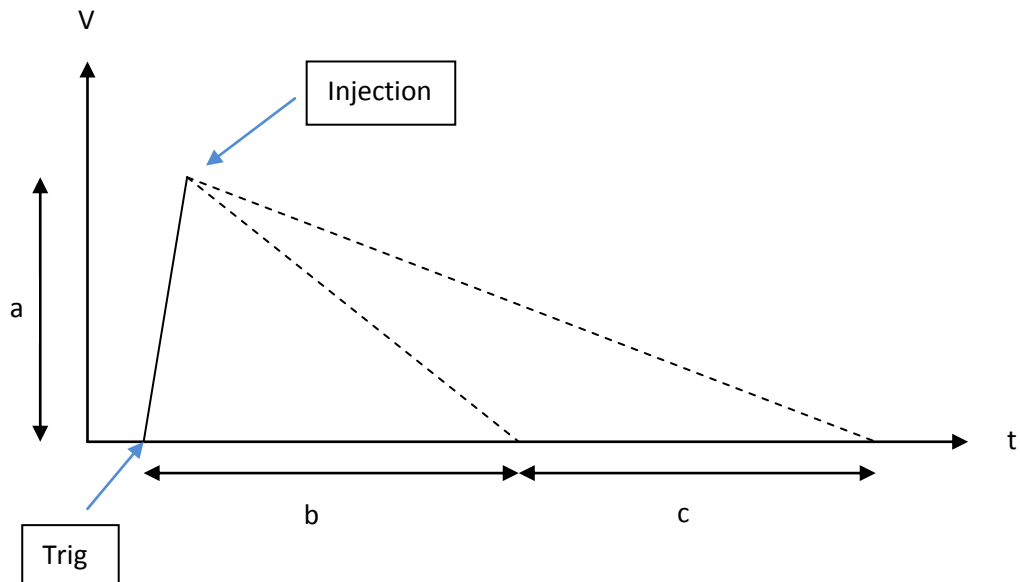*Mats Engström, 2013-05-20*

CRYRING injection bumper

Sketch showing principal function of the CRYRING injection bumper. Time relations are not to scale. The power supply is bipolar and produces positive and negative outputs at the same time, but this is not shown in the figure.

Explanation of symbols:

a. Bumper voltage, range 0 – 30 kV.
b. Constant minimum bump fall time.
c. Variable part of bump fall time. This was set in the range 0 – 4095 as a 12-bit value with no unit. The value 4095 gives the <u>shortest</u> bump fall time (= b), and the value 0 gives the <u>longest</u> bump fall time (= b + c_{max}). It should be noticed that the relation between the setting value (0 – 4095) and the resulting time (c in the figure) is not linear. This is the reason for not having a defined unit in the control system.

The values *a* and *b* are given as analog inputs to the bumper power supply. Information on voltage levels and more is found in the manual of the bumper power supply, HVmetric Pulse Supply 89127. The "Bruksanvisning" (= user´s manual) is however unfortunately in Swedish. We found two copies of the manual, and both of them have been sent to GSI. We from MSL must help in extracting the necessary information from the manual. The copy of the manual that is collected in a binder marked "Injektion" is a later update than the other one.

Please notice that there are two bumper supplies. The HVmetric is the original one. In order to allow a wider range of settings there is also an MSL-built supply, designed by Andras Paal and for that

reason often informally named "Paalometric". The "Paalometric" supply has the same interface, but allows lower stable voltage settings and a longer bump fall time.

The internal timing of the two supplies differs. This means that the trigger pulses should arrive at different times in relation to the beam pulse, depending on which supply is used.

The selection between the two bumper supplies, and the polarity change to allow injection of positive or negative ions, is done manually.

Some details on the settings for the two supplies are available, but not included here.