

Status of the REX/HIE-ISOLDE Beam Commissioning

Jose Alberto Rodriguez

on behalf of BE-OP-ISO and the HIE-ISOLDE project

Outline:

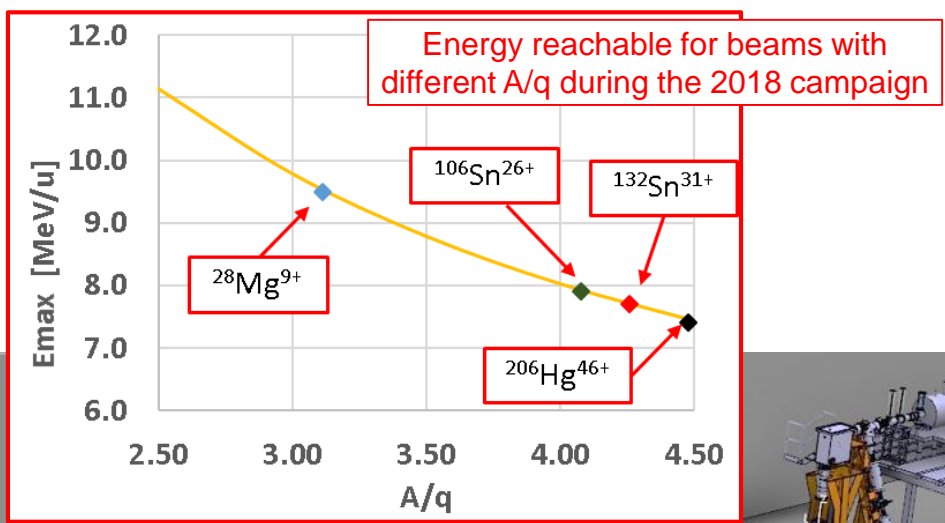


- Introduction
- Machine Checkout
- Beam Commissioning (completed)
- Beam Commissioning (pending)
- Summary

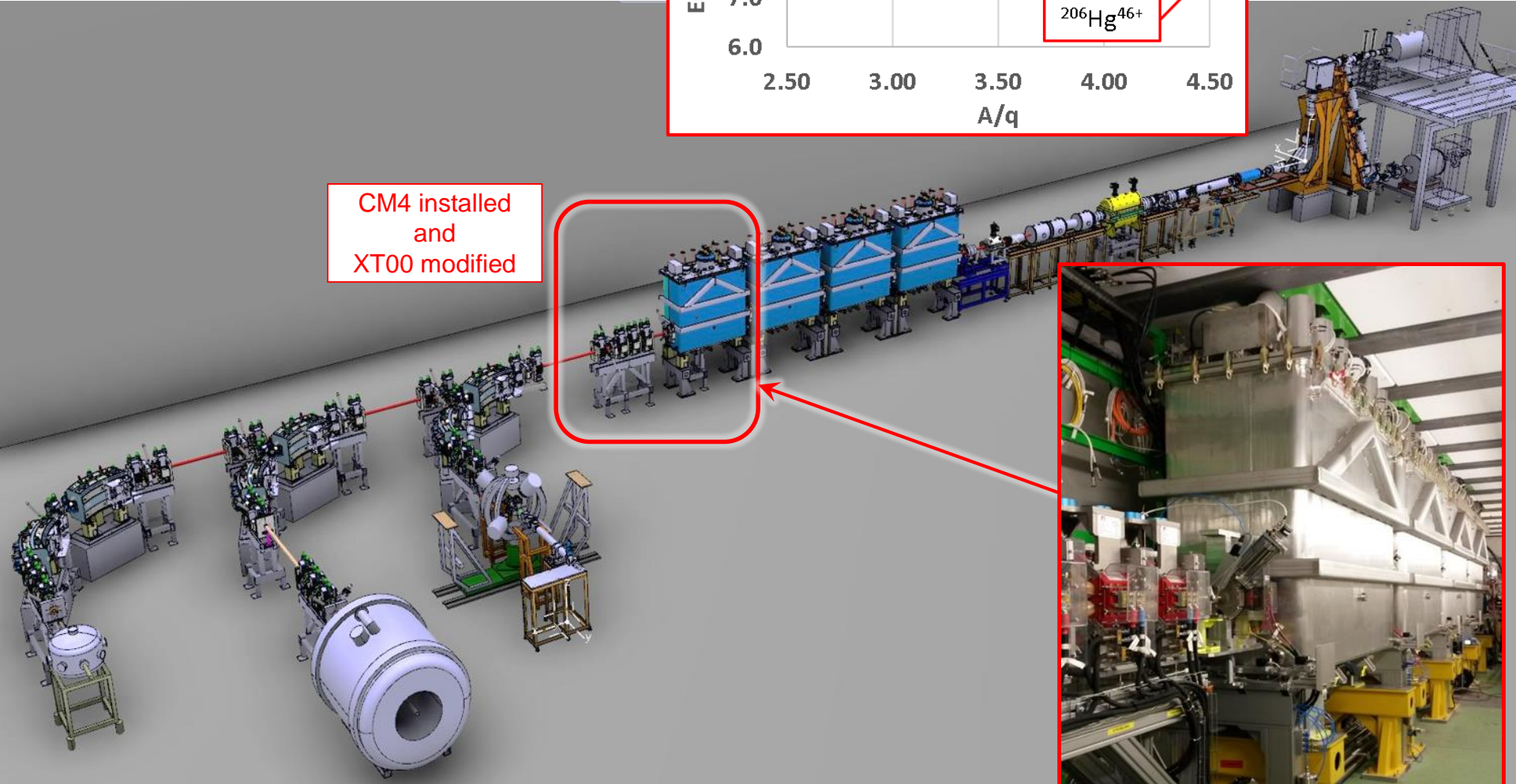
Introduction:

