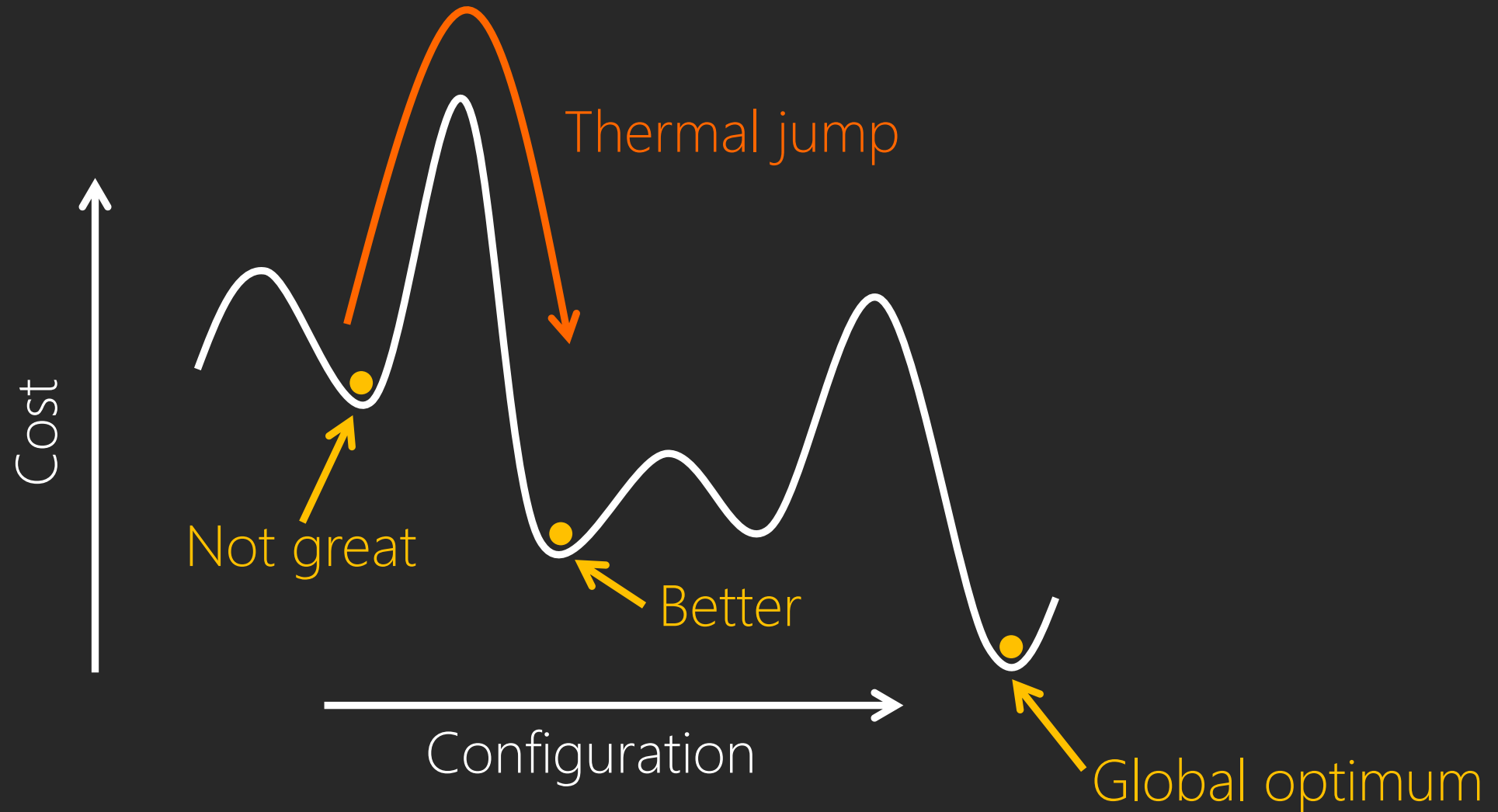# Quantum Inspired Optimisation in Healthcare
