SSVE White Balance Data Visualization

20 Dec 2021, SSVE started a trial which is an activity to write White Balance data into Pmod T-Con board.

To ensure effectiveness, PE wanna check log data compared with JND.

This probject provides two solutions as follows:

Solution 01: `VBA` + `Excel`

Sample: N < 1,000

Toolkits:

1. using `VBA` for data wrangling;
2. using `Excel` for data visualization;

Usage: to confirm production samples or OQC samples.

demerits: `Excel` performance becomes poor when datasets are bigger than 1,000;

Solution 02: `Python` + `Rlang`

Sample: N >= 1,000

Toolkits:

1. using `Python3` + `Pandas` for data wrangling
2. using `Rlang` + `ggplot2` for data Visualization

(it is rather common in Data Scientist and industry)

Usage: to confirm enormous data samples(N > 100,000,000) from SSVE production to achieve peak performance.

Author

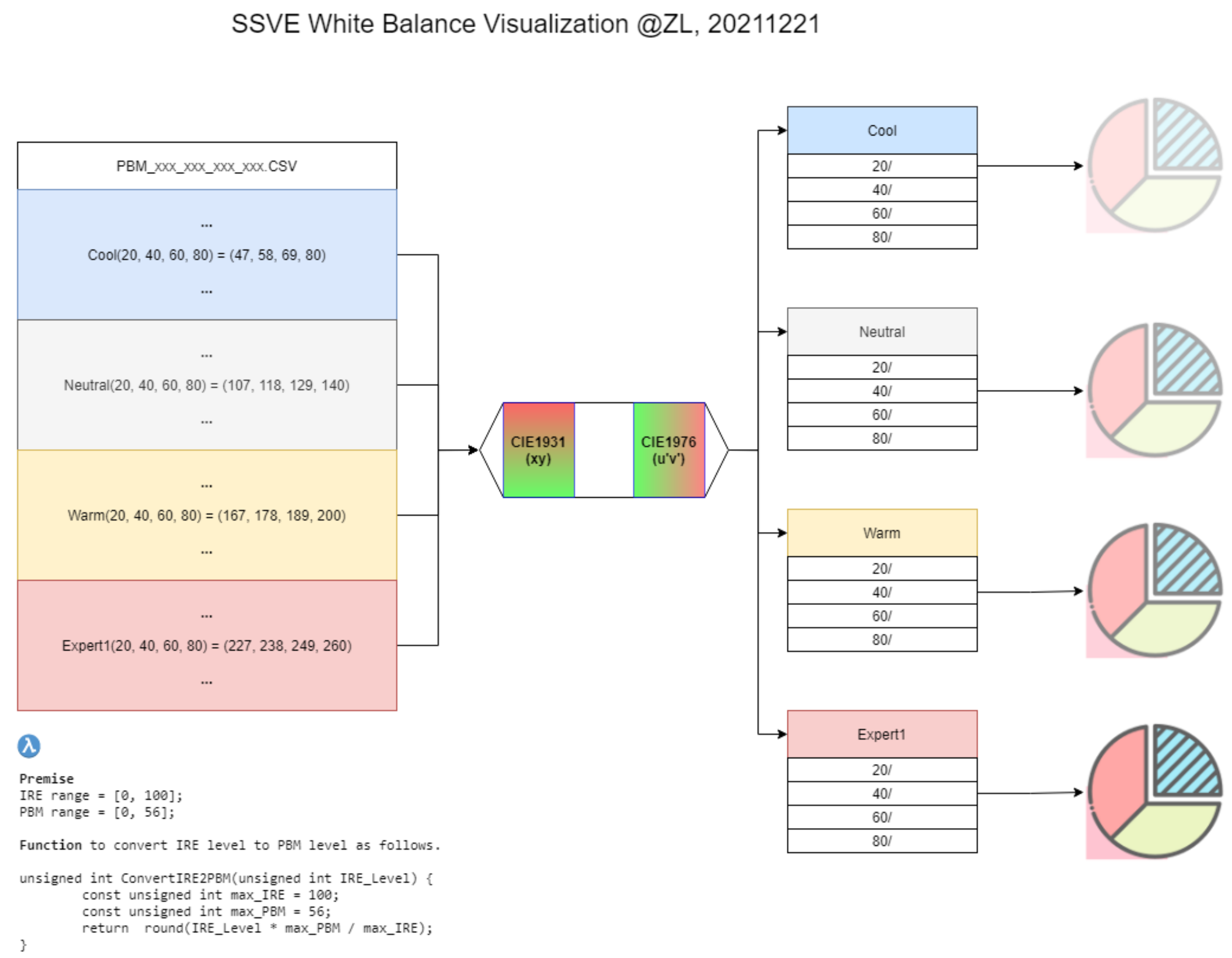
SSVE TVQA member `@Zhang Liang`, 20211220

