



HIE-ISOLDE

Upgrade group 17/2/2009

Mats Lindroos



HIE-ISOLDE: Next step with three objectives



- ✓ **ENERGY:** REX energy upgrade and increase of current capacity (Matteo Pasini)
 - Energy upgrade in 3 stages: 5.5 MeV and 10 MeV/u and lower energy capacity

- ✓ **INTENSITY:** ISOLDE proton driver beam intensity upgrade - strongly linked to PS Booster improvements including linac4 (INTENSITY WP, Richard Catherall)
 - Faster cycling of the booster
 - New target stations for ISOLDE
 - New targets
 - New target handling system

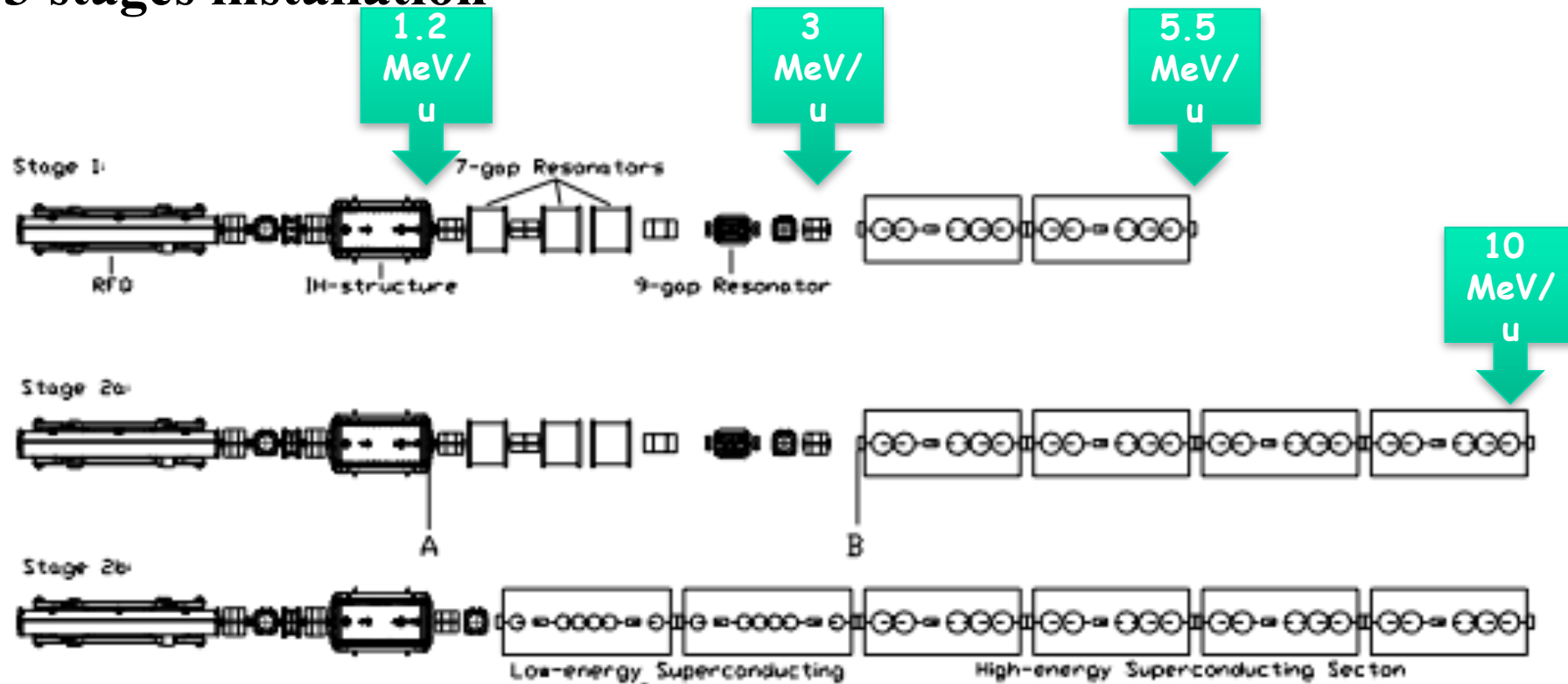
- ✓ **QUALITY:** ISOLDE radioactive ion beam quality - more than half already financed through the ISOLDE collaboration
 - Smaller longitudinal and transverse emittance
 - Done - RFQ cooler operational
 - RILIS upgrade and LARIS construction
 - Done
 - Charge breeder upgrade
 - Better mass resolution
 - Continue target and ion source developments

