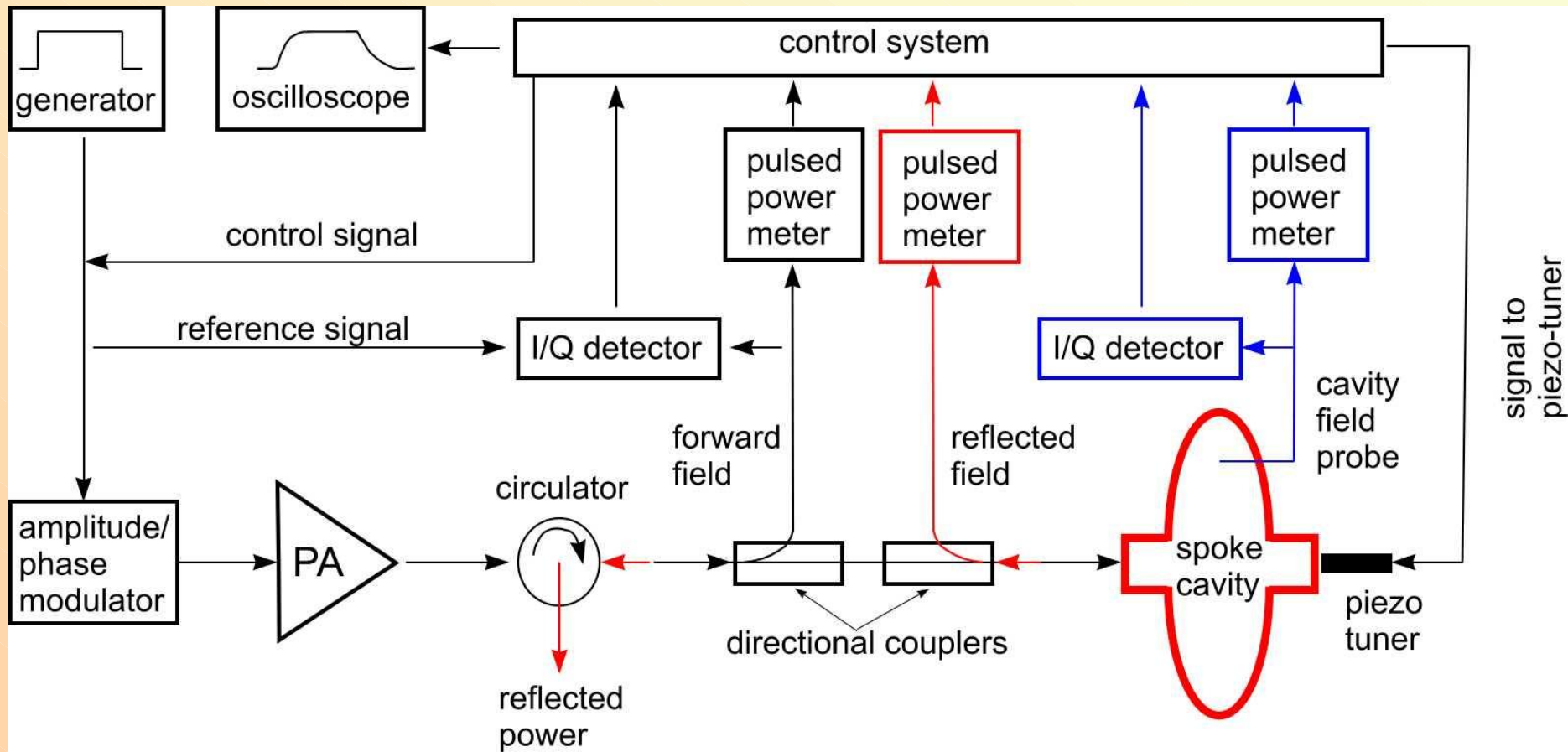


RF TESTS OF SPOKE CAVITIES

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Conceptual Layout of the FREIA Test Stand



TEST PROGRAM OF THE ESS SPOKE CAVITY AT THE FREIA

1. Test of the cavity coupler:

- re-conditioning of the coupler: 400 kW, full pulse length
- RF properties of the coupler: external Q-factor, impedance
- thermal dynamics of the coupler: static and dynamic heat losses, heat dissipation in the antenna of coupler

