



Operations of the REX/HIE-ISOLDE linac during the 2018 Physics Campaign



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Outline:



- Introduction
- Overview 2018 Operations
- High Energy Physics Campaign
- Summary



Introduction:

Phase 2B of HIE-ISOLDE operational:

- Additional cryomodule (CM4)
- ISOLDE Solenoidal Spectrometer

Transverse beam profiles and x-x' phase space projection of a ~ 250 ions per second ³⁹K⁹⁺ beam (N. Bidault's presentation later this morning)

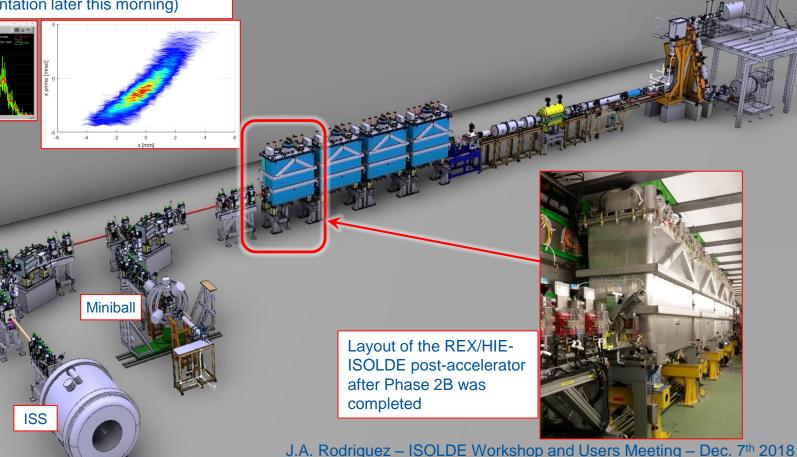
Machine check-out completed (wk. 20-21)

 Beam commissioning of the post-accelerator and the high-level control software (wk. 22-26)

Beam commissioning experimental stations (wk. 23 & 24)

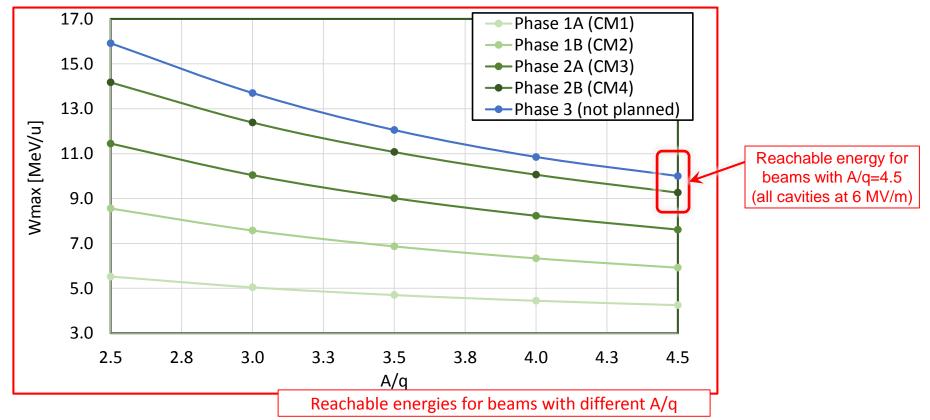
CERI

- High energy Physics campaign (wk. 28-47)
- Machine Development Studies: characterization of sub-femtoampere beams (every time there was an opportunity)



Introduction:

The highest reachable beam energy after Phase 2B for A/q = 4.5 is 9.2 MeV/u assuming all SRF cavities can operate at 6 MV/m (10 MeV/u possible for beams with A/q = 4.0 or lower)

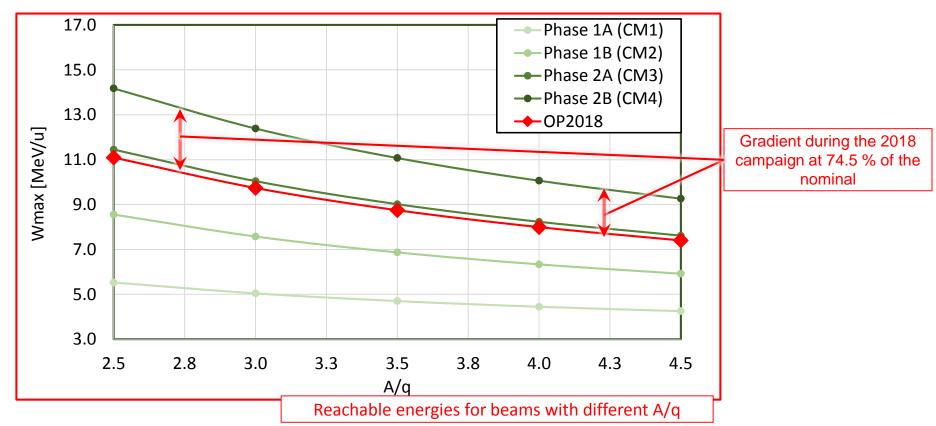




CERN

Introduction:

