

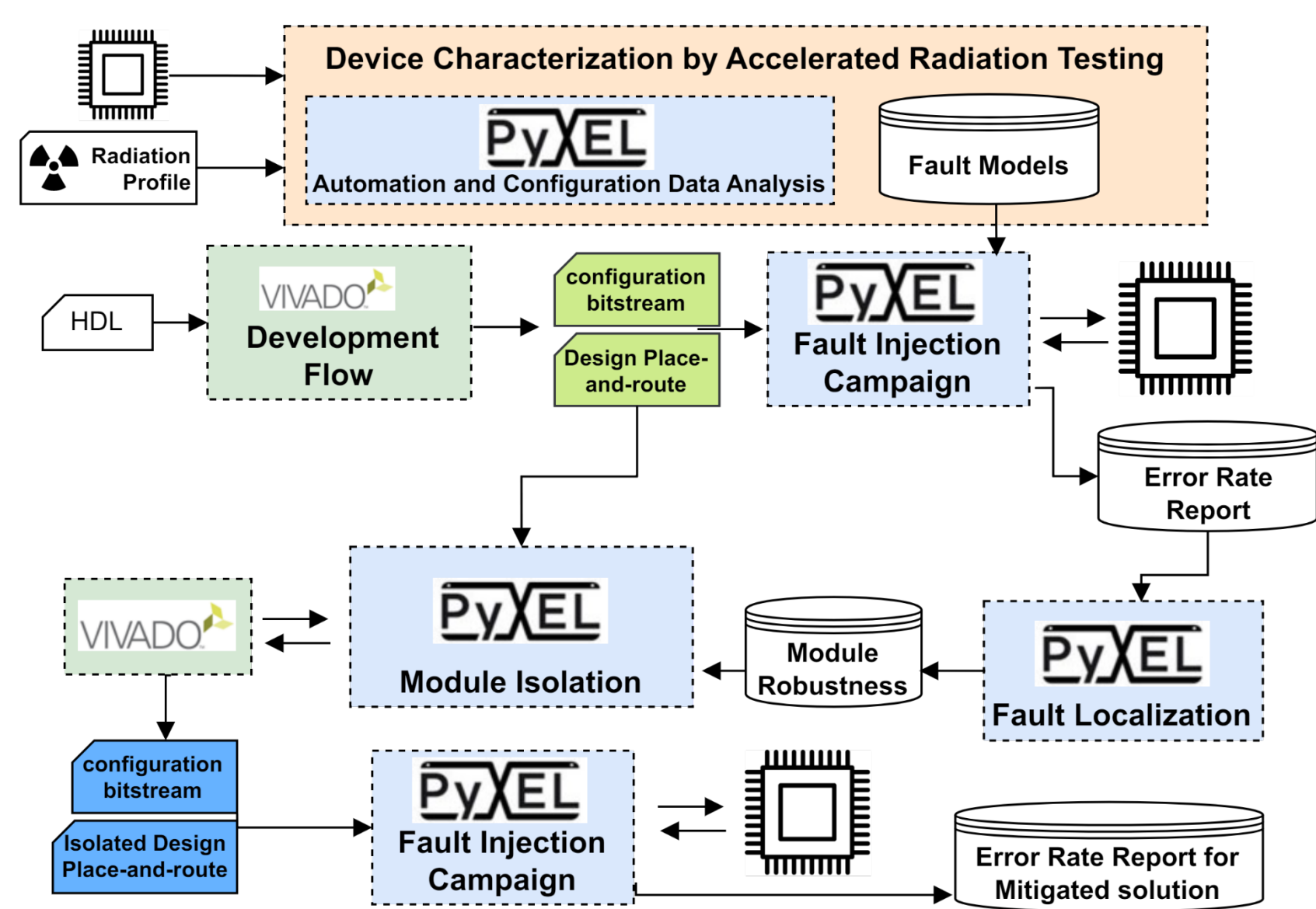
MOTIVATION

Reconfigurable SoC are flexible and performant **radiation-sensitive, heterogenous, increasingly complex Systems**. We need **methodology, techniques, and experimeta flow** for evaluating and assessing the **robustness** of System and Application based on **Reconfigurable SoCs** for safety-critical domains.