2. Basic RF test of the cavity

- Maximum accelerating gradient
- X-ray emission
- Dynamic RF losses

3. Electroacoustic stability of the cavity:

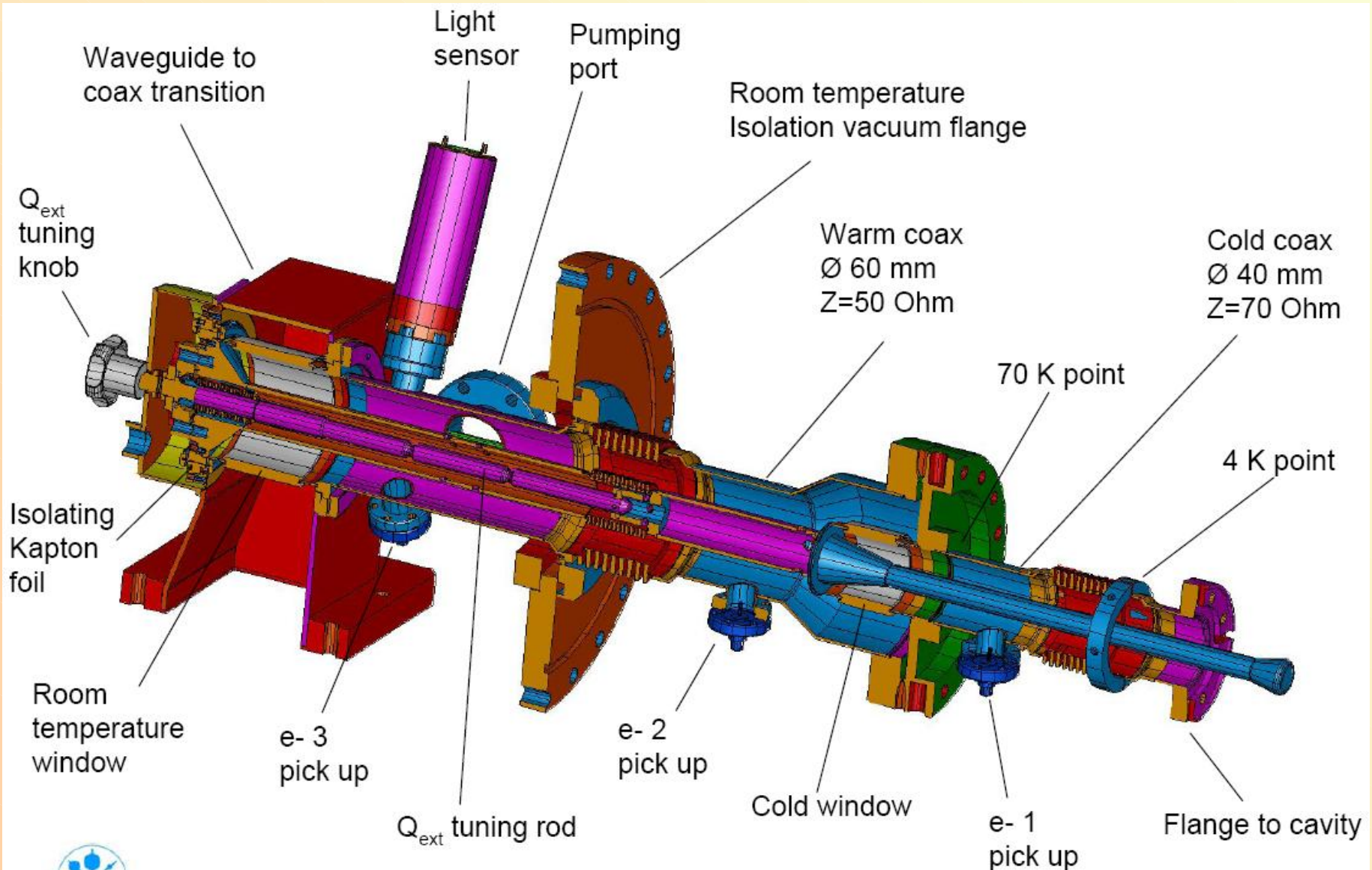
- static Lorentz detuning coefficient
- transfer function of the dynamic Lorentz detuning measured in a CW test
- transfer function of the dynamic Lorentz detuning measured in a pulsed test

