

NFRC Training for Modeling Complex Systems with WINDOW6 / THERM6

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Building Technologies Department
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Download from
<http://windows.lbl.gov/software>

Introduction

- WINDOW6/THERM6 approved (sort-of) by NFRC for modeling the following:
 - Venetian Blinds – Between Glass
 - Frits

| | | U-factor | | SHGC/VT | |
|----------------------|----------------|----------|--------|----------|--------|
| Glazing/Shading Type | Shade Position | Vertical | Tilted | Vertical | Tilted |
| Venetian Blinds | Between Glass | Y | N | Y | Y |
| Fritted Glass | n/a | Y | Y | Y | Y |

CGDB

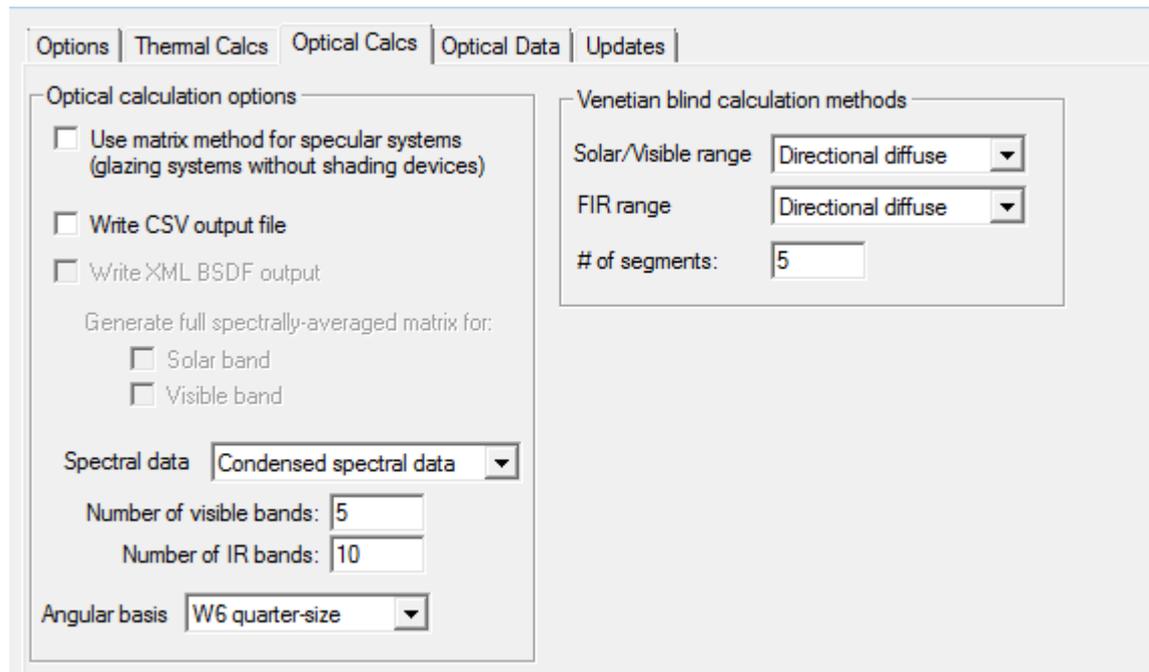
- Website
- Install 6.3 database - W63-CGDB-1.2.mdb
 - Installs into LBNL\Shared
 - Mostly woven shades -- a few frits and Venetian blinds
- Import Shading Layer Library records as needed
 - Shading Layer Library: import records from this library
 - Shade Material Library: Importing Shading Layer records automatically brings in the associated Shade Material Library records
 - All records measured by LBNL – manufacturer submittals will happen after Complex Glazing ILC is complete

Shading Layer Library

- Import records from CGDB into Shading Layer Library
 - Associated Shade Material Library records are imported automatically
- For NFRC simulations, shading layers must be in the CGDB
- Shading Layer Types relevant for NFRC:
 - Venetian Blind
 - Fritted Glass
- Venetian Blind
 - Blind geometry
 - Slat Material reference to Shade Material Library
- Fritted Glass
 - Frit coverage % input
 - Substrate layer – link to Glass Library
 - Specular glass layer – link to Glass Library
 - Diffuse glass layer – link to Glass Library
- Open-ness factor of Shade Layer
 - Don't have to calculate it – it will already be determined in CGDB

