

Technical Memo

To: Chris Cairns, Jennifer Murphy, Hamish Forgan
Company: Stavely Minerals Ltd
From: Andrew Grieve
Reviewed: Mike Millad
Date: 21 June 2020
Project: Thursdays Gossan
Subject: Sampling Duplicate Analysis



Background

In February 2020, Cube completed a review of sampling and drilling activities carried out at the Thursdays Gossan Project. Due to the poor sample recoveries and sampling methodology, the review highlighted the potential for sample bias. The review recommended a duplicate sampling program of the diamond core to determine the tenor (if any) of bias.

In April 2020, an analysis of duplicate data was completed by Cube (*Thursdays_Gossan_Duplicate_Analysis_20200520_FINAL.pdf*). At that stage there were 531 duplicate samples available for analysis. The results for this analysis generally showed, apart from Ni and Ag, there was a negative bias towards the primary sample i.e. the duplicate sample returned a higher grade. At that stage, most of the differences were considered to be within acceptable limits, but there was some concern about Pb and Zn. It was stated however that the low levels of these elements would exacerbate any differences. There was some concern that at that point in time, the spatial spread of the duplicate data was restricted to the south-eastern portion of the deposit.

In July 2020, Cube was supplied with updated duplicate data, upon which this Technical Note is based.

Process

Cube was supplied with a number of .xlsx files (assumed to be database exports), one of these being *Stavely_Duplicates_6July2020.xlsx*. This file contained 1,046 records. Cube removed some records as there were missing data, resulting in a total of 1,025 records. Of these, 737 were Diamond Drill holes (DDH) and 288 were from Sonic drill holes. The DDH data contain 23 half core duplicates, with the remainder being quarter core duplicate samples.

Assays that had negative values (assumed to be below detection) were reset to half the assumed detection value.

The duplicate data were imported into a Cube Excel template developed for the analysis of duplicates.

Analysis

Due to the different drill types (DDH and Sonic) an analysis was undertaken using the combined dataset and then DDH and Sonic separately. The relevant statistics for this analysis are tabulated in Table 1. To alleviate the skewing of the statistics due to the large number of data points around detection level, values below a chosen level were removed. Values of less than or equal to 0.005 g/t, 0.5 g/t, 100ppm, 100ppm and 100ppm for Au, Ag, Cu, Ni and Zn respectively were removed. Also, for Ag, the data point for SMD071 at depth range 111.0 - 111.9 m was removed, as the large difference between the original sample (1.6 g/t) versus the duplicate sample (1120 g/t) was creating skewed results.

Table 1: Max and Mean Statistical Analysis - Original versus Duplicate (Combined, DDH and Sonic only)

Element	Average difference (%)						Correl. Coefficient			CV Average (%)		
	All	No. of samples	DDH	No. of samples	Sonic	No. of samples	All	DDH	Sonic	All	DDH	Sonic
Au	-3.9	794	-2.6	550	-7.3	90	0.71	0.67	0.77	1.7	2.0	5.0
Ag	-2.9	613	-3.8	444	1.4	169	0.78	0.77	0.77	5.2	6.1	9.8
Cu	-2.8	791	2.9	567	-2.3	224	0.92	0.91	0.99	4.7	5.5	0.1
Ni	1.1	682	0.4	526	3.4	156	0.99	0.97	0.99	0.4	0.5	0.6
Zn	-14.9	335	-20.5	245	1.7	90	0.98	0.98	0.97	4.7	5.5	1.6

Discussion

Similar to the analysis undertaken in April, there is generally a negative bias (average difference %) towards the primary sample for combined sample types i.e. the duplicate sample returns a higher grade (Table 1). The exception for this is for Ni. Within the individual drilling types, there is a mixture of negative and positive bias. Regardless, the combined values are considered low and are not an issue of major concern. The exception is Zn, but the large number of values in the lower range i.e. 90th percentile at 800 ppm, (Figure 11) is distorting this result.

For Ag, Cu and Zn there are switches between positive and negative biases according to drill type, but again these are minor and are most likely related to the concentration of drill types within different mineralisation styles.

Looking solely at the 'average difference %' can at times mask performance within particular grade ranges. Figure 7 to Figure 11 are Q-Q plots of each element divided into combined, DDH and Sonic data sets. Generally, there are grade ranges for each element that show both positive and negative biases. For example, in Figure 7, plots for Au in the upper grade ranges (>1.0 g/t), show a bias towards the original sample for DDH but the opposite for sonic drilling. The total effect is expected to be minimal as it only affects a small number of samples.

For Ag, values above what would be considered to be economically relevant show good correlation, for both drill types (Figure 8).

For Cu (Figure 9), around the 6000 – 15,000 ppm range, sonic samples show a bias towards the duplicate, while DDH shows the reverse. Importantly in the higher-grade ranges for DDH i.e. within the Cayley Lode, there is a good correlation.

Ni analysis of Q-Q plots (Figure 10) for DDH shows an excellent correlation. There is some divergence either side of the regression line for sonic assays above 3000 ppm, but this is restricted to around 10% of assays.

Zn within DDH samples is the only element that shows a consistent duplicate bias for virtually all grade ranges, while the sonic samples show a switch from a duplicate to original at around 800 ppm (Figure 11). The reason for this is unknown, but again the number of samples within the grade ranges, which would be considered economically significant, are low.

A more comprehensive display of data is shown in the Appendix where there are also scatter plots (Figure 2 to Figure 6) and RMPD plots (Figure 12 to Figure 16) for each analyte, divided into combined, DDH and Sonic datasets.

Another method of determining the performance of duplicates is by the CVavg % (Abzalov 2008). Acceptable CVavg % values will vary according to the element and deposit style. For example, in nuggety gold deposits, CVavg % values of up to 40% are deemed acceptable, while for Au in porphyry copper style deposits, a value of up to 15% is deemed acceptable. As all CVavg % values for all elements and all drill types are well below this (Table 1) there appears to be no reason for any concern.

Spatial Analysis of Duplicates

A spatial review of the location of the duplicate samples (Figure 1) shows that there has been abundant duplicate samples taken within the Cayley Lode, but very few within the areas outside this. Depending on the upcoming geological model (i.e. the creation of mineralisation domains outside the Cayley Lode), these areas might have to be revisited in terms of retrospective duplicate sampling.

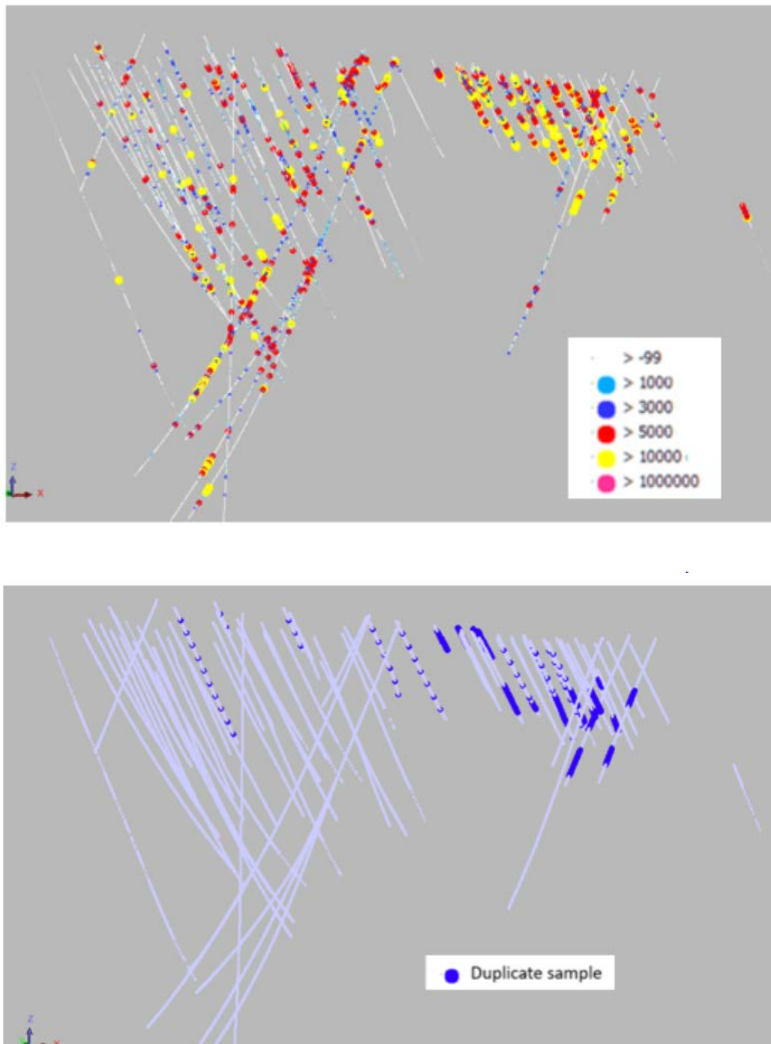


Figure 1: Northeast looking view showing Cu grades (top) and duplicate samples (bottom)

Conclusions and Recommendations

Although there are considerably more samples from the April analysis, the results for all samples combined are very similar, with the duplicate sample showing a minor positive bias. Ni is an exception. When the data is further broken down on drill types, the biases become varied between the primary and duplicate sample, but again are considered to be minor. This is most likely due to the concentration of particular drill types within certain mineralisation styles. The exception to the

minor differences is for Zn in DDH samples, where there is a 15% bias towards the duplicate sample. This is not reflected in the sonic samples.

Using an overall bias calculation can disguise performance within particular grade ranges, therefore the evaluation of data using Q-Q plots can determine if there are any grade range biases, particularly within the grades that would be considered to be economically relevant. For Cu, in the 6,000 – 15,000 ppm range, sonic samples show a bias towards the duplicate, but for DDH there is a bias towards the primary sample. Only about 10% of the samples lie within this grade range and more importantly, the correlation at the higher grade ranges (Cayley Lode) is very good, hence leading to the conclusion that there are no major issues in terms of sampling precision. There are other minor correlation issues for other elements, but these either include only very small grade ranges or occur towards the upper grade ranges; both of these only include a minor number of samples.

The overall performance of the duplicate sampling leads to the conclusion that the current program of extensive and continuous duplicate sampling throughout the mineralised intervals can cease, however Stavelly should still aim to take duplicate samples for 5 – 10% of mineralised sample intervals.

Cube is unaware of any other QAQC protocols, but if not already occurring, it is strongly recommended that selected coarse rejects and pulps be re-submitted back to the primary laboratory and also pulps be submitted to an umpire laboratory.

Depending upon the outcomes of the mineralisation model, there may be the requirement to undertake retrospective duplicate sampling of areas outside the chalcocite blanket and Cayley Lode.

Yours sincerely,



Andrew Grieve

Senior Geological Consultant

References

Abzalov, M. 2008. *Quality Control of Assay Data: A Review of Procedures for Measuring and Monitoring Accuracy and Precision*. Canadian Institute of Mining, Metallurgy and Petroleum.

