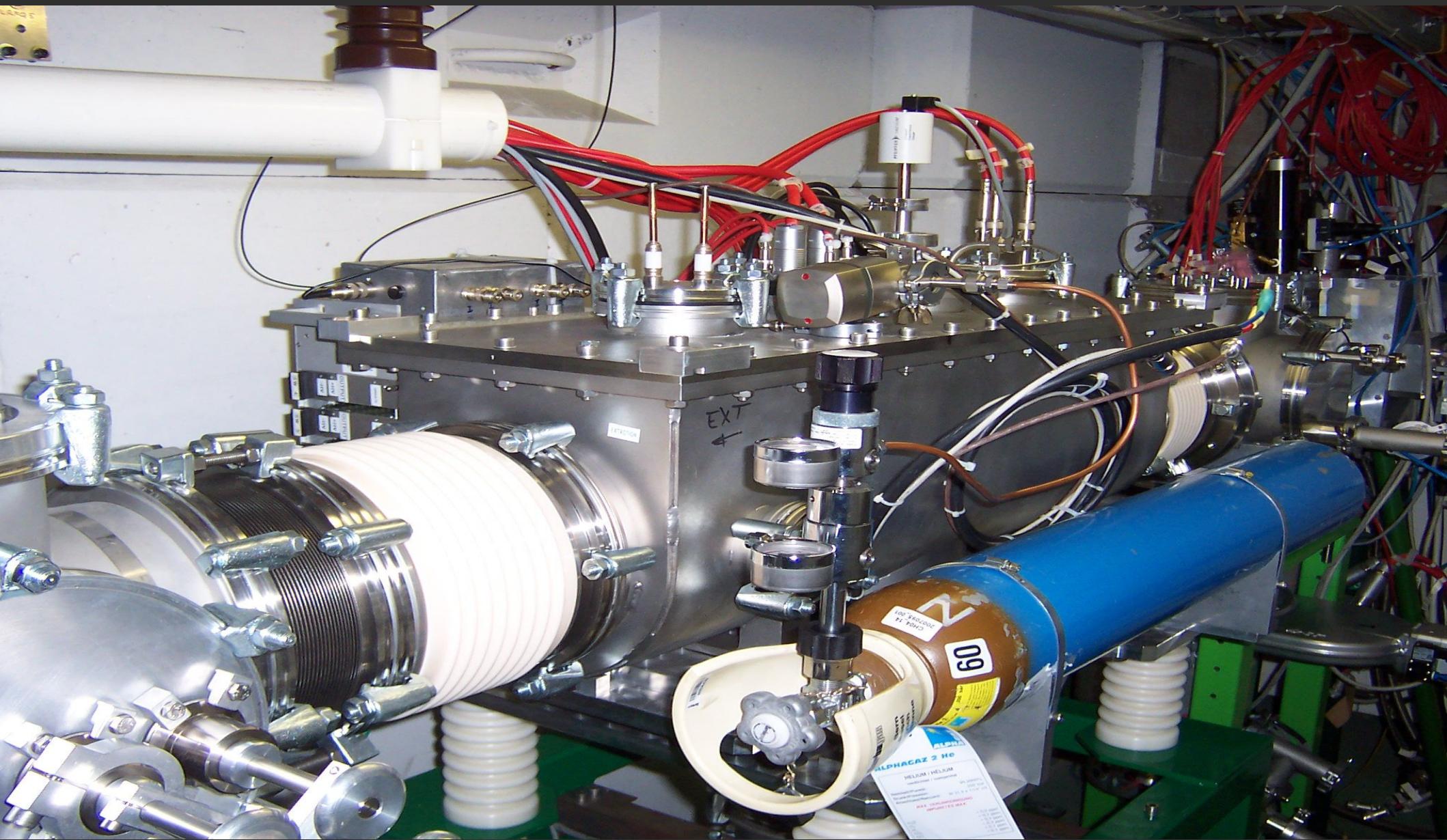
Collinear laser spectroscopy constitutes a unique diagnostic tool for ISCOOL, because

- It measures the ions/atoms on resonance, ruling out contributions from molecular beams;
- It measures the “true” bunch width and energy spread after reacceleration;
- It is possible to estimate the beam emittance and HV;

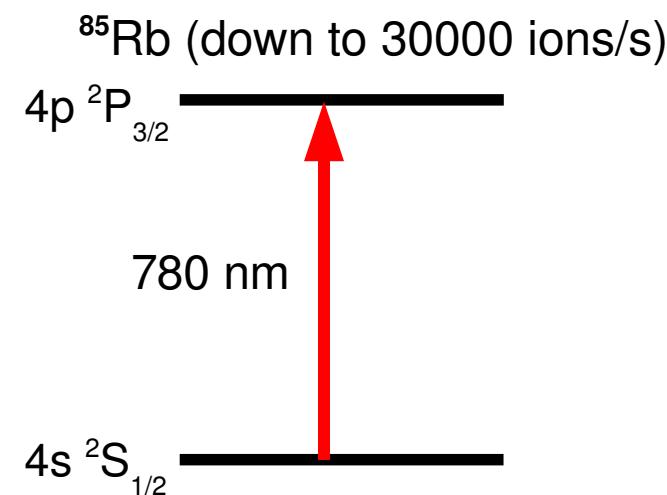
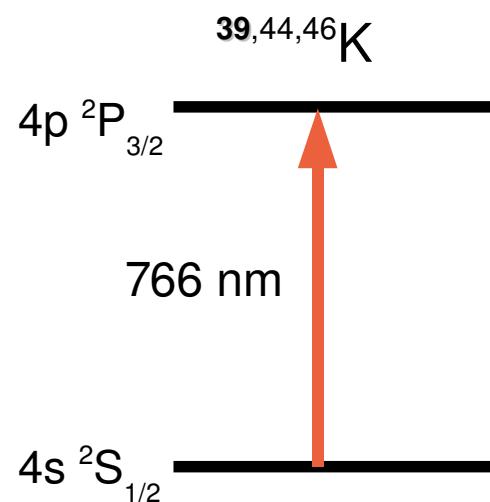
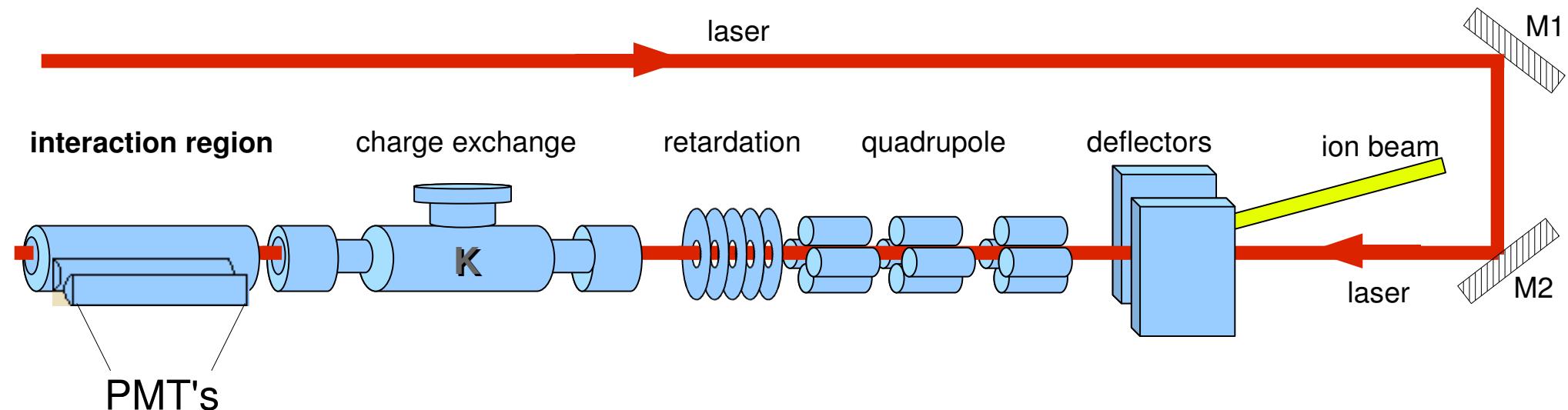
These information can be obtained from the optical spectra

