


WINDOW6 and Complex Glazing Database update

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Windows and Daylighting Research Group
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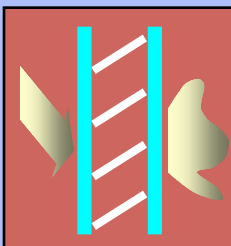
IGDB
(Specular Glass Database)



Optics
(Window Glass)



THERM
(Window Frame)



CGDB
(Complex Glazing Database)



WINDOW
(Whole Window)

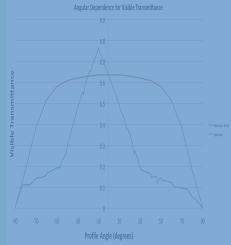
Design / Simulation Tools
DOE-2, EnergyPlus
Radiance



COMFEN
(Whole Building Commercial)



RESFEN
(Whole Building Residential)



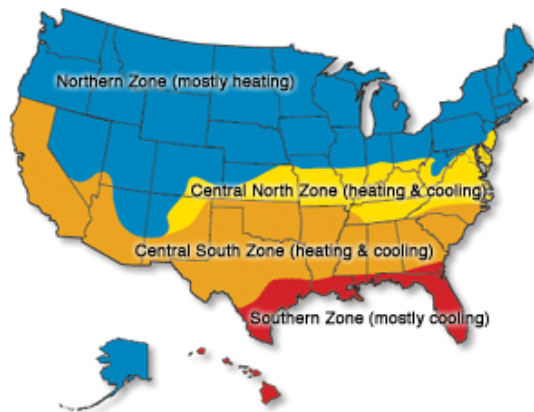
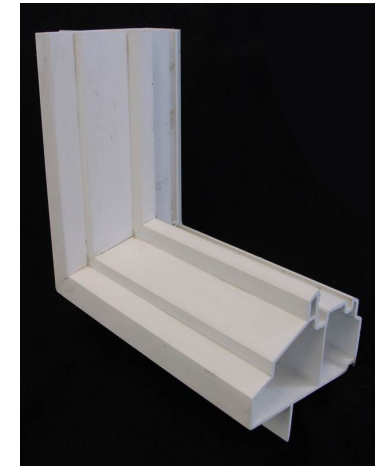
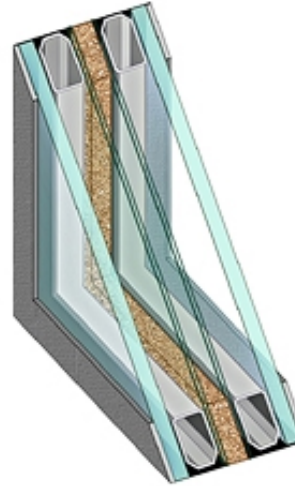
Angular SHGC/U/VT
(Rating/Labeling)

Background

How are Tools Used?

- Design of new products
- Guidelines for Product Selection
- Energy Star Compliance and Analysis
- NFRC Ratings

