Welcome!
NREL Pyrheliometer Comparisons 2004
(NPC-2004)

27 September – 8 October 2004

Solar Radiation Research Laboratory
(SRRL)

Latitude: 39.742 N
Longitude: 105.18 W
Elevation: 1828.8 m AMSL
Mean Station Pressure: 820 mBar
Time Zone: (GMT – 7.0)

Electric & Hydrogen Technologies & Systems Center
Resource Integration Group
Measurement & Instrumentation Team
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NREL Pyrheliometer Comparisons 2004
NPC-2004

Safety
Emergency Phone: Press 1 2 3 4 to call from any NREL extension
Evacuation Assembly Area: North Parking Lot

Security
Phone: 303-384-6811 or Press 6811 from any NREL extension
NREL Contractor Visitor Badges issued on first day of NPC at the Site Entrance Building. Please wear badge at all times at SRRL.
Badges will be valid for 5-day interval and renewed as needed.

Communications
Call Tom for Daily Plan – 303-384-6395 after 06:30 each morning (listen to voice-mail announcement)
SRRL Phone: 303-384-6326 (also rings outside)
Outside Local and Long Distance: Press 9 - Area Code – Number
E-mail access via PC in Electronics Lab (south wall)
User = *********
Password = *********

Food & Beverages
Lunch Menu will be circulated daily by 10:30 MDT
Beverages and snacks provided (donations accepted by Bev)

Equipment Storage
Used designated areas in SRRL and Sea Container.
Based on past experience, here’s a list of issues we need to agree on before we begin the comparisons.

1. **Schedule**

   Daily Please call Tom’s voice mail (303-384-6395) for recorded announcement.

   **Sept. 27th (morning)**
   a. Visitor check-in at Site Entrance Building.
      Please plan to arrive at NREL between 07:30 and 08:30 MDT.
   b. Transport equipment to SRRL (dry weather) or to indoor lab (TBD) if it’s wet outside.
      (You should have heard from Bev or Tom about any items received prior to the NPC.)
   c. Safety and SRRL orientation briefing.
   d. Equipment Installation & tests:
      - ALL personal computers will be **scanned for viruses** prior to their use at SRRL.
      - NREL will provide this service.
      - We will have a seating diagram to accommodate operator/solar tracker assignments, but we’ll see how this works once everyone has arrived.

   **Sept. 27th (afternoon)**
   e. Continue equipment tests as needed.
   f. Review measurement protocol and procedures.
   g. Dry-run(s) of comparison measurements (weather permitting)

   **Sept. 28th – Oct. 8th (Daily, including weekend):**

   a. Clear sky = Take Measurements!
      - Arrive at SRRL by 08:00 MDT
      - Equipment warm-up for at least 30-minutes
      - First Cavity Calibration at 08:55 MDT
      - Begin comparison "Runs" by 09:00 MDT (08:00 MST)
      - Continue measurements until sundown or clouds interfere.

   b. Cloudy sky = No Measurements, but optionally...
      - Review of previous day’s data analyses
      - Technical Briefings on Radiometry, Measurement Network Operations, etc.
      - Equipment Tests
      - NREL Tours
      - Office Time (e-mail connection available)

   c. We will determine the need for more measurements at the end of each day.
2. **SRRL Coordinates**
   Program your solar tracker using:
   - \( \text{LAT} = 39.7425^\circ \text{ North} \)
   - \( \text{LON} = 105.1778^\circ \text{ West} \)
   - \( \text{ELEV} = 1828.8 \text{ m Above Mean Sea Level (6,000 ft)} \)
   - \( \text{BARO} = 820 \text{ mBar (average station pressure)} \)

3. **Time Keeping**
   - A time keeper will be identified each day
   - All time records will be Mountain Standard Time (MST)
   - The NIST atomic clock is a local call: 9-303-499-7111.
   - We need to keep our clocks in agreement to better than 2 sec.
   - Set your system clock at the daily start-up or as often as needed to keep 2 second accuracy. Check personal computer clocks during the day.

4. **Minimum Data Set**
   Our goal for a minimum data set for these comparisons is to measure irradiance during three different days (all day or portion). Historically, we have acquired more 3,000 data values for each participating cavity radiometer. At least 300 data values are needed to provide a valid transfer of the WRR to the participating radiometers.

5. **Measurements**
   Do **NOT** apply any previous WRR correction factors to your measurements.
   Use only the **factory calibration factor** to adjust your data beyond any other adjustments you feel are needed to correct your data (e.g., pre- and post-calibration drifts in sensitivity are OK). As in the past, we will use the following terms:

   - "Calibrate" = Perform electrical calibration and wait for next measurement period to begin
   - "Reading" = A measurement of direct irradiance within 1 sec of announcement at 20-sec intervals.
   - "Run" = Collection of 33 readings taken in sequence.

The **Time Keeper** will make the following announcements for each Run:

- **Next Run Begins at HH:MM (MST) [HH:MM (MDT)]**
- T minus 6 minutes. Begin calibration
- T minus 3 minutes
- T minus 2 minutes
- T minus 1 minute
- T minus 30 sec
- T minus 10 sec
- T minus 5 - 4 - 3 - 2 - 1 - READ!

