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Irons analysis with ARL Optim'X

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Irons analysis – ARL Optim'X WDXRF low power

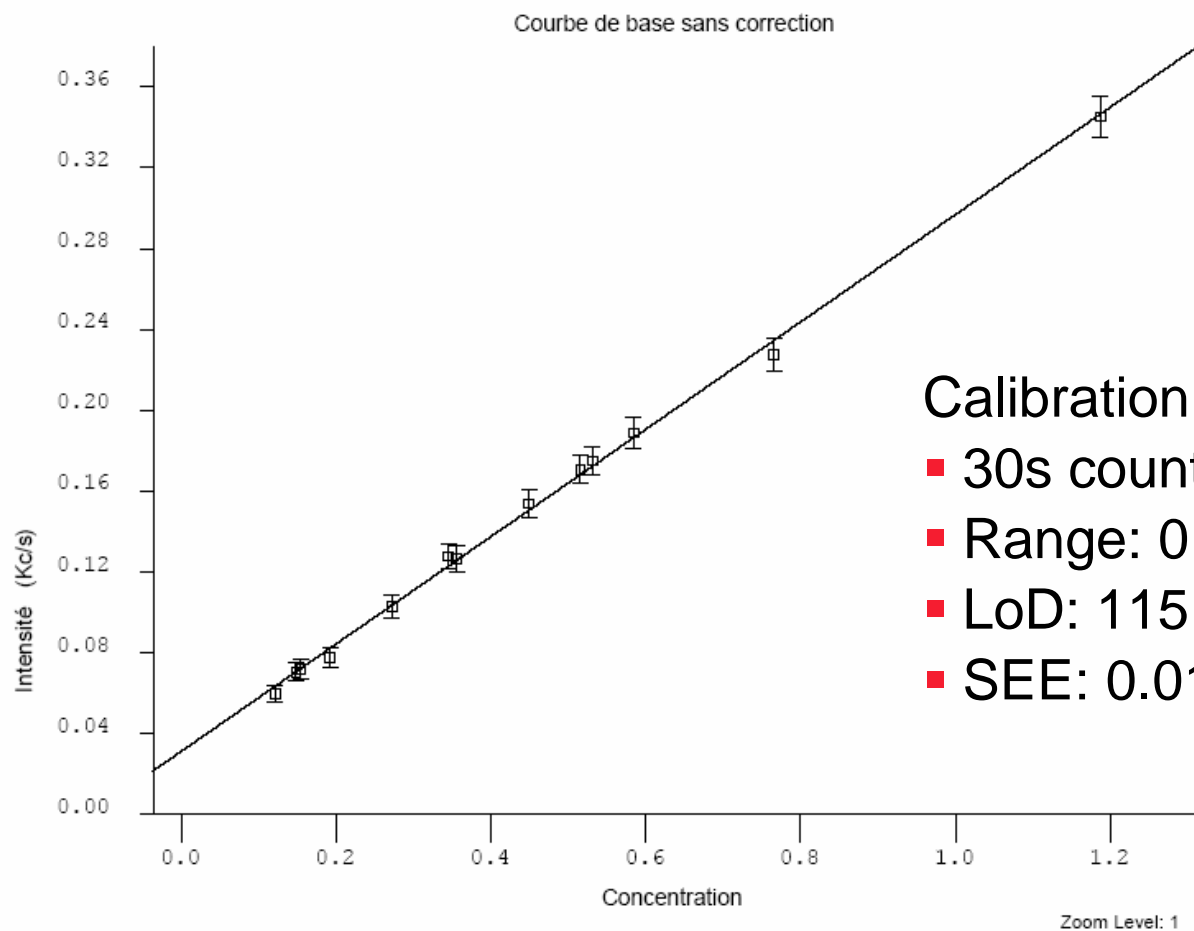
Analysis of hot metal during desulfurisation process

- ARL Optim'X configuration for this test:
 - SmartGonio with 3 crystals (element coverage F to U)
 - Collimator 0.29°
 - 50W – Rh anode X-ray tube
- Analysis of Si, Mn, S, Zn, P and Ti
 - Calibration curves established with customer samples (non certified concentrations)
- Total analysis time for 6 elements : 2 min 40s



