

# ISOLDE physics coordinator report: ISCC 7<sup>th</sup> Feb 2017

**Richard Catherall**  
**Karl Johnston**



- Overview of 2016
- Initial planning for 2017
- Safety/Access

# GPS

|    | April              |           |    |              | May       |                         |            |               | June     |           |              |     | July       |                |    |    | August |             |                  |    | September |               |                |                |           |  |
|----|--------------------|-----------|----|--------------|-----------|-------------------------|------------|---------------|----------|-----------|--------------|-----|------------|----------------|----|----|--------|-------------|------------------|----|-----------|---------------|----------------|----------------|-----------|--|
| Wk | 14                 | 15        | 16 | 17           | 18        | 19                      | 20         | 21            | 22       | 23        | 24           | 25  | 26         | 27             | 28 | 29 | 30     | 31          | 32               | 33 | 34        | 35            | 36             | 37             | 38        |  |
| Mo | COLLAPS Cr         |           |    | #582 Ti - Ti | #585 Ti-W | E491 LOR152 E492 LOR141 |            | #589 Uox - Ti |          |           |              | TSD | #577 Pb HP | #513 Nano-C-HP |    |    |        | #580 SIC-HP | #500 Nano-Uox CP |    |           | #500 Uox - Ti | Setup ISOLTRAP | Setup ISOLTRAP | #585 Ti-W |  |
| Tu | #547 Uox - Ti      |           |    | IS453 Mg     |           | IS528                   | #514 Sn-HP |               |          | Tech stop | #575 Th-Ti-n |     |            |                |    |    |        |             |                  |    |           |               |                |                |           |  |
| We | #563 Zn            | Tech stop |    |              |           |                         |            |               |          |           |              |     |            |                |    |    |        |             |                  |    |           |               |                |                |           |  |
| Th | IS593 7Be          |           |    |              |           |                         |            |               |          |           |              |     |            |                |    |    |        |             |                  |    |           |               |                |                |           |  |
| Fr |                    |           |    |              |           |                         |            |               |          |           |              |     |            |                |    |    |        |             |                  |    |           |               |                |                |           |  |
| Sa | Technical problems |           |    |              |           |                         |            |               |          |           |              |     |            |                |    |    |        |             |                  |    |           |               |                |                |           |  |
| Su |                    |           |    |              |           |                         |            |               |          |           |              |     |            |                |    |    |        |             |                  |    |           |               |                |                |           |  |
|    | Be RILIS           |           |    | Mg RILIS     | Uy RILIS  | Be RILIS                |            | Mn RILIS      | In RILIS |           |              |     |            |                |    |    |        |             |                  |    |           |               |                |                |           |  |

Sept 9th: HIE ISOLDE begins. 110Sn @ 4.5MeV/u

## Successful runs for:

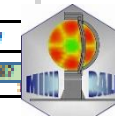
- **ISOLTRAP** (Cr Bi, Cd, Mg isotopes,)
- **CRIS** (Cu, Ra)
- **COLLAPS**: (Ni, Sn, Al, Bi)
- **Medical isotopes**: excellent runs with both 149Tb and 152Tb

- **Nuclear Astrophysics**: 16N and 64Ge
- **Solid state physics**: Mg for nitride semiconductors and Mn/In for Mossbauer spectroscopy. Cd, Hg for local structure investigations of graphene and multiferroic materials.
- **IDS**: N, Mn, In, Ba, He, Hg. Inauguration of the new ISOLDE-built neutron time of flight spectrometer.

- **Tatra spectrometer**: Hg isotopes
- 7Be collection for nTof was finally possible. Promising results....
- Bi run involving ISOLTRAP/Windmill/COLLAPS/RILIS
- First **Miniball** run with 110Sn.

# HRS

|    | April               |           |          |                       | May |               |            |            | June |    |    |    | July          |    |    |    | August |    |    |    | September |    |    |    |    |
|----|---------------------|-----------|----------|-----------------------|-----|---------------|------------|------------|------|----|----|----|---------------|----|----|----|--------|----|----|----|-----------|----|----|----|----|
| Wk | 14                  | 15        | 16       | 17                    | 18  | 19            | 20         | 21         | 22   | 23 | 24 | 25 | 26            | 27 | 28 | 29 | 30     | 31 | 32 | 33 | 34        | 35 | 36 | 37 | 38 |
| Mo |                     |           |          |                       |     | #588 Uox - CP |            |            |      |    |    |    | #573 Uox - Ti |    |    |    |        |    |    |    |           |    |    |    |    |
| Tu | #563 Uox            |           |          | #588 Uox - n Graphite |     |               | #571 Zn-HP | #583 Uox-n |      |    |    |    |               |    |    |    |        |    |    |    |           |    |    |    |    |
| We | Modulation in tests | Tech stop |          |                       |     |               |            |            |      |    |    |    |               |    |    |    |        |    |    |    |           |    |    |    |    |
| Th |                     |           |          |                       |     |               |            |            |      |    |    |    |               |    |    |    |        |    |    |    |           |    |    |    |    |
| Fr |                     |           |          |                       |     |               |            |            |      |    |    |    |               |    |    |    |        |    |    |    |           |    |    |    |    |
| Sa |                     |           |          |                       |     |               |            |            |      |    |    |    |               |    |    |    |        |    |    |    |           |    |    |    |    |
| Su |                     |           |          |                       |     |               |            |            |      |    |    |    |               |    |    |    |        |    |    |    |           |    |    |    |    |
|    | Cr RILIS            | Cu RILIS  | Ni RILIS |                       |     |               |            |            |      |    |    |    |               |    |    |    |        |    |    |    |           |    |    |    |    |



# HIE ISOLDE runs in a nutshell

GPS

HRS

| September             |                        |                              | October          |                  |                           |                           | November         |                            |                             |                       |          |
|-----------------------|------------------------|------------------------------|------------------|------------------|---------------------------|---------------------------|------------------|----------------------------|-----------------------------|-----------------------|----------|
| 35                    | 36                     | 37                           | 38               | 39               | 40                        | 41                        | 42               | 43                         | 44                          | 45                    | 46       |
| #XXX Ucx Ta           | setup IS562 (LE)       | setup IS562 (LE)             | #565 Ta-W        | 26               | setup IS557 (LE)          | setup IS557 (LE)          |                  | IS561 9Li @ 6.8MeV/u       |                             |                       |          |
| 29                    | 5                      | 12                           | IS528 19         |                  | 3                         | 10                        | 17               | 24                         | 31                          | 7                     | 14       |
| IS604 IS589 REX tests | setup IS562 (LE)       | setup LINAC 110Sn @ 4.5MeV/u | IS528            | HIE-ISOLDE (HRS) | setup IS557 (LE)          | setup LINAC 78Zn @ 4MeV/u |                  | #587 Ta - W                | #586 UCx - Ta               |                       |          |
|                       | jeune                  | Tech stop                    | IS528            |                  | setup LINAC 80Zn @ 4MeV/u |                           |                  |                            | setup IS559 (LE)            |                       |          |
| #582 LaC Ta           | IS562 108Sn @ 4.5MeV/u | 110Sn @ 4.5MeV/u             | IS528            | #584 Ucx q n     | IS557 80Zn @ 4MeV/u       | IS557 78Zn @ 4MeV/u       | HIE-ISOLDE (HRS) |                            | setup IS559 (LE)            | IS559 66Ni @ 4.5MeV/u |          |
| Stable beam Xt01      |                        |                              | HIE-ISOLDE (HRS) |                  |                           |                           |                  | setup LINAC 9Li @ 7.2MeV/u | Setup Linac 66Ni @ 4.5MeV/u |                       |          |
| Stable beam Xt01      |                        |                              |                  |                  |                           |                           |                  | IS561 9Li @ 6.8MeV/u       |                             |                       |          |
|                       | Sn RILIS               |                              | Dy RILIS         |                  | Zn RILIS                  | Zn RILIS                  |                  |                            | Ni RILIS                    | Ni RILIS              | Ni RILIS |

