LONG PULSE OPERATION OF THE JAERI SUPERCONDUCTING RF LINAC FOR FEL

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A prototype for a quasi-cw or long-pulse, and high-average power free electron laser(FEL) driven by a 15 MeV superconduct-ing rf linac has been developed, and constructed at Tokai, JAERI since 1989[1-8]. Cryogenic(stand-by loss<3.5W at 4.5K) and accelerating fields' performances(Eacc < 8MV/m and Q < 2 x10+9) of four JAERI superconducting accelerator modules were realized without any serious vibrational problem in the FEL accelerator vault.

Since modification and related maintenance of the cryogenic refrigerator system for the driver were completed in the middle of October 1995, the system has run with no trouble, and the driver has been continuously run very successfully up to now. The optical resonator system and related electron beam transport system were modified to realize larger acceptance than the old for both of the undulator radiation and energetic electron beam. An alignment and distance measurement system was newly developed, and successfully applied to actual preparatory measurement for lasing in the JAERI FEL. A far-infrared light transport line and detector room was built to realize a low-loss and low-noise measurement near the accelerator vault.

In order to realize the quasi-cw and long-pulse operation, we have improved the electron gun grid pulser and high voltage power supply, and rf amplitude and phase control systems for the JAERI superconduct- ing rf linac. The improvements in the electron gun were nearly finished, and the ones related with the rf system under way.

A beam test and commissioning of the JAERI superconducting rf linac as an FEL driver was successfully performed to get an electron beam ranging from 10 to 20 MeV with a nearly full transmission and a full current, and relatively short macro pulse of 0.1ms. Spontaneous emission and intermittent oscillation in the wavelength of around 29 μm have been observed by using the Ge(Cu) detectors and home-made fast current amplifier system. As shown in Fig.1, a sudden increase of the light signal were observed after about 43μsec later from the beginning of beam current pulse.

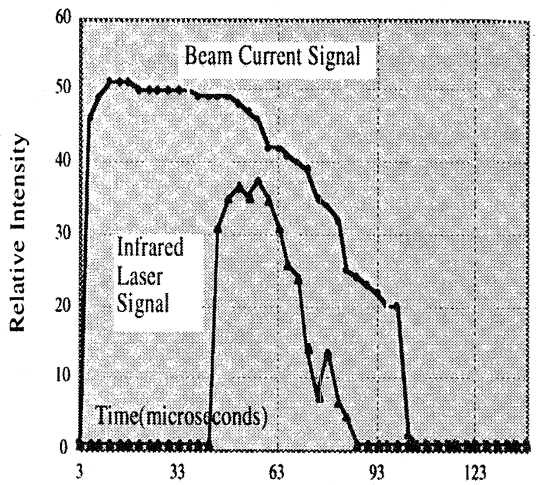

Fig.1, Intermittent oscillation in the wavelength of around 29 μm has been observed by using the Ge(Cu) detectors and home-made fast current amplifier system.

References
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