Changelog

- v0.01, initial build
- v0.02, fix visualization bug (screw non-standard charts..)
- v0.03, resize `named range` dynamically
- v0.04, create `Python3` + `Rlang` solution for scaling data and workload;
- v0.05, builder pipeline to dump all data into database

Diagram

the following the diagram of the whole process


SSVE White Balance Visualization @ZL, 20211221
PBM_xxx_xxx_xxx_xxx.CSV
...
Cool(20, 40, 60, 80) = (47, 58, 69, 80)
...
...
Neutral(20, 40, 60, 80) = (107, 118, 129, 140)
...
...
Warm(20, 40, 60, 80) = (167, 178, 189, 200)
...
...
Expert1(20, 40, 60, 80) = (227, 238, 249, 260)
...
CIE1931 (xy)
CIE1976 (u'v')
Cool
20/
40/
60/
80/
Neutral
20/
40/
60/
80/
Warm
20/
40/
60/
80/
Expert1
20/
40/
60/
80/

```
Premise
IRE range = [0, 100];
PBM range = [0, 56];

Function to convert IRE level to PBM level as follows.

unsigned int ConvertIRE2PBM(unsigned int IRE_Level) {
        const unsigned int max_IRE = 100;
        const unsigned int max_PBM = 56;
        return  round(IRE_Level * max_PBM / max_IRE);
}
```

Solution 01

toolkits: `VB.NET` + `Excel` + `VBA`;

using this approach when workload and dataset are small (<= 1,000);

Implementation

some core functionality as follows.

```

Private Sub read_PBM_csv(ByVal csv_path As String, ByRef dstWB As Workbook)
    ''' read data from a PBM csv log files at SSVE @ZL, 20211220
    cool = Array(47, 58, 69, 80)
    neutral = Array(107, 118, 129, 140)
    warm = Array(167, 178, 189, 200)
    expert1 = Array(227, 238, 249, 260)

    color_temps = Array(cool, neutral, warm, expert1)

    For i = lb To ub
```

