

UK input to ECFA TF6 detector roadmap process

This document constitutes a first input from the UK to the discussion within TF6 of the ECFA detector roadmap panel. The input has been collated from discussions with colleagues involved in calorimetry within the UK.

The main projects with UK involvement with respect to the interests of TF6 are listed below separated into ongoing (there including LHC upgrades) and future/R&D:

ONGOING:

- UK and RAL responsible for design and construction of CMS ECAL endcaps, with significant involvement in Lead tungstate crystal R&D: performance characterisation and calibration
 - o Photodetector development (Vacuum Phototriodes with Research Institute Electron, St Petersburg), characterisation and testing
 - o Design, development and support of HV system for VPTs
 - o Leading institute in endcap detector mechanical design and construction
 - o UK-designed front-end electronics and readout boards crystal and photodetector expertise followed on from previous experience on OPAL ECAL
- Imperial College involvement on the CMS upgrade high granularity calorimeter, mainly through the serenity board.

FUTURE/R&D:

- RAL and Birmingham are involved in R&D for highly granular future calorimeters. A specific interest is in the development of a “digital” calorimeter based on monolithic CMOS sensors (MAPS). There is an ongoing collaboration with the FOCAL collaboration in Alice, and (connected to that) work towards DECAL. A recent talk on the subject can be found, for example, at <https://indico.cern.ch/event/995633/contributions/4274690/attachments/2210277/3740789/CMOS%20MAPS-based%20digital%20ECAL.pdf>
- Sussex is involved in ongoing R&D for a dual-readout calorimeter in the IDEA framework, with focus on characterisation of optical readout and software simulation.

With respect to the questionnaire questions (and focusing on the FUTURE/R&D projects):

- What is the capability of constructing and testing prototypes in your country? If limited, do you have access to networks that enable to integrate into prototype projects?

The UK has the technical capability to construct prototypes (for CMOS based ECAL), if funding were to be available. Sensors would be made (almost certainly) outside the UK in one of the

well-established foundries. We are integrated into the FoCAL work that allows us to contribute intellectually while the UK has no significant funding for these projects, and expect we could have access to beam tests through DESY/CERN and as part of the CALICE Collaboration.

For the dual-readout calorimeter, the contribution from the UK is at the moment more limited, and building a prototype in our institute is not in our plans. However, we are fully integrated with the ongoing AIDAInnova projects, and with the international dual-readout effort including INFN, Korean, Croatian, US institutes. The UK has contributed to the construction of existing and future EM-size prototypes. Beam access is also obtained through these collaborations.

- For the construction of large(r) devices: will/can construction be realised “in house” or is the tendency rather towards subcontracting?

CMOS based ECAL: For larger prototypes, once we start considering m^3 level, more likely this would still be done in house at a university or STFC because the digital ECAL is inherently a thin calorimeter, ~30-40cm deep and prototyping larger scale structures is mostly to explore integration and engineering issues, as was done for the CALICE Technical Prototype.

- Is work on instrumentation recognised for careers in your country?

Instrumentation as a career is not very easy in the UK. It typically does not help a physicist to get a faculty job at a university. The alternatives to a faculty role are a position in one of the national labs, and the so-called “core” posts. The latter are positions that are funded through rolling grants and have to be renewed every three years, therefore not 100% stable. It does not help instrumentation posts in the UK that at the moment there are not many schemes that they can apply to for funding, which makes their own post seem less valuable to a university. It is worth mentioning that training and careers for people working on instrumentation are being discussed as we speak as part of the STFC Particle Physics Technology Advisory Panel (PPTAP) <https://stfc.ukri.org/about-us/how-we-are-governed/advisory-boards/pptap/>.

Sent By Iacopo Vivarelli – 3/5/2021 – amended 6/5/2021