HIE-ISOLDE

Yorick Blumenfeld

ISOLDE Facility: a few facts

- ISOLDE is the CERN radioactive beam facility
- Oldest experiment at CERN (approved > 50 y ago!)
- Provides low energy and **post-accelerated beams**
- Run by an **international collaboration since 1965 (6 → 18) @ 60.000 CHF**


Belgium

CERN


Denmark


Finland


France


Germany


Greece


Italy


India


Ireland


Norway


Poland


Romania


Spain


South Africa

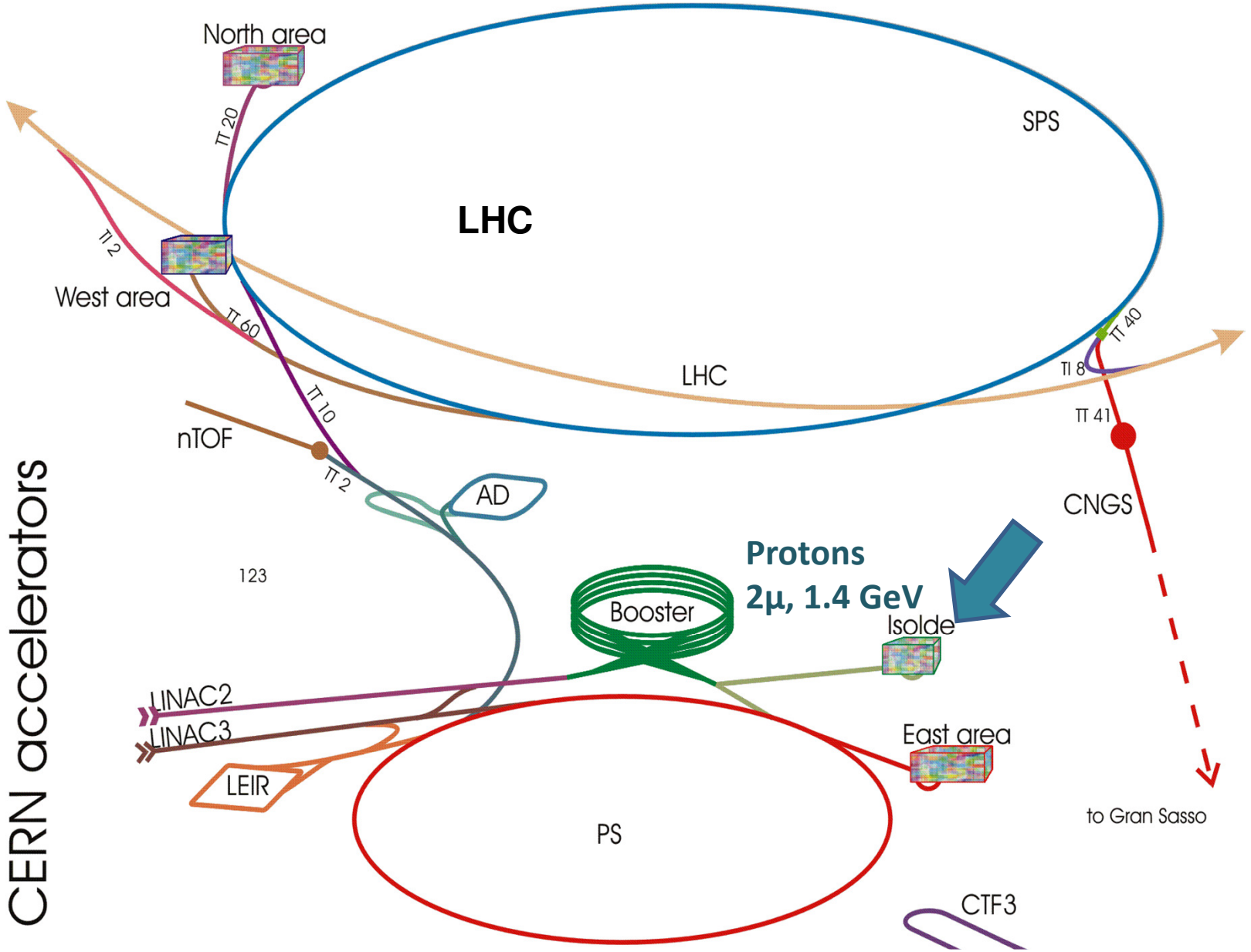

Sweden


Slovakia

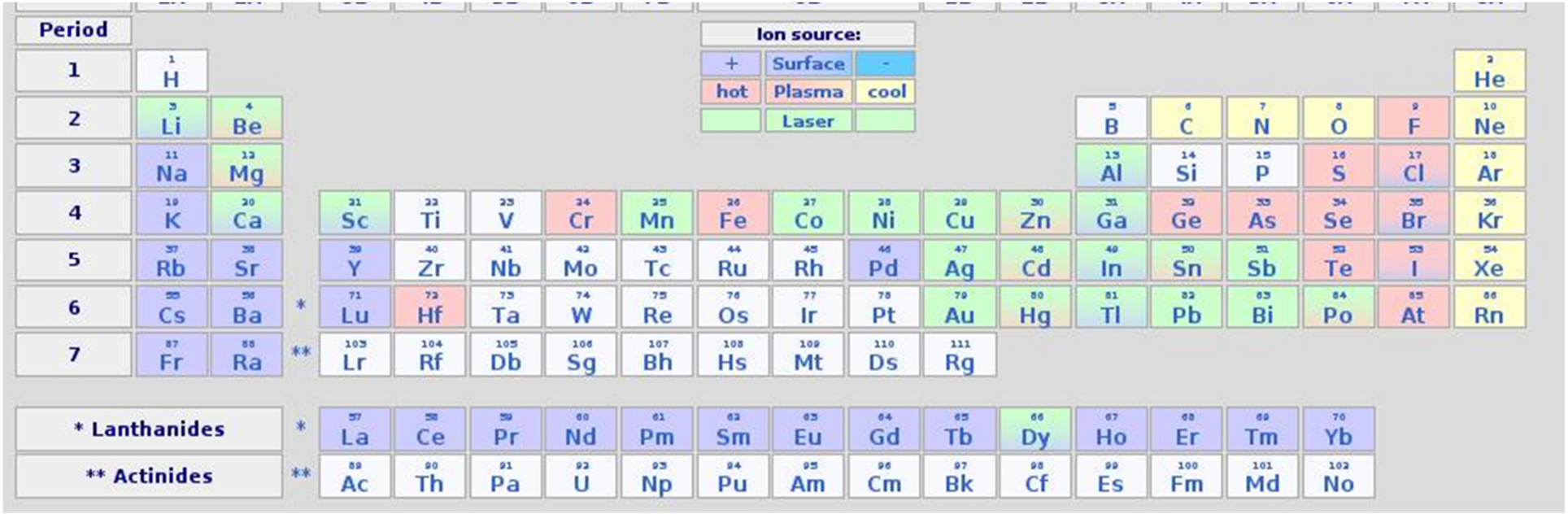

United Kingdom

- **> 500 Users from 100 Institutions, 50 experiments / year**

ISOLDE at Accelerator Complex (1992-)



