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## New exotic beams from the SPIRAL 1 upgrade

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Since 2001, the SPIRAL 1 facility has been one of the pioneering facilities in ISOL techniques for reaccelerating radioactive ion beam: the fragmentation of the heavy ion beams of GANIL on graphite targets and subsequent ionization in the Nanogan ECR ion source has permitted to deliver beams of gaseous elements (He, N, O, F, Ne, Ar, Kr) to numerous experiments. Thanks to the CIME cyclotron, energies up to 20 MeV/u could be obtained. In 2014, the facility was stopped to undertake a major upgrade, with the aim to extend the production capabilities of SPIRAL 1 to a number of new elements. This upgrade, which will become operational this year, consists in the integration of an ECR booster in the SPIRAL 1 beam line to charge breed the beam of different 1+ sources. A FEBIAD source (the so-called VADIS from ISOLDE) was chosen to be the future workhorse for producing many metallic ion beams. This source was coupled to the SPIRAL 1 graphite targets and tested on-line with different beams at GANIL. The charge breeder is an upgraded version of the Phoenix booster which was previously tested in ISOLDE. It was lately commissioned at LPSC and more recently in the SPIRAL 1 beam lines with stable beams. The upgrade will additionally permit at longer term the use of other target material than graphite. In particular, the use of fragmentation targets will permit to produce higher intensities than from projectile fragmentation, and thin targets of high Z will be used for producing beams by fusion-evaporation [1]. The performances of the aforementioned ingredients of the upgrade (targets, 1+ source and charge breeder), have been and are still being optimized in the frame of different European projects (EMILIE, ENSAR and ENSAR2). This year, the upgraded SPIRAL 1 facility will provide its first new beams for physics and further beam development will be undertaken to prepare for the next AGATA campaign. This invited contribution will describe the R&D which was undertaken for the upgrade, focusing on the radioactive ion beam and ion source R&D, and the results obtained during the on-line commissioning period.

[1]: see contributions of V. Kuchi and of P. Jardin to this conference.

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