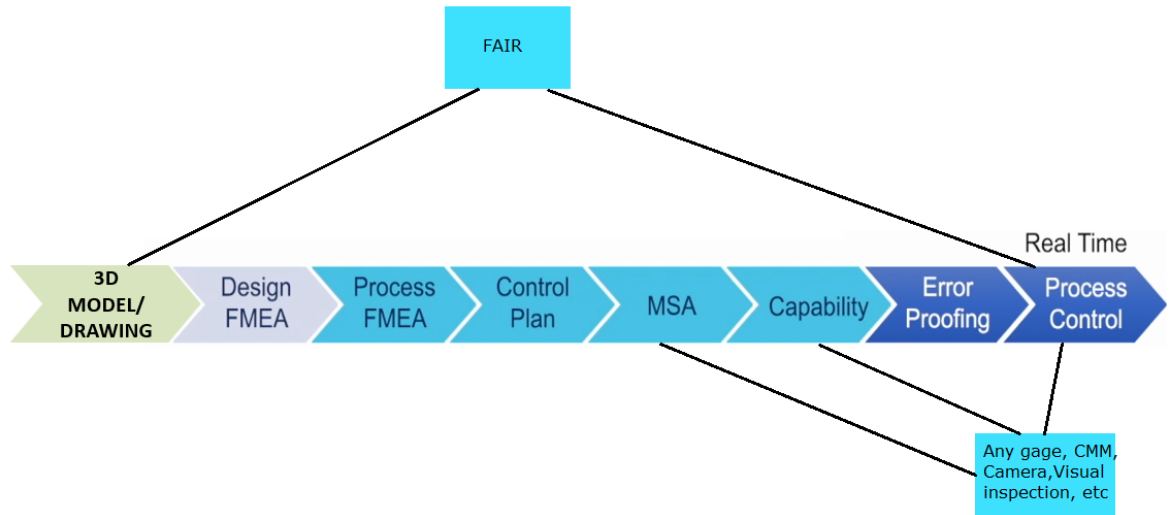




## How DataLyzer can help you to streamline your APQP Process



By Marc Schaeffers



# Integrated APQP: 3D Model/2D Drawing – Ballooning – PFD – FMEA – Control Plan – MSA – SPC – CMM – FAIR

## INTRODUCTION

Advanced Product Quality Planning (APQP) was introduced in automotive industry but is now required in more and more industries. Early in the design process product characteristics and its classification are established and specifications are defined. These characteristics are forwarded in every step of the APQP process and are measured, analyzed, controlled and reported in First Article Inspection Report (FAIR), PPAP and SPC reports.

Especially in aerospace and automotive a lot of measurements are taken with a CMM.

The process of registering all characteristics in every process step can be very time consuming. Characteristics are established during the design process and then they need to be entered in the CMM program, FAIR, the FMEA and Control Plan and the SPC program. A time-consuming step for suppliers is that they often need to balloon the drawing from the customer as well. We slowly see a shift in the supply chain that not only the drawing is exchanged but also manufacturing information by means of a 3D model.

In the picture below the full APQP process is shown

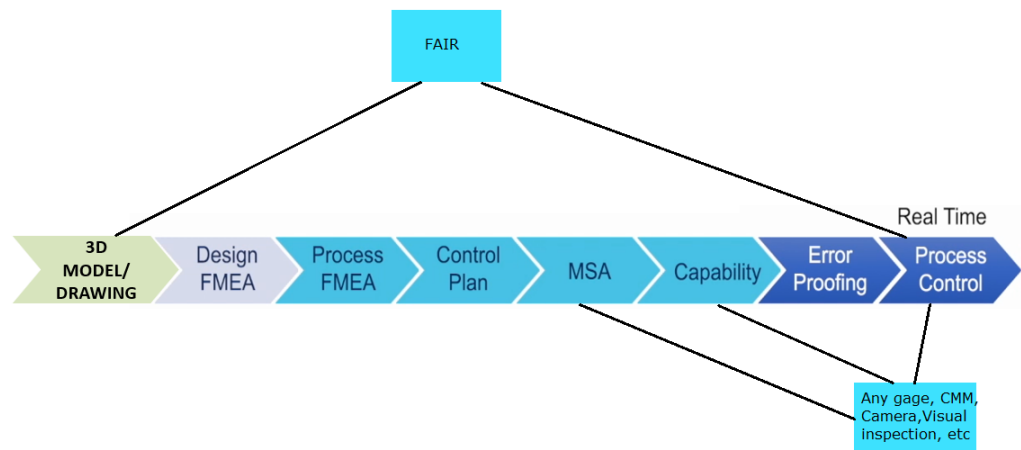


Figure 1: APQP Flow from 3D model to Real-time SPC

## BALLOONING

The 3D model created during the design process can be ballooned fully automatically.