Appendix

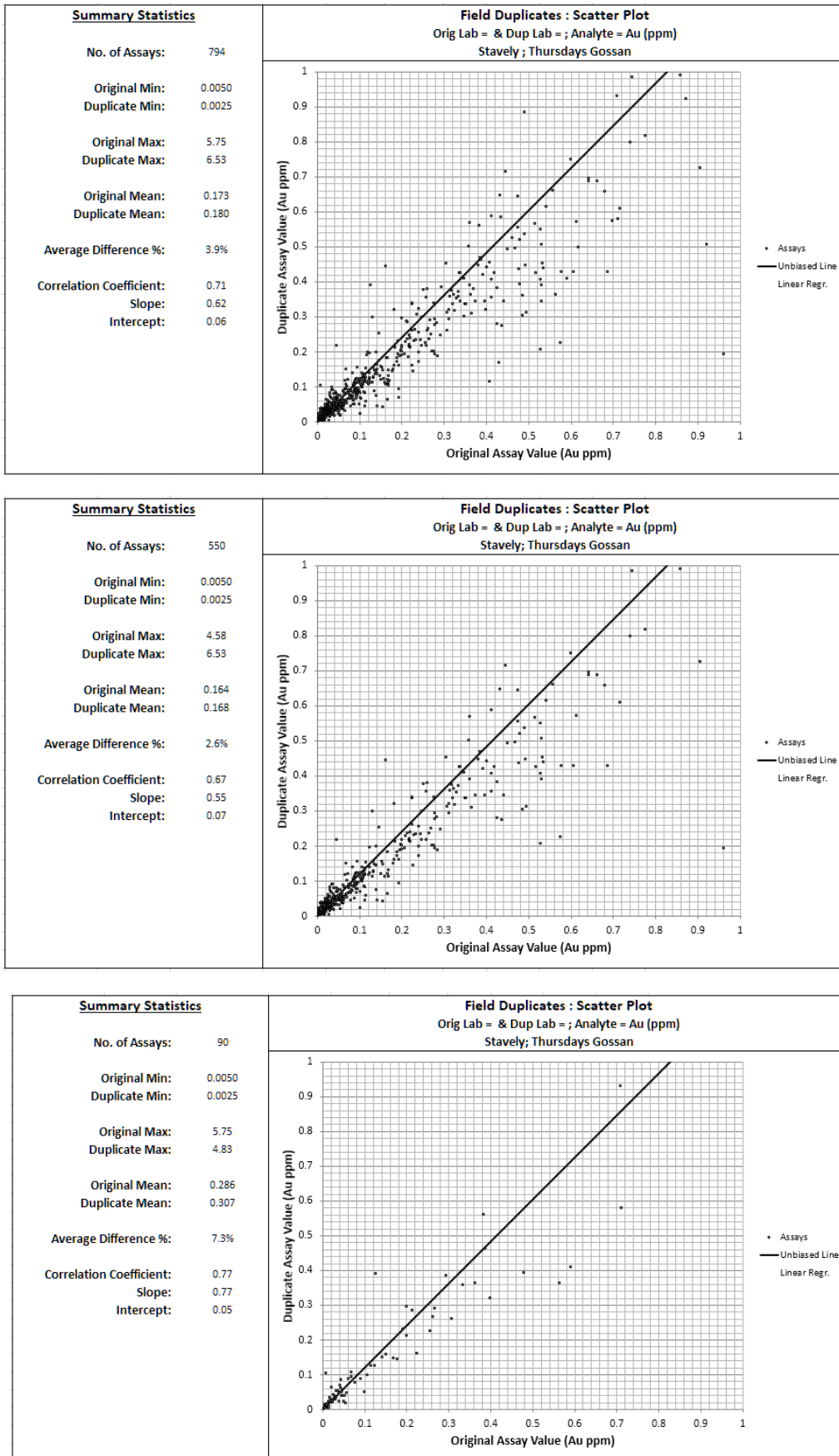


Figure 2: Au Scatter plots – All (top), DDH (middle) and Sonic (bottom).

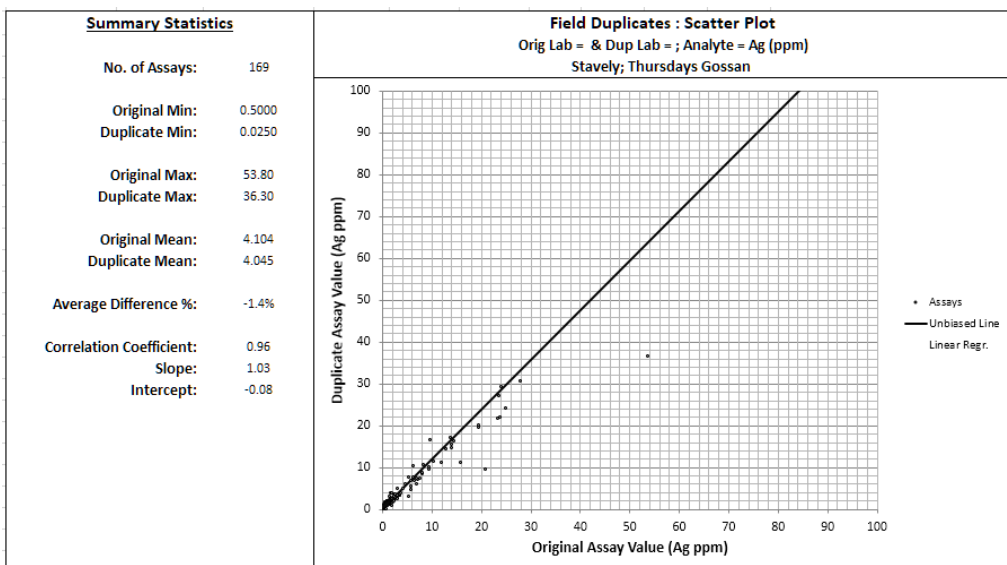
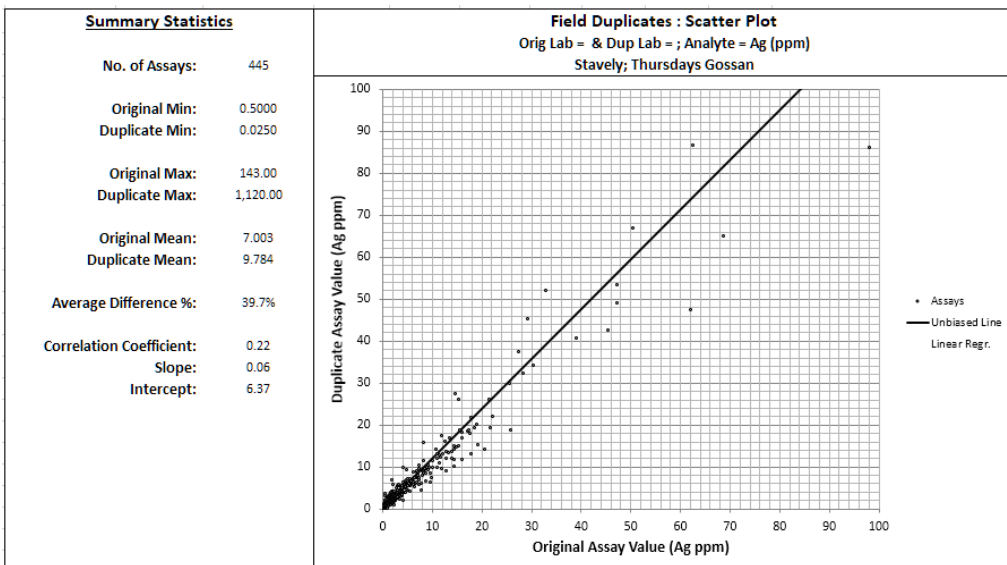
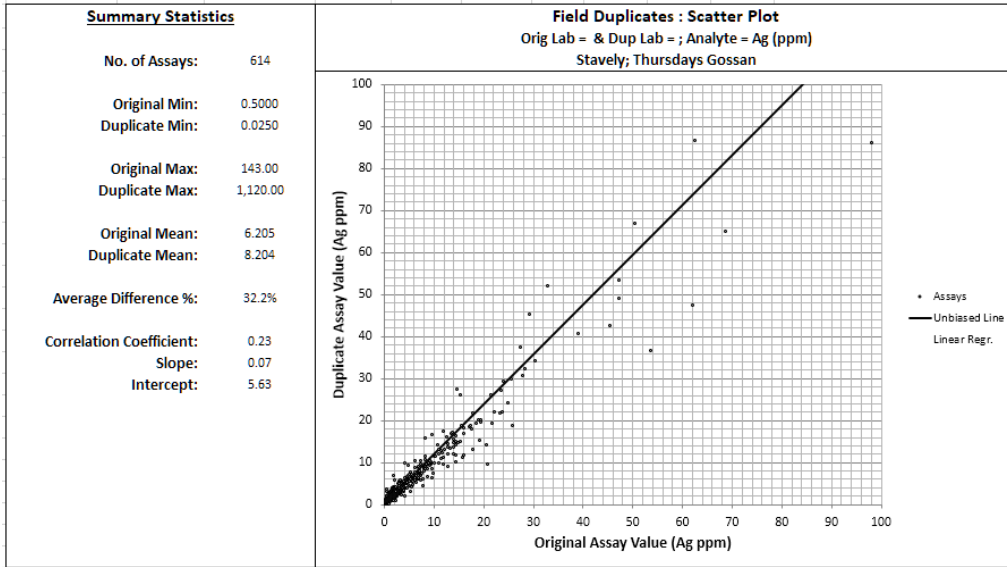


Figure 3: Ag Scatter plots – All (top), DDH (middle) and Sonic (bottom)

