

Advanced European Infrastructures for Detectors at Accelerators

AIDA 2020 - kick-off Meeting

3-5 June 2015, CERN

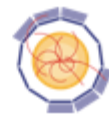
ITAINNOVA
INSTITUTO TECNOLÓGICO DE ARAGÓN



ITAINNOVA TA: Scientific & Administrative issues *Electromagnetic Compatibility Facility for electronics noise and grounding diagnostics (WP12 – Task 12.2)*



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AIDA²⁰²⁰

Dr. Fernando Arteché

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1. Introduction

- The **Instituto Tecnológico de Aragón (ITAINNOVA)** is a non-profit public Technology Centre located in Zaragoza (Spain)
 - Founded 1985
 - Facilities 15000 m²



- **ITAINNOVA activities are focused on :**
 - Applied research
 - Technical development
 - Technical services
- **Main R&D lines**
 - Material engineering
 - Industrial systems
 - Logistics
 - Multimedia Technologies
- **The number of ITA employees is 220.**

1. Introduction

- One group of ITAINNOVA focused its efforts on electrical engineering aspects for complex systems
 - Electromagnetic Compatibility issues
 - Electrical power systems designs
- Since 2009 this group has been participating in high energy physics (HEP) projects for future colliders
 - R&D on EMC (grounding & shielding issues)
 - R&D on new powering schemes
- It has been involved in :
 - CMS upgrade – HL-LHC at CERN
 - Belle II – SuperB at KEK
 - ILD - ILC
- Since 2012 ITAINNOVA became associate member of CMS



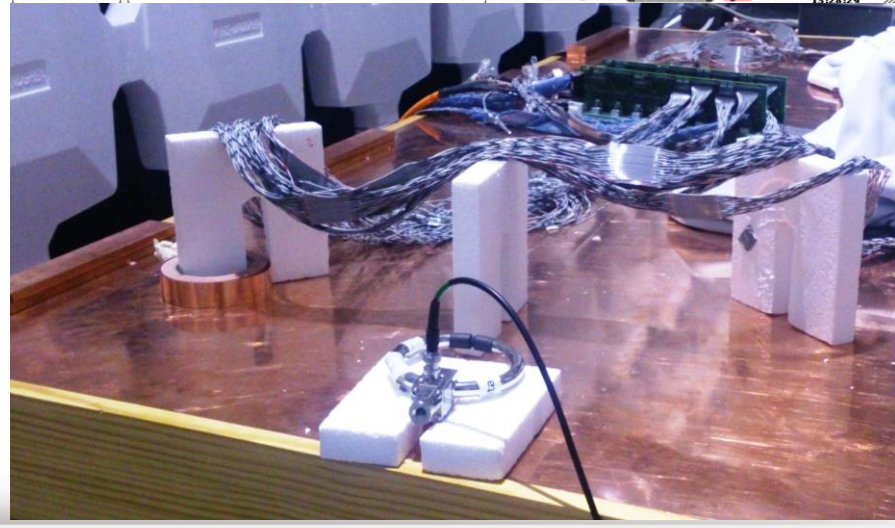
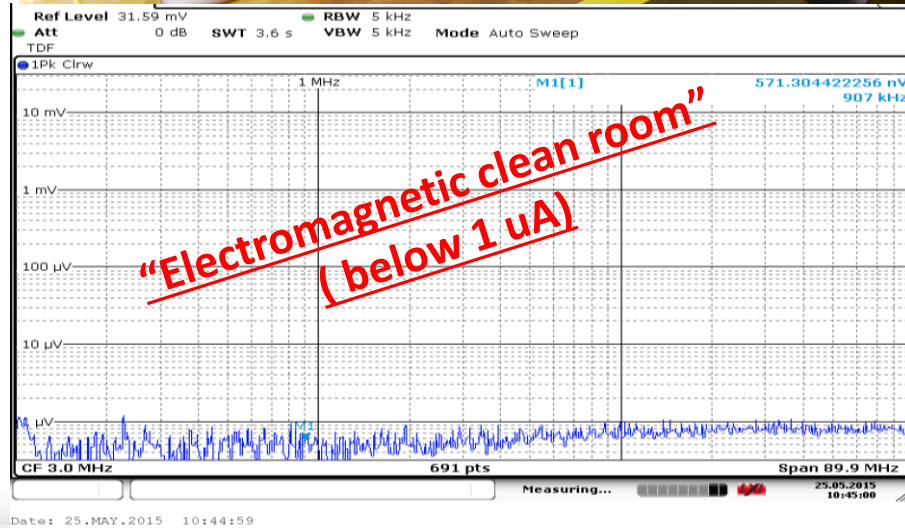
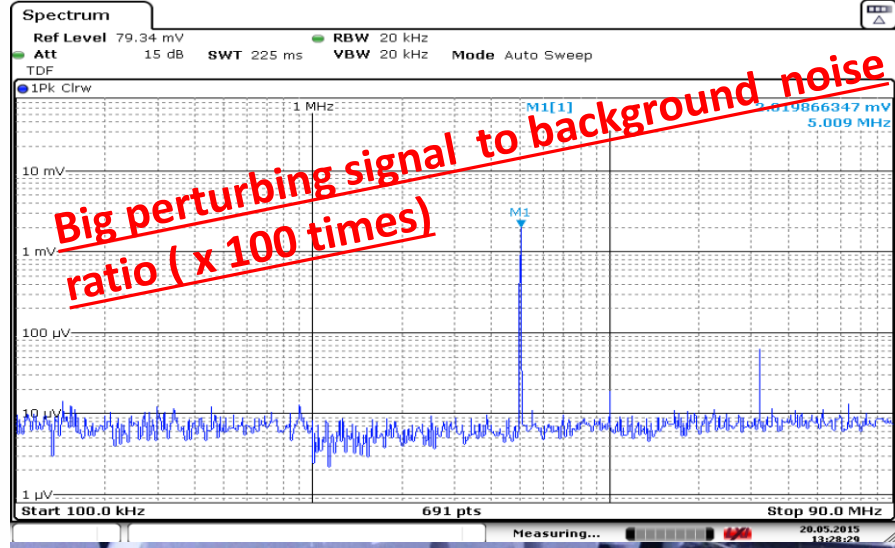
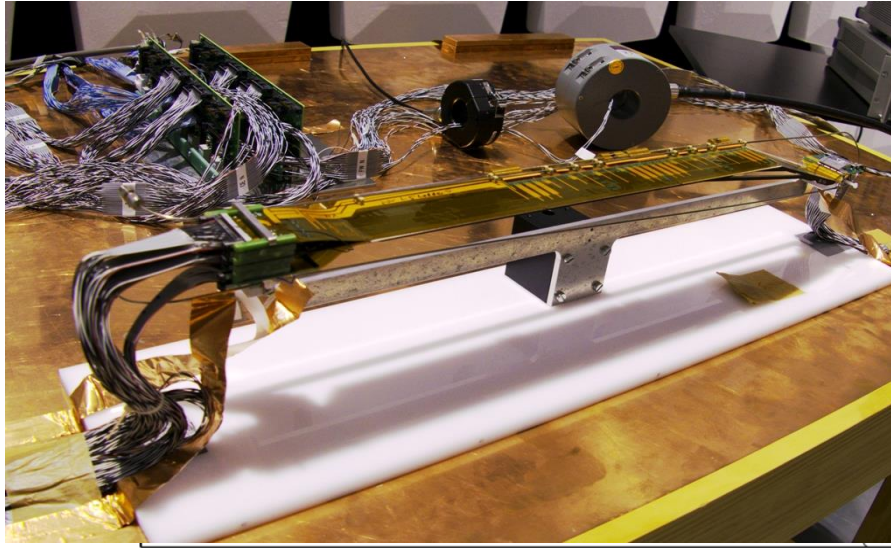
2. Scientific issues

