

100LGE





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# Physics coordinator report: Overview of 2015

Karl Johnston

v2.3 18Aug			
	Info	GPS	HRS
15	6-Apr	Easter	
	7-Apr	protons to ISOLDE	separator course - surf ion source separator course
	8-Apr	7-17h, technical stop no protons	separator course separator course stable beam for RILIS
	9-Apr		SEM-grid on separator course
	10-Apr		SEM-grid test SEM-grid test separator course
	11-Apr		sem-grid test stable beam available
	12-Apr		sem-grid test stable beam available
	16	13-Apr	Target change: nanoC #513, new
14-Apr		separator setup to CA0 sep setup to tape station stable beam to IDS?	SEM-grid test
15-Apr		Hg p-scan yield checks 8B	Target change: mass mark #537: Ca, K
16-Apr		8B, yield checks ISOLDE tape station, LA1	stable beam to COLLAPS
17-Apr		yield checks ISOLDE tape station, LA1	stable beam to COLLAPS
18-Apr		yield checks ISOLDE tape station, LA1, IDS?	stable beam to COLLAPS
19-Apr		yield checks ISOLDE tape station, LA1, IDS?	stable beam to COLLAPS
17	20-Apr	Hg Target change: molten Pb #511, new (as many pulses as poss)	Target change: SIC-Ta #522, new
	21-Apr	separator setup to CA0 sep setup to tape station stable beam to ISOLTRAP, LA1	
	22-Apr	Hg p-scan yield checks physics 1.5	
	23-Apr	Hg, IS598 Hg, Windmill-LA1, MR-TOF 4.5	separator setup to ISCOOL
	24-Apr	Hg, IS598 Hg, Windmill-LA1, MR-TOF 7.5	separator setup to ISCOOL ISCOOL setup
	25-Apr	Hg, IS598 Hg, Windmill-LA1, MR-TOF 10.5	
	26-Apr	Hg, IS598 Hg, Windmill-LA1, MR-TOF 13.5	
	27-Apr	Hg, IS598 Hg, Windmill-LA1, MR-TOF 16.5	
	28-Apr	Hg collections?	Mg separator setup to CA0 sep setup to tape station stable beam to IDS
	29-Apr	from 7h, injector MD to 17h, injector MD	Mg p-scan physics 2 yield checks
		Target change: UC-Ta	

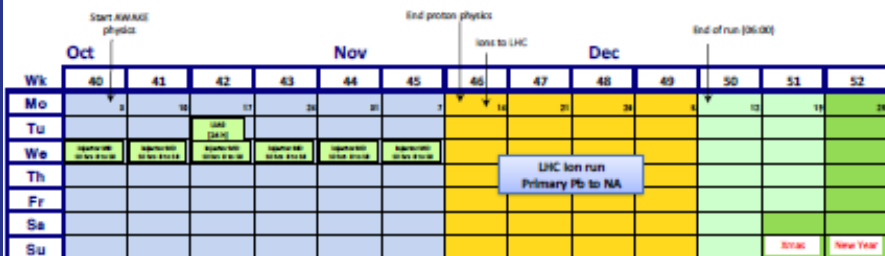
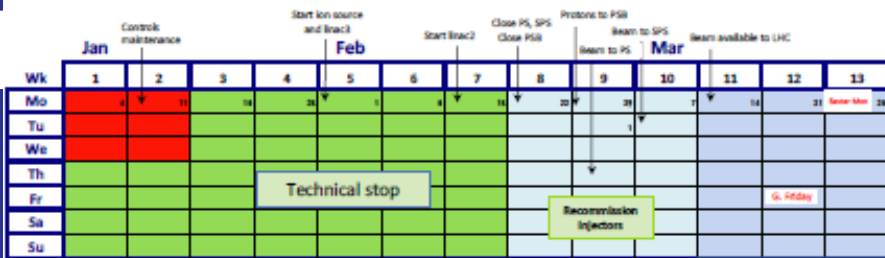
- Protons to ISOLDE since 9 April
- Physics started April 15
- Low energy until October when HIE-ISOLDE started.
- 471 Low Energy shifts requested
- 373 scheduled; ~260.5 delivered 70% (prel counting)

## ISOLDE weekly schedule

		wk	46	GPS	HRS	CA0	p's	other	visits
Monday	09/11/2015	AM	Zn	HIE ISOLDE during the day	End of STAGISO for LA2 @ 0900	GPS	GPS (standard, ~ 40%)		
	PM								
	night	REX mode overnight?							
Tuesday	10/11/2015	AM	Zn	HIE ISOLDE during the day	Target change Ucx #547 during setup of HIE-ISOLDE, else Wednesday	GPS	GPS (standard, ~ 40%)		
	PM								
	night	REX mode overnight?							
Wednesday	11/11/2015	AM	Zn	HIE ISOLDE during the day	Setup of beam through Separator & cooler	GPS	GPS (standard, ~ 40%)		
	PM								
	night	REX mode overnight?							
Thursday	12/11/2015	AM	Zn	HIE ISOLDE during the day	Set up in bunched mode	GPS	GPS (standard, ~ 40%)		
	PM								
	night	short collections in LA1?							
Friday	13/11/2015	AM	Zn	HIE ISOLDE during the day	Stable beam to CRIS Proton scan on HRS	GPS	GPS (standard, ~ 40%)		
	PM								
	night	Couple of hours of K for IDS?						CRIS	GPS/HRS
Saturday	14/11/2015	AM			CRIS	HRS	HRS (standard, ~ 40%)		
	PM								
	night								
Sunday	15/11/2015	AM							
	PM								
	night								
Monday	16/11/2015	AM		End of Protons 2015 @ 0600		HRS			
	PM								
	night								
Tuesday	17/11/2015	AM							
	PM								
	night								

- Protons end next Monday @ 0600
- Running period of 30 weeks.
- Since 22<sup>nd</sup> October, in special “HIE-ISOLDE mode

# Preliminary schedule for 2016



Based on the length of the YETS 2015-16 & EYETS 16-17 [[ATS-PM-MS-0001](#)]:

- Beam to LHC: March 14<sup>th</sup>.
- Physics at Isolde & nTOF: April 11<sup>th</sup>.
- p-physics at North Area: April 18<sup>th</sup>. (Awake October 3<sup>rd</sup>)
- East Area & AD physics: April 25<sup>th</sup>.
- Proton -> Pb November 14<sup>th</sup>.
- End of run December 12<sup>th</sup>.

INTC physics: 31 weeks. ( $\sim 1.8 \times 10^{19}$  pot for nTOF)

NA FT physics: 30 weeks (p) + 4 weeks (Pb)

AD & EA: 29 weeks.

Weekly MDs, 3 Technical stops, UA9 runs indicative (tbd by SPSC). SPS scrubbing likely needed, but no dedicated scrubbing run.

# Overview of planned experiments (HIE ISOLDE apart)



- In-source laser spectroscopy on Hg and Au (RILIS + WINDMILL + ISOLTRAP)
- : Po,  $^{34}\text{Mg}$ , Cu for ISOLTRAP



- IDS: decay of  $^{20}\text{Mg}$
- Cd, K, Mg for IDS
- $^{68}\text{Mn}$  to IDS



- SSP/biophysics/:
  - Mn and In for EC/Mössbauer
  - Cd, Ag & Hg for PAC
  - Rare earths for SSP



- CRIS: Ga, Fr, Cu

COLLAPS

- N-rich Mn and  $^{53-54}\text{Ca}$  to COLLAPS
- Tb isotopes for medicine
- LA1: decay of  $^{10}\text{C}$
- LA1:  $^{11}\text{Be}$   $\beta$ p emission
- Negative At ions

# Issues of the year

Already seen many issues from Thierry....

