

Concurrent agile verification and validation of onboard space embedded systems using a hardware-in-the-loop simulation platform

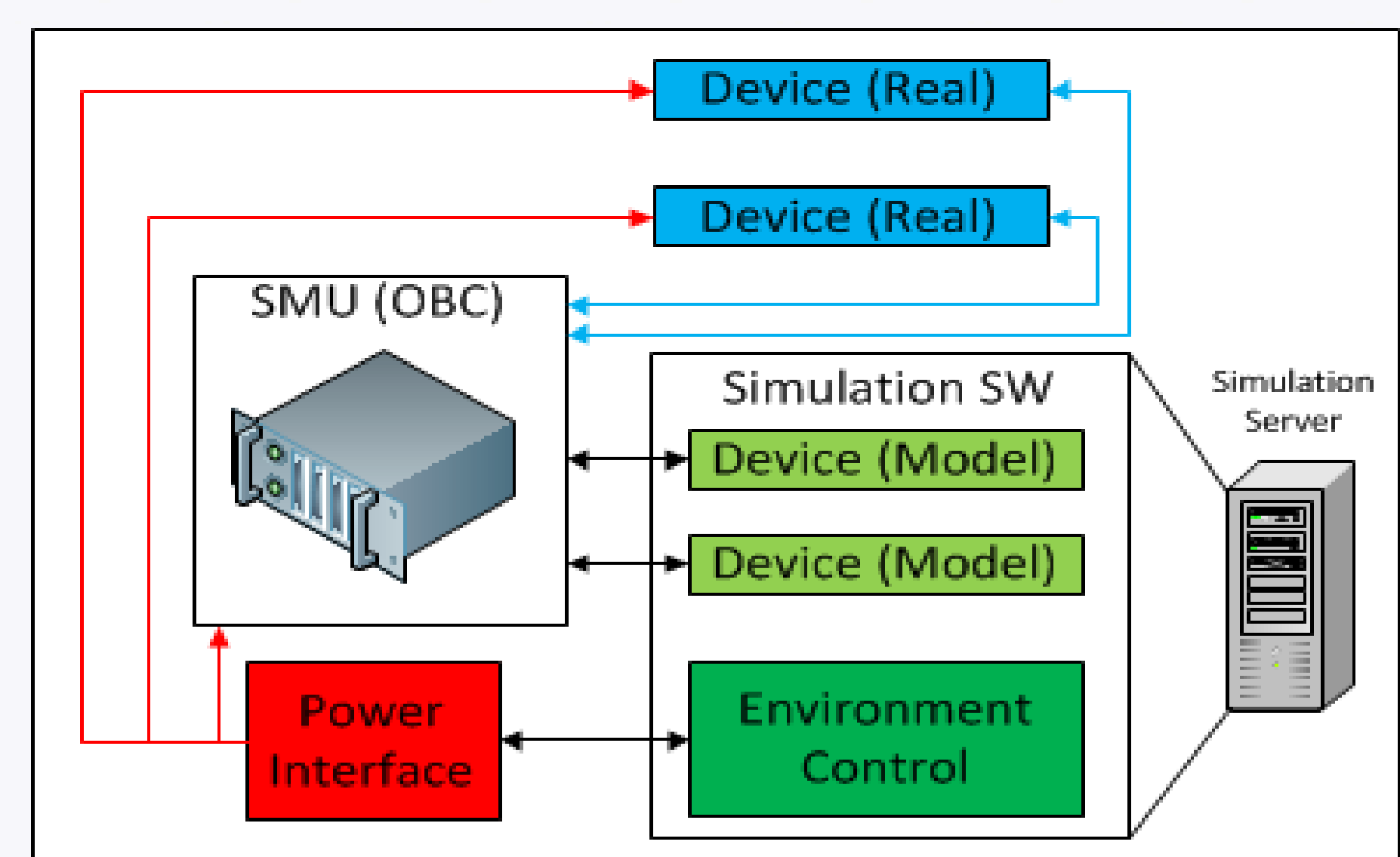


Cristóbal Nieto Peroy
Onboard Space Systems
chris.nieto@ltu.se
Supervisor: M. Reza Emami

Onboard computers (OBC) for space applications have to be flexible enough to meet the requirements of various contractors. Currently, the spaceworthiness of an OBC is validated through the verification of very detailed low-level electronics and the verification of every operational scenario, which is still not an automatized task.

The present project investigates the means to accelerate the validation procedure of RUAG's Spacecraft Management Unit (SMU) in terms of methodology and facilities. The aim is also to be able to generalize this set of practices and tools to other subsystems. In order to automatize the validation procedure an agile methodology is implemented. Specifically, Behavior Driven Development (BDD) assumes that any product can be validated if the outcomes of such product in all situations can be verified.

Then, we put the actual SMU in a hardware-in-the-loop simulation (HILS) which is running the scenarios generated by BDD. In such simulation the SMU is connected to a set of virtual devices through the server as it is done in a real spacecraft. The SMU can also interface real devices to complement the virtual ones.



