

# ISOLDE Technical Report

64th Meeting of the INTC  
24<sup>th</sup> of June 2020

Joachim Vollaire on behalf of the technical teams



# Outline

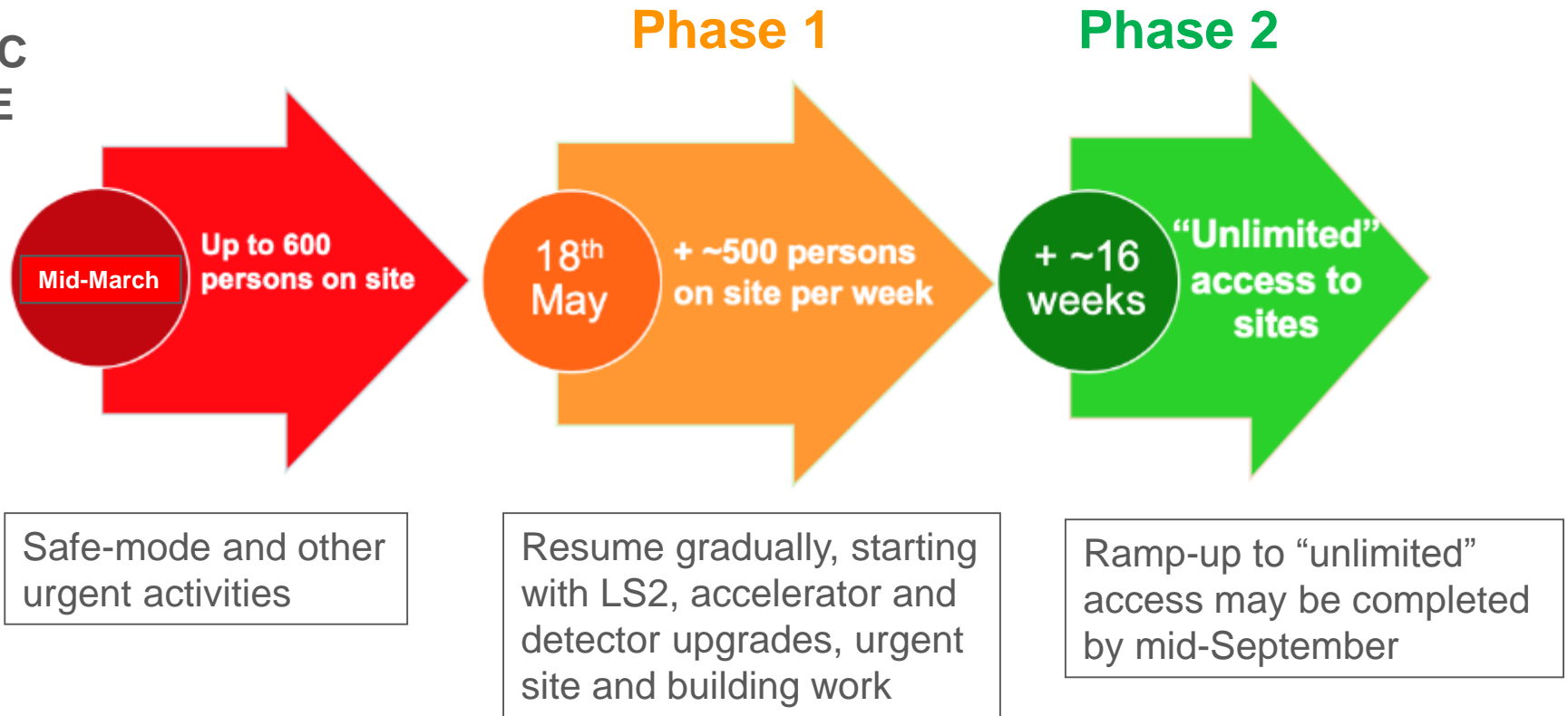
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- Highlights of activities in the target area and “Class A” laboratories
  - Frontends production and installation
  - Nano-laboratory construction
  - MEDICIS update
- LS2 activities in the experimental hall:
  - Tape Station
  - REX TRAP&EBIS
  - REX/HIE ISOLDE Linac
- Master Schedule for 2020 and 2021
- Some physics highlights