4. Lorentz detuning compensation system:

- action of the piezo tuner on the cavity: adjustment of the cavity frequency and excitation of mechanical modes
- feed-forward system for compensation of the Lorentz detuning

5 Microphonics

TTF3 Coupler Design



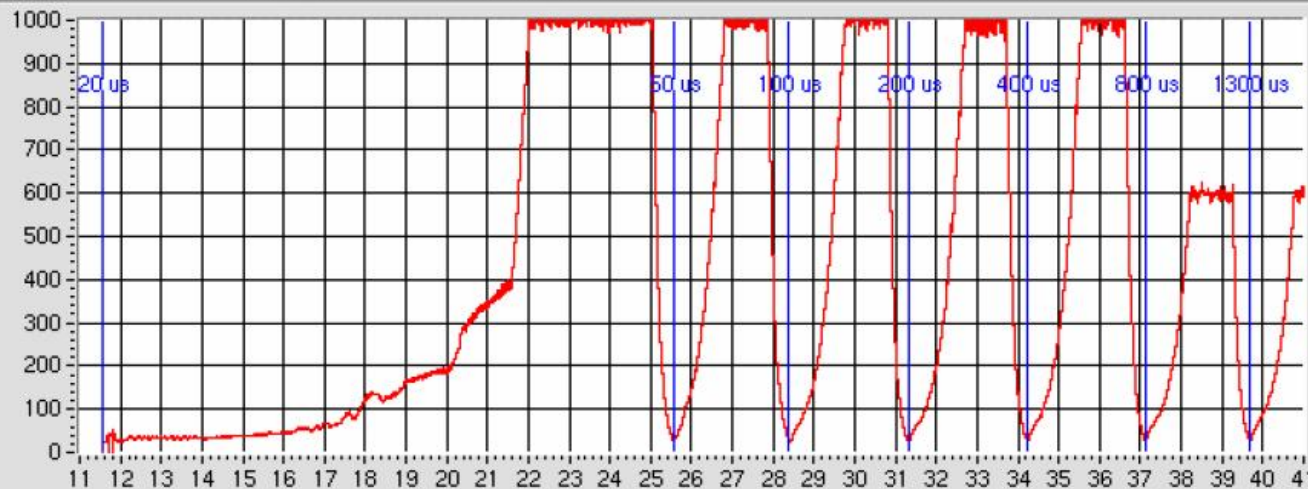
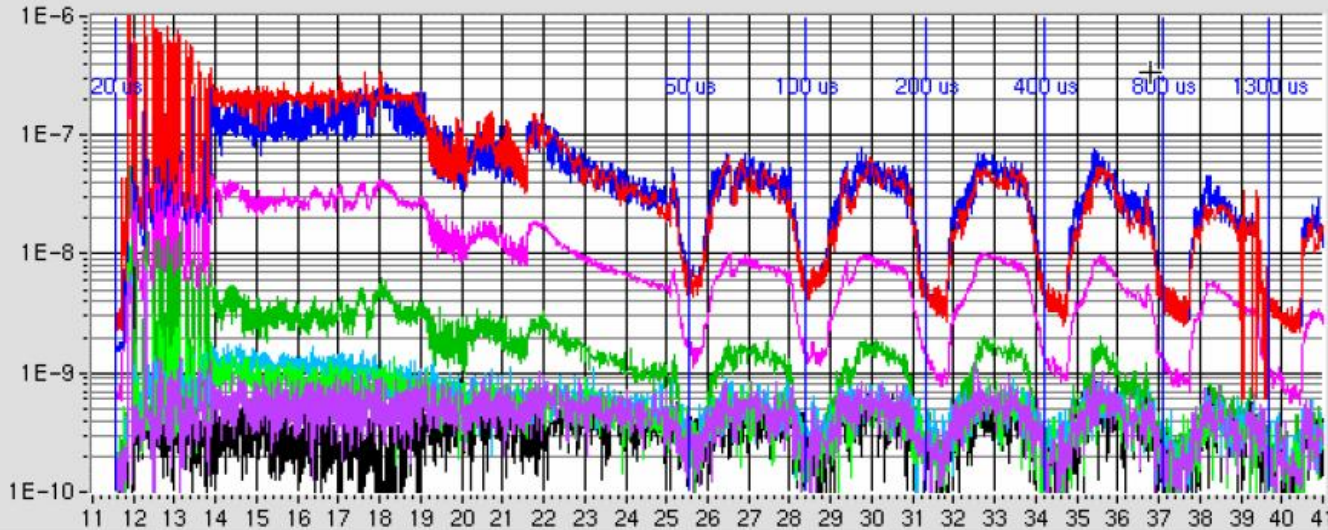
Coupler Conditioning

