

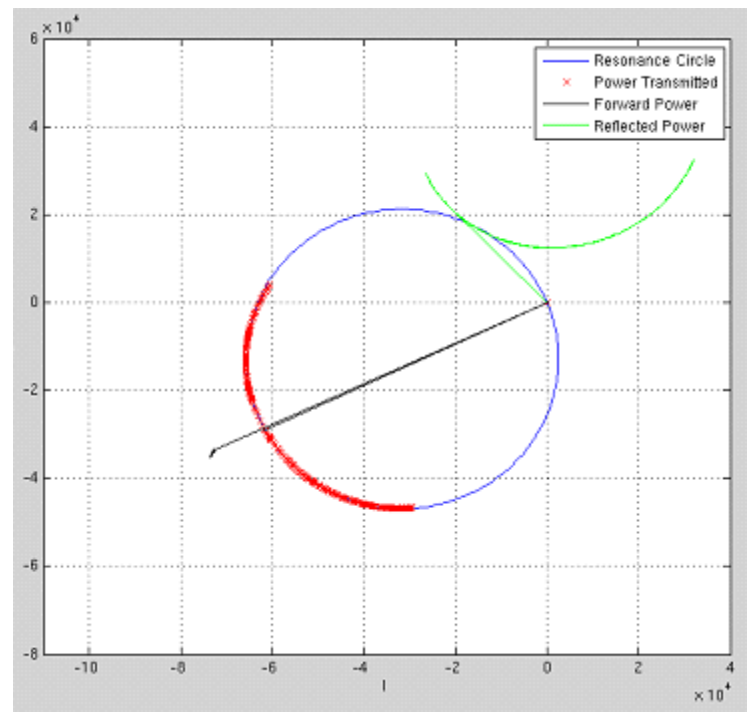
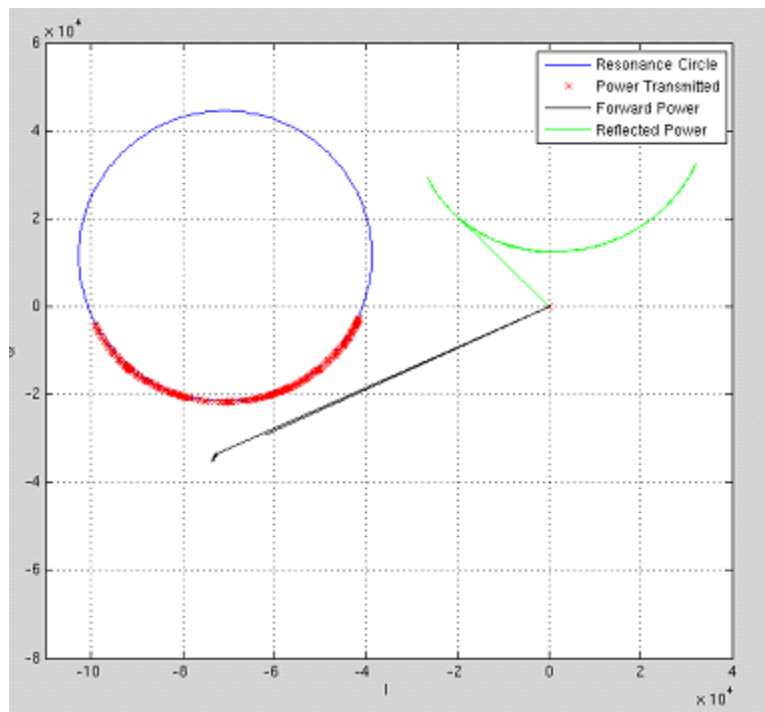
# Automation of the Gun

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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



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

$$V_{\text{field}} = A_1 * e^{i\phi_1} (V_{m\_for} + A_2 * e^{i\phi_2} V_{m\_ref})$$