New Product Design



Energy Star Map



Efficient Windows Collaborative

Product Selection Guidelines

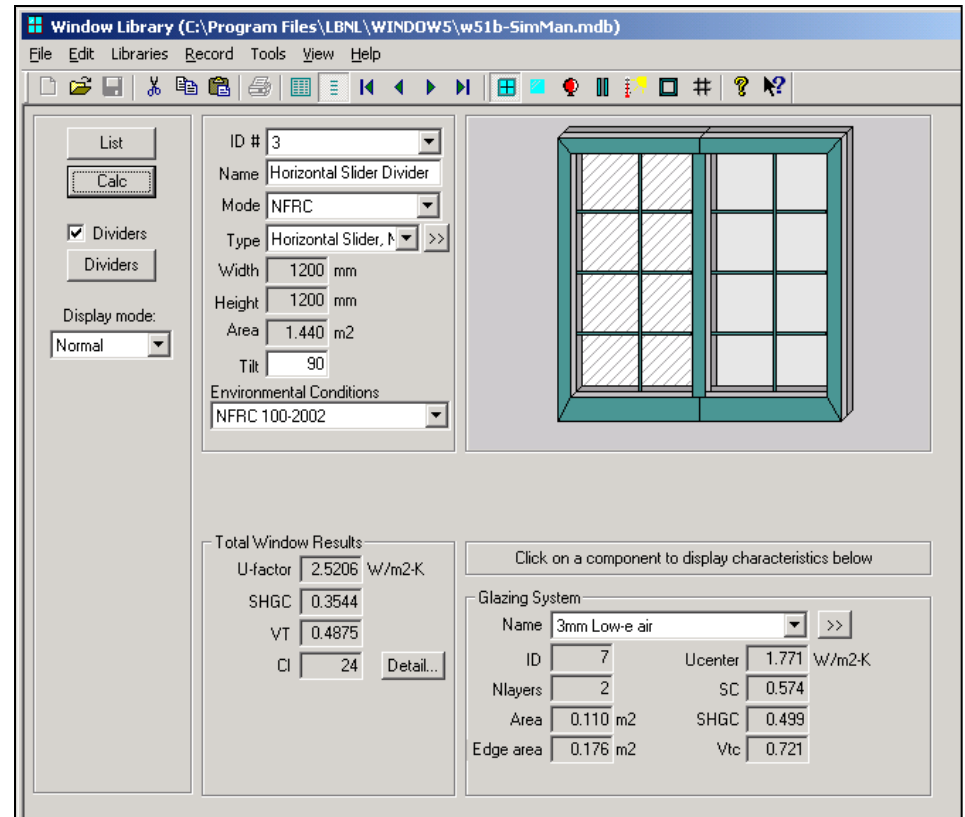
 National Fenestration Rating Council CERTIFIED	World's Best Window Co. Millennium 2000+ Vinyl-Clad Wood Frame Double Glazing + Argon Fill + Low E Product Type: Vertical Slider (per NFRC 100-97)
ENERGY PERFORMANCE RATINGS	
U-Factor (U.S./I-P) 0.35	Solar Heat Gain Coefficient 0.32
ADDITIONAL PERFORMANCE RATINGS	
Visible Transmittance 0.51	Air Leakage (U.S./I-P) 0.2
<small>Manufacturer stipulates that these ratings conform to applicable NFRC procedures for determining whole product performance. NFRC ratings are determined for a fixed set of environmental conditions and a specific product size. Consult manufacturer's literature for other product performance information. www.nfrc.org</small>	

NFRC Label



WINDOW

- Construct window from glazing system, frame and divider libraries



Complex Shading Devices

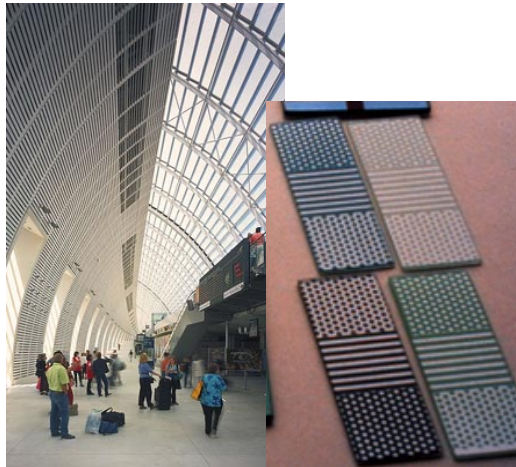
Manufacturers,
engineers, architects,
builders want to know
their performance
characteristics



