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Signals from Cygnus

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After the 1992 moratorium on underground nuclear testing, the Subcritical Experiment (SCE) program was initiated to support stockpile stewardship. The SCE laboratory is located in a tunnel complex 1,000 feet below ground surface at the Nevada National Security Site (NNSS). Cygnus is a radiographic x-ray source which is a primary diagnostic for the SCE program. The Cygnus Dual Beam Radiographic Facility consists of two identical radiographic sources, Cygnus 1 and Cygnus 2. From end to end, the Cygnus machines utilize the following components: oil-filled Marx generator, water-filled pulse-forming line (PFL), water-filled coaxial transmission line (CTL), three-cell vacuum induction voltage adder (IVA), and rod-pinch diode. The diode pulse has the following electrical specifications: 2.25 MV, 60 kA, 60 ns. Each source has the following X-ray specifications: 1-mm diameter, 4 rad at 1 m, 50 ns. SCE shots are both single-event and high-value, therefore reliability and reproducibility are key issues of Cygnus. Prior to a SCE, there are a series of test shots performed for confirmation of high levels of reliability and reproducibility. For every shot on Cygnus, voltages and currents along the machine are recorded and monitored. In this paper we present extensive analysis of electrical waveforms which includes examination of multiple parameters (e.g. amplitude, pulse width, pulse shape). The results will involve a statistically meaningful shot sample where machine setup parameters are held consistent. A computer application will be developed for automated shot analysis. Correlation between waveform characteristics and dose performance will be established. This type of extensive, automated analysis will contribute to optimized Cygnus performance on SCEs.

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