

Experimental validation of numerical codes and investigation of fault tolerance protection

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Purpose of the experiments

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

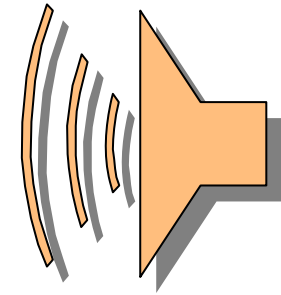
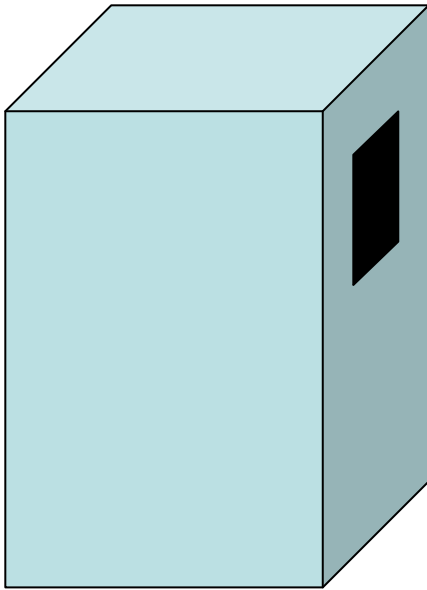
1. Radiation incident on a system
2. Penetration into the system
3. Coupling with internal parts of the system
4. Disturbance of the activity of digital circuits inside the system and assessment of the digital upset

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

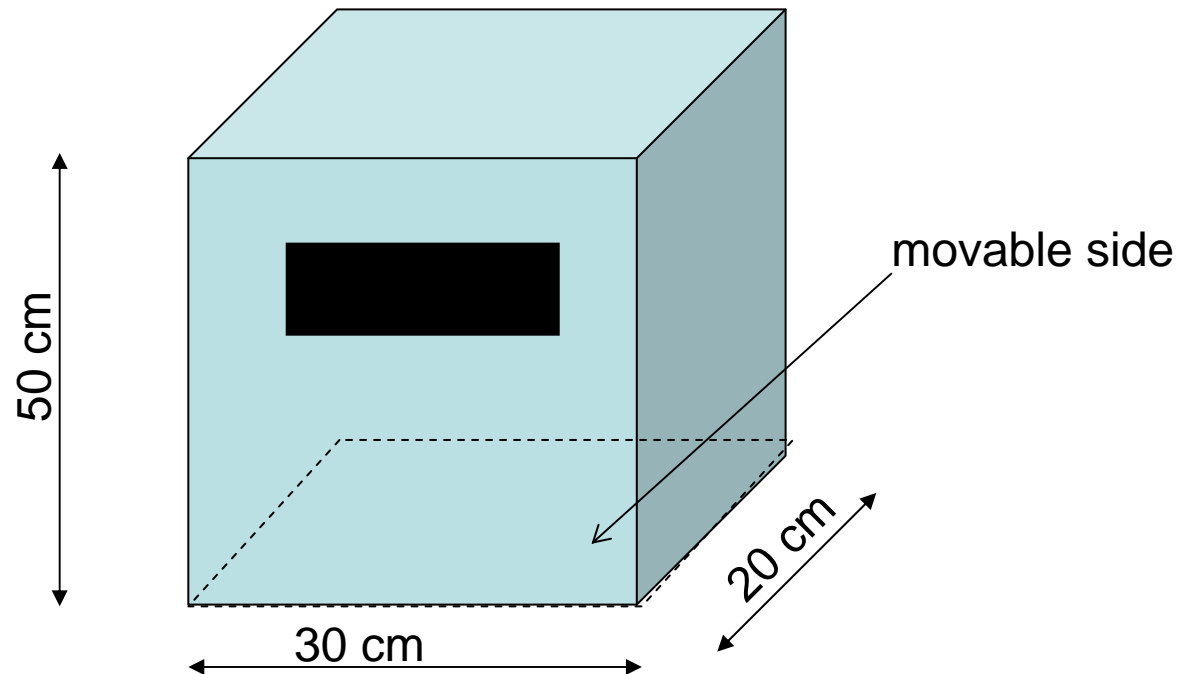
- Illumination of a cavity with an aperture to investigate the effects of the field that penetrates the enclosure.



