Expectation Values and Uncertainty

You have a system that consists of quantum particles with spin. On this system, you will perform a Stern-Gerlach experiment with an analyzer oriented in the z-direction.

Consider one of the different initial spin states described below:

A spin 1/2 particle described by:

1. $|+\rangle$
2. $\frac{i}{2}|+\rangle - \frac{\sqrt{3}}{2}|-\rangle$
3. $|+\rangle_x$

   A spin 1 particle described by:

4. $|0\rangle$
5. $|-1\rangle_x$
6. $\frac{2}{3}|1\rangle + \frac{i}{3}|0\rangle - \frac{2}{3}|-1\rangle$

- List the possible values of spin you could measure and determine the probability associated with each value of the z-component of spin.

- Plot a histogram of the probabilities.

- Find the expectation value of the z-component of spin.

- Find the uncertainty of the z-component of spin.