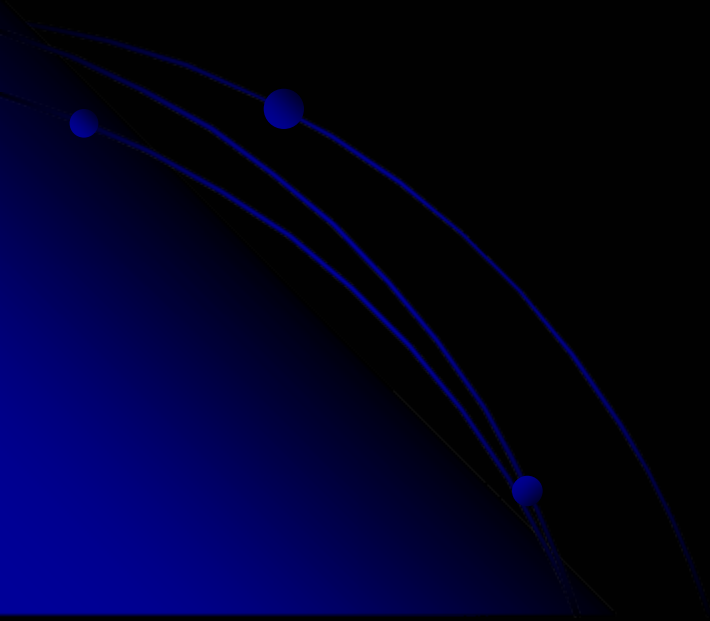


# Intermission *(5 Minutes)*

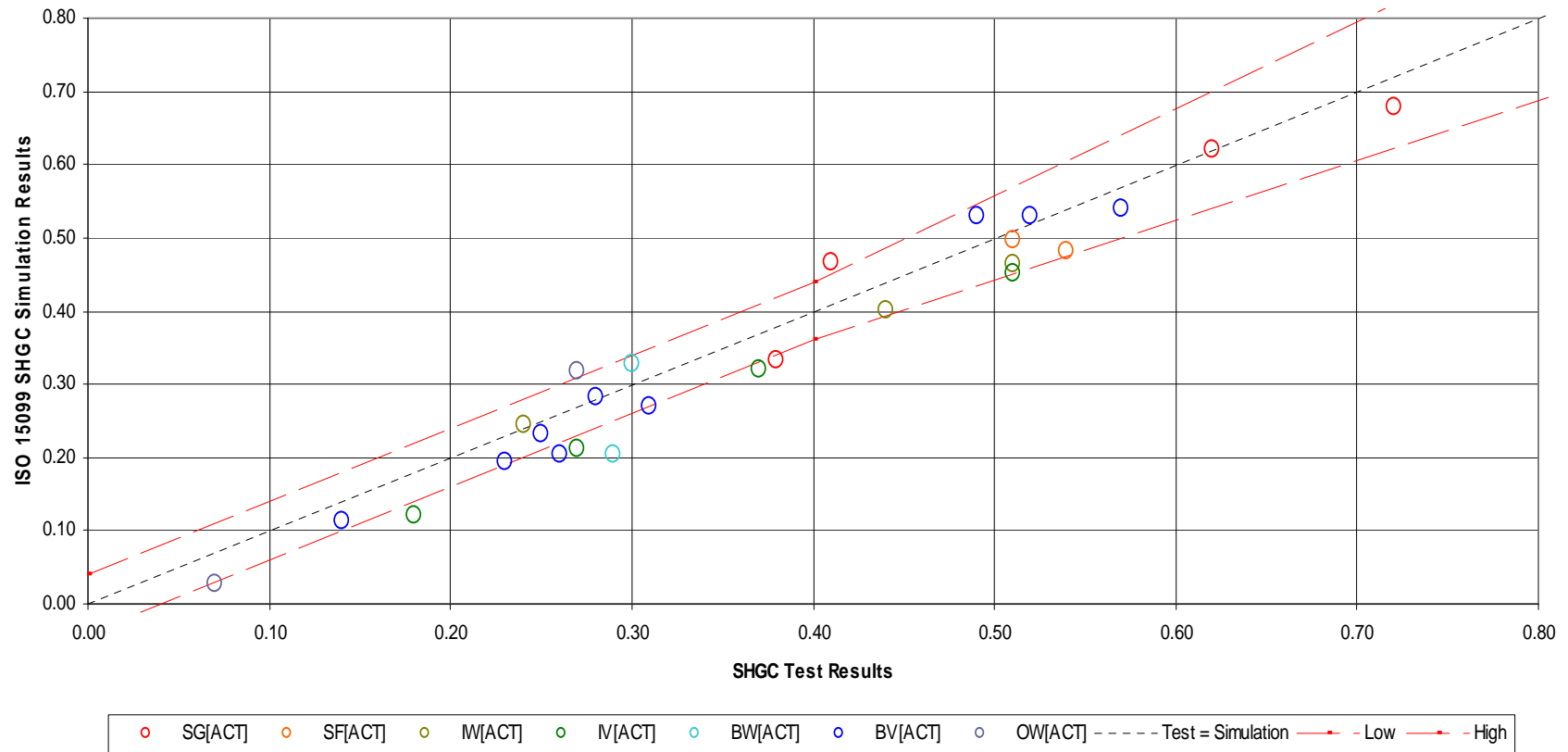


# Presentation

- Background
- Project Objectives and Tasks
- Recommendations
  - Frit Glazing
  - Indoor Screens
  - Indoor Venetian Blinds
  - Venetian Blinds Between Glazing
  - Outdoor Screens
- **Intermission (5 Minutes)**
- Analysis of All Test Specimens
- Conclusions
- Project Challenges
- Future Analysis and Research

