2. SOURCE OF NEGATIVE IONS BY CESIUM SPUTTERING

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A source of negative ions by cesium sputtering (SNICS) was designed and constructed. In parallel a test bench for ion source tests completely independent of the Pelletron Accelerator was constructed.

The test bench consists of a vacuum system (diffusion pump), a complete electronic set of source and power supplies, an Einzel lens, an electromagnetic spectrometer, Faraday cups and an emittance meter. The test bench was tested by using a duoplasmatron source with known characteristics. The output beam, after being accelerated through a 0-20 kV extraction potential and focussed by a 0-15 kV Einzel lens, was analysed by the magnetic spectrometer, which was then calibrated.

Our sputtering source has a simple axial geometry [1,2] and a helical filament of 1 mm W wire which ionizes the Cs atoms. The positive ionized Cs^+ ions are focussed to strike the cathode and, in our geometry, the negative sputtered ions from the cathode are directly focussed through the cathode potential drop (0-3 kV). The source is made in stainless steel. Cesium vapor enters the discharge region through a heated bellows type metering valve (kept at $\sim 300^oC$) connected between the cesium oven

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(kept at ~ 230°C) and the inlet canal. In order to keep the filament region hot and the cathode and flange regions cooler, a tantalum shield encloses the filament and the cathode is refrigerated with air cooling. We also used gaskets instead of viton O-rings in the flanges.

In our first tests, flat Cu sputter cathodes are being used. We are studying the Cu^- output beam as a function of several source parameters, e.g. filament current, cathode potential drop, extraction potential and bellows metering valve aperture.

The results already available show that a steady non analysed beam of 5.5 μA can be obtained during several days, with 30 A filament current, -2kV cathode potential drop, 12.5 kV extraction potential and 10μm valve aperture. The beam current is very sensitive to the filament current and we hope to increase the output current by using a 50A current filament source. The beam current is not very sensitive to changes in the cathode and extraction potentials. If the bellows metering valve aperture is increased too much. the output current increases drastically and can not be kept under control. We are still trying to find the optimum conditions for the source operation. In a preliminary test with an analysed beam the presence of some H^-, Cs^- and $CsCu^-$ beams, together with the Cu^- beam has been detected.

After 32 days of non continuous operation the source was opened and the sputter cathode showed pronounced erosion in a conical hole in its center, as in other sputtering sources[1,2], and some cylindrically symmetric erosion on the outer part of the cathode cylinder, due probably to the small tantalum shield aperture, originating a discharge region around it.

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3. TIME OF FLIGHT PULSING SYSTEM

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A $^{14}N^{6+}$ beam was pulsed and bunched at a repetition period of 400 nS for use in an experiment described in this report. The FWHM of the bunched beam on target was measured to be 5.1 nS with a 5×7.5 cm NE213 liquid scintillator and 8.5 nS with a 56 cm^3 Ge(Li) detector. Fig. 1 shows the prompt γ peak resulting from the bombardment of an ^{56}Fe foil by a ∿50 MeV $^{14}N^{6+}$ beam as measured with the two detectors.

The Pelletron bunching system is being upgraded

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