Primary Standards Laboratory
Metrology Program

AC Electrical

Fact Sheet

The AC Project of the Primary Standards Laboratory maintains a wide variety of ac and pulsed electrical measurement capabilities to provide NIST-traceable measurements for Sandia National Laboratories, the Nuclear Weapons Complex, and Work for Others customers. Metrology resources include high accuracy ac current and voltage measurement systems to quantify component ac-dc difference, unique pulsed high-voltage generation and measurement capability to certify resistive and capacitive voltage dividers, and time and frequency measurements using a NIST designed GPS system. In addition to these capabilities, the AC Project team has responsibility for the certification of waveform Measurement and Test Equipment (M&TE) utilizing our precision voltage, current, and frequency reference sources.

Pulsed High-Voltage System

The AC Project provides consultation for all its customers in the selection of appropriate new instruments and standards, developing solutions for problems that arise in the application of measurement equipment and systems, and the proper use of calibrated standards. Project staff provide key support in the auditing and approval process of both DOE/NNSA Contractor Standards Laboratories and commercial accredited laboratories by providing proficiency test items and assessing metrology competence.

Capabilities

A representative sample of our generic measurement capabilities and associated uncertainties is listed below. The NIST/National Voluntary Laboratory Accreditation Program (NIST/NVLAP) accredits us under Lab Code 105002-0.

For additional details, see http://ts.nist.gov/standards/scopes/1050020.pdf

Quantity	Typical Values	Frequency Range	Best Uncertainty *k = 3*
Time of Day	Continuous		<100 ns
Frequency reference	10 MHz		$<1x10^{-12}$
ac Voltage	0.5V - 100V	10 Hz – 1 MHz	16 – 104 ppm
	100V – 1kV	10 Hz – 100 kHz	21 – 104 ppm
ac Current	10 mA - 20 A	50 Hz – 50 kHz	100 – 170 ppm
Inductive Dividers	15, 35, 100V	60,1 k & 10 kHz	55 ppm
Capacitance	.01 - 1000 pF	1 kHz	5 ppm
	1 - 1000 pF	100 kHz – 1 MHz	0.01 – 1.3%
Inductance	10μH - 10H	100 Hz – 10 kHz	200 – 1100 ppm
	.1μH - 25H	10 kHz – 10 MHz	0.1 – 4 %
Q	95 - 607	50 kHz – 45 MHz	1.2 4.5%
ac-dc Voltage Converters	0.5 - 1000V		0.06 – 1.1%
	1 - 7V	10 Hz - 1 MHz	1.3%
		10MHz-100MHz	
ac-dc Shunts	2 mA - 16A		0.06 – 1.1%
Pulsed Voltage	0.5V - 300 kV	Variable Pulse Width	1.7%
Pulsed Current	0.25A - 2000 A	Variable Pulse Width	2%

Major Resources

- Precision ac/dc Calibration Systems, functionally identical to systems used by NIST, for ac/dc transfer measurements with upgraded LabView software data acquisition, control, and analysis. Frequency range from 10 Hz to 100 MHz.

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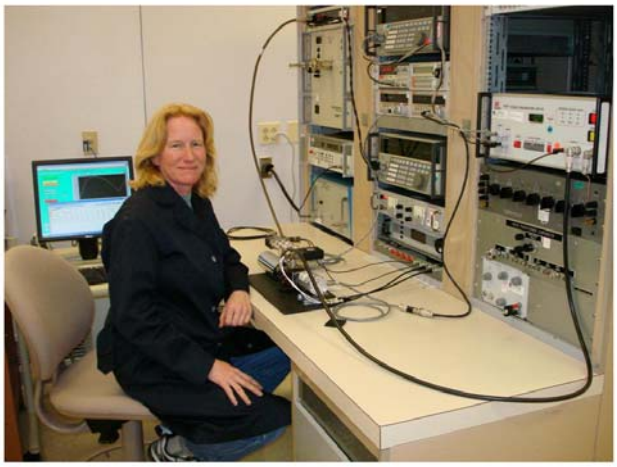
Major Resources

- Time and Frequency System: Contains GPS clocks, NIST-FMAS, NIST-connected talking clock and time-code distribution system. Computer clocks can be set over the Internet at NTP addresses:
  134.253.8.1
  134.253.8.43
  134.253.8.5
- State-of-the-art Pulsed High Voltage System for certification of resistive and capacitive voltage dividers.
- State-of-the-art NIST developed Pulsed Current Transformers for precision calibration of Current Viewing Transformers and Resistors.
- Computer-controlled, inductance and capacitance measurement systems
- Measurement of Impedance as a function of temperature; typical temperature range 10C to 35C.
- NIST designed and fabricated 1 GHz bandwidth sampling waveform analyzer to evaluate digitizer measurement of pulse amplitude, tilt, and rise-times.
- Fast-rise pulse calibration capability; picoseconds resolution.
- Calibration of inductive voltage dividers.
- Certification of waveform instruments from DC to >2 GHz using automated calibration stations.
- Certification of PXI modules for waveform measurements.

Selected Accomplishments

- Developed and fabricated NIST/Sandia thin-film multi-junction thermal converter devices at Sandia; capable of sub-ppm ac/dc difference performance.
- Collaborated with NIST to develop new standards for high-speed sampling.
- Maintain state-of-the art capability for calibration of air dielectric capacitors from 1 kHz to 10 MHz.
- Maintain and utilize national primary reference standard resistive voltage divider for pulsed voltage measurements.
- Development of temperature stabilized and electrostatic shielded capacitive voltage divider for pulsed measurement environments.
- Beta tested NIST common view time measurement system
- Active participation in IEEE and NCSLI committees.



AC Project Staff Member Evaluating the AC-DC Difference Measurement System.

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