Analysis of the Energy Gain Measurements in TBTS

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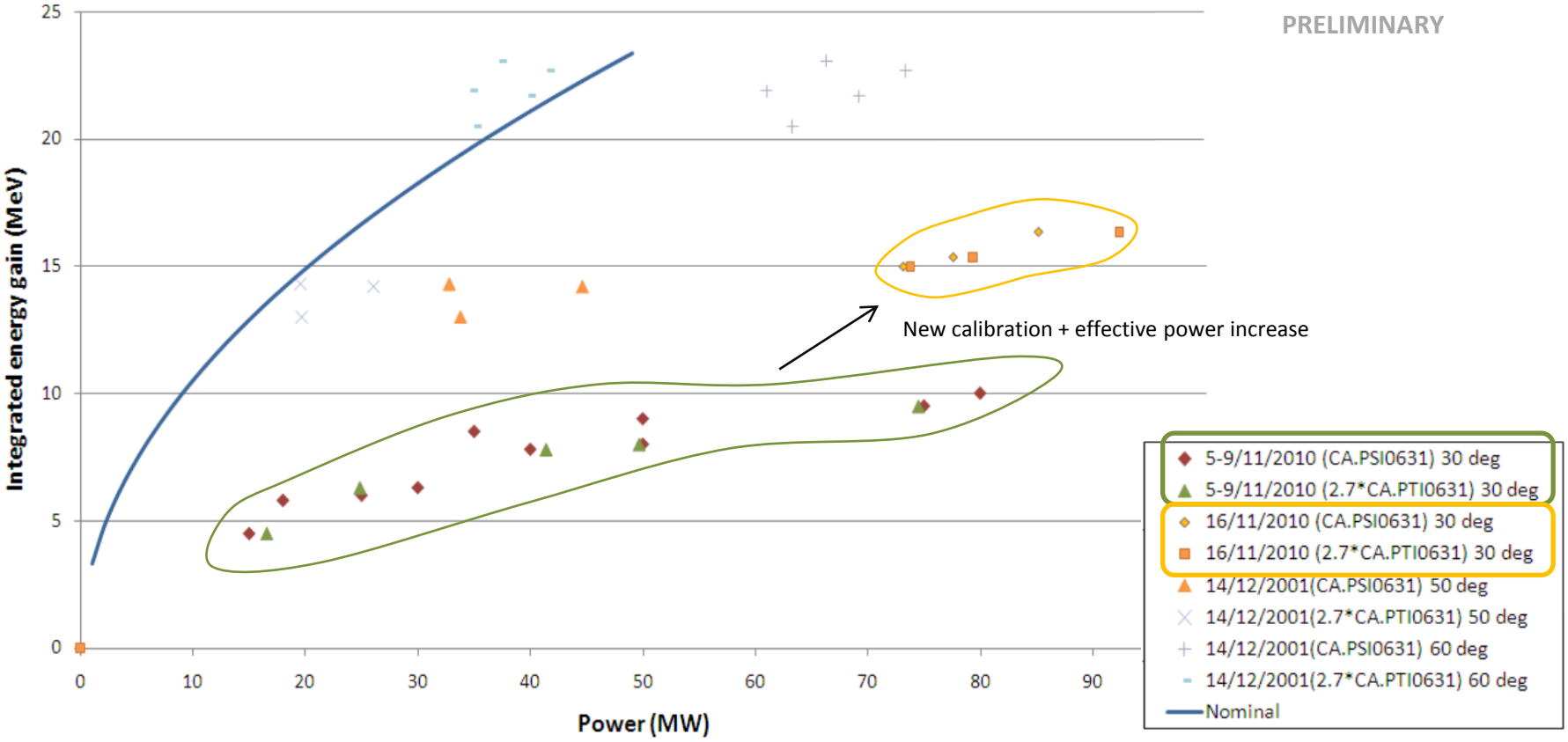
Motivation