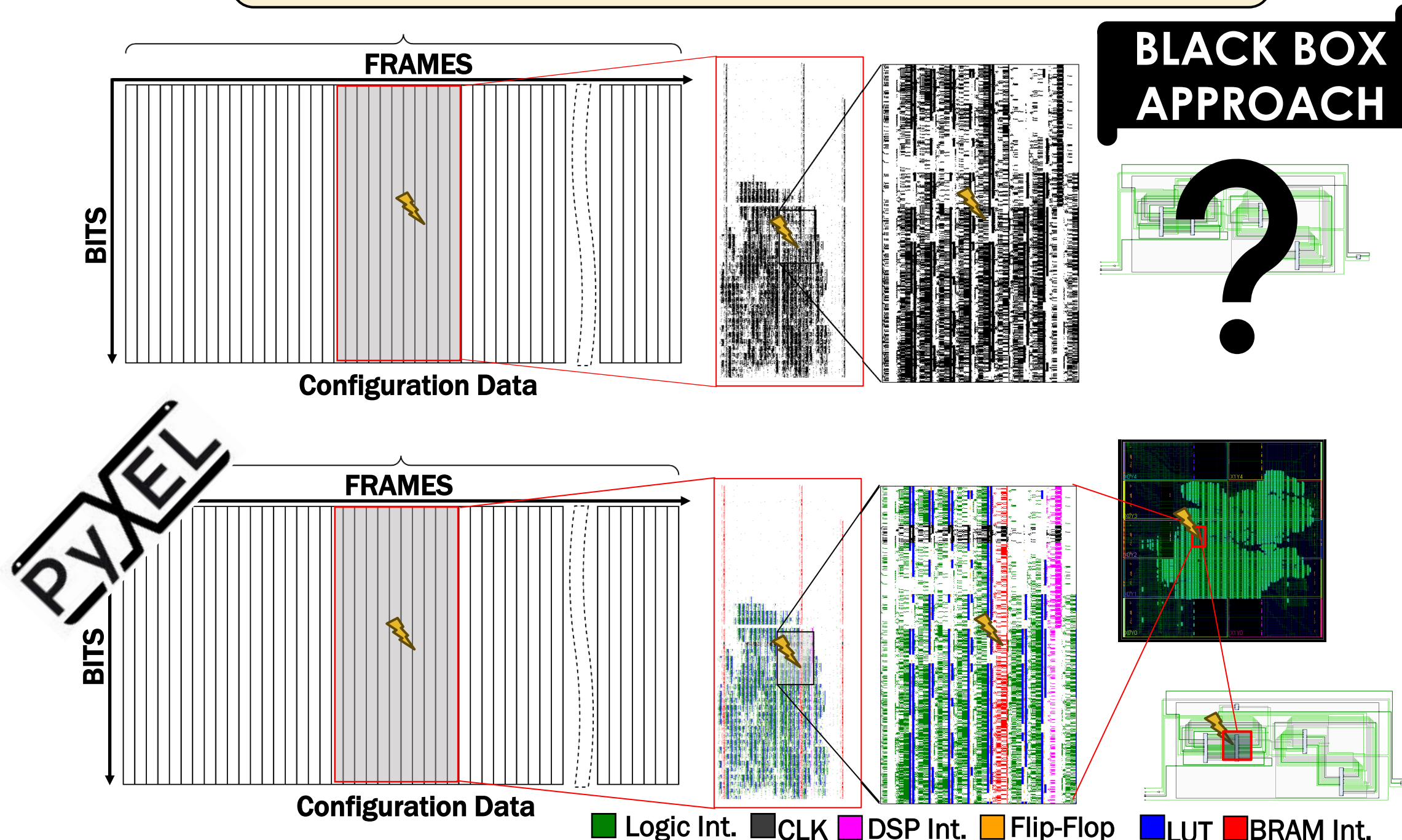
PyXEL: A TOOLKIT FOR ANALYSIS OF RECONFIGURABLE SoCs

- SoC Robustness Assessment aware of SoC and System Architectures
- Emulation and Analysis of SEU and Fault Models
- Complex Evaluation Flow, Fully Integrated with modern CAD tools
- Supporting Latest AMD Devices

