EFMO European Funding Monitor

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CNECT.C2

ICT Meeting 14/02/2025

Why funding data?

Briefings

Requests from journalists

Parliamentary Questions

Presentations

Speeches

Reports

Strategy

Public Outreach

KPIs

Interservice consultations

How much has the European Commission invested in HPC in Finland during the last 24 months?

Which quantum computing platform has received the most/least amount of public funding?

Which countries collaborate most in AI-driven robotics?

European Commission

Data fragmentation

Need to collect and combine data from different sources within the Commission

Bad topic filtering

Keyword-based filtering insufficient for capturing complex topics

Challenges

Steep learning curve

No easy way to make custom plots and retrieve accurate answers from existing tools

Lack of automation

Need to manually repeat data collection and processing steps for an updated answer

European Commission

McKinsey Quantum Technology Monitor 2024

Data fragmentation

Need to collect and combine data from different sources within the Commission

→ Provide all data in one place

Bad topic filtering

Keyword-based filtering insufficient for capturing complex topics

→ Use **LLMs** for filtering and categorizing

Solutions by EFMO

Steep learning curve

No easy way to make custom plots and retrieve accurate answers from existing tools

→ Provide easy-to-use dashboard platform

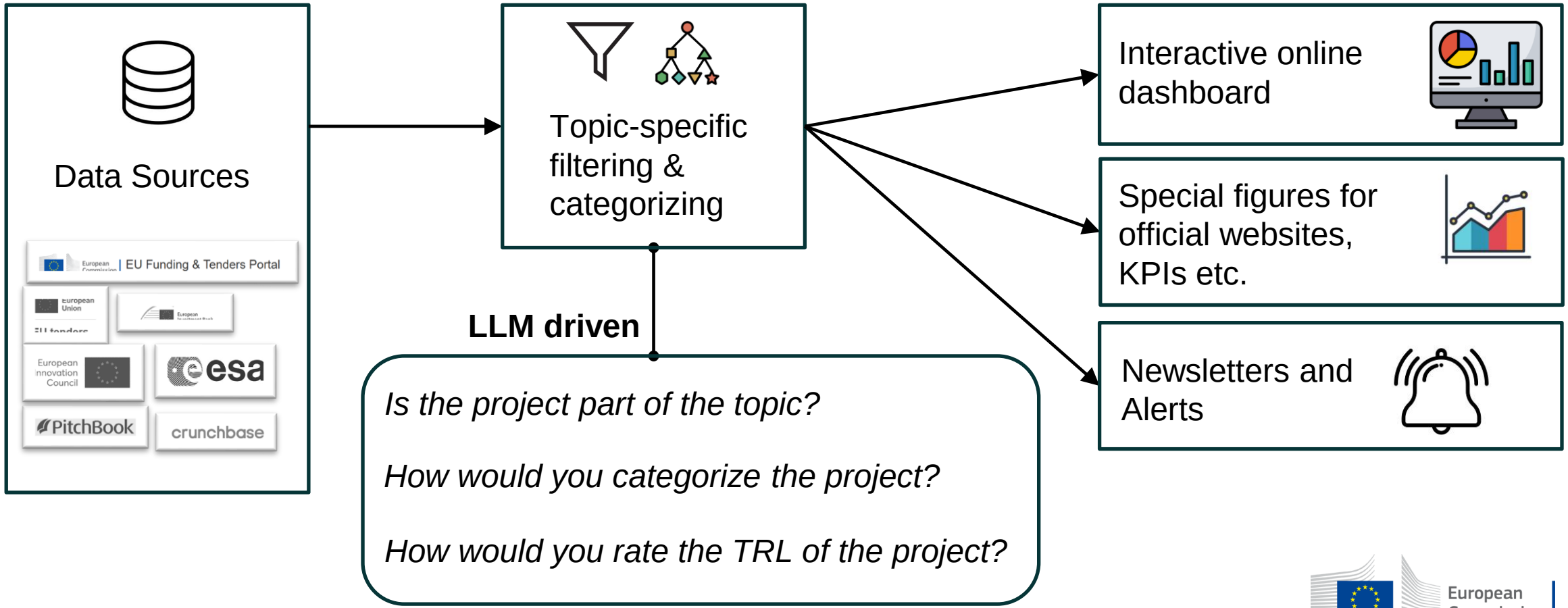
Lack of automation

Need to manually repeat data collection and processing steps for an updated answer

→ Make data workflow fully automatic

Introducing EFMO

Accurate, complete, and automatic tracking tool for funding activities, simplifying reporting and analysis across complex topics and fields.



