

RF Fault Analysis January and March 2020

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Discussion

RF fault analysis in the manner discussed in <https://arxiv.org/abs/1502.06877> was performed over the winter 2019-2020 break and after the lab shut down for the public health emergency. The results are given in the spreadsheets attached. Graphs comparing the gradients for which two day fault intervals are predicted in both data sets and of the statistical significance of the slopes of the fits are presented here. Definition: $t_value = \text{parameter_value} / \text{standard_error}$. Qualitatively, it's how many sigma away from the null hypothesis the parameter is.

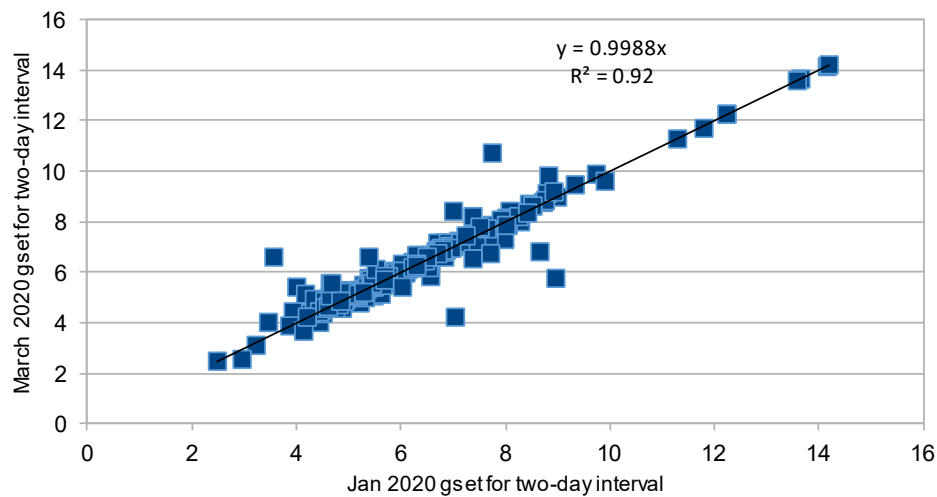


Figure 1. Comparison of all models, two day interval gsets. Three got worse, two got better.

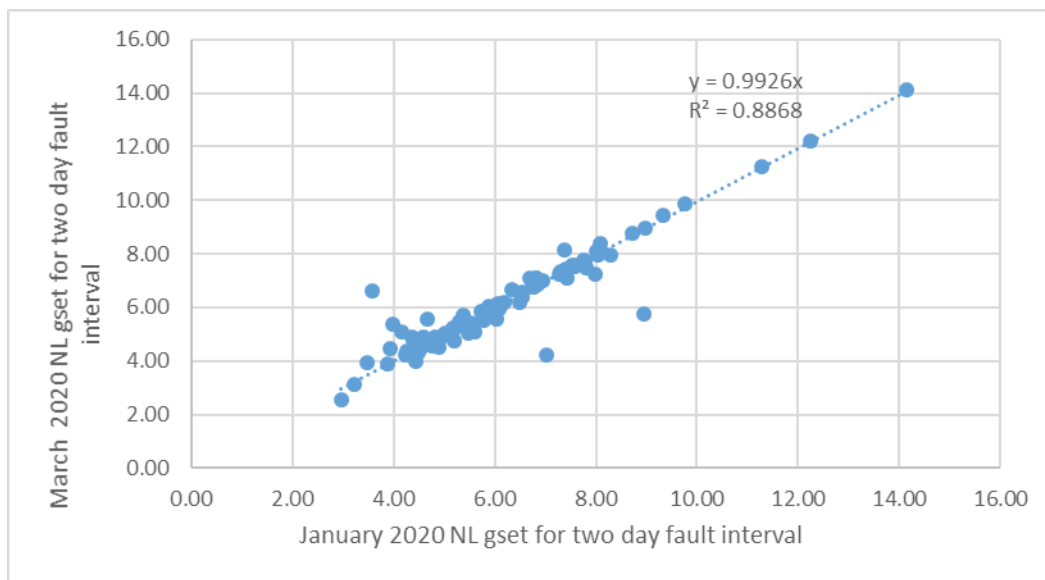


Figure 2. NL subset of figure 1.