Beam consolidation/development at ISOLDE



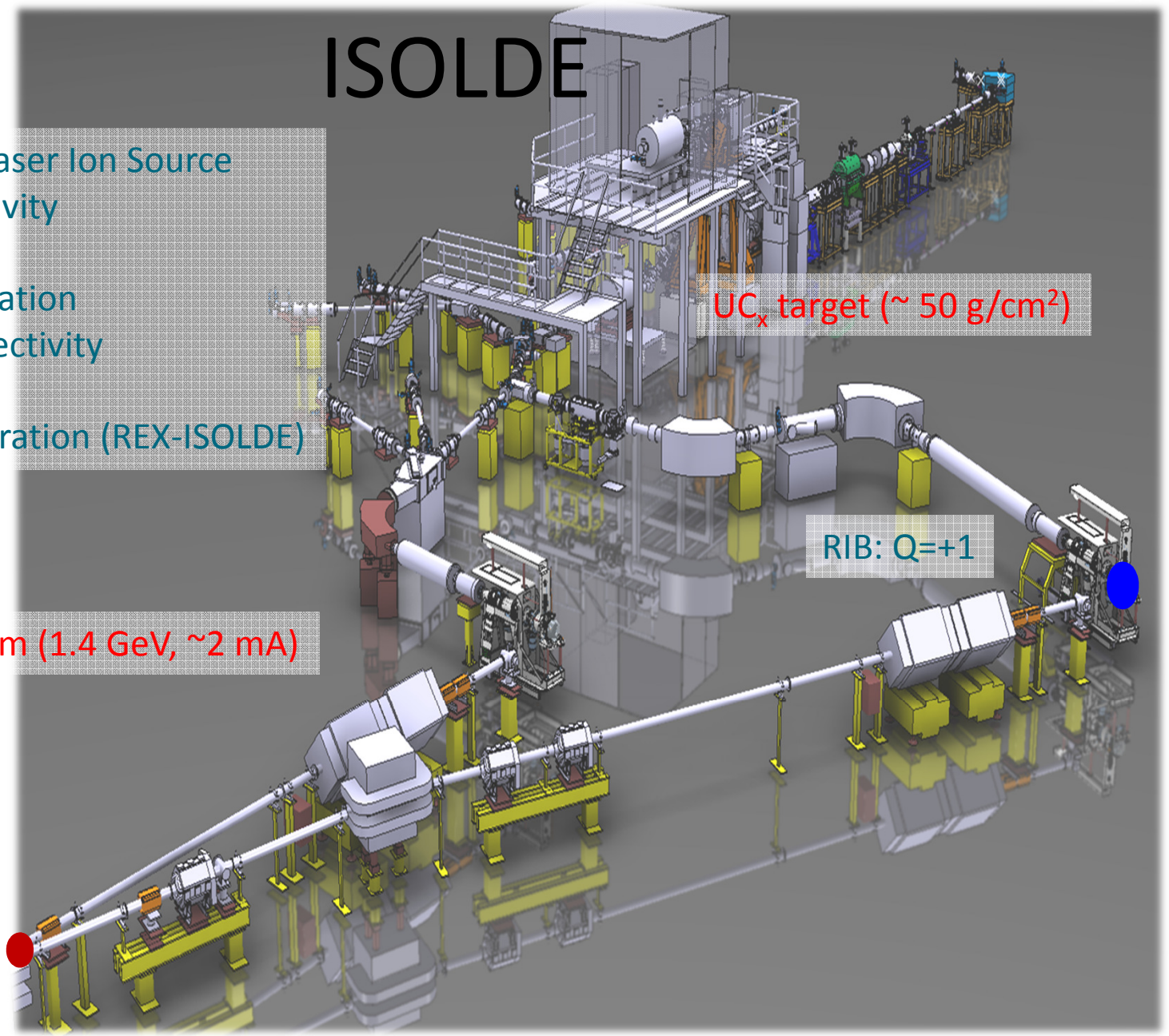
Beam development: Thierry Stora

ISOLDE

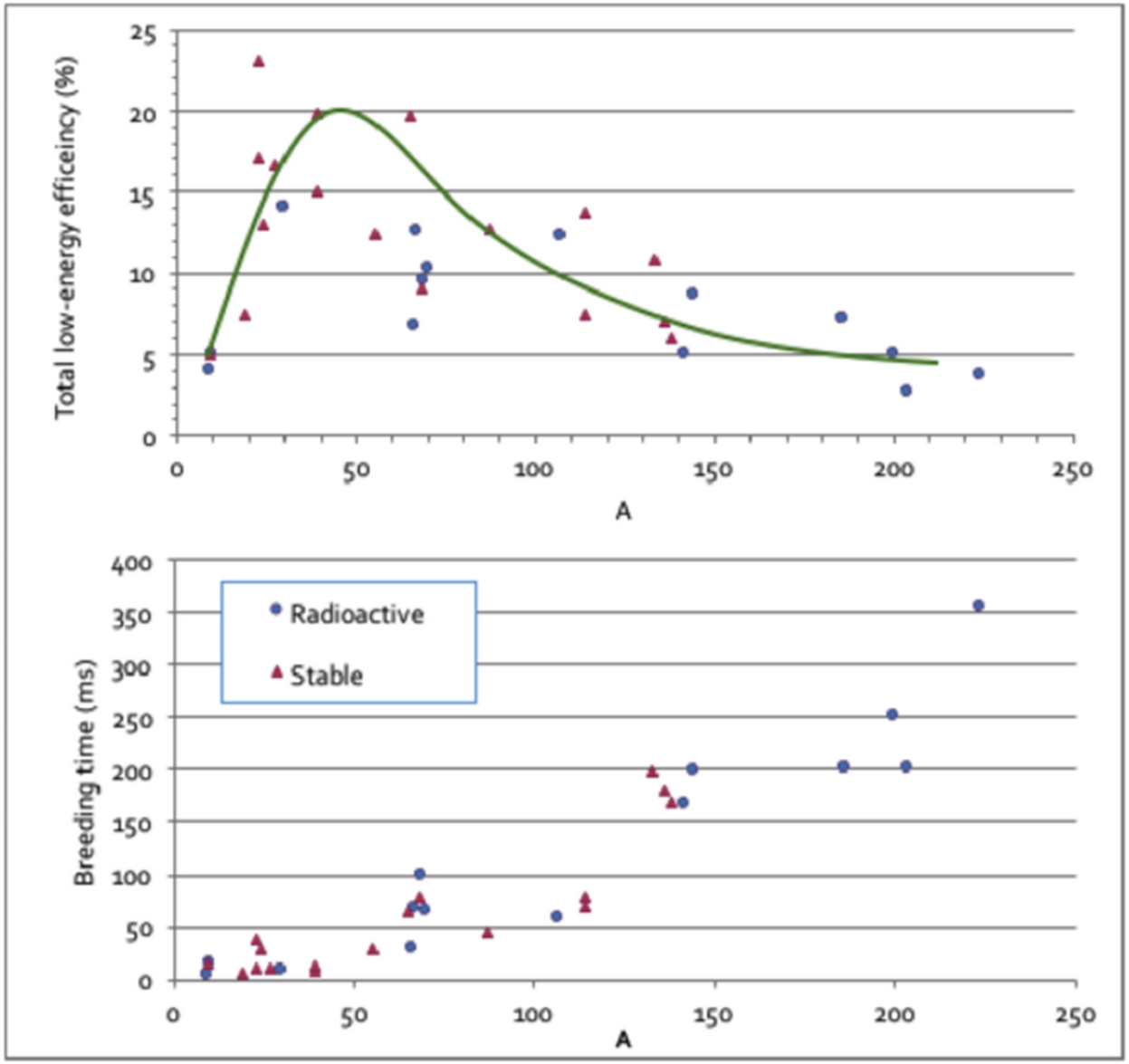
Resonant Laser Ion Source
- Z-selectivity

Mass separation
- A/Q-selectivity

Post-acceleration (REX-ISOLDE)

