AutoPlot

Generate Automatic Plots

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Background

- **AutoPlot** is an Indigenous Software created for generating plots automatically from the data (especially QC) maintained in all the sections of VFD.

- applicable for any type of data –
  - CSV,
  - TSV,
  - Excel (with single/multiple sheets)

Problems

- In order to generate Plots for QC data (maintained in Excel), currently we drag each parameter (like Date, Control limits, Spec limits, Etch Rate/Thickness/CP, etc.) manually to create/update the charts. And this consumes a good amount of valuable time in Engineer's data analysis job.
- In some sections, they are dependent on plots created in DMIS, which is not that satisfactory as it doesn't contain **'Remarks'** column feature and more.

Features

- It has 3 operation modes => Button, Shell & Auto.
- It shows the **'Remarks'** column while hovering on the data points in the Plot.
- It is very *Interactive* (zoom-in/out) and is quite *Modern*.
- A button is built-in within, for saving the plot's snapshot and can be attached in PPTs, Mail, etc.
- FYI, the entire codebase is written in Python, Bash (for automation) programming languages.
- There is no need of learning a programming language. All the modules/functions will be provided in form of packages and hence can be applied (with little parameter tweaks) for any form of data (in CSV, Excel).
- **ViEW** (another Indigenous Software) is also integrable with **AutoPlot** for adding **"Version Control"** feature to the Codebase, Excel, Word, Image (or any other format) files.
  Here, **ViEW** acts as the foundation layer for **AutoPlot**.
- It can also be used in applications where JMP software is normally preferred, here in SCL. In this, there are separate modules/functions which can replace the scripts written in **JMP Scripting Language (JSL)**.

Testing

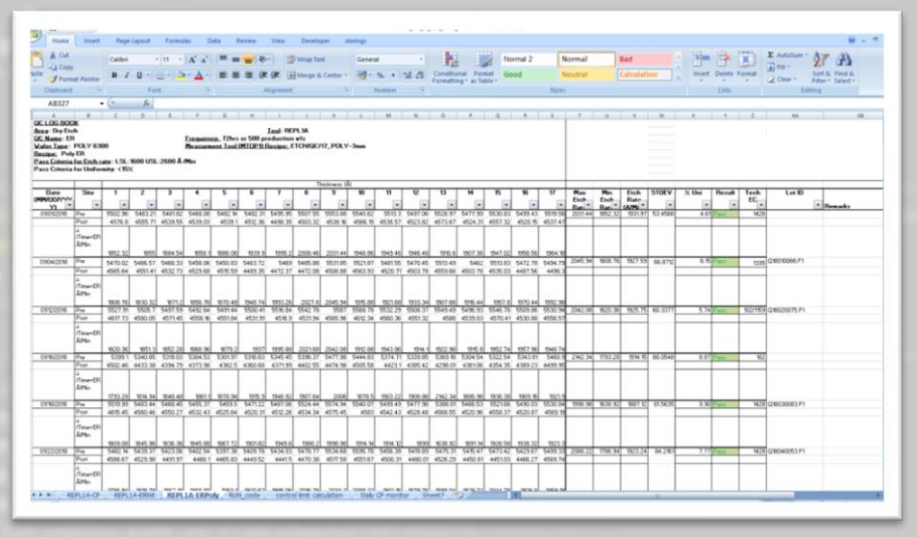
- Fully implemented in **DRY ETCH** and successfully tested for more than 2 months now.
- A sample QC data of PRS01 Equipment, **WET ETCH** has also been successfully tested as well.
- A sample QC data of FRST1 Equipment, **DIFFUSION** has also been successfully tested as well.