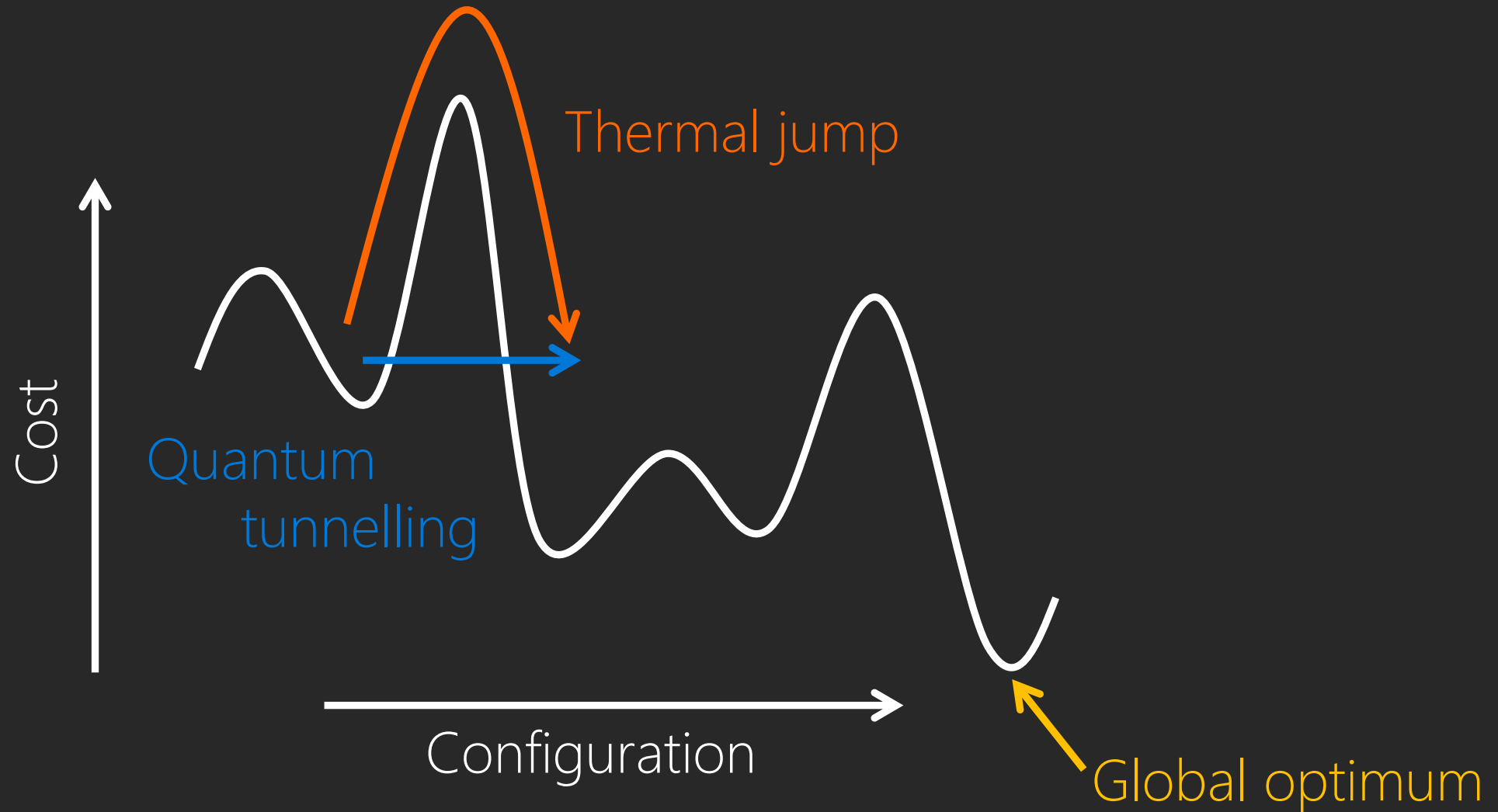
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Quantum Inspired Optimisation