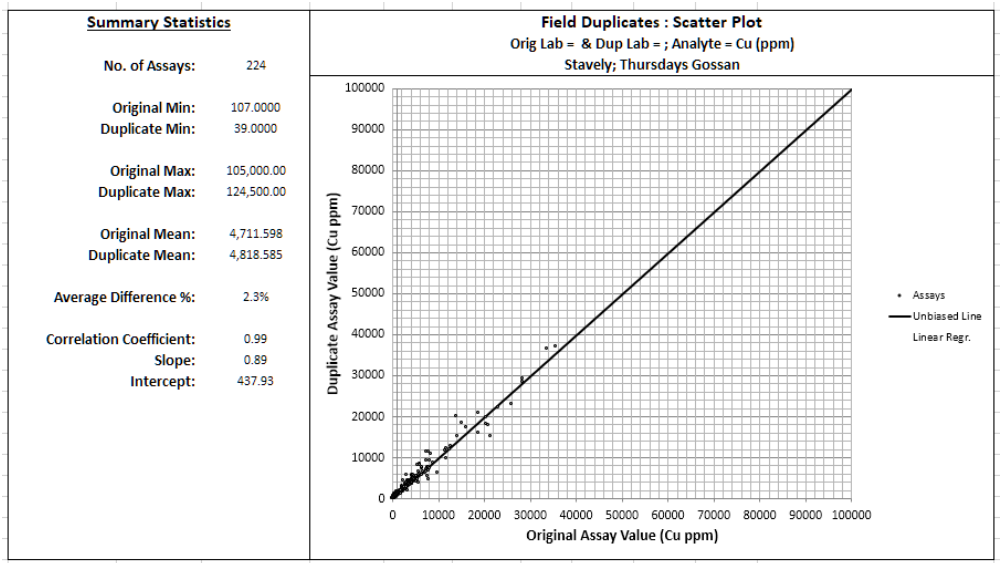
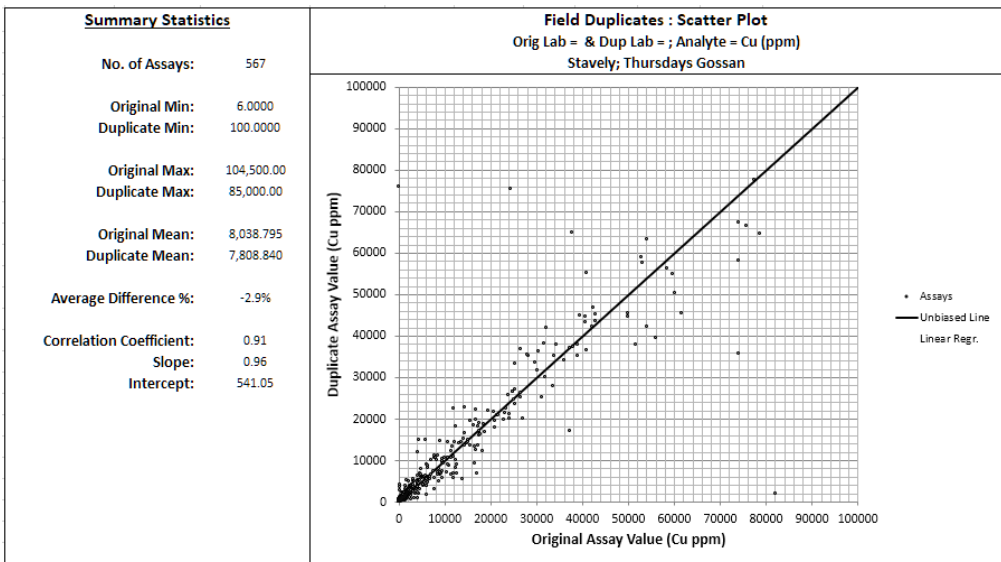
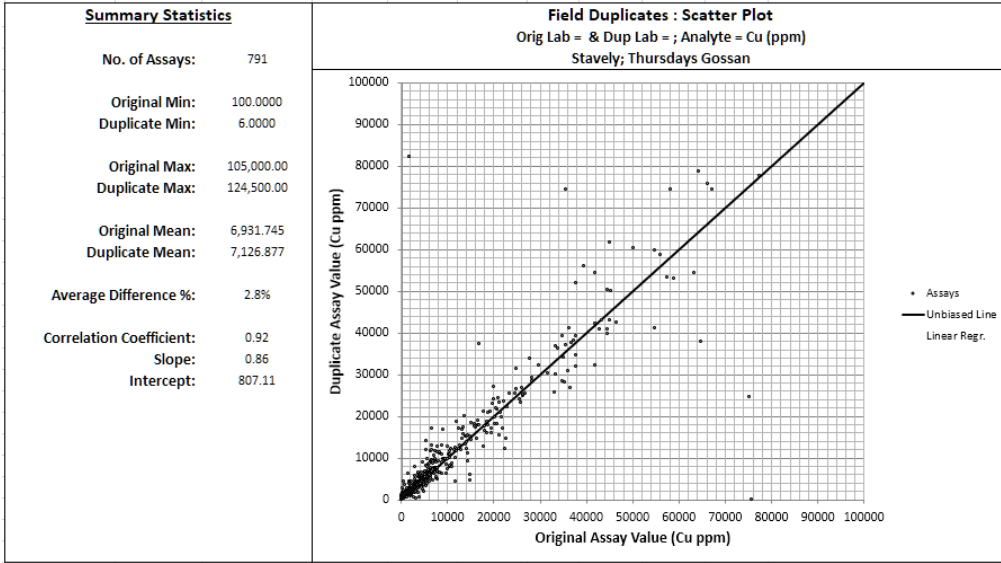


Figure 4: Cu Scatter plots – All (top), DDH (middle) and Sonic (bottom).

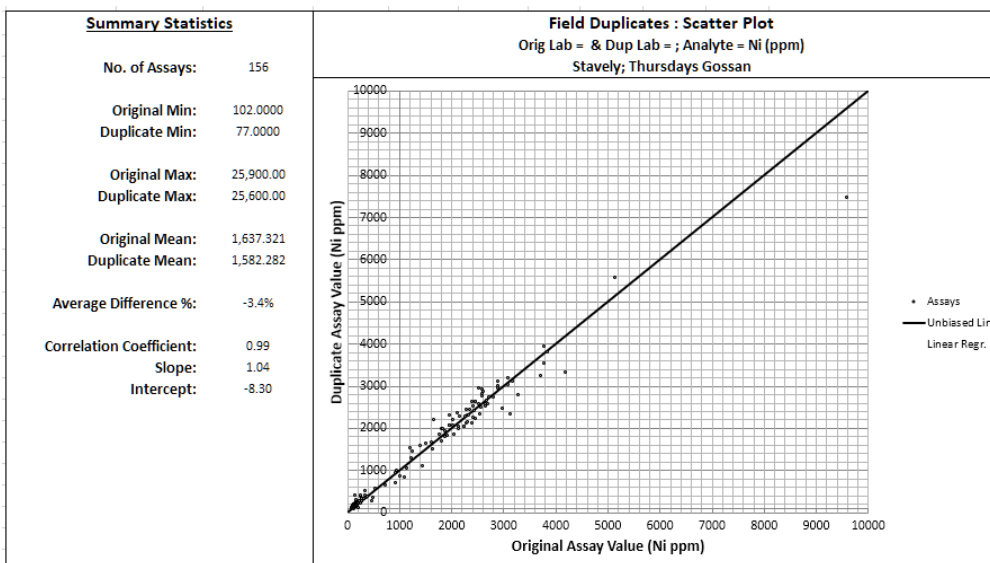
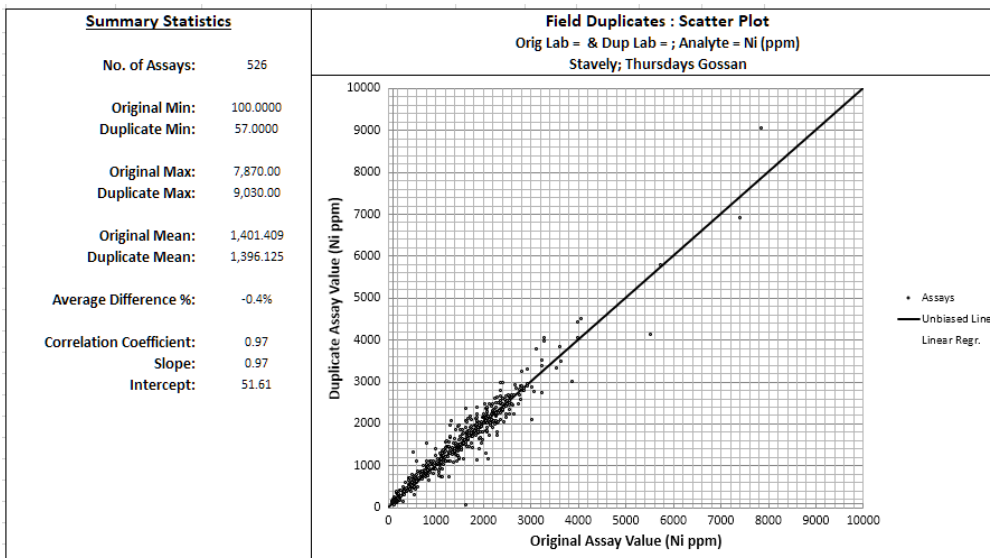
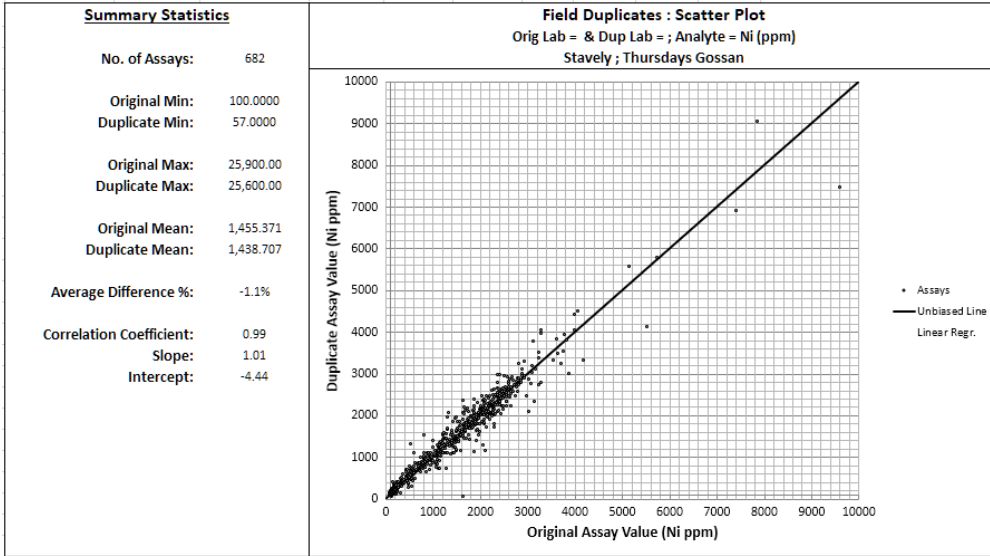


Figure 5: Ni Scatter plots – All (top), DDH (middle) and Sonic (bottom).

