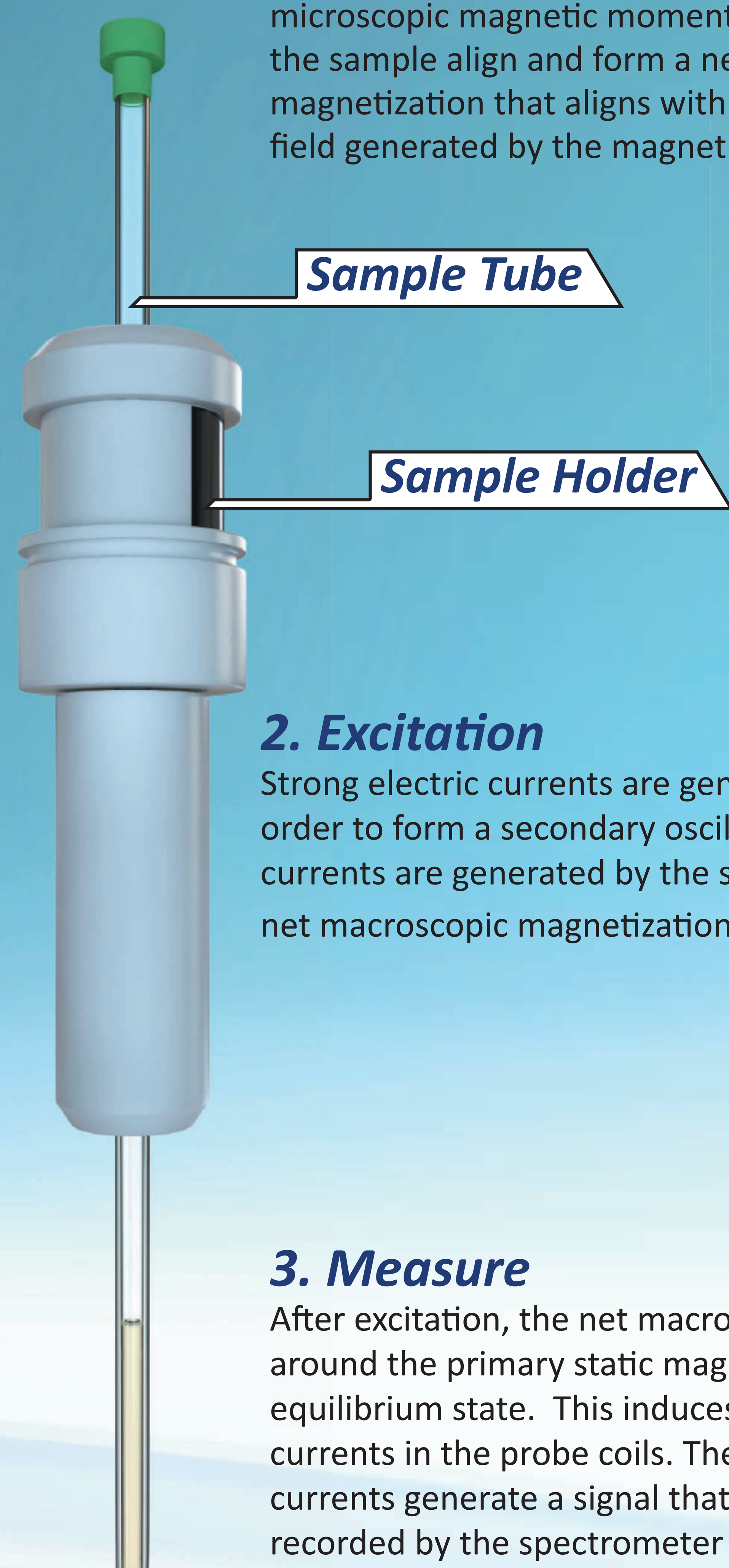
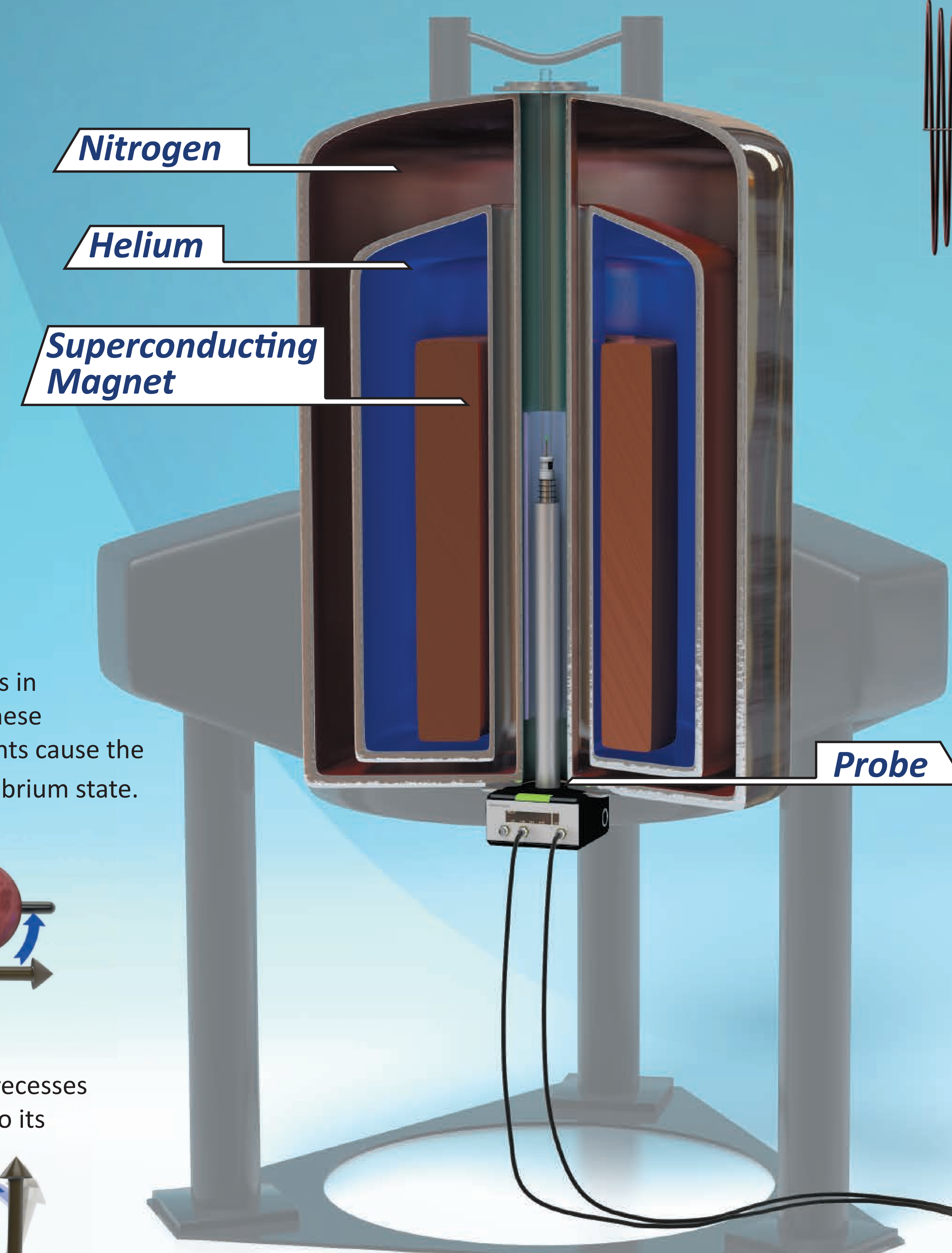
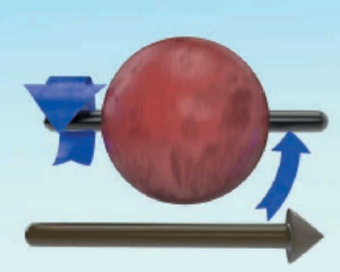
NMR: Step by Step

