



News from the 2018 HIE-ISOLDE running period

Jose Alberto Rodriguez on behalf of
BE-OP-ISO and the
HIE-ISOLDE project team

Outline:



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

Introduction:

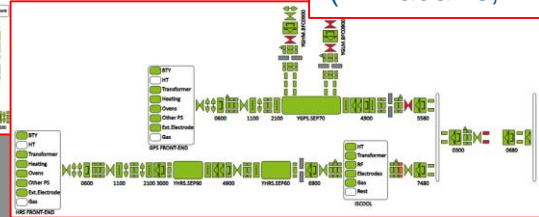
Phase 2B of HIE-ISOLDE operational:

- Additional cryomodule (CM4)
- ISOLDE Solenoidal Spectrometer

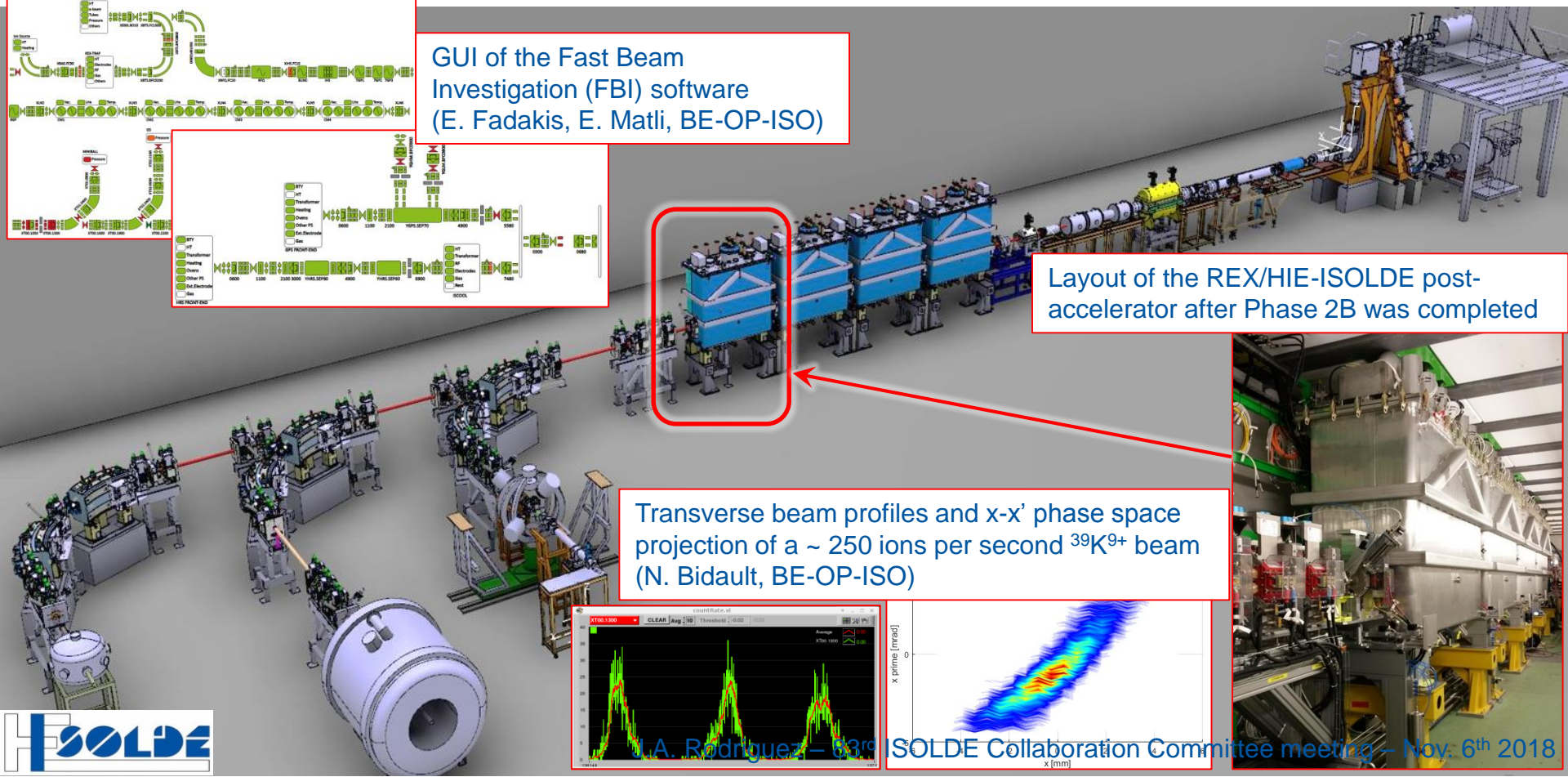
- Machine check-out completed (wk. 20-21)
- Beam commissioning of the post-accelerator and the high-level control software (wk. 22-26)
- Beam commissioning experimental stations (wk. 23 & 24)
- High energy Physics campaign (on-going since wk. 28)
- Machine Development Studies: characterization of sub-femtoampere beams, N. Bidault, BE-OP-ISO (wk. 27 & 37)



