



The beam specifications for acceptance definition are [5]:

- Theoretically:  $E_{max} = 60 \text{ keV}$ ,  $Q = 1$ ,  $\epsilon_{6 \times RMS} = 80\pi \text{ mm.mrad}$ ,
- Practically:  $30 \text{ keV}$  with  $\epsilon_{6 \times RMS} = 3\pi \text{ mm.mrad}$ , few nA.

Given these main parameters, it is clear that electrostatic optical systems are required [6, 7]. For 60 keV beam energy, the voltage amplitude specifications obtained from beam optic studies are for the quadrupoles:  $|V| < 4 \text{ kV}$ , deflector:  $|V| < 7.5 \text{ kV}$  and orbit correctors:  $|V| < 300 \text{ V}$ . We also made detailed and careful calculations:

- Include Field Maps [8], errors, correction scheme, tuning methodology,
- Fulfill the building, safety and transverse constraints.

The mechanical 3D integration and 2D detailed drawings are all done internally both at IJCLab, GANIL workshops concerning the beamlines. The experimental set-ups are realised at various french laboratories with the support of their workshops. Assembly and installation are already started (e.g. Fig. 3).

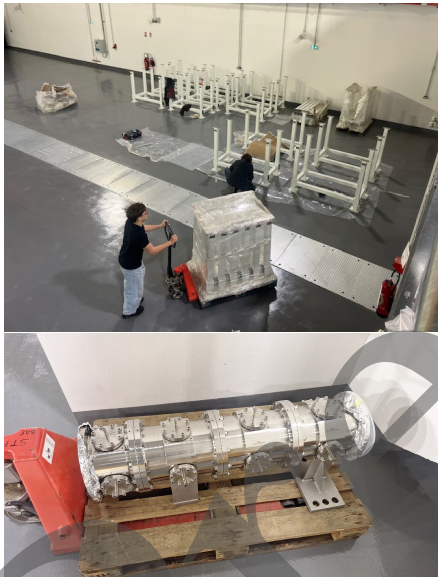


Figure 3: Examples of the current status of the assembly of the DESIR process: mechanical support (on top), 3 quadrupoles + X-Y Steerers (bottom view).

A general main planning tentative is:

- 2026: transfer lines installation,
- 2027: stable beam up to entrance of the DESIR hall,
- 2028: RIB and first experiment (official objective).

## ASSEMBLY AT GANIL

For about two years, technicians and engineers working on the DESIR project have been involved in assembling the first transfer beamline. This will allow the characterization of all technical aspects dedicated to DESIR, which will be used during the full deployment of the facility's beamlines (e.g. Fig. 4):

- 20 m long of the beam transfer line (LT-section-2) in the "salle aux piliers",

- All systems available at GANIL (optics, pumps, diagnostic boxes, alimentations ...),
- Useful test for validate many technical aspects : mounting, alignment, connection, vacuum, C&C ...,
- Learn the electrostatic specificities at GANIL,
- Apply some technical correction with reality.

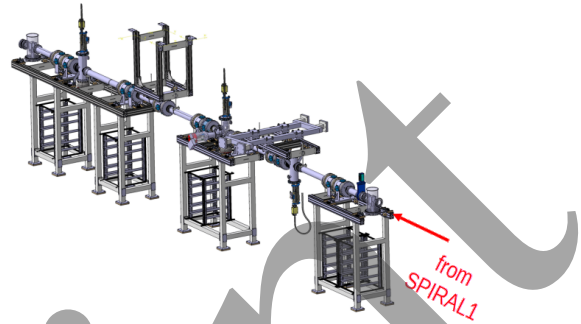


Figure 4: Isometric view of the mechanical integration of the LT-section-2 located at GANIL in the "salle aux piliers" dedicated to the full demonstration.

Figure 5 shows some photos of the current status of the assembly and installation.



Figure 5: Photos of the current assembly in the "salle aux piliers" for the LT section 2.

These developments will enable us to fully demonstrate technical feasibility and to design all the methods for both the transfer beamlines and those in the experimental hall.

## BEAM TRANSPORT STUDIES UP TO EXPERIMENTAL SET-UPS

The beam transfer line between S3-LEB, SPIRAL1, and the entrance of the DESIR experimental hall has been fully finalized. As previously shown, installation is already underway. In the experimental hall, using the same methodology as for the transfer line, we are studying the beam optics from the GPIB device to the various experimental setups that will receive the radioactive ion beams (PIPERADE, MORA, LASAGN, MLLTRAP, etc.). Figure 6 illustrates some of the new beamlines to be constructed and installed in the DESIR experimental hall.