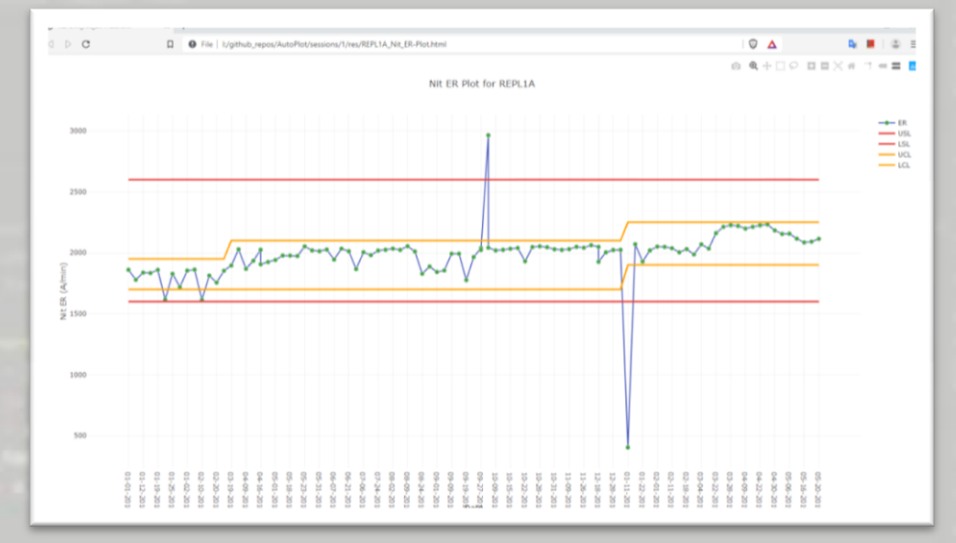
Demo: Dry Etch

Demo: Diffusion

Demo: Wet Etch

Design Model





Cleaning,
Filtering,
Re-structuring

index labels

column names

	Mountain	Height (m)	Range	Coordinates	Parent mountain	First ascent	Ascents bef. 2004	Failed attempts bef. 2004
0	Mount Everest / Sagarmatha / Chomolungma	8848	Mahalangur Himalaya	27°59'17"N 86°55'31"E	NaN	1953	>>145	121.0
1	K2 / Qogir / Godwin Austen	8611	Baltoro Karakoram	35°52'53"N 76°30'48"E	Mount Everest	1954	45	44.0
2	Kangchenjunga	8586	Kangchenjunga Himalaya	27°42'12"N 88°08'51"E	Mount Everest	1955	38	24.0
3	Lhotse	8516	Mahalangur Himalaya	27°57'42"N 86°55'59"E	Mount Everest	1956	26	26.0
4	Makalu	8485	Mahalangur Himalaya	27°53'23"N 87°05'20"E	Mount Everest	1955	45	52.0
5	Cho Oyu	8188	Mahalangur Himalaya	28°05'39"N 86°39'39"E	Mount Everest	1954	79	28.0
6	Dhaulagiri I	8167	Dhaulagiri Himalaya	28°41'48"N 83°29'35"E	K2	1960	51	39.0
7	Manaslu	8163	Manaslu Himalaya	28°33'00"N 84°33'35"E	Cho Oyu	1956	49	45.0
8	Nanga Parbat	8126	Nanga Parbat Himalaya	35°14'14"N 74°35'21"E	Dhaulagiri	1953	52	67.0
9	Annapurna I	8091	Annapurna Himalaya	28°35'44"N 83°49'13"E	Cho Oyu	1950	36	47.0

