STFC Early-Stage research and development scheme: Intention to submit (ItS)

To apply for the STFC Early-stage research and development scheme, all applicants are required to complete the below pro forma and submit it to **KEGroup@stfc.ac.uk**

Please title the email **Early-Stage research and development scheme ItS**

Any applications received which have not submitted this this version of the form will not be accepted.

These ItS will be assessed internally by a sift panel who will determine if the project is eligible for the scheme. They will determine if

- the applicant and lead institution meets the STFC criteria for holding a grant.
- the project TRL is suitable for the scheme
- the project has been developed from STFC science and fits within the STFC remit
- the project is of potential benefit to the PPAN community and/or the wider UK community

Applicant details

Lead applicant name:	
Lead applicant e-mail:	
Lead institution:	University of Oxford

If the project is planned as part of a larger collaboration, please state the names and affiliations of all partner organisations	Everyone
Project details	
Please state the proposed title of the project:	Global tracking detector design for future particle physics experiments

Please mark with an X the relevant box, stating the remit area you work in

Quantum Science	Particle physics	Astronomy	Particle astrophysics	Solar and planetary science	Nuclear Physics	Accelerator science	Supporting Computing science	Other (please state)
	X							

Please mark with an X the relevant box, stating the remit area the project is looking to target

Quantum Science	Particle physics	Astronomy	Particle astrophysics	Solar and planetary science	Nuclear Physics	Accelerator science	Supporting Computing science	Other (please state)

	X				X			

Please provide a brief (less than 300 words) overview of the project, including high level aims and objectives
The UK tracking community has ambition to provide significant leadership in the design of future particle physics experiments. Community meetings last year, in advance of the formation of the DRD-UK structure, focused on an integrated approach to the end-to-end design of tracking detectors. This matches the strength of the UK involvement in silicon tracking/vertexing detectors, for example in ATLAS, LHCb, Mu3e or the ePIC SVT. In these projects the UK has provided contributions to all aspects of the system, and this range of interests also manifests in the broad participation of UK institutes in the DRD3, DRD7 and DRD8 programmes. The activities in these programmes are strongly interconnected, and the ultimate proof of the success of the technologies to be developed within these frameworks will require the demonstration within a complete system comprising all aspects, including structure mechanics thermal management, readout etc. We therefore think that a participation of the UK groups in DRD projects must be complemented by the construction of one or two demonstrator systems that verify the simultaneous achievement of the goals of these research programmes. We also believe that such demonstrators constitute a well-defined deliverable and output of the UK DRD programme. They will put the UK in a position to contribute proven solutions for tracking/vertexing systems once the next generation collider experiments become more concrete, which will put us in a very strong position in the critical early decision phase. The exact specifications of the(se) demonstrator(s) will need to be defined in accordance with the international environment, but it is likely that two demonstrators will provide good coverage of the UK research programme, one aimed at a low-power application (as typical for electron colliders), and one aimed at a high-intensity environment (as for a future hadron collider). Both systems will strive to minimise the mass within the constraints set by their environment and specifications. This project would thus span several DRD remits: silicon sensor development, electronics design and mechanics+cooling, serving as a core project around which other DRD-UK efforts could be connected.

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One side of the project would be the development of low-mass high-strength support structures out of Carbon Fibre (CF). The University of Oxford has a large body of expertise in this field, stemming from recruitment from nearby formula-1 industry. Stiff CF support structures for the mu3e experiment have already seen 25 micron thick ladders of over 30 cm in length, with co-curing of insulating 8 micron thick kapton layers.

The other side of the project would focus on ASIC development for future particle physics experiments. This should take text from another project (DRD3 or DRD7) and state the goals of that.

In parallel, both positions will spend a sizeable fraction of their time on defining the goals and layout of the expected tracking demonstrators, combining the power requirements of the front end with the cooling and support structure on which they are to be mounted. Integrated solutions will be exploited, including co-curing of high-density interconnect PCBs within the CF stack, power routing through the support structure and the integration of cooling solutions.

Please provide a brief (less than 300 words) overview of

- who the project will benefit
- how the project has been developed from STFC science and technology


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