



FuSuMaTech



Future Superconducting Magnet Technology

FuSuMaTech phase 2

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Oxford Quantum Solutions Ltd

Annual Meeting of FuSuMaTech

21st Apr 2021, video conference Hosted by PSI

Meeting Objectives



FuSuMaTech



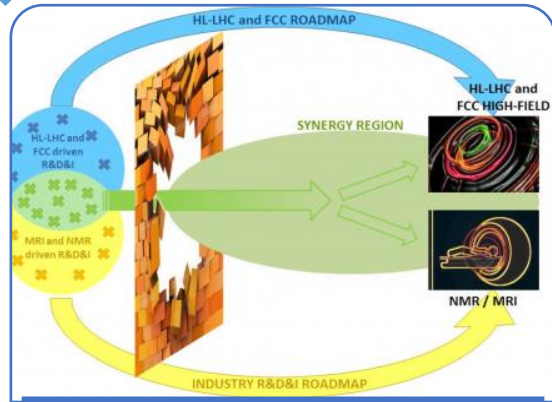
- Update on FuSuMaTech status
 - Phase 1 Objectives
 - New members
- Review status of Phase 1 WP4 and WP5
- Review Objectives for Phase 2,
 - expand the FuSuMaTech Cluster to sustain the applied superconductivity development and exploitation in Europe
 - Review Available funding (Galle)
- Review proposals for going forward:
 - Develop a Strategic Roadmap for Applied Superconductivity to guide potential funding routes
 - Individual calls
 - European challenge for Applied Superconductivity for 2 years (100-200 M Euro) – For Discussion
 - A European equivalent “ Flagship” for Applied Superconductivity Fund for 5 years (>500 M Euro ?) - For Discussion

FuSuMaTech Objectives

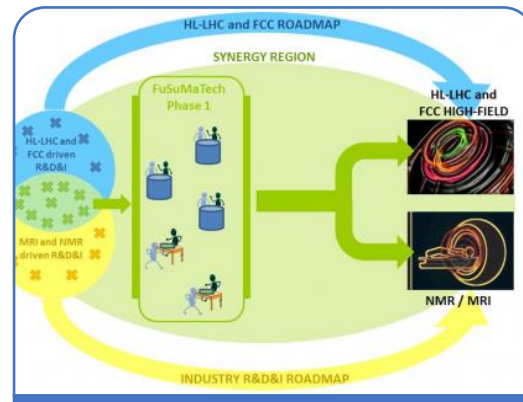
It is all about creating synergy



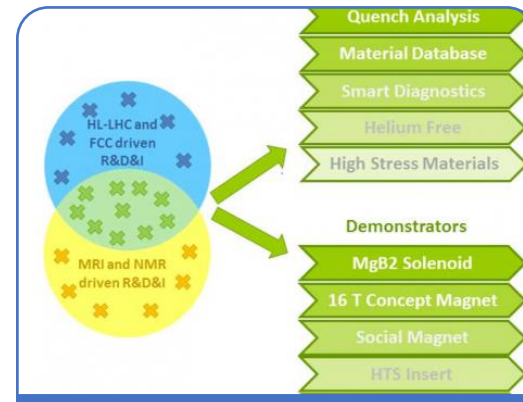
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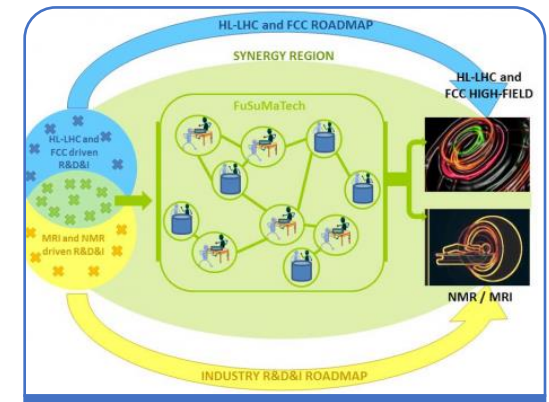
Obj 1: Moving towards a FuSuMaTech European cluster



Obj 2: Building the FuSuMaTech road mapping



Obj 3: Defining and preparing generic R&D actions 3



Obj 4: Defining and preparing pilot actions



1. Shortlist of 5 Generic R&D
2. Shortlist of 5 Technology Pilot projects

- T4.1: Quench analysis**
T4.2: Material properties database at Cryogenic temperature
T4.3: Smart diagnostics
T4.4: Heat extraction and helium free cryogenics
T4.5: New high stress materials at cryogenic temperature

- T5.1: MgB2 Technology Pilot 5 teslas.**
T5.2: Frontier edge High Field MRI concept magnet 16 teslas.
T5.3: Social Magnet, Open MRI Magnet, Mammo Magnet (Conceptual design)
T5.4: HTS insert for HFML.
T5.5: Gradient coils technology for high field MRI, over 10 Teslas.

