Here we try to use a quantum superconducting qubit called transmon to experimentally realize quantum number generator.

- Issues faced, problem overcame, and future implications of the project:

Photonic systems are idea to simulate quantum systems since photon is truly quantum. However photon does not likely to interact with others. Superconducting qubit, however, can be used to represent a photon and quantum gates can be used as photonic devices. For example, a Hadamard gate is equivalent to a beam splitter.

Quantum mechanics promises to provide true random numbers.

An awesome protocol was by Anatoly Kulikov, et al PRL 119, 240501 (2017), where they use 3 first energy eigenstates of a transmon as a qutrit, coupled to a microwave cavity. Their protocol is not justified as device independent as the authors pointed out.

Here we try to use Qiskit pulse to create 3-level qubit gates to manipulate qutrit to realize theoretical protocol of the quantum random number generator as in fig 1 of the paper.

It took us half a day to learn Pulse, half a day to come up with the idea. Unfortunately, we could not implement it.

- How the project could benefit the quantum computing community

+ Simple protocol with only one transmon.
+ Turn the negativity of unwanted exited states to be positivity.
+ Tools for other important applications such as cryptography, Monte-Carlo simulation.
+ Run experiment on real hardwares on cloud such as IBM Quantum Experience.

- Why this is important for future research or applications:

The fact that superconducting quantum systems have anharmonic multilevel structure promises to increase computational power which 2-level states do not have.

Superconducting architecture could be use to simulate other architecture.