Javier Barranco

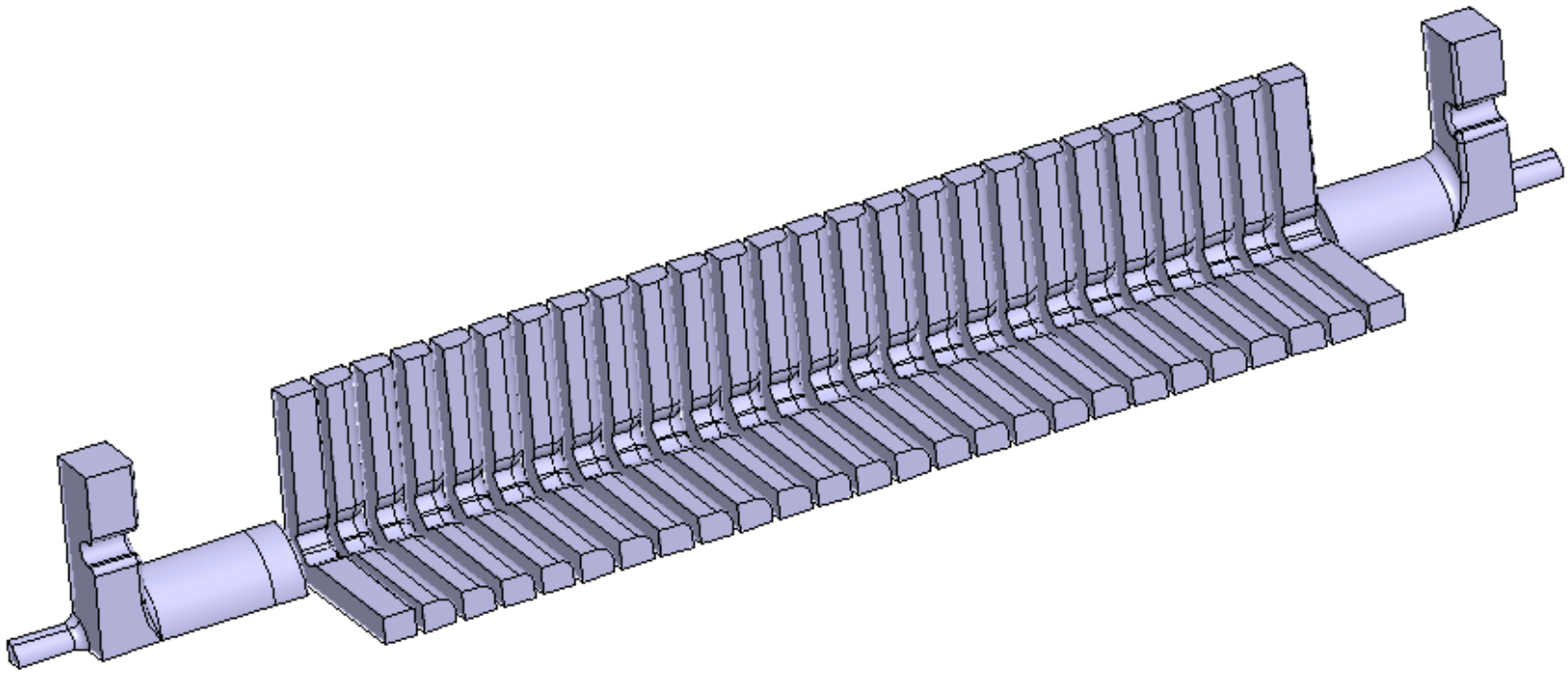
Energy Gain Measurements in TBTS

Analyzed acceleration measurements (events) in TBTS including the corresponding timestamps are gathered by **Javier Barranco Garcia** here:

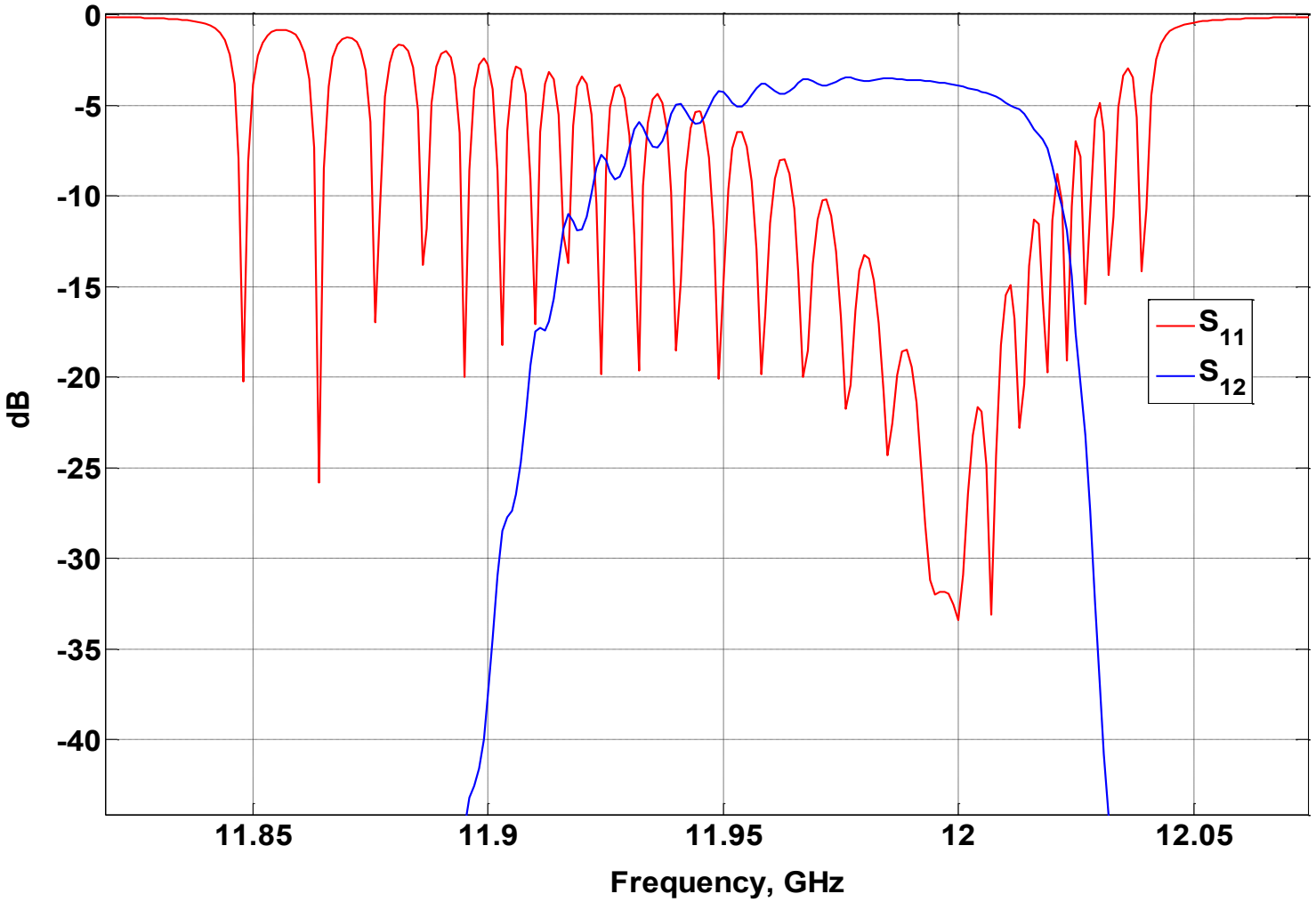
- http://elogbook.cern.ch/eLogbook/eLogbook.jsp?shiftId=1032364
- http://elogbook.cern.ch/eLogbook/eLogbook.jsp?shiftId=1032385
- http://elogbook.cern.ch/eLogbook/eLogbook.jsp?shiftId=1032677

