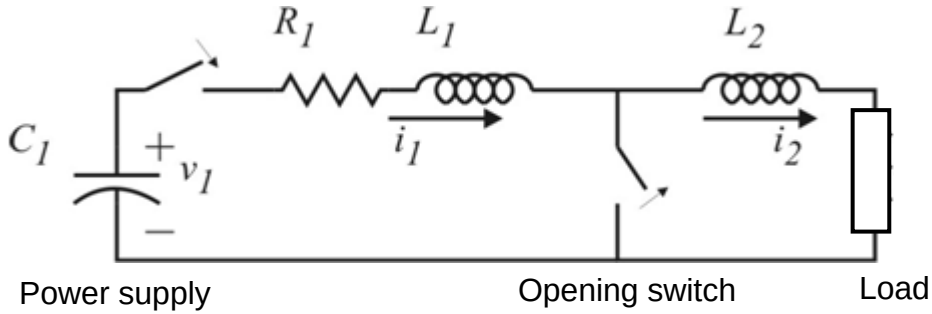
# High frequency, high voltage pulse generator development

SAND2008-5690P

**Exploratory and existing switch technologies have the potential to meet LM's aggressive pulser requirements:**

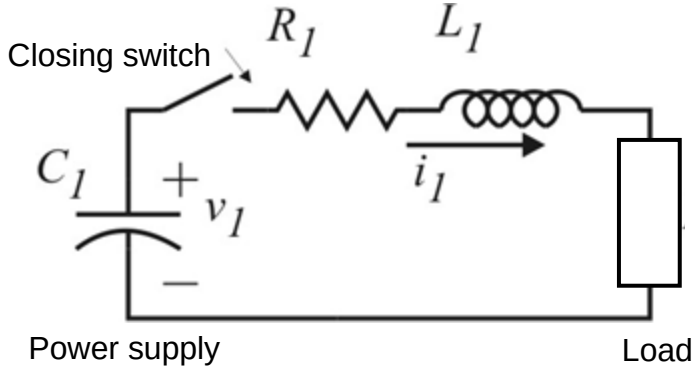
***Kilovolt class, sub-ns risetime, MHz's repetition rate***

**Opening switch topologies** utilizing
- drift step recovery diodes
- ferroelectrics (Sandia proprietary)




*Advantages: risetime predominately limited by opening switch time, not circuit inductance*
*Disadvantages: limited opening switch options, lack of developed commercial sources*

**Closing switch technology** utilizing
- avalanche transistors
- photoconductive semiconductor switches
  (Sandia developed)




*Advantages: commercially available or near-commercial components*
*Disadvantages: difficult to achieve < ns risetimes due to circuit inductance*

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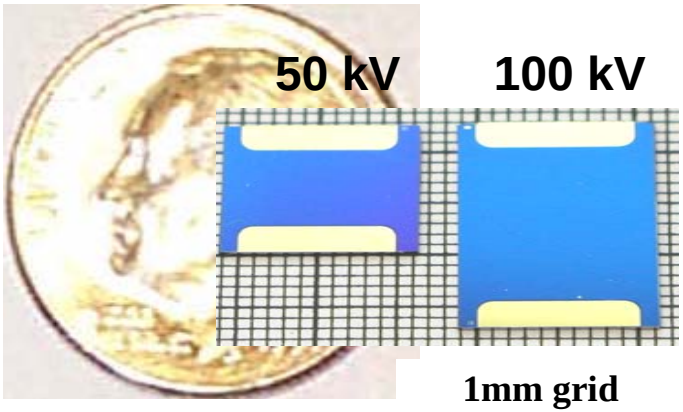
# Photoconductive Semiconductor Switching (PCSS) may be a closing switch candidate

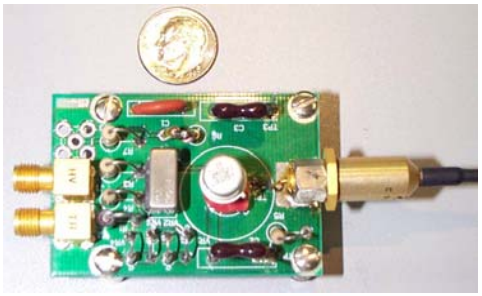
***High field gradients, low jitter (0.1ns), fast risetime (sub-ns*)***

