Automation of the Gun

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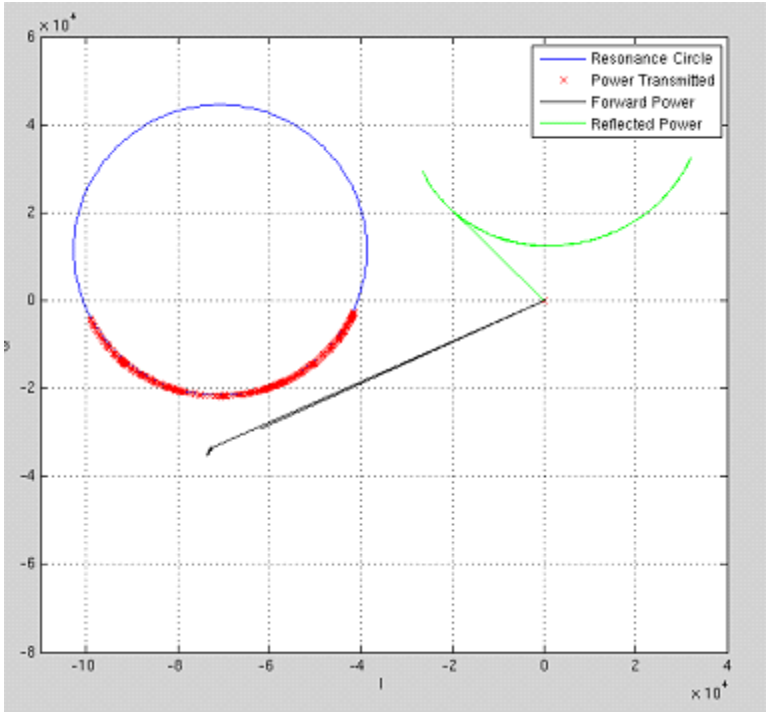
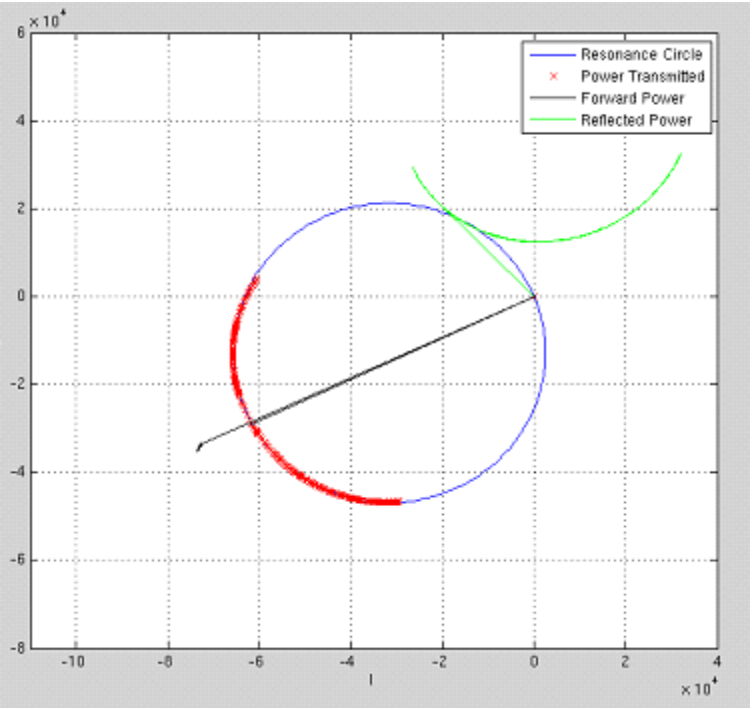
GUN at FLASH

- normal conducting cavity
- no probe, only forward and reflected
- power dissipation 5-50kW
- -21kHz / °C
- operating temperature ~59°C
- Iris temperature stabilized by water cooling
  - works perfectly in steady-state conditions
  - long transients when RF power fluctuates

Field calibration for RF-Gun





$$V_{field} = V_{for} + V_{ref}$$

$$V_{field} = A_1 * e^{i\varphi 1} (V_{m\_for} + A_2 * e^{i\varphi 2} V_{m\_ref})$$

