



# Tutorial on SCHOTT filter calculation tool

2017

# Agenda

## 1. Introduction

## 2. Properties of a single filter

- transmittance and internal transmittance
- optical density and extinction

## 3. Comparing or Combining filters

## 4. Color of a filter (combination) and its light source

## 5. Tabulated data

## 6. User defined filters and light sources

# Intention of the calculation tool

## Overview on the functions of the Excel Spreadsheet

- The calculation tool is intended to use for visualizing the optical reference values of our glasses. Internal Transmittance, Transmittance, Optical Density and Extinction data can be displayed as a function of wavelength and a desired thickness.
- The internal transmittance data is listed from 200 nm to 5200 nm.
- Some values for the color analysis can be calculated as well.
- The spread sheet offers the possibility to combine and compare several filters in respect to their optical properties.
- The user may add spectral data of filter functions as a target.
- The user may add spectral data for a user defined light source for color analysis.

## Functions that are not present

- This tool is not designed for optimizing the design process of an optical system.
- The data base contains only typical transmittance data. There are no tolerances given in this tool.
- This tool was composed with utmost care, however, there is no guarantee on the correctness of algorithms and data.

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SCHOTT reserves the right to change the optical and non-optical data without prior notice. This calculation tool renders all previous versions of the tool obsolete and was composed with utmost care.

Mainz, February 2017

# Language

**SCHOTT**  
2017

Single filter

- [Data input](#)
- [CIE diagram](#)
- [CIE data table](#)
- [Ti diabolic](#)
- [T diabolic](#)
- [Ti linear](#)
- [T linear](#)
- [Extinction](#)
- [Optical density](#)

Combination of filters

- [Data input](#)
- [Ti diabolic](#)
- [T diabolic](#)
- [Ti linear](#)
- [Ti normalized](#)

User defined curves

- [Filter](#)
- [Light source](#)

Results

- [Data table](#)
- [Copyright](#)

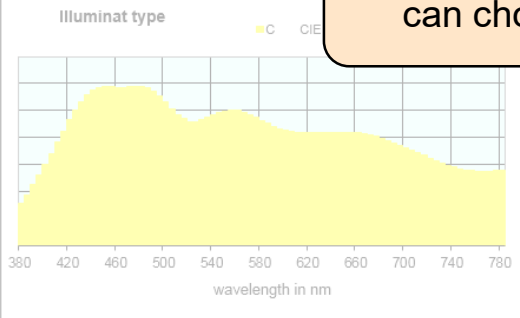
Sprache / language: **English**

Calculation of single filter with colorimetric evaluation

Select by drop-down : Filter type  
Input: Thickness d =

Select by drop-down : Illuminant type

Illuminant type



Desired color locus

NVIS Green A

$u' = 0,088$   
 $v' = 0,543$   
radius of tolerance  $r = 0,037$

**InpS** CIE diag | CIE data | Tidias | TdiaS | TlinS | TlinS | ExtS | DS | InpC | TdiaC | TdiaC | TlinC | TnormC | User | user\_light | Tau\_j data | Copyright

Only on the first spread sheet „InpS“ you can choose your preferred language.

# Menus and Overview

The screenshot shows the SCHOTT software interface. On the left is a blue menu bar with the SCHOTT logo and the year 2017. The menu is organized into several sections: 'Single filter', 'Combination of filters', 'User defined curves', 'Results', and 'Copyright'. Each section contains a list of options, some of which are underlined. Callouts point to specific parts of the interface: 'All spread sheets have the same menu bar on the left' points to the menu bar; 'Analysis of a single filter' points to the 'Single filter' section; 'Analysis of multiple filters or combinations of filters' points to the 'Combination of filters' section; 'User defined input for' points to the 'User defined curves' section, with a sub-callout listing 'own filter curves' and 'own light sources'; 'Results as tabulated data' points to the 'Results' section; and 'Note on copyright' points to the 'Copyright' section. The main area of the interface shows a graph titled 'Illuminat type' with a yellow curve. Below the graph is a table with columns for 'Desired color locus' and 'NVIS Green A'. At the bottom is a tabbed interface with various tabs, including 'InpS', 'CIE diag', 'CIE data', 'TidiaS', 'TdiaS', 'TilinS', 'TlinS', 'ExtS', 'DS', 'InpC', 'TidiaC', 'TdiaC', 'TilinC', 'TnormC', 'User', 'user\_light', 'Tau\_i data', and 'Copyright'.

SCHOTT  
2017

Single filter  
Data input  
CIE diagram  
CIE data table  
Ti diabolic  
T diabolic  
Tilinear  
T linear  
Extinction  
Optical density

Combination of filters  
Data input  
Ti diabolic  
T diabolic  
Tilinear  
Ti normalized

User defined curves  
Filter  
Light source

Results  
Data table  
Copyright

Sprache / language:  
Calculation of single filter with colorimetric evaluation  
Select by drop-down : Illuminat type  
Illuminat type  
380 420 460 500 540 580 620 660 700 740 780  
Desired color locus  
NVIS Green A  
radi

All spread sheets have the same menu bar on the left

Analysis of a single filter

Analysis of multiple filters or combinations of filters

User defined input for

- own filter curves
- own light sources

Results as tabulated data

Note on copyright

InpS CIE diag CIE data TidiaS TdiaS TilinS TlinS ExtS DS InpC TidiaC TdiaC TilinC TnormC User user\_light Tau\_i data Copyright

# Navigation

**SCHOTT**  
2017

Single filter

- [Data input](#)
- [CIE diagram](#)
- [CIE data table](#)
- [Ti diabolic](#)
- [T diabolic](#)
- [Tilinear](#)
- [T linear](#)
- [Extinction](#)
- [Optical density](#)

Combination of filters

- [Data input](#)
- [Ti diabolic](#)
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- [Tilinear](#)
- [T normalized](#)

User defined curves

- [Filter](#)
- [Light source](#)

Results

- [Data table](#)
- [Copyright](#)

Sprache / language: **English**

Calculation of single filter with colorimetric evaluation

Select by drop-down : Filter type **KG1**  
Input: Thickness **d = 3,000 mm**

Select by drop-down : Illuminant type **C**

Illuminat type **C** CIE standard illuminant C

wavelength

Desired color locus

$u^* = 0,08$   
 $v^* = 0,543$   
radius of tolerance  $r = 0,037$

Navigation is also possible with this bar  
In green marked fields inputs are possible  
Blue marked fields show the transmittance

**InpS** CIE diag CIE data TidiaS TdiaS TilinS TlinS ExtS DS **InpC** TidiaC TdiaC TilinC TnormC **User** **user\_light** Tau\_i data Copyright

# Agenda

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## 5. Tabulated data

## 6. User defined filters and light sources

# There are 9 sheets for analysis of a single filter

The screenshot displays the SCHOTT software interface for single filter analysis. The interface is divided into three main sections: a sidebar menu on the left, a main calculation area in the center, and a bottom sheet selector.

**Sidebar Menu:**

- Single filter** (highlighted with a red box)
  - [Data input](#)
  - [CIE diagram](#)
  - [CIE data table](#)
  - [Ti diabolic](#)
  - [T diabolic](#)
  - [Ti linear](#)
  - [T linear](#)
  - [Extinction](#)
  - [Optical density](#)
- Combination of filters**
  - [Data input](#)
  - [Ti diabolic](#)
  - [T diabolic](#)
  - [Ti linear](#)
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- User defined curves**
  - [Filter](#)
  - [Light source](#)
- Results**
  - [Data table](#)
  - [Copyright](#)

**Main Calculation Area:**

The main area shows the "Calculation of single filter v" section. It includes a language selector set to "English", a "Select by drop" input field, and a graph titled "Illuminant" showing a yellow curve. Below the graph is a "Desired color locus" section with a "radius of" label.