| September |                  |                  | October                      |                  |               |                  | November                     |          |              |             |
|-----------|------------------|------------------|------------------------------|------------------|---------------|------------------|------------------------------|----------|--------------|-------------|
| 35        | 36               | 37               | 38                           | 39               | 40            | 41               | 42                           | 43       | 44           | 45          |
|           | LOI168?          | LOI168?          | setup IS548 (LE)             |                  |               |                  | #586 Ucx Ta                  |          |              |             |
| 29        | 5                | 12               | 19                           | 26               | 3             | 10               | 17                           | 24       | 31           | 7           |
|           | LOI168?          |                  | setup IS548 (LE)             |                  | #566 CaO - CP |                  | setup IS551 (LE)             |          | #591 W block | #588 UCx Ta |
|           |                  | 583 Ucx - CP     | Setup Linac 142Xe @ 4.5MeV/u |                  |               | HIE-ISOLDE (GPS) | Colls: IS580; IS528; IS578   |          |              |             |
|           | jeune            |                  | IS548: 142Xe @ 4.5MeV/u      |                  |               |                  | Setup Linac 132Sn @ 5.5MeV/u |          |              |             |
| IS608     | HIE-ISOLDE (GPS) | HIE-ISOLDE (GPS) |                              | HIE-ISOLDE (GPS) |               |                  | IS551 132Sn @ 5.5MeV/u       |          |              |             |
| LOI168?   |                  |                  |                              |                  |               | IS601            |                              |          |              |             |
| Bi RILIS  |                  |                  |                              |                  |               |                  | Sn RILIS                     | Sn RILIS |              |             |

Broken 9-gap Amplifier. Only 110Sn possible

RILIS laser window required replacement. Only 78Zn possible.

Difficult setup. Transmission and alignment questions. First test of XT02

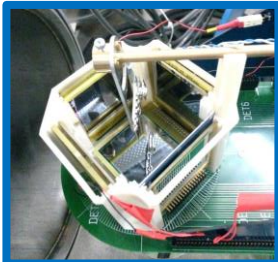
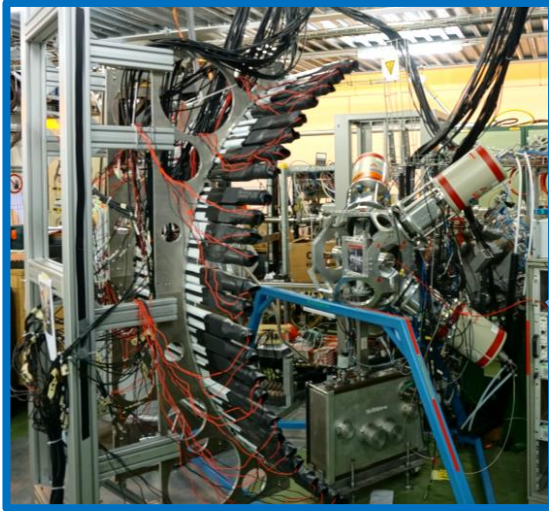
Delay due to repair of Amp; leaking target. 15 shifts instead of 30

SnS molecular beam...machine at full energy for first time: 5.5MeV/u

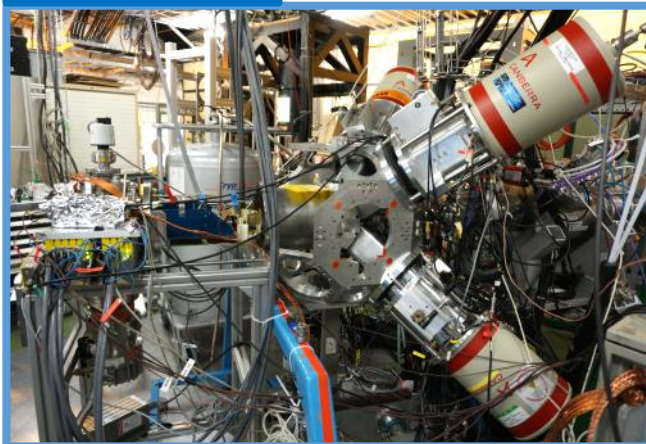
Regular trips of SC cavities: users can reset.  
Regular trips of 7-gap...15 mins each time...  
Extremely heavy load on operators for each run...

**IS609:** Study of beta-delayed neutron decay of  $^8\text{He}$  using the newly commissioned IDS Neutron Detector

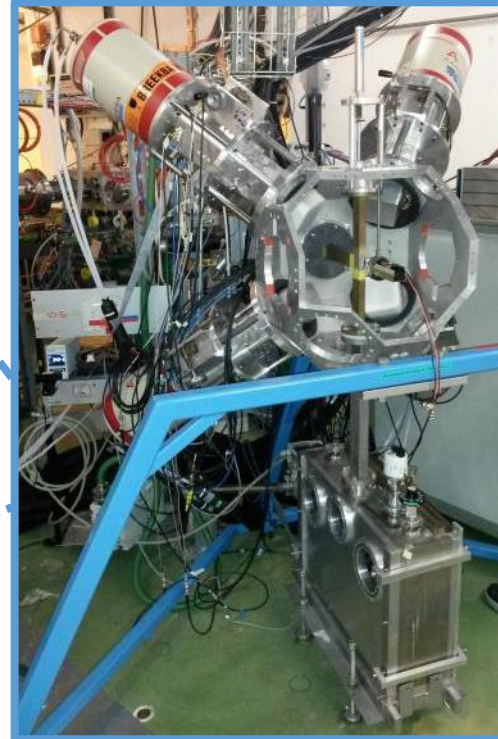
**Neutron Spectroscopy**



**Particle Spectroscopy**

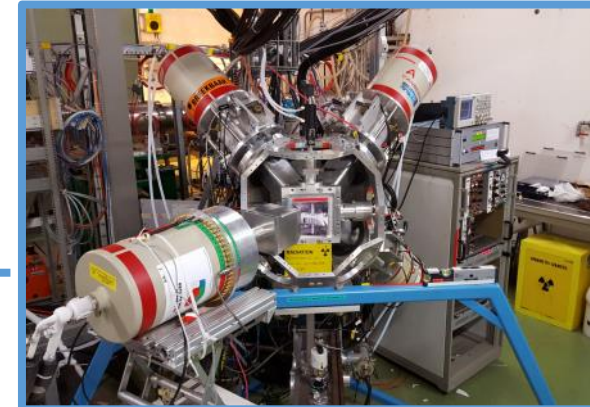


**ISOLDE  
Decay Station  
2016**



**IS588:** Study of core breaking and octupole low-spin states in  $^{207}\text{Tl}$  through gamma and beta spectroscopy of  $^{207,208}\text{Hg}$

**High beta-gamma efficiency**



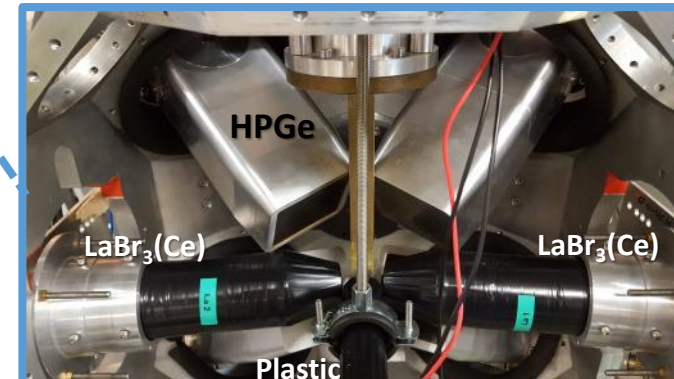
**IS610:** Gamma-ray and fast-timing spectroscopy of nuclei around the doubly-magic  $^{132}\text{Sn}$  nucleus

