Converting SAS/GRAPH to ODS Graphics

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Reason

- As of SAS 9.3, SAS has moved ODS Graphics and the Statistical Graphics procedures from SAS/GRAPH® to Base SAS®. This provides us an opportunity to eliminate SAS/GRAPH by converting SAS/GRAPH procedures to ODS Graphics procedures

Purpose

- What this presentation is
  - A brief introduction to ODS Graphics and the statements you must use to run it
  - A comparison of simple SAS/GRAPH and ODS Graphics output and the statements that produce it
- What this presentation is not
  - An exhaustive introduction to ODS Graphics
  - An introduction to graphing using SAS. Familiarity with SAS/GRAPH is assumed

Agenda

- Introduction
- SAS Statements
  - SAS/GRAPH statements going away
  - Statements still used
  - New statements
- ODS Graphics Procedures and Graph Template Language (GTL)
- Graph Comparisons
- Extras
- Wrap up

SAS/GRAPH Statements Going Away

- LEGEND
- SYMBOL
- AXIS
- GOPTIONS
- All SAS/GRAPH procedures

Statements Still Required

- FILE
- ODS HTML
- Used just as they are today

Common Statements

- TITLE
- FOOTNOTE
- NOTE
- FORMAT
- LABEL
- BY
- WHERE

ODS GRAPHICS Statement (New)

- ODS GRAPHICS ON/OFF ;
- ODS GRAPHICS ON options ;
- Common options
  - IMAGENAME
  - IMAGEMAP
  - HEIGHT
  - WIDTH
  - RESET

ODS GRAPHICS Statement Examples

```
ODS GRAPHICS ON;
ODS GRAPHICS OFF;
ODS GRAPHICS ON / IMAGENAME=xxxx;
ODS GRAPHICS ON /IMAGENAME=xxxx
   IMAGEMAP;
ODS GRAPHICS ON / RESET=ALL;
```

Statistical Graphics Procedures

- SGDESIGN
- SGPANEL
- SGPLOT
- SGRENDER
- SGSCATTER

SGPLOT

- BAND
- BUBBLE
- DENSITY
- DOT
- HBAR/VBAR
- HBOX/VBOX
- HIGHLOW
- HISTOGRAM
- HLINE/VLINE
- NEEDLE
- REFLINE
- REG
- SCATTER
- SERIES
- STEP
- VECTOR
- WATERFALL

SGRENDER

- PROC SGRENDER
  - PROC TEMPLATE
  - Graph Template Language

SGRENDER Example

```
PROC TEMPLATE;
  DEFINE STATGRAPH minimumreq;
    BEGINGRAPH;
      LAYOUT OVERLAY;
        SCATTERPLOT X=WEIGHT Y=HEIGHT;
      ENDLAYOUT;
    ENDGRAPH;
  END;
RUN;

PROC SGRENDER DATA=SASHELP.CLASS
    TEMPLATE=minimumreq;
RUN;
```

Graph Comparisons

Format of Comparison

- Three slides per comparison
  - SAS/GRAPH view
  - Side by side comparison between SAS/GRAPH and ODS Graphics
  - ODS Graphics view

Statements Used to Build Graphs

- Web page definition

```
ODS LISTING CLOSE;
FILENAME odsout  "/a-file-definition/" ;
ODS HTML  BODY="odsclass.html" (TITLE="ODS Class")
  STYLE=htmlblue
  PATH=odsout (URL=NONE) ;
```

- SAS/GRAPH statement

```
SYMBOL1 INTERPOL=JOIN;
```

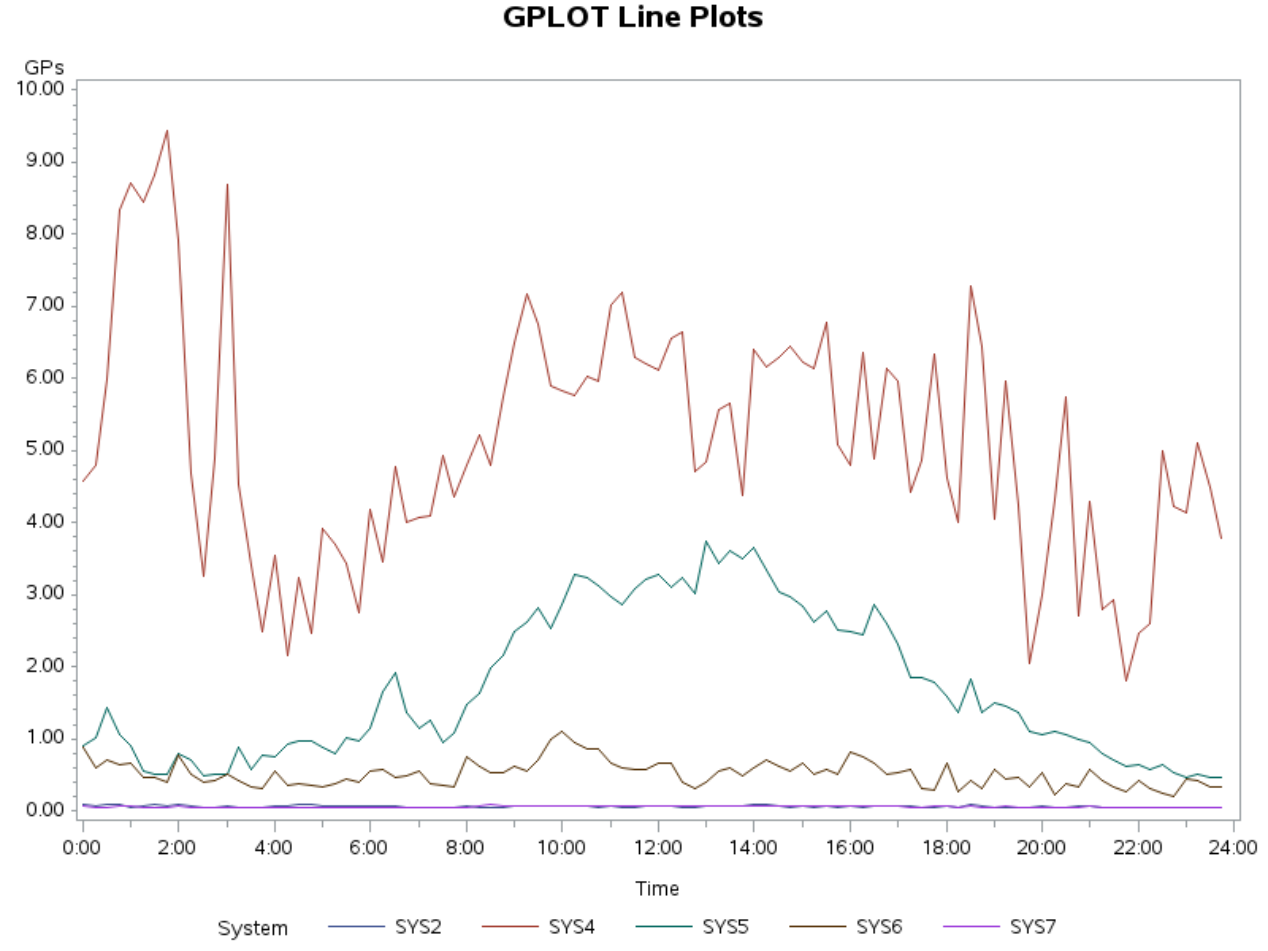
- ODS Graphics statement

```
ODS GRAPHICS ON / IMAGENAME='odsclass'
  NOBORDER NOANTIALIAS
  TIPMAX=3000
  HEIGHT=725px ;
```

Graphs we use today

- Line plots
- Bar charts
  - Simple charts
  - Grouped charts
  - Stacked charts
  - Bar charts combined with line plots
- Scatter plots
- Pie charts
- Stacked Plots

Line Plots


GPLOT Line Plots
GPs
10.00
9.00
8.00
7.00
6.00
5.00
4.00
3.00
2.00
1.00
0.00
0:00
2:00
4:00
6:00
8:00
10:00
12:00
14:00
16:00
18:00
20:00
22:00
24:00
Time
System
SYS2
SYS4
SYS5
SYS6
SYS7

Line Plots

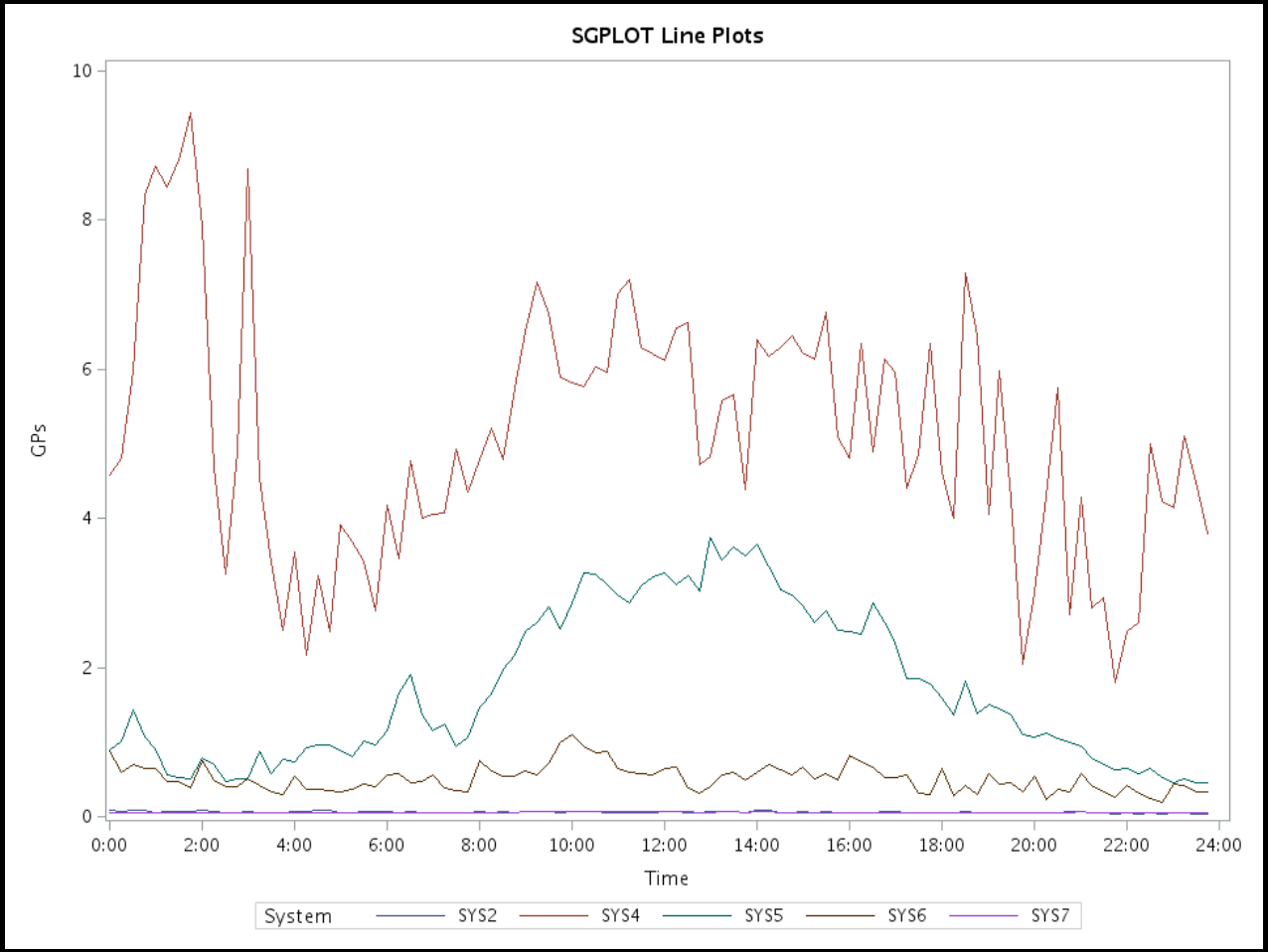
SAS/GRAPH

```
PROC GPLOT DATA=cpr70lp ;
  TITLE "GPLOT Line Plots" ;
PLOT usedgps*time=system ;
RUN;
```