Phase 2B of HIE-ISOLDE operational:

- Additional cryomodule (CM4)
- Modification of the XT00 line



CM4 installed and XT00 modified



Outline:



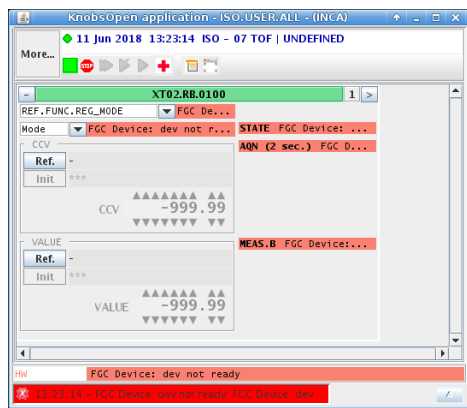
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Machine Checkout:

Wk. Main activities:

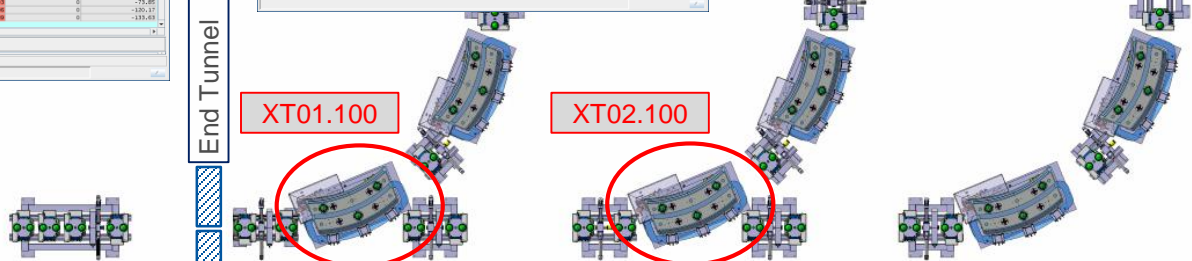
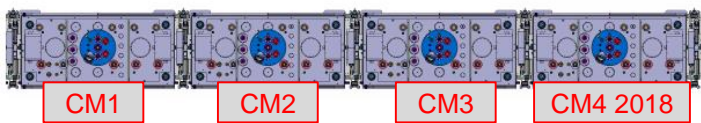
20-21 Machine checkout tests:

- Power converters
 - New FGC_63 low-level control software (power converters for the HEBT dipoles)
 - Field regulation (dipoles)
 - Automatic degaussing (XT01.0100, XT02.0100)
- Updated working sets and equipment arrays (RF, LINAC, EXP1, EXP2, EXP3)
- Beam instrumentation (hardware, low and high level controls, noise level...)