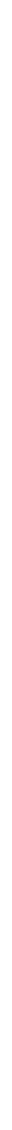


ENERGY WP: The proposed HIE-LINAC



3 stages installation







DOE proposal - Comparison EBIS/ECR/1+



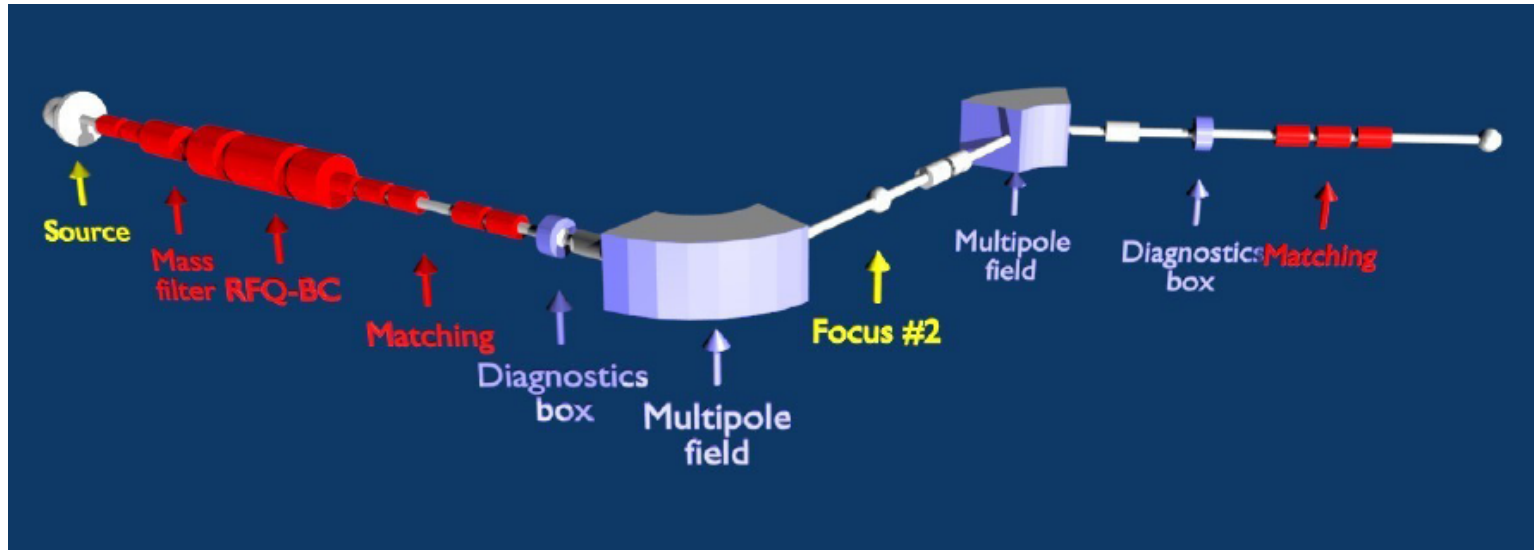
		Proposed high-intensity EBIS/T breeder	Next-generation ECR breeder	1+ scheme with stripping	Gain EBIS/T vs ECR	Gain EBIS/T vs 1+
Efficiency for single charge-state re-acceleration	ϵ (A<40)	> 60 %	< 20 %	<40%	>3	>1.5
	ϵ (A=100)	> 50 %	< 20 %	<10%	>2.5	>5
	ϵ (A=200)	> 40 %	< 20 %	<5%	>2	>8
Chance of reaching breeding performance		Present performance 25-50% of values	Present performance 20-40% of values	NA		
Breeding (trapping) time		<20 ms	>100 ms	NA	>5	NA
Beam rate limit		>10 ¹¹ /s	>>10 ¹¹ /s	no limit		
Chance of reaching beam rate capability		RHIC test EBIS: >10 ⁹ ions/pulse	No risk	No risk		
Beam purity- stable beam current intensities		pA	>> μ A	NA	>>1 000	NA