**IS474:** Fast-timing studies of nuclei below  $^{68}\text{Ni}$  populated in the  $\beta$ -decay of Mn isotopes

**IS579:** Study of octupole deformation in n-rich Ba isotopes

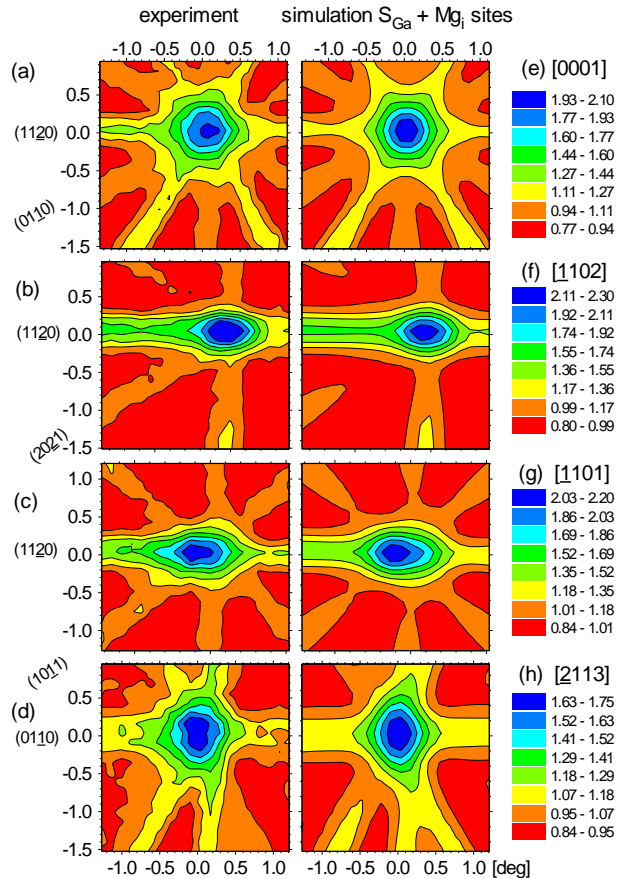
**Fast-timing studies**

**IS605:** Absolute measurement of the  $\beta\alpha$  decay of  $^{16}\text{N}$ , with significance for astrophysically important CO reaction. Particle detection was performed using silicon strip detectors of varying thicknesses.

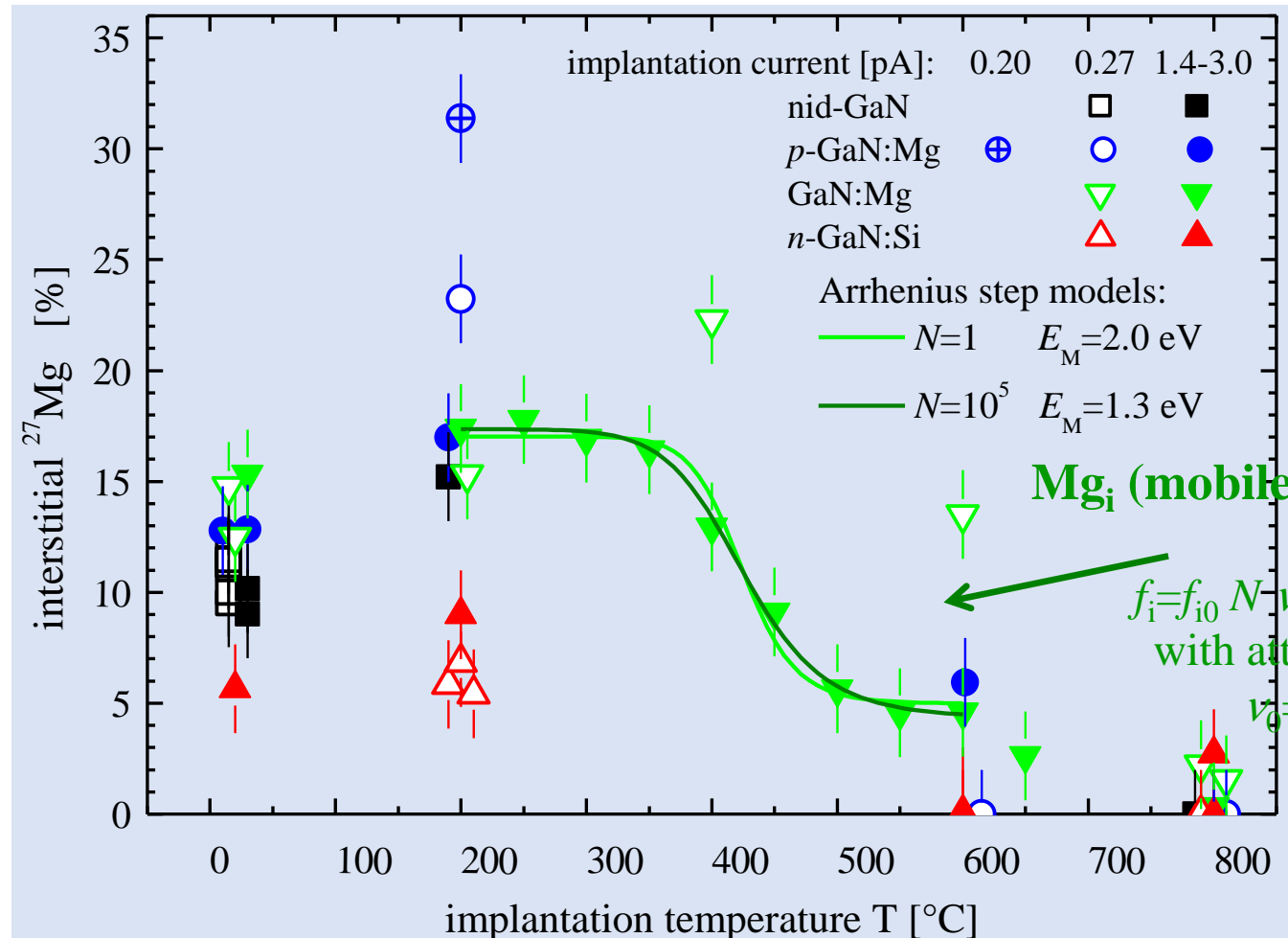


Thanks to  
Razvan  
Lica

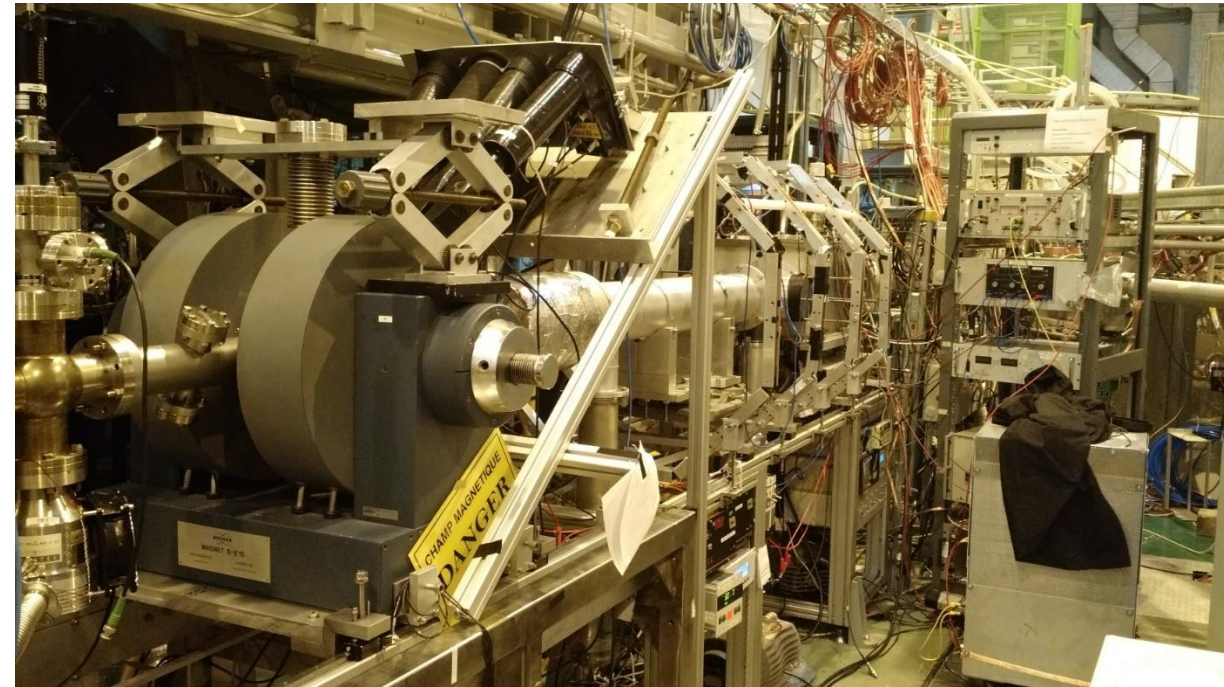
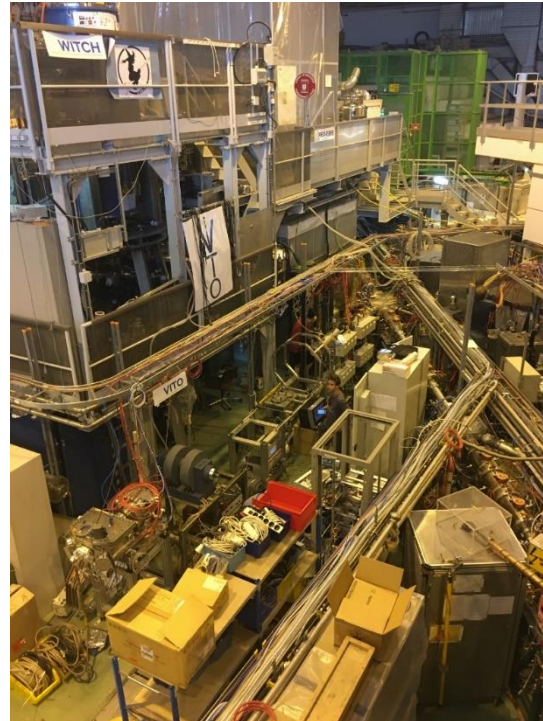
# Interstitial $^{27}\text{Mg}$ in different doping types of GaN



