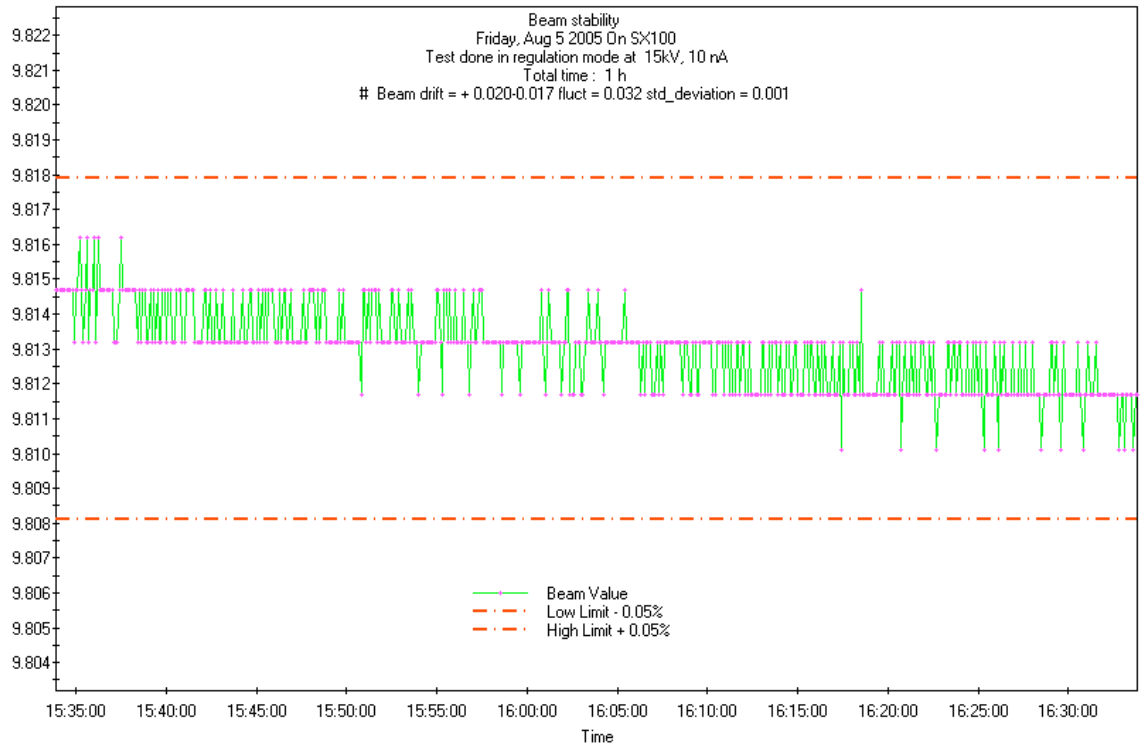
University Of Oregon

Additional Specifications

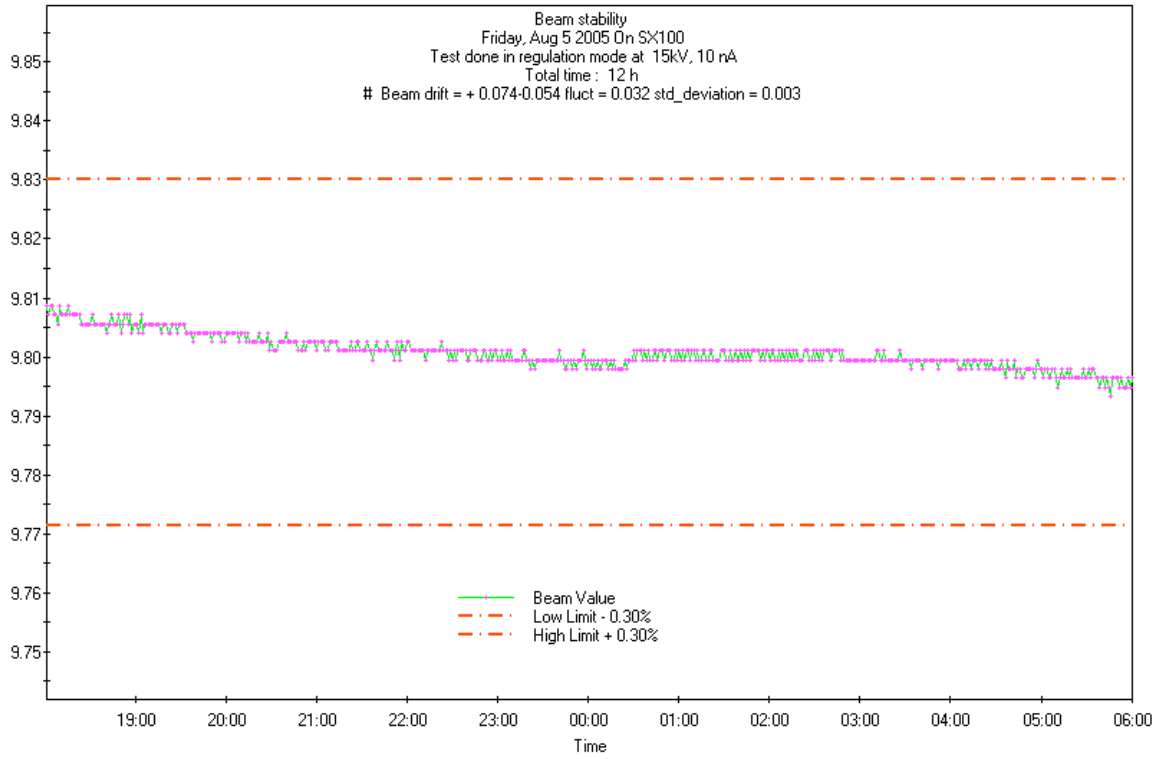
13.1.1 Beam current stability 0.1% or less per hour (+/- 0.05%) and 0.6% or less per 12 hours (+/- 0.3%) and 1.0% or less in 24 hours (+/- 0.5%) as measured at 15KeV and 10nA while repeatedly inserting the faraday cup approximately once per minute.

+/- 0.5% per hour at 15keV 10nA
+/- 0.3% per 12 hours at 15keV 10nA

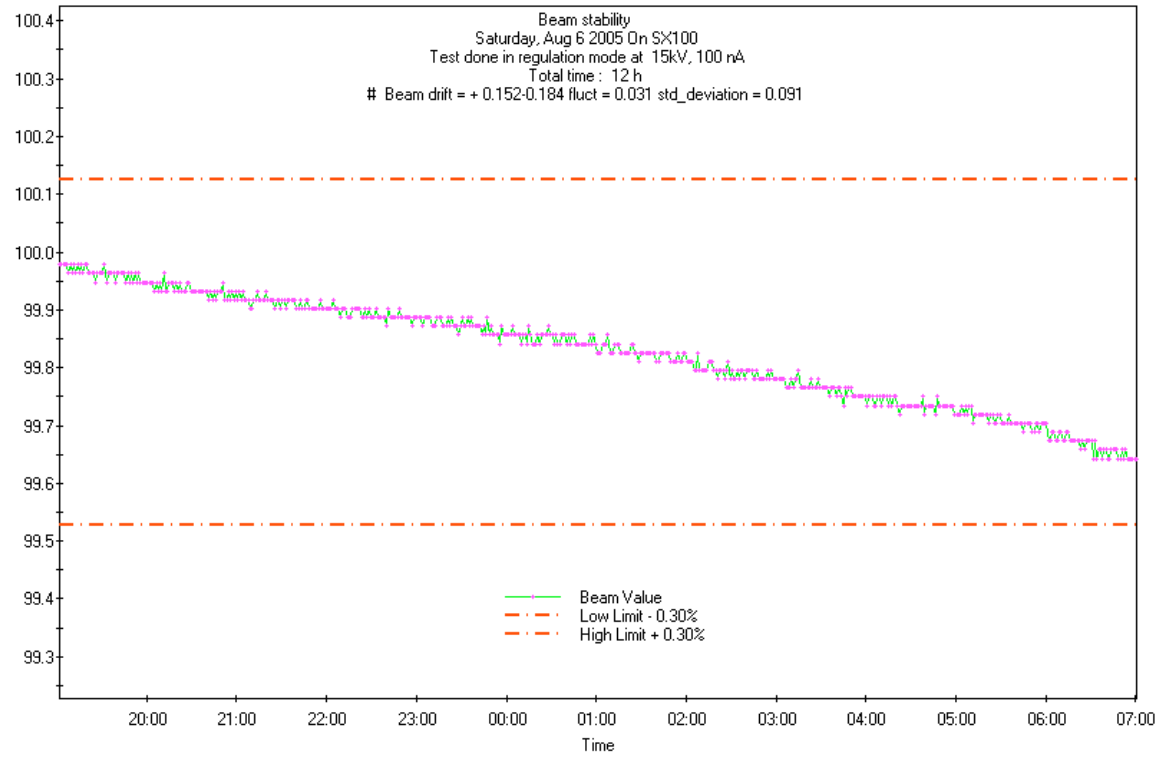
Beam current stability @ 15keV 10nA during 1 hour



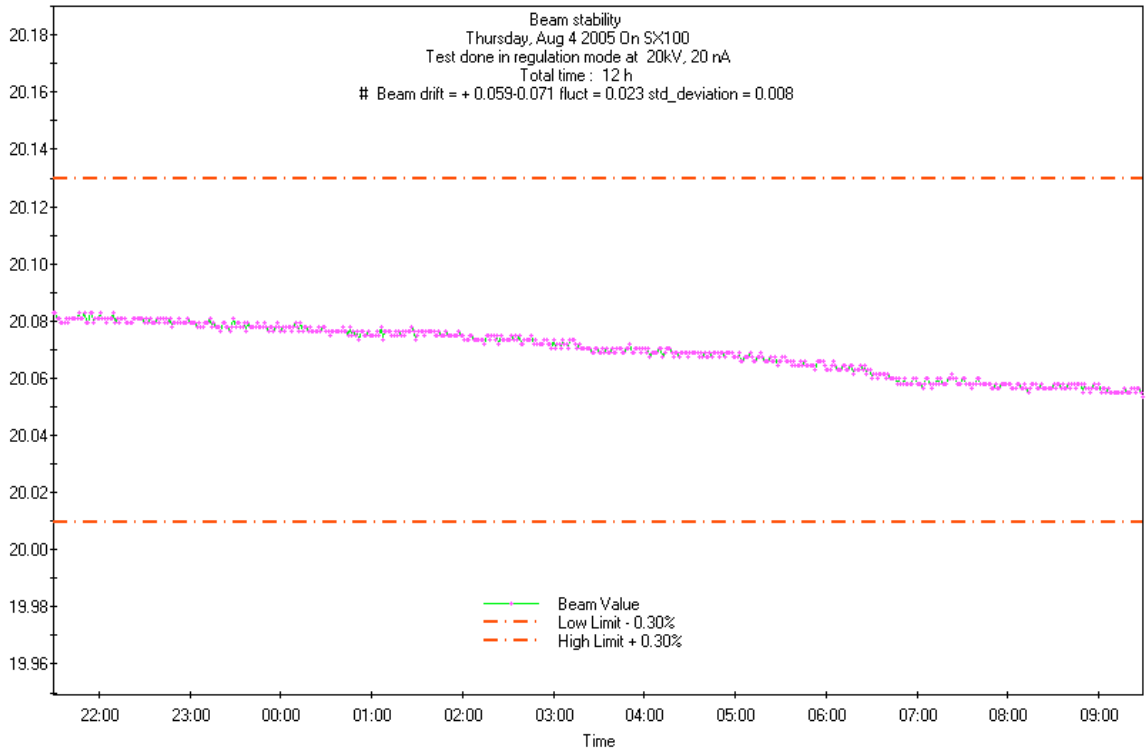
Beam current stability @ 15keV 10nA during 12 hours



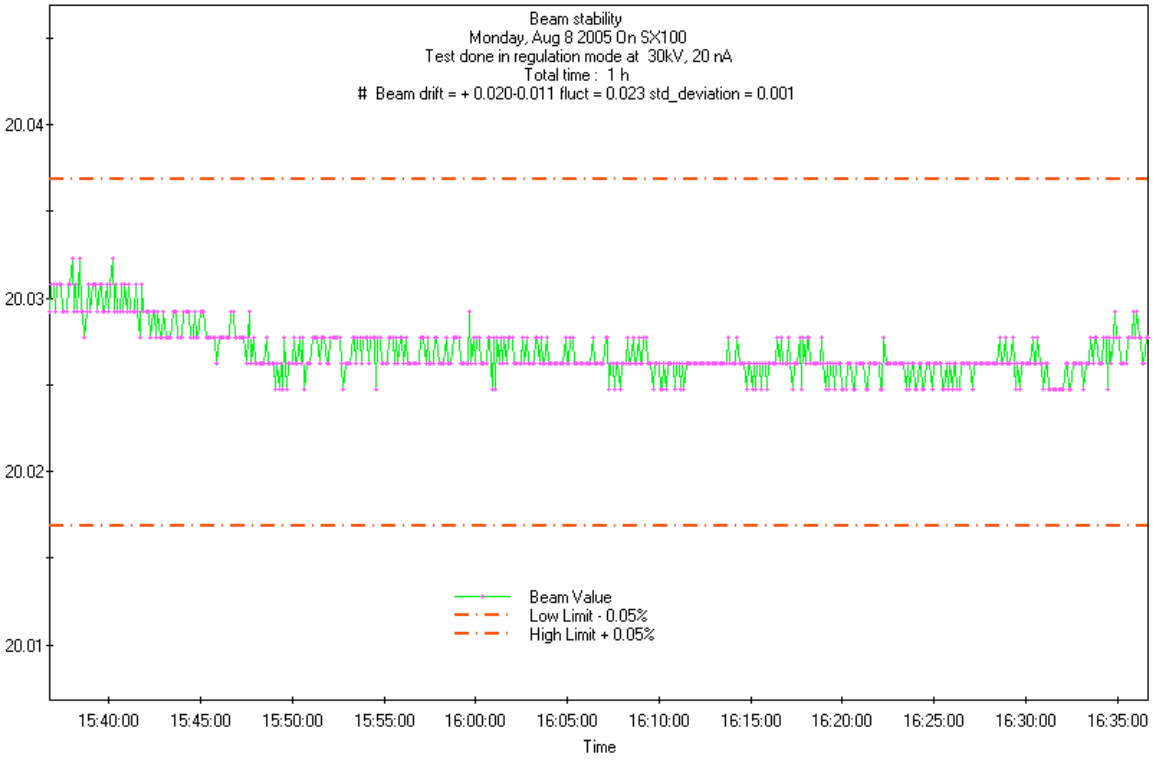
Beam current stability @ 15keV 100nA during 12 hours