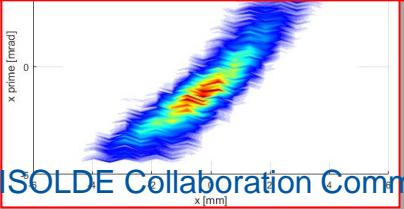
GUI of the Fast Beam Investigation (FBI) software (E. Fadakis, E. Matli, BE-OP-ISO)



Layout of the REX/HIE-ISOLDE post-accelerator after Phase 2B was completed

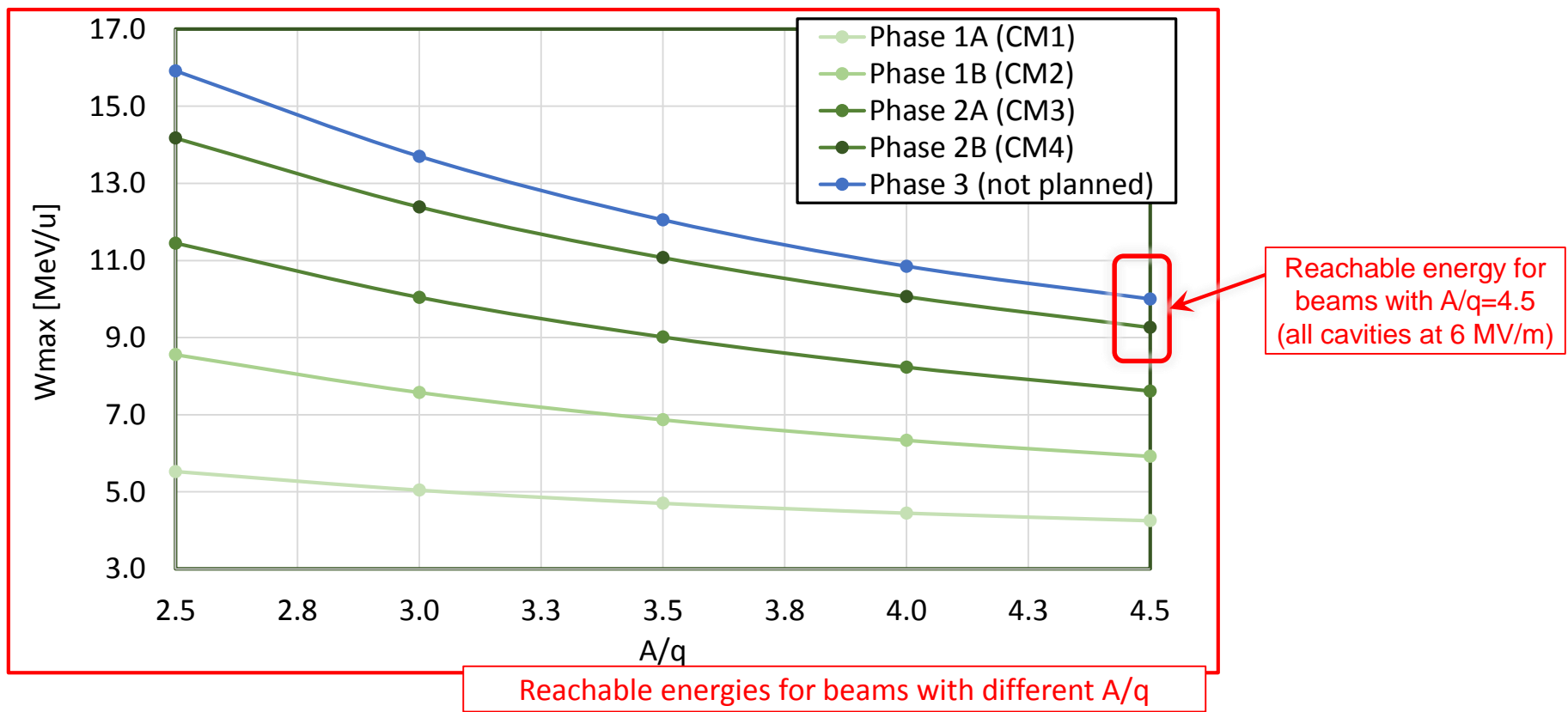


Transverse beam profiles and x-x' phase space projection of a ~ 250 ions per second $^{39}\text{K}^{9+}$ beam (N. Bidault, BE-OP-ISO)



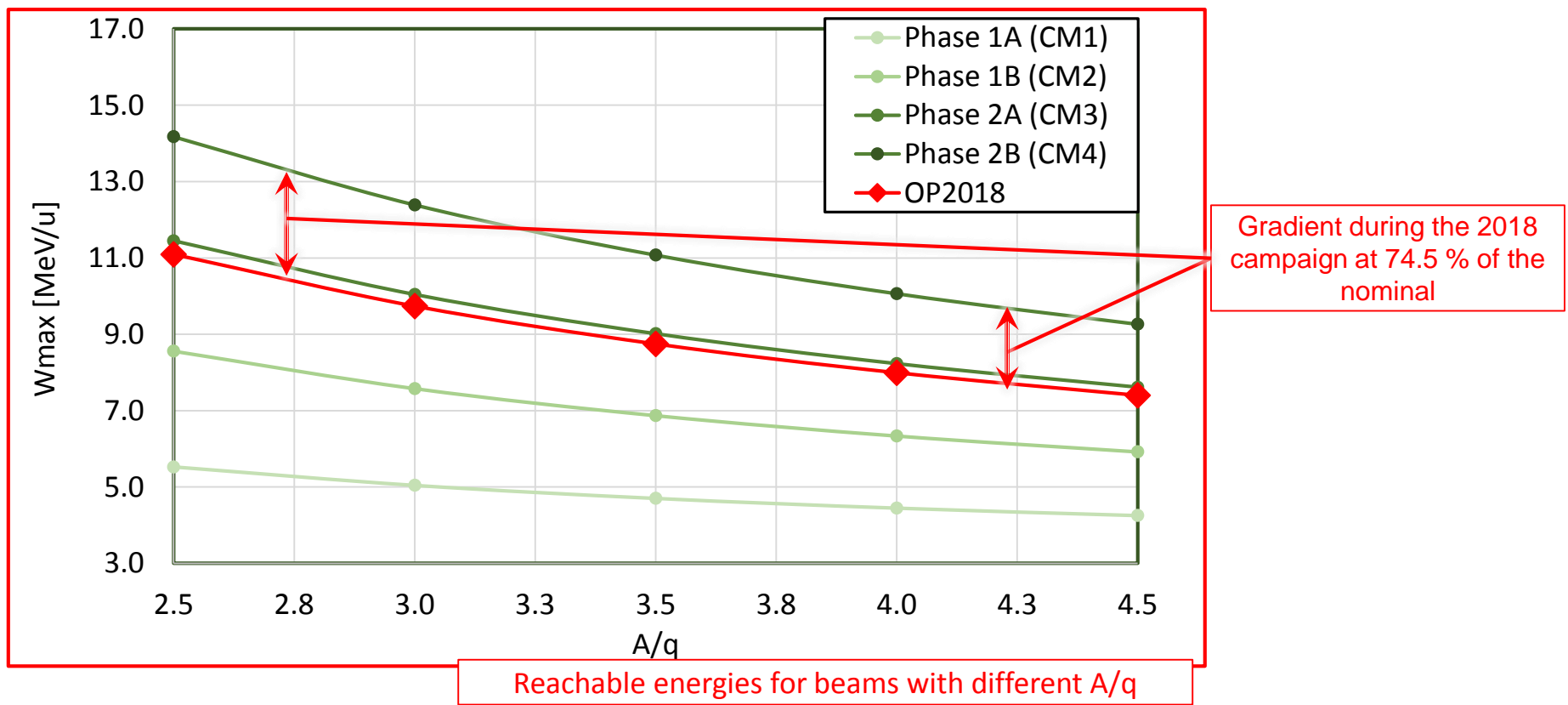
Introduction:

- 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)



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 several different issues (see Walter Venturini's presentation) the total operational gradient is limited to $\sim 75\%$ of the nominal and maximum energy reached was 7.4 MeV/u for beams with $A/q = 4.5$ (9.5 for beams with $A/q = 3.143$)
- Three of the 12 experiments conducted so far 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)
- Twelve experiments conducted despite of the relatively short Physics campaign (~ 1187 hours of RIBs)
- Two additional experiments planned before the end of the year using long lived isotopes

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	⁸ B	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	
IS543	⁴⁴ Ti		Edinburgh Chamber	
			Total	1187.3

Overview 2018 Operations:

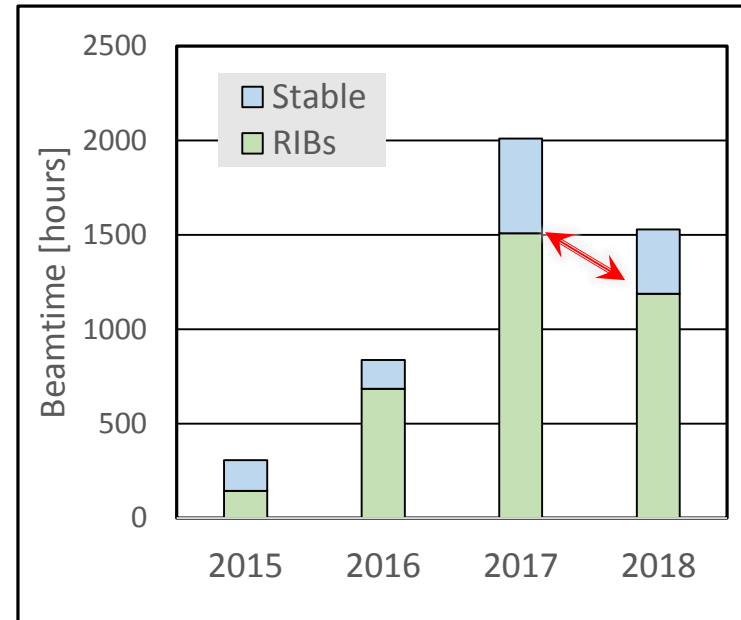
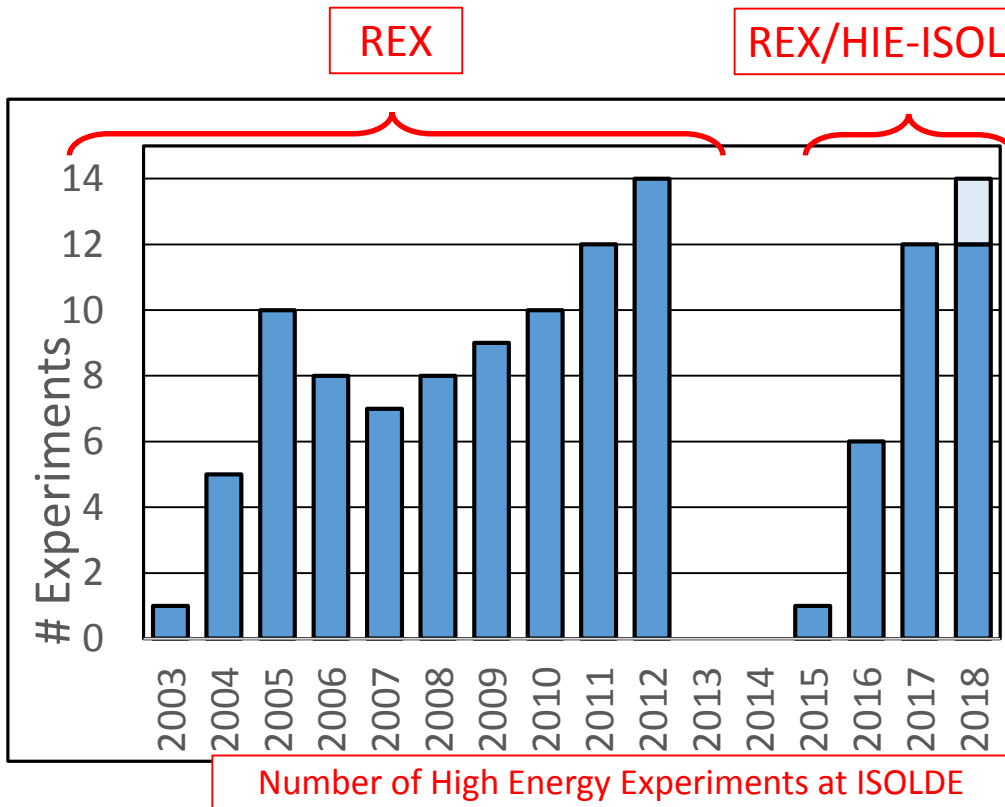
- In addition, multiple stable beams at different energies were delivered to the three experimental stations (times totalling ~ 342 hours)

