

Sort Your SAS Graphs and Create a Bookmarked PDF Document Using ODS PDF

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ABSTRACT

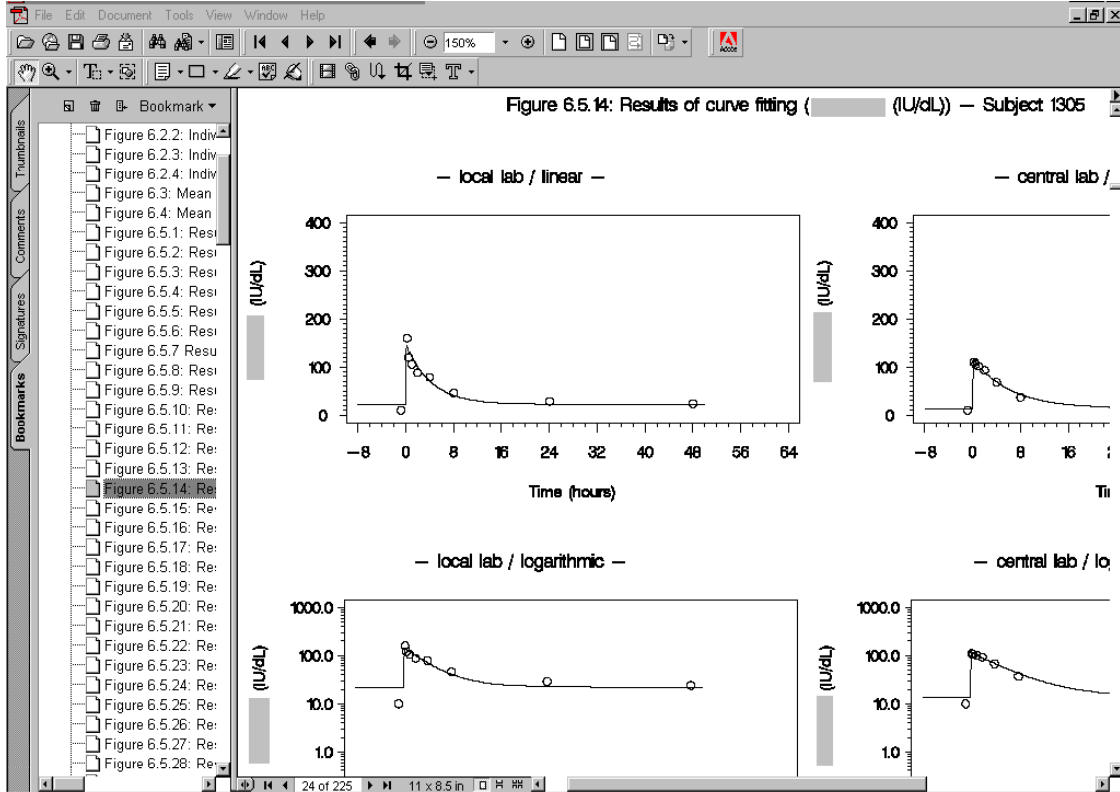
Graphs are a great tool to visualize data and they are commonly used as part of the analysis and reporting of clinical trial data. In SAS there are different possibilities for creating and storing graphs available. If it is important to provide the graphs in a user-friendly format bookmarked PDF documents are a good choice.

This paper describes a technique used to automate the sorting of graphs and the creation of bookmarked PDF documents containing all graphs using ODS PDF under SAS 8.2.

New graphs are stored in a SAS graphics catalog using a standardized description. This description, extracted from the SAS dictionary table CATALOGS, is used to sort the graphs and to create PROC GREPLAY code. The generated code can reproduce the graphs in the specified order. To create the PDF file this code is embedded in ODS statements. The descriptions are automatically translated into PDF bookmarks.

INTRODUCTION

SAS graphs are a useful tool to visualize the results of clinical trials. For the distribution of results it is nice to have all graphs together in one file and for publishing PDF format is commonly used. The graphs should be in the correct order when they are published and for navigation PDF provides bookmarks, an electronic table of contents. Unless a publishing tool is used PDF bookmarks need to be created manually. With ODS PDF SAS provides a tool for creating bookmarked PDF files automatically.



During programming it is not always feasible to create graphs in the order in which they are later used. Manual sorting of graphs can be very labor intensive and therefore it is necessary to find a process to create graphs and sort them later for publishing. This process should be automated as much as possible.

STANDARDIZING THE CREATION OF GRAPHS

In order to automate the processing of graphs it is necessary to come up with standards. The following conventions were used for the process described in this paper.

- Store all graphs in permanent SAS catalogs. E.g.

```
PROC GPLOT ... GOUT= graph.safety;
```

- Assign a standardized number to every graph that will allow for later sorting.

- The number, along with the title, is stored in the description of the graph. The description is used as a bookmark in the PDF file. E.g.

```
PLOT hb*time / description= "Figure 5.1: Hemoglobin";
```

- Too avoid working with outdated graphs, it is recommended to delete old versions of graphs. E.g.

```
PROC GREPLAY NOFS;  
  IGOUT= graph.safety;  
  DELETE _ALL_;  
  RUN;  
QUIT;
```

SORTING GRAPHS

Adhering to standards will be the basis for sorting the graphs using the information in the SAS Dictionary Table CATALOGS. It can be accessed using PROC SQL and the DICTIONARY.CATALOGS or by referencing the SASHELP.VCATALG data set in the data step. Before the figures can be sorted the metadata including the titles and the figure numbers is extracted from the catalog and written in a data step for further processing. The following relevant information can be found in the tables:

Library name (LIBNAME)	Member name (MEMNAME)	Object name (OBJNAME)	Object description (OBJDESC)
GRAPH	SAFETY	GPLOT	Figure 5.1: Hemoglobin
GRAPH	SAFETY	GPLOT1	Figure 5.2: Hematocrit

Because the figure number was standardized during the creation of the graphs it can now be extracted from the object description OBJDESC. An algorithm needs to be implemented for sorting the graphs. In our example we divided the figure numbers in its character and numeric parts to account for figure numbers containing a mixture of alphanumeric characters. These parts were then used for sorting.