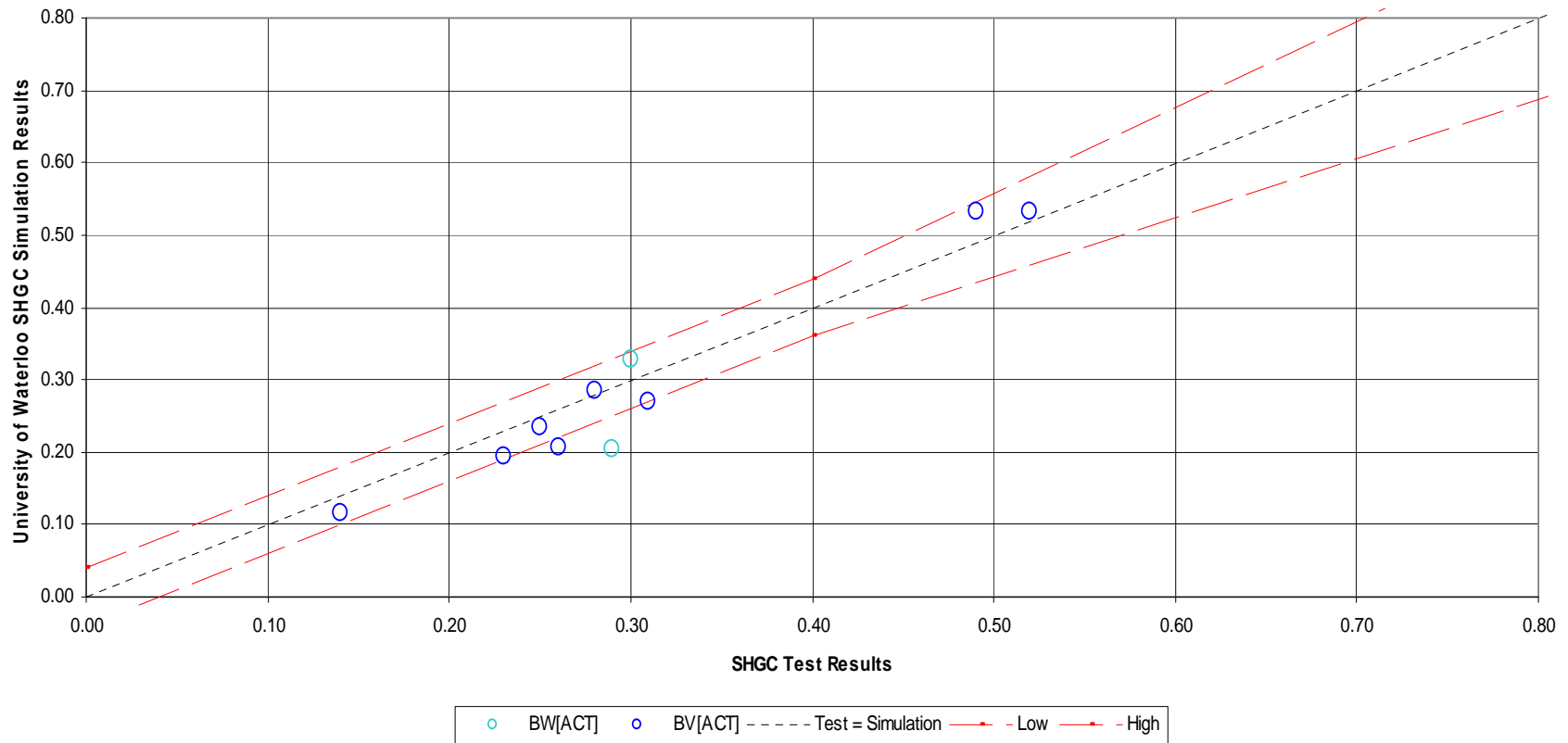
# Comparison of SHGC NFRC 201 vs. ISO 15099