Irons analysis – ARL Optim’X WDXRF low power

Analyte: SiKa_Cl LDD (30 s): 115.1 ppm BEC: 0.117 % Q: 0.266 (Kc/s)/% SEE: 0.0136

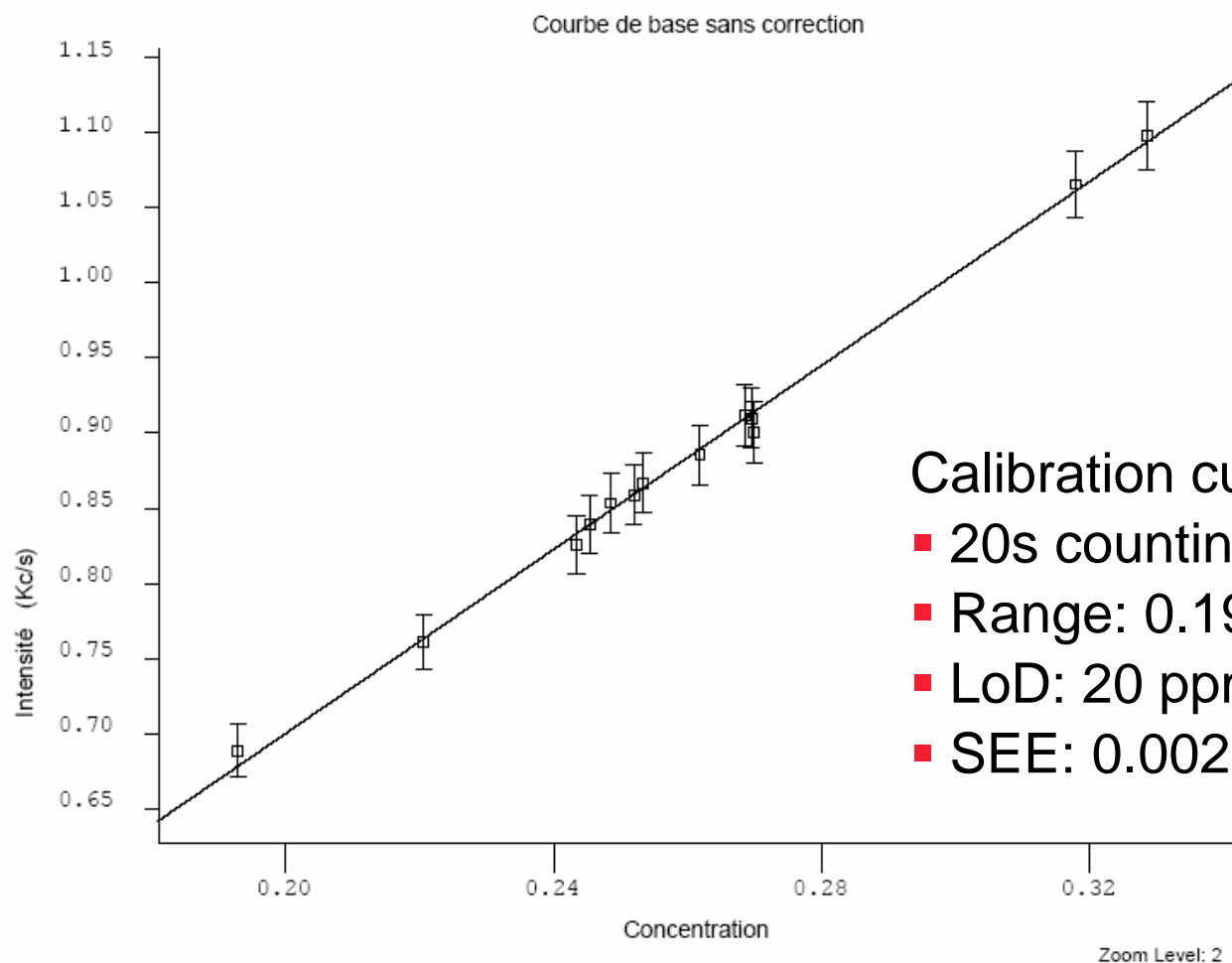


Calibration curve for Silicon

- 30s counting time
- Range: 0.1 to 1.2%
- LoD: 115 ppm
- SEE: 0.014%