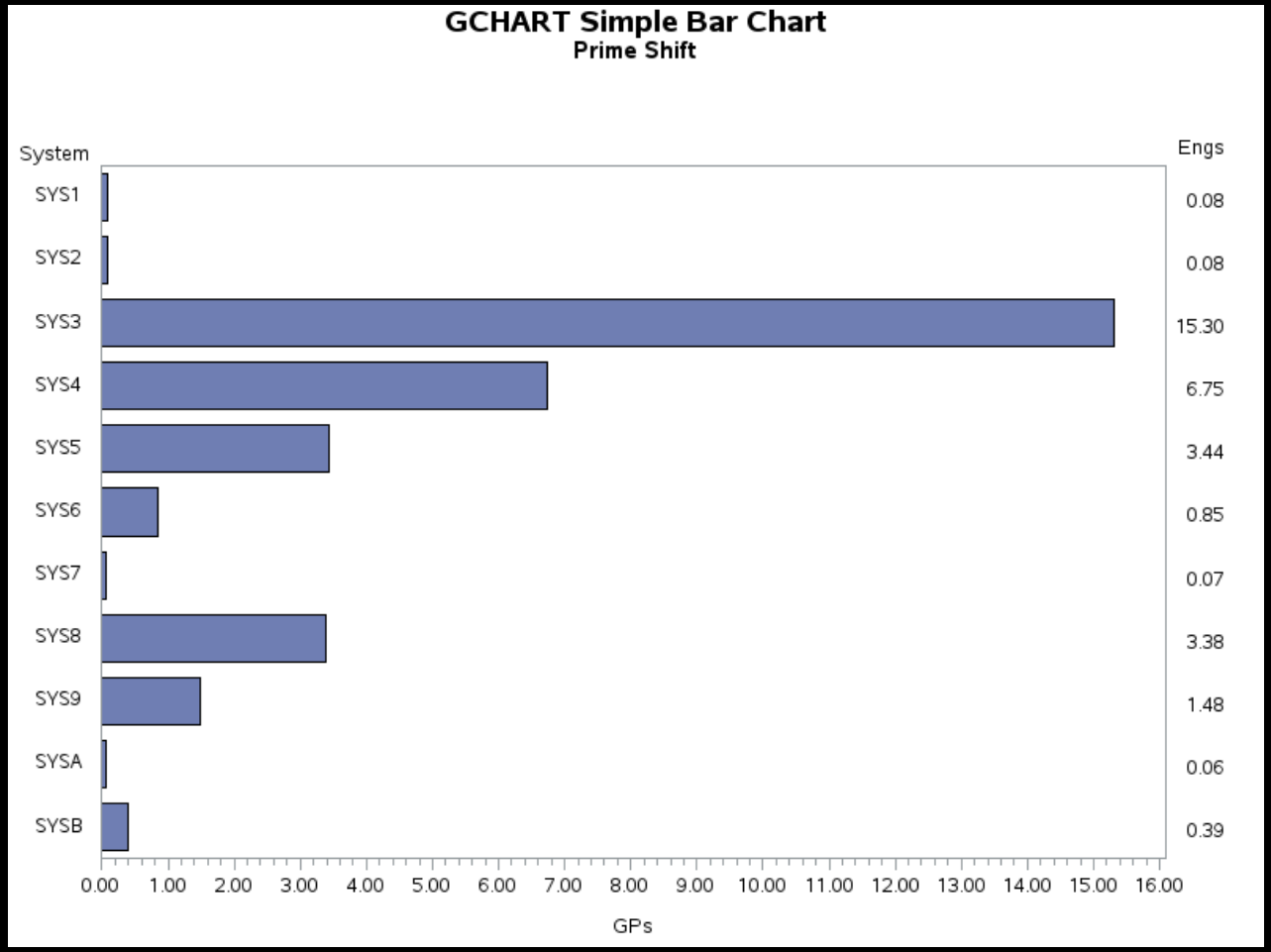
ODS Graphics

```
PROC SGPLOT DATA=cpr70lp ;
  TITLE "SGPLOT Line Plots" ;
SERIES X=time Y=usedgps /
    GROUP=system ;
RUN;
```

Line Plots


SGPLOT Line Plots
GPs
10
8
6
4
2
0
0:00
2:00
4:00
6:00
8:00
10:00
12:00
14:00
16:00
18:00
20:00
22:00
24:00
Time
System
SYS2
SYS4
SYS5
SYS6
SYS7

Simple Bar Charts



Simple Bar Charts

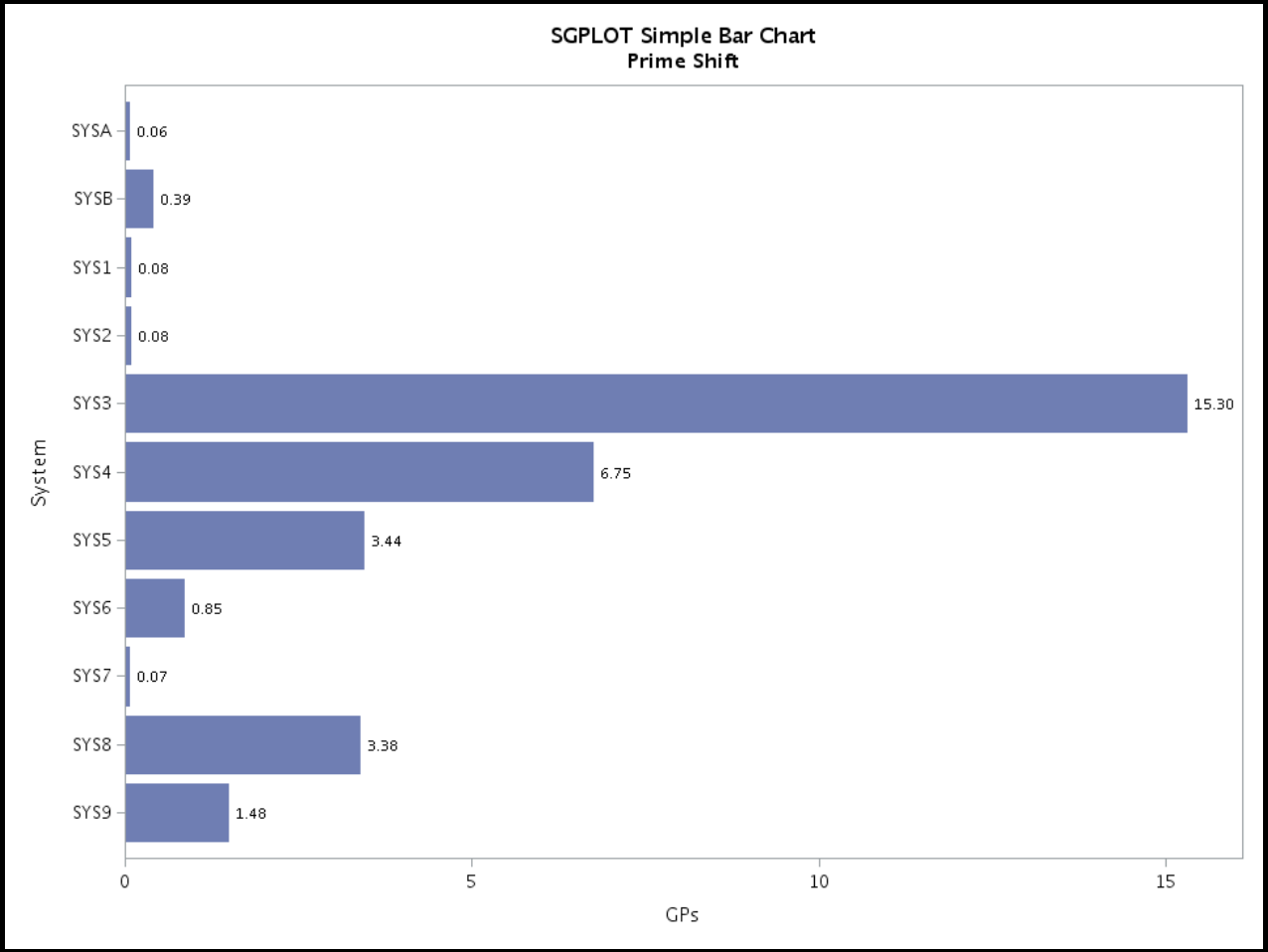
SAS/GRAPH

```
PROC GCHART DATA=meanengs ;
BY date DESCENDING shift ;
 TITLE "GCHART Simple Bar
    Chart" ;
 TITLE2 "#BYVAL(shift) Shift" ;
 HBAR   system   / DISCRETE
    SUMVAR=usedgps
     SUM
     SUMLABEL = 'Engs'
 ;
RUN;
```