In addition:

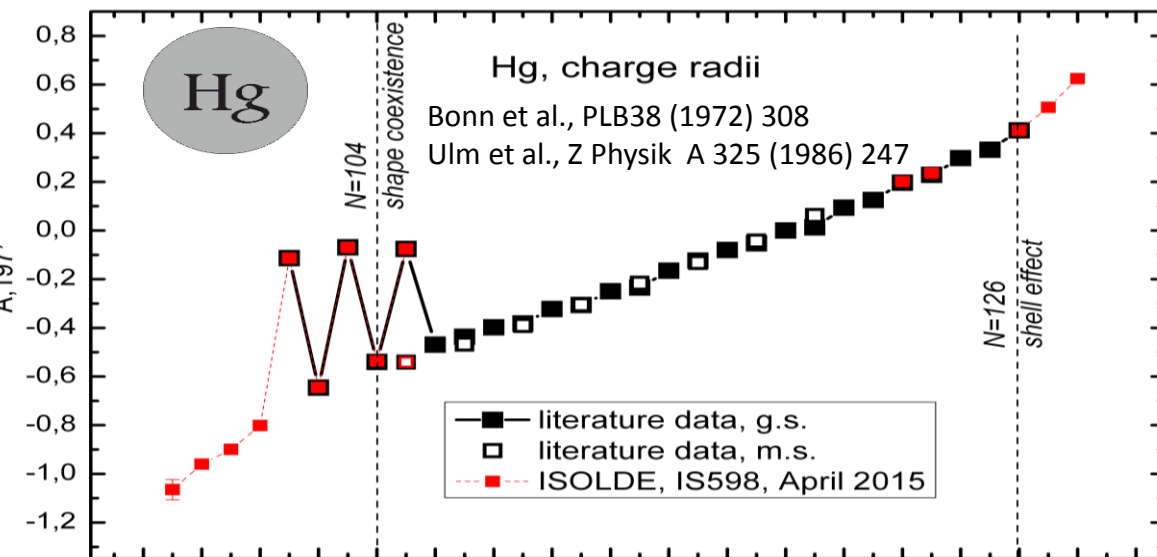
- RFQ: transmission issues, and general “belief” in the device
- Vacuum controls
- Controls in general
- BTY lines to the targets
- 60kV (even 50kV?)
  
- Positive aspects:
  - Optimiser
  - Faster cycling of the HRS magnets



> 75 % of ISOLDE Physics

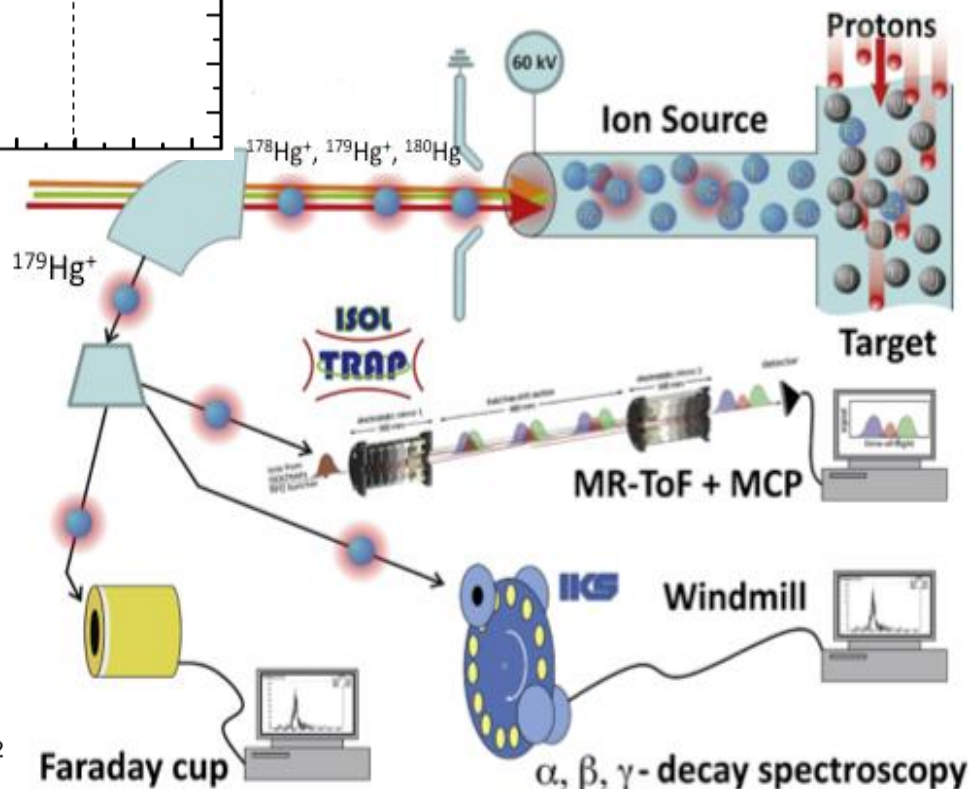
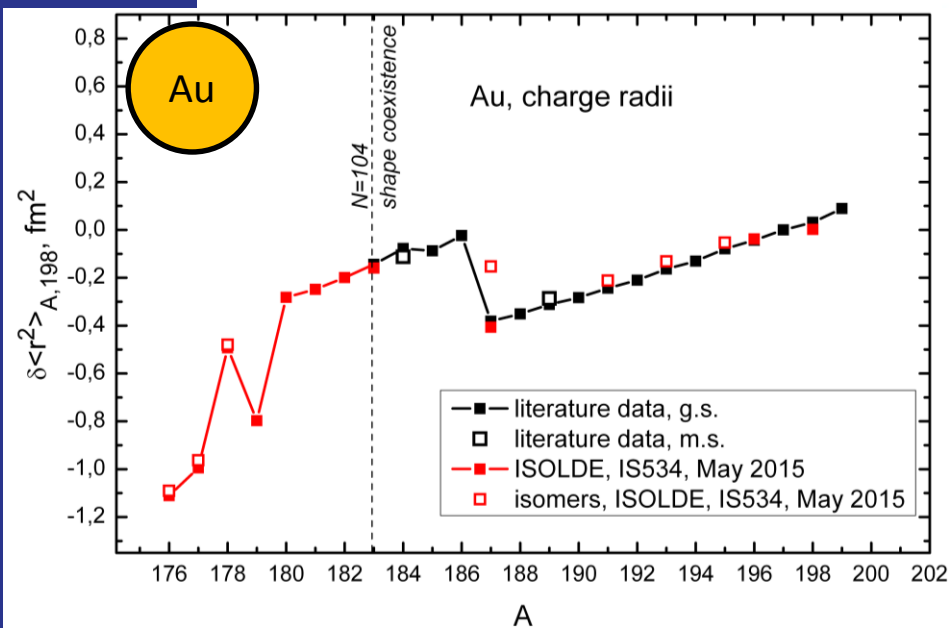
# Lasers + ion traps: n-def Hg & Au isotopes

176 178 180 182 184 186 188 190 192 194 196 198 200 202 204 206 208 210



RILIS, Windmill, ISOLTRAP teams

- Several techniques combined
- RILIS lasers to probe the hyperfine structure of Hg & Au isotopes
- Detection:
  - Alpha spectroscopy with Windmill
  - Selective ion counting in MR-ToF