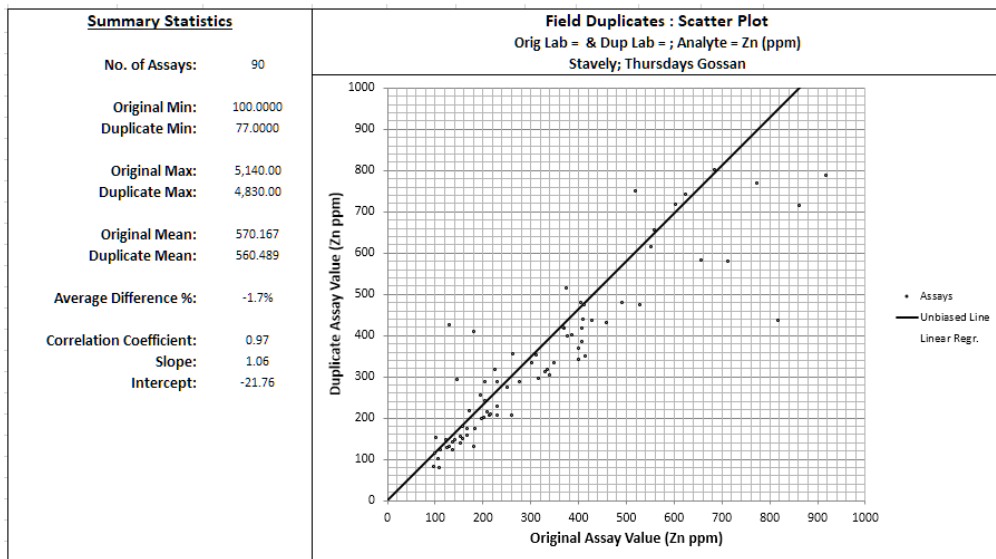
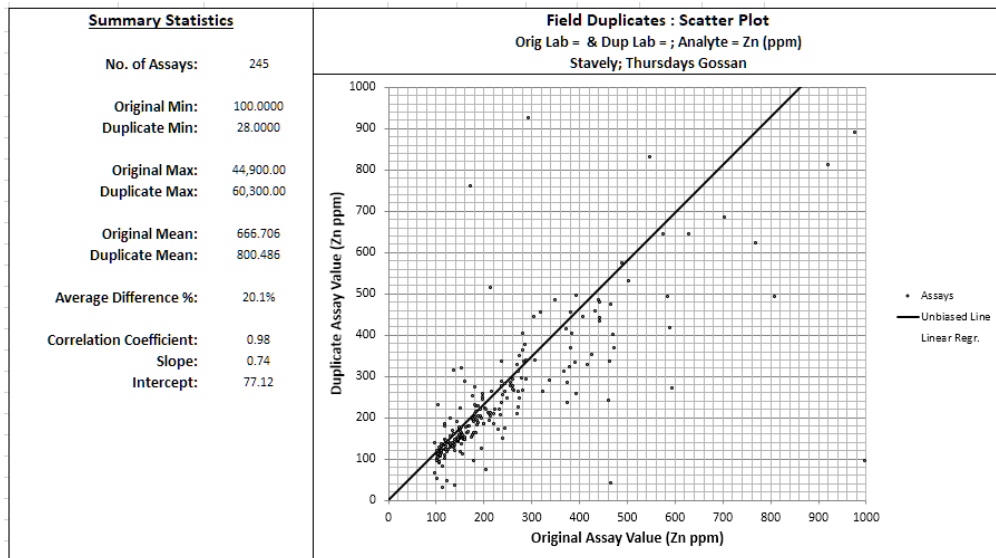
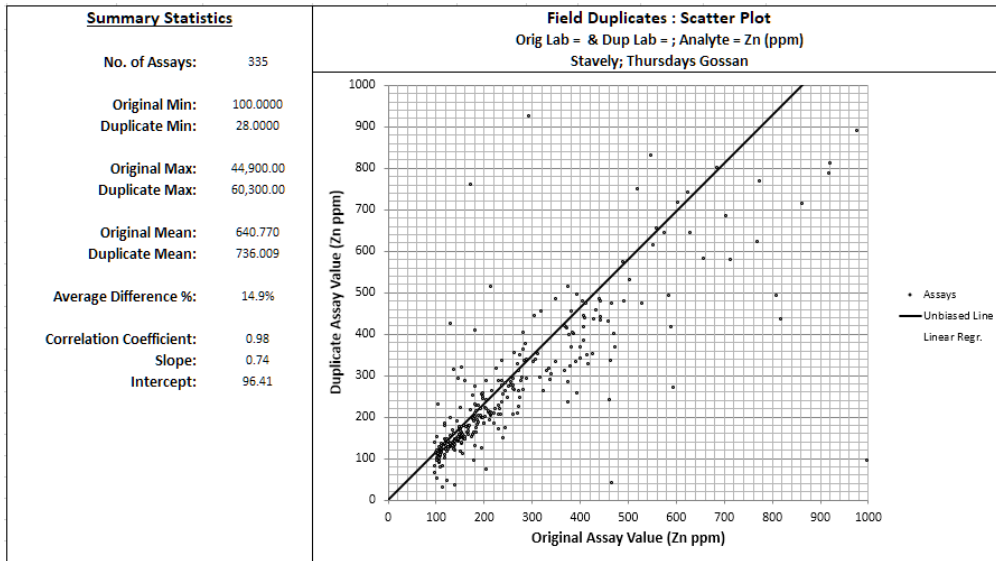


Figure 6: Zn Scatter plots – All (top), DDH (middle) and Sonic (bottom).

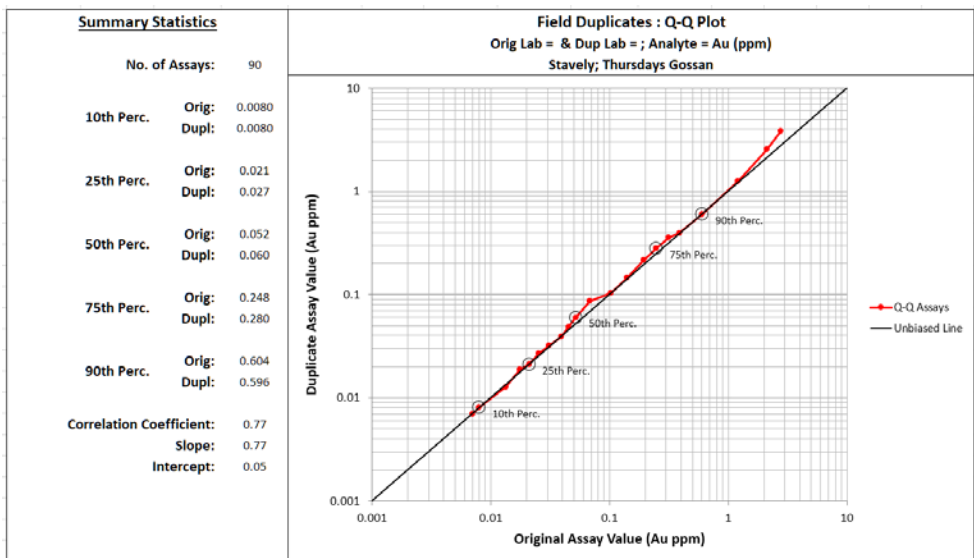
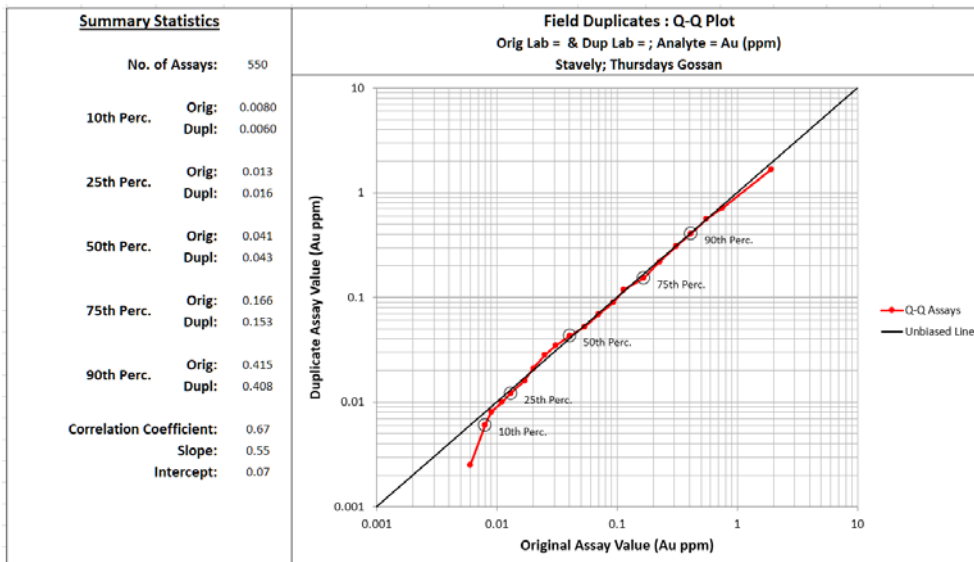
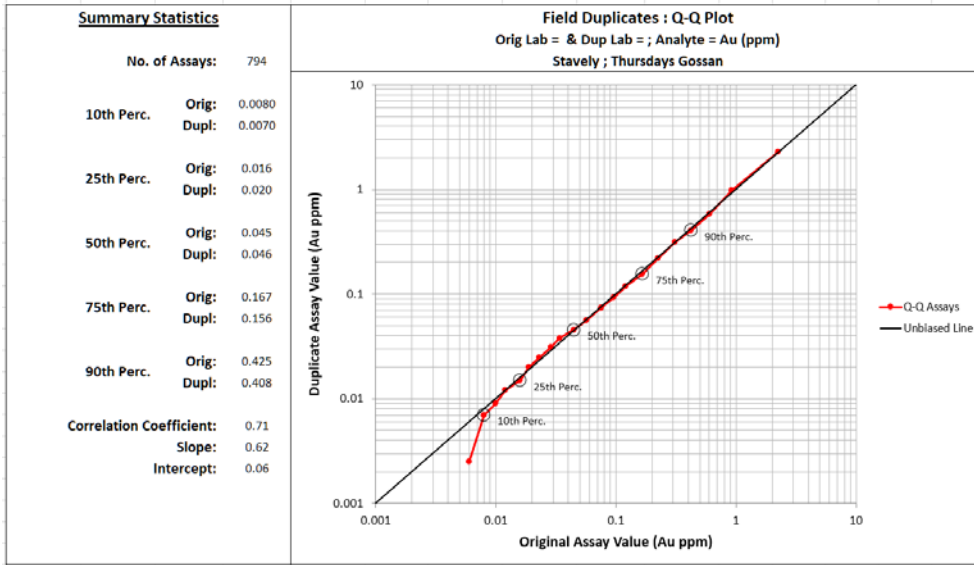


Figure 7: Au QQ plots – All (top), DDH (middle) and Sonic (bottom).