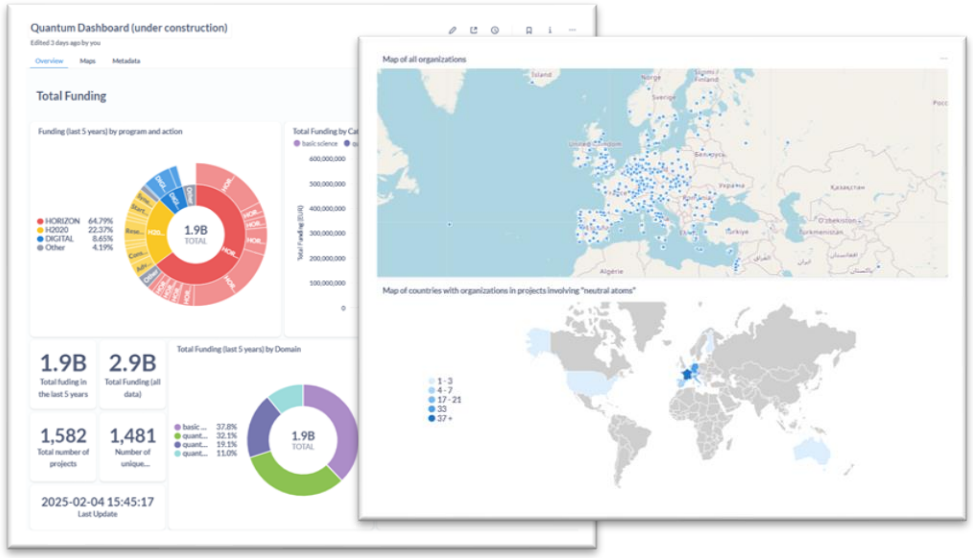
Online Dashboard – Try it Out!

Available on all corporate laptops within the Commission
Server up Mo – Fr, 7:30 – 22:30

http://quantum-monitor.cnect-srv4dev.s4dad.aws.cloud.tech.ec.europa.eu:3000/

Username: efmo@ec.europa.eu

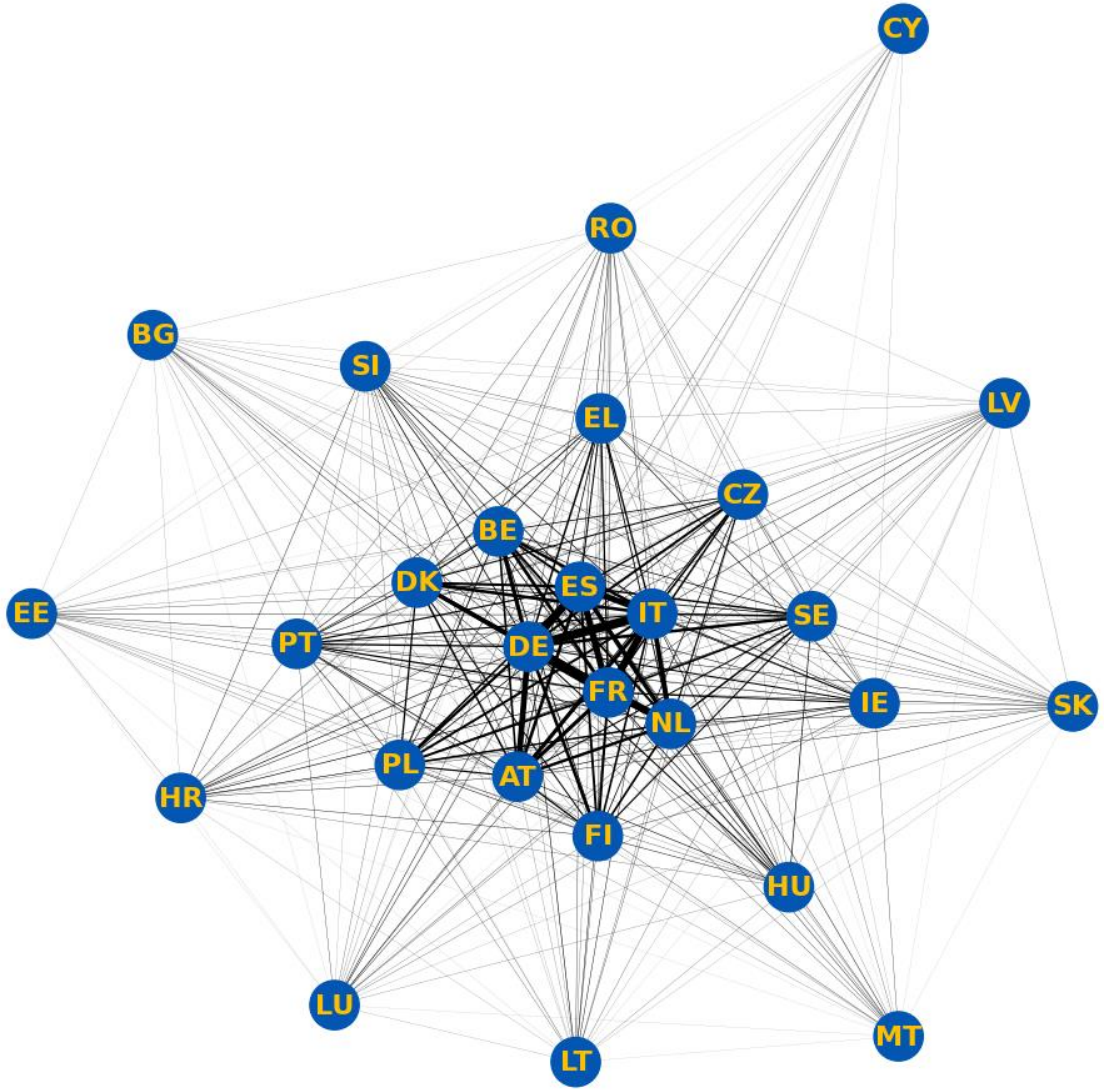
Password: BH1wQzylK6VZxl



Advanced analysis

Collaboration of EU countries in quantum technologies

*(*edge width indicates funding volume of common projects)