Optical Spectra

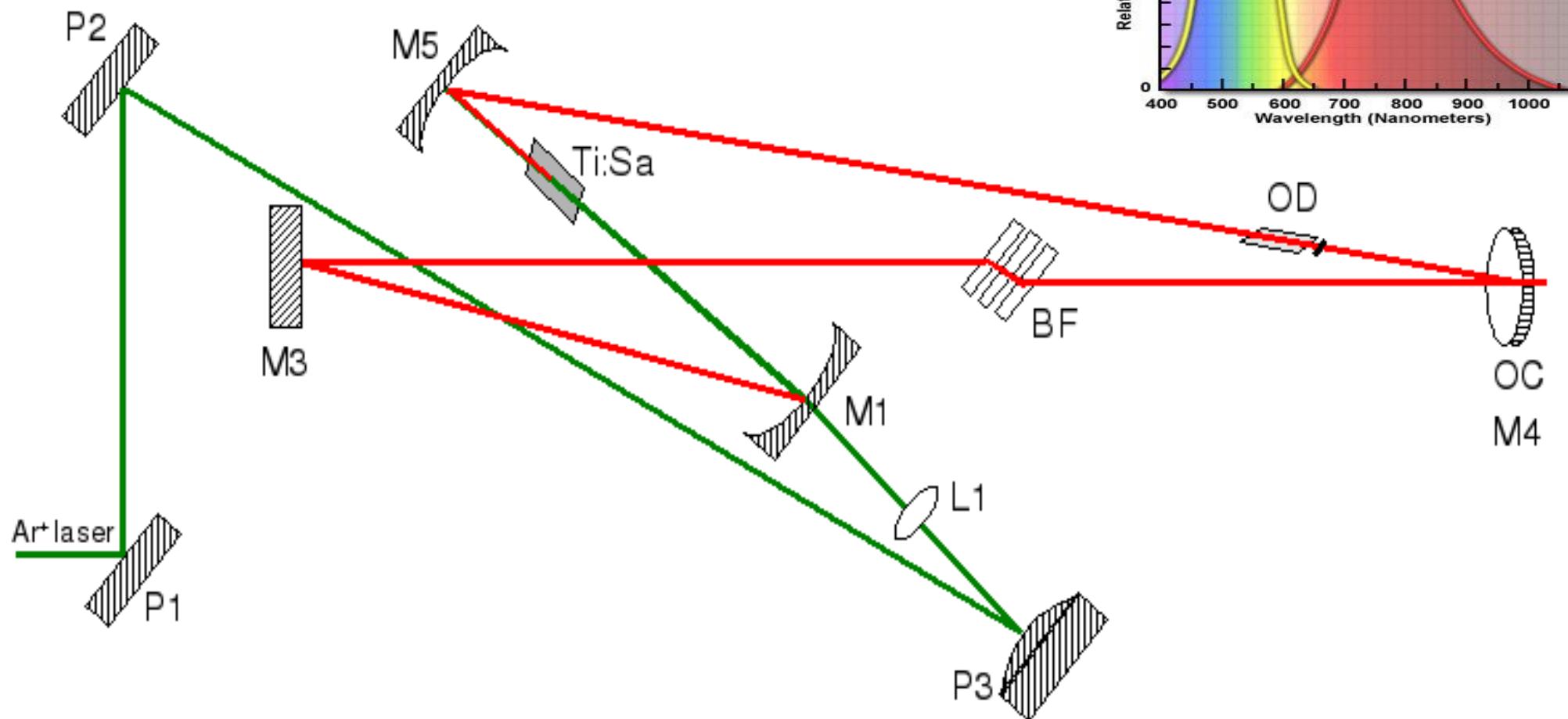




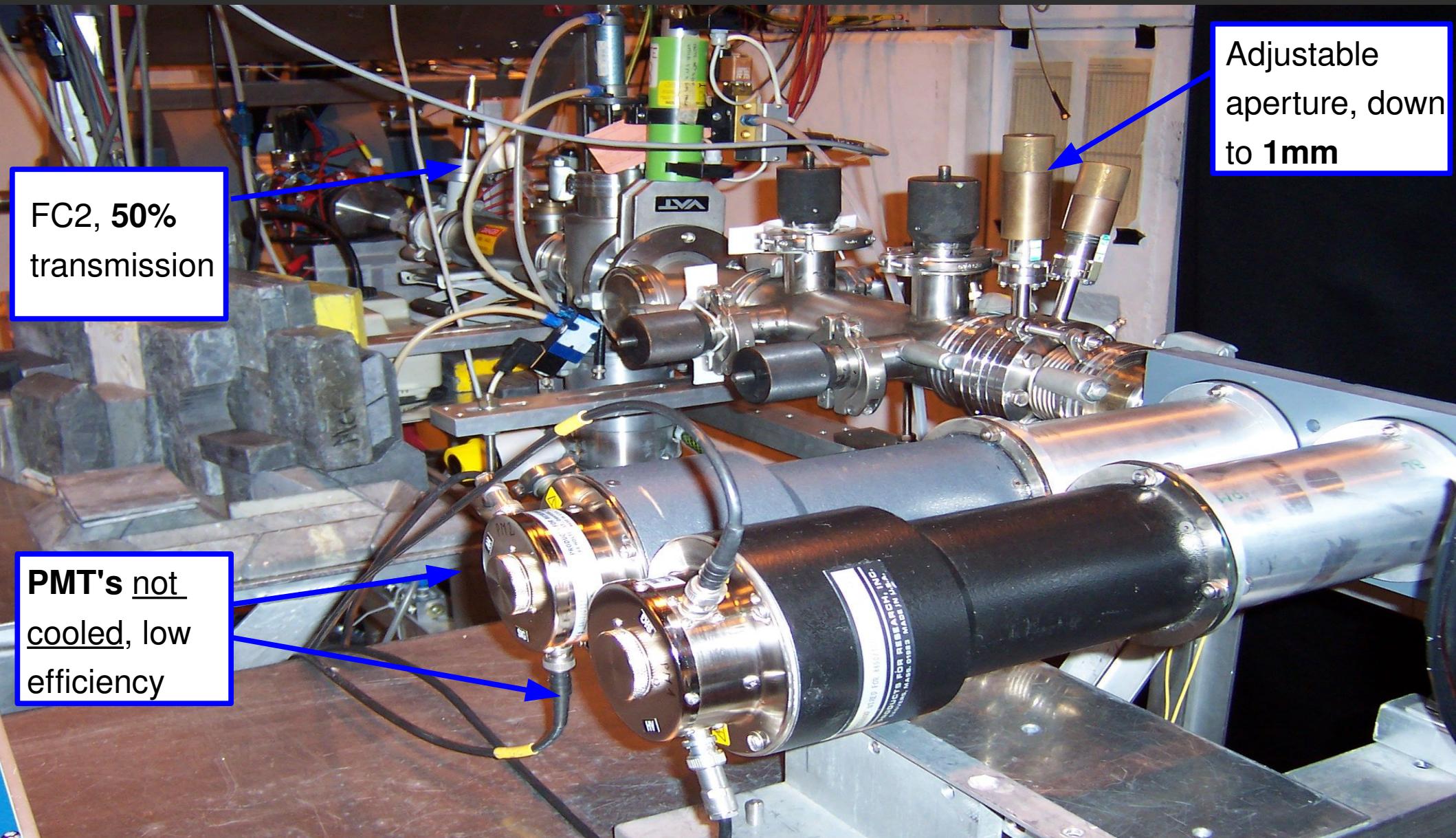
Collinear laser spectroscopy of $^{39,44,46}\text{K}$ and ^{85}Rb