Quantum Inspired Optimisation

Case Study: MRI Pulse Sequence Optimisation
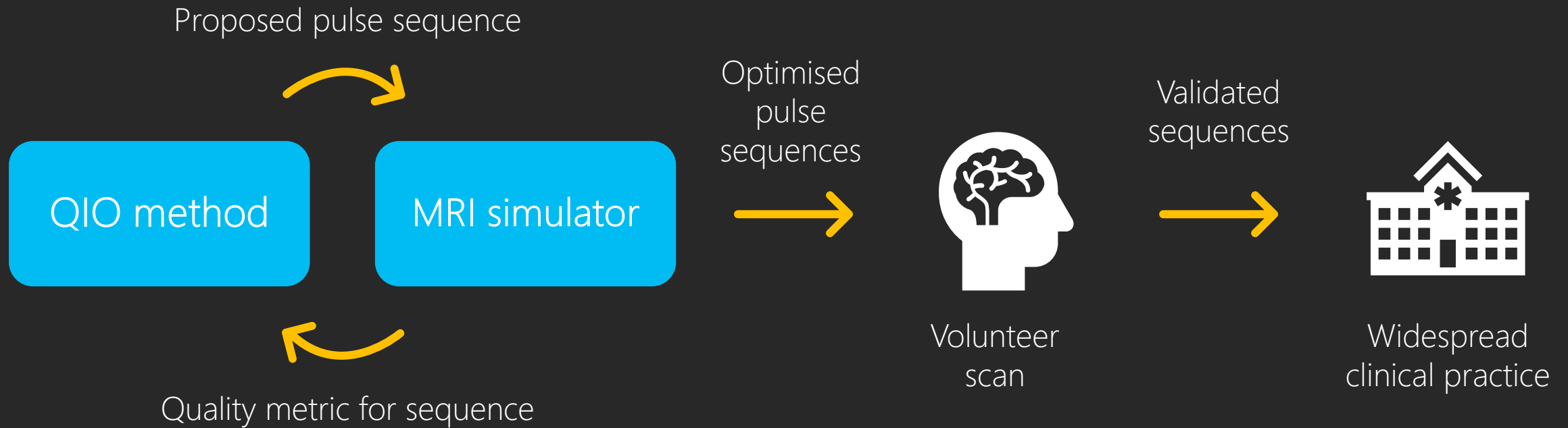
Traditional MRI:

Plot tissue parameters (T1, T2) extracted by curve-fitting magnetisation vs. time data