Summary

AI-powered data analysis for advanced insights and more accurate results
→Add more topics relevant to CNECT and beyond

Complete EC funding data
→ Add additional data sources like EIB funding, private funding, scientific publications, patents etc.

Simple-to-use dashboard available inside EC
→ Make dashboard publicly accessible via DG DIGIT

Fully automatic workflow delivering data to Quantum Flagship, JRC, CNECT
→ Expand use cases, gain users

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European Commission

Outlook

Prototype

EFMO as it is

+

Fully available inside the EC

Advanced prototype

Upgraded EFMO with more data sources and more topics

+

Fully available inside the EC

Professional tool for the EC

Upgraded EFMO with more data sources and more topics *(run by DIGIT)*

+

Fully available inside the EC

+

Certain dashboards available publicy

Professional tool for the public

Upgraded EFMO with more data sources and more topics *(run by DIGIT)*

+

Fully available inside the EC

+

Certain dashboards available publicly

+

Anyone can create their own dashboards

End of presentation

Supplementary Slides

Quantum technology dashboard

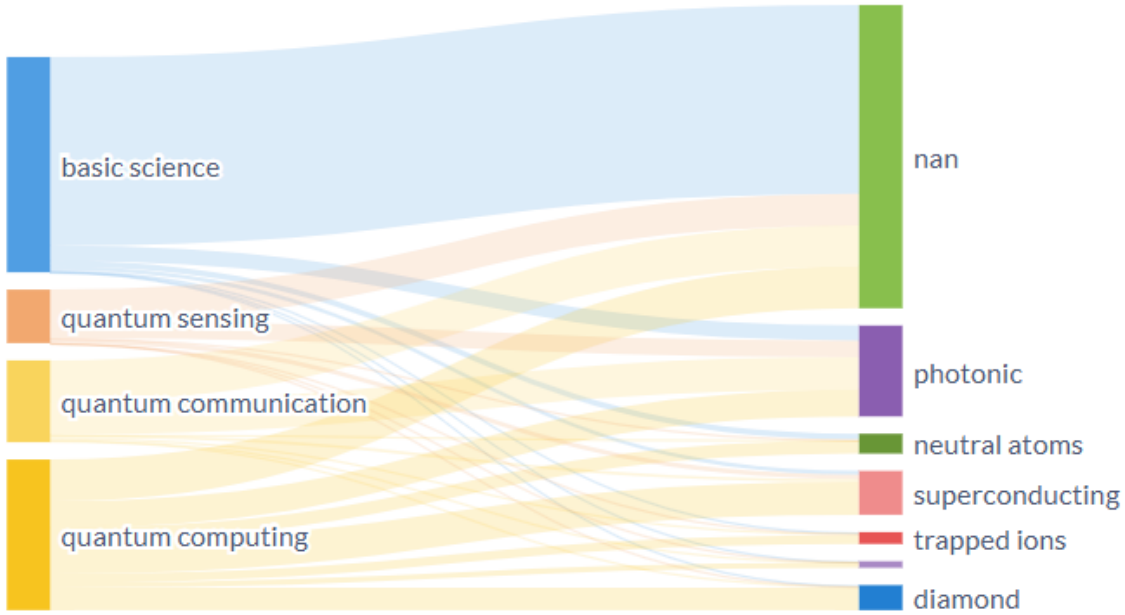
LLM is instructed to

- only include projects related to the second quantum revolution
- categorize them by pillar and platform

1.9B
Total fuding in the last 5 years

2.9B
Total Funding (all data)

1,582
Total number of projects



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Quantum technology dashboard