Sandia GaAs PCSS switches

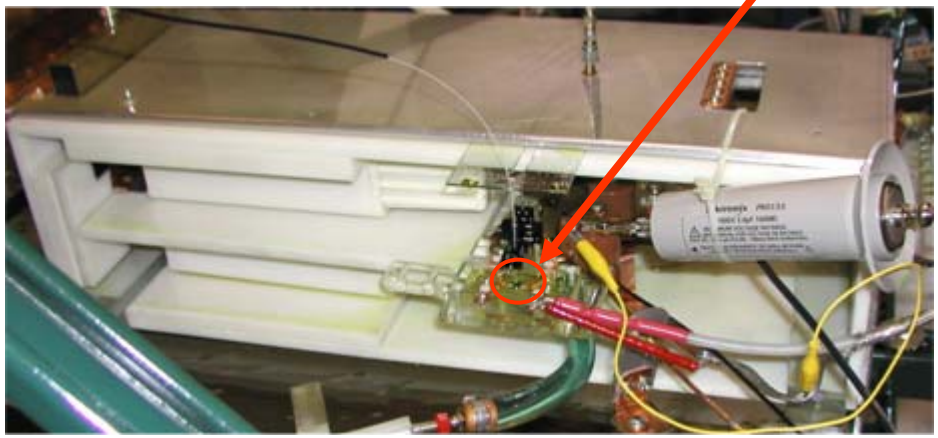



**1mm grid**

**Commercially available laser diode PCSS trigger circuit**



**PCSS switch**



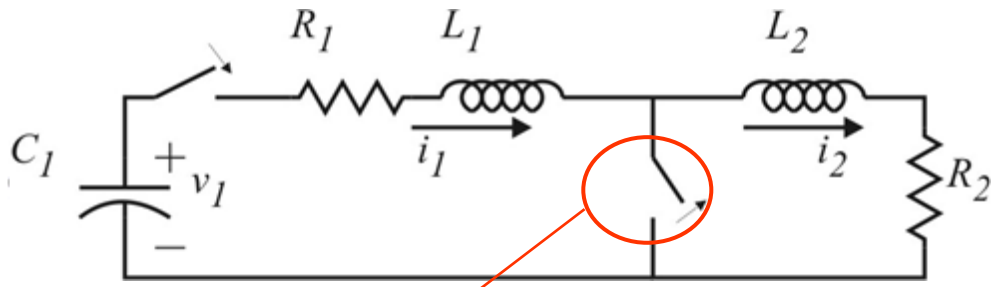
**PCSS switch (40 kV, 100A, sub-ns risetime) used to trigger a one stage, 200kV, 20 kA Marx generator under development for DOE/NNSA program**

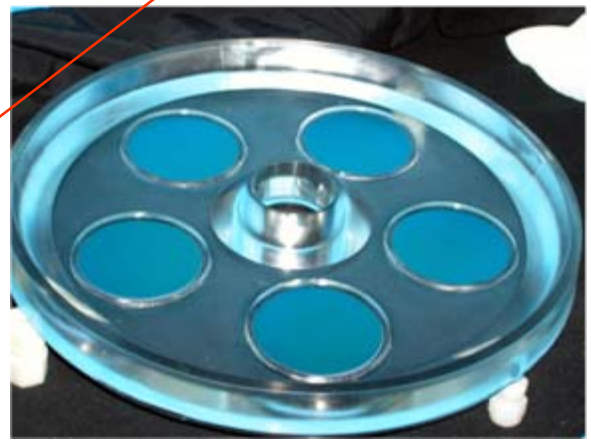
* load risetime depends on circuit parameters

# Relevant solid-state opening switch technology is under development through an internal Sandia R&D program

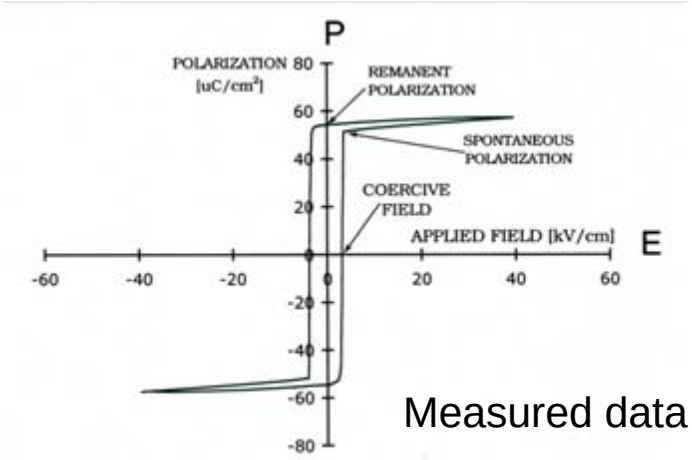
*Opening switch technology is a preferred candidate for fast risetime systems*

Materials under development through Internal R&D exhibit excellent characteristics



Multi-wafer platter created to explore extremely high power applications




Measured data

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# Project schedule / deliverables / Cost

| Year | Deliverables | Requested Funding |
|---|---|---|
| One | - Review and down-select candidate technologies<br>- Develop and demonstrate bench top pulse generator with output parameters of:<br>• 300 kHz<br>• 10 kV<br>• ≤ 5 ns pulse width FWHM into 50 ohm using commercially available materials or PCSS | $400k |
| Two | - Continue development of PCSS or proprietary solid-state opening switch technology (if indicated).<br>- Extend pulse generator performance to:<br>• ≥ 1 MHz<br>• ≤ 10 kV<br>• ≤ 2 ns pulse width FWHM<br>• ≤ 1 ns rise time | $700k |
| Three | - Optimize pulse generator for efficient operation into customer defined load at TRL 6. | $650k |