MULTIPLE HIGH VOLTAGE MODULATORS OPERATING INDEPENDENTLY FROM A SINGLE COMMON 100 kV DC POWER SUPPLY

W.L. McDaniel, P. Huynh, D.D. Anastasi, J.F. Tooker, and D.M. Hoyt
General Atomics, PO Box 85608, San Diego, California 9186-5608, USA
mcdaniel@fusion.gat.com

This paper will describe a system where three gyrotrons can be independently operated, each with their own current, voltage and timing parameters, from a single 100 kV dc power supply. The supply enables each load to be run simultaneously, sequentially, or by overlapping each other, as long as the power rating of the dc supply is not surpassed. By taking full advantage of the capabilities of the front-end power system, there is reduced cost, maintenance, and a lower number of high risk, high voltage components. The system also saves maintenance and complexity in lower level components thanks to, in part, a common safety and control system shared by each of the load regulators.

Gyrotrons have a nonlinear voltage-current characteristic that need to be isolated from each other, so they each have their own modulator. By operating parallel modulators from a single supply, versus operating parallel gyrotrons from a single modulator, different operating modes can be obtained. For example, these modulators may be run simultaneously, where two gyrotrons can be run in parallel. They may also be "phased" in and out so that they can be driven sequentially or by staggering the turn on and turn off times. This method will allow all three gyrotrons, a number not otherwise supported by the rectifier power rating, to be operated from a single 100 kV supply. In addition, different fault handling techniques, using a blended controls system will be presented. This system implements a PLC for general "Master" control, and "slow" safety protections while relying on fast analog electronic logic circuits for the critical and potentially load damaging faults. Finally, there is accepted risk of losing operation of all three gyrotrons simultaneously due to a single power supply fault. However, as presented in this paper, steps including fast logic control, and tetrode "blocking" have been implemented to mitigate this risk as much as possible.

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