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TWO YEARS EXPERIENCE WITH THE UPGRADED ELBE RF-SYSTEM DRIVEN BY 20 kW SOLID STATE AMPLIFIER BLOCKS (SSPA)

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Abstract

Since January 2012 the Superconducting 1.3 GHz CW Linac ELBE is equipped and in permanent operation with four 20 kW Solid State Amplifier Blocks (SSPA). The project and the design of the new RF system have been described in the papers [1] and. The experience gained within the first two years of operation is encouraging.

ELBE RF- SYSTEM WITH SSPA

The replacement of the klystrons by SSPA is illustrated in Fig. 1. 20 kW SSPA modules are used per cavity and one SSPA is used to operate the SRF photo gun. The RF related activities before the upgrade project are described in the papers [2] and [3]. Fig. 2 shows the new SSPA gallery at ELBE. In general the ELBE operation is now much smoother than with klystrons used before.

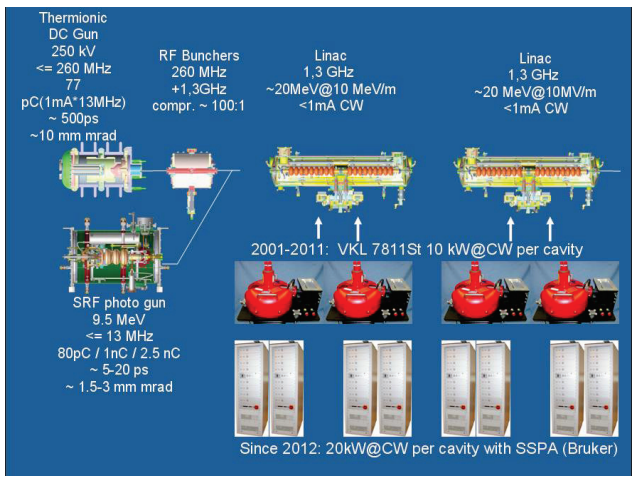

Figure 1: Layout of the upgraded ELBE RF-system.

Figure 2: The new SSPA gallery at ELBE.

MATCHING A PAIR OF SSPA

The block diagram of the driver is shown in Fig. 3. Two 10 kW SSPA are operated in parallel using hybrid waveguide couplers at the output and also 3 dB hybrid couplers (SMA-type) at the input.

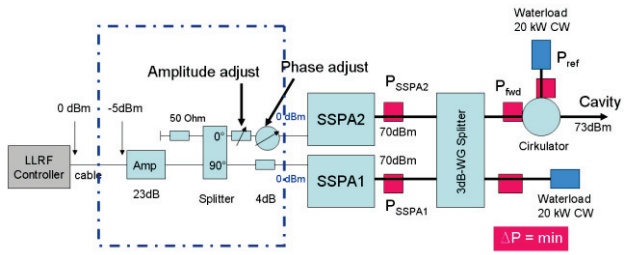

Figure 3: Block diagram of the 20 kW SSPA module.

Tuning criterion is RF power minimum at the isolated port of the 3 dB-waveguide coupler using the variable amplitude and phase adjusts in the driver box.

FAILURES DURING OPERATION

Table 1: Failures During the First Two Years of Operation

Year	Rack	Failure	Cause	Repair
2012	C3A	SMPS pimary failed	Wrong machined insulator	Spare part, (1 hr.)
2013	C4B	CAN Bus astable	Watersensor, Wire not fixed	Took a long time to fix the problem
2013	All	Overdrive (at LLRF interlocks)	Spikes caused by GaS switches at ELBE LLRF	Limiters added at all RF inputs
2014	C4A	High spurious sigs on RF caused by PS	Not really found	Spare part. (1hr)

LOST TRANSISTORS

In 2012 we lost 5 of 576 RF power transistors and replaced them during the shutdown in December 2012. Due to high redundancy the performance of the RF system was not affected. In 2013/2014 no transistors failed so far.

REFERENCES

[1] H.Büttig et.al. NIM-A 704 (2013) 7-13.
[2] H.Büttig et.al. NIM-A 612 (2010) 427-437.
[3] H.Büttig et.al. Proc. CWRF Workshop 2012, Port Jefferson, NY, http://www.bnl.gov/cwrf2012/