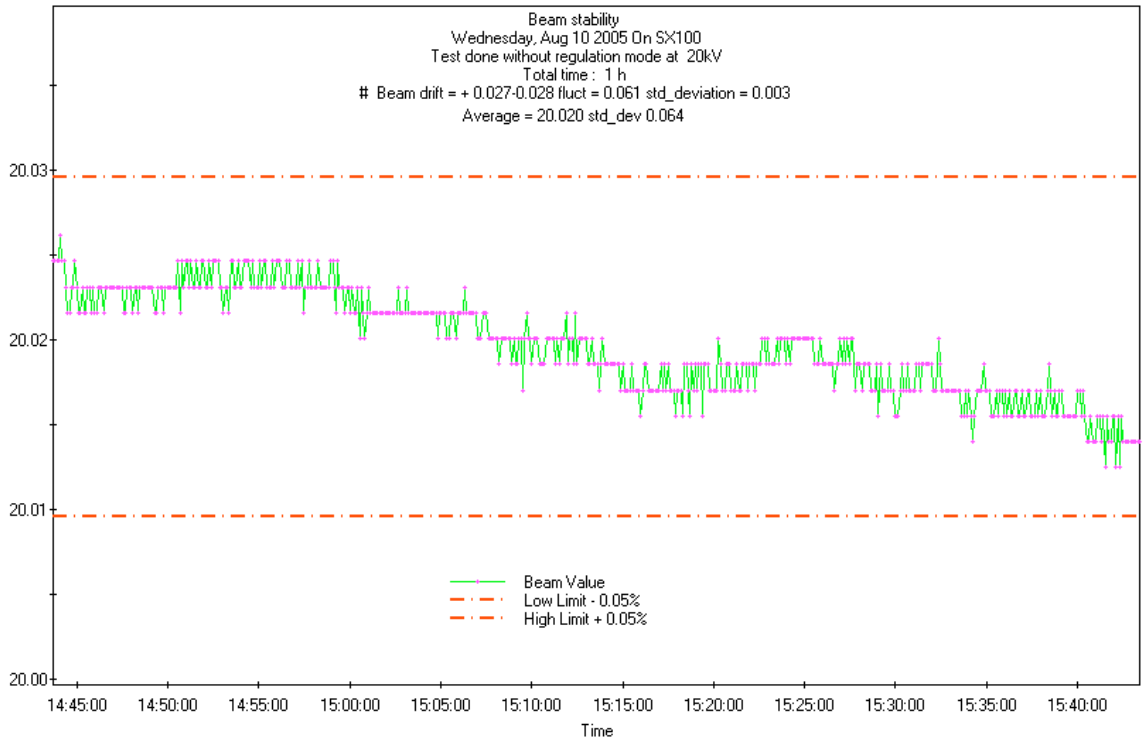
Beam current stability @ 20keV 20nA during 12 hours



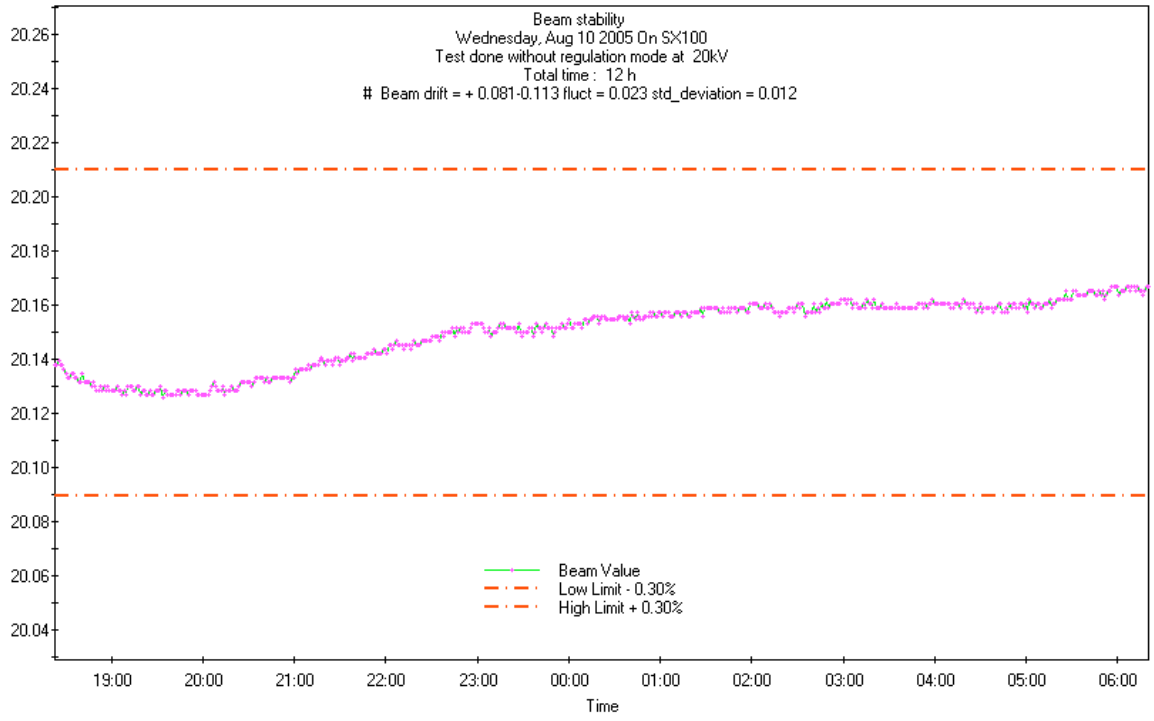
Beam current stability @ 30keV 20nA during 1 hour



Beam current stability Without Regulation @ 20keV 20nA during 1 hour



Beam current stability Without Regulation @ 20keV 20nA during 12 hours



13.2.5 Stray beam measured using a 100 micron W or Mo aperture target in a Ti target block to produce W or Mo Lα and Ti Kα k-ratios (both EDS and WDS) less than 0.0001 (0.01wt% or 100ppm) using a 100 nA beam and at operating voltages from 5 KeV to 30 KeV.

Never been measured at CAMECA. Not guaranteed.

Using LiF crystals on W Lα.

50 nA - 60s		LLIF - Spectro 3			LIF - Spectro 5		
		Bg-	**Peak**	**Bg+**	**Bg-**	**Peak**	**Bg+**
11 keV	**W**	15146	59037	14570	3759	14787	3806
	W aperture	13	43	31	30	41	39
15 keV	**W**	44155	833032	37780	8652	210032	8693
	W aperture	20	22	15	35	44	32
20 keV	**W**	97211	2357226	79372	16823	636246	17183
	W aperture	31	12	22	40	35	29
25 keV	**W**	141486	3567559	111677	22828	1024338	23777
	W aperture	13	34	31	37	26	55
30 keV	**W**	196537	4823920	154607	30335	1488699	31030
	W aperture	25	23	39	29	71	85

Ratio = W aperture Values / W Values

	LLIF			LIF		
	Bg-	**Peak**	**Bg+**	**Bg-**	**Peak**	**Bg+**
11 keV	0.000858	0.000728	0.002128	0.007981	0.002773	0.010247
15 keV	0.000453	0.000026	0.000397	0.004045	0.000209	0.003681
20 keV	0.000319	0.000005	0.000277	0.002378	0.000055	0.001688
25 keV	0.000092	0.000010	0.000278	0.001621	0.000025	0.002313
30 keV	0.000127	0.000005	0.000252	0.000956	0.000048	0.002739
Average	0.000370	0.000155	0.000666	0.003396	0.000622	0.004134

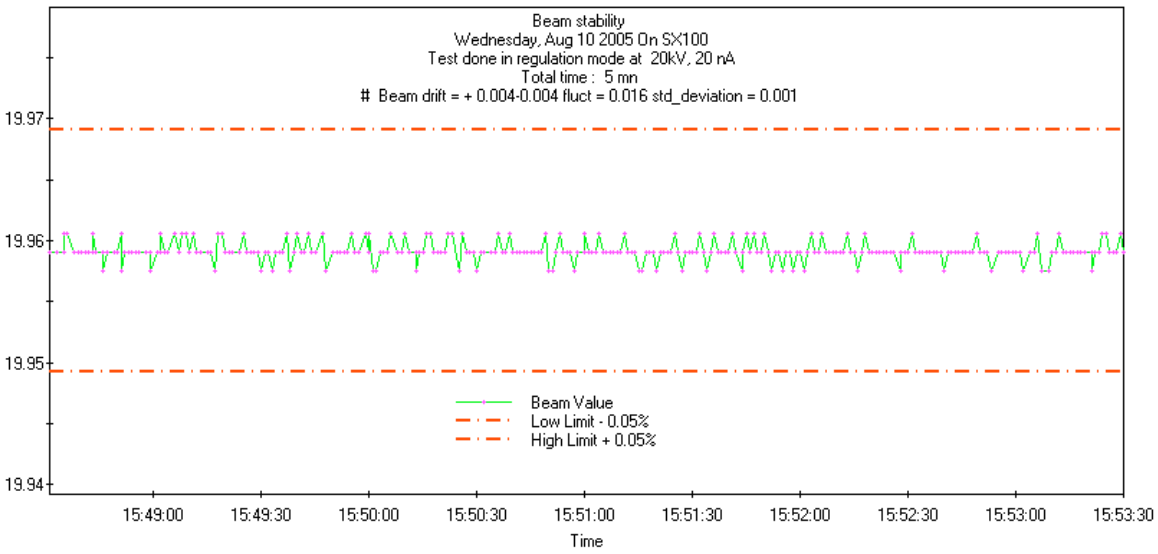
Ratio = W aperture Values / W Values
(Peak – Bg-)

	LLIF	LIF
11 keV	**0.000684**	**0.000997**
15 keV	**0.000003**	**0.000045**
20 keV	**0.000008**	**0.000008**
25 keV	**0.000006**	**0.000011**
30 keV	**0.000000**	**0.000029**

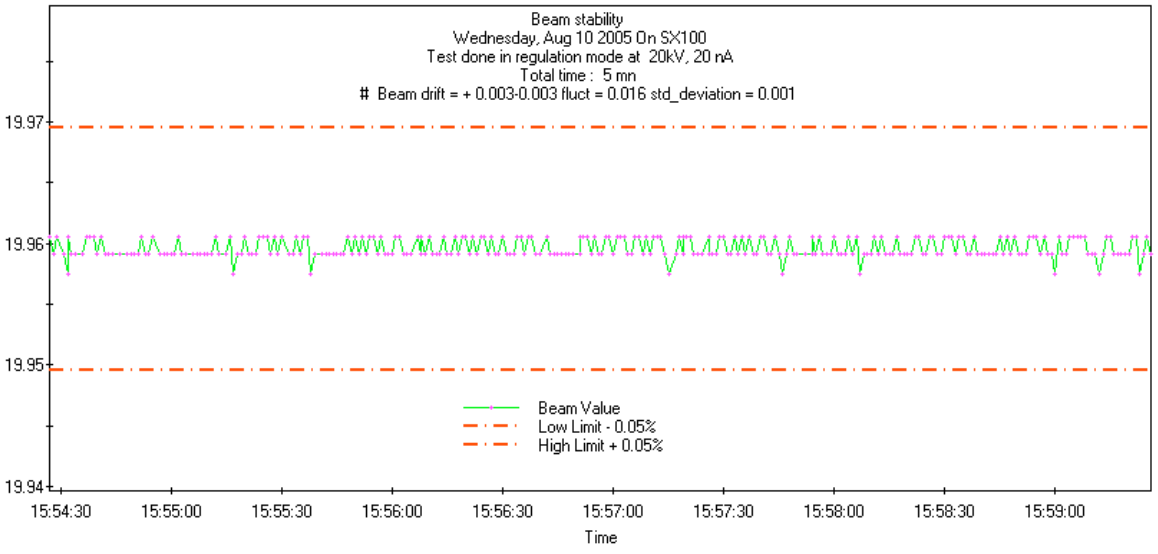
13.2.7 Beam current shall not change more than 0.5% (+/- 0.25%) and the SE image shall not vibrate or shift more than +/- 1 micron while the Spectrometers are driven over their full range when a point of interest is viewed under SE at 10,000X

