90 kW Solid-state RF Amplifier with a TE011-Mode Cavity Power-Combiner at 476 MHz

For SACLA

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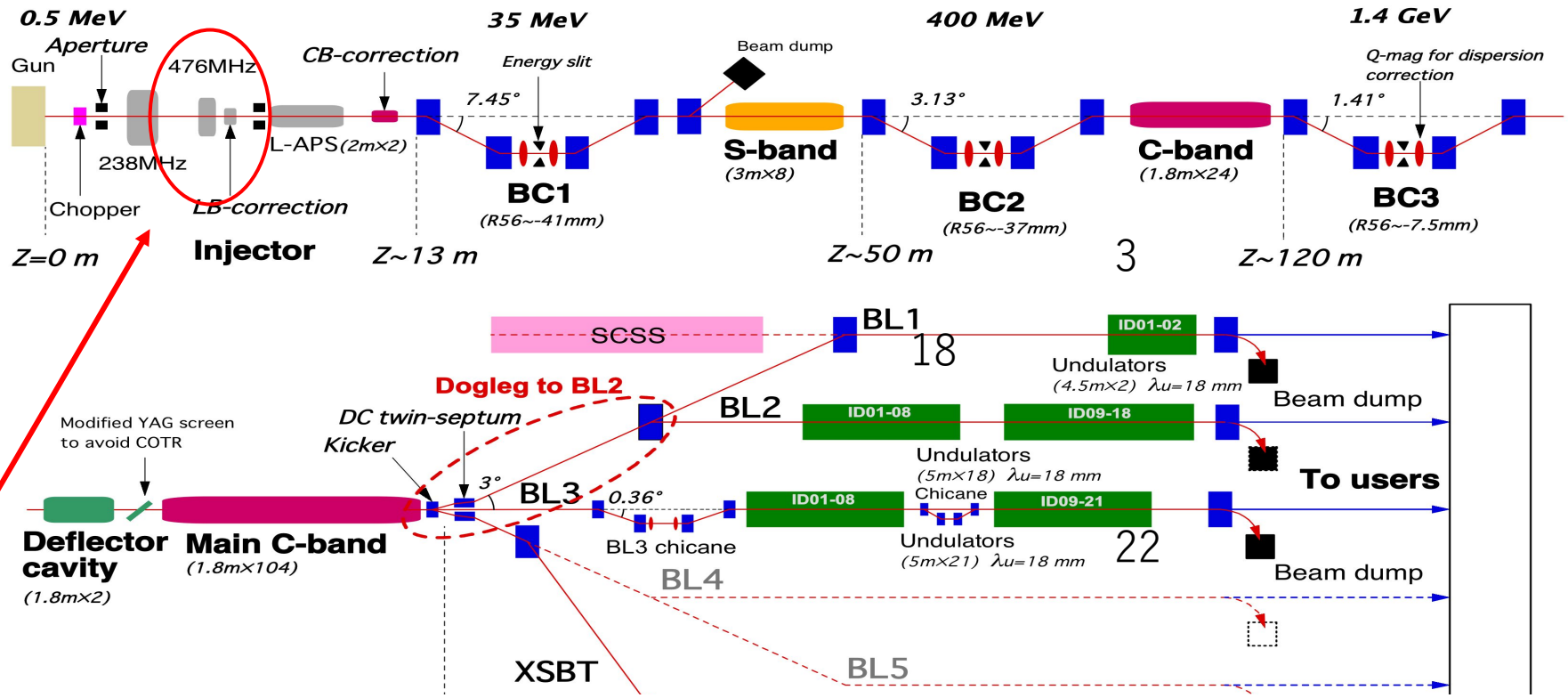
THP0091

Machine Configuration of SACLA

We have 2 laser sources, which are SACLA and SCSS+. They mainly comprise thermionic electron-guns, C-band acceleration structures, and in-vacuum undulators.



