

DV04

Don't Dream It, Be It!

Harnessing SAS GTL to Produce Customized Composite Graphics

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PhUSE Connect 2019 Amsterdam

10th-13th November 2019



10th-13th November
RAI Amsterdam
The Netherlands

EU 2019

The Clinical Data
Science Conference



Introduction

SAS can't produce high quality graphics?

- In some areas of the industry there is still a perception that SAS® cannot produce high quality graphics.
 - This is, of course, untrue!
- This presentation will show you how
- Will serve as a good reference and/or starting point for your projects



The Challenge

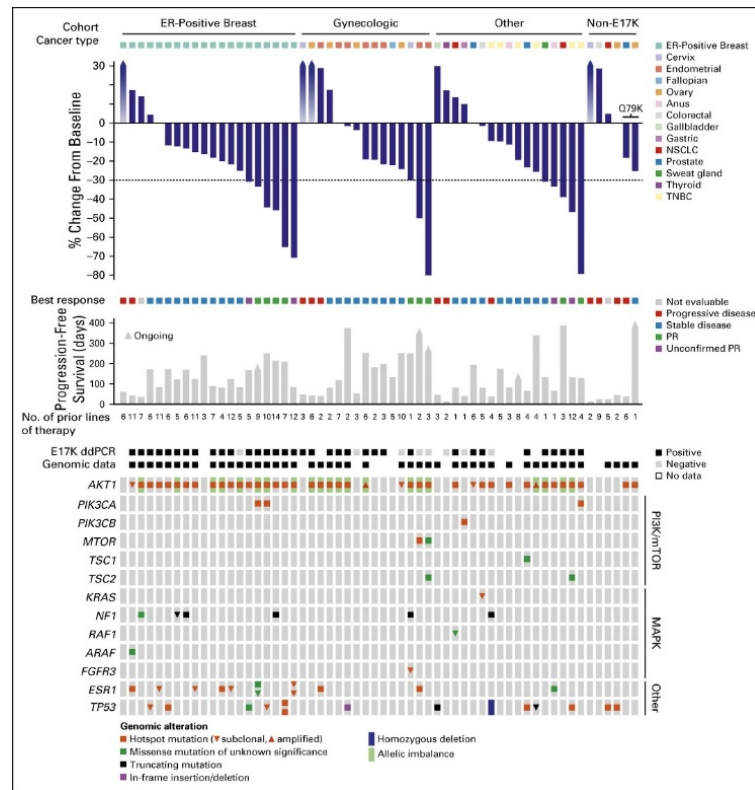
The original statement – SAS is rubbish (at graphics)

- There is a perception that SAS cannot produce high quality graphics.
- Possible causes of low quality images are:
 - Lack of SAS Graphical knowledge
 - Copy/paste of very old, often outdated code
 - Incorrect options
- Shared some high-resolution graphs with key colleagues



Challenge Accepted

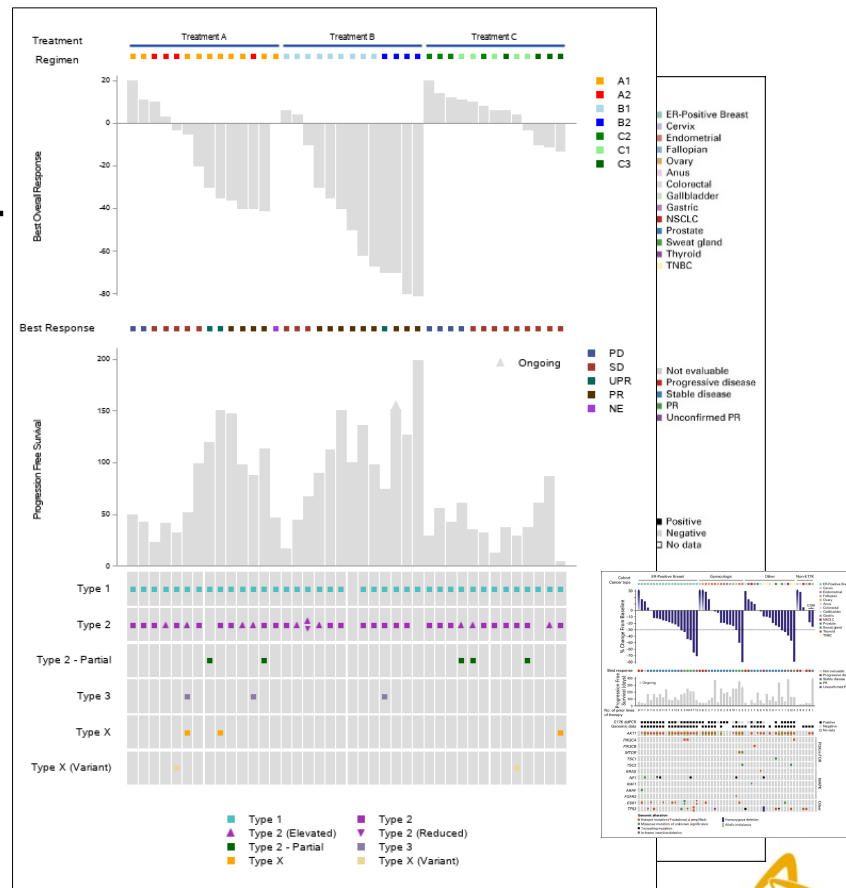
- Shown a complex graphic from an Oncology journal ^[1]
- A lot of data in one place
- Aligned vertically by patient, so trends can be followed
- “SAS can’t do anything like this”
- Challenge accepted!