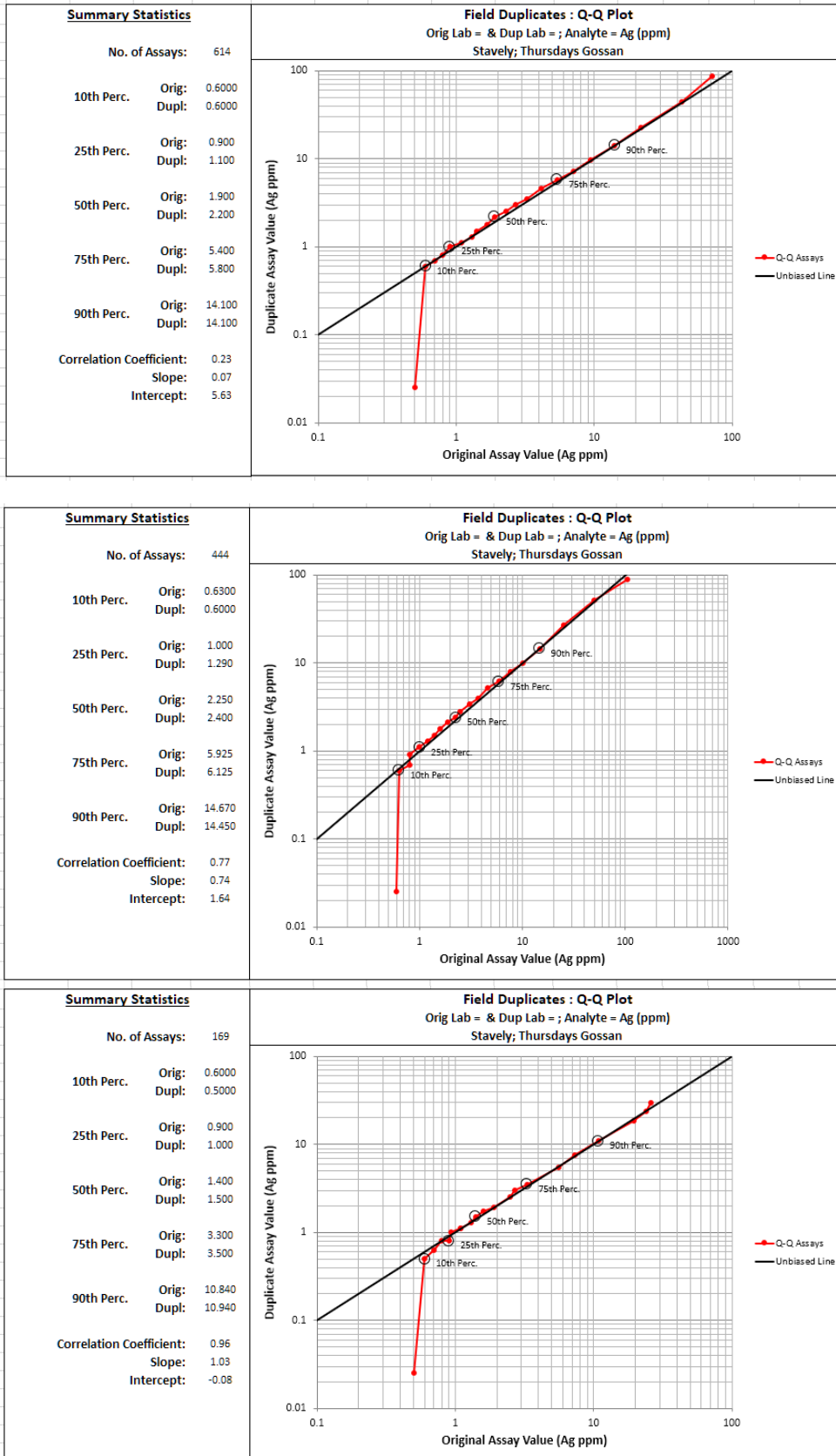


Figure 8: Ag QQ plots – All (top), DDH (middle) and Sonic (bottom).

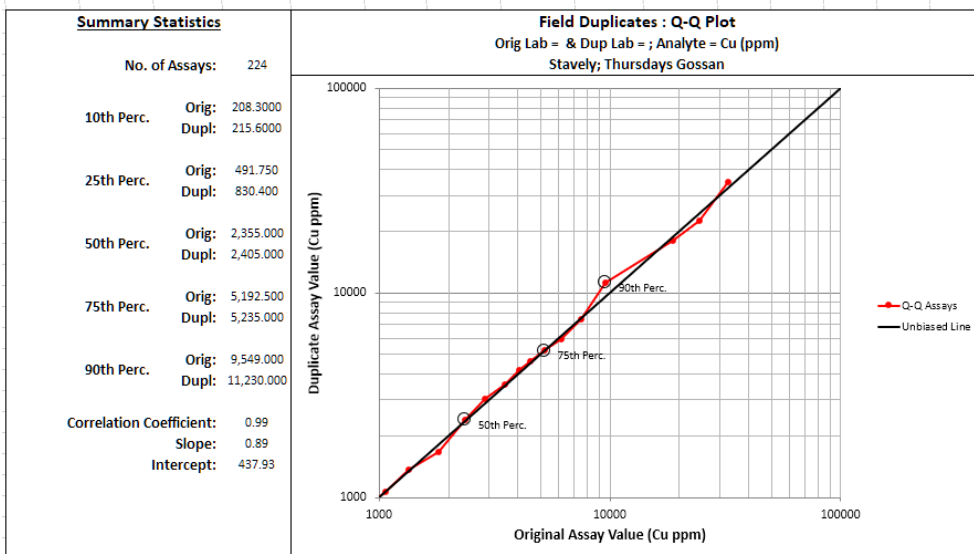
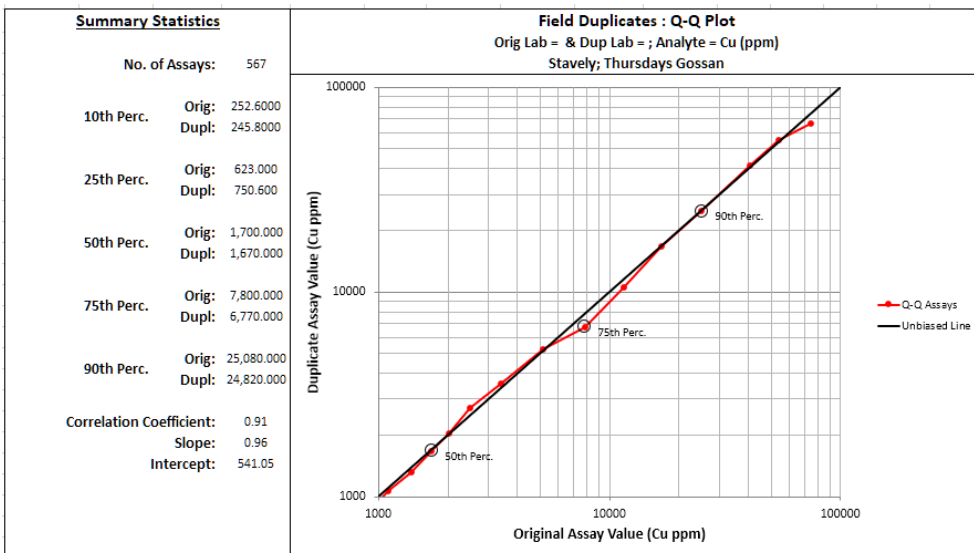
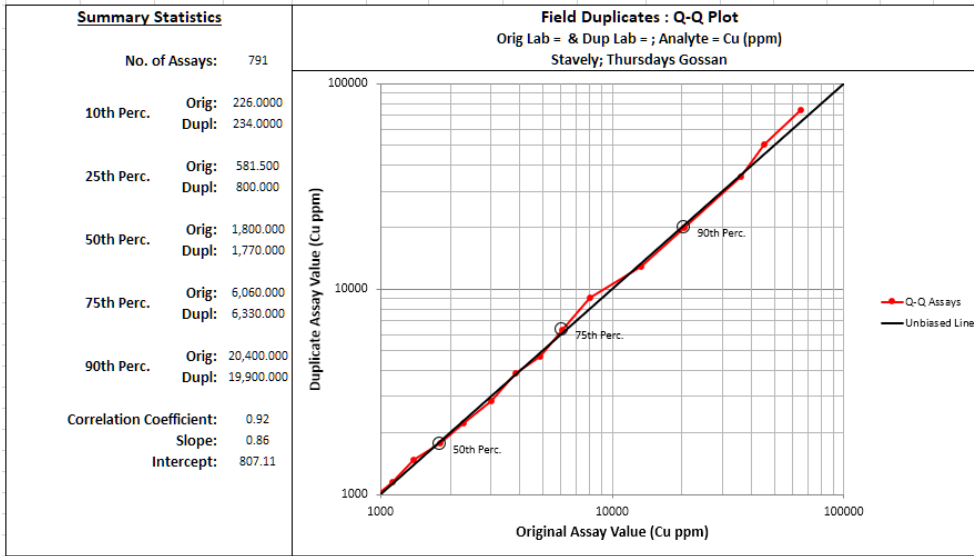


Figure 9: Cu QQ plots – All (top), DDH (middle) and Sonic (bottom).

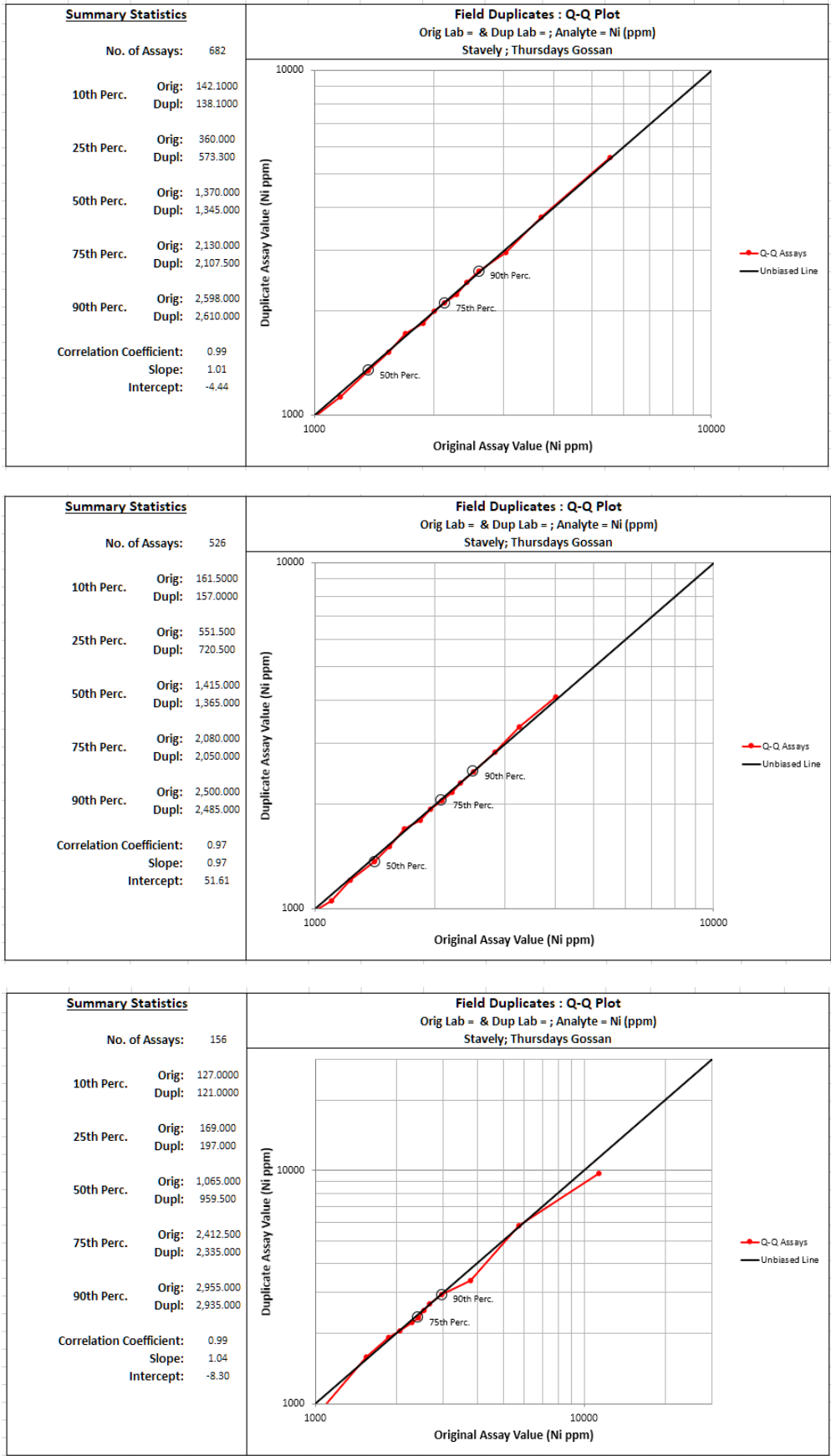


Figure 10: Ni QQ plots – All (top), DDH (middle) and Sonic (bottom).

