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## Statistical Evaluation of Arc Dynamics Measured During an Industrial VAR Melt of IN718 Under Various Arc Gaps

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An industrial scale experiment on the impacts of process variations on ingot quality of IN718 was carried out by monitoring the associated magnetic fields by VARmetric. The test performed monitored operational variations during the processing of the ingot when different arc gaps were maintained. A short, medium, long, and extra-long arc gap were chosen during the melt, the system was allowed to operate for approximately 1 hour at each arc gap before readjusting to the next arc gap. Magnetic field measurements were used to continuously determine the arc centroid position during the melt. A detailed analysis of the arc position measurements was conducted employing quantitative and statistical tools to assess the overall impact of process variations on the distribution of arcs. The arc rotation and spread were characterized for different arc gaps which clearly shows the transition from a diffuse to a constricted arc mode. A strong correlation was observed between the arc radius and arc gap which may be able to be used to monitor arc gap size in lieu of drop shorts.

### Speaker Country

United States

**Primary authors:** Mr MOTLEY, Joshua (Ampere Scientific); Mr CHARMOND, Sylvain (Abuert & Duvall); Dr MCCULLEY, Daniel (Ampere Scientific); Dr CIBULA, Matthew (Ampere Scientific); Mr PETTINGER, Nathan (Ampere Scientific); Dr HANS, Stephane (Aubert & Duval); KING, Paul (Ampere Scientific)

**Presenter:** Mr MOTLEY, Joshua (Ampere Scientific)

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