SHGC Test (NFRC 201) vs. ISO 15099 Computer Simulation Results

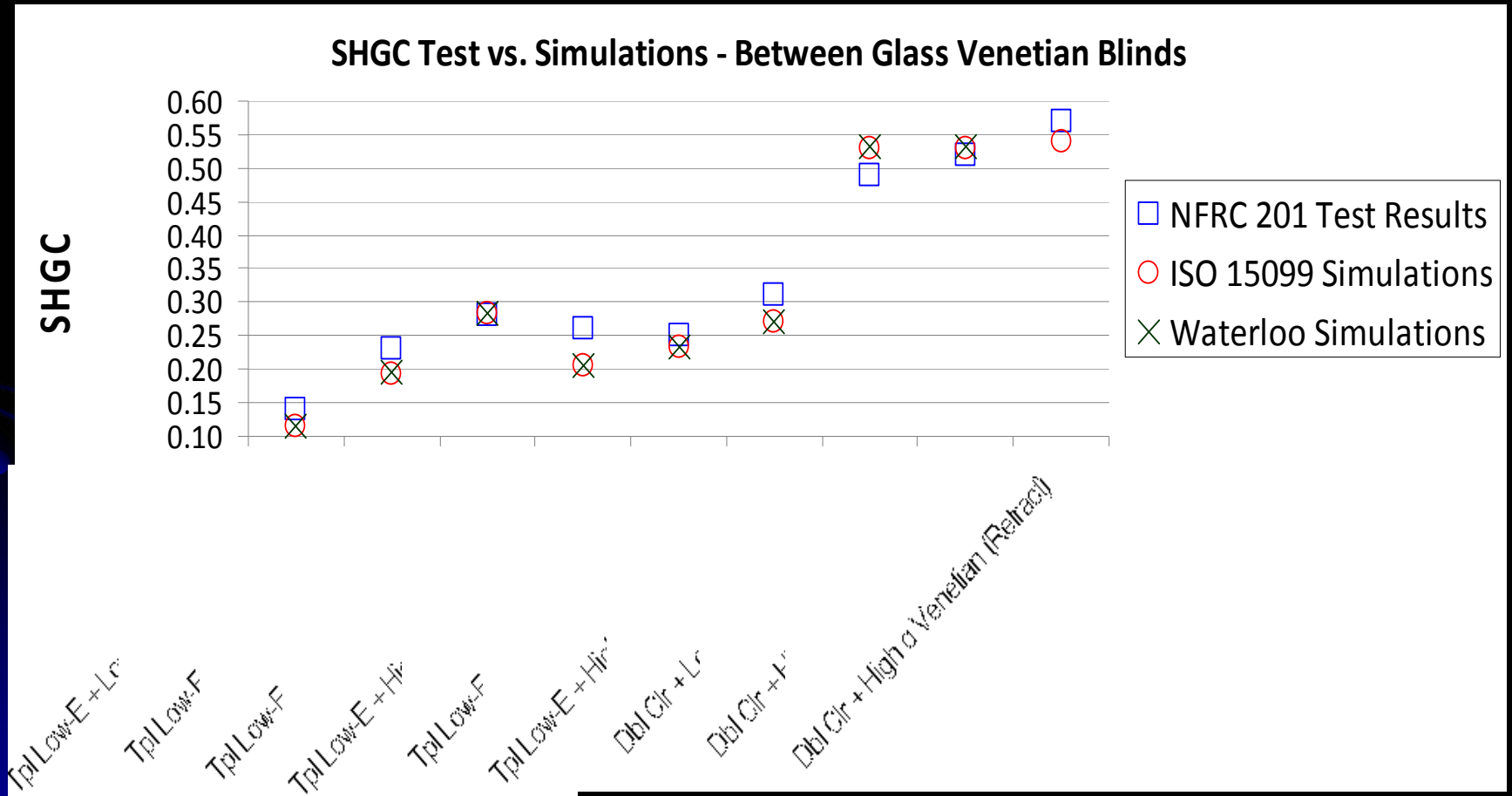


# Comparison of SHGC NFRC 201 vs. Univ. of Waterloo

SHGC Test (NFRC 201) vs. University of Waterloo Computer Simulation Results

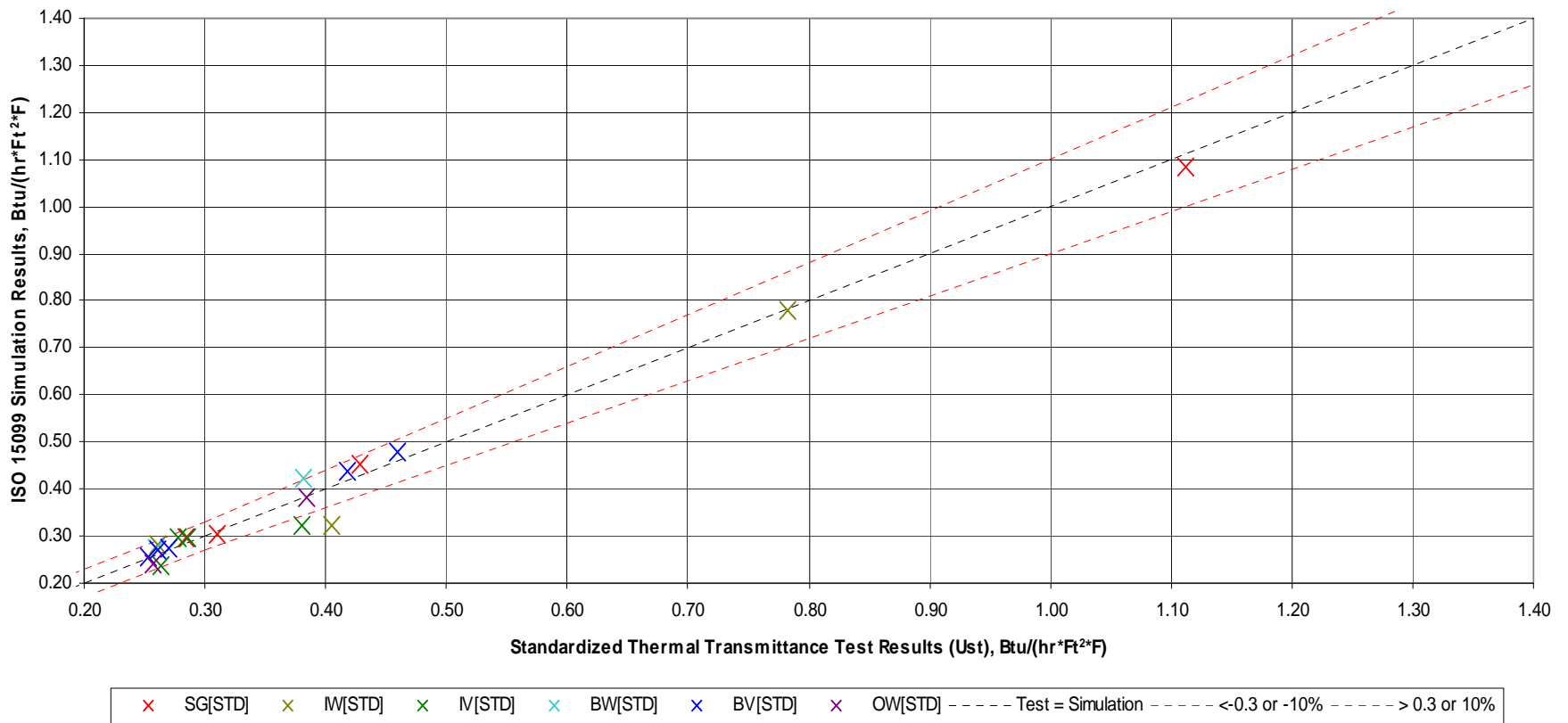


# Recommendation: SHGC Between Glazing Venetian Blinds



# Comparison of U-Factor ISO 15099

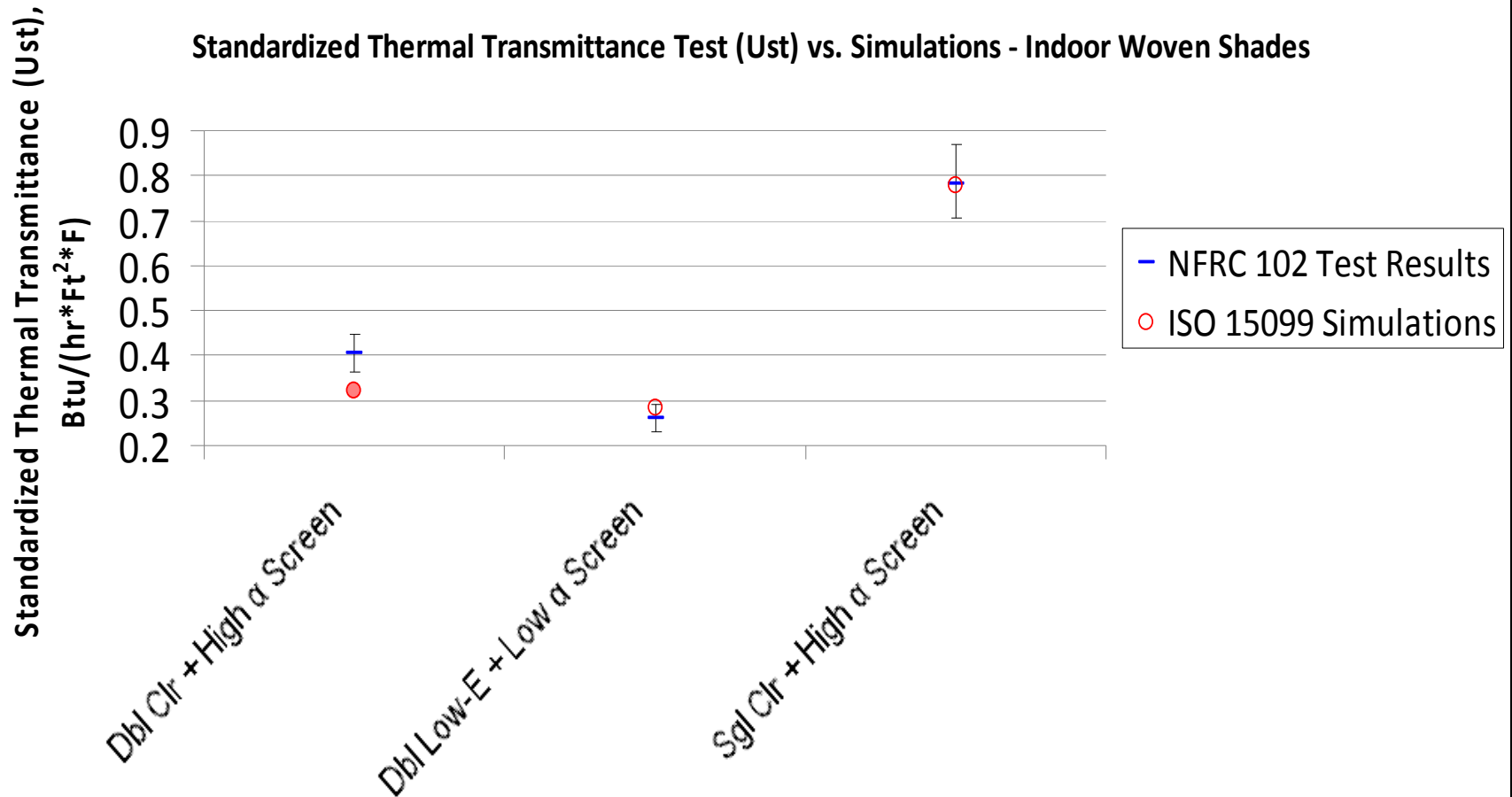
NFRC 102 Standardized Thermal Transmittance Test (Ust[CTS]) vs. ISO 15099 Computer Simulation Results