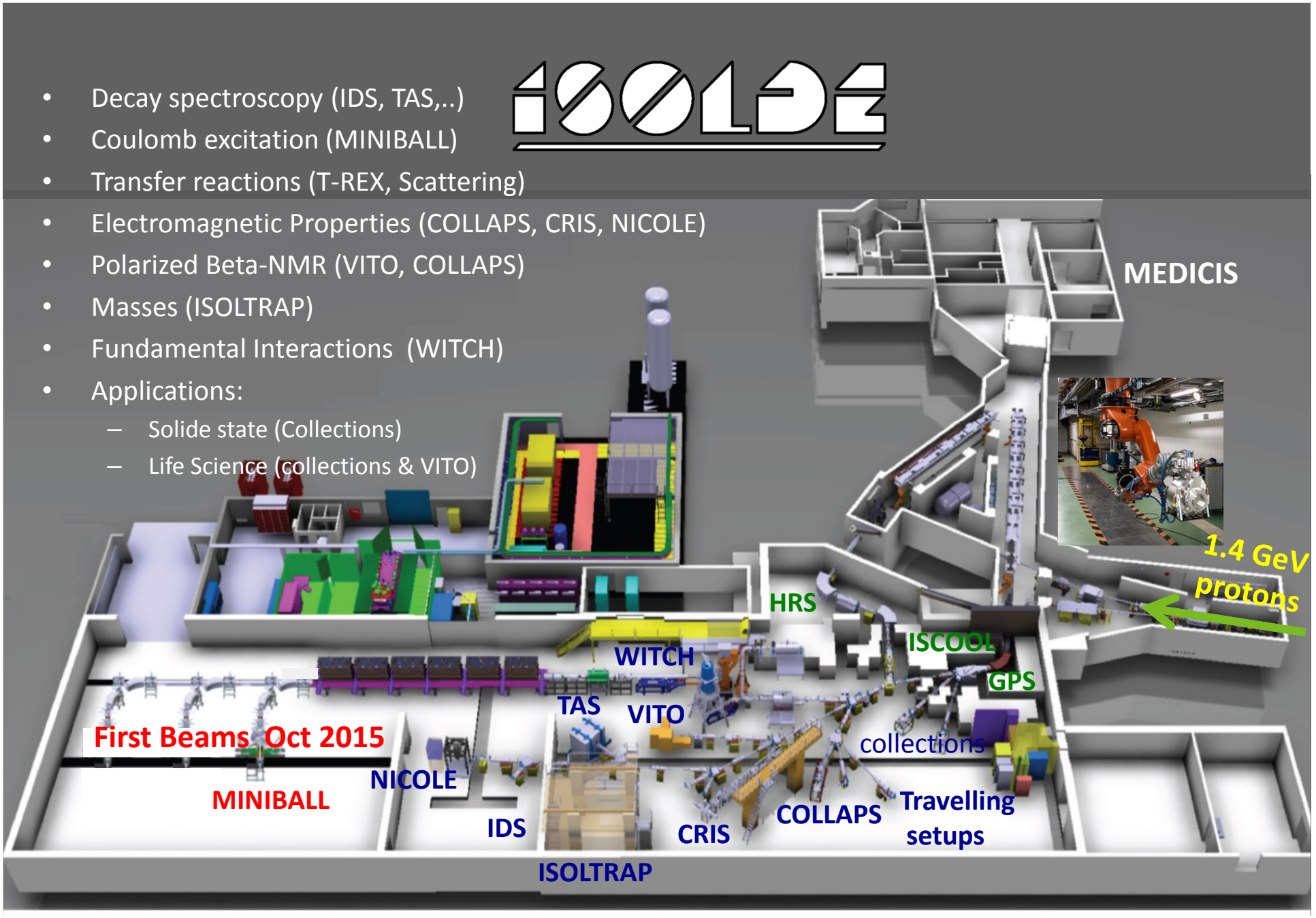


EBIS Efficiency



- Decay spectroscopy (IDS, TAS,..)
- Coulomb excitation (MINIBALL)
- Transfer reactions (T-REX, Scattering)
- Electromagnetic Properties (COLLAPS, CRIS, NICOLE)
- Polarized Beta-NMR (VITO, COLLAPS)
- Masses (ISOLTRAP)
- Fundamental Interactions (WITCH)