- Interstitial  $\text{Mg}_i$  enhanced in  $p$ -GaN and suppressed in  $n$ -GaN.
- Site change of  $^{27}\text{Mg}$  from interstitial to substitutional Ga sites as function of implantation temperature allows to estimate activation energy for migration of  $\text{Mg}_i$  as  $E_M \approx 1.3\text{--}2.0$  eV.



# Installation of the VITO beamline



First tests done in September and October

# IS624 Irradiation

Ir



# Operations during the Physics Campaign:



- From Sep. 2<sup>nd</sup> with the delivery of stable beam to the Miniball Spectrometer for testing purposes

|                |                       |                       |                       |                       |                       |                       |
|----------------|-----------------------|-----------------------|-----------------------|-----------------------|-----------------------|-----------------------|
| Experiment #   | IS562                 | IS548                 | IS557                 | IS551                 | IS561                 | IS559                 |
| RIB            | <sup>110</sup> Sn     | <sup>142</sup> Xe     | <sup>78</sup> Zn      | <sup>132</sup> Sn     | <sup>9</sup> Li       | <sup>66</sup> Ni      |
| Energy [MeV/u] | 4.5                   | 4.5                   | 4.3                   | 5.5                   | 6.8 (7.2 req)         | 4.5                   |
| Target         | GPS                   | HRS                   | GPS                   | HRS                   | GPS                   | GPS                   |
| Exp. Station   | Miniball Spect.       | Miniball Spect.       | Miniball Spect.       | Miniball Spect.       | Scattering Chamber    | Miniball Spect.       |
| Start date     | Sep. 9 <sup>th</sup>  | Sep. 26 <sup>th</sup> | Oct. 10 <sup>th</sup> | Oct. 19 <sup>th</sup> | Oct. 28 <sup>th</sup> | Nov. 4 <sup>th</sup>  |
| End date       | Sep. 18 <sup>th</sup> | Oct. 2 <sup>nd</sup>  | Oct. 16 <sup>th</sup> | Oct. 26 <sup>th</sup> | Nov. 1 <sup>st</sup>  | Nov. 14 <sup>th</sup> |
| Length [hours] | 115                   | 100                   | 130                   | 130                   | 70                    | 120                   |



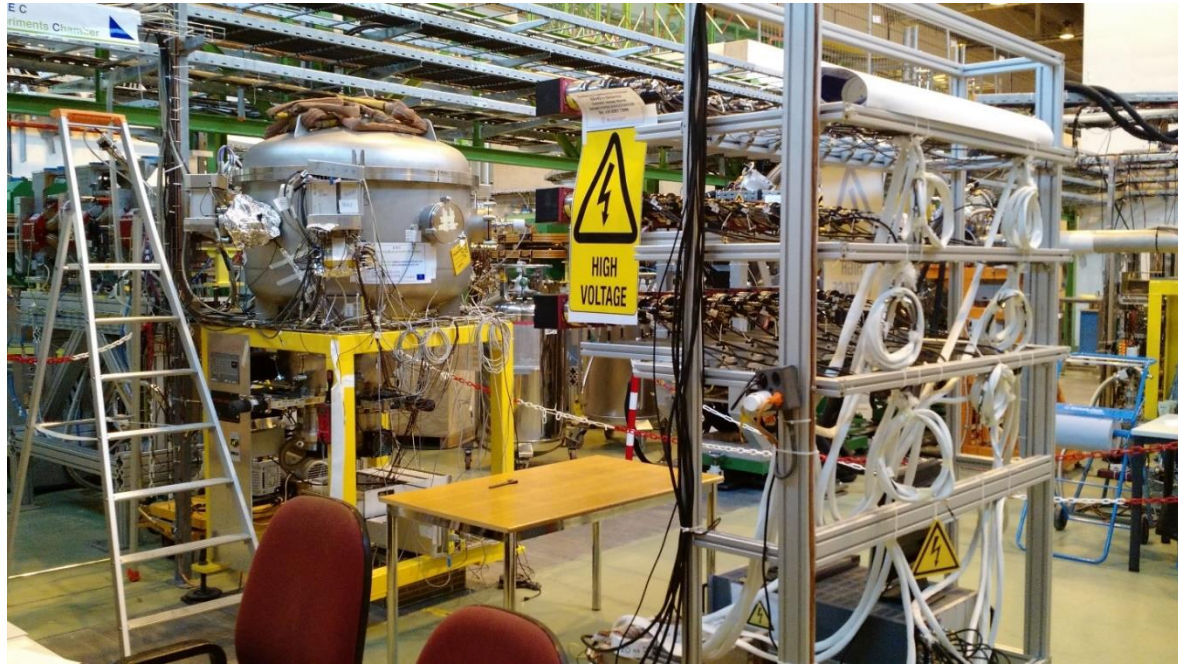
$^{110}\text{Sn}$  beams @ 4.5MeV/u: Sept 9<sup>th</sup> 2016



1 week of operation exceeded 2015 running hours (~ 3 weeks)