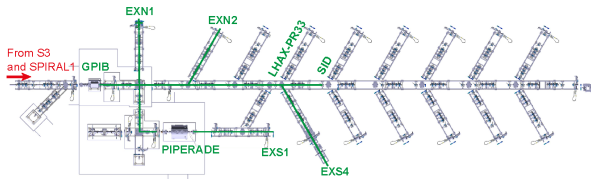


Figure 6: Top view of the mechanical design of the experimental hall (e.g. Fig. 2). 16 new lines will be available for experimental setups. Green lines are the up to date beam transport studies.

We present a selection of results obtained from beam transport studies using the TraceWin simulation tool [9] (e.g., Figs. 7, 8, and 9). Based on these results, the mechanical workshop can proceed with the implantation using the already-designed systems (quadrupoles, deflectors, steerers, diagnostic boxes, bellows, supports, electronic racks, HT platforms, etc.).

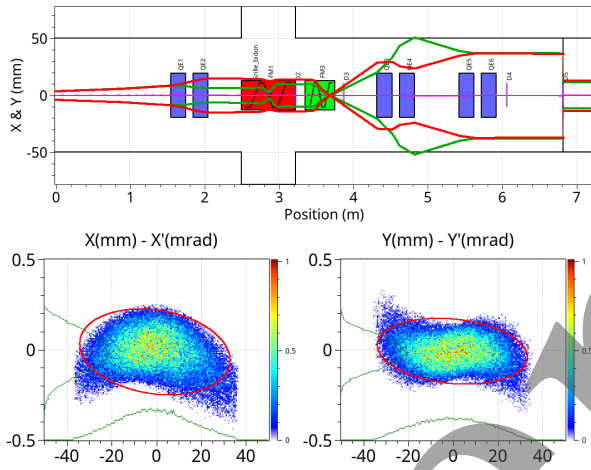


Figure 7: GPIB-EXN1 section:  $\pm\sqrt{6}$  transverse beam envelopes (top figure), transverse beam phases-space (bottom figure).

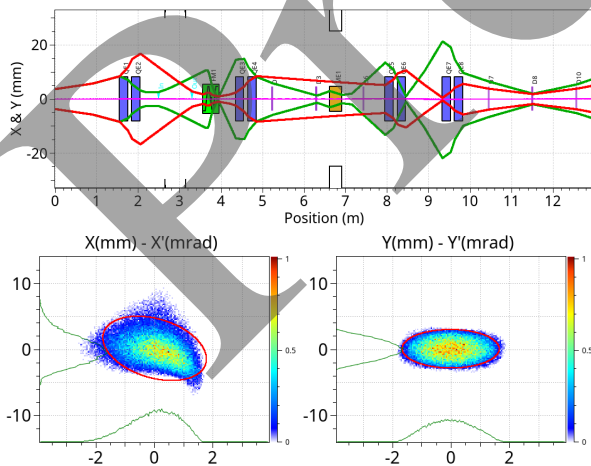


Figure 8: GPIB-EXN2:  $\pm\sqrt{6}$  transverse beam envelopes (top figure), transverse beam phases-space (bottom figure).

Mechanical integration is currently underway. Beam optics devices, utilities and auxiliary systems are partially available at GANIL. It should be noted that the experimental

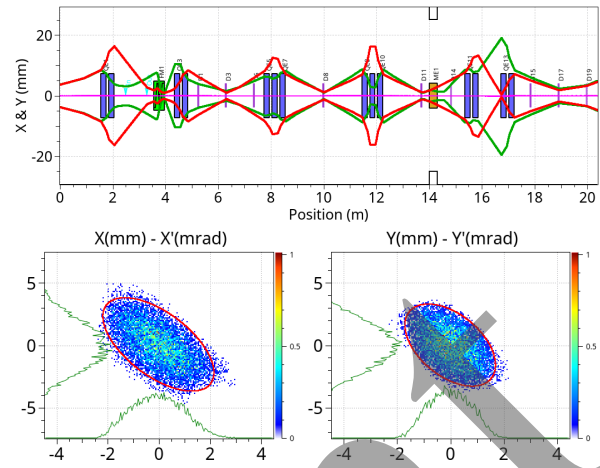


Figure 9: GPIB-EXS4:  $\pm\sqrt{6}$  transverse beam envelopes (top figure), transverse beam phases-space (bottom figure).

setups and their associated distribution beamlines will be installed in phases starting from 2027.

## CONCLUSION

We briefly recalled the optical design studies of the beamlines for the DESIR project. These studies began nearly 15 years ago and have been presented on several occasions [5–7]. The building is now fully constructed, and the installation of the beamlines started in 2025.

In this paper, we focus on the already well-advanced installation of a beamline section located in the original GANIL building, which will enable the transfer of beams from the SPIRAL1 facility associated with the historic part of GANIL. We also present a selection of beam optics for three lines that will be installed in the experimental hall, serving the experimental setups dedicated to nuclear physics research.

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