- Applications:
  - Solide state (Collections)
  - Life Science (collections & VITO)

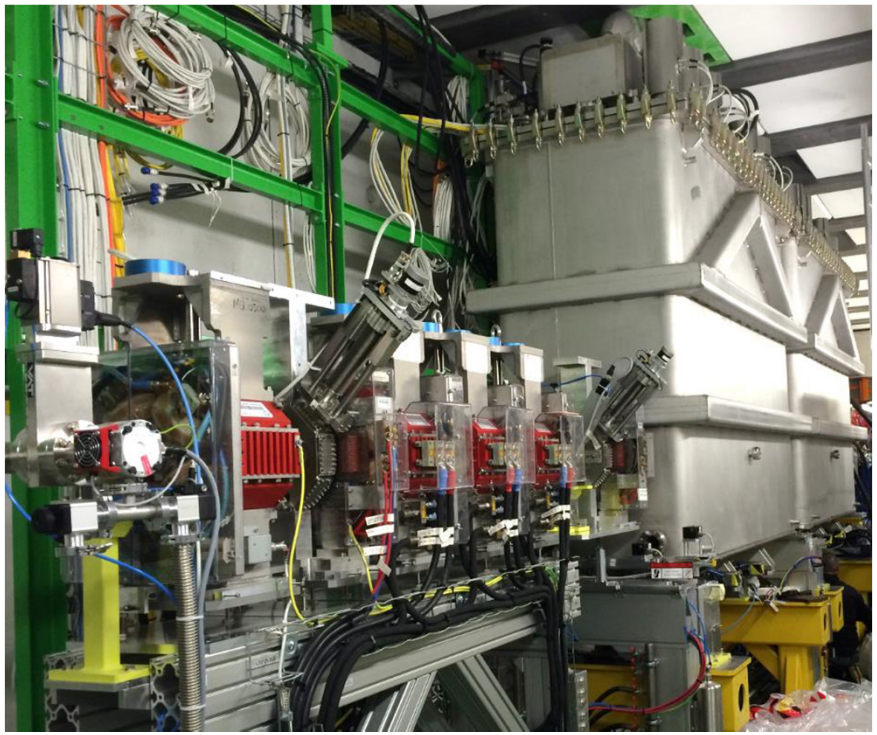
ISOLDE

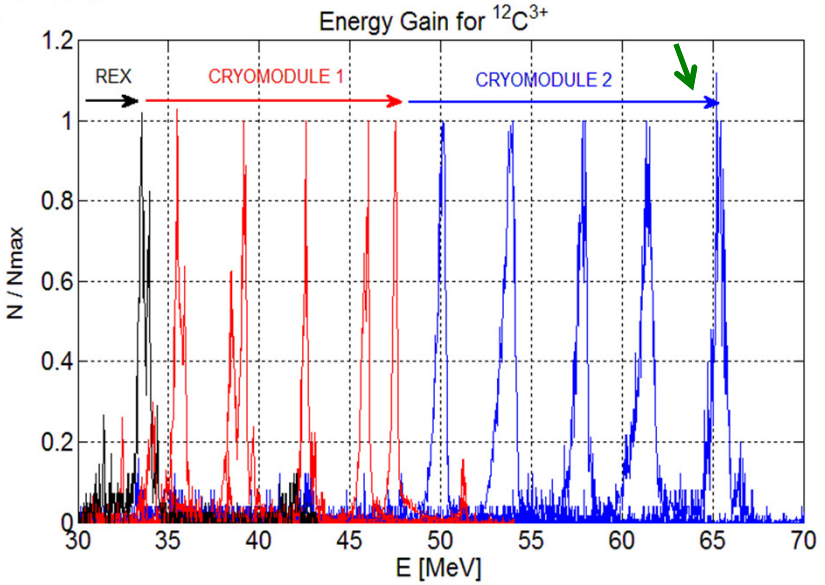


Low Energy (30-60kV) Exps, Post-accelerated Exps (5.5 MeV/u), Machine elements

Phase 1: Commissioning & Operation (2016)