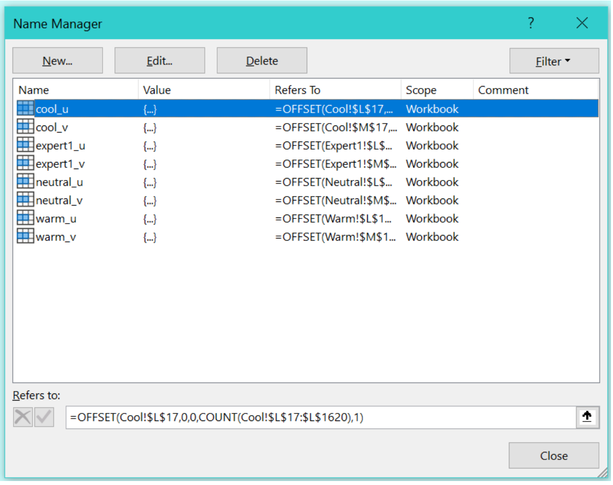
```
        dstRow = GetLastRow(dstWS_cool, dstCol_u) + 1
        dstWS_cool.Cells(dstRow, dstCol_ser).Value = dstWS_cool.Cells(dstRow, dstCol_ser).Value & parse_pbm_fp(csv_path)
        dstWS_cool.Cells(dstRow, dstCol_u).Resize(1, 2) = ConvXY_to_uv(src_ws.Cells(cool(i), col_x), src_ws.Cells(cool(i), col_y))   ' cool

        dstWS_neutral.Cells(dstRow, dstCol_ser).Value = dstWS_neutral.Cells(dstRow, dstCol_ser).Value & parse_pbm_fp(csv_path)
        dstWS_neutral.Cells(dstRow, dstCol_u).Resize(1, 2) = ConvXY_to_uv(src_ws.Cells(neutral(i), col_x), src_ws.Cells(neutral(i), col_y))   ' neutral

        dstWS_warm.Cells(dstRow, dstCol_ser).Value = dstWS_warm.Cells(dstRow, dstCol_ser).Value & parse_pbm_fp(csv_path)
        dstWS_warm.Cells(dstRow, dstCol_u).Resize(1, 2) = ConvXY_to_uv(src_ws.Cells(warm(i), col_x), src_ws.Cells(warm(i), col_y))   ' warm

        dstWS_expert1.Cells(dstRow, dstCol_ser).Value = dstWS_expert1.Cells(dstRow, dstCol_ser).Value & parse_pbm_fp(csv_path)
        dstWS_expert1.Cells(dstRow, dstCol_u).Resize(1, 2) = ConvXY_to_uv(src_ws.Cells(expert1(i), col_x), src_ws.Cells(expert1(i), col_y))   ' expert1
    Next i

    src_wb.Close False
    Set src_wb = Nothing
End Sub
```

Visualization

using some tricks to make dynamic charts.

Dynamic Chart

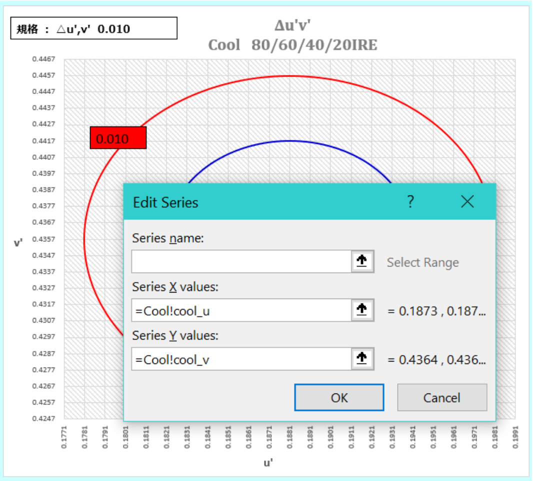
```
''' Dynamic Chart
' [ trick ]
' step1: using Formula -> Define Name to cusomize target series + offset() function
' step2: using Click Chart -> select data series -> target series

' ref: https://support.microsoft.com/en-us/office/offset-function-c8de19ae-dd79-4b9b-a14e-b4d906d11b66
' syntax: OFFSET(reference, rows, cols, [height], [width])
```



Name	Value	Refers To	Scope	Comment
cool_u	{...}	=OFFSET(Cool!$L$17,...	Workbook	
cool_v	{...}	=OFFSET(Cool!$M$17,...	Workbook	
expert1_u	{...}	=OFFSET(Expert1!L...	Workbook	
expert1_v	{...}	=OFFSET(Expert1!M...	Workbook	
neutral_u	{...}	=OFFSET(Neutral!L...	Workbook	
neutral_v	{...}	=OFFSET(Neutral!M...	Workbook	
warm_u	{...}	=OFFSET(Warm!$L$1...	Workbook	
warm_v	{...}	=OFFSET(Warm!$M$1...	Workbook	

Refers to:

=OFFSET(Cool!$L$17,0,0,COUNT(Cool!$L$17:$L$1620),1)

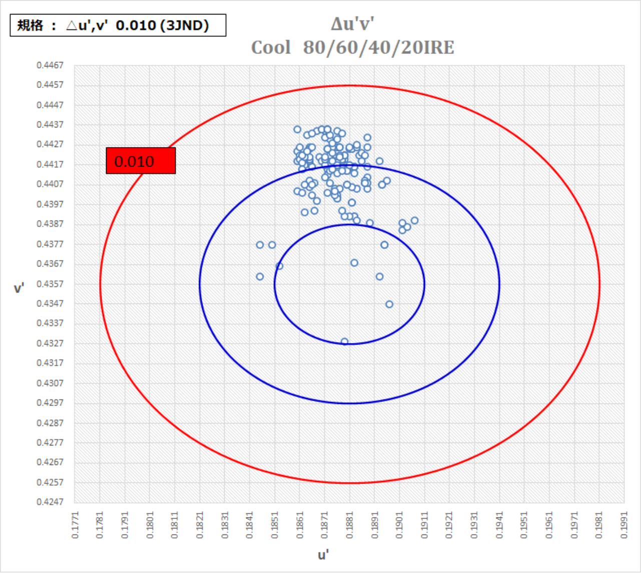


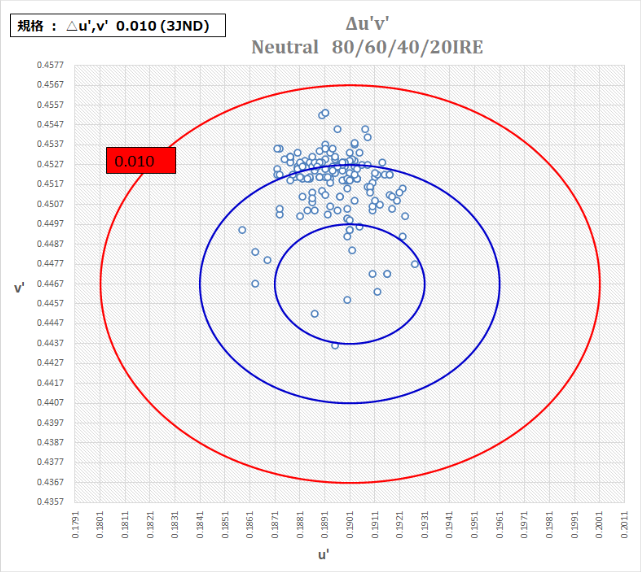
Series name:

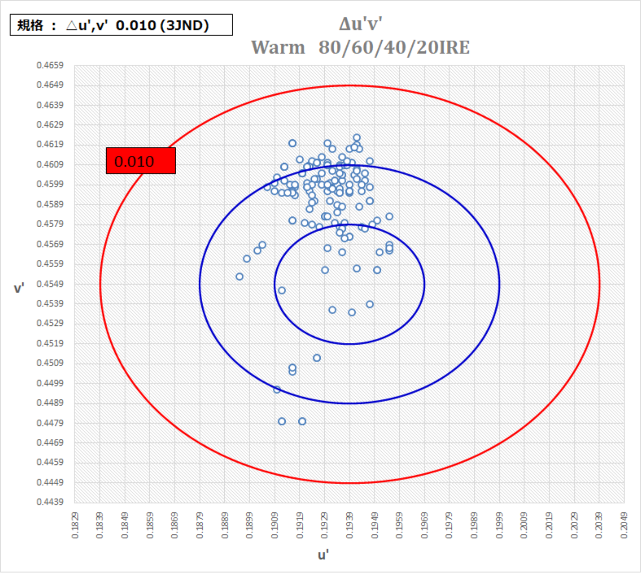
Series X values: =Cool!cool_u = 0.1873 , 0.187...

