Creating an OPENQASM interface for the Pulser python library

Pascal is a Paris based company that manufactures neutral atom quantum processors. These processors place neutral atoms in a 2D or 3D array and use optical pulses to manipulate their states. Pasqal has published an open-source python library named Pulser which simulates the workings of their processors at the optical pulse level. This library allows the user to create an array of atoms, called the register, program a set of pulses and simulate the outcome. As the company primarily focuses on analog computations and their simulation, the goal of this BTR would be to focus on "digital" quantum computing and create an interface in Pulser for the simulation of quantum circuits. This interface would take OPENQASM code as an input and automatically generate the required register and pulses to simulate the circuit. The project would contain two main goals:

- Automatically generating a register of atoms based on the amount of qubits in the circuit and what types of quantum-gates are used. For a quantum gate that acts on multiple qubits to work, the atoms must be placed within a certain distance of each other in the register.
- Translating each standard OpenQASM quantum gate into their corresponding optical pulse automatically, and if multiple single-qubit gates are applied successively on the same qubit, simplify these into a single optical pulse.

Additionally if the previous two goals are completed, it would be interesting to benchmark and assess the utility of the implemented algorithms, leading to two secondary goals:
- Comparing different alogrithms used to create a register, and determine in which situations a specific algorithm would be optimal
- Find out in which situations, if any, the simplification algorithm is faster than just creating and implementing one pulse per gate.