

**Energy Office Goal**  
**Energy Efficient Housing**  
**Homes That Work**

**Charlie Gohman**  
**Manager, Building Science and Efficiency**  
**Arizona Department of Commerce**  
**Energy Office**

# Energy Efficiency Yesterday & Today

What if you don't feel well and go see a doctor.

You walk in his office and the first thing he says is...



**Take these pills and call me in the morning**

# What is wrong with that approach?

- No diagnostic to determine what is making you sick so...
  - Some pills may help
  - Some pills may do nothing
  - Some pills may make you worse
  - Some pills may combine to kill you

**This is how we use to do deal with homes!  
(some still are)**

# Old Approach

- Measures that are completed/installed on homes with no real understanding of impact on other areas.
  - Same list used on all homes.
- Limited testing/commissioning to determine problems/issues.
- Limited analysis on cost/benefit.

# Today's Approach

- Gather complete data on the existing characteristics of the home.
  - Need information on all the characteristic that can impact your decision making process.
- Based on all the data about the house, develop a scope of work that fits the house.
- Inspection of work to insure it is completed per scope.

# **How Do You Get Homes That Work?**

- **Trained technicians**
- Two basic elements
  - Understanding of how a home works.
  - Training on making it work.

**It is key that technicians understand why, nor just what**

# How We Use to Train

- One day workshops/presentations.
  - Used to get some basic principles out.
  - Some follow up filed work
- On-site hands on
  - Used WAP clients or other volunteers

# Problems

- Limited access
- Little or no control over how the house works.
- Issues with scheduling
- Issues with just having lots of people tramping through someone's home.

It just didn't work

# Training Center as a Concept

- Idea was to have a center with a classroom and labs that could be used to simulate situations that were found in the field.
- Complete control of access
- Complete control of what was happening in the labs.

This is what we building

# Southwest Building Science Training Center

- Operated by Foundation for Senior Living Home Improvement (non-profit that does WAP work of City of Phoenix and Maricopa County).
- Funded through the Department of Commerce Energy Office, Department of Energy and Local Utilities.
- Goal: To provide building trades with the knowledge and skills needed to successfully perform diagnostic and repairs on Arizona's housing stock.

# Training

- Basics of energy and buildings
- How to gather information
- How to interpret information
- Making decisions based on your interpretations
- Doing the work right
- Make sure you achieved what you set out to do

**Our main goal is**

# Getting The Basics Right



# Main Topics

- Energy basics
- Health and Safety (appliance testing/repair)
- Pressure diagnostics
- Thermal performance/IR
- REM/Design
- Tied together with BPI certification and HPwES

# Energy Basics

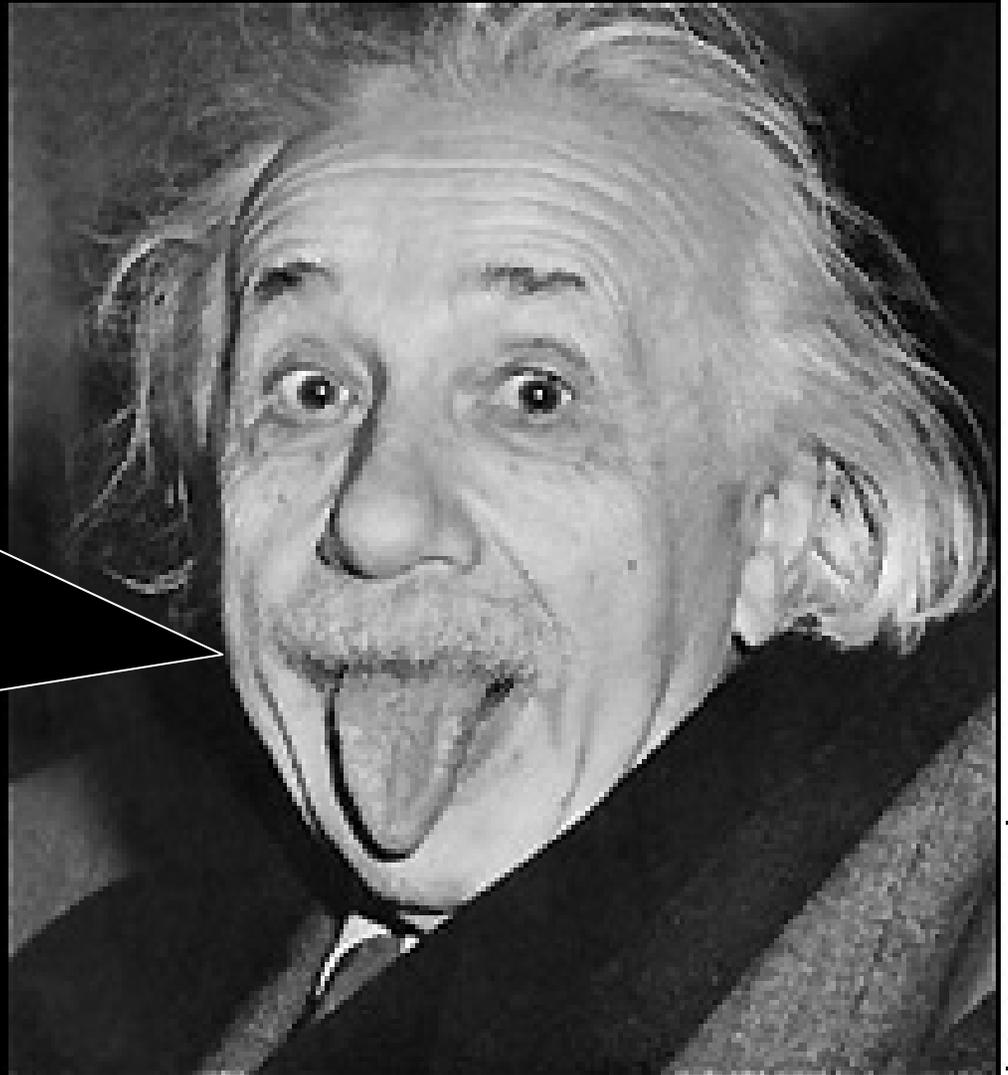
- Goal, to give trainees a basic understanding of the science/physics that impact the performance of buildings.