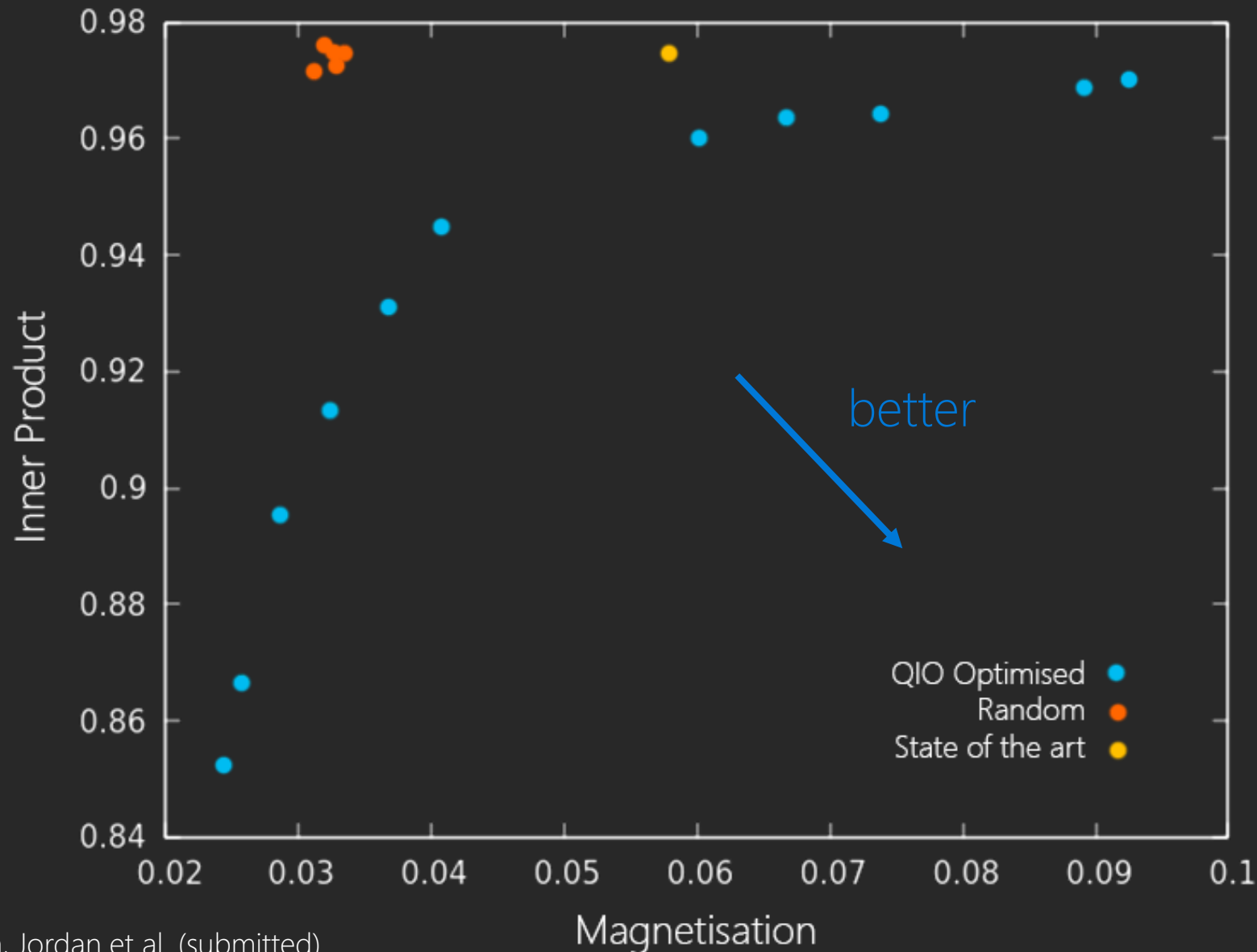## Magnetic Resonance Fingerprinting:

Deduce tissue parameters by pattern-matching measured data against dictionary of simulated tissues

