

FAST CLOSING VACUUM VALVE CONTROL FOR CYCLOTRON PROTECTION

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Abstract.- To prevent vacuum failure in the cyclotron caused by a foil window rupture, we have built and tested a protection system.

1. Introduction.- A fast closing valve is used to protect the accelerator from a sonic pressure wave caused by a foil window rupture.

The vacuum valve is located on the beam line near the cyclotron exit ; vacuum failure detectors are placed near the target windows.

The fast valve is of a commercial type ; its closing time is less than 20 ms.

The electronic is built in the laboratory.

2. Electronic firing control unit. - The normal vacuum value in the beam lines is from 10^{-4} to 10^{-5} mbar.

The detectors used are Penning gauge which offer a low residual ionisation current from 10^{-4} to 10^{-5} mbar.

When the pressure rises up, the ionisation current is maximum from 10^{-3} to 10^{-2} mbar.

An electronic trigger detects the pressure rise and produces a pulse. This pulse controls the discharge of a capacitor bank in the fast closing valve coil.

3. Conclusion and test. - We have measured the closing time of the commercial valve. This time is less than 18 ms.

We have also tested an automobile plug as sensor it can be used but at 10^{-4} mbar the plug is completely desionised and so its rising time is about 10 ms.

A penning gauge is never disionised and so its rising time is lower (≈ 1 ms).

The distance between the detector and the valve is 12 m; it is suffisant for stopping an air input ($v \approx 0,3$ m/ms). If we used an helium cooling system it would be necessary to insert a mechanical delay line on the beam line ($v \approx 1$ m/ms for He).