Irons analysis – ARL Optim’X WDXRF low power

Analyte: MnKa_CI LDD (20 s): 20.4 ppm BEC: 0.028 % Q: 3.064 (Kc/s)/% SEE: 0.0021

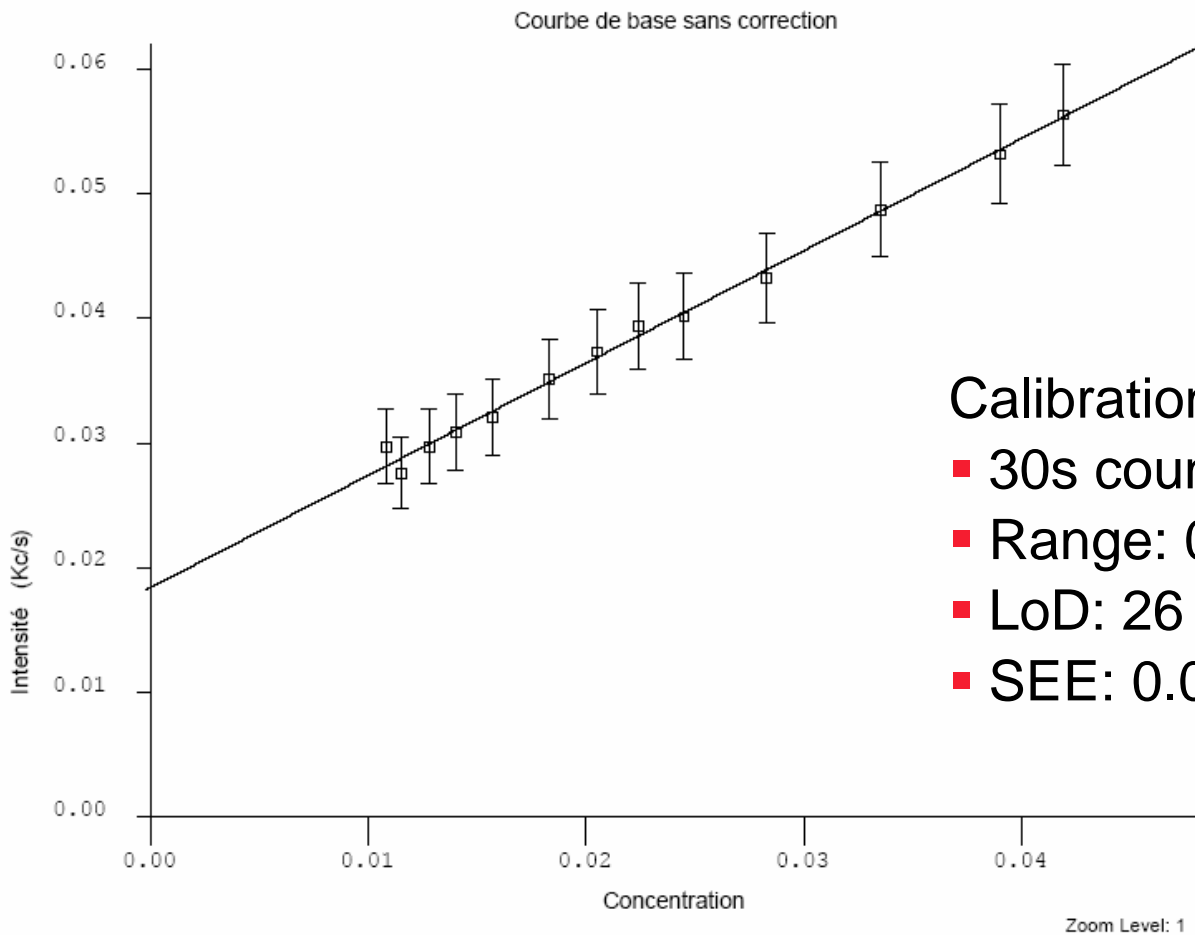


Calibration curve for Manganese

- 20s counting time
- Range: 0.19 to 0.34%
- LoD: 20 ppm
- SEE: 0.0021%

Irons analysis – ARL Optim’X WDXRF low power

