A MicroTCA Power Module Test Pad and a status update on CERN xTCA evaluation project

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Collaboration (CERN PH-ESE-BE)
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PM Test Pad – Motivation

Previous test setup:

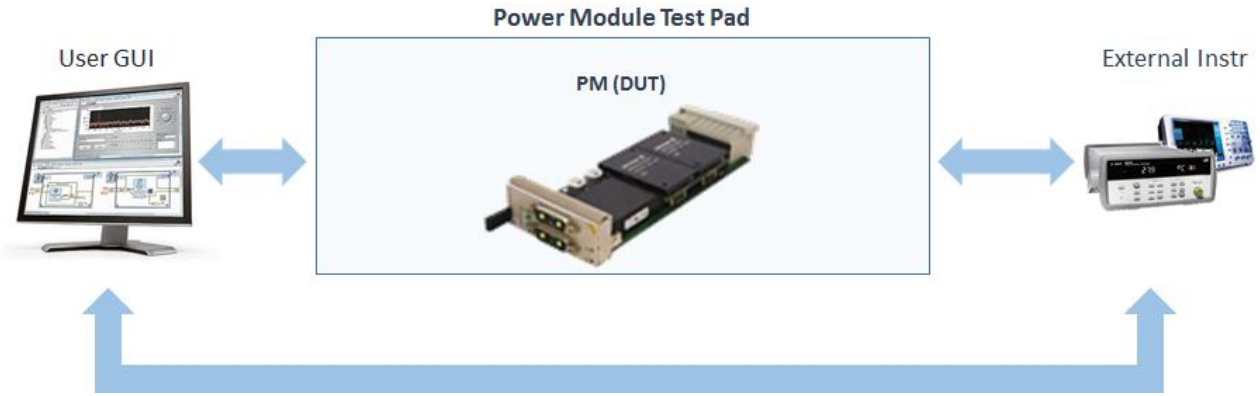
- Commercial crate hosting the power module under test
- CERN Load Modules
- Load sharing:
  - Auxiliary Power module → CU1, CU2, MCH1
  - Power Module Under Test → AMC1 to AMC12
- Load modules and instruments controlled by LabVIEW

Limitations:

- ❑ Shelf components influence the measurements (noisy CUs, Aux PM and MCH)
- ❑ Test limited to the 12 AMC channels (Impossible to test MCH and CU channels)
- ❑ Not suitable for performing EMC measurements
- ❑ Fully automatic test procedure not possible

PM Test Pad – Requirements

Objective: Test platform to perform all tests automatically.