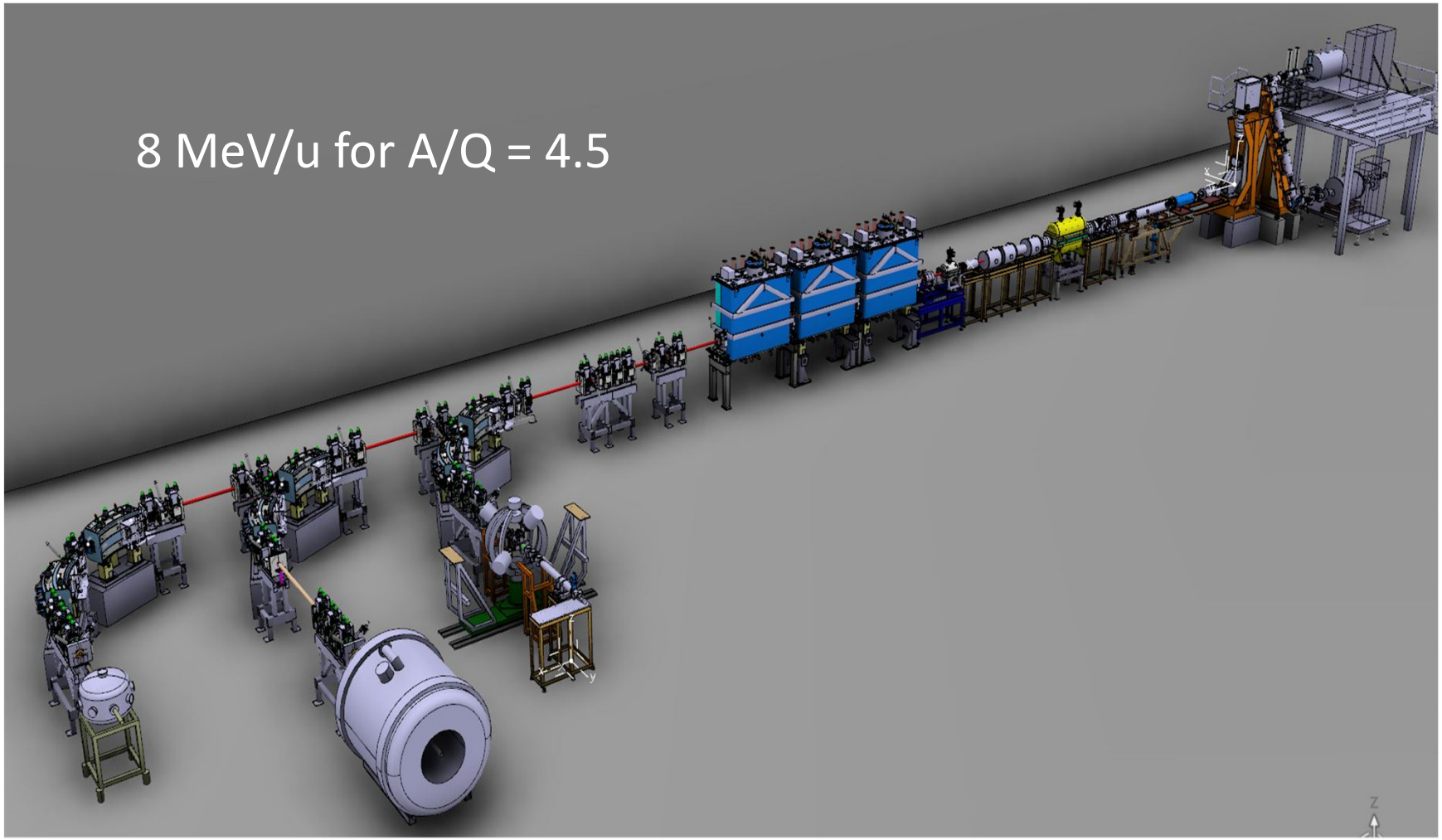
5.42 MeV/u



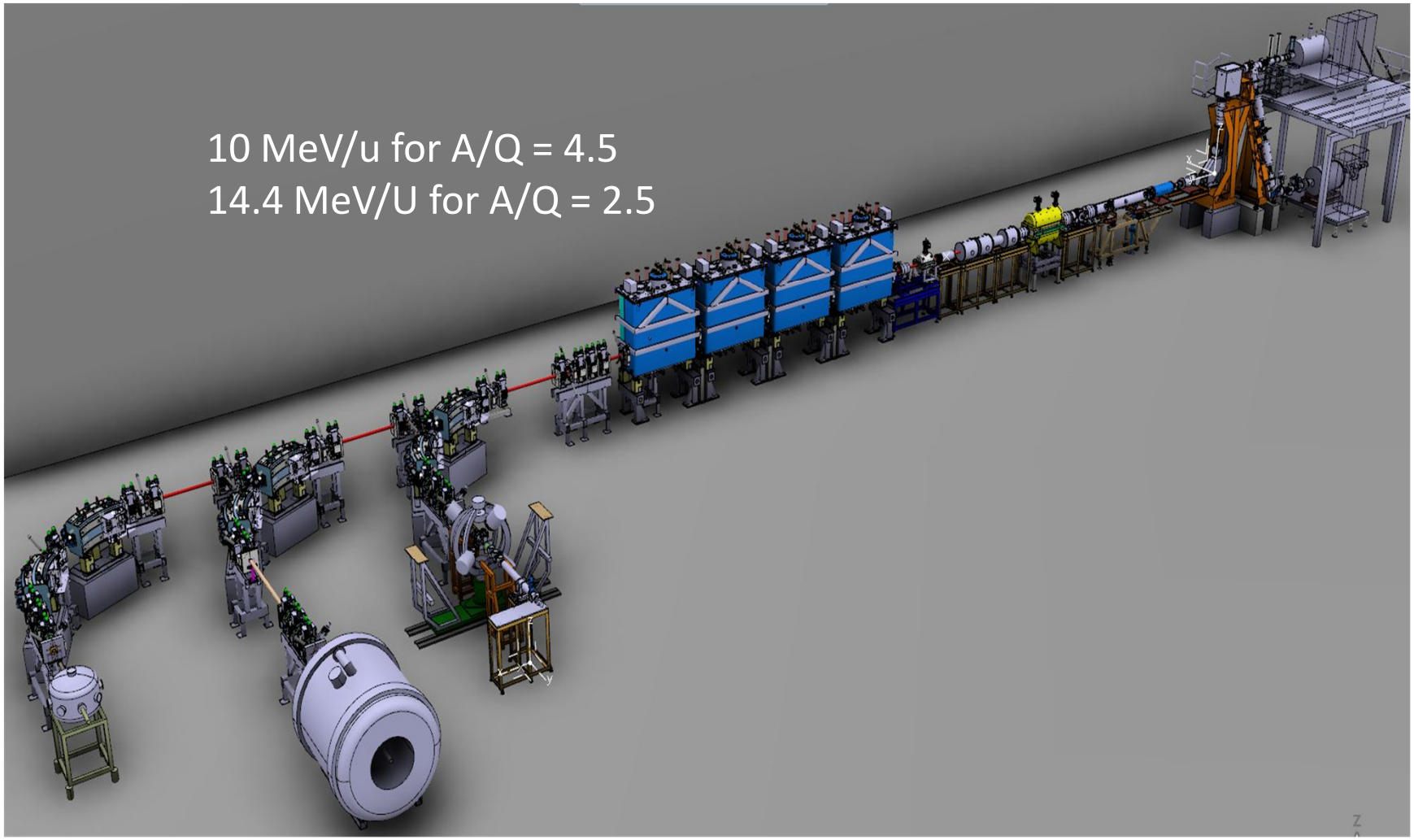


Experiment	Isotope	HEBT	Destination	Energy [MeV/u]	Shifts
IS-562	^{110}Sn	XT01	Miniball Spectrometer	4.5	12
	^{108}Sn			4.5	12
IS-548	^{142}Xe	XT01	Miniball Spectrometer	4.5	30