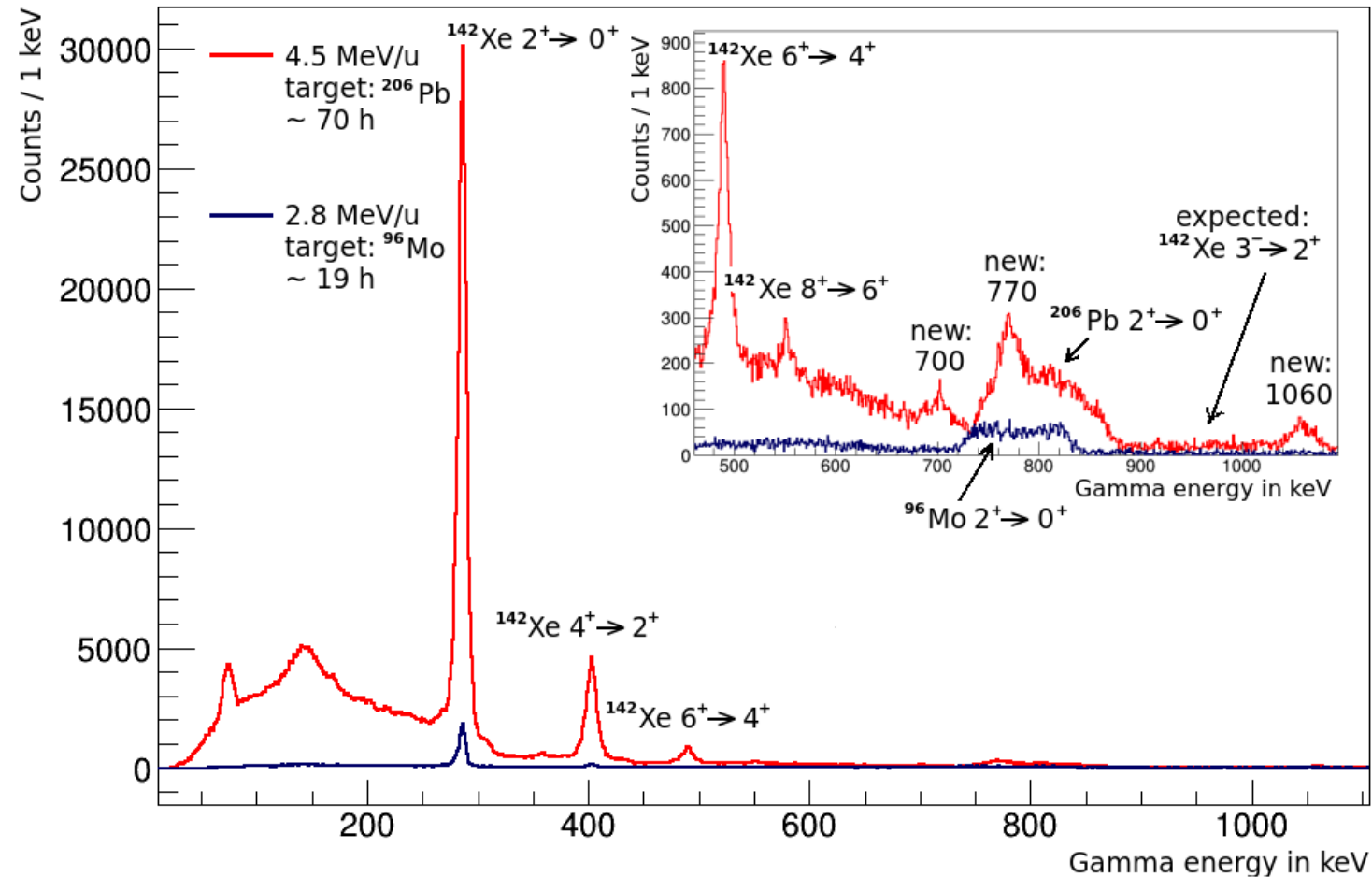


${}^9\text{Li}$  beams @ 6.8MeV/u: Oct 28<sup>th</sup> 2016



# Preliminary data from $^{142}\text{Xe}$ for IS548

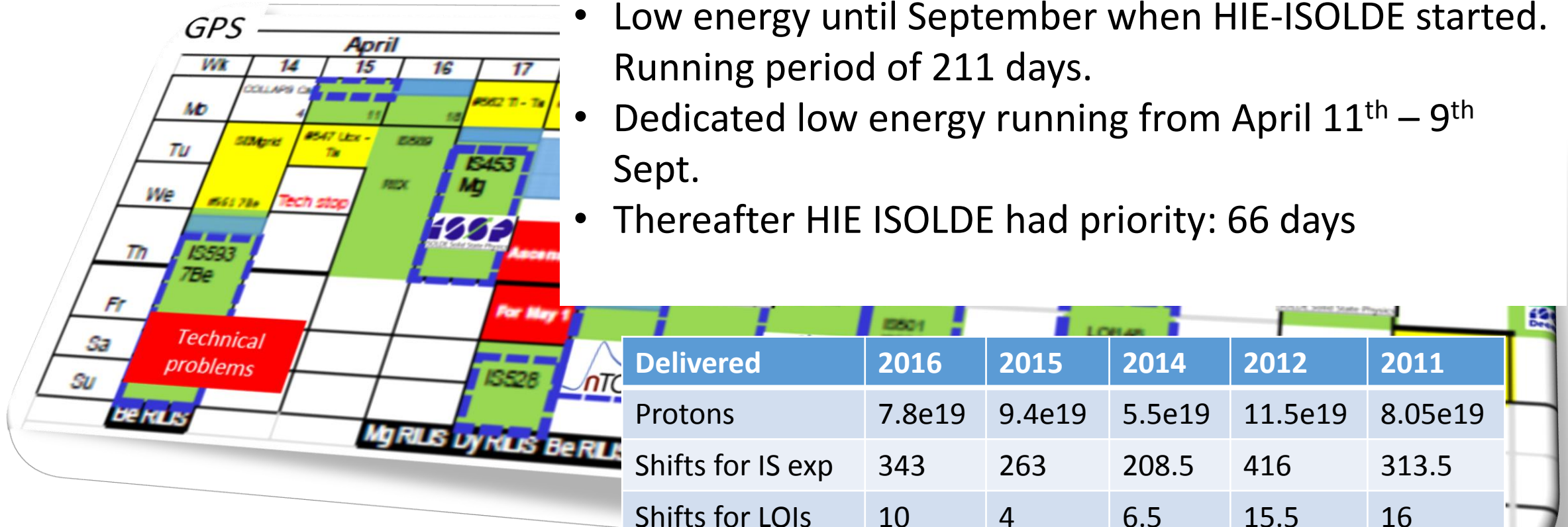
Doppler corrected with respect to Xe



Courtesy of corinna Henrich

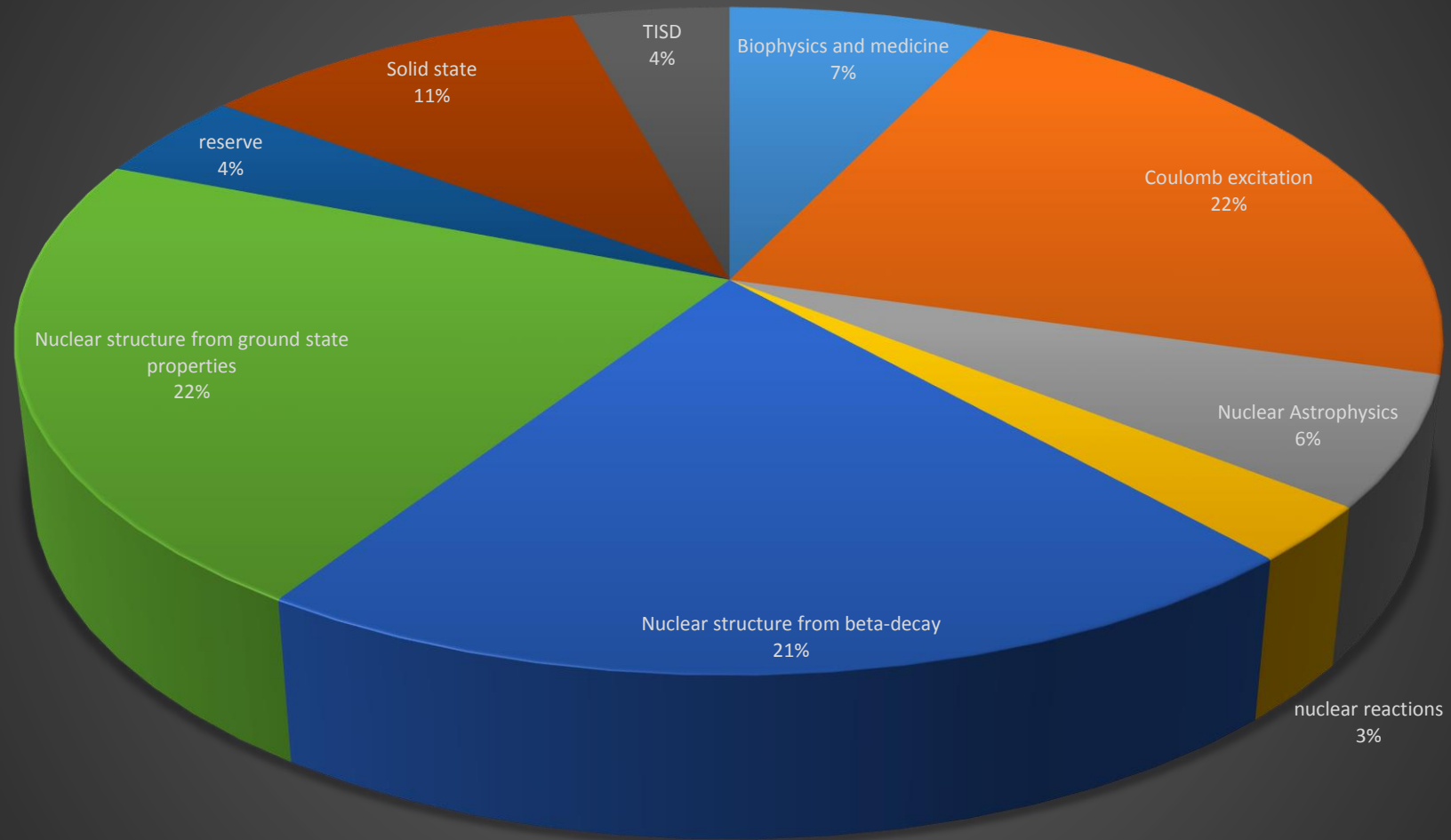
## 2016

- Protons to ISOLDE since 11 April
- Low energy until September when HIE-ISOLDE started. Running period of 211 days.
- Dedicated low energy running from April 11<sup>th</sup> – 9<sup>th</sup> Sept.
- Thereafter HIE ISOLDE had priority: 66 days



| Delivered             | 2016   | 2015    | 2014   | 2012    | 2011    |
|-----------------------|--------|---------|--------|---------|---------|
| Protons               | 7.8e19 | 9.4e19  | 5.5e19 | 11.5e19 | 8.05e19 |
| Shifts for IS exp     | 343    | 263     | 208.5  | 416     | 313.5   |
| Shifts for LOIs       | 10     | 4       | 6.5    | 15.5    | 16      |
| REX shifts (IS +LOI)  | 95     | Special | -      | 221.5   | 190.5   |
| Average IS shifts/day | 1.65   | 1.4     | 1.55   | 1.61    | 1.55    |