Continued countdowns at 20 sec intervals until 33 readings have completed a “Run”
6. Data Transfer
The following standard data format will be used by each participant to improve our data processing efficiency.

a. Single instrument per file:

YMMDD,HH:MM:SS,NNNNN,XXXX.XX

b. Multiple instrument per file:

YMMDD,HH:MM:SS,NNNNN,XXXX.XX,NNNNN,XXXX.XX,...

Where,

YYYY = Year
MM = Month
DD = Day of Month
HH = Hour (Mountain Standard Time)
MM = Minute " " "
SS = Second " " "
NNNNN = Radiometer Serial Number (not limited to 5 figures)
XXXX.XX = Irradiance (Watts per square meter)

After the last daily RUN, but before equipment tear-down, our Data Keeper (Reda) will circulate a master diskette for you to copy all of your corrected data. Cavity calibration files are not needed.

7. Data Processing
- Reda has developed an Excel spreadsheet system for reducing the data.

8. Data Reporting
- Our goal is to provide each participant with next-day analyses.
- A final report will be published by NREL within two months of the comparisons.

9. Equipment Storage
- Each participant will be given space to store systems at SRRL.
- Please let us know if you wish to have any electronics connected to AC power while in storage.

10. Courtesies
- Please get permission before touching someone else's equipment (turning off power strips, adjusting trackers, etc.) to prevent inadvertent data loss.
- Please return borrowed tools to owner.

11. Dinner on Friday (September 27th)
Please join us for a home-cooked meal at the Stoffel's!
Tom will give you directions to his home in Louisville, Colorado (about 24 miles north of NREL.)
Schedule of Events (overview)

Monday, 27 Sept 2004

 Distribute NREL Visitor Badges (See Tom)

 Participants unpack and install equipment for testing
 (Please use Seating Chart on next page)

 Tom & Team will review important logistics

 Clear Sky? Take Solar Irradiance Measurements!
 Cloudy, but no precipitation? Take Practice Data

28 September – 8 October:

 After 06:00 MDT - Check Tom's Voice-Mail announcement
 303-384-6395

 SRRL will be OPEN DAILY from 07:00 MDT to at least 17:00 MDT

 Clear Sky? Arrive SRRL by 07:30 MDT
 Install Equipment and allow electronics to warm up
 TAKE DATA!

 Cloudy Sky? Arrive SRRL by 09:00 MDT
 Technical Presentations in SIMTA Conference Room
NREL Pyrheliometer Comparisons 2004
Seating Diagram

EPLAB | NOAA/CMDL
--- | ---
John Hickey  
Mike Stein | Don Nelson

ATLAS/DSET | ASMI/NASA
--- | ---
Jerry Maybee  
Erik Naranen | Fred Denn

ARM/SGP/TWP | JRC/ESTI
--- | ---
Craig Webb  
Bill Porch | Wim Zaaiman

NOAA/SRRB | Sandia Nat'l Labs
--- | ---
Gary Hodges  
Joe Michalsky | Bill Boyson  
Phil Thacher

Lockheed Martin | FSEC
--- | ---
Jim Goza  
Bill Miller | Ly Vo

NREL
Reda
Telephone Numbers:

EMERGENCY = 1 2 3 4 (From any NREL Phone)

SRRL = 303-384-6326

Daily Schedule = 303-384-6395 (Tom)

Tom Stoffel = 303-666-9719 (Home)

NREL Staff:

Afshin Andreas Computer Issues (Virus scan, E-mail, Web Site)

Pete Gotseff Tools, Parts (Electronics and Hardware), Trackers

Bev Kay Facilities and services (Phone, Mail, Food, Supplies)

Reda NPC Data Collection & Processing, Cavity Operations

Tom Stoffel Host (Security, Safety, Logistics)

Steve Wilcox Computer Issues, Trackers, Cavity Operations
NPC-2004 Technical Discussions: Candidate Topics

The following are simply suggestions for possible presentations and discussions. Please let Tom know if you would like to add a topic!

Summary of the Ninth International Pyrheliometer Comparisons
[Don, Reda, Wim, Tom]

NPC Data Analyses for Determining the WRR Transfer Factor
[Reda]

Relating Solar Radiometers to the SI
[Phil]

Overview of NREL Broadband Outdoor Radiometer Calibrations (BORCAL)
[Tom]

Radiometer Calibration & Characterization (RCC) Software Overview
[Steve]

An Approach for Characterizing Pyranometer Thermal Offsets
[Reda]

Pyrgeometer Blackbody Calibration System Overview
[Reda]

Features of the Measurement & Instrumentation Data Center Web Site
[Tom]

Overview of the Renewable Resource Data Center
[Mary]

Accreditation of Radiometer Calibrations Performed by ATLAS/DSET
[Jerry]

Photovoltaic Performance Characterization at the European Solar Test Installation
[Wim]

The Search for a Diffuse Reference – Results of ARM IOPs
[Joe]

Proper Grounding and Shielding Techniques for Solar Measurement Stations
[Gary]
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<th>Radiometer(s)</th>
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<tr>
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<td>Sandia National Laboratories</td>
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<td>505-844-4566</td>
<td><a href="mailto:weboyso@sandia.gov">weboyso@sandia.gov</a></td>
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<td>Albuquerque, NM 87185-0752</td>
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Ibrahim Reda  
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Tom Stoffel  
Host (Security, Safety, Logistics, Food)  
Steve Wilcox  
Computer Issues, Trackers, Cavity Operations
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