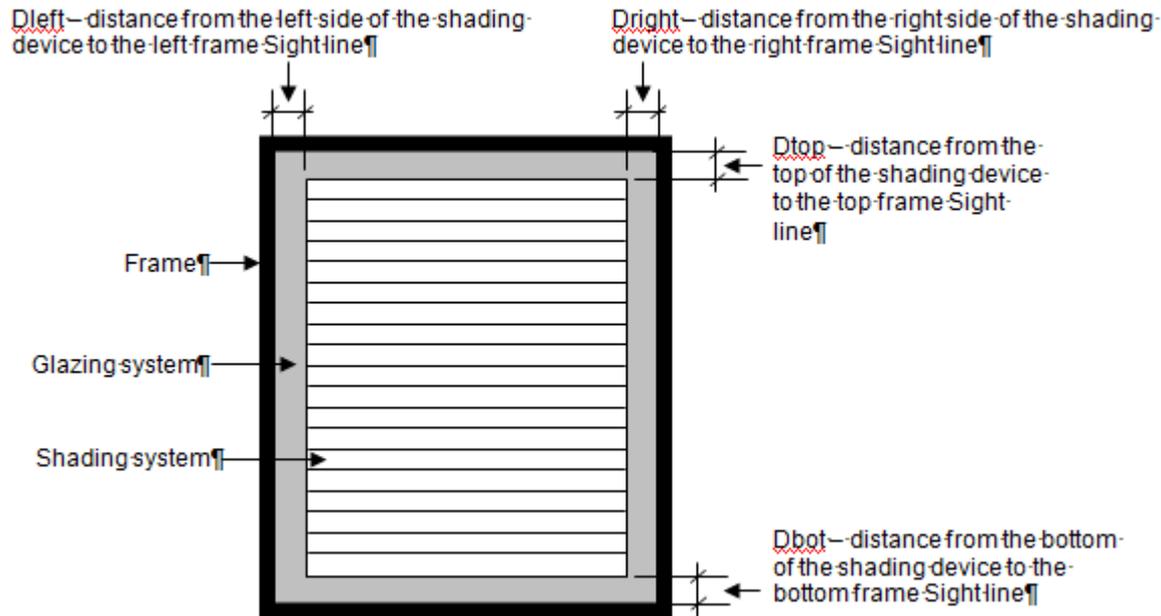
WINDOW -- Preferences

- Thermal Calcs
 - Convection Models for all shade types = ISO 15099
- Optical Calcs
 - Use program default values



WINDOW – Glazing System Definitions

- D_{top} , D_{bot} , D_{left} , D_{right}
- Set to 0 if shading system lies on the outside of the sight line



Venetian Blinds – between glass

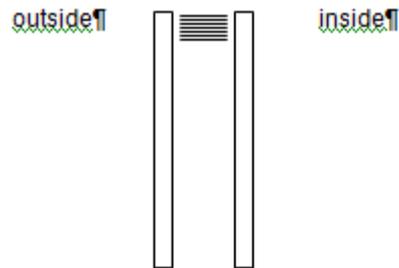
| | | U-factor | | SHGC/VT | |
|----------------------|----------------|----------|--------|----------|--------|
| Glazing/Shading Type | Shade Position | Vertical | Tilted | Vertical | Tilted |
| Venetian Blinds | Between Glass | Y | N | Y | Y |