Analyte: S Ka_Cl LDD (30 s): 26.1 ppm BEC: 0.020 % Q: 0.901 (Kc/s)/% SEE: 0.0008

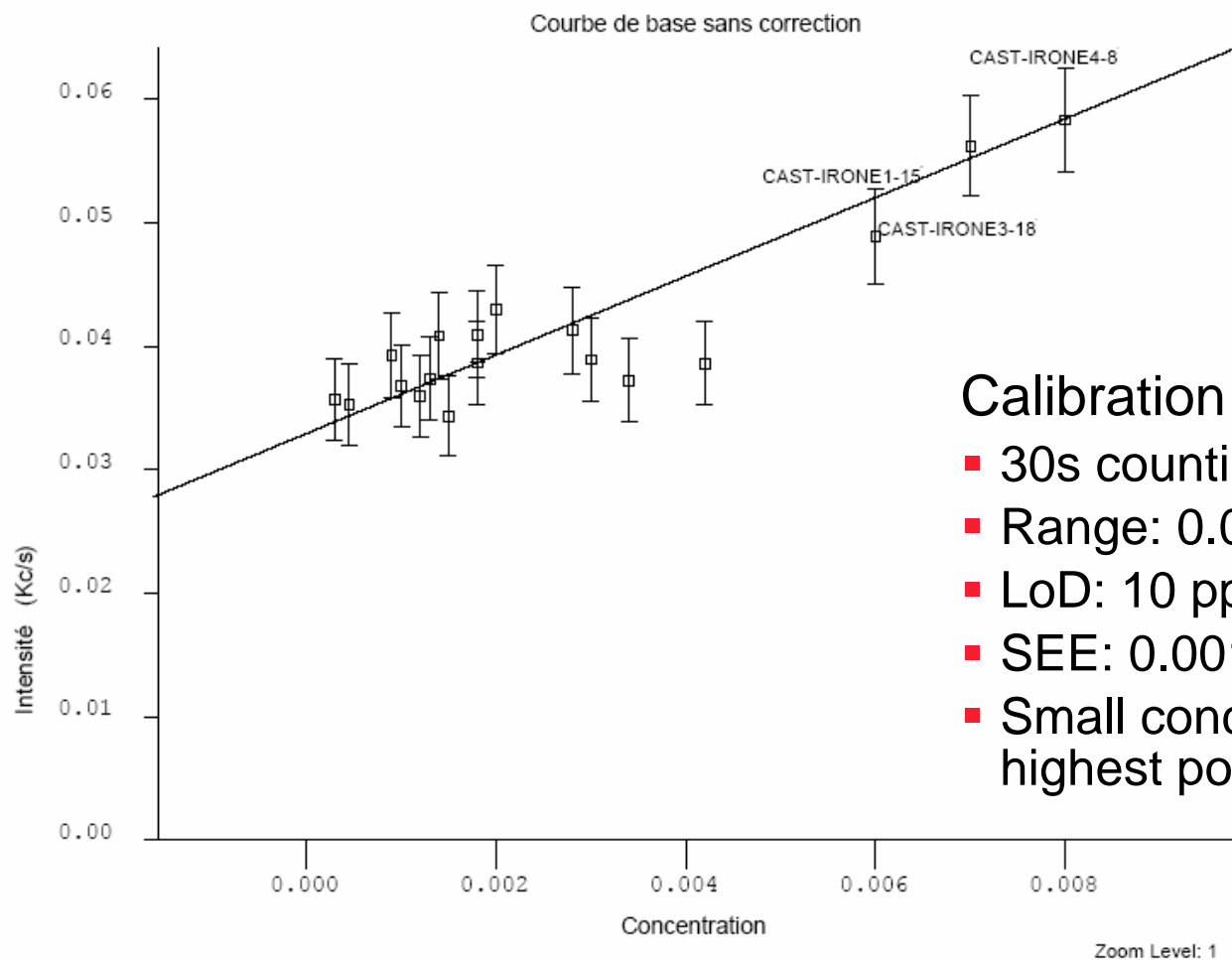


Calibration curve for Sulfur

- 30s counting time
- Range: 0.01 to 0.042%
- LoD: 26 ppm
- SEE: 0.0008%

Irons analysis – ARL Optim’X WDXRF low power

