

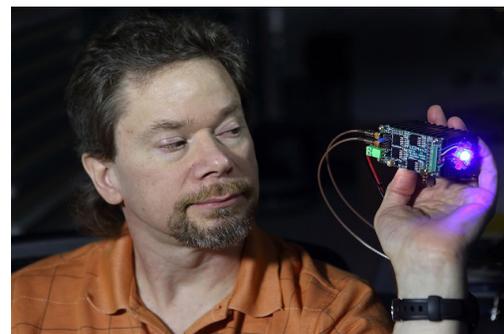
HIGH SPEED, HIGH CURRENT PULSED LED DRIVER

US Pat. No.: 9,603,210

Technology Readiness Level: 4

Basic technological components are integrated to establish that key elements will work together

Sandia's LED Pulser drives high-power LEDs to generate light pulses with shorter duration, higher repetition frequency, and higher intensity than is possible with commercially available LED drivers. This technology utilizes specially designed electronic circuitry that allows it to create intense pulses as short as ten nanoseconds that can illuminate extremely fast processes, such as fuel injection. The LED Pulser can emit up to four colors, each with independent timing and from a nearly coincident source area. This enables a wider range of optical applications and could lead to new imaging techniques.



Inventor Chris Carlen demonstrates the LED Pulser

Sandia engineers have already used the LED Pulser for research projects that formerly required more expensive pulsed lasers for specific measurements. It proved valuable in several research studies aimed towards designing a more efficient and cleaner engine. When paired with a high speed camera, researchers were able to capture detailed, high resolution images of the fuel injection process, helping them improve engine efficiency.

The Sandia LED Pulser's low cost, smaller size, and increased light intensity would allow for more widespread applications by engineers and designers seeking to predict important physical processes.

TECHNICAL BENEFITS

- Smaller and less expensive than commercially available technologies
- Capable of MHz repetition rates
- High resolution images of high speed processes
- Operates with significantly lower energy consumption
- Light-pulse duration approximately 3 orders of magnitude less (~10 ns vs. ~10 ms)
- No warm up necessary

Specification	Sandia LED Pulser	Best Commercial LED Driver	Improvement Factor
Minimum Pulse Duration	10ns	20-50ns	2-5x
Maximum Pulse Rate	2-5 MHz	660kHz	3-7x
Peak Brightness, 1mm ²	12 W	2.8 W	4x
Max. Number of Colors	4	1	4x
Size/Weight	160cc / 250 g	200cc / -	1.25x
Cost	\$600 (parts + labor)	\$2000-5000	3-8x

TECHNICAL BENEFITS

The LED Pulsar was used in Sandia's research on the science of internal combustion engine fuel injection spray. When paired with a high-speed digital camera, researchers were able to capture 200,000 high quality, detailed images that were used to develop advanced computer models of the process. The motion of liquid droplets and ligaments were effectively "frozen" by the LED Pulsar's short nanosecond duration pulses at 200 kHz, allowing researchers to see fine details they weren't able to see before.

The LED driver was used with two LEDs at different wavelengths for imaging of high-speed soot extinction. The near simultaneous imaging allowed researchers to quantify the soot concentration at high-pressures and temperatures.

This patent pending device has proven useful in combustion research, and it can have major impact on additional areas of research and manufacturing. For additional information, click on the picture below.

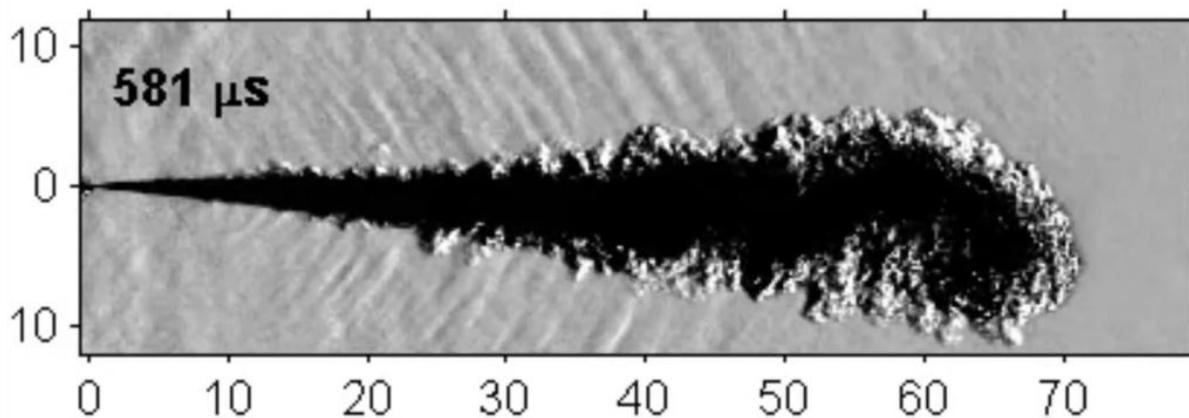


Image of spray development captured using the LED Pulsar coupled with a high-speed camera

INDUSTRIES & APPLICATIONS

- High-speed machine vision
- Ballistics
- Semiconductor manufacturing
- High-speed photography
- High-speed scanning
- Microscopy