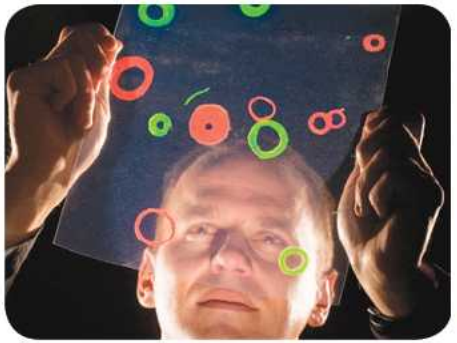
SAND2012-2728P

Exceptional service in the national interest

Sandia National Laboratories



Sandia National Laboratories

— First Impressions

Benjamin B. Yang (Ph.D., EE, Class of 2011)

U.S. DEPARTMENT OF ENERGY

NNSA National Nuclear Security Administration

Sandia National Laboratories is a multi-program laboratory managed and operated by Sandia Corporation, a wholly owned subsidiary of Lockheed Martin Corporation, for the U.S. Department of Energy's National Nuclear Security Administration under contract DE-AC04-94AL85000. SAND2011-0439P

Sandia's Sites

Sandia National Laboratories

Albuquerque, New Mexico

Livermore, California

Tonopah, Nevada

Waste Isolation Pilot Plant, Carlsbad, New Mexico

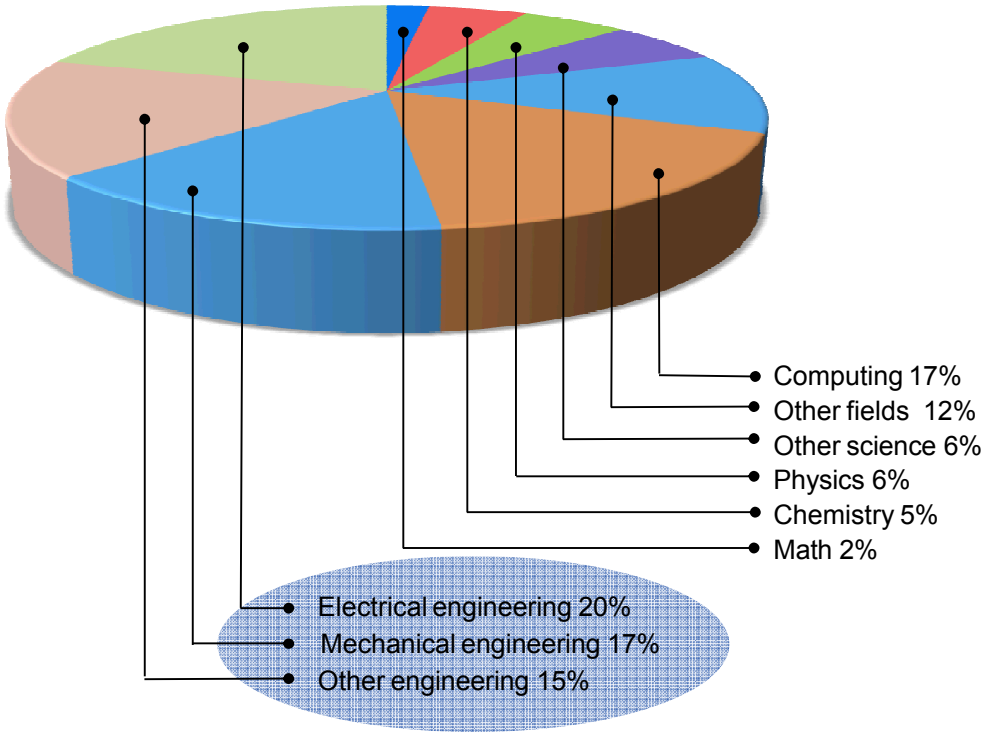
Pantex, Texas

People and Budget

(As of October 11, 2011)