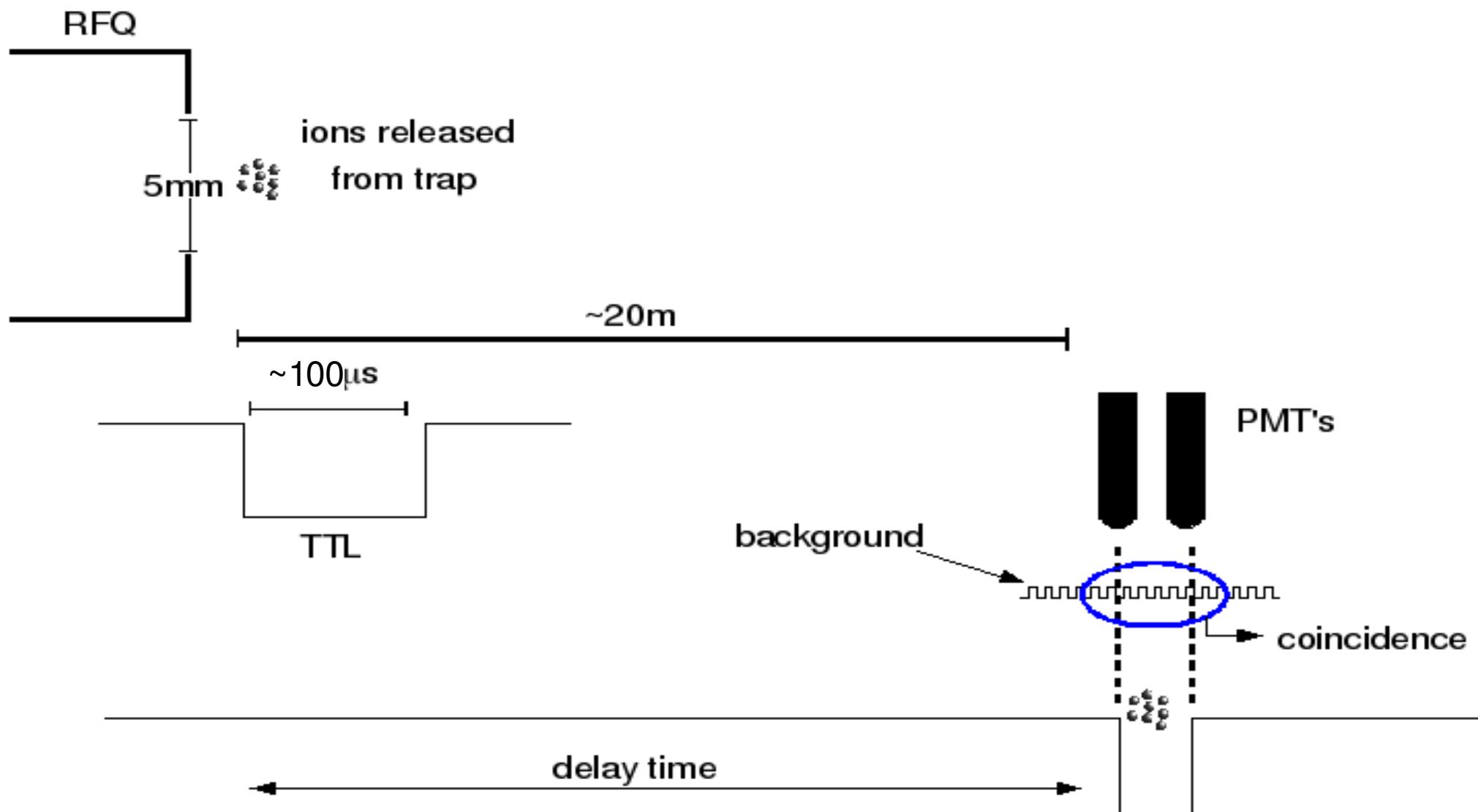
The laser system



The COLLAPS line

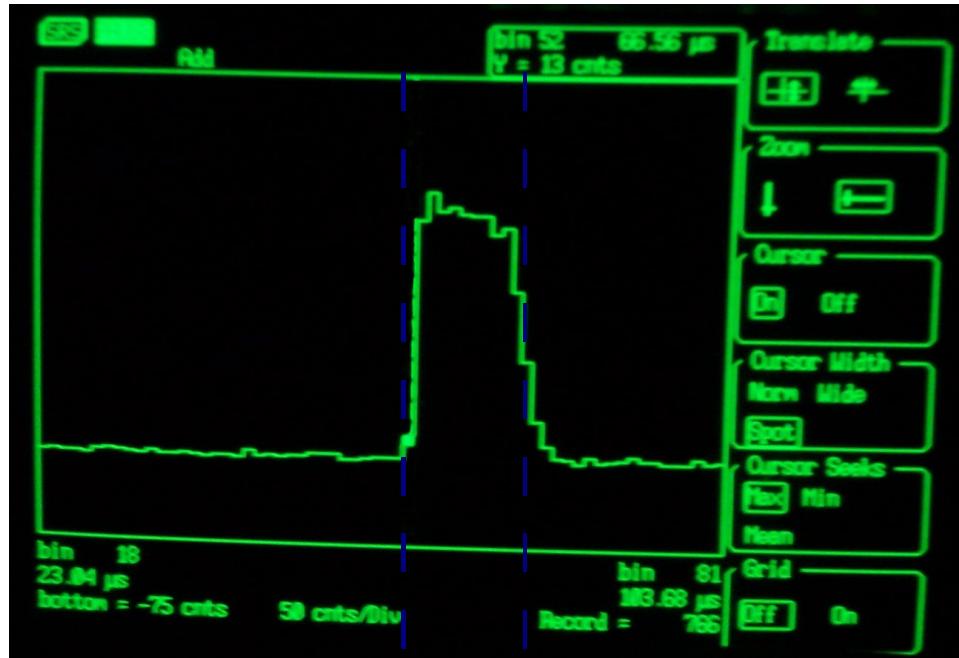


Timing of signals



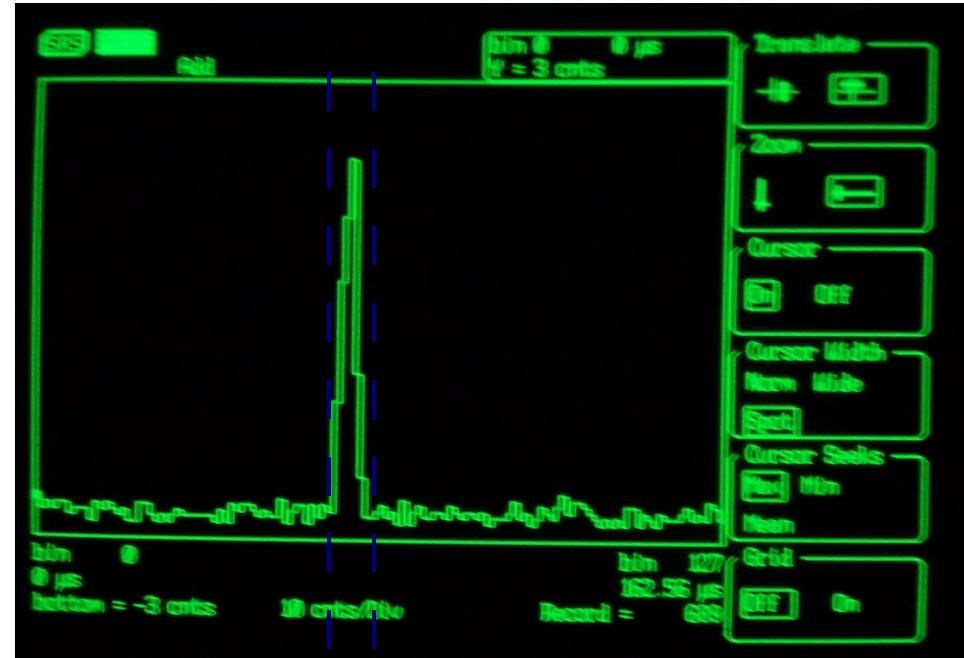
Diagnostics: Bunch width

^{85}Rb released in 100ms bunches



2pA (16mm offset)

17 μs



(25mm offset)

7 μs (FWHM ~ 5 μs)

- Laser on resonance, counting photons as a function of time after trap opens
- Fixed HV, fluke and scanning voltages
- Picture on the right has a reduced ion flux

Diagnostics: Estimate of High Voltage

HV : Nominal value: **29.997 kV**

Laser data:

HV (kV)	Centroid ^{44}K (MHz)	Centroid ^{46}K (MHz)	$\delta\nu^{44-46}$ (MHz)
30.147	947.57 ± 1.82	1204.7 ± 3.83	257.12 ± 4.24
30.097	1310.86 ± 1.82	1552.44 ± 3.86	241.58 ± 4.27
30.047	1674.41 ± 1.81	1900.42 ± 3.89	226.01 ± 4.29
29.997	2038.17 ± 1.83	2248.71 ± 3.94	210.54 ± 4.34
29.947	2402.28 ± 1.81	2597.12 ± 3.95	194.84 ± 4.34

