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The Story of the LTD Development

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In this presentation the LTD development story will be presented, which begins in the 1980's when the microsecond plasma opening switches (POS) were the focus of many pulse power scientists' research all over the world. The accompanying problems of this technology resulted in the development of the microsecond LTD to replace the long pulse Marx generator coupled to plasma opening switches. Boris Kovalchuk's design of the microsecond LTD cavity, in which the primary energy storage capacitors are directly integrated into the LTD structure, like the SPHINX accelerator of France, was the first crucial step towards the development of this new technology. This led to the invention of the fast (100 ns) LTDs, a natural step to follow which eliminated completely the need for pulse compression and power amplification. Most recently the LTD technology was further developed to generate output pulses of trapezoidal shape with very fast rise time ($< 10\text{ns}$) and flat top, named "Square Pulse LTDs." This newest version of the technology, which replaces the sinusoidal pulse output of the standard LTD, is ideally suited for applications such as flash radiography, Z-pinch, high power microwaves, etc. In this presentation a number of different types of LTDs will be described and their operation analyzed. In addition, since an LTD cavity encloses many spark gap switches, the statistical regularity of these switches, important for the viability of LTD technology, will be discussed.

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