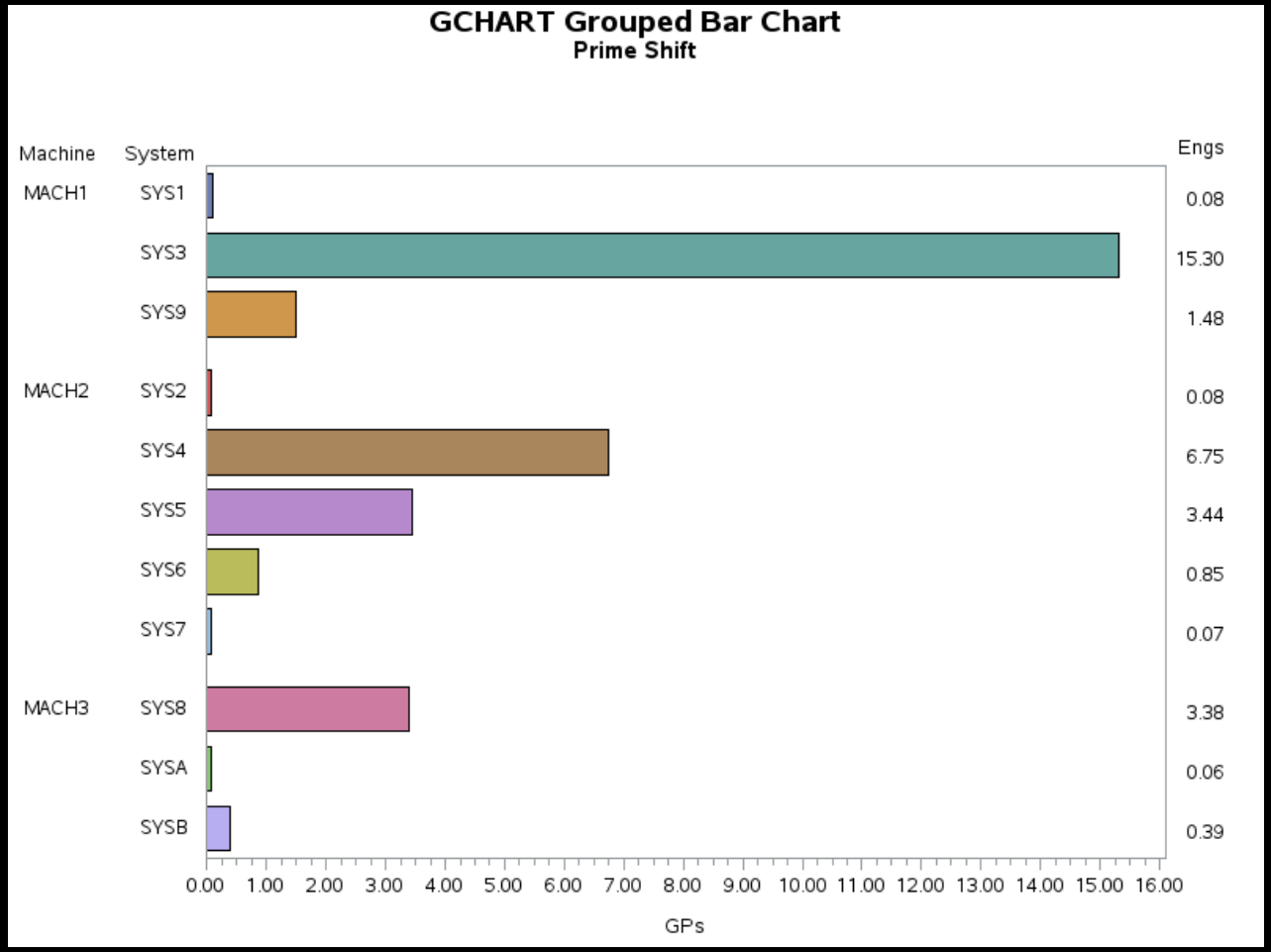
ODS Graphics

```
PROC SGPLOT DATA=meanengs
    CYCLEATTRS ;
BY date DESCENDING shift ;
 TITLE "SGPLOT Simple Bar Chart" ;
 TITLE2 "#BYVAL(shift) Shift" ;
 HBAR system /
     DATALABEL
     FILL
     RESPONSE = usedgps
     STAT     = sum
 ;
RUN;
```

Simple Bar Charts



Grouped Bar Charts



Grouped Bar Charts

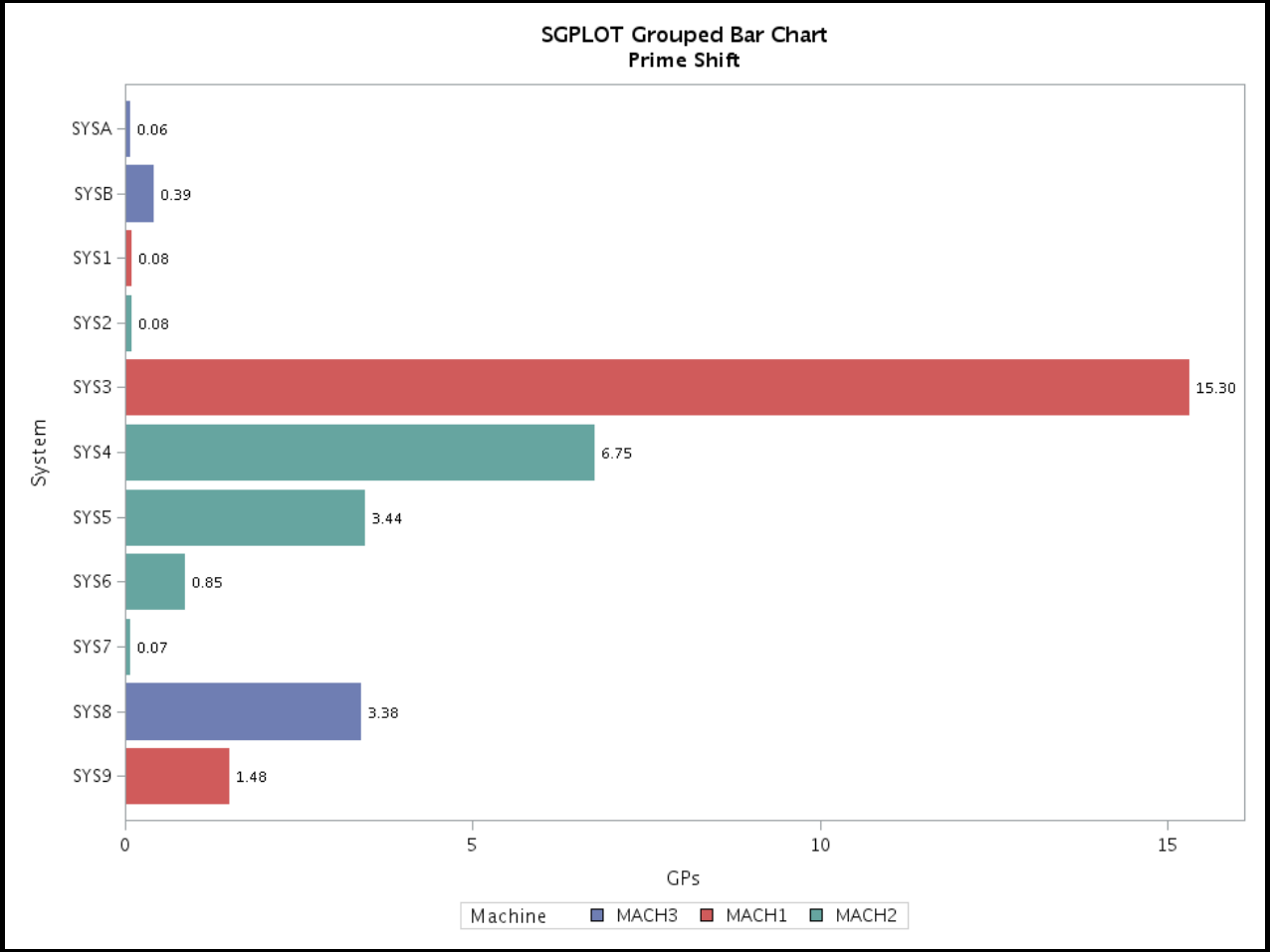
SAS/GRAPH

```
PROC GCHART DATA = meanengs ;
BY date DESCENDING shift ;
 TITLE  "GCHART Grouped Bar Chart" ;
 TITLE2 "#BYVAL(shift) Shift" ;
 HBAR   system   / DISCRETE
    SUMVAR=usedgps
     SUM
     SUMLABEL  = 'Engs'
     GROUP     = machine
     PATTERNID = MIDPOINT
     HTML      = gpdrill
     NOZERO
 ;
RUN;
*gpdrill=
 CATS('HREF="gpplt',machnum,'.html"') ;
```

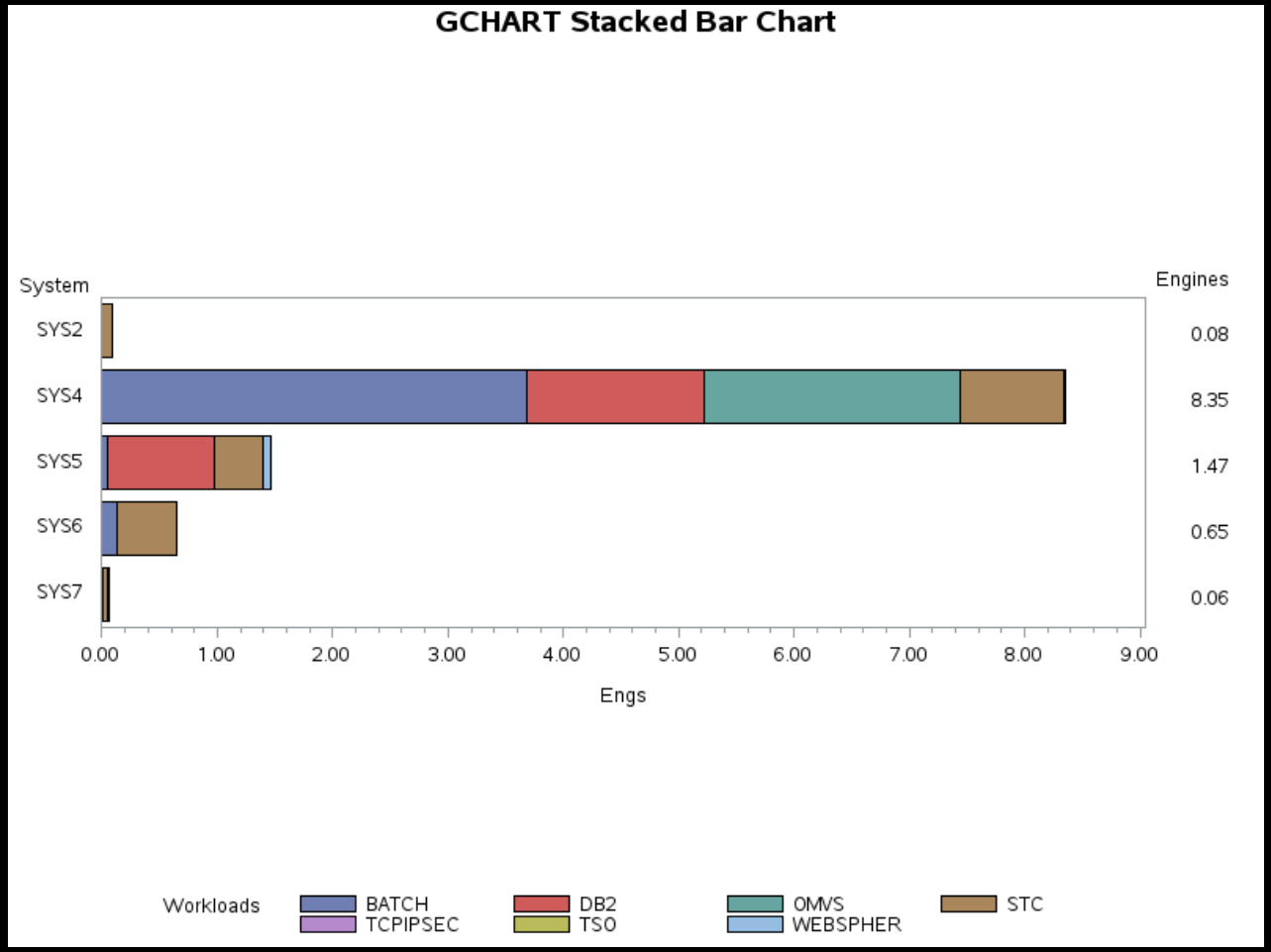
ODS Graphics

```
PROC SGPLOT DATA=meanengs
     CYCLEATTRS ;
BY date DESCENDING shift ;
 TITLE  "SGPLOT Grouped Bar Chart" ;
 TITLE2 "#BYVAL(shift) Shift" ;
 HBAR system /
      DATALABEL
      FILL
      GROUP    = machine
      RESPONSE = usedgps
      STAT     = sum
      URL      = urlgp
 ;
RUN;
* urlgp =
     CATS('gpplt',machnum,'.html') ;
```

