Background

Following current management's wishes, GRADE is structured like the Neutrino platform: GRADE is the platform (ie IdeaSquare), and it fosters (pre) R&D initiatives and related student activities (like Challenge Based Innovation). The purpose of GRADE is to bring in together institutes from different fields to work together on next-generation detection and imaging technologies. It serves as a prototype for ATTRACT. The concept and current projects were approved by the Research Board in its meeting on January 21, 2016. As part of IdeaSquare activities, GRADE projects are also annually presented to the IdeaSquare International Advisor Committee[1].

Current status of projects

1. **SIMPLE**. The main thrust of simple is currently around the Neutrino Platform activities and in testing and developing of SiPMs at IdeaSquare. It also is in close contact with University of Geneva (T. Montarulli) working on SiPMs, although this activity is not physically located at IdeaSquare. For administrative reasons, all student related activities (like CBI, eg. Aalto, Brunel, Tampere University, JWU) or new potential initiatives (like those being discussed with Turku) are initially in SIMPLE. If/when the specific activities grow to merit separate projects, they will then be treated separately. The latter is expected to happen with both Tampere TUT (Saku Makinen) and Turku (Jussi Westergren)[2]. SIMPLE is thus reaching its end, as originally launched.
2. **TT-PET**. After three years of R&D, the elements of the TT-PET project have been developed. A demonstrator chip, made by a matrix of 3x10 pixels containing full functionalities has been produced in the IHP SG13S SiGe HBT process. The results obtained with minimum-ionizing particles at the CERN SPS testbeam show an efficiency larger than 99.9% and a time resolution down to 110ps, which is by far the record for a monolithic chip. In addition, all technical details (readout system, thermo-mechanical solutions, construction procedures) have been developed. Team is now submitting a second funding request that should allow for the construction of the first TT-PET scanner over the next two years. Active work at IdeaSquare, focusing on TeraHz electronics. Lead by University of Geneva (Peppe Iacobucci).
3. **AUGMENT**. Since EDUSAFE is finished (Sept. 2016), the team is still actively interacting with EPFL, SeH (italian company from Alberto), and Mirion (previously Canberra). Mirion delivered to the project the EDUPIX, the gamma camera built from the EDUSAFE project in 2017. Tests and few demonstrations continue with this camera in labs with sources. The team is planning to do some in situ tests with the camera during LS2 if possible. EDUPIX is currently missing the robotisation and panoramic scan functions and also the virtual superposition of gamma and real images. New funding is expected to perform these improvements. Concerning the supervision system mounted on a helmet (audio and video function and operational dosimeter reading), it has been optimised and miniaturised further by SeH company. This was an in kind contribution from this company. There is one prototype here at CERN that could also think to test during LS2. No new development has been

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[1] The 2017 meeting agenda is here. The members of IAC are: Th. Lagrange (CERN, Chair), Julian Birkinshaw (LBS), M. Cavalli-Sforza (IFAE), K. Ekman (Aalto); F. Linde (NIKHEF) and R. Verganti (Milano) have stepped down and will be replaced by S. de Jong (NIKHEF) and J. Mnich (DESY; to be confirmed).

[2] For example, TUT is supporting the running of the CIJ and recently got funded to explore R&D possibilities or Augmented Man, robotics, Si-detectors, and computing. From Turku, we are currently waiting for a list of concrete project participation, including Augmented Man. Note: Arhus (C. Madsen) is helping in ATTRACT (ex-ESO).

performed on Augmented Reality since EDUSAFE ended. We are now waiting new funding to continue the developments. A submission has been made to ATTRACT. Building on EDUSAFE, a new collaboration is being created to continue work on Augmented Reality for maintenance and operation related activities at CERN. Effort coordinated by O. Beltramello.

4. **HEALTH**. The development (conducted by PhD student Johannes Leidner) of an integrated system for measurement of the 3D energy deposition in water by proton and C-ion beams has been completed. The system consist of a motorised water phantom with integrated GEMPix detector and reference PTW ion chamber, and all associated HW and SW. The system has been set-up and extensively tested at IdeaSquare before being moved to CNAO (Italy) for the measurements with clinical proton and carbon ion beams. The results are within 10% of the reference CNAO data (FLUKA simulations and Peakfinder measurements). On the other hand little progress has been made on a wider collaboration. Two institutes have signed the addendum to the MoU for the HEALTH program, CIRA (the Italian Aerospace Research Centre) and ISS (the Italian Istituto Superiore di Sanità), but no practical collaboration has been undertaken. Effort coordinated by M. Silari.

More details, as they appear in the "Grey Book", can be found [here](#).