DESIR instrumentation & experimental equipment

Ganil Community Meeting

MoHo, CAEN

October 16, 2024

DESIR instrumentation & experimental equipment

Most of the material (in French) from:

EAP S^3-DESIR meeting, October 8, 2024

https://indico.in2p3.fr/event/33830

DESIR instrumentation & experimental equipment

3 components

- Beam preparation and purification devices
- Permanent setups
- Temporary (“movable”) setups

➢ Beam preparation and purification devices

- RFQ (SHIRaC) + HRS
- GPIB+PIPERADE (+ MR-ToF-MS)
- Identification station

➢ Permanent setups

- PIPERADE
- MLLTrap
- MORA

DETRAP (ion trapping)

- LASAGN

LUMIERE (laser interaction) -> next talk by L. Lalanne

- DESIR Decay station

BESTIOL (decay spectroscopy)

➢ Temporary setups

Beam preparation and purification devices

- **RFQ (SHIRaC) + HRS**
  - RFQ refurbishment at LPC Caen (SPES design)
    -> 60-70% transmission, ΔE/E= 1 eV, 7 π.mm.mrad @5keV, 100 nA
  - HRS commissioned at LP2iB up to the 2nd optical order
    -> 80% transmission within 1 mm, R~24000 @25keV, ΔE/E= 1 eV, 2 π.mm.mrad

J. Michaud et al., NIM B541 (2023) 161 & 243

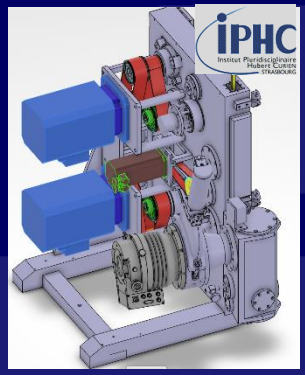
- **GPIB** *(General Purpose Ion cooler and Buncher)*
  - Partial commissioning at LP2iB, mainly used with PIPERADE
    -> 70-90% transmission in CW mode, 3/10 π.mm.mrad @ 30/3 keV, < 10 µs bunches

M. Gerbaux et al., NIMA 1046 (2023) 167631

- **PIPERADE** *(PIège de PEnning pour le Radionucléides à DEsir)*
  - Partial commissioning at LP2iB (Sideband buffer gas cooling, ToF-ICR, PI-ICR)

P. Ascher et al., NIMA 1019 (2021) 165857

To be completed at DESIR (2026->), different configuration (3 keV connexion lines - IJCLab)

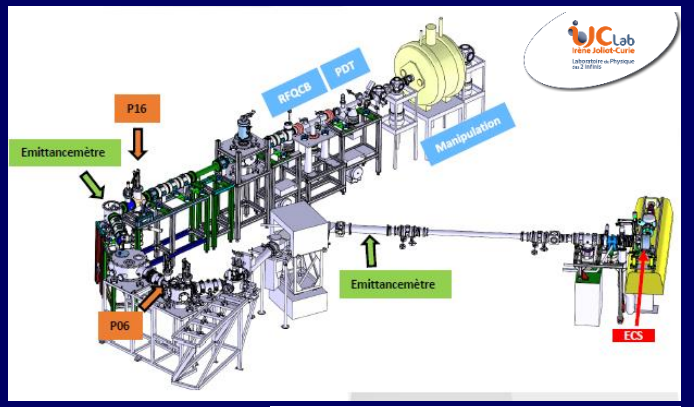


- **DESIR identification station**
  - Remote control at LP2iB (tape drive system built at IPHC)
    -> to be instrumented (+ mechanics)

Permanent setups

- **MLLTrap (mass measurements and in-trap α spectroscopy)**
  - Ongoing installation and off-line commissioning at ALTO
  - Implementation of a LHe recovery unit (RAASAH project)
    -> on-line commissioning (2025) and mass measurements (n-rich Ag - 2026)
  - Installation at DESIR in 2028

E. Minaya-Ramirez et al., NIM B463 (2020) 315
P. Chauveau et al., NIM B463 (2020) 371

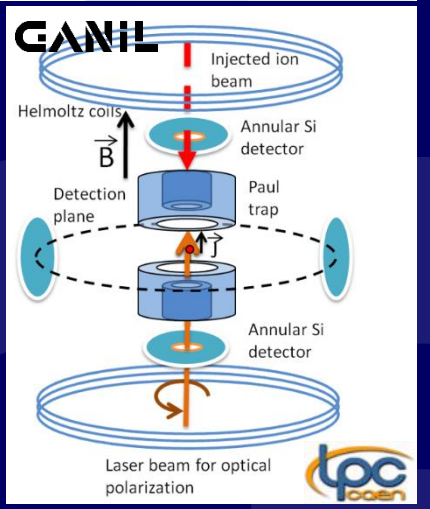


- **MORA (Matter's Origin from Radioactivity)**
  - Proof of principle and first D correlation measurements with $^{23}Mg^{+}$ at JYFL
  - Refurbishment of the LPCTrap RFQ-CB at LPC Caen
  - Installation at DESIR in 2027 (RFQ) and 2028 (MORA Trap)