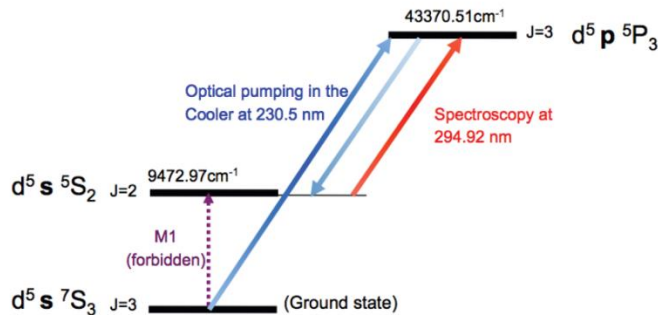




# COLLAPS Mn – June 2015

## First successful application of optical pumping in ISCOOL

- Enhancement of metastable state population



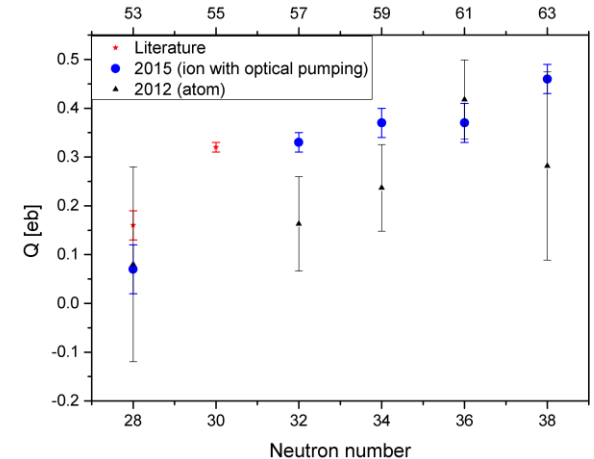
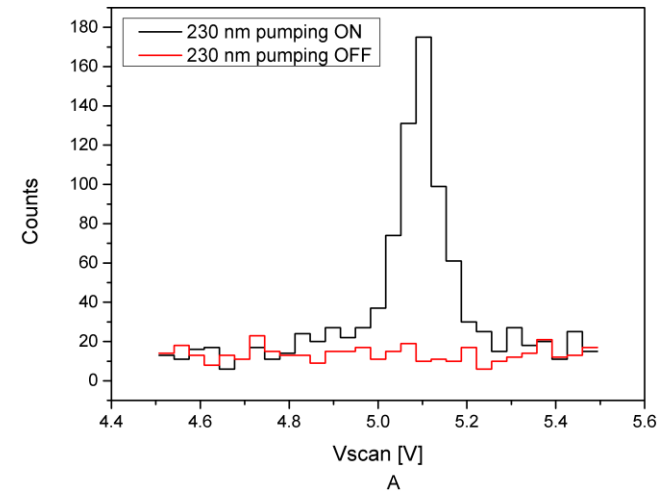
## Quadrupole moments of odd-even Mn from N = 28 up to N = 38

- Precision on Q between 5 – 10 %
- Illustrates increase in Q towards N = 40: physics goal is reached
- N = 40 out of reach, at least partly because ...

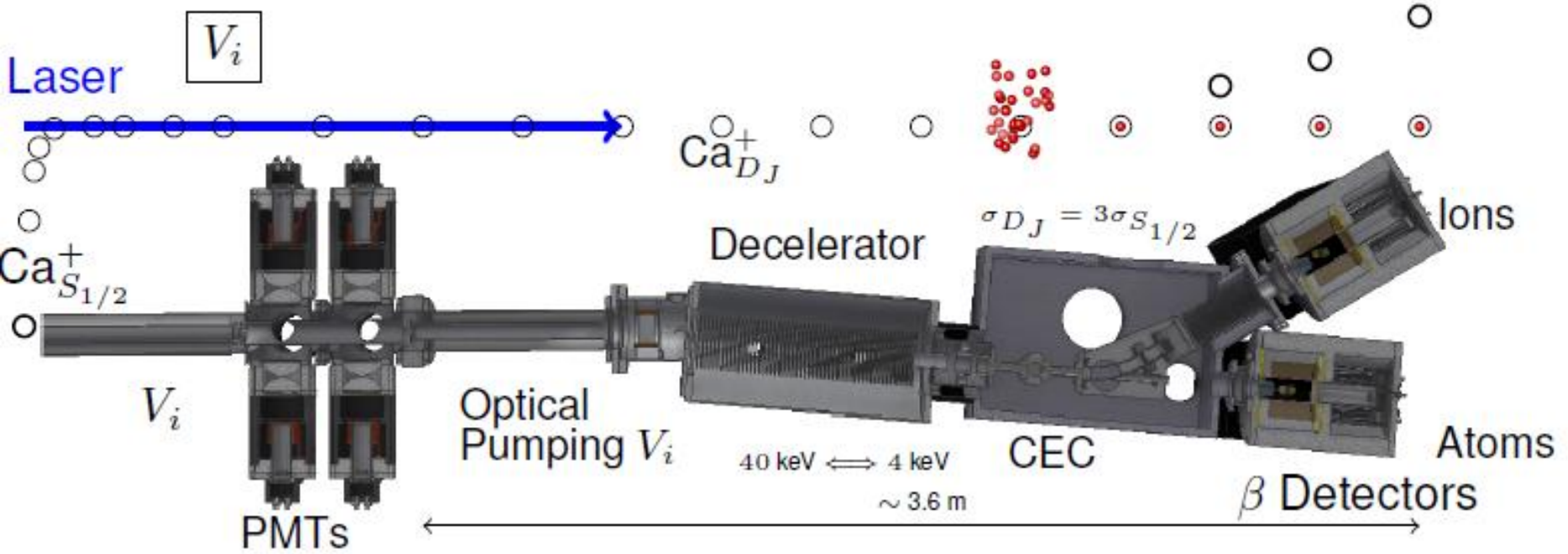
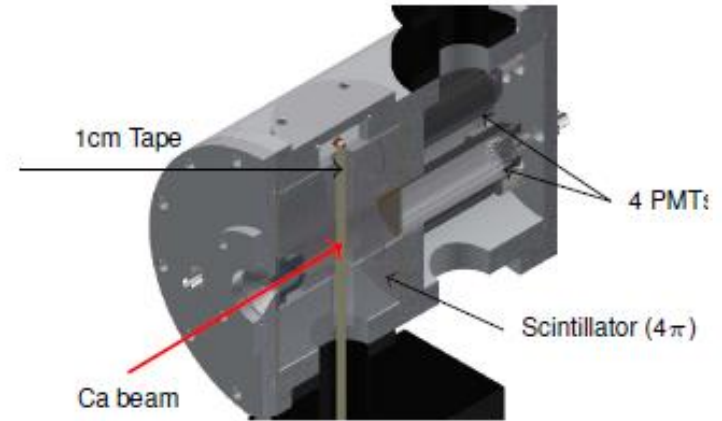
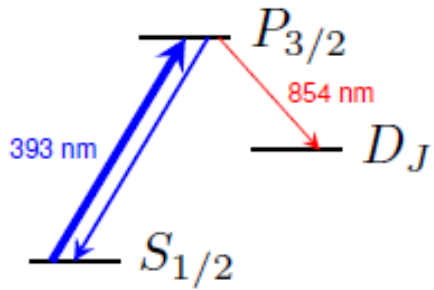
## Limited in intensity by target problems

- Yield per proton pulse ok with 2 pulses, decreased with more pulses
- Flooding due to Rb mass marker or oxygen release due oxidation of target or ... ?