Comply

<u>Beam current stability without spectrometers movements</u>

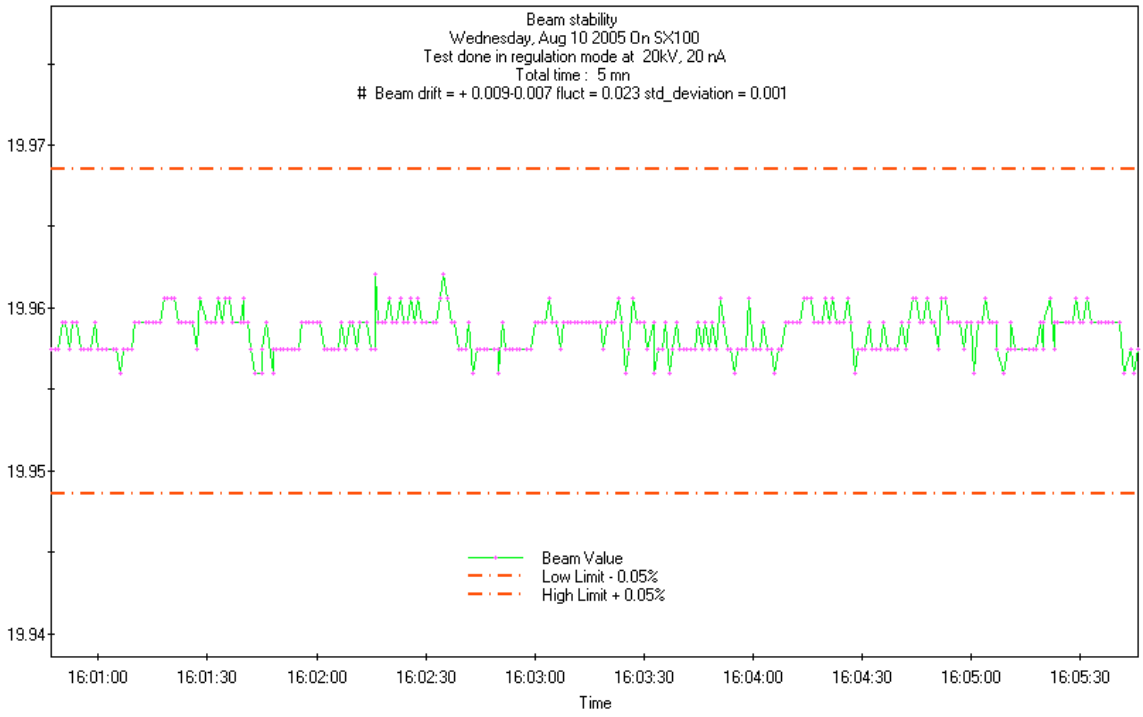


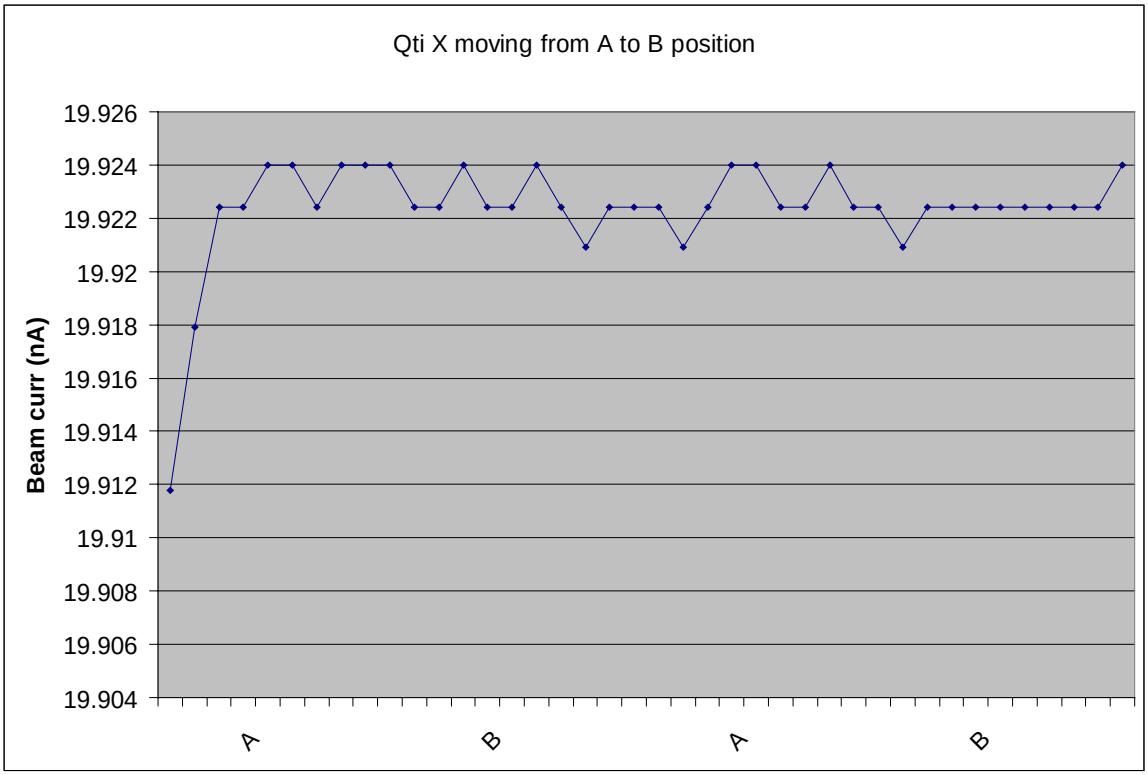
<u>Beam current stability with spectrometers movements</u>

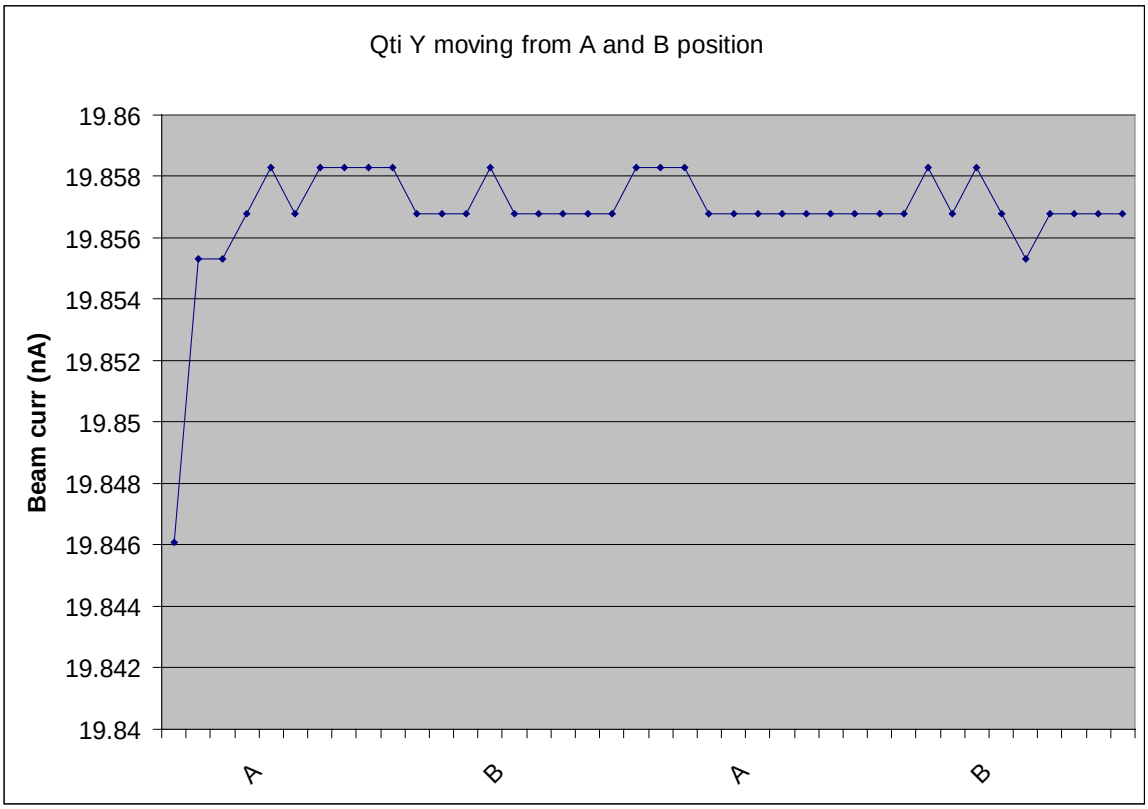


13.2.10 The beam monitoring aperture (faraday) current variation shall be less than 0.3% (+/- 0.15%) when measured on both a pure carbon sample and on a pure Fe sample at both 10KeV and 25KeV @ 50nA beam current and enough replicate measurements to achieve sufficient precision.
The stage position (stepper motor winding circuits) shall have an effect on the beam current of less than 0.1% (+/- 0.05%),

Beam stability when moving to C and Fe



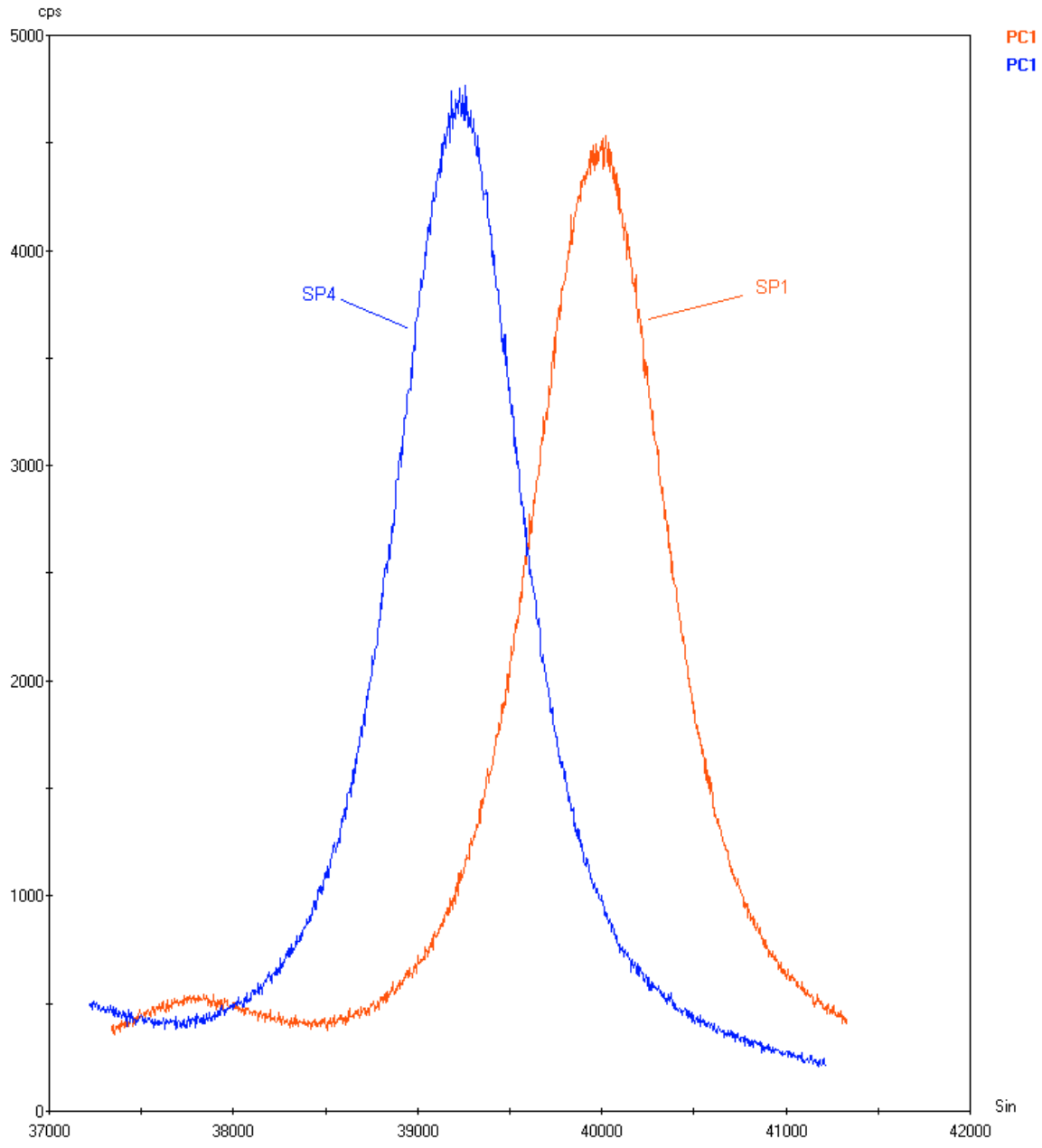

Qti X moving from A to B position
Beam curr (nA)
19.926
19.924
19.922
19.92
19.918
19.916
19.914
19.912
19.91
19.908
19.906
19.904
A
B
A
B