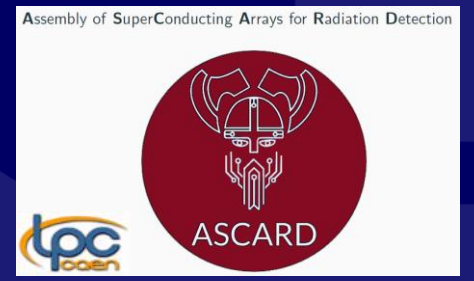
+ Production of $^{39}Ca^{+}$ at SPIRAL1 (ANR proposal) P. Delahaye et al., Hyp. Int. 2040 (2019) 63

+ β-ν correlation measurements (mirror decays)

$$D\frac{\vec{J}\cdot(\vec{p_e}\times\vec{p_\nu})}{J(E_eE_\nu)}$$



- **New projects**
  - L. Hayen, LPC Caen: ASCARD -> Precision beta-decay measurements using superconducting quantum sensors (ERC proposal)
  - P. Campbell, Univ. Manchester: laser (Doppler) cooling inside a RFQ to improve the resolution of laser spectroscopy / mass measurements / decay studies (UK funding request)

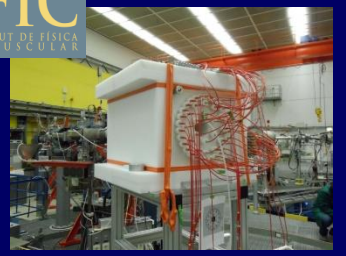
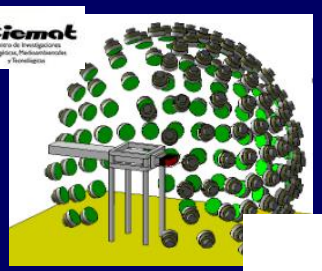


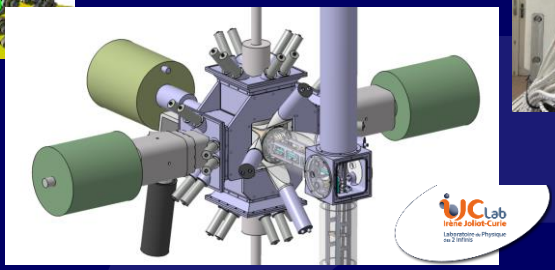
BESTIOL: decay spectroscopy studies

- **Standalone setups**
  - ALTO: COeCo (conv. e-), BEDO (β-γ), BELEN, TETRA (P(2)n)
  - LP2iB: SiCube (β-xp/α)
  - CIEMAT: MONSTER (β-n)
  - CEA-IRFU: SEASON (β-α, conv. e-)
  - IFIC-Subatech: TAGS (β-γ) -> talk by M. Fallot yesterday
    -> installation at DESIR starting by 2027-2028
    => which / when / where? BESTIOL Workshop, 12/16/2024
    https://framadate.org/US8YoJHCA2svQgs5

- **DESIR decay station**
  - Versatility following the example of the ISOLDE IDS
    -> design to be defined: mechanical integration of various types of detectors (HPGe, $LaBr_3$, Si..)
    -> detector pool, DAQ…?
  - Based on the Fast Tape Station developed by IPHC (DESIR EQUIPEX)






Conclusion

- **Beam preparation and purification devices**
  - Installation and on-site commissioning: 2026-2027
  - 4 years engineer position opened (2025-2028): https://emploi.cnrs.fr/Offres/CDD/UAR3266-CHRLAU-021

- **Permanent setups**
  - Installation (2026-2028) -> operation: 2028-2030
  - MORA, MLLTrap: first part of the physics program at JYFL and ALTO -> 2028
  - LINO asap then LASAGN
  - New projects to be consolidated (funding)

- **Temporary/Small size setups**
  - As soon as 2028, beam preparation with GPIB+PIPERADE

- **Physics program (2028->)**
  - Workshops -> LoI (2025) -> Proposals for Day1 exp. (2026)
  - Purified SPIRAL1 beams to start with and S^3-LEB beams asap
  - “Simple” decay spectroscopy experiment to start with

Next (online) Workshop December 16, 2024: BESTIOL, https://framadate.org/US8YoJHCA2svQgs5

Outlook: installation and operation of equipment at DESIR

- **Contact persons, DESIR Management, Collaborations**
  - GANIL: J.-C. Thomas
  - IJCLab: E. Minaya Ramirez (DTRAP) , M. Lebois, I. Matea (BESTIOL)
  - IPHC: L. Lalanne (LUMIERE)
  - LP2iB: B. Blank, P. Ascher (DTRAP)
  - LPC Caen: L. Hayen (DTRAP)
  - Subatech: M. Fallot

- **CaeSAR program: 2024-2029**

  -> Manpower to strengthen research activities at GANIL

  For DESIR, GANIL&LPC Caen collaboration:
  - Technician to install beam line equipment (18 months)
  - Research chair (36 months) + Post-Doc (18 months) + PhD position
  - Post-Doc (18 months) + PhD position

  => SAC meeting, November 6, 2024

Nuclear Physics Center: LPC Caen, GANIL, CIMAP

-> NFS, S3, DESIR, Interdisciplinary research, Graduate School,