$^5S_2$  (metastable)  $\rightarrow$   $^5P_3$  ionic transition  
Enhancement using optical pumping



# New experimental apparatus (2015)



Optical (2012)

ROC (2015)



# Letter of Intent : I-148

LOI  
I148

## Measurement of electron affinities of radioactive elements

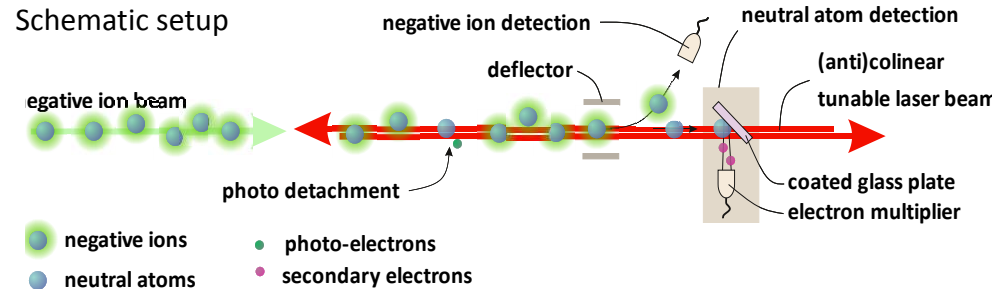
### Objectives of the LOI:

1. Yield measurement for astatine and polonium using negative ion source
2. Check beam transport of negative ions to experimental setups

### Outcome: Iodine EA measured in new beamline

- ✓ ~ -460 pA of  $^{127}\text{I}$  measured on GPS FC.490, ISOLDE wire scanners are working fine
- ✓ Integration of the GANDALPH chamber at ISOLDE GLM beamline
- ✓ Setup of a RILIS laser beam path to GLM + laser safety
- ✓ Integration into RILIS DAQ
- ✓ Achieved low  $10^{-8}$  mbar vacuum through differential pumping
- ✓ ~ 8% transmission to the neutral detector
- ✓ photodetachment signal obtained using the iodine beam
- ✓ Threshold still measurable at very low ion rates (<1 pA, FC noise), At would have been feasible
- ☐ Yield measurements for radiogenic isotopes

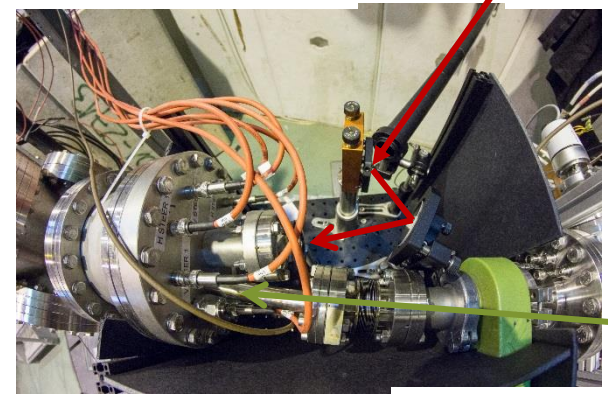
Full proposal to be submitted 2016



GLM with GANDALPH



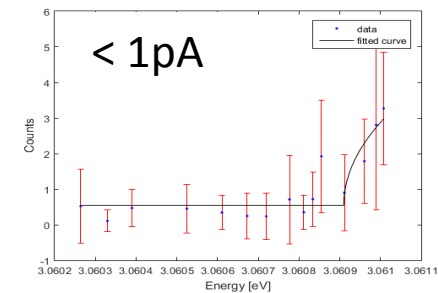
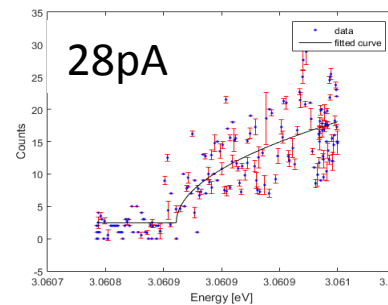
10° e.stat. bend section



RILIS laser

Ion beam from GLM

Detachment threshold measurements of iodine (simulating different yields)



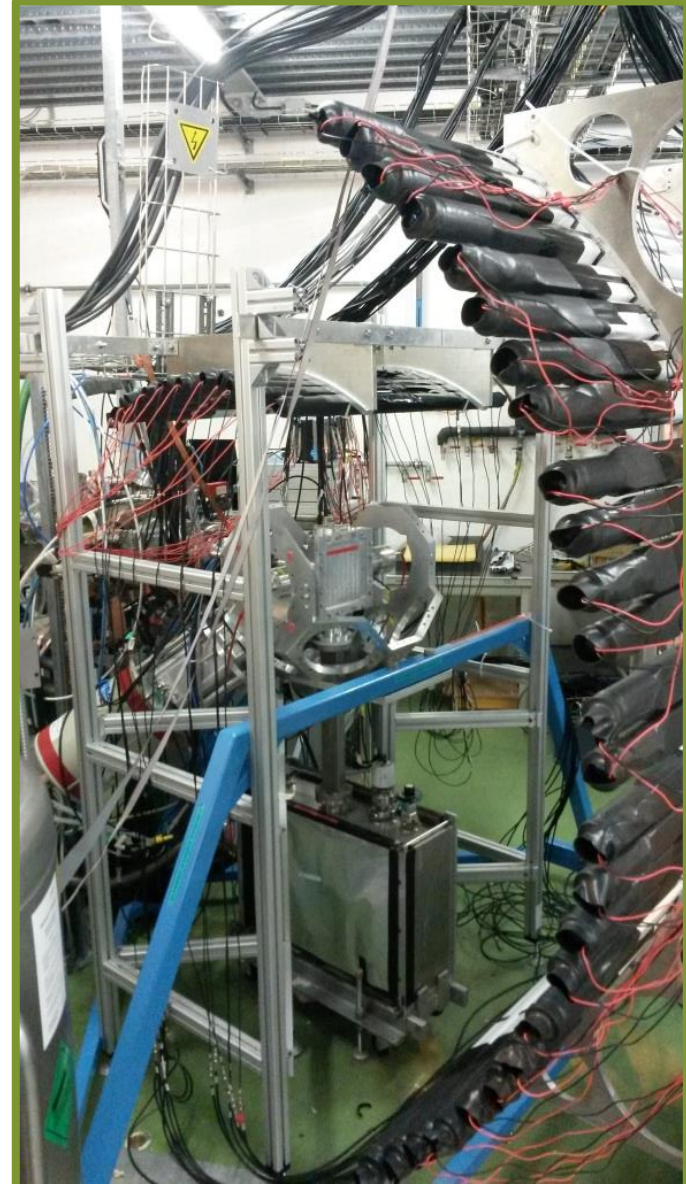
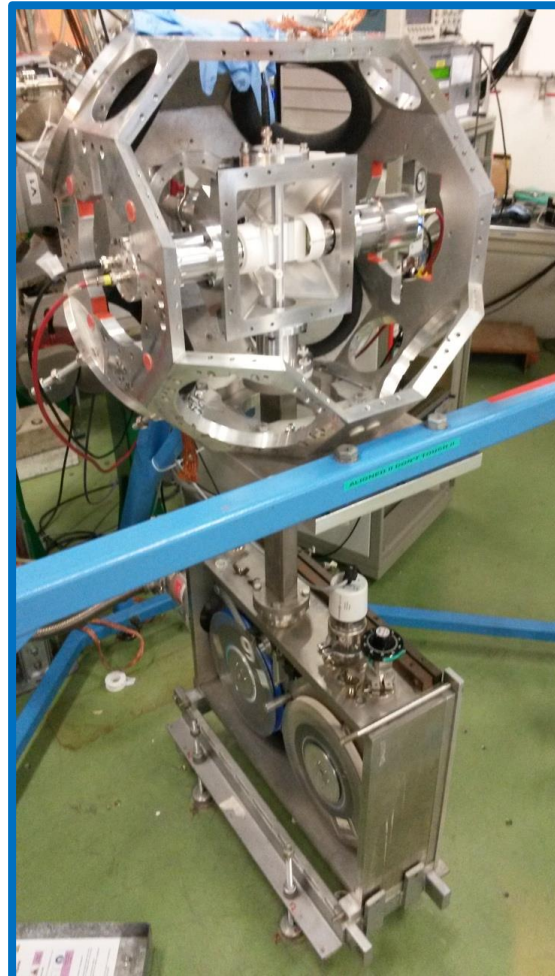