EVALUATION AND MITIGATION FLOW



FAULT MAPPING

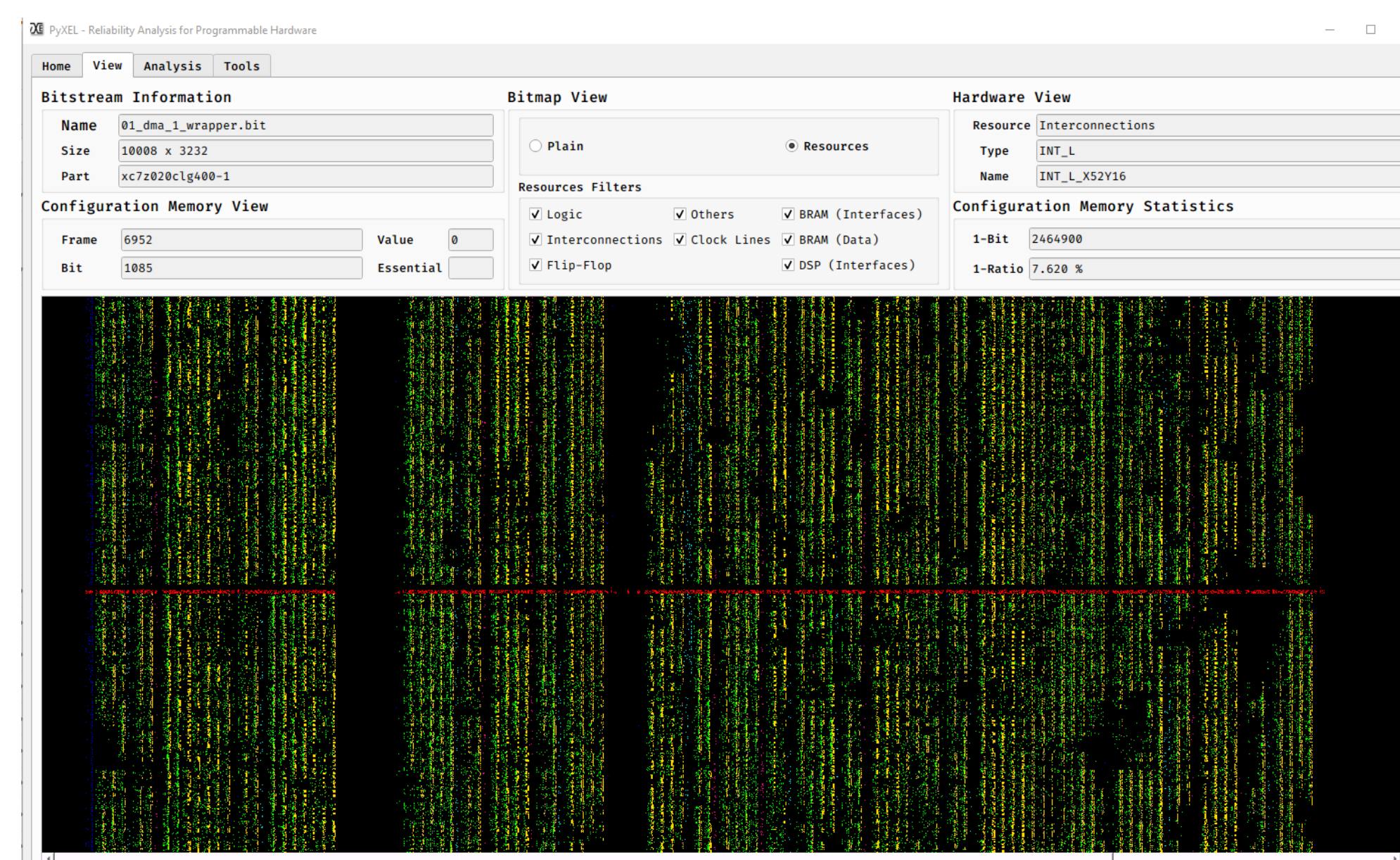
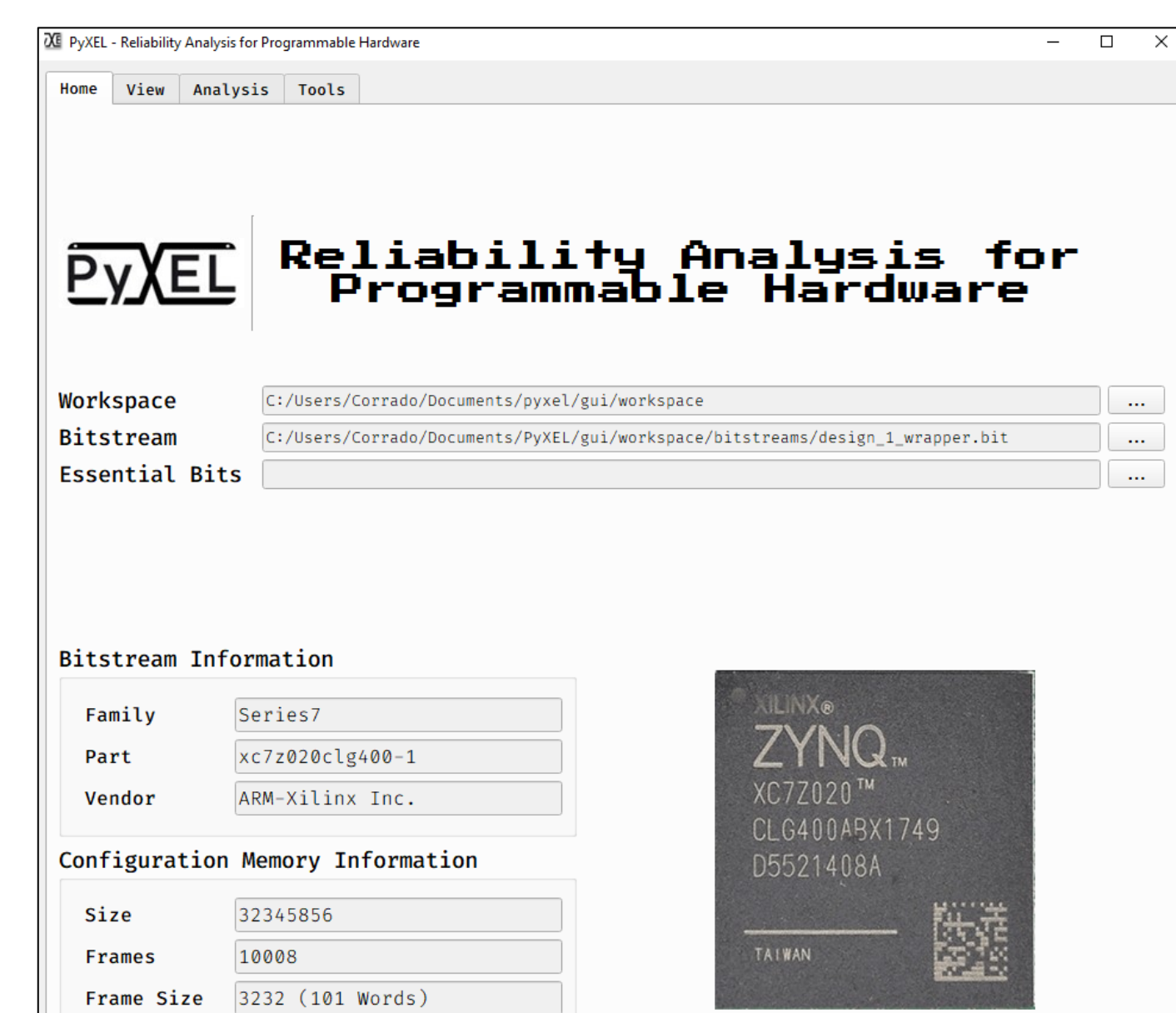