# Classroom Space



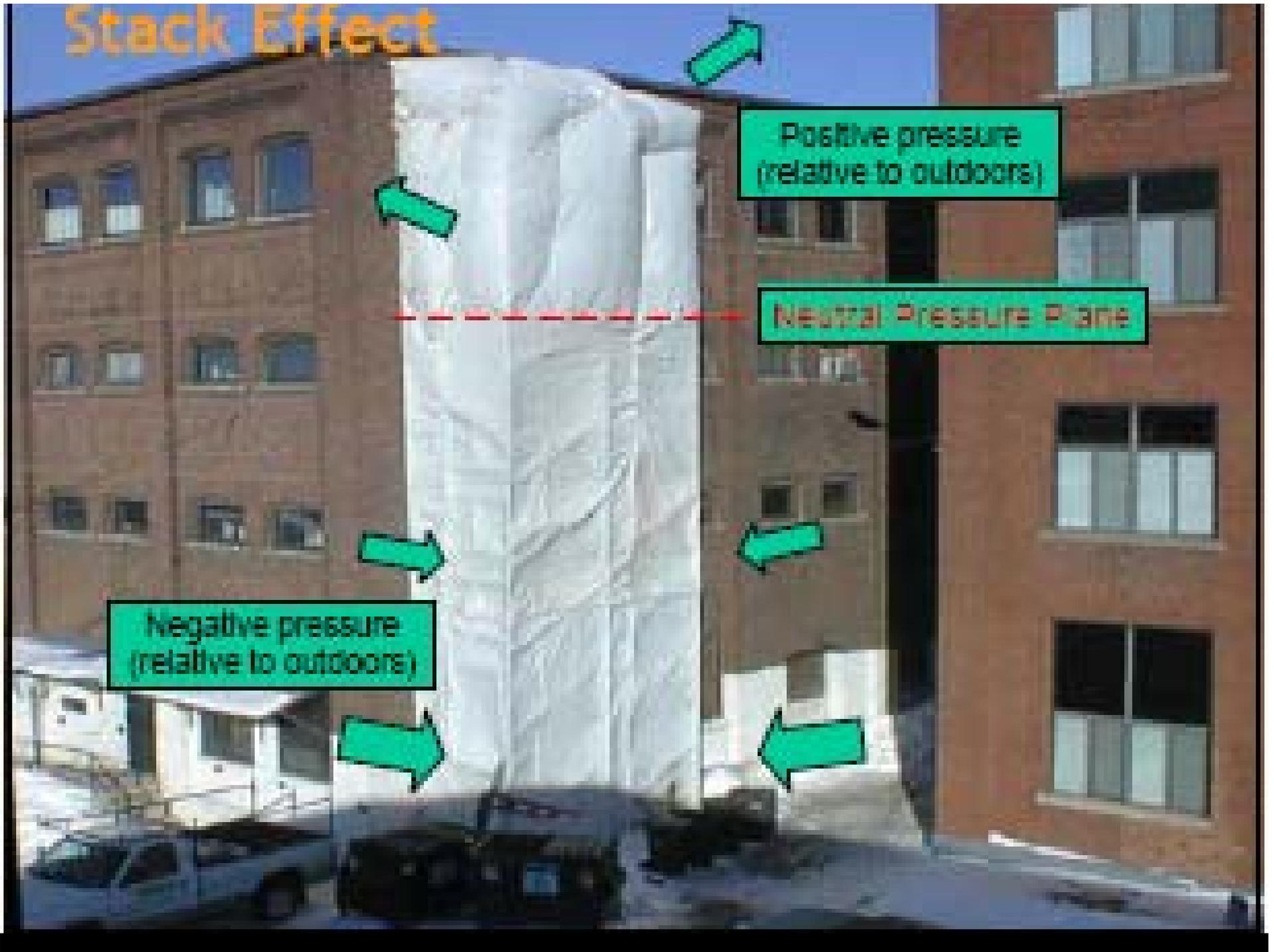
# Building Science

**It's just physics!  
And physics are  
the same in new  
or old buildings.  
The same in  
Minnesota or  
in Arizona.**



(AFP PHOTO)

# Stack Effect



Positive pressure  
(relative to outdoors)

Neutral Pressure Plane

Negative pressure  
(relative to outdoors)

# Health and Safety

- Train in the potential impact of a home that does not perform on health and safety.
  - CO testing
  - Appliance trouble shooting
  - Mold
  - Lead





**The dryer has  
been pulling the  
flame out of the  
heater.**

# CO lab



# Pressure Diagnostics

## getting control of air flow

- Pressure diagnostics is used to understand how air is flowing in a home (leakage is really only a small part).
- Without control of air, you have no control of performance or health and safety.
- Air flow drives all other aspect of a home performance.

