



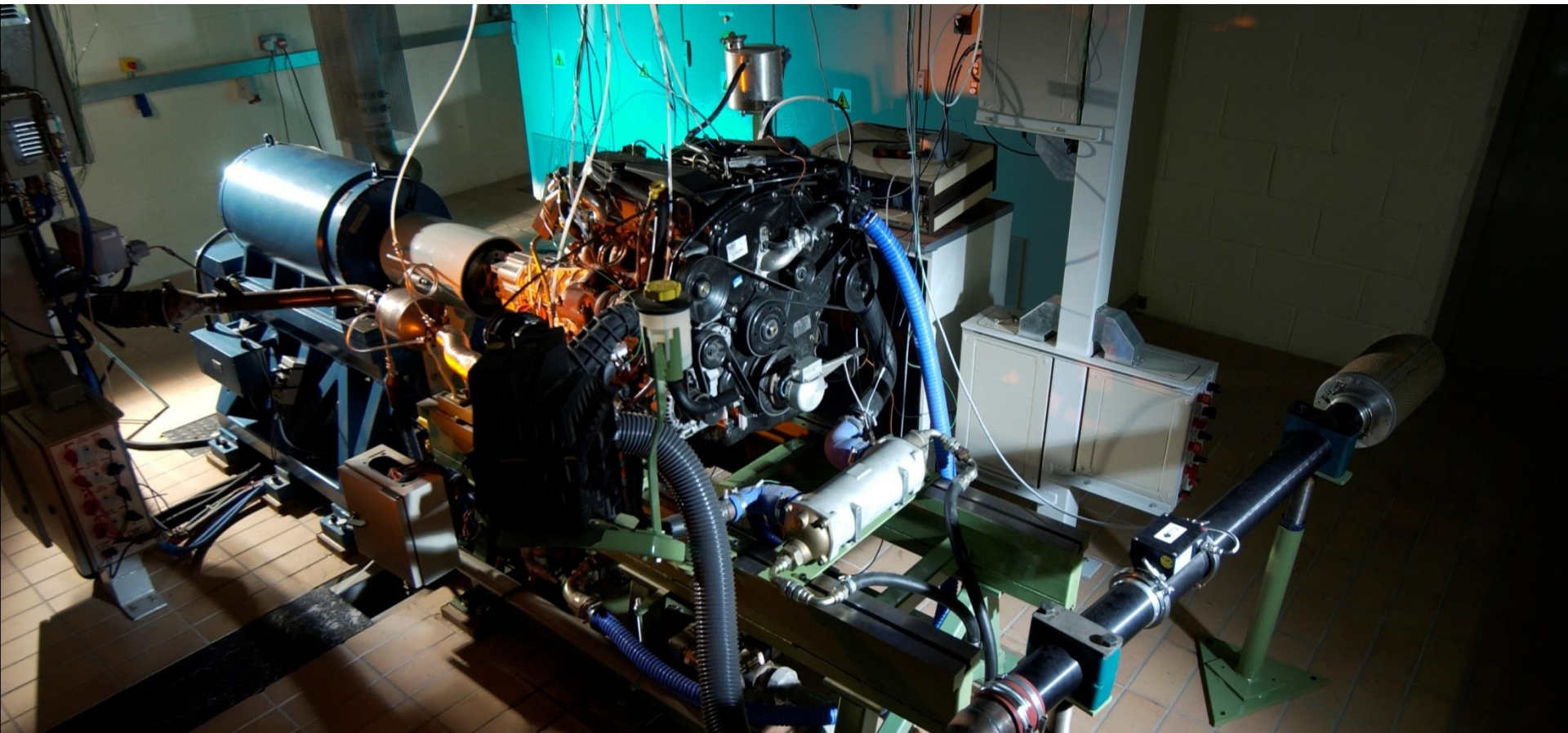
Department of
Mechanical
Engineering



UNIVERSITY OF
BATH

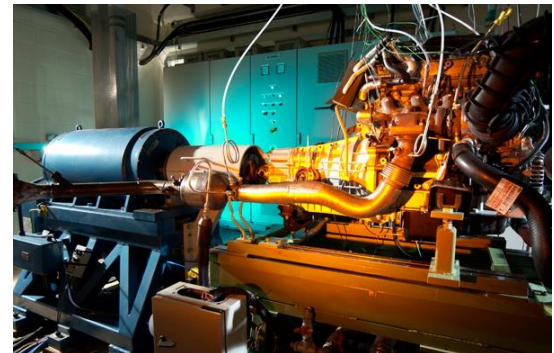
Powertrain & Vehicle
Research Centre

PVRC Capabilities & Current Research



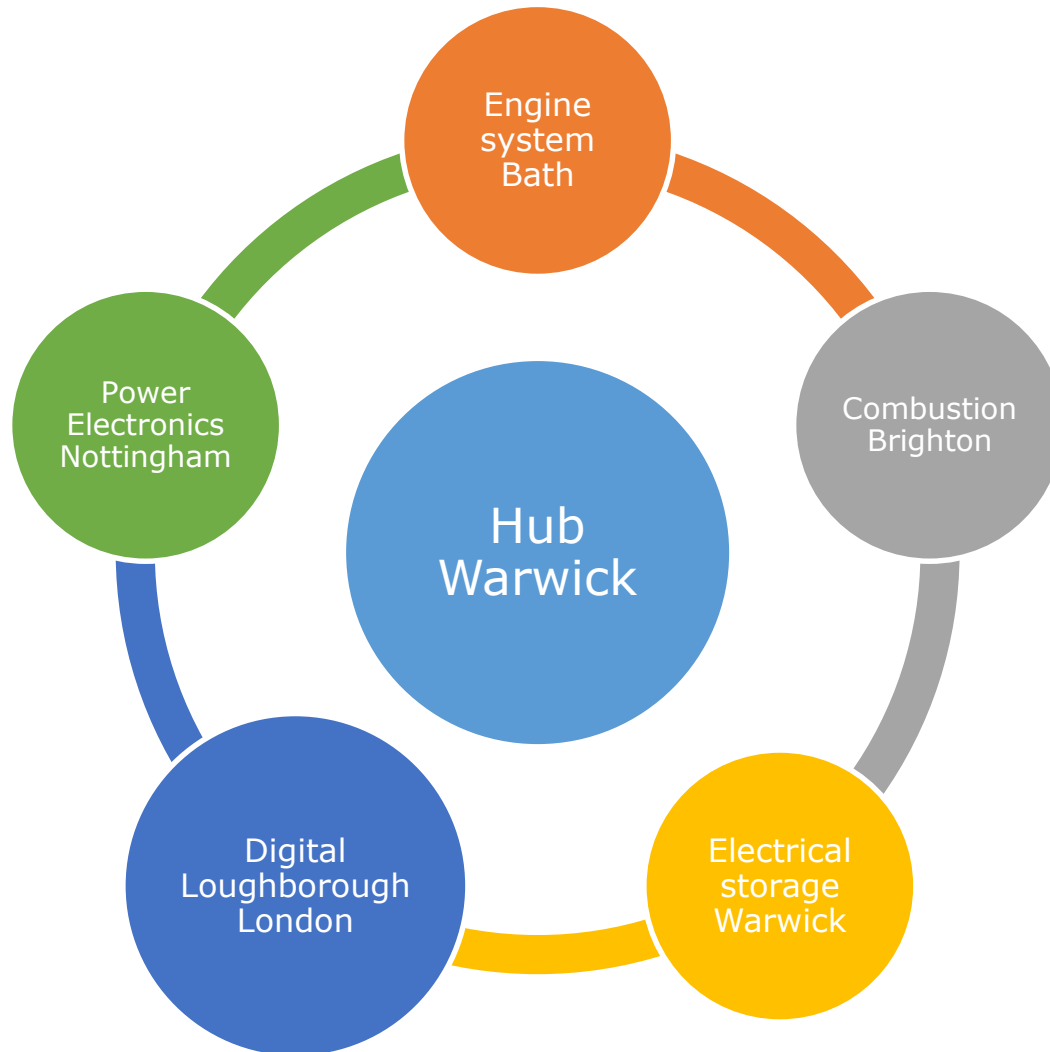
University of Bath

- University of Bath
 - South West England
 - Primarily Engineering and Science subjects
 - Mechanical, Civil, Electrical, Chemical, Biology
 - One of top 10 British Universities
- Department of Mechanical Engineering
 - 250 undergraduate masters students per year
 - Approx 90 PhD students
 - Mechanical, Automotive, Aerospace,
 - Manufacturing and Design
 - Hydraulics and control
- Powertrain and Vehicle Research Centre
 - Group of approx. 50 people
 - Capabilities in all major powertrain elements
 - System focused
 - Industrial collaborations



APC Spoke for Engine System Efficiency

- Appointments (Bath, Brighton) announced November 2nd
- Co-ordination and facilitation, regional presence



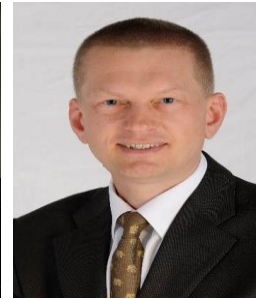
Current Staff

■ Academic Staff

- Prof. Hawley- Engineering Dean
- Prof. Chris Brace
- Prof. James Turner
- Dr. Sam Akehurst
- Dr. Colin Copeland
- Dr. Richard Burke
- Dr. Chris Bannister
- Dr. Kevin Robinson