Beam(s)	Energy [MeV/u]	Experimental station	Time [hours]
$^{22}\text{Ne}^{7+}$	6.2, 4.6, 9.5	Miniball Spect.	110.5
$^{22}\text{Ne}^{7+}$	9.5	ISS	126.8
$^{129}\text{Xe}^{31+}$	4.8	Miniball Spect.	4.0
$^{12}\text{C}^{4+}$	2.8, 4.9, 8.0	Scattering Chamber	62.8
$^{132}\text{Xe}^{31+}$	7.2	Miniball Spect.	21.0
$^{130}\text{Xe}^{29+}$	7.4	ISS	14.5
$^{181}\text{Ta}^{42+}$	7.4	Miniball Spect.	2.0
		Total	341.6

Overview 2018 Operations:

Evolution over last few years:

- More experiments in 2018 if the winter Physics program is included
- Shorter experiments during the 2018 campaign
- Higher number of isotopes and/or energies during the 2018 campaign
- Demand for stable beams slightly lower in 2018 (one week of ^{22}Ne as part of an experiment in 2017)



REX/HIE-ISOLDE number of hours of beam

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2018 REX/HIE-ISOLDE Physics Campaign

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

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 ($^{9}\text{Mo}^{23+}$)

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 $^{96}\text{Rb}^{23+}$)
 - Synchronization between PSB, REX/HIE-ISOLDE important

Experiment #	IS644
RIB (A/q)	$^{96}\text{Kr}^{23+}$ (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)	$^{16}\text{O}^{4+}$ (4.0) $^{129}\text{Xe}^{31+}$ (4.161)
Target	#659 UC VD7
EBIS breeding	86 ms

RF structure	REX				HIE	
	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 %	

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





2018 REX/HIE-ISOLDE Physics Campaign

IS506: Mapping the boundaries of the seniority regime and collective motion: Coulomb excitation studies of N = 122 isotones ^{206}Po and ^{208}Rn

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

Experiment #	IS506
RIB (A/q)	$^{212}\text{Rn}^{50+}$ (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)	$^{16}\text{O}^{4+}$ (4.0)
Target	#659 UC VD7
EBIS breeding	446 ms

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

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





2018 REX/HIE-ISOLDE Physics Campaign

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

Set-up:

- 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
- Approximate beam intensities: 0.6E6 pps of $^{222}\text{Ra}^{51+}$ with 0.3 μA proton current

Main Issues:

- Smooth experiment. No major issues

Highlights:

- Two different targets used
- Multiple isotopes and energies (i.e. demanding for operations)
- $^{228}\text{Ra}^{53+}$ heaviest post-accelerated RIB at CERN

