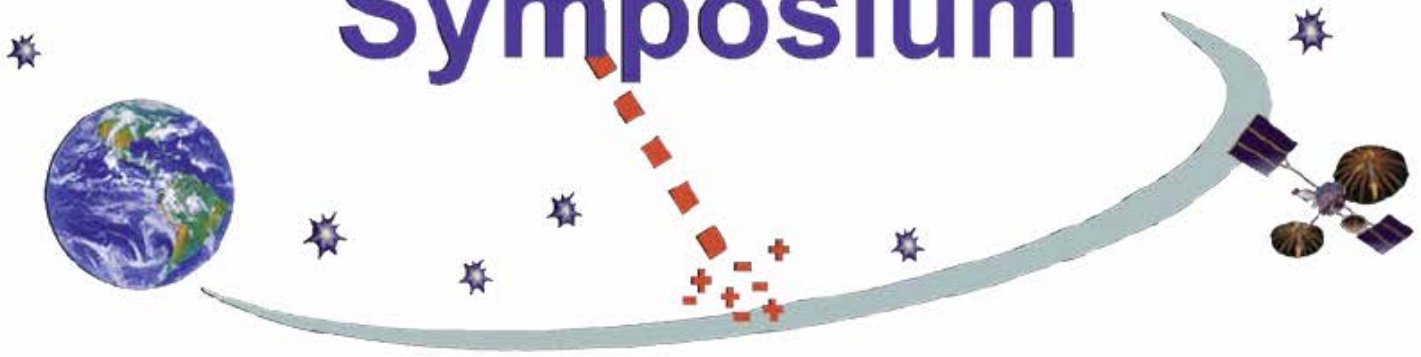
# 2012 Single Event Effects Symposium



San Diego, April 3rd – 5th, 2012

# Conference agenda

List of sessions:

- Design and Process Hardening
- Single Event Test Facilities
- SEE on Commercial Memories
- Single-Event Transients
- Single-Event Test Methods
- Destructive SEE
- Product, Technology, System SEE

# Conference agenda

- Lot of space and army oriented topics
- Memory test (NAND flash), Point of load DC/DC converters, ADC converters, FPGAs…
- SET
- Mitigation techniques like “scrubing” (removing errors from a memory's content by re-writing it periodically with correct values)
- SEL protection by an adjustable over current detection that forces a power cycling of the full system in case of SEL detection
- Device hardening by placement of redundant blocks sufiicciently far apart to not be influenced by the same incident partcle

# Quantity of laser aided diagnostics

AEROFLEX

## Single Event Functional Interrupt Location and Elimination via Pulsed Laser Scanning on a RadHard CMOS 16-bit ADC

Alfio Zanchi, Shinichi Hisano, Craig Hafer, and David B. Kerwin

*Aeroflex Colorado Springs, Inc. – Colorado Springs, CO*

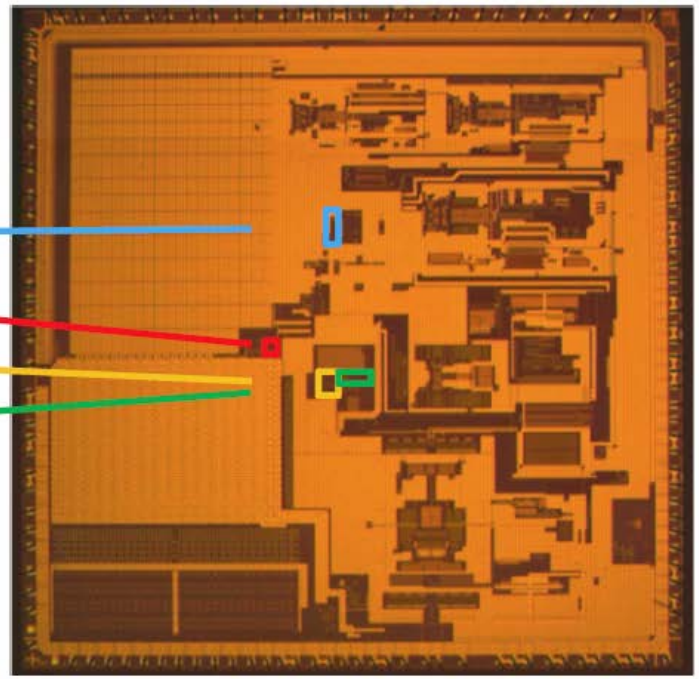
SEE Symposium – San Diego, CA (U.S.A.) – April 3rd, 2012

# SET effects due to E-H in various blocks

## Pulsed laser scanning

- Factors of uncertainty of the test
  - no direct pulse energy sense (photodiode) available in Aeroflex
  - is metallization completely open over sensitive block: no de-rating?