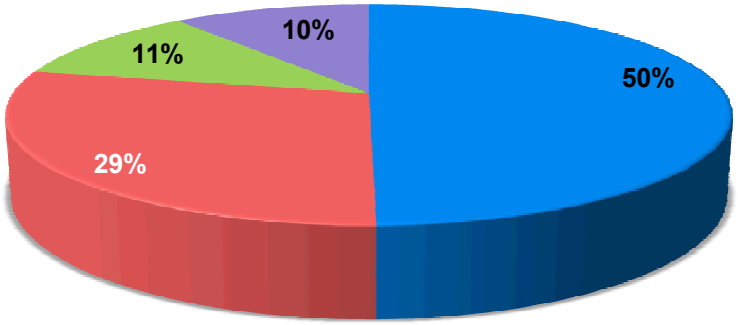
- On-site workforce: 11,876
- Regular employees: 9,122
- Gross payroll: ~$943 million

Technical staff (4,557) by discipline



FY11 Operating Revenue
$2.4 billion

(Operating Budget)



- Nuclear Weapons
- Defense Systems & Assessments
- Energy, Climate & Infrastructure Security
- International, Homeland, and Nuclear Security

The Mission Has Evolved for Decades

Sandia National Laboratories

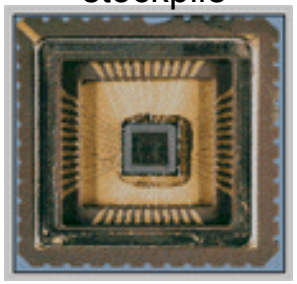
1950s	1960s	1970s	1980s	1990s	2000s
Production engineering & manufacturing engineering	Development engineering	Multiprogram laboratory	Research, development and production	Post-Cold War transition	Broader national security challenges

Microsystems Science, Technology & Components (1700)

Sandia National Laboratories

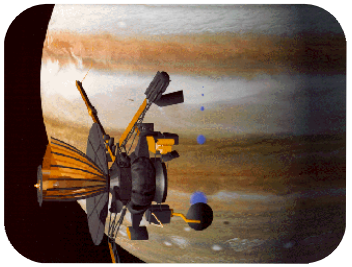
Specializes in custom microelectronics and microsystems

