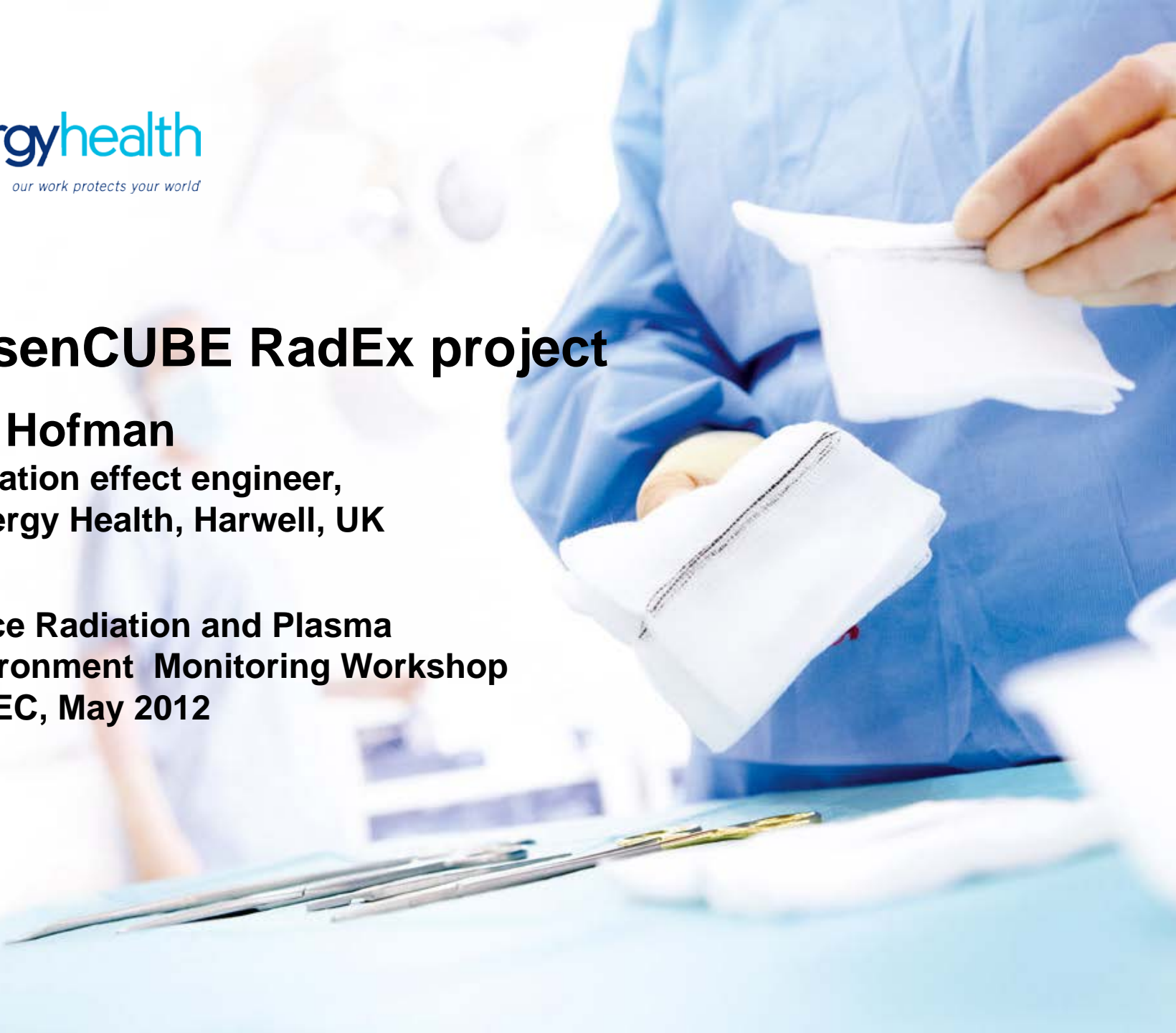


# **PilsenCUBE RadEx project**

**Jiri Hofman**

**Radiation effect engineer,  
Synergy Health, Harwell, UK**

**Space Radiation and Plasma  
Environment Monitoring Workshop  
ESTEC, May 2012**

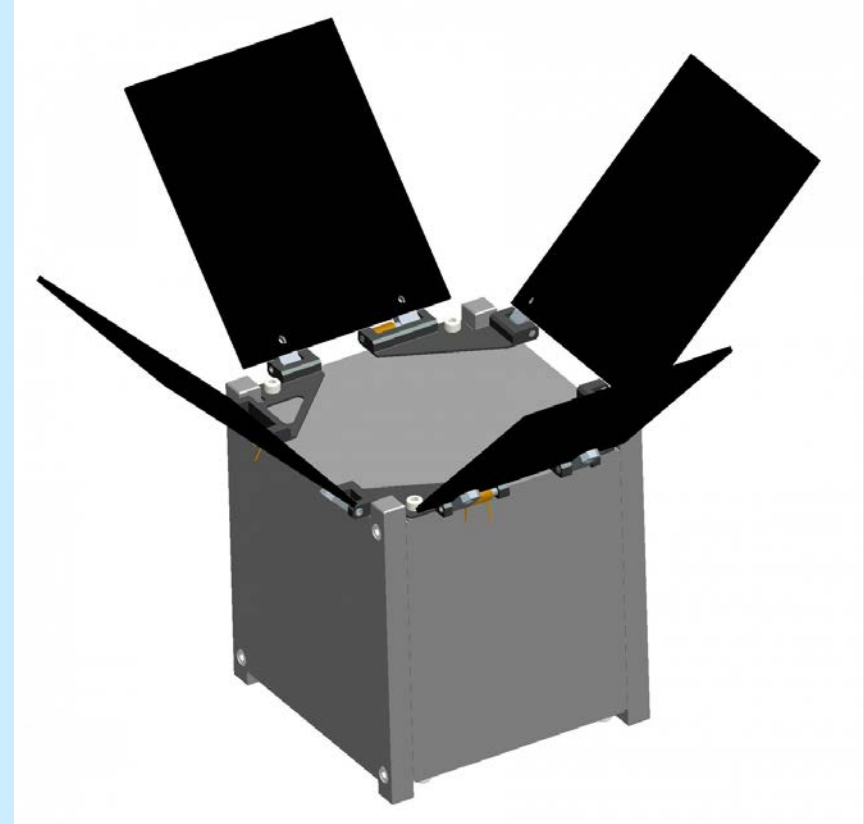


# Agenda

- **PilsenCUBE satellite**
- **RadEx experiment**
- **Test strategy**
- **Current project status and plan**
- **Contributors**