# CERN since the last INTC



Endorsement by RB, IEFC and LS2C of HIE ISOLDE early startup in 2020

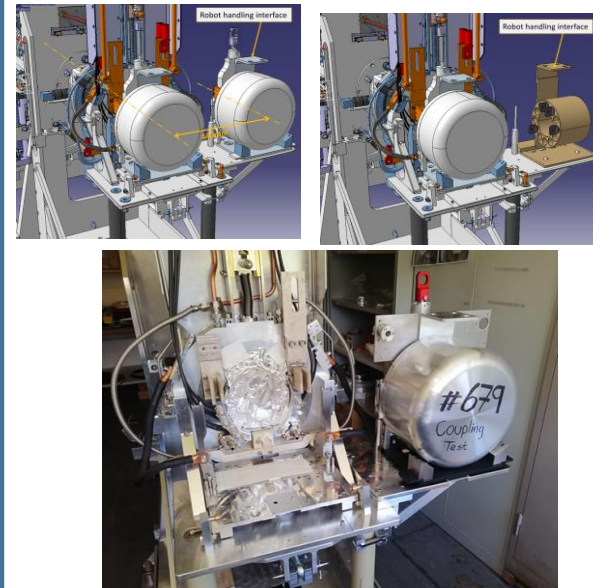


# FE10 production status (installation on GPS)

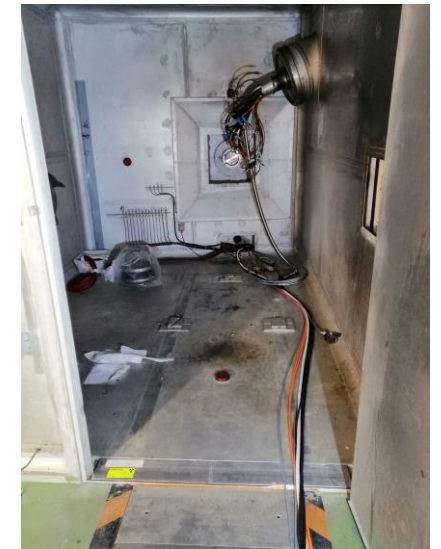
- Activity with the highest priority for the STI-RBS section when work on site resumed
- FE10 (inside Building 179) successfully vacuum tested during the last weeks
- Preparatory activities (alignment, cabling....) inside the GPS Faraday cage in view of the FE installation
- Transfer to the target area end of July and first stable beams in September



New irradiation table



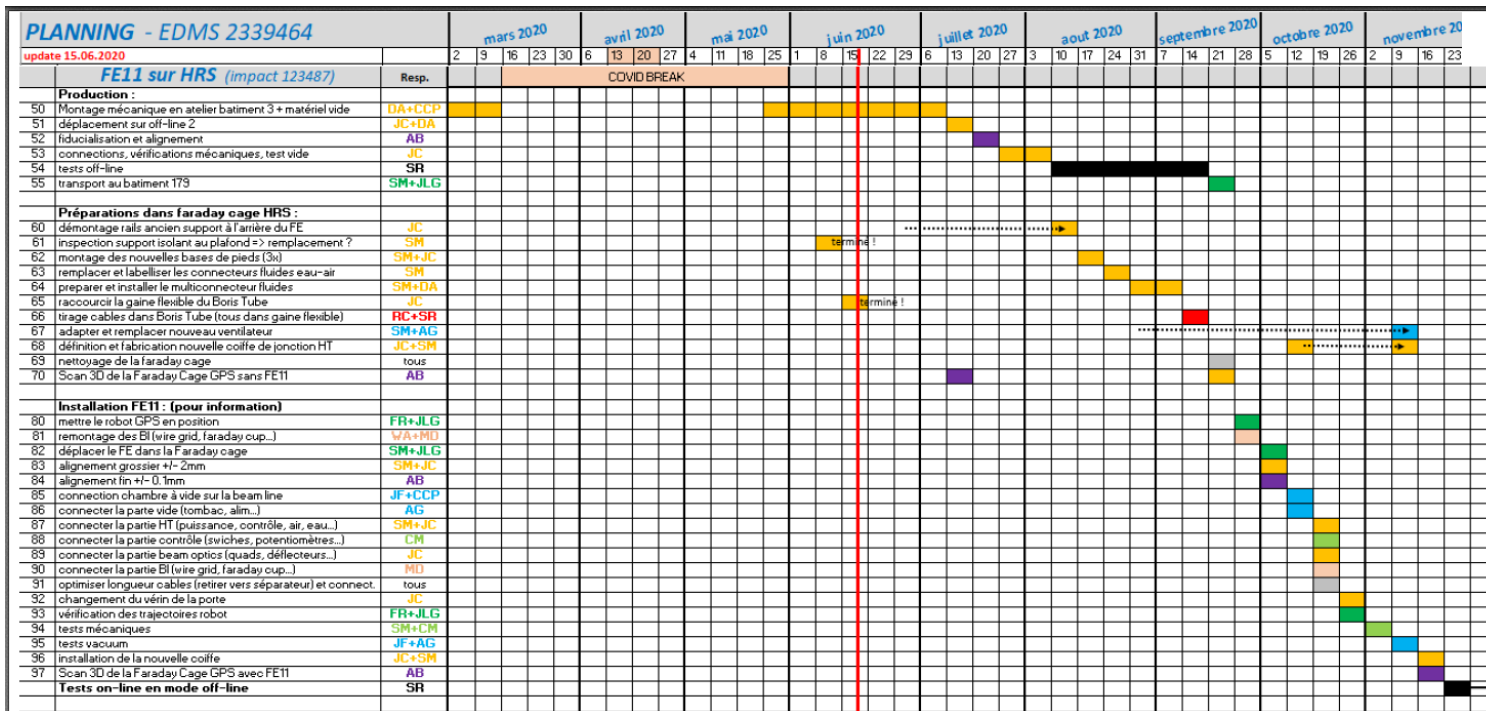
GPS Faraday Cage





# FE11 production status (installation on HRS)

- Progress with mechanical assembly resumed end of may and excellent progress since (less difficulties encountered as compared to the FE10 production).
- Stable beam testing period at offline2 starting in August. Transfer for installation in the target area in September. First stable beam tests at HRS expected in November.