$1\text{GHz} < f < 5\text{GHz}$

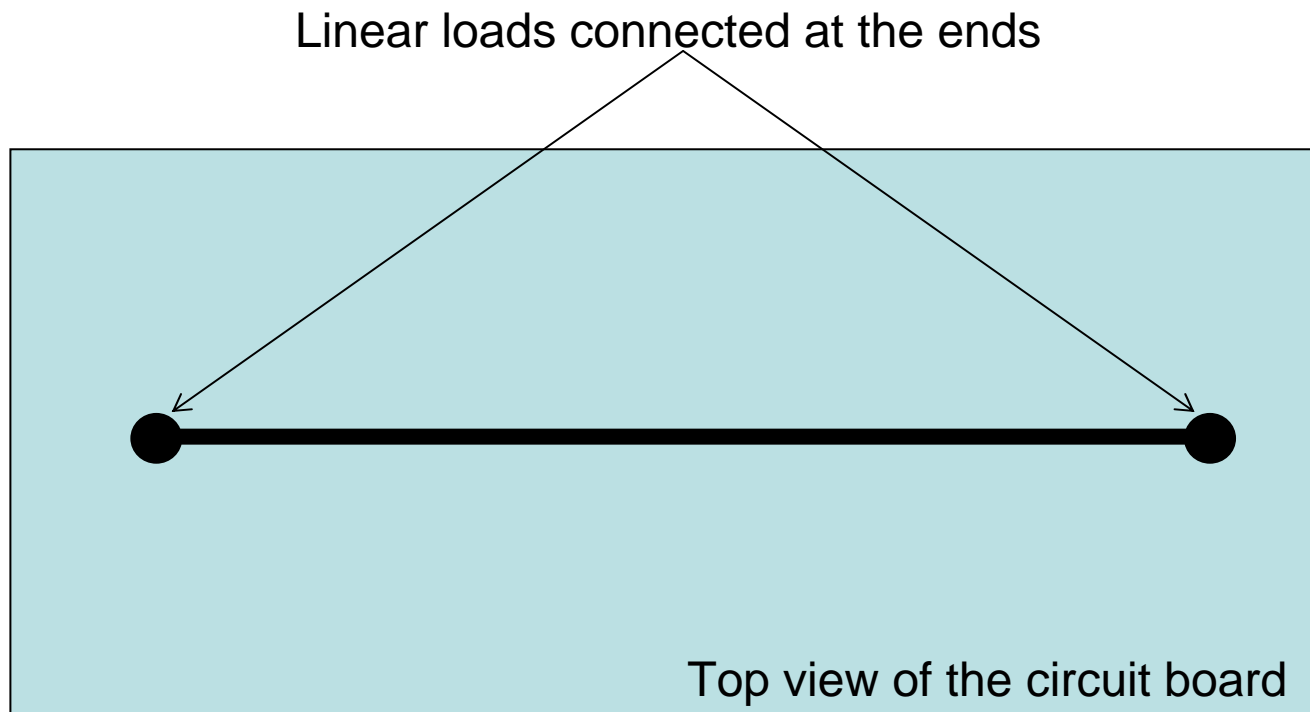
Description of the experiments

- 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.