$V_{m\_for}$ ,  $V_{m\_ref}$  – measured forward and reflected wave

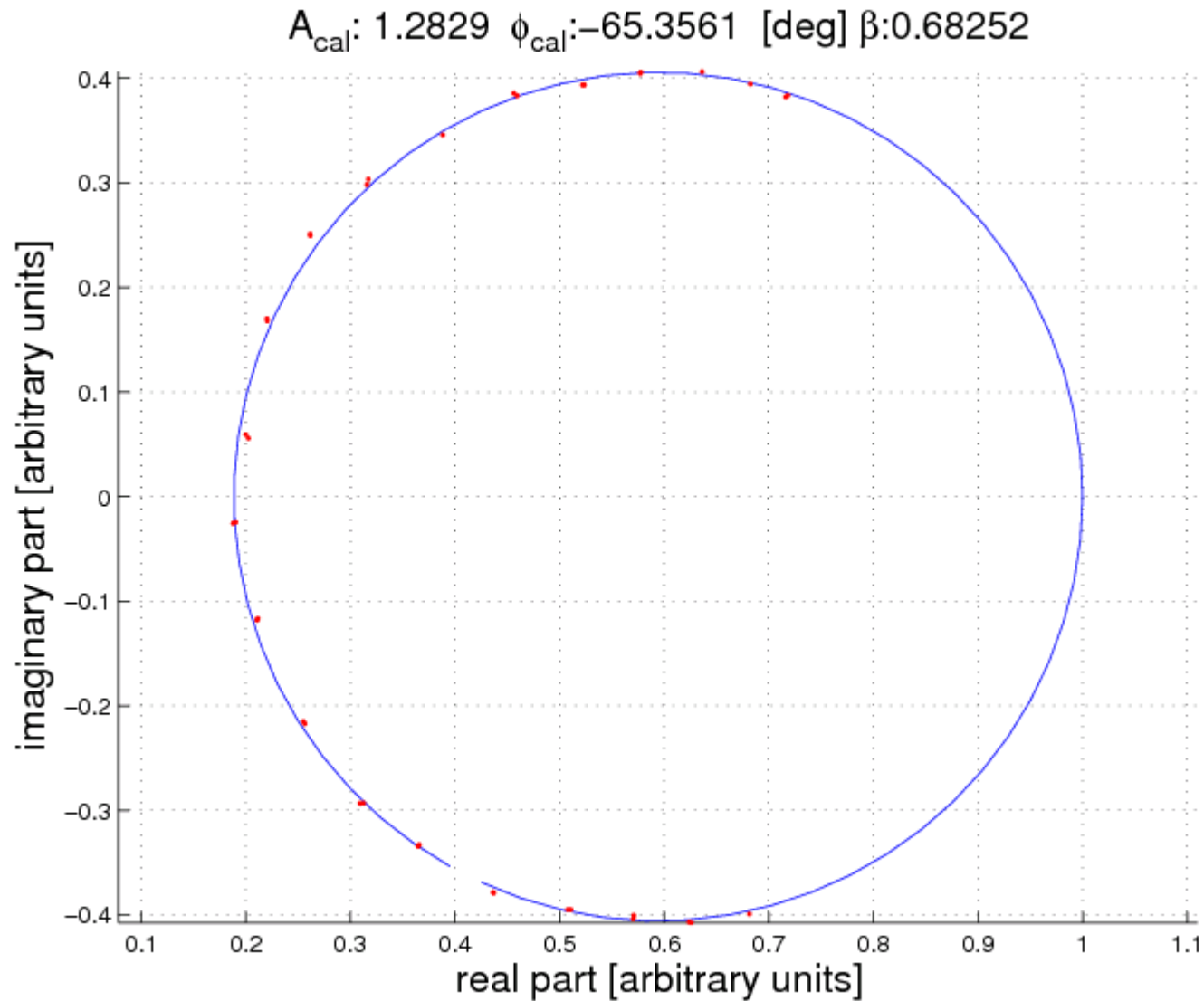
$A_1$  – loop gain