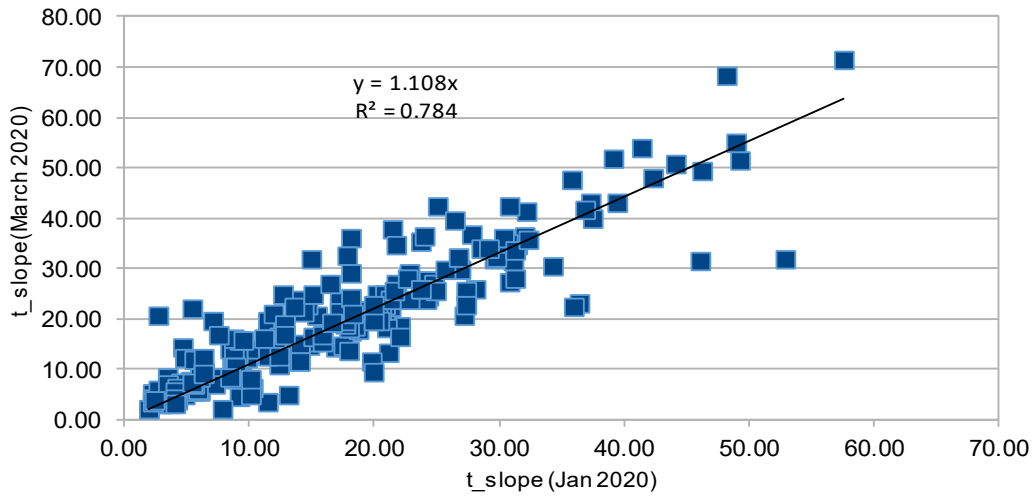


Figure 3. t_slope values for all models

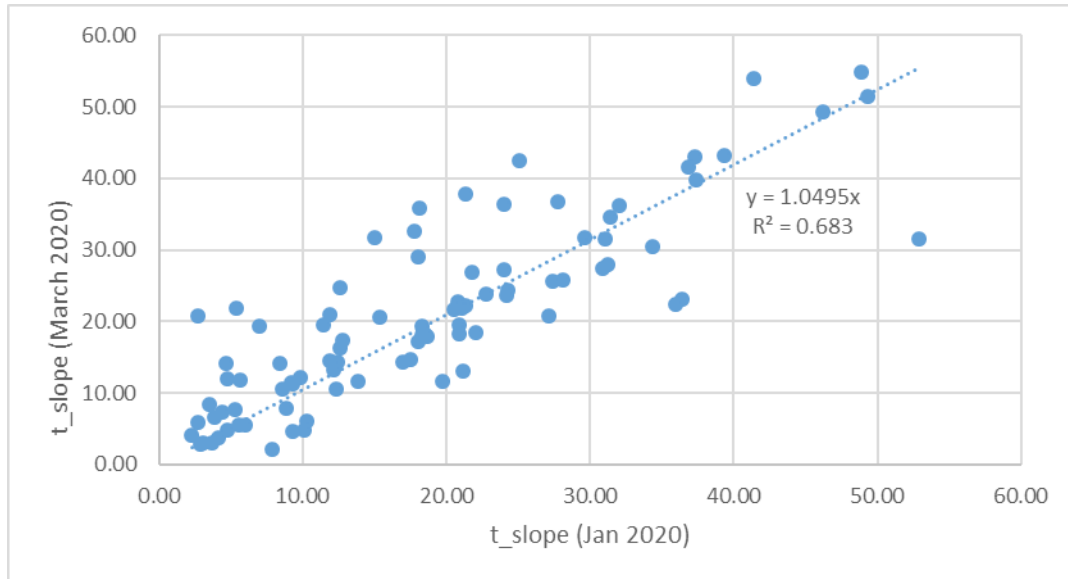


Figure 4. NL subset of Figure 3.

Figures 1 and 3 were originally made in LibreOffice. I found that LibreOffice does not compute R^2 properly when the intercept is forced to zero but Excel appears to do so, so I moved the spreadsheet to Excel. Figures 2 and 4 were created in Excel. The South Linac had many fewer faults than the North because it had about 60 MeV more headroom.

All of the analysis for the data set ending March 24 was done in JMP while away from the lab. Normally, as in December-January, an R-based script is used to fit all of the cavity data and the resulting fits are used except in cases which appear to the author to warrant further examination manually. Four R regression subroutines are used: ordinary least squares (OLS), M-weighted, MM-weighted and least trimmed squares (LTS). OLS is used unless it's clear visually that one of the others is likely better. When working manually, the author removes outliers based on histograms of residuals and RF condition (testing, maintenance, operations) during which the fault was recorded. It is likely that some of the improvement in t_slope was due to this manual selection. The three large reductions in t_slope are due to new field emitters.

Conclusion

SRF cavity behavior did not change substantially during the January to March run.