# Comparison of U-Factors Indoor Woven Shades

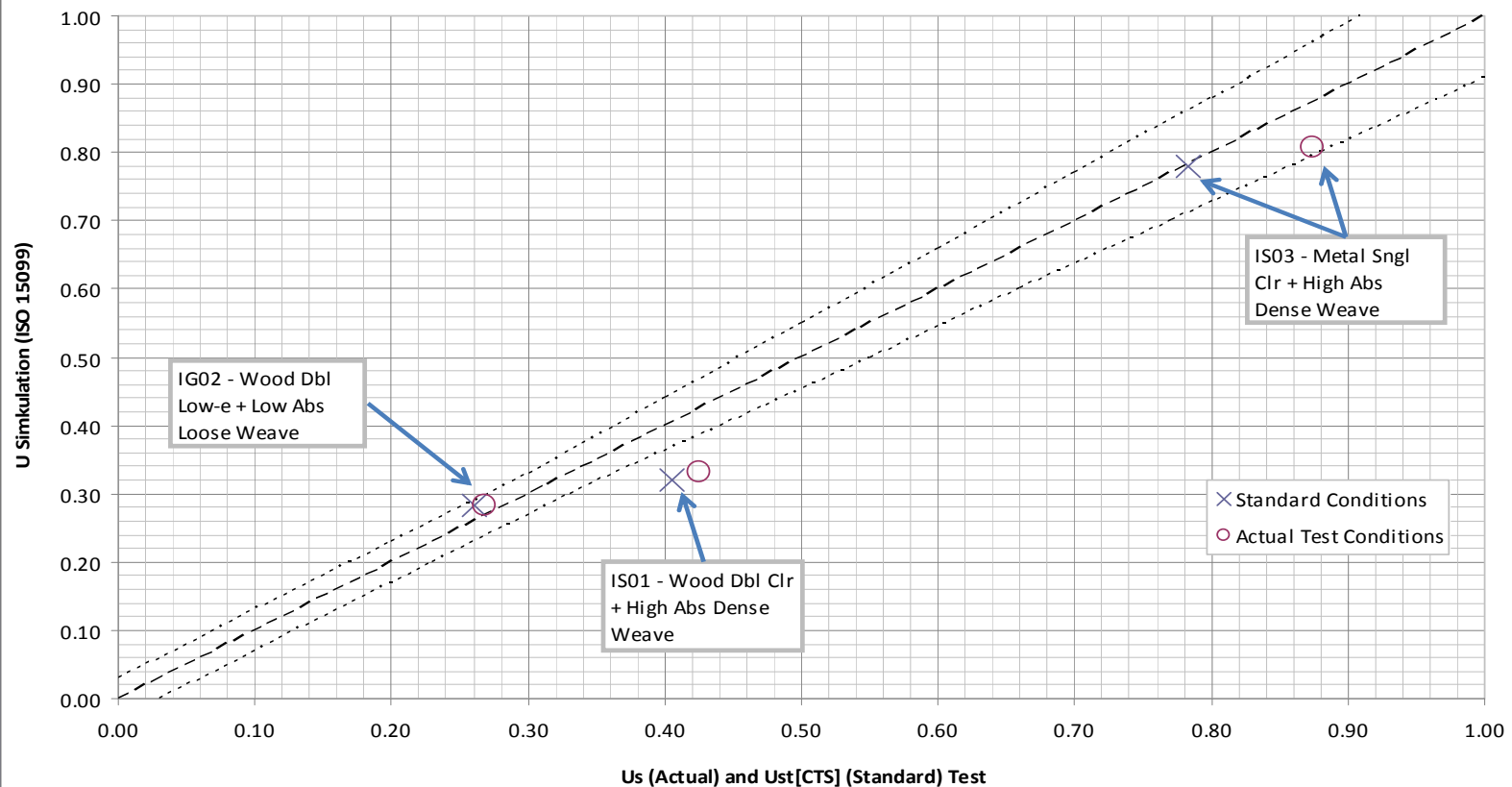
	NFRC 102	ISO 15099		
Test Specimen	Test	Simulation	% Diff.	Diff.
Dbl Clr + High $\alpha$ Screen	0.40	0.321	<b>-20.73%</b>	-0.084
Dbl Low-E + Low $\alpha$ Screen	0.26	0.282	7.97%	<b>0.021</b>
Sgl Clr + High $\alpha$ Screen	0.78	0.779	<b>-0.45%</b>	-0.004
Minimum	0.26	0.282	-20.73%	-0.084
Maximum	0.78	0.779	7.97%	0.021
Average	<b>0.48</b>	<b>0.461</b>	<b>-4.40%</b>	<b>-0.022</b>
Standard Deviation	0.269	0.2763	14.75%	0.0548

