



NFRC CMA Technical TG

CMA Methodology for products with Spacer-less Glazing-Cavities

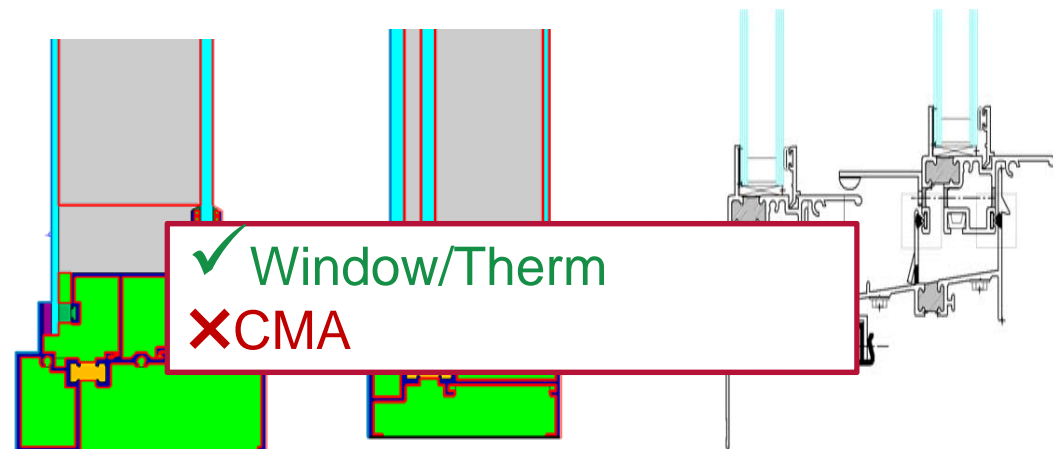
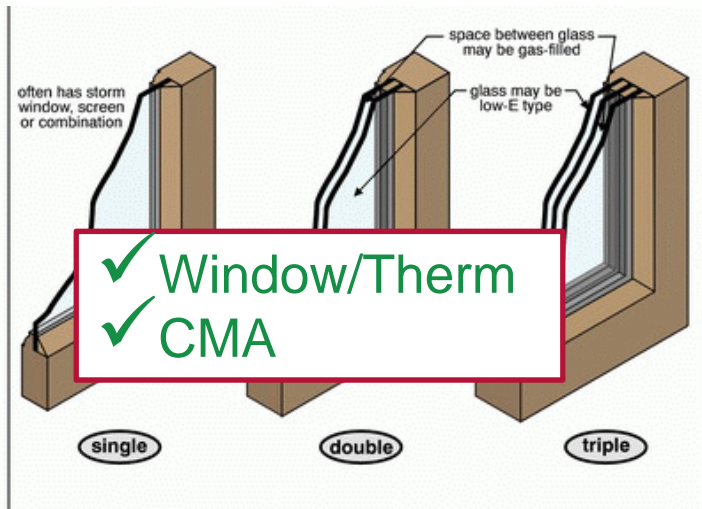
Sneh Kumar

Sneh.kumar@alcoa.com

TRACO/Kawneer/Alcoa

Background

- CMA launched in 2010 for commercial fenestration products
- Expectation to move all existing commercial product certification to CMA certification
- Limitations of CMA
 - ~~Condensation resistance (CR)~~
 - CMA does calculation for IGU and single-glazed products but NOT for Products with spacer-less glazing cavities



How CMA works

- Create High and Low (H/L) options for IGU and SESA (Spacer Edge seal assembly)
- http://nfr.org/documents/NFRC100-2010_E0A5.pdf
 - Go to section NFRC 100 - **9.3 Standard Simulation and Testing**
- Get results for –
 1. Low Glazing + Low SESA
 2. Low Glazing + Hi SESA
 3. Hi Glazing + Hi SESA
 4. Hi Glazing + Low SESA

The screenshot shows the 'U-Factors' software window with the following data:

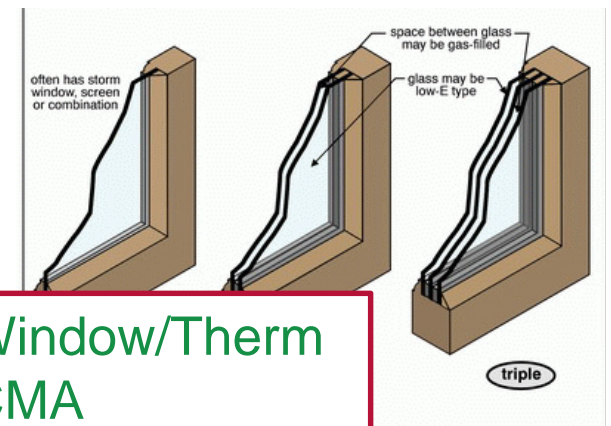
	U-factor Btu/h-ft ² -F	delta T F	Length inches	Rotation	
Edge	0.3615	70.2	2.5	90.0	Projected in Glass Plane
Frame	1.0055	70.2	0.675197	90.0	Projected in Glass Plane
SHGC exterior	1.5294	70.2	0.669291	90.0	Projected in Glass Plane

Additional settings and options shown in the interface:

- % Error Energy Norm: 8.95%
- CMA Option: Low glazing/Low spacer (with a dropdown menu open showing options: Low glazing/Low spacer, Low glazing/High spacer, High glazing/Low spacer, High glazing/High spacer)
- Buttons: Export, OK

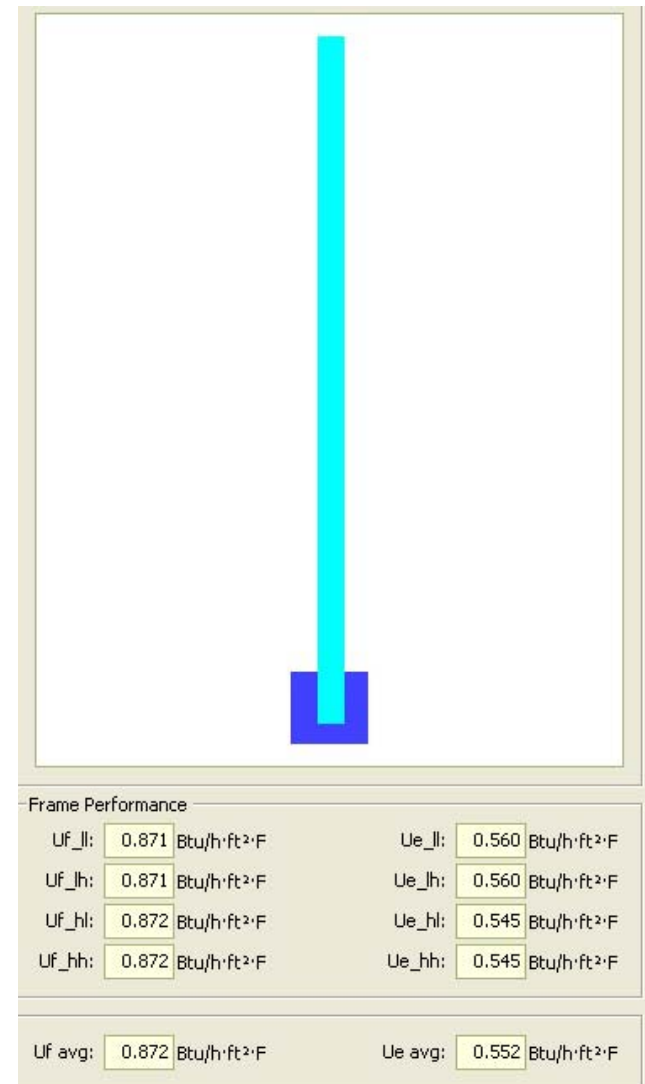
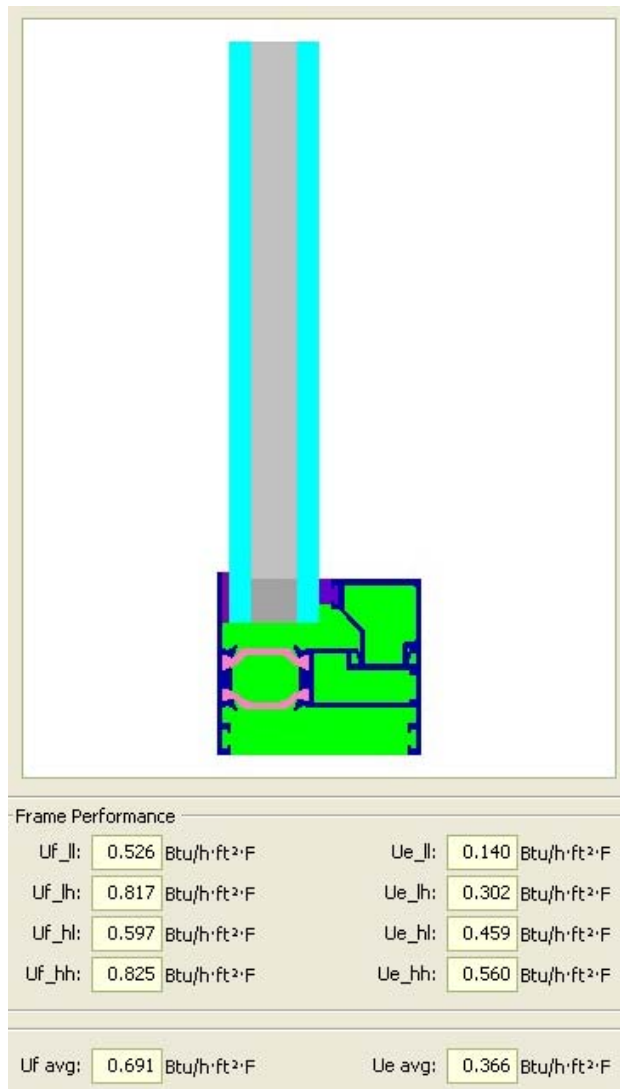
High/Low Glazing and Spacer

