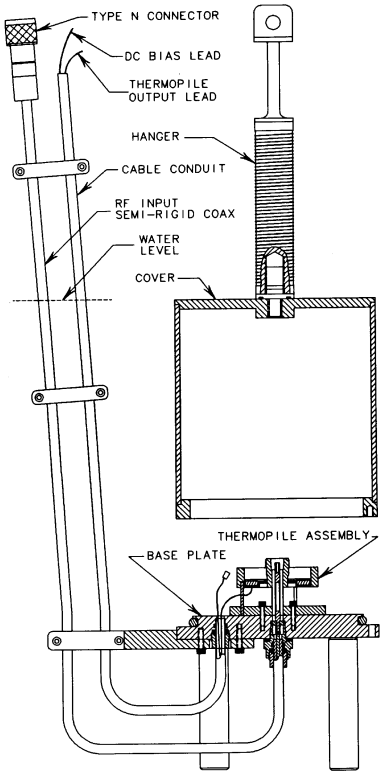

Figure 2-7. Schematic cross-section of the NIST coaxial microcalorimeter at Boulder, CO. The entire sensor configuration is maintained under a water bath with a highly-stable temperature so that RF to DC substitutions may be made precisely.

The National Power Reference Standard for the U.S. is a microcalorimeter maintained at the NIST in Boulder, CO, for the various coaxial and wave-guide frequency bands offered in their measurement services program. These measurement services are described in NIST SP-250, available from NIST on request.[7] They cover coaxial mounts from 10 MHz to 26.5 GHz and waveguide from 8.2 GHz to the high millimeter ranges of 96 GHz.

A microcalorimeter measures the effective efficiency of a DC substitution sensor which is then used as the transfer standard. Microcalorimeters operate on the principle that after applying an equivalence correction, both DC and absorbed microwave power generate the same heat. Comprehensive and exhaustive analysis is required to determine the equivalence correction and account for all possible thermal and RF errors, such as losses in the transmission lines and the effect of different thermal paths within the microcalorimeter and the transfer standard. The DC-substitution technique is used because the fundamental power measurement can then be based on DC voltage (or current) and resistance standards. The traceability path leads through the microcalorimeter (for effective efficiency, a unit-less correction factor) and finally back to the national DC standards.

In addition to national measurement services, other industrial organizations often participate in comparison processes known as round robins (RR). A round robin provides measurement reference data to a participating lab at very low cost compared to primary calibration processes. For example, the National Conference of Standards Laboratories (NCSL), a non-profit association of over 1400 world-wide organizations, maintains round robin projects for many measurement parameters, from dimensional to optical. The NCSL Measurement Comparison Committee oversees those programs.[5]

For RF power, a calibrated thermistor mount starts out at a "pivot lab," usually one with overall RR responsibility, then travels to many other reference labs to be measured, returning to the pivot lab for closure of measured data. Such mobile comparisons are also carried out between National Laboratories of various countries as a routine procedure to assure international measurements at the highest level.

Microwave power measurement services are available from many National Laboratories around the world, such as the NPL in the United Kingdom and PTB in Germany. Calibration service organizations are numerous too, with names like NAMAS in the United Kingdom.

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3. M.P. Weidman and P.A. Hudson, "WR-10 Millimeterwave Microcalorimeter," NIST Technical Note 1044, June, 1981.
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5. National Conference of Standards Laboratories, Measurement Comparison Committee, Suite 305B, 1800 30th St. Boulder, CO 80301.
6 M.P. Weidman, "Direct Comparison Transfer of Microwave Power Sensor Calibration," NIST Technical Note 1379, January, 1996.
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