

Physical Sciences Innovation Pipeline | March 2025

Energy, environment, food, advanced materials, mining and mineral processing

Program Name	Description	Partnered	Asset available for partnering	TRL 1 - 3	TRL 4 - 5	TRL 6 - 7	TRL 8 - 9
Renewables and energy innovation							
Solid oxide fuel/electrolysis cells	A solid oxide fuel cell designed with enhanced thermal management providing enhanced longevity						
Quantum dot solar cell with record efficiency	Breakthrough on low-cost next generation quantum dot solar cells that achieved a verified world record efficiency of 16.6 per cent						
Superior battery cathodes	A simple method to synthesise NMC materials with superior electrochemical properties						
Water and environmental							
Improved wastewater treatment (Lodomat)	An advanced system for wastewater treatment of sludge utilising anaerobic digestion, free nitrous acid (FNA) to inactivate nitrite oxidising bacteria (NOB), partial nitrification NOB to remove nitrogen followed by Anammox process and altering ammonium to alkalinity ratio						
Alkaline digestion of waste glass	A simple process developed for the extraction of sodium silicate from soda-lime glass, characterised by a high utilisation of the raw material and energy embodied in glass						
Biogas conversion process	An integrated process for converting biogas to green methane while producing valuable iron carbonates						
PFAS removal	Innovative technologies to capture and remediate PFAS (per- and poly-fluoroalkyl substances) environmental contamination of drinking water, wastewater, groundwater, waterways, soil and landfill						
Biobeads	Biobead utilises biological processes integrated with materials engineering to treat mining influenced wastewater whilst recovering valuable metals						
Destruction of water contaminants	Water treatment technology to destruct contaminants from water sources including PFAS and nitrate						
Food and bio processing							
Probisafe™	Probiotic lactic acid bacteria which kill/inhibit the growth of Salmonella & Listeria on fresh food products						
Cell expansion bioreactor for cell based meat and leather applications	Novel bioreactor configuration for cell-expansion that overcomes current challenges such as diffusion limitations, cost of growth media and cellular damage by shear stress						
Microtiter plate sensor for antibiotic residue detection in food	Novel sensor technology for rapid and cheap detection of antibiotic residues in food (dairy and meat)						
Algae food products	Food products using whole fresh unprocessed microalgae. Strains with optimum cell wall structure for digestibility matched with high yielding bioactives						
Native Australian liqueurs	Liqueurs based on flavours of uniquely Australian flora						
Native Australian Favoured Lollies	Soft lollies developed on flavours of native Australian flora						

Technology Readiness Levels (TRLs)

- TRL 1 Basic principles observed
- TRL 2 Technology concept formulated
- TRL 3 Experimental proof-of concept
- TRL 4 Technology validated in lab
- TRL 5 Technology validated in relevant environment
- TRL 6 Technology demonstrated in relevant environment
- TRL 7 System prototype demonstration in operational environment
- TRL 8 System complete and qualified
- TRL 9 Actual system proven in operational environment

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Advanced materials							
Alloys for 3D printing	High strength and high ductility copper alloys with inexpensive nanoparticles using innovative chemistry			●	●	●	
PHA-based bioplastic	Biodegradable PHA bioplastics, biocomposites and bio-products			●	●	●	
Nanocomposite elastomers	Strong, tough, yet low modulus elastomers enabled by reinforcement with flexible, tough nanofibres of cellulose			●	●	●	
Nanocellulose (biogels)	High aspect ratio, extremely tough nanofibers of cellulose for reinforcement, paper, cement, geopolymers, adhesives, eco-packaging and other applications			●	●		
Biomass-based composites	Novel processes to produce nanocellulose material			●	●		
Pesticide formulation technology	Silica carrier particles that encapsulate active ingredients (AI) to provide UV protection, increased rainfastness and easier formulation of hydrophobic AI			●	●		
Polymer electrolyte for flexible battery	A low cost organic electrolyte compatible with commercially viable fabrication process			●			
Advanced adjuvants for vaccine applications	Surface modification of silica-based nanoadjuvants provokes enhanced cell mediated innate immunity, cellular and humoral immune responses			●			
CO2-to-electricity generator	Electrical generator that consumes carbon dioxide			●			
Energy efficient green hydrogen production	Energy efficient and sustainable method to produce hydrogen using wastewater			●			
Mining and mineral processing							
Sustainable, eco-friendly remediation of bauxite residue	Sustainable bio-remediation of alkaline bauxite residues via microbial pH neutralisation			●	●	●	
Froth flotation measuring sensor	An <i>in-situ</i> device to accurately measure frother concentration in a flotation cell to increase efficiency, yield and revenue of a mining process			●	●		
High voltage pulse power separation system	Integrated separator system & process for preconcentration of materials using high voltage pulse power			●	●		
Quantum dot solar cell with record efficiency	Breakthrough on low-cost next generation quantum dot solar cells that achieved a verified world record efficiency of 16.6 per cent			●	●		
Bauxite residue valorisation	A novel process flow for the utilisation of bauxite residue, employing low-temperature selective leaching to extract high-value products, including hematite, silica, titanium and alumina			●	●		
Kaolin to high purity alumina	A novel process flow for the utilisation of kaolin feedstock, employing alkaline leaching and acid washing to extract high purity alumina			●	●		
Grinding mill internal design toolBox	Software technology to optimise mill liners and grate design to improve grinding performance, mill internal life and relining time			●	●		
Low-cost adsorbents for direct lithium extraction from blackmass	A novel hydrometallurgical process to enhance the recovery of critical metals like cobalt, nickel, and lithium from spent Li-ion batteries			●	●		
Flotation stability improvement system	An in-situ device to improve stability of froth in mineral flotation process, using specific sound waves			●			
Improved off-the-road wheels	Safer wheels for pneumatic tyres for off-road earth moving and mining vehicles			●			
Superior battery cathodes	A simple method to synthesise NMC materials with superior electrochemical properties			●			