# Nano-Laboratory Construction

- Extension of Building 179 (ISOLDE and MEDICIS laboratories for radioactive material handling)

## Situation mid March



## Situation mid June

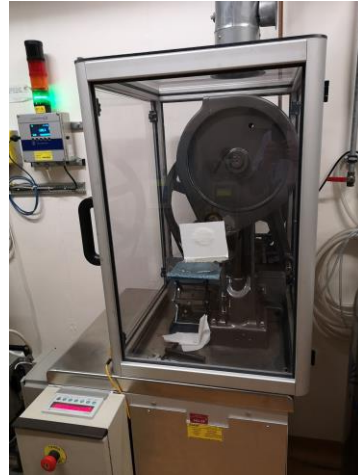


- Part dedicated to radioactive material storage (heavy density concrete)
- Work could resume earlier than other activities (according to host state guidelines)
- Overall project planning remains unchanged (Building delivered end of May 2021 with service and laboratory equipment)



# New nano-laboratory – operational constraints

Laboratory for UCx production  
(no nano-material handling allowed)



Carburation and calibration Area



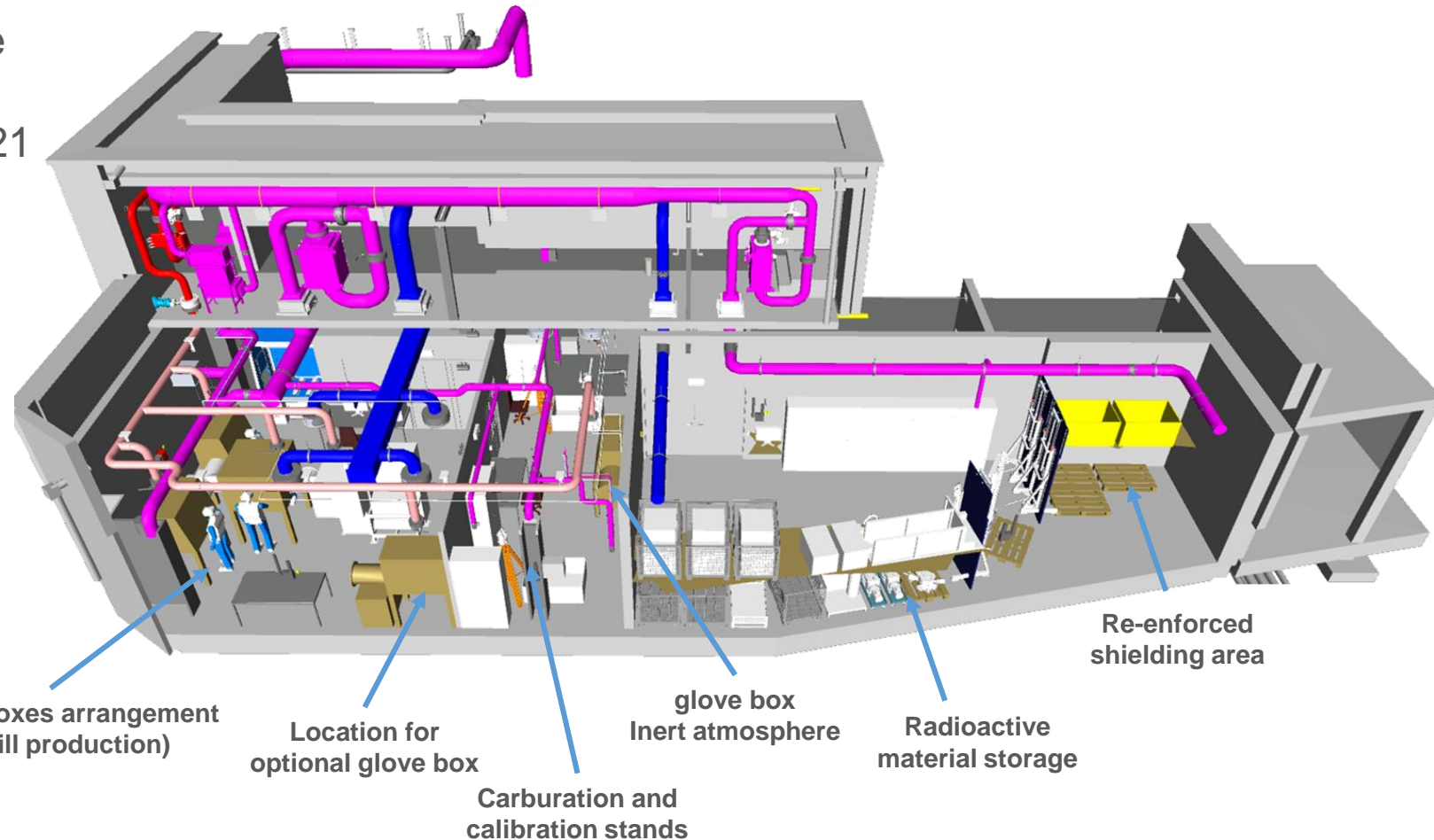
- New laboratory will offer more space and a modern infrastructure (fully enclosed process requiring less transfer of radioactive powder) for production of UCx pill (including pills from nano-material powders)
- Storage area necessary for routine targets dismantling (ISOLDE hot cell)