- Vertical products
 - U-factor
 - SHGC/VT
- Tilted products
 - SHGC/VT

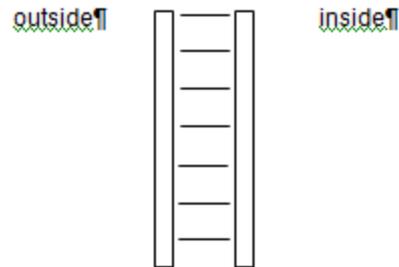
Venetian Blinds – between glass

- Open

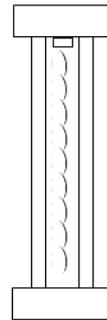
- Open retracted



- Open non-retracted



- Closed

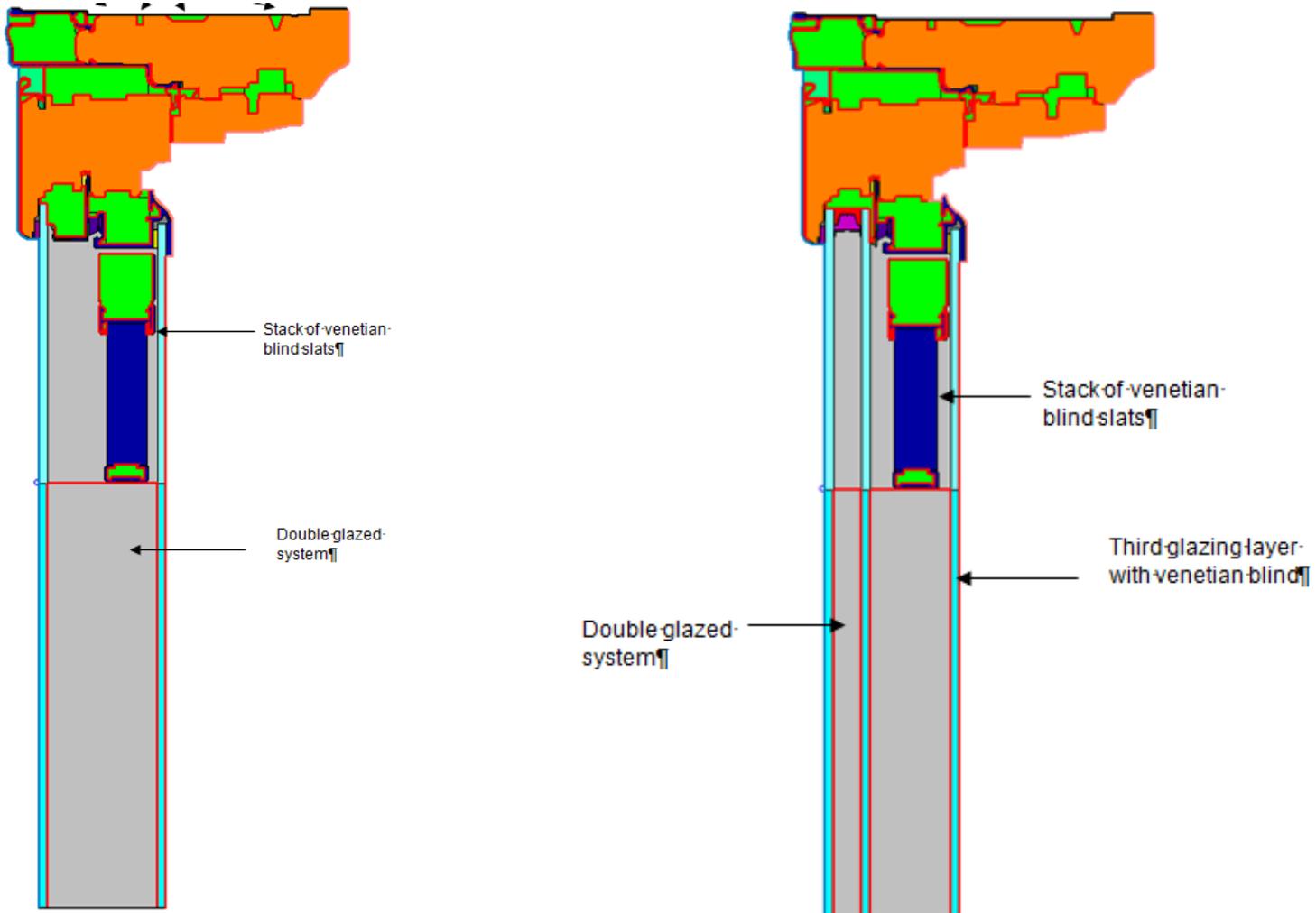


Venetian Blinds – between glass

- Open Retracted
- WINDOW
 - Make Glazing System
 - No Shading System modeled
- THERM
 - HEAD: model stack of venetian blind slats (in THERM)
 - JAMB, SILL: no venetian blind slats modeled