- The highest reachable beam energy after Phase 2B for A/q = 4.5 is 9.2 MeV/u assuming all SRF cavities can operate at 6 MV/m (10 MeV/u possible for beams with A/q = 4.0 or lower)
- Due to a several different issues (Erwin Siesling's presentation) the total operational gradient is limited to ~ 75 % of the nominal and maximum energy reached was 7.4 MeV/u for beams with A/q = 4.5 (9.5 MeV/u for beams with A/q = 3.143)
- Three of the 13 experiments conducted would have benefited from higher energies during the 2018 Physics campaign





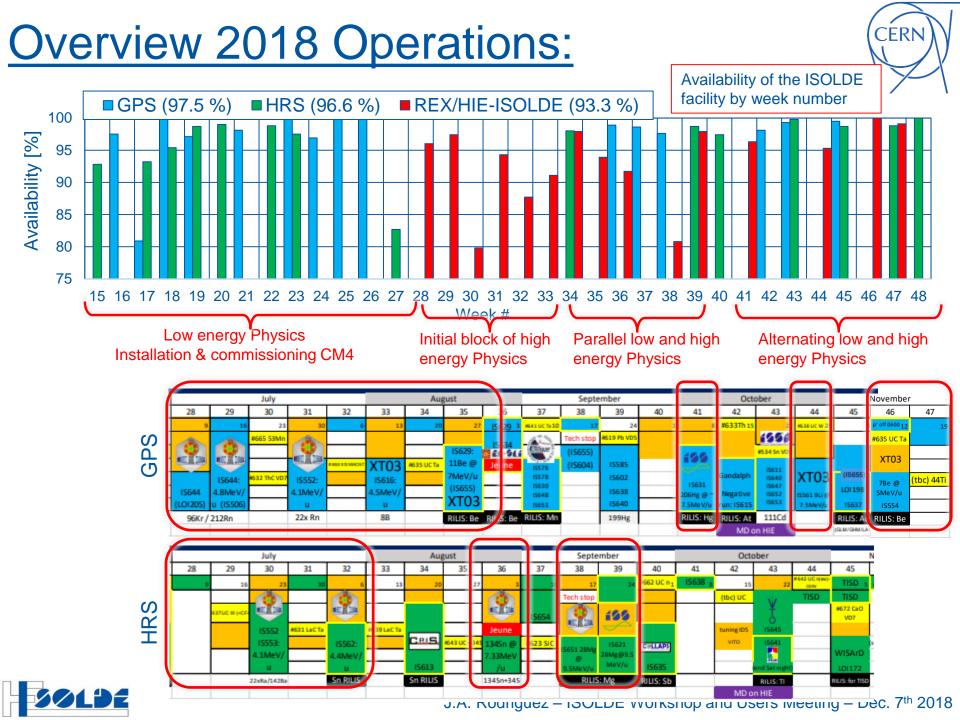
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Overview 2018 Operations:



- First radioactive ion beam (RIB) delivered on July 11th (wk. 28)
- Thirteen experiments conducted despite of the relatively short Physics campaign (~ 1322 hours of RIBs)

Experiment number	Isotope(s)	Energy [MeV/u]	Experimental station	Time [hours]
IS644	⁹⁶ Kr	4.7, 5.3	Miniball Spect.	178.2
IS506	²¹² Rn	3.8, 4.4	Miniball Spect.	49.0
IS552	^{222, 228} Ra, ^{222, 224, 226} Rn	4.3, 4.2, 5.1	Miniball Spect.	31.3, 82.9
IS553	¹⁴² Ba	4.2	Miniball Spect.	38.5
IS562	¹⁰⁶ Sn	4.4	Miniball Spect.	91.4
IS616	8B	4.9	Scattering Chamber	97.2
IS655	¹¹ Be	7.5	OTPC Chamber	117.5
IS654	^{134, 132} Sn	7.4, 7.2	Miniball Spect.	67.5
IS651	²⁸ Mg	9.5	Miniball Spect.	116.0
IS621	²⁸ Mg	9.5	ISS	116.8
IS631	²⁰⁶ Hg	7.4	ISS	98.0
IS561	⁹ Li	8.0	Scattering Chamber	103.0
IS554	⁷ Be	5.0	Scattering Chamber	135.0
			Total	1322.3