- **Conclusion**

# PilsenCUBE satellite project

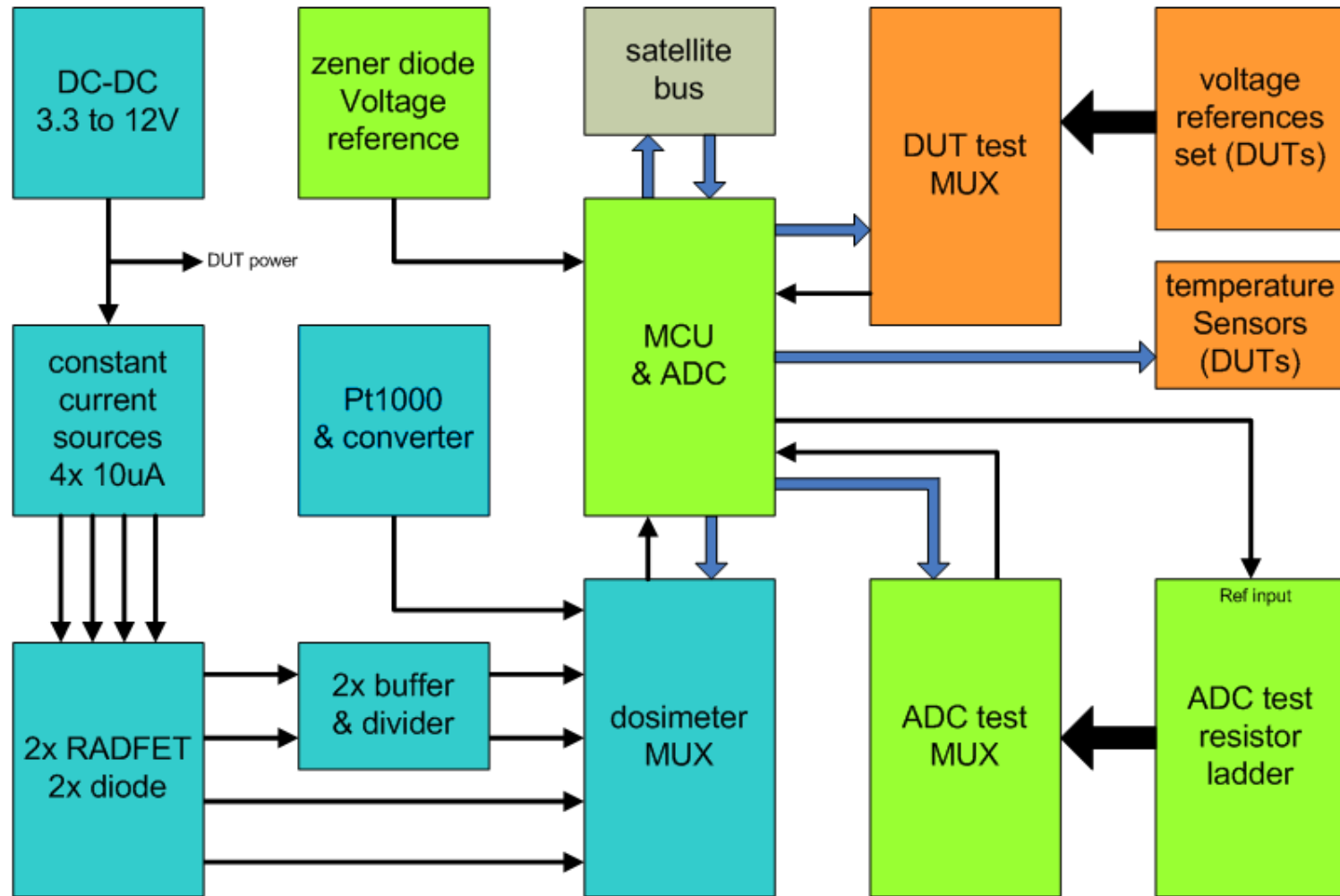
- **Technological experiment to test:**
  - **CubeSat reliable platform based on a redundant onboard computer**
  - **power system using super-capacitors**
  - **deployable solar panels**
  - **experimental transceiver using advanced software defined radio**
  - **RadEx experiment**
- **Orbit: not defined yet**