Grouped Bar Charts



Stacked Bar Charts



Stacked Bar Charts

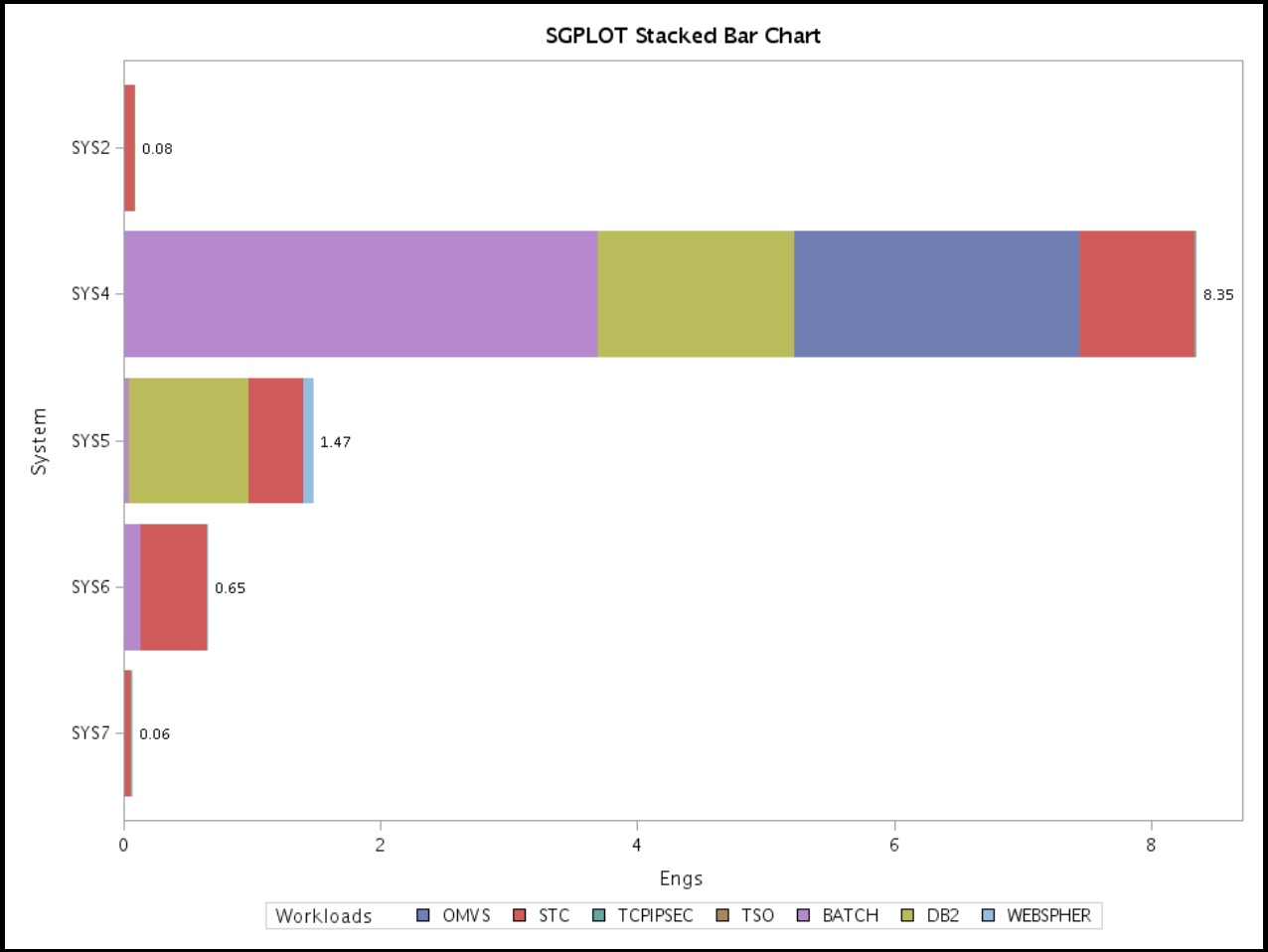
SAS/GRAPH

```
PROC GCHART DATA=freq72go ;
BY date DESCENDING shift ;
 TITLE  "GCHART Stacked Bar Chart" ;
 HBAR system    / DISCRETE
    SUMVAR=gpwkld
     SUM
     SUMLABEL    = "Engines"
     NOZERO
     SUBGROUP    = wkldname
     PATTERNID   = SUBGROUP
     HTML        = gphtml
     HTML_LEGEND = bardrill
  ;
RUN;
```

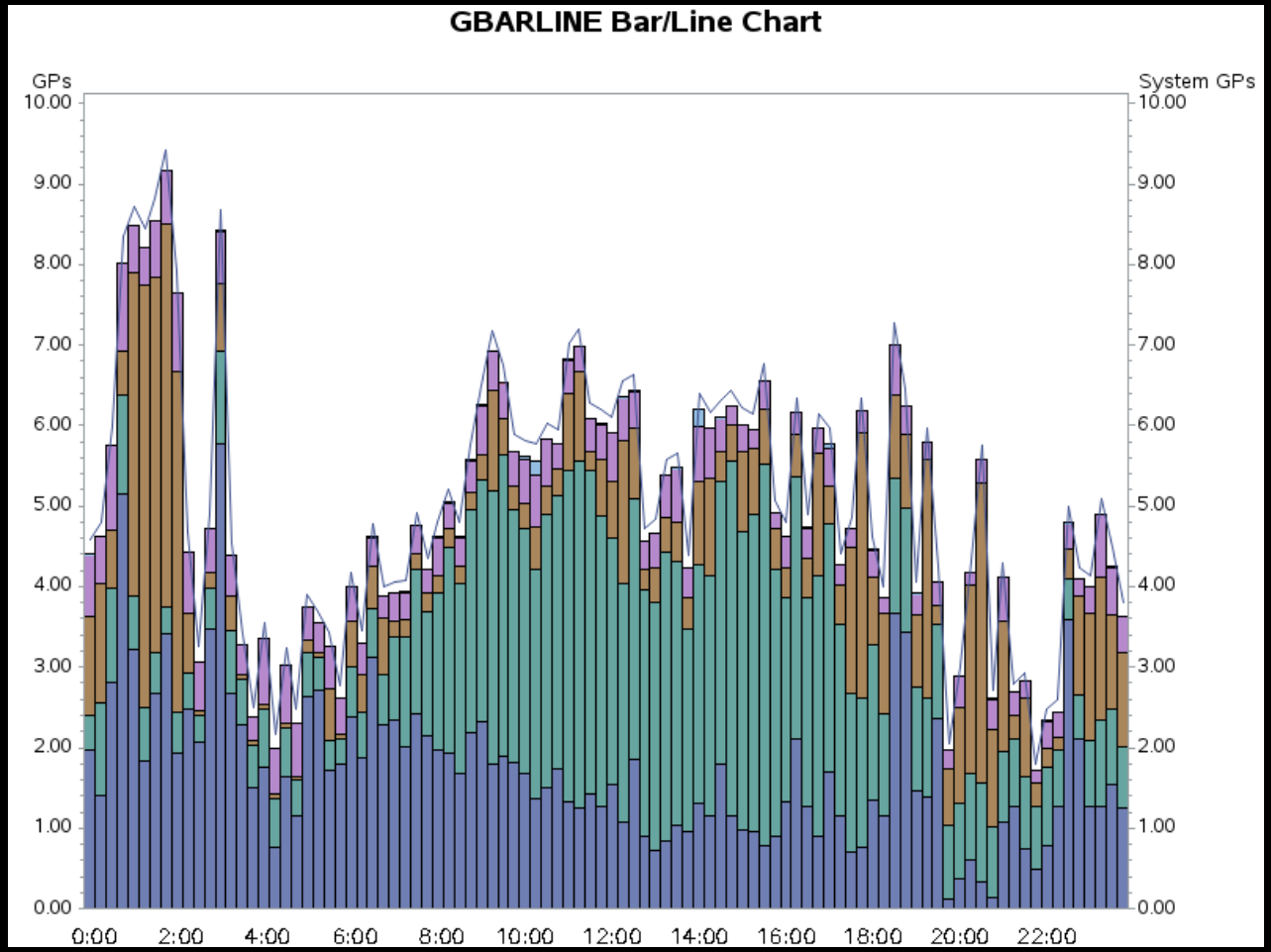
ODS Graphics

```
PROC SGPLOT DATA=freq72go ;
BY date DESCENDING shift ;
 TITLE  "SGPLOT Stacked Bar Chart" ;
 HBAR system / RESPONSE=gpwkld
     DATALABEL
     FILL
     GROUP    = wkldname
     STAT     = sum
     URL      = urlwkchtgp
  ;
RUN;
```

Stacked Bar Charts



Combined Bar/Line Charts



Combined Bar/Line Charts

SAS/GRAPH

```
AXIS99 LABEL=NONE VALUE=NONE
     NOPLANE ;
PROC GBARLINE DATA=summwkld ;
  TITLE  "GBARLINE Bar/Line Chart" ;
  BAR  time / SUMVAR=scgps
       SUBGROUP    = wkldname
       ANNOTATE    = annowkld
       MAXIS       = axis99
       DISCRETE
       SPACE       = 0
  ;
  PLOT / SUMVAR=usedgps ;
RUN;
```