Experiment #	IS552
RIB (A/q)	$^{228}\text{Ra}^{53+}$ (4.302) $^{222}\text{Ra}^{51+}$ (4.353) $^{226}\text{Rn}^{52+}$ (4.346) $^{224}\text{Rn}^{52+}$ (4.308) $^{222}\text{Rn}^{51+}$ (4.353)
Energy [MeV/u]	4.31, 4.23, 5.08
Target	GPS / HRS
Exp. station	Miniball Spect.
Start date	Jul. 25 th (15:30)
End date	Aug. 5 th (18:30)
Length [hrs]	31.25 (Ra) 82.9 (Rn)
Pilot beam(s) (A/q)	$^{16}\text{O}^{4+}$ (4.0) $^{40}\text{Ar}^{9+}$ (4.444)
Target	#632 ThC VD7 (Rn) #637 UC W (Ra)
EBIS breeding	446 ms (not EBIS optimal)

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

Low energy	REX-TRAP + EBIS	REX/HIE linac
63 % (HRS) 70 % (GPS)	6-7 % (Ra) 4-6 % (Rn)	65-70 %

Beam transmission / efficiency (approx.)





2018 REX/HIE-ISOLDE Physics Campaign

IS553: Determination of the B(E3,0+ ->3-) strength in the octupole correlated nuclei $^{142,144}\text{Ba}$ 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

Experiment #	IS553
RIB (A/q)	$^{142}\text{Ba}^{33+}$ (4.303)
Energy [MeV/u]	4.19
Target	HRS
Exp. station	Miniball Spect.
Start date	Jul. 27 th (18:30)
End date	Aug. 1 st (8:50)
Length [hrs]	38.5
Pilot beam(s) (A/q)	$^{16}\text{O}^{4+}$ (4.0)
Target	#637 UC W
EBIS breeding	144 ms (not EBIS optimal)

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

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





2018 REX/HIE-ISOLDE Physics Campaign

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**

Experiment #	IS562
RIB (A/q)	$^{106}\text{Sn}^{26+}$ (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)	$^{16}\text{O}^{4+}$ (4.0) $^{118}\text{Sn}^{29+}$ (4.069)
Target	#663 LaC
EBIS breeding	76 ms

RF structure	REX	HIE
	7GP1	SRF06
# Trips		
Downtime [mins]		
Downtime [%]		

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



2018 REX/HIE-ISOLDE Physics Campaign

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 $^{16}\text{O}^{6+}$ stable contaminant from the REX-EBIS
- Molecular beam: $^8\text{B}^{19}\text{F}_2$**
- Peak beam intensity: ~ 400 pps for 1.8 uA proton current

Main Issues:

- Original target (#650) failed before the experiment started**
- Large $^{92}\text{Mo}^{2+}$ contamination in top of the $^8\text{B}^{19}\text{F}_2$. Saturated REX-TRAP resulting in lower than expected transmission**
- Lower than requested $^8\text{B}^{19}\text{F}_2$ 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**

RF structure	REX	HIE
	7GP1	SRF06
# Trips		
Downtime [mins]		
Downtime [%]		

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

Beam transmission/efficiency (approx.)		
Low energy	REX-TRAP + EBIS	REX/HIE linac
86 %	~ 5 %	75 %





2018 REX/HIE-ISOLDE Physics Campaign

IS629: Beta decay of ^{11}Be

Set-up:

- 14 SRF cavities used
- Beam energy: 7.50 MeV/u – Energy spread (FWHM): 0.25 %
- Carbon stripping foil used to eliminate the $^{22}\text{Ne}^{8+}$ stable contaminant from the REX-EBIS
- RILIS ionization
- Beam intensity limited to $\sim 1\text{E}4$ 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 ^{11}Be to decay)

Experiment #	IS629
RIB (A/q)	$^{11}\text{Be}^{4+} \rightarrow 4+$ (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)	$^{14}\text{N}^{5+}$ (2.8) $^{22}\text{Ne}^{8+}$ (2.75)
Target	#635 UC Ta
EBIS breeding	46 ms

RF structure	REX	HIE
	7GP1	SRF10
# Trips	1	6
Downtime [mins]	15	30
Downtime [%]	0.2 %	0.4 %

