UNIVERSAL ACCELERATING COMPLEX FOR THE CUSTOM EXAMINATION

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Abstract

In this article we present the description of the universal complex for the custom examination. This complex not only allow to examine the sizes and forms of the baggage and also examine the composition of the smumggling. The problem of the founding the contraband can be effectively decided by means of γ-radiation from targets irradiated by proton beam. It is supposed to set ion injector under potential of "ground", that will simplify essentially it's power supply. The target is supposed to be mounted on insulator inside the vacuum container. The case of target will be charged up to 2MV voltage by means of an electron beam from the small-sized RF linac. A resistance divider connected to electrodes of ion source optical system is mounted inside insulator. At the same time, an electron beam deflection, with use of magnetic deflector, to a special target provides the device operation in an usual X-ray radiator mode.

Introduction

X- ray radiation are used for the custom examination nowadays. It allows to examine the sizes and forms of elements of the baggage. The γ-rays from the targets irradiated by proton beam shows the composition of smuggling (explosive substances, drug). This universal complex have the preferences of the both systems.

1 DESIGN OF COMPLEX

The new scheme of ion electrostatic acceleration differs from the same others [1] and hand principal advantages: a) the grounding of the ion injector, b) the target with the resist division is situated in vacuum camera, c) the target charging by the accelerated electrons (Fig.1). This scheme the reveals to diminish the sizes of the system preserving the main qualities of electron acceleration: high total efficiency, high medium current. Besides the danger of radioactive irradiation is diminishing a considerable degree as the result of the disappearing the corona discharge. The extending of the frontier resources of the acceleration in voltage are obtaining of the preserving the same insulators as in "atmospheric" scheme, that bring that the maximum potential increases in considerable degree in this scheme. At the same time the obtaining the high potential in this system is the ordinary problem.

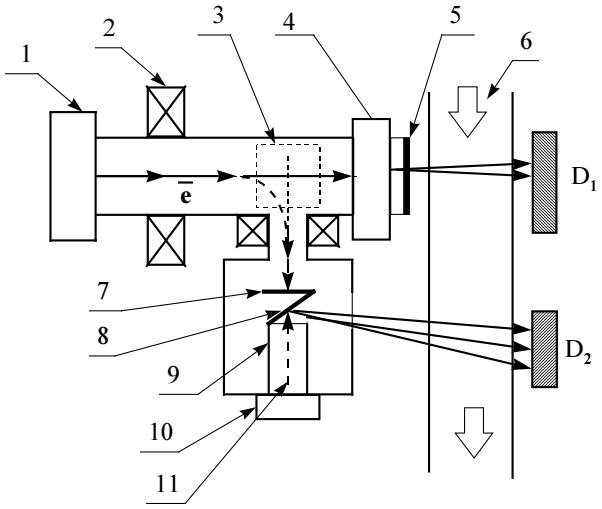

Figure 1 : Scheme of the ion electrostatic acceleration. 1 - linear accelerator of electrons, 2 - focusing magnet, 3- deflecting magnet, 4 - scanning system, 5 - target, 6 - conveyer belt, 7,8 - target, 9 - optical system of the ion acceleration, 10 - ion injector, 11 - ion beam, D1- bremsstrahlung detector, D2 - γ- ray detector.

2 DESCIPTION FUNCTIONING OF THE SYSTEM

In static conditions the system acts in the following way. The electron beam accelerating in some MeV hits the targets and charges it. The potential of target is being determined by the value of the voltage divider`s resistance and the volume of the ion injector's current, that determining of it's emission. Ion accelerate inside optical system, formed by electrodes in the direction to the charged negative target. Form and overall dimension was determined in concordance with familiar recommendation. Electrons come to the target with velocity, considerably smaller velocity of injection, as since become slower in target field, and target`s heat not much. In case of charging target by pulsar beam may be uses scheme with capacitive divider that located at the same vacuum chamber and providing quasi-constant potential of the target, though that is not necessary in the presence of pulsed reaction work of the ion source.

3 EXPERIMENT AND RESULTS

For check validity of assumptions, was set a experiment. Scheme of the experiment and experimental stand demonstrates in the Fig.2,3. The collector serves as

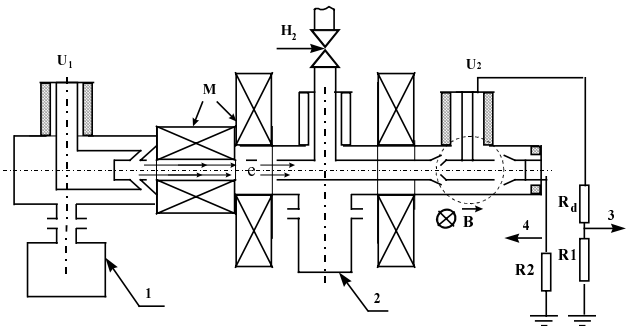

Figure 2 : Scheme of experiments stand. 1, 2 - pumps, 3,4 - to the oscillograph, M- magnet.