The Solution

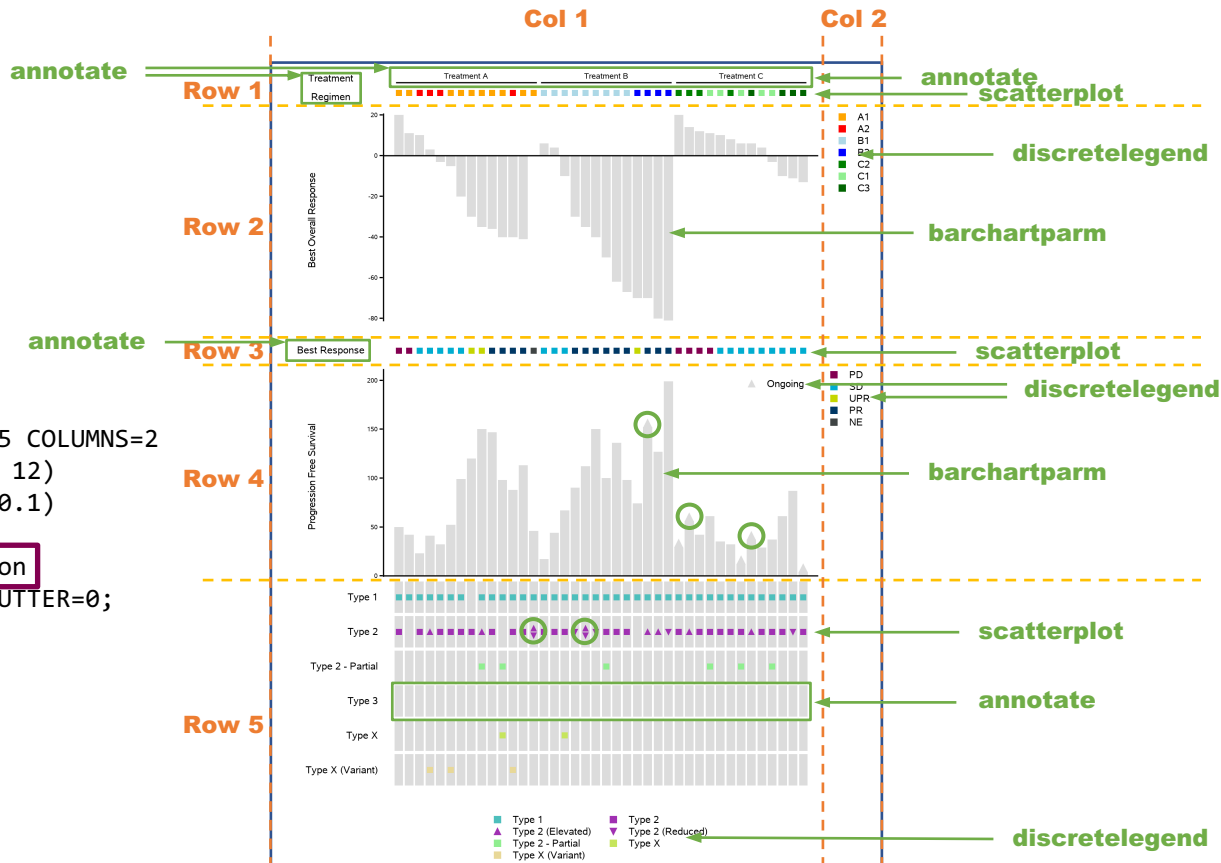
Break it down...

