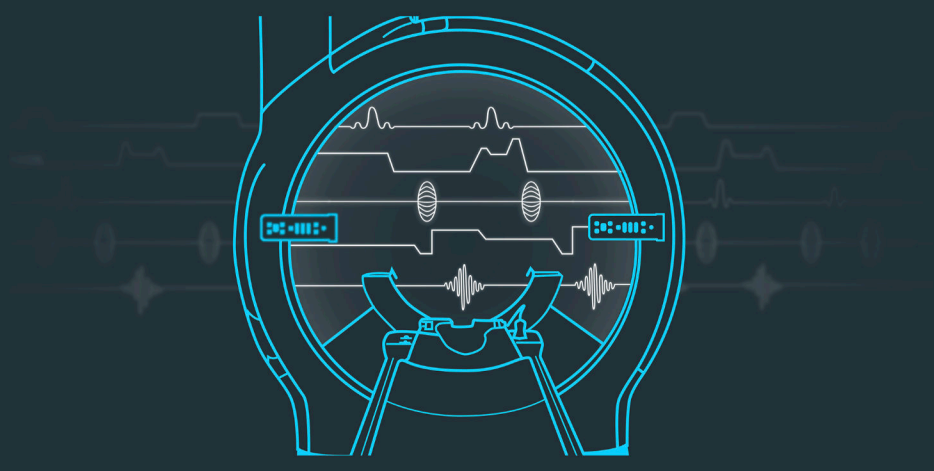
Qruise expands into magnetic resonance with new simulation and control software, Resonance

29. April 2025



Resonance uses model learning and digital twins to accelerate pulse development and enhance performance.

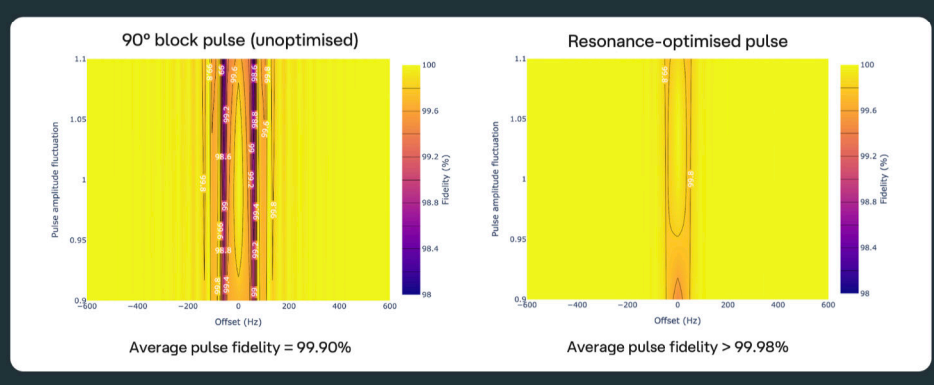
Saarbrücken, Germany | 29 April 2025 – Today, Qruise announced the release of Resonance, a new software platform for modelling and enhancing magnetic resonance (MR) systems. Building on core technologies originally developed for quantum computing, Resonance aims to tackle the key challenges in magnetic resonance imaging (MRI), nuclear magnetic resonance (NMR), and electron paramagnetic resonance (EPR).

Since its founding in 2021, Qruise has built a reputation for delivering advanced tools for quantum system modelling and control. Its flagship platform, QruiseML, is used by R&D teams to design high-fidelity quantum gates to characterise systems across all major quantum computing platforms. Resonance builds directly on this foundation, adapting these proven tools to the specific physics and hardware constraints of MR systems.

The timing of this expansion is significant: MR technologies are powerful for probing physical, chemical, and biological systems; however, they continue to face challenges such as low signal sensitivity, long acquisition times, and high operational costs. All of these hinder widespread and timely use. Due to the complex physics involved in spin control of MR systems, standard approaches often fail to produce spectrally and spatially precise pulses that are robust to inhomogeneities and system drift.

Resonance looks to address these challenges with an end-to-end solution that combines full system modelling with advanced optimisation algorithms. By integrating pulse-level design with a highly accurate digital twin of the relevant MR system, Resonance offers a highly realistic, resource-efficient simulation environment. This enables users to design and test high-fidelity, robust pulse sequences without relying on physical access to a lab or scanner, thereby accelerating the development of advanced imaging and spectroscopic protocols.

Using physics-based model learning, Resonance accurately determines system parameters from experimental data to reconstruct a high-fidelity digital twin. The digital twin can be leveraged to optimise system parameters and pulse sequences to achieve maximum performance. By generating an error budget, the software identifies key sources of error – such as magnetic field fluctuations or hardware imperfections – and adapts pulses and fields in real-time through closed-loop optimisation. All of this is seamlessly integrated into a user-friendly interface for intuitive and efficient operation.



Resonance-optimised pulses (average fidelity > 99.98%) are more robust to B_0 and B_1 fluctuations than conventional block pulses (average fidelity = 99.90%).

The impact of Qruise's approach is already visible: RF pulses designed using Resonance have demonstrated greater spectral and spatial selectivity and higher robustness than standard block pulses. In hyperpolarised ^{13}C MRI experiments, for example, Resonance-optimised pulses preserved fidelity across a wider range of field deviations and performed better than conventional non-selective sequences.

"With today's launch of Resonance, we are unveiling the first milestone in Qruise's strategic roadmap: creating a general-purpose AI Physicist that can tackle any R&D field defined by challenging physics," said Shai Machnes, CEO of Qruise. "Magnetic resonance is a mature quantum technology with a proven advantage and broad public impact. Building on our success in quantum computing and sensing, we're now bringing state-of-the-art quantum-control advances back to the domain that pioneered them. Resonance equips scientists and engineers working in MRI, NMR, and EPR with the tools needed to sharpen spatial and spectral resolution, accelerate scans, operate at lower fields, and increase robustness to inhomogeneities and transients while adapting to novel contrast agents and emerging protocols. We look forward to collaborating with academic labs, startups, and established companies to push magnetic resonance technology forward."

For more information about Resonance or to become an early adopter, visit the product page or contact our team directly.

←All news

European Innovation Council

Funded by the European Union. Views and opinions expressed are however those of the author(s) only and do not necessarily reflect those of the European Union or the European Innovation Council and SMEs Execitve Agency (EISMEA). Neither the European Union nor the granting authority can be held responsible for them. Grant agreement No 101099538