

# Development of Multistage Pseudospark Switches

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The fast injection/extraction kicker magnet system of the projected SIS100/300 accelerator complex will demand a pulse forming network that meets the following requirements:

Peak voltage:	100 kV
Peak current:	10 kA
Pulse duration:	≤ 9 μs
Charge transfer:	~ 0,1 C
Repetition rate:	4 Hz
Energy/shot:	~ 10 kJ
Peak Power/shot:	~ 1 GW

The kicker rise time has to be 250 ns or less. Therefore the current rise rate has to be higher than  $4 \cdot 10^{10}$  A/s.

Within this pulse forming network a high-power switch is necessary. One possible switch type is the pseudospark switch, also known as cold-cathode thyratron. This switch combines a high current rise rate ( $>10^{11}$  A/s), a reasonable lifetime (typ.  $10^6$  to  $10^8$  shots, depending on application), 100% current reversal capability and its low power consumption.

Single stage pseudospark switches have been produced commercially and the results are promising. These switches can withstand a voltage of about 35 kV. To meet the given requirements a multistage system is necessary. To reach the 100 kV with a reasonable low faulty shot probability a four gap system will be necessary.

As first step of development this year two different designs of two-gap pseudospark switches have been set up.

The two types are shown in Fig. 1 and Fig. 2. Type one is a single gap switch with an additional flat electrode in the middle of the gap.

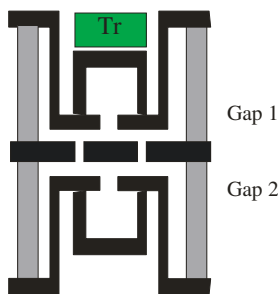


Fig. 1: Doublegap switch (Type 1)

Type 2 is a stack of two single gap switches. Charges can travel between the two switches across the drift-space ('DR'). To obtain acceptable delay and jitter values, the

coupling between the two gaps has to be optimized. The design of the drift-space is therefore crucial for the switch performance. Both systems have a single trigger unit to initiate the breakdown. At the moment one trigger unit seems to be enough to realize jitter values that meet the projected requirements. This still has to be proven. If the jitter values should be worse than estimated, there is still the possibility of a multi-trigger system. But these systems are more complicated and therefore it's better to go for a single trigger setup.

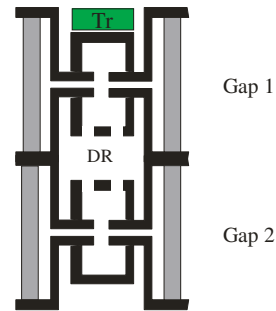


Fig. 2: Doublegap switch (Type 2)

First measurements of the hold-off voltage and the overall switching behaviour have been done. First results are shown in Fig. 3.

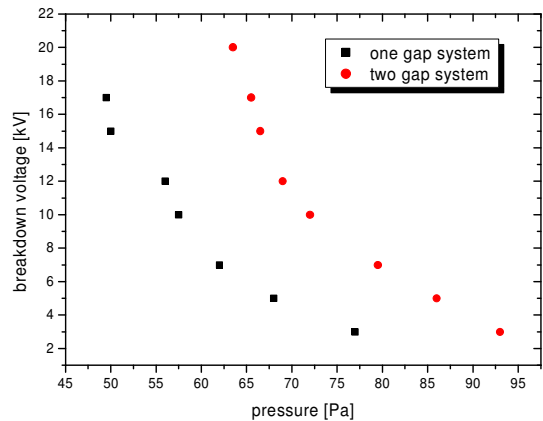


Fig. 3: Breakdown voltage of different switches

Already the first results show the positive effect of a doublegap system. The difference in the breakdown voltage is bigger with lower pressure, but the voltage probes that have been used are limited to a d.c. voltage of 20 kV. At the moment different external voltage dividers are tested at the switches to improve the overall performance of the switch.