

# Status of the GRADE Programme (Generic pre-R&D at IdeaSquare)

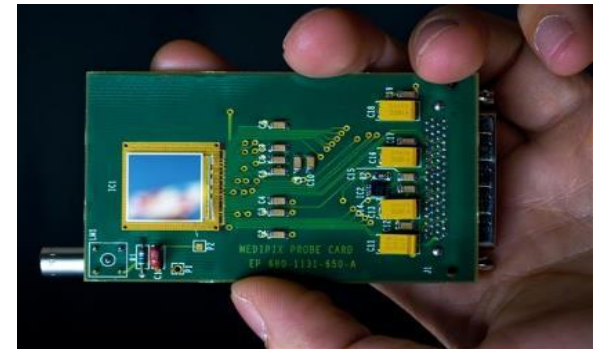
Markus Nordberg

ISAB-G, January 31, 2020

# GRADE MoU: Short Reminder

## Pre-R&D and training on detector and related technologies at IdeaSquare (B3179)

- Approved by the RB in Dec 2015 for early-stage R&D efforts on new promising detector concepts and technologies for possible use in future experiments (hi-lumi LHC, ILC, FCC...).
- Strong educational involvement to explore potential future use also outside HEP, e.g. in society, including industry and students.
- Participating institutes (also from outside HEP) contribute as in-kind. It requires institutes to spend time at IdeaSquare to design, build prototypes, test, integrate, prepare TDRs etc.).



# GRADE:

## Currently two approved projects

### SIMPLE (COMPLETED)

- To build up of an infrastructure to measure, test performance and validate prototypes of SiPMs and photosensors;
- Has achieved its original purpose and is finished. Geneva continues one thread with a related ATTRACT grant; evolved student program for a new, dedicated structure (CBI)
- Examples of related publications:
  - A. Nagai, C. Alispach, A. Barbano, V. Coco, D. della Volpe, M. Heller, T. Montaruli, S. Njoh, I. Troyano-Pujadas, Y. Renier. Characterisation of a large area silicon photomultiplier. <https://arxiv.org/pdf/1810.02275v3.pdf>
  - A. Nagaia, C. Alispach, T. Berghöfer, G. Bonanno, V. Cocoa, D. della Volpe, A. Haungs, M. Heller, K. Henjes-Kunst, R. Mirzoyan, T. Montaruli, G. Romeo, Y. Renier, H. C. Schultz-Coulon, W. Shen, D. Strom, H. Tajima, I. Troyano-Pujadas. SENSE: A comparison of photon detection efficiency and optical crosstalk of various SiPM devices. NIM Volume 912, 21 December 2018, Pages 182-185

### TT-PET

- To develop a demonstrator for a ToF PET Scanner with a chip of matrix of 3x10 pixels with efficiency larger than 99.9% and a time resolution down to 110ps;
- Involving testing and student presence at IdeaSquare;
- Main partners: Geneva, HUG, Bern
- Has received 1.9 MCHF from SNSF, funding period ended
- Has achieved the set goals and is currently seeking for additional funding. Geneva continues one thread with a received ATTRACT grant. Requested extension to EoY 2020.
- Examples of related publications:
  - G. Iacobucci, R. Cardarelli, S. Débieux, F.A. Di Bello, Y. Favre, D. Hayakawa, M. Kaynak, M. Nessi, L. Paolozzi, H. Rücker, DMS Sultan, and P. Valerio. A 50 ps resolution monolithic active pixel sensor without internal gain in SiGe BiCMOS technology. Prepared for submission to JINST

# GRADE:

## Currently four approved projects (cont'd)

### HEALTH

- To develop a radon dose monitor, and a GEMPix-based integrated system for measurement of the 3D energy deposition in water by proton and C-ion beams for medical applications;
- Involving two PhD students at IdeaSquare working on the two prototypes;
- Has received two related ATTRACT grants for further developing GEMPix
- Requested extension to EoY2020
- Main partners: CIRA, ISS
- Examples of related publications:
  - S. Romano, M. Caresana, A. Curioni and M. Silari, RaDoM2: an improved radon dosimeter, submitted for publication in JINST
  - J. Leidner, M. Ciocca, A. Mairani, F. Murtas and M. Silari, A GEMPix-based Integrated System for Measurements of the 3D Energy Distribution in a Water Phantom for Carbon Ion Beam Therapy, to be submitted for publication in Medical Physics

### AUGMENT (TERMINATED)

- To develop a demonstrator of an AR/VR tools for planned and emergency maintenance in extreme environments;
- Despite all efforts, project has not secured further funding and is to terminate in 2019.