IS-557	^{80}Zn	XT01	Miniball Spectrometer	4.0	12
	^{78}Zn			4.0	12
IS-551	^{132}Sn	XT01	Miniball Spectrometer	5.5	18
IS-561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

HIE-ISOLDE Phase 2a (2017)



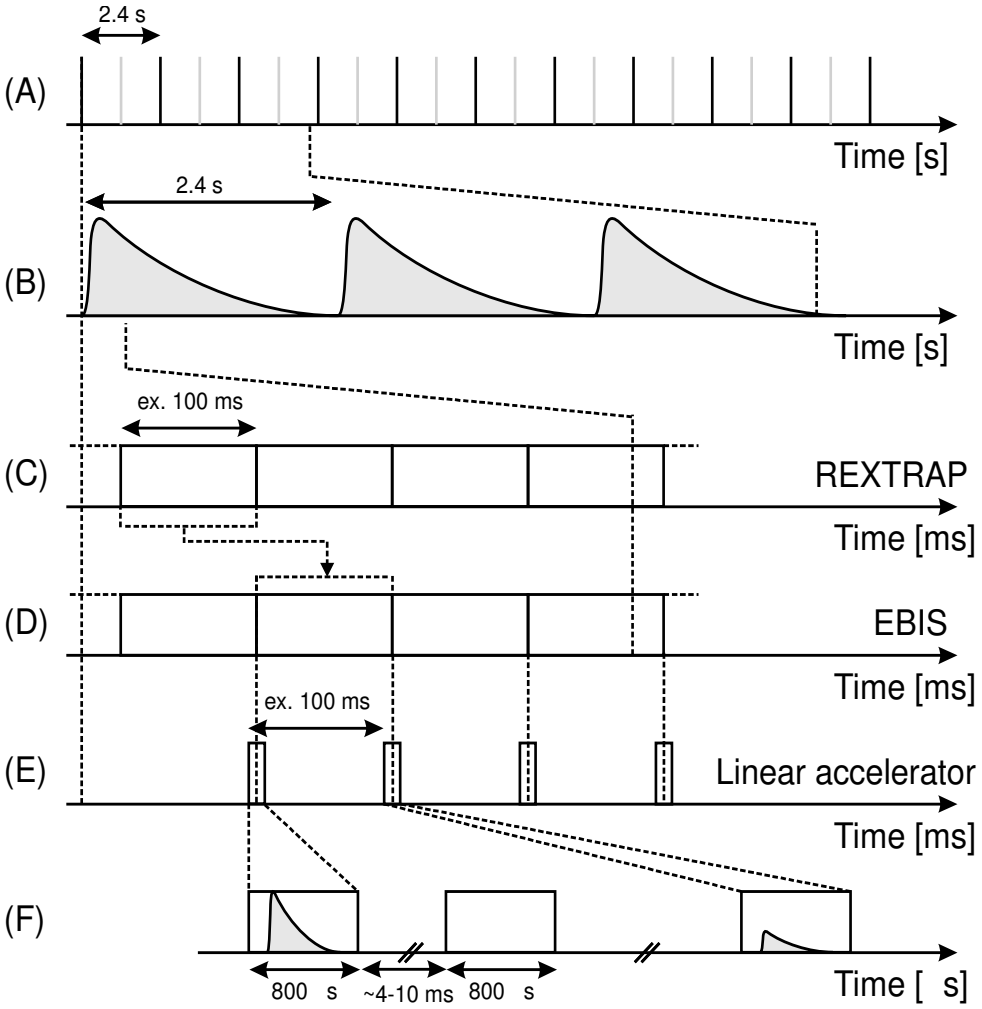
HIE-ISOLDE Phase 2b (2018)