- How to do this in SAS?
- Too complex for PROC SGPLOT
- PROC TEMPLATE/SGRENDER –Complete customisation
- PROC TEMPLATE with LAYOUT LATTICE was chosen



How was it done?

```
LAYOUT LATTICE / ROWS=5 COLUMNS=2
ROWWEIGHTS=(2 9 2 9 12)
columnweights=(0.9 0.1)
ROWDATARANGE=union
COLUMN DATARANGE=union
ROWGUTTER=0 COLUMNGUTTER=0;
```



LAYOUT LATTICE

GTL Statements



Building Blocks

Next Steps

- Built some example plots after engaging study teams
- Set out to educate study teams on what is possible
 - And empower programmers to be able to do it
- Two examples are shown at the end of the presentation
 - But before that, lets look at some of the basic GTL building blocks



A Quick Word About Templates

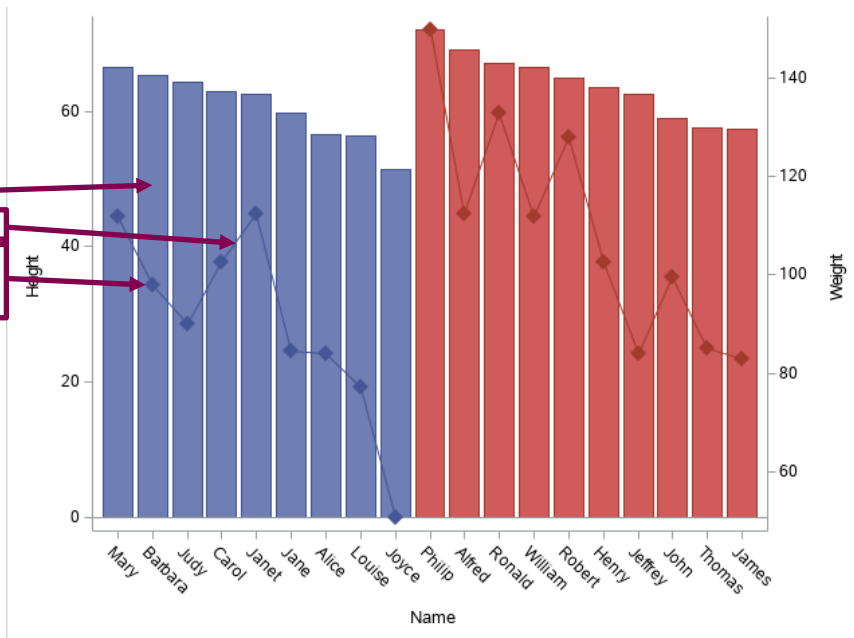
- Using a different Style Template with SGRENDER can create drastically different results
- All the following examples use the default ODS Template for their screenshots
- Larger examples use a custom ODS Style Template



Basic Plots

- Bar charts, scatter plots and line plots

```
proc template;  
  define statgraph basic;  
    begingraph;  
      LAYOUT OVERLAY / WALLDISPLAY=none;  
      barchart x=name y=height / group=sex;  
      seriesplot x=name v=weight / group=sex vaxis=v2;  
      scatterplot x=name y=weight / group=sex yaxis=y2  
        markerattrs=(size=10 symbol=diamondfilled);  
    endlayout;  
  endgraph;  
end;  
run;  
  
proc sort data=sashelp.class out=class;  
  by sex descending height;  
run;  
  
proc sgrender data=class template=basic;  
run;
```



Swimmer Plots

- Subject timeline

```
layout overlay / walldisplay=none  
  xaxisopts=(griddisplay=on)  
  yaxisopts=(reverse=true  
    display=(tickvalues) griddisplay=on);
```

