feedthrough pins **203** will be soldered or brazed to the traces on the ceramic circuit board **204** on the inside of the case **108**, and brazed or soldered to another board or interconnect flex in the inertial navigation system or other system to which it is mounted. Potentially, these solder connections may be sufficient for mechanically mounting the gyro. The feedthroughs **203** do not need to form a circular pattern if not used for mounting.

The operation of the gyro requires a modulated magnetic field transverse to the main magnetic field. The modulation frequency may be a few hundred Hertz to over 1 MHz depending on the strength of the main magnetic field. It is believed that a single turn loop **107** will be sufficient. For assembly purposes, it may be expedient to attach this loop **107** to the support.

Not illustrated in the drawings is a getter to assure that a hard vacuum is maintained inside the case **108** to prevent excessive power required to operate the cell and VCSELs or VCSEL heaters. Also not illustrated is a second layer of magnetic shielding, which may or may not be required.

The present invention, as an architecture for a chip-scale nuclear magnetic resonance gyro, is readily adaptable to facilitate the use of batch processing manufacturing methods while preserving the features and configuration of pump and readout optical beams that are required for high performance. The optimum optical configuration places the pump beam parallel to the DC magnetic field imposed on the cell containing the alkali and noble gas mixture, and places the readout beam perpendicular to the DC field. Locating readout and pump lasers on adjacent faces of the cell, as described in the prior embodiment, impacts batch processing of the device. In an alternative embodiment of the invention, modifying the cell design such that reflecting surfaces redirect the readout beam as illustrated in FIG. **4**, this limitation can be overcome. Furthermore, a logical stackup of wafers is envisioned as shown in FIG. **4**, where, ignoring electronics, source and pump lasers are fabricated on one wafer **402**, a second wafer **403** has beam forming optics, a third wafer **404** has a polarizer, wafers **405-407** comprise the cell sides and lids, and wafer **408** has pump and readout detectors. Source control and detection/signal processing electronics wafers **401** and **409** may be added to the stack as shown in FIG. **4**.

In FIG. **5**, the wafer stackup is shown to logically separate technologies for manufacturing by wafer. For example, two wafers **401** and **409** have integrated electronics, one wafer **402** has laser sources, one wafer **408** includes detectors, another wafer **404** has polarizers, another wafer **403** includes optics, and a set of wafers **501** makes up the NMR cell **502**. Segregating technologies shortens development time and enhances manufacturing yields.

The steps or operations described herein are just exemplary. There may be many variations to these steps or operations without departing from the spirit of the invention. For instance, the steps may be performed in a differing order, or steps may be added, deleted, or modified.

Although exemplary implementations of the invention have been depicted and described in detail herein, it will be apparent to those skilled in the relevant art that various modifications, additions, substitutions, and the like can be made without departing from the spirit of the invention and these are therefore considered to be within the scope of the invention as defined in the following claims.

What is claimed is:

1. An NMR gyro comprising:

a ceramic support structure having four legs extending outward from a substantially circular central portion, the support structure affixed within a substantially cylindrical enclosure;

an NMR cell suspended in relative vacuum and affixed to the support structure;

a plurality of permanent magnets disposed about the NMR cell to produce a magnetic field within the cell; and

a field coil disposed proximate the cell to produce a modulated magnetic field transverse to the magnetic field produced by the permanent magnets.

2. The NMR gyro of claim **1**, wherein the enclosure comprises a substantially cylindrical enclosure formed from HyMu 80 alloy.

3. The NMR gyro of claim **1**, wherein the ceramic support structure is affixed to a plurality of support mounts within the enclosure.

4. The NMR gyro of claim **3**, wherein the ceramic support structure is affixed to four support mounts within the enclosure.

5. The NMR gyro of claim **1**, wherein the plurality of permanent magnets disposed about the NMR cell comprises a plurality of substantially cylindrical permanent magnets disposed in a predetermined pattern about the NMR cell.

6. The NMR gyro of claim **5**, wherein the substantially cylindrical permanent magnets are disposed approximately equidistant from the cell.

7. The NMR gyro of claim **6**, wherein the substantially cylindrical permanent magnets are disposed at the vertices of a square having the cell located approximately at the center of the square.

8. The NMR gyro of claim **5**, wherein the plurality of permanent magnets comprises four permanent magnets.

9. The NMR gyro of claim **1**, further comprising a cell heater that maintains cell temperature at about 100 degrees C.

10. The NMR gyro of claim **1**, further comprising at least one pump VCSEL affixed to the support structure.

11. The NMR gyro of claim **10**, wherein the pump VCSEL forms at least a part of an integrated circuit that includes a detector.

12. The NMR gyro of claim **11**, wherein the NMR cell includes a mirrored region disposed oppositely from the VCSEL.

13. The NMR gyro of claim **10**, wherein light from the VCSEL is circularly polarized by a quarter-wave plate interposed between the VCSEL and the NMR cell.

14. The NMR gyro of claim **10**, further comprising a second VCSEL disposed orthogonally with respect to the pump VCSEL.

15. The NMR gyro of claim **14**, wherein light output from the VCSELs is tuned to an absorption wavelength of alkali metal within the NMR cell.

16. The NMR gyro of claim **15**, wherein the VCSELs are tuned by adjusting VCSEL temperature.

17. The NMR gyro of claim **15**, wherein the VCSELs are tuned by adjusting supply current provided to the VCSELs.

18. The NMR gyro of claim **17**, further comprising a circuit board including control circuitry for the VCSELs.

19. The NMR gyro of claim **18**, further comprising a plurality of feedthroughs disposed about an exterior surface of the enclosure, the feedthroughs providing electrical connection paths from the enclosure exterior to the circuit board.