# 3D model of the nano-laboratory

- Nuclear ventilation expanded to include the new laboratory (dynamic confinement) → impact activities in 2021
- Fully enclosed process:
  - 4+1+1 glove boxes
  - Enclosure of new pill-press
  - Dedicated process ventilation
- Nano-material handling considered in building specification (access SAS...)



**New pill press**

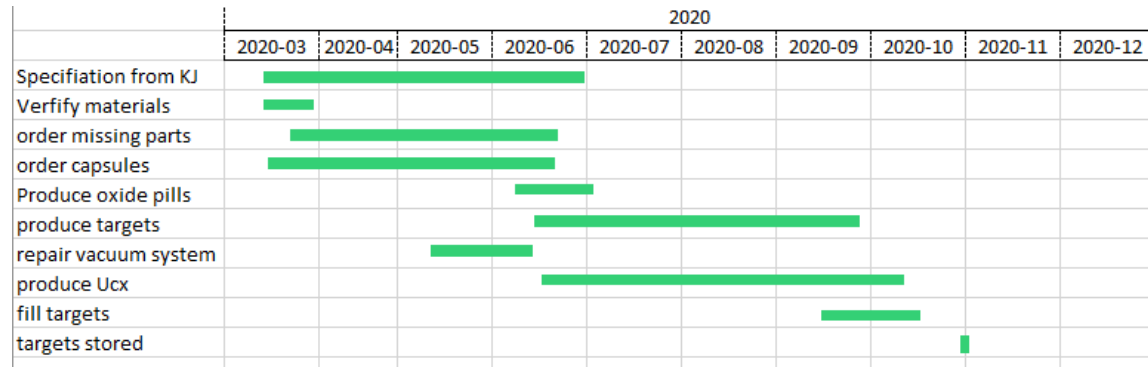


Nano-Lab. 3D model integration EN-ACE / EN-CV

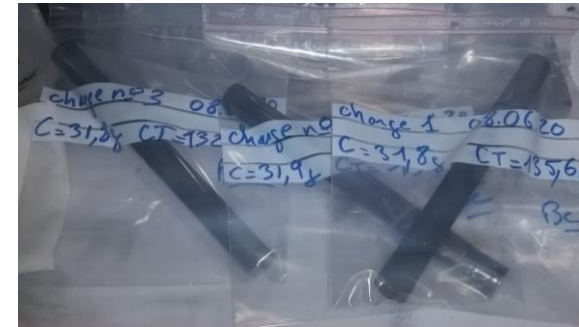


# Targets for 2021 (anticipate in 2020)

UCx targets pre-production in view of nanolab ventilation cut Q1-Q2 2021



UO+C pills production ongoing



10 targets in queue

708-UC-MK1	713-UC-VD5
709-UC-MK1	714-UC-VD7
710-UC-MK1	715-UC-MK1
711-UC-MK1	716-UC-MK1
712-UC-MK1	717-UC-MK1

## Targets to be reused for 2021

- #654-UC-MK1-W
- #635-UC-MK1-Ta
- #534-Sn-VD7
- #619-Pb-VD
- #653-UC-Ta-n
- #641-UC-Ta

## Also available: Targets from TISD tests

- #638-UC-MK1-Re
- #659-UC-VD7
- #668M-UC-VD5
- #637-UC-MK1-W

Production of storage container ongoing



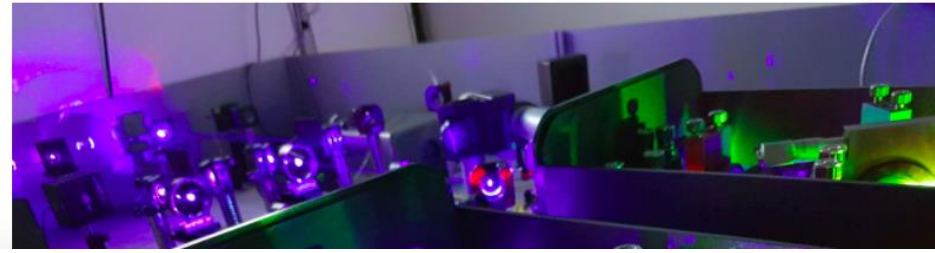
B. Crepieux, M. Owen, S. Rothe

# MEDICIS Status Report (02/20 to 06/20)

- Technical
- Successful
- Installation
- MEDICIS
- Laser alignment 15<sup>th</sup> of
- First receipt (Sm-153)
- MEDICIS website is now available!
- <https://cern-medicis.web.cern.ch/>



## WELCOME TO THE CERN-MEDICIS WEBSITE!



### NEWS!

- **25/05/2020**  
MEDICIS is restarting after the COVID outbreak!