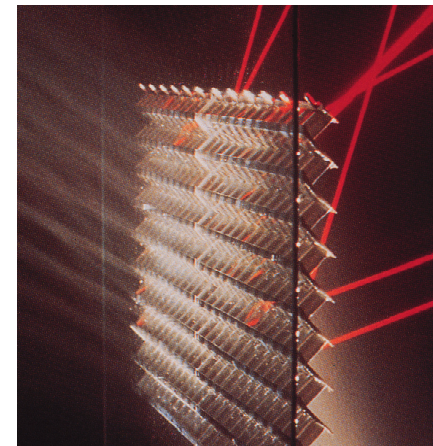
Cloth Shades /
Bug Screens



Venetian Blinds /
Integral shades



Fritted/Patterned Glass



Light Redirecting Products

Models in WINDOW6

- Venetian Blinds
- Woven Shades
- Fritted Glass

- Generic BSDF

Venetian Blind

Slat width: mm

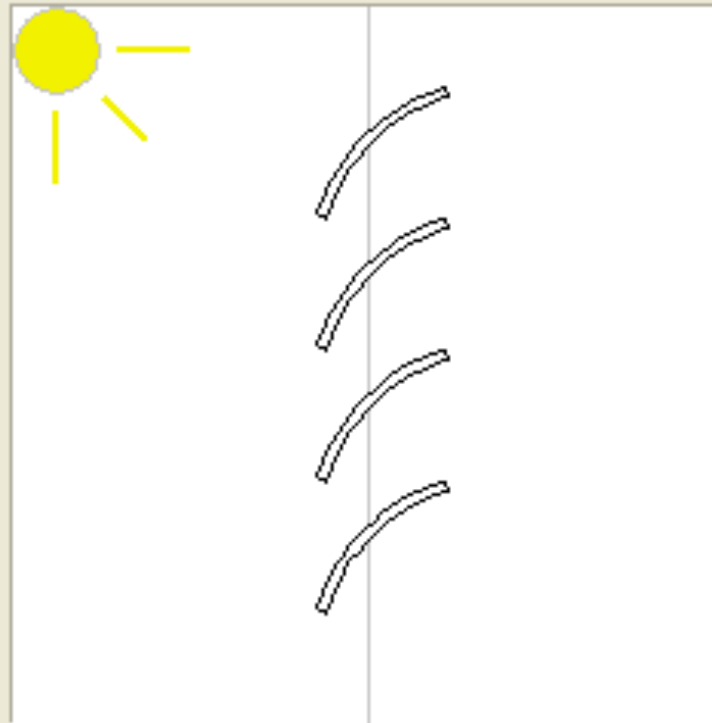
Spacing: mm

Tilt: ▾

Tilt angle: degrees

Blind thickness: mm

Rise: mm



Example Work Flow for Venetian Blinds

Manufacturer / Optical Lab

- Measure slat material in spectrophotometer
- Create XML data file and submit to LBNL

• LBNL adds to CGDB

Simulator

- Create Blind Geometry in WINDOW
Slat spacing, width, angle
- Create Glazing System
- Perform Calculation

Rating Info
U-factor,
SHGC, VT,

Angular U-
factor,
SHGC, VT

COMFEN/
RESFEN/
EnergyPlus
input

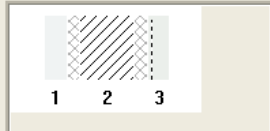
Radiance
input file

Not Implemented Yet

Glazing System Library

- List
- Calc (F9)
- New
- Copy
- Delete
- Save

ID #: 10 Name: Sample GlzSys -- Integral Venetian A, 45 de
Layers: 3 Tilt: 90 ° IG Height: 1000 mm
Environmental Conditions: NFRC 100-2004 IG Width: 1000 mm
Comment:



Overall thickness: 25.944 mm Mode: #

	ID	Name	Mode	Th
Glass 1	9803	CLEAR5.LOF	#	4
Gap 1	1	Air		2
Shade 2	2	Venetian A45		1
Gap 2	1	Air		2
Glass 3	9923	LOW-E_5.LOF	#	4

	Dbot (mm)	Dright (mm)	Dleft (mm)	Comment
	7.0	5.0	1.0	

- Report
- Radiance

Radiance

Sun Position

Date/time Month: Jan Day: 1 Time: 12:00
Latitude: 38.0 Longitude: 122.0

Manual Altitude: 42.5 Azimuth: 0.0

Room geometry: SimpleRoom

Calculation detail: Low

View: Fisheye

Sky specification: +s sunny sky, with sun

Comment:

Buttons: Calc, Close

Center of Glass Results | Temperature Data | Optical Data | An

Show Radiance Images

Protected



Radiance



Sun Position

Date/time Month Day Time

Latitude Longitude

Manual Altitude Azimuth

Room geometry

Calculation detail

View

Sky specification

Comment

Mkillum

(C:\Program Files\LBNL\WINDOW6\w6.mdb)