1. Sample and Magnet
Samples are placed in a strong magnetic field that is generated by the superconducting magnet. The microscopic magnetic moments of the nuclei in the sample align and form a net macroscopic magnetization that aligns with the static magnetic field generated by the magnet.



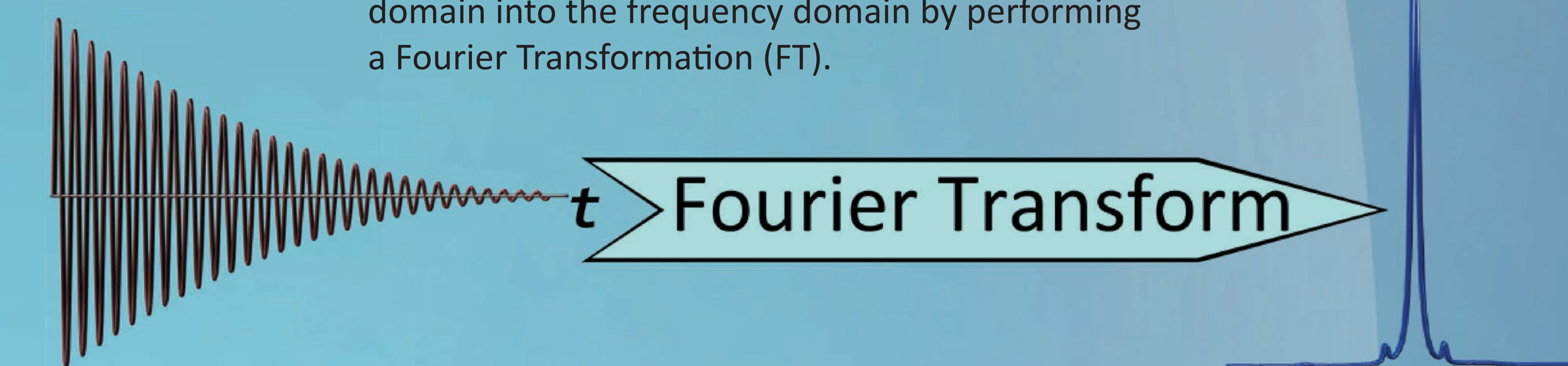


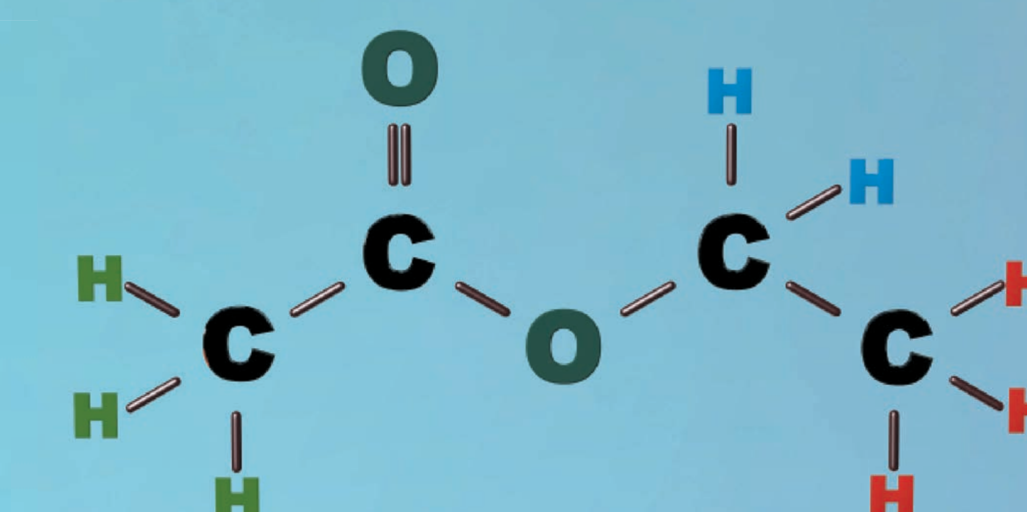
2. Excitation
Strong electric currents are generated in the probe coils in order to form a secondary oscillating magnetic field. These currents are generated by the spectrometer. The currents cause the net macroscopic magnetization to rotate from its equilibrium state.