- Glazed products
 - Low Glazing – Double glazed, low-E, with the invented gas fill properties that produces R12.5 insulation value – $U_{cog} = 0.45 \text{ W/m}^2\text{-K}$ (0.08 Btu/hr-ft²-F)
 - High glazing – Double glazed clear air - $U_{cog} = 2.684 \text{ W/m}^2\text{-K}$ (0.473 Btu/hr-ft²-F)
- Single glazing:
 - Low Glazing – Low-E single glass, with low-E facing indoor side – $U_{cog} = 3.24 \text{ W/m}^2\text{-K}$ (0.57 Btu/hr-ft²-F)
 - High glazing $U_{cog} = 5.82 \text{ W/m}^2\text{-K}$ (1.03 Btu/hr-ft²-F)
- SESA
 - Low Spacer – $k_{eff} = 0.01 \text{ W/m-K}$ (0.006 Btu/hr-ft-F)
 - HighSpacer – $k_{eff} = 10.0 \text{ W/(m-K)}$ (5.8 Btu/hr-ft-F)



✓ Window/Therm
✓ CMA

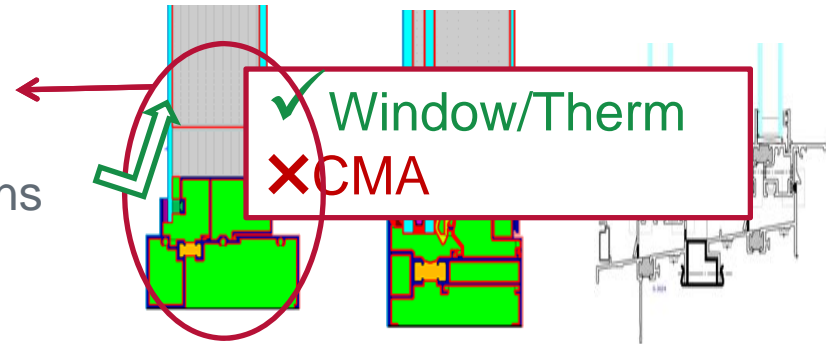
High-low options



Methodology for other Products – with all spacer-less glazing cavities (no SESA)