# Cause and Effect

- Help gain an understanding of the impact of actions.
- What happens when you close an interior door.

R1 ED.94 L83.7f S1.0f NORM

09/07/04

13:34:24

RUN

( 392.0)

87.7

86.7

85.7

84.7

83.7

82.7

81.7

80.7

79.7

14.0)

85.3

P (

MIKRON



# House of Pressure



# Mobile Home Training & Pressure Diagnostic



**Modify so we can control how the  
home performs.**



Provide trainees with a large number of potential situations they will experience.

# Blower Door





**Duct Blaster**



## **The patented Arizona High Tech Mastic Applicator**

**Five year, five thousand  
duct system warrantee**

**We will have repair  
stations for various  
retrofit techniques**



Future home of the repair stations

**We take duct sealing very seriously**



**Our duct  
crawling class  
(a beginner)**



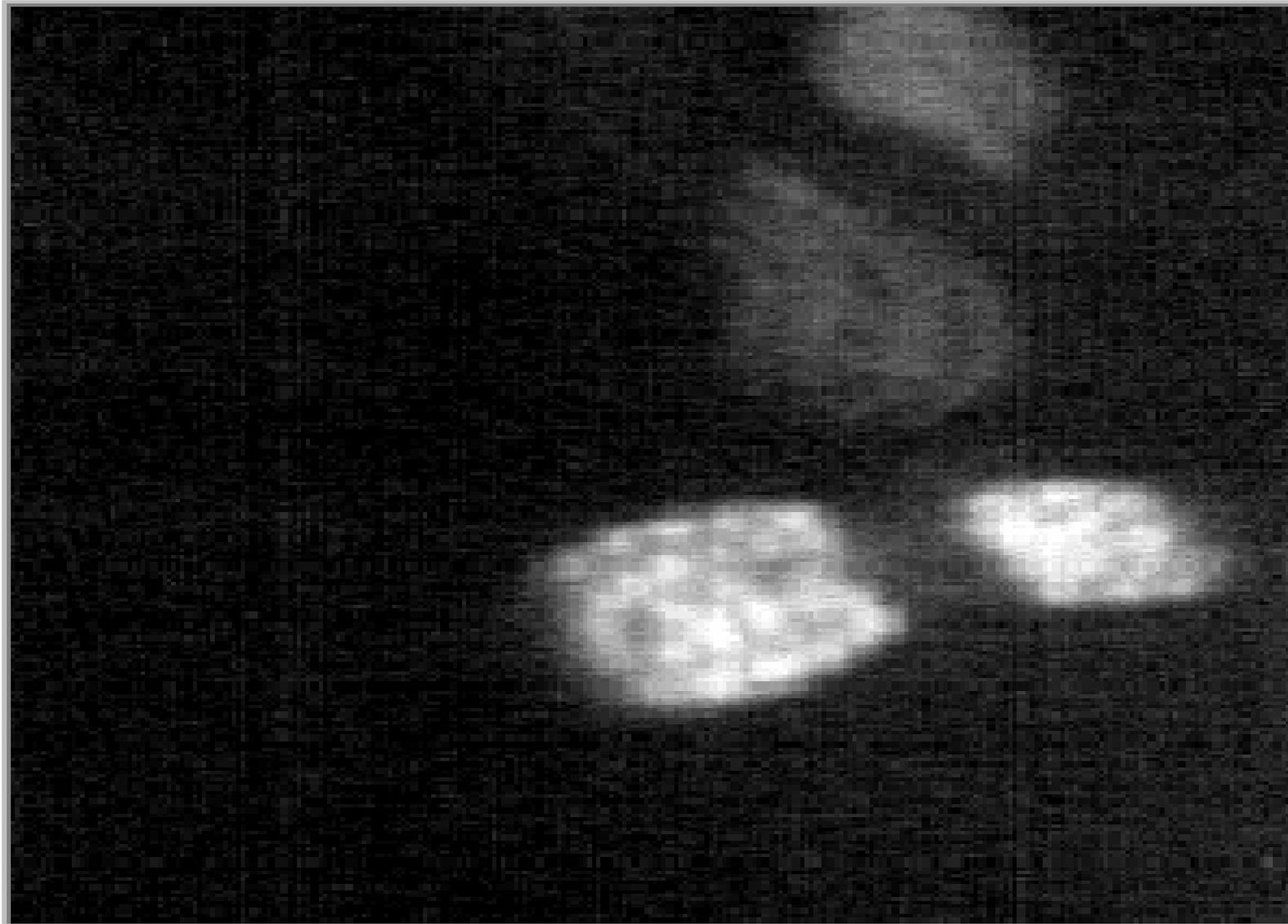
# Thermal Performance/IR

- Our goal is not to teach how to use a IR camera (we do teach this) but how to look at a home differently and see areas where there may be issues with thermal performance.
- It's not R-value, it is performance!
  - WAP example: 24 home with R-30 batt in the attic.