**ISOLDE**  
Decay Station

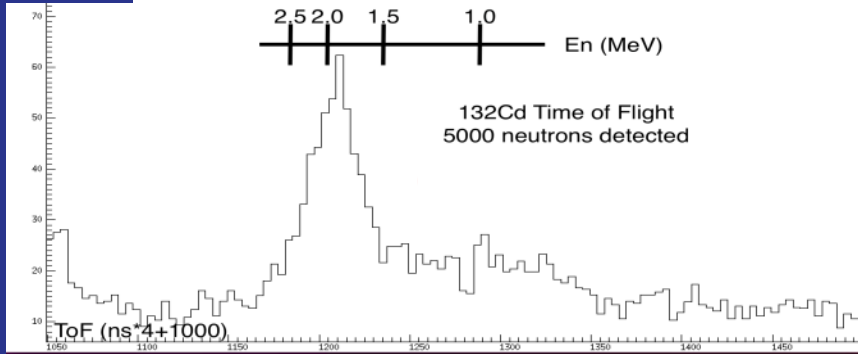
# IS599, IS600: VANDLE Campaign

VANDLE - Versatile Array for  
Neutron Detection at Low  
Energies

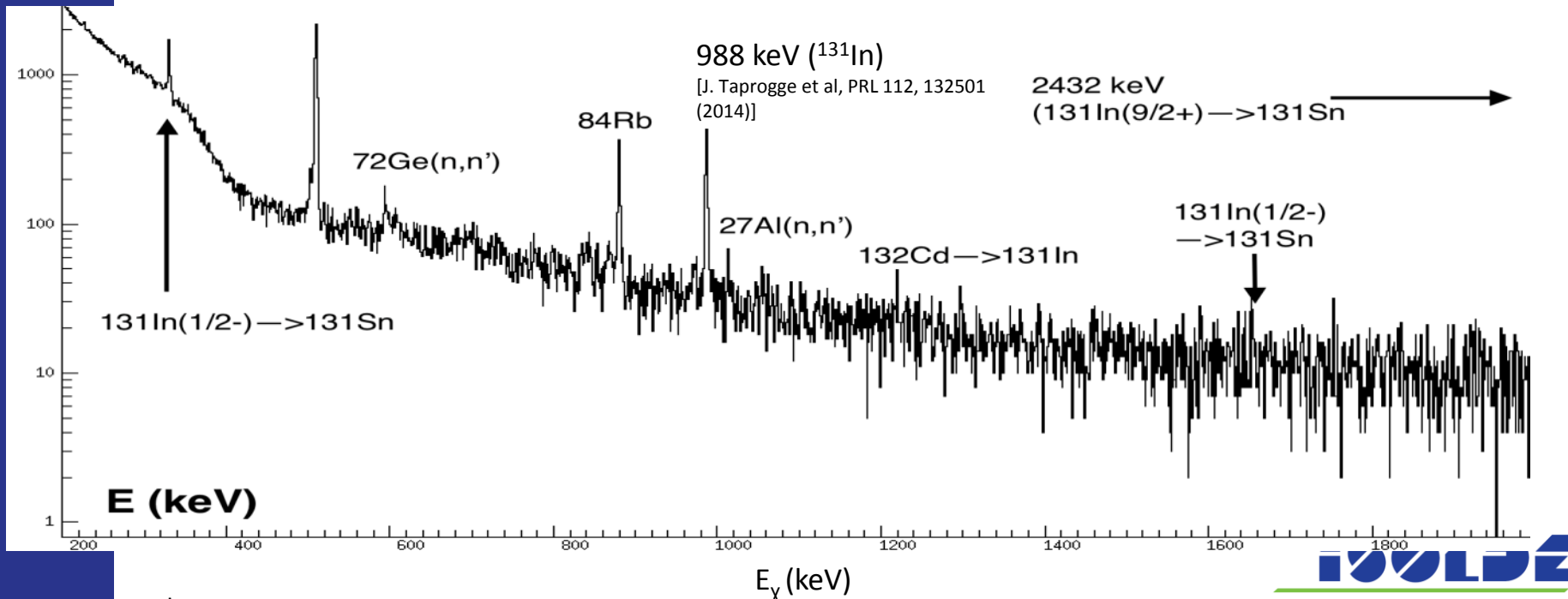
- Implantation on Tape
- 2 or 4 HPGe Clovers
- 1 Central Plastic scintillator
- **VANDLE Medium and Small bars**



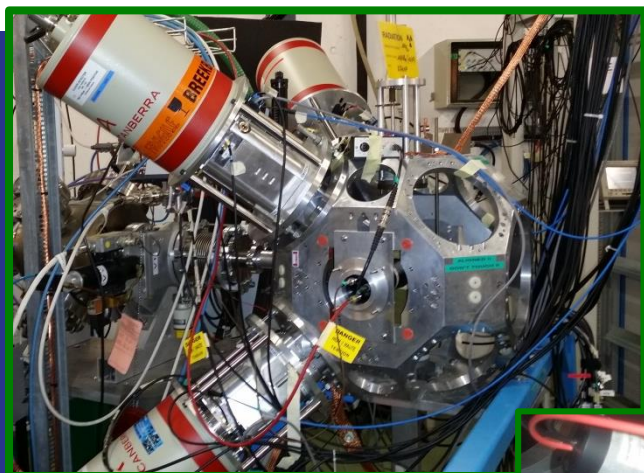
# IS600: Beta-delayed Neutron Spectroscopy of $^{130-132}\text{Cd}$ Isotopes with the ISOLDE Decay Station and the VANDLE array



- Beta decay of  $^{132}\text{Cd}$ :
  - 988 keV line observed
  - High-energy resonant neutron emission observed!