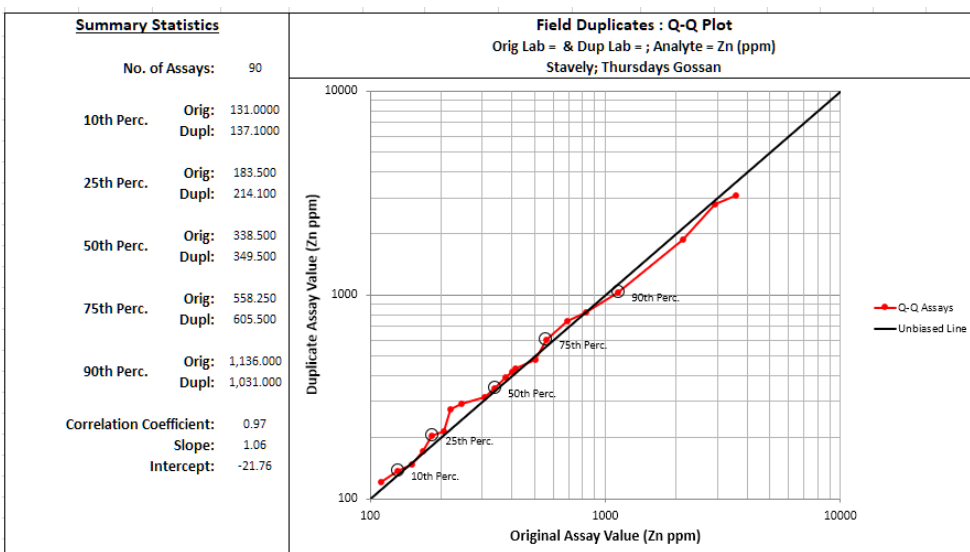
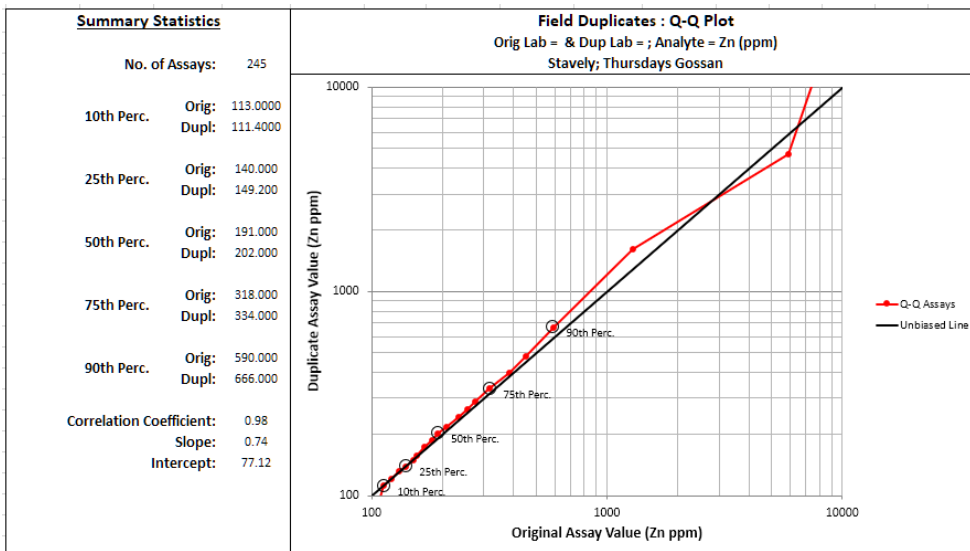
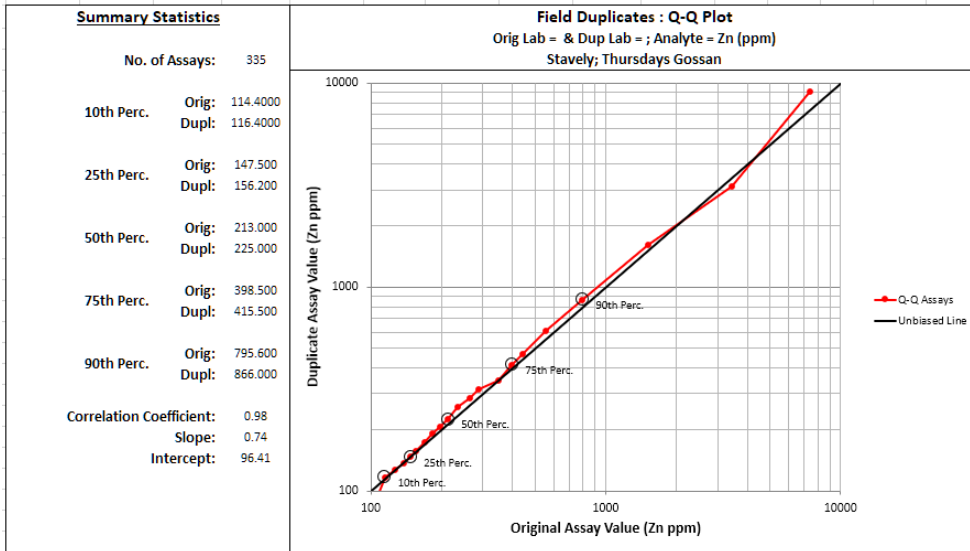


Figure 11: Zn QQ plots – All (top), DDH (middle) and Sonic (bottom).

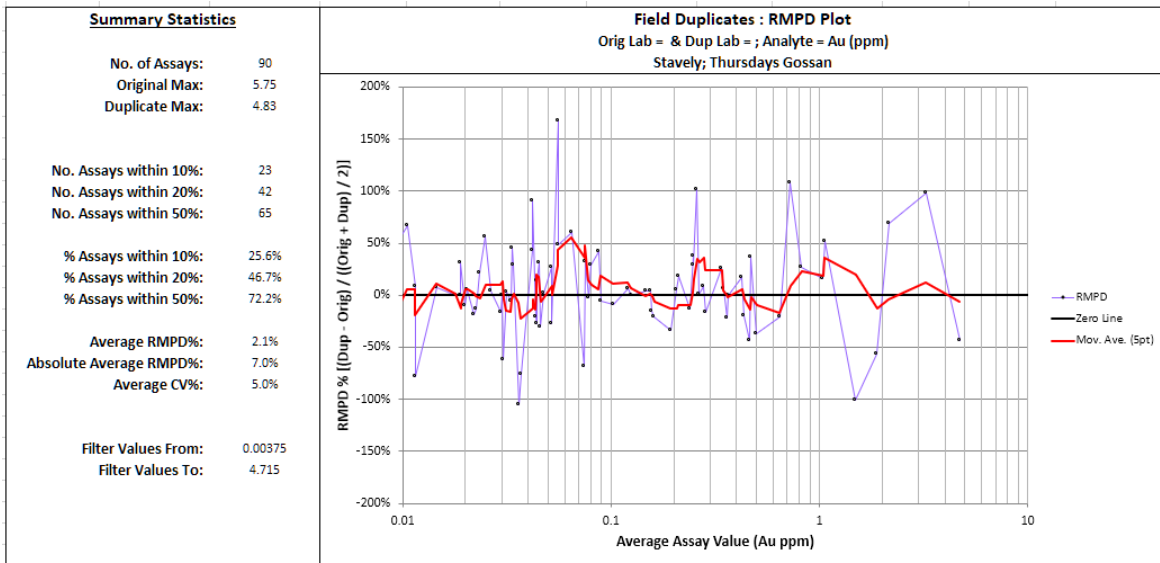
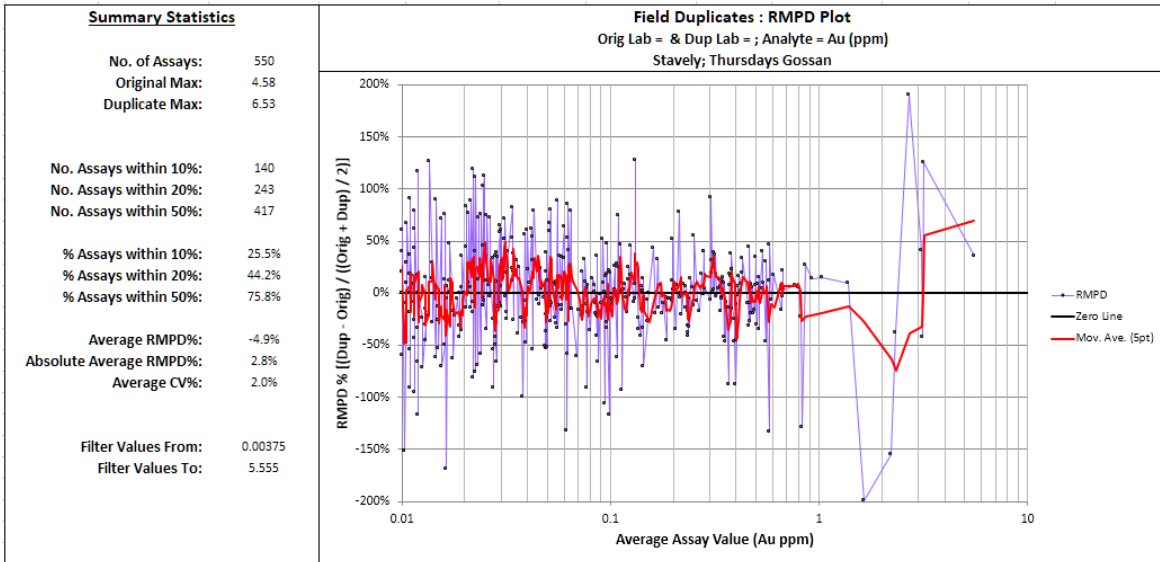
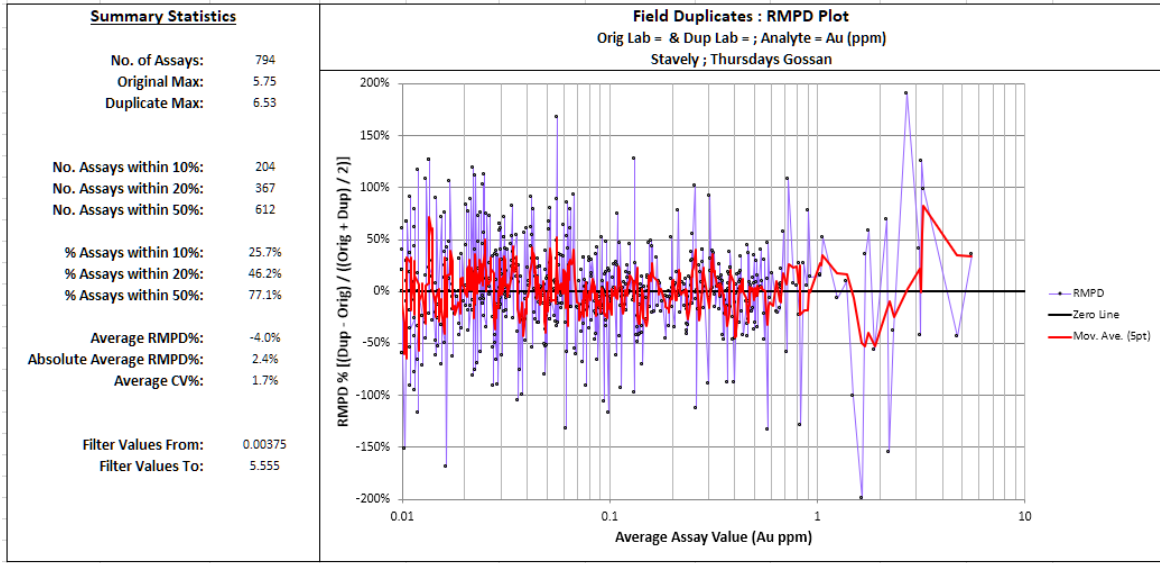


Figure 12: Au RMPD plots – All (top), DDH (middle) and Sonic (bottom).