HIE-ISOLDE Phase 3

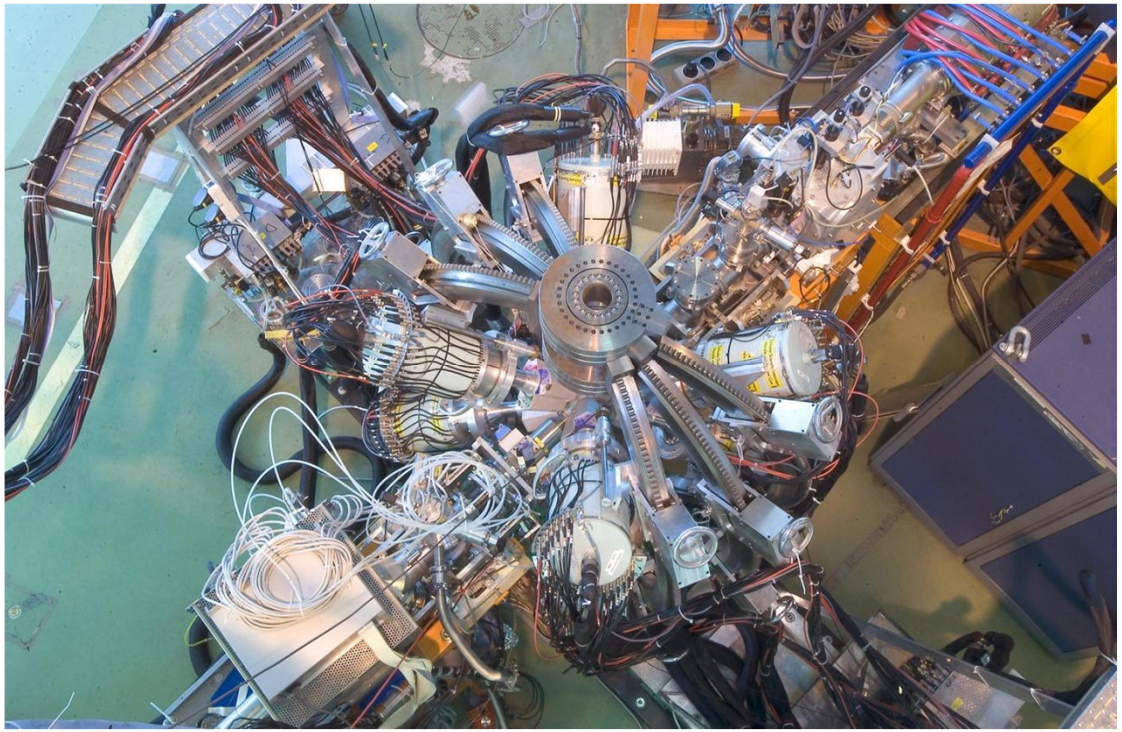
- Replacement of the REX linac by two low-beta cryomodules:
Improved reliability and continuous energy variation from 0.3 to 10 MeV/u
- Construction of a buncher/chopper to obtain microbunches separated by 100ns
For time of flight measurements.
- Delayed for lack of funds
- The storage ring plan has also been put on hold.

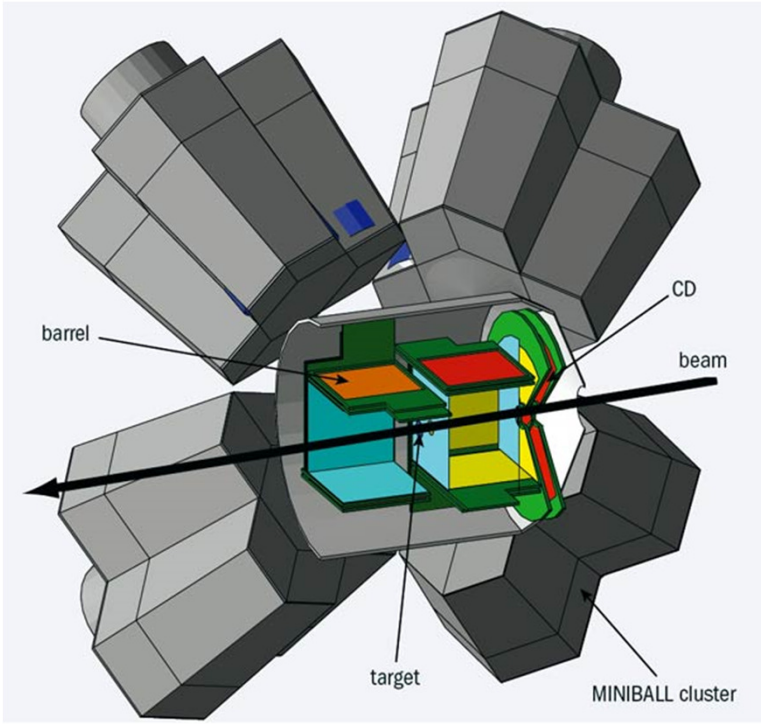
Time Structure of the beam



Time structure of the REX-ISOLDE post-accelerator.
A - Proton bunches strike the ISOLDE target,
B - Release of radionuclides from the target is modulated by the proton cycle,
C - REXTRAP accumulates, bunches and cools the quasi-continuous beam,
D - REXEBIS breeds synchronously with REXTRAP at e.g. 10 Hz,
E - Linac is synchronised to the timing of the REXEBIS with a duty cycle permitting an RF pulse of up to 1000 μs at 100 Hz,
F - Extracted beam from the REXEBIS:
Self-extraction - the pulse length is typically 50 μs, decaying exponentially.
Slow extraction - the pulse length is typically as long as 1 ms.

