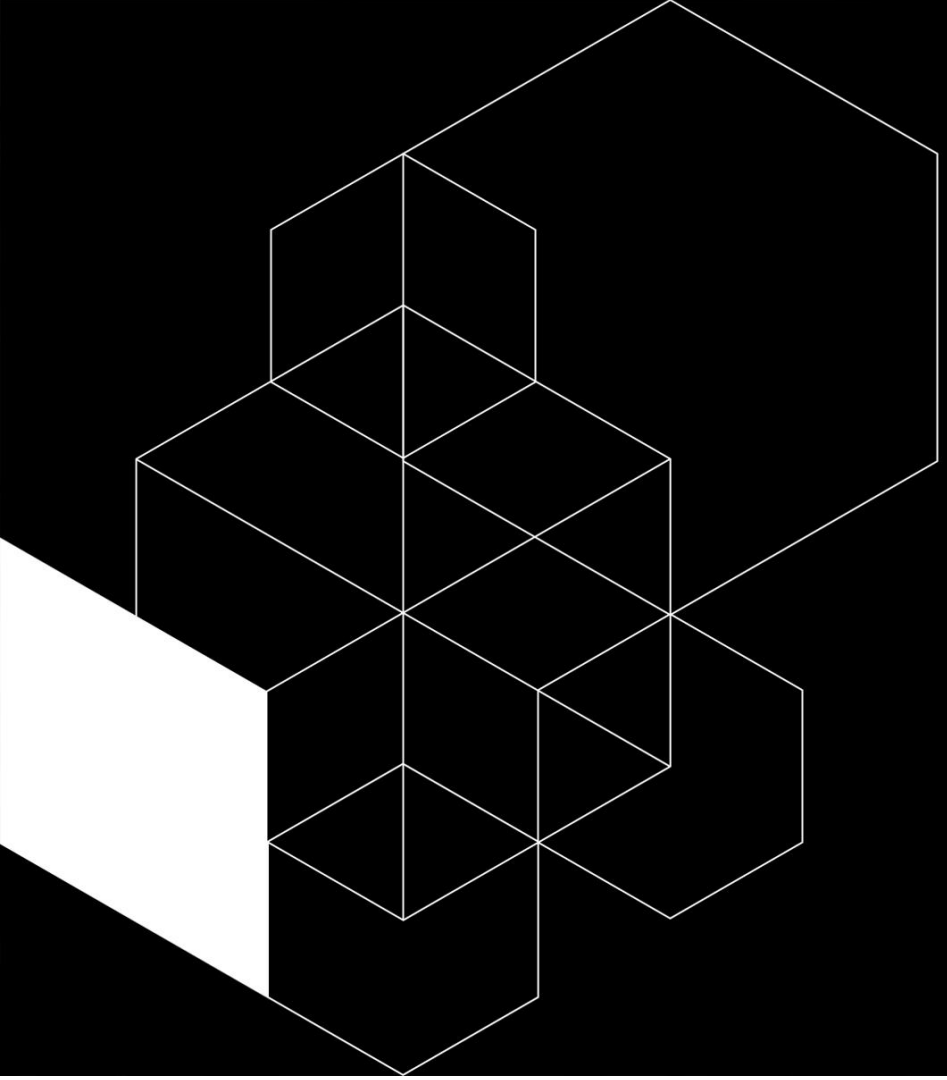

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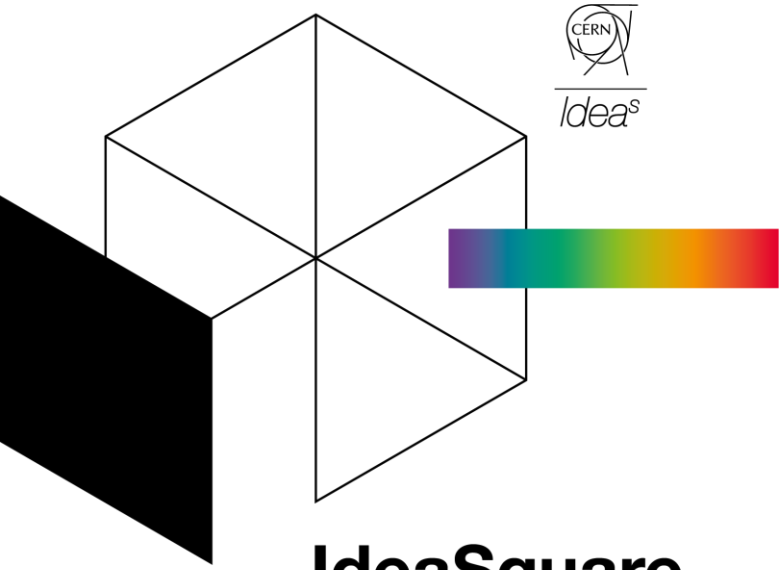