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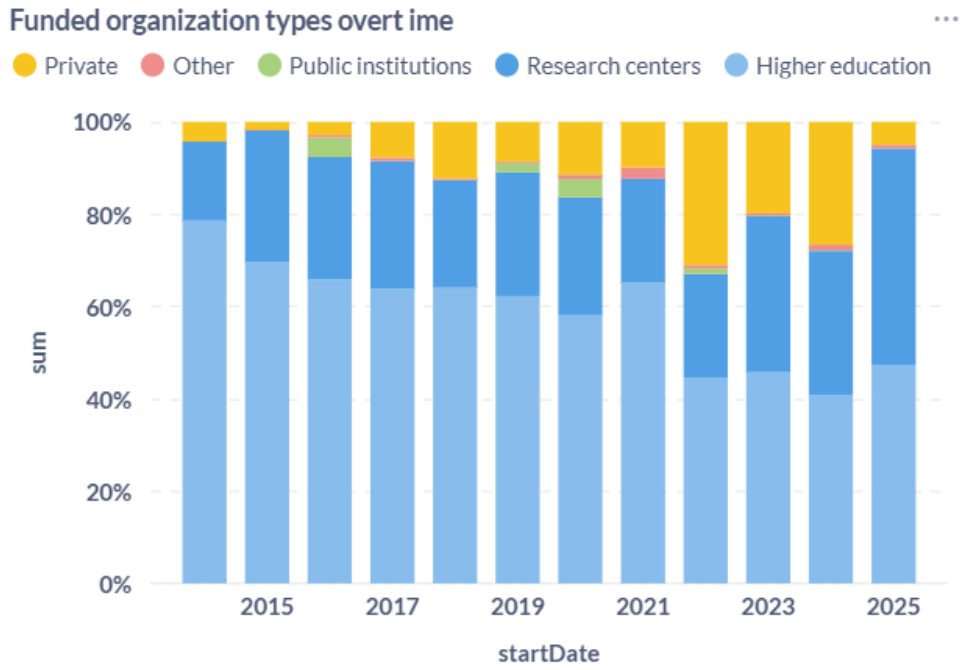

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