- Robust

- Quantitative

- Opens big design space for pulse sequences

Pulse Sequence Generation Pipeline

Proposed pulse sequence

| QIO method | MRI simulator |

Quality metric for sequence

Optimised pulse sequences

Volunteer scan

Validated sequences

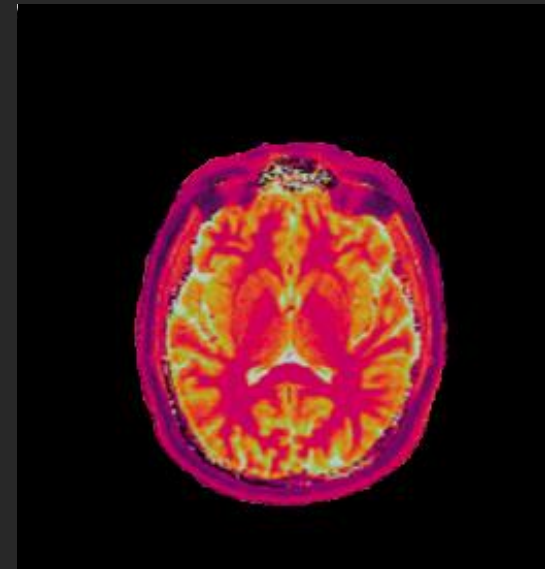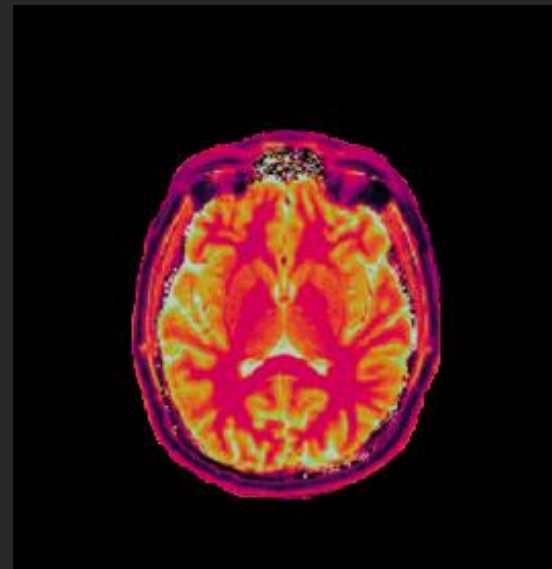Widespread clinical practice

Results In Silico

Optimise for:
- Large magnetisation
- Small inner product

Results In Vivo
(preliminary)

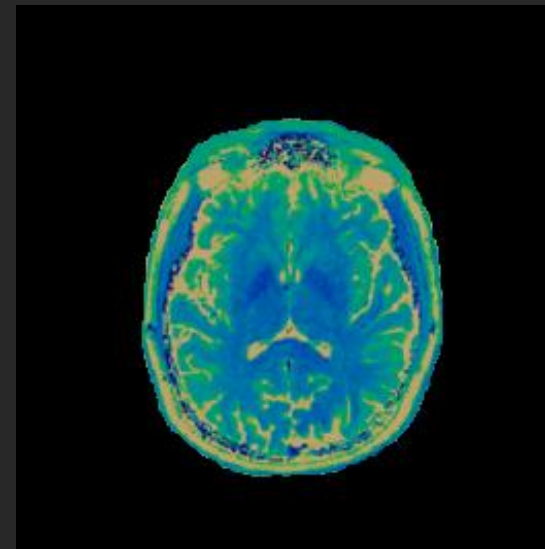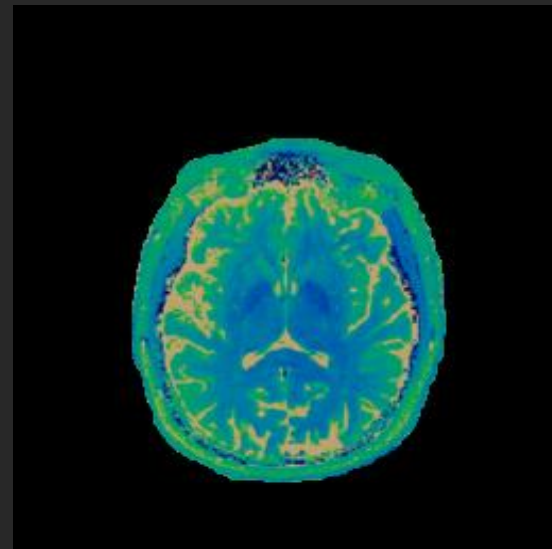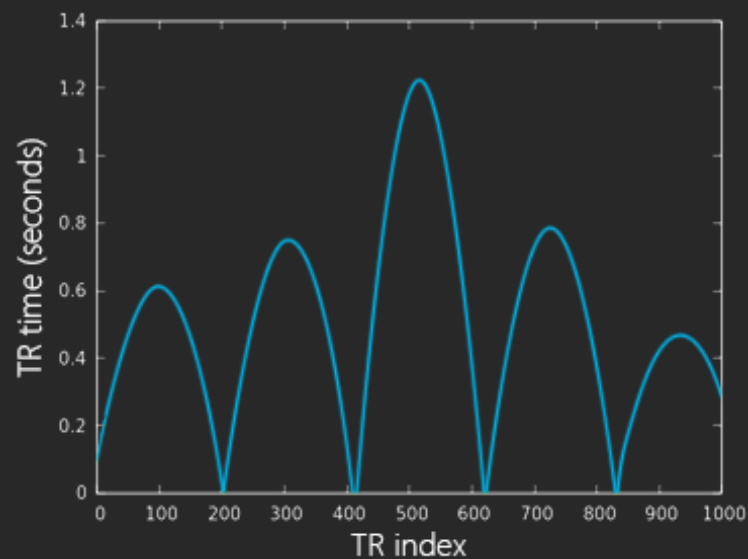|	State of the Art	QIO Generated
T1		
T2		
	35 seconds	11 seconds