IdeaSquare
The innovation space at CERN

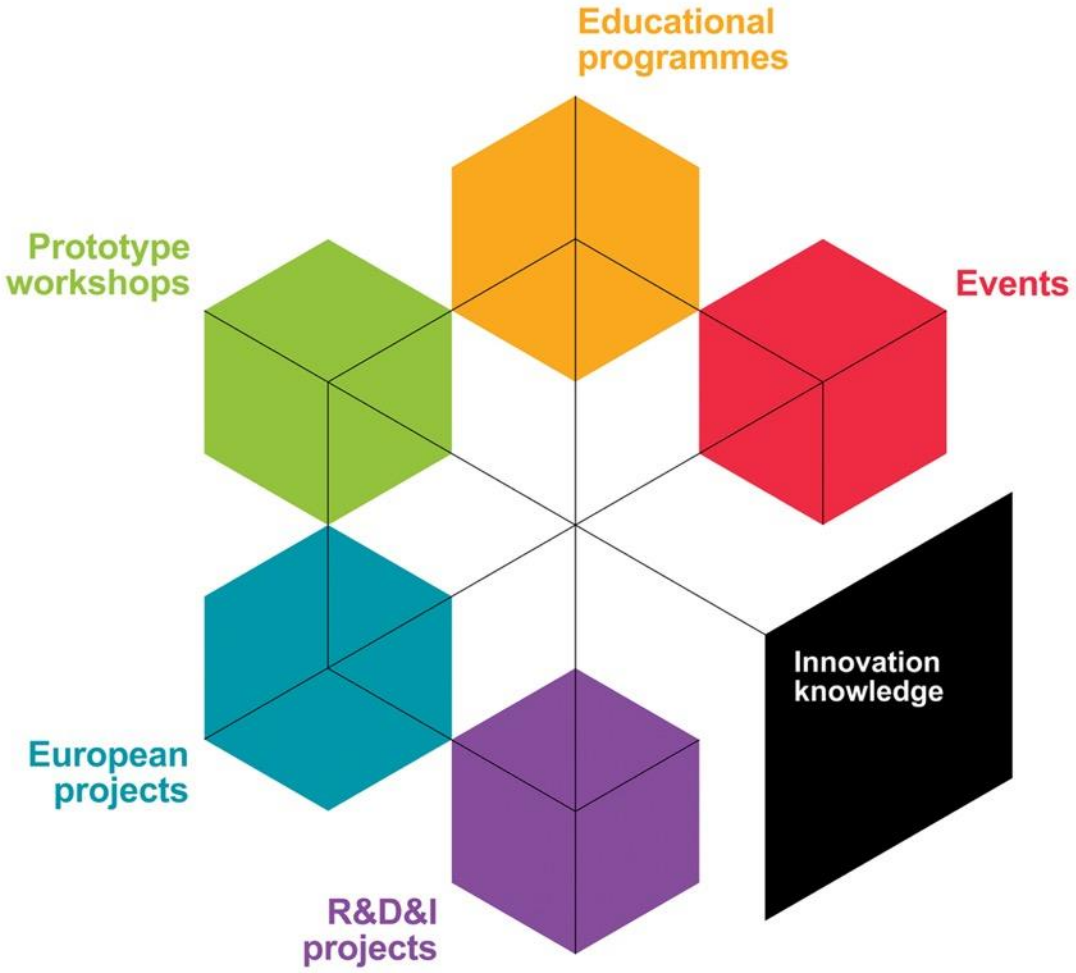
GRADE Programme (Generic pre-R&D at IdeaSquare)

Markus Nordberg (CERN)
IdeaSquare Open Doors
February 14-15, 2023

IdeaSquare

The Innovation Space at CERN

IdeaSquare is the innovation space at CERN, that uses collaborative methodologies, access to CERN expertise and cross-connectivity to ideate solutions for the future of humankind. A place where people have the licence to dream.