PYTHON TOOLKIT AND DESKTOP APP

```
from pyxel import Xbitstream

Xbs = Xbitstream('bitfile.bit')
Xbs.cmem.flip_bit(42, 1024)
Xbs.visualize()

exit(0)
```



Circuit	Error Rates			
	DDC	UD	SDC	Total
Original PaR	5.47%	1.39%	1.12%	7.98%
Hardened PaR	2.82%	0.27%	0.00%	3.09%



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International SW Registration

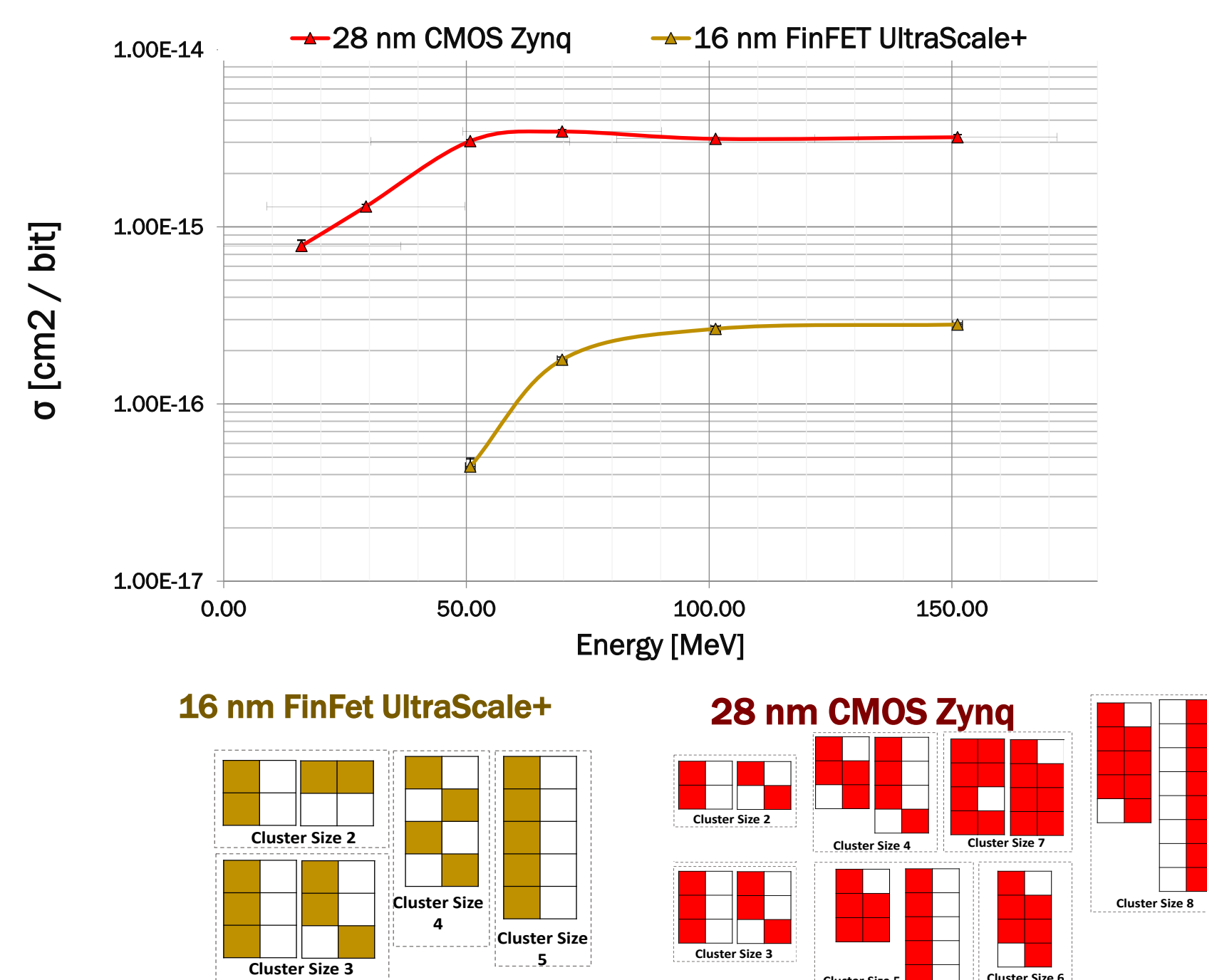
ENABLE DEVICE CHARACTERIZATION AND FAULT MODELING

- Analysis of Different **CRAM Technologies**
 - SEE Cross-Sections, MBU Characterization
- Characterization of **On-Chip RAM**
 - SEUs, MBUs, SEFIs Cross-Sections
 - MCUs based on **Physical RAM Layout**

