First Successful Operation of the FUSION FEM, W.A. BONGERS, G. VAN DIJK, C.A.J. VAN DER GEER, P. MANINTVELD, J. PLUYGERS, A.J. POELMAN, A.B. STERK, W.H. URBANUS, A.G.A. VERHOEVEN, FOM*; S.B. VAN DER GEER, M.J. DE LOOS, PULSAR** - The Fusion-FEM is the prototype of a high power, rapid-tuneable mm-wave source, operating in the range 130-260 Ghz. The device is driven by a 2 MeV, 12 A dc electron beam. Presently, the electron beam line consists of an 80 keV thermionic triode electron gun, a 2 MV dc accelerator, a step-tapered undulator, and a beam dump. Inside the undulator a rectangular corrugated waveguide is mounted, with an internal cross section of 15 x 20 mm^2. In a later stage, a depressed collector will be mounted behind the undulator, for energy recovery of the unspent electron beam. This way, the device will have a high system efficiency of over 50%. We report on the first experiments where output power, frequency spectrum, and electron beam loss have been measured, at various settings of the undulator drift gap, the beam energy and the reflection coefficient of the mm-wave cavity. Power levels of 0.5 MW at 200 GHz have been attained at a beam current of 8 A. Start-up time and output power correspond well with simulation results. The beam transport efficiency is better than 99.94%. The loss current has to be low for long pulse operation, since it has to be delivered by the 2 MV power supply. Presently, the electron energy recovery system, i.e., an electron decelerator and a depressed collector, are being installed. Electron beam simulations, including secondary and scattered particles, and the design of the depressed collector will be discussed.

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