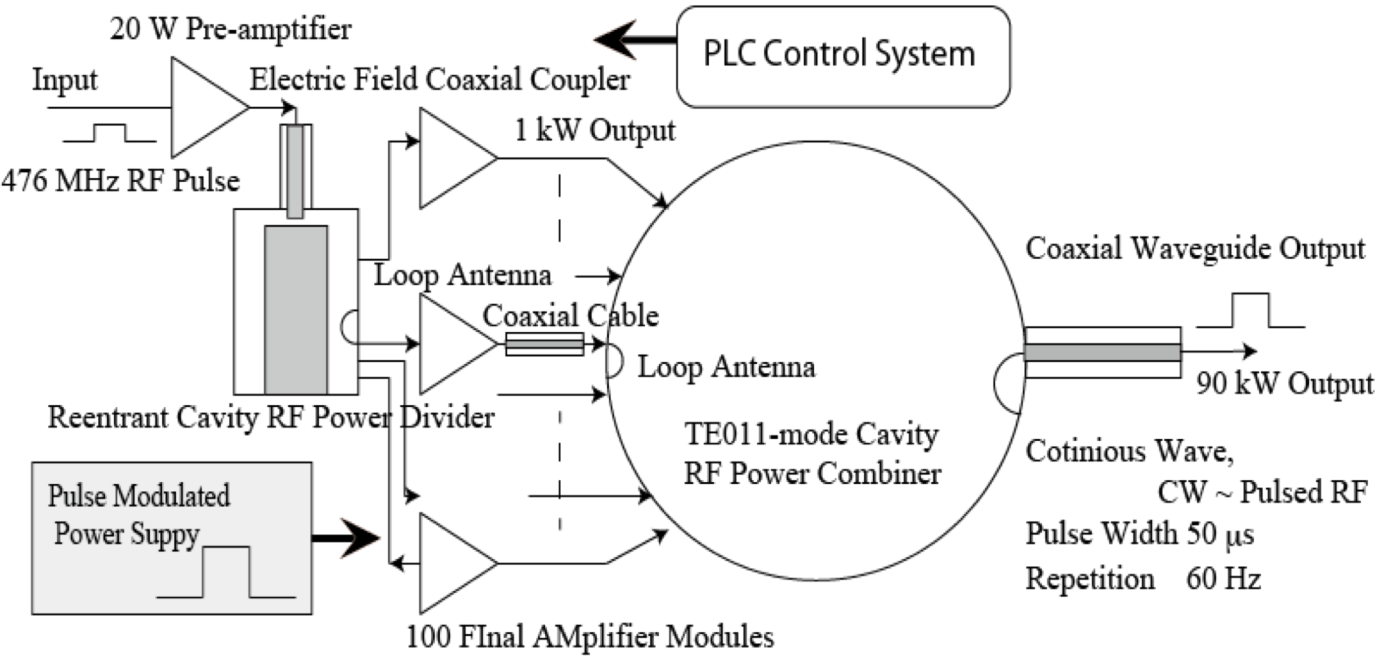
We want to replace the 90 kW, 50 μs RF source (IOT) for the 476 MHz booster cavity, Because of shortage of the IOT supply and becoming expensive.

Get further RF source stability including a low trip rate.

