Experimental validation of numerical codes and investigation of fault tolerance protection

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MURI on RF Effects - Department of Defense Grant F-49620-01-1-0436
Presented at the University of Maryland, 8 June 2002

Report Documentation Page

Form Approved
OMB No. 0704-0188

1. REPORT DATE	2. REPORT TYPE	3. DATES COVERED
JUN 2002	**N/A**	**-**

4. TITLE AND SUBTITLE	5a. CONTRACT NUMBER
Experimental validation of numerical codes and investigation of fault tolerance protection	5b. GRANT NUMBER
	5c. PROGRAM ELEMENT NUMBER
6. AUTHOR(S)	5d. PROJECT NUMBER
	5e. TASK NUMBER
	5f. WORK UNIT NUMBER
7. PERFORMING ORGANIZATION NAME(S) AND ADDRESS(ES) **University of Illinois at Chicago 851 South Morgan St., Chicago, Illinois 60607, USA**	8. PERFORMING ORGANIZATION REPORT NUMBER
9. SPONSORING/MONITORING AGENCY NAME(S) AND ADDRESS(ES)	10. SPONSOR/MONITOR'S ACRONYM(S)
	11. SPONSOR/MONITOR'S REPORT NUMBER(S)

12. DISTRIBUTION/AVAILABILITY STATEMENT
Approved for public release, distribution unlimited

13. SUPPLEMENTARY NOTES
Presentations given at the First Annual Review Meeting on June 8, 2002 DoD MURI Award F49620-01-1-0436, The original document contains color images.

14. ABSTRACT

15. SUBJECT TERMS

16. SECURITY CLASSIFICATION OF:			17. LIMITATION OF ABSTRACT	18. NUMBER OF PAGES	19a. NAME OF RESPONSIBLE PERSON
a. REPORT	b. ABSTRACT	c. THIS PAGE			
unclassified	**unclassified**	**unclassified**	**UU**	**12**	

Purpose of the experiments

Design of simple systems to perform experiments that encompass most of the tasks of the MURI proposal

1. Radiation incident on a system
2. Penetration into the system
3. Coupling with internal parts of the system
4. Disturbance of the activity of digital circuits inside the system and assessment of the digital upset

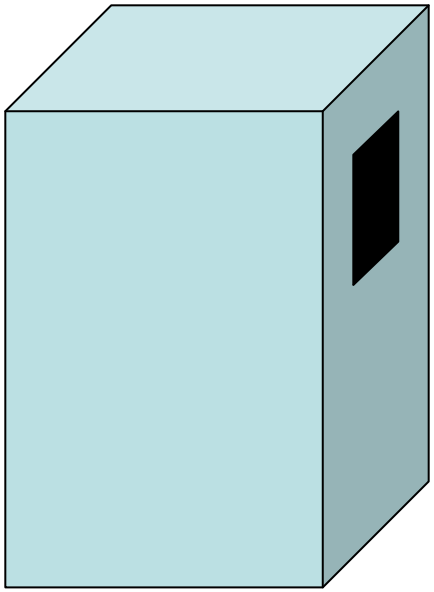
Comparisons with experiments

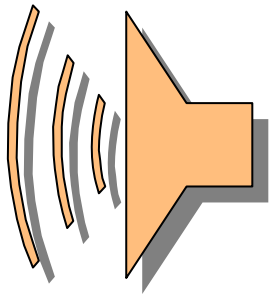
- The experiments will be paralleled by computer simulations that mimic the chain of events.

- The computer simulations will be performed by the research groups of Dutt, Michielssen and Volakis.

Description of the experiments

- Illumination of a cavity with an aperture to investigate the effects of the field that penetrates the enclosure.

