# HOLIGILM 4.4 Optimizing the graphs

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# 1. Introduction

There are two ways for graphs generating: on the computer screen (in a GNUplot window) or direct dump to the computer disk in one of common graphical formats (PNG, GIF, JPG, EPS, WMF, LaTeX).

### 1.1. Graphs displayed on the computer screen

The graphs are displayed using HOLIGILM's menu ,Results / Workplane illumination' or ,Results / Tube N illumination'. The graph is displayed on the computer screen in a GNUplot window. The modification of plots is possible using GNUplot's window menu (as described later).

### 1.2. Graphs exported to the disk (GIF, JPG, PNG, WMF, EPS, LaTeX)

The graphs are dumped according the instructions in ,Custom GNUplot commands' box in HOLIGILM's ,Options / Graph settings' menu. The plots can be modified by modifying this commands and/or adding own commands. Although this way seems on the first look to be a bit complicated, it is very convenient and very flexible. The results obtained by direct writing of plots to the disk are usually better then by copying of the content of the GNUplot's window. There are pre-prepared command files (export filters) and you can load any of them using ,LOAD' button.

Isolines					Ok
<ul> <li>Snow isolines</li> <li>Number of isoli</li> </ul>	nes: 5				
C Isolines values	:				Cancel
1,2,5,10,20,50,	100,200,500,	1000,2000,50	000,1000	0	
Colour map					
Show colour map	🔽 Loga	rithmic scale			
Full Colour	Limits:	✓ Diffuser:	150.0	klux	
C Grayscale		Room:	2.5	klux	
Inverted		Sky:	100.0	kcd/m2	
Plot orientation Show arrow pointing no Custom GNUplot command set terminal windows font set palette gamma 1.5 #N	s : "Arial, 12" #F Works on gray	Font size in pla yscale only	ots		Load Save

Field, where the GNUplot's commands for the file creation are written

Beside displaying the plot on the screen, corresponding picture is written also to the disk. The filename of the plot can be found in 'Custom GNUplot commands' and in the figure above it is 'output\_col.gif'. This name can be changed. Be aware, that due to the graphical formats limitations, the plot on the screen can look different than the plot written to the disk!

Currently following export filters are distributed with the HOLIGILM program:

#### **Bitmap formats:**

*GIF\_FullColour.gpt* – generates GIF bitmap picture in full-colour. Graphic Interchange Format is commonly accepted and widely used for pictures containing low number of colours. All bitmap formats are very popular, they can be easily postprocessed in many common programs, such as Paint (distributed with MS Windows) or GIMP (another free utility). But if the bitmap/plots are scaled-up, at higher magnification they can become unsharp (rastered). From this reason it is better to have bitmap pictures in higher resolution (1280x1024 is usually enough for good looking figures in publications) and scale-down them, if necessary. *JPG\_FullColour.gpt* – generates JPG bitmap picture in full-colour. JPEG is widely used format, especially for photographs.

*PNG\_FullColour.gpt* – generates PNG bitmap picture in full-colour. Portable Network Graphics format is newer one and replaces currently the GIF format.



An example of a graph in bitmap GIF-format

#### Vector formats:

*WMF\_FullColour.gpt* – generates WMF vector picture in full-colour. Windows MetaFile is commonly used vector format in MS Windows - based programs. Thanks to the vector-representation of the data (lines, texts, etc.), WMF graphs can be easily scaled-up without loss of the sharpness. On the other side, vector figures must be postprocessed using special graphic programs, if some postprocessing (cropping, change of colours, etc.) is needed.

*WMF\_Grayscale\_dashed.gpt* – generates WMF vector picture in grayscale. Lines are dashed, dotted and so on.

*EPS\_FullColour.gpt* – generates EPS vector picture in full-colour. Encapsuled PostScript is one of the most popular vector formats used.

*EPS\_Grayscale\_Dashed.gpt* – generates EPS vector picture in grayscale. Lines are dashed, dotted and so on.

EPS\_Grayscale\_Dashed.gpt - The same but in grayscale. Lines are dashed, dotted and so on.

*EPS\_LaTeX\_FullColour.gpt* – generates EPS vector picture in full-colour optimized for LaTeX, including code for LaTeX.

Illuminance [lux] 316 -----100 -----6 400 32 -----10 -----350 5 300 y-axis of the room [m] 4 250 3 200 150 2 100 1 50 0 0 2 3 4 0 1 x-axis of the room [m]

An example of a plot using grayscale and dashed/dotted lines. Vector WMF-format.