- ITAINNOVA - EMC facilities allow to perform Electromagnetic Compatibility Test .
 - Non-standard test (Specially focused on HEP)
 - Standard (According to European Directive 2004/108/EC)
- These tests may be used to define in any electronic device installed in HEP experiment:
 - EM noise emission level (noise emission test)
 - Conducted
 - Radiated
 - EM noise immunity level (noise injection test)
 - RF conducted and radiated noise
 - Transients test



2.1 Scientific issues: Activities

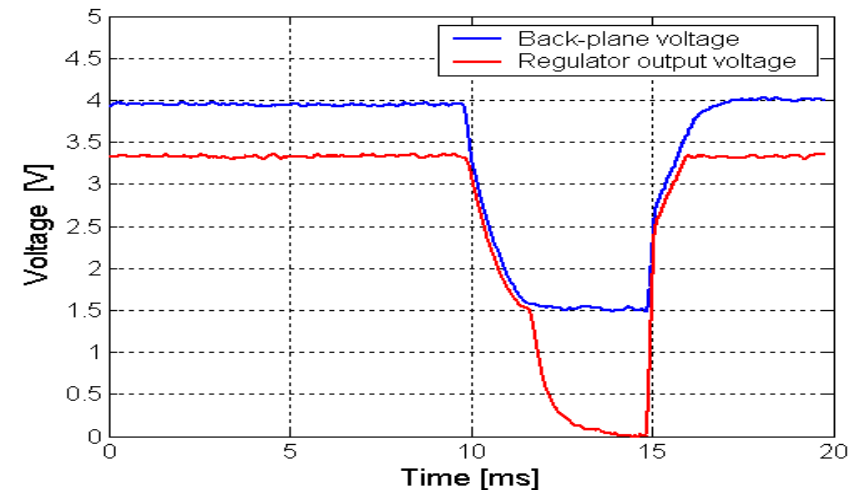
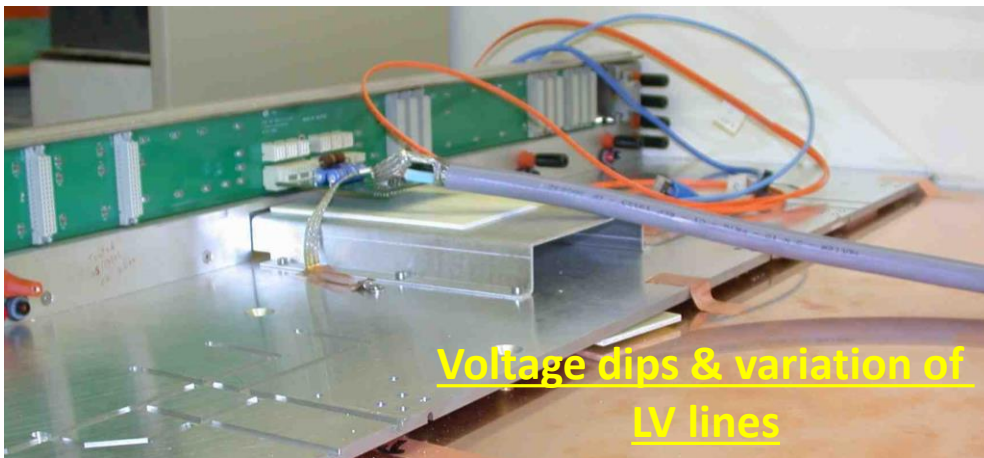
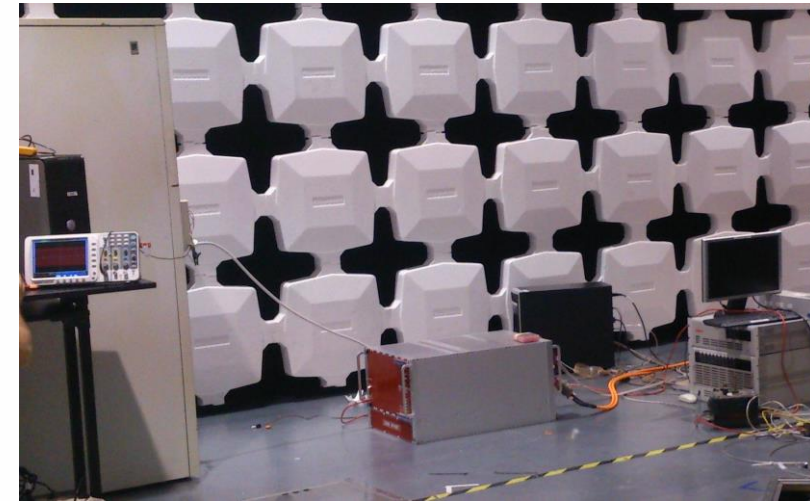
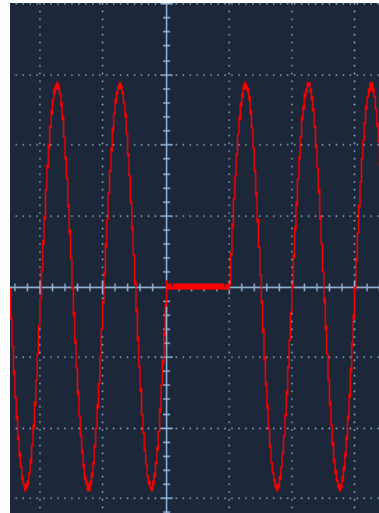
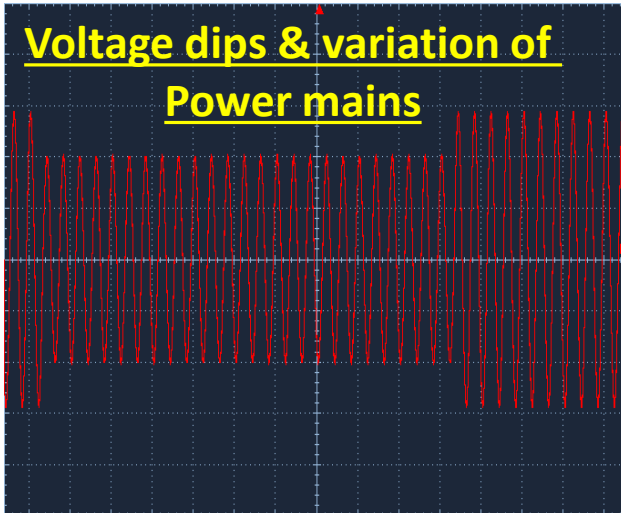
- Conducted immunity test – SVD system for Belle II



