Present status of the project

Collaboration

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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.

Google-drive

Web-site
Conceptual design

Compact superconducting RING [1]

Proof-of-concept

- $\Phi = 1.5$ m diameter ring
- multifunction SC magnets [2] o $\delta = 25$ cm length (MFSCM)
- Fixed-Field Alternating-Gradient (FFAG)
- B= 4 - 6 T
- HTS materials + cryogen free option
- Circulation time $\tau \sim 1 - 10$ $\mu$s being
- Selection by cyclotron frequency
- Various ways of operation

Simplest operation mode

- Time-of Flight (ToF)
- Energy Loss in Gas - Si detectors
- Digital Pulse Shape Analysis (DPSA)

Preliminary beam dynamics studies are ongoing [3].

Simulations

$d^{(233\text{Ra}, 234\text{Ra})}$p @ 10 MeV/u

$^{233}\text{Ra}, ^{234}\text{Ra}$ -ToF separation ~ 40 ns (10 turns)

WP2: Baseline design

- Connection from beampipe (~4K) to outside (~300K)
  - Common vacuum (HIE-ISOLDE cryostats)
  - High thermal-resistive connection (LHC)
- Test LHe and Cryogen free 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 magnet length 500 mm
  - 3 magnets in series
  - Bending angle 30°, R= 1 m
  - Common cryostat
  - Max outer diameter (including shielding): 650 mm
- FFAG using Cos theta canted coils
Combined function magnet

Fig 1. Canted coil cos theta combined Dipole and quadrupole demonstrator magnet

Fig 2. Transverse magnetic field profile on mid plane in combined function mode

Fig 3. SC Strands layers in former grooves (spars)

Fig 4. Combined function magnetic field contour

Fig 5. HL-LHC CCT Dipole, TE MSC G Kirby
Study of ring size layout

- Based on the HIE ISOLDE hall layout largest some footprint without major reconfiguration of the beam lines and equipment in the hall has been pre analysed.
- Injection line in the ring using the XT03 line.
- The dashed area in the picture represents the last portion of the line (a triplet of normal conducting quads, steerers and beam instrumentation). This part of the beam line could be adapted to the needs of the ring.
- Limited space by a safety passage, the XT02 beam line and the ISS experimental setup.
- Ring with width 3.4 m, bending sector 1 m radius
- Maximum beam rigidity of the beams will be 2 T.m (10 MeV/u for beams with $A/q = 4.5$). If possible, with a ~10% of margin (2.2 T.m)

Fig 1. Overall 90 deg sector Recoil separator ring
Operation range

- Energy range from 0.45 MeV to 10 MeV

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<th>Parameters</th>
<th>$^{11}\text{Li}$</th>
<th>$^{18}\text{Ag}$</th>
<th>$^{234}\text{Ra}$</th>
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<td>Quadrupolar gradient $G$ [T/m]</td>
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<td>$B\rho$ [Tm]</td>
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- Objective to build a recirculating accelerator ring with overall integrated dipole field of 13.6 T.m along the ring.
- Prototypes ~ 1.2 MEur