Custom radiation-hardened components for NW stockpile



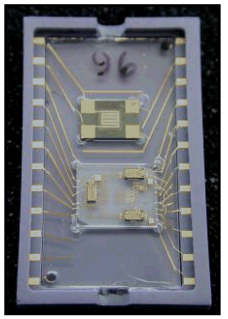
SA 3935 Digital ASIC

Radiation-hardened components for space



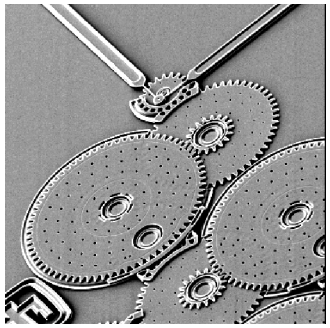
Galileo ICs

Integrated systems with added functionality

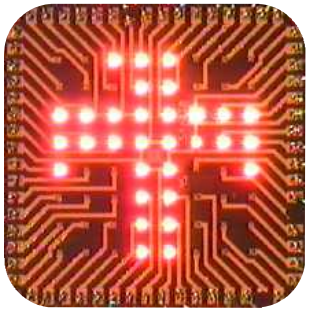


Gas Sensor Module

Next-generation micro/nano system technologies



Microelectrical Mechanical System (MEMS) micro-transmission



Visible VCSEL

Failure Analysis Overview

Sandia National Laboratories

Microfabrication Plant

Reliability

Failure Analysis

Inspection and characterization