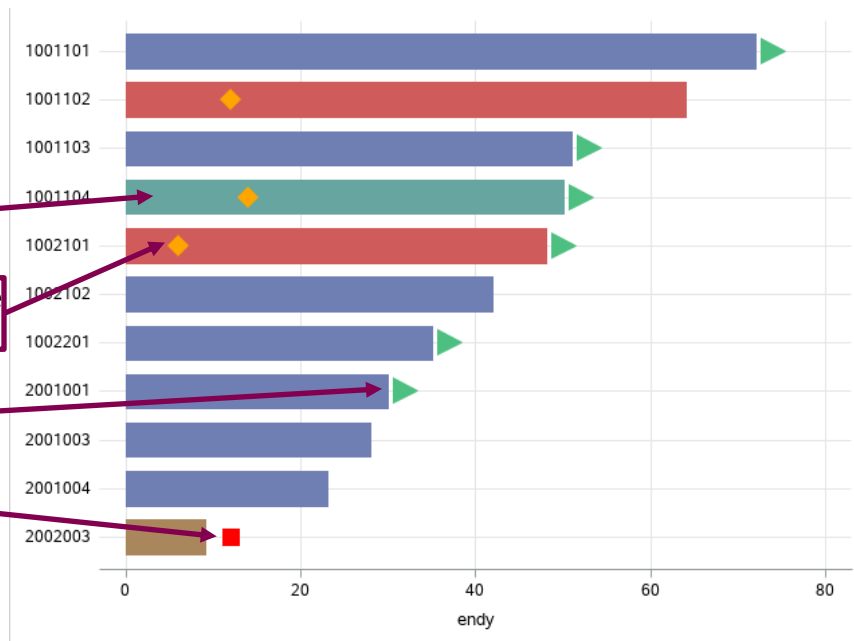
```
highlowplot low=start high=endy y=subjid / type=bar  
  group=invbor display=(fill) barwidth=0.7;
```

```
scatterplot x=scandy y=subjid / markerattrs=(color=orange  
  symbol=diamondfilled size=14);
```

```
scatterplotx=ongdy y=subjid / markerattrs=(color=big  
  symbol=trianglerightfilled size=20);
```

```
scatterplot x=enddthdy y=subjid / markerattrs=(color=red  
  symbol=squarefilled size=14);
```

```
endlayout;
```



Waterfall Plots

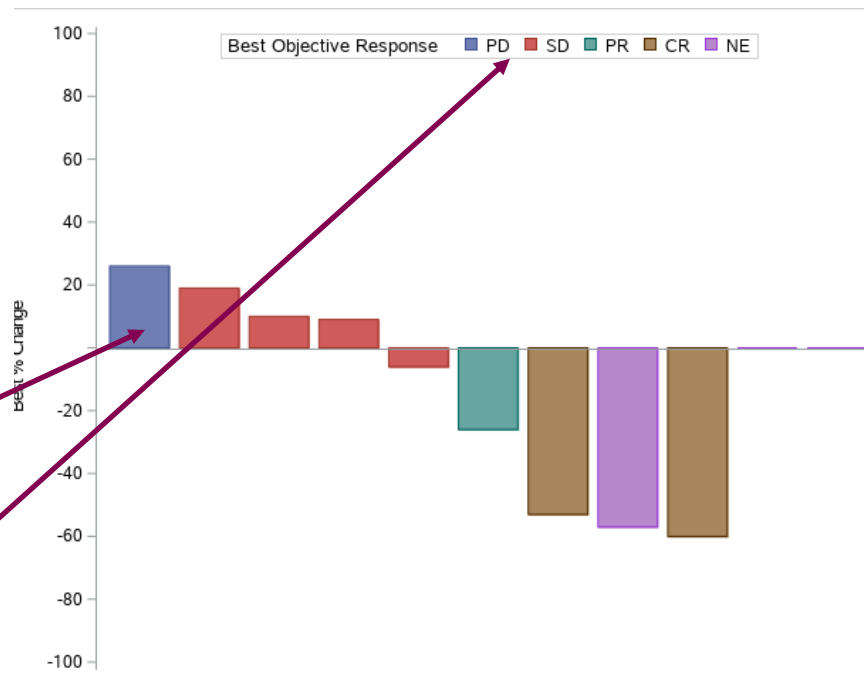
- Bi-directional bar chart, typically for best responses in Oncology

```
layout overlay /  
  walldisplay=none  
  xaxisopts=(display=(line) )  
  yaxisopts=(label="Best % Change" reverse=false  
    linearopts=(tickvaluelist=(-100 -80 -60 -40  
      -20 0 20 40 60 80 100)  
    origin=0 tickvaluepriority=TRUE));
```

```
highlowplot x=xvar low=low high=high / name="bor"  
  type=bar group=best resp;
```

```
discretelegend "bor" / title="Best Objective Response"  
  location=inside halign=center valign=top across=5;
```

```
endlayout;
```



