Contribution ID: **16** Type: **not specified**

Strategic R&D Programme on Technologies for Future Experiments

Instrumentation is a key ingredient for progress in experimental high energy physics. The Experimental Physics Department of CERN has defined a strategic R&D (Research and Development) programme on technologies for future experiments. Provided the required resources can be made available, it will start in 2020 and initially extend over five years. The selection of topics and the established work plans are the result of a transparent and open process, which lasted 14 months and involved several hundred of physicists and engineers at CERN and in the broader HEP community.

This R&D programme is in the tradition of previous similar initiatives, the DRDC projects in the 1990's and the White Paper R&D programme (2008-2011) that have been instrumental in providing the technologies which are presently in use at the LHC experiments or which will be deployed in the coming LHC upgrades (Phase-I and Phase-II). Examples of the achievements of the White Paper R&D programme are the validation of the CMOS 130 nm technology, the GEM single mask technique, radiation hard optical links, DC-DC converters and the CernVM file system.

The results of this new R&D programme will be building blocks, demonstrators and prototypes, which will form the technological basis for possible new experiments and experiment upgrades beyond the LHC Phase-II upgrades scheduled for the long shutdown LS3. These include in particular detectors at CLIC, FCC-hh and FCC-ee but also further upgrades of the LHC experiments. The main challenges come on the hadron collider side from the very high luminosity operation, leading to extreme pile-up, track density, radiation loads and data throughput, but also from the need for unprecedented precision in vertexing and tracking, combined with very low material budgets and highly granular calorimetry on the lepton collider side.

The new programme targets the primary challenges of the detectors complemented by equally demanding challenges in the domains of electronics, mechanics, cooling, magnets and software. A large part of the required R&D work will be carried out jointly with external groups from universities and research labs exploiting organically grown networks and relations, but also dynamic and efficient structures like the RD50 and RD51 collaborations. For many developments, close cooperation with industrial partners will be crucial.

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Track Classification: Instrumentation and computing