ODS Graphics

```
PROC SGPLOT DATA=summwkld
     SGANNO=annotime ;
   TITLE  "SGPLOT Bar/Line Chart" ;
  VBAR  time / RESPONSE=scgps
   GROUP=wkldname
   BARWIDTH=1 ;
  VLINE time / RESPONSE=usedgps
   GROUP=wkldname ;
  XAXIS DISPLAY=(NOLABEL NOTICKS
     NOVALUES) ;
RUN;
```

Time Axis Annotation

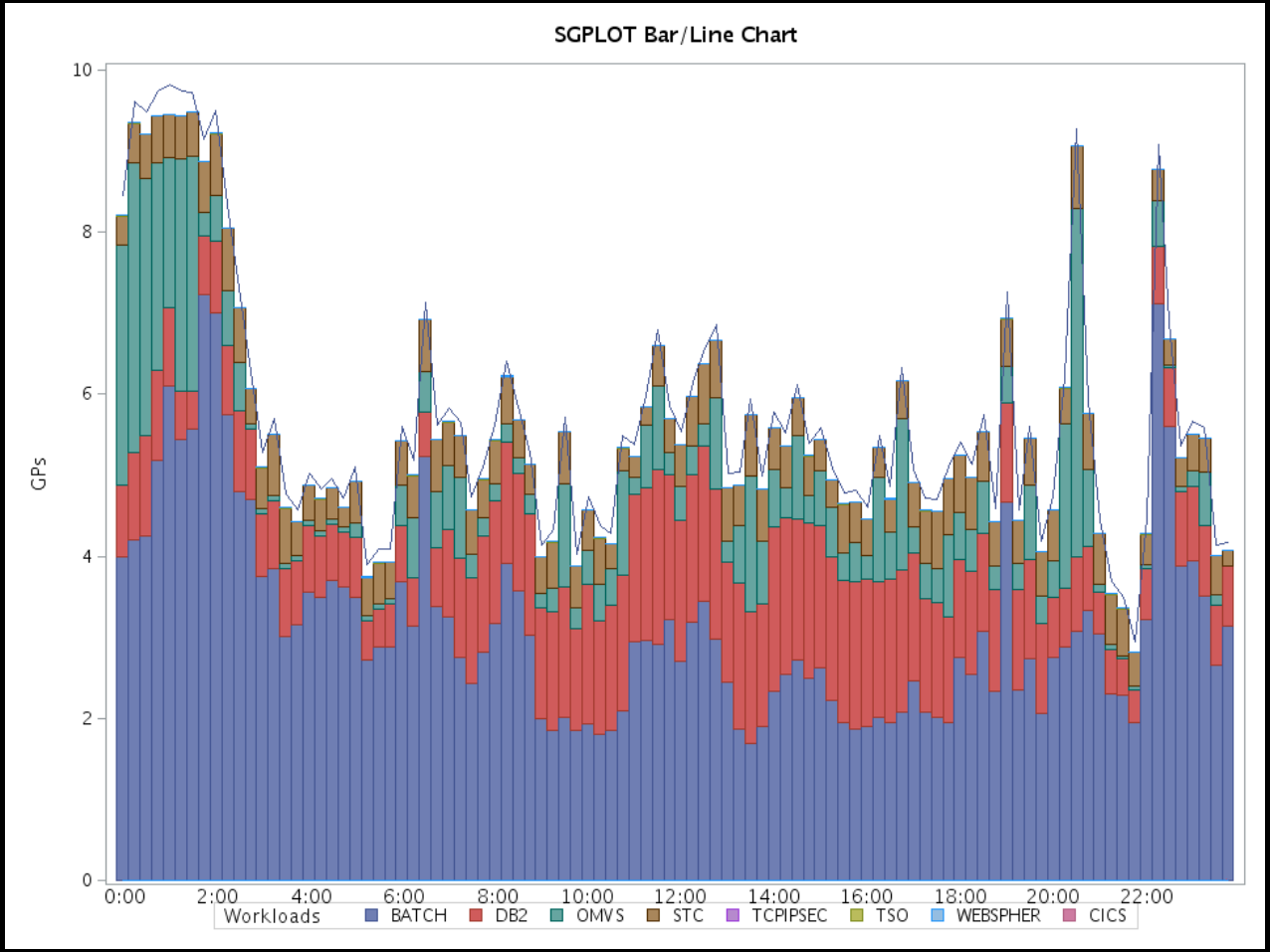
SAS/GRAPH

```
DATA annowkld ;
  SET summwkld (KEEP=date machine
      system time) ;
  IF MOD(time,7200) = 0 THEN DO;
    function  = 'label' ;
    color     = 'black'  ;
    position = '8'       ;
    when      = 'A'      ;
    STYLE     = 'simplex';
    hsys      = '5'      ;
    xsys      = '2'      ;
    ysys      = '1'      ;
    size      = 2.5      ;
    x         = time     ;
    y         = 0        ;
    text = PUT(time,TIME5.) ;
  END;
RUN;
```

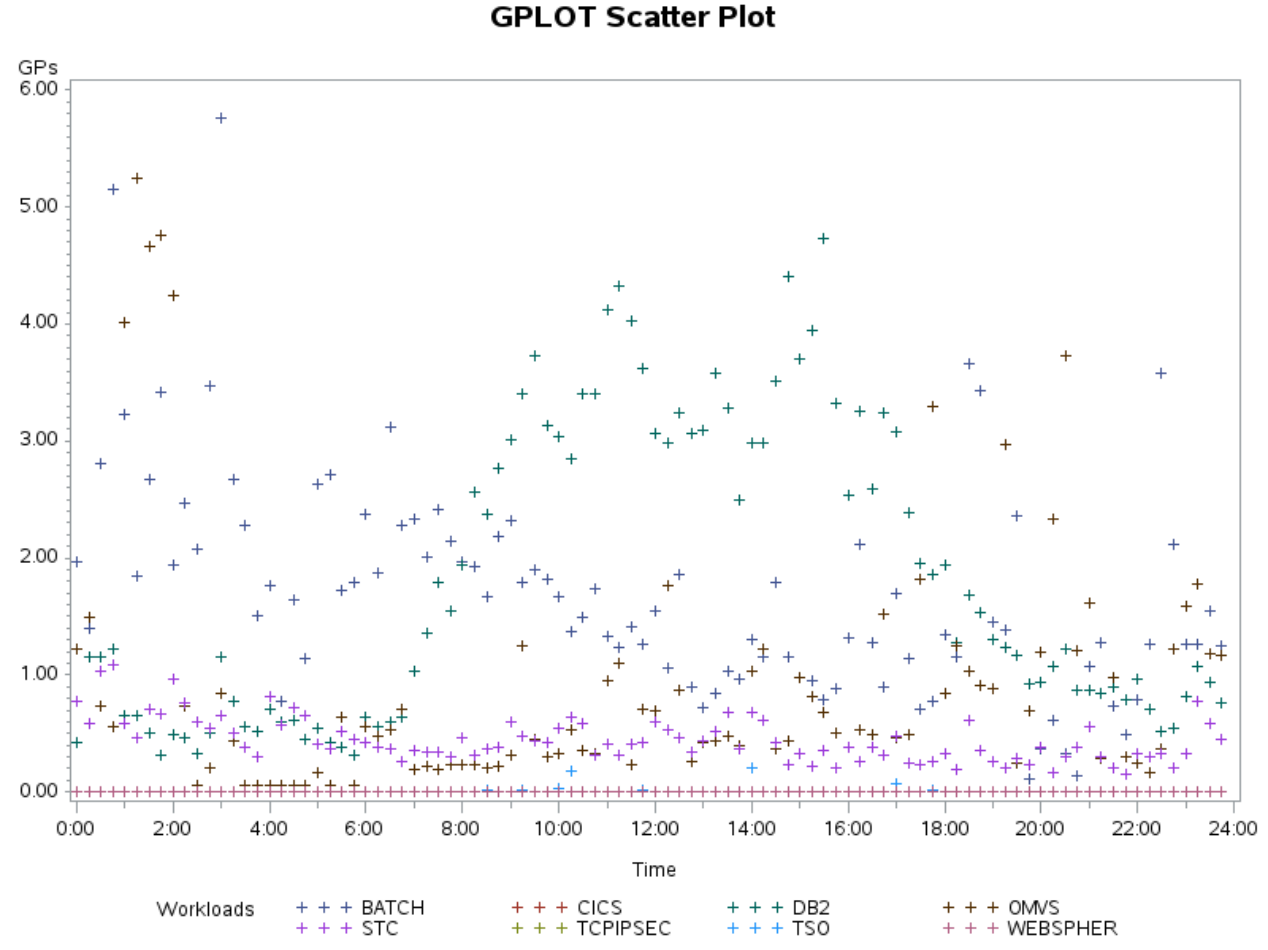
ODS Graphics

```
DATA annotime ;
  function  = 'TEXT' ;
  justify   = 'RIGHT' ;
  x1space   = 'DATAVALUE' ;
  y1space   = 'WALLPERCENT' ;
  y1        = -1.5     ;
  DO x1 = '00:00'T TO '22:00'T BY
      '02:00'T ;
    label = PUT(x1,TIME5.) ;
    OUTPUT;
  END;
RUN;
```

