Use of databases for advanced Quality Control

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Outline

- Quality control: what's included
- Databases: what are they good for?
- Some illustrations
- Conclusions

Quality control

- Is your instrument working properly?
  - Brewer was designed to collect many test data describing the instrument's "health" in addition to any measurement data
  - These tests include
    - Hg – the wavelength reference
    - SL – the spectral response test
    - DT – the linearity test
    - RS – the test for synchronicity of the mechanics and the electronics
    - Many others

How to analyse the test data?

- Look at the daily printouts
  - In most situations you will be looking at normal results, which makes it difficult to notice the beginning of a change in the instrument
- Plot daily averages
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- Use the database approach and set up criteria to define the “good”, the “bad” and the “suspicious” data.
  - Can be run as frequently as you like, even in near-real time
  - Can be configured to only show data that important
  - Highlights data according to your criteria
  - Can send an e-mail warning when a particular problem occurs

Why database?

- Extremely easy to use
- Fast and highly configurable
- No need to read all files every time you want to extract information with different criteria
- The ability to analyse many instruments together

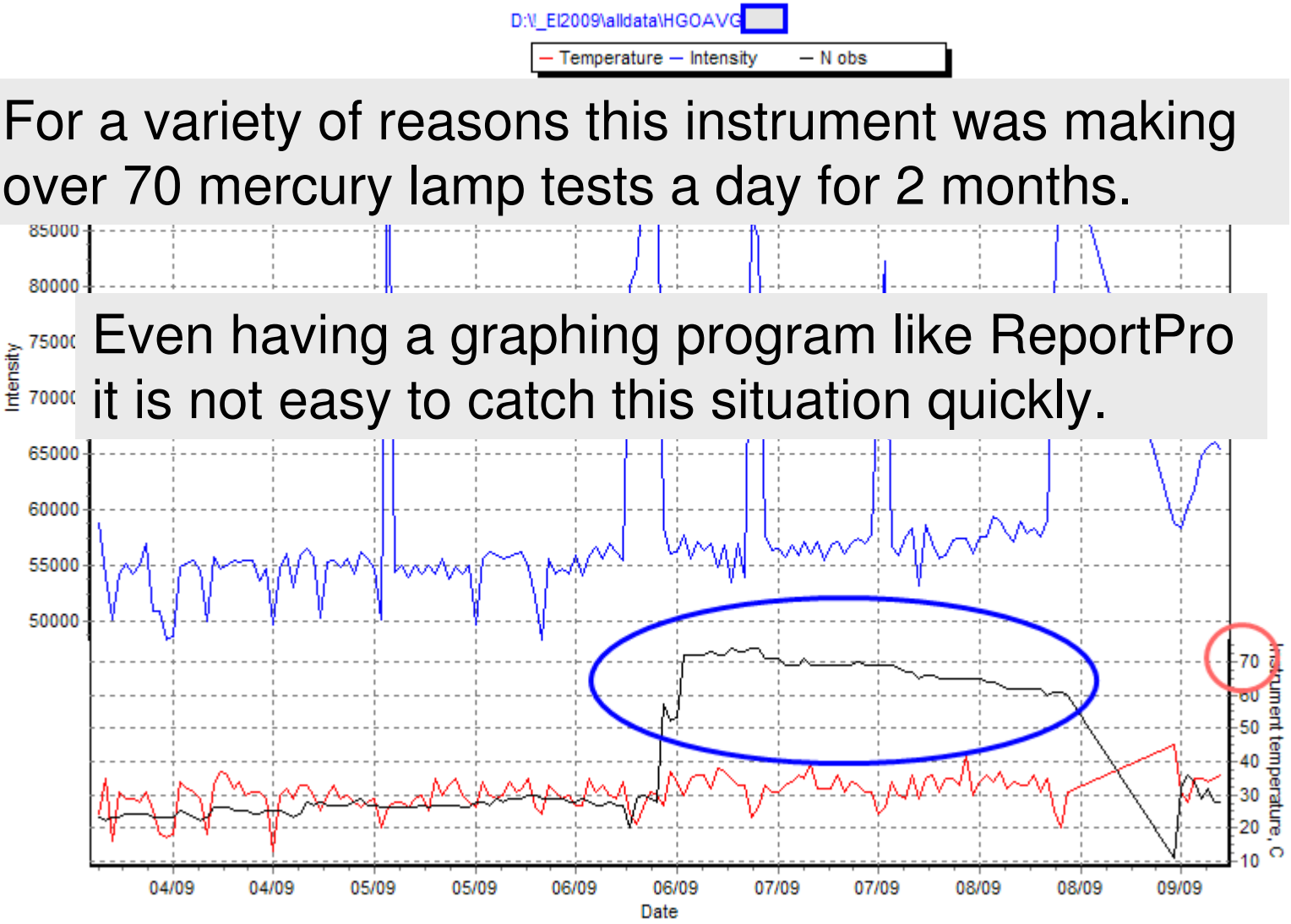
Some examples

- Just a few examples of the database system at work – more will be shown in a separate talk
- Examples are from last week from the Brewer intercomparison at El Arenisillo where we had 17 Brewers

- One Brewer at the campaign had a particularly strange behaviour: both the HG and the SL tests were unstable
- All of the information needed to solve the problem was actually available, but not in the form that is easy to understand

For a variety of reasons this instrument was making over 70 mercury lamp tests a day for 2 months.

Even having a graphing program like ReportPro it is not easy to catch this situation quickly.



Measurements and tests summary.