Kaplan Meier

- Step plot for survival analysis

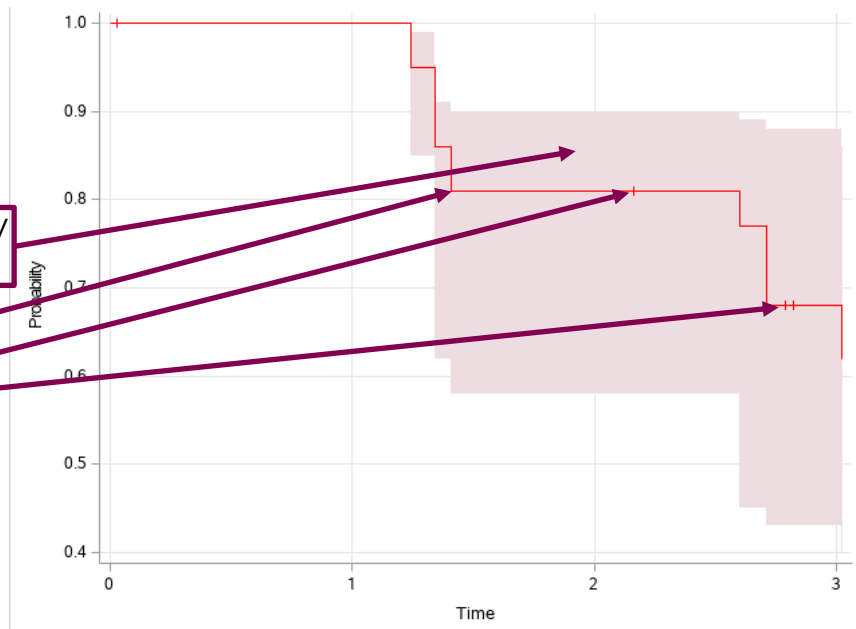
```
layout overlay /  
  walldisplay=none  
  yaxisopts=(label="Probability" griddisplay=on)  
  xaxisopts=(label="Time" griddisplay=on);
```

```
bandplot x=os_time limitlower=os_ci_l limitupper=os_ci_u /  
  type=step fillattrs=(color=pkwh);
```

```
stepplot x=os_time y=os_prob / lineattrs=(color=red);
```

```
scatterplot x=os_time y=os_censor_flg /  
  markerattrs=(symbol=plus color=red);
```

```
endlayout;
```