Magnet	Appt	ASN Appt	Phase	ASN Phase	Position TL...	Position TR...
RF01.MF1	1800	1800	0.0	0.0	3951	3951
RF01.MF2	1800	1800	0.0	0.0	3951	3951
RF01.DIP	1300	1300	120.0	120.0	1570	1680
RF01.HF1	1400	1400	140.0	140.0	1601	1601
RF01.HF2	1400	1400	140.0	140.0	1601	1601
RF01.HF3	1400	1400	140.0	140.0	1601	1601
RF01.HF4	1400	1400	140.0	140.0	1601	1601
RF01.HF5	1400	1400	140.0	140.0	1601	1601
RF01.HF6	1400	1400	140.0	140.0	1601	1601
RF01.HF7	1400	1400	140.0	140.0	1601	1601
RF01.HF8	1400	1400	140.0	140.0	1601	1601
RF01.HF9	1400	1400	140.0	140.0	1601	1601
RF01.HF10	1400	1400	140.0	140.0	1601	1601
RF01.HF11	1400	1400	140.0	140.0	1601	1601
RF01.HF12	1400	1400	140.0	140.0	1601	1601
RF01.HF13	1400	1400	140.0	140.0	1601	1601
RF01.HF14	1400	1400	140.0	140.0	1601	1601
RF01.HF15	1400	1400	140.0	140.0	1601	1601
RF01.HF16	1400	1400	140.0	140.0	1601	1601
RF01.HF17	1400	1400	140.0	140.0	1601	1601
RF01.HF18	1400	1400	140.0	140.0	1601	1601
RF01.HF19	1400	1400	140.0	140.0	1601	1601
RF01.HF20	1400	1400	140.0	140.0	1601	1601
RF01.HF21	1400	1400	140.0	140.0	1601	1601
RF01.HF22	1400	1400	140.0	140.0	1601	1601
RF01.HF23	1400	1400	140.0	140.0	1601	1601
RF01.HF24	1400	1400	140.0	140.0	1601	1601
RF01.HF25	1400	1400	140.0	140.0	1601	1601
RF01.HF26	1400	1400	140.0	140.0	1601	1601
RF01.HF27	1400	1400	140.0	140.0	1601	1601
RF01.HF28	1400	1400	140.0	140.0	1601	1601
RF01.HF29	1400	1400	140.0	140.0	1601	1601
RF01.HF30	1400	1400	140.0	140.0	1601	1601
RF01.HF31	1400	1400	140.0	140.0	1601	1601
RF01.HF32	1400	1400	140.0	140.0	1601	1601
RF01.HF33	1400	1400	140.0	140.0	1601	1601
RF01.HF34	1400	1400	140.0	140.0	1601	1601
RF01.HF35	1400	1400	140.0	140.0	1601	1601
RF01.HF36	1400	1400	140.0	140.0	1601	1601
RF01.HF37	1400	1400	140.0	140.0	1601	1601
RF01.HF38	1400	1400	140.0	140.0	1601	1601
RF01.HF39	1400	1400	140.0	140.0	1601	1601
RF01.HF40	1400	1400	140.0	140.0	1601	1601
RF01.HF41	1400	1400	140.0	140.0	1601	1601
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RF01.HF52	1400	1400	140.0	140.0	1601	1601
RF01.HF53	1400	1400	140.0	140.0	1601	1601
RF01.HF54	1400	1400	140.0	140.0	1601	1601
RF01.HF55	1400	1400	140.0	140.0	1601	1601
RF01.HF56	1400	1400	140.0	140.0	1601	1601
RF01.HF57	1400	1400	140.0	140.0	1601	1601
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RF01.HF59	1400	1400	140.0	140.0	1601	1601
RF01.HF60	1400	1400	140.0	140.0	1601	1601
RF01.HF61	1400	1400	140.0	140.0	1601	1601
RF01.HF62	1400	1400	140.0	140.0	1601	1601
RF01.HF63	1400	1400	140.0	140.0	1601	1601
RF01.HF64	1400	1400	140.0	140.0	1601	1601
RF01.HF65	1400	1400	140.0	140.0	1601	1601
RF01.HF66	1400	1400	140.0	140.0	1601	1601
RF01.HF67	1400	1400	140.0	140.0	1601	1601
RF01.HF68	1400	1400	140.0	140.0	1601	1601
RF01.HF69	1400	1400	140.0	140.0	1601	1601
RF01.HF70	1400	1400	140.0	140.0	1601	1601
RF01.HF71	1400	1400	140.0	140.0	1601	1601
RF01.HF72	1400	1400	140.0	140.0	1601	1601
RF01.HF73	1400	1400	140.0	140.0	1601	1601
RF01.HF74	1400	1400	140.0	140.0	1601	1601
RF01.HF75	1400	1400	140.0	140.0	1601	1601
RF01.HF76	1400	1400	140.0	140.0	1601	1601
RF01.HF77	1400	1400	140.0	140.0	1601	1601
RF01.HF78	1400	1400	140.0	140.0	1601	1601
RF01.HF79	1400	1400	140.0	140.0	1601	1601
RF01.HF80	1400	1400	140.0	140.0	1601	1601
RF01.HF81	1400	1400	140.0	140.0	1601	1601
RF01.HF82	1400	1400	140.0	140.0	1601	1601
RF01.HF83	1400	1400	140.0	140.0	1601	1601
RF01.HF84	1400	1400	140.0	140.0	1601	1601
RF01.HF85	1400	1400	140.0	140.0	1601	1601
RF01.HF86	1400	1400	140.0	140.0	1601	1601
RF01.HF87	1400	1400	140.0	140.0	1601	1601
RF01.HF88	1400	1400	140.0	140.0	1601	1601
RF01.HF89	1400	1400	140.0	140.0	1601	1601
RF01.HF90	1400	1400	140.0	140.0	1601	1601
RF01.HF91	1400	1400	140.0	140.0	1601	1601
RF01.HF92	1400	1400	140.0	140.0	1601	1601
RF01.HF93	1400	1400	140.0	140.0	1601	1601
RF01.HF94	1400	1400	140.0	140.0	1601	1601
RF01.HF95	1400	1400	140.0	140.0	1601	1601
RF01.HF96	1400	1400	140.0	140.0	1601	1601
RF01.HF97	1400	1400	140.0	140.0	1601	1601
RF01.HF98	1400	1400	140.0	140.0	1601	1601
RF01.HF99	1400	1400	140.0	140.0	1601	1601
RF01.HF100	1400	1400	140.0	140.0	1601	1601

OE Name	Buffer	CCV Value	AGN Value
XT01.RC.V.1950	0.00	0.00	AGN I: -0.00
XT01.RC.V.2000	49.32	CCV 49.32	AGN I: 49.32
XT02.RB.0100	7780.00	VALUE 7780.00	MEAS.B 7779.97
XT02.RQ.0100	40.49	CCV 36.00	AGN I: 36.00
XT02.RB.0500	7732.00	VALUE 7680.00	MEAS.B 7679.88
XT02.RQ.0600	37.32	CCV 37.32	AGN I: 37.32
XT02.RC.V.0600	0.00	CCV 0.00	AGN I: 0.00
XT02.RC.V.0600	0.00	CCV 0.00	AGN I: -0.00
XT02.RQ.0700	37.32	CCV 57.32	AGN I: 57.32
XT02.RQ.0800	37.32	CCV 57.32	AGN I: 57.32
XT02.RQ.0900	37.32	CCV 57.32	AGN I: 57.32
XT02.RQ.1000	37.32	CCV 57.32	AGN I: 57.32
XT02.RC.V.1150	0.00	CCV 0.00	AGN I: -0.00
XT02.RC.V.1150	0.00	CCV 0.00	AGN I: 0.00