Record Tools View Help



Glazing System Library

ID #: 10 Name: Sample

Layers: 3 Tilt: 9

Environmental Conditions: NFRC 100-2004

Comment:

Overall thickness: 25.944 mm Mode:

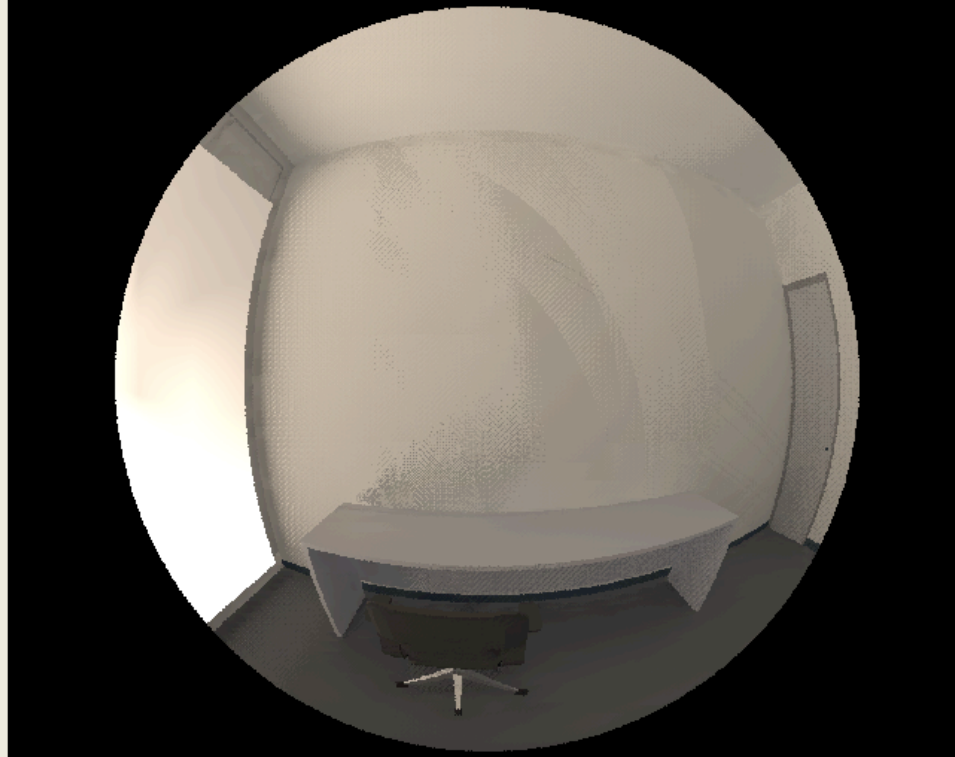
	ID	Name
Glass 1	9803	CLEAR5.LOF
Gap 1	1	Air
Shade 2	2	Venetian A45
Gap 2	1	Air
Glass 3	9923	LOW-E_5.LOF

Center of Glass Results | Temperature Data

Show Radiance Images

Protected

Image



Glazing System: 10
Run ID: 1
Image Path : c:\Program Files\LBNL\Window6\Radance\W6Results\10_0_time_1_1_12.00_38_122_+s_SimpleRoom_Low.bmp
Month: 1 Day: 1 Hour: 12.00 Latitude: 38.0 Longitude: 122.0
Detail: Low
Room: SimpleRoom
Comment:

Delete



Close

Height (mm)	Depth (mm)	Comment
5.0	1.0	

Three-Phase Method

- 100 Mb of pre-calculated HDR images for 1 view
- 10 seconds to generate an image

Three-Phase Method



Mkillum



detail **H** quality **M** variability **M**

10.90 minutes



Mkillum



with blinds

detail **H** quality **M** variability **M**

13.60 minutes

COMPLEX GLAZING DATABASE (CGDB)

- Conceptually comparable to International Glazing Database (IGDB)
- Designed for optically complex materials and devices
 - Venetian Blind slats
 - Woven Shades
 - Scattering (Diffusing) Interlayers
 - Scattering glass
 - Fritted Glass
 - Cellular shades
 - Other scattering layers/systems