Configuration & Outlook of 90 kW Amplifier

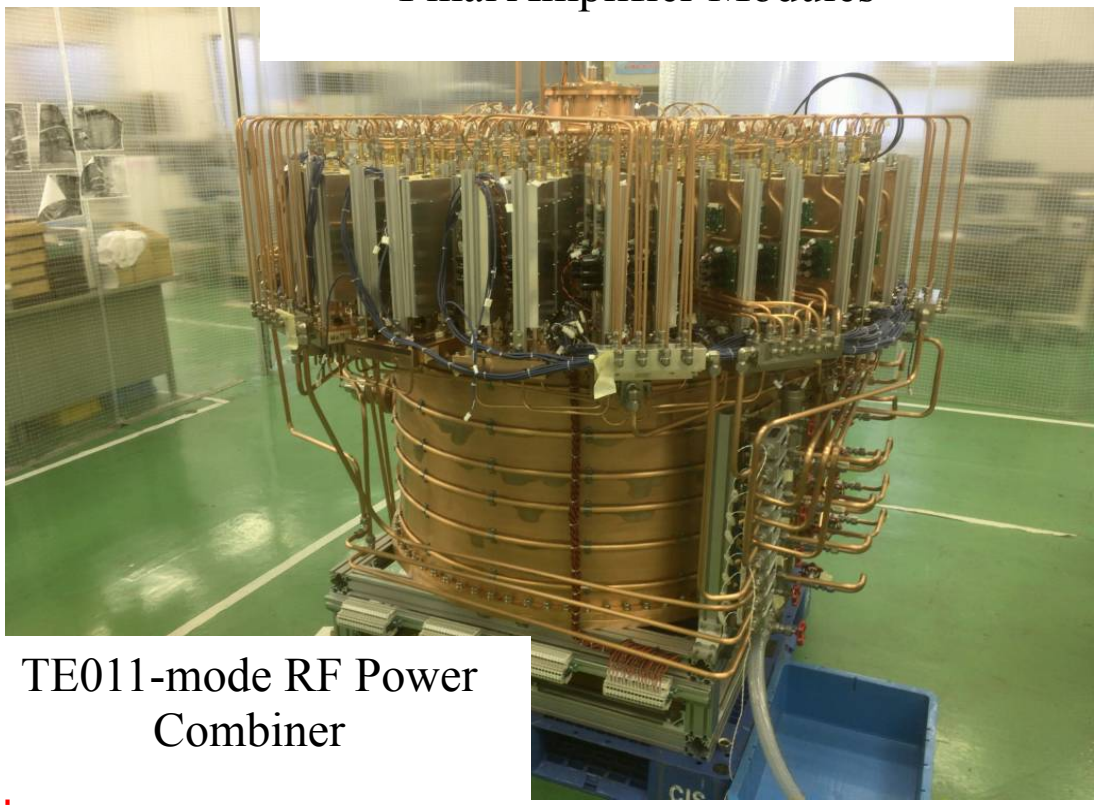
To obtain a stable RF source, we develop a solid-state amplifier.

