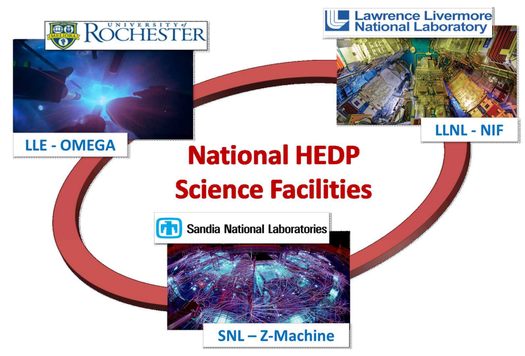
SAND2019-3143C

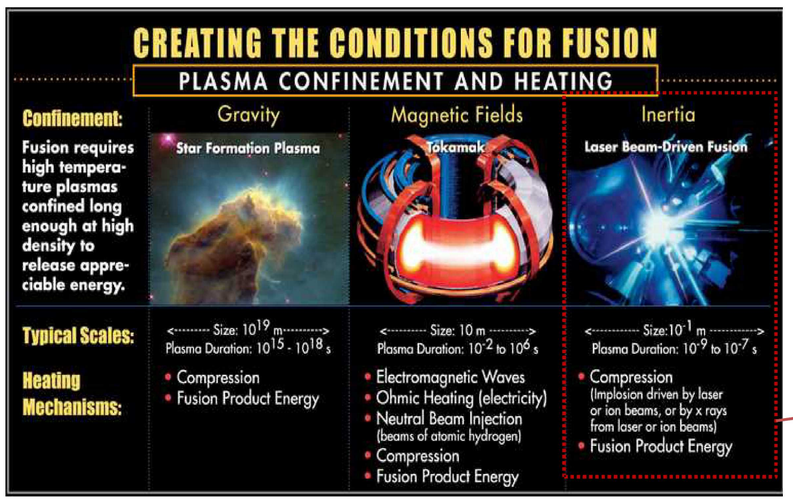
Ultra-fast CMOS Image Sensor Development at Sandia National Laboratories

WHAT

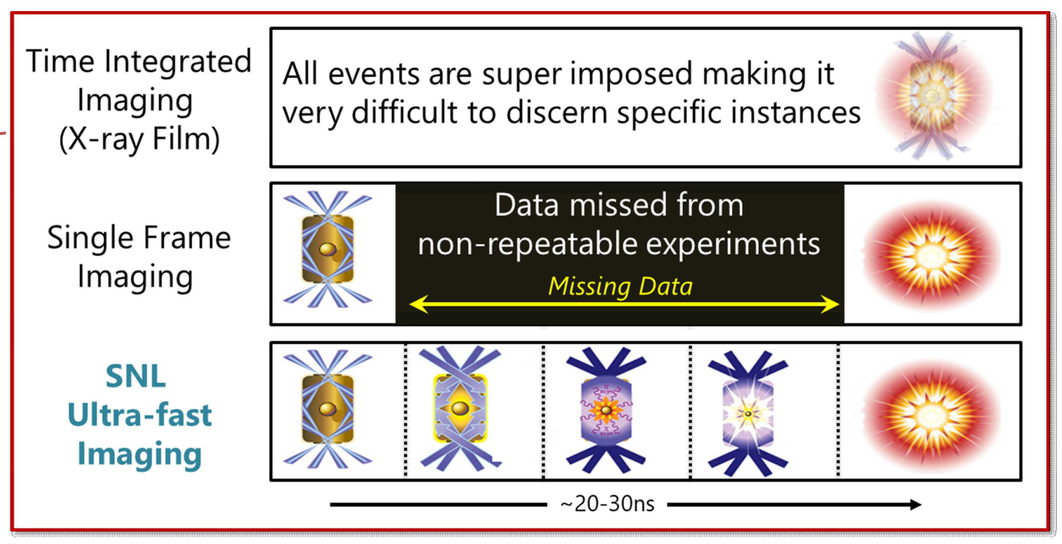
Sandia National Laboratories has developed multi-frame imaging sensors with nanosecond scale shutter speeds for imaging one-time events in national High Energy Density Physics (HEDP) facilities.



WHY



Inertial Confinement Fusion (ICF) experiments have historically relied on single frame or time integrated imaging diagnostics to give information on experiments.