# ISOLDE Pie 2016

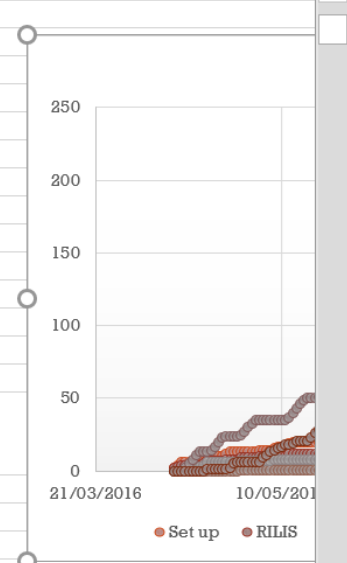


2016\_shift\_counting.xlsx - Excel

File Home Insert Page Layout Formulas Data Review View ACROBAT Power Pivot Design Format Tell me what you want to do... Karl Johnston Share

Clipboard Font Alignment Number Styles Cells Editing

|    | A                            | B                   | C         | D          | E          | F   | G   | H | I   | J | K   | L          |   |
|----|------------------------------|---------------------|-----------|------------|------------|-----|-----|---|-----|---|-----|------------|---|
| 18 | Cu run for CRIS IS531        |                     | Thursday  | 21/04/2016 |            | 1   |     | 1 |     |   | 1   |            |   |
| 19 |                              |                     | Friday    | 22/04/2016 |            | 1   |     |   |     |   | 3   |            |   |
| 20 |                              |                     | Saturday  | 23/04/2016 |            |     |     |   |     |   | 3   |            |   |
| 21 |                              |                     | Sunday    | 24/04/2016 |            |     |     |   |     |   | 3   |            |   |
| 22 |                              |                     | Monday    | 25/04/2016 |            | 2   | 1   |   |     |   | 1   | CRIS on CU |   |
| 23 |                              | Mg run on GPS       | Tuesday   | 26/04/2016 |            | 1   |     | 1 |     |   |     | 1          |   |
| 24 |                              |                     | Wednesday | 27/04/2016 |            |     |     |   |     |   |     | 3          |   |
| 25 |                              |                     | Thursday  | 28/04/2016 |            |     |     |   |     |   |     | 1          |   |
| 26 | Ni run on HRS (weasel) IS568 |                     | Friday    | 29/04/2016 |            |     | 1   |   | 0.5 | 1 | 0.5 | weasel     |   |
| 27 |                              |                     | Saturday  | 30/04/2016 |            | 0.5 |     |   |     |   | 2.5 |            |   |
| 28 |                              |                     | Sunday    | 01/05/2016 |            |     |     |   |     |   | 3   |            |   |
| 29 |                              |                     | Monday    | 02/05/2016 |            |     |     |   |     |   | 3   |            |   |
| 30 |                              |                     | Tuesday   | 03/05/2016 |            |     |     |   |     |   |     | 2          |   |
| 31 |                              |                     | Wednesday | 04/05/2016 |            | 1   | 1   | 1 |     |   |     |            |   |
| 32 |                              | Medical run (IS528) | Thursday  | 05/05/2016 |            |     |     |   |     |   |     | 3          |   |
| 33 |                              |                     | Friday    | 06/05/2016 |            |     |     |   |     |   |     | 2          |   |
| 34 |                              |                     | Saturday  | 07/05/2016 |            |     |     |   |     |   |     | 2          |   |
| 35 |                              |                     | Sunday    | 08/05/2016 |            | 1   |     |   |     | 1 |     | 1          |   |
| 36 |                              |                     | Monday    | 09/05/2016 |            | 1.5 |     |   |     |   |     | 1.5        |   |
| 37 |                              |                     | Tuesday   | 10/05/2016 |            |     |     |   |     |   |     | 1.5        |   |
| 38 |                              |                     | Wednesday | 11/05/2016 |            |     | 0.5 |   |     |   |     | 1.5        |   |
| 39 |                              |                     | Thursday  | 12/05/2016 |            | 2   | 1   |   |     |   |     | 2          |   |
| 40 | N beams for IDS IS605        | 7Be for nTOF        | Friday    | 13/05/2016 |            | 1   |     |   |     |   | 3   | 0.5        |   |
| 41 |                              |                     |           | Saturday   | 14/05/2016 |     |     |   |     |   |     | 3          | 2 |
| 42 |                              |                     |           | Sunday     | 15/05/2016 |     |     |   |     |   |     |            | 3 |

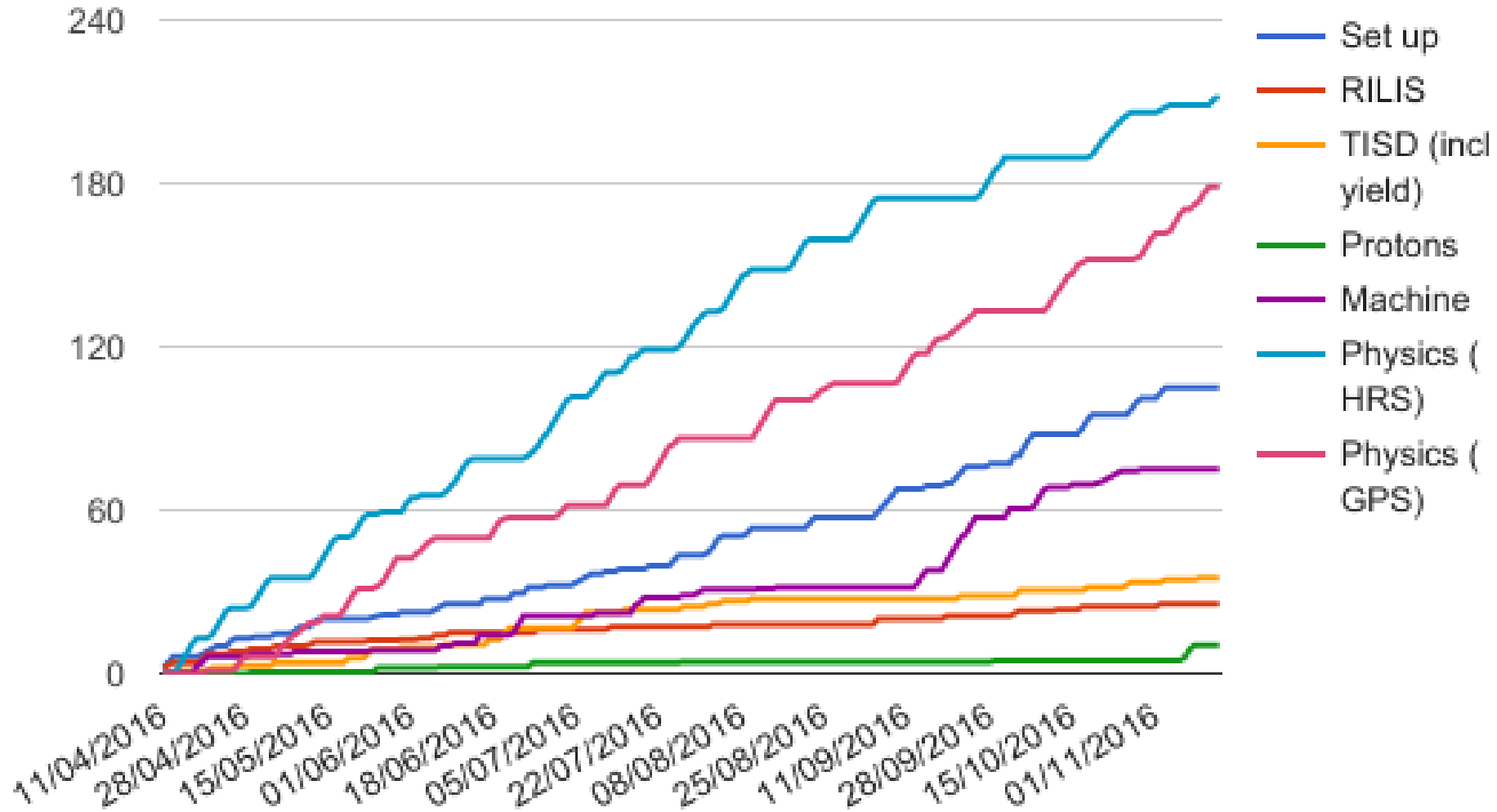


Week\_by\_week Detailed\_breakdown **final\_version** Graph Summary\_2016 Full details She ...