Stimulating instrumentation in research

GRADE MoU: Short Intro

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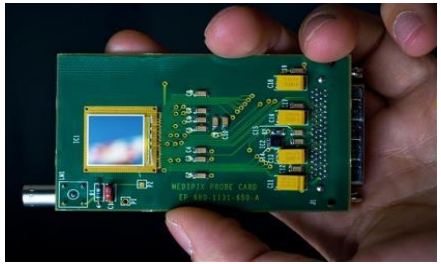
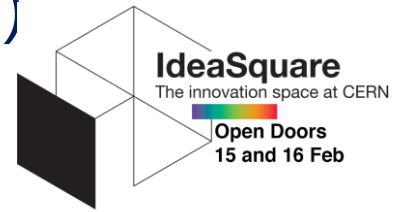
- Approved by the CERN Research Board in December 2015 for (very) early-stage R&D efforts on new promising detector concepts and technologies for possible use in future experiments (hi-lumi LHC, ILC, FCC...).
- Includes strong educational involvement to explore potential future use also outside HEP, e.g. in society, including industry and cross-disciplinary 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, EU-grants like ATTRACT etc.).
- Recognized status in Gray Book.



GRADE: Developments in 2022 (informal)



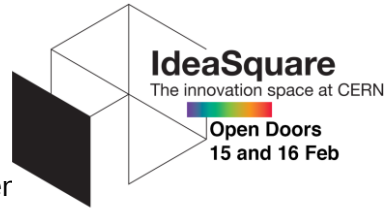
Collaborations:

- Neutrino platform (Dune) for the development of a smart and fast readout system for large tracking systems
- Members are part of the ATLAS collaboration and lead the LHC Phase-2 upgrade project of the muon barrel trigger.

Recent activities:

- Development of a new generations of detectors and related electronics for the LHC-phase 2 upgrade, the dark matter particle searches and for the next generation colliders
- Detector prototype design and test
- Chip design and bench-test
- Development of a new type of low power neuromorphic analog electronics, capable to support ns-level inference and correlation on large and sparse data sets, for a new approach to green computing.

EXAMPLES OF PAST GRADEs:



TT-PET

To develop a demonstrator for a ToF PET Scanner with a chip of matrix of 3x10 pixels with efficier 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. 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

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;

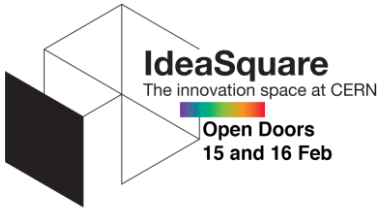
- Involving two PhD students at IdeaSquare working on the two prototypes;
- Has received two related ATTRACT grants for further developing GEMPix
- Requested extension to EoY2020
- Main partners: CIRA, ISS
- Examples of related publications:
- S. Romano, M. Caresana, A. Curioni and M. Silari, RaDoM2: 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

FROM GRADE TO ATTRACT (P1):

Selected Projects involving CERN

Proposal Number	Title	Name	Surname
700	O-possum II (Positronium surface scanning microscopy	Michael	Doser
451	Integrated Signal Processing for a New Generation of A	David Gascon	Gascon
[redacted]	Smart Wall Pipes and ducts	Sebastien Lani	Lani
[redacted]	GEMTEQ	Marco	Silari
[redacted]	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 dat	Jan	Troska
843	Radiation Dosimetry with Fiber Optic Sensors	Francesco	Fienga
251	Low Temperature Communication Link - LTCL	Daniel	Calcoen
[redacted]	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€“effective 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: Examples of new eligible projects



- Recycable materials for calorimeters (scintillators)?
- Use of TIP avalanche diodes (red wavelength) in physics??
- “Green Village” initiatives that could potentially evolve into future EU-funded projects (see P. Tello’s presentation)
- Next round of ATTRACT projects (e.g. environmental, wearable Detection & Imaging techs)?

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Thank You