_jday	_serial	aod	aode	ds	hg	hp ▲	ls	sl	sl	uv	zs
251	#		99	100	24	75			3	2	30
252	#	106		106	32	63			8	5	8
251	#		51	51	35	60			7	16	7
252	#	96		97	33	59			8	4	3
252	#		98	99	31	58			7	7	3
252	#		86	86	35	56			5	8	8
254	#		80	82	30	52			5	6	4
252	#		75	75	29	52			7	3	6
253	#	77		78	32	51			5	5	3
253	#	100		100	27	48			7	14	6
255	#		52	54	32	47		4	7	16	5

Warnings about the number of observations and tests

Fully configurable.
All criteria are in the database tables

Helps with scheduling issues for observations.

Questionable Run/Stop results. (0 sec)

Serial	Jday	slit 0	dark rs	dark counts	slit 1	slit 2	slit 3	slit 4	slit 5 ▾	slits 3+5
	2009256	0.9986	1.1667	112 / 96 (0.9M)	0.9984	0.999	0.9472	0.9983	0.8982	0.9994
	2009256	0.9333	1.2143	17 / 14 (1.4M)	0.8997	0.8999	0.9005	0.8992	0.8995	0.8996
	2009256	1.0001	1.1386	115 / 101 (0.9M)	1.0002	0.9996	0.9998	0.9991	0.9964	1.0005
	2009251	1.0031	0.9787	46 / 47 (0.6M)	0.9998	0.9993	0.9997	0.9999	0.9979	1.0006
	2009253	0.9998	3.4082	167 / 49 (1.6M)	0.9994	0.9998	0.9998	0.9978	0.9979	0.9998
	2009255	0.9958	0.8333	10 / 12 (0.6M)	0.9996	0.9994	0.9999	0.9984	0.998	1.0001
	2009257	0.9988	8.5882	146 / 17 (1.6M)	1.0006	0.9992	0.9988	0.9982	0.9984	1.0009
	2009256	0.9983	0.4	2 / 5 (1.5M)	0.9991	0.9996	0.9996	0.9996	0.9985	1.0012
	2009254	0.9969	1	30 / 30 (0.6M)	1.0004	0.9994	1.0002	0.9995	0.9986	0.999
	2009255	1.0001	3.9302	169 / 43 (1.6M)	1.0001	0.9995	1.0001	0.9988	0.9986	1.0001

Measurements and tests summary.

_jday	_serial	aod	aode	ds	hg	hp	ls	s1	sl	uv ▾	zs
254	#			77	28				8	82	3
253	#			43	20				3	71	4
256	#		113	115	29				8	24	6
255	#			116	34				10	24	6
255	#			68	28	30			7	24	3
256	#			68	29	30			8	24	4

Standard lamp R6 (0 sec)

File name	Count ▾	Serial	Expected (+/-20)	Measured	30-day history
b25009.	1	#	2110	2180	
b25709.	1	#	2110	2174	
b25709.	1	#	2230	2333	
b25409.	1	#	2000	1962	

Standard lamp intensity analysis (0 sec)

Serial	min	max	filter	fixable	30-day history
	258237	382429	0		
	467678	532804	1	yes	
	212596	578919	1	yes	
	626126	657883	0		
	666068	674760	1		
	739986	766279	0		
	760440	778696	0		
	314565	899841	0		

Suspicious HG test results (correlation<0.98 or counts<5000). (0 sec)

Serial	Jday	count	Peak	min.corr.	max.corr. ▲	30-day history
	255	4	15865	0	0.9797	
	252	4	250	0	0.9796	
	254	1	42469	0.9716	0.9716	
	250	1	74650	0.9676	0.9676	
	254	1	168307	0	0	

AP results for MB Brewer. (1 sec)

Serial	Jday	t1 off	t1 on	t2 off	t2 on	t3 off ▾	t3 on	HV off	HV on	+15V off	+15V on	+5V off	+5V on	-15V off	-15V on	+24V off	+24V on	+5V sps off	+5V sps on	-8 sp of
017	2009250	-30.0	-1.7	-30.0	-0.8	-10.8	-1.6	1408.2	1402.7	15.1	15.0	5.0	5.0	-14.9	-14.9	23.6	23.7	4.9	4.9	-8
051	2009251	21.4	21.2	22.1	21.7	21.6	21.2	1490.2	1457.4	14.8	14.3	4.9	4.8	-15.1	-15.0	24.4	25.2	4.6	4.6	-8
051	2009252	22.6	22.5	22.8	22.7	21.8	21.4	1488.4	1464.7	14.8	14.3	4.8	4.8	-15.1	-15.0	24.4	25.1	4.6	4.6	-8
145	2009258	22.6	22.5	23.0	22.8	22.1	22.1	1260.5	1256.8	14.9	14.8	5.1	5.0	-14.9	-14.9	23.6	23.7	5.0	5.0	-7
165	2009258	22.5	22.5	23.0	23.2	22.1	22.1	1337.1	1337.1	14.8	14.8	5.1	5.1	-14.9	-14.9	23.6	23.9	5.1	5.1	-7
070	2009	not a high priority		-10.2	-10.2	23.4	23.4	1446.5	1446.5	14.9	14.9	5.1	5.0	-15.1	-15.1	23.5	23.7	4.9	4.9	-8

Conclusions

- Databases help identifying data quality issues that are difficult to see otherwise
- This database approach has been successfully implemented at the Canadian Brewer Network
- Come to see a more detailed presentation about the organization and the usage of this system

I would like to thank Ken Lamb of International Ozone Services for the opportunity to come to this Workshop.