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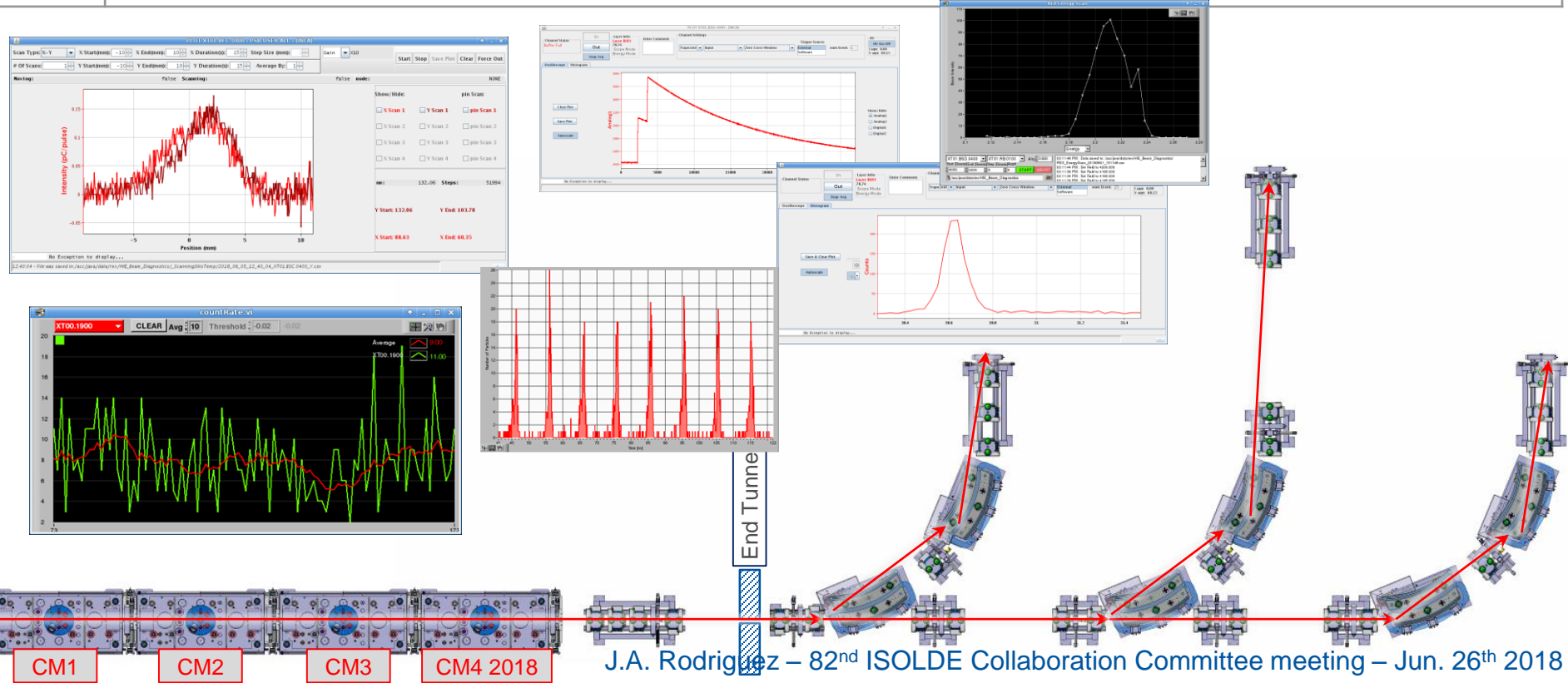


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Beam Commissioning (completed):

Wk. Main activities:

