



HIE-ISOLDE

10 YEARS following 1st HIE beam

Y. Kadi

ISOLDE Workshop and Users meeting
CERN, 3-5 December 2025



OUTLINE

- Project Key dates
- Project Scope/Roadmap
- Installation of CM1
- 2015 Achievements
- Final Cost-to-Completion
- Acknowledgements

Project Definition

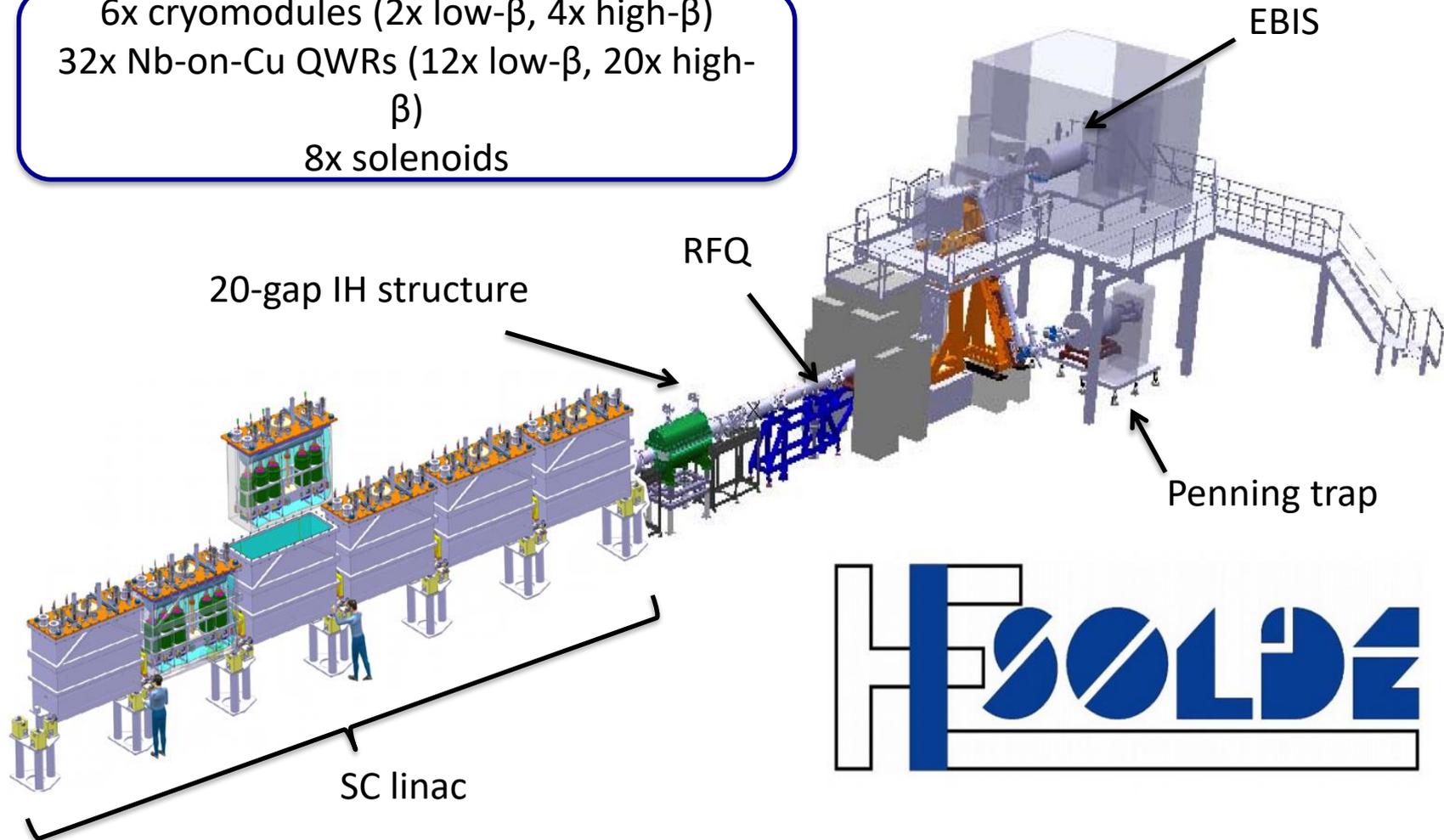
- **October 2001:** First Radioactive Ion beam Beam at REX-ISOLDE with design energy of 2.2 MeV/u delivered for physics to the MiniBall setup
- **2001 - 2002:** Proposal to upgrade REX-ISOLDE to 3.1 MeV/u, then to 4.3 MeV/u, together with beam intensity upgrade and breeding to heavier masses.
- **July 2004:** MoU to provide funding for the REX-upgrade (renamed HIE-ISOLDE in 2003) signed by ISOLDE Collaboration, Belgium, Denmark, Finland, Germany, Sweden, and UK.
- **October 2005:** Special Workshop (Nuclear Physics & Astrophysics at CERN, NuPAC) organised by INTC to review the scientific programs of ISOLDE and n_TOF (requested by Directorate and Research Board).
- **October 2006:** CERN White Paper published that classifies HIE-ISOLDE as "fourth theme" requiring external contributions (15 MCHF + 60 FTE).