Chechia Coupler / Test : D3C15 / 3

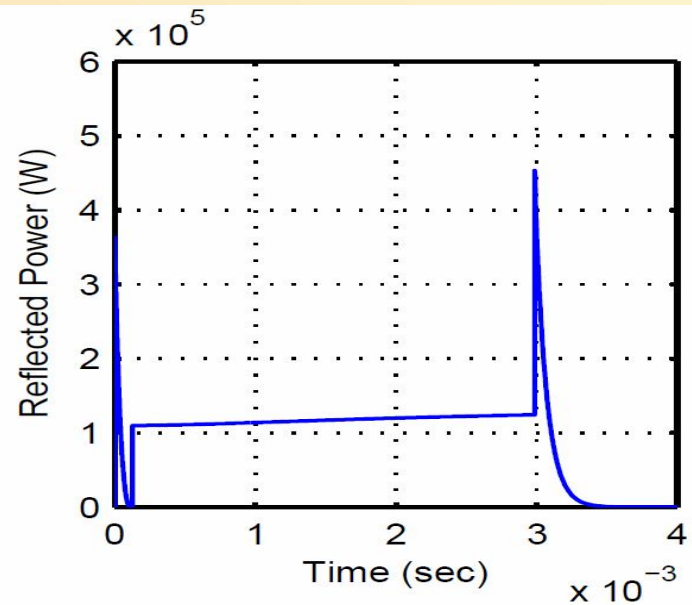
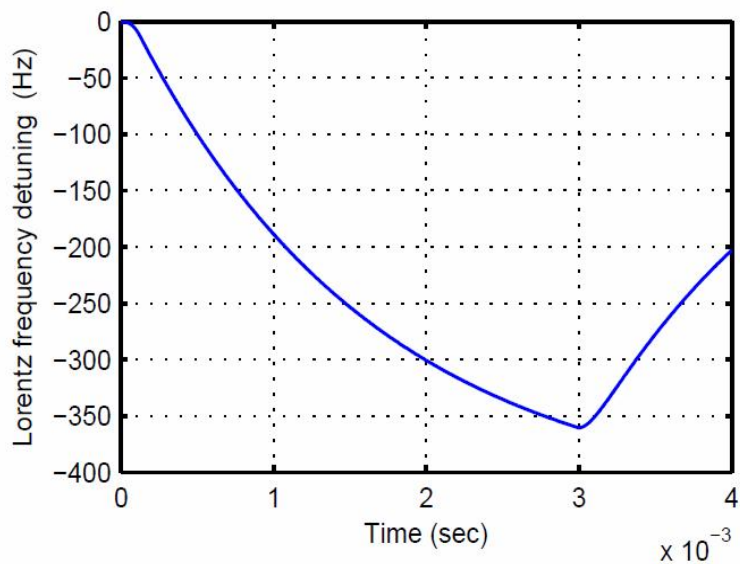
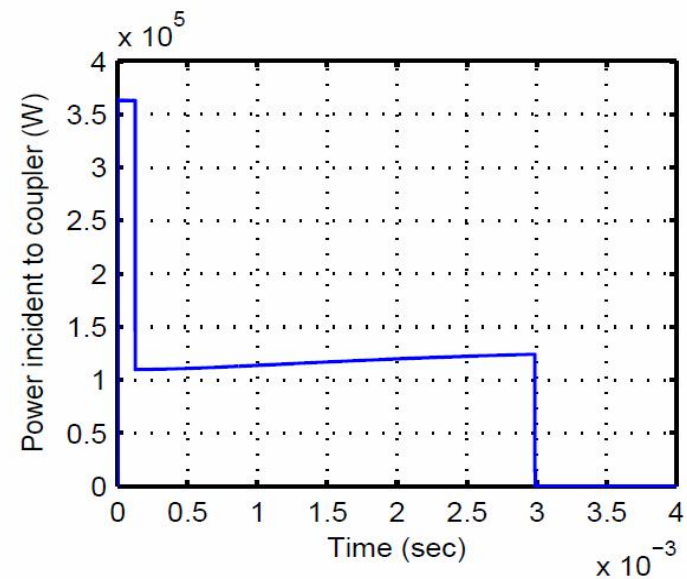
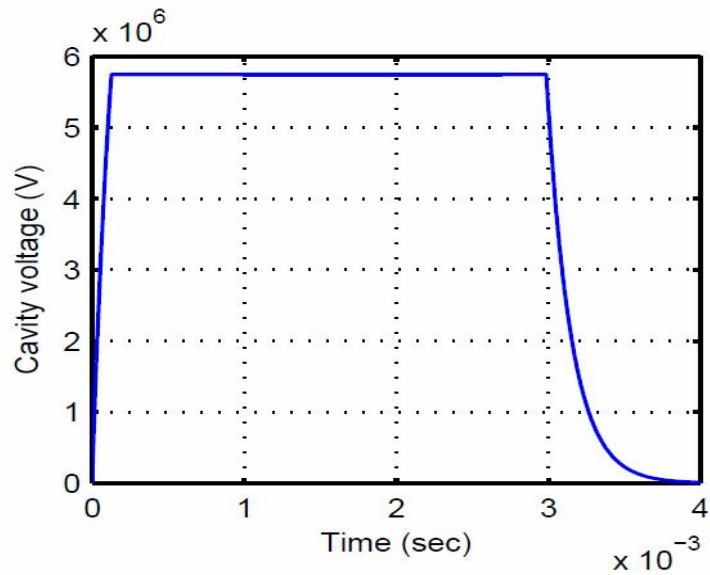
TTF III coupler (baked)