**Bottom Sheet Selector:**

The bottom selector shows a row of tabs: InpS, CIE diag, CIE data, TidiaS, TdiaS, TilinS, TlinS, ExtS, DS, InpC, TdiaC, TdiaC, TilinC, TnormC, User, user\_light, Tau\_i data, and Copyright. The "InpS" tab is highlighted with a red box.

**Callout Box:**

A callout box provides detailed descriptions for the tabs in the bottom selector:

Tab	Description
Data Input	defining the language for annotations defining the filter type and its thickness defining the light source for color analysis
CIE diagram CIE data table	color diagram and results of color analysis
Ti diabolic T diabolic	diagram for internal transmittance in <b>diabatic</b> scale diagram for transmittance in <b>diabatic</b> scale
Ti linear T linear	diagram for internal transmittance in <b>linear</b> scale diagram for transmittance in <b>linear</b> scale
Extinction	diagram for <b>extinction</b>
Optical density	diagram for <b>optical density</b>

# Single filter: Data Input

**SCHOTT**  
2017

**Single filter**  
[Data input](#)  
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User defined curves  
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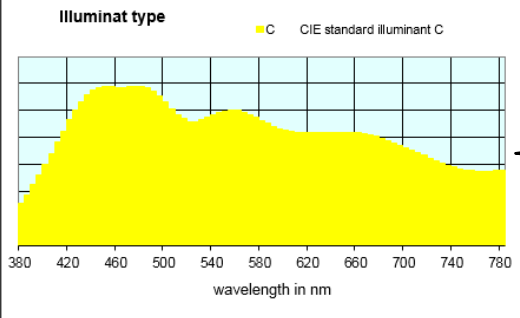
Sprache / language: **English**

Calculation of single filter with colorimetric evaluation

Select by drop-down: Filter type **KG1**  
Input: Thickness **d = 3,000 mm**

Select by drop-down: Illuminant type **C**

**Illuminat type** ■ C CIE standard illuminant C



Desired color locus **NVIS Green A**  
 $u' = 0,088$   
 $v' = 0,543$   
radius of tolerance  $r = 0,037$

**InpS** CIE diag CIE data TidiaS TdiaS TlinS TlinS ExtS DS InpC TdiaC TdiaC TlinC TnormC User user\_light Tau\_i data Copyright

Select a filter type from the drop down menu and define the thickness of the filter. Your filter combination or user defined filters are at the end of the list

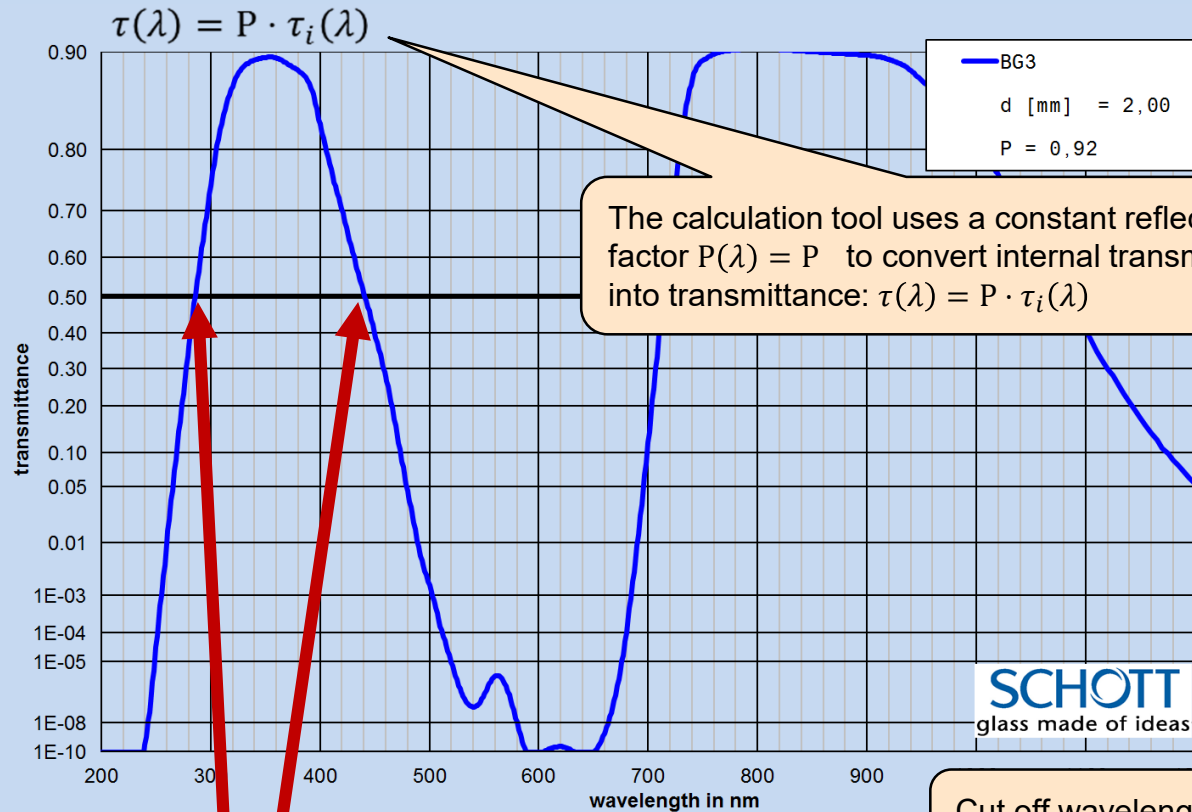
Select a light source for the color evaluation.

Graph of the spectral distribution of the emissivity of the chosen light source.

Select a NVIS color (acc. MIL-STD3009)

# Single filter: Transmittance and internal transmittance

The diabatic ordinate is not an Excel function. These are separate data sets. The linear scale is turned off.