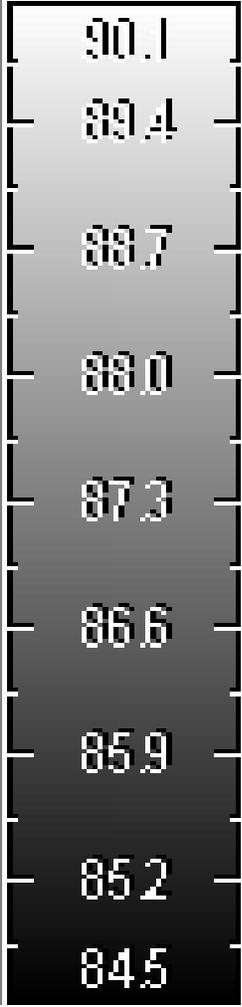


**Summer in Phoenix  
Uninsulated attic hatch is hot (white)**

**A picture is worth a 1000 words.**



( 392.0)



( 14.0)

# WAP example

WAP \$\$\$ used to insulate 24 homes with existing R-30



**R-30 batt, yes – performance ?????**

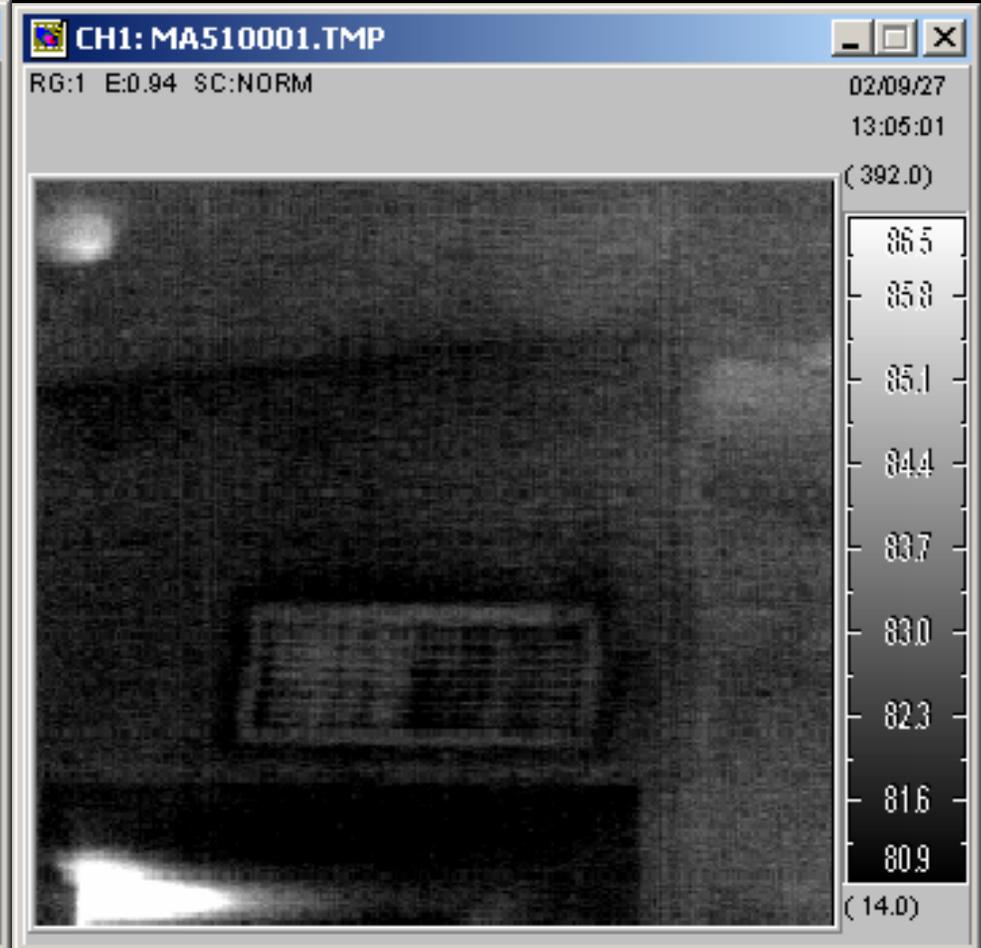