# 2. Font type and size

In the case, that the font size is too small/large for your purposes, you can easily change the font type and font size used in plots. The way how to achieve this is different for plots displayed on the screen and for plots written to the disc.

### 2.1. Displayed plots

After the plot window is displayed (see figure):

- 1. Click the left top corner of the GNUplot's window
- 2. Select menu 'Options'
- 3. Select menu 'Choose Font...'

You can use any installed font and set any available size of the font.

Restore		
Move		
Size		
Minimize	Illuminance [lux]	
] Maximize		316 -
Close Alt+F4		100 -
Options	- Rring to Tap	32 -
About		
2	Copy to Clipboard	
Command Line	Background	
	Choose Font	
	Line Styles 3	
	Print	and the set

How to select Font-dialog in GNUplot's window



An example of a scaled-down plot having larger font (font size 16)

### 2.2. Exported plots

After the export-filter is loaded (sec. 1.2), in 'Results / Graph settings' you can edit 'Custom GNUplot commands'. The info about font type and size can be easily found and can be modified:

# Writes Windows Meta	file in full-colour	A	Load
set output 'output_col.wm replot	f #picture filename #write picture	#CITIK	Save
set term windows	#return to computer display		

Setting the font type and font size in plots written to disk.

# 3. Isolines width and colour

You can change the isolines width/colour. It can be useful if the plot is scaled up/down or if you want to highlight one of the isolines. This can be made as for plots shown on the screen as for plots written to the disk.

### 3.1. Displayed plots

After the plot window is displayed (see figure):

- 1. Click the left top corner of the GNUplot's window
- 2. Select menu 'Options'
- 3. Select menu 'Line Styles...'

Restore Move		
Size Minimize Maximize	Illuminance [klux]	
Close Alt+F4	90	
Options 🗸 🗸	Bring to Top	
About 2 Command Line	Color Copy to Clipboard Background	
	ine Styles	
	nnt Jpdate C:\Documents and Settings\Admin\Application Data\wgnuplot.ini	

Selecting the ,Line Styles' menu

- 4. Select the line you want to modify
- 5. Set the new colour of the selected line
- 6. Set the witdh of the selected line
- 7. You can eventually set the style (solid, dashed,  $\dots$ ) of the line.

Line Styles	
Border Axis Line2 Line2 Line2 Line2 Line2	Illumin:
Choose Color Width 1 6	
OK Cancel Default	

Setting the Colour/Width of the selected line



An example of a plot containing a highlighted isoline

### 3.2. Exported plots

After the export-filter is loaded (sec. 1.2), in 'Results / Graph settings' you can edit 'Custom GNUplot commands'. The info about isolines width can be easily found and can be modified:

# Writes Encapsuled PostScript	picture using gravscale map and	Load
set terminal postscript eps monoch	rome dashed linewidth 2 font "A	
set output 'output_bw.eps'	#picture filenam 📄	Save
set palette gray gamma 3	#more light map	
replot	#write	
set term windows	#return to comp	

Setting the isolines width in graphs written to disk

The change of the line colour is also possible, but not as much comfortable as in plots displayed on the screen (sec. 3.1). See GNUplot's documentation for details.



An example of a scaled-down plot in WMF (font size 20, linewidth 3)

# 4. Isolines number and values

The number of isolines can be set using two modes: automatically and manually. Both settings can be accessed using 'Results / Graph settings' menu:

Isolines	İ 🖂
Show isolines	Ok
Number of isolines: 5     Isolines values:	Cancel
1,2,5,10,20,50,100,200,500,1000,2000,5000,10000	

Setting-up automatic (1) or manual (2) isolines mode

### 4.1. Automatic mode

Check 'Number of isolines' radio-button and enter number of isolines to be displayed. In this automatic-mode the isolines are distributed logarithmically and the same number of isolines is diplayed inside any decade. This implies that it is usually impossible to add one single isoline into the plot. If the entered number of isolines increases, the number of isolines shown in the plot increases stepwise. In automatic mode, the real number of isolines displayed in the plot is lower than the entered one. If you want to display exact number of isolines, use manual mode (sec. 4.2)

### 4.2. Manual mode

Check 'Isolines values' radio-button and enter the comma-separated isolines values. In the plot will be shown isolines having entered values. In the manual mode you have full control over the isolines values.