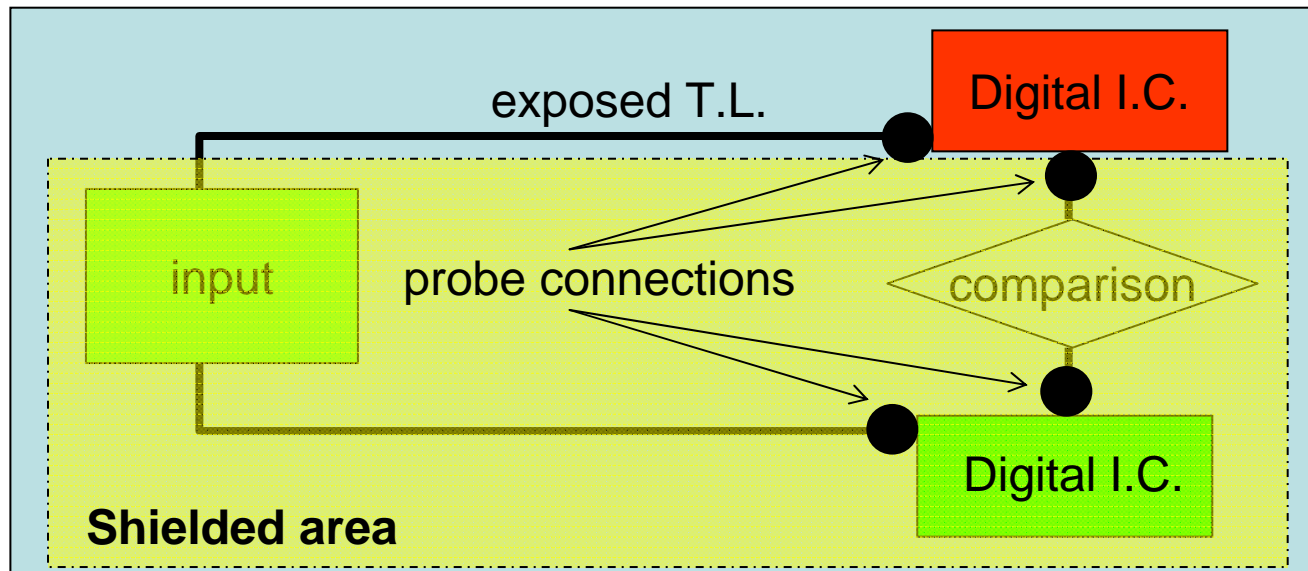
Description of the experiments

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



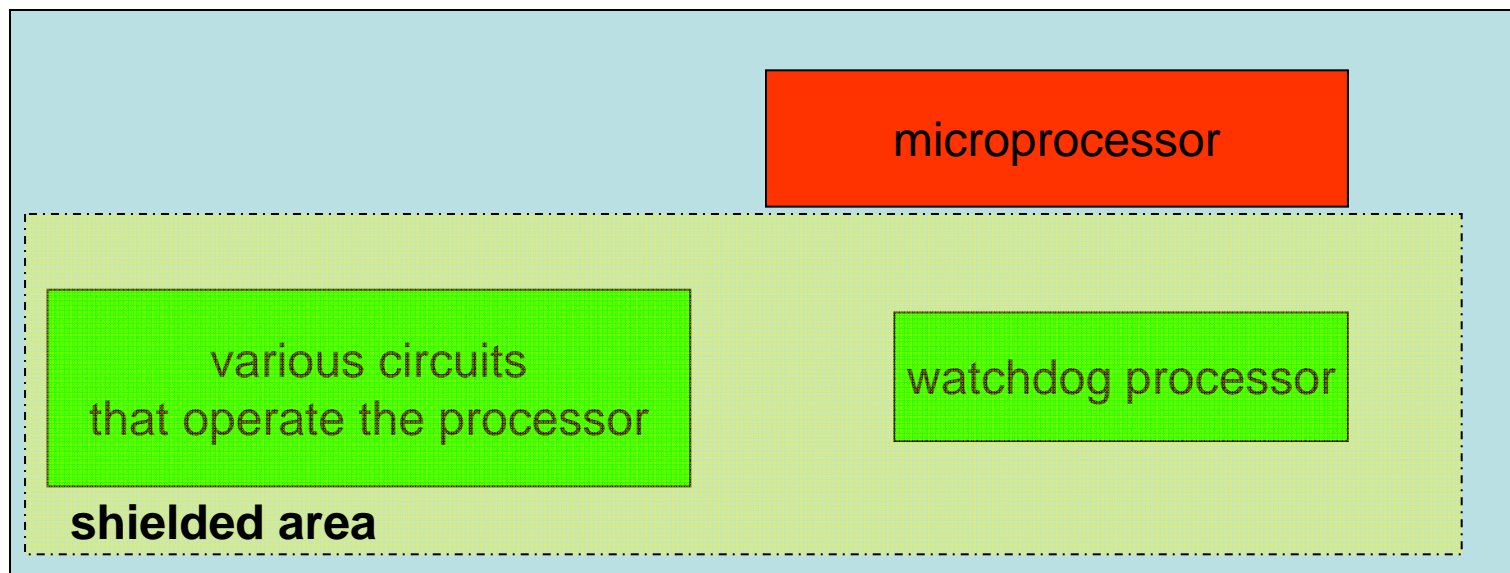
Description of the experiments