- Areas subject to laser pulses
  - Bandgap
  - POR
  - VREF generator
  - Voltage drivers



# Studies of SET with short X-ray pulses

AEROSPACE
Assuring Space Mission Success

## Single Event Transients Induced by the Absorption of Picosecond X-ray Pulses

David Cardoza, Stephen D. LaLumondiere, Michael A. Tockstein
Steven C. Witczak, Yongkun Sin, William T. Lotshaw and Steven C. Moss

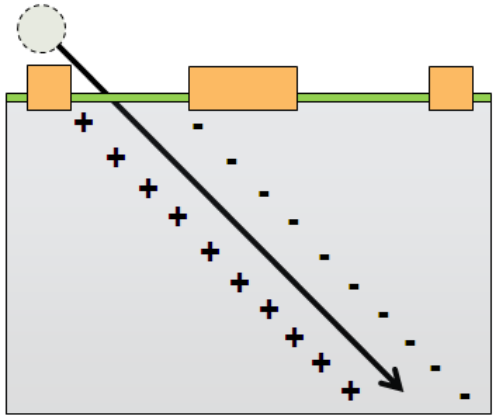
The Electronics and Photonics Laboratory
The Aerospace Corporation

4 April 2012

# SEU location by Laser or X-ray

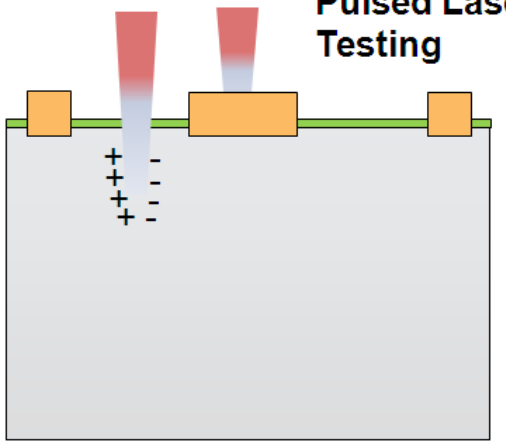
## Motivation for Short X-ray Pulses

**Traditional Accelerator Facility**



- Large Penetration Depth
  - Generates Charge Tracks
- Penetrates Metallization
- Unless microbeam facility or mask used, difficult to spatially locate upset location.

**Pulsed Laser Testing**



- Focusable – relatively high spatial resolution.
- Charge carriers generated in skin-depth volume around focus
- Unable to penetrate metallization
- Two photon techniques can be used to evade metallization via backside illumination.

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# XILINX FPGA Devices SEE evaluation