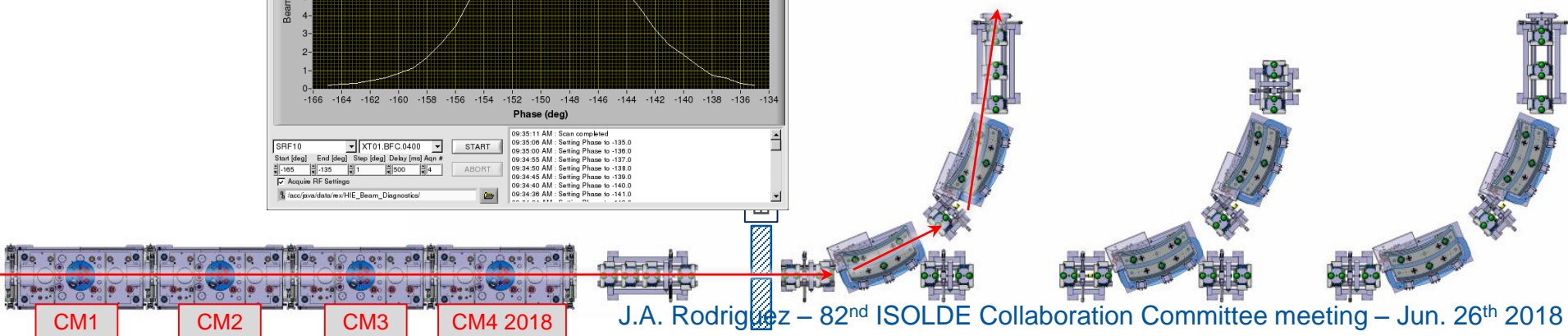
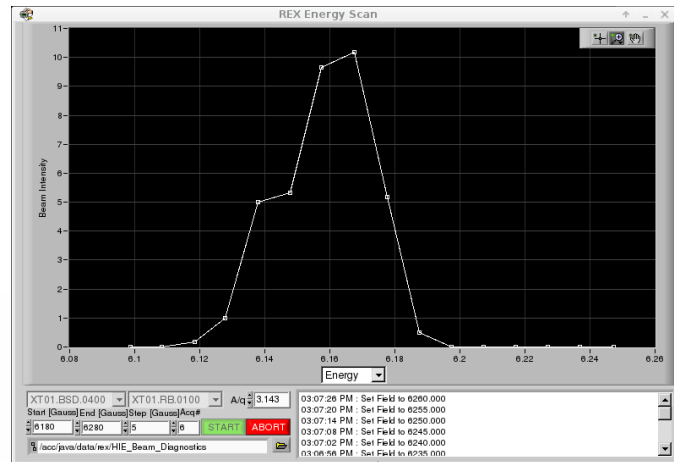
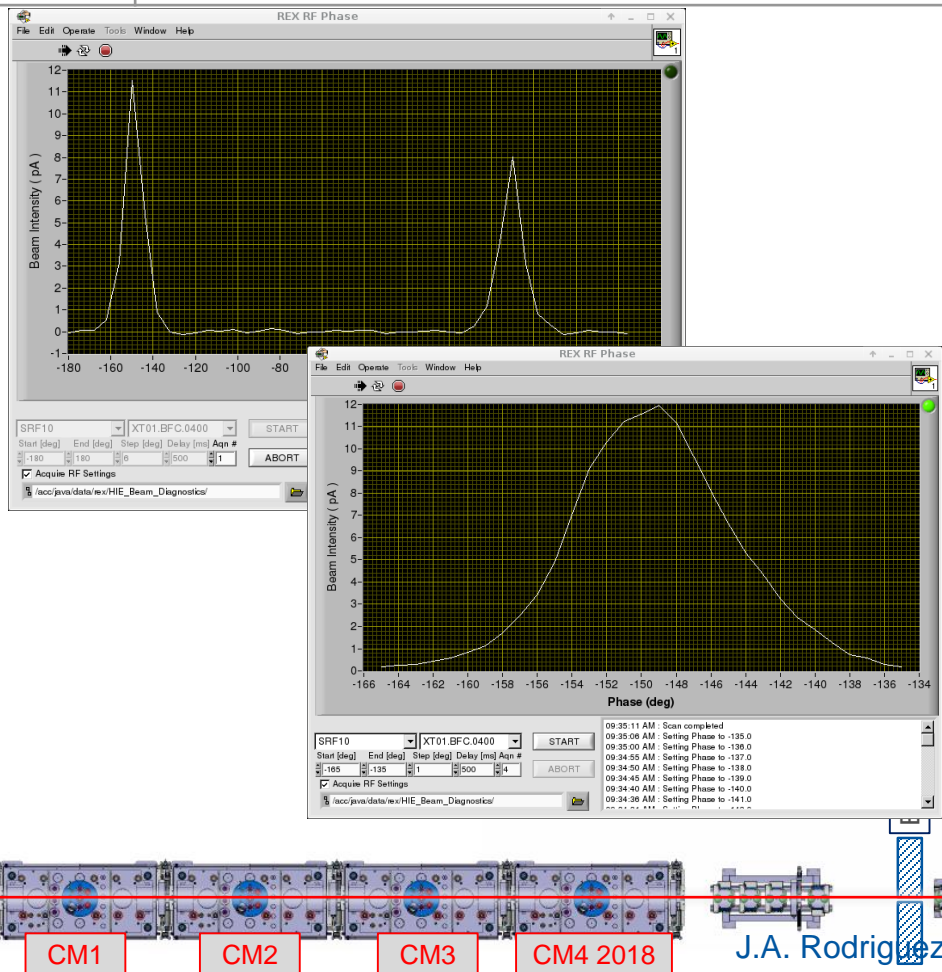
- 22 Beam Commissioning (end of hardware commissioning on May 29th):**
- First beam drifted through the cryomodules
 - Tests of all FCs, scanner slits and optics elements (except for users' FCs)
 - Set up for $^{14}\text{N}^{4+}$ at 2.2 MeV/u to the end of XT01, XT02 and XT03 (transmission: 74%, 77% and 77%)
 - Tests of the Si detectors (XT00.1900, XT00.1050, XT01.0400)
 - Tests of OP's high level applications (Count Rate, Energy Spectrum, Bunch Length, Beam Energy)



Beam Commissioning (completed):

Wk. Main activities:

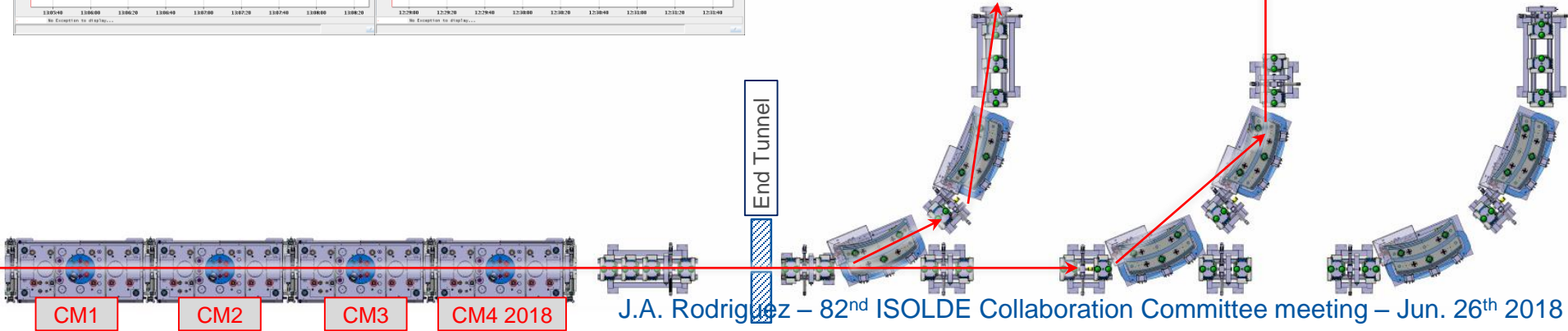
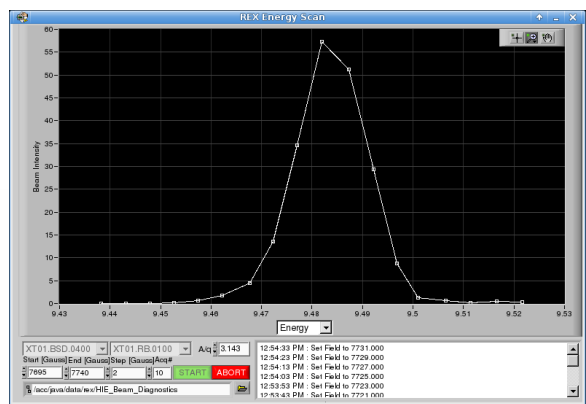
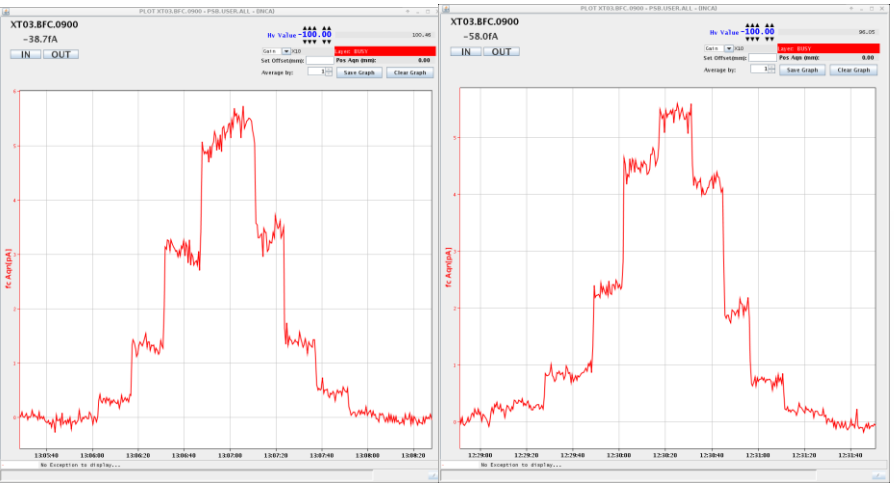
- 23
 - Phasing of the 19 operational SRF cavities
 - Set-ups for $^{12}\text{C}^{4+}$ and $^{22}\text{Ne}^{7+}$ at 9.48 MeV/u to the end of XT01
 - Slow extraction tested and applied
 - $^{22}\text{Ne}^{7+}$ at 6.16 MeV/u (10 cavities) to Miniball for the weekend on Friday at 15:00 (65 hours)



Beam Commissioning (completed):

Wk. Main activities:

- Problem with SRF19 quickly solved by our LLRF and SRF colleagues
- Set-up for $^{22}\text{Ne}^{7+}$ at 9.48 MeV/u to the end of XT02
- Beam-based calibration for SRF20 (data not analysed yet)
- $^{22}\text{Ne}^{7+}$ at 9.48 MeV/u to ISS at 2.47 T from Wed. at 10:30 to Mon. 18:45 (~99 hours)
- Scheduled ABP MD on GPS/REX-TRAP/REX-EBIS
- Set-up for $A/q=4.0$ at 7.44 MeV/u to XT01.0400