# Comparison of U-Factors Indoor Woven Shades



# Comparison of U-Factors Indoor Woven Shades

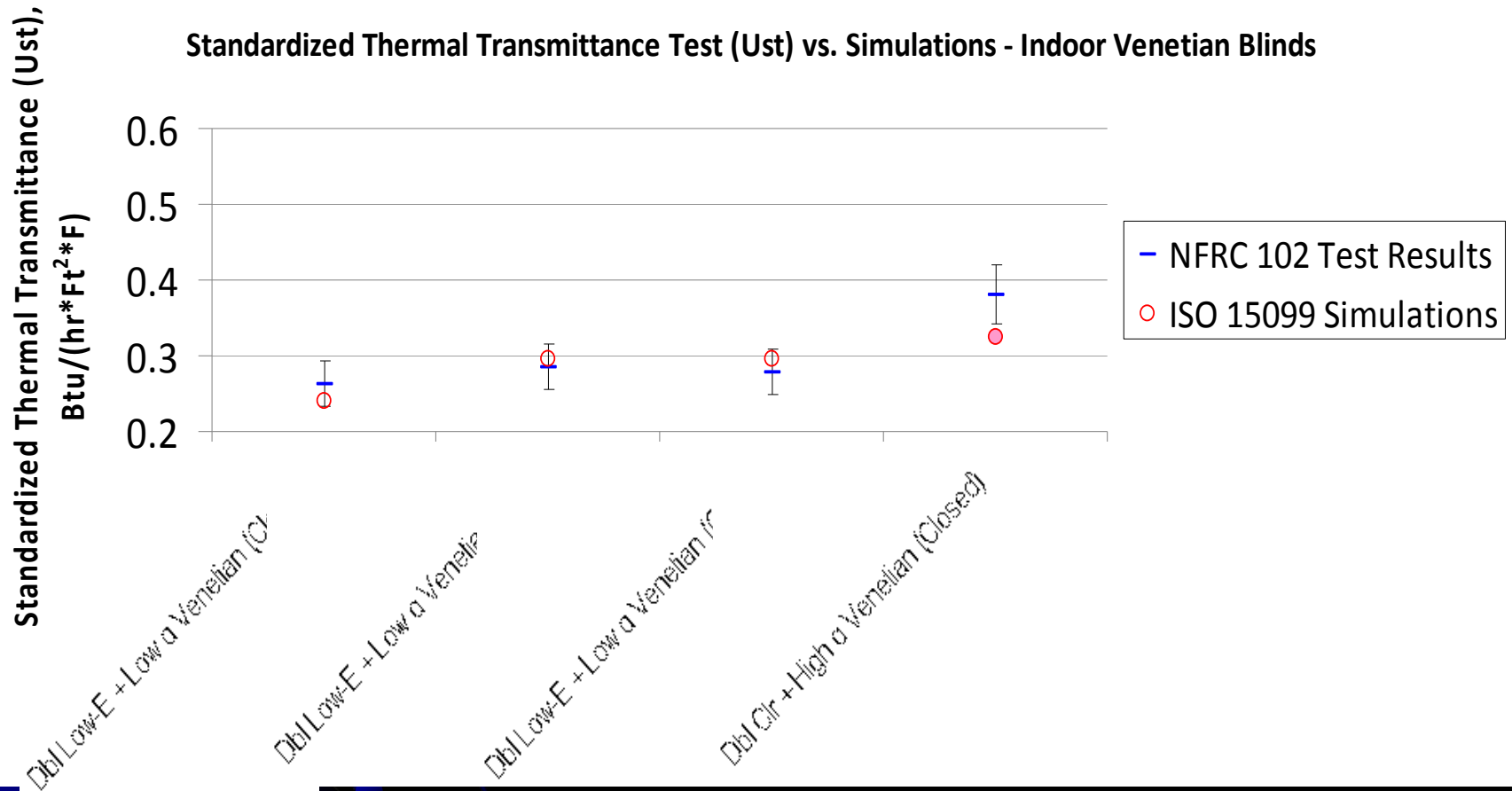
## Us vs. Actual & Ust vs. Standard For Inside Woven Shade



# Comparison of U-Factors Indoor Venetian Blinds

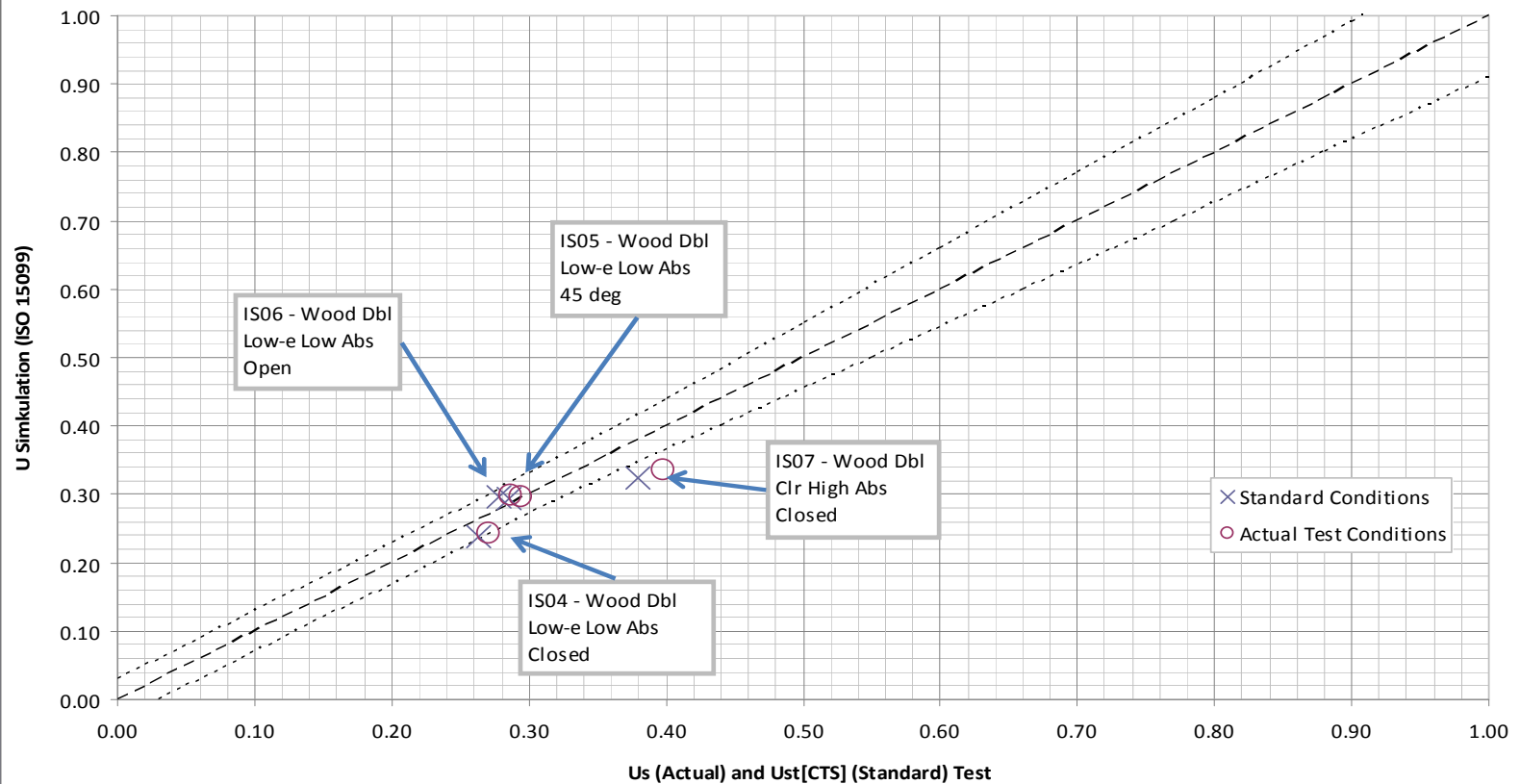
Test Specimen	NFRC 102	ISO 15099	% Diff.	Diff.
	Test	Simulation		
Dbl Low-E + Low $\alpha$ Venetian (Closed)	0.26	0.239	<b>-9.21%</b>	-0.024
Dbl Low-E + Low $\alpha$ Venetian (45°)	0.29	0.295	<b>3.48%</b>	0.010
Dbl Low-E + Low $\alpha$ Venetian (Open)	0.28	0.296	<b>6.38%</b>	0.018
Dbl Clr + High $\alpha$ Venetian (Closed)	0.38	0.324	-14.70%	<b>-0.056</b>
Minimum	0.26	0.239	-14.70%	-0.056
Maximum	0.38	0.324	6.38%	0.018
Average	<b>0.30</b>	<b>0.289</b>	<b>-3.51%</b>	<b>-0.013</b>
Standard Deviation	0.053	0.0356	10.07%	0.0338

