

**CYGNUS PFL SWITCH JITTER\***

Charles V. Mitton, George D. Corrow, Mark D. Hansen,  
and David J. Henderson,  
*NSTec, 2621 Losee Rd*  
*North Las Vegas, NV 89030 USA*

Daniel S. Nelson, Eugene C. Ormond, Steve R. Cordova,  
and Isidro Molina  
*Sandia National Laboratories*  
*Albuquerque, NM 87185-1193 USA*

John R. Smith  
*Los Alamos National Laboratory*  
*Los Alamos, NM 87545 USA*

The Cygnus Dual Beam Radiographic Facility consists of two identical radiographic sources - Cygnus 1 and Cygnus 2. Each source has the following x-ray output: 1-mm diameter spot size, 4 rad at 1 m, 50-ns Full Width Half Max. The diode pulse has the following electrical specifications: 2.25 MV, 60 kA, 60 ns. This Radiographic Facility is located in an underground tunnel test area at the Nevada Test Site (NTS). The sources were developed to produce high-resolution images on subcritical tests which are performed at NTS. Subcritical tests are single-shot, high-value events. For this application, it is desirable to maintain a high level of reproducibility in source output. The major components of the Cygnus machines are: Marx generator, water-filled pulse-forming line (PFL), water-filled coaxial transmission line, three-cell inductive voltage adder, and rod-pinch diode. A primary source of fluctuation in Cygnus shot-to-shot performance is jitter in breakdown of the main PFL switch, which is a "self-break" switch. The PFL switch breakdown time determines the peak PFL charging voltage, which ultimately affects the diode pulse. Therefore, PFL switch jitter contributes to shot-to-shot variation in source endpoint energy and dose. In this paper we will present PFL switch jitter analysis for both Cygnus machines and give the correlation with diode performance. For this analysis the PFL switch on each machine was maintained at a single gap setting which has been used for the majority of shots at NTS. In addition to this analysis, PFL switch performance for different switch gap settings taken recently will be examined. Lastly, implications of source jitter for radiographic diagnosis of subcritical shots will be discussed.

---

\* This work was done by National Security Technologies, LLC, under Contract No. DE-AC52-06NA25946 with the U.S. Department of Energy.