# IS590: Characterization of the low-lying $0^+$ and $2^+$ states of $^{68}\text{Ni}$

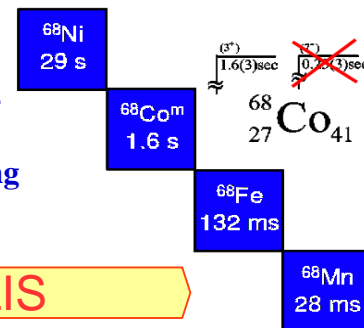


## Setup configuration for lifetime measurements

- Implantation on Tape
- 4 Ge Clovers at Backward angles
- 2 LaBr<sub>3</sub>
- 1 plastic scintillator
- $^{68}\text{Mn} \rightarrow ^{68}\text{Fe} \rightarrow ^{68}\text{Co}^m \rightarrow ^{68}\text{Ni}$
- $^{68}\text{Mn}$  yields:  $\sim 5$  ions/ $\mu\text{C}$

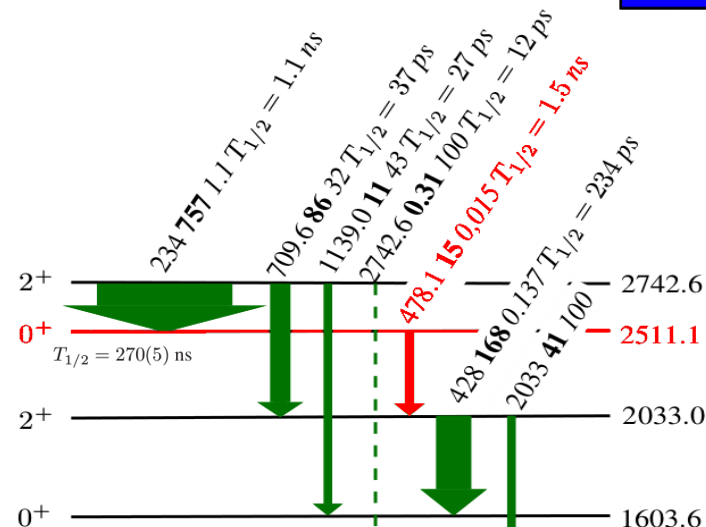
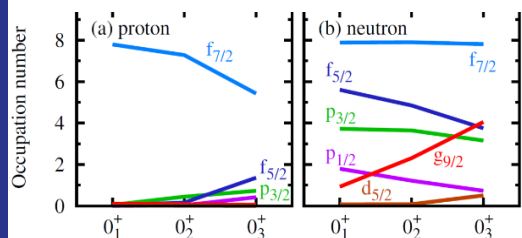
## Decay Chain:

Feeding of the  $^{68}\text{Ni}$  low-lying states via  $^{68}\text{Co}^m$



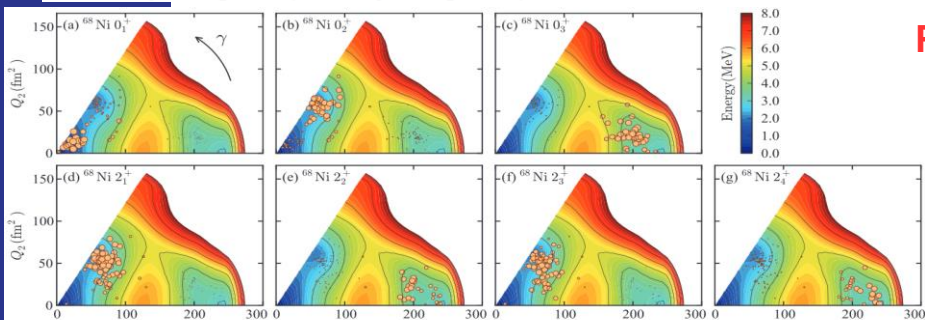
RILIS

## Monte Carlo Shell Model calculations: pf $g_{9/2}d_{5/2}$ shell



## Preliminary (from online analysis):

- **Successful target tests** performed in close collab. with the ISOLDE target team  $\rightarrow$  **High yields and low Ga contamination**
  - Possible **new transitions** observed in the decay chain
  - **Analysis** to extract the **partial half-life** of the 478-keV transition is **ongoing**
  - **Higher statistics** would potentially provide a **new refined level scheme** (e.g. solved true summing effects)
- $\Rightarrow$  **Off-line analysis is ongoing** (C. Sotty)



Potential energy surfaces (PESs) obtained from MCSM calculations

F. Flavigny et al., PRC91, 034310 (2015)  
Y. Tsunoda et al., Phys.Rev.C89,031301(R)(2014).

• Courtesy of C. Sotty

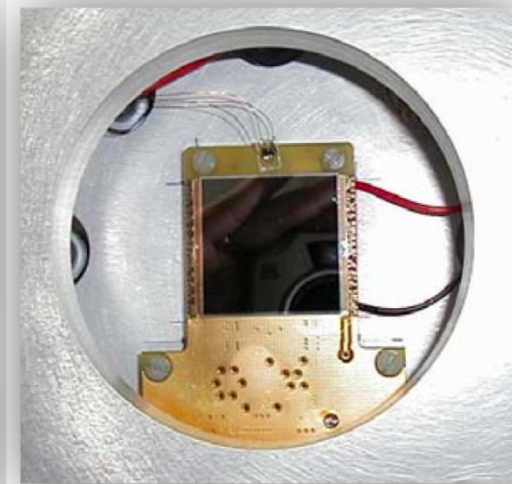
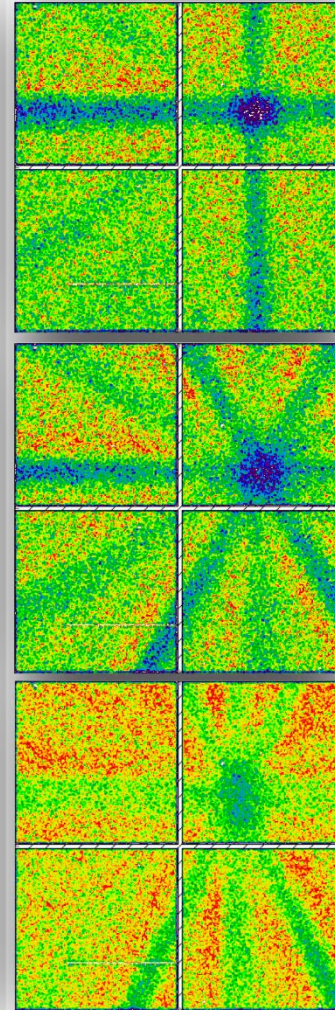
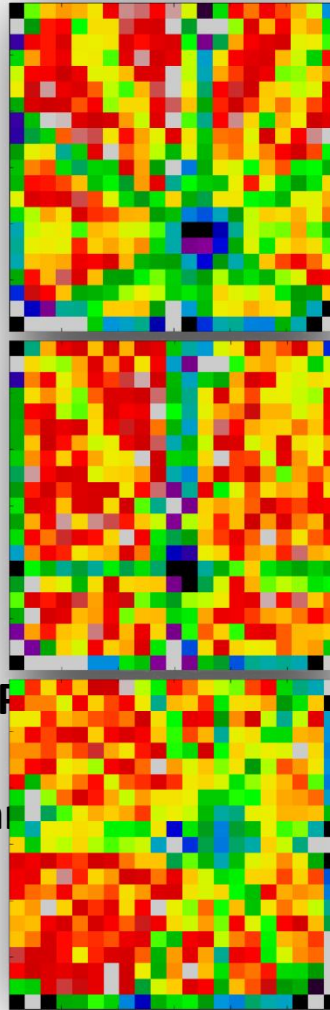
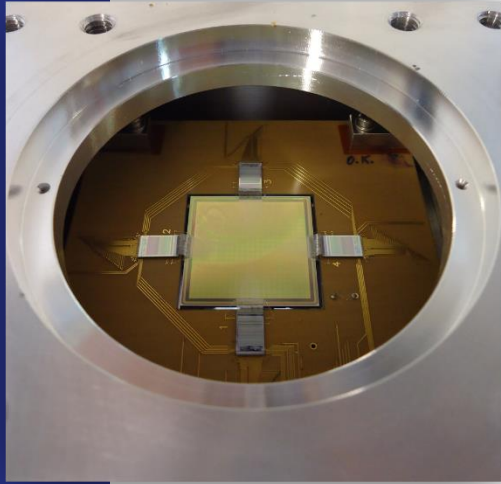