FuSuMaTech From Phase 1 to Phase 2

Synergy with Industry and the Impact on the Future Superconducting Magnet Technology



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✓ Obj. 1: Moving towards a FuSuMaTech European cluster

Phase 1



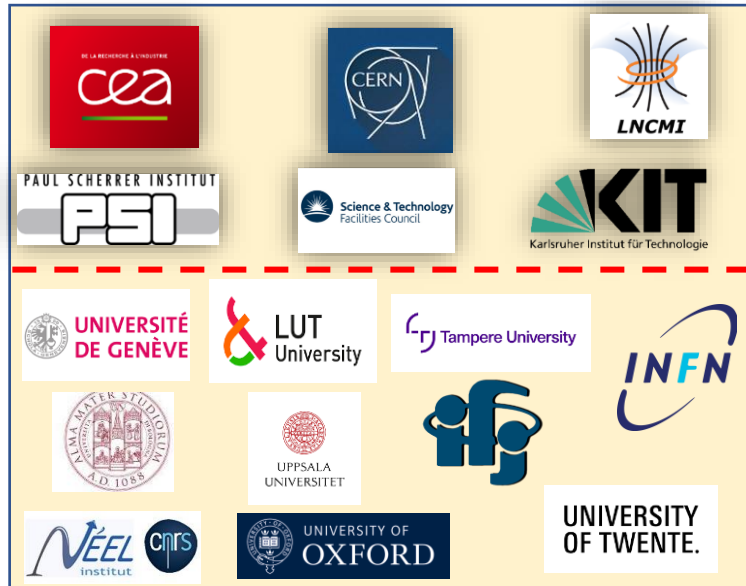
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Phase 2



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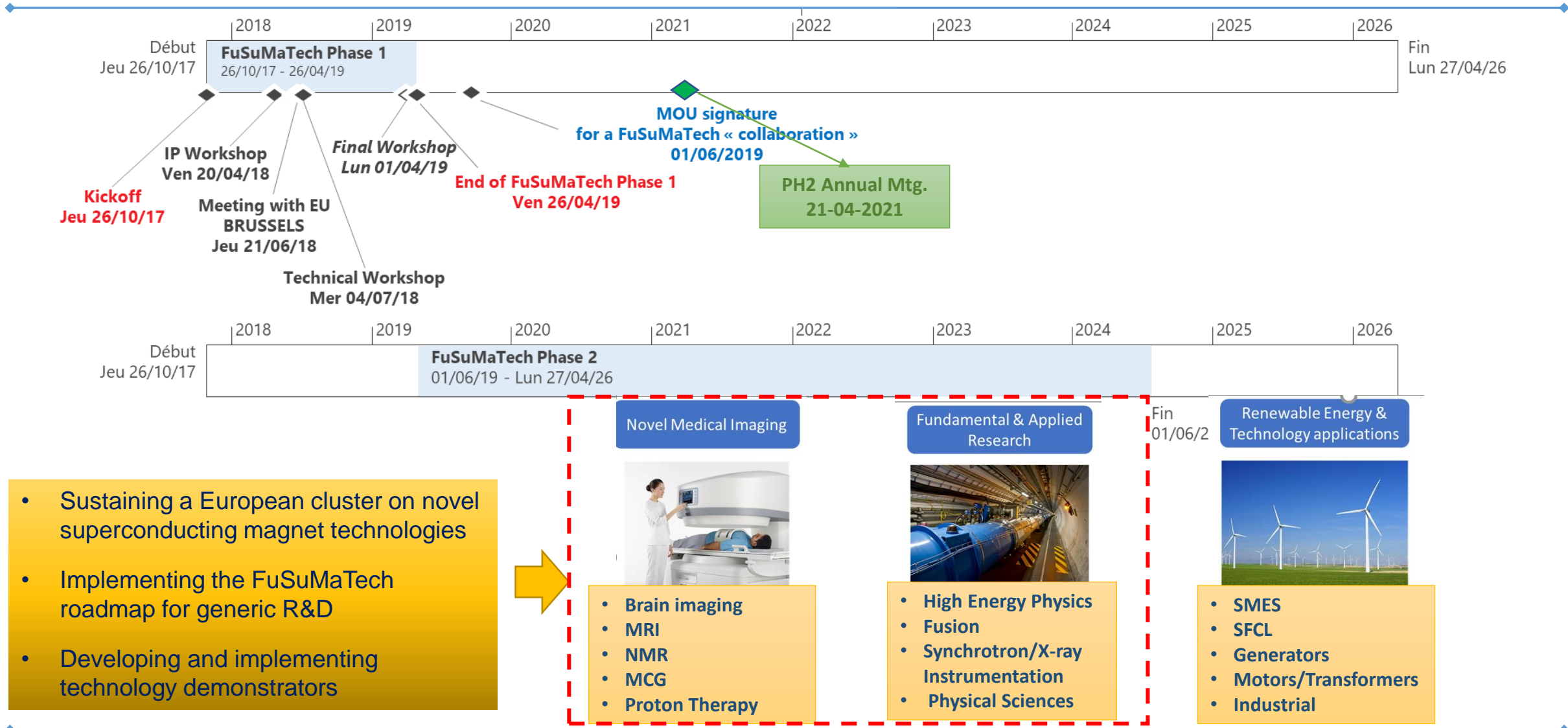
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FuSuMaTech from Phase 1 to Phase 2