- Radiated emission test – Cable radiation of SVD system for Belle II

2.1 Scientific issues: Activities

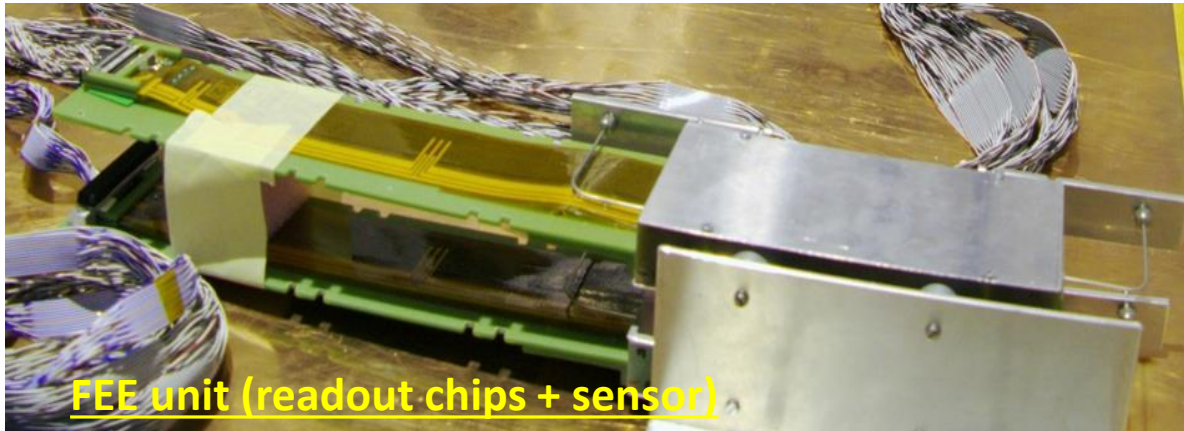
• PS Transient test – SVD for Belle II



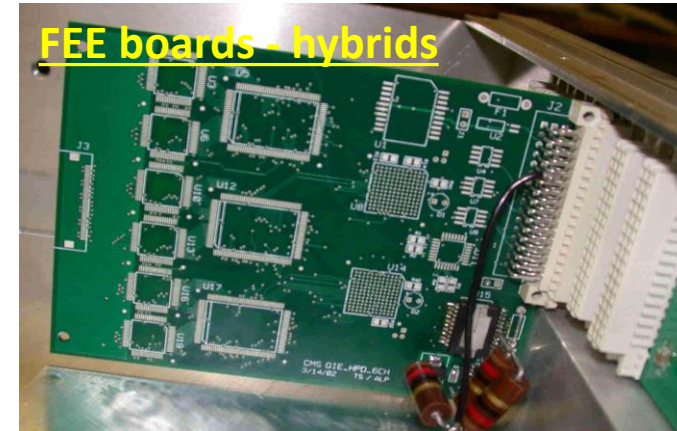
• LV regulator response to voltage dips – HCAL system for CMS

2.1 Scientific issues: Activities

- It can be used to test small components or units.....



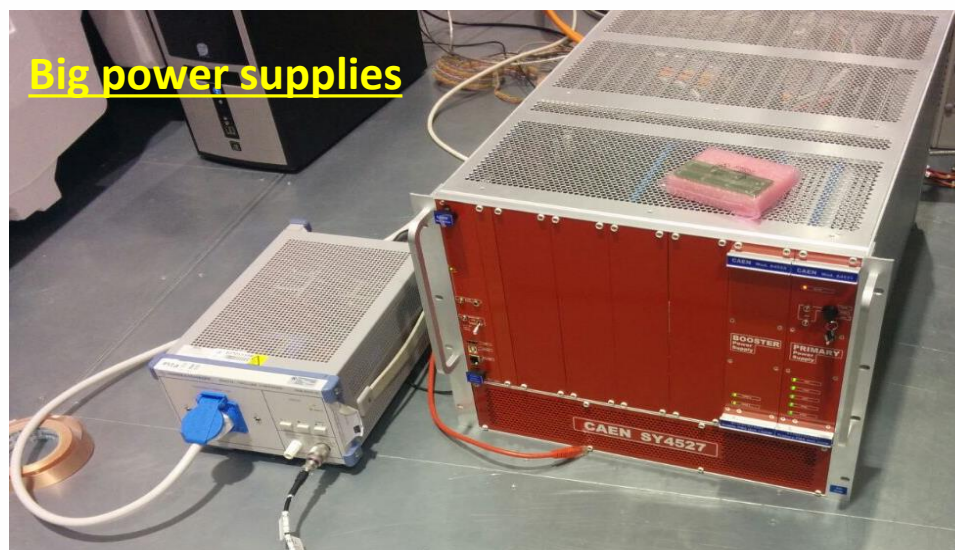
FEE unit (readout chips + sensor)



