MONOBOB II, is an electron cyclotron resonance ion source (ECRIS) based on an asymmetric magnetic structure. It has been designed for the Spirai2 project in order to ionize radioactive elements coming out from the hot targets of the Target Ion Source System. The goal was to build a long-lived ECRIS able to operate three months in the hostile environment of the production module while keeping high ionization efficiencies for gas element.

In this paper, the design of the source made of four coils is described as well as its coupling with the SPIRAL II target. A Target Ion Source System within the SPIRAL II framework has been constructed and ionization efficiencies on noble gases have been measured, with and without hot target. Results of these measurements will be presented.

Furthermore, the response time of the TISS is a relevant parameter for the SPIRAL II project in order to better estimate the total production efficiencies (isotope production, diffusion, effusion, ionization) especially for short-life isotopes. Thus measurements using noble gas pulses were performed. Experimental results were obtained: effusion/ionization time of the Target Ion Source has been measured, in particular in the case of the ion source coupled with a hot target.

SPIRAL2 Set up
A high flux of neutrons (coming from the breaking down of deuterons impinging a carbon target called "converter") induces the fission of the uranium target. The fission fragments diffuse out of target material and effuse up to the ECRIS where they will be ionize and extract in the low energy beam line. For safety reasons, in the frame of SPIRAL2 operation, the TISS will be installed in a vacuum chamber where the pressure must be lower than 10⁻³mbar after outgassing.

Tests Set up
To qualify the TISS, two fast valves were mounted on the TISS: One at the opposite of the plasma electrode hole and one on the target container, at the opposite of the aperture toward the IS to measure the contribution of the target to the response time of the TISS.

After acceleration (15kV), the beam is transported through an electrostatic lens (with moveable position), a magnetic mass spectrometer, an emittance meter (removable), before reaching a Faraday cup.

Transport optimisation
The transport of the beam from exit of the ECRIS up to the Faraday cup has been estimated by comparing the current of the most abundant elements and the total current delivered by the ECRIS. The position of the extraction lens and the voltage and position of the Einzel lens were tuned.

The optimal distance between the extraction and plasma electrode has been found equal to 31mm for 15kV of extraction voltage.

Emittance measurement
When the optimum transport was obtained, emittance measurement was performed for Ar⁺ beam  @ 15keV. As show in the figure n°1, more than 85% of the beam is include in an ellipse of 80x:mm:mm which correspond to the acceptance at the low energy beam line for SPIRAL2.

The same measurement was performed for N²⁺ beam and the emittance was less than 80x:mm:mm

Response time
To understand it, measurements were performed with injection of gas directly in the source (VP source). After time scale transformation, (injection gas by source (VP source)) the result show is due to the first ionization potential which decreases with the mass and leads to ionization rates higher for heavier elements.

The contribution of this effect to the reduction of the global response time is relatively small (some tens or hundreds of ns) compared to the effusion time of the isotopes out of the target labyrinth. But in case of short lived isotopes, the size of the target could be reduced to limit the inner-target effusion time.

Measurements were performed with injection of Ar by VP target, the temperature of the target was increased and the response time was measured. The result [Fig.6] show temperature have an influence on the time response of the TISS. The effusion time through the target is reduce due to the increase thermal excitation of the atom.

Abstract
MONOBOB II : Latest results of monocharged ions source for SPIRAL2 RIB