- **15/05/2020**  
*PRISMAP: The European medical isotope programme*, a consortium with the principal medical radionuclides providers - including MEDICIS - was submitted yesterday for funding by the European Commission; feedback expected after the summer.

- **Job opportunities!**  
Hevesy Lab at DTU Riso, Denmark, has an open permanent position for a "Cyclotron & Radionuclide Specialist for Medical Isotopes"

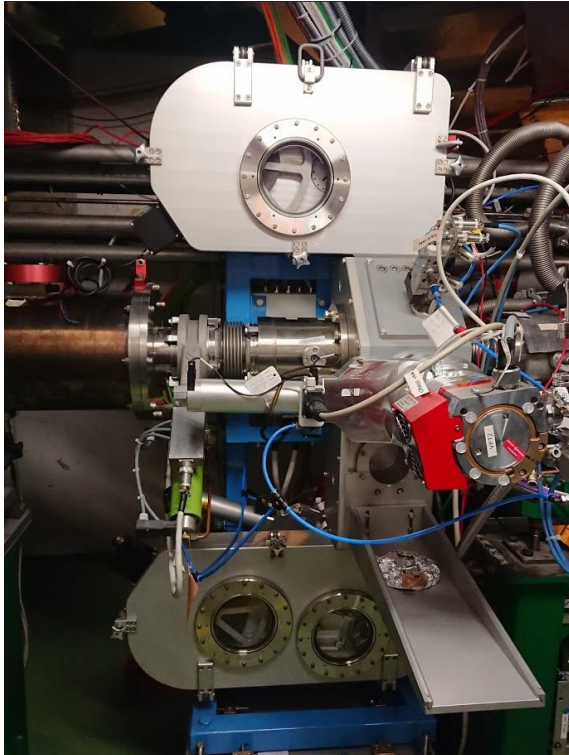
(Covid)

y 2020

ear with MELISSA

26<sup>th</sup> of June 2020

# New Fast Tape Station



- **Low level controls** to be tested/fixe*d* *EN/SMM* (ongoing)
- Basic **high-level application** / Beam instrumentation display by *BE/OP* (from Oct 2020)
- Advanced **yield measurement application** via *EN/STI* (2021)
- **Detectors** (4pi beta | (beta/gamma | alpha) with strong support by *EP/SME* (2020|2021|2022)
- Investigating SiPM electronics designed by IFIN (*Bucharest, Romania*)
- **Tapestation 2** at GLM on hold till TS1 advanced



<https://doi.org/10.1016/j.nima.2019.163263>

Courtesy S. Rothe et al.