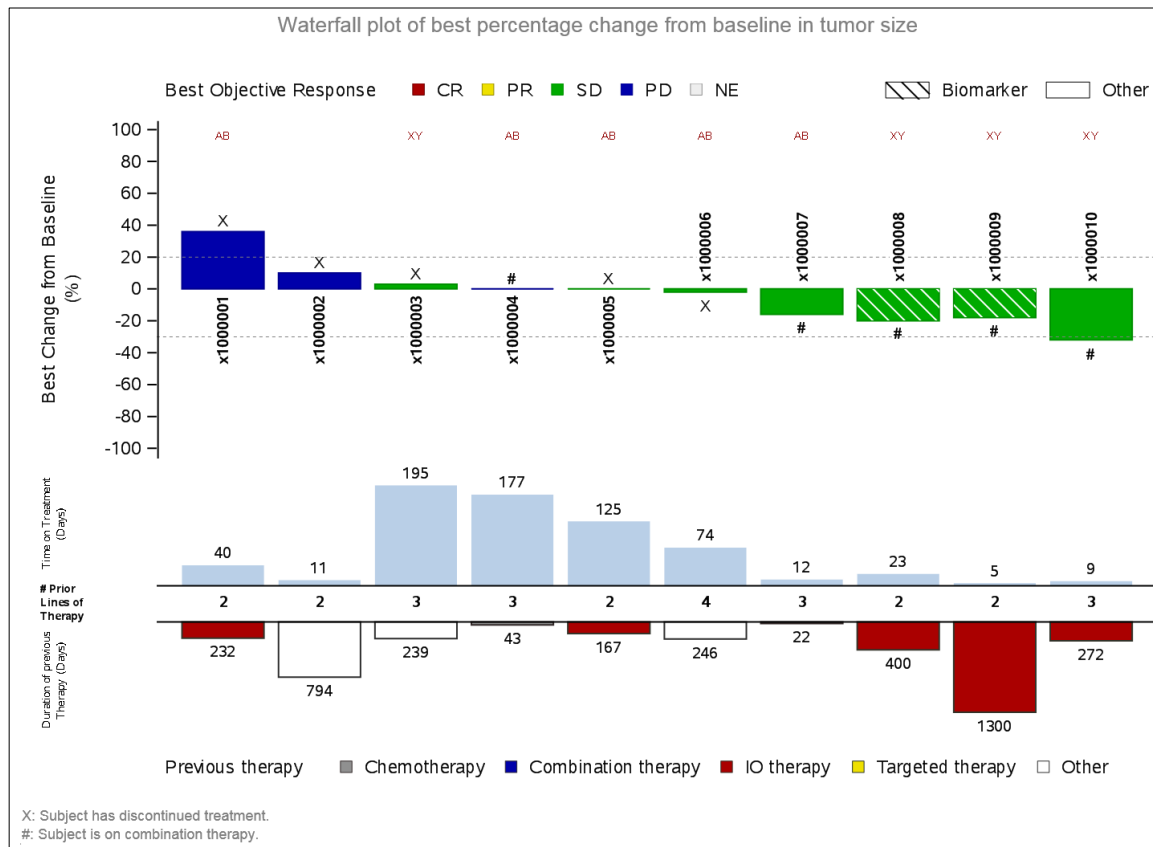


Pulling It All Together

- So far you've seen:
 - Complex plots using PROC TEMPLATE
 - Multiple plots sharing axes with LAYOUT LATTICE
 - Common plot types used in clinical trial reporting
- By combining these techniques, very detailed and informative graphics can be created
- The following final two examples demonstrate all of this



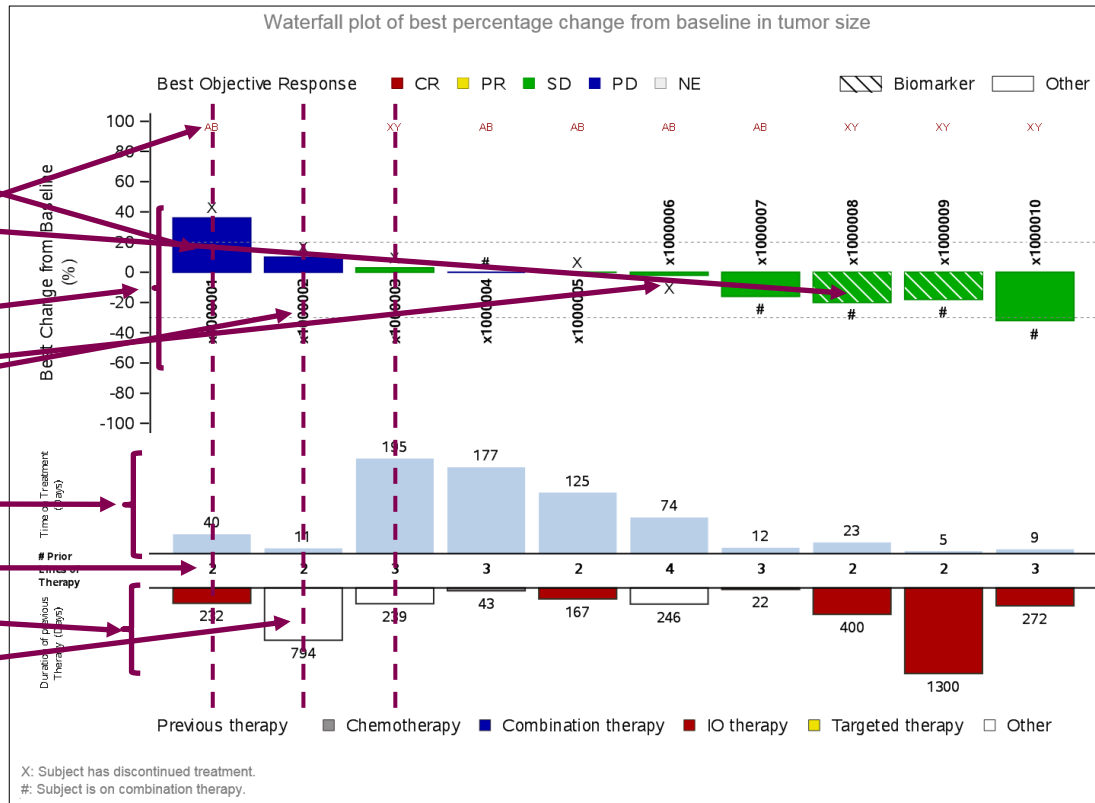
Example 1 – Waterfall Plot with Bar Chart