Analyte: ZnKa_CI LDD (30 s): 9.9 ppm BEC: 0.010 % Q: 3.189 (Kc/s)% SEE: 0.0011



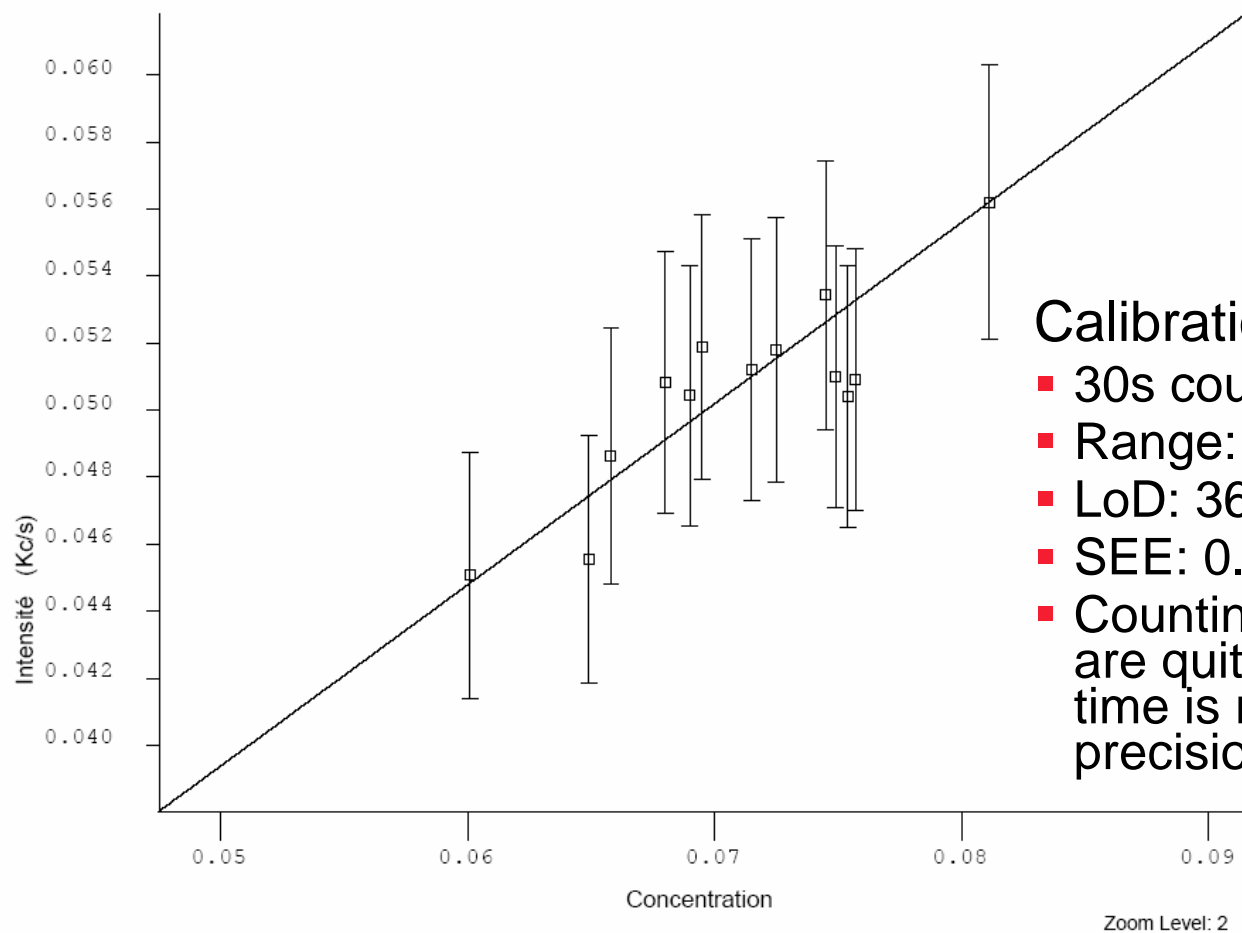
Calibration curve for Zinc

- 30s counting time
- Range: 0.001% to 0.008%
- LoD: 10 ppm
- SEE: 0.0011%
- Small concentration range with highest point at 80ppm !

