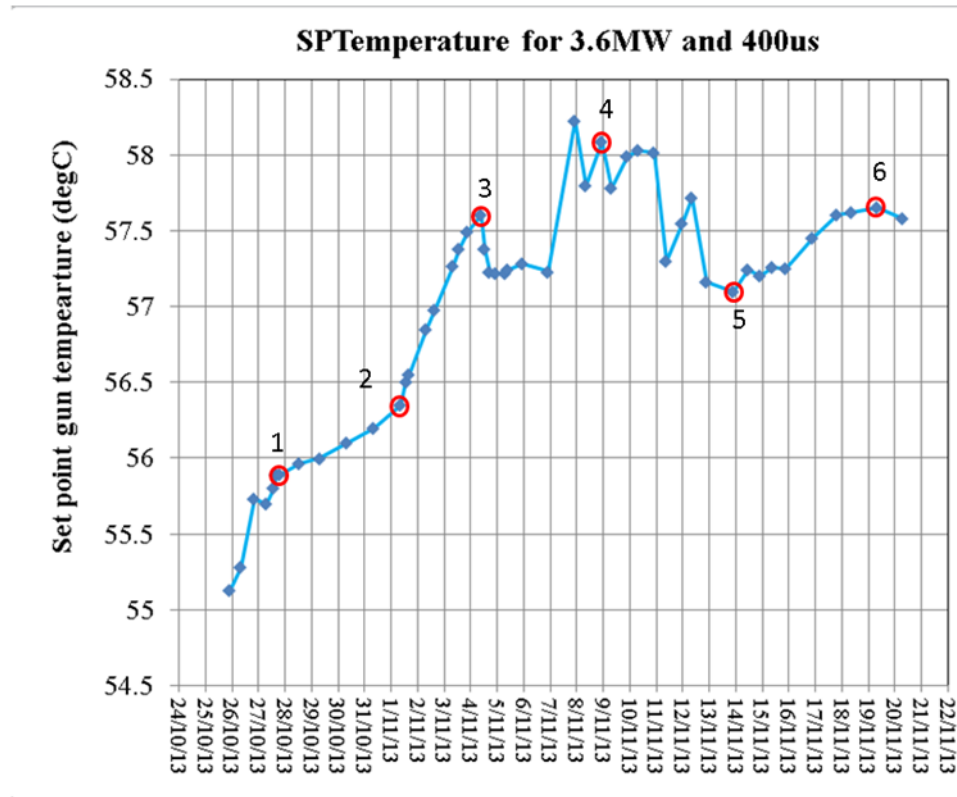


PITZ: Gun-4.4 resonance temperature drift investigation

20.11.2013, Igl, MK

Gun-4.4 Resonance temperature drift

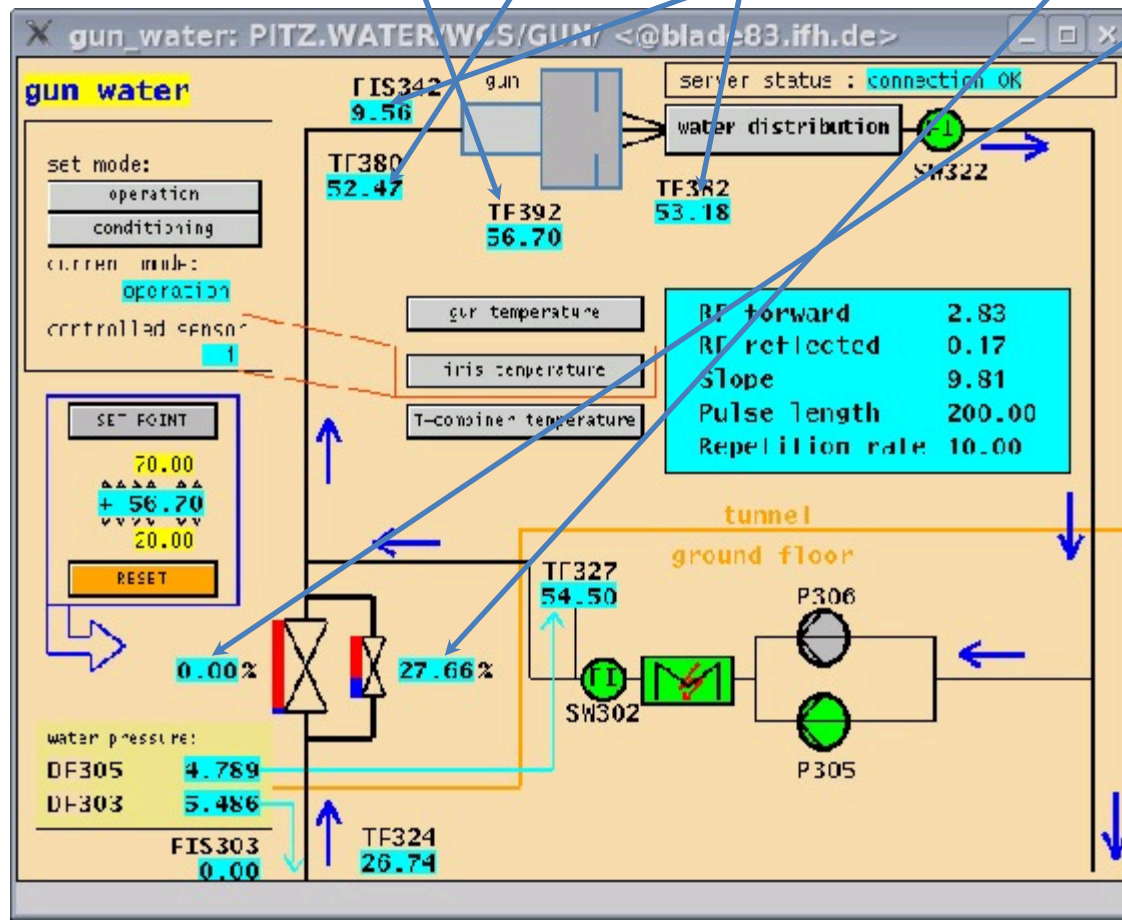


Marked point investigation – from DAQ – I.Isaev (20.11.2013)

N	time	forw power	reflection	cavity temp	incoming temp	outcomingtemp	incoming flow	small valve	big valve
1	2013-10-27 15:34-15:45	3.779 0.006	3.884 0.42	55.86 0.05	48.39 0.1	50.1 0.05	10.19 0.033	42.55 3.64	4.33 1.1
2	2013-11-01 08:58-09:10	3.799 0.017	3.352 0.95	56.24 0.13	48.65 0.26	50.46 0.177	10.322 0.085	40.54 11.86	7.94 3.14
3	2013-11-04 09:06-09:20	3.794 0.006	4.412 0.59	57.61 0.05	50.18 0.1	51.88 0.08	10.266 0.072	34.94 5.98	5.91 1.96
4	2013-11-08 22:50-23:02	3.839 0.008	4.18 0.75	58.1 0.07	50.68 0.11	52.37 0.11	10.269 0.021	34.08 4.02	5.84 1.36
5	2013-11-13 21:38-21:48	3.876 0.012	3.572 0.92	57.05 0.11	49.45 0.25	51.21 0.14	9.982 0.053	35.21 7	6.53 2.09
6	2013-11-19 08:22-08:35	3.912 0.006	4.113 0.42	57.66 0.04	50.12 0.06	51.8 0.05	9.481 0.048	37.34 1.08	3.7 0.23