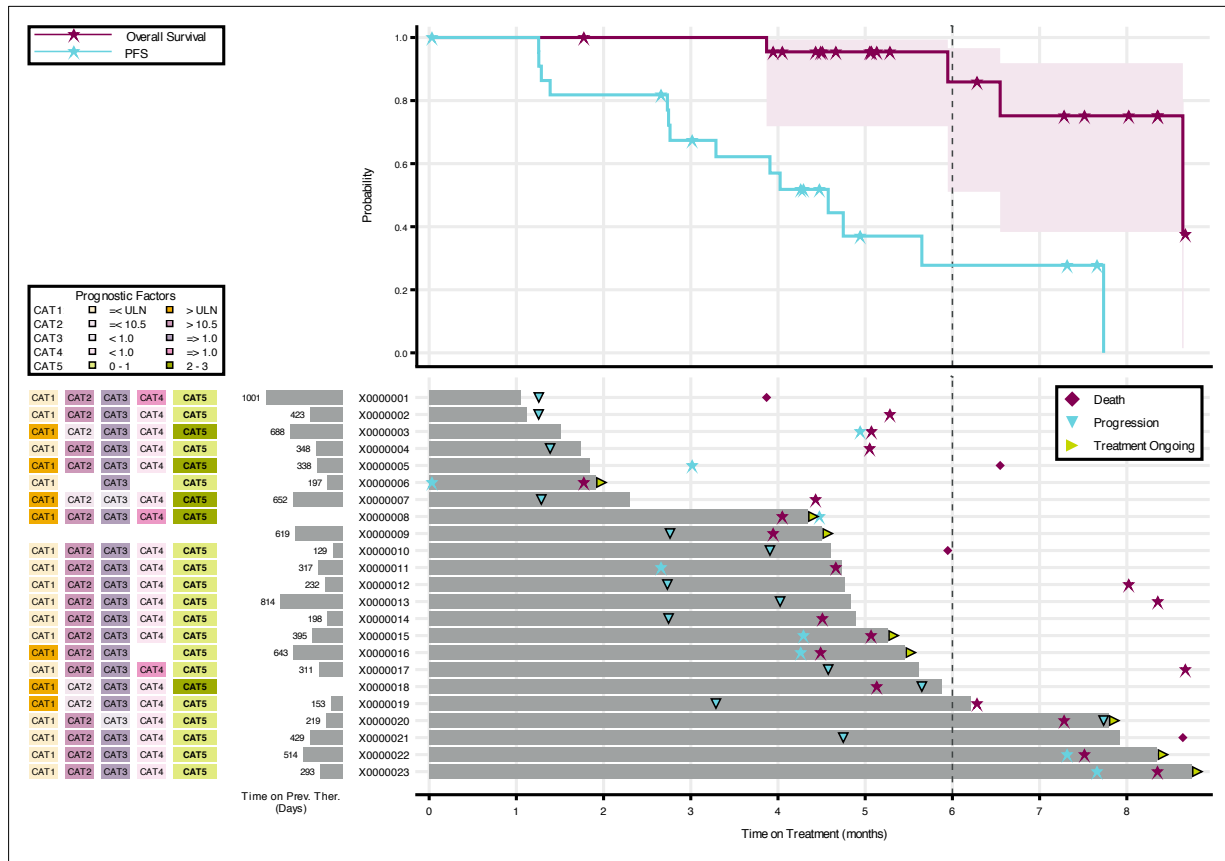
Example 1 - Elements

Aligned by subject, vertically

1. Best objective response
2. Biomarker category
3. Baseline category
4. Best tumour change
5. Treatment flags
6. Subject #
7. Time on treatment
8. # Prior lines of therapy
9. Duration previous therapy
10. Previous therapy type