$\phi_1$  – loop phase

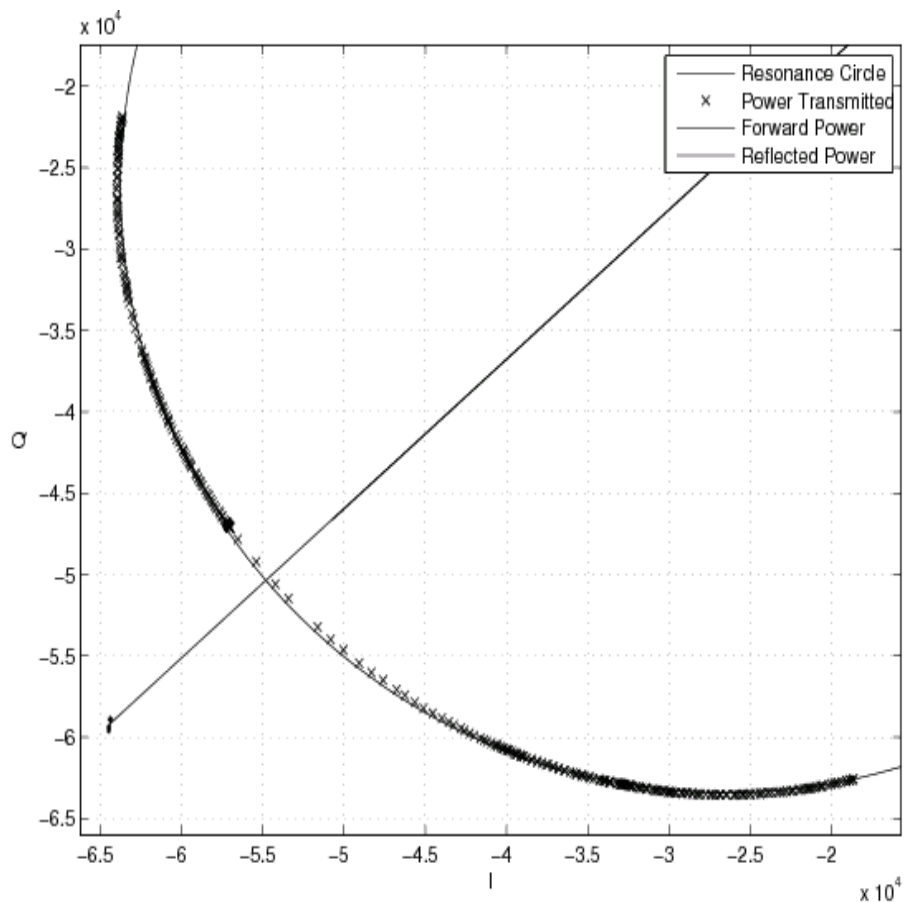
$A_2$  – amplitude scaling factor of  $V_{ref}$