# Comparison of U-Factors Indoor Venetian Blinds



# Comparison of U-Factors Indoor Venetian Blinds

## Us vs. Actual & Ust vs. Standard For Indoor Venetian Blinds



# Comparison of SHGC Between Glazing Woven Shades

Test Specimen	NFRC 201 Test	ISO 15099 Simulation	% Diff.	Diff.
Dbl Clr + Low $\alpha$ Screen	0.30	0.327	8.98%	<b>0.027</b>
Tpl Low-E + High $\alpha$ Screen	0.29	0.206	-29.11%	<b>-0.084</b>
Minimum	0.29	0.206	-29.11%	-0.084
Maximum	0.30	0.327	8.98%	0.027
Average	<b>0.30</b>	<b>0.266</b>	<b>-10.07%</b>	<b>-0.029</b>
Standard Deviation	0.007	0.0858	26.94%	0.0788

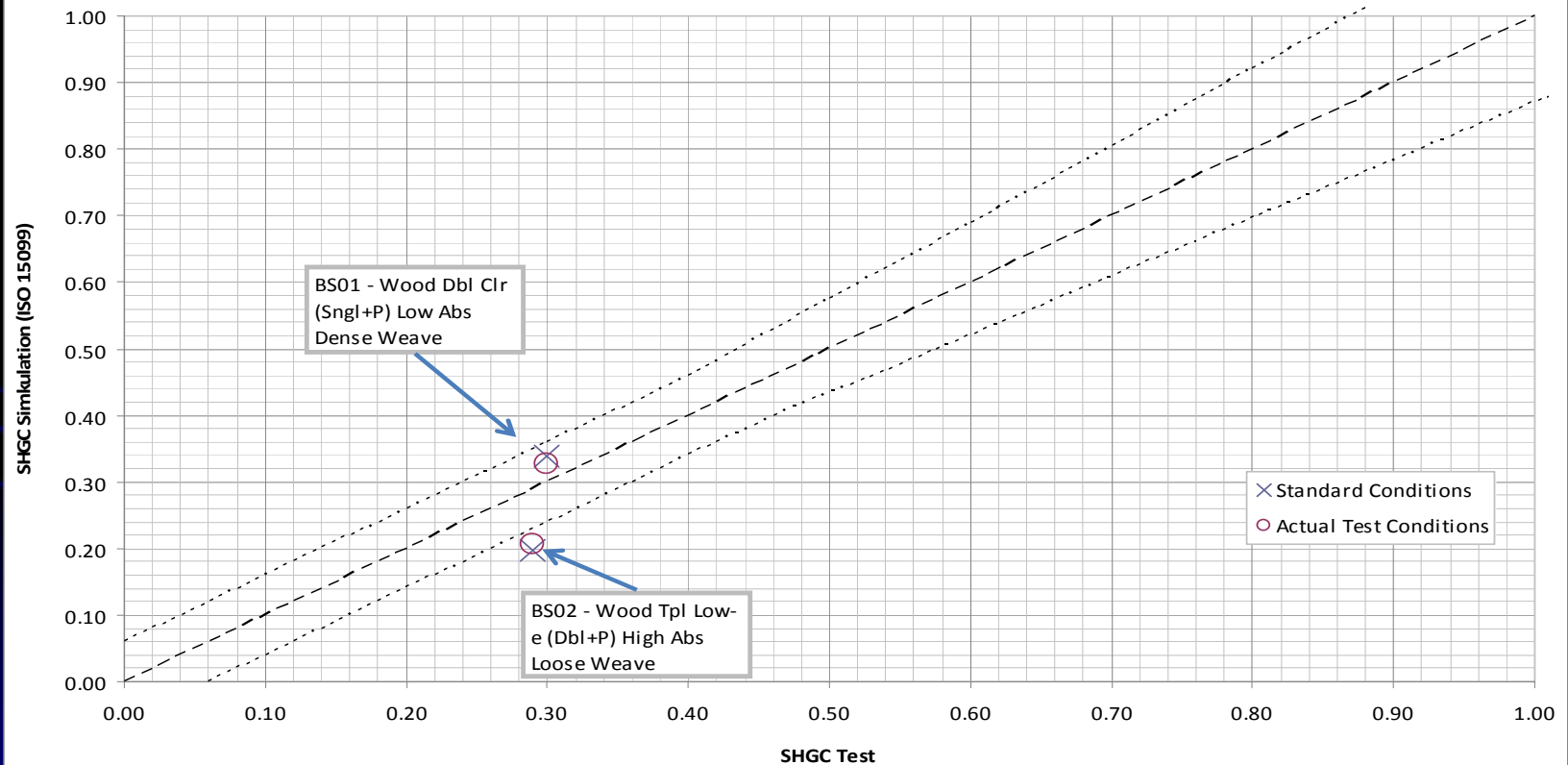
# Comparison of SHGC Between Glazing Woven Shades