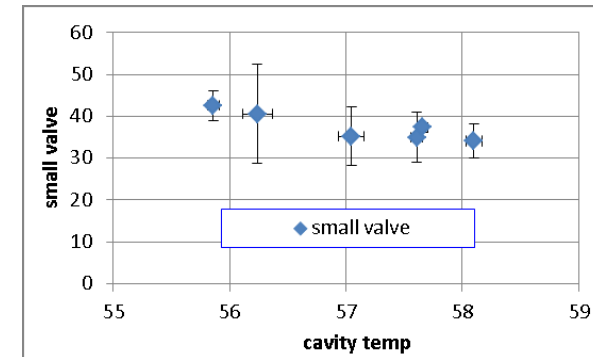
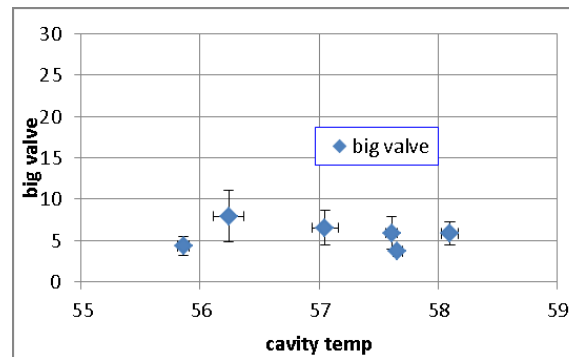
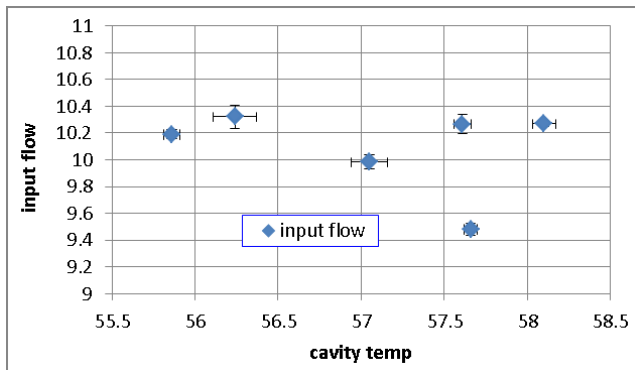
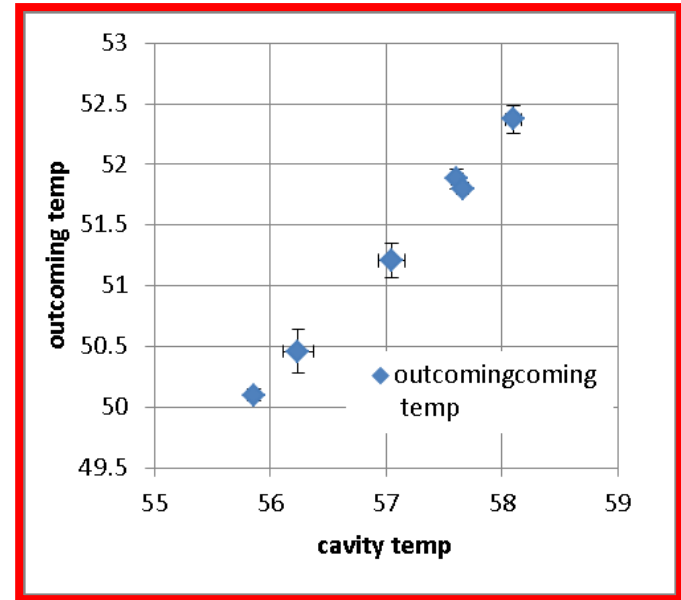
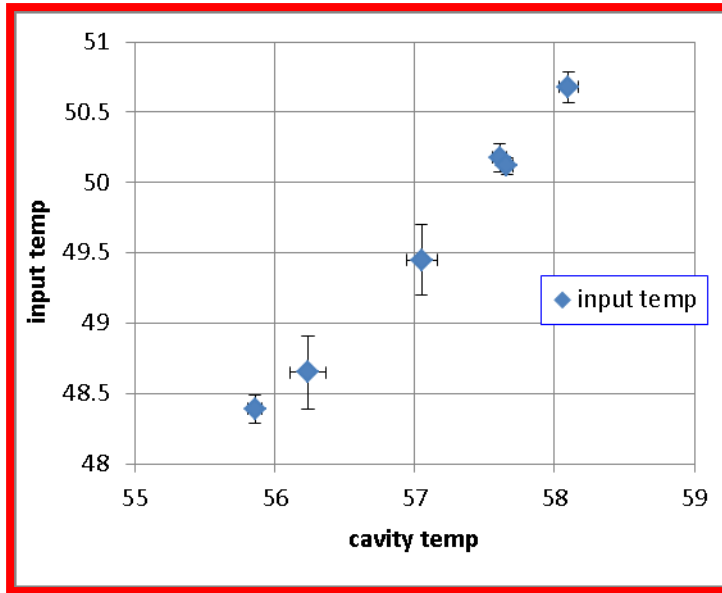
Gun-4.4 Resonance temperature drift investigations