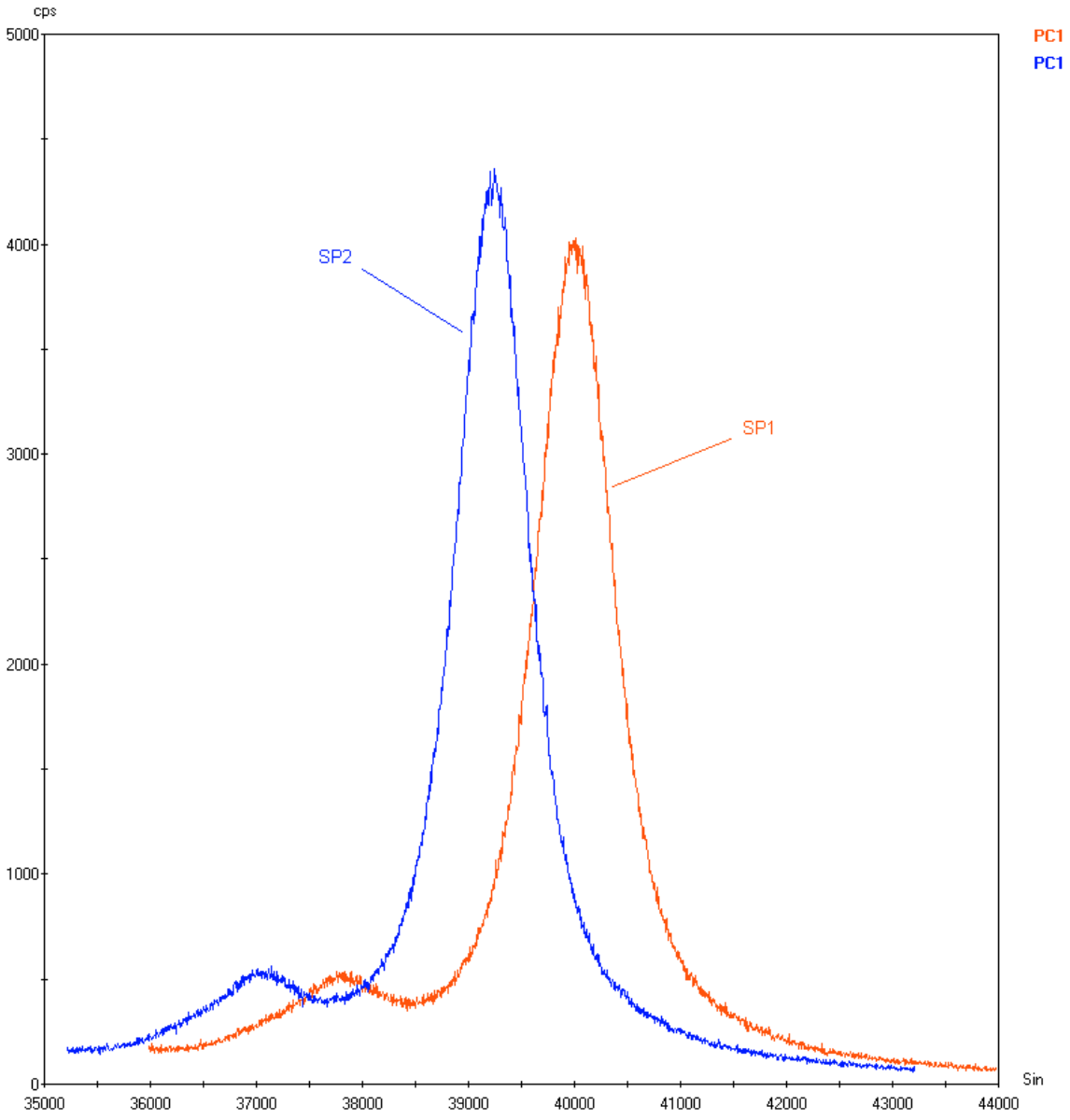

Qti Y moving from A and B position
Beam curr (nA)
19.86
19.858
19.856
19.854
19.852
19.85
19.848
19.846
19.844
19.842
19.84
A
B
A
B

13.3.3 All synthetic multi-layer “crystals” must be optimized for reduction of higher order reflections and minimize production of “fringe” reflections from “front to back” diffractions

We do not control this parameter but have not observed such "fringe" reflections.

<u>1 hour WDS spectra with PC1 on SP1 and SP4</u>




cps
5000
4000
3000
2000
1000
0
35000
36000
37000
38000
39000
40000
41000
42000
43000
44000
Sin
PC1
PC1
SP2
SP1

13.3.8 Reproducibility of Spectrometer repeatability shall meet the following criteria using the LiF, PET and TAP crystals measuring Fe and Ca on LiF, Si and Ca on PET, and Mg and Si on TAP using 15 KeV and 30 nA beam current:

- With no detector slits or wide open slits, first determine the peak location and the location at one-half the maximum (either side) for each pair of elements on each crystal,
- Count for a period of time sufficient to achieve 0.5% relative standard deviation,
- Detune the Spectrometer, position the Spectrometer to the peak of element 1, position to the location at one-half maximum for element 1, position to the peak of element 2, position to the location at one-half maximum of element 2.
  Repeat 100 times from different starting points on the Spectrometer.
  The peak intensities shall vary by less than 0.6% (+/- 0.3%) with 99% confidence levels from the previous set and the one-half the maximum intensities shall vary by less than 1.2% (+/- 0.6%) at 99% confidence levels without a backlash or re-peak procedure.

+/- 0.5% with backlash but without re-peak

- Execute a crystal change (returning to the original crystal) on each Spectrometer and immediately repeat the test in the paragraph above, Verify that the intensities measured vary less than 2% (+/- 1%) with 99% confidence levels from the previous set without a backlash or re-peak procedure;

This has not been so measured at CAMECA. We cannot guarantee this performance.

	Spectrometer moves from Fe to Ca to Fe …			
Integral mode	**LLIF - SP3**		**LIF - SP5**	
Fe Standard	15 kV - 30 nA		15 kV - 100 nA	
& Andradite	**Fe** (30s)	**Ca** (100s)	**Fe** (20s)	**Ca** (120s)
Half Peak Position	**48 030**	**83 330**	**48 030**	**83 340**
1	219389	204368	212832	117223
2	217110	204008	214240	116537
3	218806	201426	210751	115476
4	218609	203259	214776	116579
5	217356	203528	209733	117186
6	218372	203784	213227	115983
7	218428	203861	212687	116197
8	220480	204980	213540	114799
9	218321	206131	216229	115915
10	220861	205709	216110	116492

Average	218773.2	204105.4	213412.5	116238.7
Std Dev	1199.01	1329.576	2089.374	742.4825
Std Dev %	**0.548**	**0.651**	**0.979**	**0.639**

	Spectrometer moves from Ca to Si to Ca …			
Integral mode	**PET - SP1**		**PET - SP4**	
Both on Andradite	15 kV - 100 nA		15 kV - 100 nA	
5um Beam Size	**Ca** (30s)	**Si** (100s)	**Ca** (30s)	**Si** (100s)
Half Peak Position	**38 320**	**81 320**	**38 320**	**81 380**
1	266240	246948	217488	249553
2	263319	248216	213627	251066
3	261884	251780	215082	255326
4	264312	250845	217745	254607
5	261697	250770	216250	254744
6	263302	252294	216727	256518
7	264472	253941	216474	255146
8	264672	252687	216758	255042
9	263654	253327	215138	256407
10	261781	253204	212145	257194

Average	263533.3	251401.2	215743.4	254560.3
Std Dev	1467.694	2277.608	1766.004	2418.901
Std Dev %	**0.557**	**0.906**	**0.819**	**0.950**

	Spectrometer moves from Ca to Si to Ca …			
Integral mode	**LPET - SP2**		**LPET - SP3**	
Both on Andradite	15 kV - 30 nA		15 kV - 30 nA	
5um Beam Size	**Ca** (30s)	**Si** (60s)	**Ca** (30s)	**Si** (120s)
Half Peak Position	**38 330**	**81 420**	**38 330**	**81 390**
1	185494	206944	197529	180360
2	183965	206045	195600	179630
3	183206	202377	194533	179755
4	183831	208001	193351	180539
5	184814	206111	196006	182157
6	182264	205911	196141	179964
7	189305	206965	196133	179641
8	186433	208709	196023	181586
9	185713	208226	199351	183200
10	190330	205900	198405	181388

Average	185535.5	206518.9	196307.2	180822
Std Dev	2583.209	1782.194	1756.726	1216.78
Std Dev %	**1.392**	**0.863**	**0.895**	**0.673**

	Spectrometer moves With turret double flip and back to Ca …	
Integral mode	**PET - SP1**	**PET - SP4**
On Andradite	15 kV - 100 nA	15 kV - 100 nA
5um Beam Size	**Ca** (30s)	**Ca** (30s)
Half Peak Position	**38 320**	**38 320**
1	271987	227958
2	274750	222141
3	271507	225177
4	269217	219679
5	264659	221081
6	268068	216967
7	262155	223289
8	267135	219148
9	269037	220483
10	264872	225122

Average	268338.7	222104.5
Std Dev	3815.619043	3315.084388
Std Dev %	**1.422**	**1.493**

	Spectrometer moves With turret flip and back to Ca …	
Integral mode	**LPET - SP2**	**LPET - SP3**
On Andradite	15 kV - 30 nA	15 kV - 30 nA
5um Beam Size	**Ca** (30s)	**Ca** (30s)
Half Peak Position	**38 330**	**38 330**
1	171354	383520
2	169408	381311
3	167313	381142
4	174607	389229
5	173054	388462
6	171567	390247
7	171546	390097
8	172486	387160
9	170097	390682
10	168550	391850

Average	170998.2	387370
Std Dev	2189.083816	3968.876303
Std Dev %	**1.280**	**1.025**

	Spectrometer moves With turret flip and back to Fe …	
Integral mode	**LLIF - SP3**	**LIF - SP5**
On Fe standard	15 kV - 30 nA	15 kV - 30 nA
5um Beam Size	**Fe** (30s)	**Fe** (60s)
Half Peak Position	**48 040**	**48 040**
1	244853	224365
2	241610	221979
3	233264	226892
4	238978	221060
5	236625	219033
6	234400	222010
7	232931	220452
8	237200	221646
9	236013	223093
10	233547	223662

Average	236942.1	222419.2
Std Dev	3903.746475	2209.407804
Std Dev %	**1.648**	**0.993**

13.3.9 Agreement of simultaneous k-ratios between all WDS Spectrometers on the same sample relative to the same standard must be better than 0.5% (+/- 0.25%) for major elements concentrations when a counting period sufficient to achieve 0.2% relative standard deviation or better is used at 15 keV.
It is desired that the k-ratios agree within 0.3% (+/- 0.15%) for all TAP crystals when using a counting period sufficient to achieve 0.1% relative standard deviation or better is used at 15keV

This has not been so measured at CAMECA. We cannot guarantee this performance.

Using Si Ka with PET crystals

Andadite

Point	Si Ka (cps/nA)	Si Ka (cps/nA)	Si Ka (cps/nA)	Si Ka (cps/nA)	Si Ka (cps/nA)
1	52.5022	211.0686	16.328	59.0115	25.3866
2	52.6185	211.4812	15.9393	58.8208	25.2608
3	52.6239	211.9915	15.9848	58.9505	25.1451
4	52.6546	211.7716	16.1593	59.0897	25.4559
5	52.7315	211.2253	15.9892	59.2129	25.281
6	52.5165	211.3896	16.0412	58.7468	25.2497
7	52.646	211.1251	16.084	59.172	25.3556
8	52.5717	211.2227	16.245	58.7067	25.1828
9	52.6268	210.8153	16.136	58.7412	25.1755
10	52.3541	211.9795	16.1906	59.0808	25.0775
11	52.3958	211.4517	15.9659	58.9323	25.3159
12	52.3895	211.0632	15.9797	58.7241	25.2978
13	52.8435	211.4458	16.0755	58.9543	25.1166
14	52.4733	210.9376	16.0834	59.079	25.0855
15	52.6608	211.4162	16.061	59.1035	25.221
16	52.6766	210.8315	15.7266	58.8579	25.3002
17	52.7012	211.1094	15.6739	59.2903	25.1921
18	52.5109	210.8986	16.0084	58.9473	25.246
19	52.7671	211.275	16.1498	59.0615	25.1774
20	52.7988	211.058	15.9877	59.0242	25.1965

Diopside

Point	Si Ka (cps/nA)	Si Ka (cps/nA)	Si Ka (cps/nA)	Si Ka (cps/nA)	Si Ka (cps/nA)
1	83.3229	333.576	26.6669	91.6906	40.0571
2	82.9919	332.8943	26.0331	91.9883	39.6937
3	82.8993	333.1309	26.235	91.7409	39.9654
4	82.6911	333.4957	25.6568	91.6141	40.0843
5	82.4992	333.0226	26.3249	91.7364	39.6547
6	83.2921	332.5999	25.6758	91.4635	39.5855
7	82.8506	332.5864	25.3721	91.8832	39.8837
8	82.9578	333.6149	25.9968	91.9055	39.8195
9	83.1927	333.5108	26.1343	91.6498	39.7743
10	83.2254	332.8226	26.4308	91.615	39.9793
11	83.139	333.4447	26.1159	91.3628	39.909
12	83.215	332.7283	25.6719	91.4107	39.7599
13	83.082	332.8576	24.6976	91.876	39.659
14	83.1589	332.1676	24.5445	91.5127	39.6638
15	83.2131	332.7791	24.9508	91.442	39.6933
16	83.1141	332.734	25.0552	91.4792	39.7402
17	82.9231	332.8387	25.04	91.1855	39.8512
18	83.4675	333.2034	24.045	91.264	39.7514
19	82.9379	333.0551	24.1299	91.2705	39.8058
20	83.2425	333.3026	24.3509	91.1793	39.8361