■ Research Staff

- 10 post doctorate researchers
- 4 technicians
- 20 PhD students



The majority of research is in collaboration with industry



ENGINEERING



Johnson Matthey



BorgWarner Turbo Systems



MAHLE
Powertrain

Continental



上汽集团
SAIC MOTOR

TOROTRAK
Driving Change

Technology Strategy Board
Driving Innovation



Garrett
by Honeywell



EPSRC

Engineering and Physical Sciences
Research Council

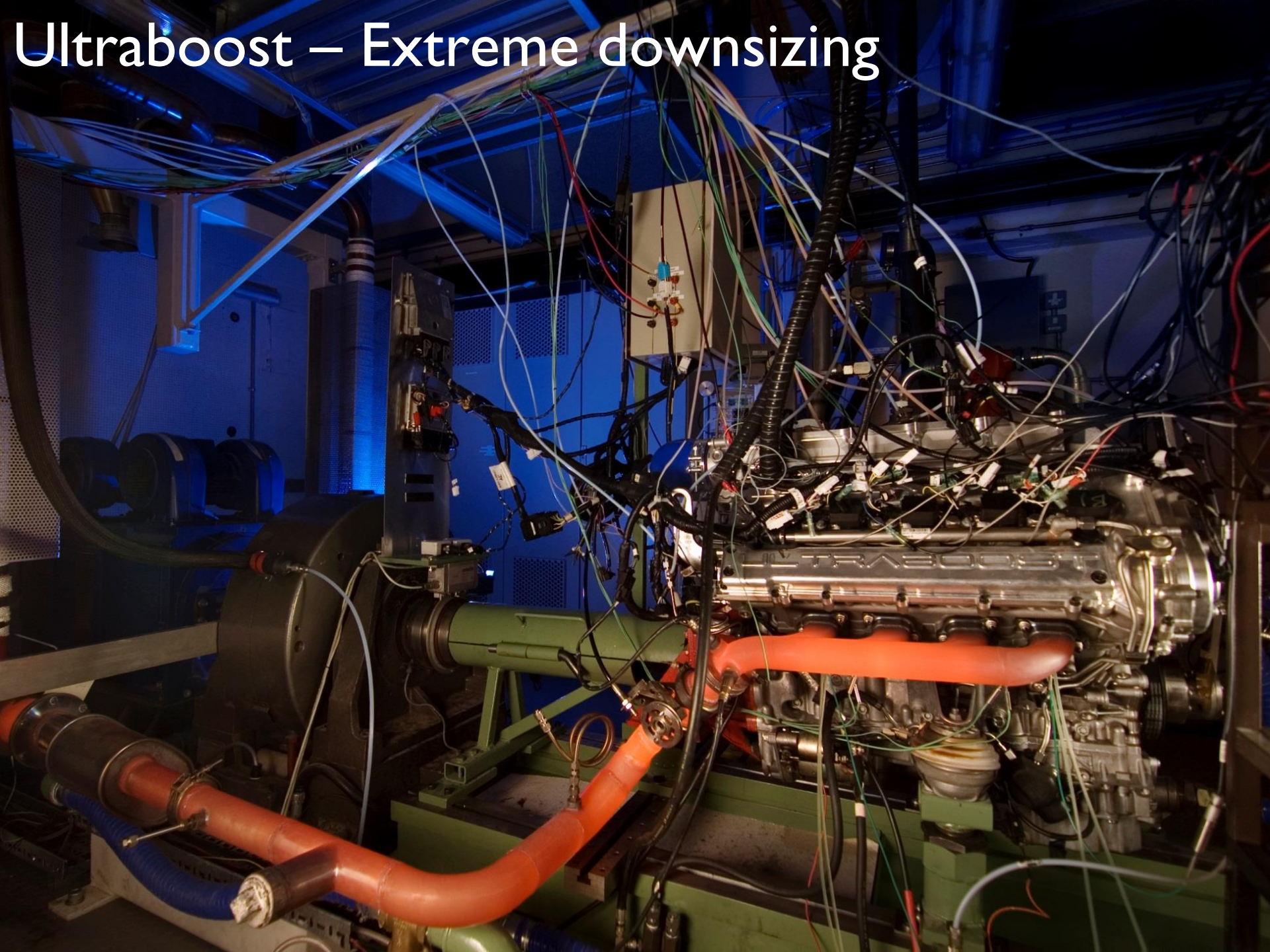


CATERPILLAR

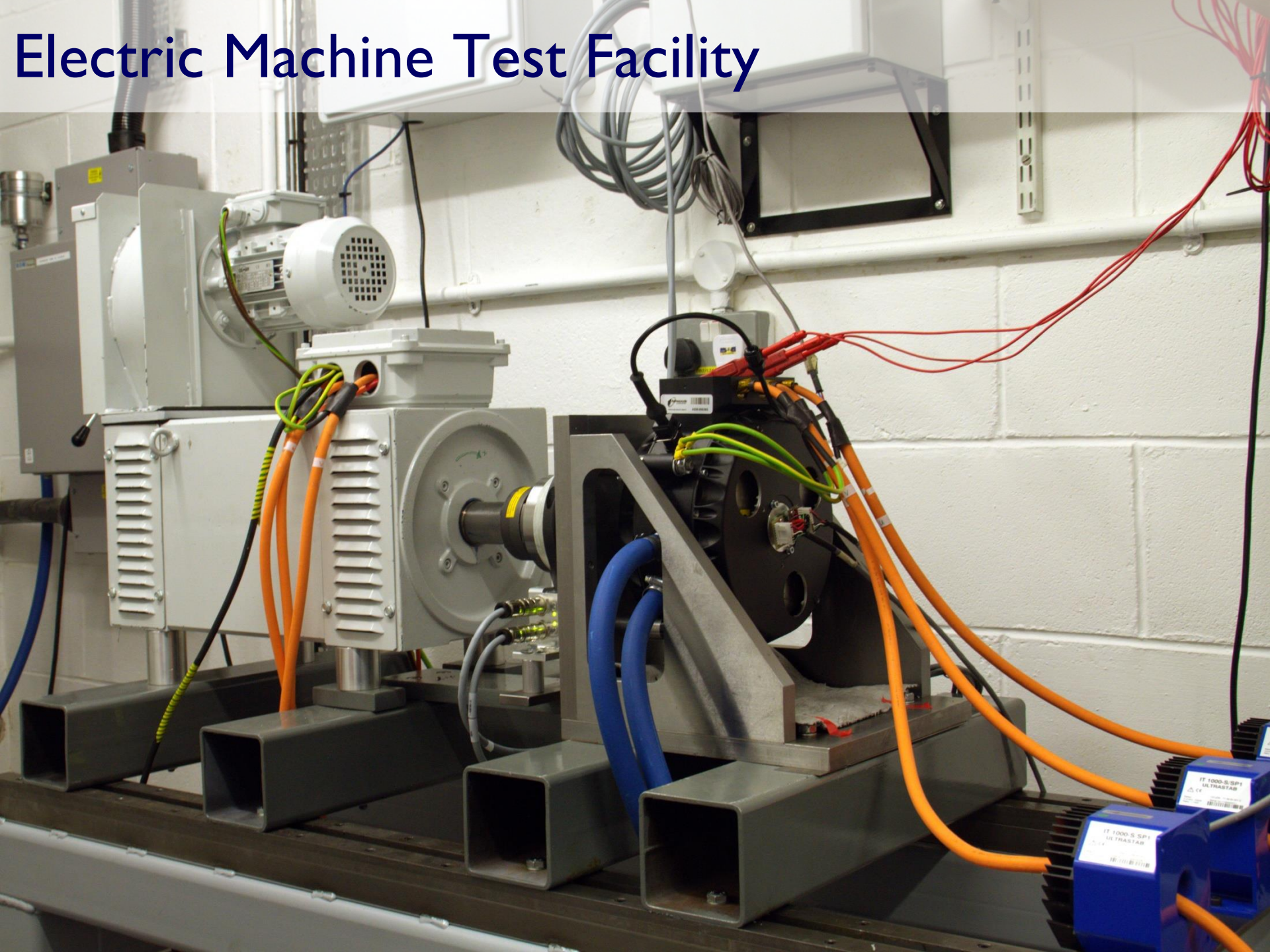
Dynamic test cell 2



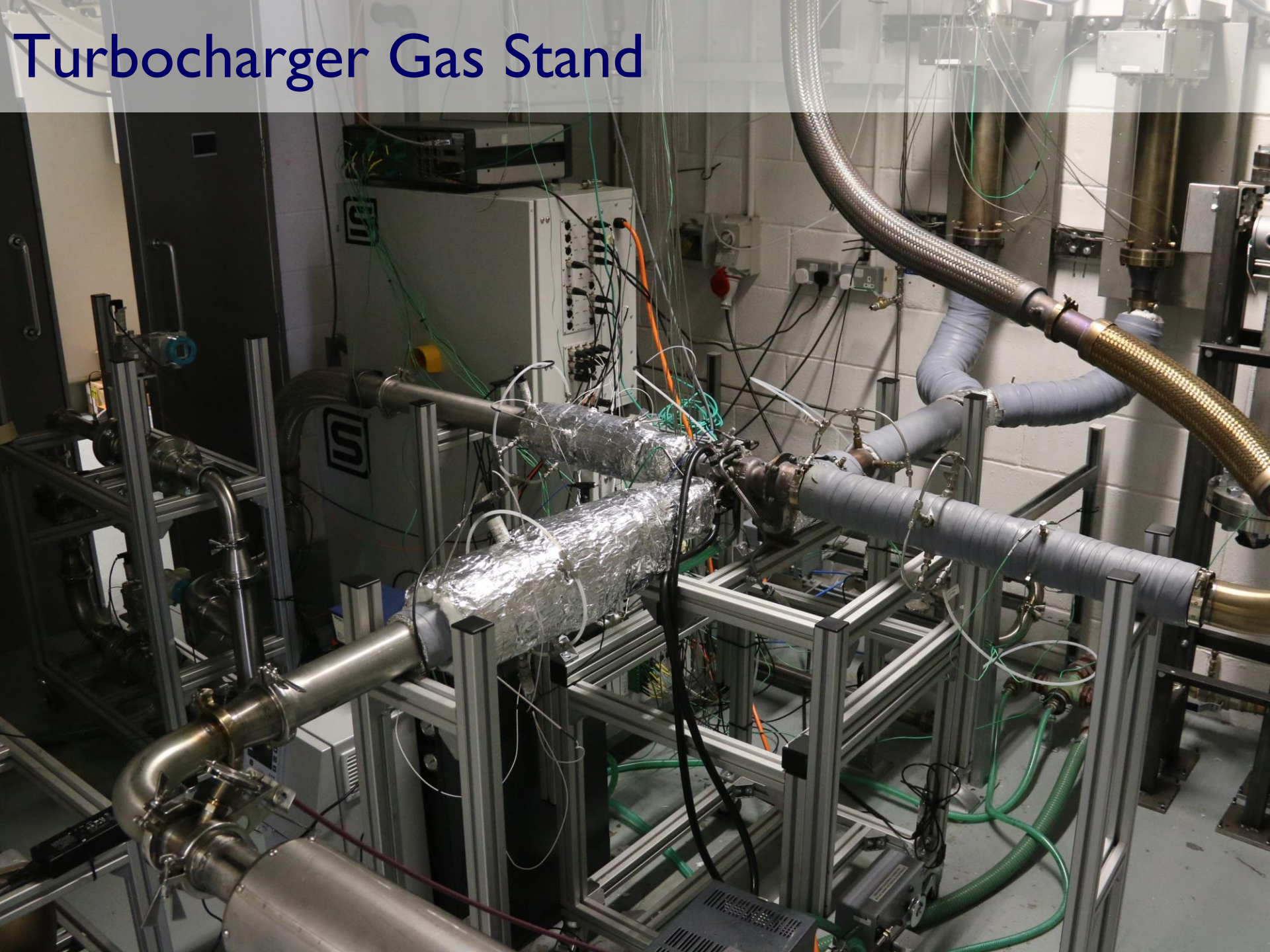
Ultraboost – Extreme downsizing