03.12.2001

= 0h



Cavity Dynamics without Beam

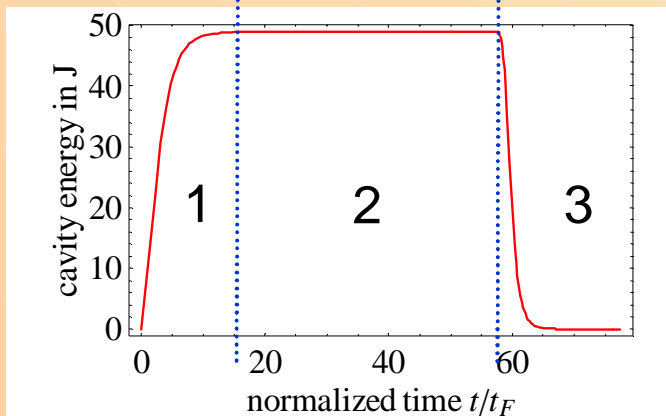
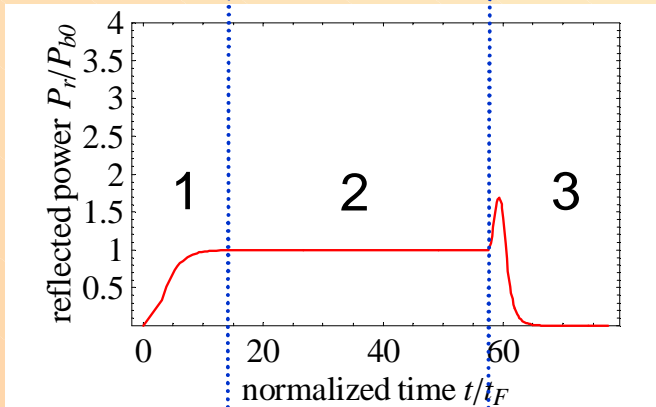
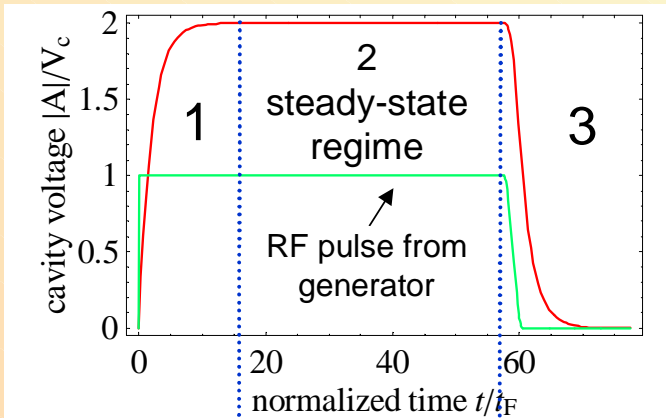
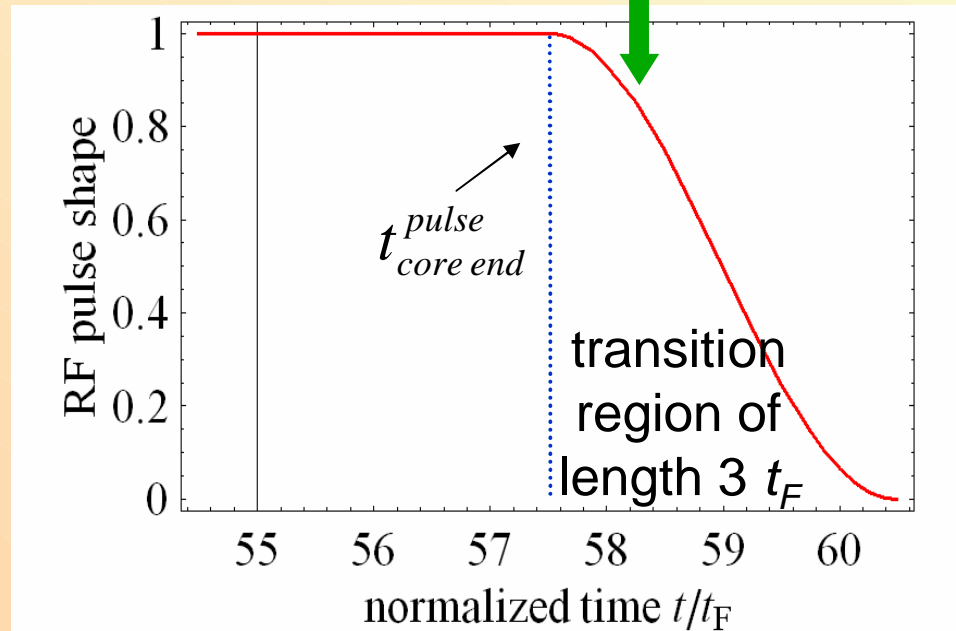


Cavity Dynamics: RF pulse shaping

By shaping the RF pulse tail one can substantially decrease the reflected power during turning off the generator RF pulse.

The pulse tail is shaped as

$$\cos^2 \left[\frac{\pi (t - t_{core\ end}^{pulse})}{2 \cdot 3 \cdot t_F} \right]$$



Signals

2 RF signals for forward/reflected waves just upstream the coupler

2-3 signals on electron activity in the coupler

1 signals of vacuum in the coupler

2 signals on temperature in the coupler

2 signals on cooling in the coupler

1 signal from cavity antenna (“fast” signal to be processed in real time)

1 signal on cavity vacuum

2 signals on X-ray emission

1-2 signals from the cryogenic system

1 signal from the piezo tuner

Requirements on LLRF and Master Oscillator

The LLRF system must support a sweep over power, pulse duration, frequency and phase for the coupler re-conditioning:

- Power variation from zero to maximum with a step of 0.1 dB
- Pulse duration variation from 10 us to 4 ms with doubling the step
- Frequency range of 1 MHz around the central frequency
- Phase variation over 2π

Capability of generation of rectangular pulses (train of pulses) with a power level and a pulse duration changing up to the maximum limits.

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