HIE ISOLDE RECOIL SEPARATOR

Wednesday, December 4, 2019

PRELIMINARY AGENDA

1. Present status of the project
2. White Book/Nuclear Physics program
3. Preparation of LoI for next INTC meeting (Feb 2020)
4. Beam dynamics, Magnets and Cryogenics
5. Next actions
6. AOB

1. Present status of the project

Collaboration

I. Martel[1,3], J.L. Aguado[1], M. Assie[2], M.A.M. Al-Aqeel[3,21], R. Berjillos[4], M.J.G. Borge[5], L. Bottura[6], W. Catford[7], J. Cederkall[8], T. Davinson[9], G. De Angelis[10], T. Ekelof[11], A.P. Foussat[6], , L. Gaffney[3], E. Galanis[12], C. García-Ramos[1], H. Glass[12], K. Johnston[6], T. Junquera[13], O. Kochebina[13], T. Kurtukian-Nieto[14], M. Losasso[6], A. Laird[15], J. L. Muñoz[16], B.S. Nara Singh[19], G. Neyens[6], D. O'Donnell[19], R. D. Page[3], J.A. Rodriguez[6], J. Resta-López[3], V. Rodin[18], J. Sánchez-Segovia[1], K. Riisager[17], A.M. Sánchez-Benítez[1], J. Sánchez-Segovia[1], B. Shepherd[18], E. Siesling[6], J. Smallcombe[3], O. Tengblad[5], D. Tommasini[6], J. Uusitalo[20], C.P. Welsch[3].

1. Univ. Huelva, Spain.
2. IPNO, Univ. Paris-Sud, Orsay, France.
3. Univ. Liverpool, United Kingdom.
4. TTI Norte, Santander, Spain.
5. IEM-CSIC, Madrid, Spain.
6. CERN, Geneva, Switzerland.
7. Univ. Surrey, United Kingdom.
8. Univ. Lund, Sweden.
9. Univ. Edinburgh, United Kingdom.
10. LNL-INFN Legnaro, Italy.
11. Uppsala University, Sweden.
12. PARAGRAF, Somersham, United Kingdom.
13. ACS, Orsay, France.
14. CENGB, Gradignan, France.
15. Univ. York, United Kingdom.
16. ESS-BILBAO, Bilbao, Spain.
17. Univ. Aarhus, Denmark.
18. Cockcroft Institute, Daresbury, United Kingdom.
19. Univ. West Scotland, United Kingdom.
20. Univ. Jyvaskyla, Finland.
21. IMIS Univ., Riyadh, Saudi Arabia.

Google-drive

Web-site

Conceptual design

Superconducting Recoil Separator for HIE-ISOLDE

To meet the physics program needs, a high-resolution recoil separator based on a **compact** superconducting (SC) mini-ring storage system has been proposed **[1].**

A proof-of-concept preliminary design features a Φ= 1.5 m diameter ring built up of multifunction SC magnets **[2]** of δ = 25 cm length (MFSCM) in a Fixed-Field Alternating-Gradient (FFAG) configuration. The MFSCMs should be able to withstand magnetic fields as high as 4 to 6 T. HTS materials and cryocooler systems are being considered in the design.

Reaction fragments circulate up to τ ~ 1 µs being differentiated by their cyclotron frequency. Various techniques of operation are under study.

In the simplest mode, the ions are extracted, identified and quantified in a focal plane detector by Time-of Flight (ToF) and Energy Loss in Gas - Si detectors. Digital Pulse Shape Analysis (DPSA) techniques will help to deal with the most challenging cases. Preliminary beam dynamics studies are ongoing **[3].**