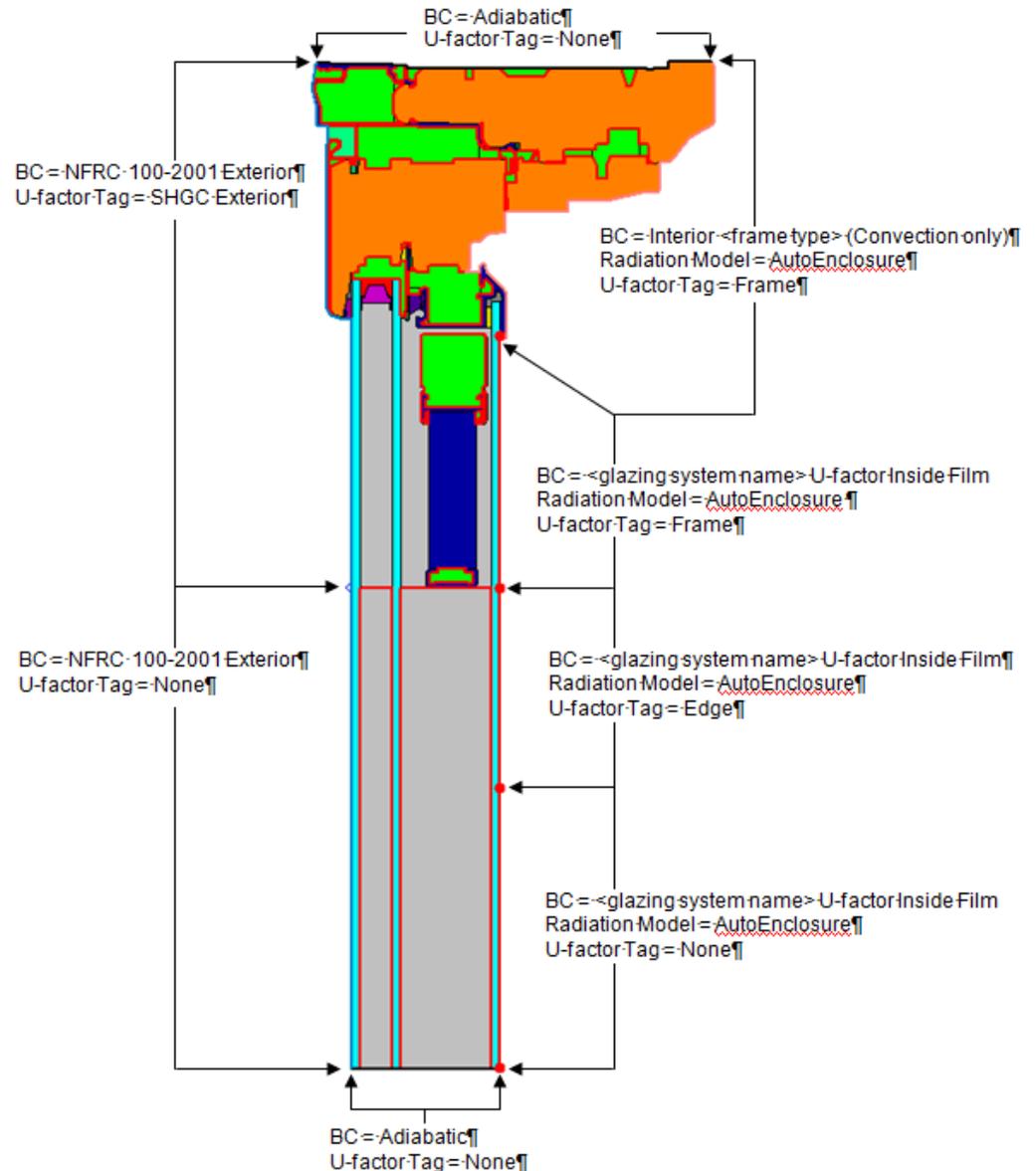
Venetian Blinds – between glass

- **Open Retracted** – model stack of blind slats



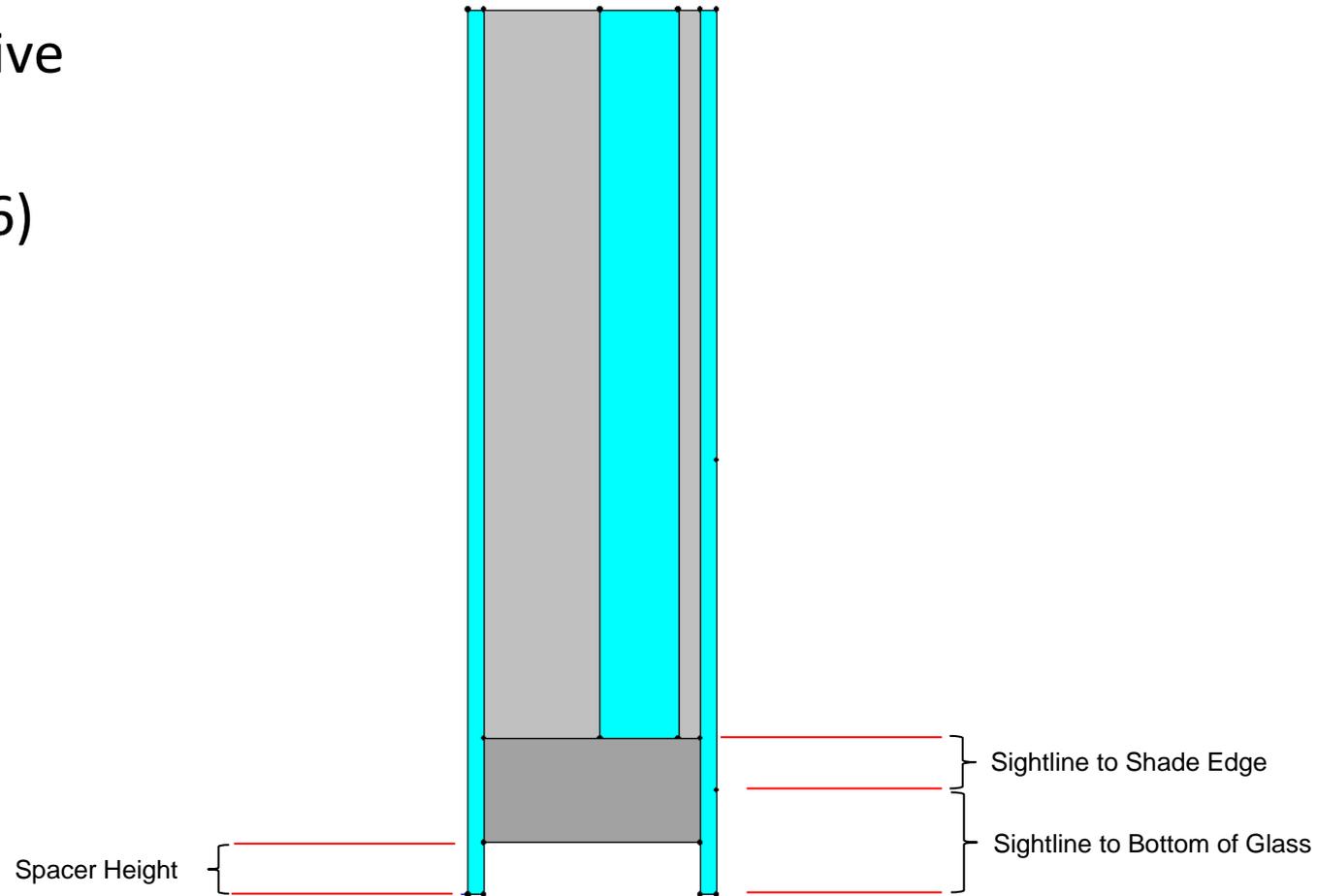
Venetian Blinds – between glass

- Open Retracted –
HEAD
Boundary Conditions



Venetian Blinds – between glass

- Setting shade position relative to frame components
- Define Sightline to Shade Edge
- Can be negative
- Can be zero
(Therm 6.3.46)



Venetian Blinds – between glass

- Open Non-Retractable
- WINDOW
 - Make Venetian Blind in Shading Layer Library
 - Make Glazing System with Venetian Blind
- THERM
 - HEAD, JAMB, SILL: Insert glazing system with shading system
 - Model VB hardware

Venetian Blinds – between glass

- Open Non-Retractable
- WINDOW
 - Make Venetian Blind shading system
 - Tilt = Fully open (0)
 - Make Glazing System with Venetian blind
 - Set Dtop, Dbot, Dleft, Dright as needed
 - Adjust gap spacing for fully open slats
 - Effective Hole Area = 1

Shading Layer Library

ID #: 23

Name: Off White Blind, Open (0 slat angle), 16 mm

Product Name:

Manufacturer: Generic

Type: Venetian blind, horizontal

Material: 31100 Off White Slat

Effective hole area fraction: 0.050

Venetian Blind

Slat width: 16.0 mm

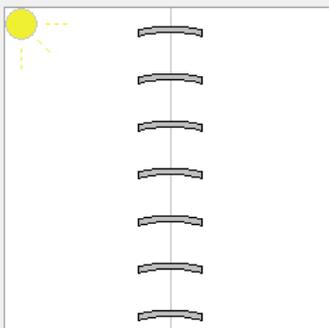
Spacing: 12.0 mm

Tilt: fully open (0°)

Tilt angle: 0 degrees

Blind thickness: 16.0 mm

Rise: 1.015 mm



Glazing System Library

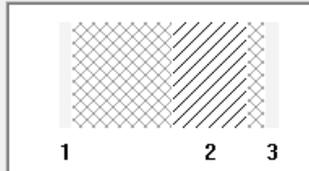
ID #: 32 Name: LowE-DbIGlz, Integral Off-White VB-Open

Layers: 3 Tilt: 90° IG Height: 1000.00 mm

Environmental Conditions: NFRC 100-2004 IG Width: 1000.00 mm

Comment:

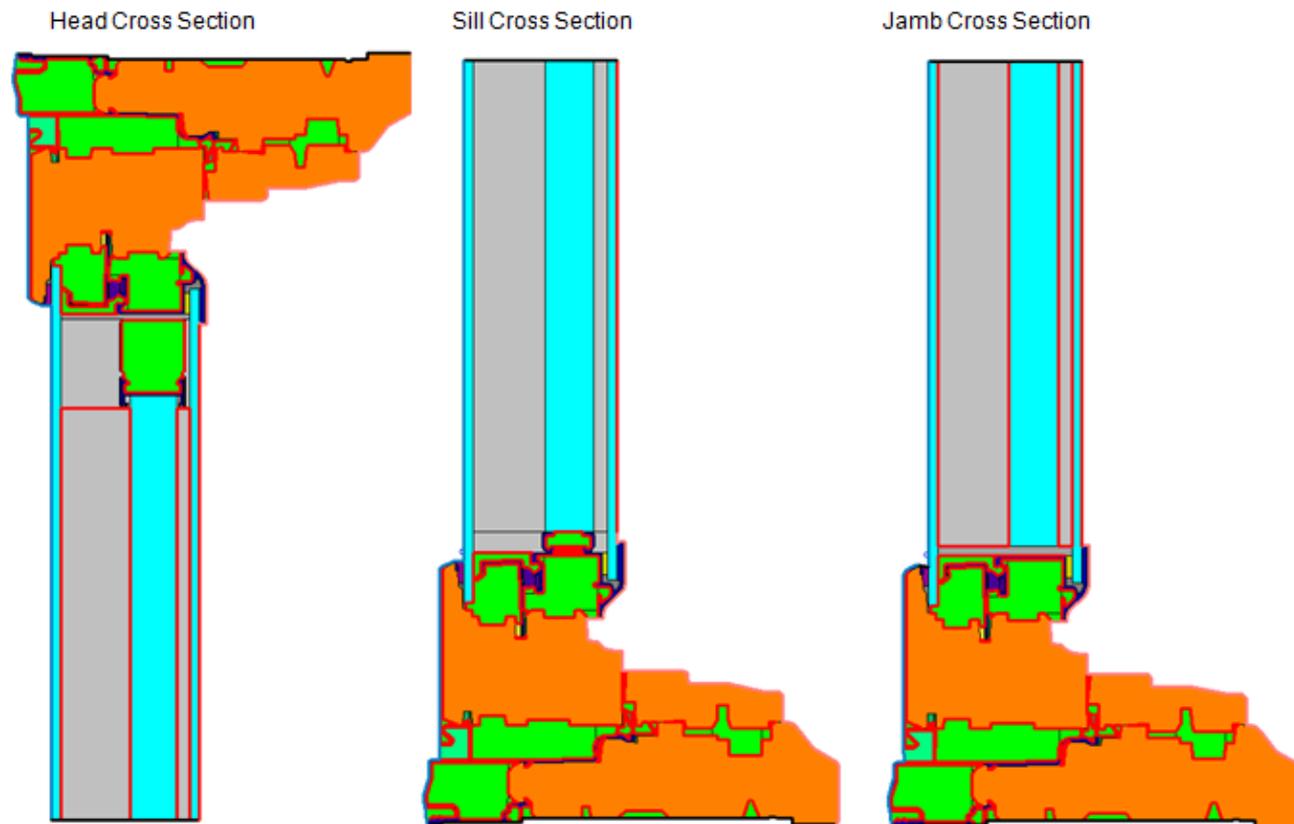
Overall thickness: 48.100 mm Mode: #



| | ID | Name | Mode | Thick | Flip | Tsol | Rsol1 | Rsol2 | Tvis | Rvis1 | Rvis2 | Tir | E1 | E2 | Cond |
|---|------------|-----------------------------|------|-------|--------------------------|-------|-------|-------|-------|-------|-------|-------|-------|-------|-------|
| ▼ | Glass 1 ▶▶ | 9801 CLEAR3.LDF | # | 3.0 | <input type="checkbox"/> | 0.876 | 0.078 | 0.078 | 0.907 | 0.082 | 0.082 | 0.000 | 0.840 | 0.840 | 1.000 |
| | Gap 1 ▶▶ | 1 Air | | 21.9 | <input type="checkbox"/> | | | | | | | | | | |
| ▼ | Shade 2 ▶▶ | 23 Off White Blind, Open (0 | | 16.0 | <input type="checkbox"/> | | | | | | | 0.000 | 0.900 | 0.900 | 1.000 |
| | Gap 2 ▶▶ | 1 Air | | 4.2 | <input type="checkbox"/> | | | | | | | | | | |
| ▼ | Glass 3 ▶▶ | 102 CLEAR_3.DAT | # | 3.0 | <input type="checkbox"/> | 0.834 | 0.075 | 0.075 | 0.899 | 0.083 | 0.083 | 0.000 | 0.840 | 0.840 | 1.000 |