⇩

Defect localization

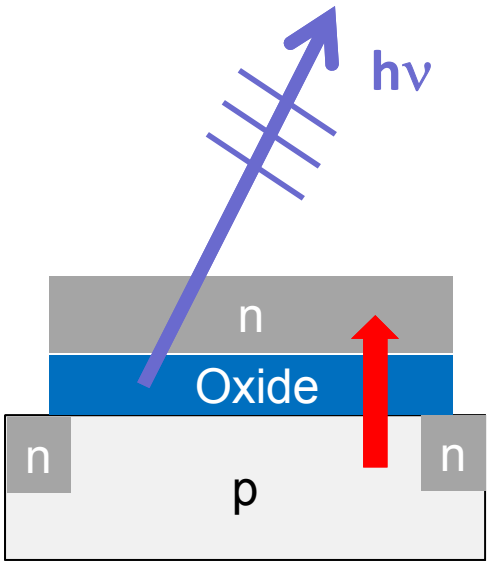
⇩

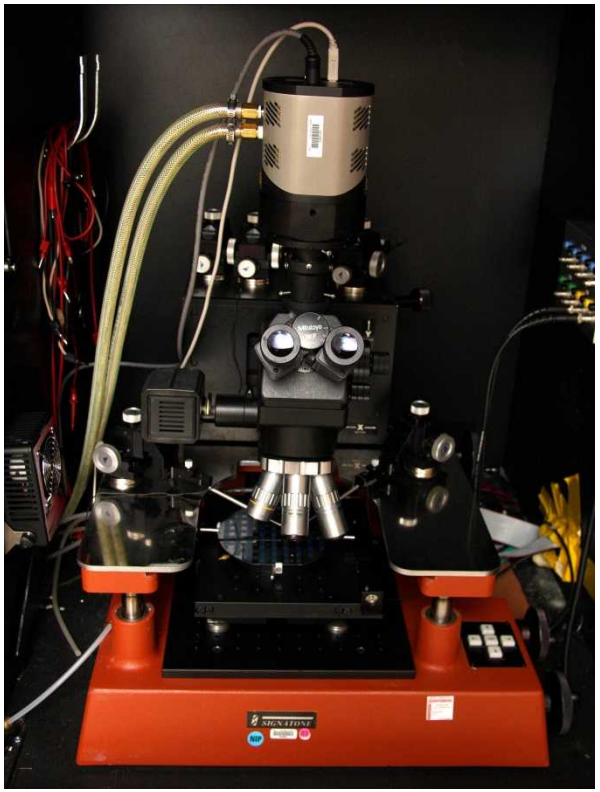
Defect characterization

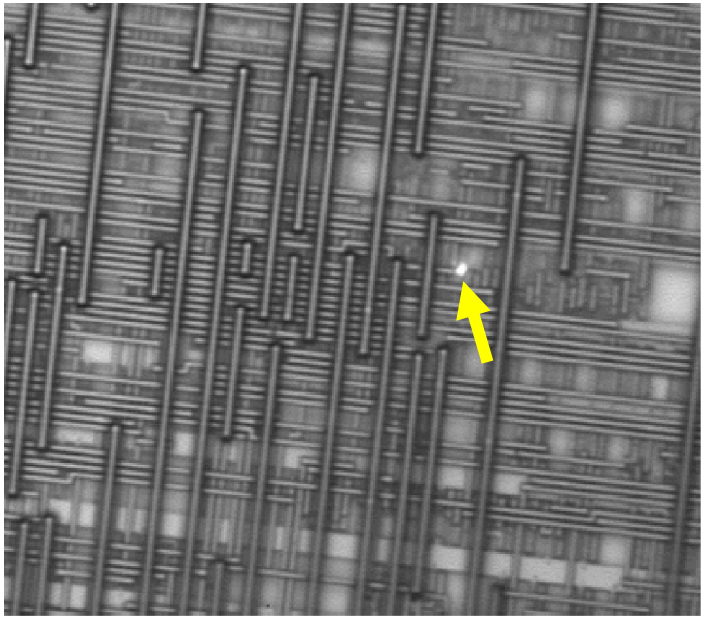
⇩

Physical Analysis

Defect Localization: Light Emission



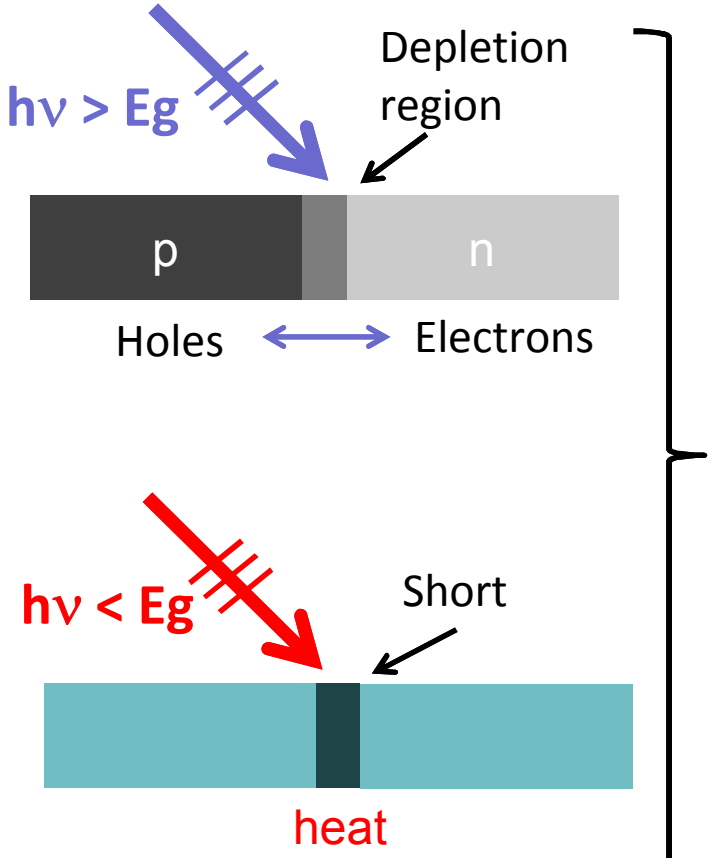


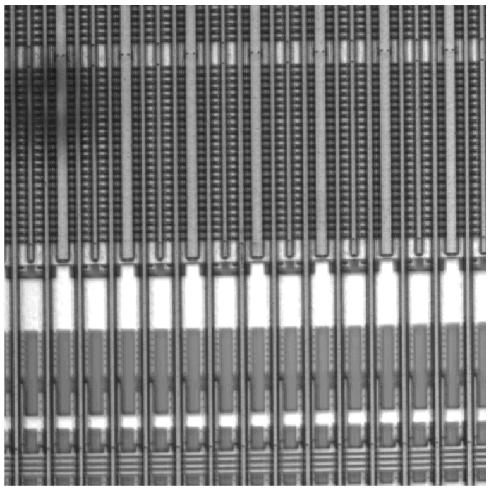


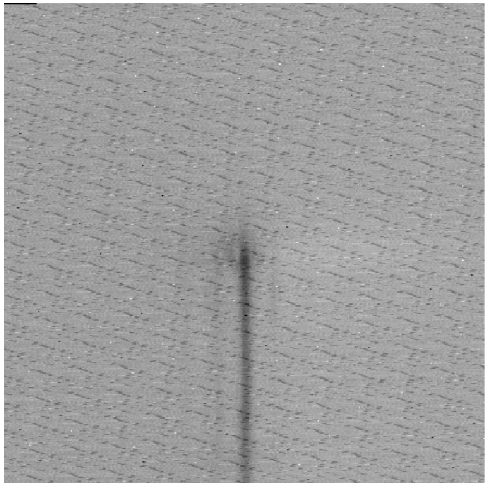
- Certain defects emit photons when biased
- Example: gate oxide defect

Defect Localization: Laser-Based Techniques

- Light-Induced Voltage Alteration (LIVA)







- Thermal-Induced Voltage Alteration (TIVA)

