New 50 kW SSPA Transmitter for the ALBA synchrotron booster

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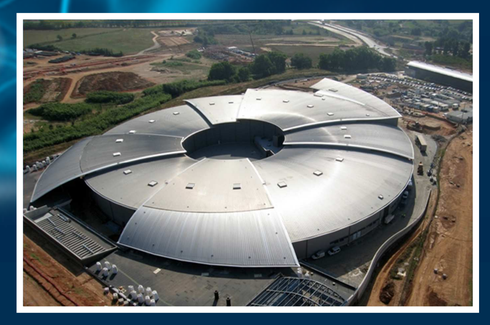


INTRODUCTION

•**ALBA**: ALBA is a 3 GeV synchrotron light source located in Barcelona and operating with users since May 2012.

•**Current RF System**: The ALBA synchrotron RF system is based in the inductive output tubes (IOT's).

•**New possibilities**: With the improving of the solid state amplifiers (SSPA) technology and the advantages they bring, one should consider them for feeding the cavities. The advantages that have to be taken into consideration are the elimination of the high voltage, the vacuum and the heater. Also the newest transistors, able to operate at bigger voltage and therefore higher power, can reach good efficiencies comparable to the one of the IOT's. In the other hand some disadvantages have to be taken into account such as combination losses and price. For all of these reasons, it has been decided to replace one of the IOT's transmitters by a SSPA one, so that both performances can be compared. The ALBA synchrotron booster, which only has one transmitter with a single tube, seems to be the best choice for this purpose.

•**What and when**: Next poster shows the design, key features and preliminary results of the BTESA SSPA that will be installed in ALBA next August 2018.

KEY FEATURES

•**Technology**. The new transmitter is made of 12 modules with a total of 96 active devices (8 transistors each one), all housed in a single 44U rack. These modules are combined in groups of four using the Gysel topology. Two hybrid combiners are used for the final combining stage.

•**Solid design and redundancy**. The design allows the transmitter to provide enough power even when multiple transistor fails occur, in the same module or in different ones. The hugely increase of redundancy (by using tens of transistors) eliminates the single point of failure, which would stop completely the operation of the machine. Also the booster cavity needs less power to operate, so a smaller transmitter has to be designed in comparison to the one needed for the storage ring.

•**Hot swap**. Each module can be replaced by a spare at any time without affecting the operation of the booster, even when the transmitter is providing power.

•**Liquid cooling**: The power supplies, the transistors and the combiners are water cooled, so no heat is transferred to the room.

•**Operating frequency**: 499.654Mhz.

•**Nominal output power (1dB compression)**: 40 kW

•**Output power (2dB compression)**: 48 kW.

•**Nominal duty cycle:** CW.

•**Gain**: >78dB.

•**Transmitter efficiency**: >60%.

•**RF power with one module off**: 40kW.

•**Quick fittings for cooling connection**.

•**Power supplies efficiency**: >95%.

Fig.1: Transmitter overall view

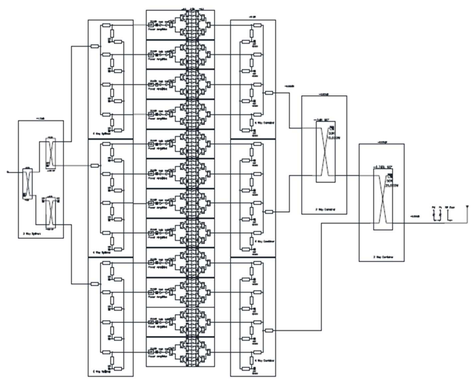


Fig.2: Electrical scheme

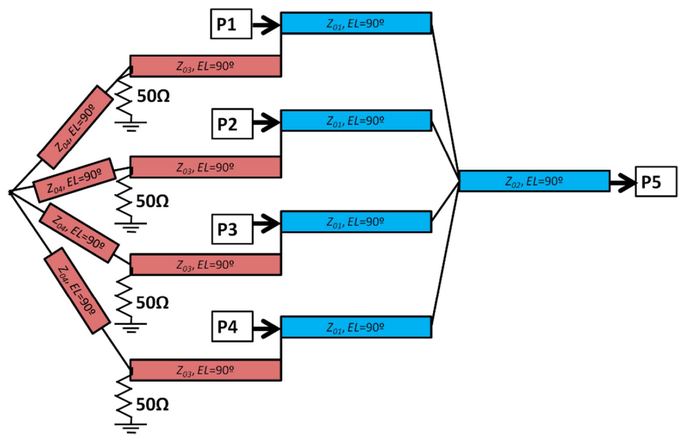


Fig.3: First stage output Gysel combiner

PRELIMINARY RESULTS

•**Module Pout**: 4200 W.

•**Module power consumption**: 6787 W.