SHGC Test vs. Simulations - Between Glass Woven Shades



# Comparison of SHGC Between Glazing Woven Shades

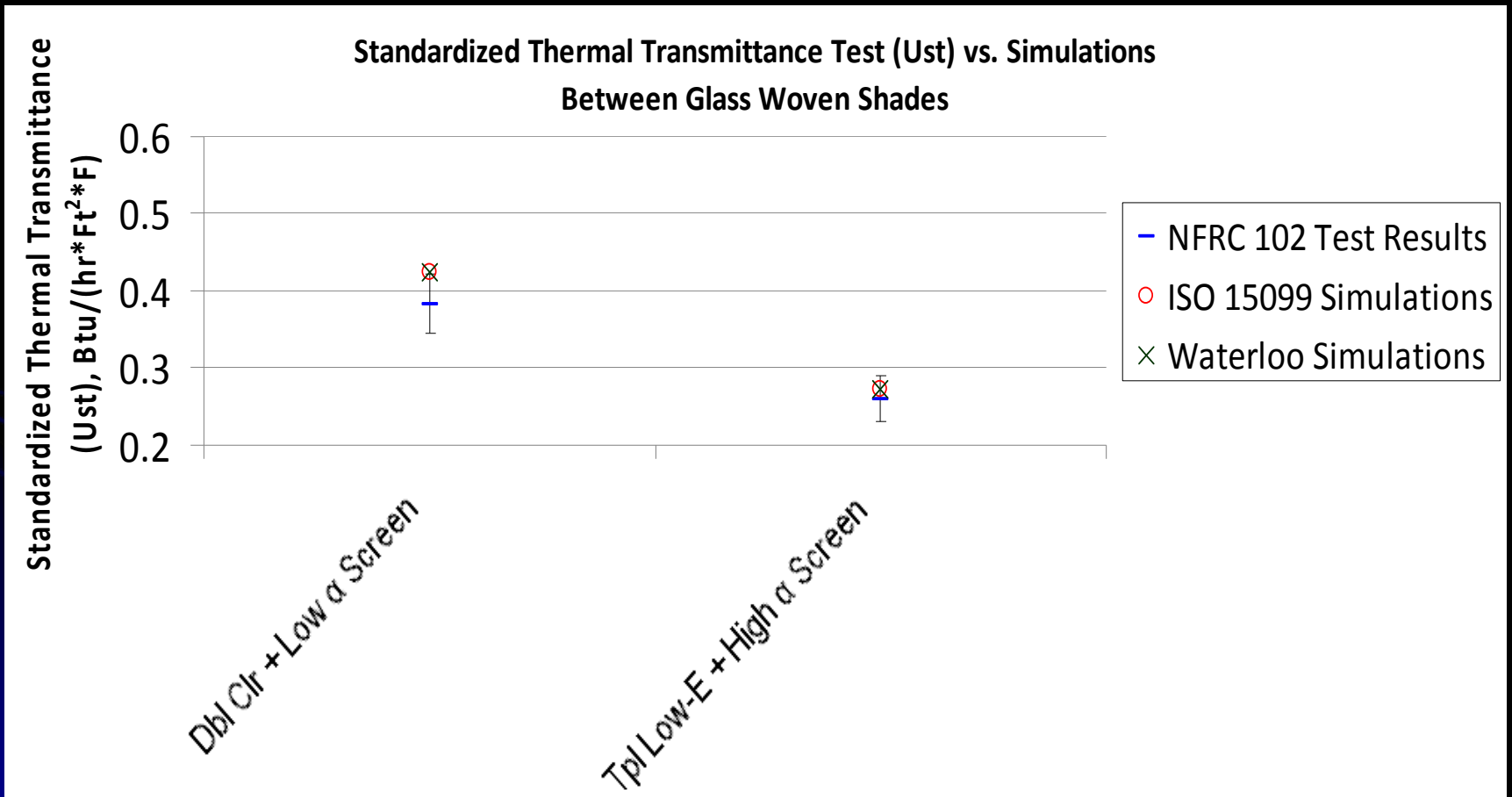
## SHGC For Between Glazing Woven Shade



# Comparison of U-Factor Between Glazing Woven Shades

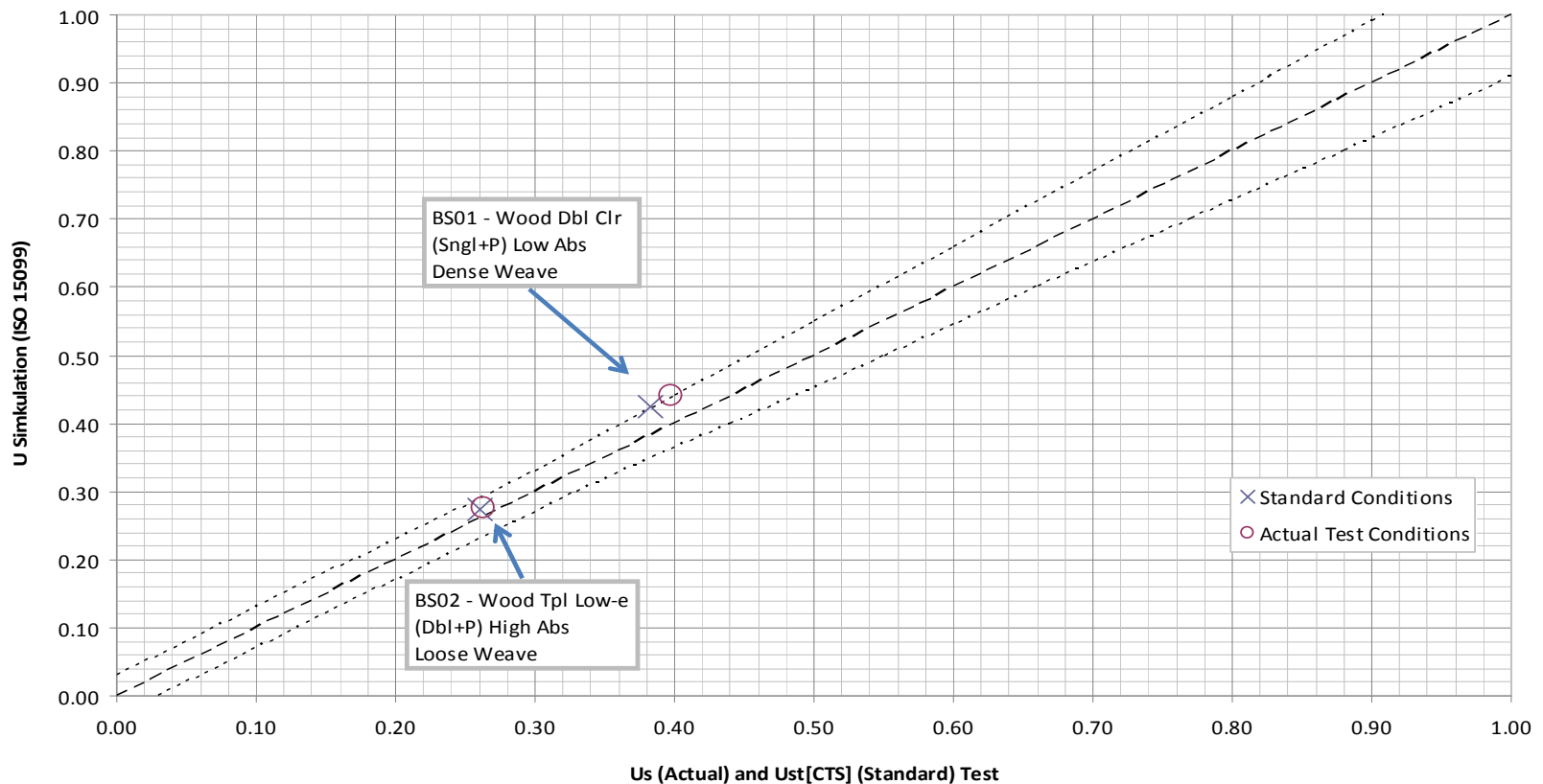
Test Specimen	NFRC 102	ISO 15099	% Diff.	Diff.
	Test	Simulation		
Dbl Clr + Low $\alpha$ Screen	0.38	0.424	<b>11.01%</b>	0.042
Tpl Low-E + High $\alpha$ Screen	0.26	0.273	4.84%	<b>0.013</b>
Minimum	0.26	0.273	4.84%	0.013
Maximum	0.38	0.424	11.01%	0.042
Average	<b>0.32</b>	<b>0.349</b>	<b>7.93%</b>	<b>0.027</b>
Standard Deviation	0.086	0.1070	4.36%	0.0208