Venetian Blinds – between glass

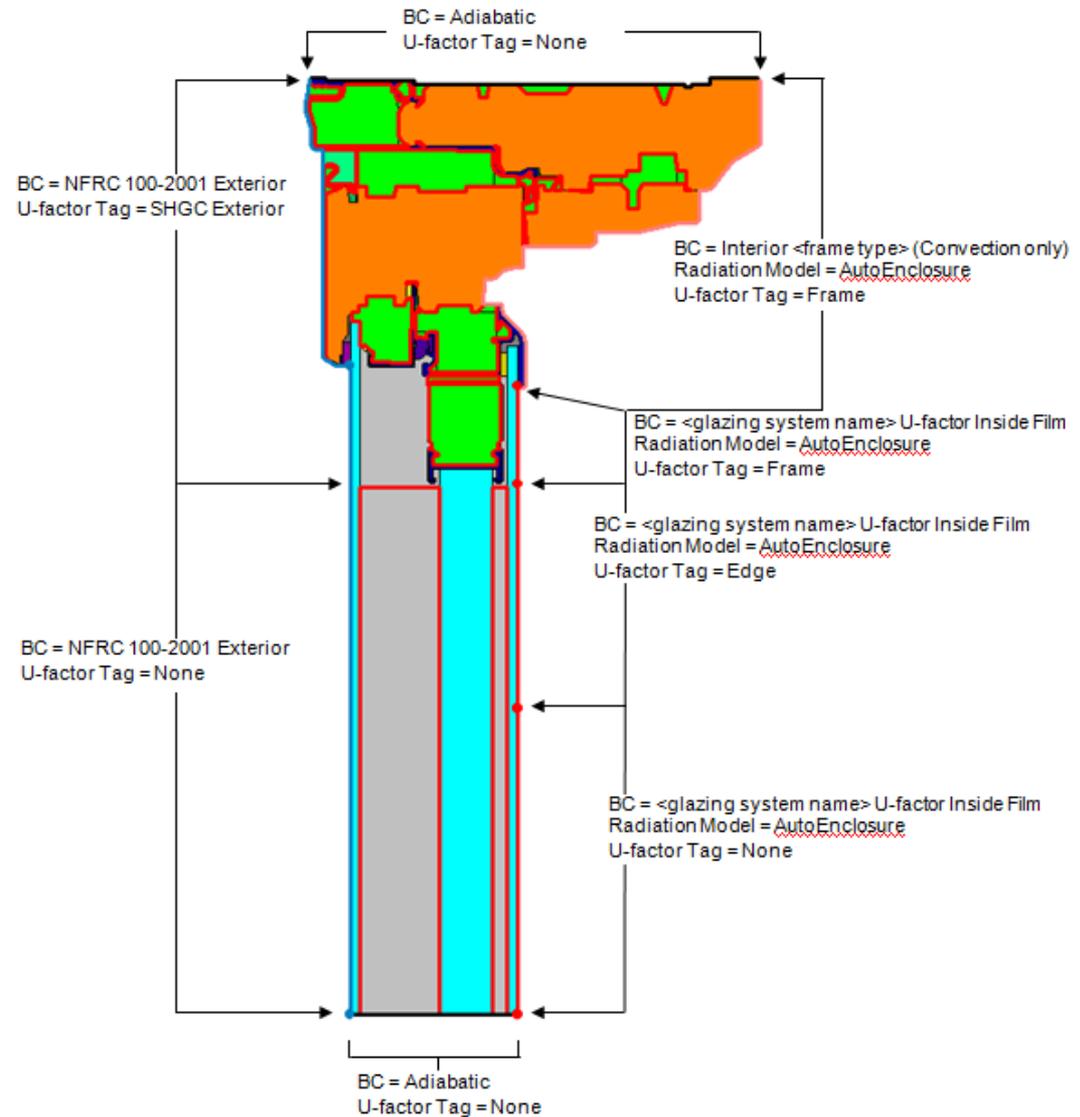
- Open Non-Retractable
- THERM
 - HEAD, JAMB, SILL: Insert glazing system with shading system
 - Model VB hardware



Venetian Blinds – between glass

Open Non-Retractable

- HEAD
Boundary Conditions
 - Frame tags determine by VB hardware



Venetian Blinds – between glass

- Closed
- WINDOW
 - Make Venetian Blind in Shading Layer Library
 - Make Glazing System with Venetian Blind
- THERM
 - HEAD, JAMB, SILL: Insert glazing system with shading system
 - Model VB hardware

Venetian Blinds – between glass

- Closed
- WINDOW
 - Make Venetian Blind shading system
 - Tilt = Closed (90°)
 - Make Glazing System with Venetian blind
 - Set Dtop, Dbot, Dleft, Dright as needed
 - Adjust gap spacing for closed slats
 - Effective Hole Area = 0

Shading Layer Library

ID #:

Name:

Product Name:

Manufacturer:

Type:

Material:

Effective hole area fraction:

Venetian Blind

Slat width: mm

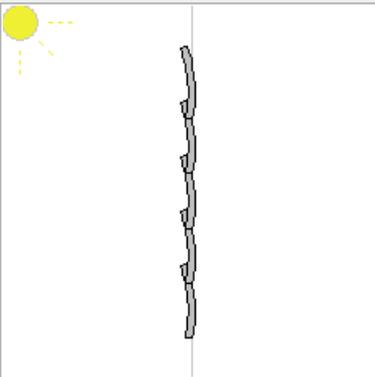
Spacing: mm

Tilt:

Tilt angle: degrees

Blind thickness: mm

Rise: mm



Help

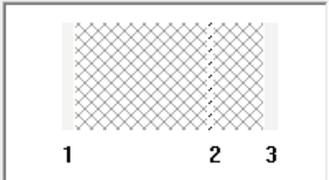
Glazing System Library

ID #: Name:

Layers: Tilt: IG Height: mm

Environmental Conditions: IG Width: mm

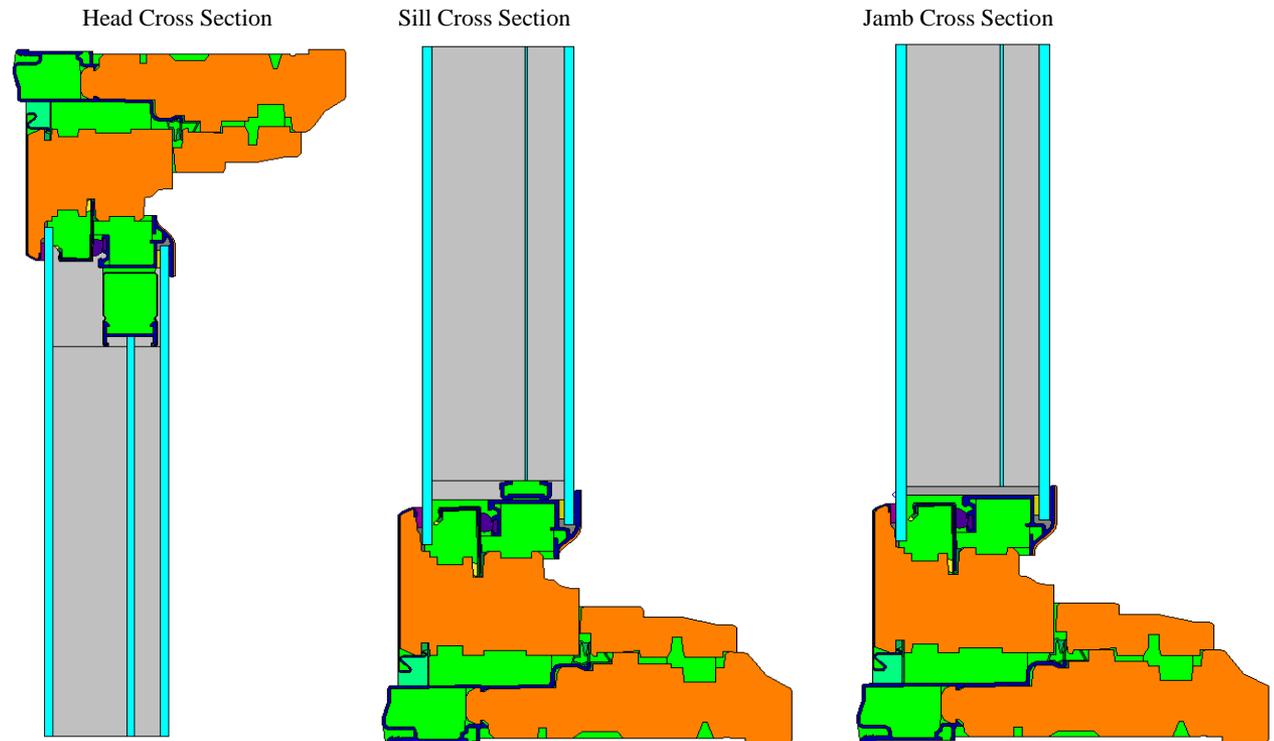
Comment:

Overall thickness: mm Mode:


| | ID | Name | Mode | Thick | Flip | Tsol | Rsol1 | Rsol2 | Tvis | Rvis1 | Rvis2 | Tir | E1 | E2 | Cond |
|---|------------|-------------------------------|------|-------|--------------------------|-------|-------|-------|-------|-------|-------|-------|-------|-------|-------|
| ▼ | Glass 1 ▶▶ | 9801 CLEAR3.LOF | # | 3.0 | <input type="checkbox"/> | 0.876 | 0.078 | 0.078 | 0.907 | 0.082 | 0.082 | 0.000 | 0.840 | 0.840 | 1.000 |
| | Gap 1 ▶▶ | 1 Air | | 28.6 | <input type="checkbox"/> | | | | | | | | | | |
| ▼ | Shade 2 ▶▶ | 24 Off 'White Blind, Closed (| | 1.1 | <input type="checkbox"/> | | | | | | | 0.000 | 0.900 | 0.900 | 1.000 |
| | Gap 2 ▶▶ | 1 Air | | 10.9 | <input type="checkbox"/> | | | | | | | | | | |
| ▼ | Glass 3 ▶▶ | 102 CLEAR_3.DAT | # | 3.0 | <input type="checkbox"/> | 0.834 | 0.075 | 0.075 | 0.899 | 0.083 | 0.083 | 0.000 | 0.840 | 0.840 | 1.000 |