N	time	forw power		reflection		cavity temp		incoming temp		outcomingcoming temp		incoming flow		small valve		big valve	
1	2013-10-27 15:34-15:45	3.779	0.006	3.884	0.42	55.86	0.05	48.39	0.1	50.1	0.05	10.19	0.033	42.55	3.64	4.33	1.1
2	2013-11-01 08:58-09:10	3.799	0.017	3.352	0.95	56.24	0.13	48.65	0.26	50.46	0.177	10.322	0.085	40.54	11.86	7.94	3.14
3	2013-11-04 09:06-09:20	3.794	0.006	4.412	0.59	57.61	0.05	50.18	0.1	51.88	0.08	10.266	0.072	34.94	5.98	5.91	1.96
4	2013-11-08 22:50-23:02	3.839	0.008	4.18	0.75	58.1	0.07	50.68	0.11	52.37	0.11	10.269	0.021	34.08	4.02	5.84	1.36
5	2013-11-13 21:38-21:48	3.876	0.012	3.572	0.92	57.05	0.11	49.45	0.25	51.21	0.14	9.982	0.053	35.21	7	6.53	2.09
6	2013-11-19 08:22-08:35	3.912	0.006	4.113	0.42	57.66	0.04	50.12	0.06	51.8	0.05	9.481	0.048	37.34	1.08	3.7	0.23



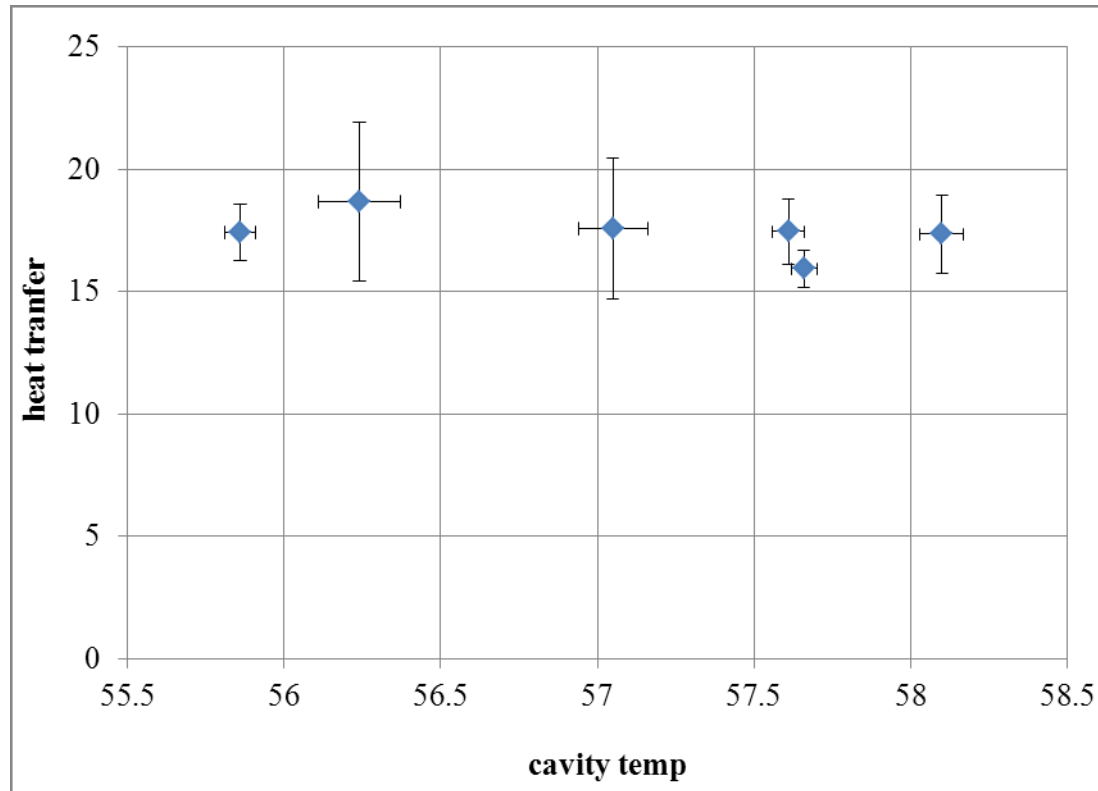
Gun-4.4 Resonance temperature drift investigations