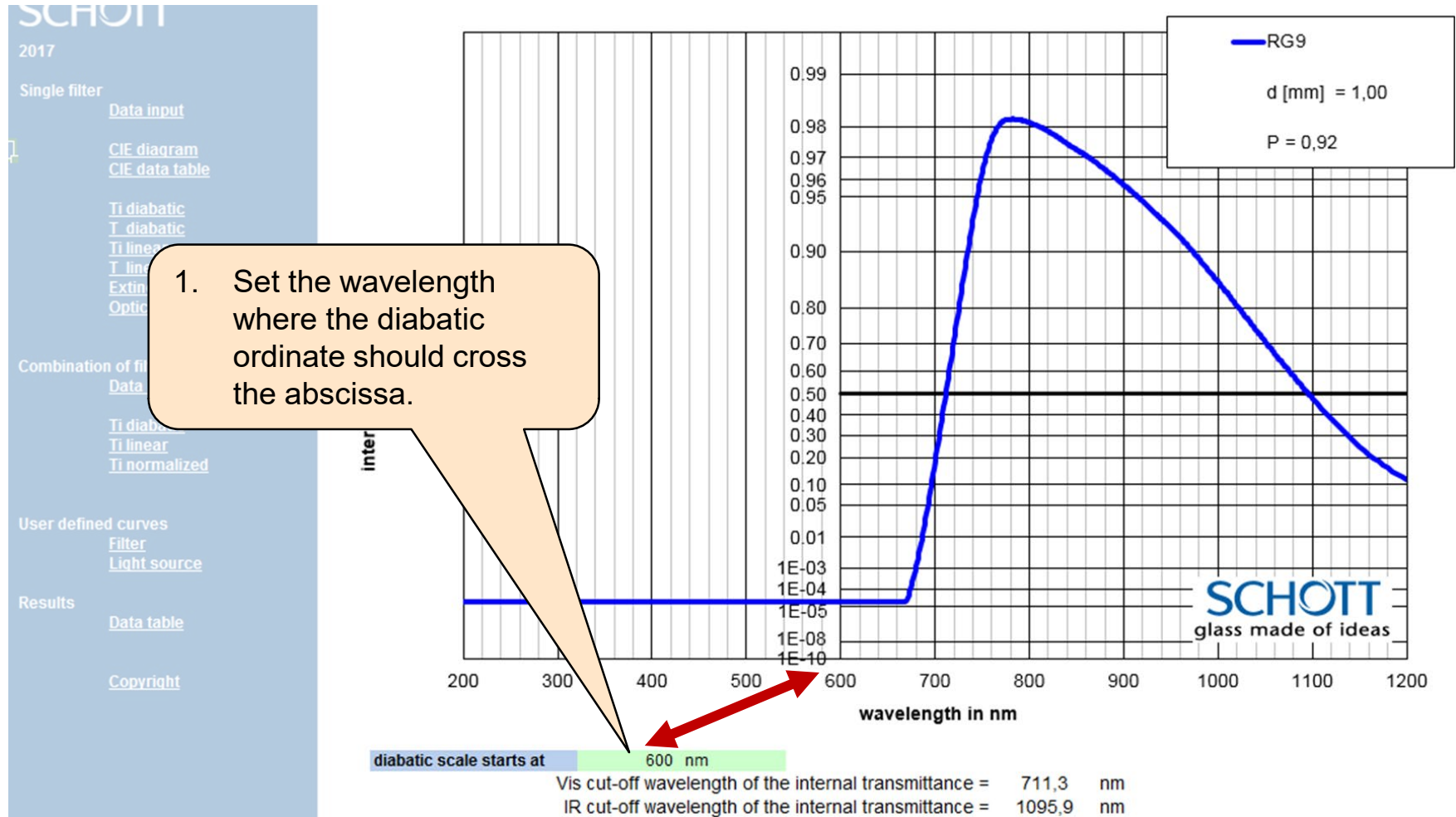
The calculation tool uses a constant reflection factor  $P(\lambda) = P$  to convert internal transmittance into transmittance:  $\tau(\lambda) = P \cdot \tau_i(\lambda)$

UV cut-off wavelength of the spectral transmittance = 285,9 nm  
Vis cut-off wavelength of the spectral transmittance = 441,1 nm  
Red cut-off wavelength of the spectral transmittance = 713,6 nm  
IR cut-off wavelength of the spectral transmittance = 1082,2 nm

Cut off wavelengths are listed if it is feasible.

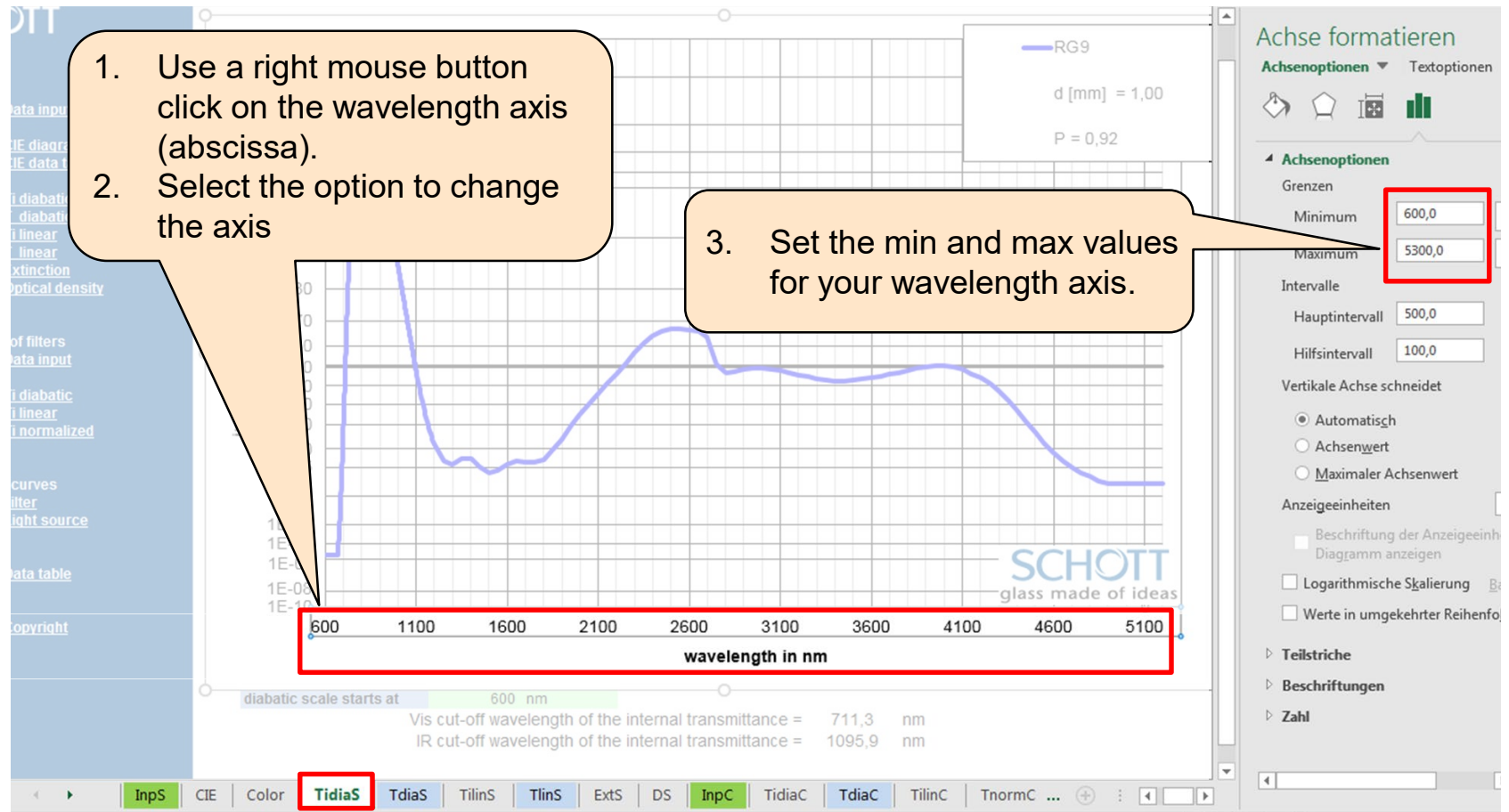
# Single filter: IR data and changing the wavelength range

## (1) wavelength change for diabolic scale



# Single filter: IR data and changing the wavelength range

## (2) change of wavelength range



# Agenda

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## 5. Tabulated data

## 6. User defined filters and light sources

# Comparing /Combining filters: There are 4 sheets for multiple filter analysis

**SCHOTT**  
2017

Single filter

[Data input](#)

[CIE diagram](#)  
[CIE data table](#)

[Ti diabolic](#)  
[T diabolic](#)  
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[T linear](#)  
[Extinction](#)  
[Optical density](#)

**Combination of filters**

[Data input](#)

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User defined curves  
[Filter](#)  
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Results  
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[Copyright](#)

Calculation of cemented glass filter combination (up to 5 types)  
and comparison with a given target

Type : COMBI

$$\tau_i \text{ COMBI} = \tau_{i1} \times \tau_{i2} \times \tau_{i3} \times \tau_{i4} \times \tau_{i5}$$

$$\tau_i \text{ COMBI} = P_{ef} ( \tau_{i1} \times \tau_{i2} \times \tau_{i3} \times \tau_{i4} \times \tau_{i5} )$$

Display graph?		choose the filter glass type	input glass thickness	Reference thickness
NO	Target	V-LAMBDA	1,000 mm	1,00 mm
YES	Filter 1			
YES	Filter 2			
NO	Filter 3			
NO	Filter 4			
NO	Filter 5			
NO	Combination			

effective reflection factor of the combination

**Data Input** defining filter types and their thickness

Ti diabolic diagram for internal transmittance in **diabatic** scale

T diabolic diagram for transmittance in **diabatic** scale

Ti linear diagram for internal transmittance in **linear** scale

Ti normalized diagram for internal transmittance in **linear** scale with all graphs normalized for their maximum transmittance = 1

InpS
CIE diag
CIE data
TidiaS
TdiaS
TilinS
TlinS
ExtS
DS
InpC
TidiaC
TdiaC
TilinC
TnormC
User
user\_light
Tau\_i data
Copyright

# Comparing filters: defining filter types and other input

**SCHOTT 2017**

Single filter

- Data input
- CIE diagram
- CIE data table
- Ti diabolic
- T diabolic
- Ti linear
- T linear
- Extinction
- Optical density

**Combination of filters**

- Data input
- Ti diabolic
- T diabolic
- Ti linear
- Ti normalized

User defined curves

- Filter
- Light source

Results

- Data table
- Copyright

Define a name for your combination. The thickness is computed automatically.