# Before and after pictures after we moved the insulation.

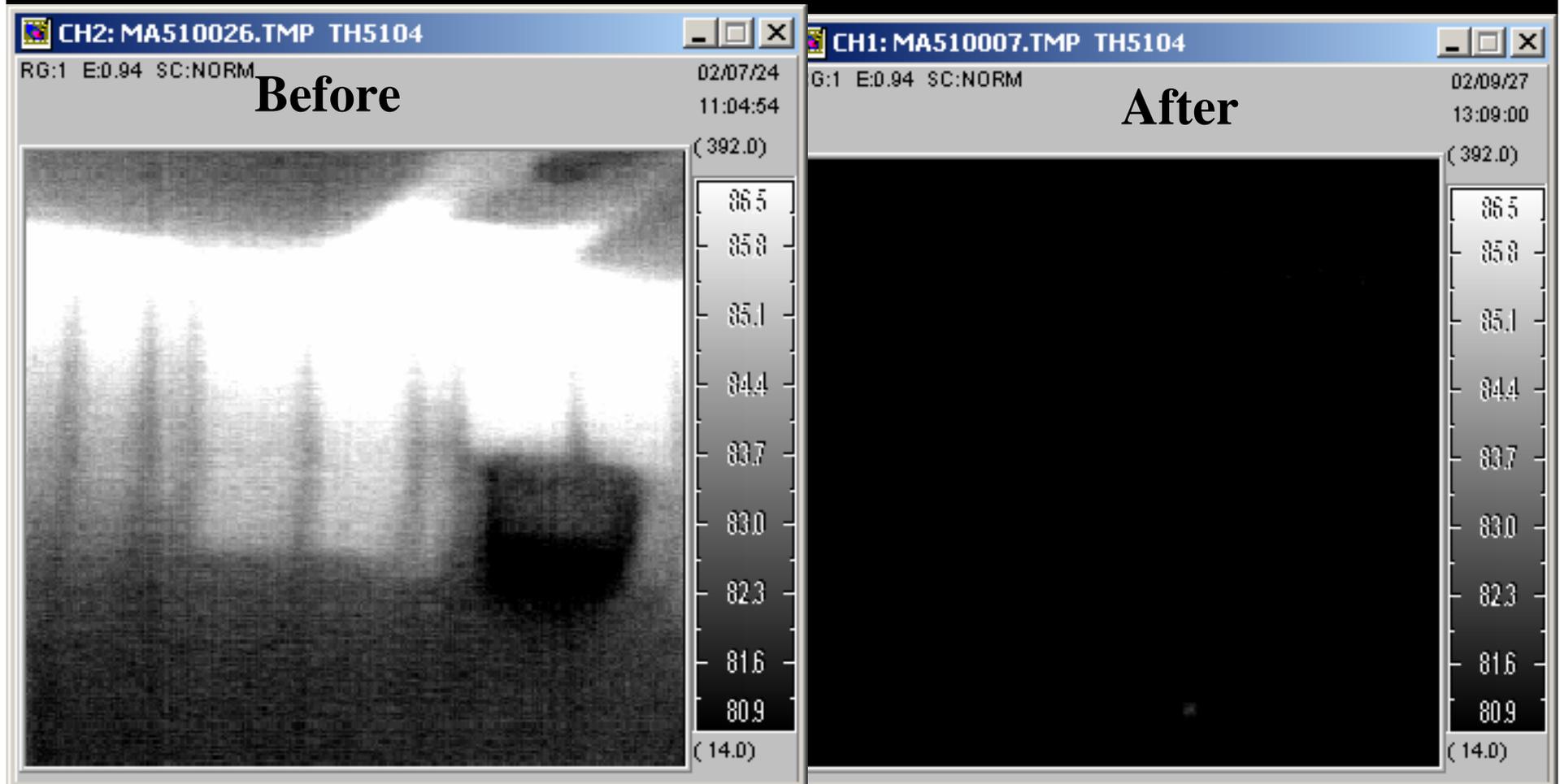
## Before (R-30 batt)



## After (R-30 batt moved)



# We will modify the lab walls to demonstrate various insulation problems





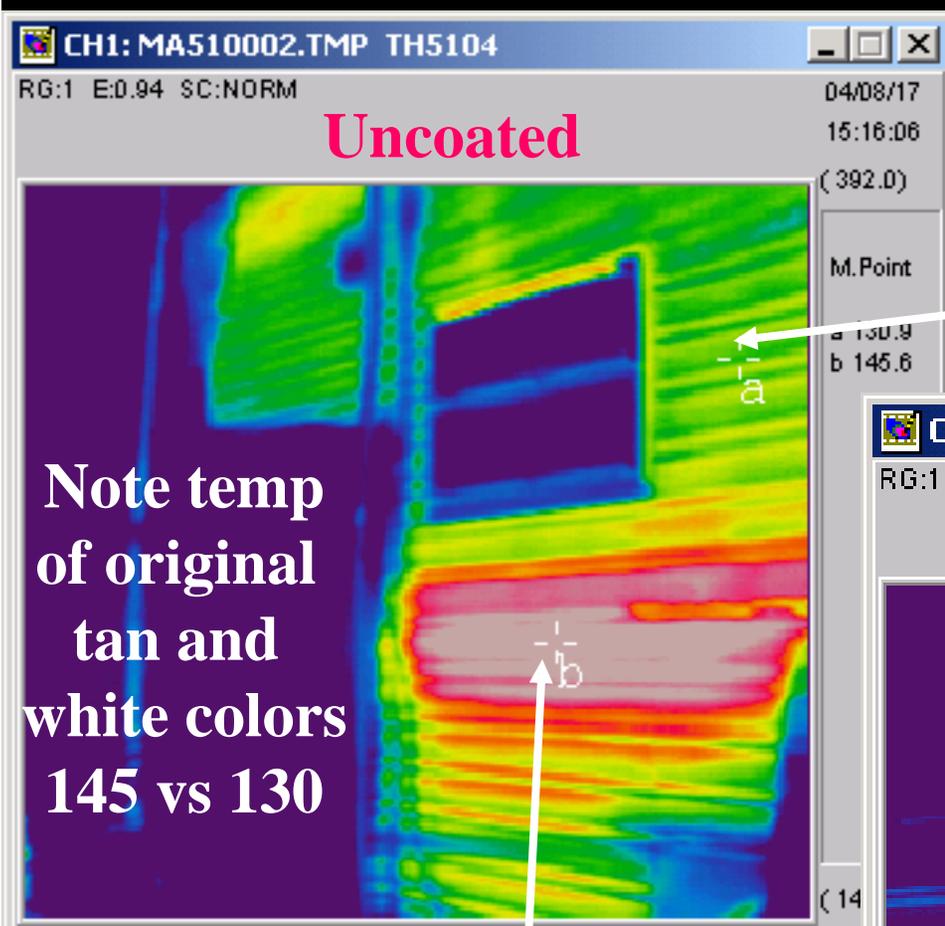
**Before white coating**  
**Note light tan paint**

