

Development of electronics for ion source KRION-6T



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KRION-6T is a new electron string ion source (ESIS) designed at LHEP JINR to produce beams of highly charged heavy ions. Its operation is based on step by step ionization of the ions by hitting with electrons of the electron string. The electron string arises in reflex mode of the electron beam ion source (EBIS) operation under very specific conditions.

The first ESIS KRION-2M was proposed, designed, produced and put into operation in the Laboratory of High Energy Physics of Joint Institute for Nuclear Research in Dubna by Prof. Evgeny Donets (1935 - 2021) and his team; Prof. E.D. Donets earlier also was an inventor of EBIS and one of the founders of the scientific direction physics of highly charged ions.

In 2012 new KRION-6T ESIS was created and successfully put into operation later on; in the 55th Nuclotron run (February - April 2018) the C6+, Ar16+ and Kr26+ ion beams were produced, accelerated and used for physics experiments. In April 2022 Krion-6T ESIS was installed on a HV platform of a new HILAC injector which is a part of a NICA/MPD assembly which are under construction now at VBLHEP, JINR.



Special electronics ensures KRION-6T ion source functioning was designed, created and put into operation

- Slow control system (thermometry, vacuum etc.)
- Electron beam production system

The new KRION-6T ion dynamics control system was developed in 2017. Its task is to create a special potential distribution for particle ionization and complex signal for beam extraction.

- DC potential barrier formation modules (+3 kV, 10 mA);
- Pulsed pot. barrier form. modules (+2.5 kV, 8 mA);
- Beam extraction modules with a complex RE form;

- Ion dynamics control system (ionization and extraction processes)
- Ion beam diagnostic system

Thermometry system and temperature controller :

- Measurement scale: 4 300 K;
- Accuracy: ± 0,3 % up 30 K;
- Measurement channels: 8;
- ADC resolution: 24 bit;
- Meas.frequency: 1 Hz 3.75 kHz;
- Onboard current source: 10, 100 uA ± 0.01%;

Beam current measurement module is a new low bipolar current measurement module with the 4 different scale inputs:

Канал 4

- Channel 1 : 100 fA 10 pA;
- Channel 2 : 10 pA 10 nA;
- Channel 3 : 10 nA 10 uA;
- Channel 4 : 10 uA 10 mA.



Krion-6T ESIS was created and successfully put into operation. Bench work and several accelerator runs demonstrated the full operability of new electronic systems. After several improvements, the new systems provided the characteristics set in the terms of reference. The designed electronics ensure operation of Krion-6T ion source during bench work and as a part of accelerator runs.