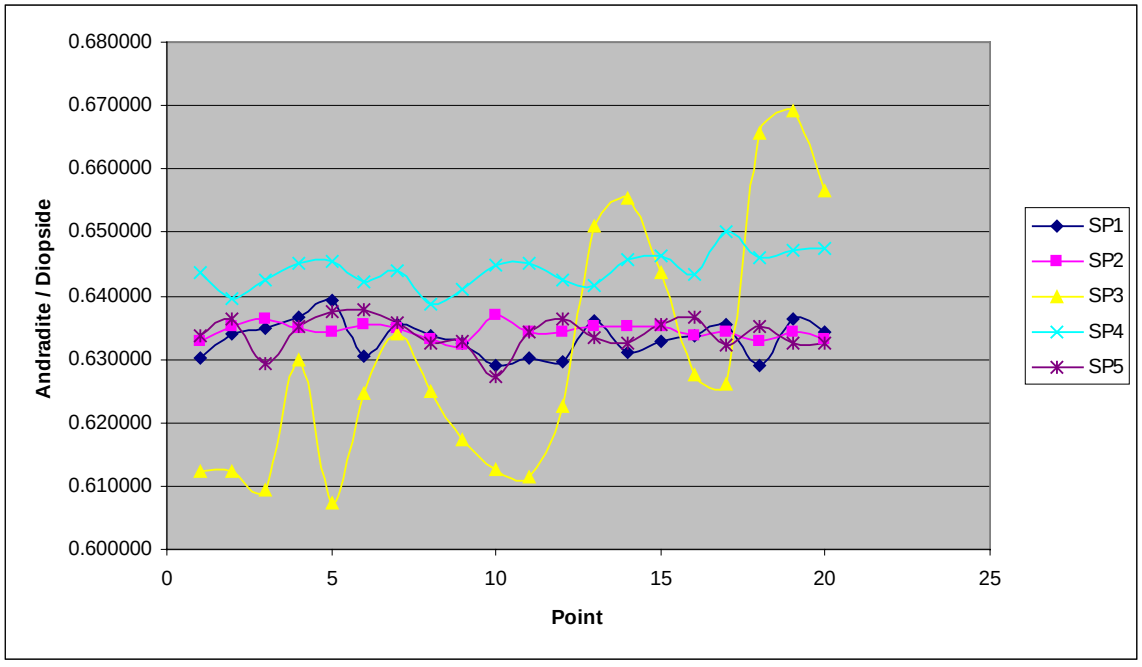
Andradite / Diopside

Point	Si Ka (cps/nA)	Si Ka (cps/nA)	Si Ka (cps/nA)	Si Ka (cps/nA)	Si Ka (cps/nA)
1	0.630105	0.632745	0.612295	0.643594	0.633760
2	0.634020	0.635280	0.612271	0.639438	0.636393
3	0.634793	0.636361	0.609293	0.642576	0.629172
4	0.636763	0.635005	0.629825	0.644985	0.635059
5	0.639176	0.634267	0.607379	0.645468	0.637528
6	0.630510	0.635567	0.624760	0.642298	0.637852
7	0.635433	0.634798	0.633925	0.643992	0.635738
8	0.633716	0.633133	0.624885	0.638772	0.632424
9	0.632589	0.632109	0.617426	0.640931	0.632959
10	0.629064	0.636914	0.612566	0.644881	0.627262
11	0.630219	0.634143	0.611348	0.645036	0.634341
12	0.629568	0.634341	0.622459	0.642420	0.636264
13	0.636040	0.635244	0.650893	0.641672	0.633314
14	0.631000	0.635034	0.655275	0.645583	0.632453
15	0.632843	0.635305	0.643707	0.646350	0.635397
16	0.633787	0.633634	0.627678	0.643402	0.636640
17	0.635543	0.634269	0.625954	0.650216	0.632154
18	0.629118	0.632943	0.665768	0.645899	0.635097
19	0.636224	0.634354	0.669286	0.647104	0.632506
20	0.634277	0.633232	0.656555	0.647342	0.632504

Average	**0.633239**	**0.634434**	**0.630677**	**0.644098**	**0.633941**	**0.635278**

Average Dev %	**-0.320886**	**-0.132839**	**-0.724186**	**1.388369**	**-0.210458**

Std Dev %	**0.002893**	**0.001225**	**0.019612**	**0.002779**	**0.002671**



Using Si Ka with TAP crystals

MgO

Point	Si Ka (cps/nA)	Si Ka (cps/nA)	Si Ka (cps/nA)
1	813.7609	2397.09	995.2975
2	813.297	2393.891	994.9694
3	812.9285	2393.721	994.7827
4	812.6423	2391.426	994.1443
5	814.3069	2393.879	993.2196
6	812.3088	2392.995	994.0614
7	813.2328	2394.858	994.4711
8	812.7198	2396.069	993.0273
9	813.2502	2397.367	993.4836
10	813.6678	2393.55	993.3082
11	812.4248	2395.001	994.3347
12	813.5861	2394.129	995.3665
13	814.0377	2392.822	993.6684
14	814.7326	2393.563	992.7018
15	812.6605	2395.118	992.6241
16	814.1846	2392.848	993.1516
17	813.7188	2392.422	993.8757
18	813.9092	2390.958	994.9016
19	814.2451	2392.275	993.8627
20	813.3411	2395.746	994.7484

Diopside

Point	Si Ka (cps/nA)	Si Ka (cps/nA)	Si Ka (cps/nA)
1	133.756	392.925	163.7135
2	134.3949	391.2892	163.6671
3	134.0812	393.0999	163.6603
4	134.1124	392.2014	163.6241
5	134.5343	392.3194	164.7619
6	134.1656	392.6701	164.32
7	133.8019	392.1416	163.657
8	134.0946	393.2679	163.4501
9	133.5202	392.6559	163.8774
10	133.8356	391.8766	163.5262
11	134.2803	393.0464	164.2023
12	133.78	393.1992	162.7843
13	134.2863	393.2124	163.8041
14	134.1325	393.663	164.1121
15	134.1907	393.5378	163.8762
16	134.519	392.244	164.0255
17	133.8607	391.9184	164.1898
18	133.7999	391.4343	163.8664
19	134.0402	391.4756	164.5855
20	133.8587	391.7767	163.6382

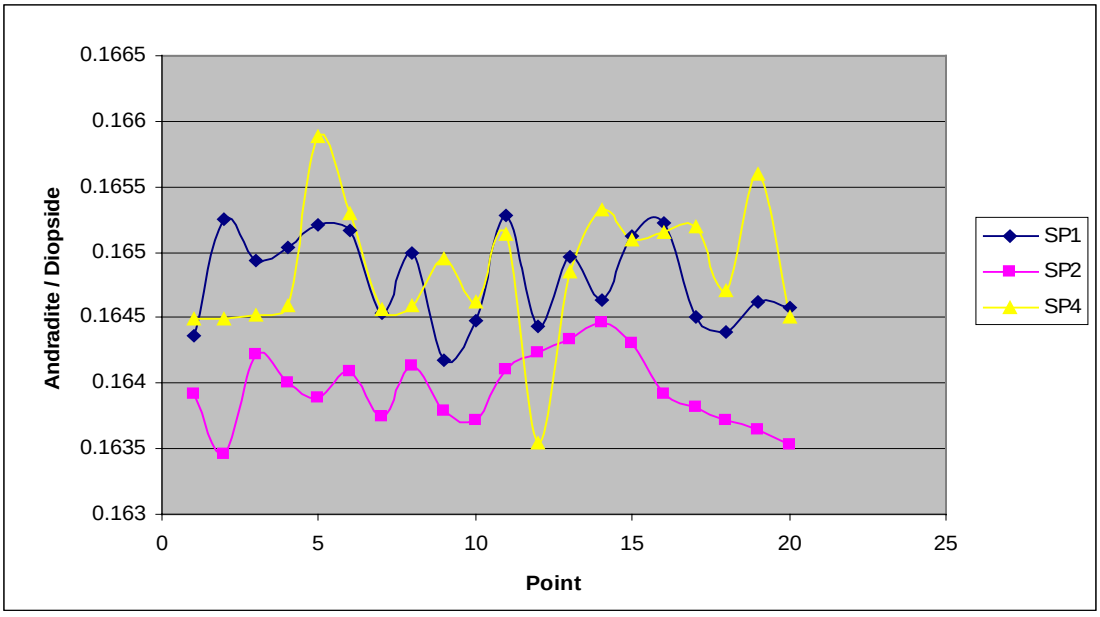
Diopside / MgO

Point	Mg Ka (cps/nA)	Mg Ka (cps/nA)	Mg Ka (cps/nA)
1	0.164367691	0.1639175	0.164487
2	0.165247013	0.163453223	0.164494607
3	0.164936031	0.164221269	0.164518643
4	0.165032512	0.164003151	0.164587877
5	0.165213263	0.16388439	0.165886678
6	0.16516576	0.164091484	0.16530166
7	0.16453087	0.163743153	0.164566874
8	0.164994873	0.164130457	0.164597791
9	0.164180962	0.163786312	0.164952295
10	0.164484326	0.163721919	0.164627857
11	0.165283359	0.164111163	0.165137855
12	0.164432504	0.164234759	0.163542072
13	0.164963244	0.164329984	0.164847851
14	0.164633771	0.164467365	0.165318628
15	0.165125166	0.164308314	0.165093916
16	0.165219288	0.163923492	0.165156558
17	0.164504863	0.163816584	0.165201544
18	0.164391679	0.163714419	0.164706138
19	0.164618983	0.163641555	0.165601848
20	0.164578797	0.163530149	0.164502099

Average	**0.164795248**	**0.163951532**	**0.16485649**	**0.164534**

Average Dev %	**0.158522803**	**-0.35426692**	**0.195744116**

Std Dev %	**0.000355164**	**0.000280565**	**0.000508622**



Using Cu La with TAP crystals and Cu Ka with LIF crystals

Cu

Point	Cu La (cps/nA)	Cu La (cps/nA)	Cu Ka (cps/nA)	Cu La (cps/nA)	Cu Ka (cps/nA)
1	239.8053	690.6703	640.3991	274.0981	169.9462
2	239.845	692.5643	638.282	273.445	170.6216
3	239.5984	689.2037	639.881	274.3295	169.6139
4	239.8609	691.0809	639.9575	274.0875	170.1848
5	240.0151	692.2791	637.4436	273.3381	170.7173
6	239.7037	691.3198	639.4858	273.6768	170.3241
7	239.3095	689.5903	639.9203	273.9993	170.5046
8	240.1796	694.3931	638.1323	273.1089	170.7103
9	240.0139	692.5613	639.2401	274.1991	170.4264
10	240.1326	692.8925	639.3802	273.4635	170.7882
11	240.3006	693.2702	639.6183	273.8936	170.5535
12	239.3354	690.5184	637.5254	274.4802	170.199
13	239.7333	692.0017	638.2997	274.0529	170.4676
14	240.0657	690.7666	637.6223	273.7746	169.8147
15	240.1597	691.5555	638.0478	273.8313	169.7012
16	240.1272	691.7628	639.6709	274.3647	170.1292
17	240.1266	691.2322	636.8067	274.2719	170.1512
18	237.4767	684.7818	633.1365	271.8877	168.5519
19	239.9283	691.6858	637.149	273.5586	169.8441
20	240.5865	692.0515	636.9587	273.4796	169.5992

Cu60Au40

Point	Cu La (cps/nA)	Cu La (cps/nA)	Cu Ka (cps/nA)	Cu La (cps/nA)	Cu Ka (cps/nA)
1	107.6889	311.4233	428.1433	124.6592	113.6188
2	107.7106	311.5518	427.5258	124.2925	113.9325
3	107.6265	310.8399	427.1212	124.5524	113.7812
4	107.7127	310.2263	426.341	124.1181	113.313
5	107.7187	310.8373	426.2722	124.7011	113.6588
6	107.8746	312.3677	426.558	124.5519	114.2868
7	107.468	311.266	426.6069	124.7743	114.305
8	107.6038	310.6542	427.084	124.3369	115.0957
9	107.7635	311.2145	428.0472	124.8694	114.5809
10	107.8079	311.5166	426.5454	124.5645	114.7938
11	107.9345	311.7492	426.7053	124.8282	115.6698
12	108.1487	311.6563	426.8928	124.9904	114.938
13	108.1313	311.6398	426.5013	124.7555	114.6517
14	108.2033	311.4567	428.4253	124.8616	115.0762
15	108.5994	313.736	427.2799	124.8341	115.0464
16	108.6712	314.3816	427.2932	124.9272	115.1511
17	108.6995	312.4121	426.3552	124.4878	114.6923
18	108.8851	314.6124	427.6913	125.1247	116.0358
19	108.7928	314.0704	427.5407	125.1233	115.5155
20	108.7106	313.1703	426.812	124.6197	114.5886

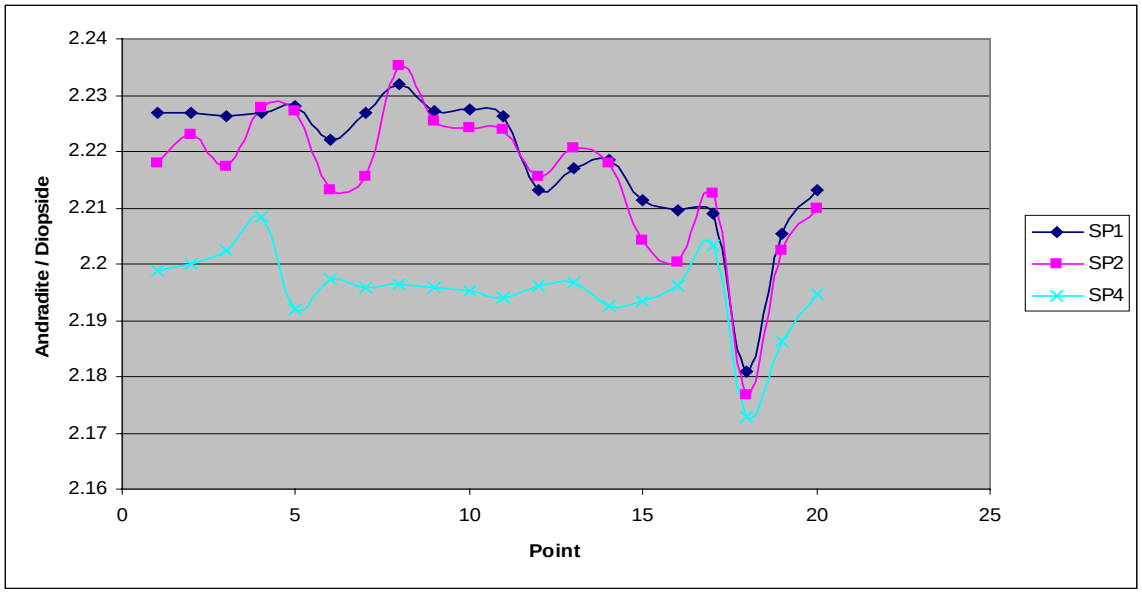
Cu/Cu60Au40 TAP

Point	Cu La (cps/nA)	Cu La (cps/nA)	Cu La (cps/nA)
	sp1	sp2	sp4
1	2.226833963	2.217786209	2.198779553
2	2.226753913	2.222950726	2.200012068
3	2.226202655	2.217230478	2.202522794
4	2.226858114	2.227667029	2.208279856
5	2.228165583	2.227142946	2.191946182
6	2.222058761	2.213160324	2.19729125
7	2.226797744	2.215437279	2.195959424
8	2.232073588	2.235260621	2.196523317
9	2.227228143	2.225350361	2.195887063
10	2.227411906	2.224255465	2.195356622
11	2.226355799	2.223807471	2.19416446
12	2.213021516	2.215640756	2.196010254
13	2.217057411	2.220517726	2.196719984
14	2.218654145	2.217857571	2.192624474
15	2.211427503	2.204259314	2.193561695
16	2.209667327	2.200392135	2.196196665
17	2.209086518	2.21256539	2.203203045
18	2.180984359	2.176588717	2.172933881
19	2.205369289	2.202327249	2.186312222
20	2.213091456	2.209824814	2.194513388