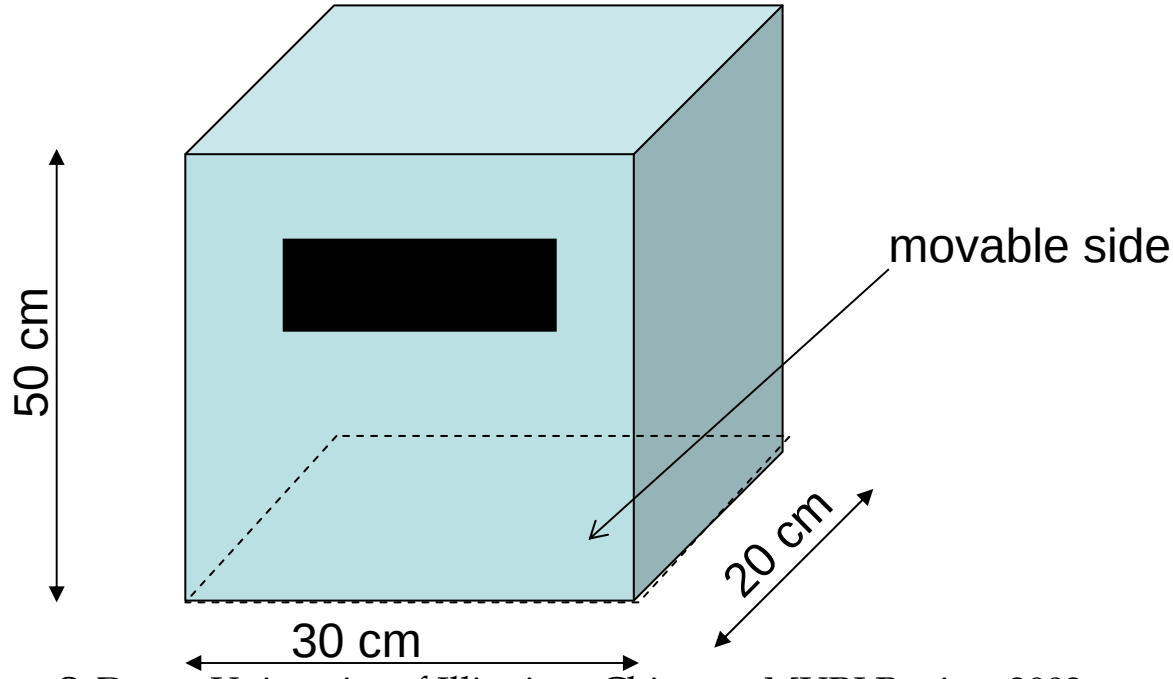




1GHz<f<5GHz

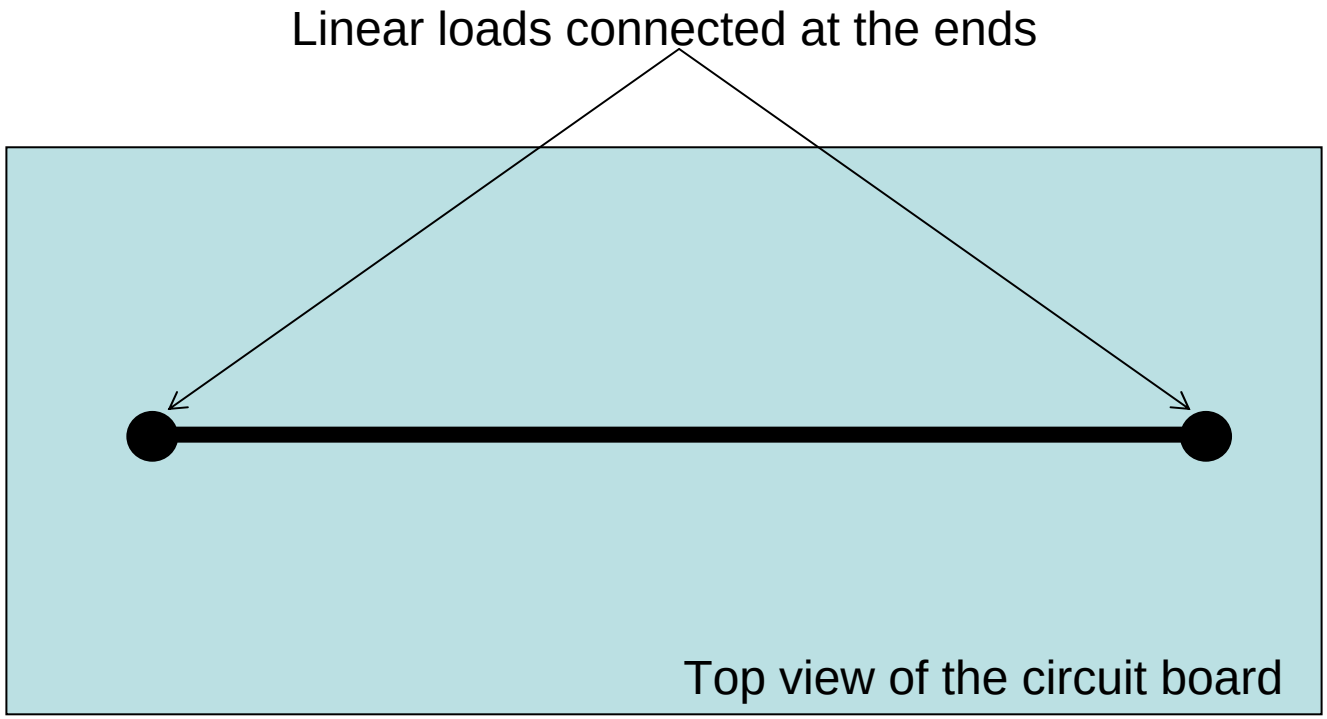
Description of the experiments

- The experiments consider a metallic cavity with an aperture. The size of the cavity is similar to a mini-tower computer chassis. The aperture represents one of the slots found in the back of a computer.