E.I. Cole Jr. *et. al.*, IEEE LEOS 2003

Defect Characterization: Optical/SEM/Nanoprobing

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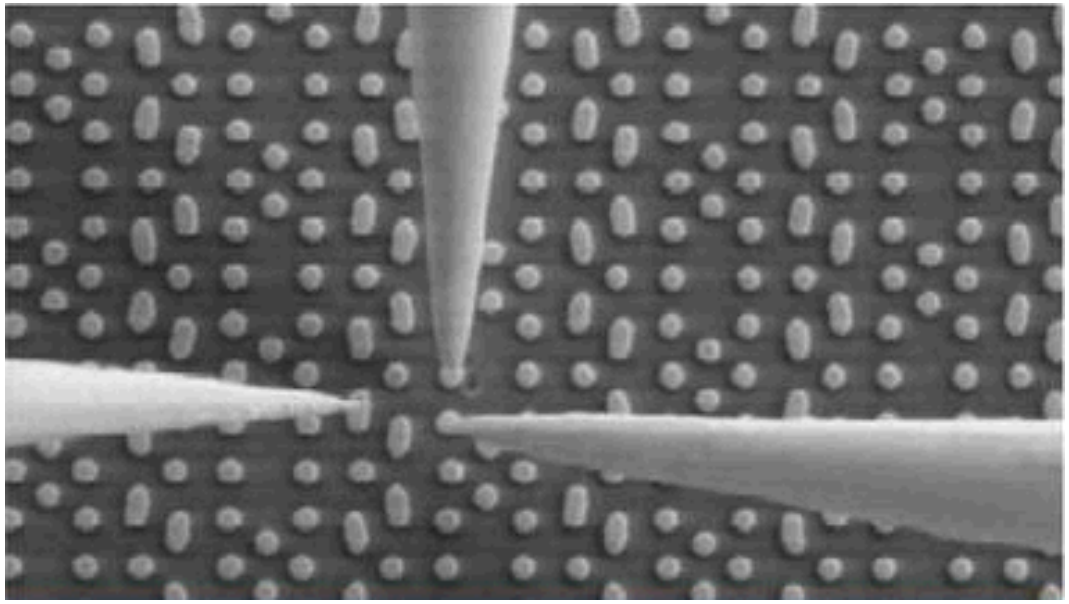
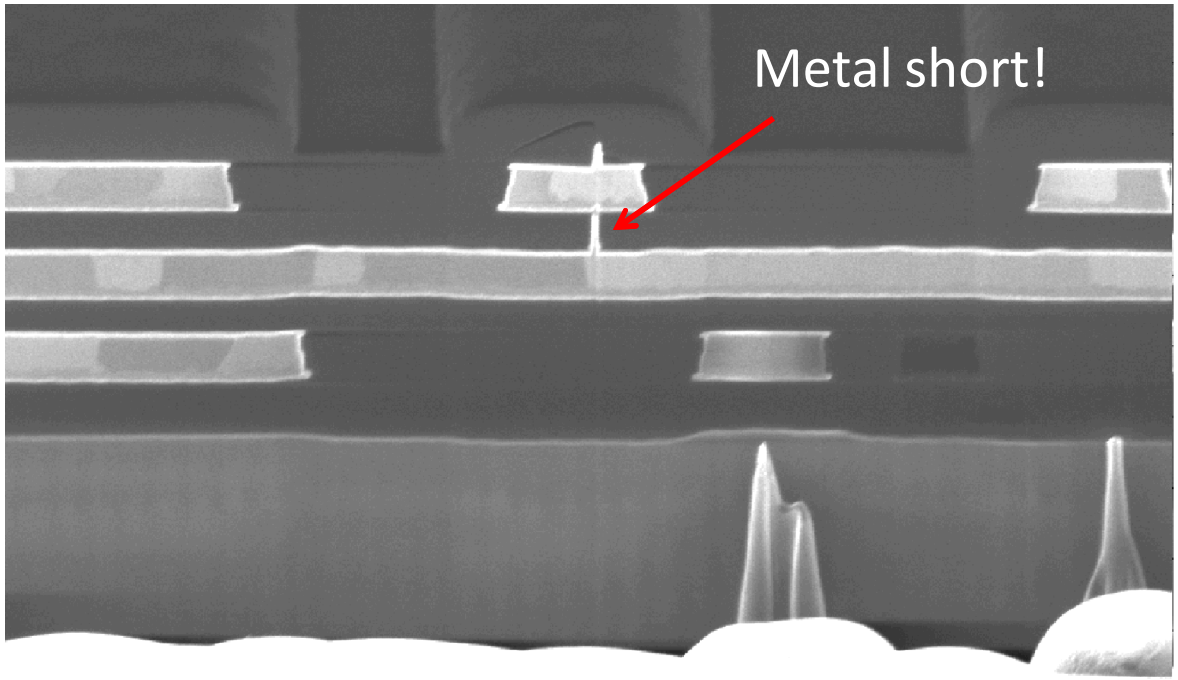