Input: define a target filter at a certain thickness

Up to 5 different filters each at a different thickness can be chosen

Input: the effective reflection factor  $P_{eff}$  of the cemented filter combination must be specified by the user

Input: Which curves should be displayed?

Combination (up to 5 types) given target			
$\tau_1 \times \tau_2 \times \tau_3 \times \tau_4 \times \tau_5$ ( $\tau_1 \times \tau_2 \times \tau_3 \times \tau_4 \times \tau_5$ )			
Display graph?	Target	Choose the filter glass type	input glass thickness
NO		V-LAMBDA	1,000 mm
YES	Filter 1	KG1	3,000 mm
YES	Filter 2	KG2	5,000 mm
NO	Filter 3	Ti=1	0,000 mm
NO	Filter 4	Ti=1	0,000 mm
NO	Filter 5	Ti=1	0,000 mm
=			
Combination		C1	total thickness
			8,000 mm
effective reflection factor of the combination $P_{eff}$ =			0,91

Navigation bar: InpS | CIE diag | CIE data | TidiaS | TdiaS | TlinS | TlinS | ExtS | DS | **InpC** | TidiaC | TdiaC | TlinC | TnormC | User | user\_light | Tau\_i data | Copyright

# Comparing /Combining filters: There are 4 sheets for multiple filter analysis

**SCHOTT**  
2017

Single filter

[Data input](#)

[CIE diagram](#)  
[CIE data table](#)

[Ti diabolic](#)  
[T diabolic](#)  
[Ti linear](#)  
[T linear](#)  
[Extinction](#)  
[Optical density](#)

Combination of filters

[Data input](#)

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Calculation of cemented glass filter combination (up to 5 types)  
and comparison with a given target  
Type : COMBI

$\tau_i \text{ COMBI} = \tau_{i1} \times \tau_{i2} \times \tau_{i3} \times \tau_{i4} \times \tau_{i5}$   
 $\tau_i \text{ COMBI} = P_{ef} ( \tau_{i1} \times \tau_{i2} \times \tau_{i3} \times \tau_{i4} \times \tau_{i5} )$

Display graph?		choose the filter glass type	input glass thickness	Reference thickness
NO	Target	V-LAMBDA	1,000 mm	1,00 mm
YES	Filter 1	KG1	3,000 <sup>0</sup> mm	2,00 mm
YES	Filter 2	KG2	5,000 <sup>0</sup> mm	2,00 mm
NO	Filter 3	Ti=1	0,000 <sup>0</sup> mm	1,00 mm
NO	Filter 4	Ti=1	0,000 <sup>0</sup> mm	1,00 mm
NO	Filter 5			
=				
effective reflection factor of the combination				

Ti diabolic      diagram for internal transmittance in **diabatic** scale

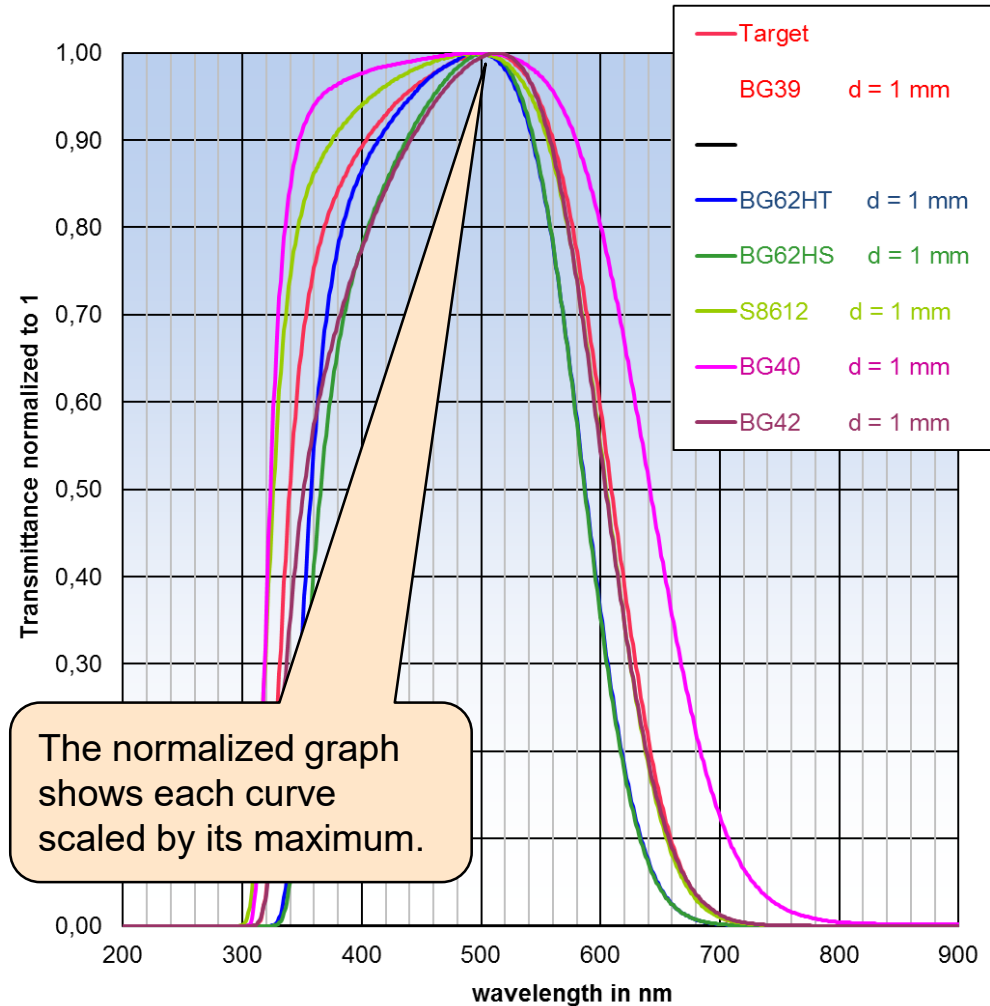
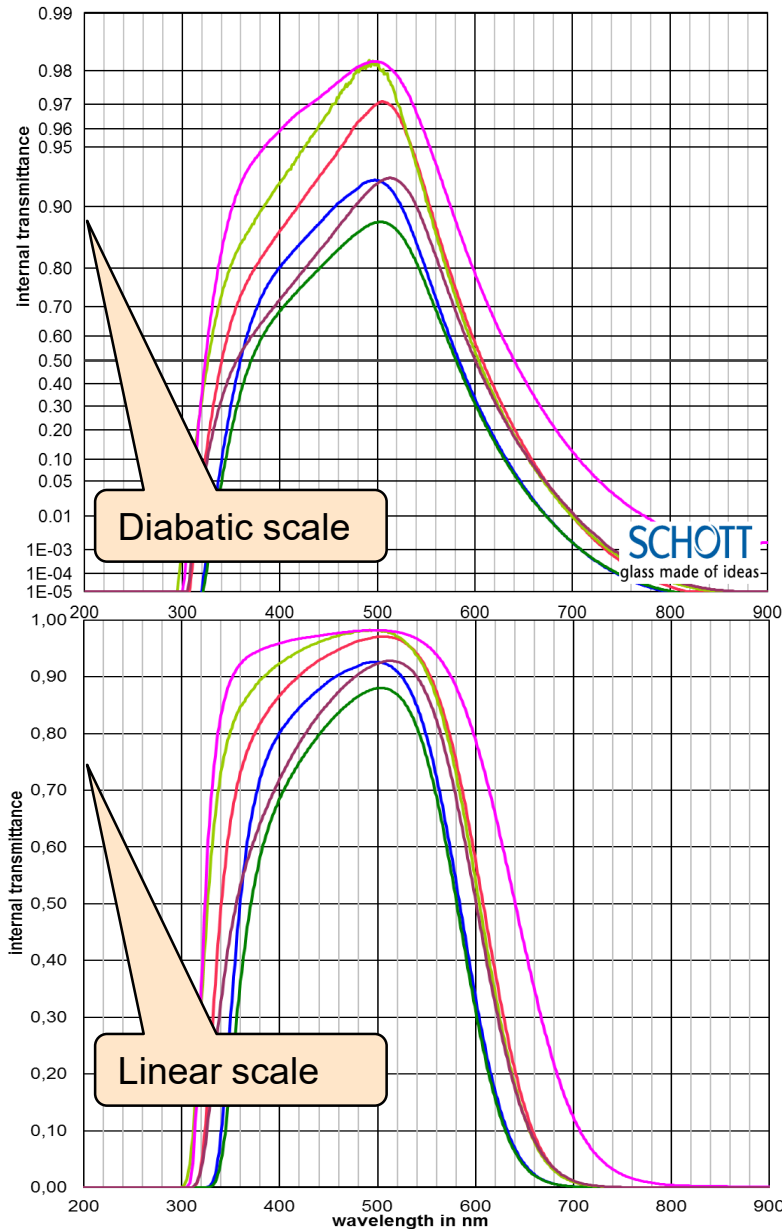
T diabolic      diagram for transmittance in **diabatic** scale