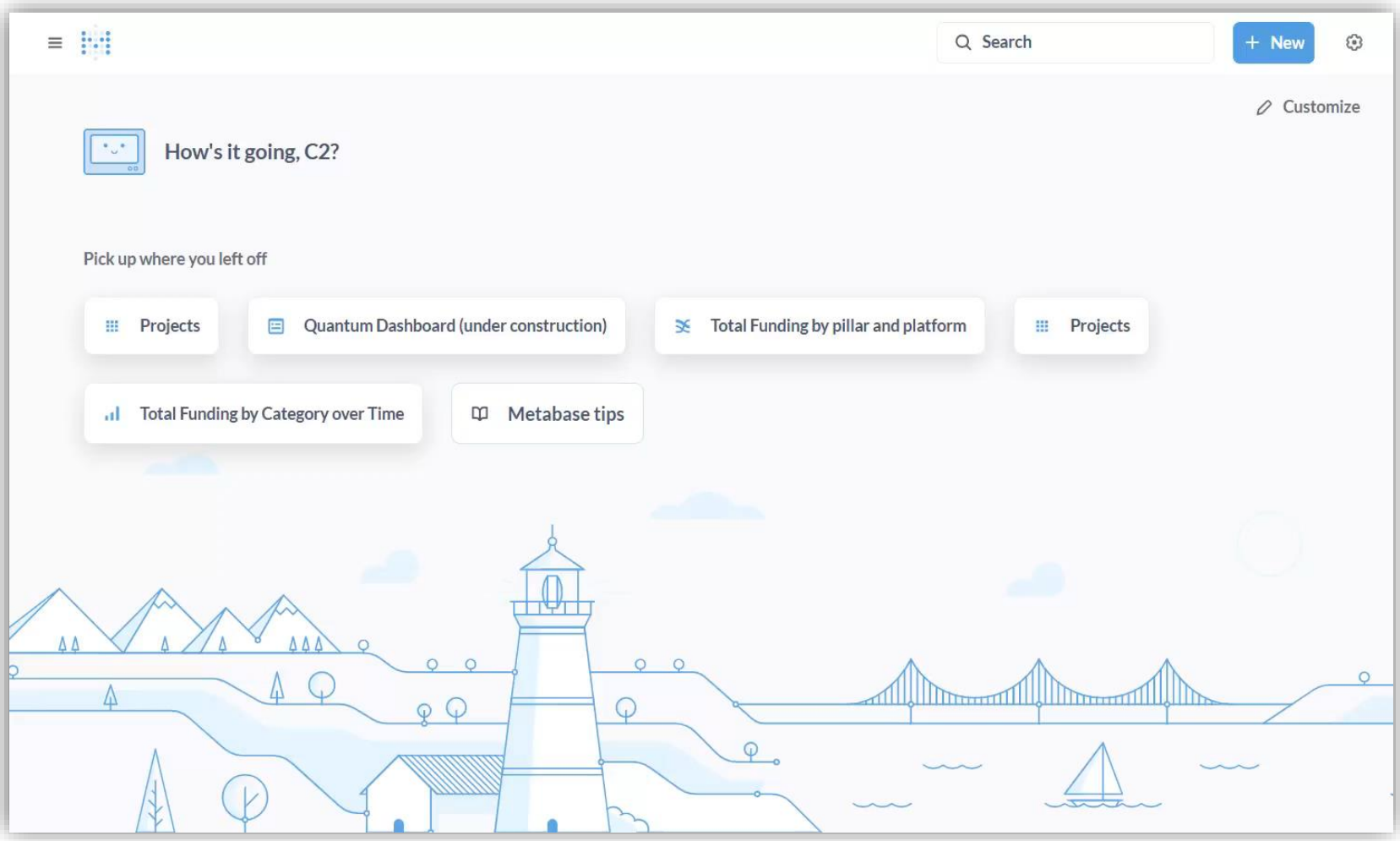
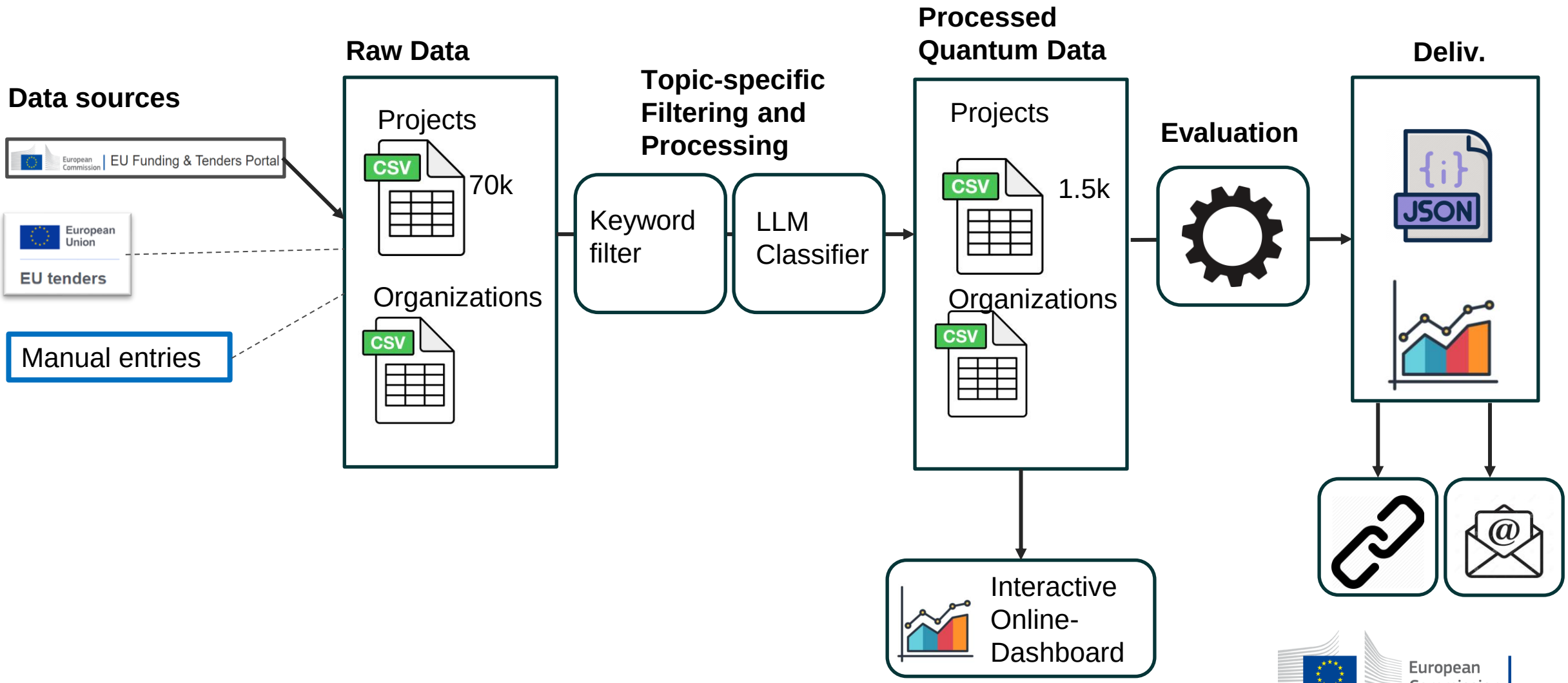
Dashboard usage