$\phi_2$  – relative phase between  $V_{for}$  and  $V_{ref}$

# Calibration by bump signal



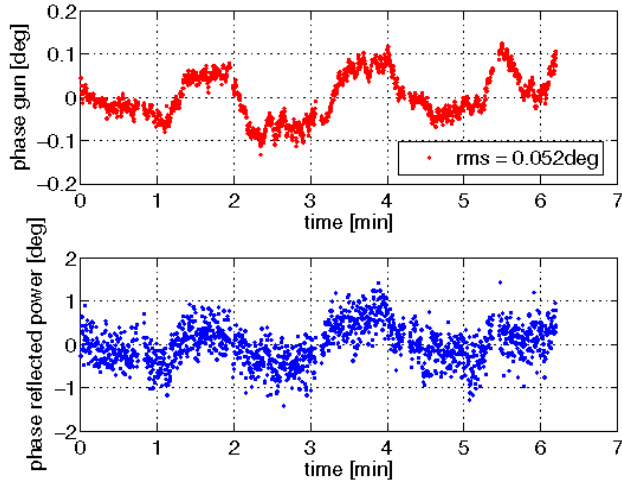
# Fitting data to resonance curve



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

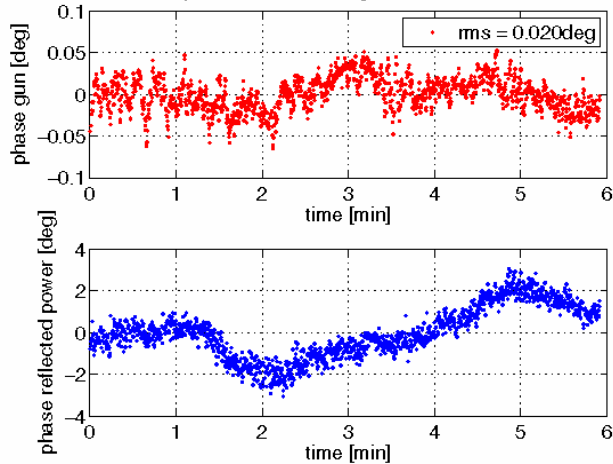
# GUN calibration results

Gun - laser if stability, cal= -0.326nC/deg,2008-11-12T113135-detuning-gt

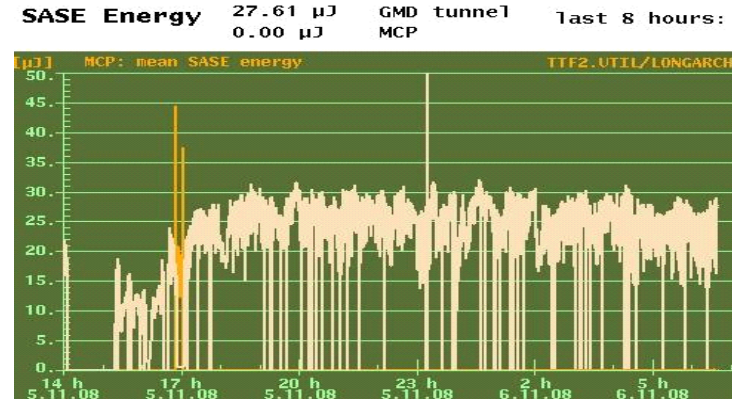
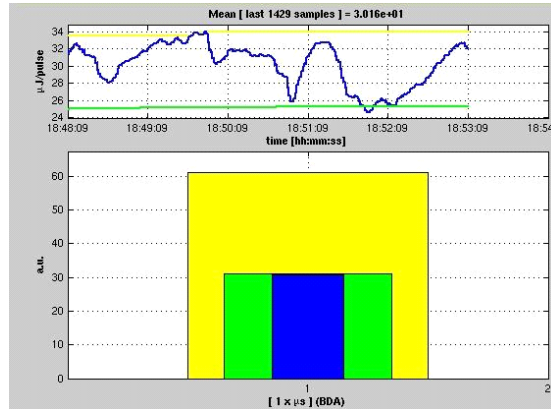


**Before calibration**

Gun - laser if stability, cal= -0.326nC/deg,2008-11-13T102219-detuning-gt



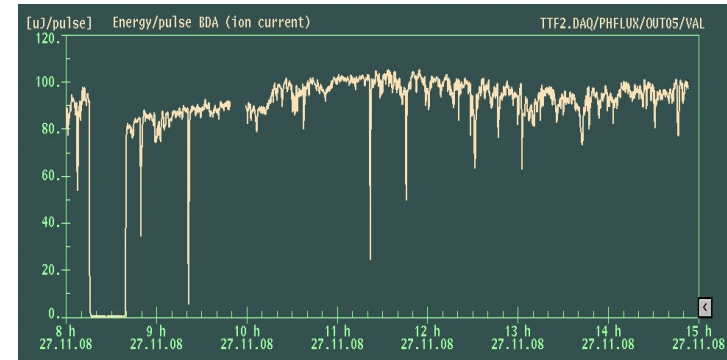
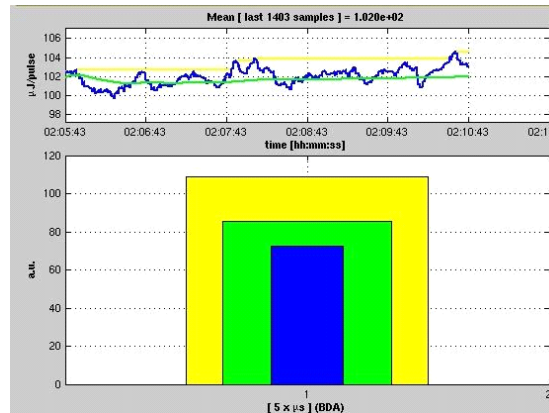
**After calibration**