Combined Bar/Line Charts



Scatter Plots



Scatter Plots

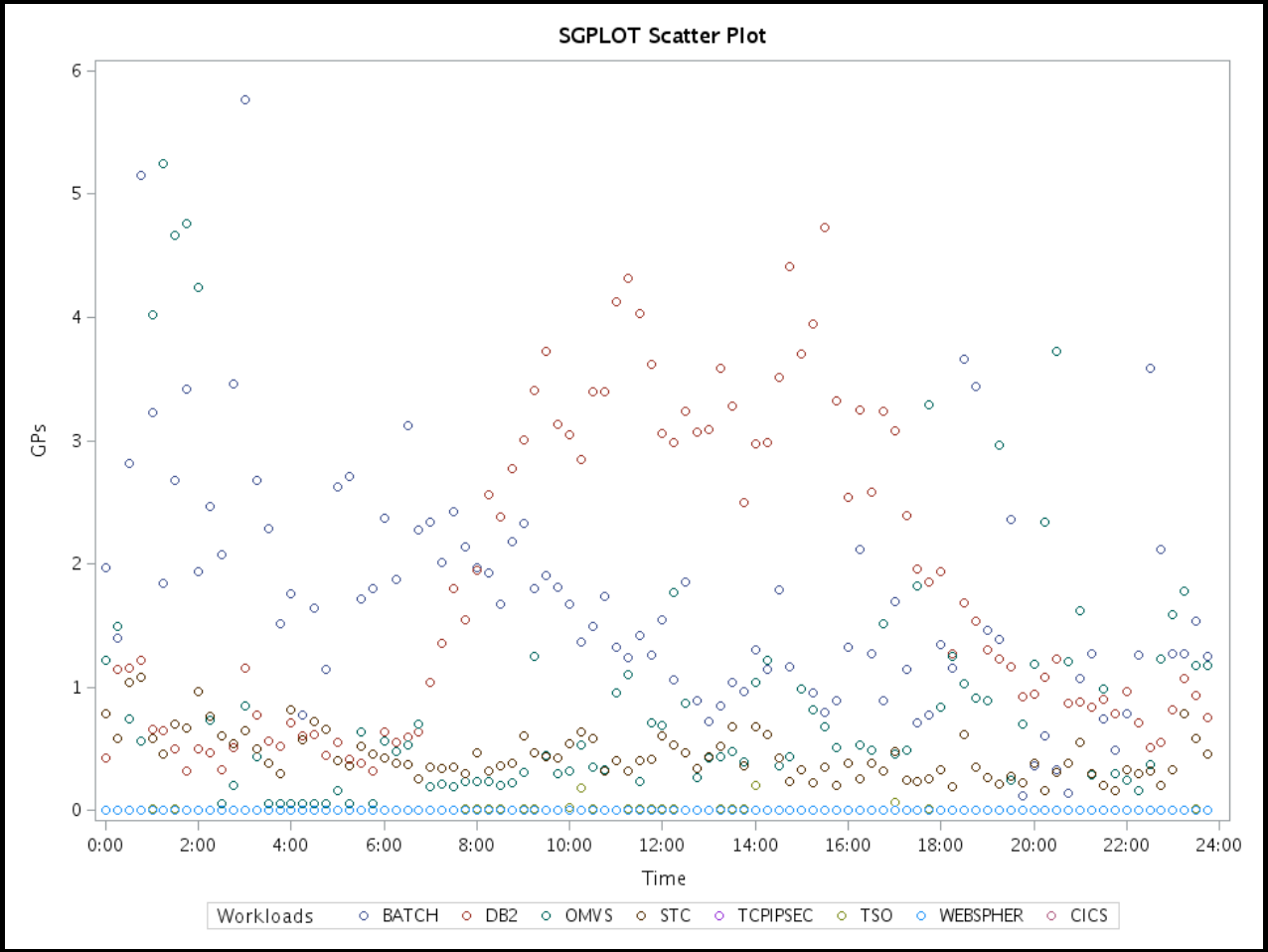
SAS/GRAPH

```
symbol1;
PROC GPLOT DATA=summwkld ;
  BY date machine system ;
  TITLE  "GPLOT Scatter Plot" ;
  PLOT scgps*time=wkldname ;
RUN;
```

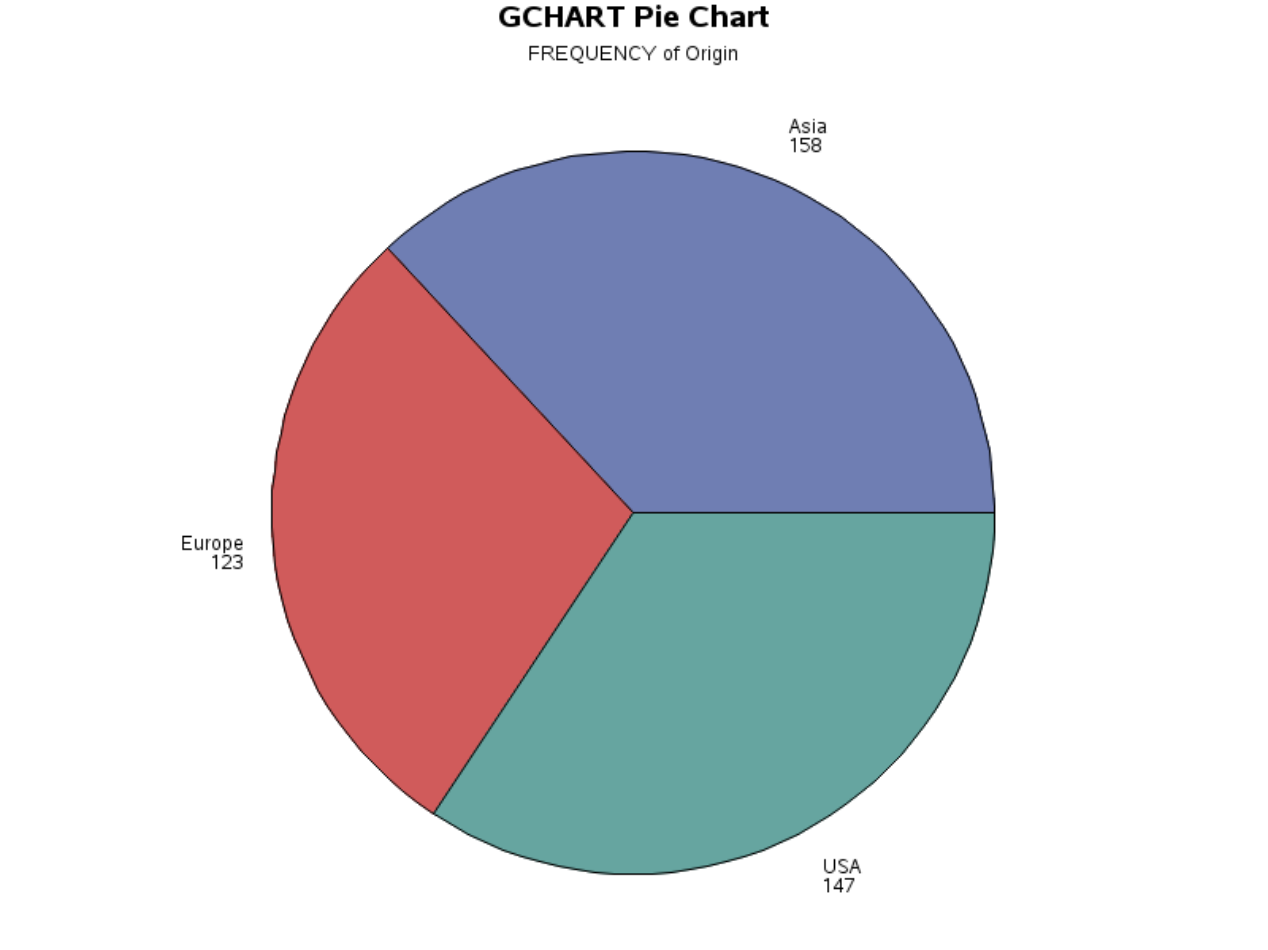
ODS Graphics

```
PROC SGPLOT DATA=summwkld ;
BY date machine system ;
  TITLE  "SGPLOT Scatter Plot" ;
  SCATTER X=time Y=scgps /
    GROUP=wkldname ;
RUN;
```

Scatter Plots



Pie Charts


GCHART Pie Chart
FREQUENCY of Origin
Asia
158
Europe
123
USA
147

Pie Charts

SAS/GRAPH

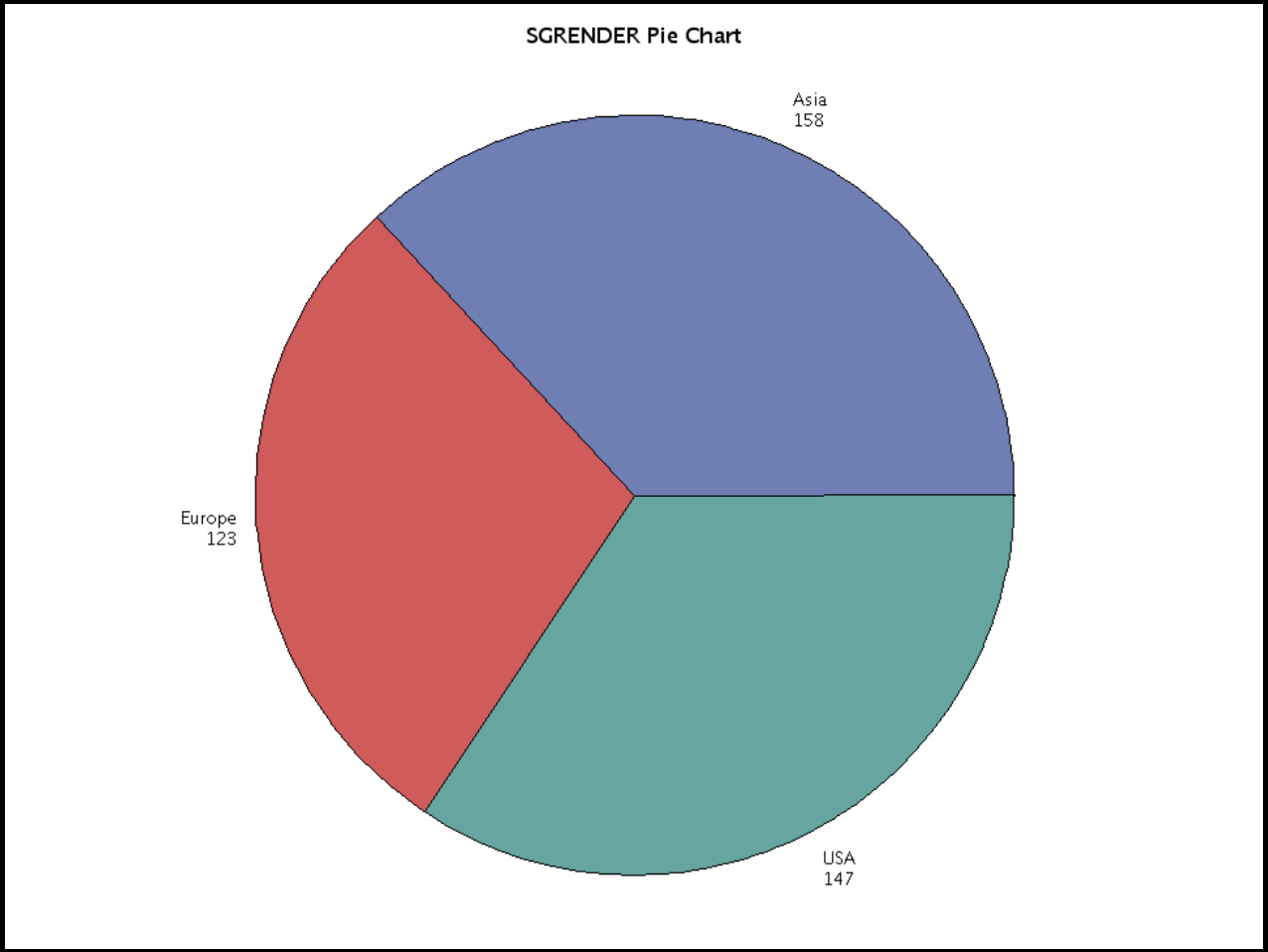
```
PROC GCHART DATA=sashelp.cars ;
 TITLE 'GCHART Pie Chart' ;
 PIE origin /
    FILL=solid
    SLICE=outside
    VALUE=outside
    COUTLINE=BLACK
 ;
RUN;
```