data

Generate Plots

- Button
- Shell
- Auto

Coding Essentials

- Editor, Compiler

Modules: Global variables

```
# Global variables
line_color = '#3f51b5'      # line (trace1) color for any plot
marker_color = '#43a047'    # marker color for any plot
marker_border_color = '#ffffff'     # marker border color for any plot
cl_color = '#ffa000'    # control limit line color for any plot
sl_color = '#e53935'    # spec limit line color for any plot
cp_plot_title = 'CP Plot for RESP1B'  # title for CP plot
cp_plot_xlabel = 'Date'   # xaxis name for CP plot
cp_plot_ylabel = 'delta CP (no.s)'     # yaxis name for CP plot
cp_plot_html_file = 'RESP1B_CP-Plot.html'   # HTML filename for CP plot
cp_plot_trace_count = 2    # no. of traces in CP plot
er_barc_plot_title = 'BARC ER Plot for RESP1B'  # title for ER plot
er_barc_plot_xlabel = 'Date'        # xaxis name for ER plot
er_barc_plot_ylabel = 'BARC ER (A/min)'   # yaxis name for ER plot
er_barc_plot_html_file = 'RESP1B_BARC_ER-Plot.html'   # HTML filename for ER plot
er_barc_plot_trace_count = 5    # no. of traces in ER plot
unif_barc_plot_title = 'BARC Uniformity Plot for RESP1B'  # title for Unif plot
unif_barc_plot_xlabel = 'Date'      # xaxis name for Unif plot
unif_barc_plot_ylabel = 'BARC Unif (%)'    # yaxis name for Unif plot
unif_barc_plot_html_file = 'RESP1B_BARC_Unif-Plot.html'   # HTML filename for Unif plot
unif_barc_plot_trace_count = 2    # no. of traces in Unif plot

sht_cp_columns = ["Date (MM/DD/YYYY)", "delta CP", "USL", "Remarks"]    # Columns for CP
# Columns for BARC Layer Dataframe
Dataframe
sht_er_barc_columns = ["Date (MM/DD/YYYY)", "Layer", "Etch Rate (A/Min)", "% Uni",

"Remarks", "LSL", "USL", "LCL", "UCL", "% Uni USL", "% Uni UCL"]
# Excel file directory
excel_file_directory = "\\\\vmfg\\VFD FILE SERVER\\SECTIONS\\DRY ETCH" +
"\\QC Log Book\\Final QC Log Book\\UNT_02_LOG_BOOK\\\\UNT02_Ch_A_QC_LOG_BOOK.xlsm"
```

Modules: Date Formatter

```
"""
"Description": Date formatter to format the excel date (issue: one date less in plotly chart) as "%m-%d-%Y %H:%M:%S"
"x": datetime list
"return": formatted datetime list
"""
def date_formatter(x):
    x_fmt = []
    for a in x:
        a = a.strftime("%m-%d-%Y %H:%M:%S")
        x_fmt.append(a)
    return x_fmt
```

Modules: CP Plot

```
"""
"Description": This function plots CP Chart with traces v/s
Date
"draw_plotly_resp1b_cp_plot": Draw Plotly's Plot for RESP1B CP
"x": Date (x-axis) for CP Chart
"y1": Delta-CP (y-axis) for CP Chart
"y2": USL (y-axis) for CP Chart
# "y3": UCL (y-axis) for CP Chart
"""
def draw_plotly_resp1b_cp_plot(x, y1, y2, remarks):
    trace1 = go.Scatter(
            x = x,
            y = y1,
            name = 'delta-CP',
            mode = 'lines+markers',
            line = dict(
                    color = line_color,
                    width = 2),
            marker = dict(
                    color = marker_color,
                    size = 8,
                    line = dict(
                        color = marker_border_color,
                        width = 0.5),
                    ),
            text = remarks
    )

    trace2 = go.Scatter(
            x = x,
            y = y2,
            name = 'USL',
            mode = 'lines',
            line = dict(
                    color = sl_color,
                    width = 3)
    )

    trace3 = go.Scatter(
            x = x,
            y = y3,
            name = 'UCL',
            mode = 'lines',
            line = dict(
                    color = cl_color,
                    width = 3)
    )

    data = [trace1, trace2, trace3]
    layout = dict(
            title = cp_plot_title,
            xaxis = dict(title= cp_plot_xlabel),
            yaxis = dict(title= cp_plot_ylabel)
        )
    fig = dict(data= data, layout= layout)
    py.offline.plot(fig, filename= cp_plot_html_file)
```

