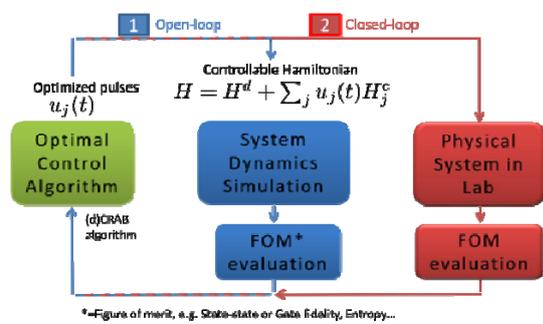


Optimal Quantum Engineering 4GS		Start Date: November 1 st 2014
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 <p>*Figure of merit, e.g. State-state or Gate Fidelity, Entropy...</p>		<p>Abstract: We have implemented the dCRAB algorithm[1], previously developed at the Institute of Complex Quantum systems in Ulm, in a generic, multi-purpose software suite called RedCRAB, which allows for remote and facilitated world-wide access to our servers running 24/7. Consequently, arbitrarily many scientists can use its capabilities in tailoring dynamical pulse sequences (i.e. time dependent degrees of freedom to be adjusted in favor) for a wide spectrum of physical systems. Applications are therefore not limited to quantum information protocols, as needed for example for metrology and sensing, but also cover different branches of physics, as energy science, AMO physics, and condensed matter. To achieve experimental feasibility, a series of features such as subsequent reevaluation steps, incorporation of standard deviation resulting from measurement and fault tolerance, had to be added to the bare optimization algorithm. Besides experimental application, theorists are benefiting as well, as they can test and optimize various systems in the open loop optimization branch of the software. RedCRAB has already been successfully employed in synthesizing a single qubit gate in the NV center [2] and enhancing the evaporative cooling ramps needed to achieve a BEC [3]. Current ongoing projects include fast transport of neutral atoms in an optical lattice experiment (in collaboration with Bonn University) and state preparation of Rydberg atoms in collaboration with Harvard University. On the theoretical side, we could recently employ optimal control to enhance the visibility of the Dynamical Casimir effect in a parametrically driven system in collaboration with Insubria University [4] and we are currently working on the identification of the effective dimensionality of quantum systems in continuous space, extending a previous work of one of the PIs [5]. Future development of RedCRAB will be a graphical user interface and improved thread handling on the server side.</p>
Recent results: <ul style="list-style-type: none"> • <i>Development of multi-purpose, remote-access optimal control software suite RedCRAB</i> • <i>Test and successful implementation on various experiments and theoretical projects</i> • <i>Theoretical analysis on system dimensionality and the context of optimal control</i> • <i>Contributions (talk, poster) to nine international conferences, workshops and exchange meetings</i> 		Publications: <ul style="list-style-type: none"> [1] N. Rach, M. Müller, T. Calarco, S. Montangero. PRA 92, 062343 (2015) [2] F. Frank, T. Unden, J. Zoller, R. Said, T. Calarco, S. Montangero, B. Naydenov, F. Jelezko: arXiv: 1704.06514 [3] R. Heck, O. Vuculescu, J. Sorensen, J. Zoller et. al. arXiv very soon [4] F. Hoeb, F. Angaroni, J. Zoller, T. Calarco, G. Strini, S. Montangero, G. Benenti. arXiv: 1706.00048 [5] S. Lloyd, S. Montangero. PRL 113, 010502 (2014)
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