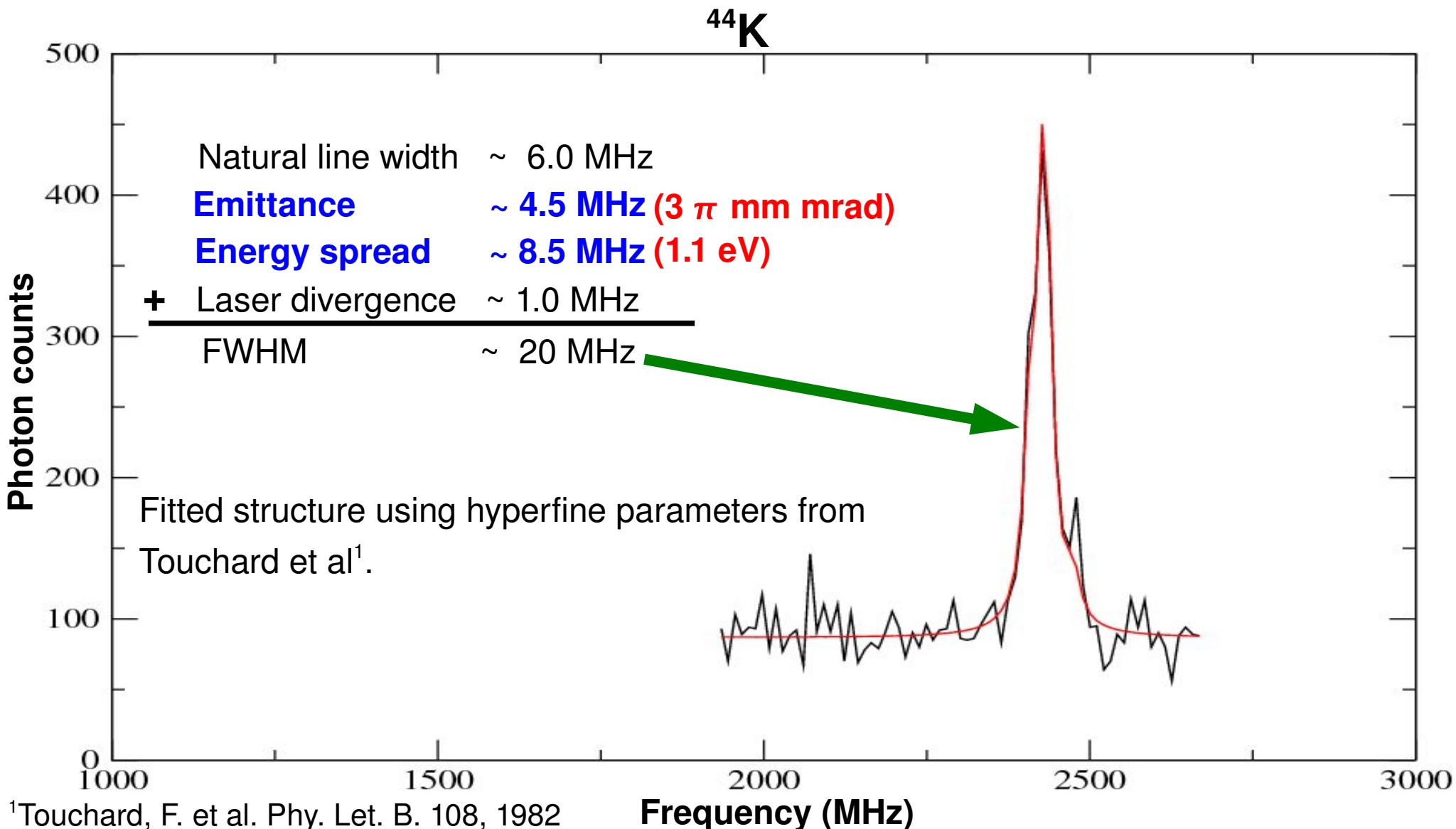
Comparing the IS data with the value found in the literature¹

$$\delta\nu^{44-46} = 198.5(2) \text{ MHz}$$

One can say the cooler voltage corresponds to its nominal value with **0.1%** accuracy

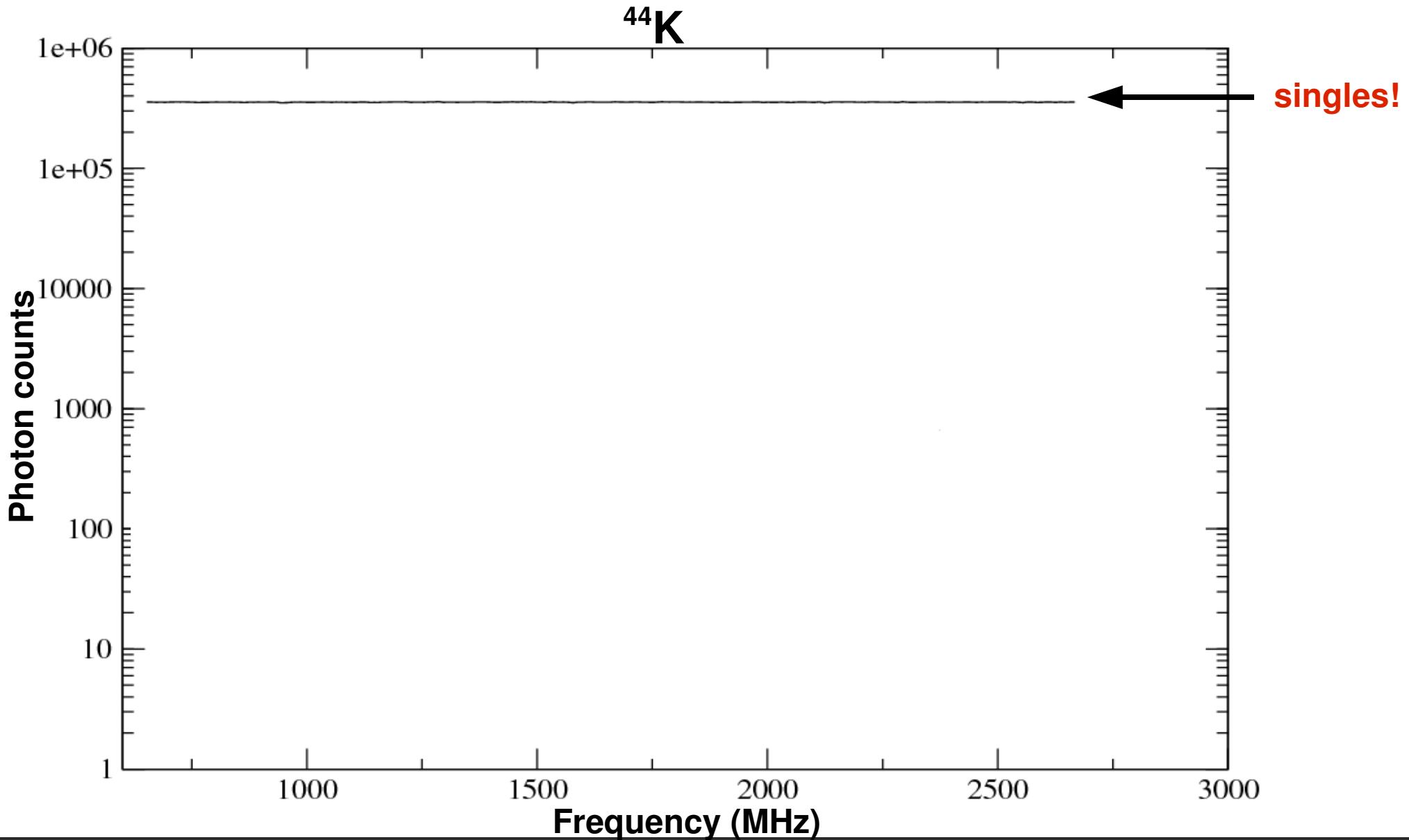
¹Touchard, F. et al. Phy. Let. B. 108, 1982