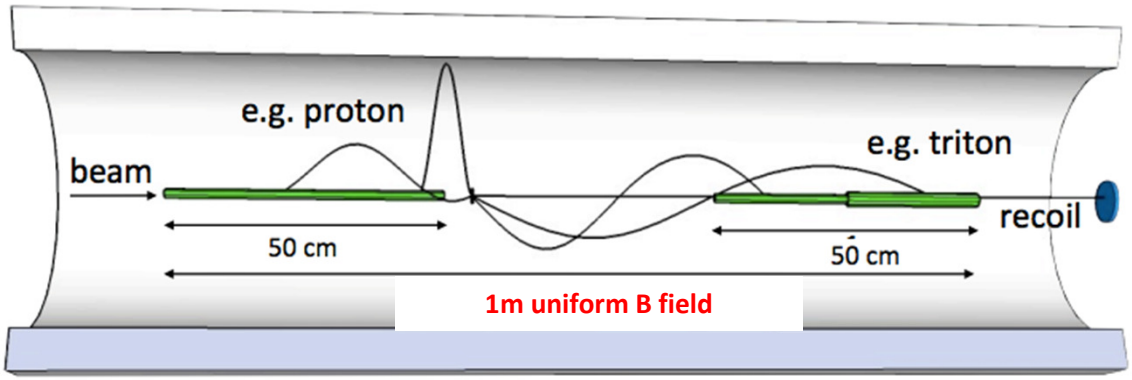
Miniball + T-Rex

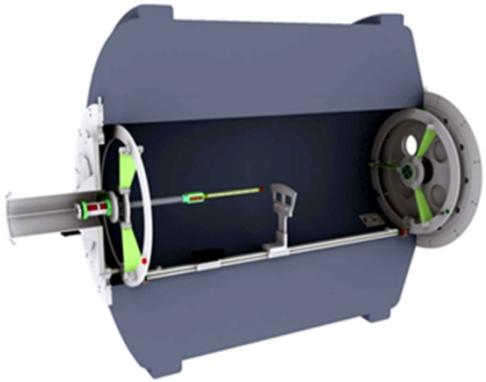




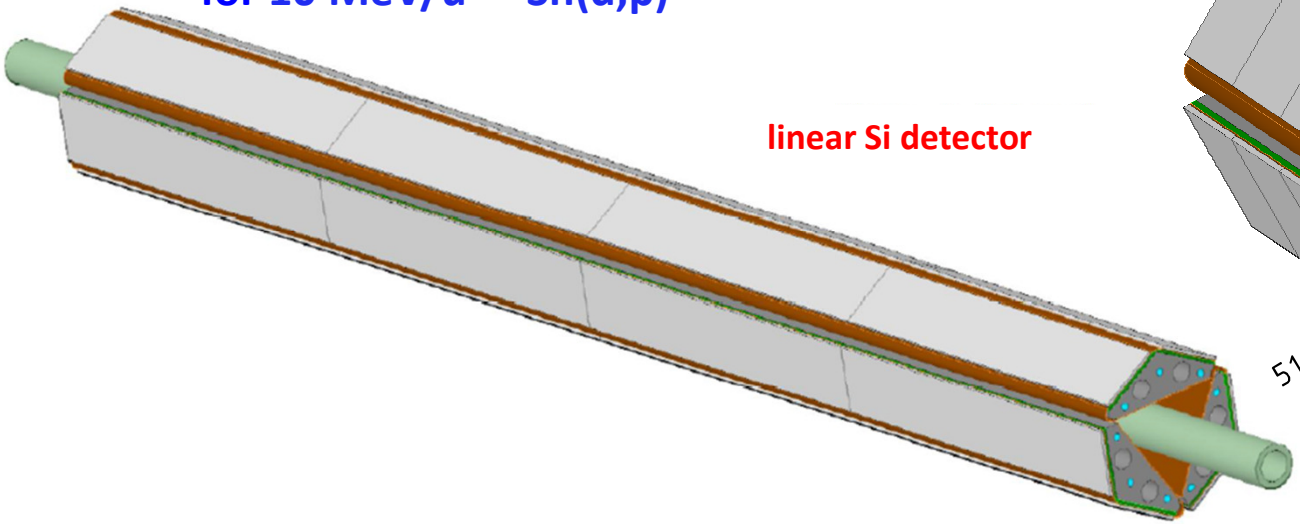
External target: HELIOS

Funded by UK

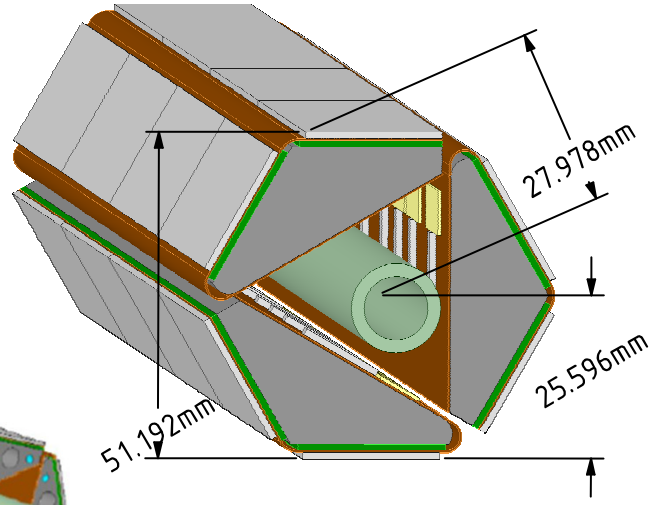




e.g. Q-value = 1.01 E_{lab} (MeV) - 9.92 - 0.21 z (cm)
for 10 MeV/u ^{132}Sn(d,p)



linear Si detector



4 x 125 x 25 mm; 1 mm strips
R^3B-type ASIC readout

How to Obtain Beam Time

- The INTC meets three times per year
- It accepts LOIs and proposals at least twice per year
- They are discussed by a technical committee
- Proposals are presented orally
- An LOI for GASPARD has already been presented in 2011.
- Warning: Long shutdown 2 in 2019-2020.