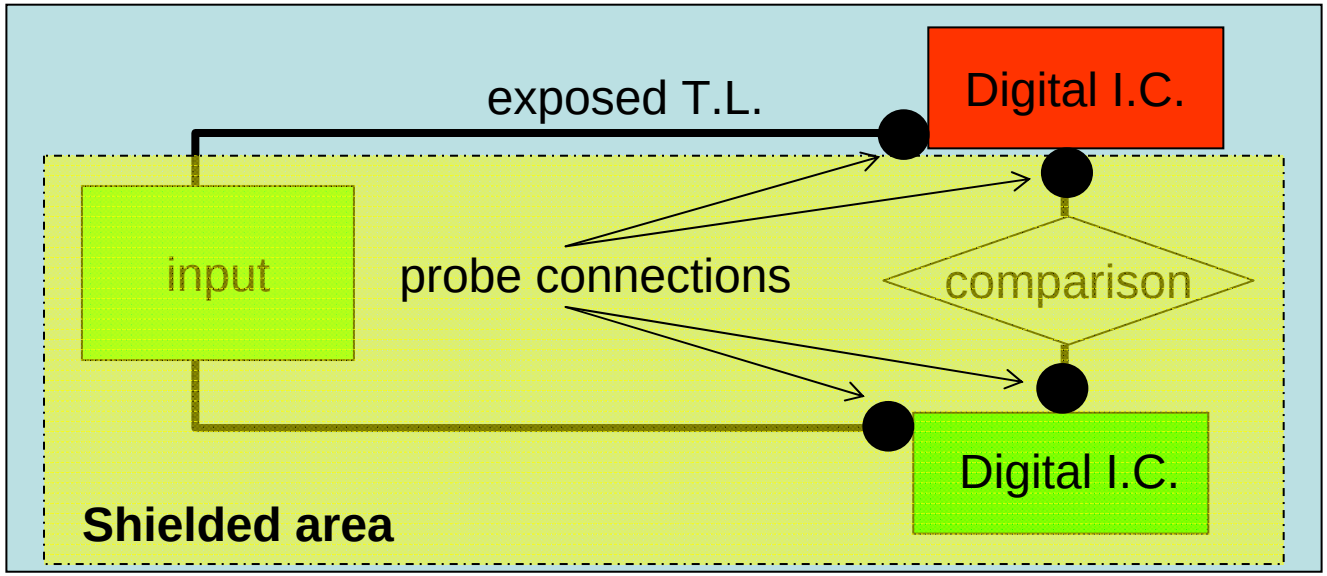
Description of the experiments

- The bottom of the cavity is movable and hosts the device under test (DUT).
  - At the beginning, a simple transmission line is considered.