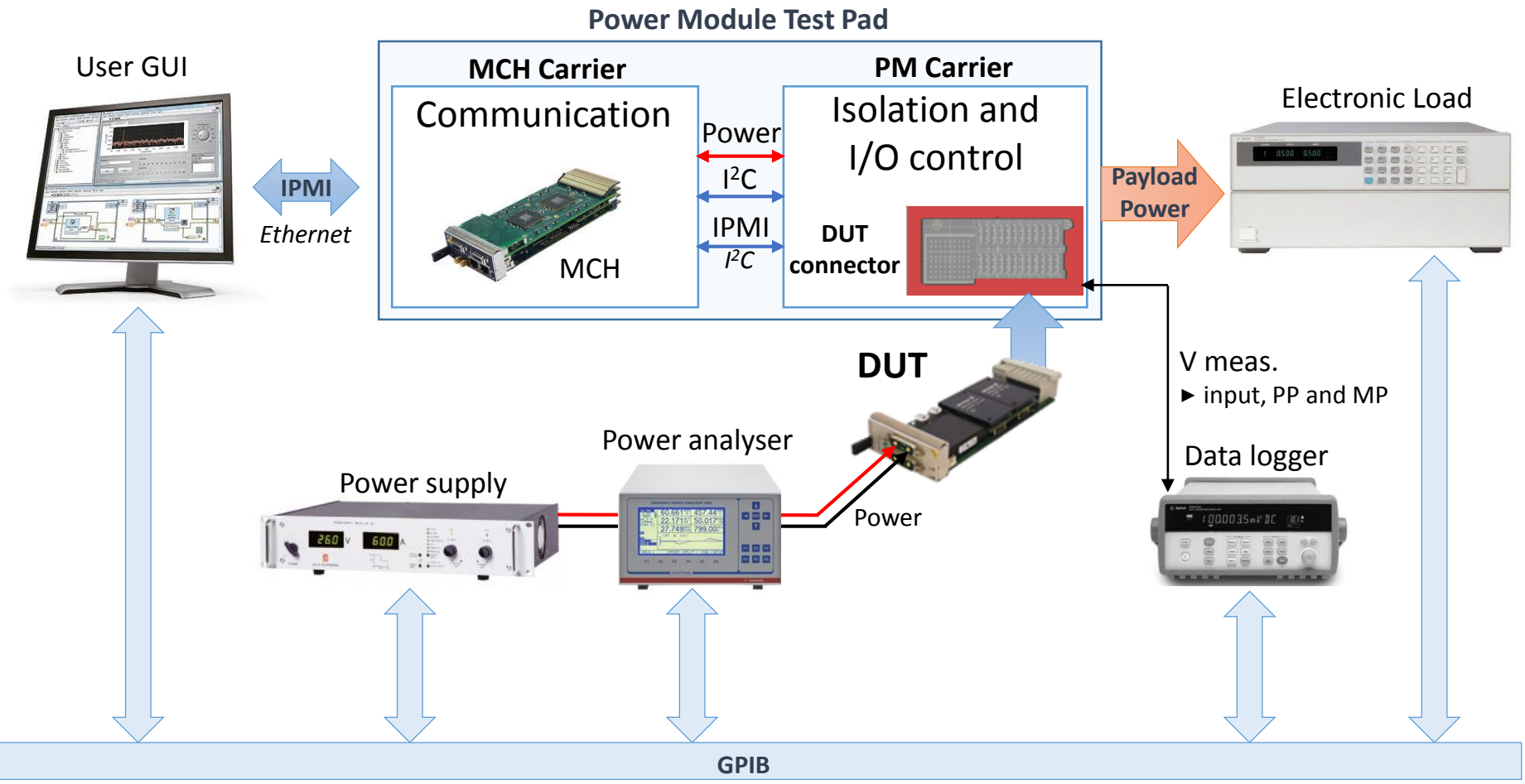


- Full PM I/O (PS, EN#, …) control and monitoring to emulate the MTCA shelf environment
- Full instrumentation connectivity (Electronic load, power analyzer, data logger …)
- Galvanic isolation between PM under test and test control circuitry
- Test pad compatible with different PM topologies (PM physical size, AC or DC input compatible, operating range and specs)
- Sufficient cooling of DUT
- PM test pad layout to accommodate EMI measurement features (LISN, EMI receiver)