Ti linear        diagram for internal transmittance in **linear** scale

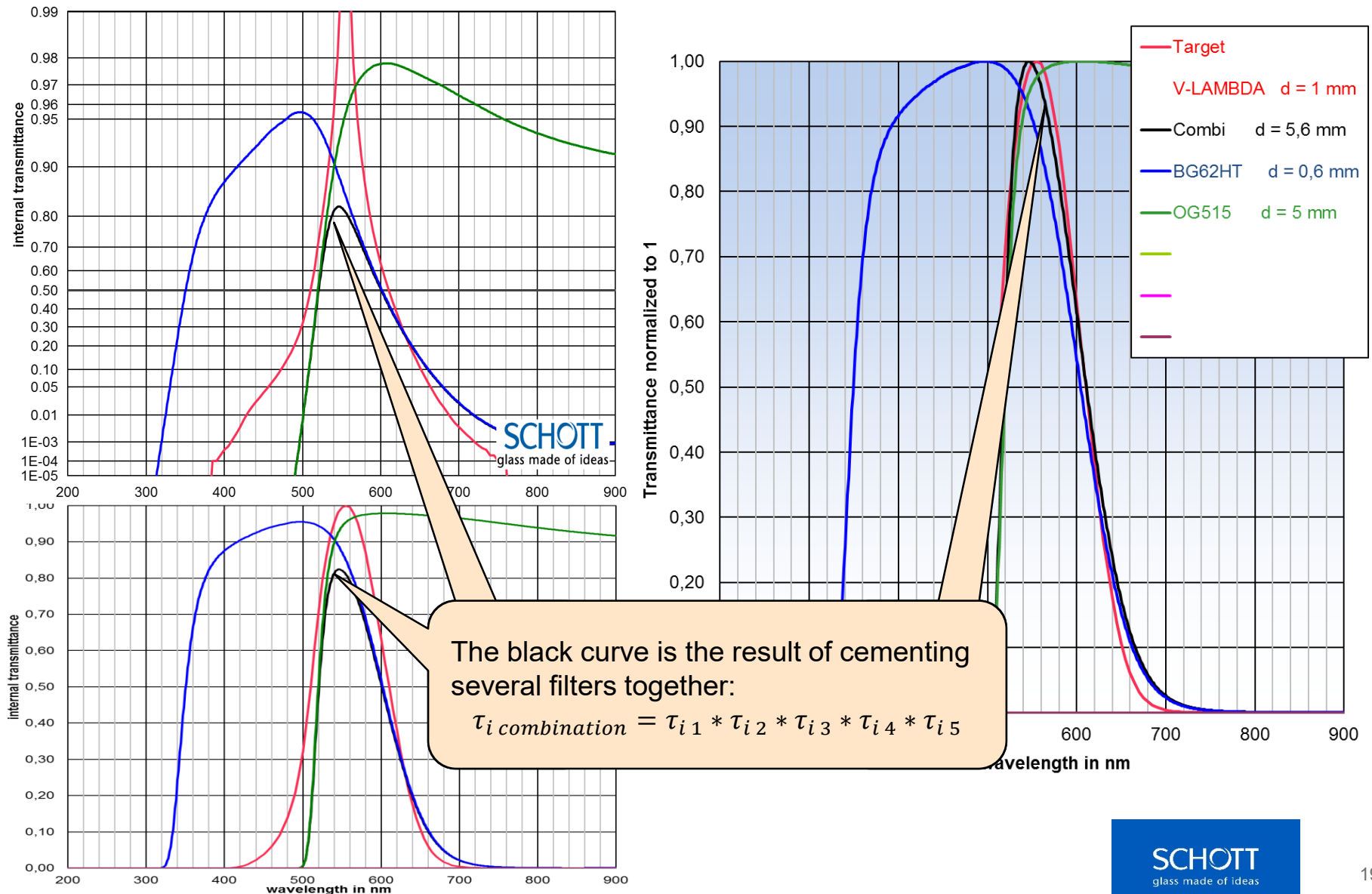
Ti normalized   diagram for internal transmittance in **linear** scale with  
all graphs normalized for their maximum transmittance = 1

InpS
CIE diag
CIE data
TidiaS
TdiaS
TilinS
TlinS
ExtS
DS
InpC
TidiaC
TdiaC
TilinC
TnormC
User
user\_light
Tau\_i data
Copyright

# Comparing filters: diabatic, linear, normalized scale



# Combining filters: internal transmittance in diabatic, linear, normalized scale



# Agenda

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2. Properties of a single filter
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6. User defined filters and light sources

# Color of light source and filtered radiation

- All required data input for color analysis has to be given in the sheet „**Data input**“ for a single filter.
- The user can choose any single filter glass type or the cemented combination of several filter glasses, which are given in the sheet „**Data input**“ for „**Combinations of filters**.“
- The color of filtered radiation is a function of
  - the filter glass type
  - the filter glass thickness
  - the light source
- The color of a light source or filtered radiation can be described by the definitions of the CIE made in 1931 and 1976. The results are given as a graph or tabulated data