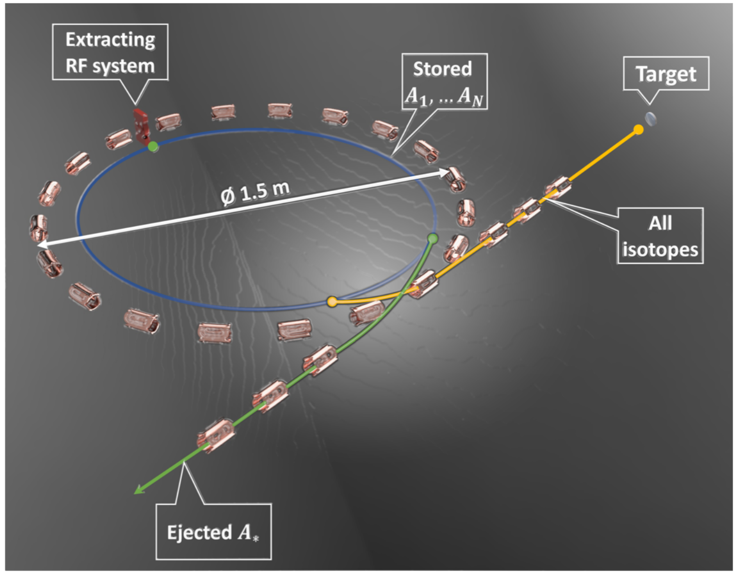
Simulated example

d(^{233}Ra,^{234}Ra)p @ 10 MeV/u
^{233}Ra,^{234}Ra -ToF separation ~ 40 ns (10 turns)

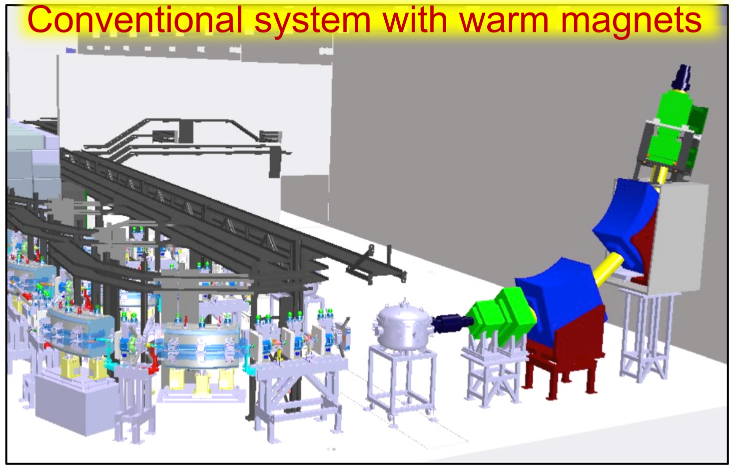
[1] I. Martel. 84th ICC meeting. CERN, March 2019.

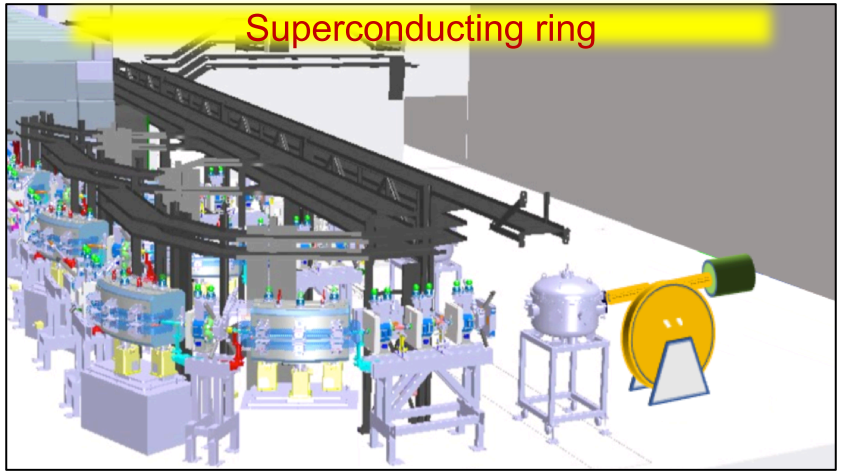
[2] C. Bontoiu et al., IPAC-2015, WEPMN051

[3] J. Resta –López, Nucl. Inst. Meth. A – in preparation



XT03 Beam line @ HIE-ISOLDE





Project participants – Design study - EU application 2020

1. CSIC-MADRID, SPAIN
2. UNIVERSITY OF HUELVA, SPAIN
3. UKRI-STFC, UK
4. ISOLDE-CERN, CERN, SWITZERLAND
5. UNIVERSITY OF LIVERPOOL, UK
6. COCKCROFT INSTITUTE, UK
7. UNIVERSITY OF LUND, LUND, SWEDEN
8. CENBG, BOURDEUX, FRANCE
9. UNIVERSITY OF WEST SCOTLAND, UK
10. UNIVERSITY OF AARHUS, DENMARK
11. UNIVERSITY OF UPPSALA/FREIA, SWEDEN
12. ESS-BILBAO, SPAIN