Overview 2018 Operations:



 In addition, multiple stable beams at different energies were delivered to the three experimental stations (total time ~ 369 hours)

Beam(s)	Energy [MeV/u]	Experimental station	Time [hours]
²² Ne ⁷⁺	6.2, 4.6, 9.5	Miniball Spect.	110.5
²² Ne ⁷⁺	9.5	ISS	126.8
¹²⁹ Xe ³¹⁺	4.8	Miniball Spect.	4.0
¹² C ⁴⁺	2.8, 4.9, 8.0	Scattering Chamber	89.8
¹³² Xe ³¹⁺	7.2	Miniball Spect.	21.0
¹³⁰ Xe ²⁹⁺	7.4	ISS	14.5
¹⁸¹ Ta ⁴²⁺	7.4	Miniball Spect.	2.0
		Total	368.6

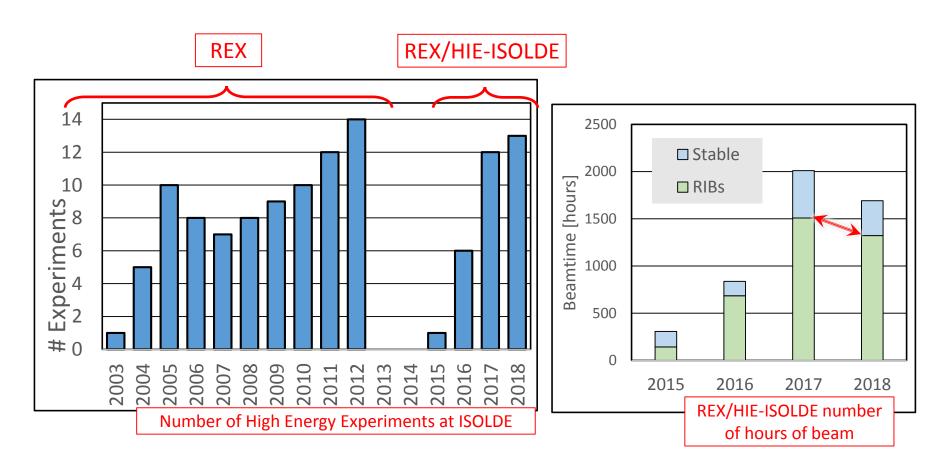


Overview 2018 Operations:



Evolution over last few years:

- Shorter campaign than in 2017 (133 vs. 145 days).
- Shorter experiments than during the 2017 campaign (101.7 vs. 125.7 hrs)
- Higher number of isotopes and energies → More time spent setting up the machine
- Demand for stable beams slightly lower in 2018 (one week of ²²Ne as part of an experiment in 2017)



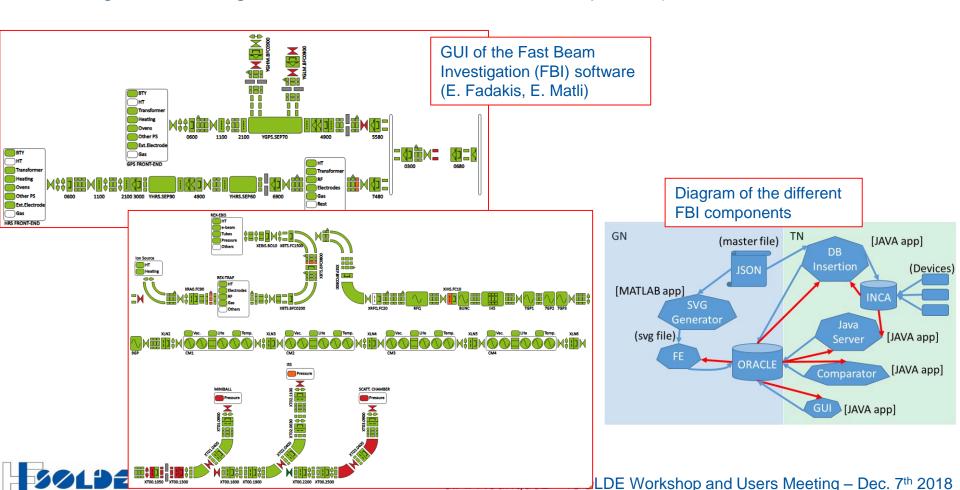


Overview 2018 Operations: FBI software



Fast Beam Investigation (FBI) systematically used during the high energy Physics campaign

- Initial prototype for the linac tested at the end of 2017
- Low energy and new REX/HIE-ISOLDE frontends released and commissioned in 2018
- Used to identified the source of multiple problems during the year (trips and instabilities of RF, HT, target/line heating and electrostatic devices, vacuum spikes...)