**Difference in temperatures  
between tan and  
white painted areas is 15 °  
(145 ° and 130 ° - see next slide)**

**Mobile home before and  
after white coating. This is  
a standard measure on  
mobile homes. These slides  
document impact**

**After white coating**





**Uncoated**

Note temp of original tan and white colors 145 vs 130

10 ° difference between original white paint and white coating

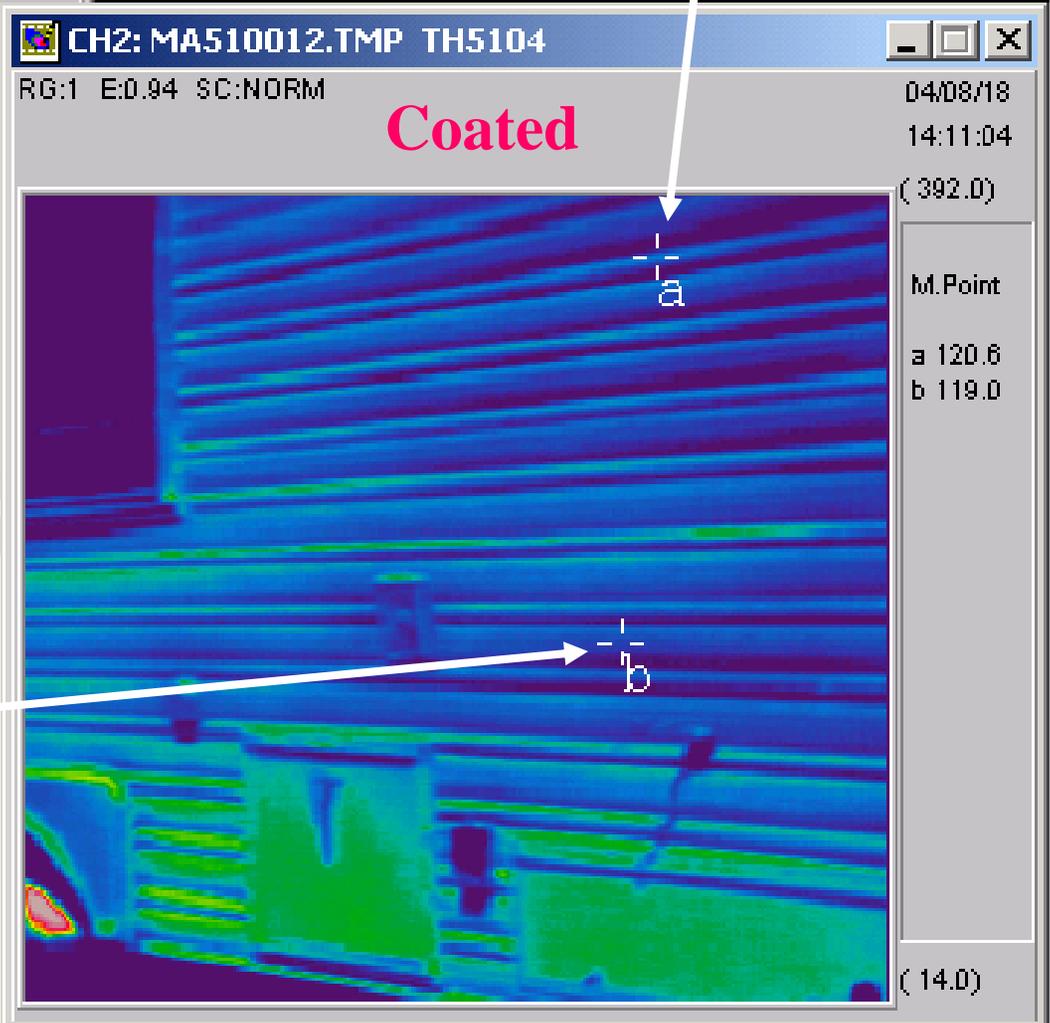
130°

120°

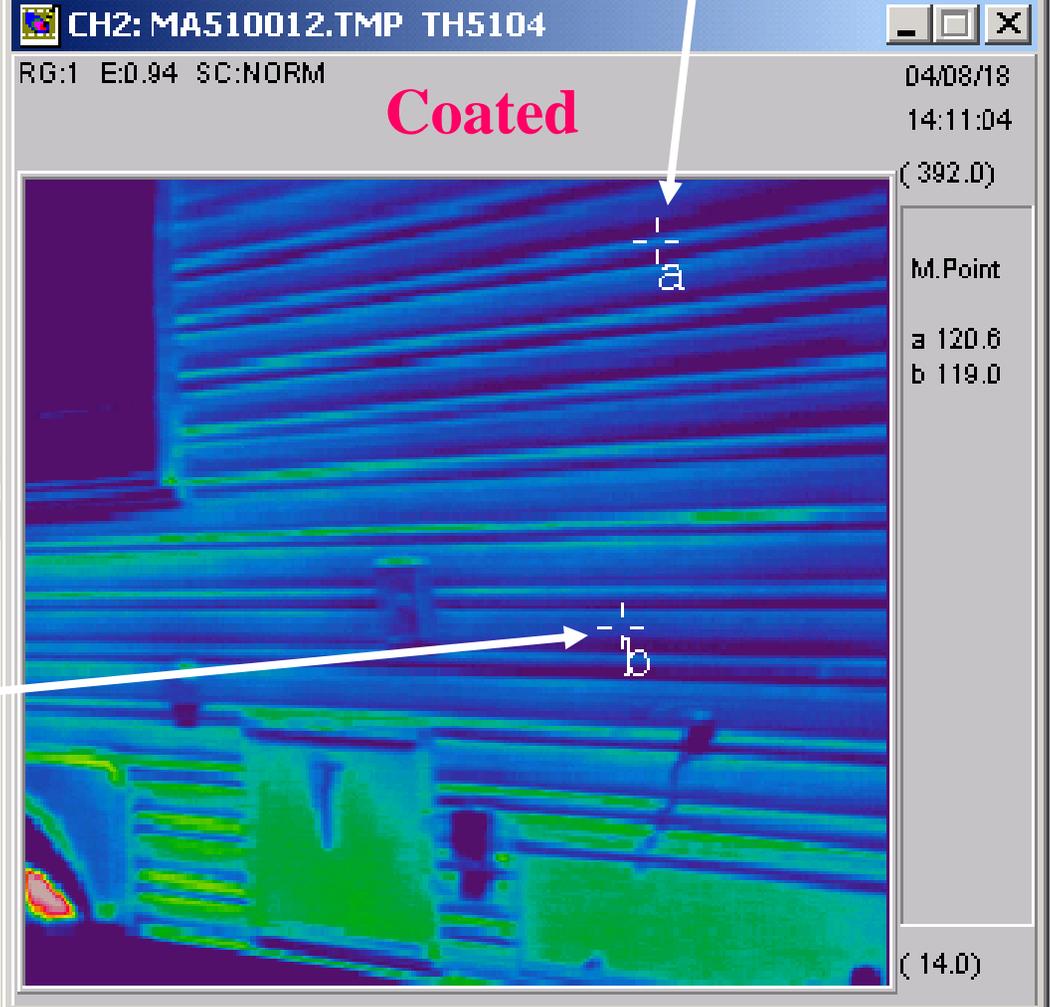
145° (tan)