	Proposed High-Intensity EBIT	MSU EBIT	TITAN EBIT	BNL test EBIS	REX-EBIS
Electron beam energy (keV)	< 60	< 30	< 60	<30	< 6
Electron beam current (A)	< 10	< 5	<5	<20	< 0.5
Central current density (A/cm ²)	<10 ⁵	<10 ⁴	<10 ⁴	<600	<200
Magnet design	Helmholtz Coil + Solenoid	Helmholtz Coil + Solenoid	Helmholtz Coil	Solenoid	Solenoid
Maximum magnetic field (T)	9	6	6	5	2
Trap length (m)	1 m	0.5 m	0.1 m	0.7 m	0.8 m

O. Kester et al.



Upgrade of HRS



- Improved emittance, multipole corrections and instrumentation
- Challenge to implement it at existing facility



HIE-ISOLDE external contribution: Where are we?



- External grant from Belgium
- Second grant from Belgium approved for both physics programme and SC linac construction for HIE-ISOLDE
- Proposal submitted in the UK for HIE-linac
- Approved WP in EUCARD for R&D on thin film techniques
- RFQ cooler WP and RILIS WP financed and (almost) completed
- Proposal being prepared in the US to DOE for joint development of new high-intensity EBIS
- Discussions with CERN Mgt on CERN contribution.



Total all parts of project



		Swiss Francs			
		Still required		Received	
		Staff	Material	Staff	Material
		FTE	kCHF	FTE	kCHF
1a *	LINAC prototyping and cryo design	0.0	425	5.5	
1b *	LINAC 3.0 - 5.5 MeV/u	25.5	2,416		4,472
1c	Linac 5.5 - 10 MeV/u	19.0	3,350		
1d	LINAC lower energies	9.5	1,325		
1e *	Beam lines for experimental area	1.0	0		500
2 *	TS consolidation		2,000		
	ENERGY	55.0	9,516	5.5	4,972
3	Targets & Front-ends	25.8	8,040		60
4	PSB 900 ms	9.0	2,000		
	INTENSITY	34.8	10,040	0.0	60
5 *	RFQ cooler	0.0	0		500
6 *	RILIS upgrade	0.0	0		2,400
7	REX trap and charge breeder	12.1	2,238		
8	High-charge state beams	1.1	800		
9	New HRS	0.8	1,100		
	QUALITY	1.9	4,138	0.0	2,900
10 *	Radiation protection consolidation	1.0	750		
11	Vacuum consolidation	8.5	2,408		
	CONSOLIDATION	9.5	3,158	0.0	0
	TOTAL	101.2	26,852	5.5	7,932
	Total Material		34,784		
	Total Personnel		8,981		
	PHASE I	27.5	5,591	5.5	7,932
	Total Material Phase I		13,523		
	Total Personnel Phase I		2,778		



Next steps



- The HIE-ISOLDE project
 - Presentation at workshop for CERN non LHC meeting
 - Full project approval
 - Review panel of HIE-LINAC R&D work on first Belgium grant, 15-16 June 2009

- New grant proposals , in-kind contributions and collaborations
 - HIE-linac (UK grant proposal)
 - New EBIS construction, commissioning and installation (DOE proposal)
 - New High Resolution Mass separator
 - Looking for collaboration partner(s)
 - Study and engineering support for intensity upgrade (SPES, EURISOL collaboration)
 - Highly complex, interaction with other ISOL facilities is essential
 - Looking for collaboration partner(s)
 - Target development (ESS-S training program)
 - New beams and higher instantaneous beam power
 - Looking for collaboration partner(s)