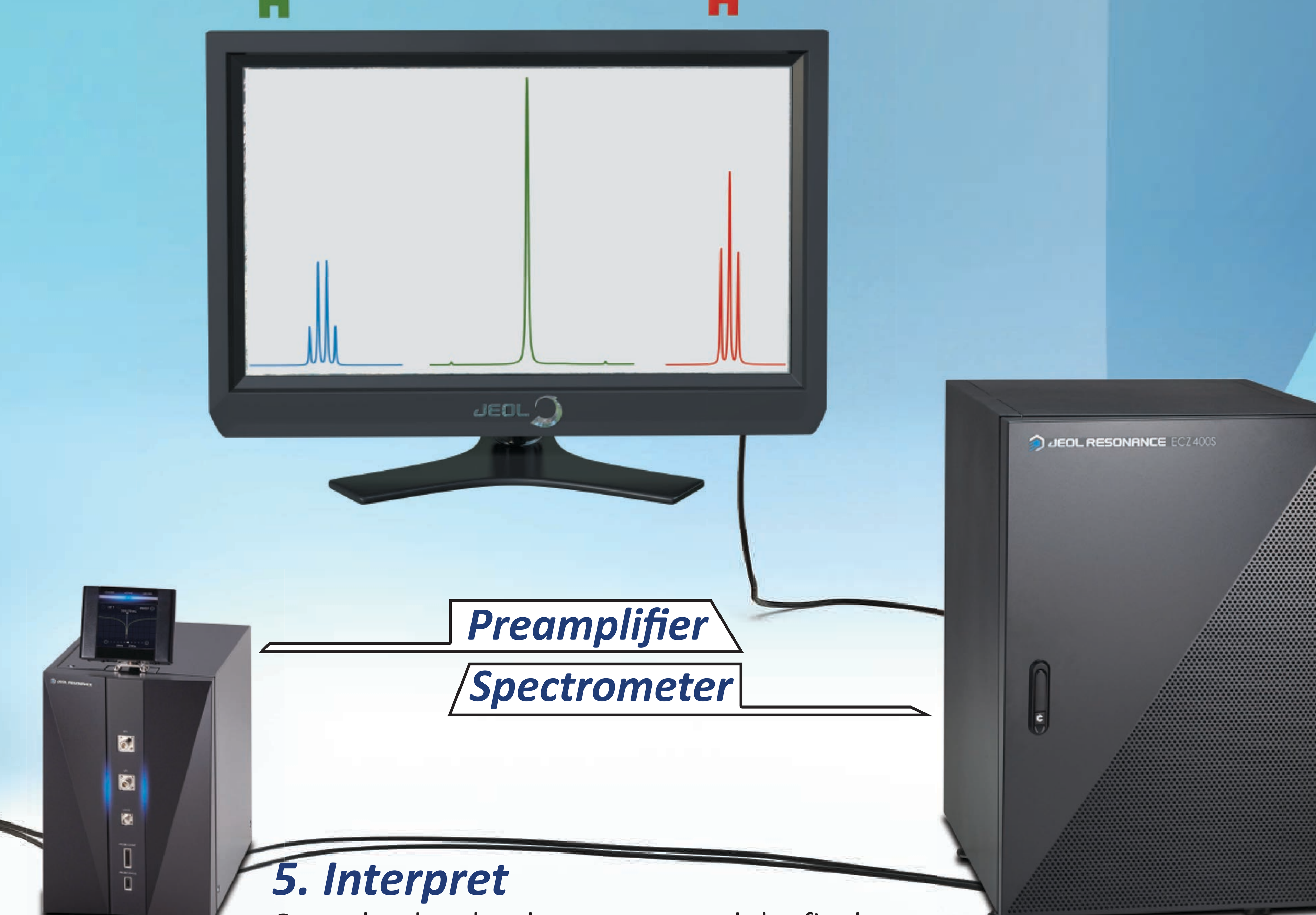


3. Measure
After excitation, the net macroscopic magnetization precesses around the primary static magnetic field as it returns to its equilibrium state. This induces weak currents in the probe coils. These currents generate a signal that is recorded by the spectrometer as a function of time. This signal is known as the Free Induction Decay (FID).

4. Process
The FID is mathematically converted from the time domain into the frequency domain by performing a Fourier Transformation (FT).







5. Interpret
Once the data has been processed the final step is interpretation. Parameters such as chemical shifts, peak shapes, linewidths, and intensities can be extracted from the spectrum. These basic parameters can provide a wealth of unique information allowing the user to:

- Ascertain chemical structure
- Determine purity or quantitative mixture content
- Gain insight into a variety of dynamic processes of a large range of timescales
- Study interactions between molecules, including drug-target interactions

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