Vm_for, Vm_ref – measured forward and reflected wave

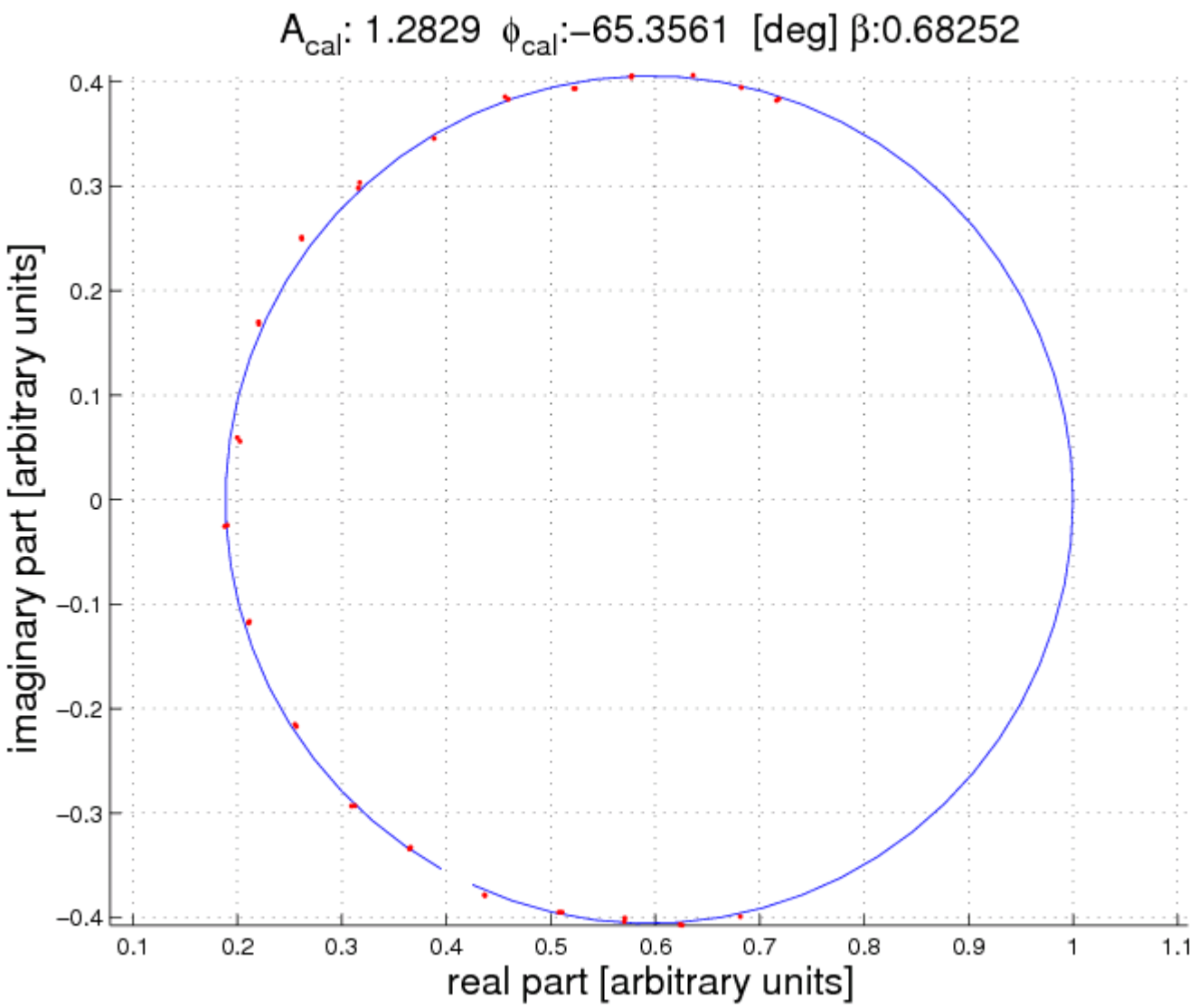
A_1 – loop gain

φ_1 – loop phase

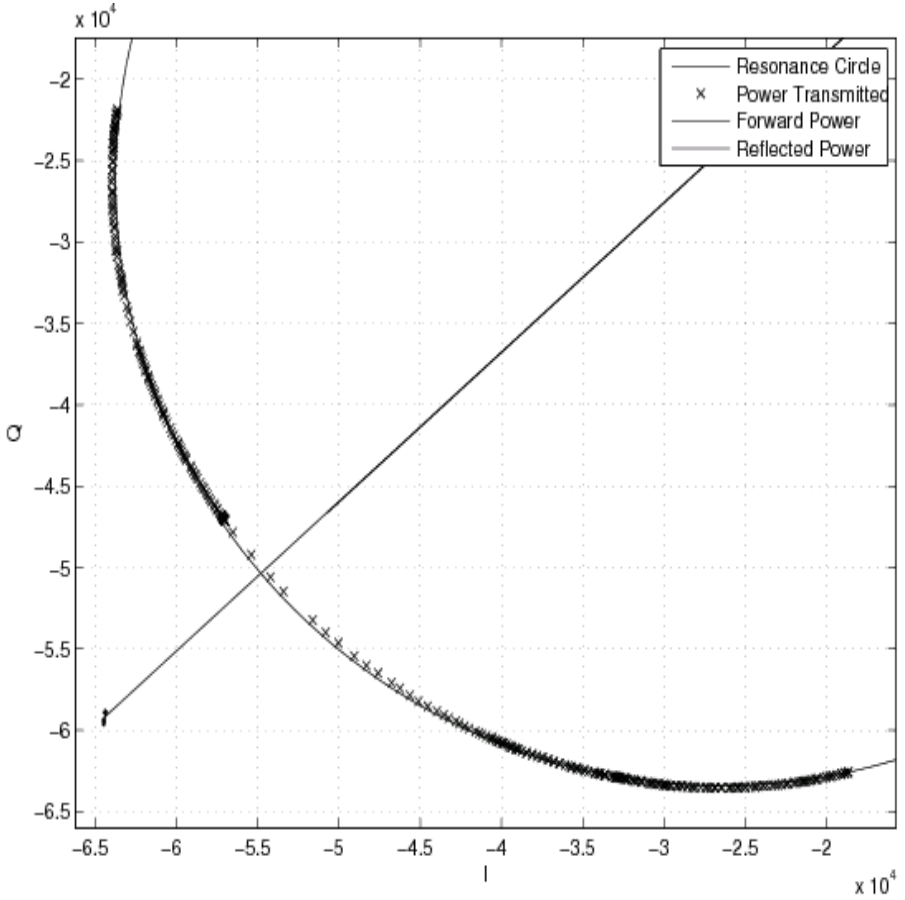
A_2 – amplitude scaling factor of V_ref

φ_2 – relative phase between V_for and V_ref

Calibration by bump signal

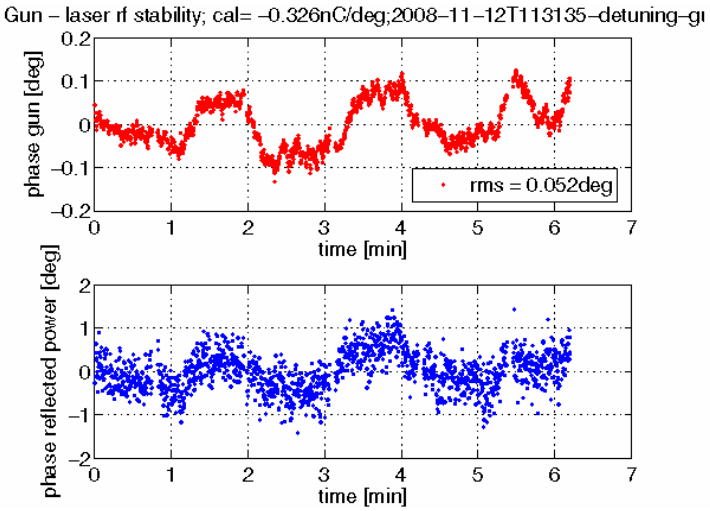