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IS644: A Coulomb-nuclear excitation study of shape co-existence in ⁹⁶Kr

Set-up:

- 11 and 9 SRF cavities used
- Beam energies: 5.32, 4.72 MeV/u Energy spread (FWHM): 0.4 %
- Plasma ionization
- Typical beam intensity: 3000 pps for 1.8 uA proton current

Main Issues:

- Around 4 hours without protons
- Trips of electrostatic elements in the low energy beam lines
- Contamination from the target (96Mo²³⁺)

Highlights:

- Very weak beam (i.e. difficult set-up and optimization)
- Very short half-live (80 ms)
 - Lower than desired the operational breeding time
 - Decay products in the beam (mostly ⁹⁶Rb²³⁺)
 - Synchronization between PSB, REX/HIE-ISOLDE important

DE 4	REX				HIE	
RF structure	IH	7GP1	7GP3	9GP	SRF05	SRF09
# Trips	1	2	1	1	2	1
Downtime [mins]	15	30	15	15	10	5
Downtime [%]	0.5 %		0.1	%		

Experiment #	IS644
RIB (A/q)	⁹⁶ Kr ²³⁺ (4.174)
Energy [MeV/u]	5.32, 4.72
Target	GPS
Exp. station	Miniball Spect.
Start date	Jul. 11 th (19:30)
End date	Jul. 20 th (11:00)
Length [hrs]	87.0, 91.25
Pilot beam(s) (A/q)	¹⁶ O ⁴⁺ (4.0) ¹²⁹ Xe ³¹⁺ (4.161)
Target	#659 UC VD7
EBIS breeding	86 ms

Beam tra	Beam transmission/efficiency (approx.)			
Low	REX-TRAP	REX/HIE		
energy	+ EBIS	linac		
88 %	4.6 %	69 %		



IS506: Mapping the boundaries of the seniority regime and collective motion: Coulomb excitation

studies of N = 122 isotones ²⁰⁶Po and ²⁰⁸Rn

Set-up:

- 8 and 5 SRF cavities used
- Beam energies: 4.35 MeV/u Energy spread (FWHM): 0.6 %
- Slow extraction applied
- Plasma ionization
- Typical beam intensity: 1E7 pps for 1.8 uA proton current.

 Users decided to lower the proton current to 0.2 uA to avoid pile-up in their detectors

Main Issues:

Smooth experiment. No major issues

Highlights:

- No downtime due to the room temperature or SRF
- Set-up not optimized since beam intensity was too high for the users and switching time of only a few hours available

DE etweeture	REX	HIE
RF structure		
# Trips	0	0
Downtime [mins]	0	0
Downtime [%]		

Experiment #	IS506
RIB (A/q)	²¹² Rn ⁵⁰⁺ (4.24)
Energy [MeV/u]	4.35, 3.82
Target	GPS
Exp. station	Miniball Spect.
Start date	Jul. 20 th (19:30)
End date	Jul. 22 nd (22:00)
Length [hrs]	25.0, 24.0
Pilot beam(s) (A/q)	¹⁶ O ⁴⁺ (4.0)
Target	#659 UC VD7
EBIS breeding	446 ms

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Beam transmission/efficiency (approx.)			
Low REX-TRAP REX/HIE			
energy	+ EBIS	linac	
88 %	~ 5 %	69 %	



IS552: Measurements of octupole collectivity in Rn and Ra nuclei using Coulomb excitation

- 8 and 10 SRF cavities used
- Beam energies: 4.31, 4.23 and 5.08 MeV/u Energy spread (FWHM): 0.6 %, 0.25 %, 0.3 %
- Slow extraction applied
- Plasma and surface ionization
- Beam intensities: ~ 0.6E6 pps of ²²²Ra⁵¹⁺ for 0.3 uA p current

Main Issues:

Smooth experiment. No major issues until the ThC broked at the end of the beam time

Highlights:

- Two different targets used
- Multiple isotopes and energies (i.e. demanding for operations)
- ²²⁸Ra⁵³⁺ heaviest post-accelerated RIB at CERN

	REX	HIE		
RF structure		SRF07	SRF09	SRF10
# Trips	7	1	5	8
Downtime [mins]	15	5	25	40
Downtime [%]	0.2 %		1.0 %	