Irons analysis – ARL Optim’X WDXRF low power

Analyte: P Ka_Cl LDD (30 s): 35.6 ppm BEC: 0.023 % Q: 0.541 (Kc/s)% SEE: 0.0030

Courbe de base sans correction

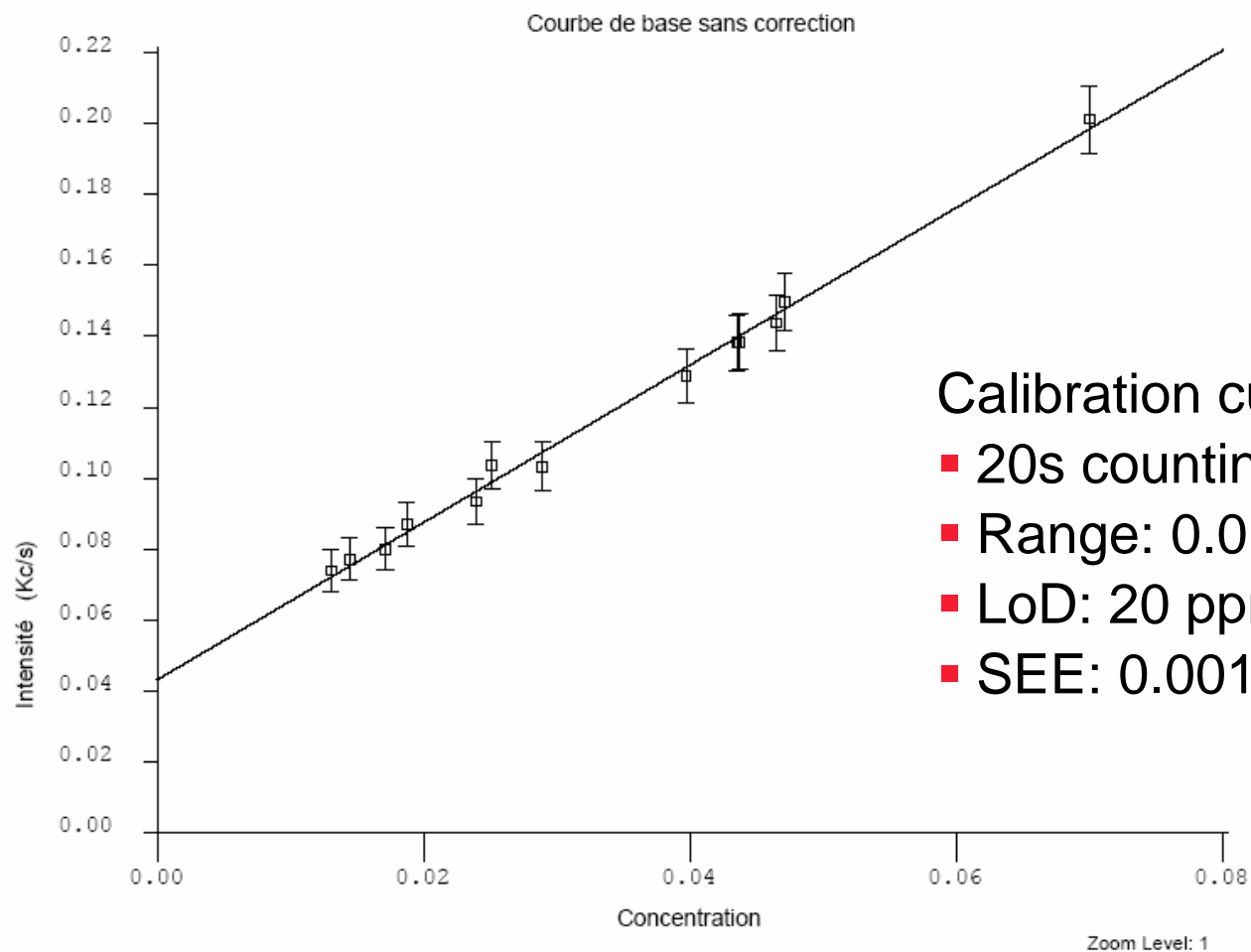


Calibration curve for Phosphor

- 30s counting time
- Range: 0.06 to 0.082%
- LoD: 36 ppm
- SEE: 0.003%
- Counting statistics (vertical bars) are quite large: longer counting time is required for P to improve precision

Irons analysis – ARL Optim’X WDXRF low power

Analyte: TiKa_CI LDD (20 s): 19.9 ppm BEC: 0.020 % Q: 2.217 (Kc/s)/% SEE: 0.0013



Calibration curve for Titanium

- 20s counting time
- Range: 0.01% to 0.07%
- LoD: 20 ppm
- SEE: 0.0013%

Cast irons analysis

- ARL Optim'X configuration for the following test:
 - 1 Fixed monochromator for carbon
 - SmartGonio with 3 crystals for the other elements



Cast iron analysis – WDXRF low power

Repeatability test:

- Fixed channel for Carbon analysis; 60s counting per element on SmartGonio
- Excepting Carbon, 15s counting time would increase Std Dev by factor 2 which would still be acceptable for most elements

	Fixed ch.	Gonio	Gonio	Gonio	Gonio	Gonio	Gonio	Gonio	Gonio	Gonio	Gonio
Counting time	300s	60s	60s	60s	60s	60s	60s	60s	60s	60s	60s
Element	C	Si	S	P	Mn	Ni	Cr	Mo	V	Cu	Ti
Run nr.	%	%	%	%	%	%	%	%	%	%	%