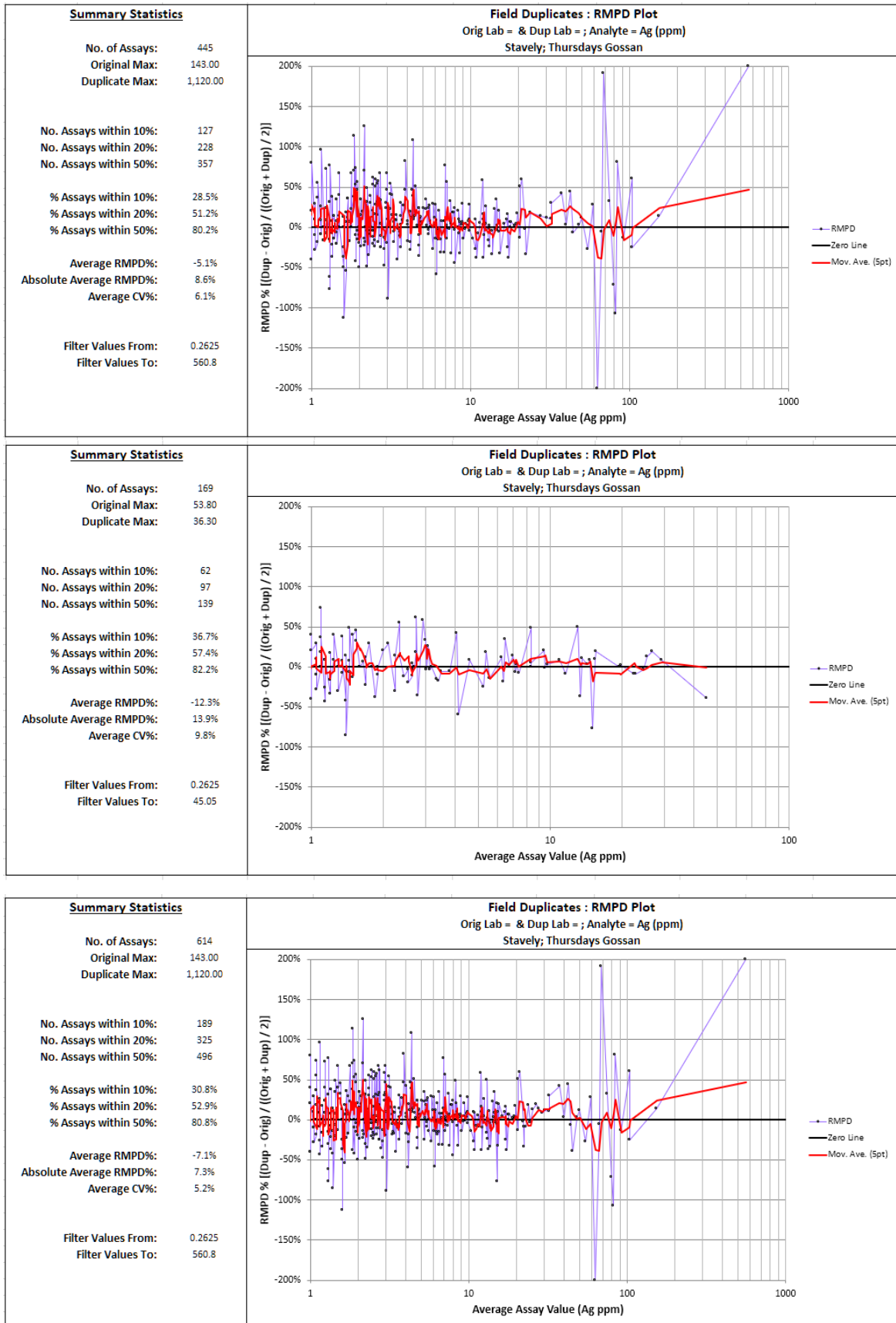


Figure 13: Ag RMPD plots – All (top), DDH (middle) and Sonic (bottom).

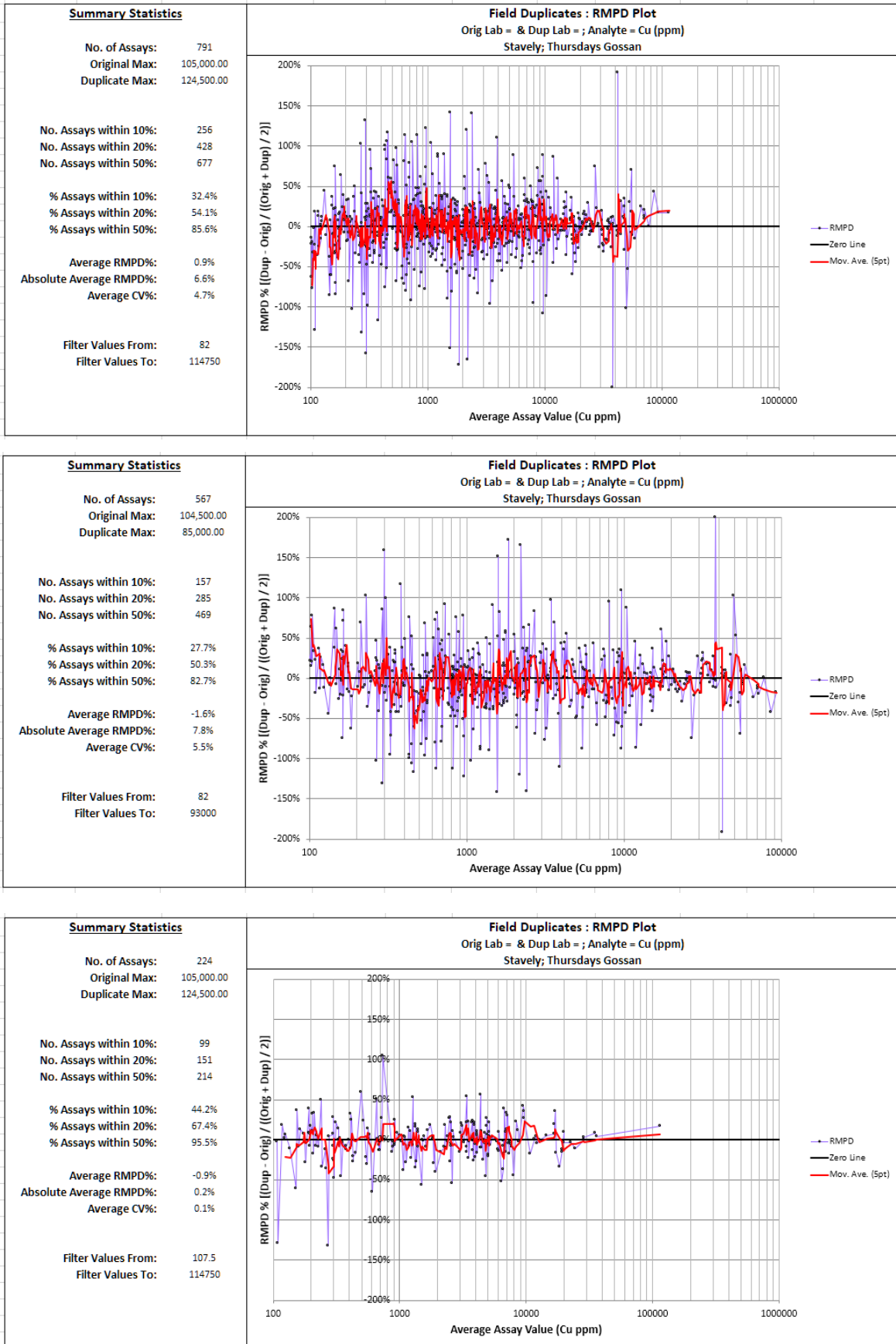


Figure 14: Cu RMPD plots – All (top), DDH (middle) and Sonic (bottom).