Architecture of the simulation

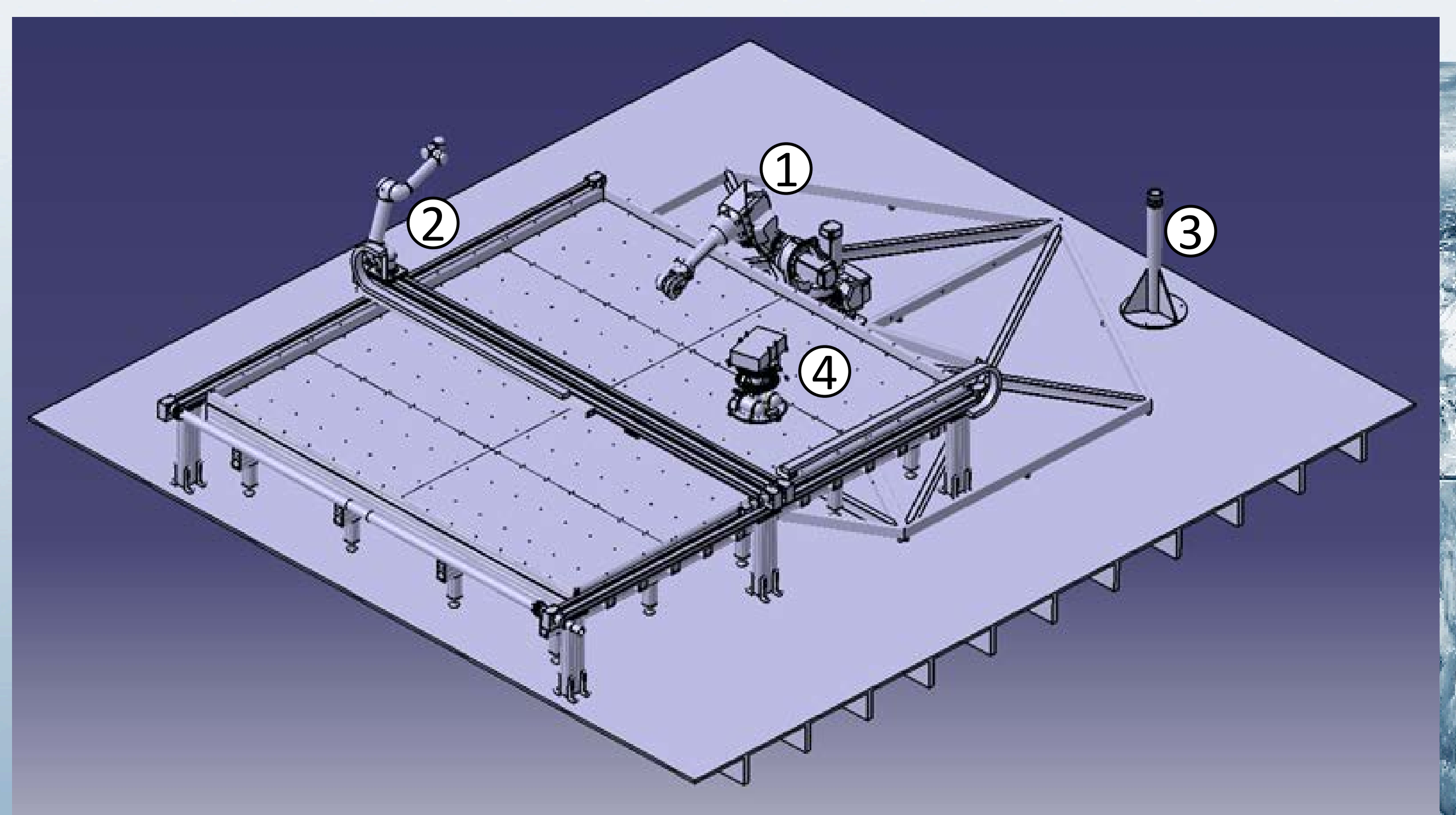
The Onboard Space Systems group has developed an Integrated Design and Simulation Environment (IDSE). Such environment, which performs HILS simulations, can emulate the space dynamics of a payload up to a 6U cubesat.

The IDSE dynamic emulation is achieved by:

1. Fixed-base 6 d.o.f. Robot Manipulator
2. Free-base 6 d.o.f. Robot Manipulator
3. Static 3 d.o.f. Air Bearing Stand
4. Floating-base 5 d.o.f. Air Bearing Stand.

In collaboration with:

RUAG



Overview of the IDSE



EUROPEISKA UNIONEN
Europeiska regionala
utvecklingsfonden



RIT
RYMD FÖR INNOVATION OCH TILLVÄXT

**GRADUATE SCHOOL OF
SPACE TECHNOLOGY**

**LULEÅ
UNIVERSITY
OF TECHNOLOGY**