Beam transmission / efficiency (approx.)	Low energy	REX-TRAP + EBIS	REX/HIE linac
Control (oppion)	63 % (HRS) 70 % (GPS)	6-7 % (Ra) 4-6 % (Rn)	65-70 %

Experiment # **IS552**

²²⁸Ra⁵³⁺ (4.302) ²²²Ra⁵¹⁺ (4.353) RIB (A/q) ²²⁶Rn⁵²⁺ (4.346) ²²⁴Rn⁵²⁺ (4.308)

²²²Rn⁵¹⁺ (4.353) Energy [MeV/u]

Start date

Target

GPS / HRS **Target**

4.31, 4.23, 5.08

Jul. 25th (15:30)

#637 UC W (Ra)

Miniball Spect. Exp. station

Aug. 5th (18:30)

31.25 (Ra) Length [hrs] 82.9 (Rn)

Pilot beam(s) ¹⁶O⁴⁺ (4.0) (A/q)⁴⁰Ar⁹⁺ (4.444) #632 ThC VD7 (Rn)

446 ms (not EBIS **EBIS** breeding optimal)



J.A. Rodriguez – ISOLDE Workshop and Users Meeting – Dec. 7th 2018

IS553: Determination of the B(E3,0+ ->3-) strength in the octupole correlated nuclei 142,144Ba

using	Coulomb	excitation

Set-up:

- 9 SRF cavities used
- Beam energies: 4.19 MeV/u Energy spread (FWHM): 0.5 %
- Slow extraction applied
- Surface ionization
- Approximate beam intensities: 1.1E6 pps for 1 uA proton current

Main Issues:

- Severe CERN-wide power cut
- Around 20 hours without protons
- Lost most of the LHe in a cryomodule (~ 10 hrs. to recover)
- Stability of the cryoplant affected the SRF cavities (particularly SRF06). New set-up bypassing this cavity prepared

Highlights:

 Reduced set-up time since same target as in previous experiment was used

DE ctructure	HIE	
RF structure	SRF06 (bypassed)	
# Trips	95	
Downtime [mins]	475	
Downtime [%]	15 %	

	Experiment #	IS553
	RIB (A/q)	¹⁴² Ba ³³⁺ (4.303)
	Energy [MeV/u]	4.19
	Target	HRS
n	t _{Exp.} station	Miniball Spect.
	Start date	Jul. 27 th (18:30)
	End date	Aug. 1 st (8:50)
	Length [hrs]	38.5

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(A/q)	,
Target	#637 UC W
EBIS breeding	144 ms (not EBIS optimal)

¹⁶O⁴⁺ (4.0)

Beam transmission/efficiency (approx		
Low	REX/HIE	
energy + EBIS		linac
64 %	7 %	68 %



Pilot beam(s)



IS562: Transfer Reactions and Multiple Coulomb Excitation in the 100Sn Region

Set-up:

- 8 SRF cavities used
- Beam energy: 4.40 MeV/u Energy spread (FWHM): 0.2 %
- RILIS ionization
- Typical beam intensity: 1E5 pps for 2 uA proton current

Main Issues:

- Periodic laser re-optimization needed
- Around 20 hours without protons

Highlights:

Very smooth experiment

DE etweeture	REX		HIE	
RF structure	IH	7GP2	SRF07	
# Trips	1	1	11	
Downtime [mins]	15	15	55	
Downtime [%]	0.5 %		0.5 %	

Experiment #	IS562
RIB (A/q)	¹⁰⁶ Sn ²⁶⁺ (4.077)
Energy [MeV/u]	4.40
Target	HRS
Exp. station	Miniball Spect.
Start date	Aug. 8 th (16:30)
End date	Aug. 13 th (8:30)
Length [hrs]	91.4
Pilot beam(s) (A/q)	¹⁶ O ⁴⁺ (4.0) ¹¹⁸ Sn ²⁹⁺ (4.069)
Target	#663 LaC
EBIS breeding	76 ms

Beam transmission/efficiency (approx.)			
Low REX-TRAP REX/HIE			
energy	nergy + EBIS linac		
77 % 11 %		70 %	





IS616: Reaction mechanisms in collisions induced by ⁸B beam close to the barrier.

