INFLUENCE OF THE SWITCH JITTER ON THE PERFORMANCE OF THE TW PULSED POWER GENERATOR KALIF-HELIA

P.J.W. Hoppé, J. Singer and H. Bluhm

Forschungszentrum Karlsruhe, Institut für Hochleistungsimpuls- und Mikrowellentechnik, P.O. Box 3640, D-76021 Karlsruhe, Germany

High power switches are used in almost any pulsed power generator to add up and/or concentrate the energy delivered to the load. The amount of energy delivered strongly depends on the switch synchronism: for 'ideal' switching the highest energy is expected.

KALIF-HELIA is a TW pulsed power generator based on the high energy linear induction adder principle [1,2]. The energy stored in the Marx generator charged to 95kV is 357kJ. The energy delivered by the Marx is first transferred to 4 intermediate store capacitors and second via 4 laser triggered gas switches to 12 water filled pulse forming lines. These lines discharge via 12 PFL switches and 12 pre-pulse switches to 6 induction cells. Assuming ideal switching of all gas- and water switches the estimated pulse energy into a 15Ohm load for the considered arrangement is from 110 to 130kJ, depending on the switch-out timing of the PFL water switches [3].

For negative polarity operation the beam energy produced by an electron diode was achieved from electrical measurements and from calorimeter data. Both consistently showed beam energies of typically 60kJ, the peak energy measured was 70kJ for a PFL water switch gap of 30mm. Many possible reasons for this unexpectedly low beam energy were discussed [3]. One of these was the jitter of the gas- and water switches. On basis of many experiments performed at different Marx charge voltages with PFL water gaps of 30 and 40mm and 3 different electrode forms the following results were achieved:

- the influence of the jitter of the 4 gas switches is not significant compared to the jitter of the 12 PFL water switches.
- for Marx charge voltages from 75 to 95kV the 30mm PFL water gap delivered higher energies. No influence of the electrode form was observed.
- for ideal switching an energy of just 75kJ would have been expected. Hence the switch performance achieved can not explain the unexpectedly high energy losses.

[1] J. Ramirez et al., Proc. 5th IEEE Int. Pulsed Power Conf., Arlington VA, (1985) 143

[2] J. Fockler et al., Proc. 9th IEEE Int. Pulsed Power Conf., Albuquerque, vol. 1 (1993) 431

[3] P. Hoppé et al., Proc. 12th Int. Conf. High Power Particle Beams, Haifa (Israel), vol. 1 (1998) 218

[4] P. Hoppé et al., Proc. 13th IEEE Int. Pulsed Power Conf., Las Vegas NV, (2001) 591