Project Implementation

- **July 2007:** Initial contribution received from the Belgian Big Science Grant (K.U. Leuven) for the HIE-ISOLDE linac prototyping (1'025 kCHF)
- **November 2008:** first high-beta prototype cavity (Q1)
- **November 2009:** HIE-ISOLDE project approved by CERN Research Board.
- **January 2010:** Official start of HIE-ISOLDE with a projected cost of 37 MCHF and 143 FTE.
- **April 2010:** EU FP7 CATHI Marie Curie Initial Training Network is approved (56 FTE)
- **November 2011:** Start of construction works.
- **October 2015:** First Radioactive Ion beam Beam at HIE-ISOLDE with energy of 4.3 MeV/u delivered for physics to the MiniBall setup

40 MV SC Linac

6x cryomodules (2x low- β , 4x high- β)
32x Nb-on-Cu QWRs (12x low- β , 20x high- β)
8x solenoids





Electrical feedthroughs

Adjusters



Vacuum vessel

Current leads



Helium vessel

Ni-plated thermal shield



Bellows

Mechanical structure



Solenoid

Cavities

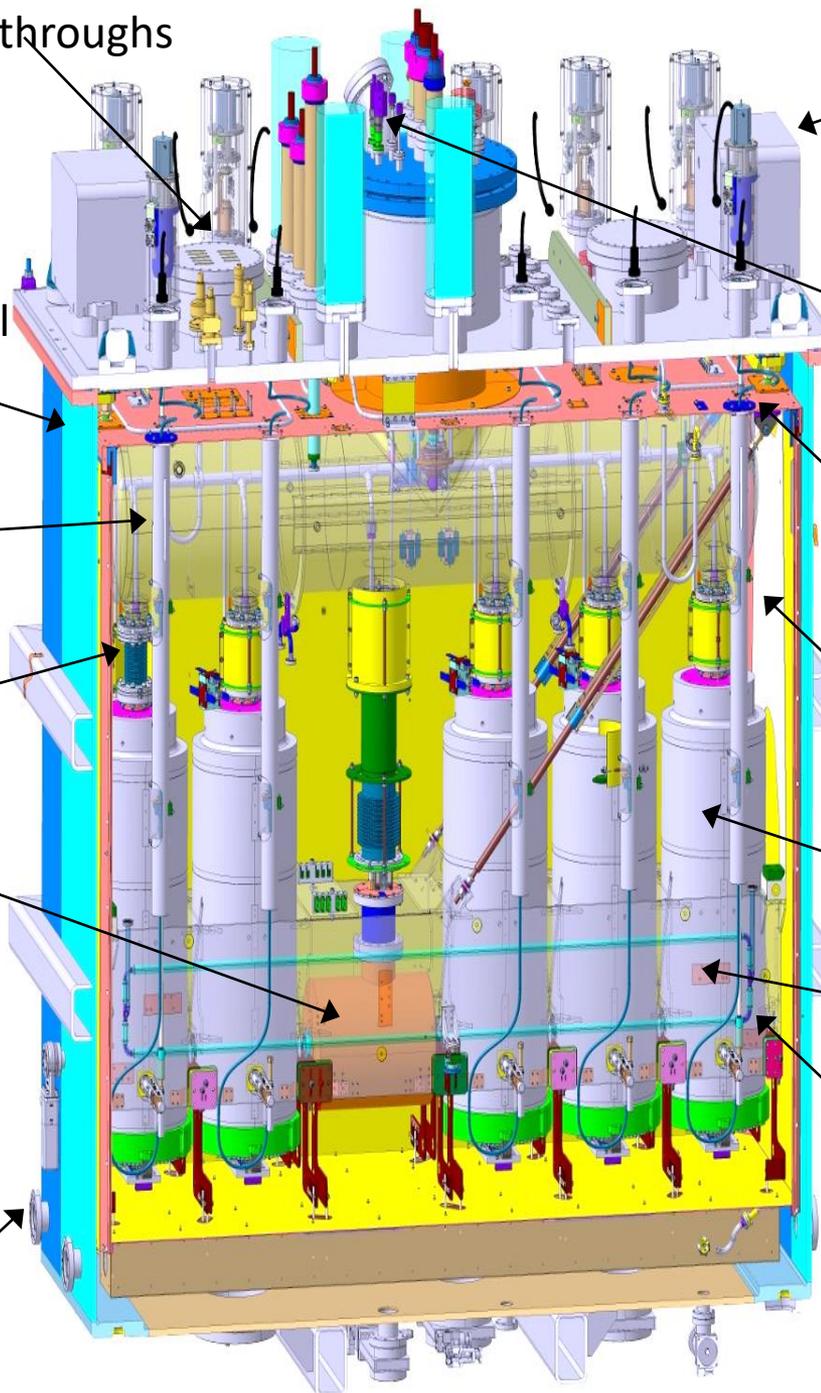


Instrumentation

Supporting frame



Viewports



HIE-ISOLDE Cryomodule #1

Late august 2014: Assembly start

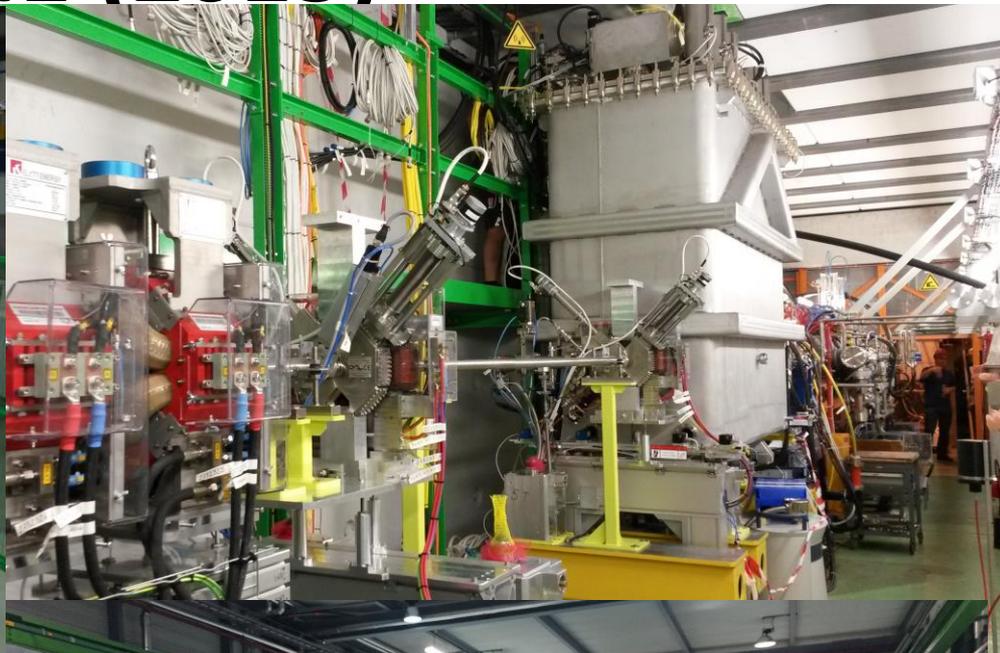
Assembly time of CM1: 30 weeks
Baseline : 27 weeks