ODS Graphics

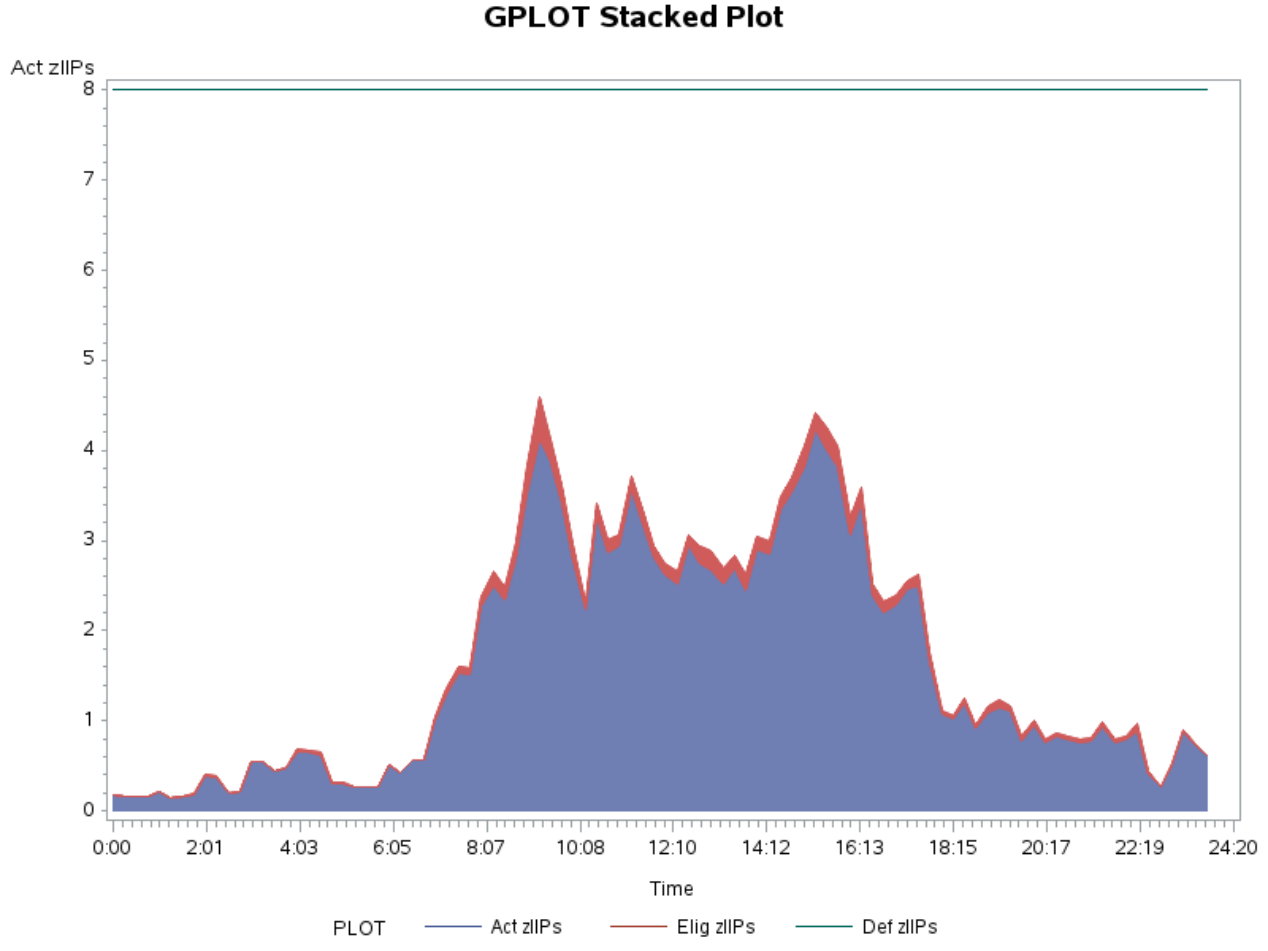
```
PROC TEMPLATE;
DEFINE STATGRAPH simplepie;
 BEGINGRAPH;
  ENTRYTITLE 'SGRENDER Pie Chart' ;
  LAYOUT REGION;
   PIECHART CATEGORY=ORIGIN /
     DATALABELLOCATION=OUTSIDE;
  ENDLAYOUT;
 ENDGRAPH;
END;
RUN;

PROC SGRENDER DATA=sashelp.cars
      TEMPLATE=simplepie;
RUN;
```

Pie Charts



Stacked Plots



Stacked Plots

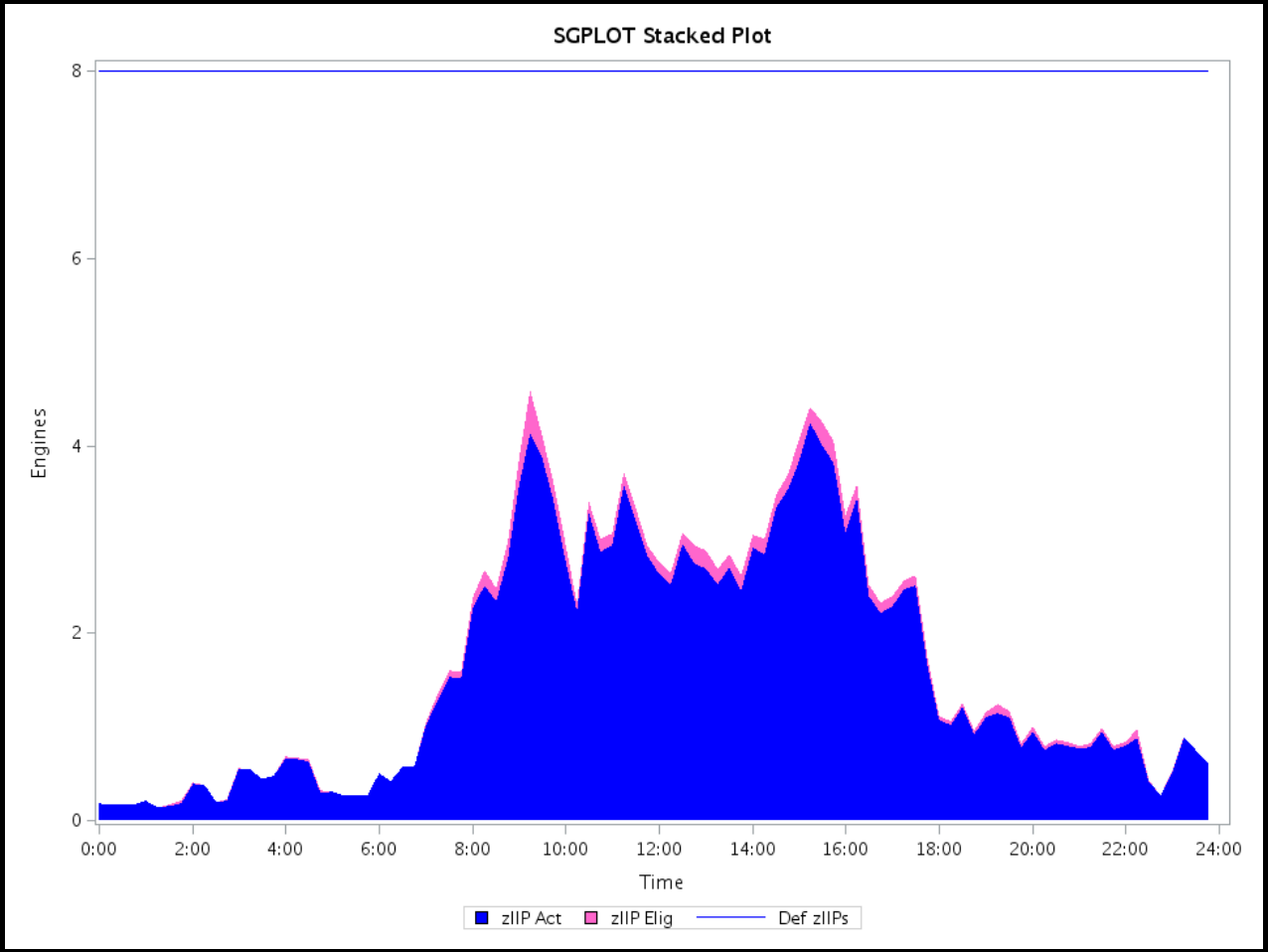
SAS/GRAPH

```
PROC GPLOT DATA=cpr70lp ;
  BY date machine system ;
  FORMAT sczips sczipa lparzips   3.  ;
  TITLE  "GPLOT Stacked Plot" ;
  PLOT (sczips sczipa lparzips)*time /
     OVERLAY
      AREAS   = 2
      LEGEND
      HTML_LEGEND = combrpt
      HTML        = combrpt
  ;
RUN;
```

ODS Graphics

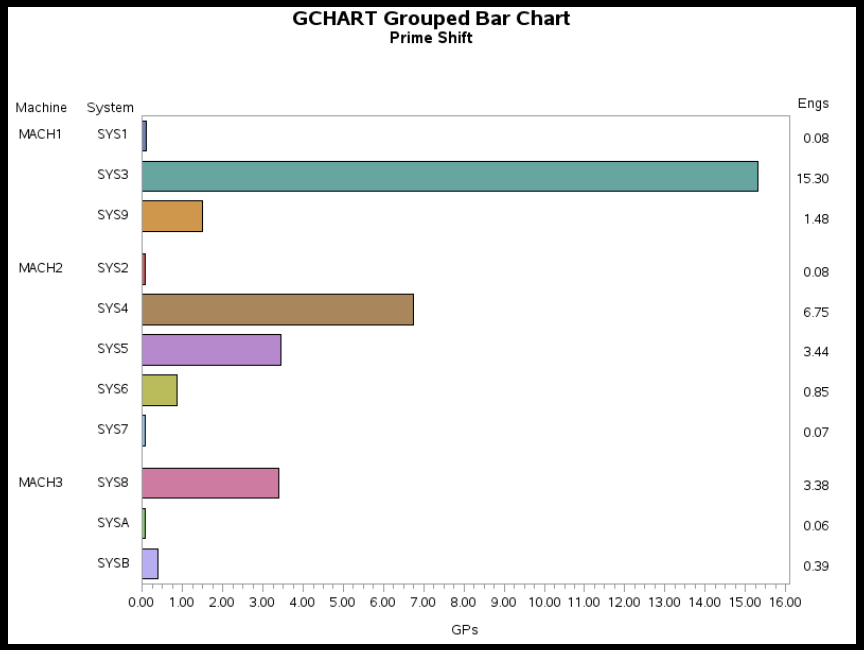
```
PROC SGPLOT DATA=cpr70lp ;
  TITLE  "SGPLOT Stacked Plot" ;
  BY date machine system ;
  BAND X=time LOWER=0
     UPPER=sczips    / FILL
     FILLATTRS=(COLOR=CX0000FF)
     LEGENDLABEL='zIIP Act' ;
  BAND X=time LOWER=sczips
     UPPER=sczipa    / FILL
     FILLATTRS=(COLOR=CXFF66CC)
     LEGENDLABEL='zIIP Elig' ;
  SERIES X=time Y=lparzips /
     LINEATTRS=(PATTERN=1
     COLOR=CX0000FF)
    URL=urlcombrpt ;
  YAXIS MINOR LABEL='Engines'
     INTEGER ;
RUN;
```

