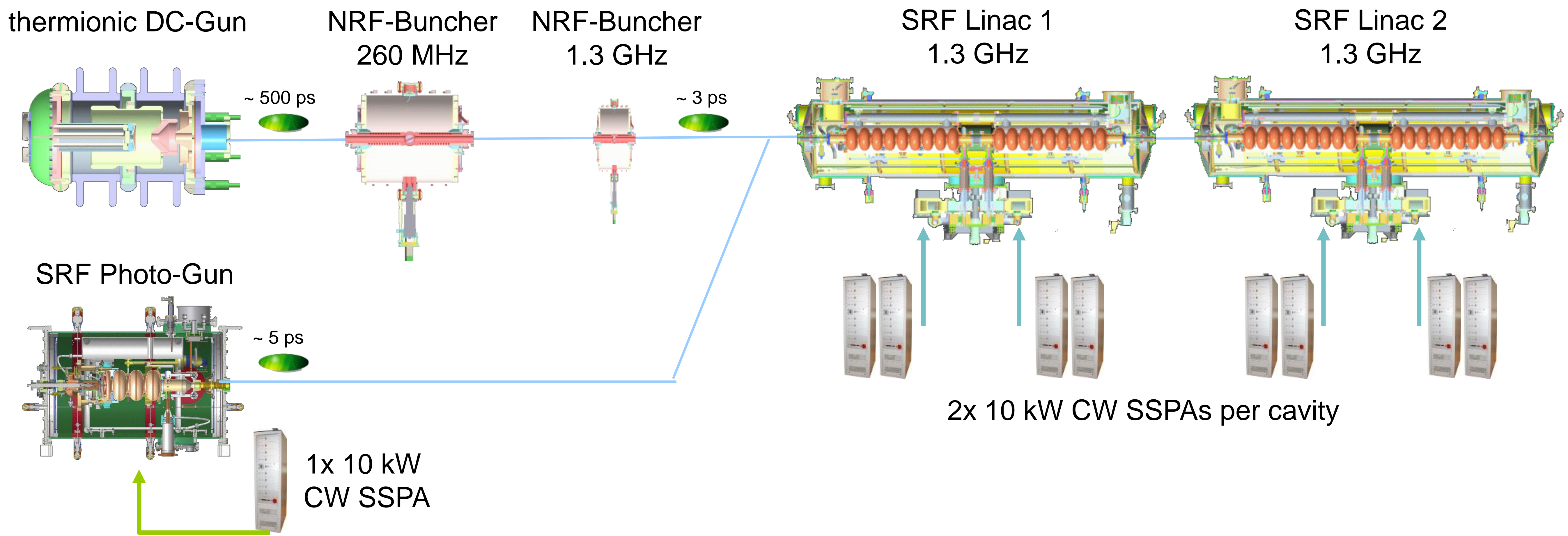


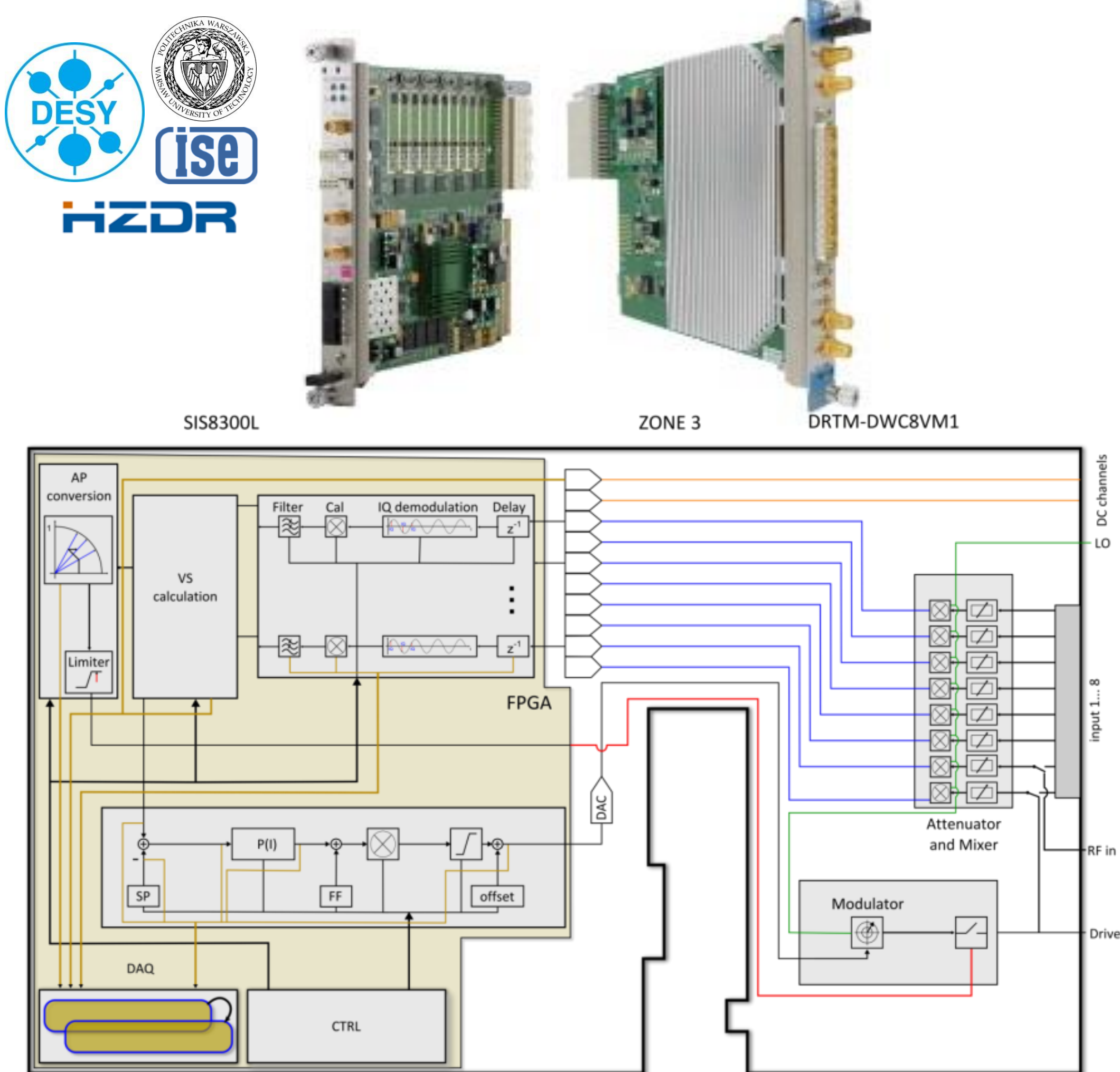
FIRST EXPERIENCE USING A MICROTCA.4-BASED LLRF-CONTROLLER DRIVING THE SSPA HIGH POWER RF SYSTEM AT ELBE.

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- ELBE accelerator consists of **2 NRF** buncher cavities, **4 SRF TESLA** cavities and a **3.5-cell SRF-gun** cavity
- solid state power amplifiers (SSPAs) are used to drive the modules