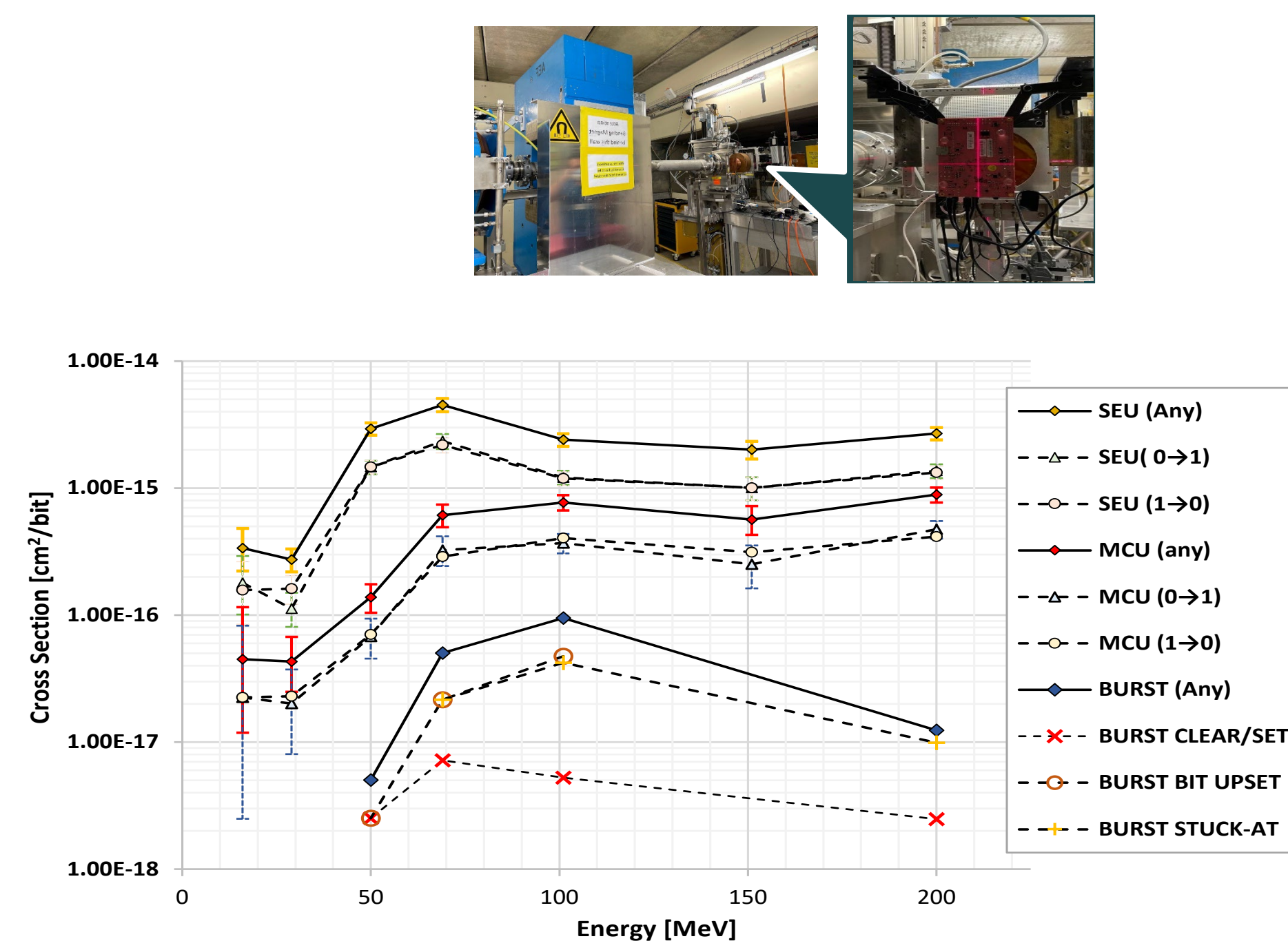


PROTONS 40-160 MEV

16nm FinFET vs 28nm CMOS

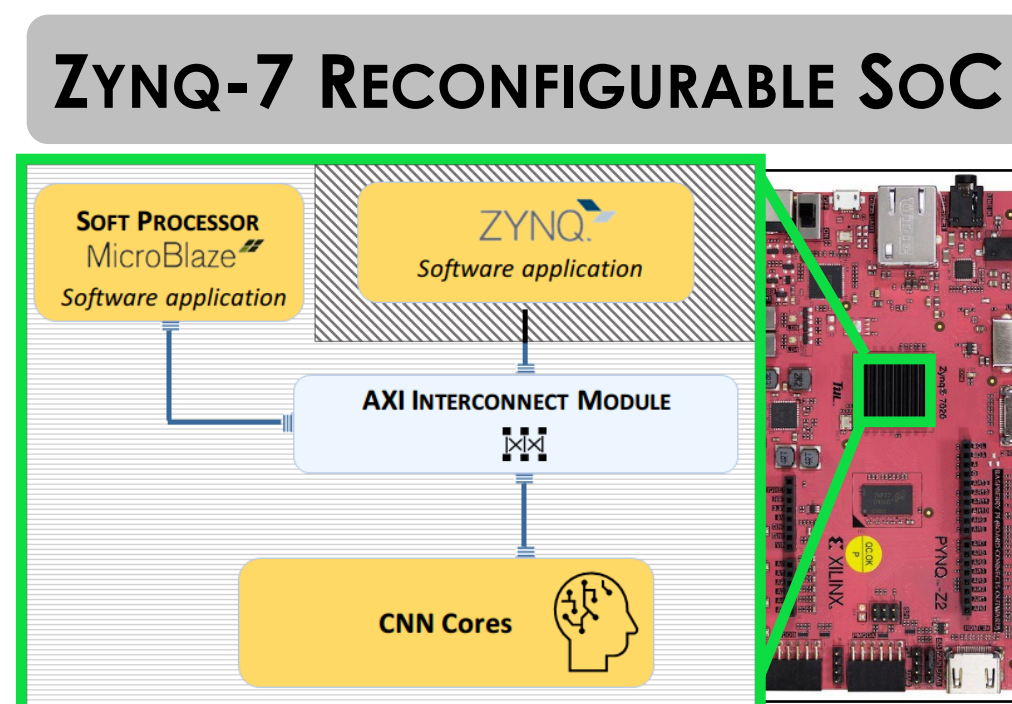


ZYNQ-7020 ON-CHIP MEMORY