# First on-line run with Timepix

$^{24}\text{Na}$  : GaN  $\beta^-$  - Emission Channeling

Si PAD detector 22x22 1.4mm pixels

Timepix Quad detector 512x512 55 $\mu\text{m}$



2012-2014 NEW FAST VATAGRA  
PAD detector  
(22x22 = 484 pads 1.4 x 1.4 mm)  
> 5.5 kHz

## ●QUAD Medipix

→ High position resolution

•Improvement on **dislocation**  
**multiple** sites determination

●Medipix collaboration supporting  
with **TIMEPIX 3**

→ **1.5ns** time resolution

→ **~40M** hits/s/cm<sup>2</sup>

•Will combine **high position**  
with **low sample damage**

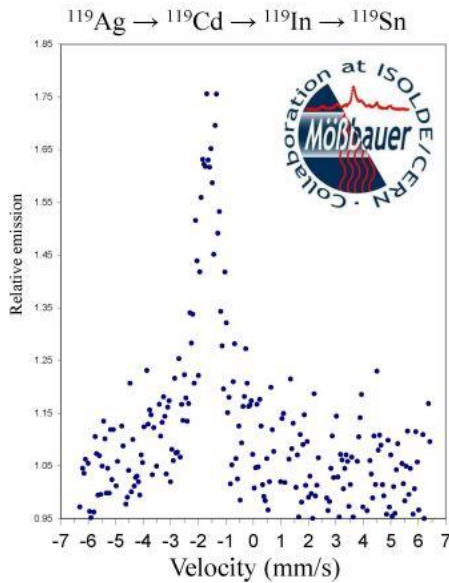
# Mössbauer experiments

- First  $^{119}\text{Sn}$  emission Mössbauer spectrum of  $^{119}\text{Ag}$  ion-implanted Si at 300K was measured at ISOLDE/CERN.  
( $^{119}\text{Ag} \rightarrow ^{119}\text{Cd} \rightarrow ^{119}\text{In} \rightarrow ^{119}\text{Sn}$ )

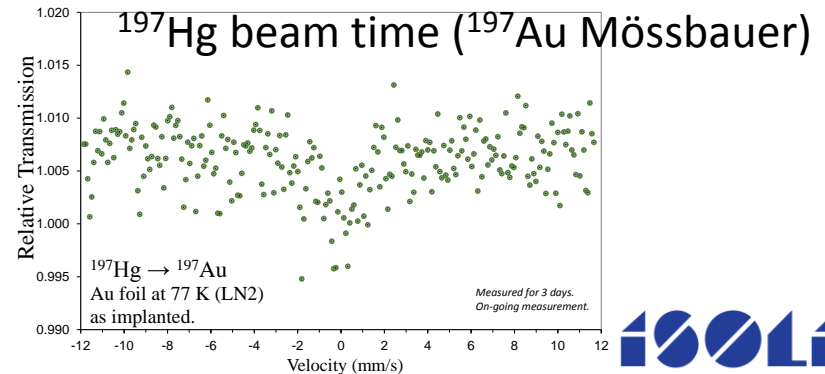
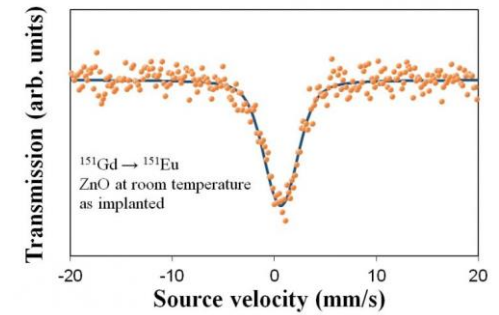
- May 2015: Mn/In beamtime
  - Laser ionized  $^{119}\text{In}$   $\rightarrow 10^9$   $^{119}\text{In}/\text{s}$  (factor 20)  
(good measurement in minutes instead of questionable in hour)

18-19 June 2015

First  $^{119}\text{Sn}$  emission Mössbauer spectrum of  $^{119}\text{Ag}$  ion-implanted Si at 300K



- June/July 2015: Dy beamtime
  - Test of  $^{152}\text{Dy}$  for  $^{152}\text{Eu}$  eMS
  - Samples made in minutes
  - Measurements of  $\sim 20$  samples ongoing





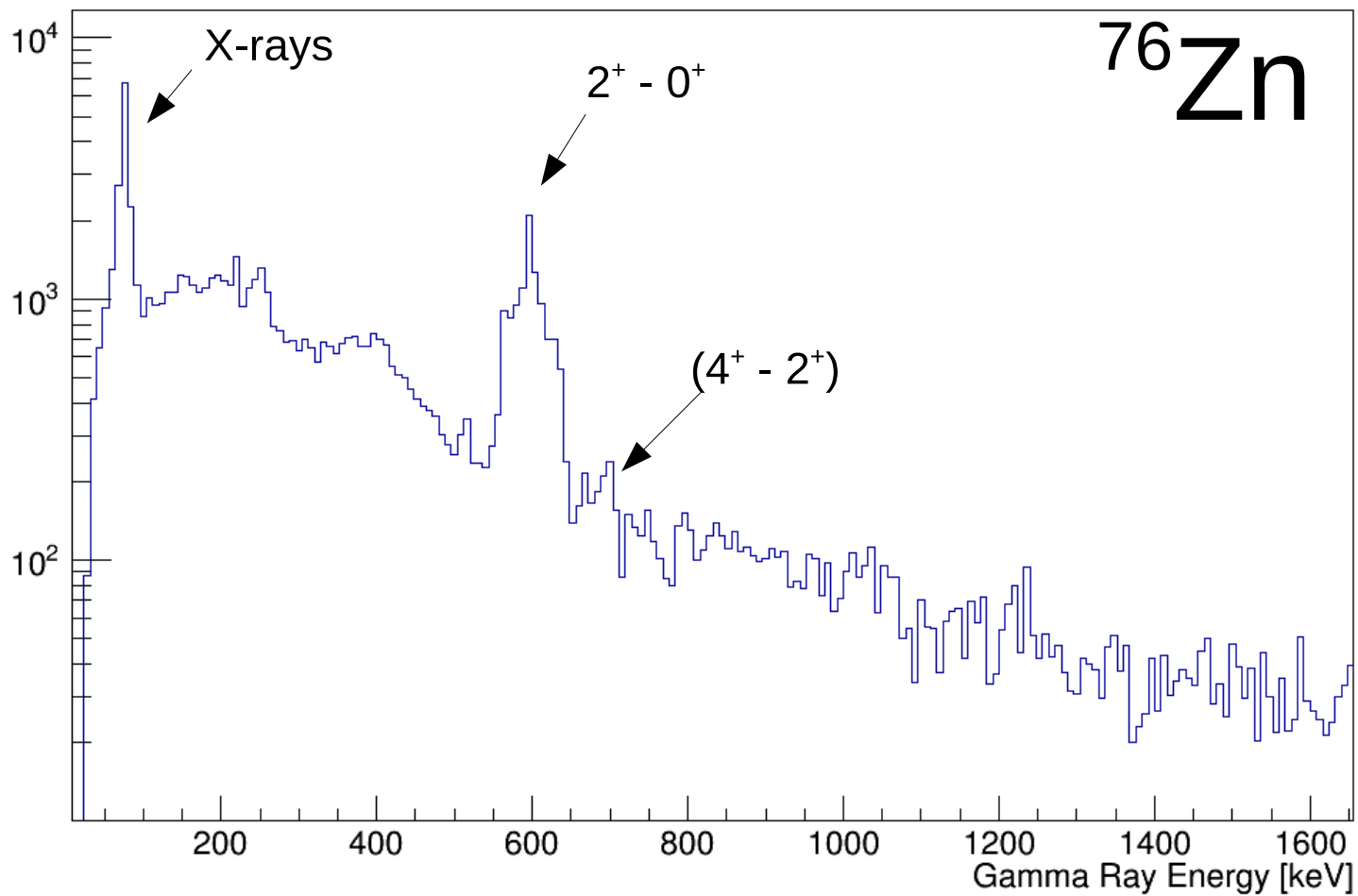
# 22<sup>nd</sup> October.....