INITIAL CGDB CONTENT

- Existing Product Measurements:
 - 100 Woven Shade screens
 - 14 Frits
 - 7 Venetian Blinds
 - 3 Diffusing Laminates
- Measured at LBNL

CGDB – Technical

- Stored in Access-2007 format: .ACCCDB
- All data submitted will be XML
- BSDF' s will stay as native XML in database
- Other complex data (eg frit measurements) will be parsed.
- LBNL will provide XML version of CGDB

TIMELINE

- Sept 2011
 - CGDB Beta (W6 and W7beta)
 - WINDOW 7 / THERM7 Beta
- Jan 2012
 - CGDB Inter-laboratory comparison (ILC)
 - CGDB 1.0 Release
- September 2012
 - WINDOW 7 / THERM 7 Release

Radiance – WINDOW6 links

- W6 can read genBSDF XML files as a layer definition
- W6 writes out BSDF XML files for a system that can be used with mkillum or 3-phase method
- Embedded link to win32 radiance binaries for visualization.

```

<Layer>
  <Material> ☹ </Material>
  <DataDefinition>
    <IncidentDataStructure>Columns</IncidentDataStructure>
    <AngleBasis> ☹ </AngleBasis>
  </DataDefinition>
  <WavelengthData>
    <LayerNumber>System</LayerNumber>
    <Wavelength unit="Integral">Visible</Wavelength>
    <SourceSpectrum>CIE Illuminant D65 1nm.ssp</SourceSpectrum>
    <DetectorSpectrum>ASTM E308 1931 Y.dsp</DetectorSpectrum>
    <WavelengthDataBlock>
      <WavelengthDataDirection>Transmission Front</WavelengthDataDirection>
      <ColumnAngleBasis>LBNL/Klems Full</ColumnAngleBasis>
      <RowAngleBasis>LBNL/Klems Full</RowAngleBasis>
      <ScatteringDataType>BTDF</ScatteringDataType>
      <ScatteringData> ☹ </ScatteringData>
    </WavelengthDataBlock>
  </WavelengthData>
  <WavelengthData> ☹ </WavelengthData> Transmission Back
  <WavelengthData> ☹ </WavelengthData> Reflectance Front
  <WavelengthData> ☹ </WavelengthData> Reflectance Back
</Layer>
</Optical>
</WindowElement>

```

```
<Layer>
```

```
  <Material> ☹ </Material>  
  <DataDefinition> ☹ </DataDefinition>  
  <WavelengthData> ☹ </WavelengthData>  
  <WavelengthData> ☹ </WavelengthData>  
  <WavelengthData> ☹ </WavelengthData>  
  <WavelengthData> ☹ </WavelengthData>
```

} Visible

```
<WavelengthData>
```

```
  <LayerNumber>System</LayerNumber>  
  <Wavelength unit="Integral">NIR</Wavelength>  
  <SourceSpectrum>CIE Illuminant D65 1nm.ssp</SourceSpectrum>  
  <DetectorSpectrum>ASTM E308 1931 Y.dsp</DetectorSpectrum>  
  <WavelengthDataBlock>  
    <WavelengthDataDirection>Transmission Front</WavelengthDataDirection>  
    <ColumnAngleBasis>LBNL/Klems Full</ColumnAngleBasis>  
    <RowAngleBasis>LBNL/Klems Full</RowAngleBasis>  
    <ScatteringDataType>BTDF</ScatteringDataType>  
    <ScatteringData> ☹ </ScatteringData>  
  </WavelengthDataBlock>  
</WavelengthData>  
<WavelengthData> ☹ </WavelengthData>  
<WavelengthData> ☹ </WavelengthData>  
<WavelengthData> ☹ </WavelengthData>
```