Diagnostics: Emittance & Energy spread

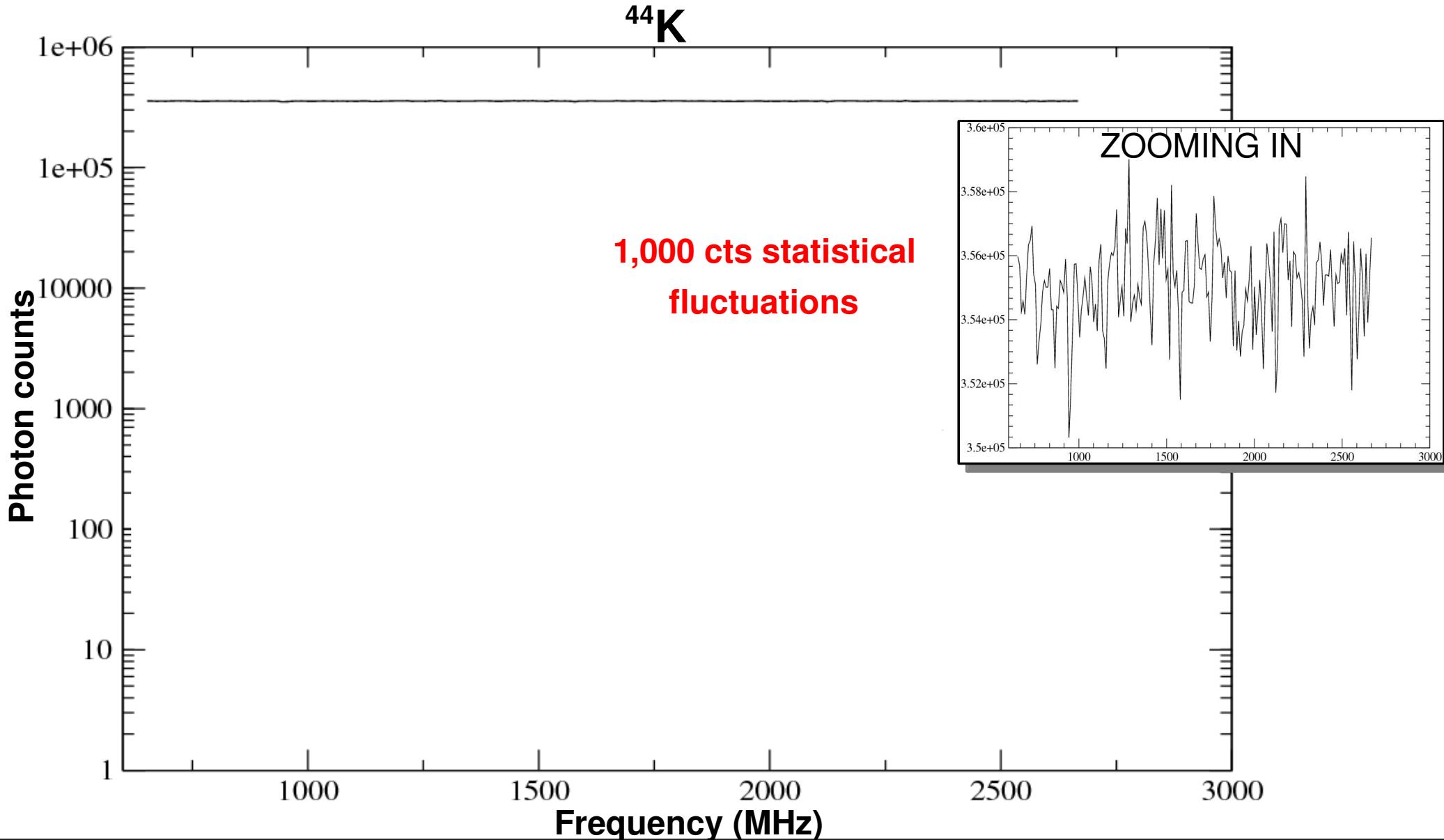


¹Touchard, F. et al. Phys. Let. B. 108, 1982

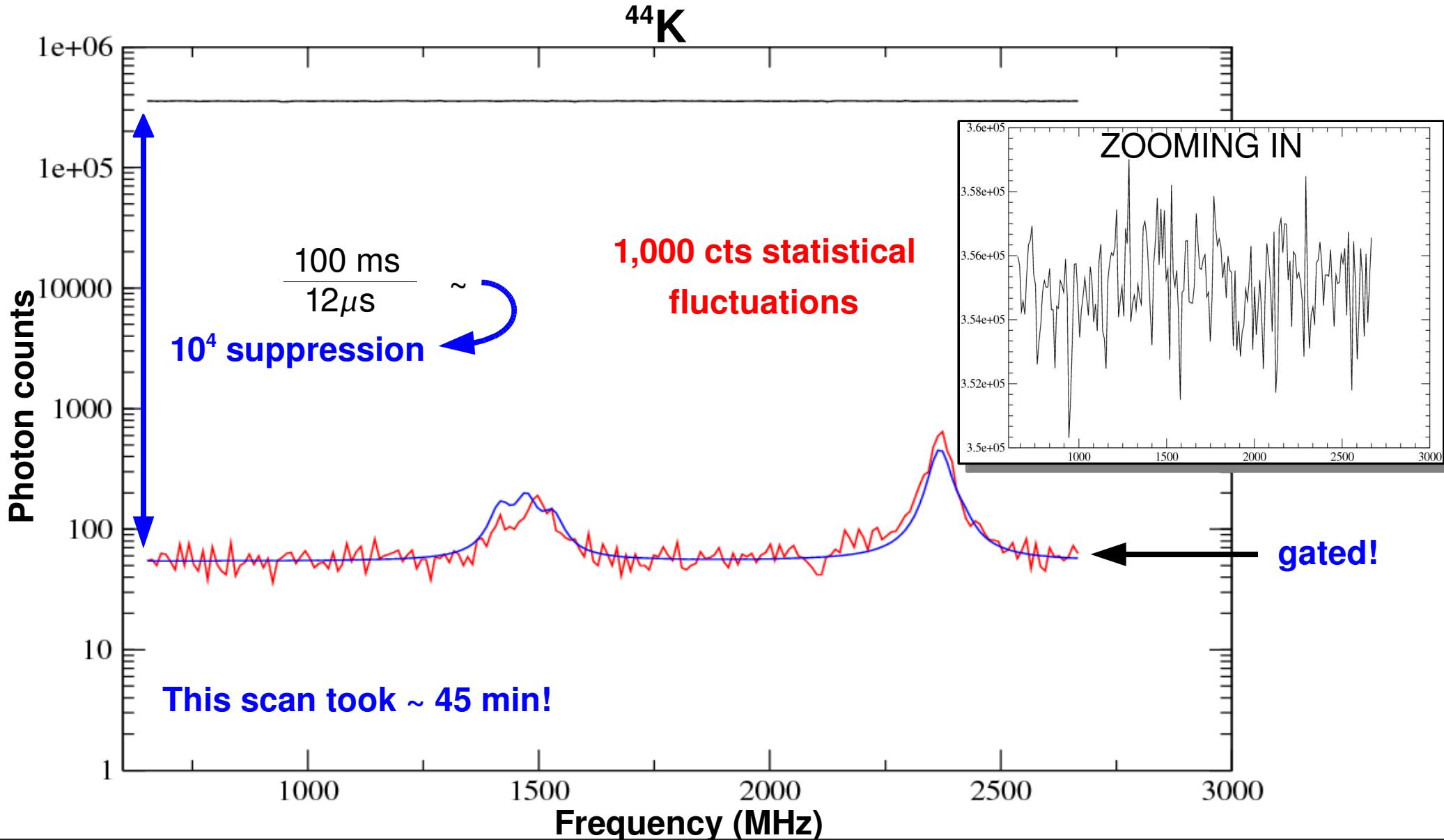
Bunched-beam laser spectroscopy: ^{44}K



Bunched-beam laser spectroscopy: ^{44}K

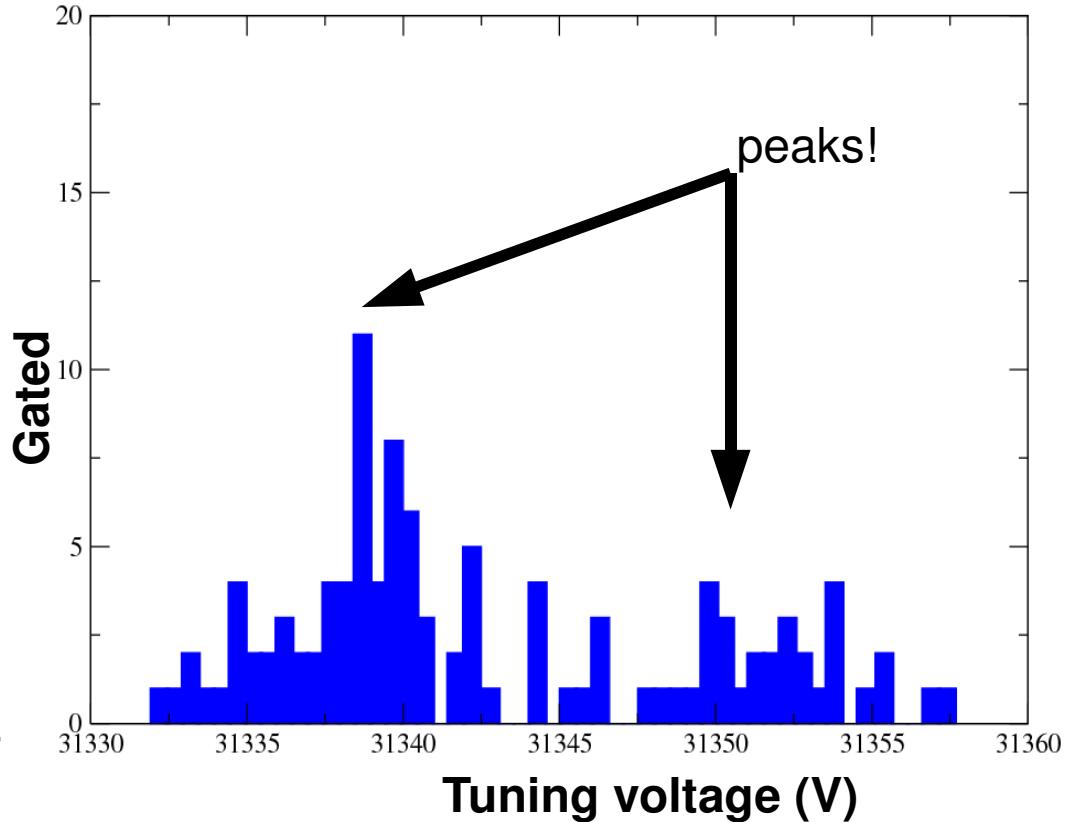
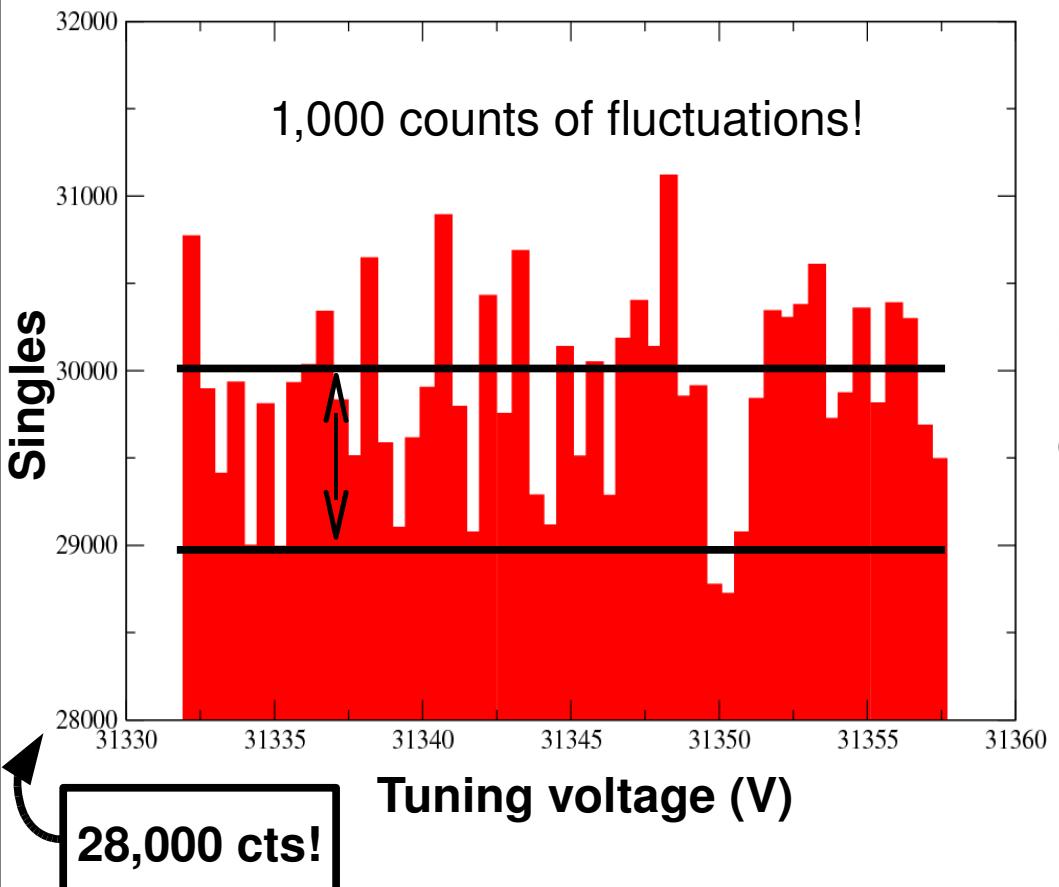


Bunched-beam laser spectroscopy: ^{44}K



Bunched-beam laser spectroscopy: ^{85}Rb

PMT's cooled with chiller unit, reduced dark counts to 150 counts/s



73 scans * 18 ch * 0.3 dwell time = **18 min**
with 30 000 ions/s

Prognosis



- Bunch widths of $\sim 10\mu\text{s}$
- Energy spread $\sim 1\text{eV}$
- Background suppression $\sim 10^4$

Comments:

The laser measurements of beams coming from ISCOOL confirms the device is in good shape. We are looking forward to the next online period.

