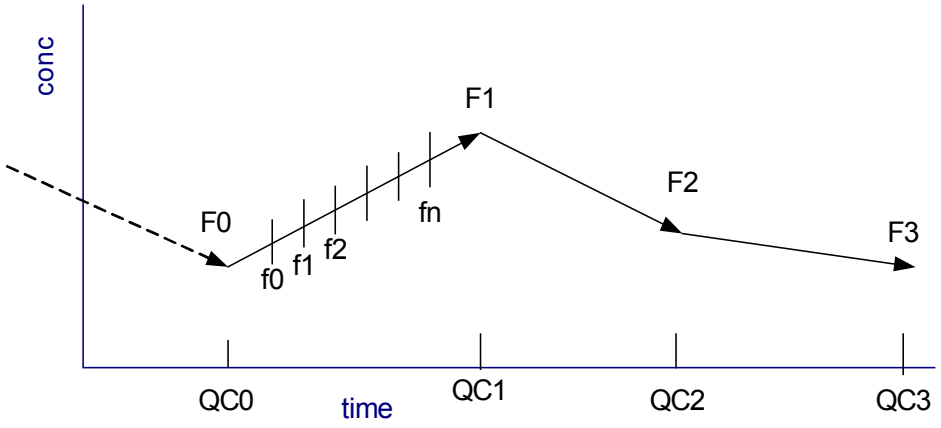
Online Worksheet Notes

How to use Drift Correction, single point

Issue

The primary factors limiting accuracy and precision using Inductively Coupled Plasma Mass Spectrometry (ICP-MS) in matrix-matched external standardization are machine drift and variation of the instrument response as a function of mass. In this case we assume the drift is linear and changes proportional to the time and the sampling. An analytical procedure and an off-line data reduction algorithm have been developed which correct for these variations and produce a significant improvement in analytical accuracy and precision. In this technique, a 'drift correction' standard is analyzed after every group of samples (5 recommended).

The drift correction is calculated from the QC Drift Correction values:



1. Calculation of F_o, F_1, .. F_n

$$F_n = \frac{STD}{QC_n}$$

2. Calculation of the QC factors f_o, f_1, .. f_m

$$f_x = f_{x-1} - \left(\frac{F_1 - F_2}{n} \right)$$

$$n = Tag(QC_2) - Tag(QC_1)$$

n = number of readings between two QC's
F_1 = QC-Factor left from f_x
F_2 = QC-Factor right from f_x
$F_{0=} f_0$ = the first QC factor is the STD/QC factor

This technique assumes that the drift is linear and the elapsed time between tags is constant. In this case, "Tag" is the elapsed time.

STD	10		© by Online Worksheet		
TAG	**SampleID**	**Rd**	**STD/QC**	**fx**	**Rd*fx**
1	QC	10	1.000000	**1.000000**	10.0000
2	Smp-1	5		0.987854	4.9393
3	Smp-2	10		0.975709	9.7571
4	Smp-3	20		0.963563	19.2713
5	Smp-4	30		0.951417	28.5425
6	Smp-5	40		0.939271	37.5709
7	Smp-6	50		0.927126	46.3563
8	Smp-7	60		0.914980	54.8988
9	Smp-8	70		0.902834	63.1984
10	Smp-9	80		0.890688	71.2551
11	Smp-10	90		0.878543	79.0688
12	Smp-11	100		0.866397	86.6397
13	Smp-12	200		0.854251	170.8502
14	Smp-13	500		0.842105	421.0526
15	Smp-14	1000		0.829960	829.9595
16	Smp-15	2000		0.817814	1635.6275
17	Smp-16	3000		0.805668	2417.0040
18	Smp-17	4000		0.793522	3174.0891
19	Smp-18	5000		0.781377	3906.8826
20	QC	13	0.769231	0.769231	10.0000

=D9*F9

=F8-(E8-E27)/(B27-B8)

$$f_x = f_{x-1} - \left(\frac{F_1 - F_2}{n}\right)$$

$$F_n = \frac{STD}{QC_n}$$

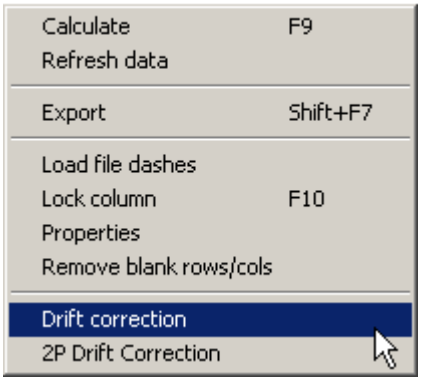
$$n = Tag(QC_2) - Tag(QC_1)$$

assumed the drift is linear and the elapsed time between tags is constant. In this case, "Tag" is the elapsed time.

Solution

Online Worksheet includes two Drift Correction tools

1. Drift Correction, where only one DC-QC is used through the run
2. Two point drift correction, where two DC-QC's are used through the run. This method is not discussed in this note.



In order to run the drift correction, the Worksheet file needs to be configured in a predefined format. The worksheet needs this format to know from where to load the DC-STD (Drift standard sample) and the subsequent DC-QC (Drift QC samples).

Configure a worksheet where the DC-STD (Drift standard) is on the first row. The DC-STD should start with a '~' character (NOS: non-sample flag).