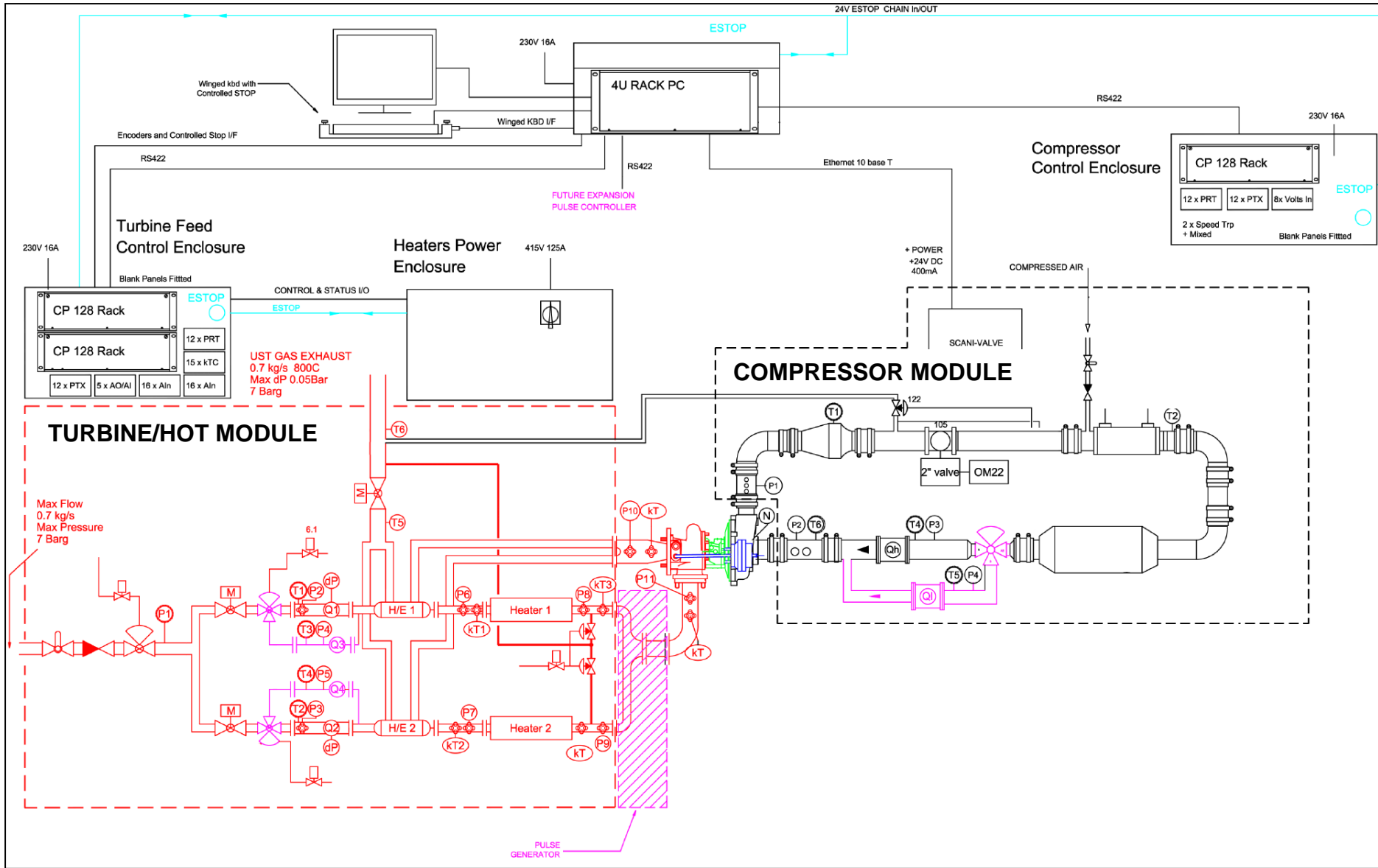
Electric Machine Test Facility



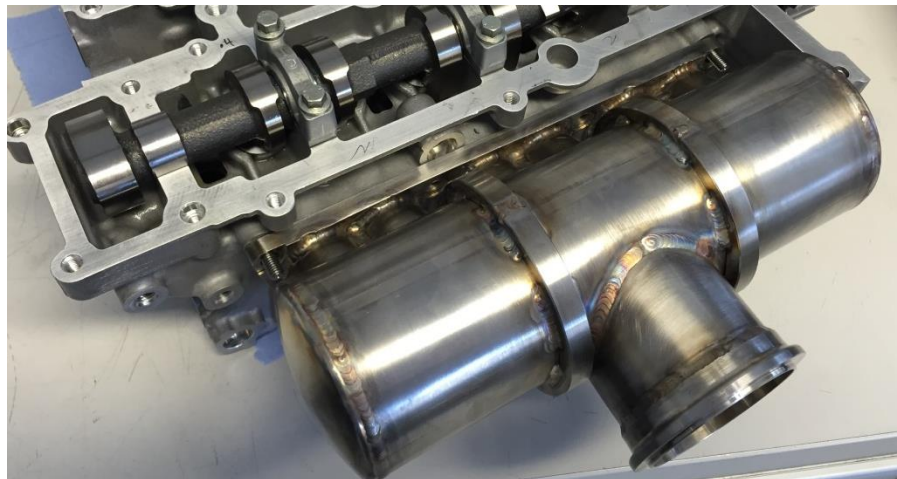
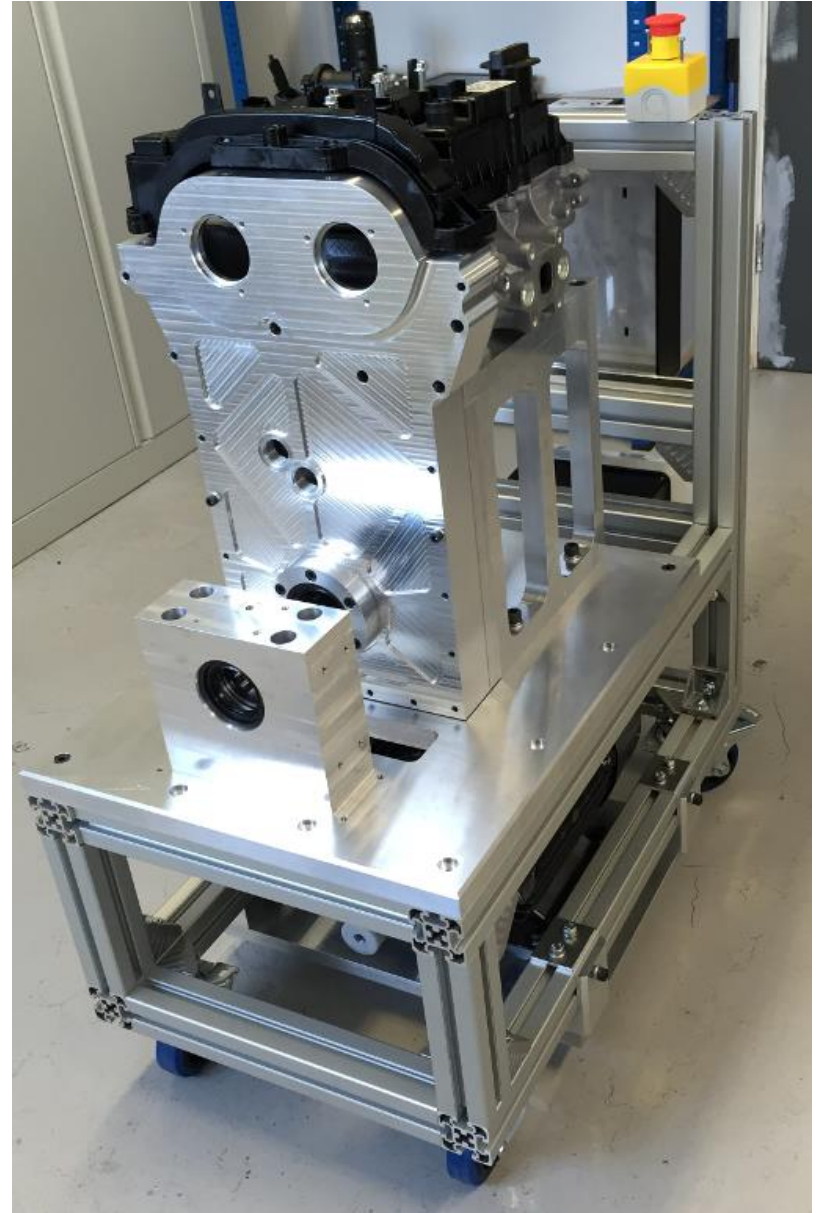
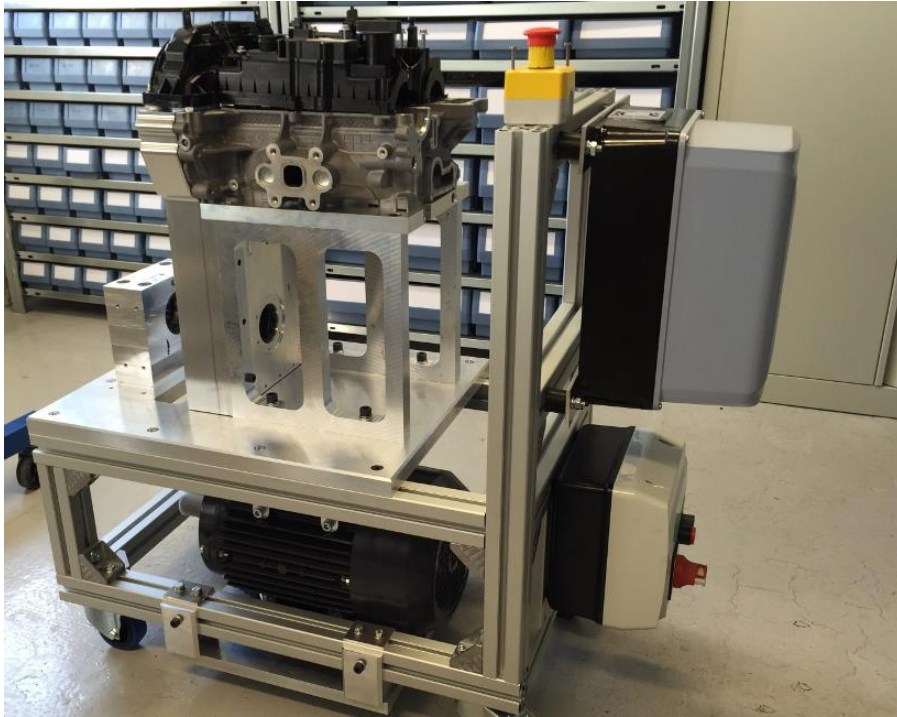
Turbocharger Gas Stand