FuSuMaTech



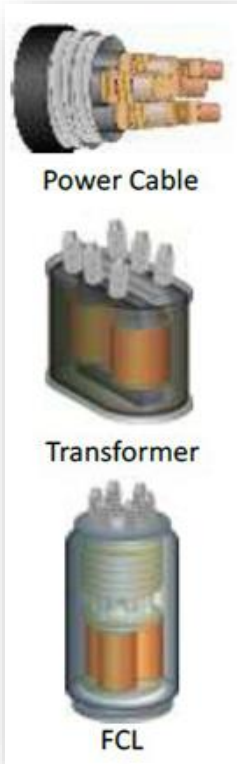
- Sustaining a European cluster on novel superconducting magnet technologies
- Implementing the FuSuMaTech roadmap for generic R&D
- Developing and implementing technology demonstrators



Diverse applications of Superconducting Technologies



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- ### Industrial applications
- Non-destructive Testing
 - Inductive Heaters
 - Magnetic separation
 - Crystal Growth

- ### Research & Medical Magnets
- Medical/LS - MRI, NMR, Proton Beam Therapy
 - Basic Sc Res/Physical sciences RM(LTS)
 - HEP- Beamlines/Accelerates/ Detectors (LTS)
 - Fusion - LTS & HTS
 - UHF >25T (LTS+HTS)
 - 5T-20T >20K (HTS)
 - Bench Top Applications (LTS+HTS)
 - 0.5-5T >20K-77K

- ### Power & Energy Applications
- Fault Current Limiters (FCL)
 - Transmission Cables
 - SC Magnet Energy Storage
 - Generators (Wind/Utility)
 - Transformers
 - Motors
 - Synchronous Condensers



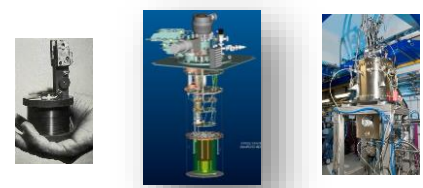
- ### Microelectronics
- Quantum Computing
 - Faster Computers
 - Power Electronics

Superconducting Applications

- ### Communications
- Satellite channels
 - Wireless devices
 - Antennae

- ### Defence & Security
- Detectors/Sensors
 - Rail gun
 - Degaussing cables

- ### Transportation
- Electric planes
 - Maglev
 - Ships
 - Rocket propulsion



Funding – Route 1

Specific calls



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- Route 1 – Available now
 - EU calls (TBC)
 - Cluster 5 “Energy, Climate and mobility”,
 - Cluster 1 “Health”,
 - Cluster 4 “Industry, Digital and Space”
 - SWISS Calls – TBC
 - UK calls –(RIUK) TBC
- Not different from Phase 1
 - Will not sustain FuSuMaTech cluster
 - Good route but not enough for sustainability

More details from Gaëlle DECROIX

Funding – Route 2

EIC Applied Superconductivity Challenge



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• Route 2 – For Discussion

- EIC Pathfinder challenges
 - **EIC Pathfinder Challenges** aim to **build on new, cutting-edge directions in science and technology** to disrupt a field and a market or create new opportunities **by realising innovative technological solutions** grounded in high-risk/high-gain research and development.
- 5 Pathfinder Challenges selected for 2021-2022
 1. Awareness inside
 2. Tools to measure & stimulate activity in brain tissue
 3. Emerging Technologies in Cell & Gene Therapy
 4. Novel routes to green hydrogen production
 5. Engineered living materials