Temperature, C	Total Number of Events
37	17
50	6
55	5
60	11

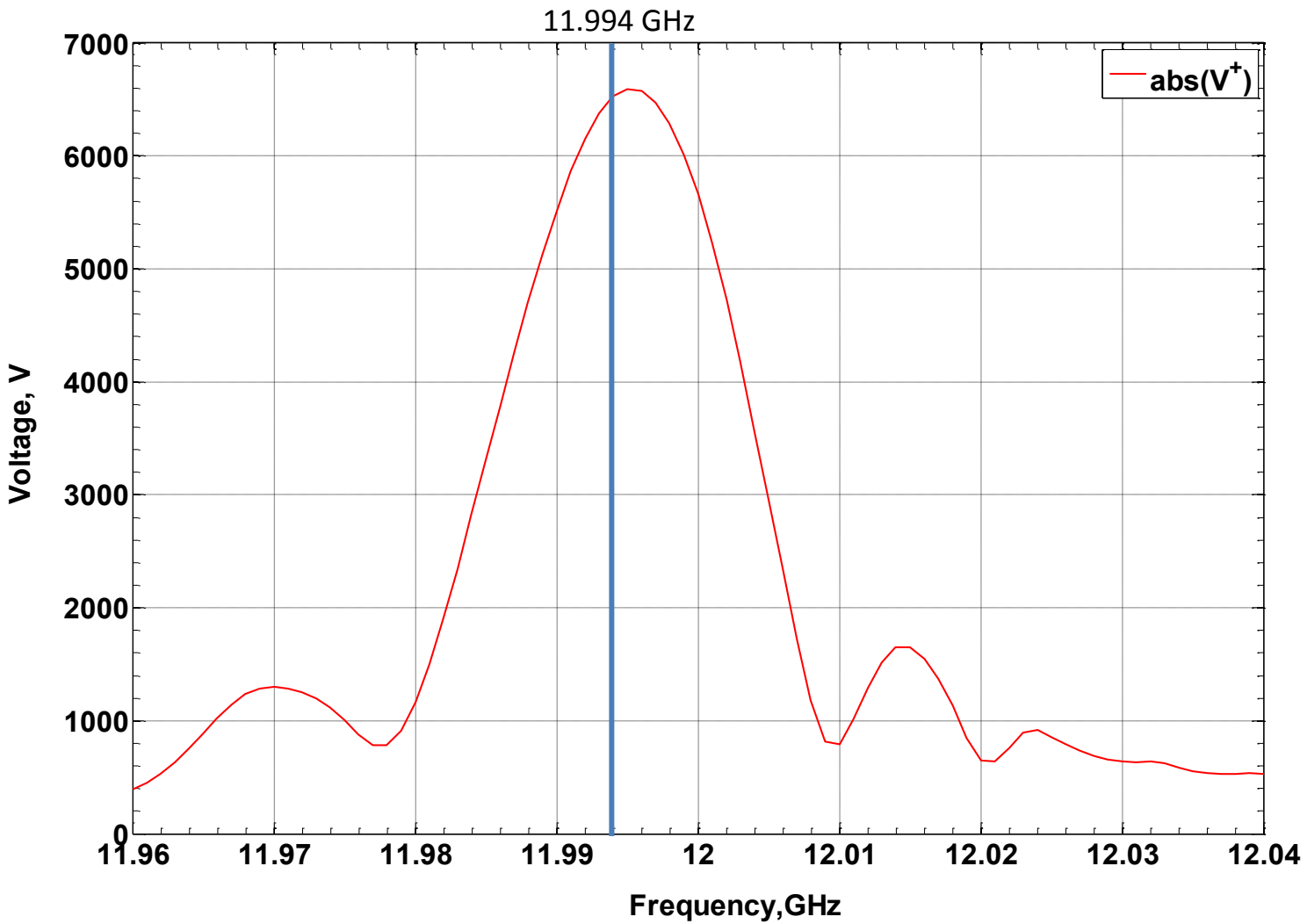
One quarter of the TD24_tank (12WDSDVG1.8T) AS installed in TBTS