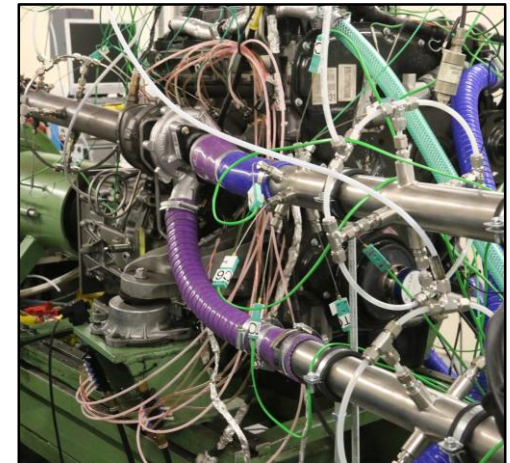
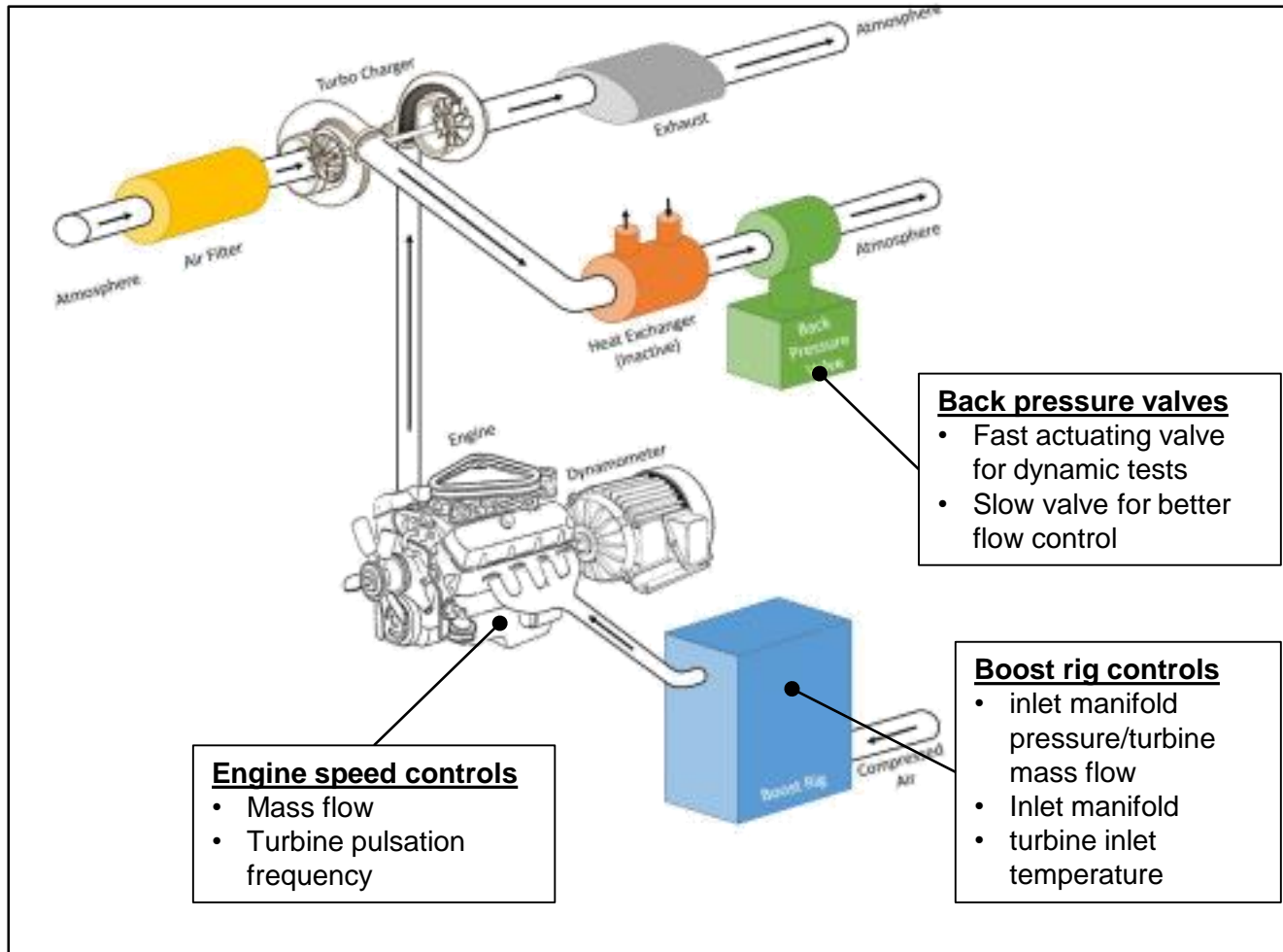
Turbocharger Test Facility



Pulsating Flow Facility



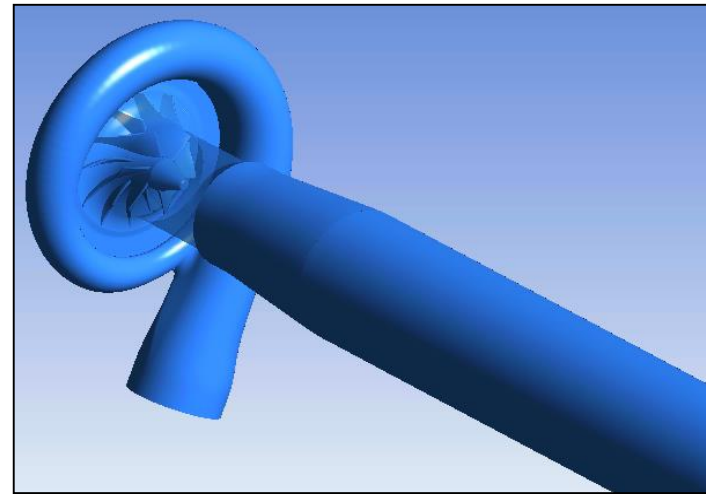
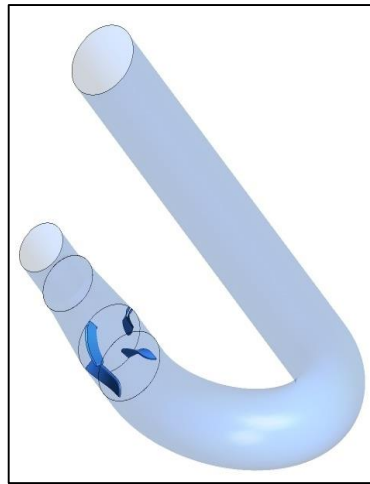
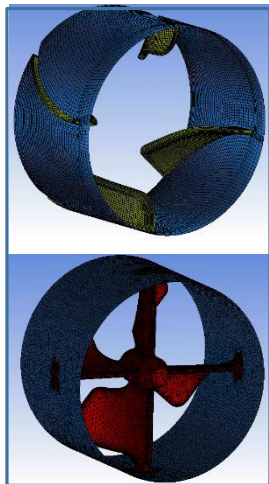
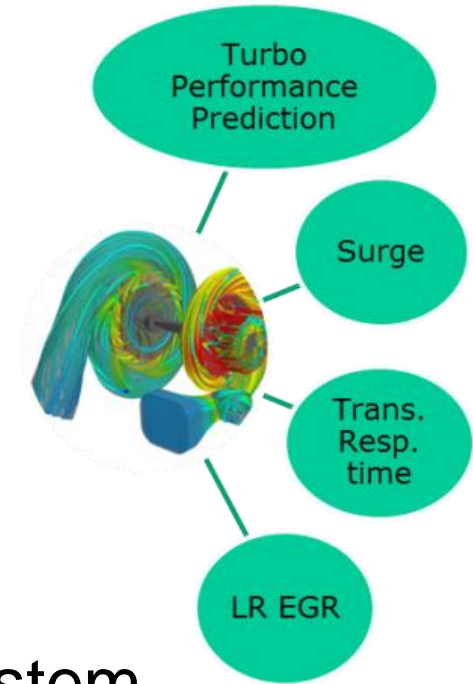
Engine driven gas-stand