Average	**2.218754985**	**2.215501129**	**2.19543991**	**2.209899**

Average Dev %	**0.400756392**	**0.253516352**	**-0.654272744**

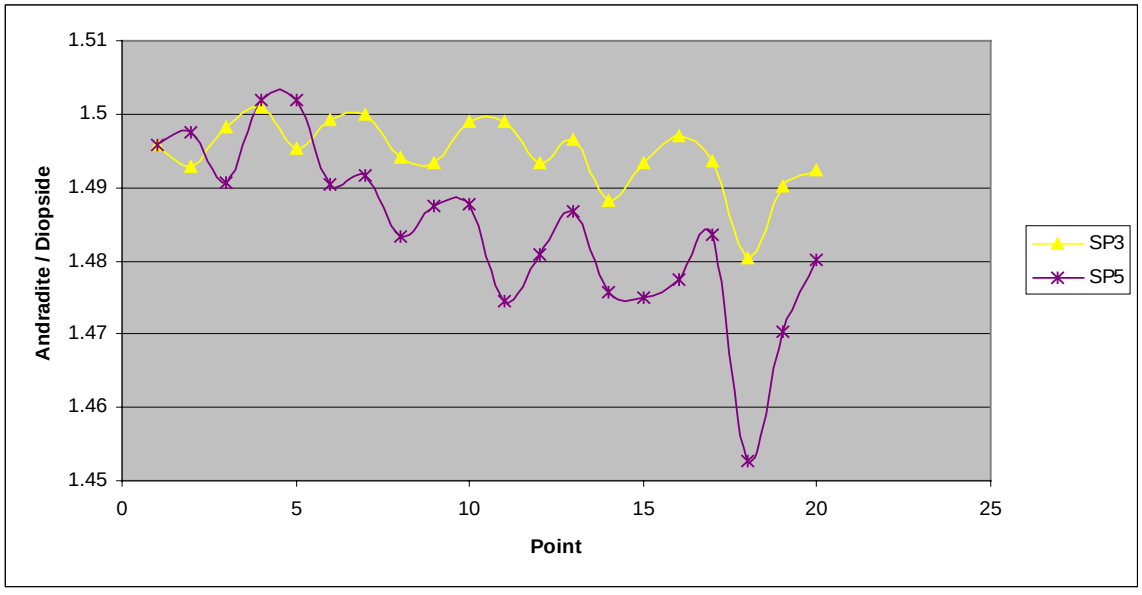
Std Dev %	**0.011920415**	**0.012772867**	**0.006999819**



Cu/Cu60Au40 LIF

Point	Cu Ka (cps/nA) sp3	Cu Ka (cps/nA) sp5
1	1.49575878	1.495757744
2	1.492967208	1.497567419
3	1.498125122	1.49070233
4	1.501046111	1.501900047
5	1.495390973	1.502015682
6	1.499176665	1.490321717
7	1.500023324	1.491663532
8	1.494161102	1.483203108
9	1.493386944	1.487389259
10	1.49897338	1.487782441
11	1.498969664	1.474485994
12	1.49340865	1.480789643
13	1.496594969	1.486830112
14	1.488292825	1.475671772
15	1.493278294	1.475067451
16	1.497030376	1.477443116
17	1.493606036	1.483545103
18	1.480358614	1.452585323
19	1.490265137	1.470314373
20	1.492363617	1.480070443

Average	**1.49465889**	**1.484255331**	**1.48945711**
Average Dev %	**0.349239964**	**-0.349239964**	
Std Dev %	**0.004752936**	**0.011758172**	

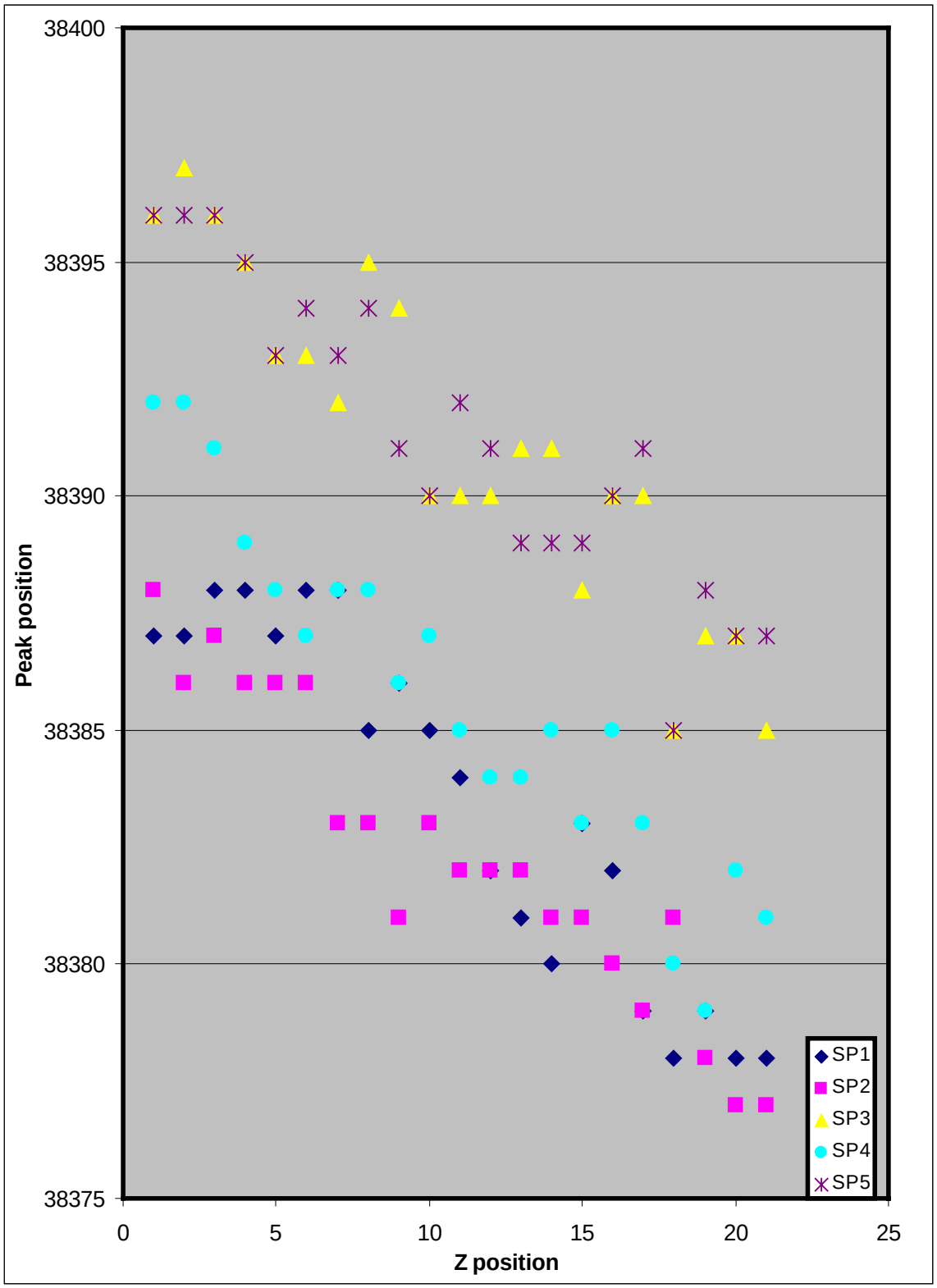


13.3.14 Verify that the instrument is aligned so that all crystals peak at an identical stage Z position within +/- 1 um by scanning the Z axis over a +/- 20 um range while counting x-ray signals with 0.5% counting precision or better

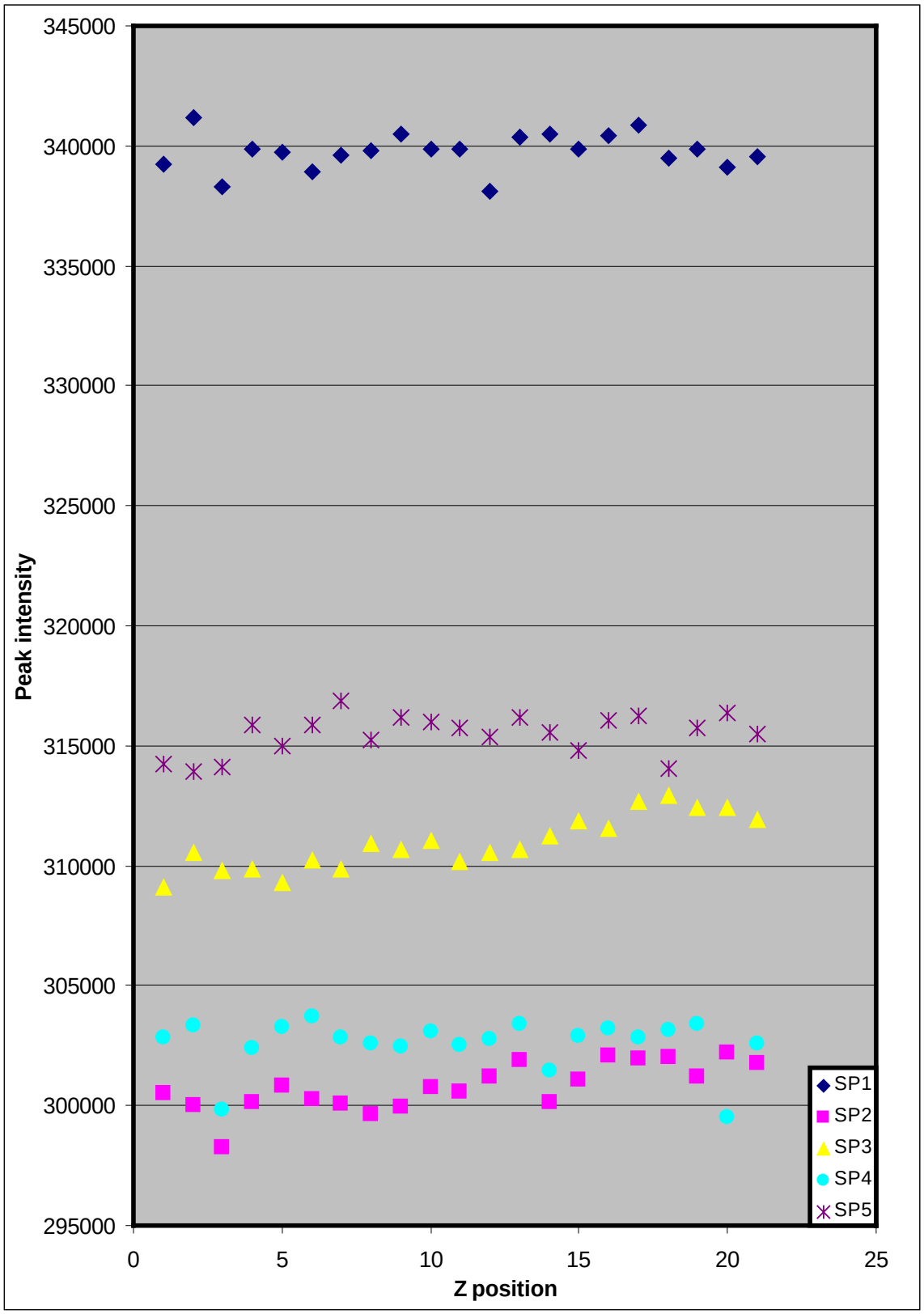
Should be attainable but has never been measured at CAMECA so is not guaranteed.