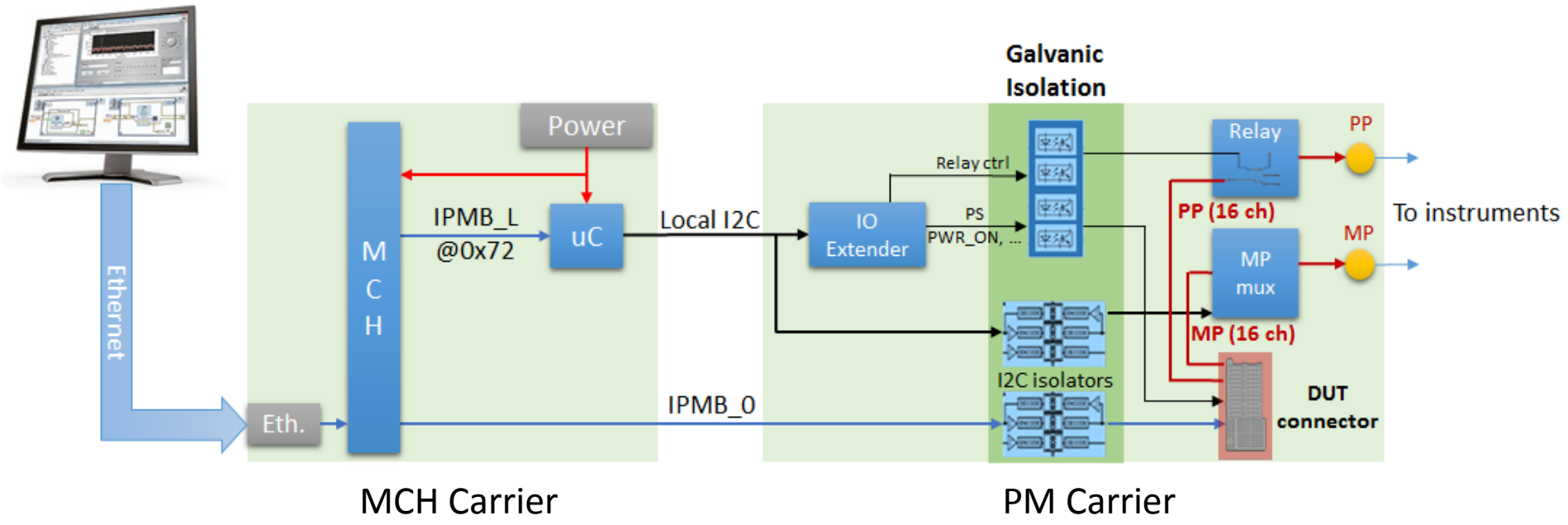
PM Test Pad – Test procedure

- Init. and Warm up phase — Automatic
  - Active all payload power and wait for 15 minutes monitoring the output voltages
- Functionality — Automatic
  - Validation of PICMG requirement (IPMI commands, autonomous mode …)
- Sensor accuracy — Automatic
  - Measurement of the power module's sensor accuracy
- Soak test — Automatic
  - Heat the device monitoring the output voltages
- Load regulation (Management power and payload power) — Automatic
  - Measurement of the output voltage varying the output power
- Line regulation — Automatic
  - Measurement of the output voltage varying the input voltage
- Efficiency — Automatic
  - Measurement of the power module's efficiency for different output power
- EMI — Semi-automatic
  - Measurement of the power module's electromagnetic interference