## From 250nm to 28nm Terrestrial SER Xilinx FPGA Devices

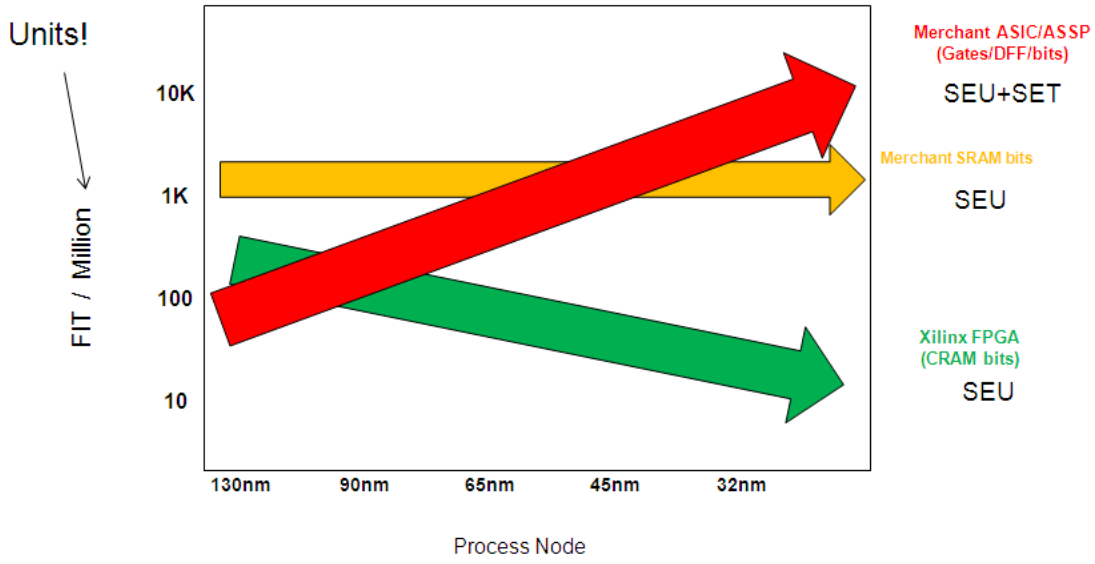
**Austin Lesea**

For Presentation

# XILINX FPGA Devices SEE evaluation

Advances in protection of the configuration memory

## Xilinx View: our per bit FIT gets better








XILINX

# Destructive test of IGBTs



## Trench Fieldstop Insulated Gate Bipolar Transistor (IGBT) failures at ground level

Antoine Touboul, Lionel Foro, Frédéric Wrobel, Frédéric Saigné

# Destructive test of IGBTs

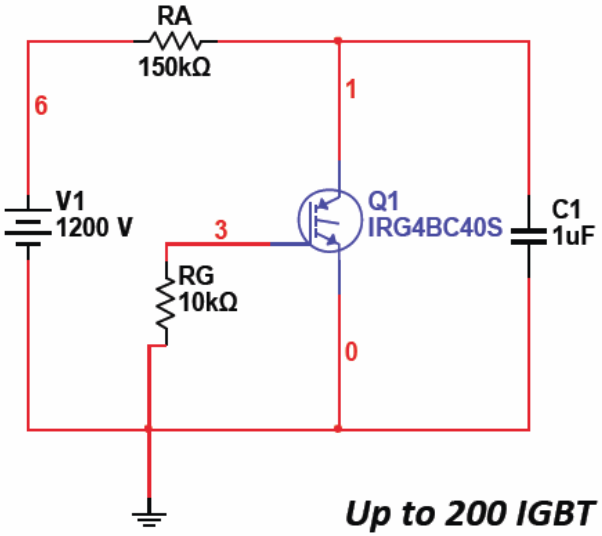
## 1200V-IGBT failures under ANITA atmospheric like spectrum,TSL

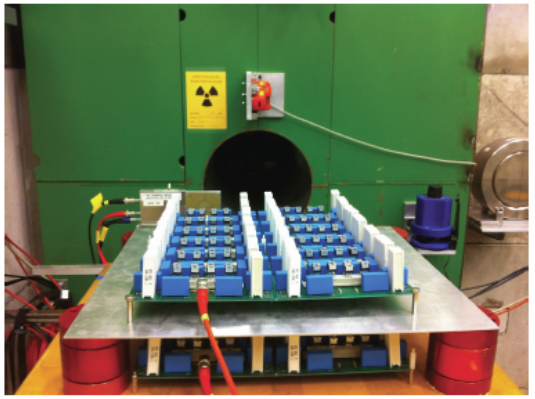
Sensitive state for SEE triggering is OFF state

**$V_{CE}$ from 70% to 100% of $V_{CEMAX}$, $V_{GE}$=0V**

Contrary to test of digital devices, the failure does not affect a bit but the whole device itself.