Fitting data to resonance curve

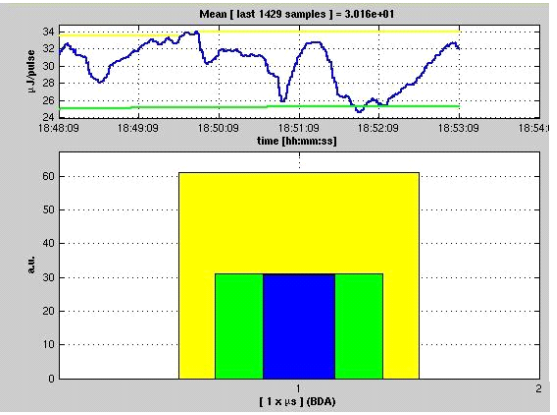


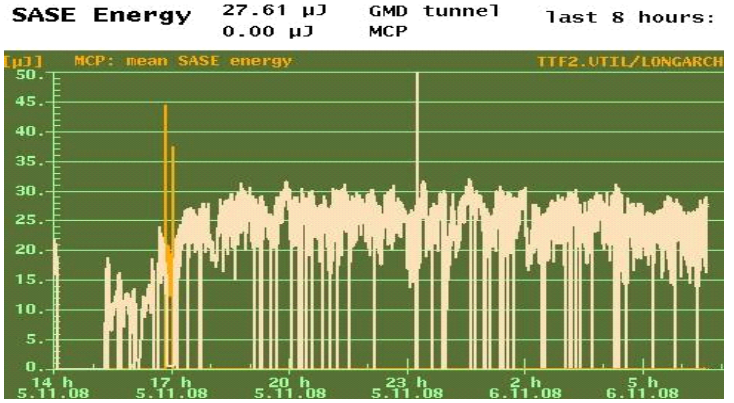
	POW FOR I	POW FOR Q	POW REF I	POW REF Q
OFFSET	+ 780	+ 1950	+ 1350	+ 940
GAIN	+ 1.00	+ 1.00	+ 1.00	+ 1.00
Cal MW HV	+ 3.19			
PHASE	+ 0.00 deg		- 65.0 deg	
LOOP PHASE	+ 28.0 deg			
	Expert settings			