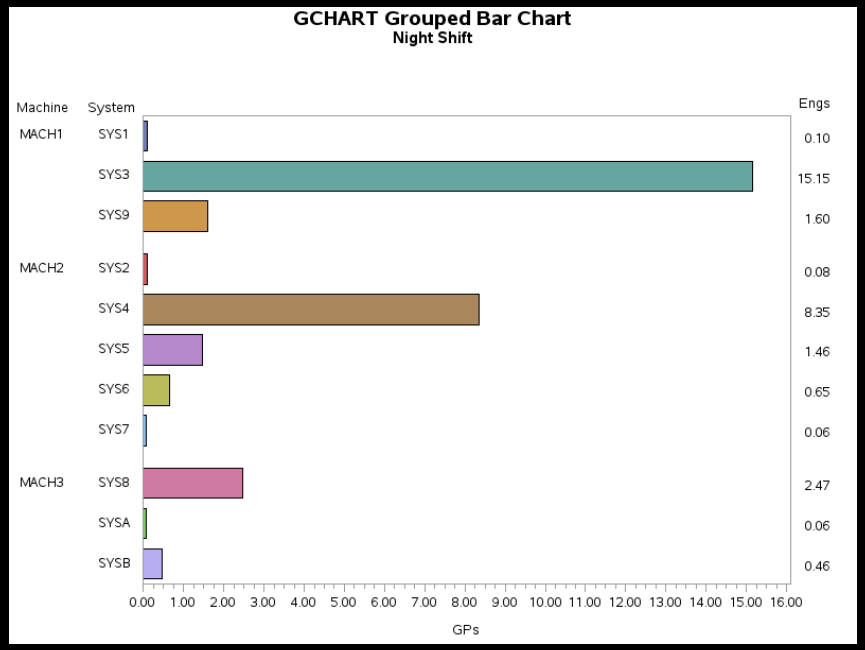
Stacked Plots



Extras

Panels


GCHART Grouped Bar Chart
Prime Shift
Machine
System
Engs
MACH1
SYS1
0.08
SYS3
15.30
SYS9
1.48
MACH2
SYS2
0.08
SYS4
6.75
SYS5
3.44
SYS6
0.85
SYS7
0.07
MACH3
SYS8
3.38
SYSA
0.06
SYSB
0.39
0.00 1.00 2.00 3.00 4.00 5.00 6.00 7.00 8.00 9.00 10.00 11.00 12.00 13.00 14.00 15.00 16.00
GPs


GCHART Grouped Bar Chart
Night Shift
Machine
System
Engs
MACH1
SYS1
0.10
SYS3
15.15
SYS9
1.60
MACH2
SYS2
0.08
SYS4
8.35
SYS5
1.46
SYS6
0.65
SYS7
0.06
MACH3
SYS8
2.47
SYSA
0.06
SYSB
0.46
0.00 1.00 2.00 3.00 4.00 5.00 6.00 7.00 8.00 9.00 10.00 11.00 12.00 13.00 14.00 15.00 16.00
GPs

Panels

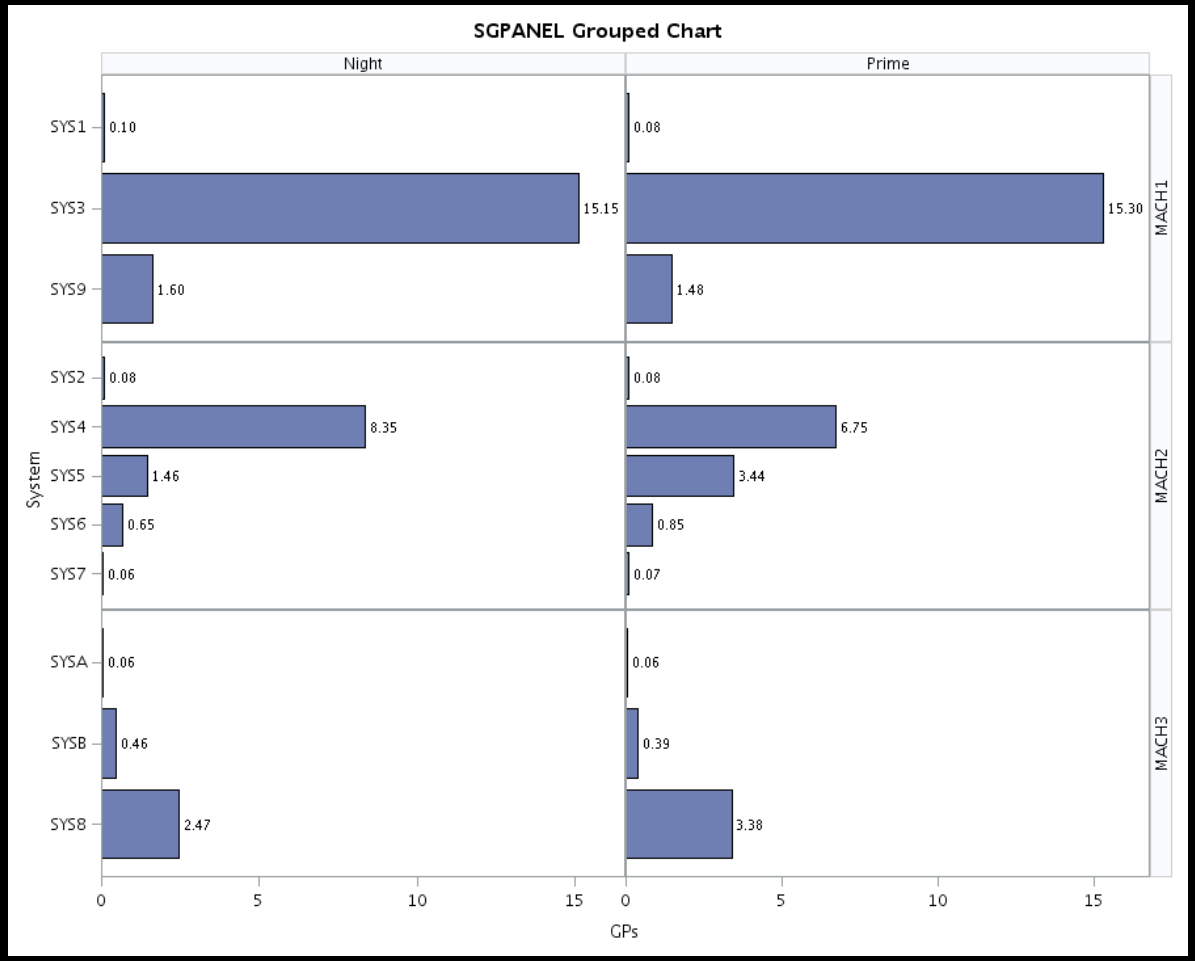
SAS/GRAPH

```
PROC GCHART DATA = meanengs ;
BY date DESCENDING shift ;
 TITLE  "GCHART Grouped Bar Chart" ;
 TITLE2 "#BYVAL(shift) Shift" ;
 HBAR   system   / DISCRETE
    SUMVAR=usedgps
     SUM
     SUMLABEL  = 'Engs'
     GROUP     = machine
     PATTERNID = MIDPOINT
     HTML      = gpdrill
     NOZERO   ;
RUN;
```

ODS Graphics

```
ODS GRAPHICS ON / WIDTH=900px ;
PROC SGPANEL DATA=meanengs
     CYCLEATTRS ;
BY date ;
 TITLE  "SGPANEL Grouped Chart" ;
 PANELBY shift machine  /
     LAYOUT=lattice
   UNISCALE=column
   NOVARNAME   ;
 HBAR  system  / RESPONSE=usedgps
   DATALABEL
   URL=urlgp ;
 COLAXIS OFFSETMIN=0;
RUN;
```

Panels


SGPANEL Grouped Chart
Night
Prime
MACH1
MACH2
MACH3
System
SYS1
SYS3
SYS9
SYS2
SYS4
SYS5
SYS6
SYS7
SYSA
SYSB
SYS8
0.10
15.15
1.60
0.08
15.30
1.48
0.08
8.35
1.46
0.65
0.06
0.08
6.75
3.44
0.85
0.07
0.06
0.46
2.47
0.06
0.39
3.38
0
5
10
15
GPs

Create Custom Data Tips

```
PROC SGPLOT DATA= pimean ;
 BY date ;
 SCATTER X=srvcper Y=sysplexsys /
  GROUP=mappi
  URL=urlpi
  MARKERATTRS=(SIZE=15px SYMBOL=circlefilled)  ;
 XAXIS DISCRETEORDER=unformatted ;
RUN;
```

```
PROC TEMPLATE;
DEFINE STATGRAPH pisummplot ;
BEGINGRAPH;
    ENTRYTITLE "SGRENDER PI SUMMARY for " _BYVAL_ ;
    LAYOUT overlay ;
    SCATTERPLOT X=srvcper  Y=sysplexsys /
      GROUP=mappi
       URL=urlpi
       NAME='pisumm'
       MARKERATTRS=(SIZE=15px SYMBOL=circlefilled)
       ROLENAME=(_pi=perfindx _plex=sysplex
                 _sys=system _svcl=srvclass _per=period)
       TIP=(_plex _sys _svcl _per _pi) ;
      DISCRETELEGEND 'pisumm' /  TITLE="PI Level" ;
    ENDLAYOUT;
  ENDGRAPH;
 END;
RUN;

PROC SGRENDER DATA=pimean TEMPLATE=pisummplot ;
 BY date ;
RUN;
```

Wrap Up

SAS ODS Graphics Manuals

- All SAS 9.3 manuals are available at http://support.sas.com/documentation/onlinedoc/base/index.html
- Under SAS Procedures Guides, see
  - SAS 9.3 Output Delivery System: User's Guide
  - SAS 9.3 ODS Graphics: Procedures Guide
- Under ODS Graphics, see
  - SAS 9.3 Graph Template Language: User's Guide
  - SAS 9.3 Graph Template Language: Reference

Recommended Reading

- Statistical Graphics in SAS, Warren F. Kuhfeld, 2010, ISBN 978-1-60764-485-9
- Using PROC SGPLOT for Quick High Quality Graphics, Delwiche and Slaughter, http://www.wuss.org/proceedings08/08WUSS%20Proceedings/papers/how/how05.pdf
- Graphics Sample Output Gallery, http://support.sas.com/sassamples/graphgallery/PROC_SGPLOT.html
- SAS Notes and Concepts for ODS, http://support.sas.com/rnd/base/ods/templateFAQ/index.html