# 5. Full-colour, grayscale and black&white plots

### 5.1. Displayed plots

On plots displayed on the screen you can easily change between following graph styles:

- Full colour (colour map, coloured isolines)
- Grayscale without isolines
- Black and white (dashed isolines, no colour map)

A grayscale graph (grayscale map) with dashed isolines can be obtained in a very easy way using export filters (sec. 5.2)

#### **Full-colour graphs**

This is the default plot generated by HOLIGILM and corresponding settings in 'Results / Graph settings' are shown in the next figure:

af settings				- E
Isolines				Ok
<ul> <li>Snow isolines</li> <li>Number of isol</li> <li>Isolines values</li> </ul>	ines: 5			Cancel
1,2,5,10,20,50,	100,200,500,1000,2000,50	000,1000	0	
,				
Colores and				
Colour map	Logarithmic scale			
Colour map Show colour map Full Colour	☐ Logarithmic scale Limits: ☑ Diffuser:	150.0	klux	
Colour map Show colour map Full Colour C Grayscale	└ Logarithmic scale Limits: ✓ Diffuser: └ Room:	150.0	klux	

Setting-up colour map with coloured isolines

#### Grayscale graphs without isolines

Corresponding settings in 'Results / Graph settings' are shown in the next figure (uncheck the 'Show isolines' checkbox):

Graf settings				
Isolines Show isolines Number of isolin Isolines values 1,2,5,10,20,50,1	nes: 5 : 00,200,500,1000,2000,500	00, 1000	0	Ok Cancel
Colour map				
C Full Colour	Limits: Diffuser:	150.0	klux	
Gravscale	Room:	2.5	klux	
Inverted	Sky:	100.0	kcd/m2	

Setting-up the grayscale plot without isolines

Illuminance [klux]



An example of a grayscale plot without isolines

#### Black&white isolines graphs

Corresponding settings in 'Results / Graph settings' are shown in the next figure (uncheck the 'Show colour map' checkbox):

Ok
cale
ser: 150.0 klux
1: 2.5 klux
100.0 kcd/m2
so iu: orr

Setting-up isolines plot without the colour map

After the plot window is displayed, uncheck the 'Options / Colour' menu item in the GNUplot window (see next figure) and the isolines will change to black dashed/dotted lines. You can eventually change the line styles (i.e. dashed to solid) and the isolines width using Gnuplot's 'Options / Line Styles...' menu. In black&white mode the 'Monochrome' section is used (see figures below).

gnuplot graph		X
	Illuminance [klux]	
Options About 2	Bring to Top     Color	
Command Line	Copy to Clipboard <b>3</b> Background Choose Font Line Styles Print Update C:\Documents and Settings\Admin\Application Data\wgnuplot.ini	

Switching to the black&white isolines plot



An example of a scaled-down black&white isolines plot (font size: 20, linewidth: 3)

### 5.2. Exported plots

There are prepared export filters (see also sec. 1.2) for following types of plots:

- Full-colour (colour map, coloured isolines)
- Grayscale (grayscale map, black dashed/dotted isolines)

Please, load any of prepared export filters (see also sec. 1.2). Using the 'Results / Graph settings' menu you can switch on/off the isolines or the colour-map, so totally 6 various plots can be written to the disk.

Illuminance [klux]



Total luminous flux below the optical interface: 4570 lm Exterior illuminance: 44.2 klux Efficiency: 48.7% Average cosine: 0.666

An example of a scaled down grayscale plot with black dashed/dotted isolines (WMF, font size: 20, linewidth: 3)

# 6. Logarithmic scale

In the case, that there are areas with very high / very low illumination (often in tube illumination plots), it is not easy to show all details in the illumination patterns – dark areas or light areas are without details. Some change in brightness / contrast of the picture can help (see also sec. 8.1), but in some cases it doesn't solve the problem. In such cases, HOLIGILM can show logarithms of the illumination in the plots. If you (and expected readers of your work) are familiar with logarithms, they can solve the problem.

To switch this feature on, check the 'Logarithmic map' checkbox in 'Results / Grapg settings' dialog:

Sho	w isolines		Ok
	<ul><li>Number of isolines:</li><li>Isolines values:</li></ul>	5	Cancel
	3,10,30		

Switching-on the logarithmic scale



Linear (left) and logarithmic (right) illumination scale. Logarithmic scale allows observe more details in both high and low illuminated areas.

# 7. Limiting the illumination

In the case, that there are very high illuminated areas (hot-spots), setting the upper-limit of the illumination can result in more details visible in "normally" illuminated region. Use "Limits:" check-boxes to activate this option in corresponding plots:



Unlimited (left) and limited to 150 klux (right) illumination scale. Limited scale allows you to suppress the bright "hot-spot" in the centre of the high illuminated area.

