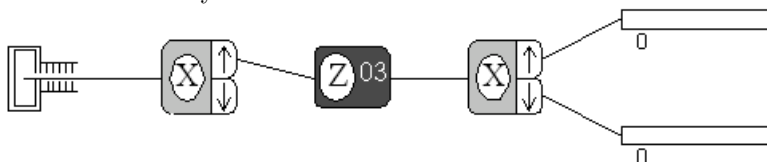# Unknown States From a Magnetic Field (Spin-1/2)

Make an unknown state using the following setup with a magnet in between two Stern-Gerlach analyzers:

Consider the magnet for now as a black box that transforms the input $|+\rangle_x$ state into a new state $|\psi\rangle$. Use <u>random</u> as the initial state and set the strength of the magnet to a number from 1-20 corresponding to the position of your computer in the lab. Use the last analyzer to measure the probabilities for the state $|\psi\rangle$ to have six possible spin projections along the three axes. Keep the first Stern-Gerlach analyzer and the middle magnet oriented as shown in the figure. Fill in the table on the worksheet and deduce the state $|\psi\rangle$, in terms of the $|\pm\rangle$ basis. Design an experiment to verify your results. From the results of the whole class, can you figure out what the magnet does?

State $|\psi\rangle$ made with magnet. B=_____

Probabilities	Axis		
Result	x	y	z
Spin up ↑			
Spin down ↓			