# RadEx experiment goals

- The goal is to design a miniature radiation experiment module capable of:
  - measuring the total dose the satellite electronics is receiving
  - continuous monitoring of the performance of devices under test (DUTs) to evaluate their TID induced degradation
  - functional and parametric self-test of the data acquisition part to ensure objective test results as well as to observe potential TID degradation of its performance
- Focused on analogue and mixed-signal devices TID degradation
- Open design compatible with CubeSat platforms
- Complex total dose ground test planned
- Comparison of ground and in-orbit data – validation of TID tests

# RadEx experiment block diagram



# RadEx hardware details

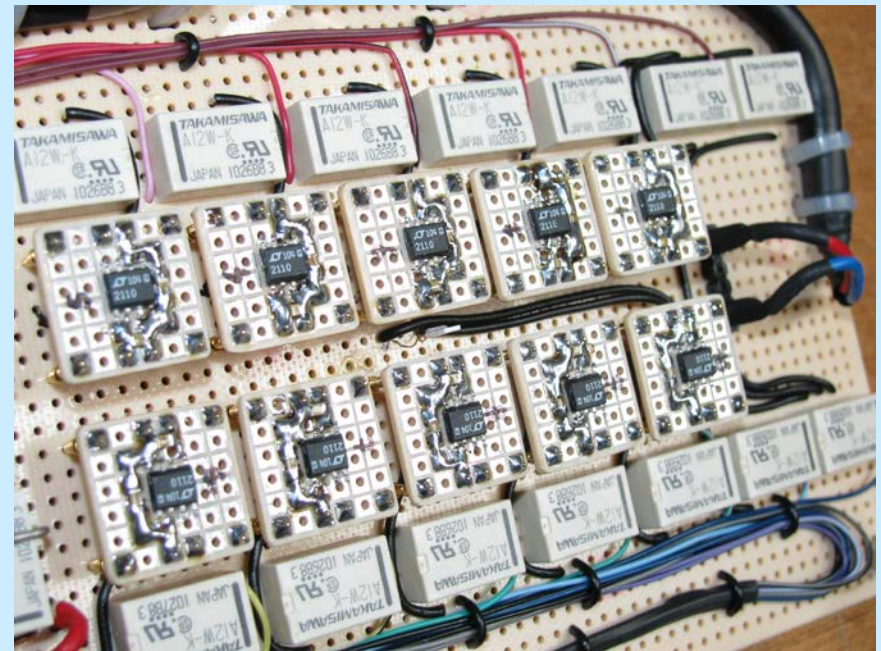
- **Half of PC104 PCB size, 5 mm height max, 100mW aver. max**
- **RADFETs: two candidates to be tested during development:**
  - **Tyndall 400nm implanted**
  - **REM?**
- **Selected DUTs:**
  - **Voltage references (3 types: LT1021, LM185, REF05)**
  - **Smart digital temperature sensor (DS18B20+)**
  - **AD converters:**
    - **Integrated to the MCU, ADuC842, 12-bit**
    - **External to the MCU, PN TBD, 24-bit (~20-bit effective)**

# RadEx ground radiation test plan

- **Complex TID test campaign planned:**
  1. **TID tests of DUTs** – a detailed characterisation of DUT degradation under various thermal conditions and dose rates.
  2. **Component level TID tests** of module subsystems as a part of the crucial parts selection process.
  3. **Dosimeter test** - TID and temperature sensitivity of the selected RADFET will be characterised to obtain calibration data and verify the function of the readout circuit.
  4. **Final system level TID test** of the completed RadEx modules will be done once the module design is closed. **Results to be compared with in-orbit data.**
  5. **Dosimeter pre-flight calibration** – the flight RADFET will be irradiated to a low dose to obtain calibration data (slope)

# RadEx project status and plan

- Preliminary design closed
- DUT TID tests in progress
- MCU TID test in development
  
- Final TID tests: Q3 2012
- Integration with satellite: Q4 2012
- Launch late: NET Q3 2013





# RadEx project contributors



**Thank-you all!**

## Conclusion

- **CubeSat class total dose experimental module in development**
- **Open design easy to integrate with other pico-satellites**
- **Complex TID test to be performed using same technique like in space**
- **First Czech CubeSat to be launched**
  
- **Data published at RADECS 2014?**

**Thank-you for listening.**