FEE boards - hybrids



Small DC-DC



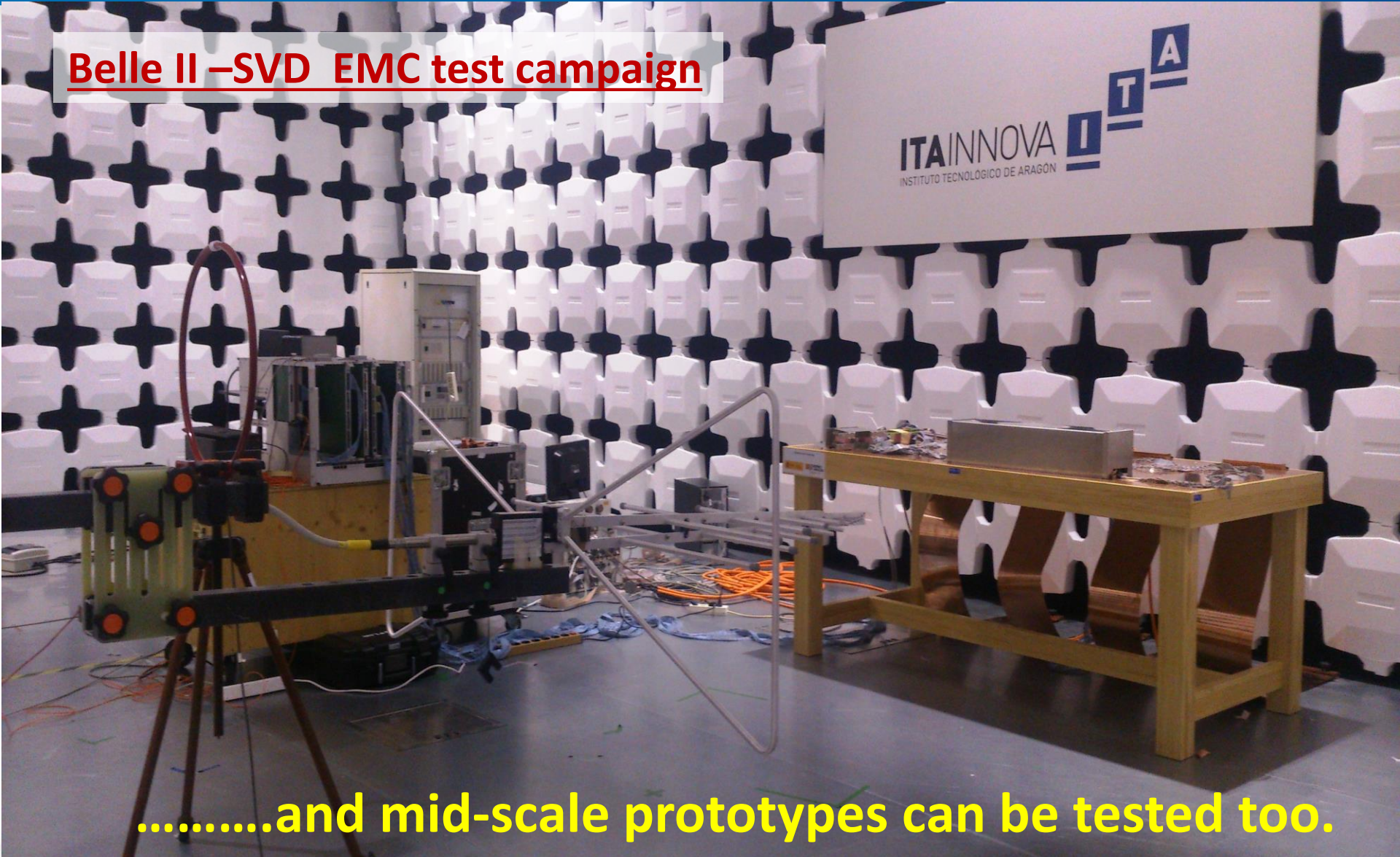
Big power supplies



Hybrids

2.1 Scientific issues: Activities

Belle II –SVD EMC test campaign



.....and mid-scale prototypes can be tested too.



2.2 Scientific issues: Equipment

The EMC equipment at ITAINNOVA is :

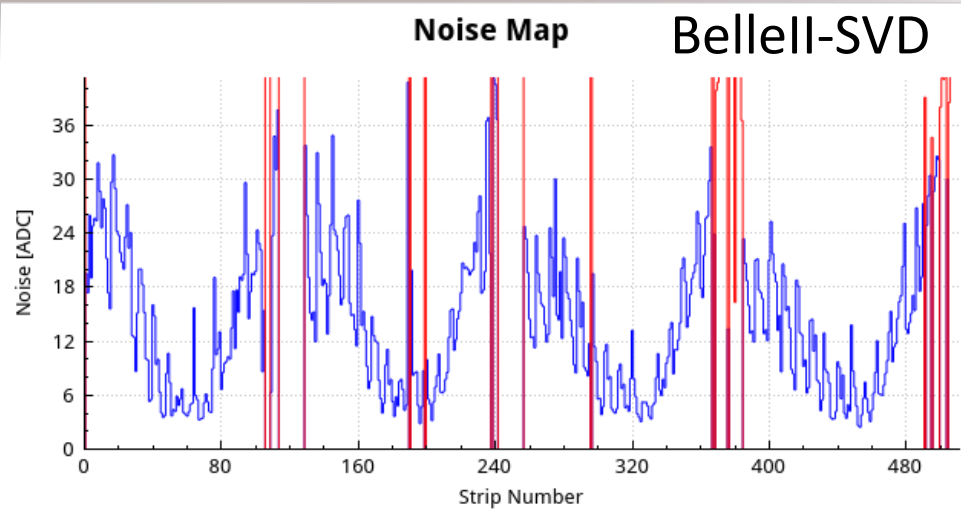
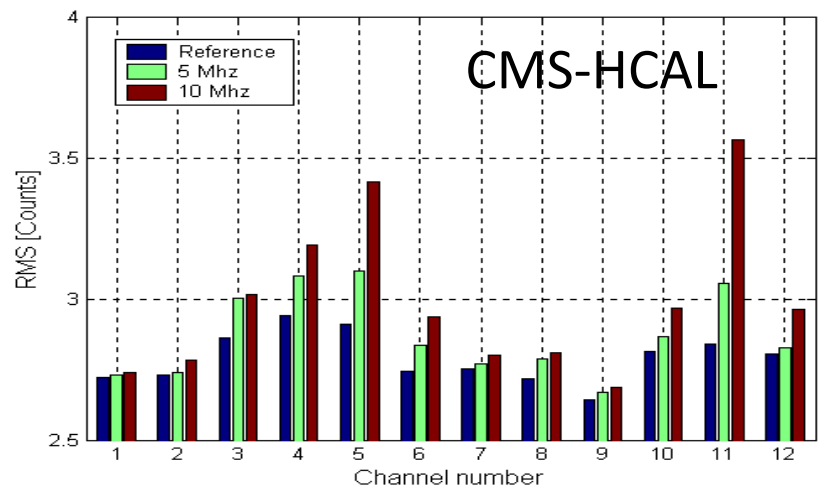
- 2 X Semi-anechoic chamber
- Faraday cage
- Equipment to perform transient tests
- Electrostatic discharge (ESD) up to 30 kV
- Current probes from 20 Hz up to 400 MHz.
- Antennas from DC up to 18 GHz.
- RF Generators up to 20 GHz & Amplifiers up to 6 GHz.
- Spectrum Analyzers and EMI Receivers from 20 Hz up to 28 GHz
- 2 channel oscilloscopes (2 Gs/s).
- Shielding effectiveness measurement system (20 MHz – 1 GHz).