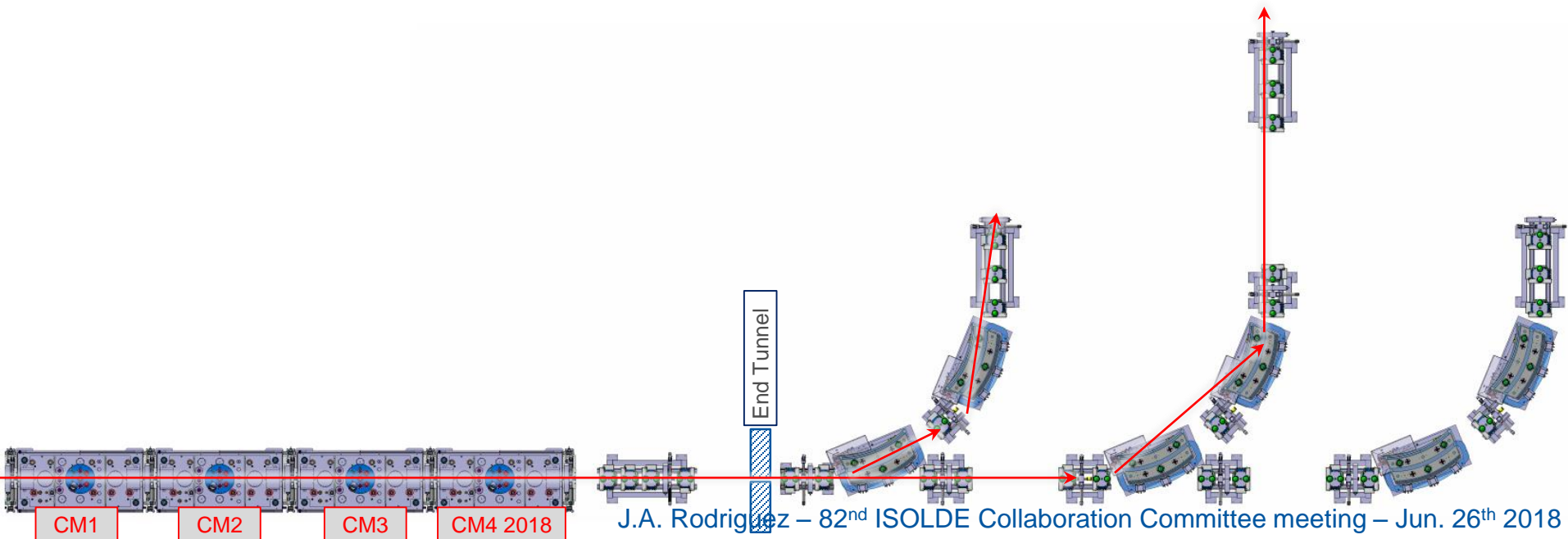


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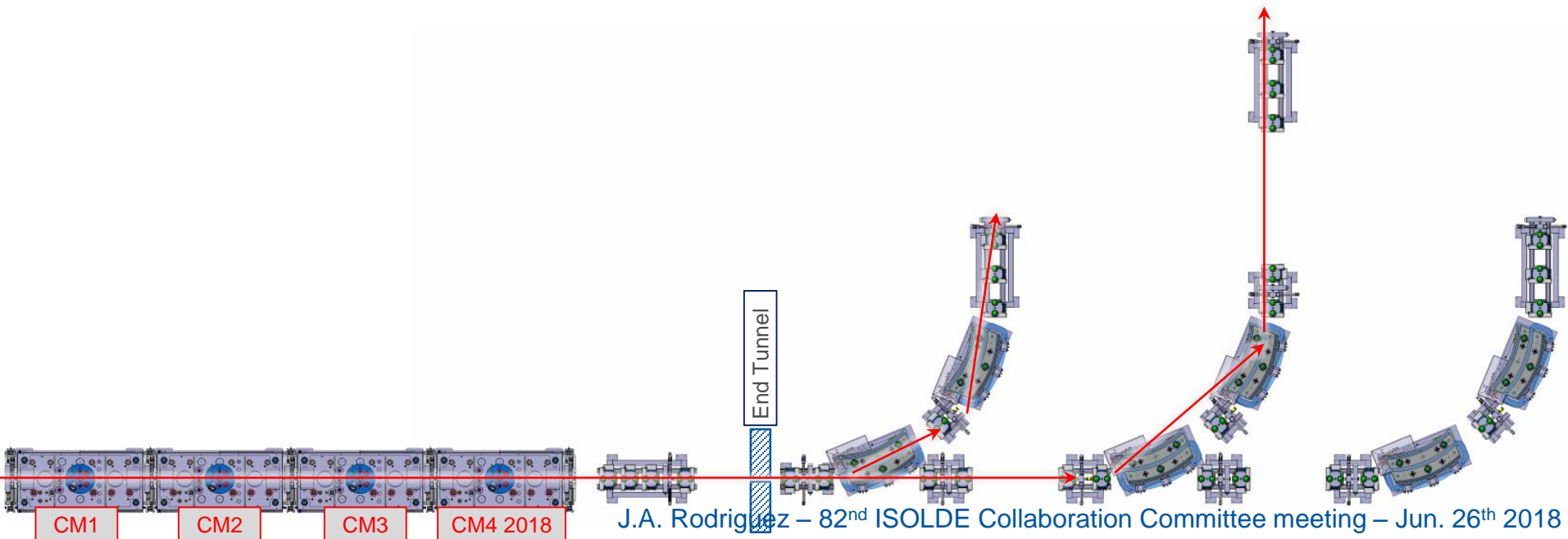
Beam Commissioning (pending):

Wk.	Main activities:
26	<ul style="list-style-type: none"> ➤ ^{39}K from Ion Source to REX-TRAP, REX-EBIS and REX/HIE-ISOLDE linac (completed N. Bidault) ➤ Automation software tested (completed N. Bidault) ➤ Transverse phase space characterization (on-going N. Bidault) ➤ Commissioning of the XT00.1300 Silicon detector ➤ Conclude set-up for $A/q=4.0$ at 7.44 MeV/u to the end of XT01 and XT02 ➤ Commissioning of changes in low and high level BI software



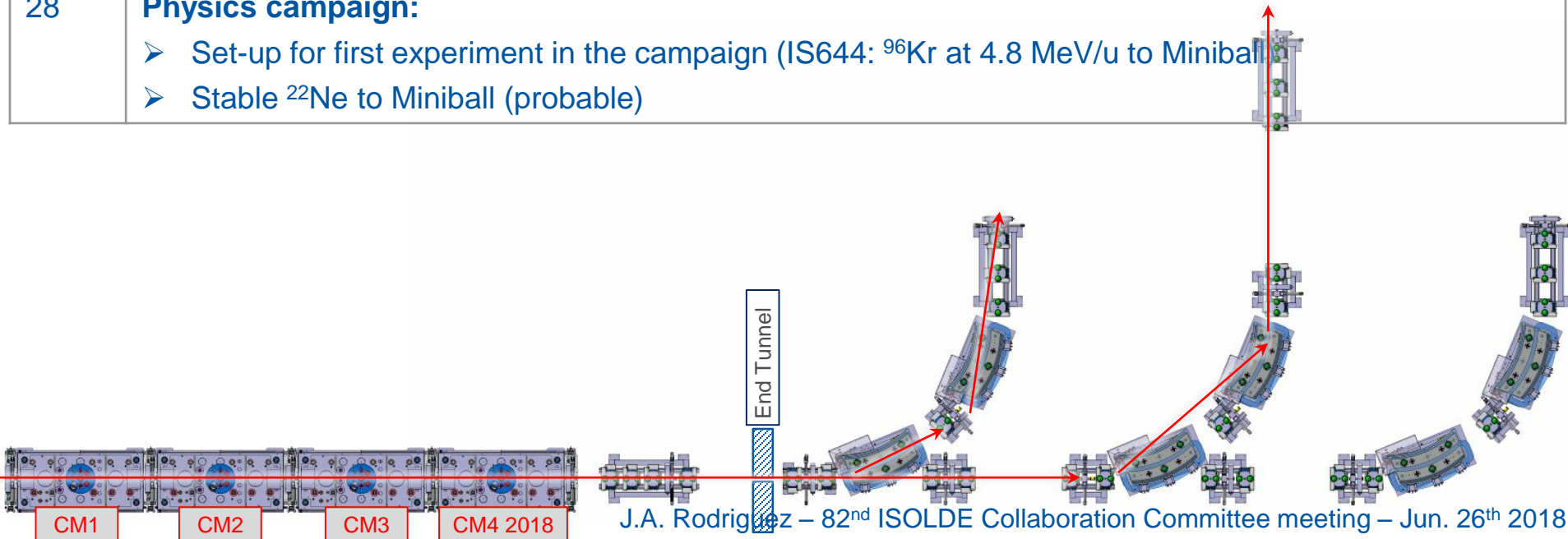
Beam Commissioning (pending):