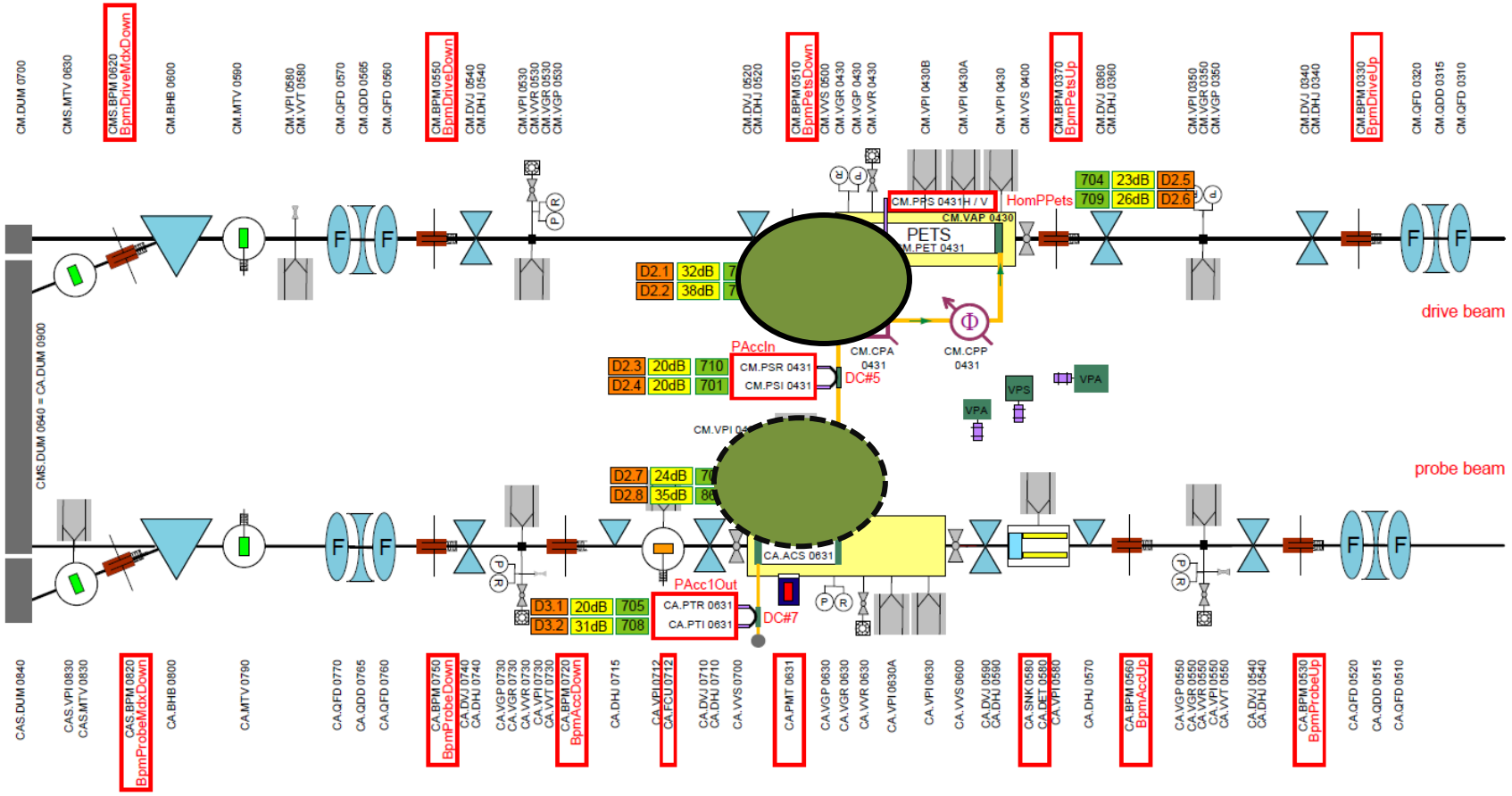
Results of the S-parameters HFSS Simulation



Accelerating Voltage in TD24 (P_{in} = 4W)