- What 's the purpose of these tests ?
- What is the information that can be obtained once the data is processed?....
- These tests are very good for:
 - Grounding topologies evaluation
 - Diagnosis
 - FEE designs
 - Detection of sensitive areas
 - FEE frequency response to noise
 - Noise distributions – EM mapping
 - Conducted or radiated
 - Filter designs
 - Noise emission specification from PS

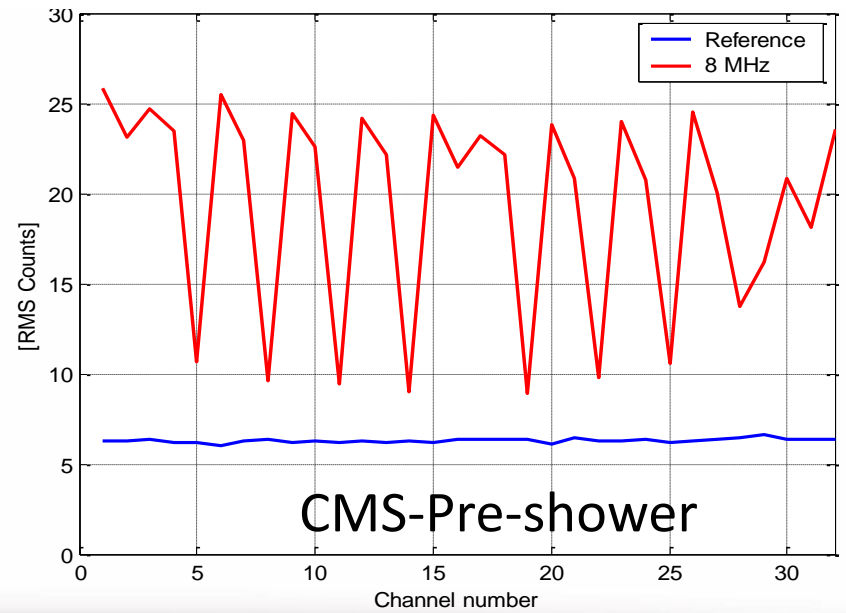


2.3 Scientific issues: Test goals



• Diagnosis & Sensitive areas

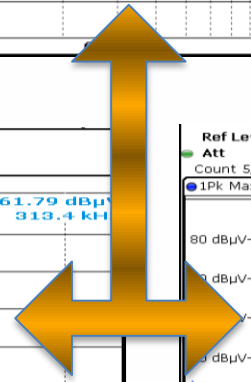
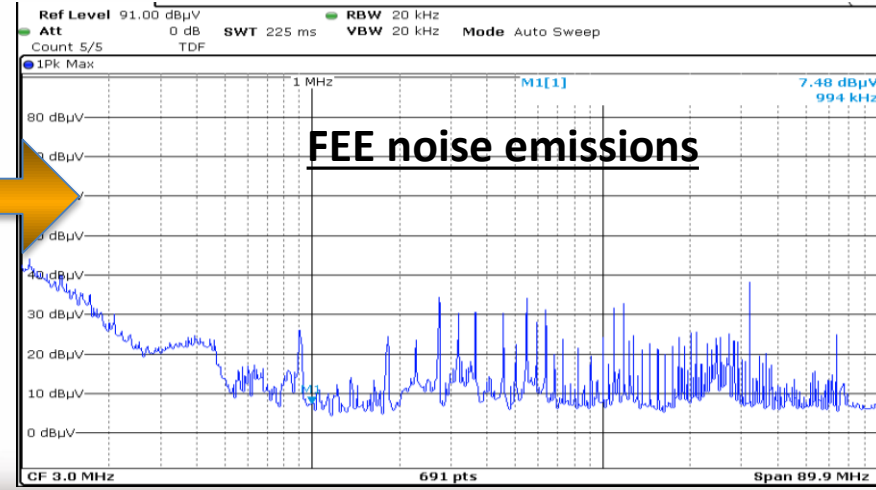
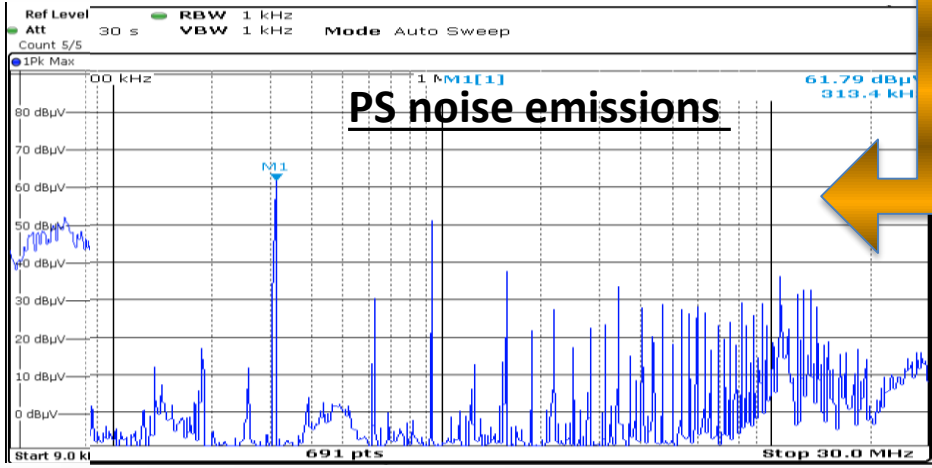
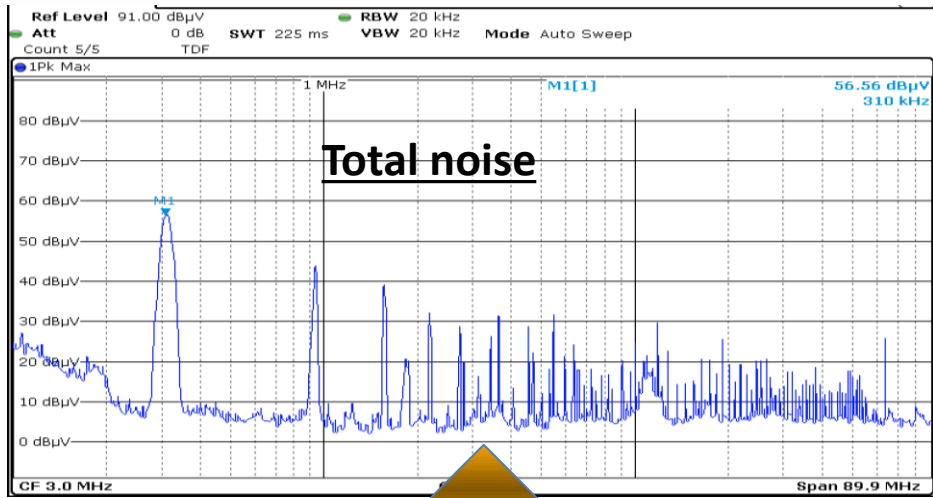
- CMS- HCAL – Ground connection photodiodes-Board
- CMS- Pre-shower - Ground connections between paths
- Belle II – SVD - APV25 signature