Wk.	Main activities:
26	<ul style="list-style-type: none"> ➤ ^{39}K from Ion Source to REX-TRAP, REX-EBIS and REX/HIE-ISOLDE linac (completed N. Bidault) ➤ Automation software tested (completed N. Bidault) ➤ Transverse phase space characterization (on-going N. Bidault) ➤ Commissioning of the XT00.1300 Silicon detector ➤ Conclude set-up for $A/q=4.0$ at 7.44 MeV/u to the end of XT01 and XT02 ➤ Commissioning of changes in low and high level BI software
27	<ul style="list-style-type: none"> ➤ Set-up for $^{40}\text{Ar}^{9+}$ ($A/q=4.44$) at 7.44 MeV/u to the end of XT01 and XT02 ➤ Longitudinal phase space characterization ➤ Beam-based calibration of the rest of the SRF cavities



Beam Commissioning (pending):

Wk.	Main activities:
26	<ul style="list-style-type: none"> ➤ ^{39}K from Ion Source to REX-TRAP, REX-EBIS and REX/HIE-ISOLDE linac (completed N. Bidault) ➤ Automation software tested (completed N. Bidault) ➤ Transverse phase space characterization (on-going N. Bidault) ➤ Commissioning of the XT00.1300 Silicon detector ➤ Conclude set-up for $A/q=4.0$ at 7.44 MeV/u to the end of XT01 and XT02 ➤ Commissioning of changes in low and high level BI software
27	<ul style="list-style-type: none"> ➤ Set-up for $^{40}\text{Ar}^{9+}$ ($A/q=4.44$) at 7.44 MeV/u to the end of XT01 and XT02 ➤ Longitudinal phase space characterization ➤ Beam-based calibration of the rest of the SRF cavities
28	<p>Physics campaign:</p> <ul style="list-style-type: none"> ➤ Set-up for first experiment in the campaign (IS644: ^{96}Kr at 4.8 MeV/u to Miniball) ➤ Stable ^{22}Ne to Miniball (probable)





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Summary:



Commissioning of the REX-TRAP, REX-EBIS and REX Linac:

- All systems recommissioned by week 20 (similar to 2017)
- Proof of concept for a new method to characterize very weak stable contaminants from the REX-EBIS (N. Bidault, IPAC'18 conference proceedings)

Machine Check-out and Beam Commissioning of HIE-ISOLDE (completed):

- Field regulation and automatic degaussing of the HEBT dipoles
- Set-ups for $^{12}\text{C}^{4+}$ and $^{22}\text{Ne}^{7+}$ using all the SRF cavities to end of XT01 and XT02
- Beam to Miniball (65 hours of $^{22}\text{Ne}^{7+}$ at 6.16 MeV/u)
- Beam to ISS (99 hours of $^{22}\text{Ne}^{7+}$ at 9.48 MeV/u)
- Initial set-up for $A/q=4.0$ using all the SRF cavities to XT01.0400

Beam Commissioning of HIE-ISOLDE (pending):

- Set-up for $^{40}\text{Ar}^{9+}$ ($A/q=4.44$) at 7.44 MeV/u to the end of XT01 and XT02
- Transverse and longitudinal phase space characterization
- Beam-based calibration of the SRF cavities

Back-up slides:



First part of the High Energy Physics Campaign:



GPS schedule 2018

June					July					August		
22	23	24	25	26	27	28	29	30	31	32	33	34
28	4	11	18	25	2	9	16	23	30	6	13	20
	IS610	ISBM	Tech Stop #655 Ta - W	Medical isotopes IS528 IS638	UC VD7			ThC VD7		#680 MWCNT		
	#634 LIST	²² Mg to LA1 IS614									XT03 IS616:	(tbc)
			IS528				IS644: 4.8MeV/ u (IS506)		IS552: 4.1MeV/ u		4.5MeV/ u	
	RILIS: In	RILIS: Mg	RILIS: Dy	RILIS: Dy (night-time)		96Kr / 212Rn			22x Rn		8B	

HRS schedule 2018

June					July					August		
22	23	24	25	26	27	28	29	30	31	32	33	34
28	4	11	18	25	2	9	16	23	30	6	13	20
	#626 Ta - W	TBC	Tech Stop	Machine development	#652 UC Ta (+CF4)							
			Machine development	Machine development				UC W (+CF4)				
	IS620	IS649			IS650 IS637 IS608			IS552 IS553: 4.1MeV/ u	LaC		LaC	
K beams	Sc RILIS				RILIS: Bi			22xRa/142Ba		Sn RILIS		Sn RILIS
										IS562: 4.4MeV/ u		IS613

Target change

CERN holiday

Setting up/proton scan/yield

Physics GPS

Physics HRS

RILIS run