1 May 2015: Assembly completed

Mid-June 2015: Successfully
cooled to 4.5K



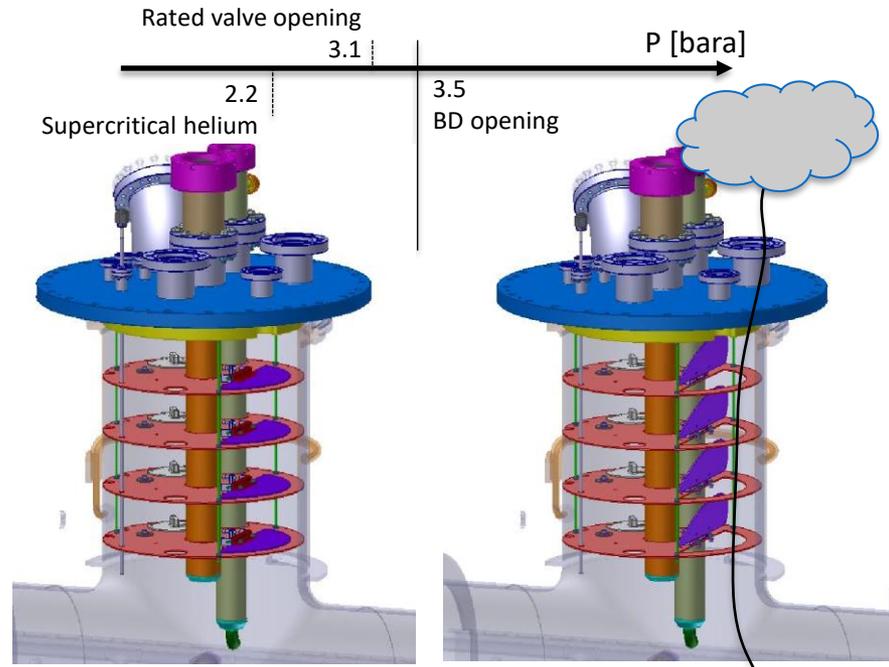
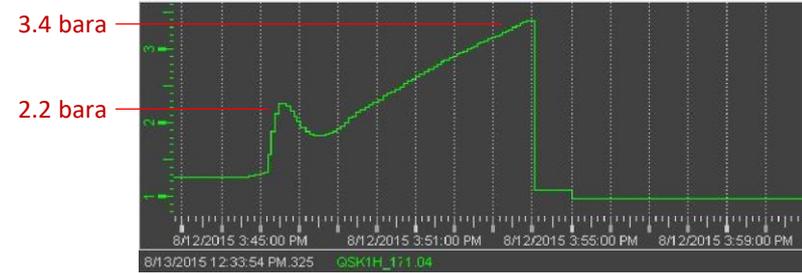
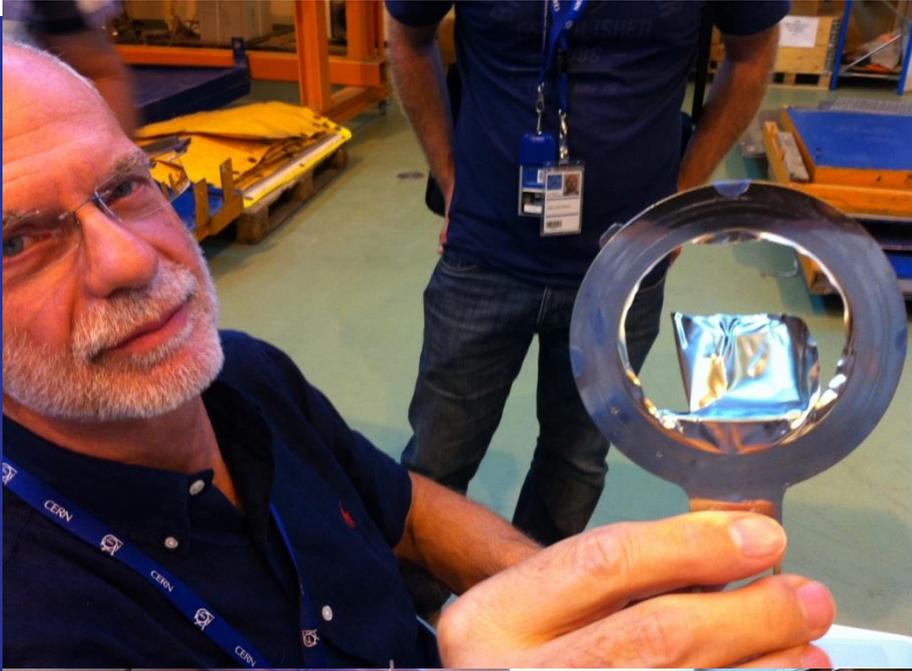
Installation & Commissioning of CM1 (2015)