Fully-automized funding monitor



LLM-based Classifier

For each project….

Model in use: *Meta-Llama-3.1-8B-Instruct*

Prompt:

```
The following description belongs to an EU-funded quantum project. Classify the project by assigning it
to one of the following categories:
            - "quantum computing": A quantum computer is a computer that exploits quantum mechanical
phenomena, by manipulating quantum bits (qubits) and quantum gates, including firmware, error-
correction,readout, diagnostics and characterisation systems
            - "quantum sensing":
                                    (…)

Select exactly one category. Only respond with the category name without quotation marks, nothing else!

„PiQASO aspires to provide fully optimized and operational implementations as-a-service for an ensemble of crypto algorithms and protocols, including key encapsulation,
 digital signatures, (authenticated) key exchange, authorization, identity management, long-term data security, multi-party secure computation, providing a fully funct
ional equivalent of Public Key Infrastructure (PKI) which is robust against future algorithmic and quantum computing advances but also practical enough to be integrate
d in CTS and infrastructures without the need of any additional specialist hardware to be installed on the client side, thus, enabling quantum-safe application-layer e
ncryption/decryption services that can be consumed by any legacy system. The envisioned solution includes the development of programmable optimizations and accelerator
s capable of enhancing the execution of a multitude of crypto families, in a cost-effective manner, with the additional benefit of designing for crypto agility; the ab
ility to reconfigure an application or system with a different PQ crypto algorithm or implementation depending on requirements and resource availability. PiQASO crypto
 agility is supported through the provision of operational (specification) implementations of NIST final candidates enabling quantum-safe application-layer encryption/
decryption services that can be consumed by any legacy system. This aims to enable users and systems to make coordinated transitions in a policy- and compliance govern
ed manner. Furthermore, PiQASO's PQC Ensemble is offered through a set of design modalities with certifiable security. Moreover, PiQASO features an extensive and ambit
ious demonstration plan involving 14 end-users from diverse industrial sectors, such as automotive, automation, finance, energy, healthcare, aerospace, online media, u
nmanned aerial vehicles and transportation."
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Response: quantum communication → *new dimension in data*

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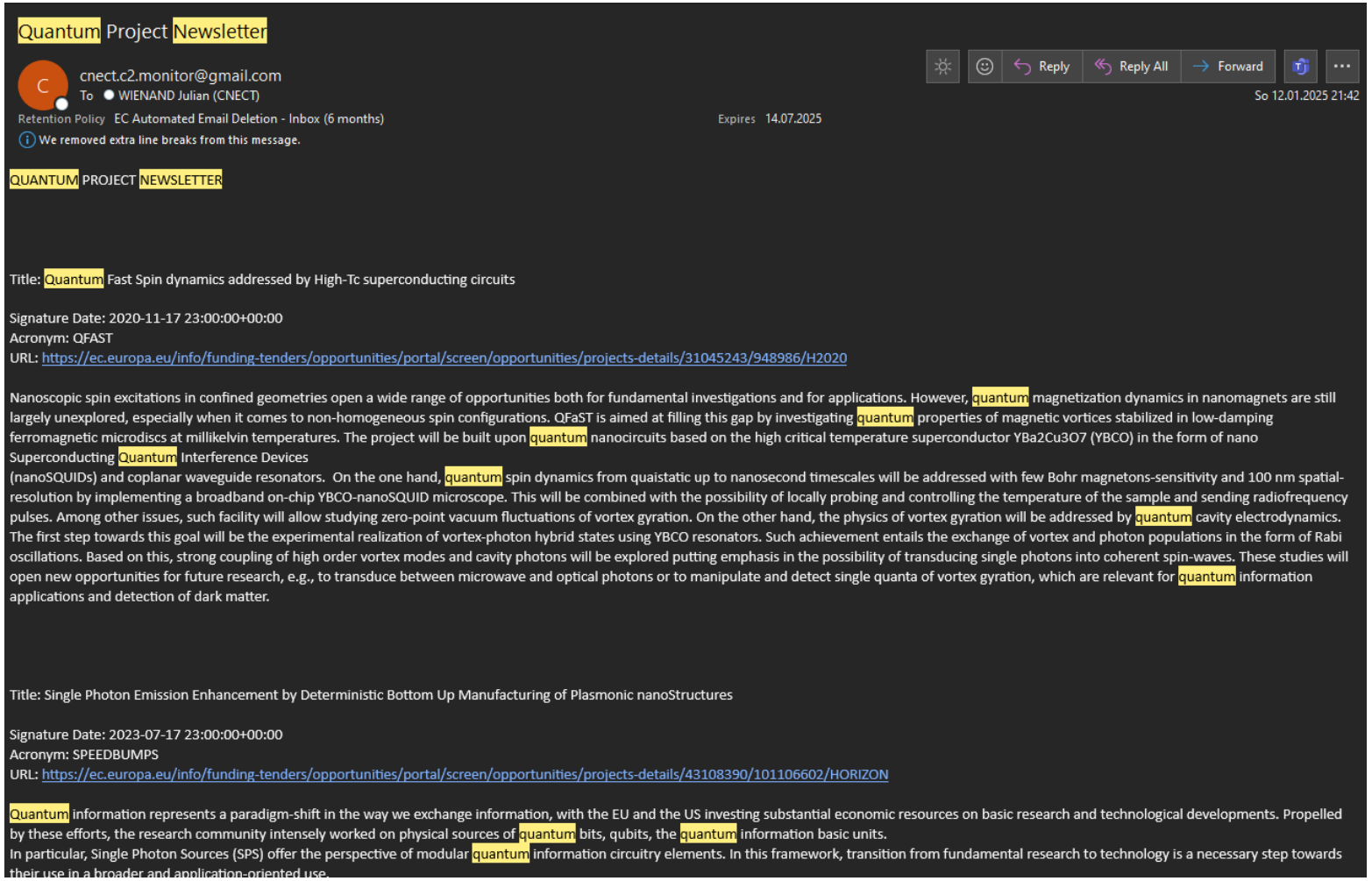
Weekly project newsletter



Quantum Project Newsletter

cnect.c2.monitor@gmail.com
To WIENAND Julian (CNECT)

Reply | Reply All | Forward

So 12.01.2025 21:42

Retention Policy EC Automated Email Deletion - Inbox (6 months) Expires 14.07.2025

We removed extra line breaks from this message.

QUANTUM PROJECT NEWSLETTER

Title: Quantum Fast Spin dynamics addressed by High-Tc superconducting circuits

Signature Date: 2020-11-17 23:00:00+00:00
Acronym: QFAST
URL: https://ec.europa.eu/info/funding-tenders/opportunities/portal/screen/opportunities/projects-details/31045243/948986/H2020

Nanoscopic spin excitations in confined geometries open a wide range of opportunities both for fundamental investigations and for applications. However, quantum magnetization dynamics in nanomagnets are still largely unexplored, especially when it comes to non-homogeneous spin configurations. QFaST is aimed at filling this gap by investigating quantum properties of magnetic vortices stabilized in low-damping ferromagnetic microdiscs at millikelvin temperatures. The project will be built upon quantum nanocircuits based on the high critical temperature superconductor YBa2Cu3O7 (YBCO) in the form of nano Superconducting Quantum Interference Devices