# Comparison of U-Factor Between Glazing Woven Shades



# Comparison of U-Factor Between Glazing Woven Shades

Us vs. Actual & Ust vs. Standard For Between Glazing Woven Shade



# Conclusions

- Comparison of Test & Simulation Results
  - SHGC (26 Tests)
    - Simple Glazing Systems (Without Attachment)
      - Within 0.06 (14%)
    - Between Glazing Venetian Blinds have better agreement than Indoor Venetian Blinds
    - Venetian Blinds have better agreement than Woven Blinds
    - Test results are typically higher than simulation results

# Conclusions

- Comparison of Test & Simulation Results
  - U-Factor (20 Tests)
    - Simple Glazing Systems (Without Attachment)
      - Within  $\pm 0.03$  (6%)
    - Between Glazing Venetian Blinds and Outdoor Woven Shades have better agreement than Indoor Woven Shades & Venetian Blinds

# Project Challenges

- Test Specimens

- Did not Receive What Was Expected

- Clear glass was actually Low-E

- Replaced test specimens

- Air cavity was actually argon gas filled

- Simulated with 90% argon gas

- Optical properties of coating supplied by manufacturer was different than measured by LBNL

- Used LBNL data

- Attachment not installed as requested

- LBNL & ATI documented actual installation afterwards

# Project Challenges

- Test Specimen Installation
  - Specimens were not installed as instructed
    - PI Visit at beginning of project (10/06/08)
    - Letter requesting all electronic data (01/22/10)
      - Inadequate response – Resubmit (05/19/10)
    - Letter requesting installation information (04/08/10)
      - No response – Resolved by Phone (06/20/10)
    - LBNL Visit to ATI (10/13/10)
      - Finalized Test Specimen Documentation (11/04/10)

# Project Challenges

## Test Specimen Installation

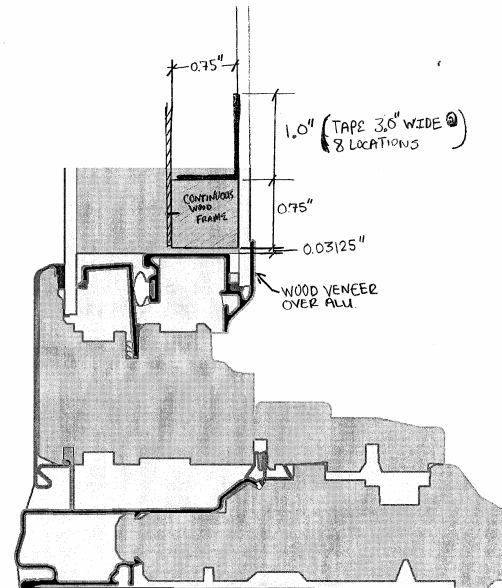


# Project Challenges

## Test Specimen Installation



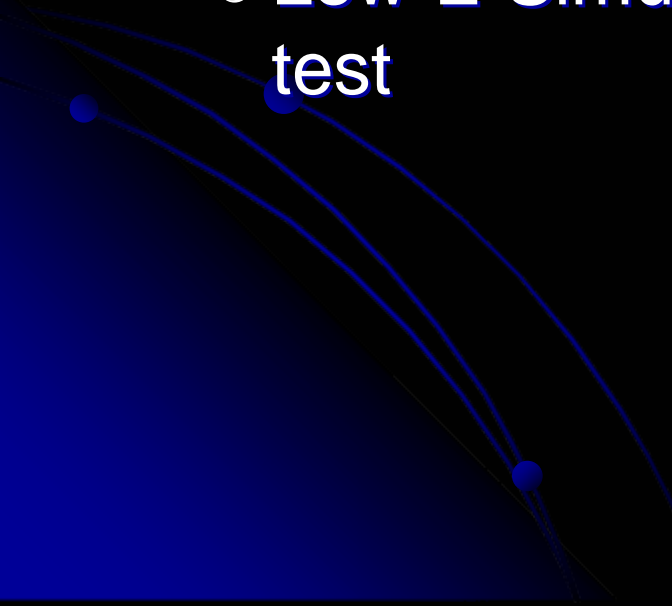
sBS01 86542.14-301-41



# Project Challenges

- Test Specimen Installation
  - Specimens were not installed as instructed
    - Verification of specimens & materials
      - Incomplete photographs of SHGC test specimens
        - 20 pictures of 17 test specimens (out of 26)
      - No pictures of U-Factor test specimens
  - Instrumentation of Specimens
    - Although windows were instrumented as instructed, few blinds or screens were instrumented for surface temperatures

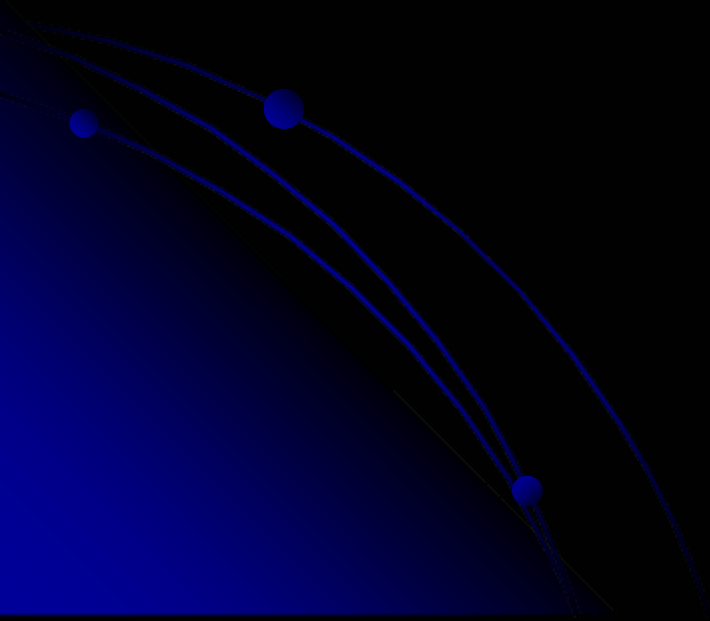
# Future Research

- Adjust SHGC Results Using Actual Spectra for Date and Location of Test
    - Clear Glass Simulation is -0.018 (-2.2%) less than test
    - Low-E Simulation is -0.032 (-15.9%) less than test
- 

# Future Research

- Product Types Needing Future Validation
  - SHGC & U-Factor of Between Glazing Woven Blinds
  - U-Factor Indoor Woven Shades
  - U-Factor Indoor Venetian Blinds
  - Broader range of frit glazing
- All Future Tests ***MUST BE WITNESSED*** by Scientist or PI

Questions or Comments?



**Project Participants**  
*W. Ross McCluney/Sun Pine  
Consulting*

*D. Charlie Curcija/Carli*

*Thank You !*



# **Project Monitoring Task Group**

*Joe Hayden/Pella*

*Christian Kohler/LBNL*

*Robin Mitchell/LBNL*

*Bipin Shah/WinBuild*

*Peter Lyons/P. Lyons & Ass.*

*Ray McGowan/NFRC*

*Thank You !*