For example: The figure number A.10.2 consists of three parts: the character A and the numbers 10 and 2. It is divided in the character variables C1= "A", C2= "" and C3= "" and the numeric variables N1= ., N2= 10 and N3= 2. The sorting is then done by the new variables N1 C1 N2 C2 N3 C3.

After sorting the graph metadata SAS code is created to reproduce the graphs in the correct order. This is done by writing SAS code out to a text file that later can be included in our SAS program. In our example the sorted metadata is in the data set GRAPHS and the SAS code is written to the file GRAPHREPLAY.TXT:

```
DATA _NULL_;  
  SET graphs;  
  FILE "graphreplay.txt";  
  PUT "IGOUT= " libname +(-1) "." memname " ";  
  PUT "REPLAY " objname " ";  
  PUT "RUN;";  
  RUN;
```

CREATING A BOOKMARKED PDF DOCUMENT

Starting in SAS version 8.2 it is possible to embed PROC GREPLAY code in ODS statements. Combining PROC GREPLAY and ODS can be used to save the graphs as a PDF file:

```
ODS LISTING CLOSE;
ODS PROCLABEL="Figures"; ❶

OPTIONS ORIENTATION=LANDSCAPE; ❷
ODS PDF FILE="figures.pdf" STYLE=printer; ❸
GOPTIONS HSIZE=... HORIGIN=... TARGET=psg ROTATE=LANDSCAPE; ❹

PROC GREPLAY NOFS; ❺
  %INCLUDE "graphreplay.txt"; ❻
QUIT;

ODS PDF CLOSE; ❼
ODS LISTING;
RUN;
```

EXPLANATION

- ❶ SAS produces a high-level PDF bookmark containing the name of the SAS procedure used for creation, in this case PROC GREPLAY. With ODS PROCLABEL this bookmark can be overwritten. In our example we use "Figures" as the bookmark label with sub-bookmarks referencing the graphs.
- ❷ The value for the SAS OPTION ORIENTATION must be the same as the value for the GOPTION ROTATE. The OPTION ORIENTATION must be set correctly before submitting the ODS PDF statement.
- ❸ The ODS PDF FILE statement determines the name of the PDF output file. All output is written to this file until the ODS PDF CLOSE (❷) is submitted. In the example the graphs are written to figures.pdf.

The default background color for graphs is gray. In order to obtain a white background the "STYLE= printer" option was added to the ODS PDF statement.
- ❹ The referenced target device in the GOPTIONS statement should be the same used during the creation of the graphs. The target device PSG used in the example is a modified PostScript device driver. In addition to the target the HSIZE, HORIGIN, etc. options are specified to reproduce the graph in the correct size and position on the paper.
- ❺ The option NOFS in the GREPLAY procedure stands for "No Fullscreen" and prevents the procedure to process in line mode, which is the default.
- ❻ The file graphreplay.txt is included. This file contains the IGOUT and REPLAY statements necessary for the PROC GREPLAY procedure.

PDF files created using ODS PDF under SAS version 8.2 might produce a warning message when they are opened in Adobe Acrobat. This warning reads, "file is damaged but being repaired". After saving the file in Adobe Acrobat this warning disappears. Saving also has the advantage that the files are optimized, which reduces the file size significantly. Newer version of Adobe Acrobat will automatically optimize the PDF files when saving. In older versions "Save As" must be used.

RESTRICTIONS

The following restrictions should be observed when using the described procedure for creating PDF files with ODS PDF.

- All graphs must be in the same orientation.
- All graphics catalogs should be created with the same target device.
- The description parameter DES is limited to 40 characters when PROC GREPLAY and TREPLAY are used to place multiple graphs on one page.
- An open parenthesis in the graphics description leads to a missing bookmark in the PDF document.
- Hardware fonts used for rotated labels of the vertical axis might not be displayed correctly in the PDF document.
- When using the BY statement to process multiple graphs keep in mind that the figure number must be unique.

SOFTWARE REQUIREMENTS

The process described in this paper was developed using SAS version 8.2 under Windows. SAS/GRAPH® has to be licensed for the creation of graphs. For using ODS PDF the full version of Adobe Acrobat and the Acrobat Distiller printer driver do not have to be installed on your system. However, it is recommended to use Adobe Acrobat for optimizing the PDF files and reducing the file size.

CONCLUSION

Starting in SAS version 8.2 it is possible to create PDF documents including bookmarks without using additional software.

There are different ways to sort the figures as long as a standard is used. To ensure that the PDF file is created correctly the restrictions should be followed.

Programming standards and the information in the dictionary table CATALOGS are not only helpful for creating PDF files. The information can also be used to support program documentation.

PDF files are widely used for distribution of information electronically. With the process described in this paper it is easy to quickly publish graphics results. Because of the bookmarks the resulting PDF file is user friendly and easy to navigate through. The process is automated and the PDF document can quickly be re-published in case of last minute changes.

REFERENCES

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