} NIR

```
</Layer>
```

```
</Optical>
```

```
</WindowElement>
```

DEMO

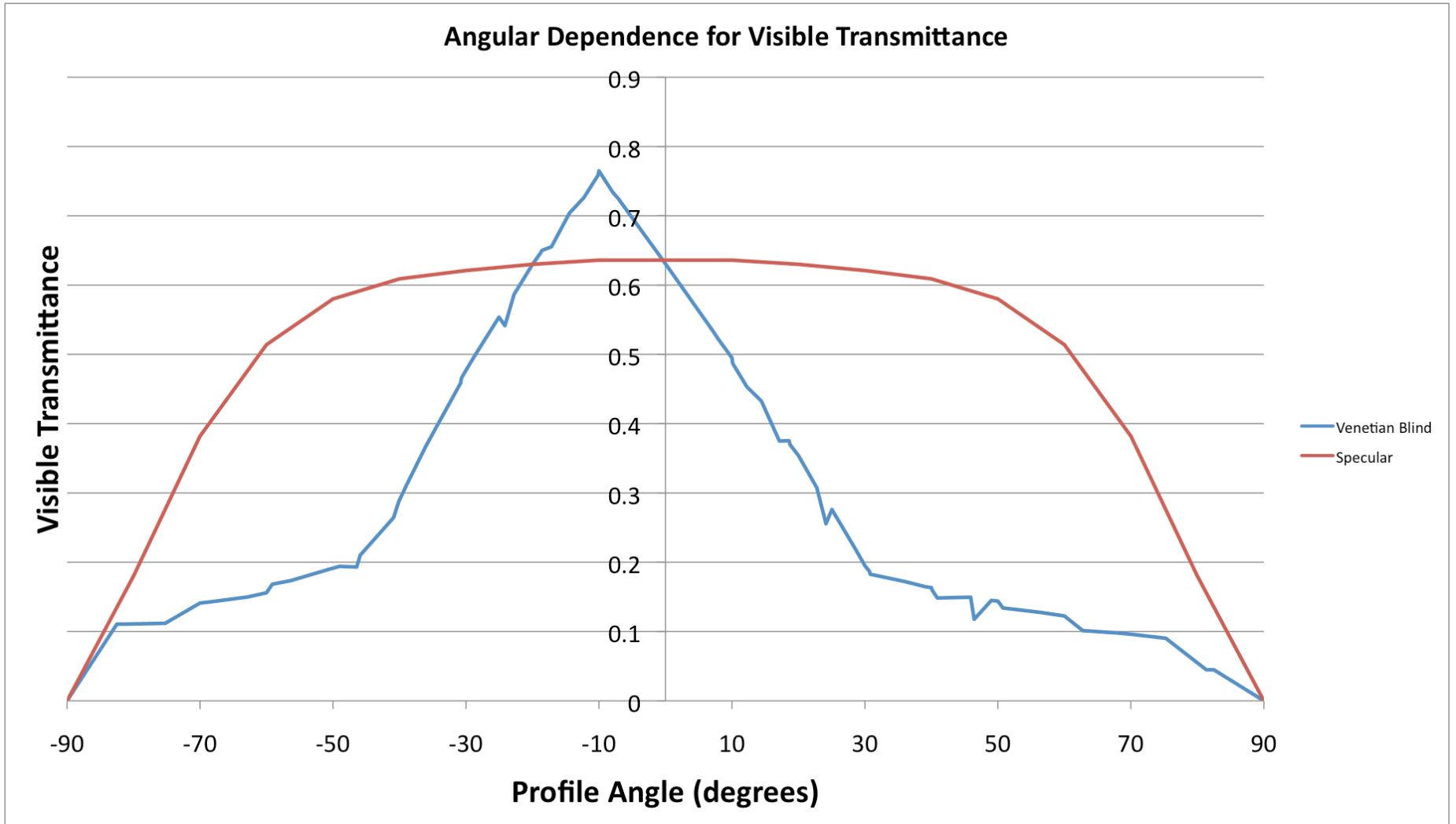
CURRENT AVAILABILITY

- WINDOW 6 / THERM 6 – version 6.3 available now
 - Incorporated selected scattering materials and layers
 - LBNL can add selected new materials & layers
 - Soon releasing version which natively reads genBSDF output (without NIR data)

CURRENTLY UNDER DEVELOPMENT

- Vertical blinds analytical model
- Honeycomb/Cellular shades analytical model
- Perforated screens analytical model
- Application of University of Waterloo thermal models for indoor and outdoor venetian blinds

ANGULAR SHGC AND VT OUTPUT



Thank you

Contact info

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