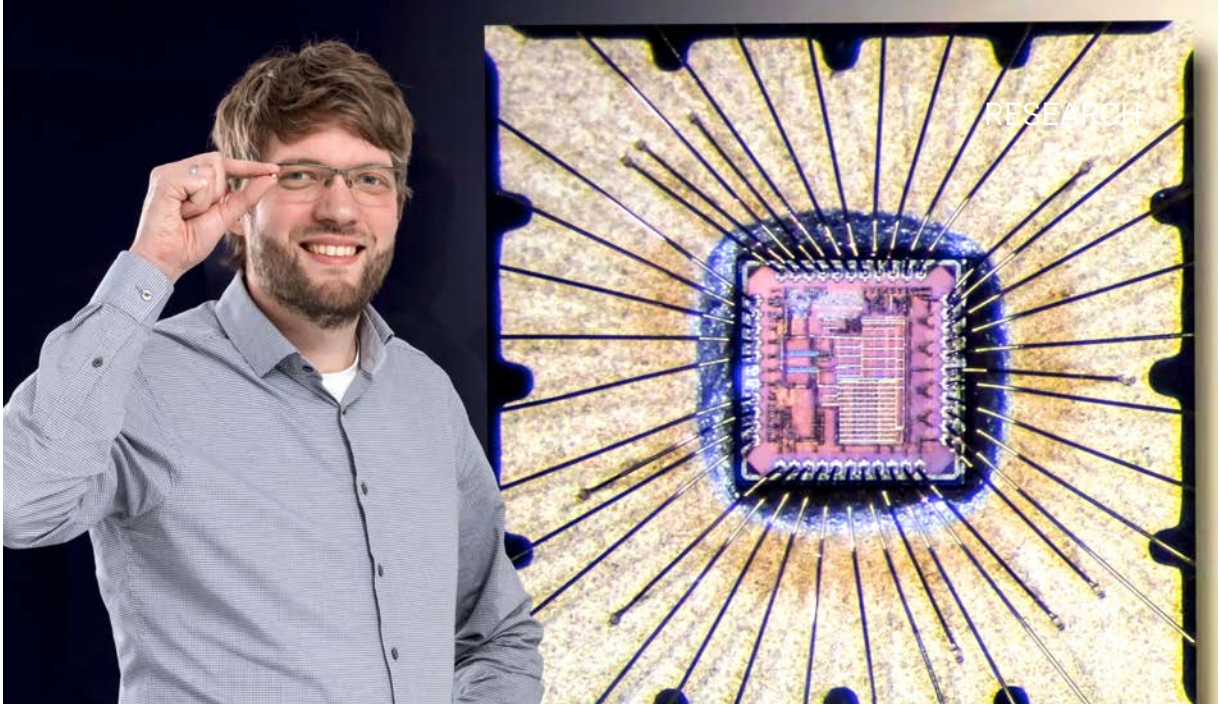

THIS IS HOW SMALL
Dr. André Zambanini's chips are for qubit control. They have an edge length of only one millimetre and are barely thicker than paper.

DR. ANDRÉ ZAMBANINI

DESIGNER IN THE QUANTUM REALM

Tiny electrical circuits for the freezing cold: physicist Dr. André Zambanini (ZEA-2) develops the control system for quantum chips. – **TEXT** Janosch Deeg –

The chip is barely bigger than a grain of sand. On it: thousands of electrical wires that are up to a thousand times thinner than a human hair. "We want to use these tiny devices to control qubits, which are to drive computing power in quantum computers almost immeasurably in the future," says Dr. André Zambanini, team leader at ZEA-2. Together with around 20 employees, the 37-year-old physicist develops the necessary integrated circuits, which must not be affected by extreme cold. "This is because qubits need minus 273 degrees Celsius. At the same time, you still have to control each of them individually with wires," he explains. This is still quite feasible with a handful of qubits. "But if you want to connect millions of them at some point, there is a real space problem!" Zambanini's miniature controller is supposed to solve it.

"Totally new ground"

The Aachen native already developed chips for a particle detector in his doctoral thesis at IKP-1. In 2015, he changed to ZEA-2 to join his current team – which was just being formed at the time and which he has been leading since 2018. "By then, I had eight years of leadership experience as a deputy platoon leader with the Federal Agency for Technical Relief, the THW," says the father of two. "As people volunteer for THW, you have to strengthen their self-motivation." This has also shaped his leadership style at Forschungszentrum Jülich, says the 37-year-old. "My credo for the team: it isn't 'have to', it's 'want to'! This helps us to break totally new ground technically in many respects, day after day."

Developing the complex design of the chips takes one to two years. The data then goes to the chip factory for production. A particular hurdle since 2020 has been the global semiconductor crisis. "With our small order quantities, we actually only need very little of the rare goods. However, the waiting lists are so long that the production time has now almost doubled to six months. Special requests resulting from our research work are also no longer dealt with," says Zambanini. Still, he remains confident: "Manufacturing is still possible. And when our sixth quantum control chip so far arrives in August, that will be really exciting again!" This is the case also because there is always the danger that the subsequent tests in the laboratory at ZEA-2 and in cooperation with the PGI will uncover a conceptual error. "But we learn a lot from every mistake. This is how we are getting closer and closer to powerful quantum computers!"

MORE ON THIS TOPIC IN THE "EFFZETT" MAGAZINE
go.fzj.de/fz-quantum