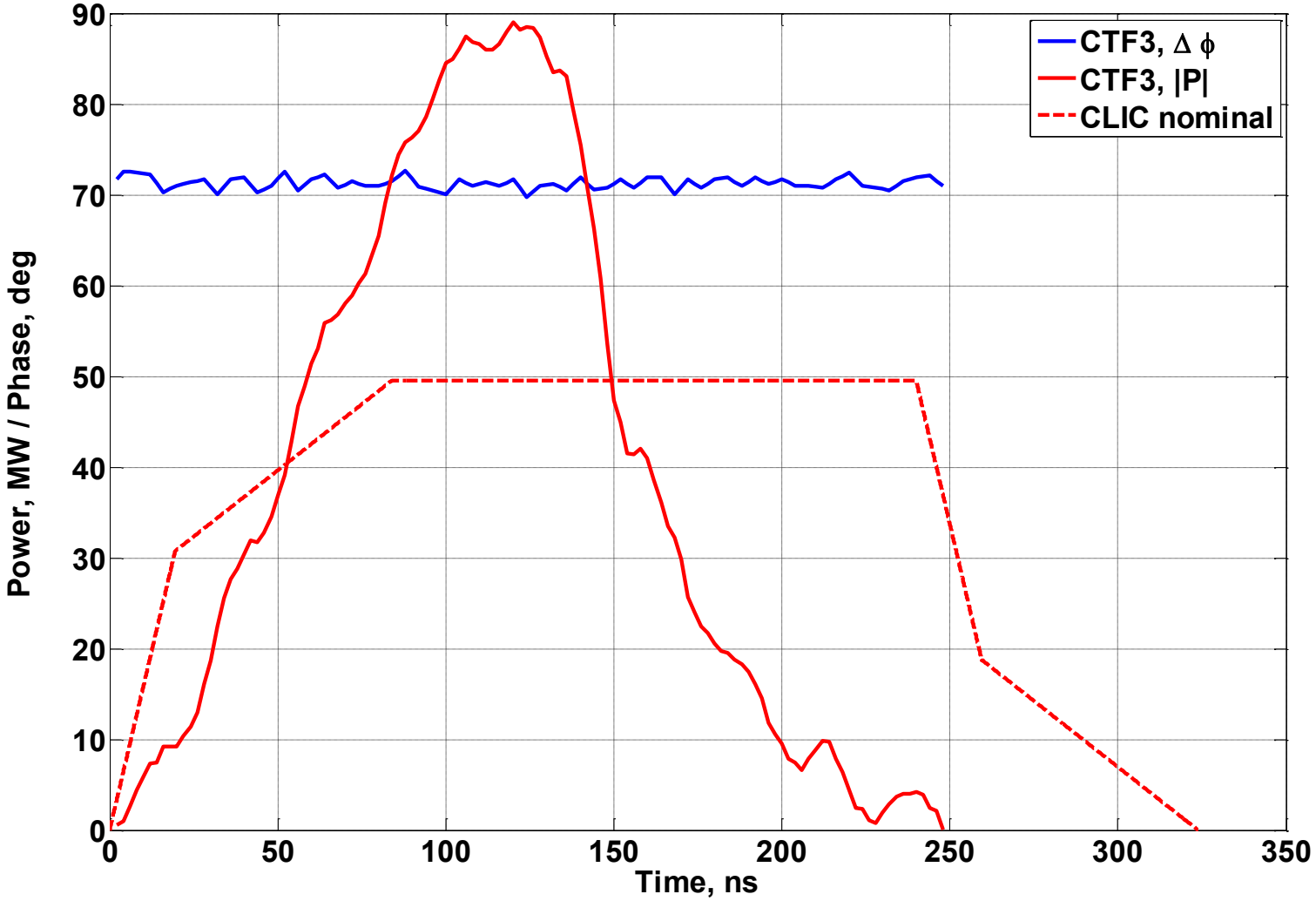


Layout of the Instrumentation for the CTF3 Two-beam Test-stand

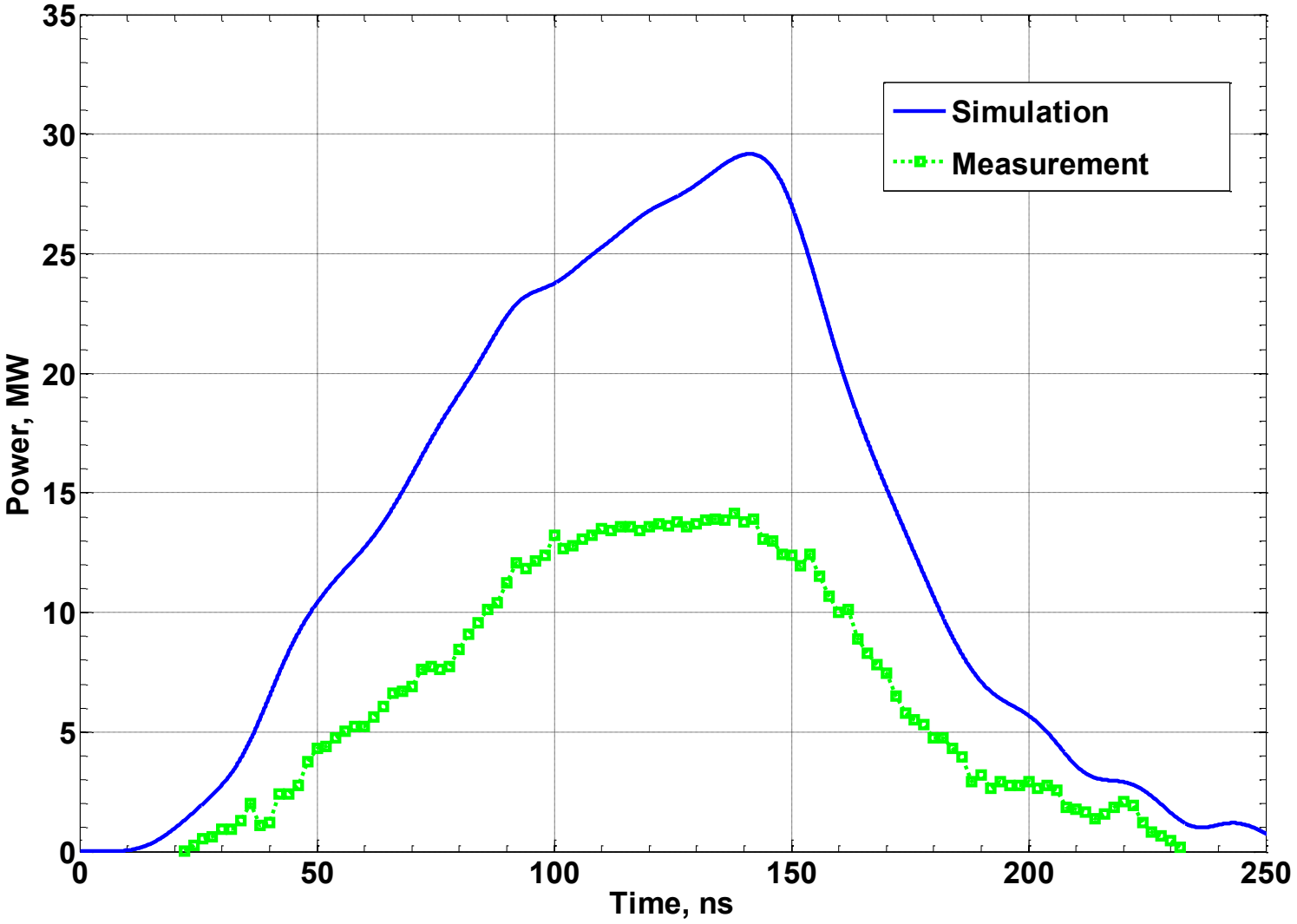


Important input from Alexey Dubrovskiy: to use **PPI0431** signal instead of the PSI0631 one and then take into account recirculation in PETS and waveguide network between PETS and AS. In this way more reliable input pulse is obtained for AS.