# GRADE:

## Summary of Resources 2016 – 2019

- As stated in the MoU, contributions from institutes are in-kind (hardware, personnel);
- Support from CERN through existing activities through IdeaSquare (i.e. facilities, admin. support);
- Only *total* resources allocated through IdeaSquare are reported here (e.g. grants for external activities are not included)

	Estimated
	in-kind (FTE)
<b>SIMPLE</b>	8
<b>TT-PET</b>	3
<b>HEALTH</b>	1
<b>AUGMENT</b>	0
<b>Total</b>	<b>12</b>

Note: CBI interactions not included

	Contributions	Payments	Balance
		(subs.)	12.09.19
<b>SIMPLE</b>	<b>289.2</b>	<b>100.0</b>	<b>189.2</b>

Accounts: T290401, T290402, T290403

Note: other GRADE projects do not have team accounts

# GRADE:

## What have we learned so far? (2016 – 2019)

### On the Positive side:

- An admin-light way to start to build a collaboration (mainly in-kind contributions)
- Introducing new non-HEP institutions to the HEP world – and vice versa
- Good interactions at IdeaSquare between researchers and CBI students

### On the Negative Side:

- It takes time & effort to create “critical mass” to start building prototypes...
- ... but only a few months to kill the progress (e.g. lack of funding at home, admin complications etc.)
- There is only a limited amount of support IdeaSquare can offer (mainly space). Hard to gain from “CERN leverage” due to small size of projects
- ATTRACT has been crucial but could not help all the projects (SIMPLE, AUGMENT, MRI-ISOLDE)

# ATTRACT:

## Selected Projects involving CERN

Proposal Number	Title	Name	Coordinator Surname
700	O-possum II (Positronium surface scanning microscopy)	Michael	Doser
451	Integrated Signal Processing for a New Generation of A	David Gascon	Gascon
	Smart Wall Pipes and ducts	Sebastien Lani	Lani
	GEMTEQ	Marco	Silari
	SMART (Supersensitive Multipurpose Advanced Radiat	Francesco	Pietropaolo
952	Hybrid High-precision In-vivo Imaging in Particle Thera	Piergiorgio	Cerello
493	HIOS: Heterogenous I/O for Scale	Viktor	Khristenko
197	SiPhoSpace - Radiation-tolerant high-speed optical da	Jan	Troska
843	Radiation Dosimetry with Fiber Optic Sensors	Francesco	Fienga
251	Low Temperature Communication Link - LTCL	Daniel	Calcoen
	LaGEMPix	Marco	Silari
1103	Development and Application of Versatile Highly UV F	Stephan	Malbrunot
150	FASTPIX	Walter	Snoeys
720	Development of radiation-hard and cost â€œeffective i	Hans	Zaunick
259	Detection of DC beams using electro-optical crystal an	Michal	Krupa
101	Quantum Optimization of Worldwide LHC Computing C	Anita	Bens
151	The Curious Cryogenic Fish (CCF)	Giovanna	Lehmann Miotto
586	Nano-photonics applied to ultrafast single photon qua	Matteo	Salomoni
855	Ultra High-level Radiation Monitoring with Thin Metal	Federico	Ravotti

# GRADE:

## New Addendum: CBI Student Project

- Challenge Based Innovation (CBI) has evolved from SIMPLE and other projects at IdeaSquare;
- To provide a platform for students to prototype and test detection and imaging-related challenges with societal implications, benefiting from on on-going R&D projects;
- The students stay at IdeaSquare and make active use of the laboratory facilities there and interact with the researchers on the CERN site and elsewhere;
- Increasing CERN visibility in the education-mission pillar;
- A test platform for student involvement in 2<sup>nd</sup> phase of ATTRACT (2021);
- The funding comes from the participating universities. IdeaSquare provides the space and administrative support.





# GRADE:

## Institutes planning to join new CBI Project (Annex 2)

- Aalto University
- Brunel University
- ESADE
- University of Reggio Emilia
- Porto Polytechnic
- IED Barcelona
- UPC Barcelona
- INFN Bologna
- Mannheim TU
- University of Ferrara
- University of Geneva
- University of Lausanne
- Tampere University (TAU)
- Swinburne DF



# Thank you for your attention

Website: <http://cern.ch/ideasquare/>