GUN calibration results



Before calibration

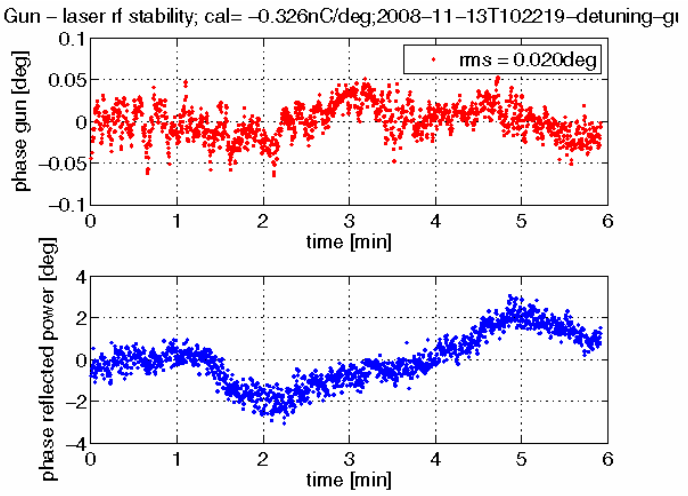




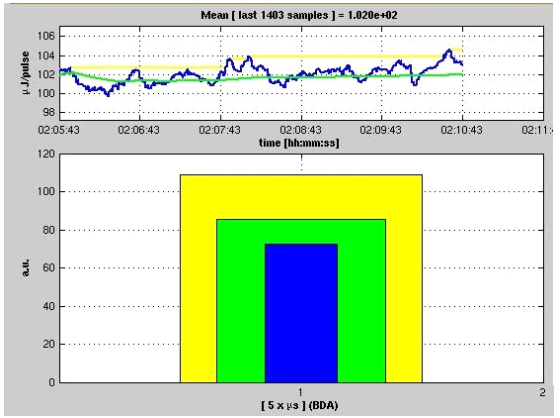
RF Gun field measurement calibration

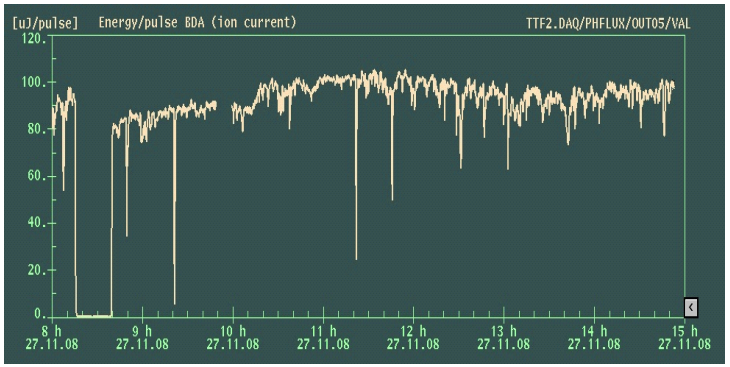
$U_{trans} = U_{for} + U_{ref}$