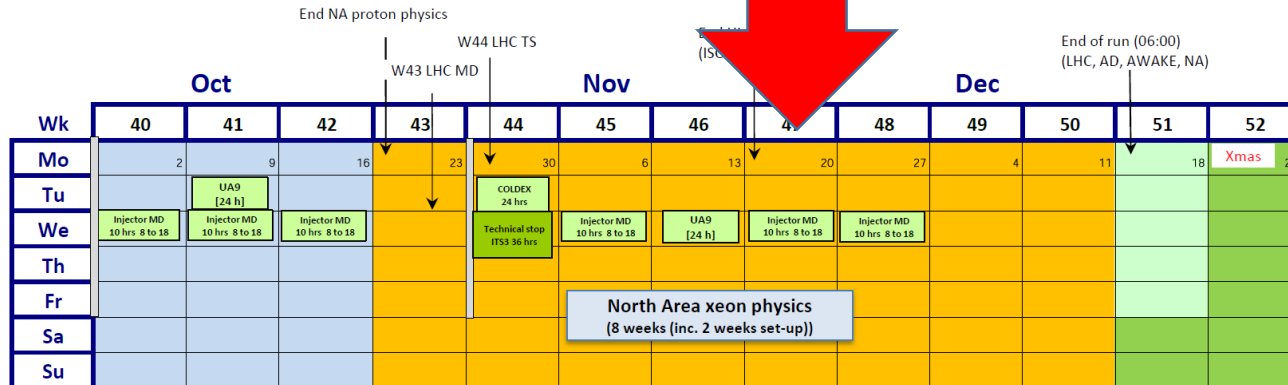
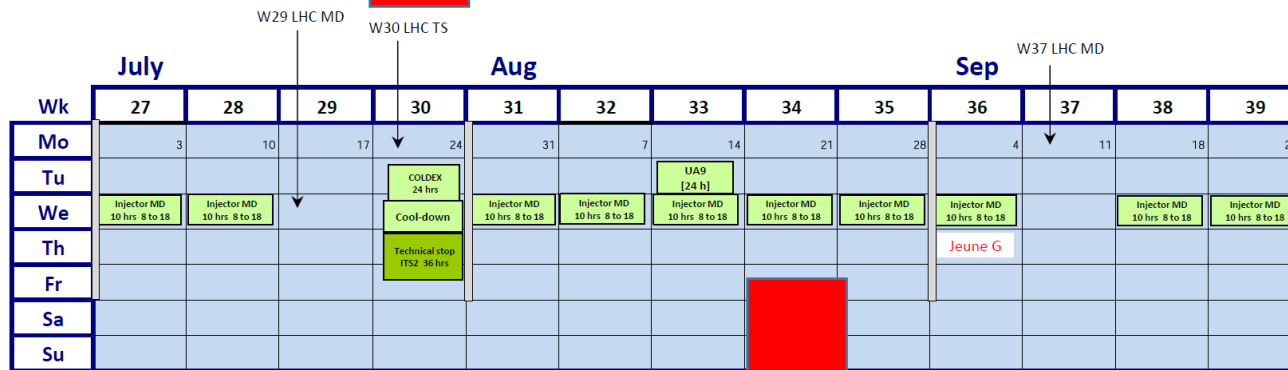
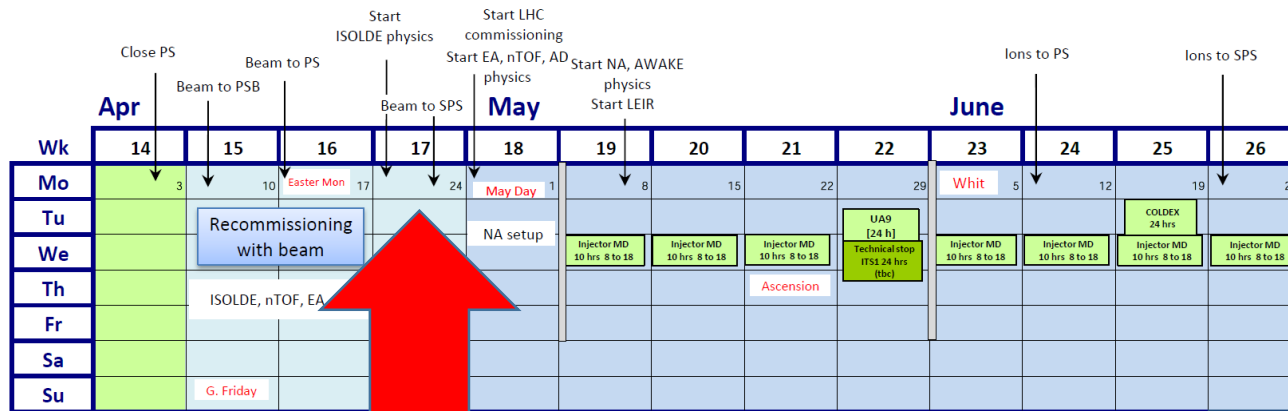
Ready Circular References 85%

Windows taskbar with icons for File Explorer, Chrome, Spotify, Outlook, PowerPoint, Excel, Word, and other applications. System tray shows ENG US, 13:02, and 07/02/2017.

# Machine use in 2016



# Schedule 2017



- 24<sup>th</sup> April: start of physics 2017
- Protons finishing on 20<sup>th</sup> November
- Running period of 210 days. (perhaps one more week is possible, but too soon to say)
- Low energy until ~ week 26.
- Interleave HIE & LE physics from end of June onwards.
- 3 CMS → some “flexibility” in energy
- Miniball requirements to be decided/discussed soon...
- 3<sup>rd</sup> beamline needs to be installed in good time:
  - Expect some demands for the scattering chamber
- Targets for 2017: nanostructured?
- Length of runs....
- Availability of RILIS (see next slide)
- Autumn:
  - Negative ion run
  - MEDICIS start-up
  - LIEBE tests: block GPS for ~ 3 weeks?



## Shift backlog

| Row Labels           | Sum of Remaining shifts (beginning 2017) | Count of Exp. no. |
|----------------------|--|-------------------|
| BIO                  | 53                                       | 4                 |
| COLLAPS              | 53                                       | 5                 |
| COLLAPS; VITO        | 26                                       | 1                 |
| Collections          | 30                                       | 3                 |
| CRIS                 | 44.5                                     | 6                 |
| fast-timing          | 1.5                                      | 1                 |
| Gandalph             | 9  | 1                 |
| HIE                  | 733.5                                    | 37                |
| IDS                  | 83                                       | 11                |
| IDS - aarhus/madrid  | 0  | 1                 |
| ids -aarhus/madrid   | 0  | 2                 |
| IDS LA1              | 2  | 1                 |
| in-source            | 22.5                                     | 1                 |
| ISOLTRAP             | 64                                       | 11                |
| la1                  | 17                                       | 4                 |
| LA1 ; IDS; Bucharest | 3  | 1                 |
| LA1 -aarhus/madrid   | 0  | 1                 |
| LA1 Bordeaux         | 5  | 1                 |
| la1, hi-energy       | 0  | 1                 |
| LA1; TATRA           | 3  | 1                 |
| MEDICAL              | 4  | 1                 |
| NICOLE               | 29                                       | 2                 |
| REX                  | 163.5                                    | 12                |
| SSP                  | 101.5                                    | 25                |
| target               | 0  | 1                 |
| TAS                  | 11.5                                     | 3                 |
| TISD                 | 12                                       | 1                 |
| Windmill             | 0  | 1                 |
| Windmill, ISOLTRAP   | 0  | 1                 |
| Windmill; ISOLTRAP   | 3  | 1                 |
| <b>Grand Total</b>   | <b>1474.5</b>                            | <b>142</b>        |

## RILIS

In 2016: ~80% of runs were RILIS ionised...loss of expertise since then

[http://indico.cern.ch/event/520747/attachments/1260963/1863951/PGM\\_rilis\\_operation.pdf](http://indico.cern.ch/event/520747/attachments/1260963/1863951/PGM_rilis_operation.pdf)

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The Students and Fellows have their own projects and commitments in addition to RILIS maintenance, setup and operation

24-hour 7-days a week unlimited RILIS operation is not TECHNICALLY possible

Students are not authorised to be placed in a position of sole responsibility for the RILIS installation

For students: Out-of-hours or shift work is only allowed if they are an active participant of an experiment

Co-authorship of papers...