1. ACS, FRANCE
2. TTI NORTE, SPAIN
3. PARAGRAF, UK

WP1	**Project Coordination and Management**
WP2	**System specifications and selection of technologies**
T2.2	Physics case/White book
T2.3	Conceptual design and critical components
WP3	**Design study of the spectrometer**
T3.1	Beam dynamics FFAG
T3.2	Charge breeder development
T3.3	Beam transport (SEC)
T3.4	Multiharmonic buncher
T3.5	Solid State Power Amplifier
T3.6	Re-buncher
T3.7	RF and LLRF systems
T3.8	Superconducting multifunction magnet design
T3.9	Magnetic probes
T3.10	Magnet test bench design
T3.11	Injection/extraction system
T3.12	Cryostat, cryogenic system, control
T3.13	Standard beam instrumentation
T3.14	Specialized beam instrumentation
T3.15	Safety: machine protection
T3.16	Safety: personal protection
T3.17	Budget and timeline
WP4	**Design study of physics detectors**
T4.1	Focal plane detectors and ancilliary systems
T4.2	Control system and DACQ for physics detectors

WP5	**Construction of prototypes**
T5.1	Beam transport line
T5.2	Multiharmonic buncher
T5.3	Solid State Power Amplifier
T5.4	Multifunction magnets
T5.5	Magnetic probes
T5.6	Magnet test bench
T5.7	Cryostat, cryogenic system, control
T5.8	Integration/preliminary test
WP6	**Local systems, integration and installation**
T5.1	Standard beam instrumentation
T5.2	Vacuum systems
T5.3	Integration mechanical systems
T5.4	Installation
T5.5	Safety
WP7	**Prototype evaluation**
T7.1	Testing plan and initial machine studies
T7.2	Integration control systems
T7.3	Hardware commissioning
T7.4	Stable beam commissioning
T7.5	Radioactive beam commissioning
T7.6	Initial operations
T7.7	Data acquisition software
T7.8	Data analysis
WP8	**Exploitation and dissemination**

Calendar (previous version)

	M	T	W	T	F	S	S	M	T	W	T	F	S	S
OCTOBER		1	2	3	4	5	6	7 Start	8	9	10	11	12	13
	14	15	16	17	18	19	20	21	22	23	24	25	26	27
NOVEMBER	28	29	30	31	1	2	3	4	5	6	7	8 Section 3	9	10
	11	12	13	14	15	16	17	18	19	20	21	22	23	24
DECEMBER	25	26	27	28	29	30	1	2	3	4	5	6 Section 2	7	8
	9	10	11	12	13	14	15	16	17	18	19	20	21	22
JANUARY	23	24	25	26	27	28	29	30	31	1	2	3 Section 1	4	5
	6	7	8	9	10	11	12	13	14	15	16	17	18	19
FEBRUARY	20	21	22	23	24 Section 4/5	25	26	27	28	29	30	31 Complete document	1	2
	3 Start revision	4	5	6	7	8	9	10	11	12	13	14 End revison	15	16
	17	18	19	20	21	22	23	24	25	26	27	28	29	1

Budget for design study

- 3 Meuro max.
- Participants should finish uploading costs
- CERN budget

- Delay: several meetings to improve definition and scope during previous 2 months
- Physics cases
- Calendar of deliveries must be shifted forward by ~ 8 weeks ~ April 2020

2. White Book/Nuclear Physics program

Contact: Teresa Kurtukian-Nieto,
CENGB, Gradignan, France.

Mass	< 50	50 – 120	110 - 150	150 - 200	> 200
Contact	M. Aussie, IPNO I. Martel, Huelva	Joakim Cederkall Lund	Giacomo d'Angelis INFN-LNL	Teresa Kurtukian-Nieto CENGB	Liam Gaffney Liverpool

	Direct reactions	*Inelastic*	*Transfer Few/Multi*	*Coulex*	*Deep inelastic*	*Fusion-Evaporation*	*Focal plane decay*	**Beyond HIE-ISOLDE**
Structure		X	X	X		X	X	X
Dynamics	X		X		X	X		
Astrophysics			X				X	X

3. Preparation of LoI for next INTC meeting (Feb 2020)

In addition to the ongoing review of status reports at ISOLDE, the INTC is requesting **letters of intent** for new experiments or collaborations which intend to **occupy space in the ISOLDE hall** in the coming years or for existing experiments that intend to increase their current **space allocation**.