Peak Position on Ca Ka when Z axis is moving

	SP1	SP2	SP3	SP4	SP5
Z range	PET	LPET	LPET	PET	PET
-10	38 387	38 388	38 396	38 392	38 396
-9	38 387	38 386	38 397	38 392	38 396
-8	38 388	38 387	38 396	38 391	38 396
-7	38 388	38 386	38 395	38 389	38 395
-6	38 387	38 386	38 393	38 388	38 393
-5	38 388	38 386	38 393	38 387	38 394
-4	38 388	38 383	38 392	38 388	38 393
-3	38 385	38 383	38 395	38 388	38 394
-2	38 386	38 381	38 394	38 386	38 391
-1	38 385	38 383	38 390	38 387	38 390
Z = 56	38 384	38 382	38 390	38 385	38 392
1	38 382	38 382	38 390	38 384	38 391
2	38 381	38 382	38 391	38 384	38 389
3	38 380	38 381	38 391	38 385	38 389
4	38 383	38 381	38 388	38 383	38 389
5	38 382	38 380	38 390	38 385	38 390
6	38 379	38 379	38 390	38 383	38 391
7	38 378	38 381	38 385	38 380	38 385
8	38 379	38 378	38 387	38 379	38 388
9	38 378	38 377	38 387	38 382	38 387
10	38 378	38 377	38 385	38 381	38 387


38400
38395
38390
38385
38380
38375
Peak position
0
5
10
15
20
25
Z position
SP1
SP2
SP3
SP4
SP5

Counts on Ca Ka Peak			Repeak every Z position		
20kV	**SP1**	**SP2**	**SP3**	**SP4**	**SP5**
20nA	PET	LPET	LPET	PET	PET
Z range	60s	20s	20s	60s	50s
-10	339219	300485	309105	302833	314250
-9	341167	300024	310568	303306	313930
-8	338307	298265	309771	299808	314129
-7	339864	300124	309838	302396	315888
-6	339719	300825	309303	303273	314965
-5	338898	300267	310228	303735	315855
-4	339605	300057	309872	302860	316864
-3	339814	299616	310932	302581	315223
-2	340465	299948	310645	302436	316195
-1	339857	300762	311037	303057	315967
Z = 64	339868	300575	310186	302543	315747
1	338137	301205	310545	302780	315346
2	340380	301893	310673	303410	316171
3	340467	300116	311214	301459	315569
4	339890	301067	311827	302875	314807
5	340398	302058	311531	303208	316071
6	340867	301945	312658	302837	316233
7	339482	302027	312921	303146	314056
8	339837	301214	312425	303407	315724
9	339131	302198	312438	299537	316366
10	339526	301793	311929	302572	315475

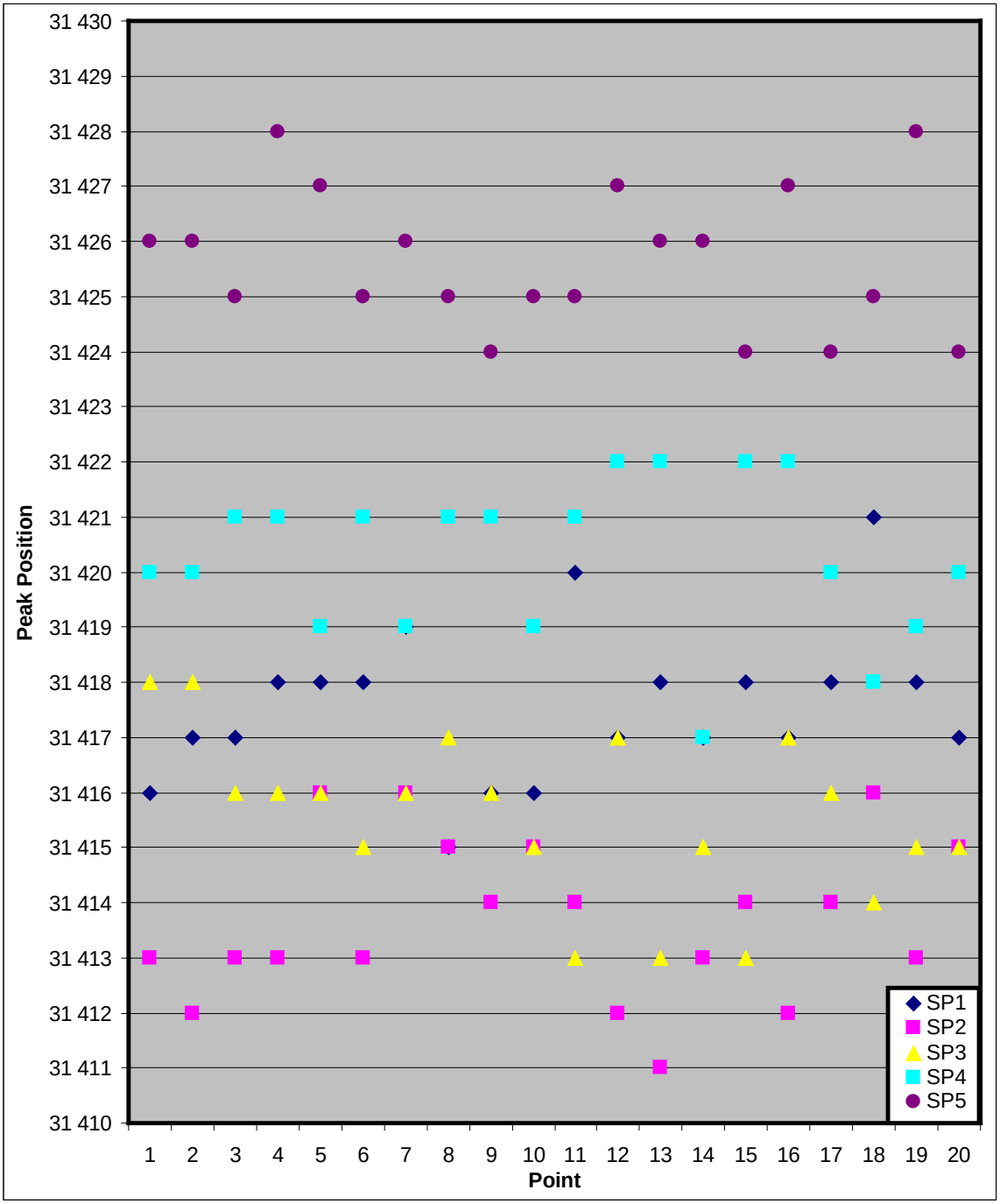

345000
340000
335000
330000
325000
320000
315000
310000
305000
300000
295000
Peak intensity
0
5
10
15
20
25
Z position
SP1
SP2
SP3
SP4
SP5

13.3.16 The reproducibility of the ROM peaking (instrument based) method must be equivalent to the precision of the intensity measurements

Should be attainable but has never been measured at CAMECA so is not guaranteed.

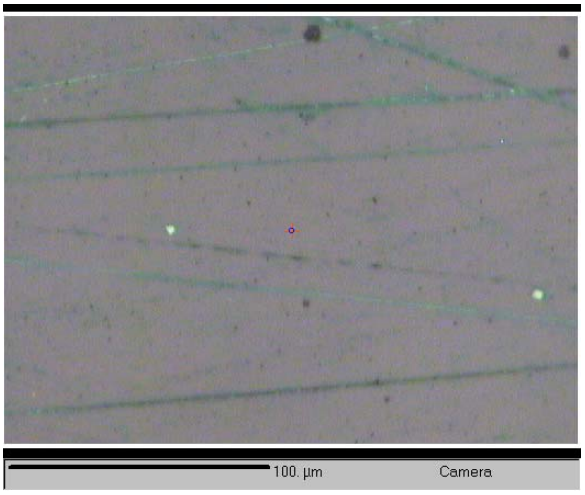
on Ti Ka	SP1	SP2	SP3	SP4	SP5
	PET	LPET	LPET	PET	PET
1	31 416	31 413	31 418	31 420	31 426
2	31 417	31 412	31 418	31 420	31 426
3	31 417	31 413	31 416	31 421	31 425
4	31 418	31 413	31 416	31 421	31 428
5	31 418	31 416	31 416	31 419	31 427
6	31 418	31 413	31 415	31 421	31 425
7	31 419	31 416	31 416	31 419	31 426
8	31 415	31 415	31 417	31 421	31 425
9	31 416	31 414	31 416	31 421	31 424
10	31 416	31 415	31 415	31 419	31 425
11	31 420	31 414	31 413	31 421	31 425
12	31 417	31 412	31 417	31 422	31 427
13	31 418	31 411	31 413	31 422	31 426
14	31 417	31 413	31 415	31 417	31 426
15	31 418	31 414	31 413	31 422	31 424
16	31 417	31 412	31 417	31 422	31 427
17	31 418	31 414	31 416	31 420	31 424
18	31 421	31 416	31 414	31 418	31 425
19	31 418	31 413	31 415	31 419	31 428
20	31 417	31 415	31 415	31 420	31 424

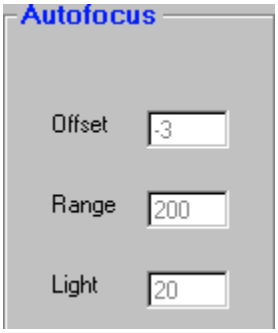
Std Dev %	**1.39**	**1.45**	**1.50**	**1.41**	**1.30**


31 430
31 429
31 428
31 427
31 426
31 425
31 424
31 423
31 422
31 421
31 420
31 419
31 418
31 417
31 416
31 415
31 414
31 413
31 412
31 411
31 410
Peak Position
1 2 3 4 5 6 7 8 9 10 11 12 13 14 15 16 17 18 19 20
Point
SP1
SP2
SP3
SP4
SP5

13.5.6 The auto focusing reproducibility must be tested by performing the following test:
100 repeated auto-focuses that reproduce the stage Z position within 1 um each time on a static flat polished carbon coated Cu sample (dark blue color).

Comply with 20 repeated autofocus.





Z position Reference: 17

Z reading positions (20 times): 17 – 17 – 17 – 17 – 18 – 17 – 17 – 18 – 17 – 18 – 18 – 17 – 17 – 18 – 17 – 17 – 17 – 18 – 17 – 18.

Average on Z for 20 times Optical Auto focus = **0.35 µm**

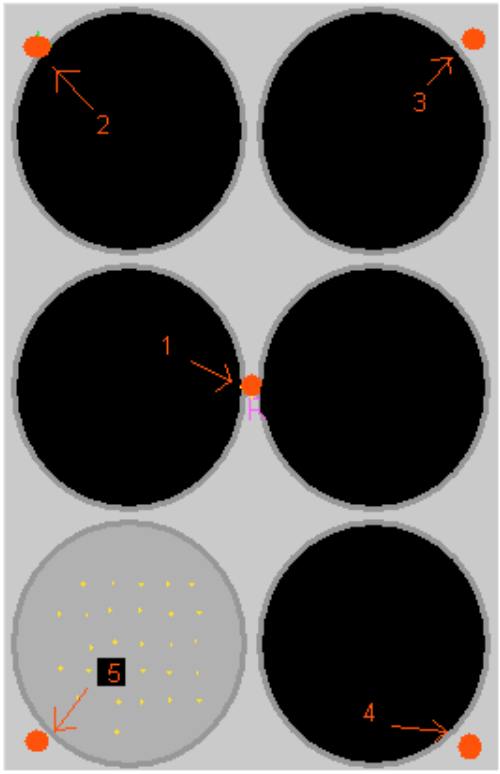
13.8.2 A minimum of 5 mm/sec speed (10 mm/sec desired) and less than or equal to +/-1 micron reproducibility (+/- 0.5 micron desired) for X and Y axis positioning, and 1 mm/sec speed (2 mm/sec desired) and less than or equal to +/-1 micron reproducibility (+/- 0.5 micron desired) for Z axis positioning as determined by driving from a point of interest to stage limits and back to the point of interest at 10,000X in SE image mode for X and Y and reflected light for Z over 200 times without discernable failure of reproducibility;

Speed for X and Y motions: 15mm/sec

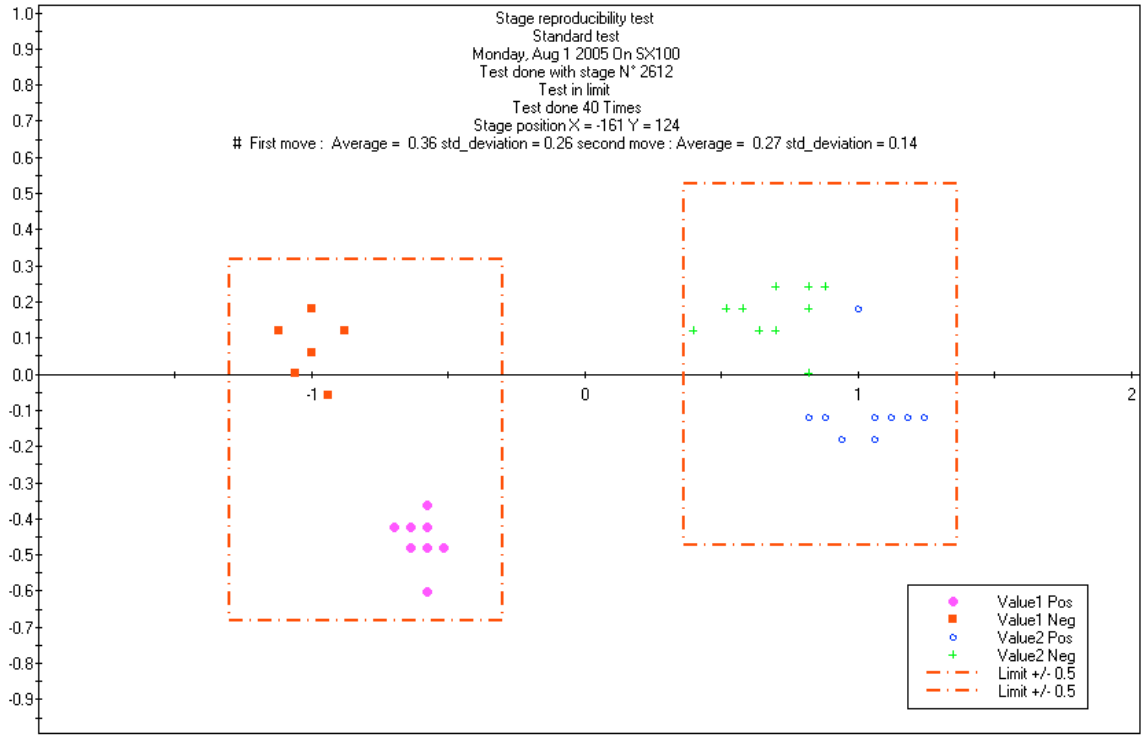
Reproducibility for X and Y motions: within 1µm with backlash.

