The invention claimed is:

1. A method of performing a magnetic resonance analysis of a sample comprising:

placing a sample in a radio frequency field and a magnetic field having a static field direction;

rotating the sample or the magnetic field about a rotational axis, the rotational axis being disposed at an angle of about 54°44' relative to the static direction;

selecting a region of the sample, thus providing a selected region of the sample;

pulsing the radio frequency to provide a pulse segment comprising:

three spatially selective read pulses;

two spatially selective storage pulses; and

three spatially selective phase pulses;

collecting data representative of the selected region of the sample generated by the pulsed radio frequency; and wherein the pulsing further comprises a PHORMAT pulse sequence to isolate a particular voxel of interest.

2. The method of claim 1, wherein pulsing the radio frequency to provide the spatially selective read pulses comprises applying a magnetic gradient parallel to the static direction.

3. The method of claim 2, wherein pulsing the radio frequency further comprises applying a magnetic gradient perpendicular to the rotational axis.

4. The method of claim 1, wherein pulsing the radio frequency further comprises applying a magnetic gradient parallel to the rotational axis.

5. The method of claim 1, further comprising synchronizing at least one of the spatially selective read pulses, the spatially selective storage pulses, and the spatially selective phase pulses with the rotation of the sample or the magnetic field.

6. The method of claim 1, wherein pulsing the radio frequency further comprises synchronizing a magnetic gradient with the rotation of the sample or the magnetic field.

7. The method of claim 6, wherein pulsing the radio frequency further comprises applying a magnetic gradient perpendicular to the rotational axis.

8. The method of claim 7, wherein pulsing the radio frequency further comprises applying a magnetic gradient parallel to the rotational axis.

9. The method of claim 1, wherein pulsing the radio frequency further comprises applying a magnetic gradient parallel to the rotational axis during the spatially selective storage radio frequency pulses.

10. The method of claim 1, wherein the sample or magnetic field is rotated at a rate sufficiently slowly such that pulsing a static field gradient can be treated as pulsing the field gradient of a fixed sample and a fixed magnetic field.

11. The method of claim 1, wherein the sample is rotated at a rate of less than 100 Hz.

12. The method of claim 1, wherein the sample is rotated at a rate of about 10 Hz or less.

13. The method of claim 1, wherein selecting a region of the sample comprises obtaining a first magnetic resonance analysis of the sample.

14. The method of claim 13, wherein the first magnetic resonance analysis of the sample comprises a magnetic resonance image.

15. The method of claim 1, wherein selecting a region of the sample comprises determining coordinates of the selected region, further comprising synchronizing a magnetic gradient with the rotation of the sample or the magnetic field based on the coordinates.

16. The method of claim 15, wherein selecting a region of the sample involves a first processor, further comprising outputting the coordinates to a second processor, wherein the second processor synchronizes the magnetic gradient with the rotation of the sample or the magnetic field.

17. The method of claim 1, wherein pulsing the radio frequency further comprises saturating at least a portion of the sample outside the selected region of the sample.

18. The method of claim 1, wherein the rotation rate is varied while the magnetic resonance analysis is being performed.

19. The method of claim 1, further comprising rephasing a read signal during acquisition of the read signal and varying a magnetic read gradient in order to generate a magnetic resonance analysis of a plurality of regions of the sample.

20. The method of claim 1, wherein the spatially selective read pulses are frequency selective.

21. The method of claim 1, further comprising generating a magnetic resonance analysis of isotropic and anisotropic data.

22. The method of claim 1, further comprising generating a magnetic resonance analysis of the irradiated region comprising determining anisotropic susceptibility broadening for a chemical species present in the selected region.

23. The method of claim 22, further comprising diagnosing a disease or physiological condition based on the anisotropic susceptibility broadening.

24. A method of performing a magnetic resonance analysis of a sample comprising:

placing a sample in a radio frequency field and a main external magnetic field;

selecting a region of the sample, thus providing a selected region of the sample;

rotating the sample or the main external magnetic field about a rotational axis, the rotational axis being disposed at an angle of about 54°44' relative to the main external magnetic field direction;

pulsing the radio frequency to provide a magic angle turning pulse sequence comprising:

applying a rotating pulsed magnetic read gradient perpendicular to the axis of rotation and pulsing the radio frequency to provide three spatially selective read pulses in order to isolate a particular voxel of interest, wherein the pulsed rotating gradient is synchronized with the sample or main magnetic field rotation and at least one read pulse;

applying a rotating pulsed magnetic storage gradient perpendicular to the axis of rotation and pulsing the radio frequency to provide two spatially selective storage pulses to isolate a particular voxel of interest, wherein the pulsed rotating gradient is synchronized with the sample or main magnetic field rotation and at least one storage pulse;

applying a pulsed magnetic storage gradient parallel to the axis of rotation and pulsing the radio frequency to provide three spatially selective phase pulses; and

generating a magnetic resonance analysis of the selected region.

25. The method of claim 24, further comprising synchronizing at least one of the read gradient, phase gradient, and the storage gradient with the rotation of the sample or the magnetic field.

26. The method of claim 24, wherein applying a magnetic read gradient comprises applying a plurality of magnetic read gradients in a plurality of orthogonal directions.

27. The method of claim 1, further comprising applying at least one rotating pulse magnetic field gradient during each of