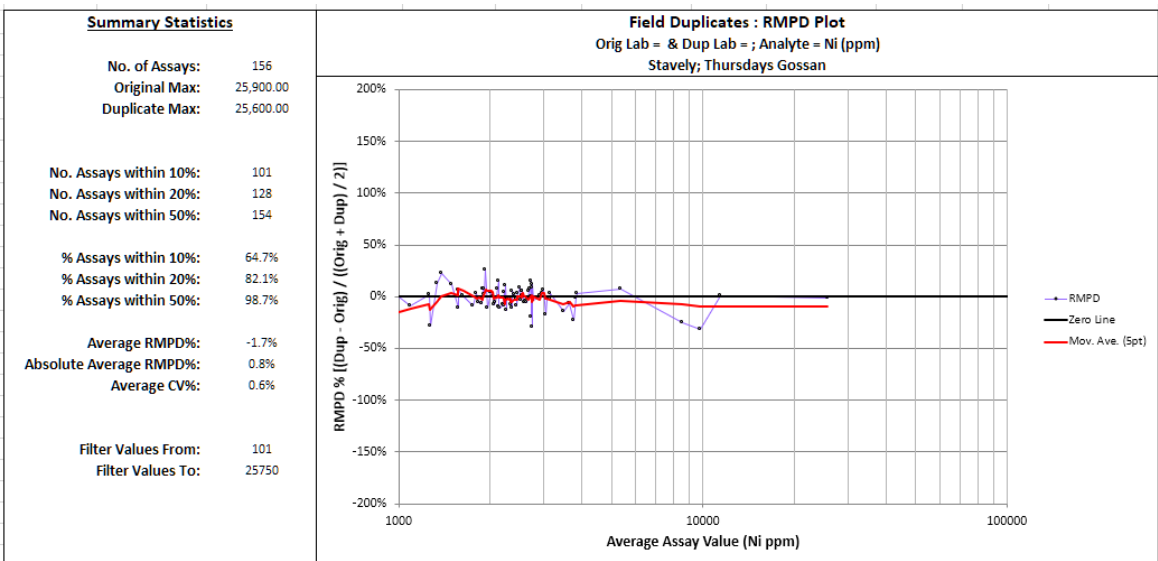
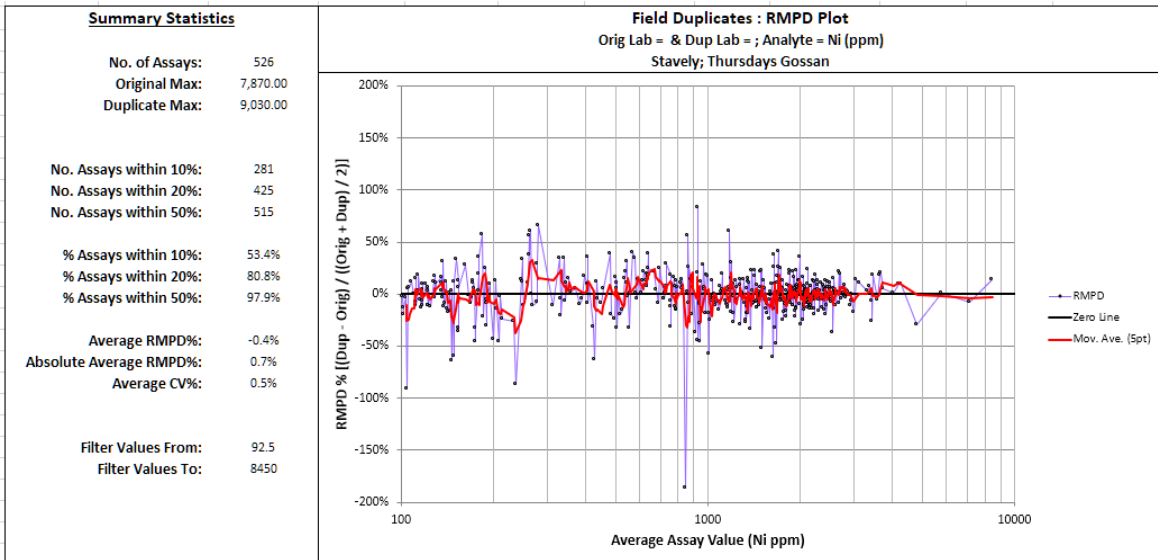
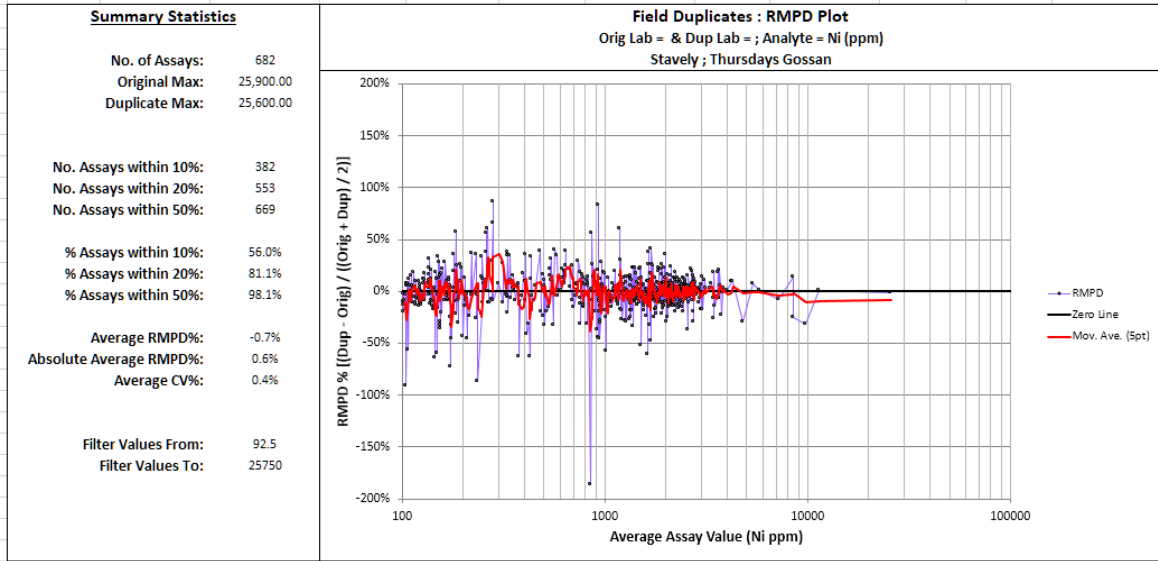


Figure 15: Ni RMPD plots – All (top), DDH (middle) and Sonic (bottom).

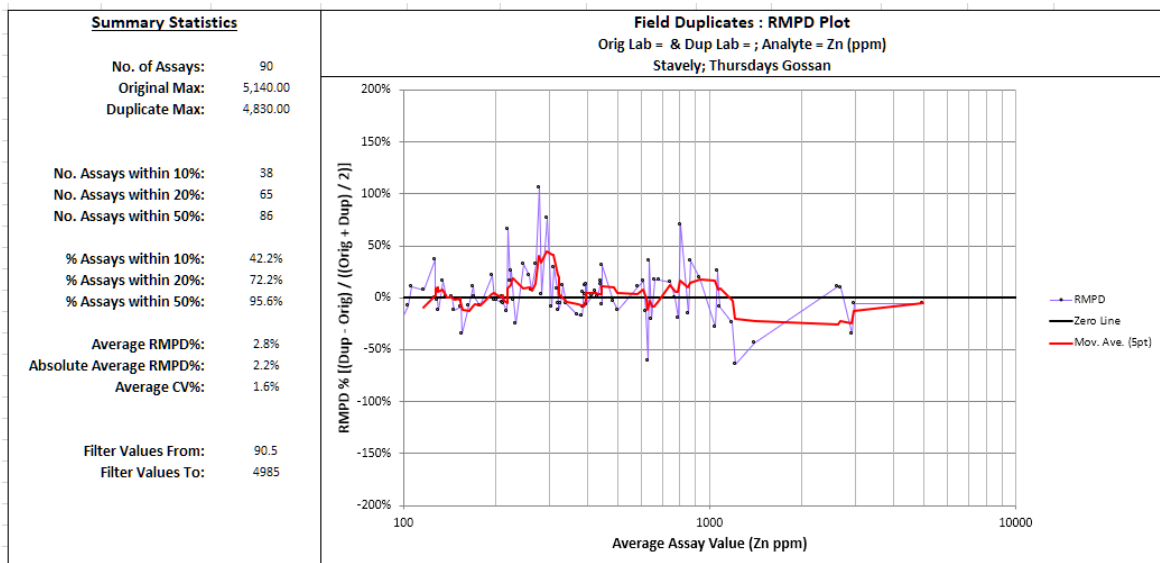
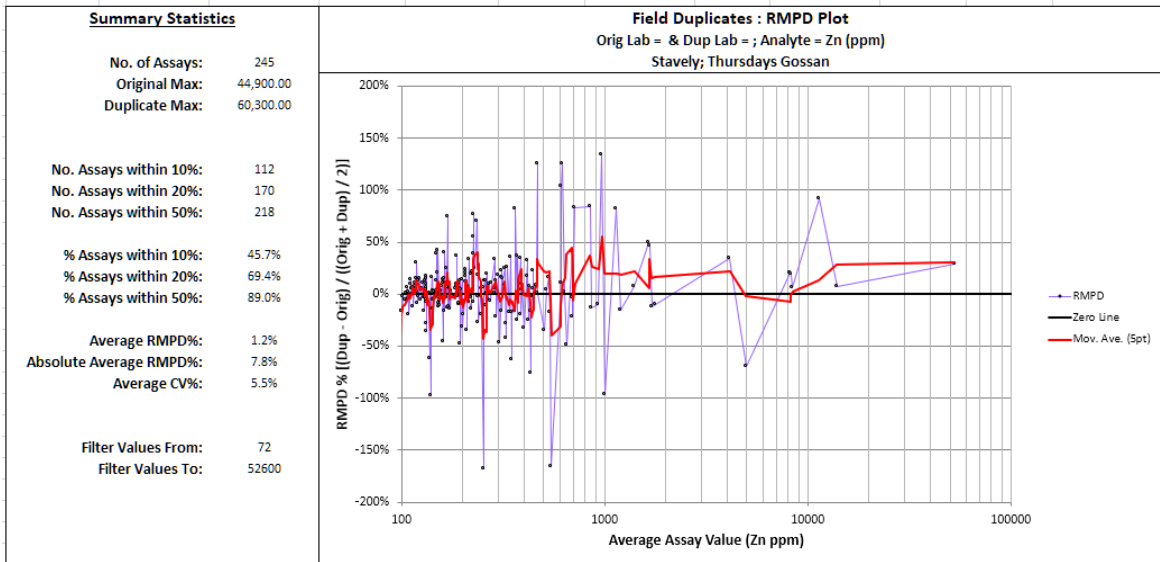
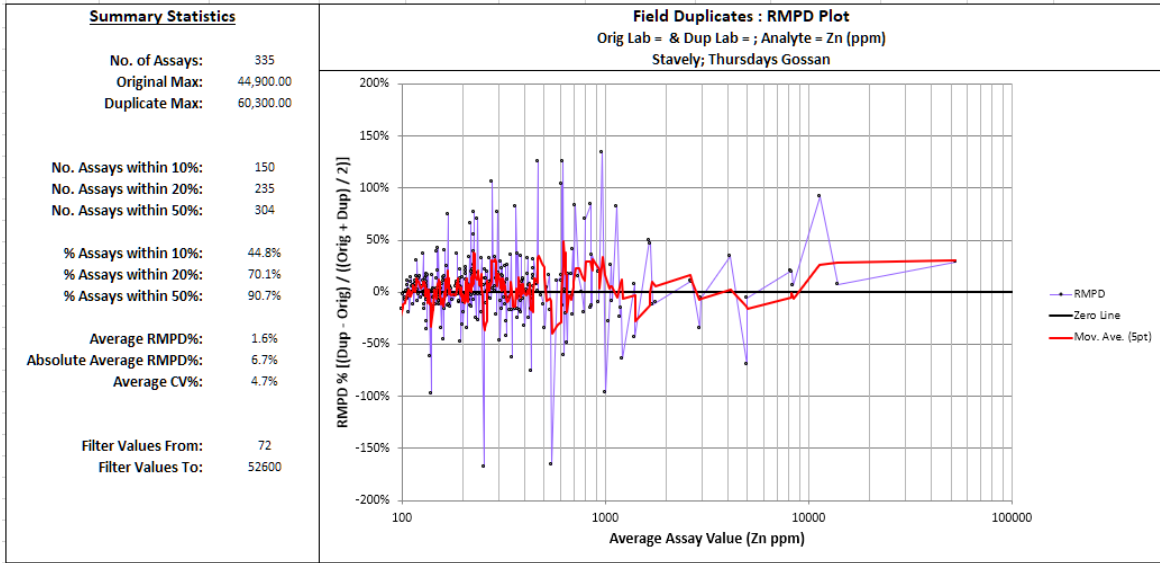


Figure 16: Zn RMPD plots – All (top), DDH (middle) and Sonic (bottom).