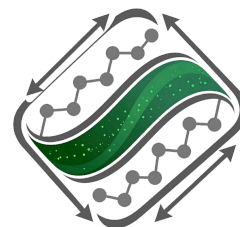


Reconfigurable Quantum Materials for Low-Energy Electronics



AEA Ignite Team for “From Lab to Fab: Advancing a New Low-Energy Transistor Towards Large-scale Manufacturing” (IG250200225)

SUMMARY: This AEA project aims to bring a new low-energy electronic technology from proof of concept towards commercialisation by using quantum materials in thin-film form to create a heterostructure platform with significantly lower energy consumption than current technology. After 6 months of work, we have completed the first milestone for the AEA project: Large-Scale Channel-Material Growth, which has successfully increased the project's TRL by experimentally validating the theoretical concepts in a reproducible laboratory environment.

DEVICE FABRICATION AND PERFORMANCE: To realise the proposed heterostructure transistor channel based on atomically thin films, our team has developed and optimised a device fabrication process for assembling dual-gate field-effect transistors. We successfully incorporated our novel transistor channel material ("AEA Channel") into the devices. Under an

external electric field, AEA Channel shows significantly stronger band gap modulation through the Stark effect compared with conventional bilayer two-dimensional materials.

THIN FILM QUALITY: Using advanced transmission electron microscope (TEM), we have verified the quality and interfacial stability of the AEA Channel.

ONGOING WORK: Aligned with the project schedule, device modelling and experiments on incorporating ferroelectrics are in progress.

BUSINESS DEVELOPMENT: We are working with TQ Transistors to expand the scope of the R&D program through engaging with new external collaborators. □

Team members: Yuefeng Yin*, Kaijian Xing, Weiyao Zhao, Mike Klymenko, Michael S. Fuhrer, Nikhil V. Medhekar, Wayne Johnson, Thomas Wrappe, Stuart Douglas. **Corresponding author:** Yuefeng Yin (yuefeng.yin@monash.edu)

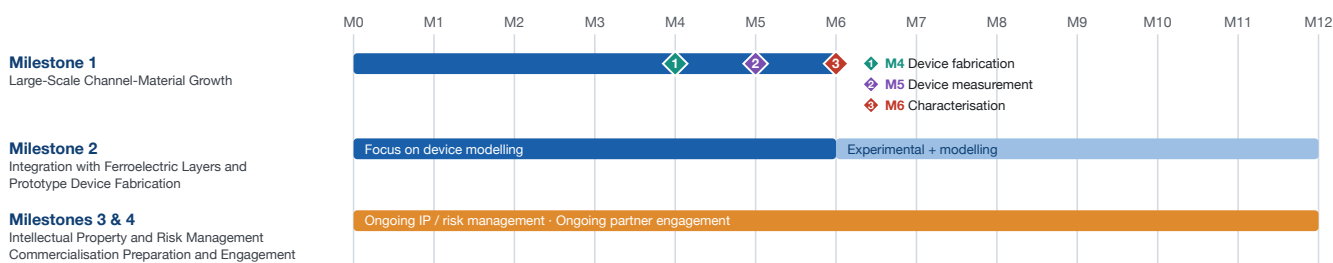


Fig. 1. Project timeline by stage and key events. Project milestones across the 12-month programme, with key Milestone 1 events numbered.

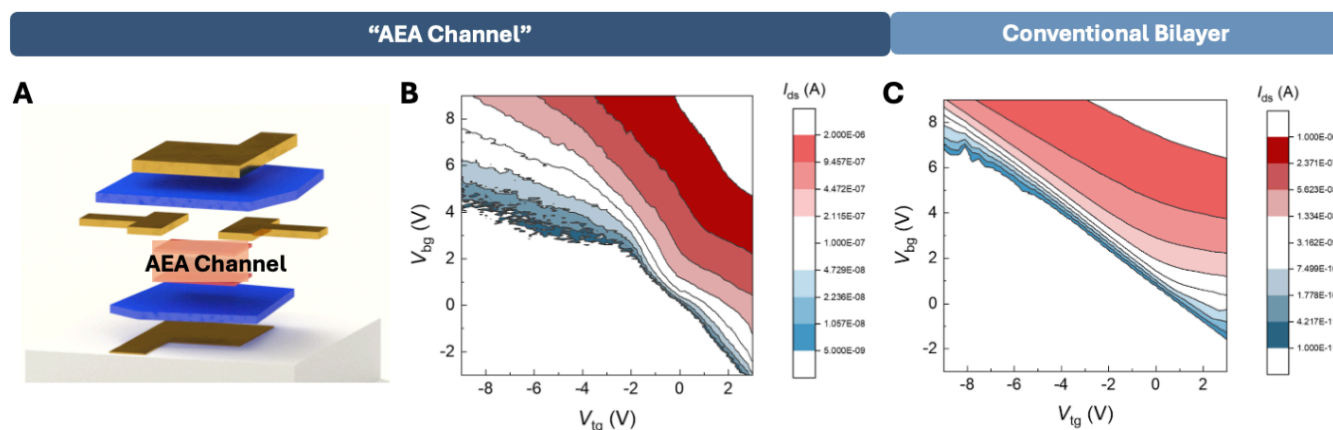


Fig. 2. Reconfigurable heterostructure for enhanced electric field response. The transistor device incorporating the AEA channel (A), shows a much sharper field response (B) than conventional bilayer (C).