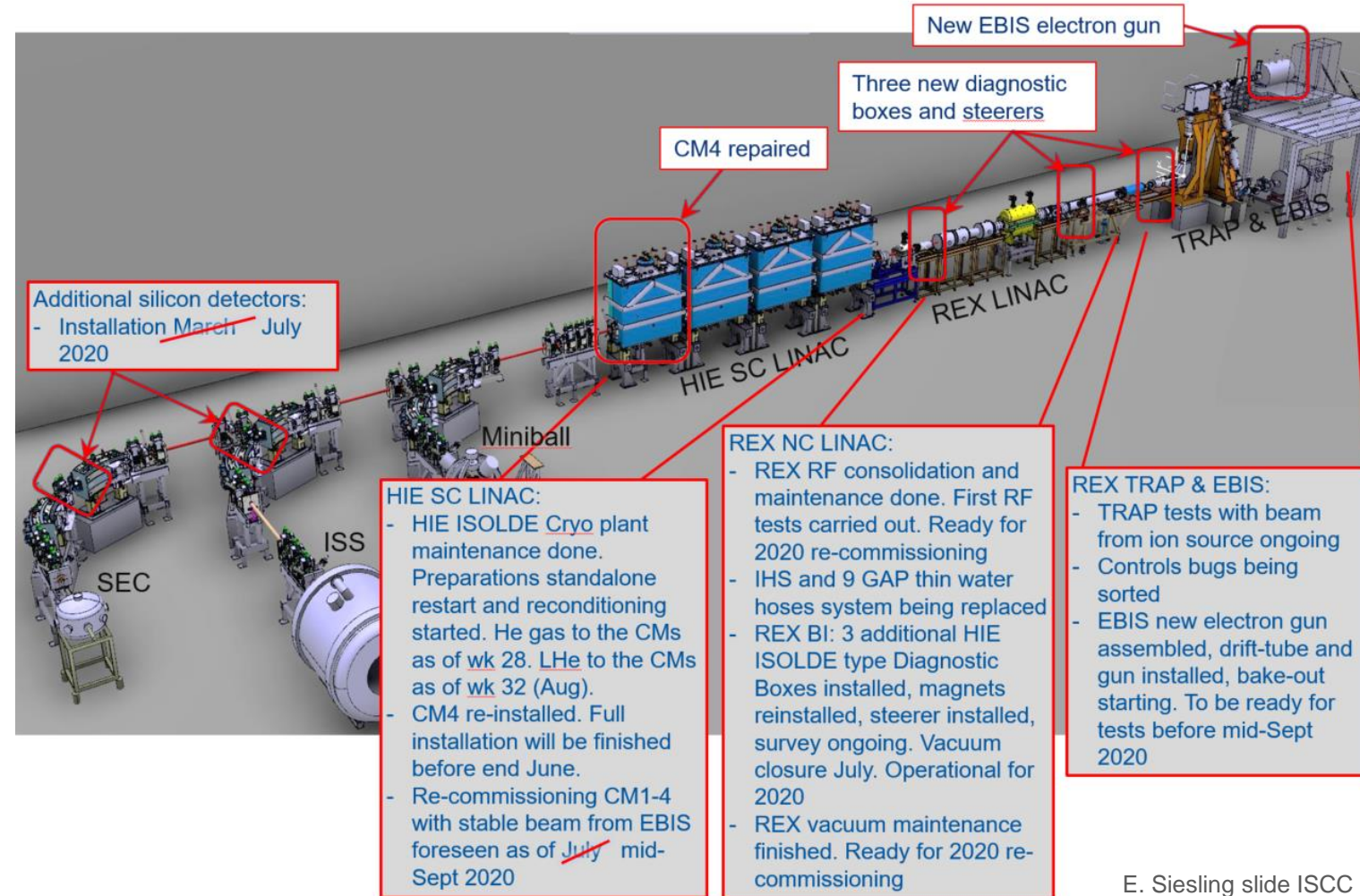
Courtesy of S. Rothe



# Status REX & HIE ISOLDE

## May 2020:

- Overall REX/HIE ISOLDE installation planning was reviewed in the frame of CERN wide prioritisation of activities and allocation of resources taking COVID-19 delay and measures for a progressive re-start as of 18th May in account
- **REX/HIE ISOLDE aim:** Maintain for 2020: Crucial Hardware tests, EBIS new gun, HIE ISOLDE Cooldown, Cryo Module recommissioning and Beam (stable) Commissioning.
- **Abandoned for 2020:** extensive Machine Studies
- As of today, all REX / HIE ISOLDE LS2 tasks are on track with regard to the new COVID revised planning



E. Siesling slide ISCC

# REX EBIS new immersed Electron gun and Drift Tube work

realign with  $\pm 0.1$  mm transverse precision



Refurbished drift tube

Courtesy Fredrik Wenander, Gunn Khatri BE-ABP, Simon Mataguez BE-OP, et al.

E. Siesling slide ISCC



# REX 3 new diagnostic boxes + additional steerer



## Main progress:

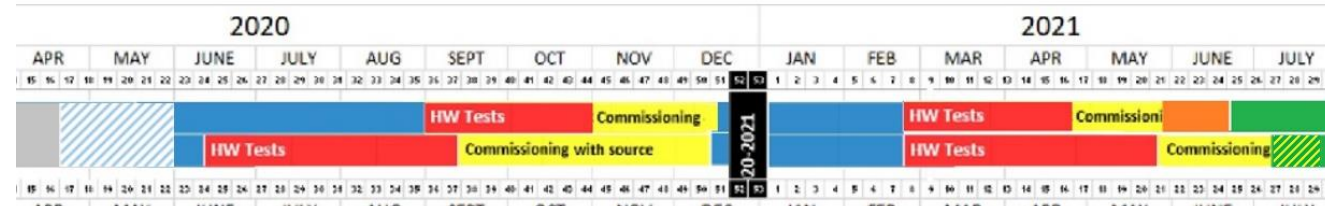
- All three boxes, the two magnets and the two steerers in place
- All vacuum chambers and related equipment in place

**Aim:** To be ready second week of July for RF tests (tunnel closed and vacuum OK) and for HIE Cryo cooldown as of Aug (restricted tunnel access).