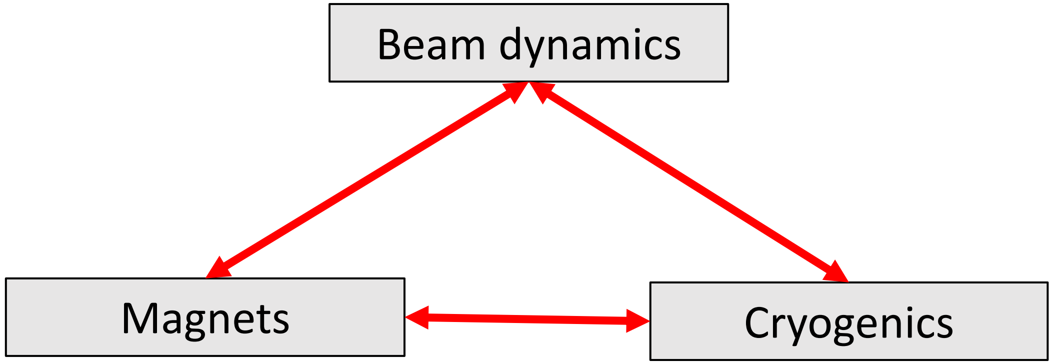
These letters should indicate **future plans** with a summary of **expected space requirements** along with a brief indication of the future **physics programme** and the **status** of the current collaboration. They should be **5-6 pages maximum**. In general letters of intent do not require a presentation to the committee. If, in special cases it is judged necessary, the spokesperson will be contacted in advance of the meeting.

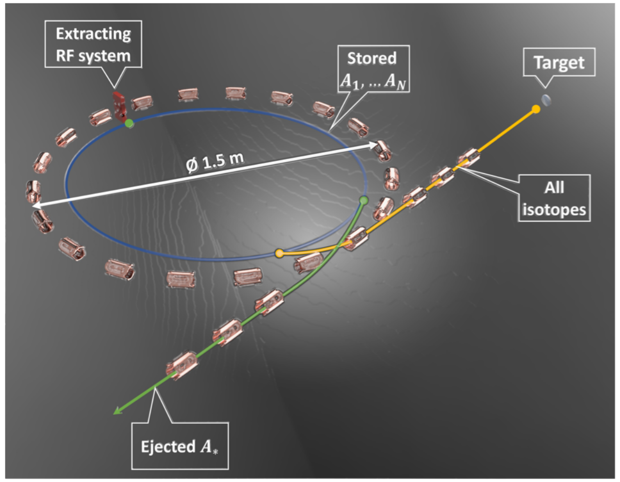
ISOLDE and Neutron Time-of-Flight Experiments Committee (INTC)

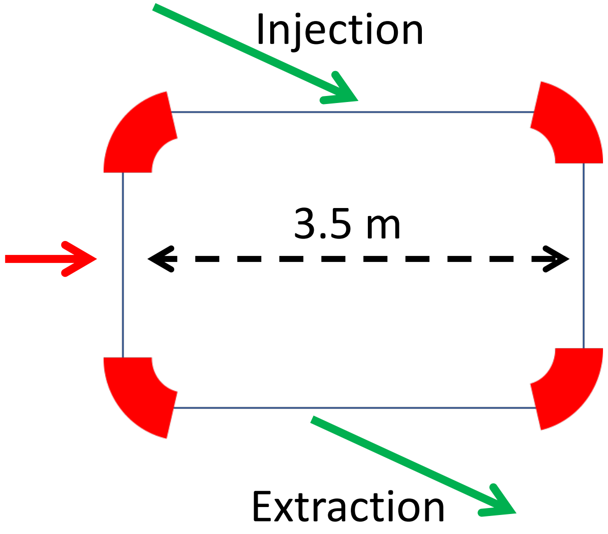
Dates for 2020

Wednesday and Thursday, 5-6 February
Wednesday and Thursday, 1-2 July
Tuesday and Wednesday, 3-4 November

4. Beam dynamics, Magnets and Cryogenics







WP2: Baseline design

- Connection from beampipe (~4K) to outside (~300K)
  - Common vacuum (HIE-ISOLDE ctostats)
  - High thermal-resistive connection (LHC)
- Test LHe and Cryocooler option
- Magnets: Q + D
- Beampipe diameter: 110 -150 mm
- Dipole strength: 1.5 Tm
- Quadrupole strength: 40 T/m
- Max peak field: 5 T
- Typical magnet geometry:
  - Total length 500 mm
  - 3 magnets, in series, Bending angle 30°
  - Common cryostat
  - R= 1 m
  - Max outer diameter (including shielding): 650 mm
- FFAG Cosine canted coils

5. Next actions

- LoI for INTC
- Meet with CERN

6. AOB