

# Quantum Computing Algorithms: Introduction and Data Fusion Examples

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## INTENDED AUDIENCE

The intended audience are engineers, PhD students, or people who are working in the field of data fusion, robotics and target tracking interested in the current state, example methods and algorithms, and the potential of quantum computers for the field of information processing.

## DESCRIPTION

Quantum algorithms for data fusion may become game changers as soon as quantum processing kernels embedded in hybrid processing architectures with classical processors will exist. While emerging quantum technologies directly apply quantum physics, quantum algorithms do not exploit quantum physical phenomena as such, but rather use the sophisticated framework of quantum physics to deal with “uncertainty”. Although the link between mathematical statistics and quantum physics has long been known, the potential of physics-inspired algorithms for data fusion has just begun to be realized. While the implementation of quantum algorithms is to be considered on classical as well as on quantum computers, the latter are anticipated as well-adapted “analog computers” for unprecedentedly fast solving data fusion and resources management problems. While the development of quantum computers cannot be taken for granted, their potential is nonetheless real and has to be considered by the international information fusion community.

## BIO OF THE PRESENTERS

**Felix Govaers** received his Diploma in Mathematics and his PHD with the title “Advanced data fusion in distributed sensor applications” in Computer Science, both at the University of Bonn, Germany. Since 2009 he works at Fraunhofer FKIE in the department for Sensor Data Fusion and Information Processing where he was leading the research group “Distributed Systems” for three years. Since 2017 he is the deputy head of the department “Sensor Data and Information Fusion”. The research of Felix Govaers is focused on data fusion for state estimation in sensor networks and non-linear filtering. This includes track-extraction, processing of delayed measurements as well as the Distributed Kalman filter and track-to-track fusion. Felix Govaers is a senior member of the IEEE, where he serves for the IEEE Transactions on Aerospace and Electronic Systems and as an Associate Editor since 2014. He is member of the ISIF Board of Directors, and since 2020 Felix Govaers is a Distinguished Lecturer for the IEEE.

**Martin Ulmke** received the Diploma degree and the Ph.D. (Dr. rer. nat.) degree in physics from the Aachen Technical University (RWTH), Germany, in 1991 and 1995, respectively. He has been employed as a Scientist with Fraunhofer FKIE (former FGAN), Department Sensor Data and Information Fusion (SDF), since 2001. He is head of the research group “Distributed Sensor Systems” at SDF. From 1995 to 1998, he was a Research Associate in condensed matter theory with the University of California, Davis, CA, and the University of Augsburg, Germany. From 1998 to 2001, he has been employed as a Systems Engineer with MTU Aero Engines, Munich.