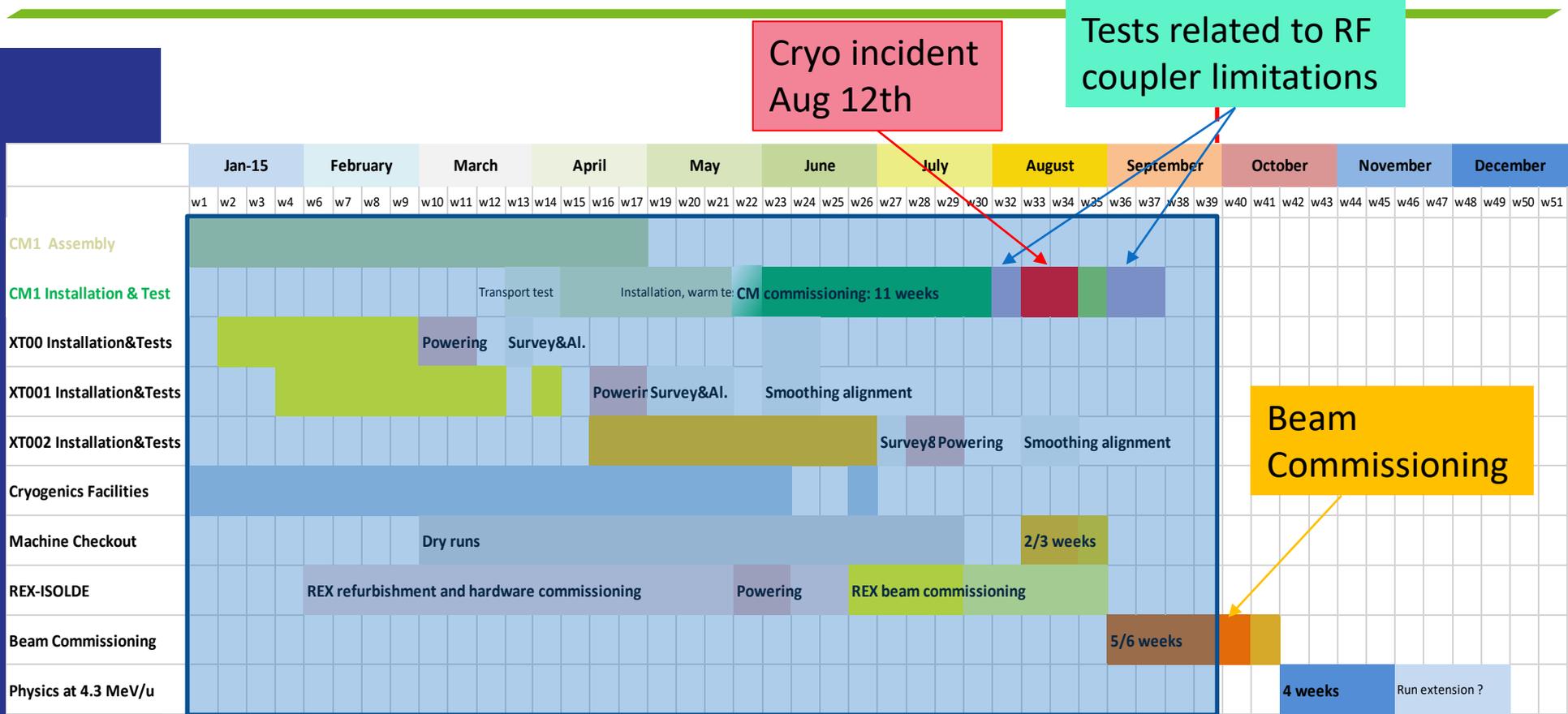
Visit of CERN DG 27/05/2015



Cryogenics incident 12.8.2015



HIE ISOLDE roadmap 2015



All HEBT hardware commissioned on time

CM1 cooled down and hardware tests completed

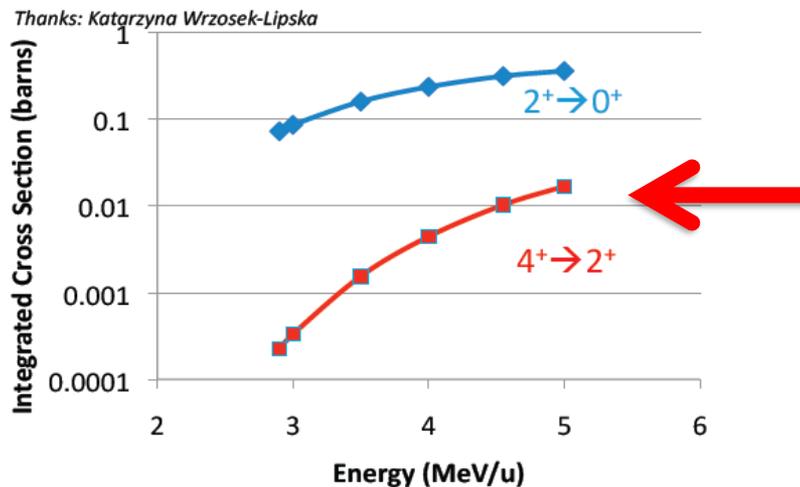
Issue with power coupler → looking for an operational point !