Example 2 – KM, Swim and Prognostic Factors



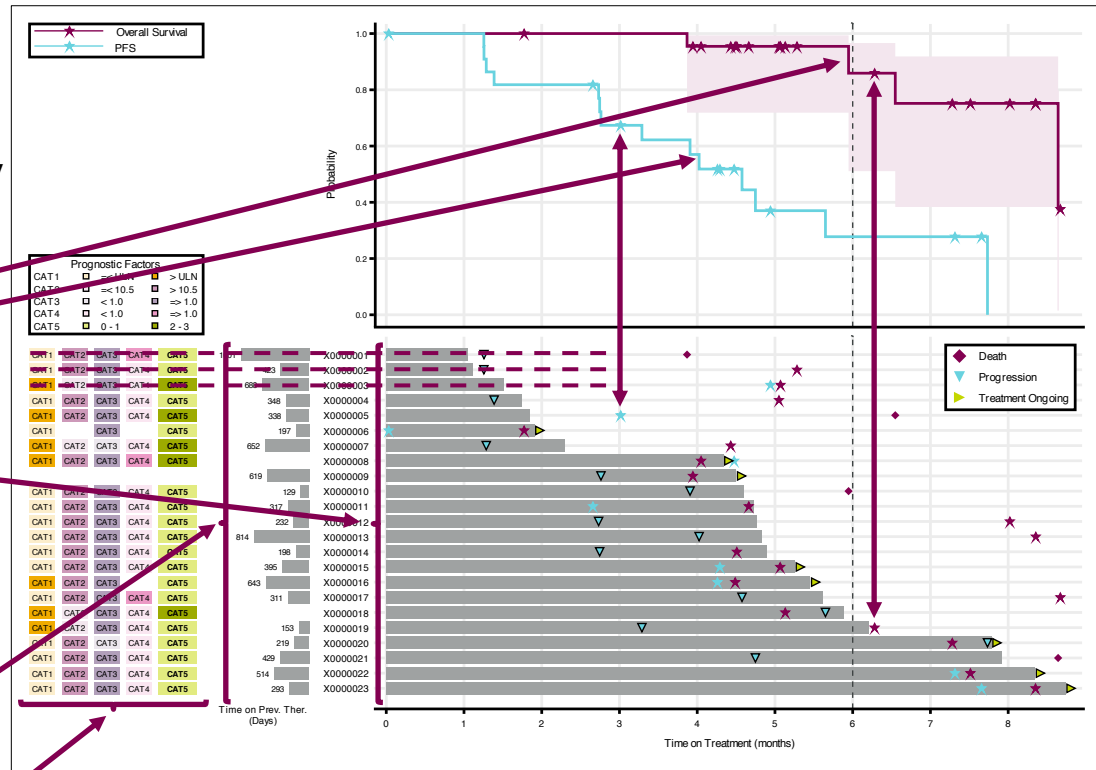
Example 2 – Elements

Reverse “L” shape

Right-hand plots share x-axis

Lower plots aligned horizontally

- KM plot for OS, & 95% CI
- KM plot for PFS
- Swim plot, showing:
 - Time on treatment
 - Death & Progression
 - Ongoing treatment
- Time on previous therapy
- 5 Baseline prognostic factors
 - Colour coded Unk/Low/High indicator



Conclusion

- Challenged the notion that SAS Graphics cannot be high quality and “publication ready”
- Built a library of macros and code fragments...and used them on live projects
- Graphics were run regularly to allow quick decision making on the very latest data
- Very positive feedback received



Final Thoughts

- Start with a clean sheet
- Look at the questions that you want answered
 - Design the graphic(s) in blocks
 - Format the input data
 - Get requirements from key stakeholders
- If you can dream it, SAS ODS Graphics can produce it!



Questions