ICP0001-SEP02.WSH

Sample ID	A r@Au ppm	B Au-DC ppm	C Au-COR ppm	D COMMENT
1 ~+STD-L		10.000		Drift standard, can be a OnLQC STD
2 +Wash 1		2.000		
3 +Wash 1		3.000		
4 QT09		12.000		
5 +STD-L		10.00		1th QC run of drift standard
6 smp 1	4.94	5.000	4.940	
7 smp 2	9.76	10.000	9.762	
8 smp 3	19.28	20.000	19.286	
9 smp 4	28.57	30.000	28.571	
10 smp 5	37.62	40.000	37.619	
11 smp 6	46.43	50.000	46.428	
12 smp 7	55.00	60.000	55.000	
13 smp 8	63.33	70.000	63.333	
14 smp 9	71.43	80.000	71.428	
15 smp 10	79.28	90.000	79.286	
16 smp 11	86.90	100.000	86.905	
17 smp 12	171.43	200.000	171.428	
18 smp 13	422.62	500.000	422.619	
19 +STD-L	10.00	12.00	10.00	2nd QC run of drift standard

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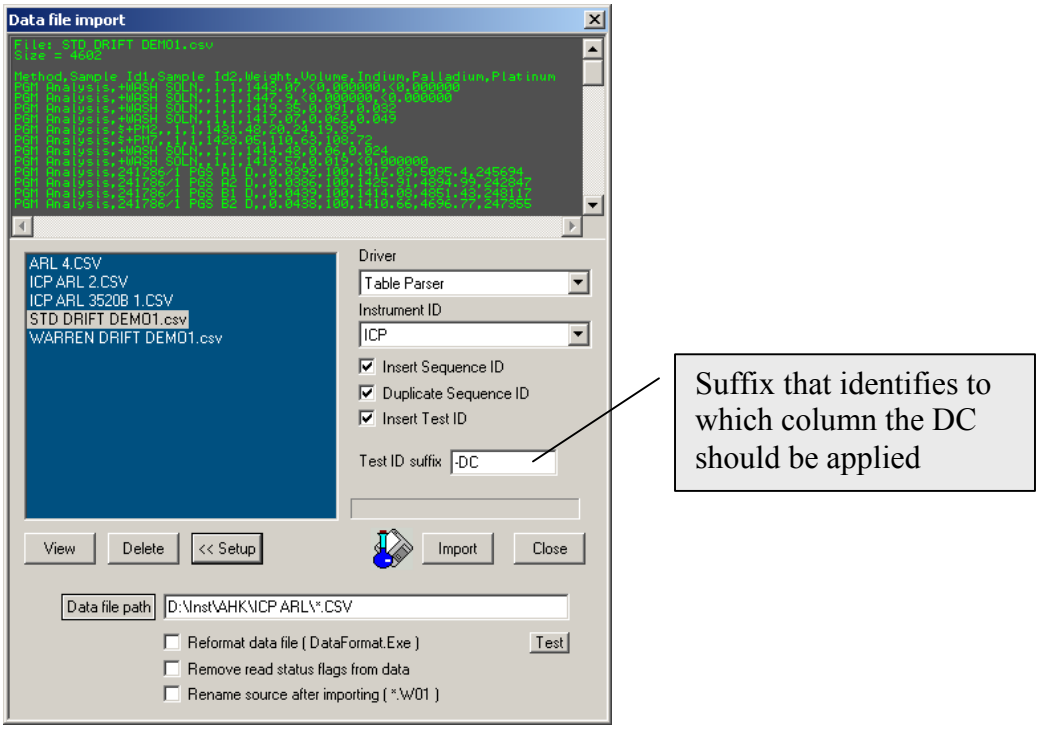
Drift QC standard

Column inserted by the DC tool

The column header (Test ID's) where the drift correction should be applied must have the '-DC' suffix. When importing large batches from an ICP run, use the Test ID suffix from the import dialog, as shown in the figure below. When running the DC a column is automatically inserted to the right of the column identified with the '-DC'. The new column ID will have a '-COR' suffix and this column will include all drift corrected data.



All subsequent DC-QC (drift control samples) should match exactly the DC-STD entered in the first row of the worksheet but without the '~' character. We recommend inserting a DC-QC each 5 samples to get a higher precision.

Conclusion

The advantage of the drift correction tool is that the data accuracy is improved after the run, saving a lot of time on ICP's runs. Because the DC-column is inserted right beside the instrument source data column, the technician is free to decide how to proceed.

The next screen shot shows a worksheet after the classical drift correction has been applied to an ICP run.

ICP0001-OCT02.WSH

Sample ID	A Palladium-DC	B Palladium-COR	C Platinum-DC	D Platinum-COR
1 ~+PM7	27500		27000	
2 +PM7	27650		27250	
3 241786/1 PGS	5095.4	5064.9	245694	243324
4 241786/1 PGS	4894.99	4862.97	242847	240390
5 241786/1 PGS	4851.43	4816.99	248117	245490
6 241786/1 PGS	4696.77	4660.81	247355	244620
7 241786/1 PGS	4622.03	4584.06	240873	238096
8 241786/1 PGS	---	---	244593	241658
9 +PM7	27759	27500	27341	27000
10 242029/1 PGM	490466	485249	160547	158076
11 242029/1 PGM	492083	486206	162262	159291
12 242029/1 PGM	488772	482296	161126	157706
13 242029/1 PGM	491828	484669	161635	157732
14 242029/1 PGM	487936	480196	160953	156597
15 242029/1 PGM	492764	484303	162380	157512
16 242029/1 PGM	490622	481557	163501	158122
17 +PM7	28055	27500	28003	27000
18 241999/1 A1 D	H497862	H497862	167617	161472
19 241999/1 A2 D	H503186	H503186	170251	163865
20 241999/1 A3 D	H499261	H499261	167781	161346
21 241999/1 B1 D	H502394	H502394	169123	162493
22 241999/1 B2 D	H502907	H502907	168646	161892
23 241999/1 B3 D	H500440	H500440	167569	160717
24 +PM7	28132	27500	28176	27000

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