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





2018 REX/HIE-ISOLDE Physics Campaign

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

Set-up:

- All 19 SRF cavities used
- Beam energy: 7.39 MeV/u
- Molecular beam: $^{134}\text{Sn}^{34}\text{S}$
- 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
- Problem with cavity SRF09
- Target broke after pushing to try to maintain ^{134}Sn yields

Highlights:

- Only a few hours of ^{134}Sn (very low rates) delivered to the users
- Users asked to change to ^{132}Sn
- SRF09 had to be bypassed and a new set-up prepared (~ 4 hrs)
- Experiment stopped days before scheduled when target broke

Experiment #	IS654
RIB (A/q)	$^{134}\text{Sn}^{31+}$ (4.323) $^{132}\text{Sn}^{31+}$ (4.258)
Energy [MeV/u]	7.39
Target	HRS
Exp. station	Miniball Spect.
Start date	Sep. 5 th (16:30)
End date	Sep. 9 th (11:30)
Length [hrs]	38.5, 16
Pilot beam(s) (A/q)	$^{140}\text{Ar}^{9+}$ (4.444) $^{134}\text{Xe}^{31+}$ (4.323)
Target	#643 UC + 34S
EBIS breeding	196 ms

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

Beam transmission/efficiency (approx.)		
Low energy	REX-TRAP + EBIS	REX/HIE linac
67 %	5 %	67 %





2018 REX/HIE-ISOLDE Physics Campaign

IS651: Nuclear Shell Evolution in the Island of Inversion Studied via the $^{28}\text{Mg}(t,^{30}\text{Mg})p$ 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
- ^{28}Si contamination specially at the beginning of the run (~16 % reported by the users). Contamination reduced over time

Highlights:

- Highest velocity RIB at ISOLDE ($\beta = 0.14 > \beta_g$)

Experiment #	IS651
RIB (A/q)	$^{28}\text{Mg}^{9+}$ (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)	$^{22}\text{Ne}^{7+}$ (3.143)
Target	#623 SiC
EBIS breeding	45 ms

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

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





2018 REX/HIE-ISOLDE Physics Campaign

IS621: Single-particle behaviour towards the “island of inversion” - $^{28,30}\text{Mg}(d,p)^{29,31}\text{Mg}$ 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)

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

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

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





2018 REX/HIE-ISOLDE Physics Campaign

IS631: The (d,p) reaction on ^{206}Hg

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 ^{206}Pb contamination
- Proton current limited to ~ 0.5 μA (STAGISO)
- Slow extraction applied (1 ms RF pulse)
- Approx. beam intensity at exp. station:: 1.8E6 pps for 0.6 μA proton current (peak), 0.6E6 pps for 0.4 μA proton current (typical)

Main Issues:

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

Highlights:

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

Experiment #	IS631
RIB (A/q)	$^{206}\text{Hg}^{46+}$ (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)	$^{40}\text{Ar}^{9+}$ (4.444) $^{130}\text{Xe}^{29+}$ (4.483)
Target	#619 Pb VD5
EBIS breeding	440 ms

RF structure	REX	HIE	
	IH	SRF04	SRF10
# Trips	4	1	2
Downtime [mins]	60	5	10
Downtime [%]	1 %	0.25 %	

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





2018 REX/HIE-ISOLDE Physics Campaign

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 $^{12}\text{C}^{4+}$ and $^{15}\text{N}^{5+}$ stable contaminants from the REX-EBIS
- Approx. beam intensity at exp. station: $2\text{E}5$ 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:

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

RF structure	REX	HIE	
	IH	SRF04	SRF10
# Trips			
Downtime [mins]			
Downtime [%]			

Beam transmission/efficiency (approx.)		
Low energy	REX-TRAP + EBIS	REX/HIE linac
100 %	4.2 %	74 %

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Summary:



- HIE-ISOLDE Phase 2B fully 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 (very good feedback from users)
 - Multiple MDs conducted to improve the understanding of the linac
- Overall, very successful Physics Campaign:
 - First two experiment at the ISS
 - Number of experiments: 12 + 2 (winter Physics)
 - RIBs: 1187 hours so far
 - Stable beams: 341 hours so far