Set-up:

- 7 SRF cavities used
- Beam energy: 4.90 MeV/u Energy spread (FWHM): 0.3 %
- Carbon stripping foil used to eliminate the ¹6O6+ stable contaminant from the REX-EBIS
- Molecular beam: ⁸B¹⁹F₂
- Peak beam intensity: ~ 400 pps for 1.8 uA proton current

Main Issues:

- Original target (#650) failed before the experiment started
- Large ⁹²Mo²⁺ contamination in top of the ⁸B¹⁹F₂. Saturated REX-TRAP resulting in lower than expected transmission
- Lower than requested ⁸B¹⁹F₂ target yields
- Electric power glitch affected the cryoplant. It took days to recover stable conditions which had an impact on the SRF cavities in CM2

Highlights:

- Proton current at 2.5 uA during part of the experiment
- Only a fraction of the requested beam intensity was delivered

DE etweeture	HIE		
RF structure	SRF06	SRF07	
# Trips	28	13	
Downtime [mins]	140 65		
Downtime [%]	2.8 %		

Experiment #	IS616
RIB (A/q)	⁸ B ^{3+ → 5+} (2.667)
Energy [MeV/u]	4.90
Target	GPS
Exp. station	Scatt. Chamber
Start date	Aug. 16 th (4:00)
End date	Aug. 21st (8:00)
Length [hrs]	97.2
Pilot beam(s) (A/q)	¹⁶ O ⁶⁺ (2.667)
Target	#513 (used)
EBIS breeding	17 ms

Low	REX-TRAP	REX/HIE
energy	+ EBIS	linac
86 %	~ 5 %	75 %



IS629: Beta decay of ¹¹Be

Set-up:

- 14 SRF cavities used
- Beam energy: 7.50 MeV/u Energy spread (FWHM): 0.25 %
- Carbon stripping foil used to eliminate the ²²Ne⁸⁺ stable contaminant from the REX-EBIS
- RILIS ionization
- Beam intensity limited to ~ 1E4 pps on request from the users

Main Issues:

Periodic optimization of the laser needed

Highlights:

- OTPC Experimental chamber located passed the Scattering Chamber
- Unusual beam time structure requested (~30 s gap with no beam after proton impact to allow for the ¹¹Be to decay)

DE etweeture	REX	HIE	
RF structure	7GP1	SRF07	SRF10
# Trips	1	2	11
Downtime [mins]	15	10 55	
Downtime [%]	0.2 %	1.0 %	

Experiment #	IS629
RIB (A/q)	¹¹ Be ^{4+ → 4+} (2.75)
Energy [MeV/u]	7.5
Target	GPS
Exp. station	OTPC Chamber
Start date	Aug. 29 th (20:00)
End date	Sep. 4 th (8:30)
Length [hrs]	117.5
Pilot beam(s) (A/q)	¹⁴ N ⁵⁺ (2.8) ²² Ne ⁸⁺ (2.75)
Target	#635 UC Ta
EBIS breeding	46 ms

Beam transmission/efficiency (approx.)			
Low REX-TRAP REX/HIE			
energy	+ EBIS	linac	
70 %	9 %	70 %	





IS654

7.39

HRS

134Sn31+ (4.323)

132Sn31+ (4.258)

Miniball Spect.

IS654: First spectroscopy of the r-process nucleus ¹³⁵Sn

Set-up:	

- All 19 SRF cavities used
- Beam energy: 7.39 MeV/u
- Molecular beam: ¹³⁴Sn³⁴S
- Slow extraction applied (1 ms RF pulse)
- Beam intensity at exp. station: 2E3 pps for 1 uA proton current

Main Issues:

- Low and quickly decreasing target yields
- Pro
- Tare

Highl

- Only
- Use
- SRF
- Exp

oblem with cavity SRF09				Start dat	e	Sep	o. 5 th (16:30)		
rget broke after pushing to try to maintain ¹³⁴ Sn yields				End date	9	Sep. 9 th (11:30)			
nlights: lly a few hours of ¹³⁴ Sn (very low rates) delivered to the users					Length [hrs]		38.5	5, 16	
ers asked to change to ¹³² Sn F09 had to be bypassed and a new set-up prepared (~ 4 hrs					Pilot beam(s)		¹⁴⁰ Ar ⁹⁺ (4.444) ¹³⁴ Xe ³¹⁺ (4.323)		
periment stopped days before scheduled when target broke					;	#64	3 UC + 34S		
					EBIS bre	eeding	196	ms	
RF structure		X	HIE		Beam tra	ansmission/e	effici	ency (approx.)
	IH	9GP	SRF09				_	REX/HIE	_
# Trips	1	1	43		Low	REX-TRA	12	KEV/UIE	

DE etweeters	RI	HIE	
RF structure	IH	9GP	SRF09
# Trips	1	1	43
Downtime [mins]	15	15	215
Downtime [%]	0.4 %	0.4 %	6.2 %