(nanoSQUIDs) and coplanar waveguide resonators. On the one hand, quantum spin dynamics from quaistatic up to nanosecond timescales will be addressed with few Bohr magnetons-sensitivity and 100 nm spatial-resolution by implementing a broadband on-chip YBCO-nanoSQUID microscope. This will be combined with the possibility of locally probing and controlling the temperature of the sample and sending radiofrequency pulses. Among other issues, such facility will allow studying zero-point vacuum fluctuations of vortex gyration. On the other hand, the physics of vortex gyration will be addressed by quantum cavity electrodynamics. The first step towards this goal will be the experimental realization of vortex-photon hybrid states using YBCO resonators. Such achievement entails the exchange of vortex and photon populations in the form of Rabi oscillations. Based on this, strong coupling of high order vortex modes and cavity photons will be explored putting emphasis in the possibility of transducing single photons into coherent spin-waves. These studies will open new opportunities for future research, e.g., to transduce between microwave and optical photons or to manipulate and detect single quanta of vortex gyration, which are relevant for quantum information applications and detection of dark matter.

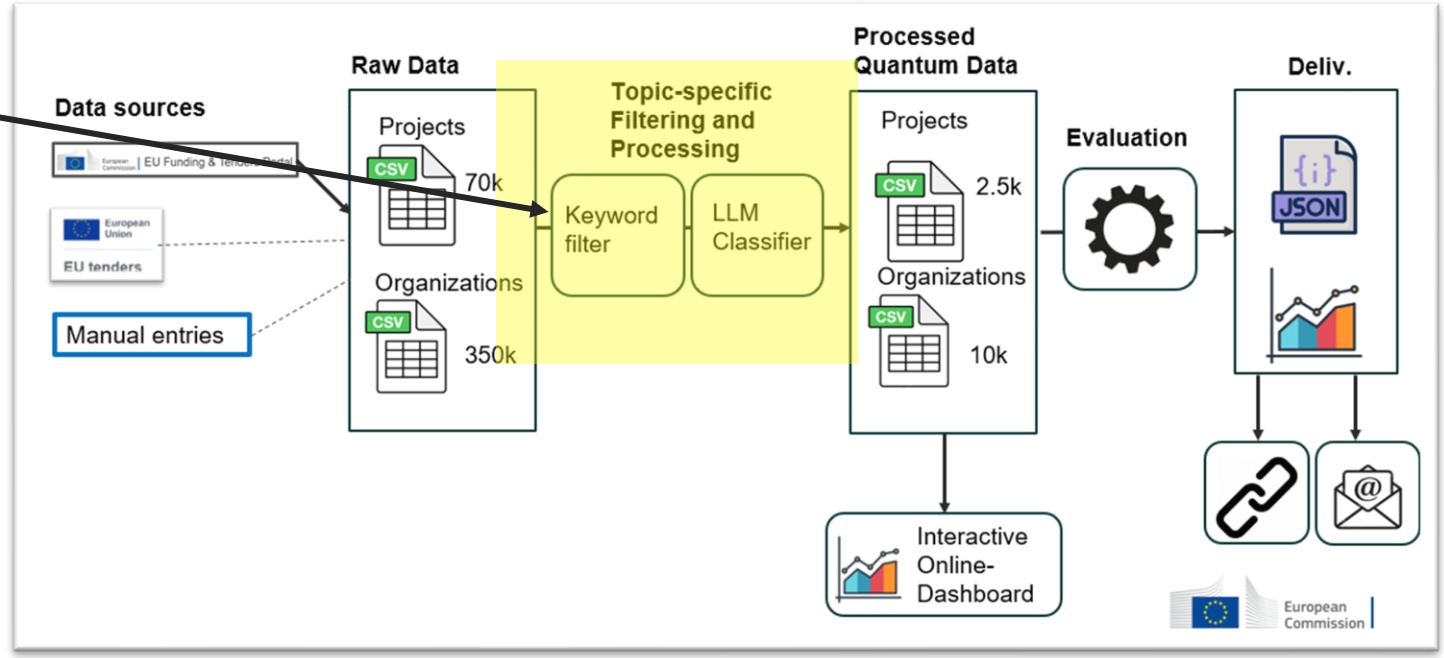
Title: Single Photon Emission Enhancement by Deterministic Bottom Up Manufacturing of Plasmonic nanoStructures

Signature Date: 2023-07-17 23:00:00+00:00
Acronym: SPEEDBUMPS
URL: https://ec.europa.eu/info/funding-tenders/opportunities/portal/screen/opportunities/projects-details/43108390/101106602/HORIZON

Quantum information represents a paradigm-shift in the way we exchange information, with the EU and the US investing substantial economic resources on basic research and technological developments. Propelled by these efforts, the research community intensely worked on physical sources of quantum bits, qubits, the quantum information basic units.
In particular, Single Photon Sources (SPS) offer the perspective of modular quantum information circuitry elements. In this framework, transition from fundamental research to technology is a necessary step towards their use in a broader and application-oriented use.

Adaption to other fields of interest

→ **Adapt filtering settings**



Adaption to other fields of interest

List of keywords

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"trapped ion", "quantum cryptography", "quantum communic", "quantum dyn", "quantum comput",
                "quantum simula", "quantum dot", "supercoducting qubit", "neutral atoms", "quantum
physic", "quantum optic", "quantum circuit", "quantum superposit", "quantum metrology", "quantum sens",
                "quantum gas", "quantum inform", "quantum scatt","ultracold atom", "ultracold molecul",
"quantum noise", "quantum projec", "quantum grav", "quantum phase", "quantum correlati", "quantum
entangle",
                    "atom interferom", "quantum transport", "quantum imagi", "feshbach resonan",
"ultracold gas", "optical clock", "optical lattice clock", "quantum critic", "quantum magnet", "quantum
techno", "quantum engineer", "quantum optimi", "quantum financ", "quantum interfer", "quantum gas
microsc",
                "quantum key distrib", "quantum encryp", "quantum internet", "quantum photon",
"variational quantum", "quantum correl", "quantum syste", "quantum effect",
                    "quantum thermodynamics", "quantum emitter", "quantum fluid", "quantum material", "qkd
network", "euroqci", "psot-quantum", "wave function", "quantum diagnostics",
                "non-classical st", "entangled state", "multi-mode enta"]
```