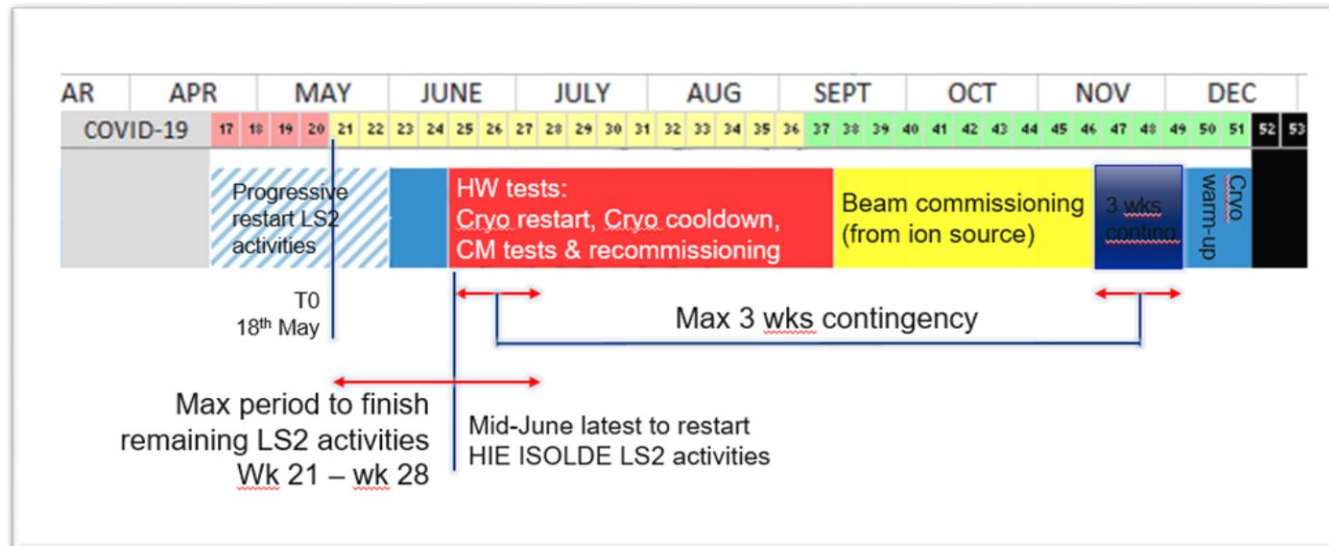
Courtesy Candy Capelli EN-MME, Nicolas Chritin EN-MME, Simon Mataguez BE-OP, William Andreatza, Enrico Bravin, Sergey Sadovich BE-BI, Jose Ferreira Somoza, Guillermo Merino Fernandez TE-VSC, Transport Team – E. Siesling slide ISCC



# Revised LS2 Master Schedule for ISOLDE



## REX / HIE ISOLDE LS2 activities



HIE-ISOLDE ready for beam commissioning  
 ISOLDE low energy Exp. Area ready for beam commissioning  
 Cooling water back HW tests start  
 ISOLDE low energy Exp. Area ready for beam commissioning (with source)  
 HIE-ISOLDE ready for beam commissioning (with source)  
 HIE-ISOLDE Physics start  
 ISOLDE low energy Exp. Area Physics start  
 Protons from PSB BTY setting-up

### Physics 2021:

- Low E Physics start end-June 2021 (was end-April)
- HIE-ISOLDE Physics start end-July 2021 (was mid-May)

E. Siesling LS2C 12 June 2020 / ISCC 23 June 2020

# Some recent ISOLDE physics output

## First measurements on radioactive molecules...

Article

### Spectroscopy of short-lived radioactive molecules

<https://doi.org/10.1038/s41586-020-2299-4>

Received: 24 July 2019

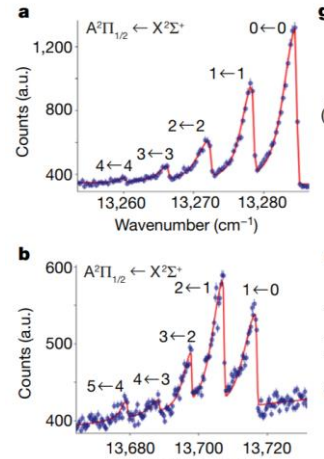
Accepted: 13 March 2020

Published online: 27 May 2020

Open access

R. F. Garcia Ruiz<sup>1,2,3</sup>, R. Berger<sup>1,2</sup>, J. Billowes<sup>1</sup>, C. L. Binnersley<sup>1</sup>, M. L. Bissell<sup>1</sup>, A. A. Breier<sup>1</sup>, A. J. Brinson<sup>1</sup>, K. Chrysalidis<sup>1</sup>, T. E. Cocolios<sup>1</sup>, B. S. Cooper<sup>1</sup>, K. T. Flanagan<sup>1</sup>, T. F. Giesen<sup>1</sup>, R. P. de Groote<sup>1</sup>, S. Franchoo<sup>1</sup>, F. P. Gustafsson<sup>1</sup>, T. A. Iasev<sup>1,2</sup>, Á. Koszorus<sup>1</sup>, G. Neyens<sup>1,4</sup>, H. A. Perrett<sup>1</sup>, C. M. Ricketts<sup>1</sup>, S. Rothe<sup>1</sup>, L. Schweikhard<sup>1</sup>, A. R. Vernon<sup>1</sup>, K. D. A. Wendt<sup>1</sup>, F. Wienholtz<sup>1,5</sup>, S. G. Wilkins<sup>1,4</sup> & X. F. Yang<sup>1,5</sup>