Target		#64	43 UC + 34S	
EBIS breeding		196	6 ms	
Beam tra	ransmission/effic		ciency (approx.))
Low	REX-TRAP		REX/HIE	
energy	+ EBIS		linac	
67 %	5 %		67 %	



Experiment #

Energy [MeV/u]

RIB (A/q)

Target

Exp. station

IS651: Nuclear Shell Evolution in the Island of Inversion Studied via the ²⁸Mg(t,³⁰Mg)p reaction

Set-up:

- All 19 SRF cavities used close to the highest possible gradients
- Beam energy: 9.47 MeV/u Energy spread (FWHM): 0.4 %
- RILIS ionization
- Slow extraction applied (1 ms RF pulse)
- Typical beam intensity at exp. station: 1.2E6 pps for 1.75 uA proton current

Main Issues:

- Around 20 hours without protons
- ²⁸Si contamination specially at the beginning of the run (~16 % reported by the users). Contamination reduced over time

Highlights:

■ Highest velocity RIB at ISOLDE ($\beta = 0.14 > \beta_a$)

DE etweeters	HIE		
RF structure	SRF09	SRF20	
# Trips	1	2	
Downtime [mins]	5	10	
Downtime [%]	0.2 %		

Experiment #	IS651
ts _{RIB} (A/q)	²⁸ Mg ⁹⁺ (3.111)
Energy [MeV/u]	9.47
Target	HRS
Exp. station	Miniball Spect.
Start date	Sep. 20 th (10:20)
End date	Sep. 25 th (11:15)
Length [hrs]	116
Pilot beam(s) (A/q)	²² Ne ⁷⁺ (3.143)
Target	#623 SiC
EBIS breeding	45 ms

Beam transmission/efficiency (approx.)			
Low	ow REX-TRAP REX/HIE		
energy	+ EBIS	linac	
87 %	11 %	70 %	



IS621: Single-particle behaviour towards the "island of inversion" - 28,30Mg(d,p)29,31Mg in inverse

kinematics

Set-up:

- First radioactive beam to the ISOLDE Solenoid Spectrometer
- All 19 SRF cavities used close to the highest possible gradients
- Beam energy: 9.47 MeV/u Energy spread (FWHM): 0.4 %
- RILIS ionization
- Slow extraction applied (1 ms RF pulse)
- Typical beam intensity at exp. station: 1.2E6 pps for 1.75 uA proton current

Main Issues:

Close to 3 hours without protons

Highlights:

 Only a few hours set-up time (same target, isotope and energy as previous experiment)

DE etweeture	HIE
RF structure	SRF07
# Trips	1
Downtime [mins]	5
Downtime [%]	0.1 %

Experiment #	IS621
RIB (A/q)	²⁸ Mg ⁹⁺ (3.111)
SEnergy [MeV/u]	9.47
Target	HRS
Exp. station	ISS
Start date	Sep. 26 th (12:15)
End date	Oct. 1st (11:00)
Length [hrs]	118.8
Pilot beam(s) (A/q)	²² Ne ⁷⁺ (3.143)
Target	#623 SiC
EBIS breeding	45 ms

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Beam transmission/efficiency (approx.)			
Low	REX-TRAP	REX/HIE	
energy	+ EBIS	linac	
87 %	11 %	70 %	





IS631: The (d,p) reaction on ²⁰⁶Hg

Set-up:

- Highest A/q in 2018 (i.e. REX peak powers close to limit)
- All 19 SRF cavities used close to the highest possible gradients
- Beam energy: 7.38 MeV/u Energy spread (FWHM): 0.4 %
- RILIS ionization to reduce ²⁰⁶Pb contamination
- Proton current limited to ~ 0.5 uA (STAGISO)
- Slow extraction applied (1 ms RF pulse)
- Approx. beam intensity at exp. station:: 1.8E6 pps for 0.6 uA proton current (peak), 0.6E6 pps for 0.4 uA proton current (typical)

Main Issues:

 Periodic RILIS re-optimization needed to maintain rates (not always requested by the users)

Highlights:

 Very little downtime due to room temperature or SRF despite of the very demanding conditions

RF structure	REX	HIE	
	IH	SRF04	SRF10
# Trips	4	1	2
Downtime [mins]	60	5	10
Downtime [%]	1 %	0.2	5 %