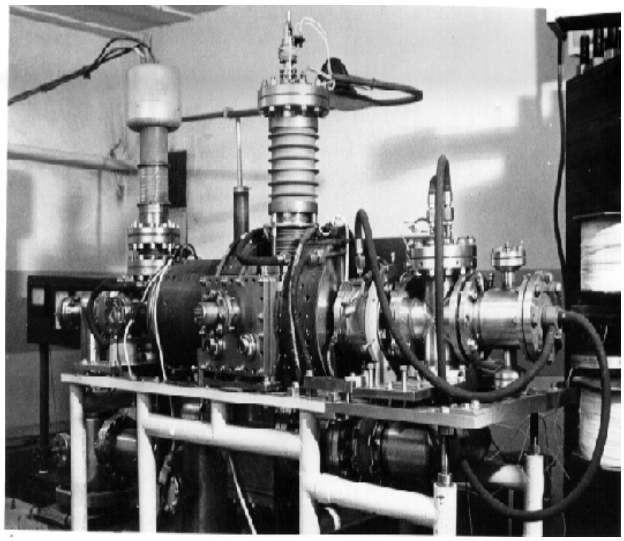

Figure 3 : Experiments stand.

a target, charged electrons beam from injector to 50 eV. The ion beam that forming in the cylinder discharge chamber, established on the electrons` path near collector, at the expense ignition of plasma-beam discharge. About presence the accelerated ion we can say variation signal with collector when gas introduction in plasma. here are had been gotten following results. When the potential of electron injector is equal to 22 kV, current electron beam is equal to 2 A and value of induction focusing magnetic field is 0,15 T, the collector charging up to potential 16 kV, for 0,1μs, the ion current reach quantity to 10 mA. Operating mode of electron of electron injector - pulse, with duration ~ 120 μs.

Finding results give basis for full-scale using the present acceleration. The ion injector was made on the basis of microwave discharge in magnetic field (Fig.4).

Figure 4 : Ion injector.

Electrostatic system that was made and test, have series of electrodes fixed of insulators. The resistors of division locate inside of insulator and make galvanic joining with electrodes. This system was stood the successful test in vacuum (Fig.5). In the capacity of the high-voltage supplying system we

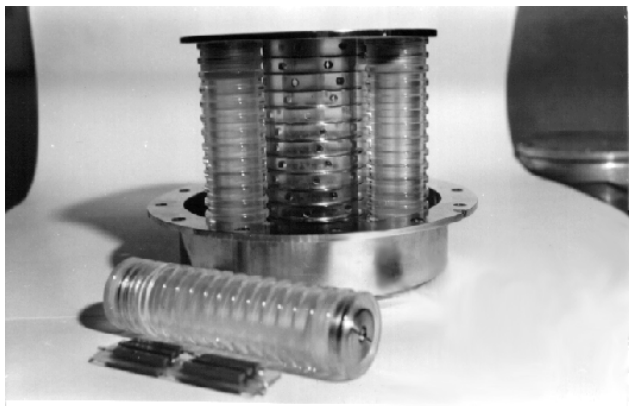

Figure 5: Optical system of ion accelerating with resistance divider .

propose to use the electron linac on power in 0,8 MeV with middle current 400 microampere. General view electron linac point at Fig.6. Prospective size this equipment (with system feeding) -1∗2∗2 m^3.

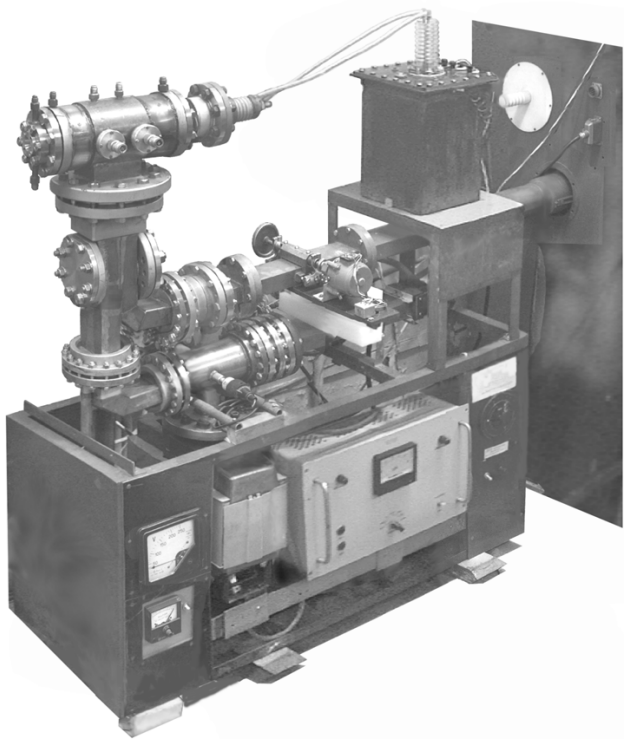

Figure 6 : Linear electron accelerator.

4 INCLUSION

In this article we propose the new scheme for the universal custom examination complex. The experimental stand was made and tasted in MEPhI The sises of system were determined - $1*2*2$ m^3.

REFERENCES

[1] Y. Ysosep, “Detection system proof-of-principle device using electrostatic acceleration, International linear accelerator conference, Geneva, Switzerland, 1996, Vol. I, P. 444-446.