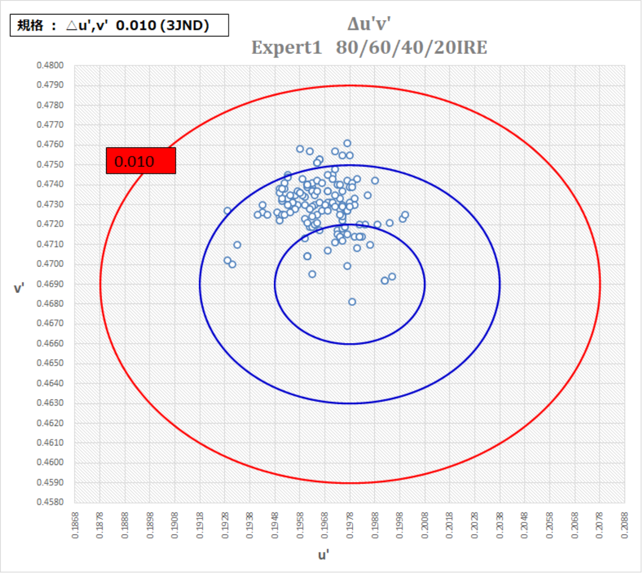
Series Y values: =Cool!cool_v = 0.4364 , 0.436...

Gallary









Solution 02

toolkits: `Python3` + `Pandas` + `Rlang` + `ggplot2`;

using this approach when workload and dataset are enormous (>=1,000);

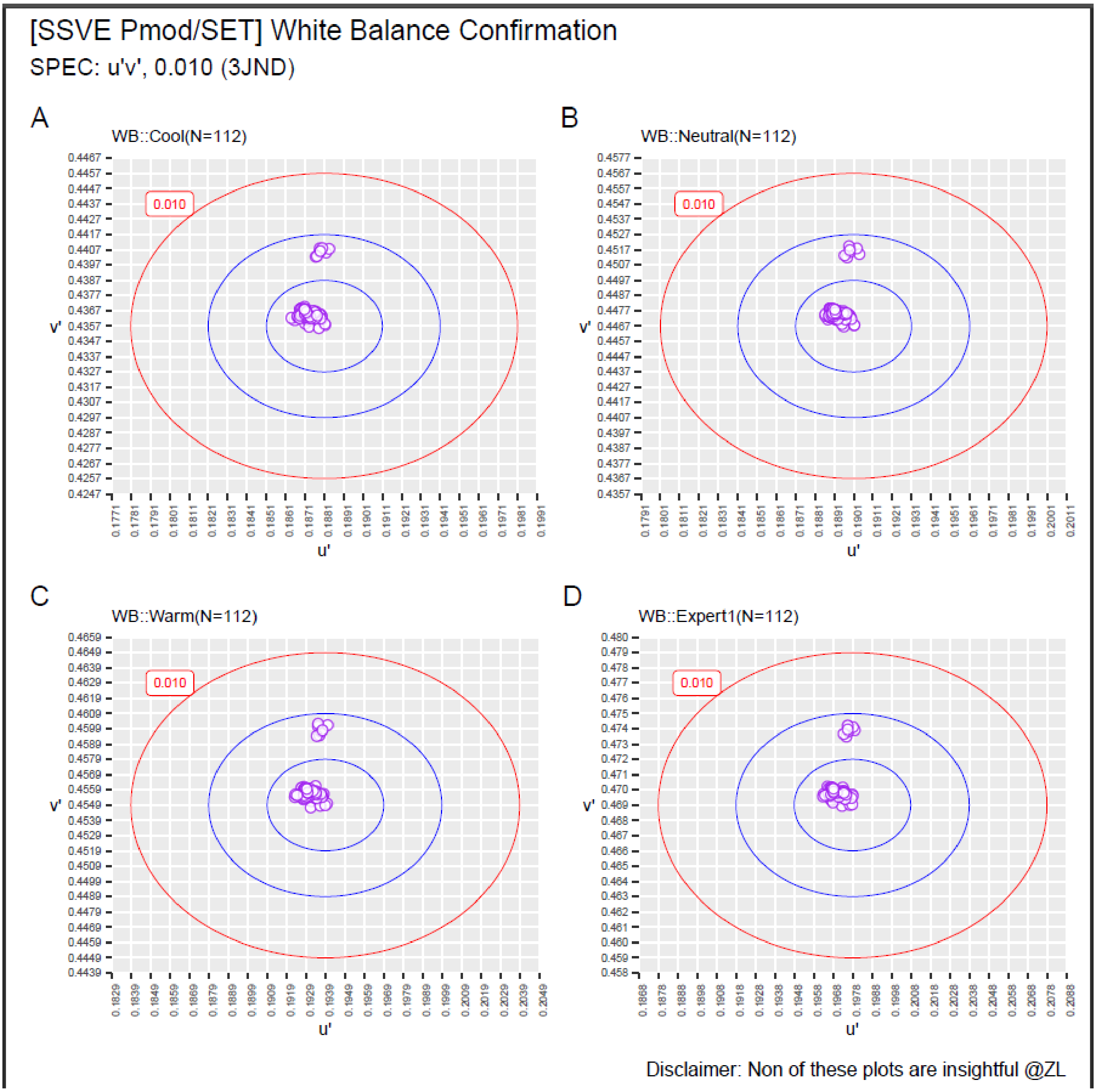
Implementation

```
def main()->None:
    root:Path    = './src'
    pfs          = PBM_FileStruct()
    holder       = Holder()
    offset:float = .0

    pw = PBM_Wrangler(pfs, root, holder, offset)
    pw.work('./data/wb.db', 'wb')
```