Modules: ER Plot

```
"""
"Description": This function plots ER Chart with traces v/s Date.
"draw_plotly_resp1b_er_barc_plot": Draw Plotly's Plot for RESP1B BARC
ER": Date (x-axis) for ER Chart
"y1": ER (y-axis) for ER Chart
"y2": USL (y-axis) for ER Chart
"y3": LSL (y-axis) for ER Chart
"y4": UCL (y-axis) for ER Chart
"y5": LCL (y-axis) for ER Chart
"""
def draw_plotly_resp1b_er_barc_plot(x, y1, y2, y3, y4, y5, remarks):
    trace1 = go.Scatter(
            x = x,
            y = y1,
            name = 'ER',
            mode = 'lines+markers',
            line = dict(
                    color = line_color,
                    width = 2),
            marker = dict(
                    color = marker color,
                    size = 8,
                    line = dict(
                        color = marker_border_color,
                        width = 0.5),
                    ),
            text = remarks
    )

    trace2 = go.Scatter(
            x = x,
            y = y2,
            name = 'USL',
            mode = 'lines',
            line = dict(
                    color = sl_color,
                    width = 3)
    )

    trace3 = go.Scatter(
            x = x,
            y = y3,
            name = 'LSL',
            mode = 'lines',
            line = dict(
                    color = sl_color,
                    width = 3)
    )

    trace4 = go.Scatter(
            x = x,
            y = y4,
            name = 'UCL',
            mode = 'lines',
            line = dict(
                    color = cl_color,
                    width = 3)
    )

    trace5 = go.Scatter(
            x = x,
            y = y5,
            name = 'LCL',
            mode = 'lines',
            line = dict(
                    color = cl color,
                    width = 3)
    )

    data = [trace1, trace2, trace3, trace4, trace5]
    layout = dict(
            title = er_barc_plot_title,
            xaxis = dict(title= er_barc_plot_xlabel),
            yaxis = dict(title= er_barc_plot_ylabel)
        )
    fig = dict(data= data, layout= layout)
    py.offline.plot(fig, filename= er barc plot html file)
```

Modules: Unif Plot

```
"""
"Description": This function plots Unif Chart with traces v/s Date.
"draw_plotly_resp1b_unif_barc_plot": Draw Plotly's Plot for RESP1B BARC
Unif Date (x-axis) for Unif Chart
"y1": Unif (y-axis) for Unif Chart
"y2": USL (y-axis) for Unif Chart
"y3": UCL (y-axis) for Unif Chart
"""
def draw_plotly_resp1b_unif_barc_plot(x, y1, y2, y3, remarks):
    trace1 = go.Scatter(
            x = x,
            y = y1,
            name = 'Unif',
            mode = 'lines+markers',
            line = dict(
                    color = line_color,
                    width = 2),
            marker = dict(
                    color = marker_color,
                    size = 8,
                    line = dict(
                        color = marker_border_color,
                        width = 0.5),
                    ),
            text = remarks
    )

    trace2 = go.Scatter(
            x = x,
            y = y2,
            name = 'USL',
            mode = 'lines',
            line = dict(
                    color = sl_color,
                    width = 3)
    )

    trace3 = go.Scatter(
            x = x,
            y = y3,
            name = 'UCL',
            mode = 'lines',
            line = dict(
                    color = cl_color,
                    width = 3)
    )

    data = [trace1, trace2, trace3]
    layout = dict(
            title = unif_barc_plot_title,
            xaxis = dict(title= unif_barc_plot_xlabel),
            yaxis = dict(title= unif_barc_plot_ylabel)
        )
    fig = dict(data= data, layout= layout)
    py.offline.plot(fig, filename= unif_barc_plot_html_file)
```

Utilities

- **Stage-2:** Applying Nelson rules (Under development)
- Like in JMP, one can write custom script to generate plots out of data (in any format).
- Various types of plots can be created – Line, Scatter, Box, Qiver, Contour (2-D, 3-D), Heatmap,