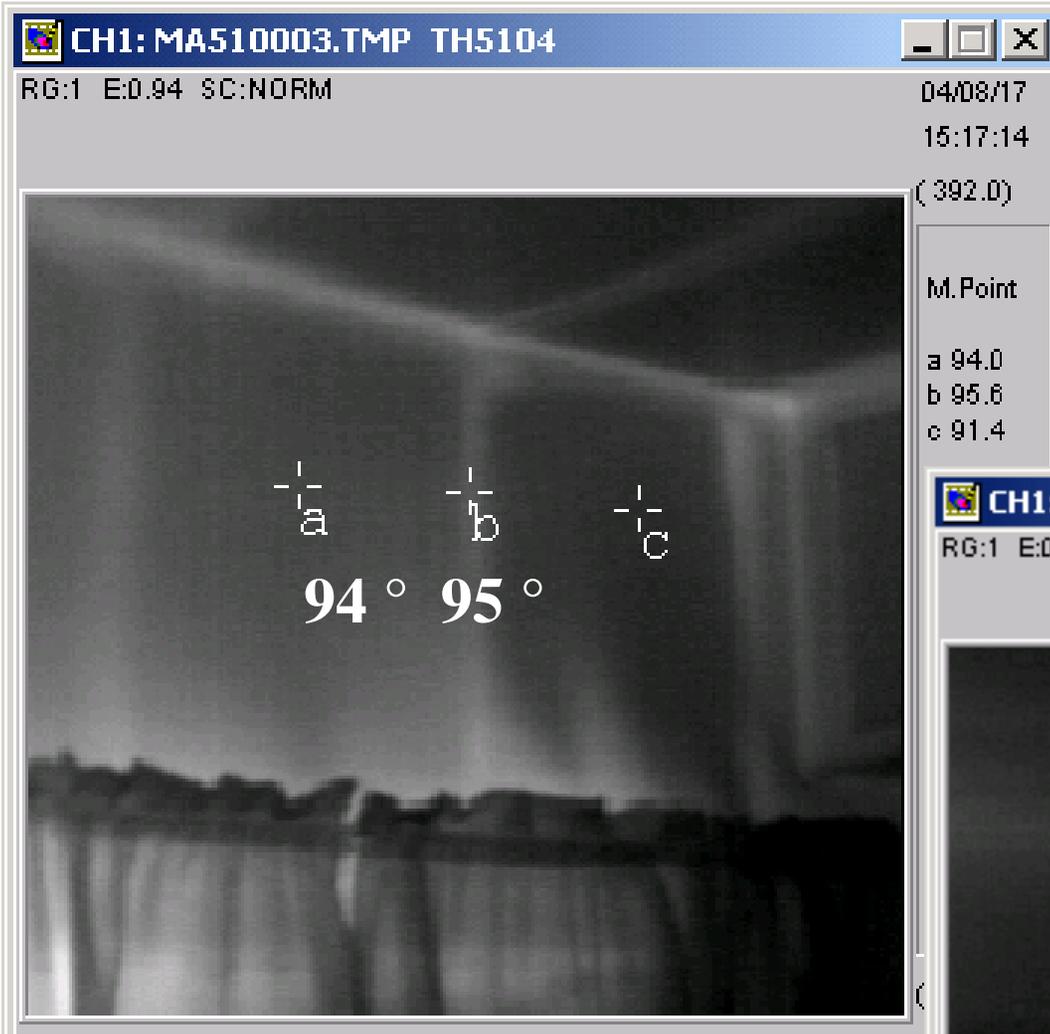
119°

26 ° difference between the original tan painted area and white coated areas.



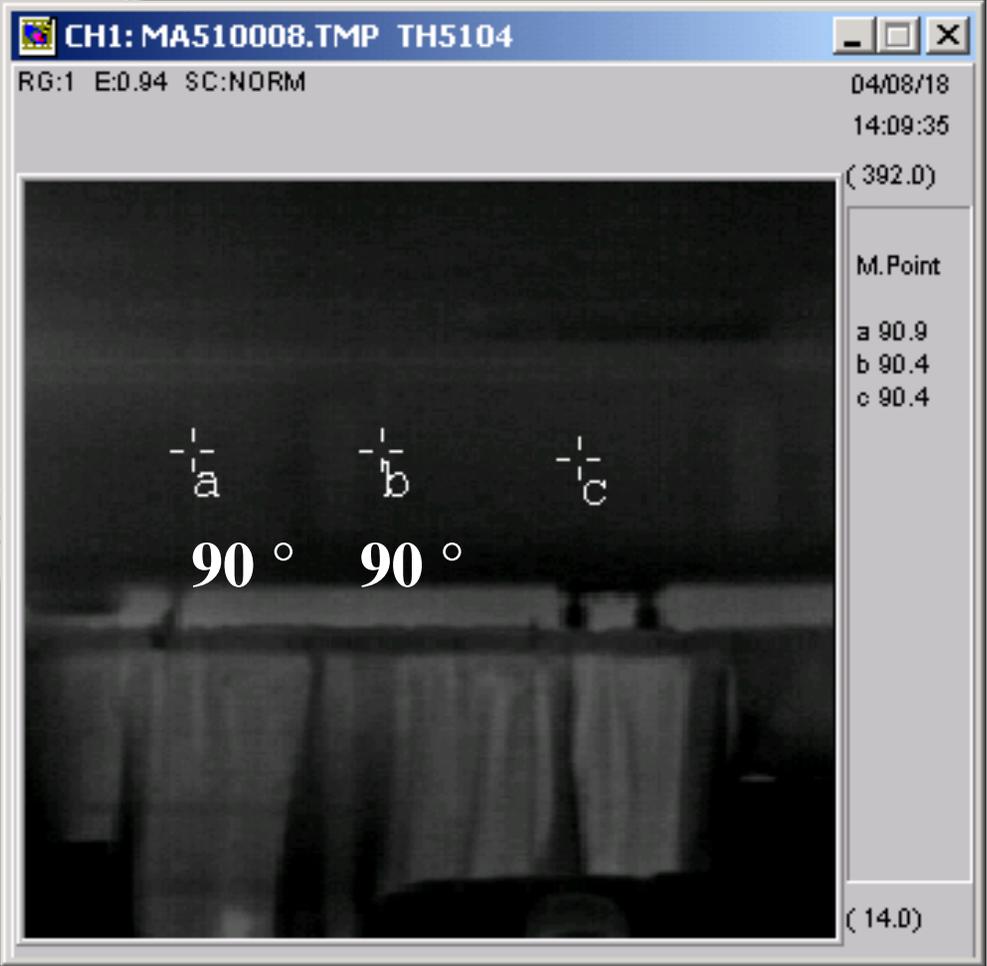
**Coated**





**Interior temperatures  
 (infrared)  
 before coating**

**Interior temperatures  
 (infrared)  
 after coating**





Before reflective roof coating - 93 degree ceiling temperature

After reflective roof coating – 87 degree ceiling temperature



# REM/Design

- Class to get people started, as with all these topics, practice, practice, practice.

# Building Performance Institute

## BPI

- BPI provides nationally recognized building science certifications.
- Foundation for Senior Living Home Improvement is an affiliate of BPI and trains and certifies local technicians at the Training Center.
- Presently half of our agencies have a BPI certified technician. Others in the process.

# Home Performance with Energy Star (HPwES)

- The SBSTC is working with EPA to sponsor HPwES in Arizona.
- Basically a EPA label on the contractor.
- BPI certification is the base technical requirement.
- SBSTC will coordinate and monitor performance.

# The Future



**Build a house to expand  
the hands on training**

?