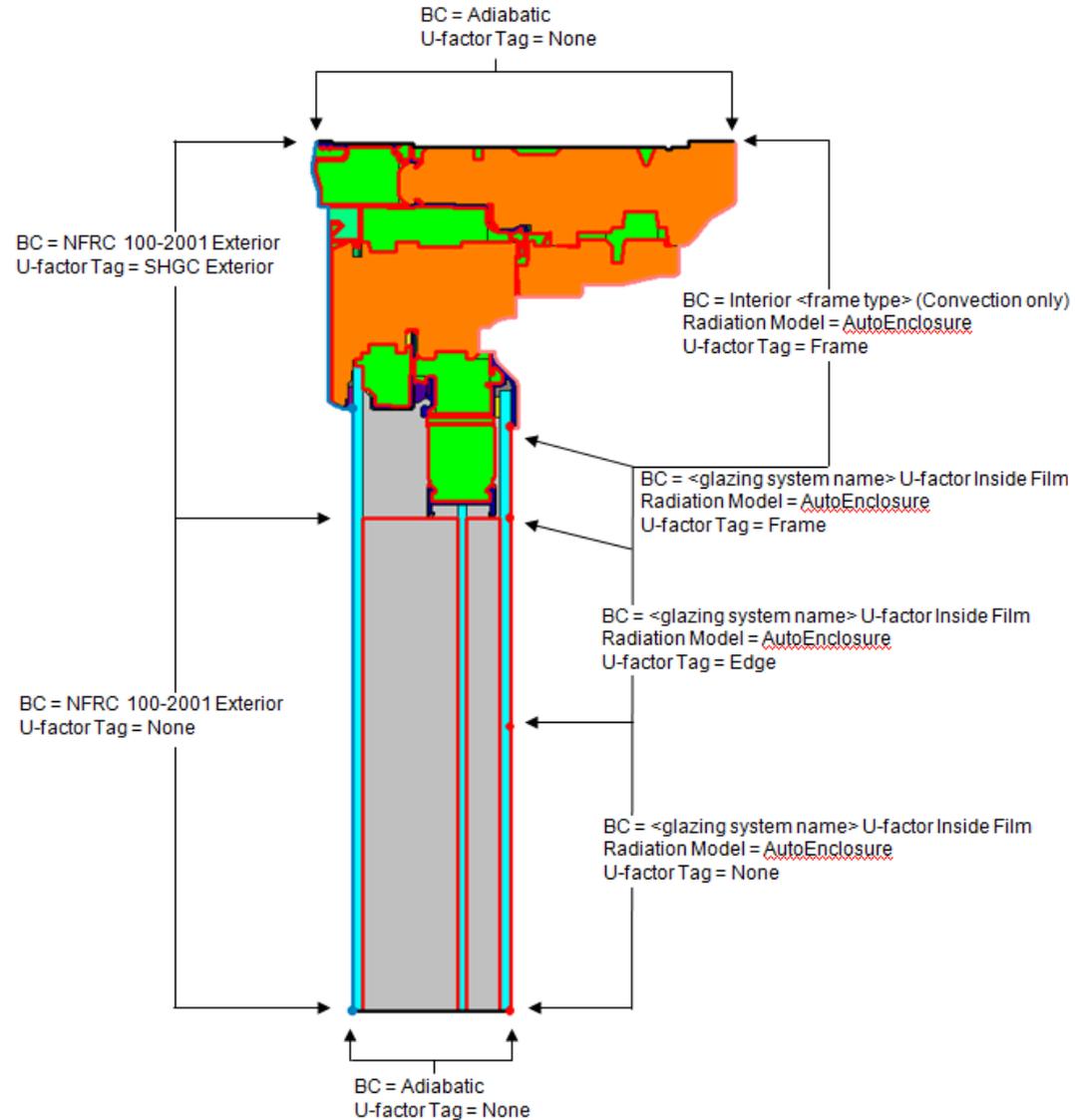
Venetian Blinds – between glass

- Closed
- THERM
 - HEAD, JAMB, SILL: Insert glazing system with shading system
 - Model VB hardware



Venetian Blinds – between glass

- Closed
 - HEAD
- ## Boundary Conditions
- Frame tags determined by VB hardware



Venetian Blinds – between glass

WINDOW

- Frame Library
 - Import THERM frames for **open** and **closed** cases
- Window Library
 - Generate whole products for **open** and **closed** cases
 - **U-factor**, **SHGC** and **VT**

Fritted Glass

| | | U-factor | | SHGC/VT | |
|----------------------|----------------|----------|--------|----------|--------|
| Glazing/Shading Type | Shade Position | Vertical | Tilted | Vertical | Tilted |
| Fritted Glass | n/a | Y | Y | Y | Y |

- Vertical products
 - U-factor
 - SHGC/VT
- Tilted products
 - U-factor
 - SHGC/VT
- Previous seminar on this topic

Fritted Glass

- WINDOW
 - Make Frit in Shading Layer Library
 - Use Frit records from CGDB
 - % = set to appropriate value
 - Make Glazing System with Frit layer
 - Set to **Shade**
 - Can be any layer location in glazing system

Shading Layer Library

ID #:

Name:

Product Name:

Manufacturer:

Type:

Fritted glass

Glass substrate:

Frit coverage: %

Frit optical data

Specular:

Diffuse:

Creating new frit layers is an advanced operation and requires understanding of the referenced spectral data. Only the substrate on which the frit was measured can be used as a substrate. Email [windowhelp@lbl.gov](mailto>windowhelp@lbl.gov) for details.

Glazing System Library

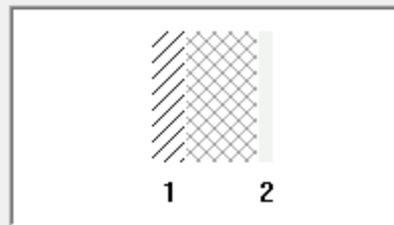
ID #: Name:

Layers: Tilt: ° IG Height: mm

Environmental Conditions: IG Width: mm

Comment:

Overall thickness: mm Mode:



| | ID | Name | Mode | Thick | Flip | Tsol | Rsol1 | Rsol2 | Tvis | Rvis1 | Rvis2 | Tir | E1 | E2 |
|----------------------|-----|-------------|------|-------|--------------------------|-------|-------|-------|-------|-------|-------|-------|-------|-------|
| ▼ Fritted glass 1 ▶▶ | 17 | White Frit | | 6.0 | <input type="checkbox"/> | 0.771 | 0.062 | 0.063 | 0.884 | 0.065 | 0.066 | 0.000 | 0.840 | 0.840 |
| Gap 1 ▶▶ | 1 | Air | | 12.7 | <input type="checkbox"/> | | | | | | | | | |
| ▼ Glass 2 ▶▶ | 102 | CLEAR_3.DAT | # | 3.0 | <input type="checkbox"/> | 0.834 | 0.075 | 0.075 | 0.899 | 0.083 | 0.083 | 0.000 | 0.840 | 0.840 |

Fritted Glass

WINDOW

- THERM
 - Use Frit glazing system in frames
- WINDOW
 - Frame Library
 - Import THERM files with Frit
 - Window Library
 - Generate whole products using Frit glazing system
 - U-factor, SHGC and VT

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