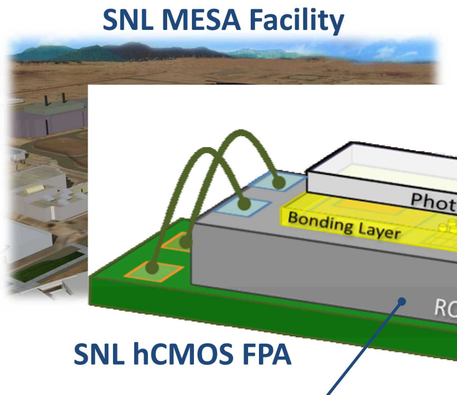


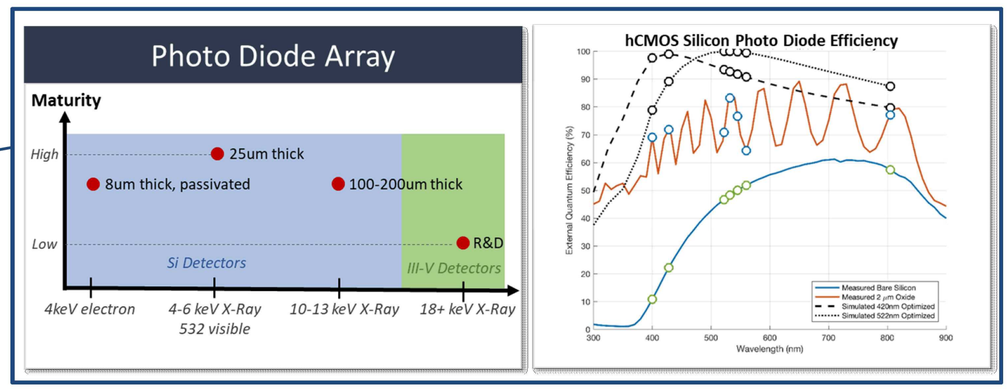
Sensor design goals focused on enabling significant increases in:

- ***Temporal history of experiments*** (multiple frames of data per experiment)
- ***Data accuracy and fidelity*** (images captured from a single experiment)
- ***Facility cost savings and availability*** (more data collected in less time)

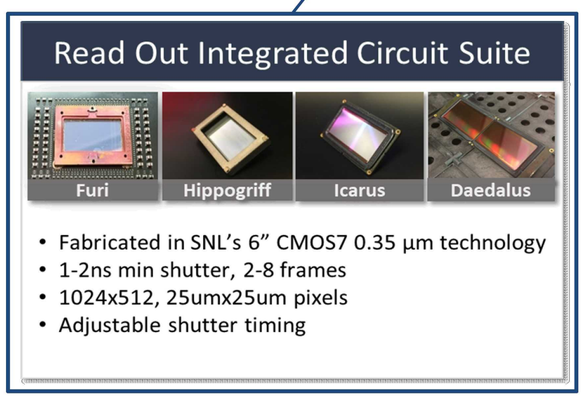
HOW

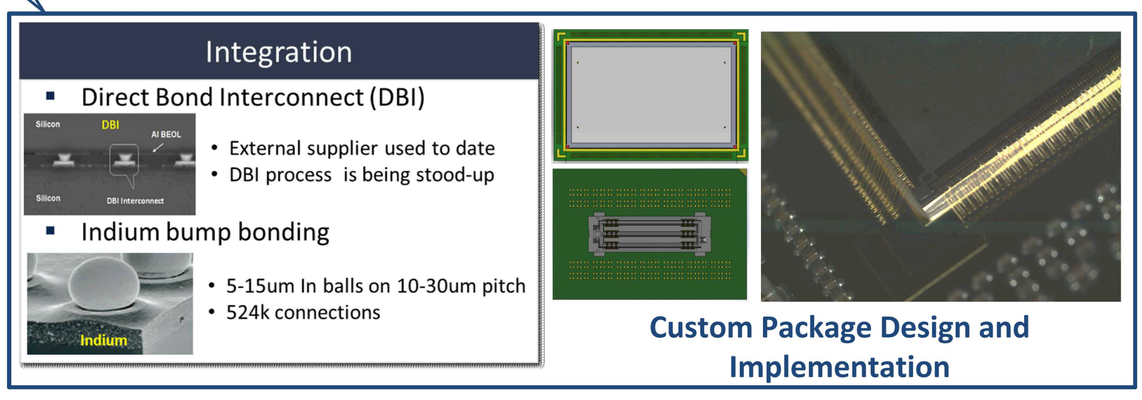
Sandia has developed the base technologies required to realize a family of high speed CMOS Focal Plane Arrays (FPA) that have that have become transformational diagnostics at all HEDP facilities.