1<sup>st</sup> beam of  $^{74}\text{Zn}^{25+}$  to HIE-ISOLDE  
Now running on  $^{76}\text{Zn}$

- Special beam permit: operation of cryomodules only during working hours, and not during weekend.
- However, stability of the lasers allowed for night-time operation of Zn → opportunistic REX run during off-hours.
- Heavy load on the operators but greatly appreciated by the users.
- Now a need to have a workshop to organise and discuss priorities for next year





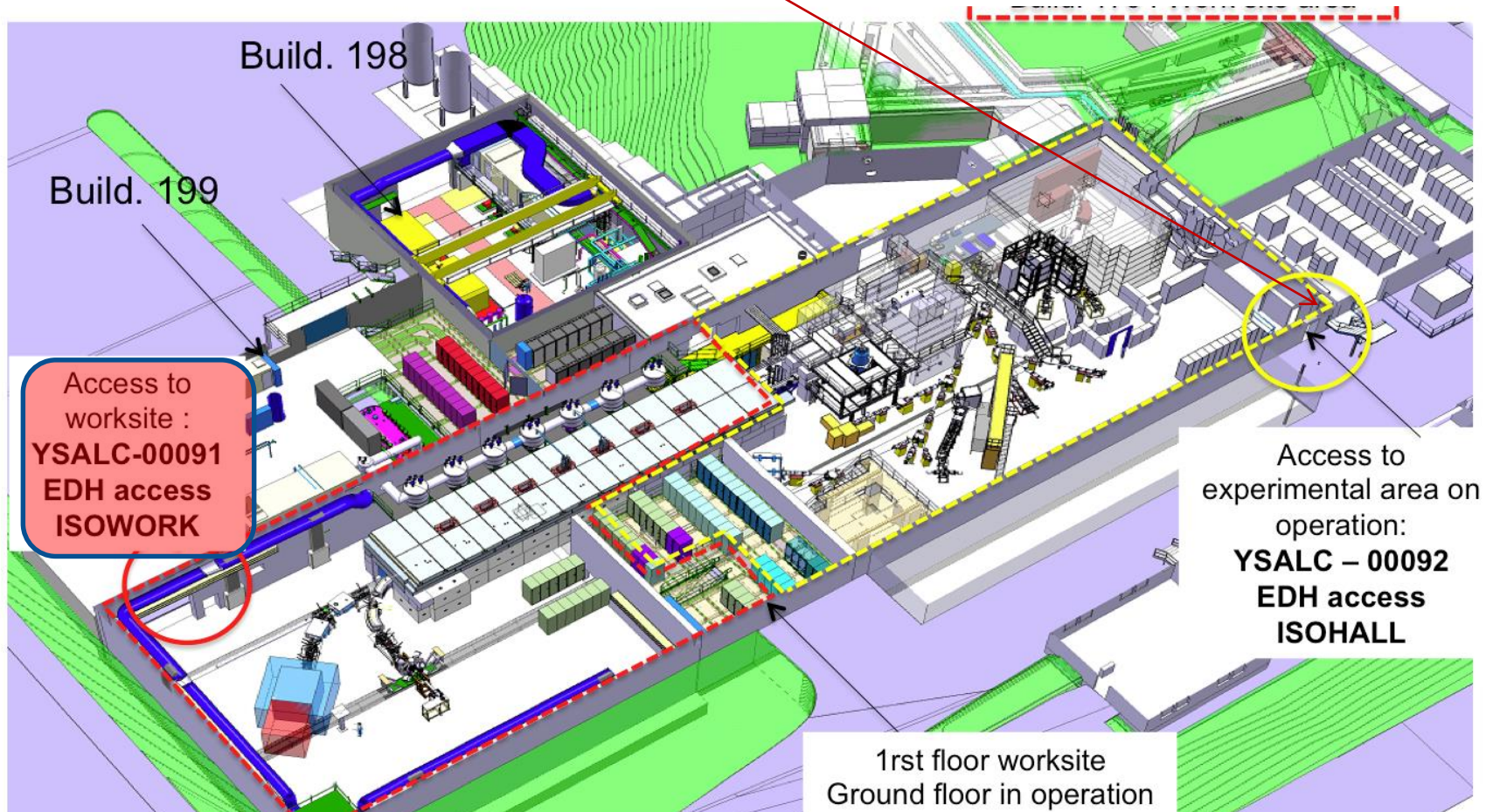
# Access to ISOLDE

**Users with and without dosimeter:** ([www.cern.ch/isolde/get-access-isolde-facility](http://www.cern.ch/isolde/get-access-isolde-facility))

- No temporary dosimeters possible → has been fairly successful .
- Training
  - Currently Tuesdays @ 1300:
  - Follow 2-h RP ISOLDE practical course
  - **1 hour electrical course.**
  - **Negotiating about having two sessions per week during physics time.**
- NOTE for training – registration min 1 week before, only via EDH (new users-preregistration via email, but once registered: also via EDH)
- Now being applied...leading to some confusion.

# Access to ISOLDE

- Suppression of ISOWORK
- Access to HIE-ISOLDE recommended for only local physicists when moving equipment
- Access for users from Jura side for all, **from May 2015:**
  - **NEW: Tourniquet operational, opens via dosimeter**
  - **ISOLDE door still opens with CERN card (to be changed soon)**
  - **Soon: Card reader to be moved to 508 for dosemeters**



# Visits to ISOLDE

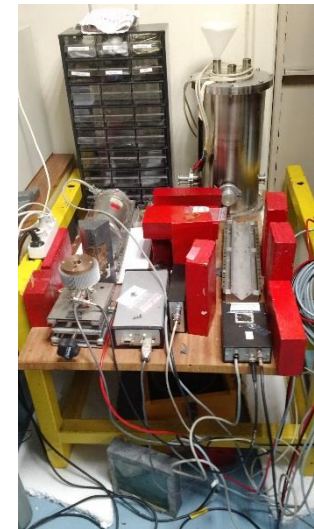
- RP watching even more closely
- ISOLDE as Controlled RP area:
- Only professional visits allowed
  - Our suggestion – university students, uni and school teachers, VIPs
- Non-professional visits access on case-by-case basis
  - High-school students above 16y
  - Private-public visits: friends, family
- No visits during the opening of beamlines or making high-intensity collections
- All visits
  - announced to myself, Richard, or Kara
  - Included in weekly schedule
  - discussed and (not-)approved in Tuesday Isolde technical meeting
  - Dedicated calendar available [https://espace.cern.ch/isolde-visits-info/\\_layouts/15/start.aspx#/Lists/Calendar/calendar.aspx](https://espace.cern.ch/isolde-visits-info/_layouts/15/start.aspx#/Lists/Calendar/calendar.aspx)
- RP make a survey prior to **each** visit.

# Building 508



Installation of  
labs...SSP/chemistry

Lasers: COLLAPS/CRIS  
Tooling workshop etc



# Building 275



Old SSP lab is now emptied and decontaminated. Awaiting report from RP  
Installation of new offline setups

Building now shared with AD

Still a lot of material to be stored/cleared.

100LGE