μTCA.4 LLRF Controller



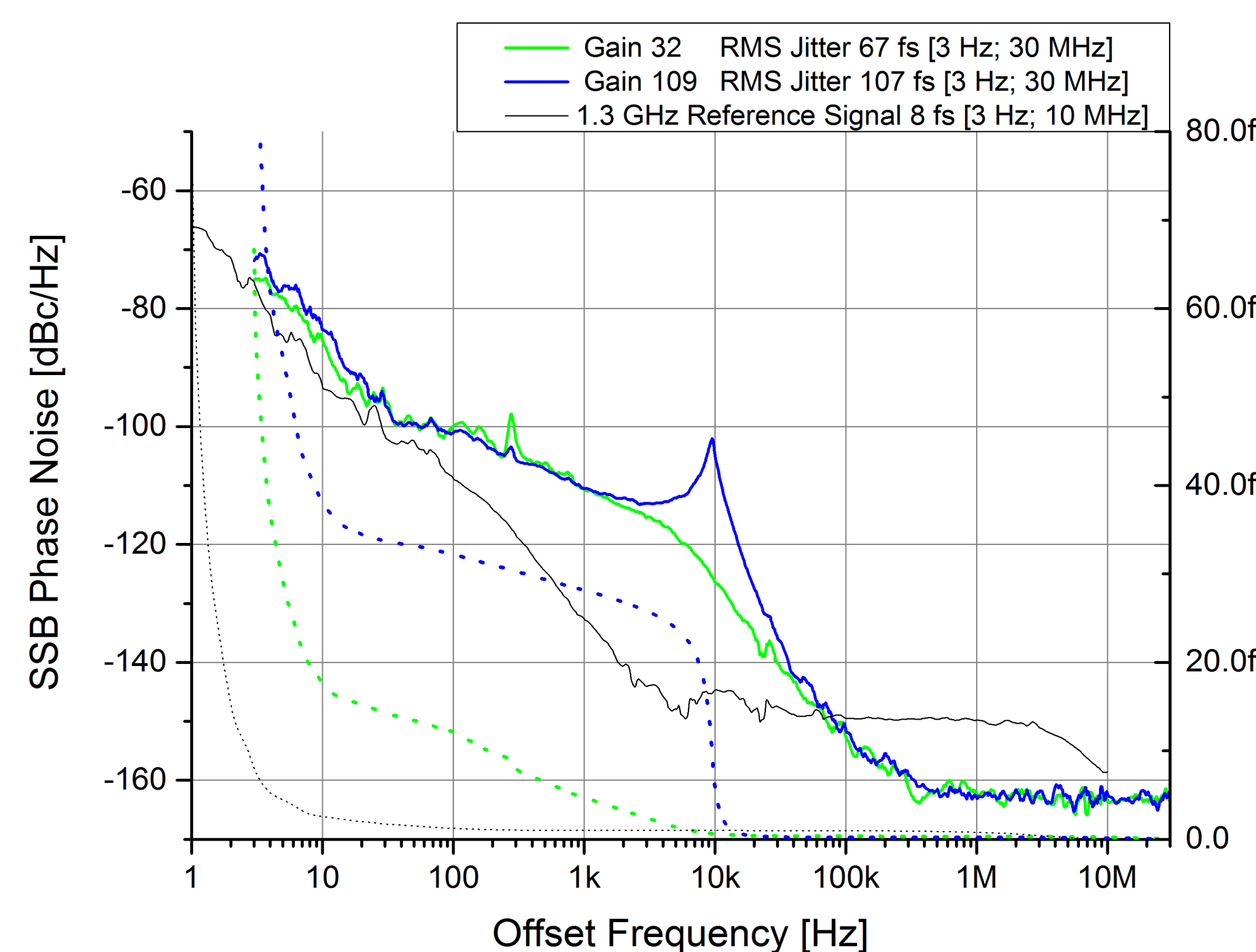
- transition from analogue to digital LLRF
- strong collaboration with DESY (MSK) and ISE, Warsaw
- digital LLRF enables high flexibility like
 - variable gain and loop filter settings
 - feedforward algorithms
 - beam loading compensation
 - beam-based feedback
- modular, compact design based on μTCA.4 standard
- Software and Firmware optimization ongoing
- User operation expected in 2017

Solid State Amplifier (SSPA)



- class AB, 72 LDMOS-FETs (28V)
- frequency: 1300 MHz +/- 5 MHz
- gain: 70dB, Flatness +/- 0.2dB
- output: 9.5 kW € 1dB comp
- output Noise Pwr: -96dBm@1Hz
- 2nd harmonic: better -45dBc
- 3rd harmonic: better -60dBc
- power supply: 380/400V 50/60 Hz
- fused: 50A/phase
- cooling: deionized water
- dimension: 42U 19"rack

Performance studies (snapshot)



- improved field stability in amplitude and phase
- implementation of PI-controller

	100 μA CW	600 μA CW Loop gain 24	Analog System
Amplitude Stability [%]	0.0145	0.0235	0.053
Phase Stability [deg]	0.023 (49 fs)	0.024 (51 fs)	0.046 (88 fs)

References

- [1] I. Rutkowski et al., "Precision regulation for SRF cavities using MTCA.4", 3rd MTCA Workshop 2014, Hamburg, Germany
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- [3] M. Kuntzsch et al., "MTCA.4-based LLRF system tests at ELBE", 2nd MTCA Workshop 2013, Hamburg, Germany
- [4] <http://www.sigmaphi.fr/rf-transmitters.html>