Block-diagram of the amplifier



Actual fabrication condition of the amplifier

Final Amplifier Modules

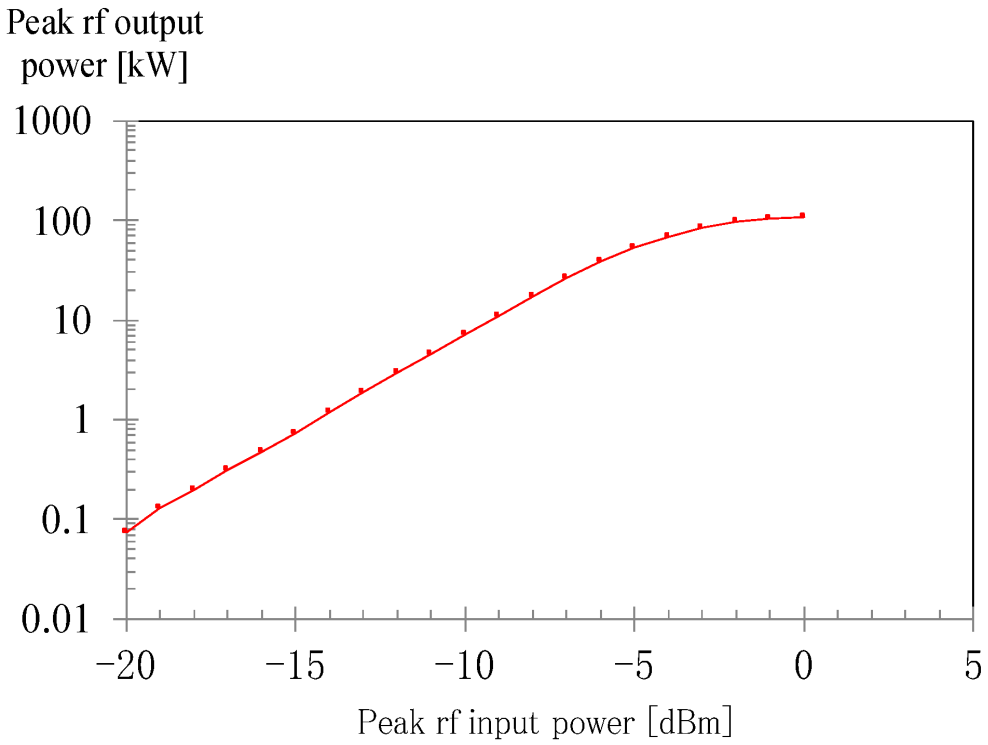


TE011-mode RF Power Combiner

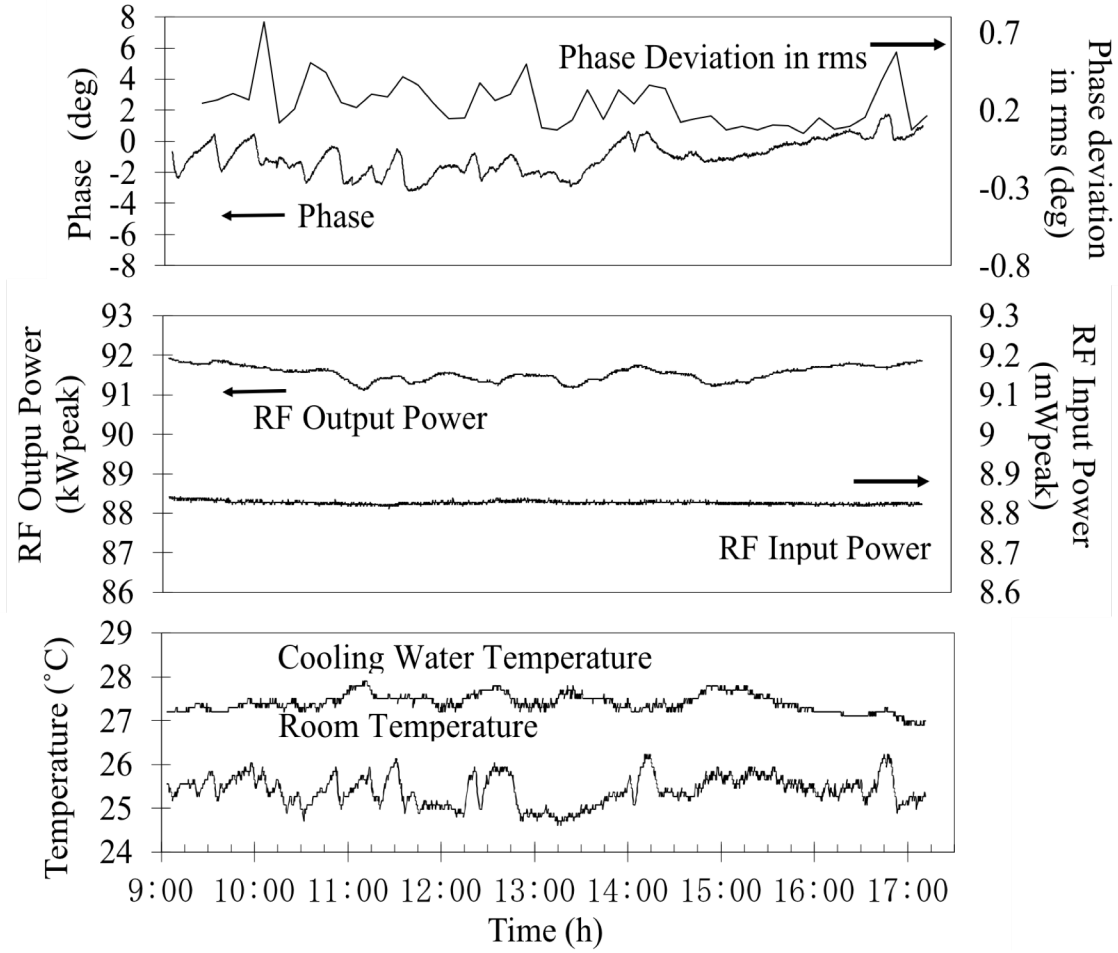
Adaptable to pulse or CW operations both.
Hence we need the extreme low-loss RF power combiner.

