

Development of Toshiba E3736H



Toshiba has developed for the first time in the world, a horizontally-oriented multi-beam klystron, Toshiba E3736H. The prototype model was approved by DESY, Germany. This klystron will be used in the EURO-XFEL facility commissioning in 2013, which is expected to be a high-power X-ray source of the next generation.

For accelerators in the next generation, higher power, and higher efficiency microwave sources are required than ever before. Toshiba E3736H klystron can provide 1.3 GHz, 10 MW microwaves, achieving 65.4% of the power conversion efficiency with beam voltage at 118.8 kV. Here, the efficiency is about 1.3 times as high as, and the beam voltage is 50 kV lower than that of a single beam klystron with the same frequency and output power. Compared to usual single-beam klystrons, this multi-beam klystron can provide microwaves of aiming power under lower beam wattage condition, therefore, it allows saving as much amount of CO₂ deposit accompanying klystron operation.

In a usual case, one electron beam is employed for one klystron tube. On the other hand, a multi-beam klystron loads several electron beams, which is the very key to the higher power conversion efficiency. In order to achieve multiple beam operation, Toshiba has utilized numerical simulation codes and determined optimal beam conditions. In the Euro-XFEL facility, klystrons are horizontally installed in accelerator tunnels, and therefore, mechanical structure of water circuits is well considered. With long time experience of klystron developments and its state-of-the-art technique, Toshiba has overcome difficulties and completed a desirable multi-beam klystron whose output is stable even under long pulse operation. Specifications of this multi-beam klystron also satisfies requirements of GDE, the planner of the International Linear Collider.

Now, Toshiba E3736H is on detail inspection concerning endurance and reliability. For the Euro-XFEL facility, 27 multi-beam klystrons are required. Other than academic use, new applications of klystron are now forthcoming; a microwave source for Radar and sterilizer of commercial use, for cancer treatment of medical use. Toshiba will continue further development to satisfy such applications.

The detail of this multi-beam klystron will be reported in EPAC'08 held on June 23, Italy.

Specifications of Toshiba E3736H

Operation frequency:	1.3 GHz
Peak output power:	10.05 MW
Averaged output power:	151 kW
Efficiency:	65.40%
Gain:	47.9 dB
RF pulse width:	1.5 ms
Beam pulse width:	1.7 ms
Pulse repetition rate:	10 pps
Beam voltage:	118.8 kV
Beam current:	129.5 A
Approximate dimension:	L:2552 mm W:1050 mm H:1150 mm
Approximate weight:	2800 kg

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Toshiba Horizontal MBK E3736H Complete

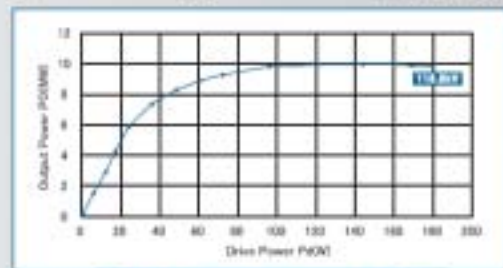
Full power test at DESY was successfully done (@2008/02)
and this is the first Horizontal MBK developed for the Euro-XFEL at DESY.
It might also be used for the ILC.

Test Result(@DESY)

Output Power	: 10.05MW	Gain	: 48dB
Pulse Length	: 1.5msec	Efficiency	: 65.4%
Rep.Rate	: 10pps	Klystron Length	: 2.3m
Beam Voltage	: 118.8kV	Klystron Weight	: 340kg
Beam Current	: 129.5A	System Length	: 2.5m
		System Weight	: 2,800kg



Horizontal MBK E3736H



Output Power Characteristics

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