Visualization

```
### plot
plot.wb <- function(df.temp, temp,
                    temp.breaks.x, temp.breaks.y,
                    temp.minor.x, temp.minor.y,
                    temp.jnd1, temp.jnd2, temp.jnd3) {

  p <- ggplot(df.temp) +
    geom_point(aes(x=u,
                   y=v),
               colour="purple",
               shape=21,
               fill='white',
               stroke=.5,
               alpha=.8,
               size=2) +
    #  coord_cartesian(xlim=c(0.1771, 0.1991),
    #                  ylim=c(0.4247, 0.4467)) +
    scale_x_continuous(breaks = temp.breaks.x,
                       minor_breaks = temp.minor.x) +
    scale_y_continuous(breaks = temp.breaks.y,
                       minor_breaks = temp.minor.y) +
    labs(title=gsub(' ', '', paste('WB::',
                                   temp,
                                   '(N=',
                                   length(df.temp$u),
                                   ')')),
         x="u\'",
         y="v\'") +
    annotate(geom='label',
             x=min(temp.jnd3$du)+0.002,
             y=max(temp.jnd3$dv)-0.002,
             label='0.010',
             colour='red',
             size=2) +
    theme(plot.title = element_text(size=8),
          #panel.grid.major.x = element_blank(),
          #panel.grid.major.y = element_blank(),
          panel.grid.minor.x = element_blank(),
          panel.grid.minor.y = element_blank(),
          axis.title.x = element_text(size=8),
          axis.title.y = element_text(angle=0, size=8, vjust=0.5),
          axis.text.x = element_text(angle=90, size=5),
          axis.text.y = element_text(size=5)) +
    geom_path(data=temp.jnd1,
              aes(x=du,
                  y=dv),
              size = 0.2,
              color = 'blue'
    ) +
    geom_path(data=temp.jnd2,
              aes(x=du,
                  y=dv),
              size = 0.2,
              color = 'blue'
    ) +
    geom_path(data=temp.jnd3,
              aes(x=du,
                  y=dv),
              size = 0.2,
              color = 'red'
    )
  return(p)
}
```

Gallary



[SSVE Pmod/SET] White Balance Confirmation

SPEC: u'v', 0.010 (3JND)

Disclaimer: Non of these plots are insightful @ZL

About

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