**1 failure=1 device lost**
**Hard to get good statistics**



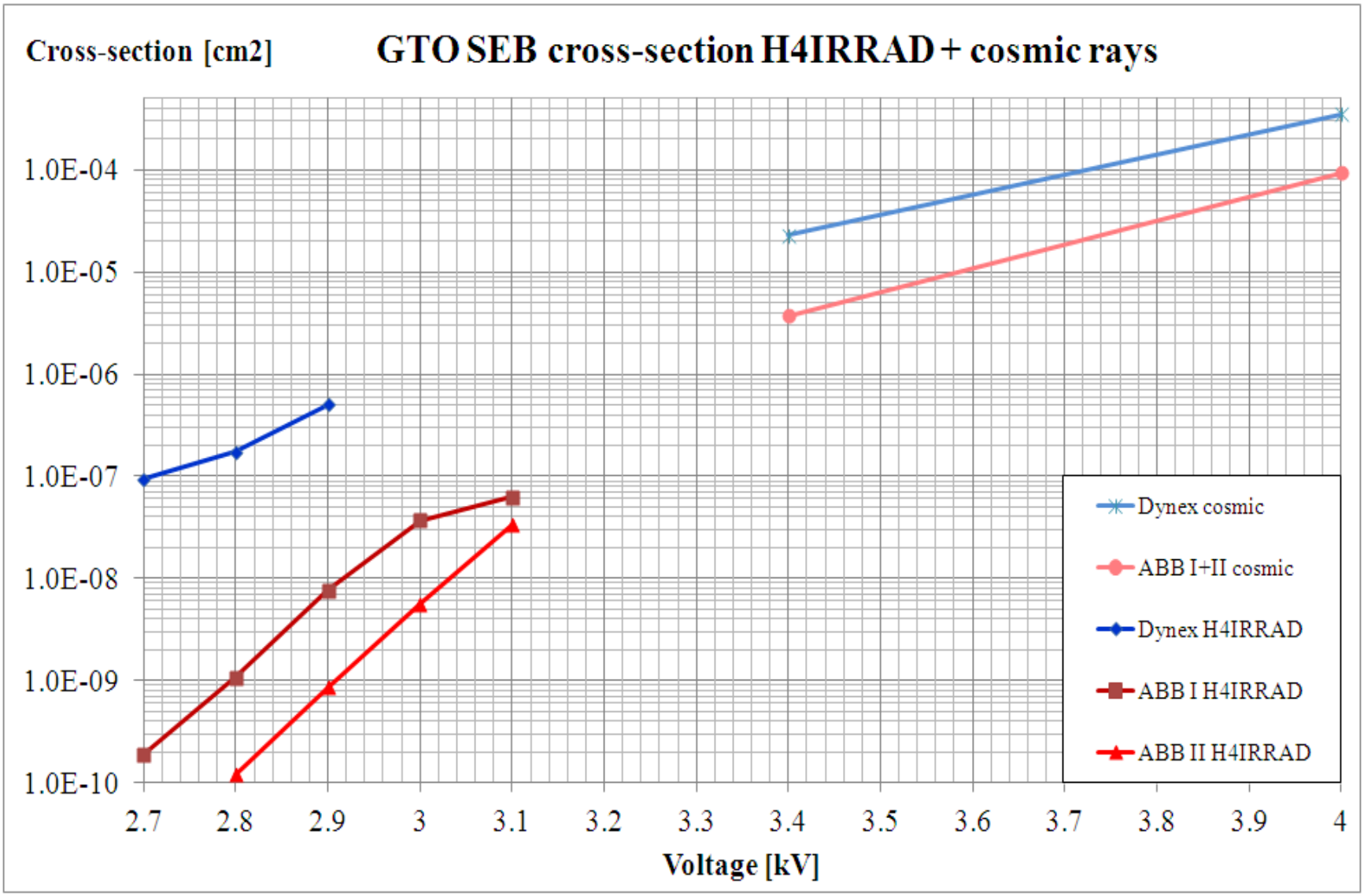



***Up to 200 IGBT tested in the same time***

# Conference agenda

## Non-destructive SEB tests of HV GTO-like thyristors

# Conference agenda



# Conference agenda

## Measurement output example

- Influence of experienced SEBs to c-s measurement - Dynex at 2.7 kV:
  - c-s = $1{,}22.10^{-7}$ $cm^2$ after first 49 SEBs
  - c-s = $1{,}24.10^{-7}$ $cm^2$ after 99 SEBs
  - c-s = $0{,}92.10^{-7}$ $cm^2$ after 162 SEBs