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



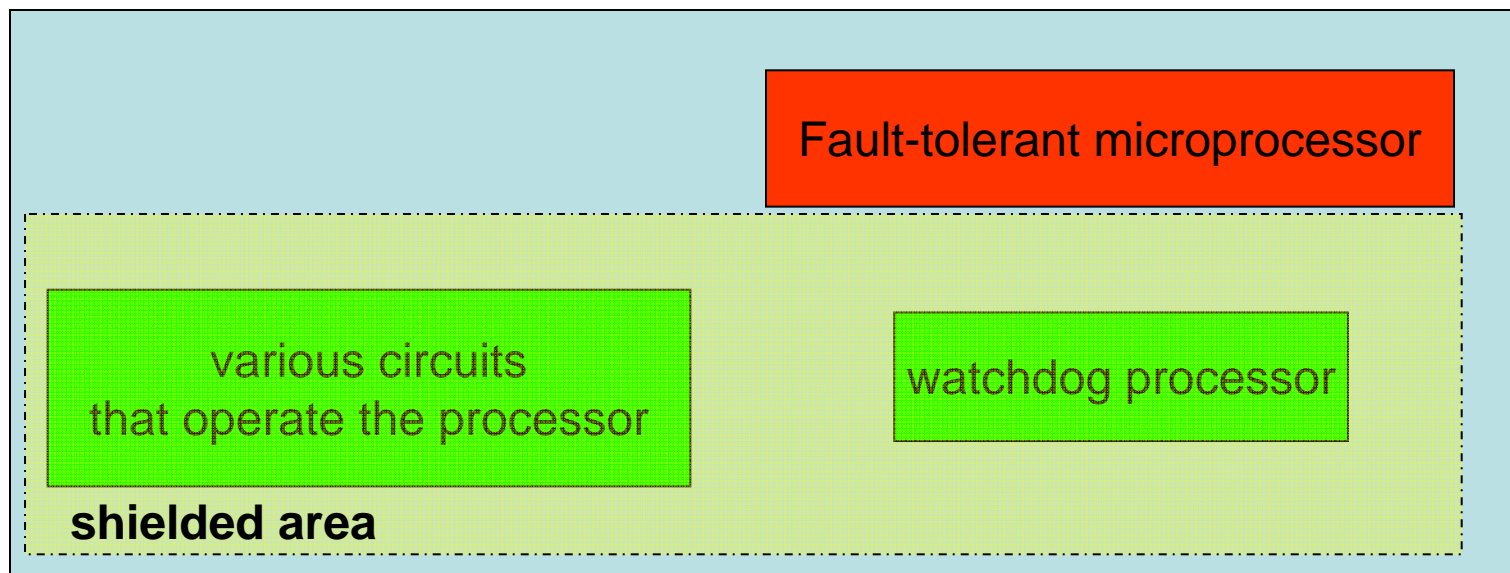
Description of the experiments

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