2.3 Scientific issues: Test goals

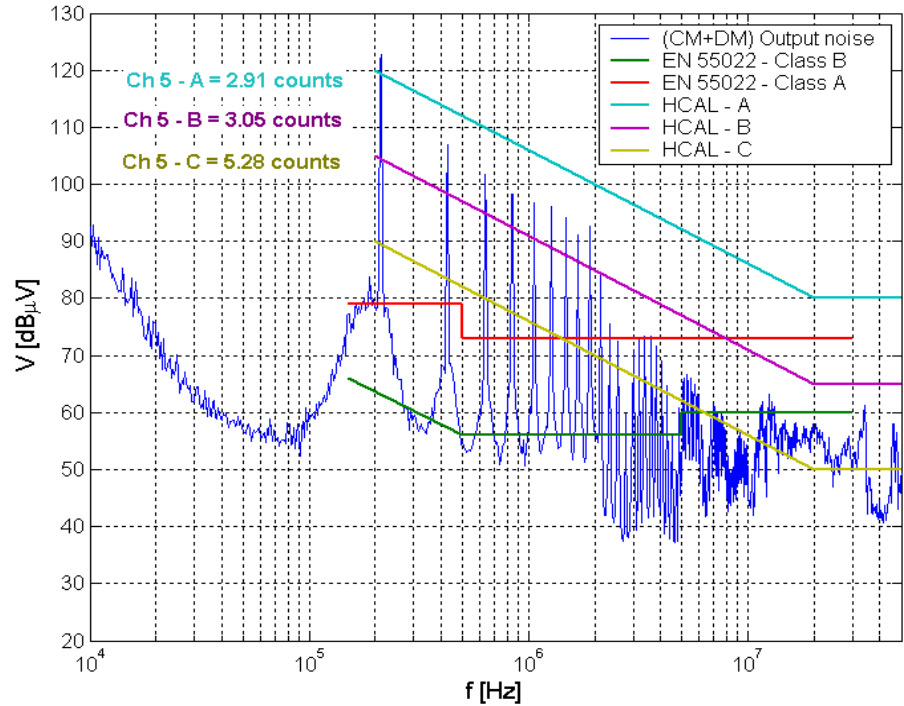
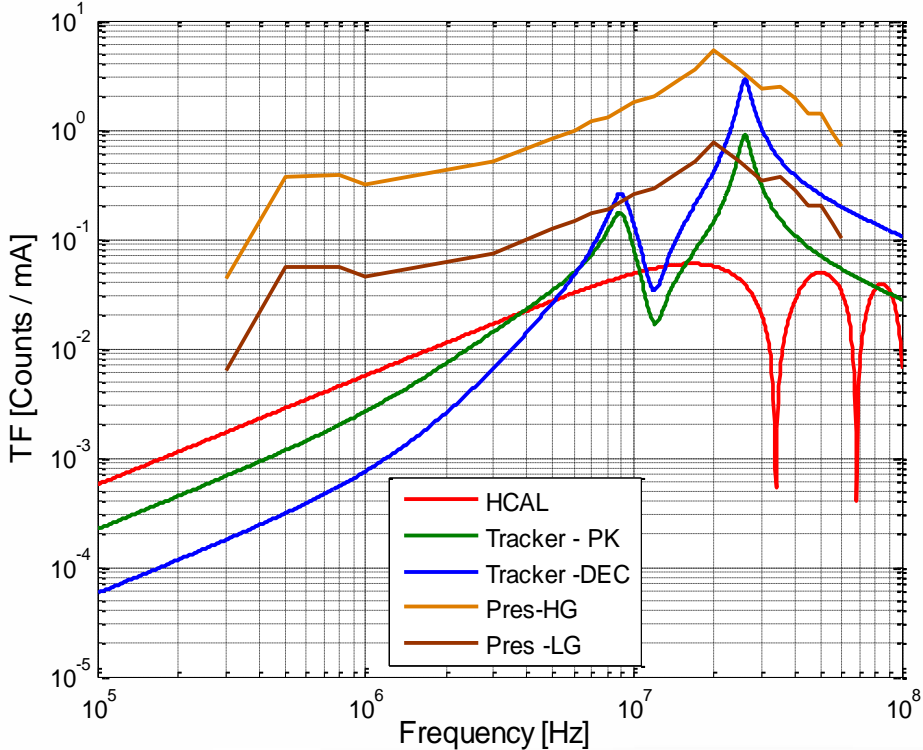
- Conducted noise mapping : Filtering designs

Belle II - SVD



2.3 Scientific issues: Test goals

- To quantify the sensitivity of the FEE to noise currents
 - Ensuring compatibilities among sub-systems
 - It helps to evaluate and quantify designs



3. Administrative issues

- ITA offers the possibility to perform any EMC test for a period of **5 weeks per year**.
- **Access duration:**
 - Standard access (components) : Less than 1 week
 - Extended access (large systems) 2 - 3 weeks.
- **Users are expected to request the access a few months** in advance and to have a technical discussion about its specific needs prior to the access (Follow the official TA procedure)
 - **On site review is very recommended - 1 day meeting !!!!**
- **Users are expected to be present at ITA** during the tests while ITA engineers will operate the testing equipment of the facility
 - It is possible to ask for a remote access – It is mainly focused on EMC directive tests or PS noise emissions tests.

- **After the test campaign ITAINNOVA will provide:**
 - A report with the test descriptions and test log
 - A ftp sever will be created to transfer the data
 - Spectrum profiles
 - Log files and pictures
 - The analysis of the data is excluded, nevertheless some help in order to analyze the data as well as support to design the test campaign will be provided.
- The cost of shipping equipment under test will NOT be covered.

3.1 Administrative issues:

Reimbursement policy

- Travel expenses for one person to get access to the facility will be covered by AIDA2020 for each project approved.
- Only economy class air travel and second class train travel will be reimbursed.
- Car travel will be reimbursed at 0.25 EUR/kilometer up to a maximum of 150 EUR per complete trip.
- Hotel will be booked and paid directly by ITAINNOVA. User name, passport number as well as arrival and departure dates should be provided in advance.
- A per diem allowance of 36 EUR/day for each working day will be paid.
- A ticket for lunches will be provided by ITAINNOVA for each working day.



3.1 Administrative issues:

Reimbursement policy

- Official taxes will be deducted from the reimbursement based on Spanish regulations
- All receipts and tickets in original form including boarding cards must be enclosed and returned with the claim.
- Claims must be made within two months after travel completion.
- The claim form must be filled in and returned to the ITAINNOVA secretary (rlpeco@itainnova.es)
- The time frame for reimbursement is a two-month period.



4. First EMC TA access

- HEPHY institute (from Vienna) has requested an access
 - Extended access - **Full EMC characterization of SVD prototype for Belle II (2 weeks)** – Visitors – It is completed
 - Standard access (3 days) – **Conducted noise emissions of DC-DC converters** – Remote access – End of June
- We spent one day in Vienna designing the test campaign
 - Very useful (a month in advance)
- The test campaign was very useful - It finished last Monday
 - 70 GB of data
 - More than 500 measurements
 - 10-12 working hours per day (for two weeks)
- This is the first time that a HEP detector has been characterized in a semi-anechoic chamber.

