



Press release

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Pack Quantique Ile-de-France: to explore the potential of quantum computing, the region and its partners support the aeronautics, space and defence (ASD) industries

As part of the Pack Quantique (PAQ), initiated at the end of 2020, the Ile-de-France region will fund three new initiatives aimed at exploring the advantage of quantum computing for the needs of ASD industries. These involve both major industry players (Airbus, MBDA and Naval Group), leading academic players (ONERA and Inria) and innovative technology start-ups (Pasqal, Quandela and Alice & Bob) to provide innovative solutions to concrete problems.

In partnership with Teratec, GENCI and Le Lab Quantique, the Paris Region is strengthening its leadership in acquiring the quantum advantage. Three new initiatives have been launched to promote the adoption and development of quantum computing by economic players, manufacturers and start-ups in the Paris Region and beyond.

Three major companies in the aeronautics, space and defense (ASD) sectors will benefit from the expertise of Quandela, Pasqal, and Alice & Bob, three startups specialized in the development of quantum computing technologies.

These young innovative companies receive funding from the region in order to explore the potential of their quantum technologies on the use cases proposed by industrial companies, which today use digital simulation codes that are particularly demanding in terms of computing power.

In this context, the use of quantum computing technologies aims to facilitate the design of devices that are more powerful, more robust and more efficient in their energy consumption.

- The first project in this new series of the Quantum Pack is led by the start-up Pasqal and ONERA. Proposed by Airbus, it concerns an analysis of the behaviour of the airflow around the aircraft and the aerodynamic forces acting on its surfaces and is entitled "Quantum Advantage for the resolution of Partial Differential Equations" (AQUAEDP). On today's High Performance Computing (HPC) machines, these calculations take hours or even days. Quantum machines offer an opportunity to drastically reduce these computation times but imply the adaptation of algorithms and the redesign of computation codes.

Pasqal will propose a hybrid classical-quantum algorithmic approach to significantly improve the accuracy of the results obtained. It will rely on its expertise in the field of quantum neural networks (QNN). This approach will be tested on a 100 qubit analog quantum computer, which will be made available to researchers in the near future via the national [HQI](#) platform.

According to Marc Morere, Airbus Research & Innovation Manager, "*this initiative will enable Airbus to drastically improve the accuracy of its models*", while "*offering ONERA the opportunity to guarantee the sustainability of this new know-how in the field of quantum computing*", (underline Alain Refloch and Julie Amoyel, respectively in charge of High Performance Computing and Corporate Communication).

"*By combining Airbus' and ONERA's expertise in aeronautics with our own in quantum mechanics, using our proprietary solvers for differential equations, we collectively have a key tool for the aerospace and aviation industries,*" said Benno Broer, Chief Commercial Officer of Pasqal.

- The second project in this new series involves Quandela, ONERA and MBDA. It deals with the control of the physico-chemical phenomena that govern combustion. This control becomes particularly difficult when one increases the number of chemical components involved, as well as the number of parameters (geometry, for example) to be taken into account. This is one of the keys to improving the robustness and thermodynamic efficiency of engines and reducing polluting emissions. The subject seemed promising to MBDA, ONERA and Quandela, which decided to investigate it jointly within the framework of the "Quantum Advantage for the Design of Engines in Aeronautics" (AQCMA) project. Thanks to its Perceval simulator, as well as its 6-qubit photonic NISQ (*Noisy Intermediate-Scale Quantum*) chip, the start-up Quandela will experiment with a global and hybrid classical-quantum approach to improve the accuracy of complex models.

Valérien Giesz, CEO and co-founder of Quandela, said: "*Our discussions with ONERA researchers have made us aware of the many obstacles they face in simulating fluids in combustion chambers. To this end, the AQCMA project will allow us to explore the potential benefits of noisy photonic quantum processors to solve real-world problems.*"

- The third project is entitled "*Quantum Machine Learning with Cat Qubits*" (QML Cat). It explores, on the initiative of Naval Group, Inria and Alice & Bob, the advantage that partially corrected quantum technologies (or "cat qubits") could bring in the field of *Machine Learning*. The latter makes it possible to make the most of the considerable volume of data created by the platforms of the ships designed by Naval Group to offer, among other things, predictive maintenance, obstacle classification or trajectory prediction services. Any trick that could increase the efficiency of NISQ computers will be an asset in the demonstration of increasingly realistic use cases.



While for Théau Péronnin, CEO and co-founder of Alice & Bob, "it now seems clear that *Machine Learning* algorithms will benefit from a quantum advantage", for Romain Kukla, in charge of Naval Group's quantum technology research program, the "objective of this project is to verify that the associated quantum *Machine Learning* routines are relevant and can bring algorithmic acceleration to these different use cases". "The particular resistance to certain errors offered by Alice & Bob's quantum processor could lead to much greater efficiency," says Harold Ollivier, a researcher at Inria's Quantum Tech.



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About us

About the Quantum Pack of the Ile de France region



In partnership with Teratec, GENCI and Le Lab Quantique, the Ile-de-France region is strengthening its leadership in acquiring the quantum advantage by promoting the appropriation and development of quantum computing by economic players, manufacturers and startups. This three-year program will help

strengthen the leadership of the Paris Region, and more broadly that of France, in the field of quantum computing on a European scale, and improve the international competitiveness of local companies. It also aims to promote the dynamism and attractiveness of the Paris Region to attract new companies.

About GENCI

Created by the public authorities in 2007, GENCI (Grand Equipement National de Calcul Intensif) is a major research infrastructure, a public operator aiming to democratize the use of digital simulation through high performance computing associated with the use of artificial intelligence and quantum computing to support French scientific and industrial competitiveness.

GENCI has three missions:

- Implementing the national strategy for equipping French scientific research with intensive computing resources associated with Artificial Intelligence, storage, massive data processing and quantum computing, in conjunction with the three national computing centres (CEA/TGCC, CNRS/IDRIS, France Universités/CINES)



- Support the realisation of an integrated HPC ecosystem at national and European level and contribute to the strengthening of European computing capacities in the framework of the PRACE infrastructure and the EuroHPC initiative
- Promote digital simulation and high performance computing to academic research and industry

GENCI is a civil company owned 49% by the French government represented by the Ministry of Higher Education and Research, 20% by the CEA, 20% by the CNRS, 10% by the universities represented by France Université and 1% by Inria.

About Teratec

Teratec is a European competence centre for high-performance digital technologies, bringing together more than ninety companies, research laboratories and universities. It was created in 2005 on the initiative of major industrialists with the aim of :

- Federating all the industrial and academic players, suppliers and users,
- Provide access to the most powerful systems,
- To promote and increase the attractiveness of the area by encouraging economic development.

The Teratec Quantum Computing Initiative (TQCI), launched in 2018, brings together industrial users, technology providers and research centres to develop skills in the field of quantum computing and to support its members towards a better understanding of what the use of quantum technologies can bring them. <https://teratec.eu>

About Le Lab Quantique

Le Lab Quantique is an association under the law of 1901 whose mission is to promote quantum technologies in France and internationally. In order to create synergies between public and academic actors, large groups and startups, Le Lab Quantique organizes events (workshops, hackathons, scientific and artistic exhibitions) bringing together all the actors of the ecosystem. It produces content to promote quantum technologies and help identify use cases, coordinates regional and national funding initiatives and supports workforce development by connecting innovation and talent.

The board of the association is composed of members from QC Ware, Pasqal, Quantinuum, Quantonation, BMW Group and QuantX. The association has also received the support of leading French industrialists as well as public institutions such as the BPI.