The collaboration

- The University of Manchester, UK

J. Billowes, P. Campbell, B. Cheal, E. Mané



- Universität Mainz, Germany

R. Neugart, D. Yordanov

- GSI, Germany

W. Noertershaeuser, K. Blaum, C. Geppert

- IKS, KU Leuven, Belgium

K.T. Flanagan, G. Neyens, P. Vingerhoets



- The University of Birmingham, UK

D.H. Forest, G. Tungate

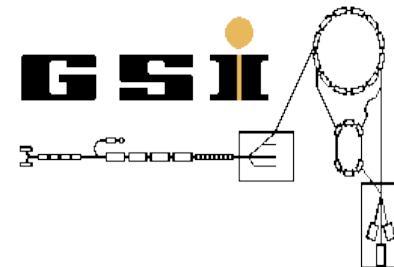


- University of Jyväskylä, Finland

A. Jokinen, I.D. Moore, J. Äystö

- VSM, KU Leuven, Belgium

P. Lievens



- New York University, USA

H.H. Stroke



- And The ISOLDE collaboration



Acknowledgements

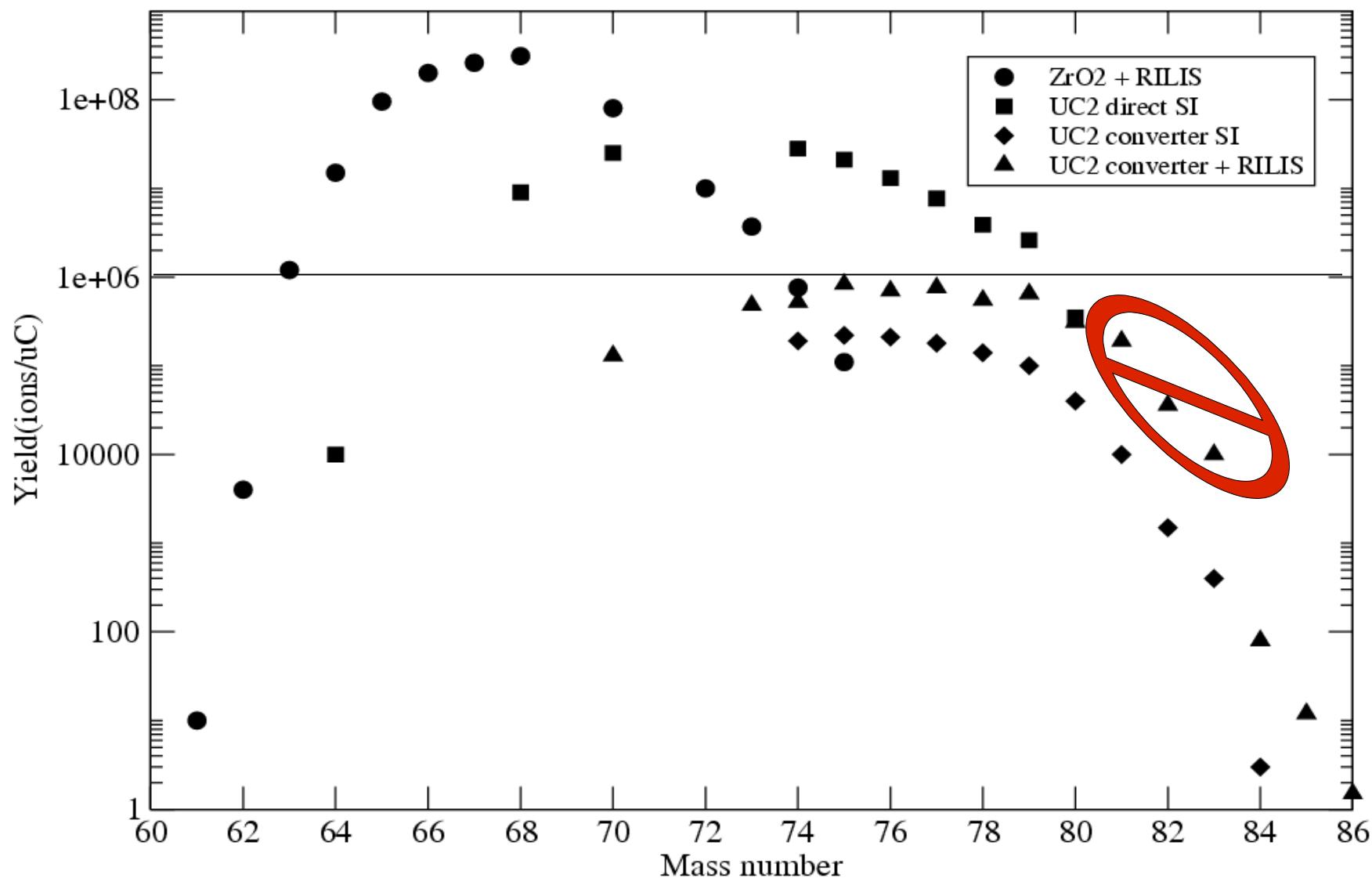
- Erwin Siesling (AB-OP)
- Magnus Erikson (AB-OP)
- Pascal Fernier (AB-OP)
- Jerome Sarret (AB-ATB-IF)
- Ermano Barbero (AB-ATB-IF)
- Julien Parra-Lopez (AB-PO)
- Nicolas David (AB-PO)
- Hannah Franberg (AB-OP)
- Pierre Delahaye (PH-IS)
- Magdalena Kowalska (PH-IS)
- Mats Lindroos (PH-IS)
- Richard Catherall (PH-IS)
- Ivan Podadera (CSIC)
- AB-OP, AT-VAC, AB-PO, TS-CV, TS-EL, SC-RP, AB-ATB, PH-IS



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Thanks for listening

Déjà vu: Gallium proposal revisited



Déjà vu: Gallium proposal revisited