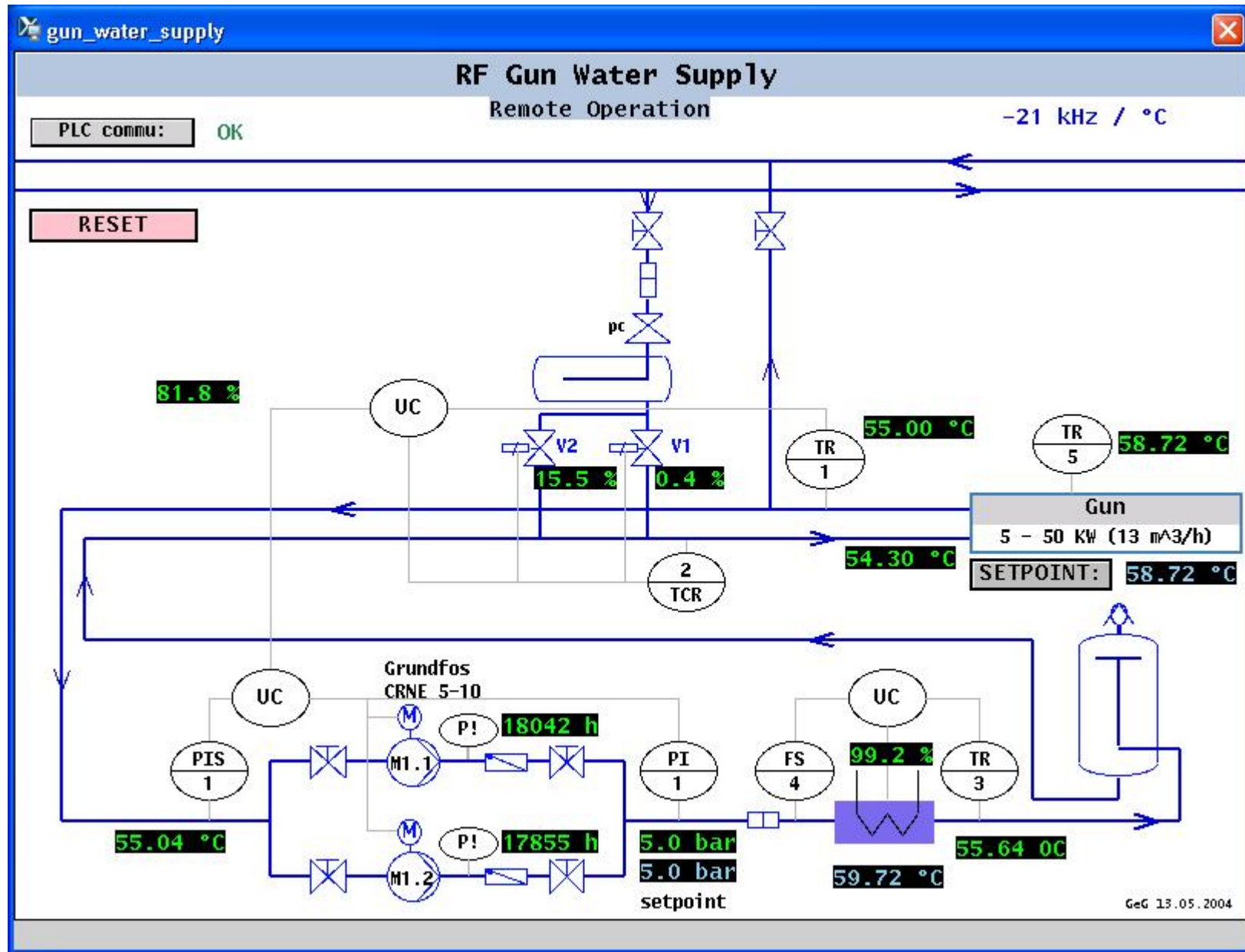
RF Gun field measurement calibration

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

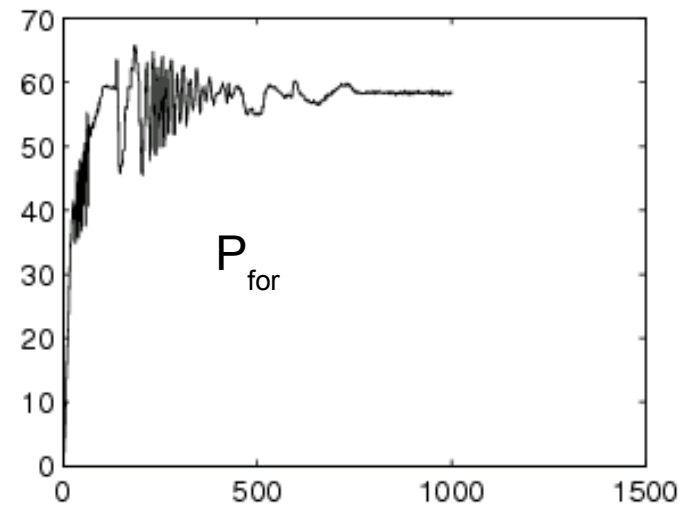
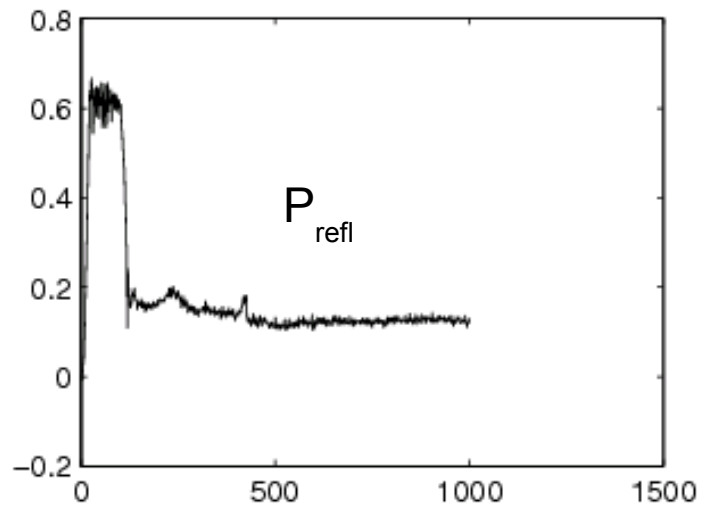