In figure 2 you see how a Siemens NX model is automatically ballooned using DISCUS ballooning software.

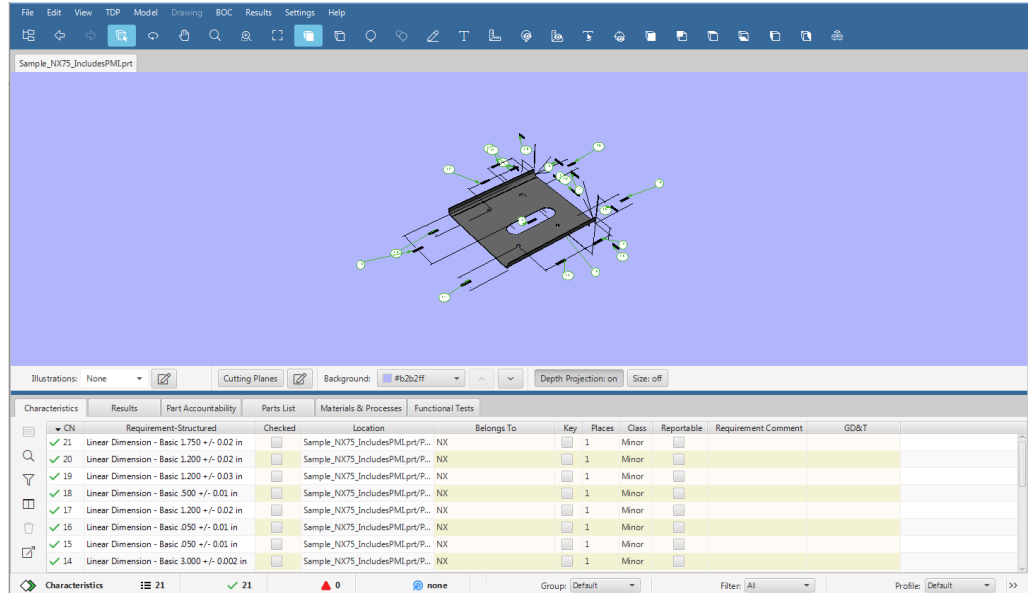


Figure 2: Siemens NX model ballooned with DISCUS

The 3D example above is ballooned with DISCUS software, but ballooning can be done also on 2D drawings or even PDF documents.

In addition to the balloons the full list of characteristics and additional information like classification and eventually also manufacturing information can be exported to a file.