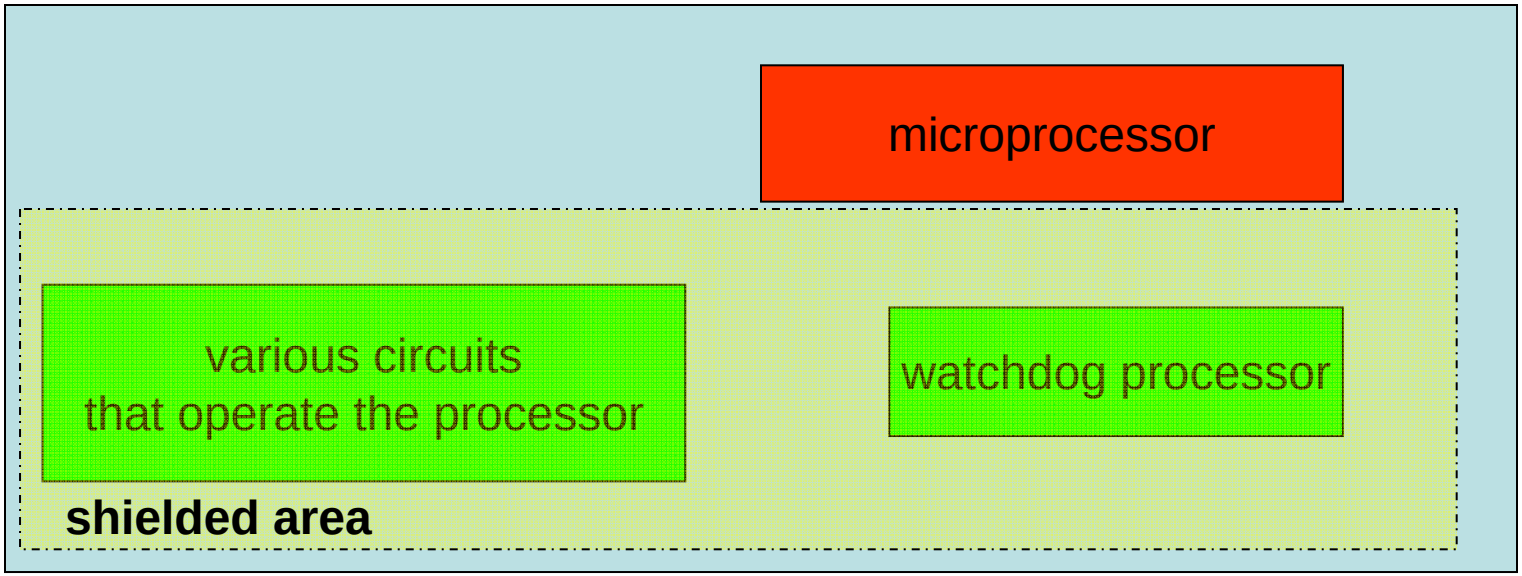
Description of the experiments

- A simple digital circuit connected to some transmission lines and an identical circuit to study its behavior under EMI.



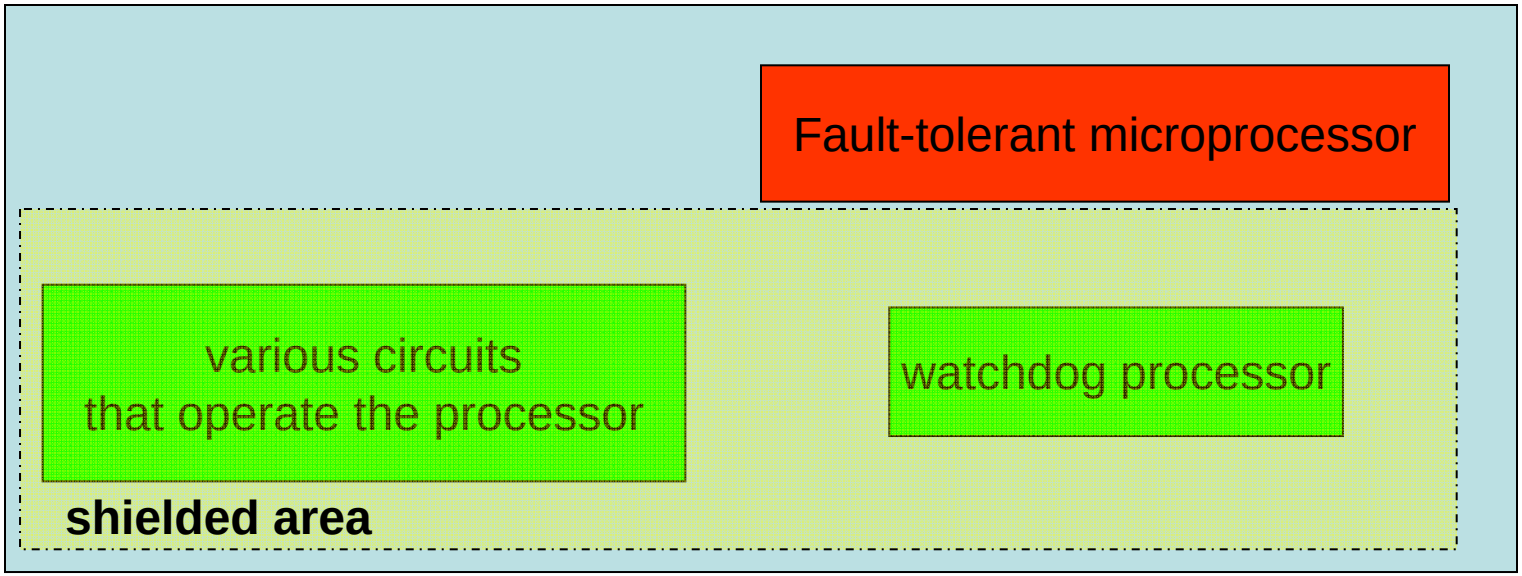
Description of the experiments

A complex digital circuit containing a basic microprocessor and a watchdog processor



Description of the experiments

A complex digital system containing a fault-tolerant microprocessor and a watchdog processor



Description of the experiments

Reduction of the total field inside the cavity

- Introduce damping elements within the cavity (resistors, impedance sheets…)

Additional considerations

- The UIC electromagnetic lab has recently purchased a new fast digital oscilloscope (6GHz bandwidth, 20 Gsample/S) to carry out the measurements ($60,000).

Extension of the BLT equations

- Studies to extend the BLT equations to incorporate non purely transmission line effects

- The purpose is to study the problem of the field penetrating the cavity through an aperture using the BLT equations and assess their accuracy