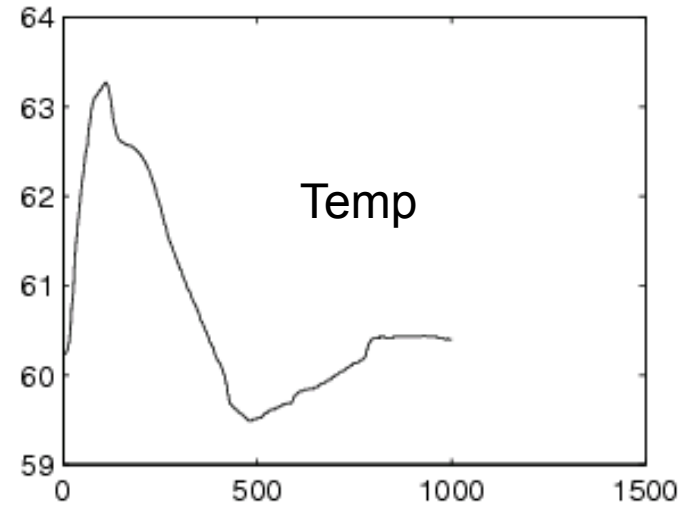
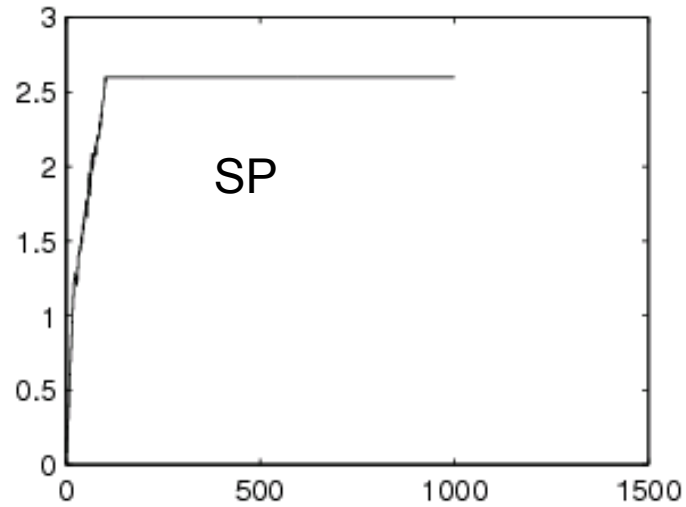
SASE intensity fluctuations down from 25% to a few percent



# 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