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Adaption to other fields of interest

Categorization taxonomy

- **"quantum computing":** A quantum computer is a computer that exploits quantum mechanical phenomena (also quantum simulators), by manipulating quantum bits (qubits) and quantum gates, including firmware, error-correction,readout, diagnostics and characterisation systems, and also software and algorithms. Quantum simulators are devices that actively use quantum effects to answer questions about realizable model systems and, through them, to get results about systems of practical interest (such as superconductors, simulated using arrays of cold atoms). Quantum software refers to software designed to run on quantum computers, including SDKs and frameworks, programming languages, development tools, orchestration, UI, QaaS, end-user software, cloud, AI and machine learning. This category should also include technologies enabling quantum computing and quantum simulators and building blocks of quantum computers and quantum simulators, if they can be considered a part of the second quantum revolution, e.g. qubits, control electronics, twpa amplifiers.
- **"quantum sensing":** The application of quantum systems to constructing more sensitive or more compact sensors of physical properties or fields, such as temperature, distance/displacements, electric or magnetic fields, and also accelerations, rotations, pressure and gravity. Quantum sensing applications also include quantum imaging and lidar. This category should also include technologies enabling quantum sensing and metrology, if they can be considered a part of the second quantum revolution.
- **"quantum communication":** communication that uses quantum physics to transmit and protect data, and potentially to enable

(…)

DIGITAL Dashboard vs EFMO

DIGITAL QLIK dashboard

Data about DEP

1d keyword categorization (intransparent, probably inaccurate)

Limited Interactivity plots for breaking down data by existing field
(e.g. cannot display projects / organizations directly)

Limited ability to create new plots
(e.g. only few chart options, limited fields, e.g. cannot filter by date)

No text search filter (rely on keyword categorization)
(cannot search for keywords manually)

Cannot create dashboards / save own plots
(need to start from zero later)

EFMO

Entire Commission Data (can filter by program, use ither LLM-filtered data or raw unfiltered data)

Fully interactive and custimizable plots (both in terms of data and style)

State-of-the-art topic-specific LLM based categorization

Basic and advanced smart plotting, can filter on / use all fields in the data without resztrictions. Smart handling of date and country data

Can freely search any field (including description) using keywords

Can save progress for later use (automatically updated with new data)

Can share plots and dashboard through public links

EFMO can distribute material to websites

EFMO can send newsletters by email highlighting new projects

Data fragmentation

Need to collect and combine data from different sources within the Commission

Provide all data in one place
limited to one program, restricted use of fields (e.g. date fields, geographic info)

Bad topic filtering

Keyword-based filtering insufficient for capturing complex topics

Use **LLMs** for filtering and categorizing

Data is pre-labelled with keywords
No custom keyword search

EFMO DIGITAL QLIK dashb.

Steep learning curve

No easy way to make custom plots and retrieve accurate answers from existing tools

Provide easy-to-use dashboard platform

Limited plotting / data exploration and styling capabilities → download data for processing in Excel

Lack of automation

Need to manually repeat data collection and processing steps for an updated answer

→ Make data workflow fully automatic

Dashboard is automatic, but cannot save filte settings / custom plots