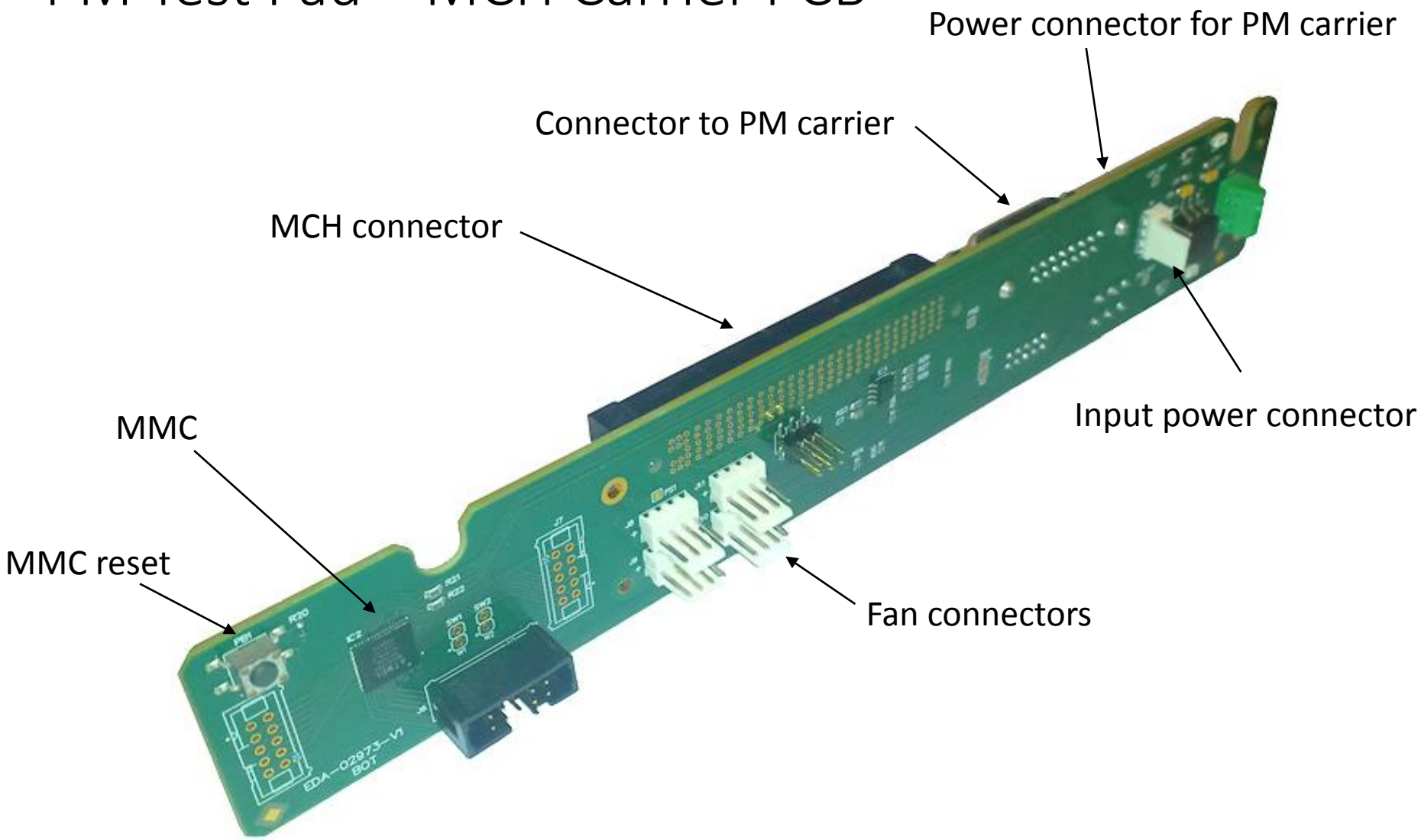
PM Test Pad – Functional concept



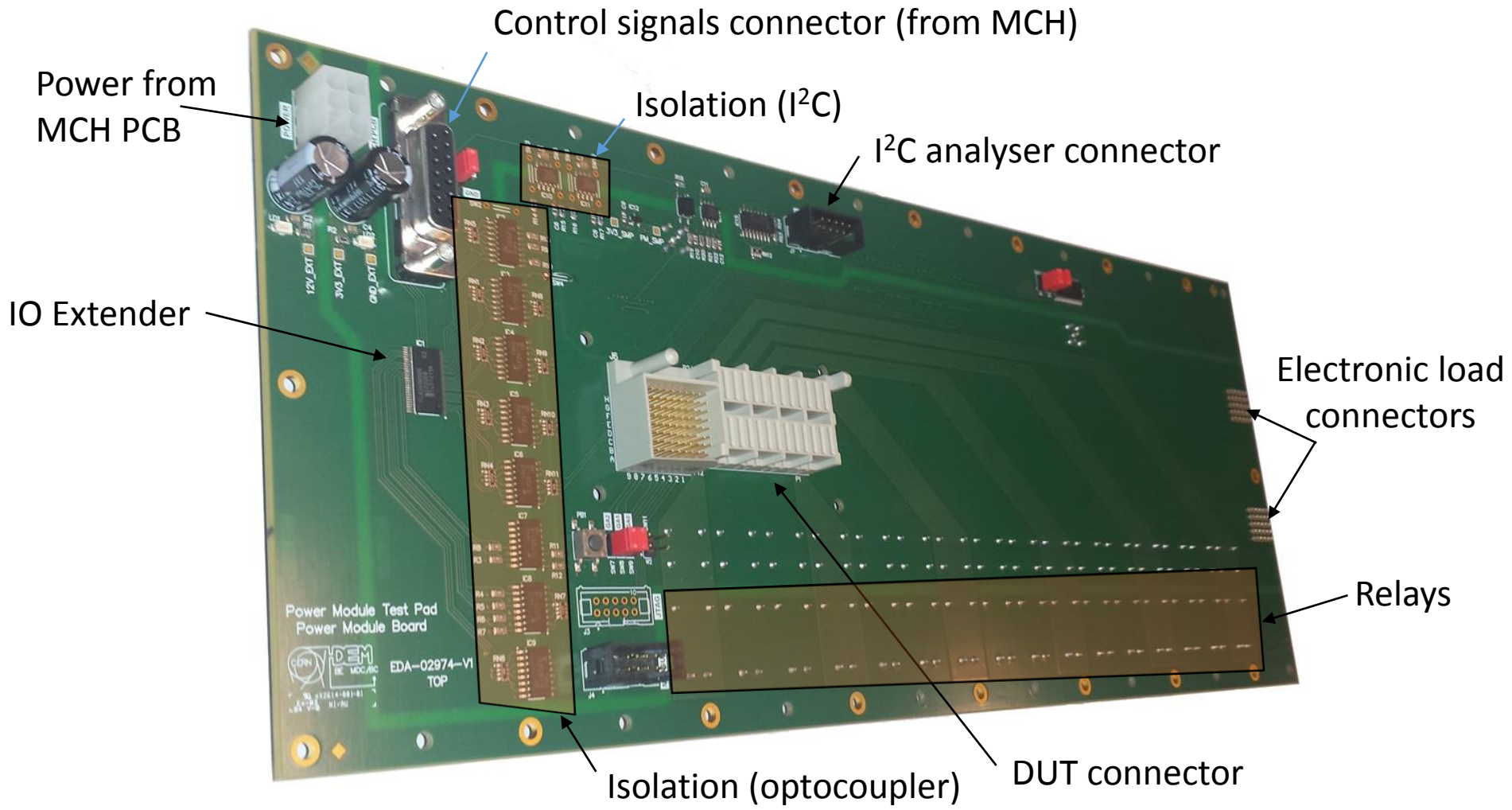
PM Test Pad – Hardware implementation



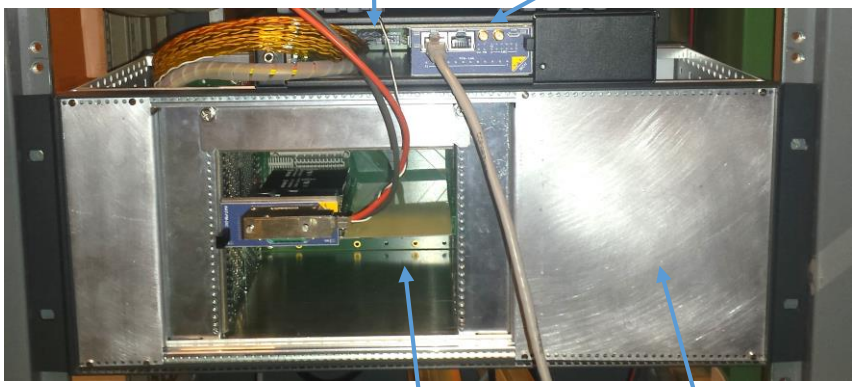
PM Test Pad – MCH Carrier PCB



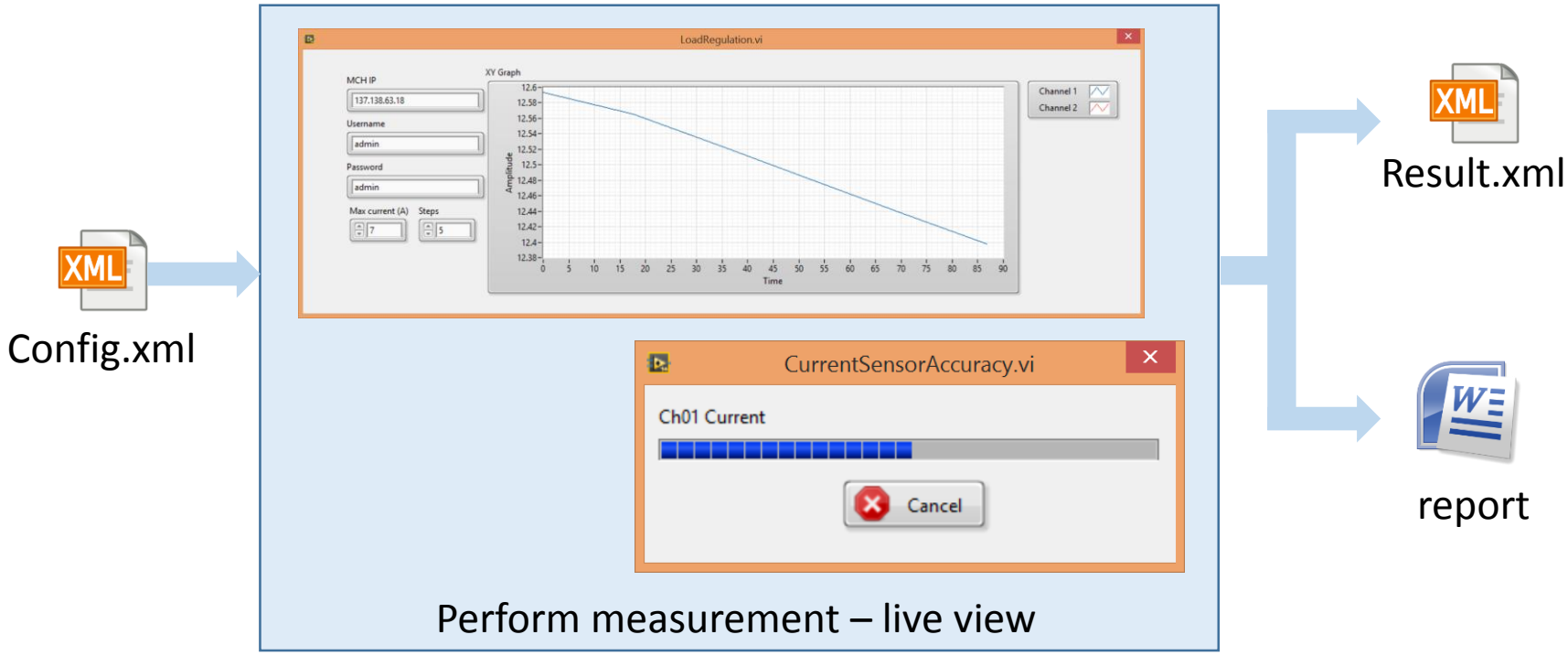
PM Test Pad – PM Carrier PCB



PM Test Pad – Test setup



PM Test Pad – Software implementation



PM Test Pad – Software implementation

Config.xml

- Tests configuration
  - Specification (Pass/Fail criteria)
  - Test conditions
  - Test sequences to be performed
- One configuration file per PM model
  - Offering text config. flexibility

Results.xml

- Results
  - Test outcome (Passed/Failed)
  - Measured values
  - Verbose report upon failures
- Generation of test reports based on the results in the XML file
  - External software developed to format the results

```
<?xml version="1.0" encoding="UTF-8"?>

<Config>
    <!-- General configuration -->
    <GeneralConfig>
        <mchip>137.138.63.18</mchip>
        <username>admin</username>
        <password>admin</password>
        <pmname>UTC010-000-010_rev-E</pmname>
    </GeneralConfig>

    <!-- Line Regulation test (PP)-->
    <LoadRegulation type="PP">
        <steps>5</steps>
        <max_curr>7.5</max_curr>
        <channels>
            <channel>1</channel>
            <channel>10</channel>
            <channel>16</channel>
        </channels>
        <spec>
            <maxvoltage>15</maxvoltage>
            <minvoltage>10</minvoltage>
        </spec>
    </LoadRegulation>

    <!-- Load Regulation test (MP)-->
    <LoadRegulation type="MP">
        <channels>
            <channel>5</channel>
            <channel>8</channel>
            <channel>10</channel>
            <channel>14</channel>
        </channels>
        <spec>
```