# There are two types of color diagrams available: x-y- or u'-v'- chromaticity diagram

SCHOTT

2017

Single filter

Data input

CIE diagram

CIE data table

Ti diabatic

T diabatic

Ti linear

T linear

Extinction

Optical density

Combination of filters

Data input

Ti diabatic

T diabatic

Ti linear

T linear

Ti normalized

User defined curves

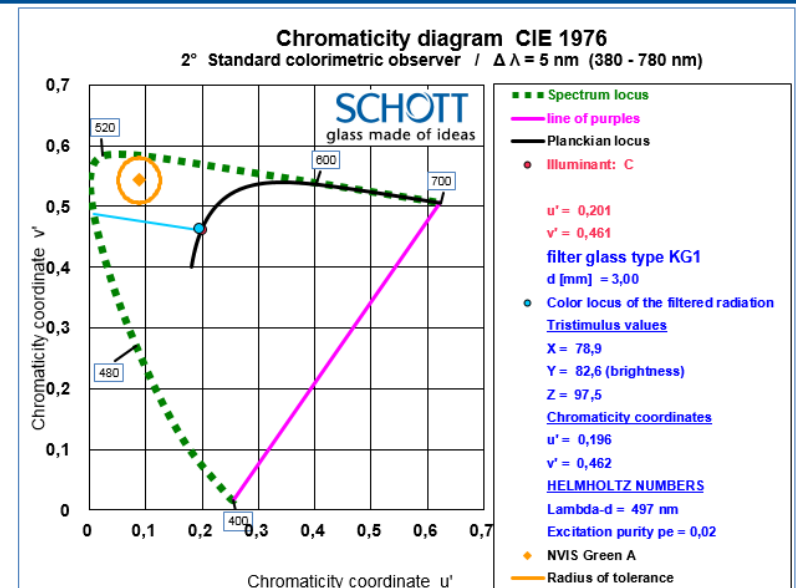
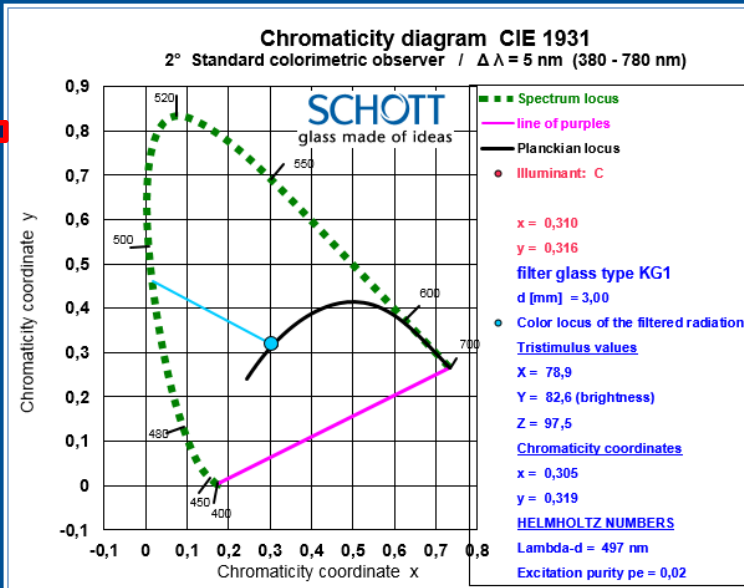
Filter

Light source

Results

Data table

Copyright



InpS

CIE diag

CIE data

TidiaS

TdiaS

TilinS

TlinS

ExtS

DS

InpC

TidiaC

TdiaC

TilinC

TnormC

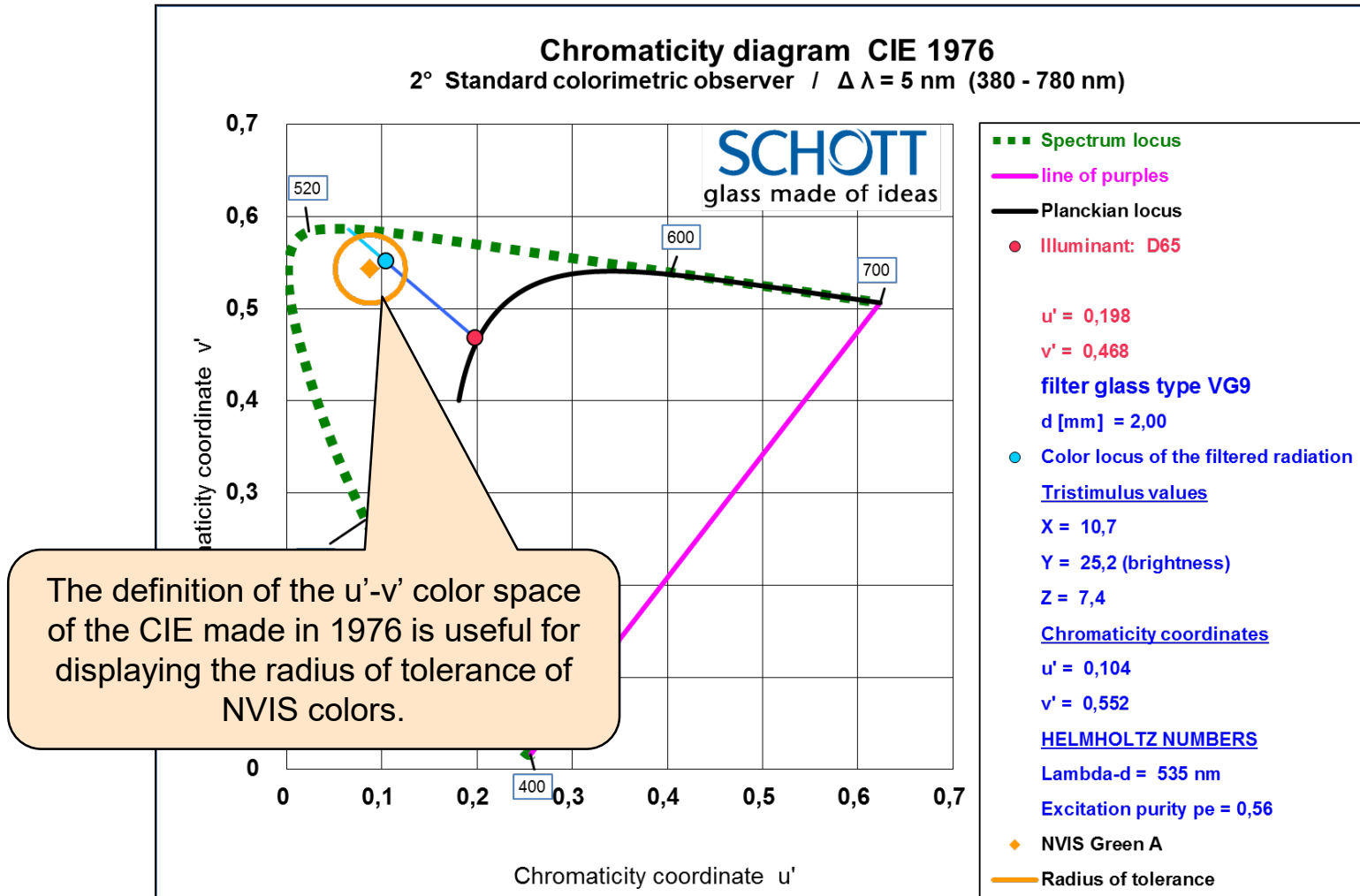
User

user\_light

Tau\_i data

Copyright ...