1	2.81	1.74	0.013	0.97	0.099	0.032	2.39	0.134	0.038	0.0183	0.084
2	2.93	1.76	0.012	0.973	0.101	0.031	2.38	0.133	0.0385	0.0176	0.082
3	2.94	1.76	0.012	0.956	0.099	0.029	2.39	0.134	0.0377	0.018	0.084
4	2.9	1.74	0.014	0.96	0.099	0.031	2.39	0.134	0.0376	0.0196	0.083
5	2.85	1.73	0.013	0.956	0.098	0.03	2.39	0.134	0.0386	0.0173	0.082
6	2.81	1.75	0.013	0.957	0.099	0.032	2.39	0.134	0.0373	0.0201	0.084
7	2.83	1.76	0.012	0.968	0.1	0.029	2.39	0.134	0.0385	0.0183	0.081
8	2.83	1.75	0.013	0.957	0.098	0.031	2.39	0.135	0.0383	0.0198	0.083
9	2.82	1.75	0.013	0.959	0.1	0.03	2.39	0.135	0.0381	0.015	0.082
10	2.82	1.74	0.014	0.968	0.1	0.031	2.4	0.136	0.038	0.0152	0.085
Moyenne	2.854	1.75	0.013	0.962	0.099	0.031	2.39	0.134	0.0381	0.0179	0.083
St Dev	0.050	0.009	0.0008	0.006	0.0008	0.001	0.003	0.0007	0.0004	0.0015	0.0009

Conclusion

- Despite its low power the ARL Optim'X shows surprisingly good performance for hot metal
- Analysis of 6 elements can be performed in less than 3 minutes
- Counting times can be modulated for each element depending on the performance requirements
- Addition of one or two fixed channels alongside the SmartGonio helps decrease the total time of analysis if necessary
- Even carbon analysis in cast iron can be performed, but a counting time of at least 300s using a fixed channel is necessary