Input to EP-ESE to RCS-IT technical committee from EP-ESE (Electronics systems for Experiments)

3 Sections:

- Front-end: Detector-specific electronics in the detectors
- Back-end: electronics modules such as FPGA-based processors, dedicated PCBs
- Micro-electronics: ASICs, specific to detectors and common developments

→ Large spectrum of different use cases and software:

EP-ESE IT needs

1. **Engineering tools & Software & programming languages**

Tools & software

- Altium,
- Ansys SiWave & HFSS,
- Ansys Lumical suite (FDTD, INTERCONNECT, MODE, Multiphysics),
- Autocad (mainly Inventor including the CAM module for driving the CNC machines),
- Cadence schematic entry & PCB routing,
- Cadence ASIC design tools,
- Cadence Sentaurus TCAD,
- Igor (close to Mathlab but low cost, used by Opto team to control instrumentation and perform data analysis - we purchase the licences regularly),
- Mathlab/Mathematica,
- ModelSim,
- Labview,
- Pentaho,
- Polar Instruments (PCB stack-up calculation),
- Quartus,
- Sigasi (VHDL/Verilog IDE) - extensive use,
- Synopsys OptoDesigner,
- Vivado

Programming languages

- Mostly use C, C++, Python, Igor, and Labview.

  Python is becoming increasingly popular (for instrument and testbench control, and for system tests)

2. **IT infrastructure for micro-electronics design (ASIC)**

- > 50 persons in EP-ESE-ME + experiment collaborators use micro-electronics design software and design storage facilities. The machines are physically located in IT but

maintained and managed by MIC-trained engineers with insufficient experience in computing cluster operation. **The aim is to increase maintenance and performance by using dedicated IT manpower.**
- Industry trend to support **cloud computing services** for ASIC tools and its applicability to EP-ESE-ME ASIC design activity **needs to be assessed**.

2. **Infrastructure for Code Synthesis and Continuous integration**

- Continuous Integration: **very interested** in ATS proposal for a **Continuous Integration (CI) central service provided by IT**
- Processing power: we regularly **need special powerful servers** to run our simulations or firmware synthesis jobs (we often need images higher than 100GB). Therefore, we **rely on the possibility of purchasing customized high-performance machines**. We took part in the Spec Committee launched by IT (Michal's team) 18 months ago for new server PCs for EDA applications.
- Disk Space: installing the latest Vivado/Vitis suite locally on a machine requires a minimum of 150 GB of Disk Space.
- This means that this cannot be used in "typical" CERN PCs! **What does IT advise for this type of application?**
- **File management system for synthesis of large jobs**: Given that AFS is being phased out, we need a working centrally supported alternative. Neither EOS nor cvmfs can fulfil that role because of their limitations and the bad performance for many (small) files. Something like a centrally maintained NFS service could work.
- At present all servers are physically in ESE and maintained by electronics engineers. **Assess the option to host and maintain these servers in IT** similar to ASIC servers.

3. **Operating system**

- Linux: we need a **clear guideline of what Linux distribution** and version will be supported by CERN and for how long. It is not practicable that this changes every few months as it was the case with CentOS8 and CentOS8-Stream.

4. **Data management**

- We use of **CERNbox as a "gateway" for the component tests being performed** out of CERN (for production): the industrial testing houses write the test results of the ASICs or Modules in CERNbox (in anonymous mode), and then we automatically insert them into CERN databases: we discovered recently that CERNbox team keeps **changing** the way they handle data being 'anonymously' uploaded there **without notifying the users** (they add some random letters to the file names for example). That regularly screws up the storage and the follow-up of production test results (such tests are currently happening continuously 24/7 for more than 200'000 chips - including during Xmas break)

5. **Web tools**

- we make large use of various web tools and databases (mostly for test results of electronics pool and Power instruments and equipment for of boards and ASICs). We routinely use all kinds of DBs, Okad/Openshift, Grafana, etc. These are all nice tools, but they require a high level of expertise in computing science, which we don't have. Unfortunately, the support provided by IT is often targeting computing scientists

with a sound background in this field. In ESE getting expertise in each of these tools (or simply keeping up with the updates for maintenance purposes) is a huge investment. **We would appreciate some closer/individual support from IT.**

6. **Microsoft Users Committee**

- A committee was created a bit more than 1 year ago as a link between EP and IT. People from ESE group were nominated to interact, but no progress was made.