Beam Commissioning well advanced

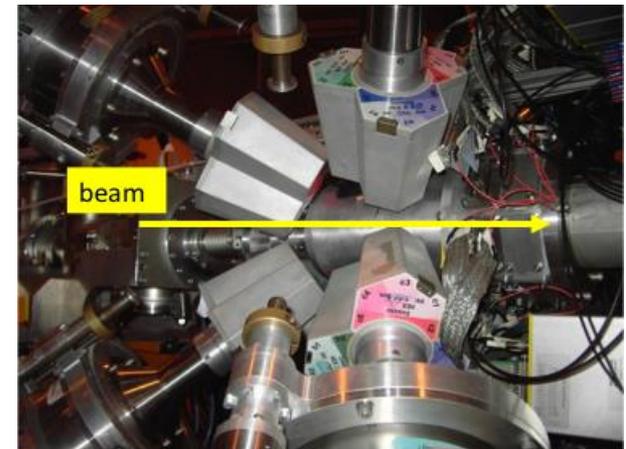
Day-1 Experiment Oct 2015 @ HIE

- Coulomb Excitation in $^{74-80}\text{Zn}$
- Motivation: How large is the $N=50$ shell gap at ^{78}Ni (magic nucleus)?
What does the effective proton-neutron interaction look like ?

Higher energy higher cross section for multi-step Coulomb excitation

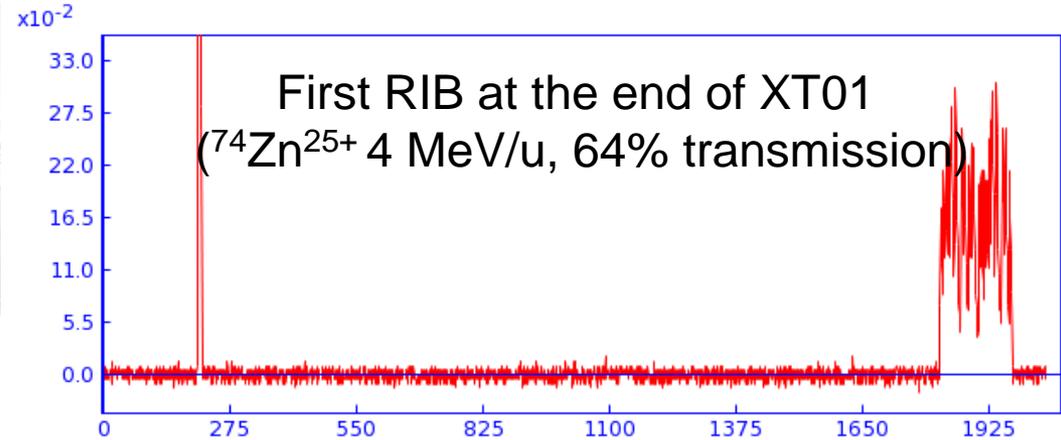


Miniball+CD



- Remove previous discrepancy in the $B(E2: 4^+ \rightarrow 2^+)$ in ^{74}Kr and determine and $B(E2: 6^+ \rightarrow 4^+)$.