Experiment #	IS631
RIB (A/q)	²⁰⁶ Hg ⁴⁶⁺ (4.478)
Energy [MeV/u]	7.38
Target	GPS
Exp. station	ISS
Start date	Oct. 10 th (18:30)
End date	Oct. 15 th (8:30)
Length [hrs]	98
Pilot beam(s) (A/q)	⁴⁰ Ar ⁹⁺ (4.444) ¹³⁰ Xe ²⁹⁺ (4.483)
Target	#619 Pb VD5
EBIS breeding	440 ms

Beam transmission/efficiency (approx.)		
Low	ow REX-TRAP REX/HIE	
energy	+ EBIS	linac
80 %	7.5 %	68 %





IS561: Transfer reactions at the neutron dripline with triton target

Set-up:

- 15 SRF cavities used
- Beam energy: 8.0 MeV/u Energy spread (FWHM): 0.8 %
- Carbon stripping foil used to reduced the ¹²C⁴⁺ and ¹⁵N⁵⁺ stable contaminants from the REX-EBIS
- Approx. beam intensity at exp. station: 2E5 pps for 2 uA proton current

Main Issues:

- Beam rates at the experimental station lower than in the experimental proposal (~ 15 %)
- Several trips of the target line heating

Highlights:

DE etweeters	REX	HIE		
RF structure	7GP1	SRF04	SRF10	SRF14
# Trips	1	1	7	1
Downtime [mins]	15	5	35	5
Downtime [%]	0.2 %		0.6 %	

Experiment #	IS561
RIB (A/q)	⁹ Li ^{3+ → 3+} (3.0)
Energy [MeV/u]	8.0
Target	GPS
Exp. station	Scatt. Chamber
Start date	Oct. 31st (18:30)
End date	Nov. 5 th (9:00)
Length [hrs]	103
Pilot beam(s) (A/q)	¹² C ⁴⁺ (3.0)
Target	#638 UC Re
EBIS breeding	30 ms

Beam transmission/efficiency (approx.)		
Low	REX-TRAP	REX/HIE
energy	+ EBIS	linac
95 %	4.2 %	74 %





IS554: Search for higher excited states of ⁸Be to study the cosmological ⁷Li problem

Set-up:

- 10 SRF cavities used
- Beam energy: 5.0 MeV/u Energy spread (FWHM): 0.5 %
- Carbon stripping foil used to eliminate the ¹⁴N⁴⁺ stable contaminants from the REX-EBIS
- Approx. beam intensity at exp. station: 1E6 pps (target temperature adjusted over time to maintain acceptable rates)

Main Issues:

- Some stability problems with SRF10
- Occasional need to re-optimize the lasers
- Occasional need to adjust the breeding time due to degrading e- beam cathode

Highlights:

 Experiment conducted after PSB stopped using a preirradiated target

DE etweeture	HIE	
RF structure	SRF09	SRF10
# Trips	1	44
Downtime [mins]	5	220
Downtime [%]	2.7	′ %

Experiment #	IS554
RIB (A/q)	$^{7}\text{Be}^{2+} \rightarrow ^{4+} (3.5)$
Energy [MeV/u]	5.0
Target	GPS
Exp. station	Scatt. Chamber
Start date	Nov. 15 th (15:30)
End date	Nov. 21st (11:00)
Length [hrs]	135
Pilot beam(s) (A/q)	¹⁴ N ⁴⁺ (3.5)
Target	#635 UC Ta
EBIS breeding	28 ms

Beam transmission/efficiency (approx.)			
Low	REX-TRAP REX/HIE		
energy	+ EBIS	linac	
86 %	2.5 %	73 %	



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- Introduction
- Overview 2018 Operations
- High Energy Physics Campaign
- Summary



Summary:



- HIE-ISOLDE Phase 2B operational (4 cryomodules and 3 HEBTs lines)
- > Highlights:
 - Improved of the reliability of normal and superconducting RF (downtime no longer dominated by RF systems)
 - Better machine scalability and reproducibility of set-ups
 - Reduced set-up time significantly over the last few years (linac not in the critical path)
 - Systematic monitoring of the status of the accelerator (FBI) during the whole campaign
 - Multiple MDs conducted to improve the understanding of the linac
- Overall, very successful Physics Campaign:
 - Number of experiments: 13
 - First two experiment at the ISS
 - RIBs: 1322 hours
 - Stable beams: 369 hours
- The Operations team would like to thank:
 - Equipment owners for their support during the year (specially our colleagues in BE/BI, BE/RF, TE/VSC, BE/ABP)
 - L. Gaffney and J. Konki for always been there during Miniball and ISS experiments
 - The users of the facility for their patience and understanding when problems appeared