Config. file example

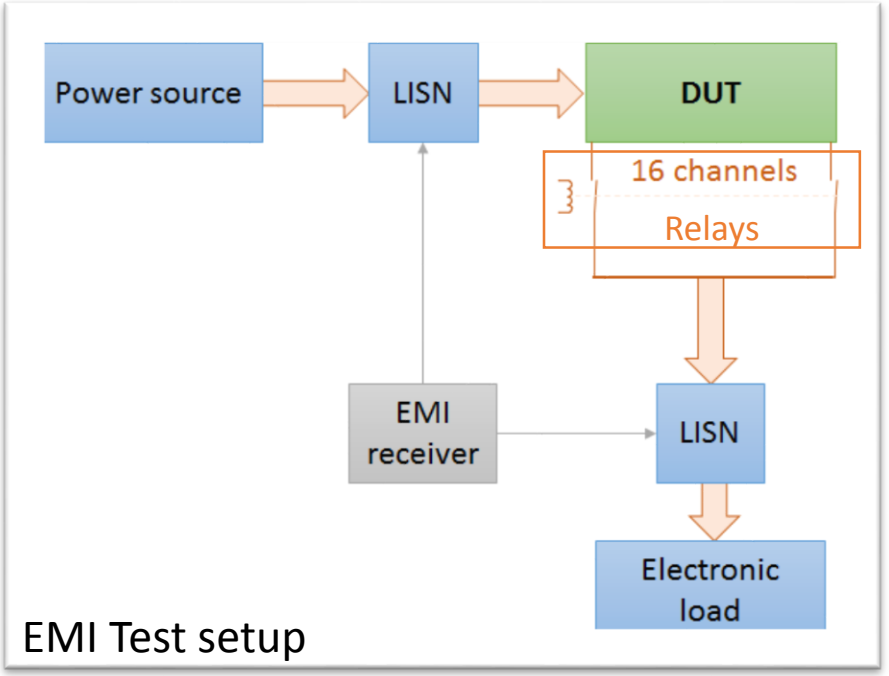
PM Test Pad – Summary

Status:

- PCBs produced and tested
- PM Test Pad functional
  - Most of the test features successfully implemented
- Graphical user interface
- Easily adaptable through configuration files
- Full test report generation

Plans:

- EMI Test to be implemented
- Efficiency test to be implemented



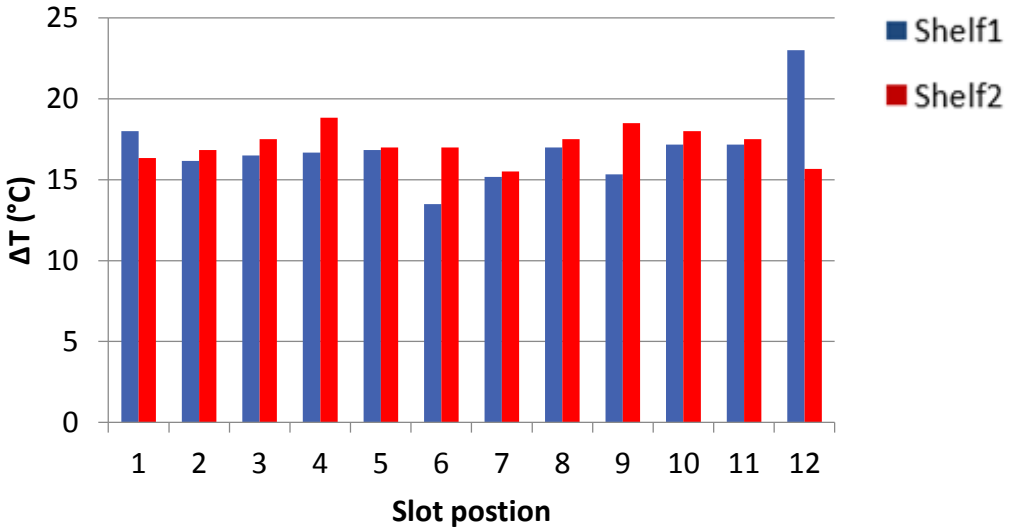
EMI Test setup

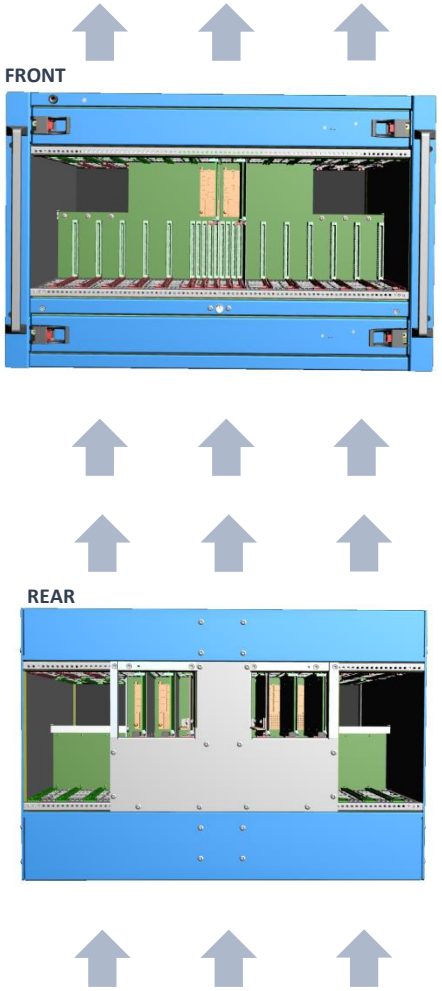
Status update on CERN xTCA evaluation project

CERN xTCA evaluation project – Custom shelves evaluation

Custom shelves:

- Vertical cooling
  - Adaptation to the existing rack cooling system
- Slot quantities for up to:
  - 12 AMCs DW-FS (front)
  - 6 RTMs (DW-FS) (rear)
  - 6 PMs (SW-FS, 4 PM operating max, 2 front-4 rear)
  - 2 MCHs (SW-FS) (front)
  - 1 JSM (rear)
- Manufacturers: Schroff and ELMA





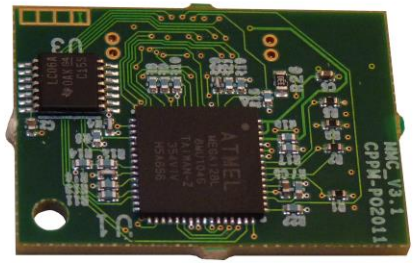
CERN xTCA evaluation project – CERN MMC

MMC hardware

- Mezzanine board
- Atmega128

MMC software

- DESY / CPPM / CERN collaboration

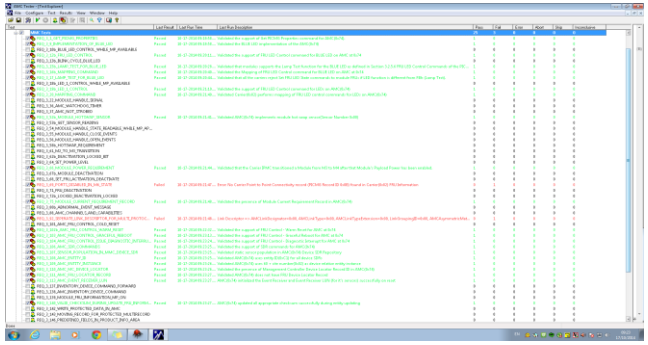


CERN MMC

Status

- All HPM.1 mandatory commands are implemented
- Polaris Network tester outcome
  - 25 automatics tests passed
  - 3 failed (FRU information data related)

Polaris Network tester



Summary

- PM Test Pad is ready to carry out tests
- Custom shelves have been evaluated
- MMC software is fully functional with HPM.1 implemented
- Price inquiry has been launched for series production of custom shelves and PM for use at CERN
- A similar program is on going for ATCA

Thank you

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