The FPAs created thus far make use of silicon detectors fabricated in-house and optimized for detecting a variety of spectra.

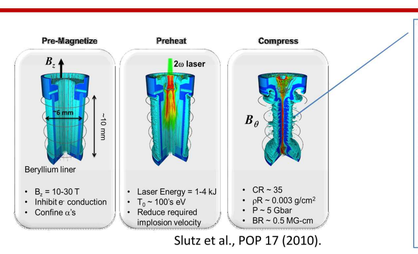




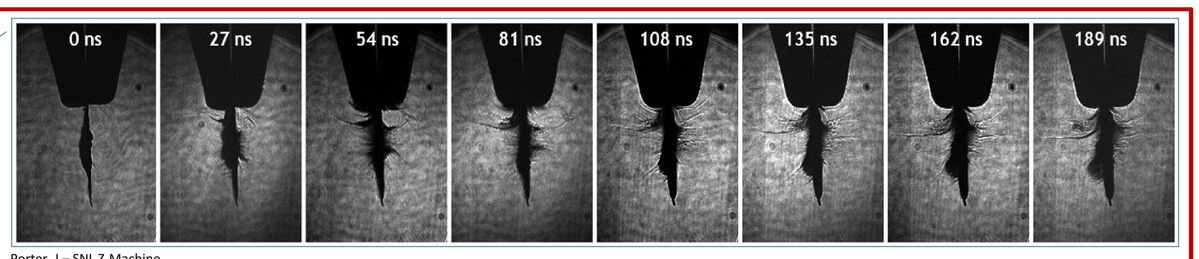
Sandia make use of industry standard 3D wafer/die bonding technologies and custom packaging solutions.

RESULTS

The suite of sensors Sandia has developed are the worlds fastest multi-frame X-ray FPAs and are delivering meaningful data on HEDP experiments. *Are there other applications where they could make an impact?*

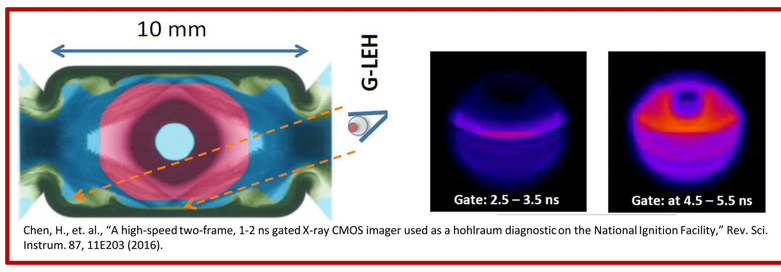


Slutz et al., POP 17 (2010).



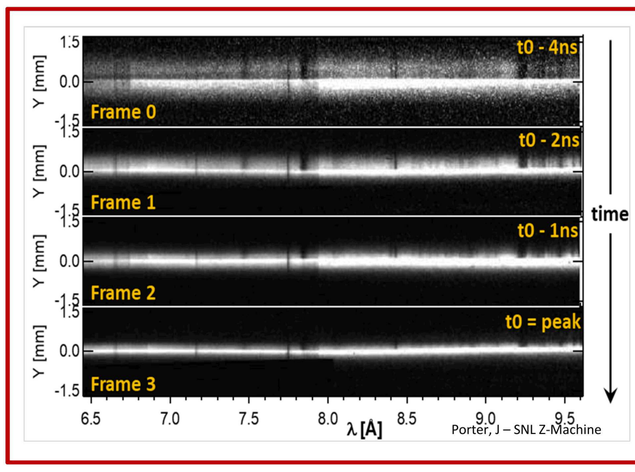
Porter, J – SNL Z-Machine

Z-Machine pre-heat diagnostic studying how laser energy best heats a gas prior to compression



Chen, H., et. al., "A high-speed two-frame, 1-2 ns gated X-ray CMOS imager used as a hohlraum diagnostic on the National Ignition Facility," Rev. Sci. Instrum. 87, 11E203 (2016).

GLEH NIF diagnostic studying capsule implosion



Porter, J – SNL Z-Machine

Time resolved X-ray opacity spectrometer observing the opacity of Nickel under conditions found in the solar interior

U.S. DEPARTMENT OF ENERGY
National Nuclear Security Administration

Sandia National Laboratories is a multimission laboratory managed and operated by National Technology & Engineering Solutions of Sandia, LLC, a wholly owned subsidiary of Honeywell International Inc., for the U.S. Department of Energy's National Nuclear Security Administration under contract DE-NA0003525