**MINIBALL**

**SCATTERING EXPERIMENTS**

**ISS**

**COLLAPS**

**ISOLTRAP**

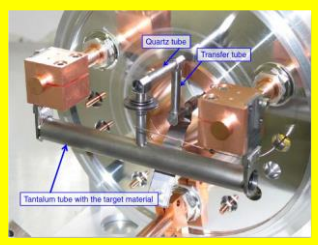
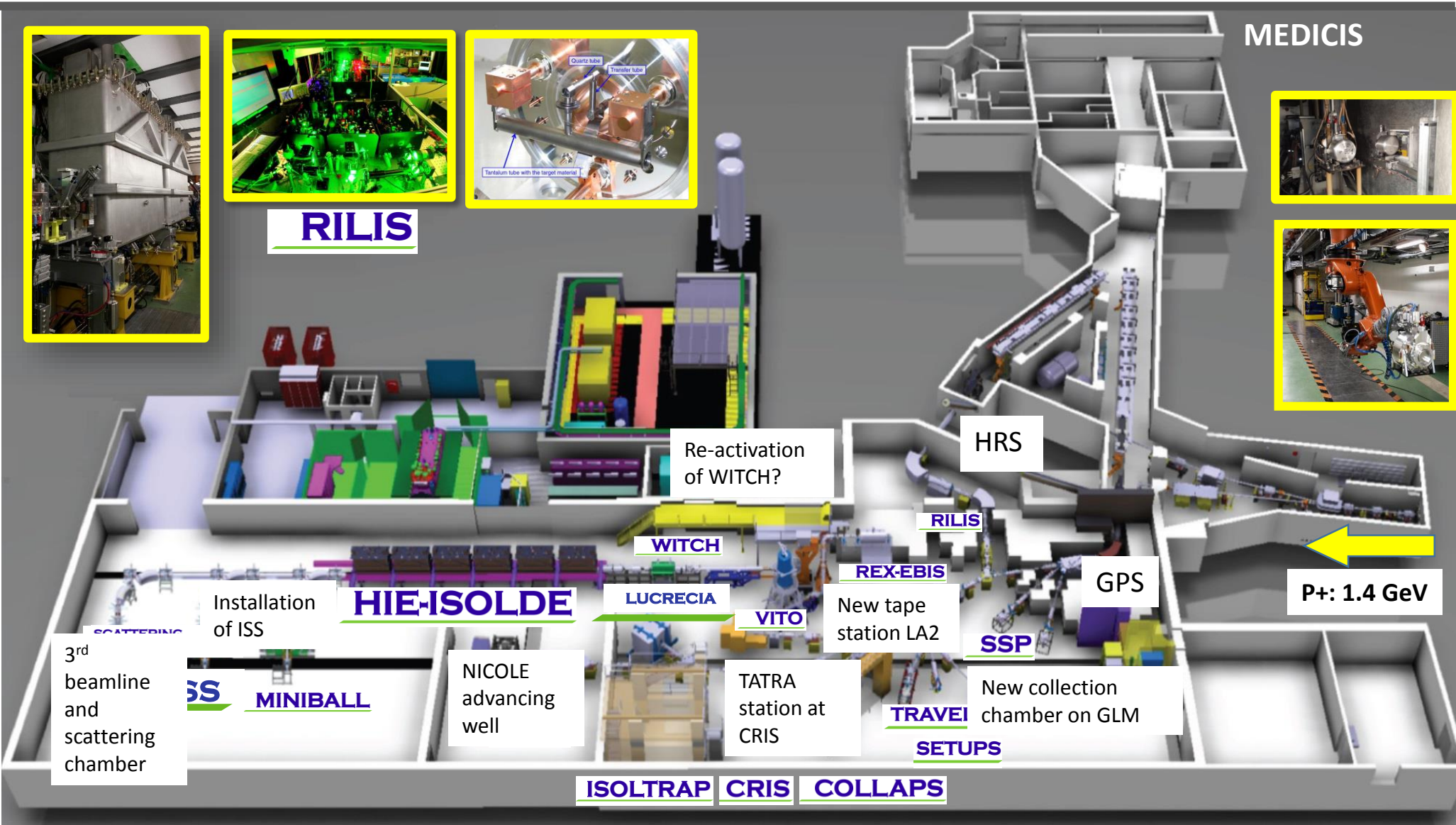
**CRIS**

**VITO**

**IDS**

**SSP**

**MEDICAL ISOTOPES**



# Safety and training etc

Required training for **ISOHALL**

Online:

- Safety at CERN
- RP supervised (changed since last year)
- Basic electrical awareness

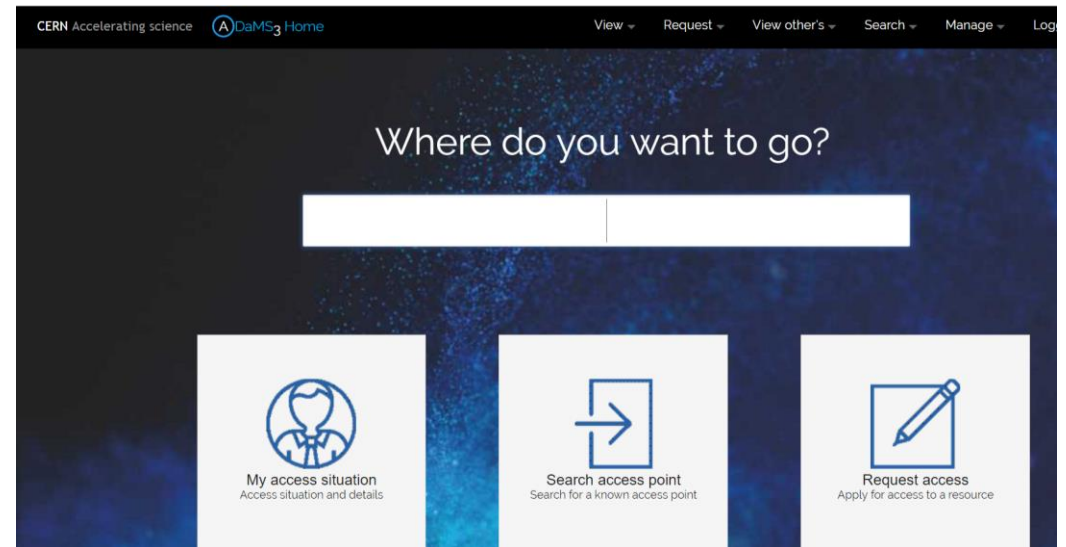
Hands-on:

- Electrical awareness
- RP hands-on

Every Tuesday @ 1300 – 1700), training centre Prevezsin.

External trainer: try to have confirmation of participation 3 weeks in advance.

Registration in EDH...



Access now via ADAMS rather than EDH.

(not yet an improvement, especially in terms of easily displaying information)

# Safety continued...

Helmets and safety shoes in the hall....

Control on entering and leaving

Visit of OFSP to CERN Jan 2017.

New highly shielded chamber needed for medical isotopes: design pending approval

Re-configuration of GLM/GHM space for better practice

WDP to be followed for more collections.