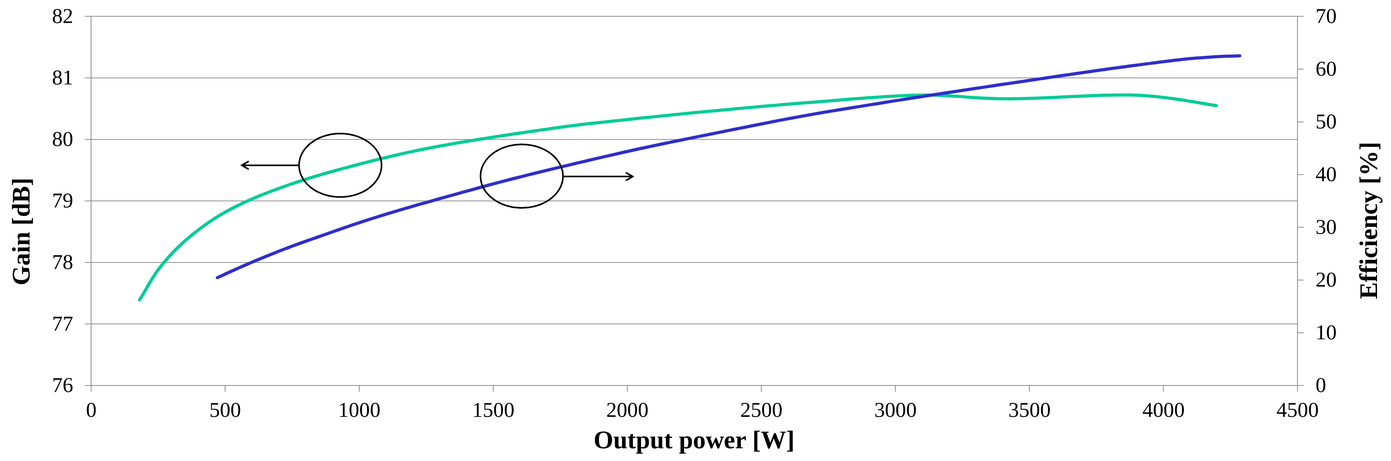
•**PF**: 0.95.

•**Module efficiency**: 61.9%.

•**Module gain**: >79 dB.

•**Transmitter efficiency**: >60.2%.

•**Combiner insertion loss**: <0.1 dB



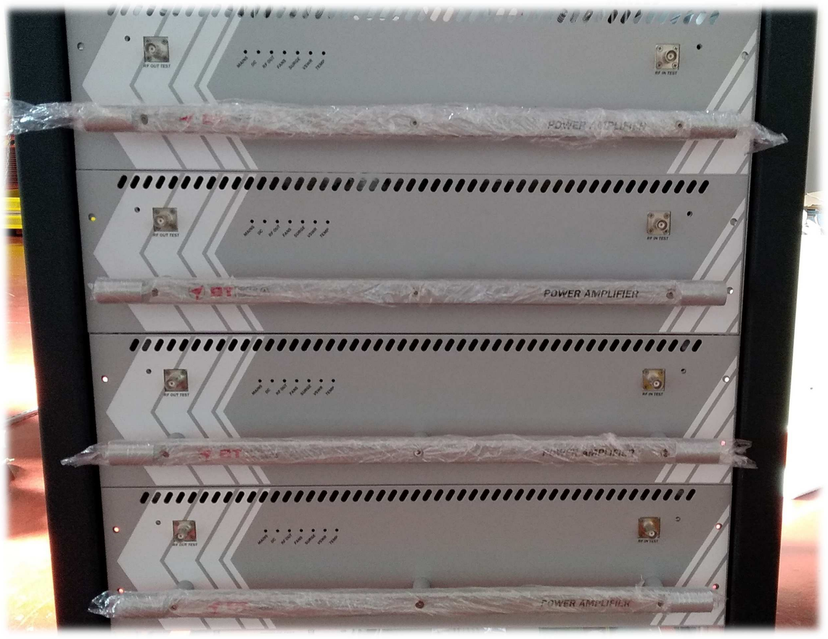


Fig.4: Basic modules

Fig.5: Gysel combiner

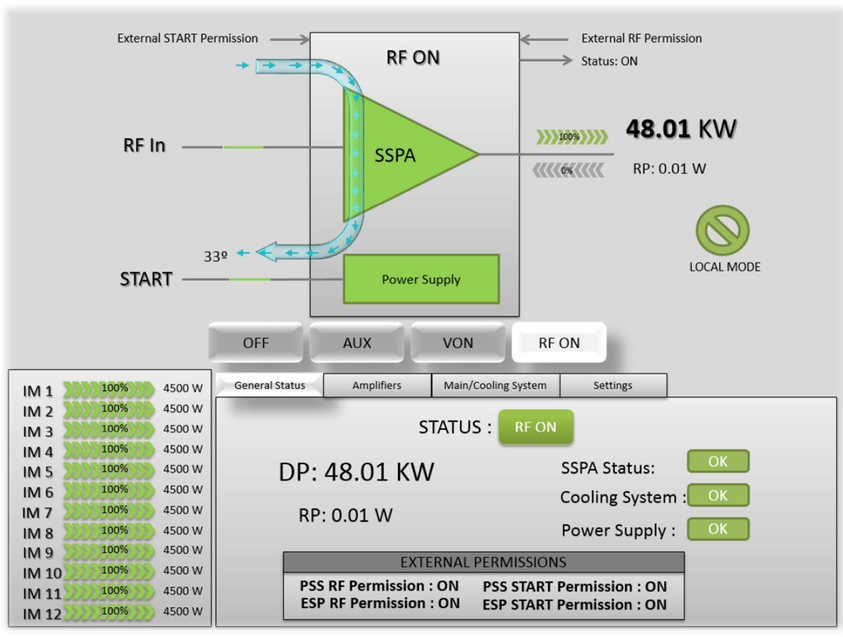


Fig.6: Control GUI