SASE intensity fluctuations down from 25% to a few percent

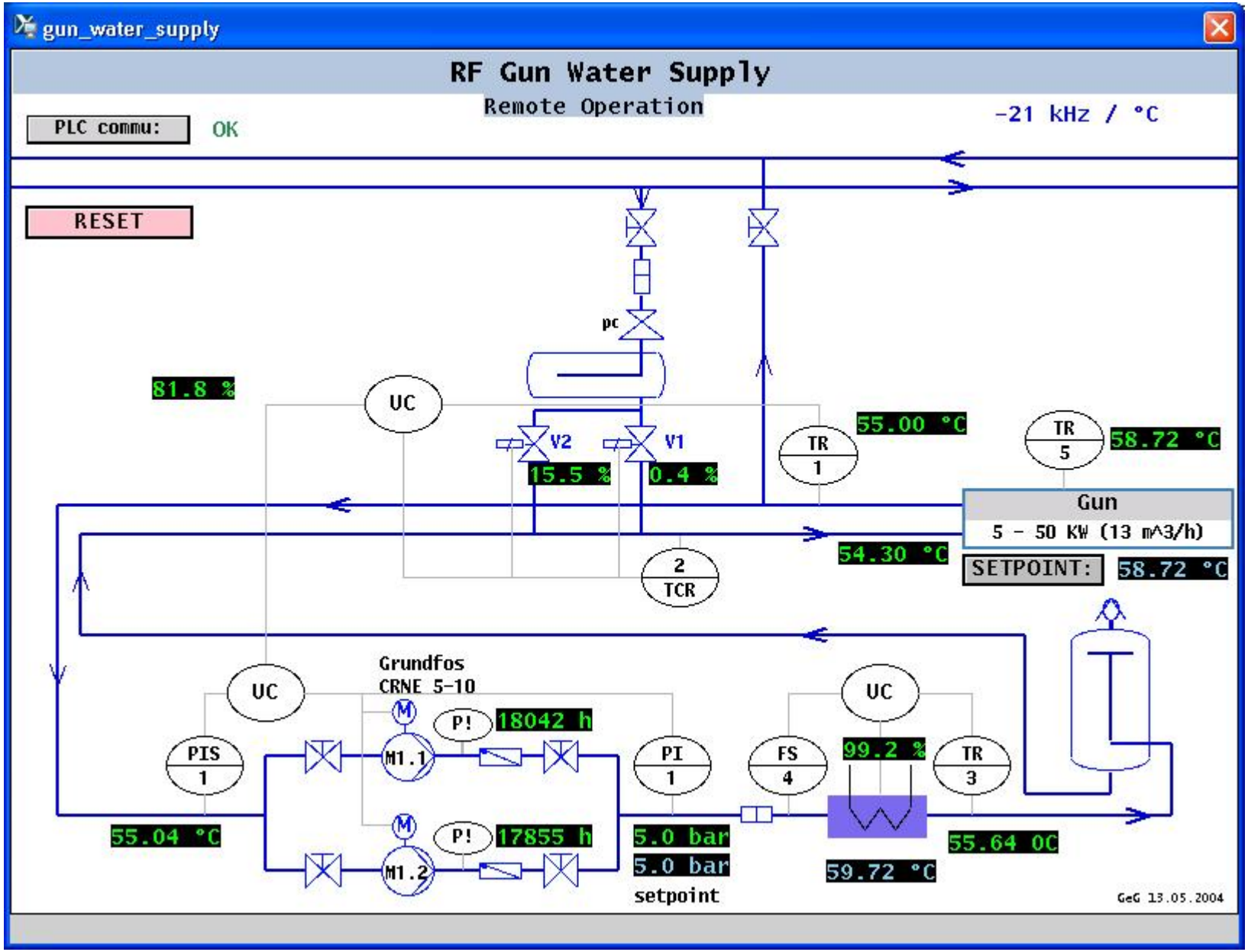


After calibration

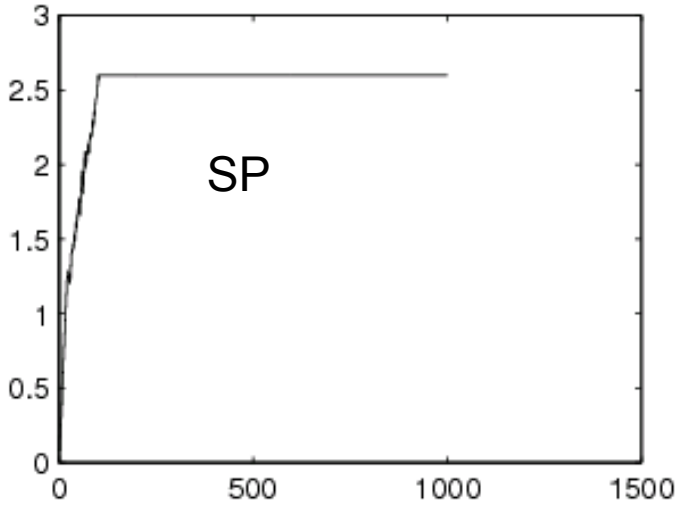


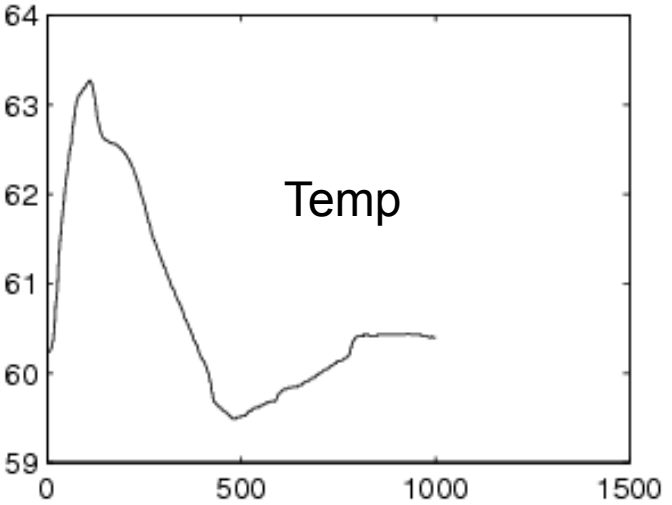


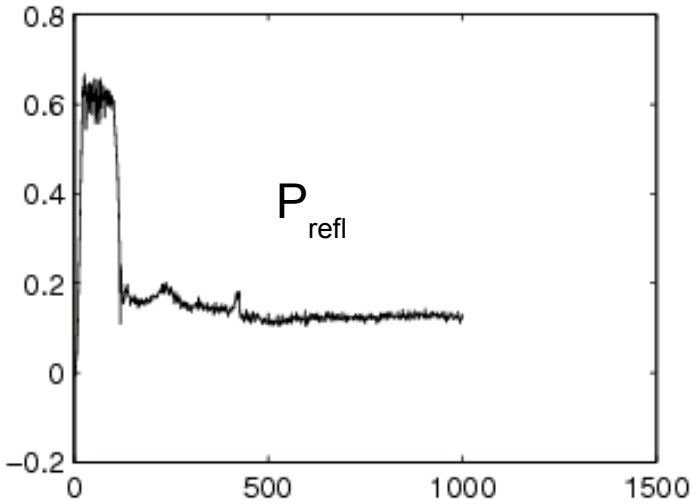
Gun temperature regulation

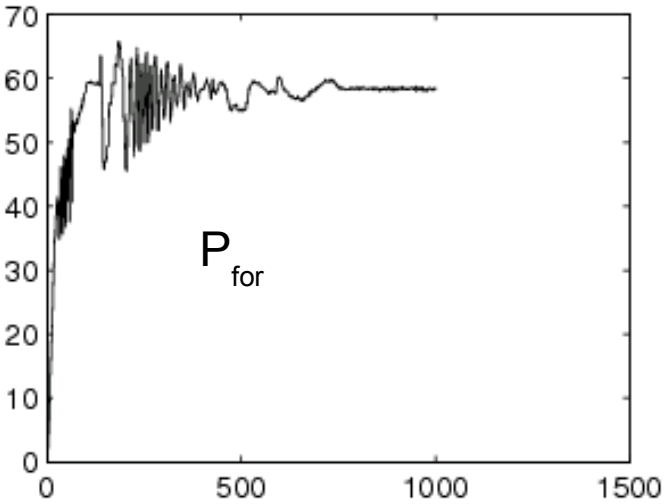


Gun startup with FF









time [s]

Conclusion

- GUN calibration with temperature scan and bump tested and signal compared with good agreement
- several startup-strategies for the GUN tested