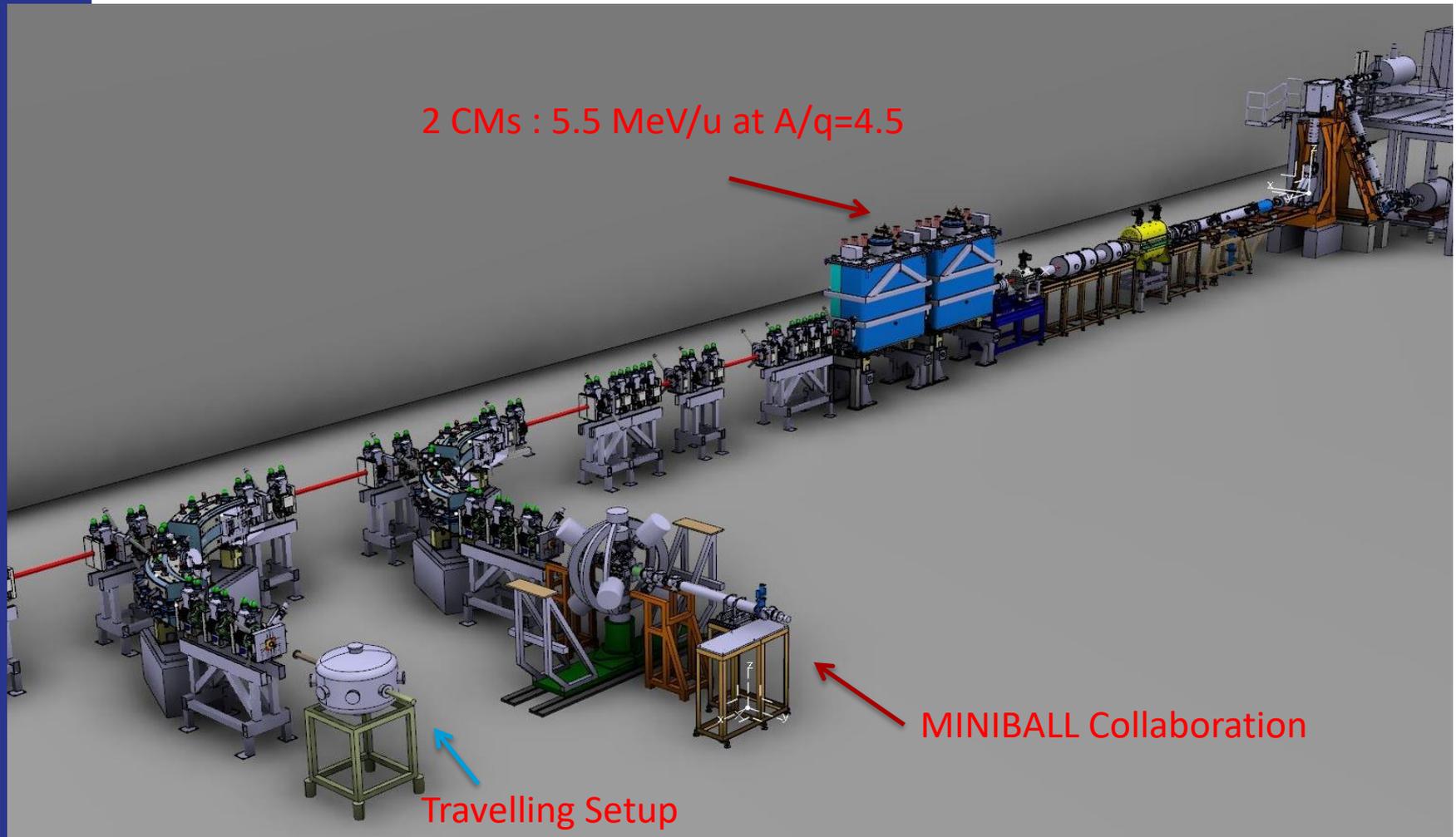
First beam on 22.10.2015 @ 17h02