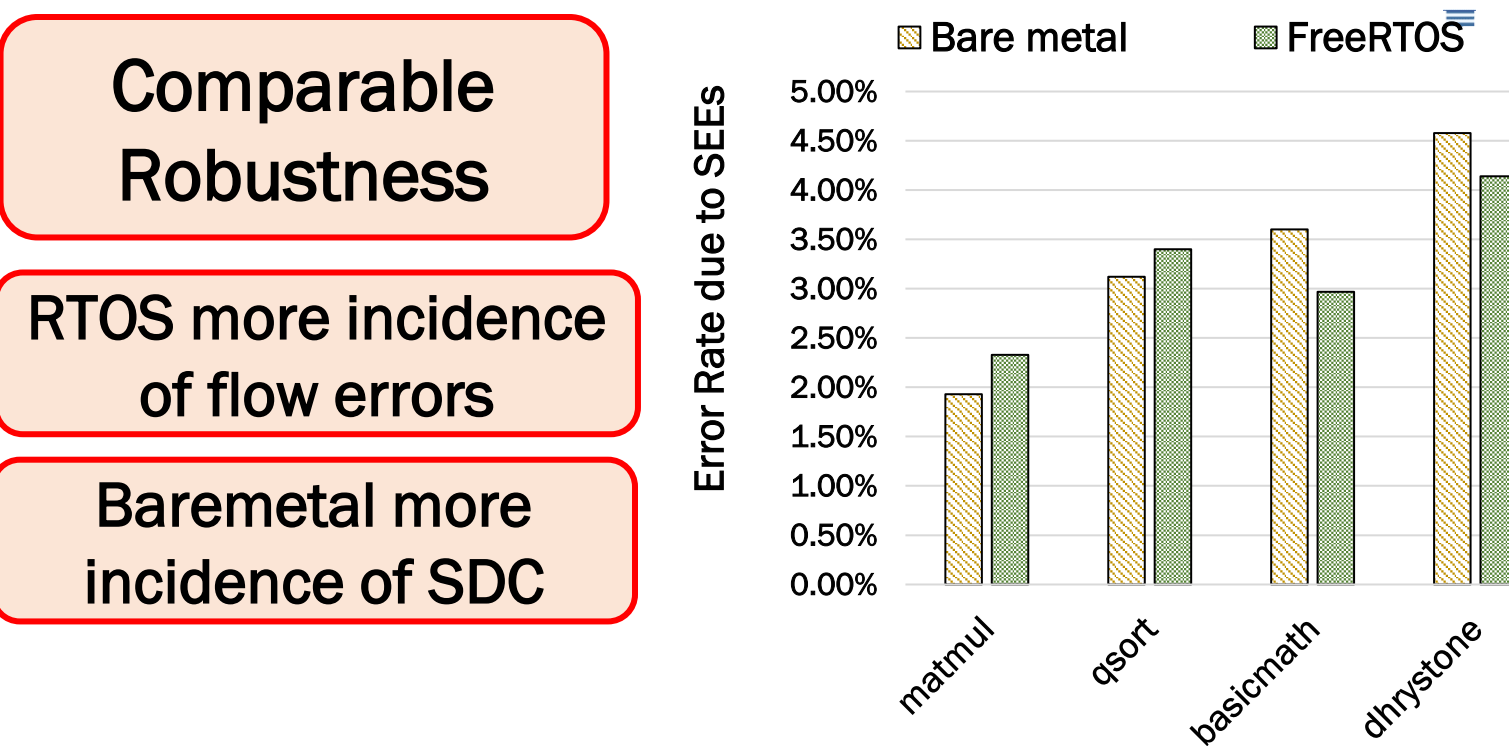


SUPPORT RELIABILITY ANALYSIS OF RECONFIGURABLE SoCs

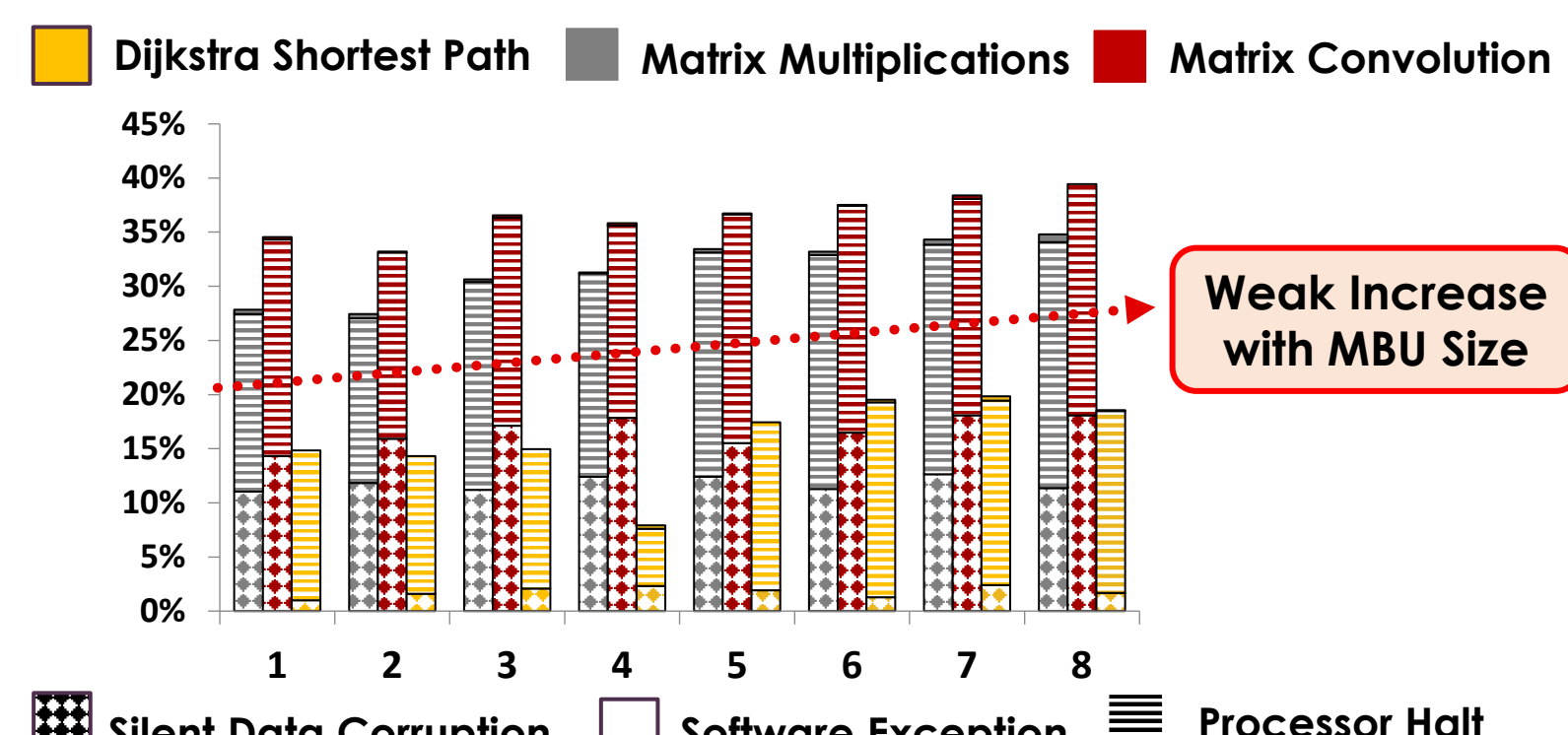
- Methodologies for Analysis of components of Reconfigurable SoCs
 - Hard and Processors, Accelerators
 - Hardware and Software Stacks
 - Fault Modeling and Analysis