90 MW Pulse in CTF3 vs CLIC nominal (100 MV/m unloaded) pulse

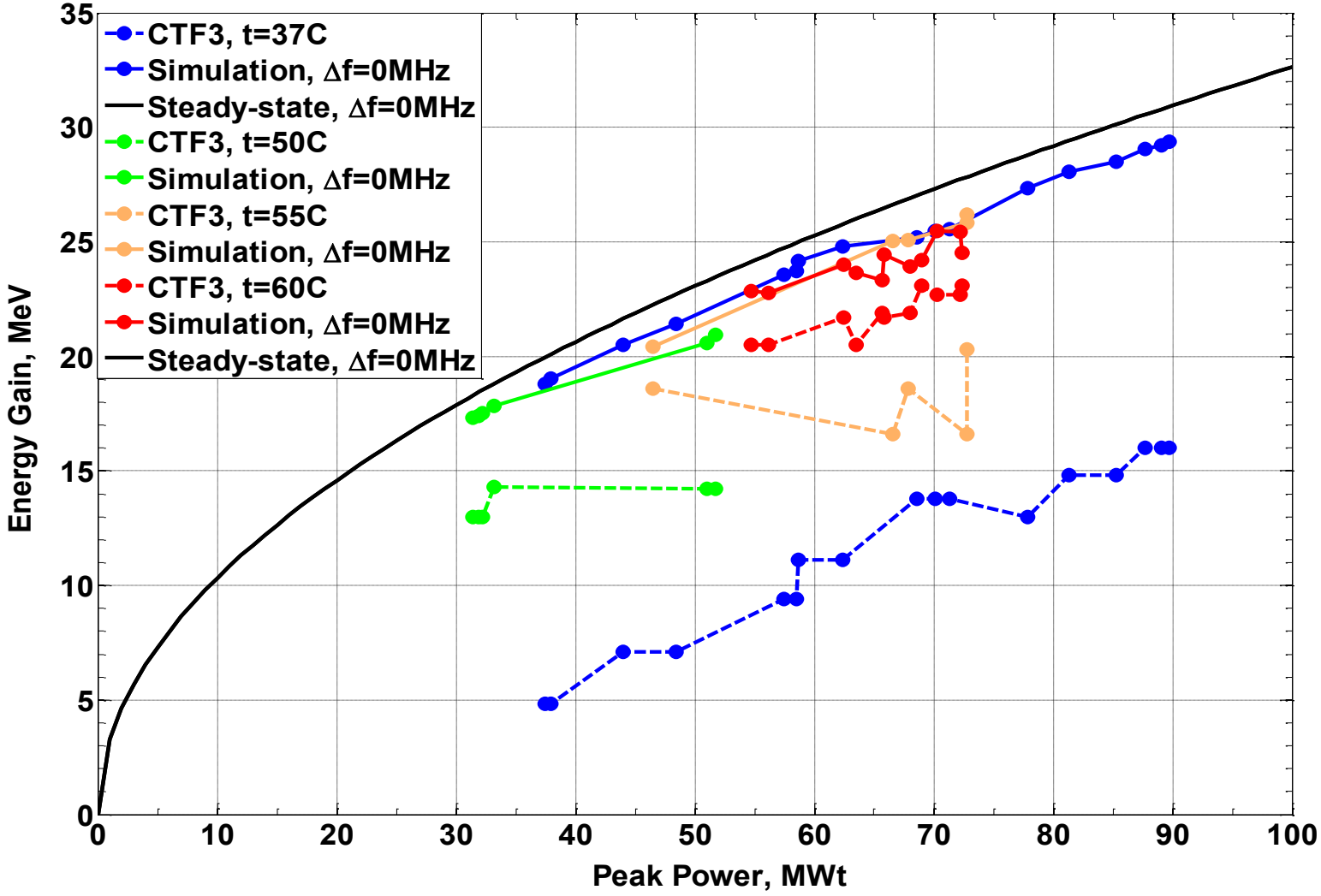


Simulation of the Transmission



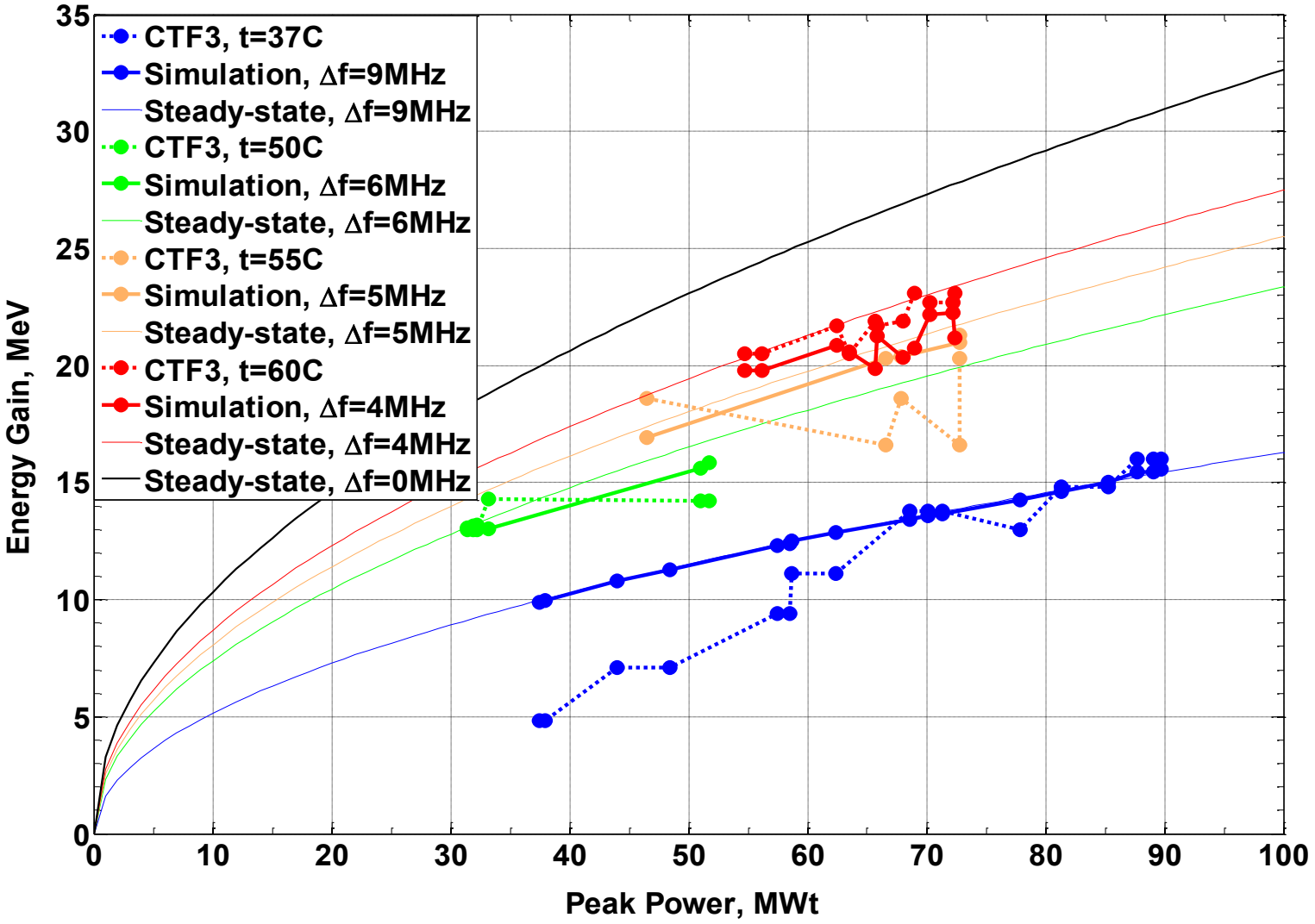
$P_{trans}(t)$ = conv $(S_{12}(t), \text{sqrt}(|P(t)|) * \exp(i*(\omega_0*t+\Delta\varphi)))$

Simulation of the Energy Gain (no detuning)



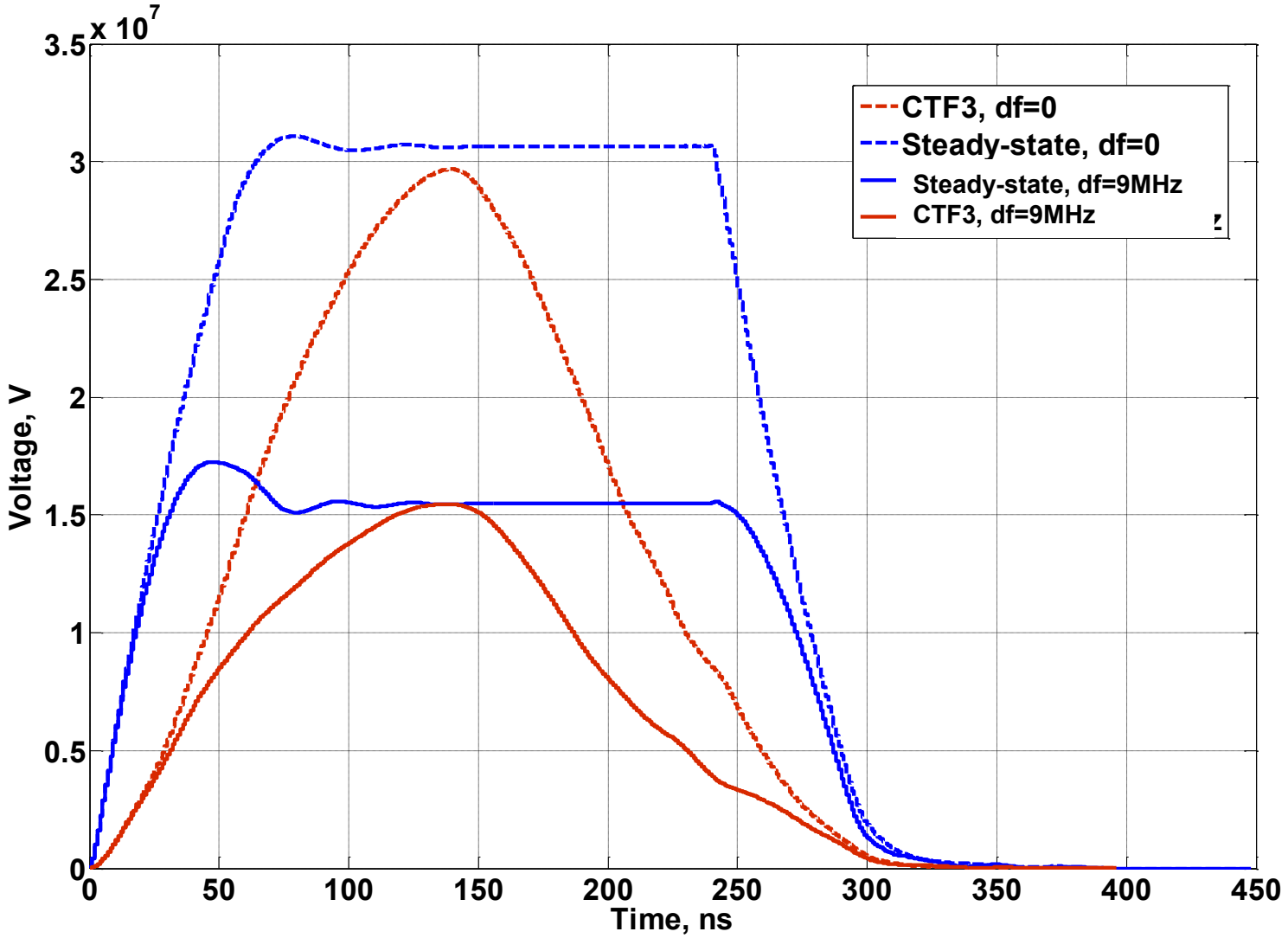
$V_{acc}(t)$ = conv ($R_V(t)$, sqrt(|$P(t)$|) * exp (i*(ω_0*t+$\Delta\varphi(t)$)))

