Quick update on status of CERN QTI

started in 2021, now about 1.5 years into 3 year program

covers four strands:

Computing & Algorithms	Simulation & Theory	Sensing, Metrology & Materials	Communications & Networks
• Assess the **areas of potential quantum advantage** in HEP applications (QML, classification, anomaly detection, tracking) • Develop **common libraries of algorithms, methods, tools**; benchmark as technology evolves • Collaborate to the development of shared, **hybrid classic-quantum infrastructures**	• Identify and develop techniques for **quantum simulation** in collider physics, QCD, cosmology within and beyond the SM • Co-develop quantum computing and sensing approaches by providing **theoretical foundations** to the identifications of the areas of interest	• Develop and promote **expertise in quantum sensing** in low- and high-energy physics applications • Develop quantum sensing approaches with emphasis on **low-energy particle physics measurements** • Assess **novel technologies and materials** for HEP applications	• **Co-develop CERN technologies relevant to quantum infrastructures** (time synch, frequency distribution, lasers) • Contribute to the **deployment and validation of quantum infrastructures** • Assess requirements and **impact of quantum communication on computing applications** (security, privacy)

currently: 2.5 PhD's
+ 0.5 new in 2023

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Progress update of CERN QTI:

Nov. 1-4: QT4HEP conference: https://indico.cern.ch/event/1190278/

Theory, <u>sensors</u> : Nov. 1

topics chosen to overlap with
<u>CERN focus and expertise</u>

Caterina Braggio
Applications of superconducting technologies to particle detection

DM searches via RF, superconducting electronics, coatings, cavities

Oliver Buchmuller
Scaling up of atomic interferometers for the detection of dark matter

AION, MAGIS, ... DM searches via atom interferometers in vertical shafts

Piet Schmidt
Applying traps and clocks to the search for new physics

AD, ISOLDE: symmetry & BMS tests via precision spectroscopy

Ian Shipsey
Applications of quantum devices to HEP detectors

Quantum systems for HEP
(novel or enhanced detectors) *

Steven Hoekstra
Molecular systems for tests of fundamental physics

AD, ISOLDE: symmetry & BMS tests via precision spectroscopy

Gianluca Cavoto
Development of detectors for ultra-low energy neutrinos

neutrino physics at the low energy frontier (CNB)

* involvement of QTI-funded doctoral students:
quantum dots for scintillators, graphene for GEM's, DAQ from AMO

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Next steps:

① QTI: complete present (detector) R&D projects by end 2023/mid-2024

② in 2023: propose a fine-tuned <u>follow-on</u> to the first initiative with focus on a number of WP-like projects, with specific development goals in mind that leverage CERN expertise / infrastructure   <u>close interaction between TH & EXP</u>

③ in 2023: the <u>implementation of the ECFA detector R&D roadmap</u> will also take place; DRD5 to be a collaboration for Quantum Sensing related detector R&D with a handful of WP-like projects

platform convenors identified

<u>LOI</u> based on 3-4 initial projects subm. to DRDC

<u>formal</u> constitution of DRD5 / "RDq" collaboration

proposal based on 3-4 initial projects subm. to DRDC

<u>1.2023 ff</u>   <u>3.2023</u>   <u>7.2023</u>   <u>9.2023</u>

<u>interested parties</u> identified / approached by platform convenors

<u>projects</u> proposed by interested parties (initial main focus on HEP)

<u>workshop</u> to brainstorm / discuss the proposed projects and select the initially most promising ones

<u>preparation</u> of LOI

<u>conference</u> to discuss & fine-tune the proposed projects and to explore further ideas

"town-hall meeting"

<u>preparation</u> of proposal containing the "DRDC" projects, (as well as indicating additional "non-DRDC" projects)

call for wide participation in RDqi

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