Electrical characterization of individual transistors through nanoprobing

- Defect localization is followed by:
  - Visual characterization with optical or scanning electron microscope (SEM)
  - Electrical characterization
  - Deprocessing (if necessary)

Physical Analysis: SEM/FIB/TEM



- Focused Ion Beam tools create cross sections
- Examination by a scanning electron microscopy (SEM) or transmission electron microscope (TEM)

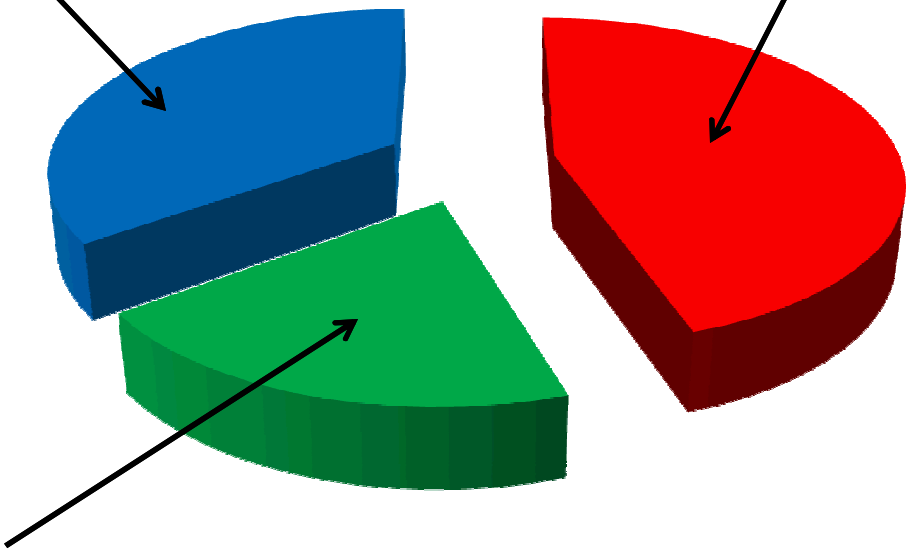
E.I. Cole Jr. *et. al.*, IEEE LEOS 2003

My Day

Anti-counterfeit Technology Development

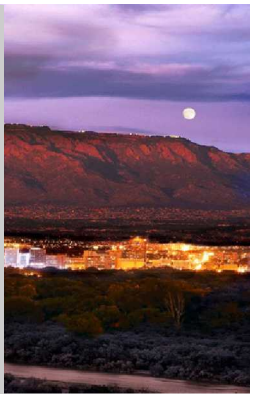
Failure Analysis AKA “Day Job”

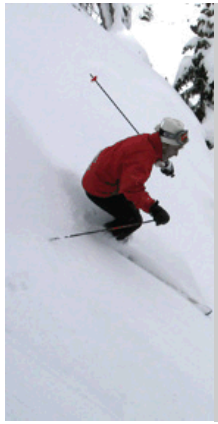
Photovoltaic and Power Systems Reliability



Working at Sandia / Living in New Mexico

- Working at Sandia:
  - Diversified portfolio and work opportunity
  - Great amount of freedom
  - Many opportunities for self-investment
  - Meaningful work
  - Good work-life balance





- Living in New Mexico
  - Gorgeous scenery and year-round outdoors activities
  - 300 days of sunshine
  - Unique culture