For products without any SESA

- Generate Therm6 files for two CMA options
 - Low glazing (0.08 Btu/hr-ft²-F)
 - High glazing (0.472 Btu/hr-ft²-F)



Follow the similar process as single glazed products (glazing without spacer)

- **Automated Process** - LBNL creates a custom Non-SESA CMA Glazing option in Therm6 that generate the high/low options – *more complex, Time(?)*
 - No CMAST modifications required
- **Manual Process** – Labs Simulate the Therm6 files with high and low glazing
 - CMAST modification required to create Frame cross-section data as the Frame data can not be imported from the .Thmx file
 - Manual import of results in to CMAST for all the high and low options – **NON Automated**
 - **Once Frame Cross-section data is available, CMAST would generate the simulation results**

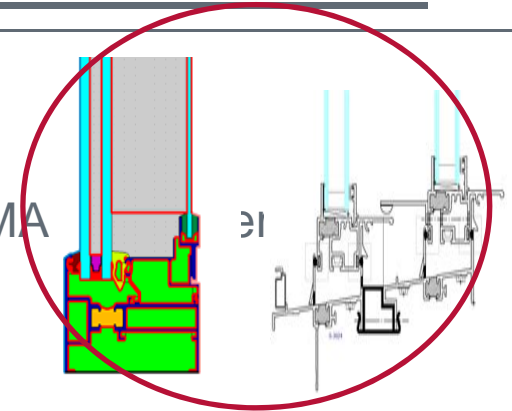
Methodology for other Products - with combination SESA

At least 1 cavity with SESA cavity and 1 without SESA

Follow manual process of creating & importing Therm files in CMA

Therm6 files for four CMA options

1. Low Glazing + Low SESA
2. Low Glazing + Hi SESA
3. Hi Glazing + Hi SESA
4. Hi Glazing + Low SESA



Challenge

- Low glazing (0.08 Btu/hr-ft²-F) - OK
- **High glazing (0.472 Btu/hr-ft²-F)** - Difficult to achieve with 3 layers of glass (worst U-Factor ~ 0.35 Btu/hr-ft²-F)

Solution

1. Use fictional gas with high conductivity to create high glazing with U of 0.472 ? OR
2. Define new high and low glazing for such products (remember high and low glazing for single glazed products are different from regular glazed products)

Methodology for other Products - with combination SESA

- 2nd solution - Define separate high and Low Glazing options
 - Low glazing (0.08 Btu/hr-ft²-F) - leave as existing – easy to achieve
 - High glazing (0.472 Btu/hr-ft²-F) -
 - For I3 products (COG_High_U =0.335)

ID #: 13 Name: I3-High
 # Layers: 3 Tilt: 90 °
 Environmental Conditions: NFRC 100-2010
 Overall thickness: 1.959 inches Mode: #

	ID	Name	Mode	Thick	Flip	Tsol	Rsol1	Rsol2	Tvis	Rvis1	Rvis2	Tr	E1	E2	Cond	Comment
▼	1	Gap 1	1	Air		0.250										
▼	103	Glass 1	#	CLEAR_6.DAT		0.236	0.771	0.070	0.070	0.884	0.080	0.080	0.000	0.840	0.840	0.578
▼	1	Gap 2	1	Air		1.000										
▼	103	Glass 2	#	CLEAR_6.DAT		0.236	0.771	0.070	0.070	0.884	0.080	0.080	0.000	0.840	0.840	0.578
▼	1	Gap 3	1	Air		0.236										
▼	103	Glass 3	#	CLEAR_6.DAT		0.236	0.771	0.070	0.070	0.884	0.080	0.080	0.000	0.840	0.840	0.578