N	time	forw power		reflection		cavity temp		incoming temp		outcomingcoming temp		incoming flow		small valve		big valve	
1	2013-10-27 15:34-15:45	3.779	0.006	3.884	0.42	55.86	0.05	48.39	0.1	50.1	0.05	10.19	0.033	42.55	3.64	4.33	1.1
2	2013-11-01 08:58-09:10	3.799	0.017	3.352	0.95	56.24	0.13	48.65	0.26	50.46	0.177	10.322	0.085	40.54	11.86	7.94	3.14
3	2013-11-04 09:06-09:20	3.794	0.006	4.412	0.59	57.61	0.05	50.18	0.1	51.88	0.08	10.266	0.072	34.94	5.98	5.91	1.96
4	2013-11-08 22:50-23:02	3.839	0.008	4.18	0.75	58.1	0.07	50.68	0.11	52.37	0.11	10.269	0.021	34.08	4.02	5.84	1.36
5	2013-11-13 21:38-21:48	3.876	0.012	3.572	0.92	57.05	0.11	49.45	0.25	51.21	0.14	9.982	0.053	35.21	7	6.53	2.09
6	2013-11-19 08:22-08:35	3.912	0.006	4.113	0.42	57.66	0.04	50.12	0.06	51.8	0.05	9.481	0.048	37.34	1.08	3.7	0.23



Gun-4.4 Resonance temperature drift investigations (incl. HT=heat transfer)

N	time	forw power		reflection		cavity temp		incoming temp		outcomingtemp		incoming flow		small valve		big valve		heat transfer	
		mean	err	mean	err	mean	err	mean	err	mean	err	mean	err	mean	err	mean	err	mean	err
1	2013-10-27 15:34-15:45	3.779	0.006	3.884	0.42	55.86	0.05	48.39	0.1	50.1	0.05	10.19	0.033	42.55	3.64	4.33	1.1	17.4249	1.140673
2	2013-11-01 08:58-09:10	3.799	0.017	3.352	0.95	56.24	0.13	48.65	0.26	50.46	0.177	10.322	0.085	40.54	11.86	7.94	3.14	18.6828	3.25022
3	2013-11-04 09:06-09:20	3.794	0.006	4.412	0.59	57.61	0.05	50.18	0.1	51.88	0.08	10.266	0.072	34.94	5.98	5.91	1.96	17.4522	1.320375
4	2013-11-08 22:50-23:02	3.839	0.008	4.18	0.75	58.1	0.07	50.68	0.11	52.37	0.11	10.269	0.021	34.08	4.02	5.84	1.36	17.3546	1.597876
5	2013-11-13 21:38-21:48	3.876	0.012	3.572	0.92	57.05	0.11	49.45	0.25	51.21	0.14	9.982	0.053	35.21	7	6.53	2.09	17.5683	2.861673
6	2013-11-19 08:22-08:35	3.912	0.006	4.113	0.42	57.66	0.04	50.12	0.06	51.8	0.05	9.481	0.048	37.34	1.08	3.7	0.23	15.9281	0.744868