# Color of filtered radiation in $u'$ - $v'$ -coordinates



# Color of light source and filtered radiation

**SCHOTT**

2017

Single filter

[Data input](#)

[CIE diagram](#)

**[CIE data table](#)**

[Ti diabolic](#)

[T diabolic](#)

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filter glass type	KG1		
glass thickness d =	3,00 mm		
<b>COLORIMETRIC EVALUATION</b>			
<b>COLOR LOCUS OF ILLUMINANT</b>			
Chromaticity coordinates	x	0,310	according to CIE N0 15.2 (1986)
	y	0,316	2° standard colorimetric observer
			380 nm - 780 nm $\Delta\lambda = 5$ nm
<b>COLOR LOCUS OF THE FILTERED RADIATION</b>			
Chromaticity coordinates	x	0,305	
	y	0,319	
	u'	0,196	
	v'	0,462	
Tristimulus value	Y	82,6	(brightness)
Tristimulus values	X	78,9	
	Y	82,6	(brightness)
	Z	97,5	
<b>HELMHOLTZ NUMBERS</b>			
Excitation purity	p <sub>e</sub>	0,02	
Dominant wavelength	$\lambda_d$	497 nm	
Tristimulus value	Y	82,6	(brightness)
<b>INTEGRATED TRANSMITTANCE VALUES</b>			
Luminous transmittance	$\tau_{v,De5}$	82,6%	according to DIN EN ISO 4007: 2012
UV-A transmittance	$\tau_{UVA}$	71,9%	315 nm - 380 nm
UV-B transmittance	$\tau_{UVB}$	10,5%	280 nm - 315 nm
Infrared transmittance	$\tau_{IRA}$	1,8%	780 nm - 1400 nm

► InpS CIE diag **CIE data** TidiaS TdiaS TilinS TlinS ExtS DS InpC TidiaC TdiaC TilinC TnormC User user\_light Tau\_i data Copyright

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2. Properties of a single filter
  - transmittance and internal transmittance
  - optical density and extinction
3. Comparing or Combining filters
4. Color of a filter (combination) and its light source
5. Tabulated data
6. User defined filters and light sources

The internal transmittance data is listed for the specified thicknesses

- The sheet „**Tau\_i data**“ contains the internal transmittance data for the chosen filter types.
- The data is listed from 200 to 1100 nm in steps of 1 nm and from 1200 nm to 5200 nm in steps of 50 nm.

SCHOTT			Results of calculation of internal transmittance															
2017																		
Single filter			Single filter		Calculation of a combination of filters													
Data input			filter glass type	Target	Filter 1	Filter 2	Filter 3	Filter 4	Filter 5	Combination								
CIE diagram			KG1	V-LAMBDA	KG1	KG2	Ti=1	Ti=1	Ti=1	C1								
CIE data table			0.920	1.000	0.920	0.920	1.000	1.000	1.000	0.908								
			2.00	1.00	2.00	2.00	1.00	1.00	1.00	---								
			3.000	1.000	3.000	5.000	0.000	0.000	0.000	8.000								
			λ[nm]	τ <sub>i</sub>	τ <sub>i</sub> Target	τ <sub>i1</sub>	τ <sub>i2</sub>	τ <sub>i3</sub>	τ <sub>i4</sub>	τ <sub>i5</sub>	τ <sub>i</sub> combination							
Combination of filters	Ti diabatic	200	3.16E-08		3.16E-08	3.16E-13	1.00E+00	1.00E+00	1.00E+00	1.00E+00	1.00E-20							
	T diabatic	201	3.16E-08		3.16E-08	3.16E-13	1.00E+00	1.00E+00	1.00E+00	1.00E+00	1.00E-20							
	Ti linear	202	3.16E-08		3.16E-08	3.16E-13	1.00E+00	1.00E+00	1.00E+00	1.00E+00	1.00E-20							
	T linear	203	3.16E-08		3.16E-08	3.16E-13	1.00E+00	1.00E+00	1.00E+00	1.00E+00	1.00E-20							
	Extinction	204	3.16E-08		3.16E-08	3.16E-13	1.00E+00	1.00E+00	1.00E+00	1.00E+00	1.00E-20							
	Optical density	205	3.16E-08		3.16E-08	3.16E-13	1.00E+00	1.00E+00	1.00E+00	1.00E+00	1.00E-20							
		206	3.16E-08		3.16E-08	3.16E-13	1.00E+00	1.00E+00	1.00E+00	1.00E+00	1.00E-20							
		207	3.16E-08		3.16E-08	3.16E-13	1.00E+00	1.00E+00	1.00E+00	1.00E+00	1.00E-20							
		208	3.16E-08		3.16E-08	3.16E-13	1.00E+00	1.00E+00	1.00E+00	1.00E+00	1.00E-20							
		209	3.16E-08		3.16E-08	3.16E-13	1.00E+00	1.00E+00	1.00E+00	1.00E+00	1.00E-20							
		210	3.16E-08		3.16E-08	3.16E-13	1.00E+00	1.00E+00	1.00E+00	1.00E+00	1.00E-20							
		211	3.16E-08		3.16E-08	3.16E-13	1.00E+00	1.00E+00	1.00E+00	1.00E+00	1.00E-20							
		212	3.16E-08		3.16E-08	3.16E-13	1.00E+00	1.00E+00	1.00E+00	1.00E+00	1.00E-20							
		213	3.16E-08		3.16E-08	3.16E-13	1.00E+00	1.00E+00	1.00E+00	1.00E+00	1.00E-20							
		214	3.16E-08		3.16E-08	3.16E-13	1.00E+00	1.00E+00	1.00E+00	1.00E+00	1.00E-20							
	User defined curves		215	3.16E-08		3.16E-08	3.16E-13	1.00E+00	1.00E+00	1.00E+00	1.00E+00	1.00E-20						
		216	3.16E-08		3.16E-08	3.16E-13	1.00E+00	1.00E+00	1.00E+00	1.00E+00	1.00E-20							
		217	3.16E-08		3.16E-08	3.16E-13	1.00E+00	1.00E+00	1.00E+00	1.00E+00	1.00E-20							
Filter		218	3.16E-08		3.16E-08	3.16E-13	1.00E+00	1.00E+00	1.00E+00	1.00E+00	1.00E-20							
Light source		219	3.16E-08		3.16E-08	3.16E-13	1.00E+00	1.00E+00	1.00E+00	1.00E+00	1.00E-20							
		220	3.16E-08		3.16E-08	3.16E-13	1.00E+00	1.00E+00	1.00E+00	1.00E+00	1.00E-20							
Results		221	3.16E-08		3.16E-08	3.16E-13	1.00E+00	1.00E+00	1.00E+00	1.00E+00	1.00E-20							
	Data table	222	3.16E-08		3.16E-08	3.16E-13	1.00E+00	1.00E+00	1.00E+00	1.00E+00	1.00E-20							
		223	3.16E-08		3.16E-08	3.16E-13	1.00E+00	1.00E+00	1.00E+00	1.00E+00	1.00E-20							
		224	3.16E-08		3.16E-08	3.16E-13	1.00E+00	1.00E+00	1.00E+00	1.00E+00	1.00E-20							
		225	3.16E-08		3.16E-08	3.16E-13	1.00E+00	1.00E+00	1.00E+00	1.00E+00	1.00E-20							
		226	3.16E-08		3.16E-08	3.16E-13	1.00E+00	1.00E+00	1.00E+00	1.00E+00	1.00E-20							
		227	3.16E-08		3.16E-08	3.16E-13	1.00E+00	1.00E+00	1.00E+00	1.00E+00	1.00E-20							
		228	3.16E-08		3.16E-08	3.16E-13	1.00E+00	1.00E+00	1.00E+00	1.00E+00	1.00E-20							
		229	3.16E-08		3.16E-08	3.16E-13	1.00E+00	1.00E+00	1.00E+00	1.00E+00	1.00E-20							
		230	3.16E-08		3.16E-08	3.16E-13	1.00E+00	1.00E+00	1.00E+00	1.00E+00	1.00E-20							
		231	3.16E-08		3.16E-08	3.16E-13	1.00E+00	1.00E+00	1.00E+00	1.00E+00	1.00E-20							
		232	3.16E-08		3.16E-08	3.16E-13	1.00E+00	1.00E+00	1.00E+00	1.00E+00	1.00E-20							
▶ InpS CIE diag CIE data TdiaS TdiaS TlinS TlinS ExtS DS InpC TdiaC TdiaC TlinC TnormC User user_light Tau_i data Copyright																		