Speed and reproducibility for Z are not specified.

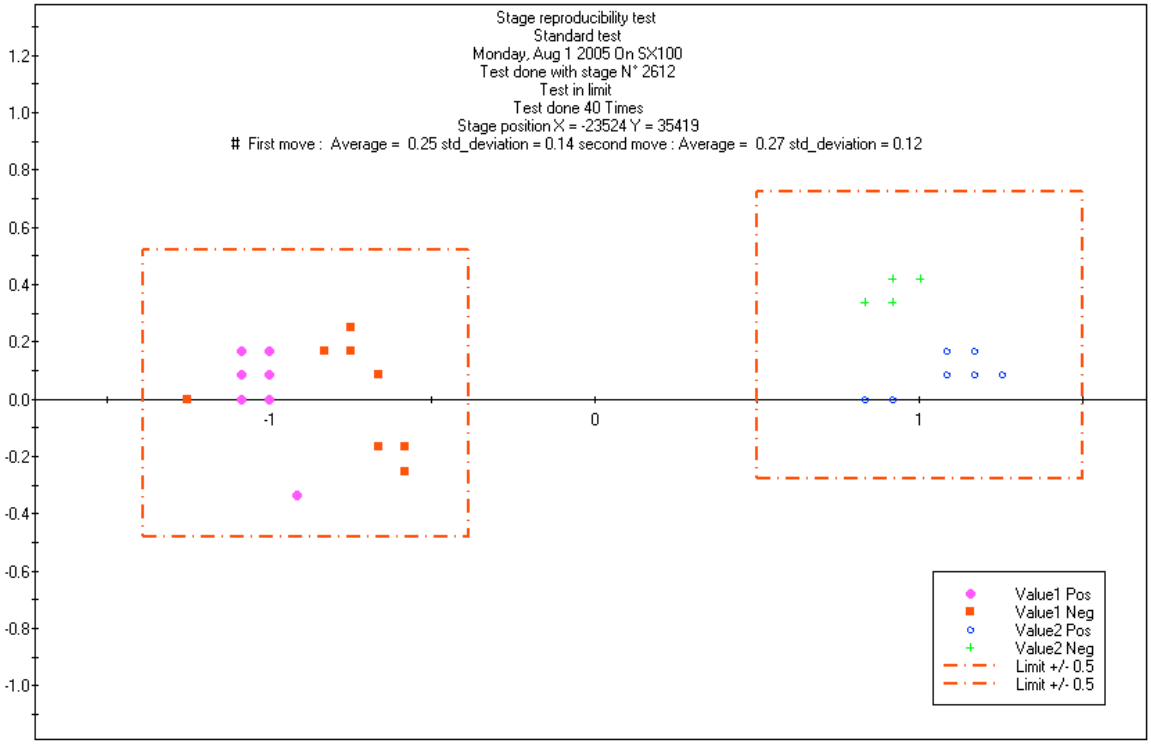
<u>Stage reproducibility on different X.Y.Z positions</u>



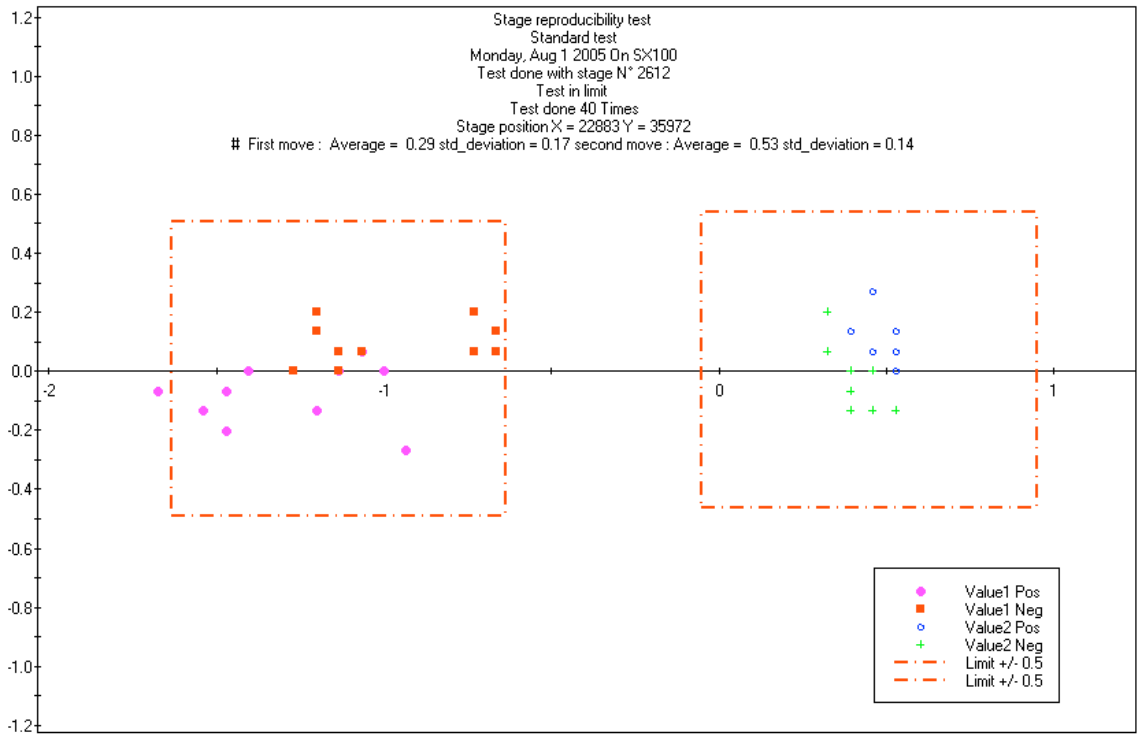
Test 1 (on the middle of the holder) – CAMECA specification



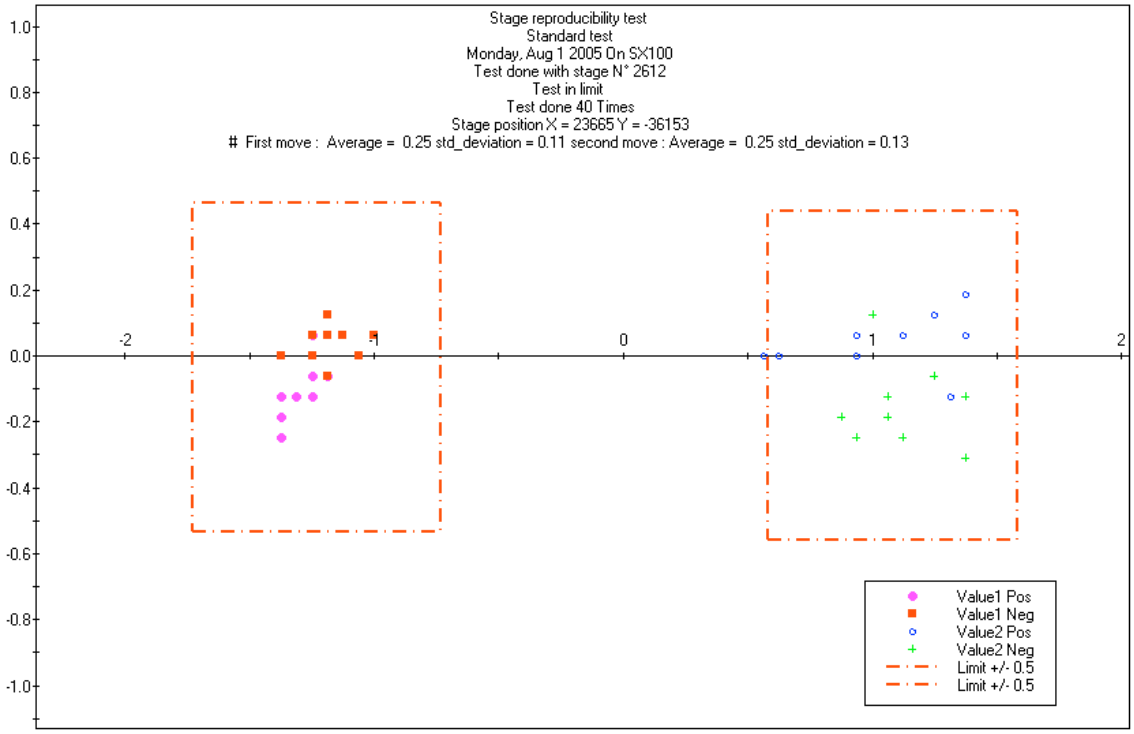
Test 2 (on the top left hand side of the holder)



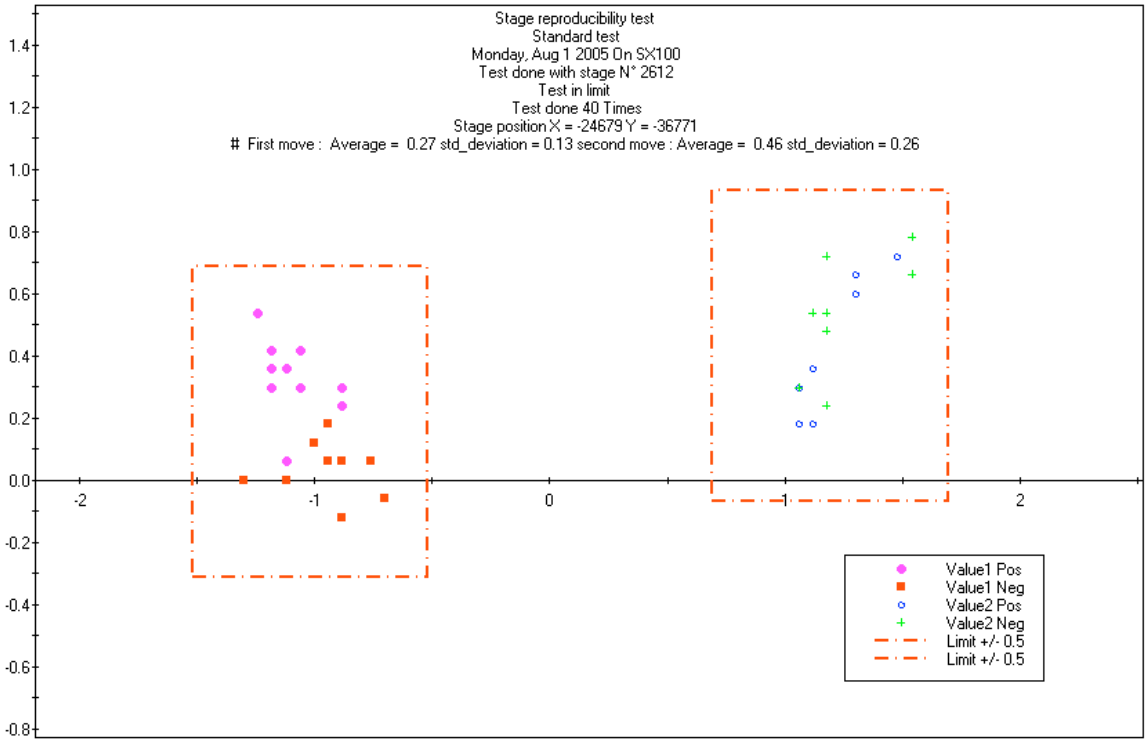
Test 3 (on the top right hand side of the holder)



Test 4 (on the bottom right hand side of the holder)

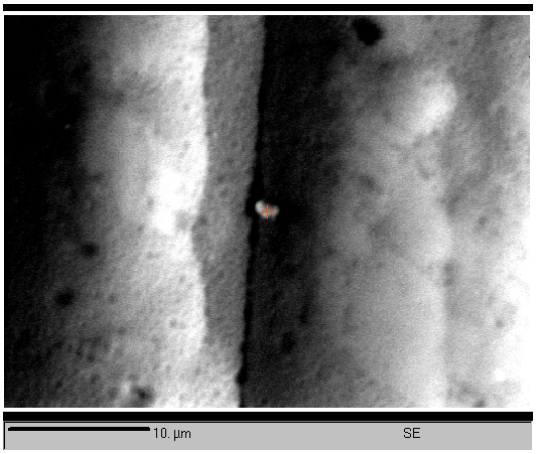


Test 5 (on the bottom left hand side of the holder)



13.8.3 After the test described in Section 13.8.2, the stage and beam position shift shall be less than +/- 1 micron after 30 minutes as viewed in SE at 10,000X;

Should be attainable but has never been measured at CAMECA so is not guaranteed.



Reference image at 10,000X

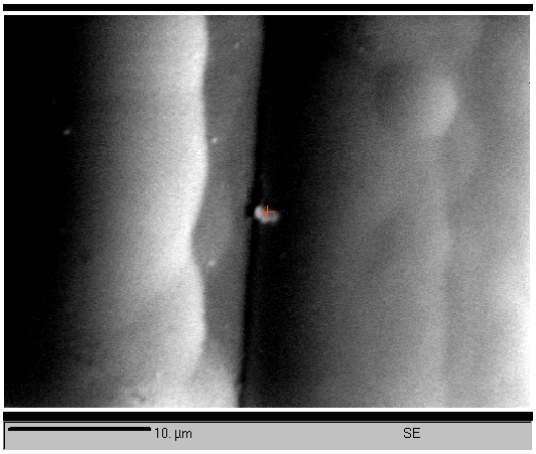


Image after 30 minutes

Result: 0.25 micron