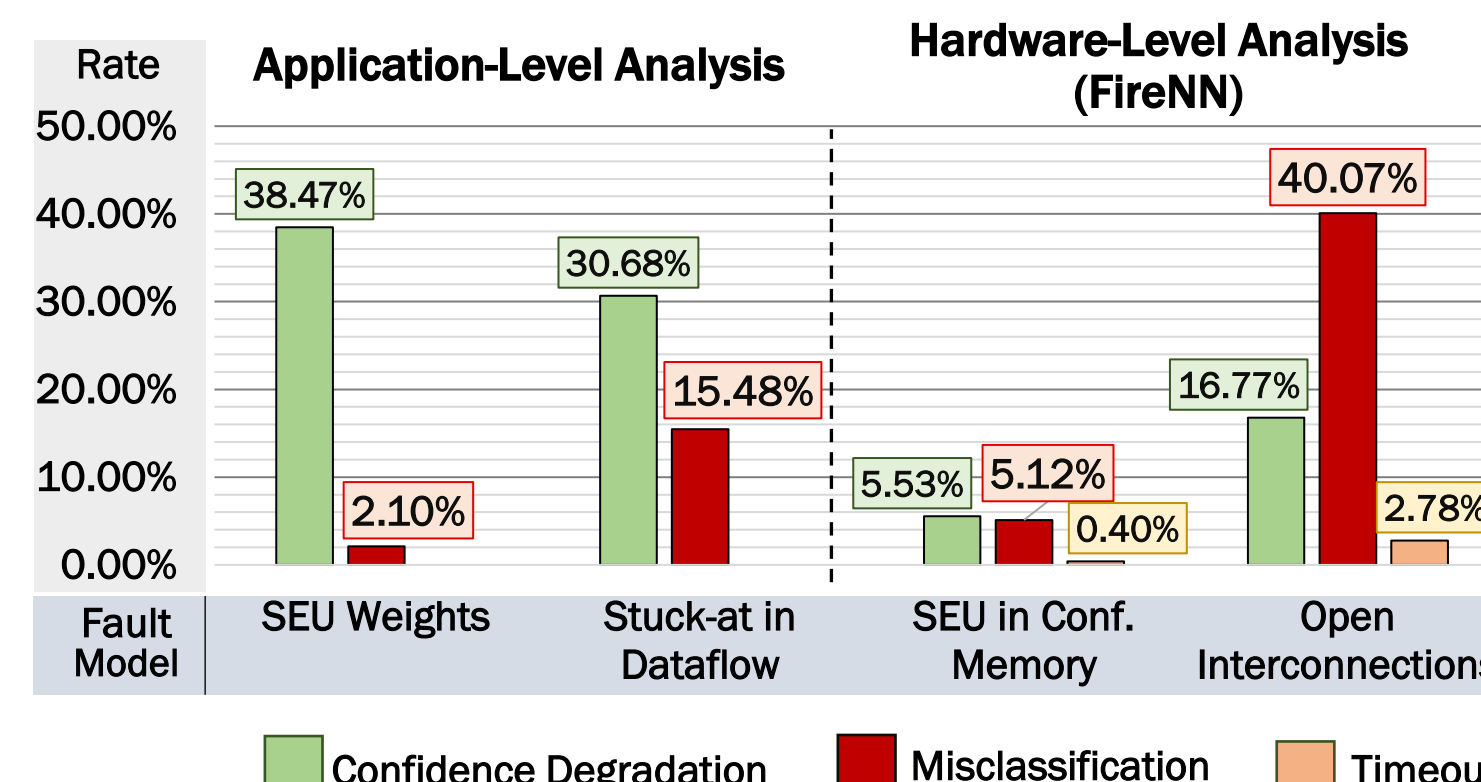
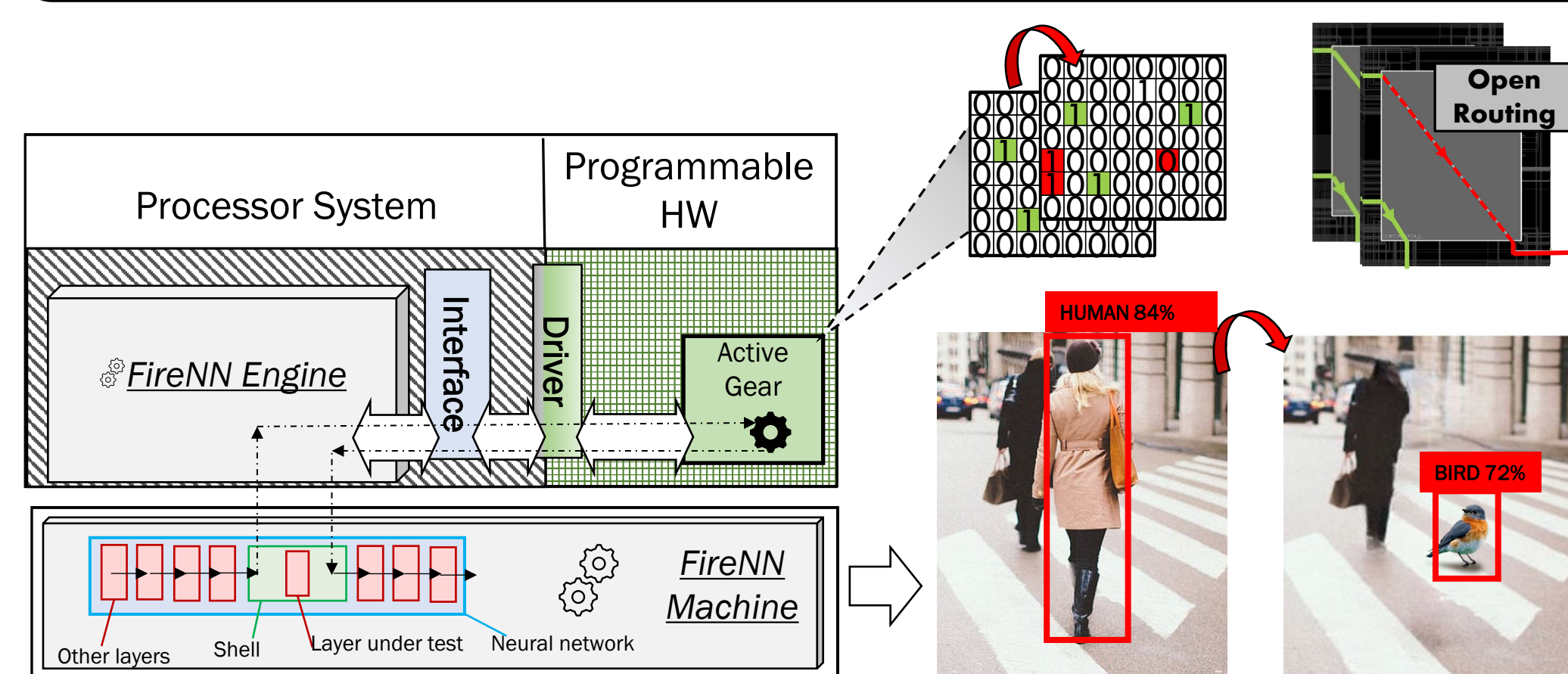
BAREMETAL VS RTOS SOFTWARE STACK ON HARD PROCESSORS AGAINST SEU AND MCU IN OCM



RTOS SOFTWARE STACK ON SOFT PROCESSORS AGAINST SEU AND MCU IN CRAM



FIRENN: NEURAL NETWORKS RELIABILITY EVALUATION ON HYBRID PLATFORMS



Hardware Reutilization plays a central role that must be considered

Misclassification Outcomes are much more common