RF Output Characteristics of the amplifier

Rf output power as a function of the input rf power.
The rf output power reaches 109 kW at peakn (50μs).



Rf power trend of the phase and amplitude of the amplifier output for 8 hours.



Performance summary of the amplifier

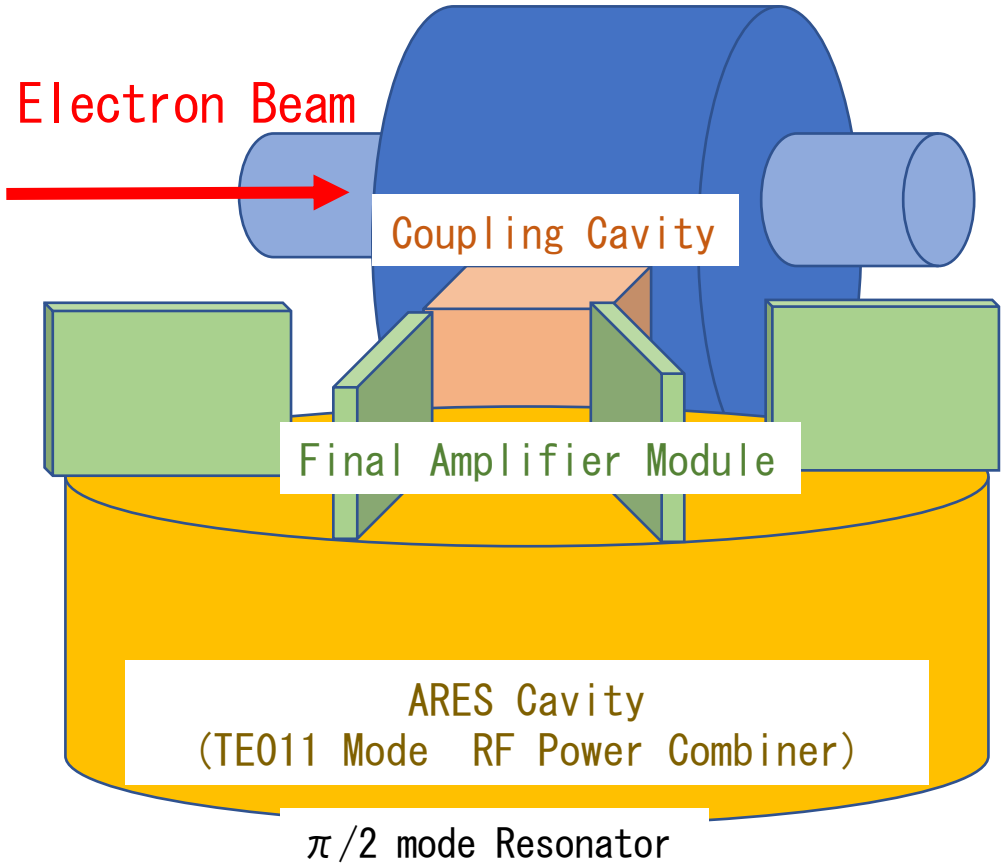
Summary of the measured parameters of the amplifier.

RF output power	109.0 kW
Rf amplitude stability in rms for 8 hours	+/- 0.5 % /K
Rf phase stability in rms for 8 hours	+/- 0.4 deg./K
Total insertion loss of the combiner	- 0.135 dB
Standard deviation of the losses (combiner input)	0.105 dB
Rms deviation of the phases (combiner input)	2.71 deg.

We expect 100 times lower stabilities, because of possible 10 mK control.

Possible Dream – Our Amplifier & Combiner method applies to ARES

Ring Acceleration Cavity (500 MHz)



More detail
Come to THPO091

Idea for removing RF high-power waveguides, hybrids and a circulators