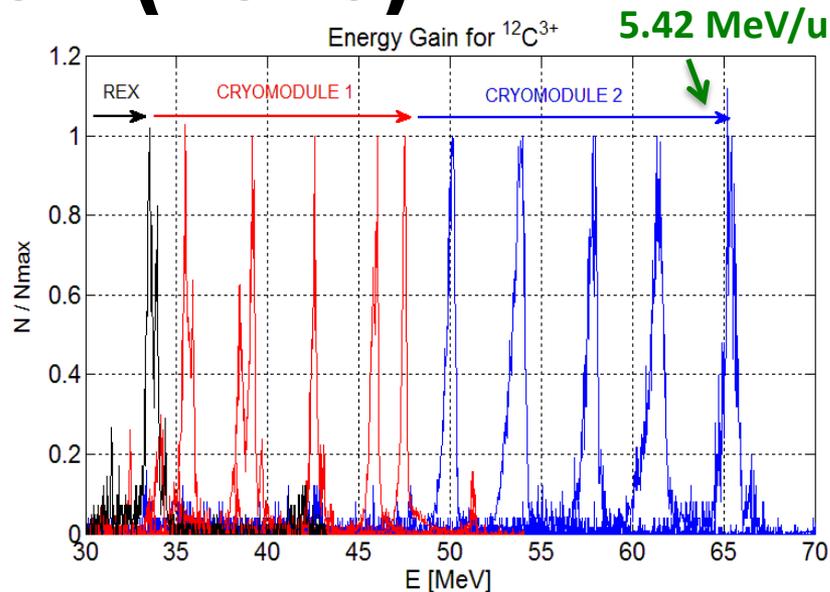
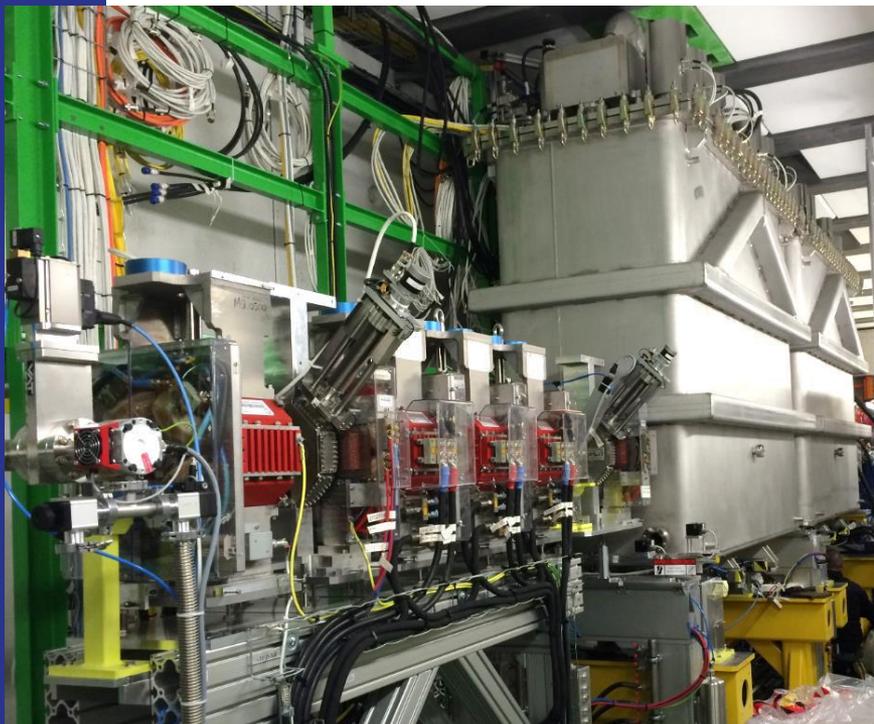
ISOLDE Smile-person