- Engine based test stand allowing independent control of compressor/turbine
- External boosting system provides combustion air
- Backpressure valve controls compressor

Capabilities: Simulation

- Matlab/ Simulink
- 1D Gas-Dynamic Simulation
 - Ricardo-Wave
 - GT-Power
- Computational Fluid Dynamics
 - ANSYS CFX
 - CD-ADAPCO, Star CCM+
- Access to University of Bath HPC system



Centre for Low Emissions Vehicle Research (CLEVeR)



Overview of Capabilites

Background

- Facility initially established through £1million EPSRC grant in 1997
- 15 years successful collaborative research
- Developed tools and techniques to improve testing precision, notably in partnership with BP, Ford
- EPSRC Equipment grant in 2014 allowed £2.5 million investment to modernise the facility
- **Bridge the gap between the real world and the laboratory**

Scientific aim

- **Closing the gap between real world vehicle operation and the laboratory**
- This requires three key facets, **precision, flexibility and data availability**
- when combined, these properties enable observation of the interactions between real usage factors and the widest possible range of new technologies.
- This capability is needed to maximize the benefits offered by novel powertrain technologies and to develop tools and techniques to address real world performance challenges

Areas of Scientific Activity

- Future Fuels
- Next Generation EV, HEV
- Real World Emissions, Driver Behaviour and Styles
- Vehicle Systems Integration and Improved Controls

Centre for Low Emissions Vehicle Research

Four wheel drive dynamometer

Robot driver with real driving characteristics and direct mode for mapping

Wheel torque measurement and control

Comprehensive raw emissions measurements

In cylinder measurements

Battery emulation and EV instrumentation

Full PCM access

-10 to +50C temperature control

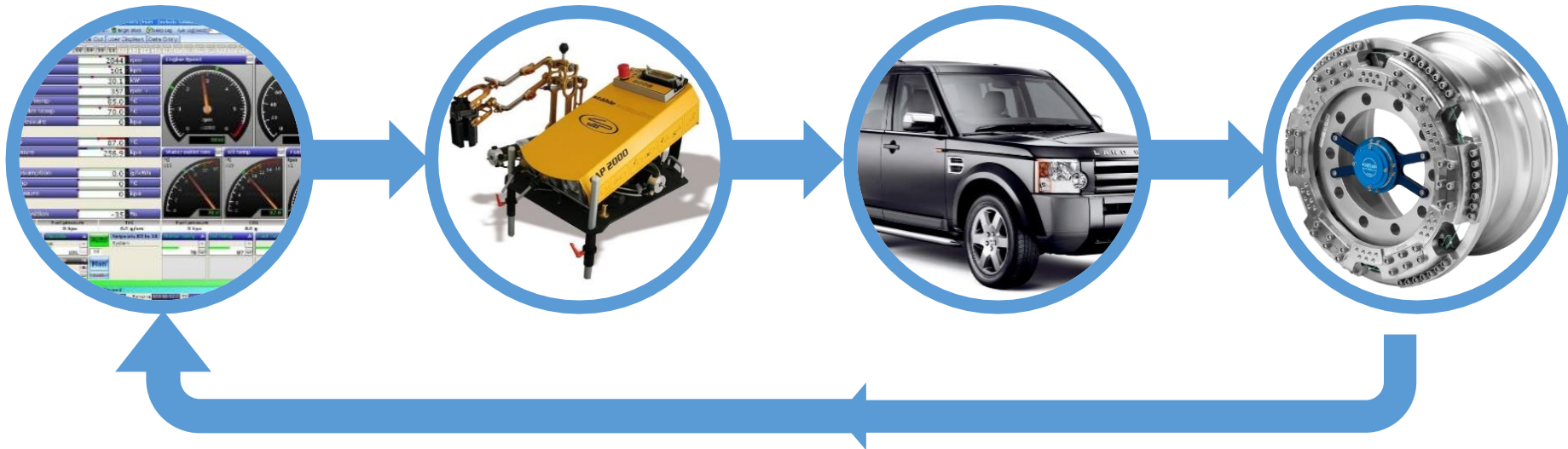
Full frontal area road speed air flow

Humidity control, Combustion air conditioning

Altitude simulation?

Operating point control options

1. Vehicle model, tractive effort & rolls speed feedback – **business as usual**
2. Vehicle and tyre model, wheel torque & speed feedback – **high precision**
3. Vehicle, tyre, transmission model - engine torque & speed feedback – **future aim**



Access and Charging Model

- Target access split is 75% academic, 25% industrial users, access allocated according to priorities set by Management Board to encourage high quality science, collaboration, impact and innovation.
- 12 weeks/year for business
 - 4 weeks for SMEs, part funded by voucher initially
 - 8 weeks for larger companies
- 32 weeks for academic use
 - 6 weeks for academic groups/trials, part funded by voucher initially
 - 28 weeks for longer term research programmes @ FEC

Furture plans

- **New Institute for Powertrain Systems** in the planning stage
 - Designed to allow improved academic/industrial collaboration
 - Improved training for undergraduates, masters and PhD
 - Co-location of industrial collaborators
 - Aligned with APC aim to build UK automotive infrastructure
 - Allows us to rationalise and expand our facilities

Contact

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