	B	C	D	E	F	G	H	I
1	Balloon number	Classification	Structure requirement	LSL	Target	USL	Requirement	UOM
2	21	Minor	Linear Dimension - Basic: 1.750 +0.02 in	1.730	1.750	1.770	1.750 0.02 -0.02	in
3	20	Minor	Linear Dimension - Basic: 1.200 +0.02 in	1.180	1.200	1.220	1.200 0.02 -0.02	in
4	19	Minor	Linear Dimension - Basic: 1.200 +0.03 in	1.170	1.200	1.230	1.200 0.03 -0.03	in
5	18	Minor	Linear Dimension - Basic: .500 +0.01 in	0.490	.500	0.510	.500 0.01 -0.01	in
6	17	Minor	Linear Dimension - Basic: 1.200 +0.02 in	1.180	1.200	1.220	1.200 0.02 -0.02	in
7	16	Minor	Linear Dimension - Basic: .050 +0.01 in	0.040	.050	0.060	.050 0.01 -0.01	in
8	15	Minor	Linear Dimension - Basic: .050 +0.01 in	0.040	.050	0.060	.050 0.01 -0.01	in
9	14	Minor	Linear Dimension - Basic: 3.000 +0.002 in	2.998	3.000	3.002	3.000 0.002 -0.002	in
10	13	Minor	Linear Dimension - Basic: 2.000 +0.001 in	1.999	2.000	2.001	2.000 0.001 -0.001	in
11	12	Minor	Linear Dimension - Basic: 2.500 +0.001 -0.002 in	2.498	2.500	2.501	2.500 0.001 -0.001 -0.002	in
12	11	Minor	Linear Dimension - Basic: .500 +0.01 in	0.490	.500	0.510	.500 0.01 -0.01	in
13	10	Minor	Radius - Basic: .250 +0.002 -0.001 inR	0.249	.250	0.252	.250 0.002 -0.002 -0.001	in
14	9	Minor	Linear Dimension - Basic: 6.000 +0.001 in	5.999	6.000	6.001	6.000 0.001 -0.001	in
15	8	Minor	Linear Dimension - Basic: 3.000 +0.01 in	2.990	3.000	3.010	3.000 0.01 -0.01	in
16	7	Minor	Radius - Basic: .300 +0 -0.3 inR	0.000	.300	0.300	.300 0 -0.3	in
17	6	Minor	Linear Dimension - Basic: 1.200 +0.01 in	1.190	1.200	1.210	1.200 0.01 -0.01	in
18	5	Minor	Radius - Basic: .300 +0 -0.3 inR	0.000	.300	0.300	.300 0 -0.3	in
19	4	Minor	Linear Dimension - Basic: 1.000 +0.01 in	0.990	1.000	1.010	1.000 0.01 -0.01	in
20	3	Minor	Linear Dimension - Basic: .050 +0.01 in	0.040	.050	0.060	.050 0.01 -0.01	in
21	2	Minor	Linear Dimension - Basic: 2.000 +0.001 in	1.999	2.000	2.001	2.000 0.001 -0.001	in
22	1	Minor	Radius - Basic: .250 +0 -0.25 inR	0.000	.250	0.250	.250 0 -0.25	in

Figure 3: Example characteristic file

The next step in the APQP process is to create the Process Flow, FMEA and Control Plan to establish what needs to be measured.

### PFD, FMEA and CONTROL PLAN

DataLyzer FMEA supports full integration of Process Flow, FMEA and Control Plan.

During the process of creating the Process Flow, PFMEA and Control Plan the characteristics can be automatically added from the DISCUS output file.

File										
New Edit View										
Common			Print		Import	Export to			Others	
Part / Process number	Process Name / Operation Description	Machine / Device / Jig / Tool	Characteristic				Class	Method		
			No.	Product	Process	Product / Process Specification / Tolerance		Evaluation / Measurement technique	Sample Size	Sample Frequency
010	Step 10	Machine 10								
020	Step 20	Machine 20A								
		Machine 20B								
030	Step 30	Machine 30								

Figure 4: Example Control Plan

DataLyzer FMEA offers a very flexible import module where you can define templates for import from almost any ballooning software capable of exporting the information to Excel.



When importing characteristics from any file, you will need to add the characteristics to the appropriate process step. When possible, you also need to add the contents of the other fields that are not available in the characteristic file into the FMEA or control plan.

You can accomplish this by first importing the file into an internal table.