Ma, Jordan et al. (submitted)

Algorithm-driven Insight

Human Experts

QIO

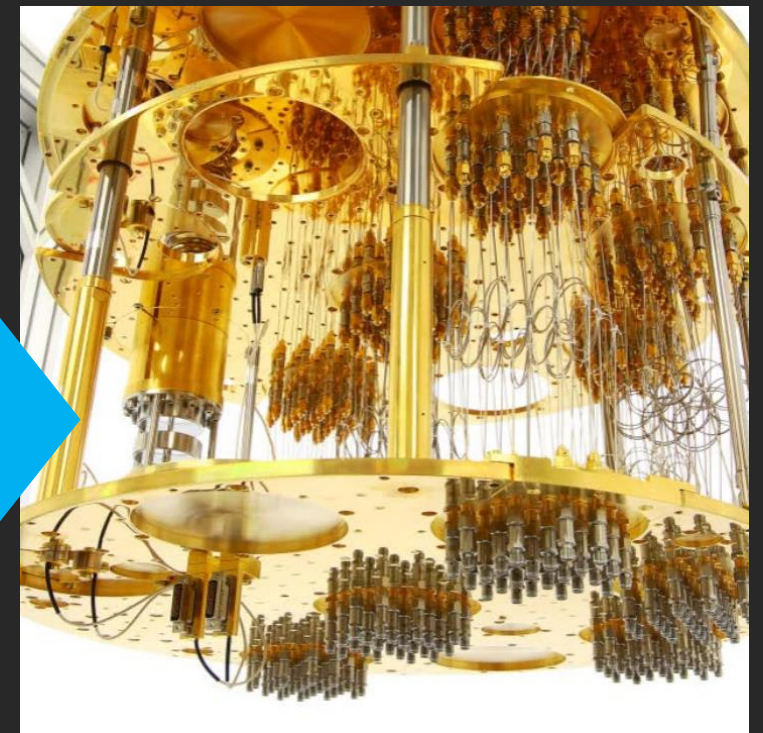Ma, Jordan et al. (submitted)
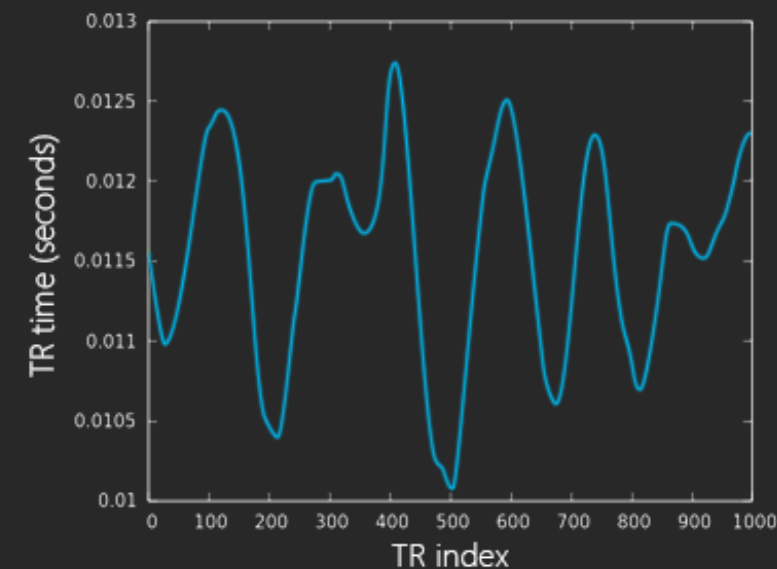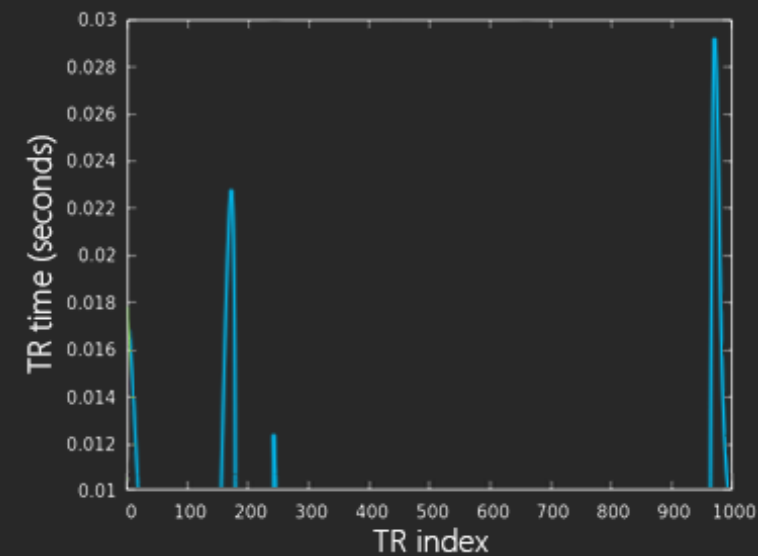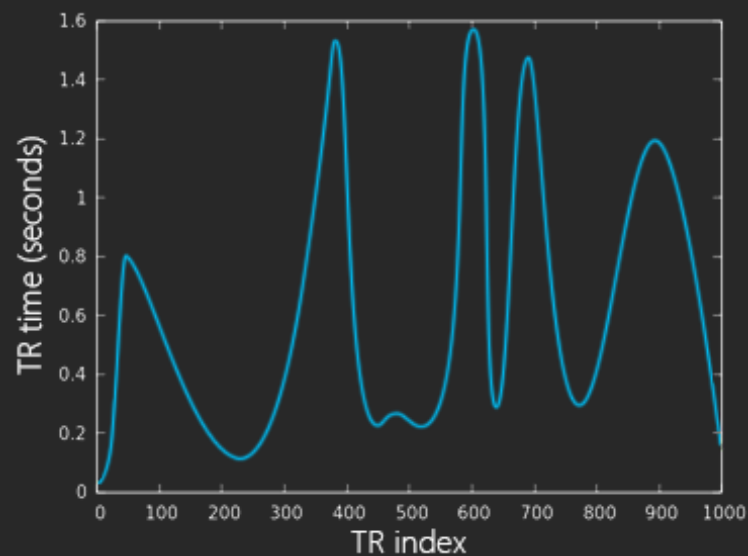
Hardware Evolution

Today | Future

Prototype on CPU

Port to FPGA/GPU

Run on quantum hardware
(quadratic speedup)

QIO: Industry Scenarios

Automotive:

Vehicle routing & logistics ([Ford](#))

Air traffic control

Other travelling salesman problems

Manufacturing/Energy:

Power grid management ([DEWA](#))

Shop floor optimisation, process optimisation, job shop scheduling

Network/chip design, circuit fault diagnosis

Chemical, oil & gas

Material discovery

Government:

City planning

Routing traffic/pedestrians in emergency scenarios (catastrophe planning)

Public transport scenarios

Health:

MRI pulse sequence optimisation ([CWRU](#))

Health worker shift scheduling

Ambulance routing

Finance:

Risk modelling optimisation scenarios ([WTW](#))

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