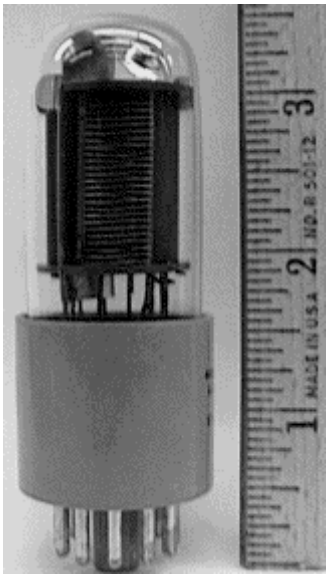

EXPERIMENTAL OBSERVATION AND NUMERICAL CHARACTERIZATION OF A CLASSICAL WIDE BAND ELECTRONIC NOISE SOURCE

Presentation P64 at the 2nd Experimental Chaos Conference, 1993

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Abstract

The output of an overdriven 931A photomultiplier tube provides the basis for an empirical study of a wide band electronic noise source. Various measures of noise and chaos are applied and compared over control parameter space. The output response to periodic, chaotic, and steady input drive is analyzed.

A curious historical fact prompted the beginning of a series of discussions and experiments involving a 931a photo multiplier. During World War II, the development of radar for detecting and tracking aircraft led to the simultaneous need for a wide band electronic noise sources. Although other sources of noise were tried, with a gain of 10^7 and a bandwidth of several hundred megahertz, the photo multiplier was the most successful radar jamming source. As a noise source the tube was operated with a non-modulated input light source and with high gain. The output amplifier photoelectric shot noise was "white" and thus undistinguished from natural noise sources.

Was the output of the World War II radar jammers noise? Was it "white"? Could it have been "Chaotic"? The results of two sets of experiments designed to address these questions is presented.

A purely resistive voltage divider, a housing for the tube, and a 1000 volt DC power supply form the heart of the experiment. the data acquisition was carried out with a CAMAC based wave form recorder controlled via GPIB from a 386/25 Mhz PC. The PC was on the network allowing information to be converted and transported to a variety of platforms for numerical characterization.

The first series of experiments was called SVR, Supply Voltage Ramp. With the photo tube in a light free housing, the supply voltage was ramped up from zero to one thousand Volts DC. At a regular interval of voltage settings, the output of the system was acquired.

The second series of experiments was called ACR. At a fixed supply voltage the voltage of an AC light source was ramped from 0 to 100% in 10% steps.

Analysis performed at the Florida State University included Mutual Information, False Nearest neighbors, Predictability based on the lag from the mutual information and the embedding dimension from False Nearest neighbors. With Predictability we detected evidence for low dimensional deterministic dynamics.

References

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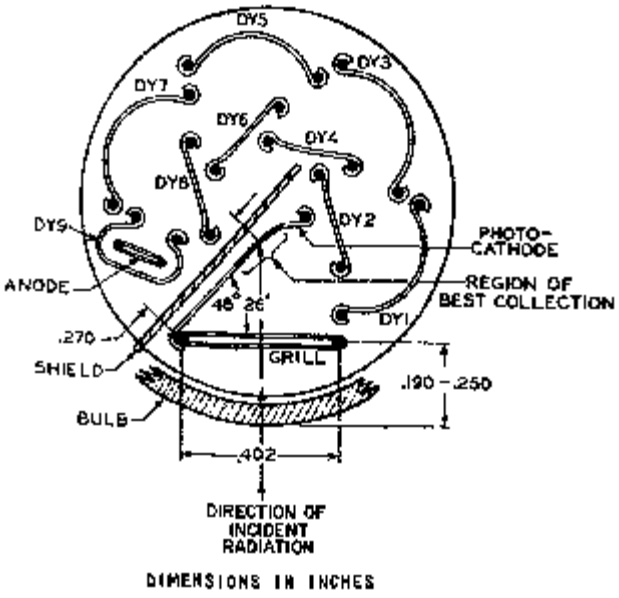
Figures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DIRECTION OF INCIDENT RADIATION
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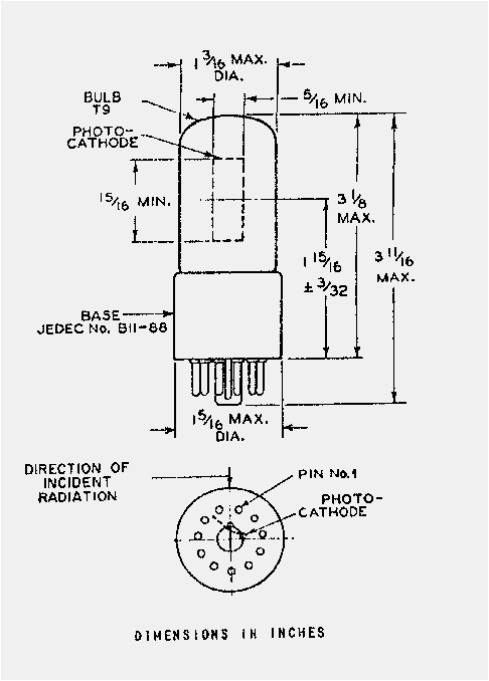
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