... proven to be the ideal probes to search for physics beyond Standard Model



396 | Nature | Vol 581 | 28 May 2020

LETTERS

<https://doi.org/10.1038/s41567-020-0868-y>

nature physics

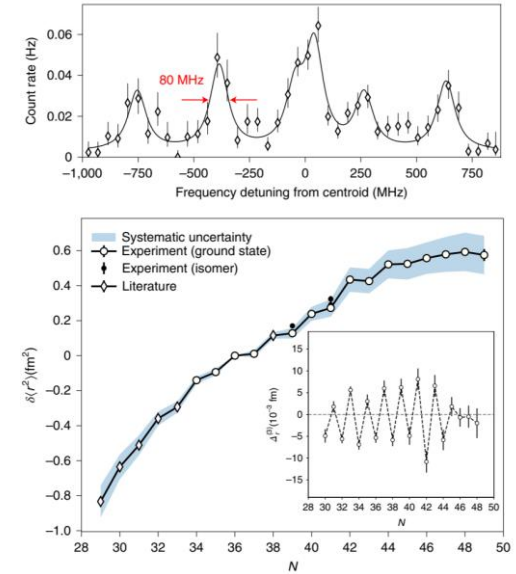
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OPEN

### Measurement and microscopic description of odd-even staggering of charge radii of exotic copper isotopes

R. P. de Groote<sup>1,2,3,4</sup>, J. Billowes<sup>1</sup>, C. L. Binnersley<sup>1</sup>, M. L. Bissell<sup>1</sup>, T. E. Cocolios<sup>1</sup>, T. Day Goodacre<sup>1,4,5</sup>, G. J. Farooq-Smith<sup>1</sup>, D. V. Fedorov<sup>6</sup>, K. T. Flanagan<sup>1</sup>, S. Franchoo<sup>1</sup>, R. F. Garcia Ruiz<sup>1,4,5</sup>, W. Gins<sup>1,2</sup>, J. D. Holt<sup>1,3,10</sup>, Á. Koszorus<sup>1</sup>, K. M. Lynch<sup>1</sup>, T. Miyagi<sup>1</sup>, W. Nazarewicz<sup>11</sup>, G. Neyens<sup>1,9</sup>, P.-G. Reinhard<sup>12</sup>, S. Rothe<sup>1,3,4</sup>, H. H. Stroke<sup>13</sup>, A. R. Vernon<sup>1,3</sup>, K. D. A. Wendt<sup>1,4</sup>, S. G. Wilkins<sup>1,4</sup>, Z. Y. Xu<sup>1</sup> and X. F. Yang<sup>1,15</sup>

NATURE PHYSICS | VOL 16 | JUNE 2020 | 620–624 |



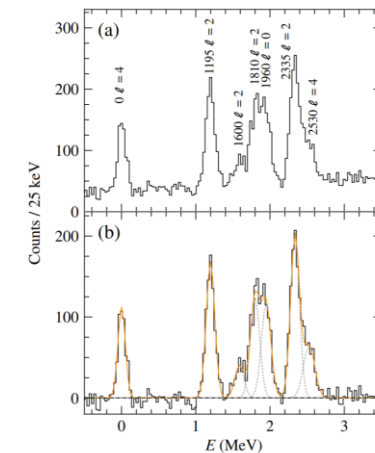
Courtesy of K. Johnston and G. Neyens

PHYSICAL REVIEW LETTERS 124, 062502 (2020)

### First Exploration of Neutron Shell Structure below Lead and beyond $N = 126$

T. L. Tang,<sup>1</sup> B. P. Kay,<sup>1,\*</sup> C. R. Hoffman,<sup>1</sup> J. P. Schiffer,<sup>1</sup> D. K. Sharp,<sup>2</sup> L. P. Gaffney,<sup>3</sup> S. J. Freeman,<sup>2</sup> M. R. Mumpower,<sup>4,5</sup> A. Arokiaraj,<sup>6</sup> E. F. Baader,<sup>3</sup> P. A. Butler,<sup>7</sup> W. N. Catford,<sup>8</sup> G. de Angelis,<sup>9</sup> F. Flavigny,<sup>10,11</sup> M. D. Gott,<sup>1</sup> E. T. Gregor,<sup>9</sup> J. Konki,<sup>3</sup> M. Labiche,<sup>12</sup> I. H. Lazarus,<sup>12</sup> P. T. MacGregor,<sup>2</sup> I. Martel,<sup>7</sup> R. D. Page,<sup>7</sup> Zs. Podolyák,<sup>8</sup> O. Poleshchuk,<sup>6</sup> R. Raabe,<sup>6</sup> F. Recchia,<sup>13,14</sup> J. F. Smith,<sup>15</sup> S. V. Szewc,<sup>16,17</sup> and J. Yang<sup>6</sup>

- First ISS paper.
- First “high energy” HIE paper: 7.38MeV/u



- LS2 activities have resumed since mid-May with increasing number of personnel allowed on site
- COVID related safety measures included in work practices and organization
- Activities planning were revised to include the duration of the closure and available resources
- Very strong support and commitment from groups to finalize ISOLDE LS2 work to allow the full recommissioning of the machine in 2020 (new front ends, new tape station, new beam instrumentation, new REX/EBIS e<sup>-</sup> gun, repaired CM4....)
- Execution of the extensive machine study program foreseen in 2020 will however not be possible
- Opportunities to recover part of the time for machine studies will be investigated in the coming months (keep the Cryo plant running over the winter closure ?)



Thank you for your  
attention!



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