# 8. Arrow pointing north

To make the interpretation of the results easier, an arrow pointing north can be placed into workplane illumination and diffuser illumination plots. Check the corresponding check-box in 'Graph settings' menu:

🔽 Inverted	Sky:	100.0 ko	cd/m2	
Plot orientation     Show arrow pointing north	<b>`</b>			
Custom GNUplot commands				
# Writes Windows Metafile using grayscale map and black dash				Load
set output 'output_bw.wmf' set palette gray gamma 3	#picture # #more lig	filename ht map		Save

Activating the arrow pointing north in plots



An example of a workplane illumination plot in inverted grayscale palette and containing an arrow pointing north

# 9. 3D plots

### 9.1. Colourmap and wire model

Radiative patterns are presented as 3D-plots. In the case the colour map is turned off (uncheck the "Show colour map"-checkbox in "Graph settings)", a wire-model of the diagram is displayed:



Radiative pattern (overcast, transparent diffusor) using colourmap



The same radiative pattern using wires

### 9.2. Linear and logarithmic scale

If bright hot-spots are presented, the radiative pattern in linear scale is not very illustrative. In such cases, the logarithmic scale (menu "Graph settings / Logarithmic scale checkbox") can be a proper choice:



An example of a radiative pattern containing bright hot spots (clear sky, transparent diffuser)

Log of luminous intensity [a.u.]



The same radiative pattern in logarithmic scale



Corresponding workplane illumination plot shows the presence of hot-spots

### 9.3. Rotating plots

After the plot is displayed, you can rotate it using your mouse to show some interesting features:



Various views of the same diagram

Warning: Some angles of view need the resizing of the plot window to conserve the aspectratio (circle is shown as circle, not as ellipse). This problem will be solved in future version of HOLIGILM-tool.

# 10. Legend

### 10.1. Position of the legend

If you are not satisfied with the position of the legend, or you want to switch it off, you can change it using 'Custom GNUplot commands' in 'Results / Graph settings' dialog (see also sec. 1.2).

Please, write one from following commands unto the 'Custom GNUplot commands' box. If you are using an export filter, add the command BEFORE the 'replot' command (see figures below):

- set key bmargin (legend will be displayed on the bottom)
- set key rmargin (legend will be displayed on the right)
- set key at x,y,1 (legend will be displayed on the position x,y in the room coordinate system)
- **unset key** (no legend will be displayed)

- Custom GNUplot commands set key bmargin	Load
	Save

Setting-up the position of the legend



Setting-up the exact position of the legend in an export-filter



An example of a plot with specially placed legend (using 'set key at 6.5,4,1' command)

Be careful at choosing of the coordinates in 'set key at' command. If you choose a position outside the printable area of the plot, an error will occur and the plot will not be displayed!

### 10.2. Number format

If you want to change the number of decimal places in the legend, use following command in 'Custom GNUplot commands' in 'Results / Graph settings' dialog:

• set clabel '%.2f'

and the numbers will be displayed with 2 decimal places. '%.0f' means that numbers will be displayed wit no decimal places. In export filters place the command before the ,replot' command (see also sec. 7.1).

# 11. Working with plots

In the case you are sending your work for publication in a professional publishing company, it is usually full enough to send plots in separate files in any graphical format described above (sec. 1.2). The publishing company will insert pictures in a suitable place and will also change the picture size, if needed.

Sometimes it is necessary to prepare 'camera-ready' paper, which will be published 'as is'. Some useful instructions you find in this section.

### 11.1. Microsoft Office Word

MS Word is a generally accepted word editor. The processing of the pictures in MS Word is very simple and very handy. We describe MS Word 2003, but described operations are similar also in earlier versions of the MS Word and in MS Word 2007 (its menu system can be changed to 2003-look, if needed).

#### **11.1.1. Inserting the picture**

#### A. From the GNUplot window

If you have the picture displayed on the screen in the GNUplot window, use 'Options / Copy to Clipboard' menu (see figure below).

The next step is to place the picture stored in the Clipboard into your paper in MS Word. Many people use 'Edit / Paste' menu command, but better solution is to use 'Edit / Paste special...' command. (see figures below). The MS Word then shows all import filters available (e.g. Picture (metafile), Bitmap, ...) and you can try, which import filter gives best results.



