CLAIMS

What is claimed is:

1. A partial pressure detector, comprising:

a thermal conductivity ~~gauge~~ sensor configured to sense a pressure of a mixture of gases within a vacuum chamber;

an input configured to receive a total pressure reading from a species-independent pressure sensor of the mixture of gases in the vacuum chamber; and

a controller configured to provide an output proportional to a partial pressure of a species of gas in the vacuum chamber as a function of the pressure as sensed by the thermal conductivity ~~gauge~~ sensor and the received total pressure reading, the controller having a resolution scaled to a range of expected partial pressures of the species.

2. The partial pressure detector of claim 1, wherein the function includes a difference in pressure between the pressure as sensed by the thermal conductivity ~~gauge~~ sensor and the received total pressure reading.

3. The partial pressure detector of claim 2, wherein the function is according to the following:

$$\Delta TP = TP_{PG} - TP = xPP_S$$

where ΔTP represents a weighted partial pressure of the species; TP_{PG} is the pressure as sensed by the ~~Pirani~~ thermal conductivity sensor, TP is the total pressure reading as received from the species-independent pressure sensor, x is a species-dependent factor, and PP_S is the partial pressure of the species.

4. The partial pressure detector of claim 3, wherein the output is the partial pressure of the species (PP_S).

5. The partial pressure detector of claim 3, wherein the species is water and x is ~~about~~ 0.4.

6. The partial pressure detector of any one of claims 1-5, wherein the controller is further configured to provide a second output, the second output representing a total

pressure of the mixture of gases within the vacuum chamber as sensed by the thermal conductivity ~~gauge~~sensor.

7. The partial pressure detector of any one of claims 1-6, wherein the thermal conductivity ~~gauge~~ sensor is a Pirani gauge.

8. The partial pressure detector of any one of claims 1-7, wherein the species-independent sensor is a capacitance diaphragm gauge.

9. The partial pressure detector of any one of claims 1-8, further comprising an input port configured to connect to an output of the species-independent pressure sensor.

10. The partial pressure detector of any one of claims 1-9, further comprising the species-independent pressure sensor.

11. The partial pressure detector of any one of claims 1-10, further comprising a trigger configured to zero the output of the controller.

12. The partial pressure detector of any one of claims 1-11, wherein the controller is further configured to adaptively average the output.

13. A partial pressure detector, comprising:

a housing;

a thermal conductivity ~~gauge~~ sensor at least partially contained within the housing and configured to sense a thermal response of a sensor wire to a mixture of gases within a vacuum chamber; and

a controller, contained within the housing, configured to:

determine a pressure of the mixture of gases within the vacuum chamber based on the sensed thermal response of the thermal conductivity ~~gauge~~sensor,

receive a total pressure reading from a species-independent pressure sensor of the mixture of gases in the vacuum chamber, and

provide an output proportional to a partial pressure of a species of gas in the vacuum chamber as a function of the determined pressure and the received total pressure reading.

14. The partial pressure detector of claim 13, wherein the function includes a difference in pressure between the determined pressure and the received total pressure reading.

15. The partial pressure detector of claim 14, wherein the function is according to the following:

$$\Delta TP = TP_{PG} - TP = xPP_S$$

where ΔTP represents a weighted partial pressure of the species; TP_{PG} is the pressure as sensed by the ~~Pirani~~ thermal conductivity sensor, TP is the total pressure reading as received from the species-independent pressure sensor, x is a species-dependent factor, and PP_S is the partial pressure of the species.

16. The partial pressure detector of claim 15, wherein the output is the partial pressure of the species (PP_S).

17. The partial pressure detector of claim 15, wherein the species is water and x is ~~about~~ 0.4.

18. The partial pressure detector of any one of claims 13-17, wherein the controller has a resolution scaled to a range of expected partial pressures of the species.

19. The partial pressure detector of any one of claims 13-18, wherein the controller is further configured to provide a second output, the second output representing a total pressure of the mixture of gases within the vacuum chamber as determined based on the sensed thermal response of the ~~Pirani~~ thermal conductivity sensor.

20. The partial pressure detector of any one of claims 13-19, wherein the thermal conductivity ~~gauge~~sensor is a Pirani gauge.

21. The partial pressure detector of any one of claims 13-20, wherein the species-independent pressure sensor is a capacitance diaphragm gauge.

22. The partial pressure detector of any one of claims 13-21, further comprising an input port configured to connect to an output of the species-independent pressure sensor.

23. The partial pressure detector of any one of claims 13-22, further comprising the species-independent pressure sensor.

24. The partial pressure detector of claim 23, wherein the species-independent pressure sensor is contained within the housing.

25. The partial pressure detector of any one of claims 13-24, further comprising a trigger configured to zero the output of the controller.

26. The partial pressure detector of any one of claims 13-25, wherein the controller is further configured to adaptively average the output.

27. A method of detecting a partial pressure of a gas species, comprising:

with a thermal conductivity ~~gauge~~sensor, sensing a pressure of a mixture of gases within a vacuum chamber;

with a species-independent pressure sensor, sensing a total pressure of the mixture of gases within the vacuum chamber; and

providing an output proportional to a partial pressure of a species of gas in the vacuum chamber as a function of the pressure as sensed by the thermal conductivity ~~gauge~~ sensor and the total pressure as sensed by the species-independent pressure sensor, the output provided by a controller having a resolution scaled to a range of expected partial pressures of the species.

28. The method of claim 27, wherein the function includes a difference in pressure between the pressure as sensed by the thermal conductivity ~~gauge~~sensor and the total pressure as sensed by the species-independent pressure senor.

29. The method of claim 28, wherein the function is according to the following:

$$\Delta TP = TP_{PG} - TP = xPP_S$$

where ΔTP represents a weighted partial pressure of the species; TP_{PG} is the pressure as sensed by the ~~Pirani~~ thermal conductivity sensor, TP is the total pressure as sensed by ~~as received from~~ the species-independent pressure sensor, x is a species-dependent factor, and PP_S is the partial pressure of the species.

30. The method of claim 29, wherein the output is the partial pressure of the species (PP_S).

31. The method of claim 29, wherein the species is water and x is ~~about~~ 0.4.

32. The method of any one of claims 27-31, further comprising providing a second output, the second output representing a total pressure of the mixture of gases within the vacuum chamber as sensed by the thermal conductivity ~~gauge~~sensor.

33. The method of any one of claims 27-32, wherein the species is a solvent of a sample undergoing lyophilization in the vacuum chamber.

34. The method of any one of claims 27-33, wherein the mixture of gases is binary.

35. The method of any one of claims 27-34, wherein the thermal conductivity ~~gauge~~ sensor is a Pirani gauge.

36. The method of any one of claims 27-35, wherein the species-independent sensor is a capacitance diaphragm gauge.

37. The method of any one of claims 27-36, further comprising calibrating the controller to the species-independent pressure sensor.

38. The method of claim 37, further comprising zeroing an output of the controller.

39. The method of any one of claims 27-38, further comprising adaptively averaging the output.

40. A partial pressure detector, comprising:

a species-dependent sensor configured to sense a pressure of a mixture of gases within a vacuum chamber;

an input configured to receive a total pressure reading from a species-independent pressure sensor of the mixture of gases in the vacuum chamber; and

a controller configured to provide an output representing an amount of a species of gas in the vacuum chamber as a function of the pressure as sensed by the species-dependent sensor and the received total pressure reading, the controller having a resolution scaled to a range of expected partial pressures of the species.