Simulation of the Energy

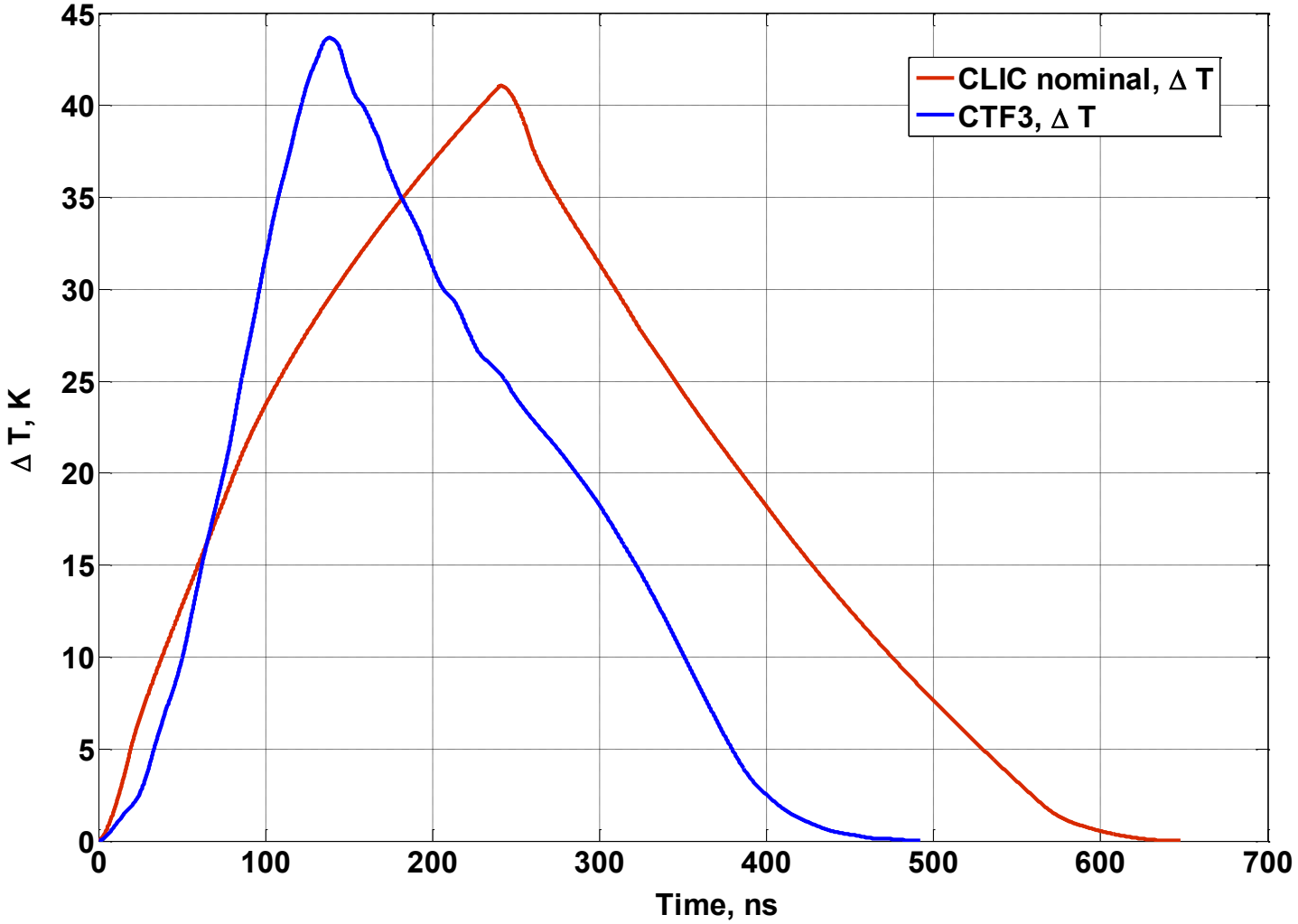


$V_{acc\ detuned}(f) := V_{acc}(f - \Delta f)$, assuming that Δf=+10MHz at 30C and Δf = -1MHz/5C

Effect of the detuning in the comparison with the steady-state



Pulse-Surface Heating for 90MW CTF3 pulse vs CLIC nominal pulse



$\Delta T(t) = \alpha * \mathrm{conv}\ (1/\mathrm{sqrt}(t), |P(t)|)$, normalization: ΔT (100ns, 100MV/m) = 28K

Conclusions

- Introducing detuning we've got rather good correlation between the simulations and measurements of the acceleration
- Pulse shape effect can also be clearly seen now, even though there is an interesting detuning effect
- There are still some calibration errors in the TBTS instrumentation
- Pulse-surface heating was comparable with the one for the CLIC nominal pulse