• Proposal – For Discussion and approval

- Develop an Applied Superconductivity Challenge for 2023-2024 (**~150M Euro**)
- Need a **Strategic Road map for Superconductivity**
 - Now local roadmaps with no strategic Roadmap linking various interests/topics
- Need FuSuMaTech to work with ESA and CONECTUS
 - FuSuMaTech only body linking Research and academia with Industrial partners
- **Propose to have a Subcommittee from FuSuMaTech and representative from ESAS and CONECTUS (plus other bodies TBC) to develop an EIC Pathfinder Challenge**
- **Need to engage with EU on requirements for a SC challenge**

EIC Pathfinder funding schemes	European Innovation Council (EIC) aims to identify and support breakthrough technologies and game changing innovations to create new markets and scale up internationally
EIC Pathfinder Open	bottom-up approach with no predefined topic
EIC Pathfinder Challenges	top-down challenge-driven calls for tackling specific technology breakthroughs by portfolios of projects

	Pathfinder Open	Pathfinder Challenges
Total budget	€168 million	€132 million
Proposals (indicative)	Up to €3 Mio	Up to €4 million
Funding rate	100% of eligible costs	100% of eligible costs
Opening	9 April 2021	15 June 2021
Deadline	19 May 2021 at 17:00 CET	27 October 2021 at 17:00 CET
Length of proposal	17-page proposal – Section 1 to 3	25-page proposal
Applicants	Consortia: Min. 3 partners from 3 different MS/AC (of which at least 1 partner in a MS) Legal entities: all types are eligible	1. Single legal entities in a MS/AC (conditions apply) 2. Consortia: - If 2 partners: from different MS/AC, otherwise - Min. 3 partners from 3 different MS/AC (of which at least 1 partner in a MS) (unless differently stated in the Challenge chapter)

Courtesy of Gaëlle DECROIX

Funding – Route 3

Applied Superconductivity “Flagship”

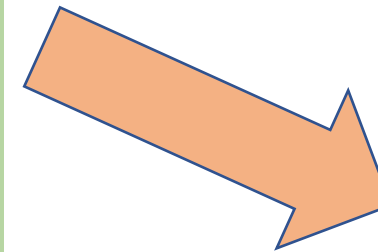
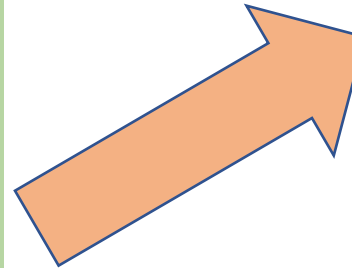
- Route 3 – For Discussion
 - Superconductivity “Flagship”
 - Equivalent to GRAPHENE Flagship, Quantum Flagship,
 - Need to engage with EU in the near term
 - Funding ~ **1 Billion Euro**
 - ESA submitted a Flagship proposal (2017?)
 - PV has more details
- **Proposal – For Discussion and approval**
 - Develop a Superconductivity Flagship from 2023 or 2025 ?
 - Need a **Strategic Roadmap for Superconductivity**
 - Need FuSuMaTech to work with ESAS and CONECTUS
 - **Propose to have a Subcommittee from FuSuMaTech and representative from ESAS and CONECTUS (plus other bodies TBC) to develop a Flagship proposal**

FET Flagships	Future Emerging Technologies (FET) programme
<ul style="list-style-type: none"> • FET invests in transformative frontier research and innovation with a high potential impact on technology, • FET Flagships can only be realised through a long-term and sustained effort at European level by: 	<p>Benefit EU economy & society.</p> <ul style="list-style-type: none"> • building on large scale research cooperation across academia, industry & national research programmes • Mobilising Europe's best researchers around an ambitious R&D roadmap.
<p>The FET Flagships run typically for a period of 10 years</p>	<ul style="list-style-type: none"> • Mobilise hundreds of researchers across Europe with an overall support of around EUR 1 billion.
<p>Graphene/Brain/Quantum</p>	

Both; Route 1 (SC Challenge) and Route 2 (SC flagship) will require

- A Strategic Roadmap for SC
- Dedicated effort from the SC community to develop the roadmap
- Clear objective and targets to exploit the potential from SC on various sectors

- Need a **Strategic Road map for Superconductivity**
- Need FuSuMaTech to work with ESAS and CONECTUS
- Need to engage with EU on requirements for a SC challenge and **EIC SC Challenge FET SC Flagship**
- Propose to have a Subcommittee from FuSuMaTech and representative from ESAS and CONECTUS (*plus other bodies TBC*) to develop Routes for Partnerships and Funding
 - Vote



Funding Route 2 – For Discussion

Proposal – For Discussion and approval

- Develop an Applied Superconductivity EIC Challenge for 2023-2024
- **(~150M Euro)**

Funding Route 3 – For Discussion

Proposal – For Discussion and approval

- Develop a proposal for a Superconductivity Flagship from 2023 or 2025 ?
- **~ 1 Billion Euro**