Center of Glass Results | Temperature Data | Optical Data | Angular Data | Color Properties

Ufactor	SC	SHGC	Rel. Ht. Gain	Tvis	Keff	Gap 1 Keff	Gap 2 Keff
Btu/h-ft ² -F			Btu/h-ft ²		Btu/h-ft-F	Btu/h-ft-F	Btu/h-ft-F
0.335	0.701	0.610	145	0.703	0.0641	0.0245	0.0794

- For I4 products (COG_High_U =0.26)

ID #: 15 Name: I4-High
 # Layers: 4 Tilt: 90 °
 Environmental Conditions: NFRC 100-2010
 Overall thickness: 2.445 inches Mode: #

	ID	Name	Mode	Thick	Flip	Tsol	Rsol1	Rsol2	Tvis	Rvis1	Rvis2	Tr	E1	E2	Cond	Comment
▼	1	Gap 1	1	Air		0.250										
▼	103	Glass 2	#	CLEAR_6.DAT		0.236	0.771	0.070	0.070	0.884	0.080	0.080	0.000	0.840	0.840	0.578
▼	1	Gap 2	1	Air		1.000										
▼	103	Glass 3	#	CLEAR_6.DAT		0.236	0.771	0.070	0.070	0.884	0.080	0.080	0.000	0.840	0.840	0.578
▼	1	Gap 3	1	Air		0.250										
▼	103	Glass 4	#	CLEAR_6.DAT		0.236	0.771	0.070	0.070	0.884	0.080	0.080	0.000	0.840	0.840	0.578

Center of Glass Results | Temperature Data | Optical Data | Angular Data | Color Properties

Ufactor	SC	SHGC	Rel. Ht. Gain	Tvis	Keff	Gap 1 Keff	Gap 2 Keff	Gap 3 Keff
Btu/h-ft ² -F			Btu/h-ft ²		Btu/h-ft-F	Btu/h-ft-F	Btu/h-ft-F	Btu/h-ft-F
0.260	0.627	0.546	129	0.632	0.0590	0.0242	0.0752	0.0278

Changes required in CMAST

(without LBNL-Therm6 changed)

The screenshot displays the CMAST software interface with several sections:

- General:** Fields for Server ID, Client ID (6), Name, Description, Notes, Framing Product Line, Manufacturer, Inspection Agency, Definition Path, and Status (Design).
- Frame Upload:** A field for THERM File with a 'Show Image' checkbox.
- Frame Component Details:** Fields for Frame Type, Sash Type, Thermal Break, Cross Section Type, PFD (0.000 in.), Outdoor Wetted Length (0.000 in.), Material Absorptance (0.500), Frame Emissivity (0.900), Glazing Pocket Width (0.000 in.), and Width Tolerance (0.197 in.).
- Frame Performance:** A table of performance metrics.
- Visibility:** A dropdown menu set to 'My Company Only' and a button for 'Additional Persons & Companies'.

Annotations include a blue arrow pointing to the 'THERM File' field and a blue oval around the 'Frame Component Details' section.

Metric	Value	Unit
Uf_ll	0.000	Btu/h·ft²·F
Uf_lh	0.000	Btu/h·ft²·F
Uf_hl	0.000	Btu/h·ft²·F
Uf_hh	0.000	Btu/h·ft²·F
Uf avg	0.000	Btu/h·ft²·F
Ue_ll	0.000	Btu/h·ft²·F
Ue_lh	0.000	Btu/h·ft²·F
Ue_hl	0.000	Btu/h·ft²·F
Ue_hh	0.000	Btu/h·ft²·F
Ue avg	0.000	Btu/h·ft²·F

Add Options for data entry

1. Import Thermx file
2. Manual entry