HIE-ISOLDE Phase 1 (2010-2016)



Phase 1: Commissioning & Operation (2016)



Experiment	Isotope	HEBT	Destination	Energy [MeV/u]	Shifts
IS-562	^{110}Sn	XT01	Miniball Spectrometer	4.5	12
	^{108}Sn			4.5	12
IS-548	^{142}Xe	XT01	Miniball Spectrometer	4.5	30
IS-557	^{80}Zn	XT01	Miniball Spectrometer	4.0	12
	^{78}Zn			4.0	12
IS-551	^{132}Sn	XT01	Miniball Spectrometer	5.5	18
IS-561	^9Li	XT02	Scattering Chamber	6.9 (7.2 req.)	15
IS-559	^{66}Ni	XT01	Miniball Spectrometer	5.5	24

Staged Installation of Linac

- REX accelerator (existing): $W = 3 \text{ MeV/u}$



6x cryomodules
32x QWRs
8x solenoids

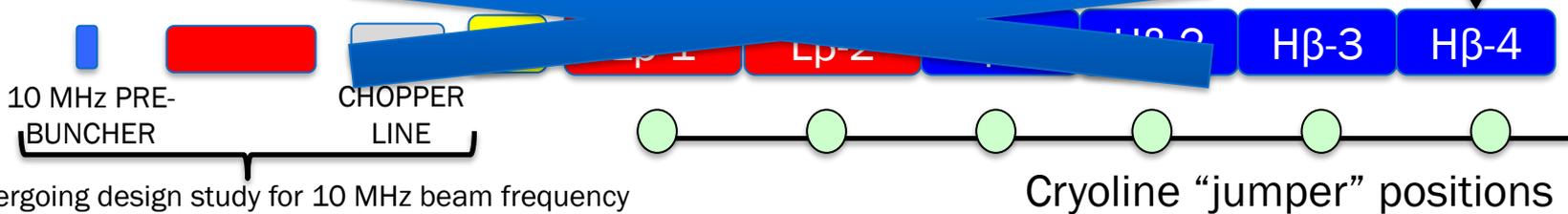
- HIE Phase 1 (2015/2016): $W = 5.5 \text{ MeV/u}$



- HIE Phase 2 (2017/2018): $W = 10 \text{ MeV/u}$



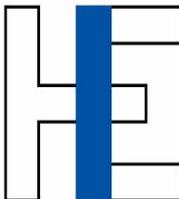
- HIE Phase 3 (??): 10 MeV/u



Undergoing design study for 10 MHz beam frequency for time-of-flight particle ID requested by experiments.

KEY:

RFQ	IHS	7G1,2,3	9GP	LOW-β CRYO.	HIGH-β CRYO.



CtC (1st November 2018)

Cost to Completion (P+M)

in kCHF 78,187

Material CERN	26,440
Collaboration	12,551
In-kind	382
Personnel CERN	33,946
Fellows EU	4,868
	<hr/>
	78,187

P vs M distribution (without in-kind)



Material Budget

in kCHF 39,373



CtC reduced by 950 kCHF
700kCHF Infrastructure
250 kCHF Machine

Cryomodule Infrastructure in SM18



Cryomodule Infrastructure in SM18



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Big thanks to our CATHI Fellows



Where do we CATHI Marie Curie Fellows come from ?



In memory of M. Lindroos & N. Delruelle





ENGINEERING
DEPARTMENT

Thanks for your attention