Copying the picture from GNUplot window to Clipboard

📱 GraphOptimizing.doc - Microsoft Word								
Eile	Edit	View	<u>I</u> nsert	F <u>o</u> rmat	<u>T</u> ools	T <u>a</u> ble	<u>W</u> indow	He
100	5	<u>U</u> ndo Typ	ing C	trl+Z	11 J		L 🞸 🛙	<del>ງ -</del>
44 N	U	Can't <u>R</u> ep	eat C	trl+Y	nan 🚽 1	2 -	BI	σΙ
Final S		<u>С</u> ору	C	trl+C		à - X	- 1 🤖	aby
	2	<u>P</u> aste	C	trl+V			5	2
1	$\leq$	Paste Spe	ecial				- · E	<u> </u>
1	_		*		2			

Using 'Paste Special...' menu in MS Word

#### **B.** From the graph written to disk

If you have used export-filters (see sec. 1.2), the picture was written to the disk in selected format (GIF, WMF, ...). Use 'Insert / Picture / From File...' menu to insert the graph into your MS Word document.



Inserting the graph from file

### **11.1.2.** Resizing the picture

Resizing allows change the dimensions of the figures. Graphs generated by HOLIGILM are (advisedly) too large and need to be scaled down. As the result also the bitmap graphs (GIF, JPG, PNG) look smoothly.

In the MS Word 'click' on the inserted figure and 8 'hot points' are displayed (see figure below). 'Catch' any from 'hot points' and move it – the corresponding dimension of the figure will change. Four 'hot points' in corners are very useful – their moving doesn't change the aspect ratio of the figure.



#### **11.1.3.** Cropping the picture

Cropping is a removal of unused white space around the graphs. HOLIGILM's bitmap graphs (GIF, JPG, PNG) are already cropped. MS Word supports cropping in a very convenient way.



Selecting the 'Crop' tool

Click on the inserted figure. Eight 'hot points' are displayed and a 'Picture'-toolbar is displayed somewhere on your screen. If not, right-click any toolbar (e.g. menu bar) and select 'Picture toolbar':



Selecting the 'Picture'-toolbar (if not done automatically)

Then select the 'Crop'-tool (see figures above), move any 'hot point' and the picture will be cropped. If you move 'hot point' outside the picture, a white space will be added to the picture.



Heavily cropped graph (legend and descriptions of axes were removed)

#### 11.1.4. Adjusting contrast / brightness

If your graph is too dark or too bright, you can adjust it using 'Picture toolbar':



, Contrast' and , Brightness' tools.

### 11.2. Open Office Writer

Open Office Writer is an Open Source alternative to the Microsoft Office Word. Open Office Writer can save your work directly in PDF format (a commonly used format which can be displayed correctly or printed correctly on any computer having free Adobe Acrobat Reader installed). In the following text the version Open Office 2.4 is described.

### 11.2.1. and 11.2.2. Inserting and resizing the picture

The menu structure and the picture control is practically the same as in MS Word. So you can use instructions from sec. 9.1.1 and sec. 9.1.2 for inserting and resizing of plots. The only difference is in cropping of the picture and in brightness / contrast settings.

### **11.2.3.** Cropping the picture

The cropping is very easy:

1. Right-click the picture and in the roll-up menu select 'Picture...' item and the 'Picture' dialog will be displayed.

2. Select the 'Crop' tab in the 'Picture' dialog.

3. Use 'up' and 'down' spinners to change the dimensions of cropped margins. Look at the preview-pane to see, which part of the picture will be displayed in the document.

#### 11.2.4. Setting the contrast / brightness

Use the 'Picture' toolbar (see also sec. 9.1.3 and 9.1.4). The only difference (in comparision to MS Word) is, that you have to select (and display) 'Colour' toolbar by pressing the 'Colour' tool on the 'Picture' toolbar. Here you can adjust contrast, brightness and gamma (very useful parameter not supported in MS Word) of the picture.

# 11.3. LaTeX

LaTeX is often used by professionals or scientists. LaTeX has many advantages (i.e. produces very professionally looking pages), but is very uncomfortable for ordinary users - LaTeX doesn't use WYSIWYG (What You See Is What You Get).

LaTeX has very limited capability for pictures processing. In generally, LaTeX shows the picture 'as is' (but can scale it up/down). So, you have to use some other program to prepare figures into final appearance (cropping, resizing, adjusting brightness and contrast, ...). LaTeX users commonly use the GIMP (free Open Source utility), but many use also 'Adobe Photoshop' or 'Corel Photo Paint'.