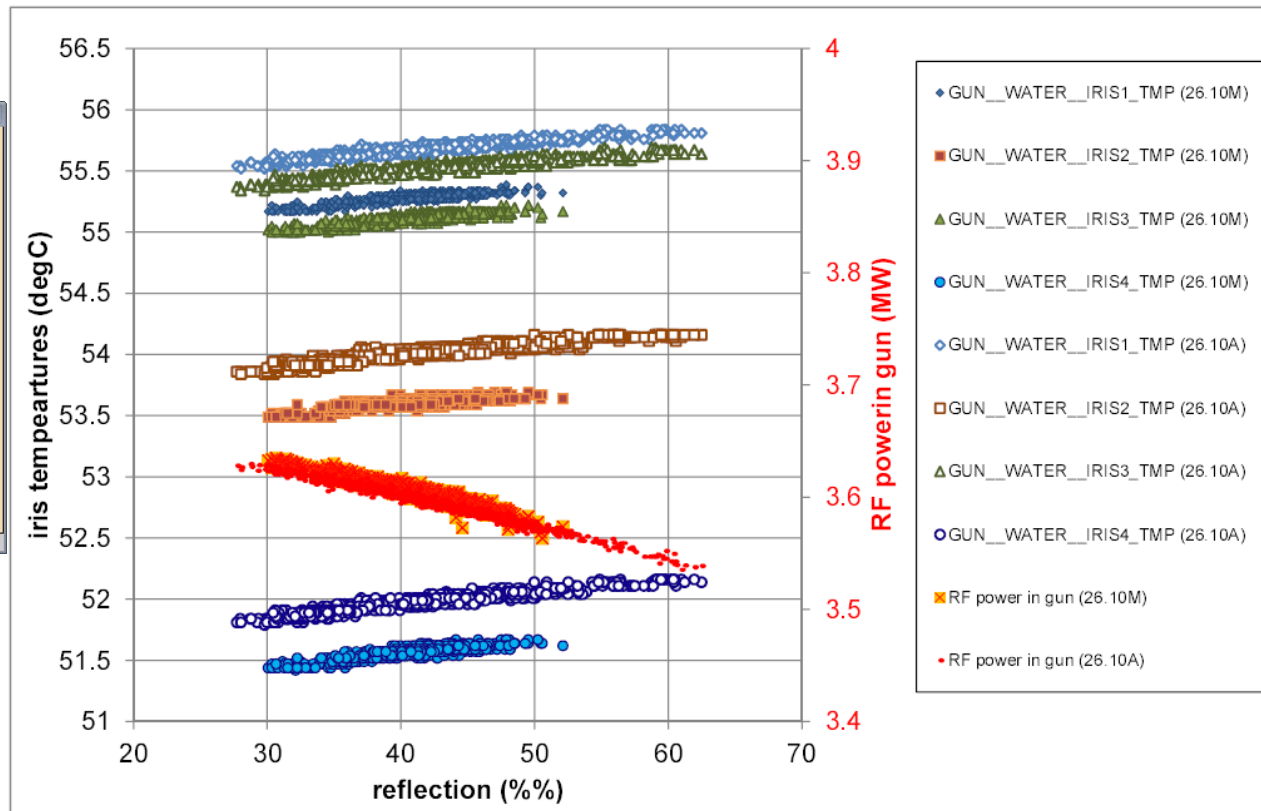
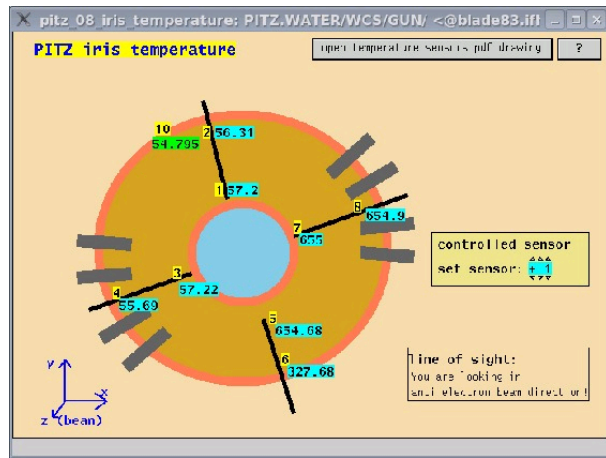


$$HT \propto V_{flow}(T_{out} - T_{in})$$

$$\left(\frac{\delta HT}{HT}\right)^2 = \left(\frac{\delta V_{flow}}{V_{flow}}\right)^2 + \frac{\delta T_{out}^2 + \delta T_{in}^2}{(T_{out} - T_{in})^2}$$

Resonance temperature at various iris sensors

Temperature shift by 0.4 °C detected by all the 4 iris sensors (e.g. 26.10M-A)



Conclusions

- The resonance temperature drift/variation of $\sim 3\text{degC}$ over a month of conditioning seems to be real:
 - The same temperature difference observed at various gun iris sensors
 - There is a direct linear correlation of the gun iris temperature with temperature of input and output water channels
 - Water flow is almost constant for the monitoring measurements
 - Estimated heat transfer is constant within error bars
 - Cathode re-insertion/exchange experiments show that these manipulations cannot explain the observed temperature drift