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Sensors, data, communications, robotics and medtech

Partnered ● Asset available for partnering ●

Program name	Description	TRL 1-3	TRL 4-5	TRL 6-7	TRL 8-9
Sensors, devices and optoelectronics					
Force Sensing Device (UAVs, robotics)	Novel method of detecting force and torque for various applications	●	●	●	
Quantum LIFE microscope	Imaging the living activity of cells	●	●		
Microtiter plate sensor for antibiotic residue detection in food	Novel sensor technology for rapid and cheap detection of antibiotic residues in food (dairy and meat).	●			
MOF-Perovskite composite material for display applications	New class of composite material which enhances the optical properties and stability of perovskites for next-generation displays, bioimaging, and solar applications.	●			
Ultra high sensitivity magnetometer	Ultra-sensitive chip sized detection of magnetic fields at room temperatures	●			
Quantum dots (QD) for display applications	Process for synthesising highly stable QDs with efficient light emission demonstrated in deep red and near IR (process can also be applied to green and blue QDs)	●			
Quantum Gravity (Q Grav)	Q-Grav is a contactless weighbridge determining the mass and mass distribution of large objects such as trucks, planes, helicopters, ships and silos for example without needing to weigh them on traditional scales.	●			
Big data solutions, analytics and communications					
Tinyrange cyber security lab	A cyber range runtime environment that takes a lesson plan and runs a series of configured virtual machines	●	●	●	
Causal Network Topology Analysis for risk management	SaaS platform presents the complete risk landscape as a single connected system and enables detailed risk management strategies to inform risk-mitigation decision-making.	●	●		
UAVs and robotics					
Safety rotor	A lightweight safety feature for minimising blade impact in unmanned aerial vehicle (UAV) operation	●	●	●	
Y4	A more efficient quadrotor unmanned aerial vehicle (UAV) design with longer duration suitable for industrial applications	●	●	●	
Medical technologies					
Quantum technology for terahertz imaging and sensing	High-performance terahertz laser feedback interferometric imaging and sensing	●	●		
Sleep apnea assessment	At-home screening and/or diagnosis of sleep apnea using snore sounds captured on a mobile phone	●	●		
RF coil-element for UHF MRI	RF coil-element designed to have low sensitivity to loading changes, superior inter-element isolation, and better efficiency regarding RF energy deposition	●	●		
Imaging the living activity of cells	A quantum-limited light scattering technique in tracking the positions of biomolecules and observing the living activity occurring within micron-scale regions of cells	●	●		
MRI-guided radiotherapy system	A novel design of a superconducting magnet for an MRI system which allows patient access and LINAC-patient relative movement while minimising the sense of claustrophobia experienced by patients	●			
Iris Freckles	A low-cost melanoma pre-screening tool to encourage individuals with the highest risk of developing cutaneous melanoma using a mobile phone to detect pigmented iris freckles	●			
AI-enabled Evidence-Based Medicine	An AI enabled environment for ICU's to assist clinicians to make timely and informed life-critical decisions	●			

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| TRL 4 Technology validated in lab | TRL 9 Actual system proven in operational environment |
| TRL 5 Technology validated in relevant environment | |

For further information regarding any of these assets please contact us at enquiries@uniquet.com.au