**MONITORING OF LOW INTENSITY ION BEAMS AT FLNR ACCELERATOR COMPLEX**

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**ABSTRACT**

Detectors are developed to diagnose ion beams inside the accelerator, during beam transportation, and to control beam in the user area. The intensity of beam in the range from several ions per second up to pnA, the energy, the density distribution and the grade of the beam are monitored by the detectors. Depending on the operating conditions the ionization chambers, proportional counters, the scintillation detectors and lamellar sensors with dual screen are used. The main criteria for the detector design are the reliability in long time operation under radiation, in magnetic fields and in rapidly changing vacuum conditions, and the possibility of quick repair or replacement. The diagnostic detectors are located in the channels to study the radiation resistance of electronics, and in the channel for the biological research.

**Measurement of beam current inside the cyclotron**
The detector based on secondary emission with three lamellas

The detector operates in two modes: proportional counter and ionization chamber. The working gas is an air. The measurement range is from few ions/s up to 10⁹ ions/s in the proportional counter mode and up to 10⁸ ions/s in ionization chamber mode. The transition from one mode to another is caused by changing the voltage on the detector.

The scale of beam current measurement on each lamellae ranges from 1 pA to 10 nA.

**Detectors to measure the beam profile during transportation of the beam to users**
The detector based on secondary emission with 13 or 25 lamellas

**Detectors to measure the energy of ion beam during the transportation to the user area.**
The method is based on the time of flight measurements.

**Detectors to measure the spatial uniformity of ion beam distribution in the irradiation region of the user objects.**
The monitoring the distribution homogeneity and the ion beam intensity during irradiation of the objects.

**REFERENCES:**
1. V.A. Skuratov et al. Ion Beam Diagnostics for SEE Testing at U400M FLNR JINR Cyclotron, RADECS 2012 Proceedings