# Agenda

1. Introduction
2. Properties of a single filter
  - transmittance and internal transmittance
  - optical density and extinction
3. Comparing or Combining filters
4. Color of a filter (combination) and its light source
5. Tabulated data
6. User defined filters and light sources

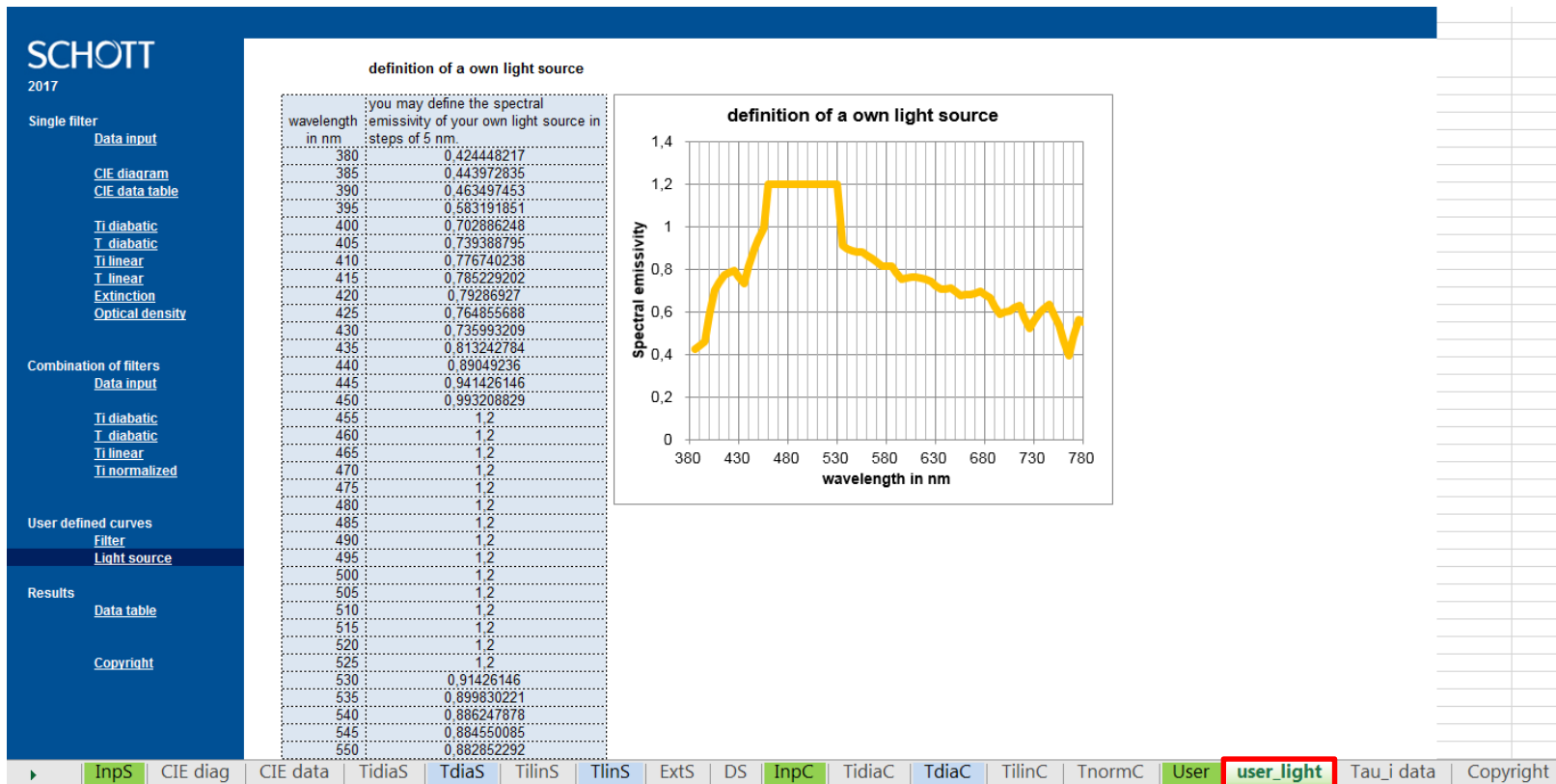
# The user may define his own filter glass types

- The sheet „**User**“ has space for 100 different filter curves.
- The internal transmittance has to be given in values ranging from  $0 < \tau_i < 1$ .

SCHOTT														
2017														
Single filter	User type name	V-LAMBDA	Mycurve	upper limit	linear	coating	water							
	Reflection factor P	1.00	0.90	0.90	0.90	1.00	0.96							
	Reference thickness in mm	1.00	2.00	1.00	1.00	1.00	1000.00							
Data input	free for text and notes	380 - 780 nm	Example	Example	Example	Example	stein (1981; Internet)							
	$\lambda$ [nm]	$\tau_{i01}$	$\tau_{i02}$	$\tau_{i03}$	$\tau_{i04}$	$\tau_{i05}$	$\tau_{i06}$	$\tau_{i07}$	$\tau_{i08}$	$\tau_{i09}$	$\tau_{i10}$	$\tau_{i11}$	$\tau_{i12}$	$\tau_{i13}$
CIE diagram	200	0.001					9.90E-04							
CIE data table	201	0.001			0.15075		4.07E-03							
	202	0.001			0.1515		7.15E-03							
Ti diabatic	203	0.001			0.15225		1.02E-02							
T diabatic	204	0.001			0.153		1.33E-02							
Ti linear	205	0.001			0.15375		1.64E-02							
T linear	206	0.001			0.1545		3.31E-02							
Extinction	207	0.001			0.15525		4.99E-02							
Optical density	208	0.001			0.156		6.66E-02							
	209	0.001			0.15675		8.34E-02							
	210	0.001			0.1575		1.00E-01							
Combination of filters	211	0.001			0.15825		1.42E-01							
Data input	212	0.001			0.159		1.84E-01							
	213	0.001			0.15975		2.26E-01							
Ti diabatic	214	0.001			0.1605		2.68E-01							
T diabatic	215	0.001			0.16125		3.11E-01							
Ti linear	216	0.001			0.162		3.45E-01							
Ti normalized	217	0.001			0.16275		3.80E-01							
	218	0.001			0.1635		4.14E-01							
	219	0.001			0.16425		4.49E-01							
User defined curves	220	0.001			0.165		4.84E-01							
Filter	221	0.001			0.16575		4.92E-01							
Light source	222	0.001			0.1665		5.00E-01							
	223	0.001			0.16725		5.08E-01							
Results	224	0.001			0.168		5.16E-01							
Data table	225	0.001			0.16875		5.24E-01							
	226	0.001			0.1695		5.28E-01							
	227	0.001			0.17025		5.33E-01							
Copyright	228	0.001			0.171		5.38E-01							
	229	0.001			0.17175		5.43E-01							
	230	0.001			0.1725		5.48E-01							
	231	0.001			0.17325		5.51E-01							
	232	0.001			0.174		5.54E-01							
	233	0.001			0.17475		5.58E-01							
	234	0.001			0.1755		5.61E-01							
	235	0.001			0.17625		5.64E-01							
<div> <div>►</div> <div>InpS</div> <div>CIE diag</div> <div>CIE data</div> <div>TidiaS</div> <div>TdiaS</div> <div>TilinS</div> <div>TlinS</div> <div>ExtS</div> <div>DS</div> <div>InpC</div> <div>TidiaC</div> <div>TdiaC</div> <div>TilinC</div> <div>TnormC</div> <div>User</div> <div>user_light</div> <div>Tau_i_data</div> <div>Copyright</div> </div>														

# The user may define his own light source

- The sheet „**user\_light**“ offers the possibility to define the spectrum of an own light source.
- The emissivity is normalized within the color analysis. Thus, the total intensity of the data input does not affect the results of color calculation.



# Addendum

- Any comments or suggestions are welcome.
- If you have any questions or recommendations please contact your local sales representative.