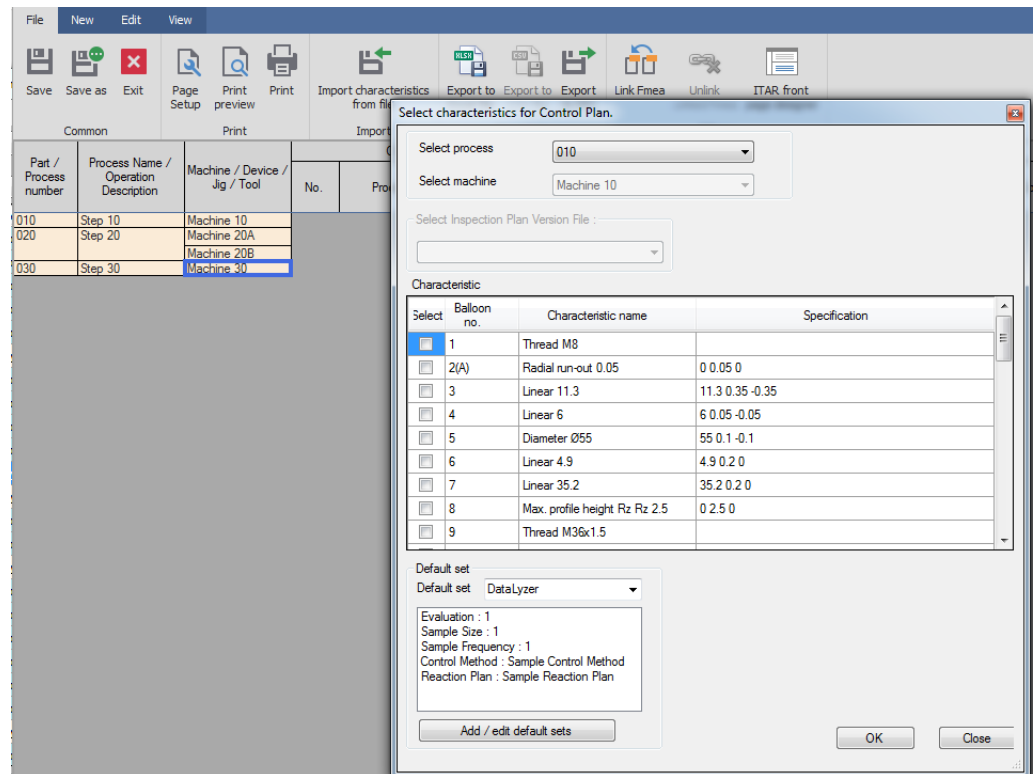


Figure 5: Import table to assign characteristics to process steps

When the file is imported into the table, the data is converted so it will fit in the FMEA/Control Plan format. The table also offers the option to select a default set for the additional fields. For example, a fixed subgroup size is often used for all characteristics. That information can be added in a default set. Another example is if you want to refer to a standard out of control action plan (OCAP) for this product, then you can add this entry as a default for the reaction plan field.

After the default sets are complete, select the characteristics per process step/machine field.

When finished, the characteristics are added to the specific process step and the list is updated. You can then select the following step and select the appropriate characteristics for that step



The screenshot shows a software interface with a menu bar (File, New, Edit, View) and a toolbar with icons for Save, Save as, Exit, Page Setup, Print, and Import/Export options. Below the toolbar is a table with columns for Part / Process number, Process Name / Operation Description, Machine / Device / Jig / Tool, and Method. The table contains data for steps 10, 20, and 30. A dialog box titled 'Select characteristics for Control Plan.' is open, showing a dropdown for 'Select process' (010) and 'Select machine' (Machine 10). Below this is a table of characteristics with columns for 'Select', 'Balloon no.', 'Characteristic name', and 'Specification'. The table lists several characteristics, with 'Linear 4.9' (balloon no. 6) selected.

Part / Process number	Process Name / Operation Description	Machine / Device / Jig / Tool	No.	Product	Process	Product / Process Specification / Tolerance	Evaluation / Measurement technique	Sample Size	Sample Frequency	Control method	Reaction Plan	Filters
010	Step 10	Machine 10	1	Thread M8			1	1	1	Sample Control Method	Sample Reaction Plan	<input type="checkbox"/>
			3	Linear 11.3		11.3 0.35 -0.35	1	1	1	Sample Control Method	Sample Reaction Plan	<input type="checkbox"/>
			6	Linear 4.9		4.9 0.2 0	1	1	1	Sample Control Method	Sample Reaction Plan	<input type="checkbox"/>
			5	Diameter Ø55		55 0.1 -0.1	1	1	1	Sample Control Method	Sample Reaction Plan	<input type="checkbox"/>
			4	Linear 6		6 0.05 -0.05	1	1	1	Sample Control Method	Sample Reaction Plan	<input type="checkbox"/>
020	Step 20	Machine 20A										
		Machine 20B										
030	Step 30	Machine 30										

Figure 6: Assigning characteristics to steps/machine

The process continues until all relevant characteristics are added to the process step.

When the Process Flow, FMEA and Control Plan are ready you can export all required information to the DataLyzer SPC system or you can create inspection sheets if you do not want to use DataLyzer SPC. Both methods can be used to create FAIR reports.

### MSA

Before any measurement is made a full MSA study is required in the APQP process. DataLyzer MSA supports you with this process. The DataLyzer gage management supports calibration and MSA and is integrated with the SPC software so you can pick the characteristics which were entered in the Control Plan directly from the SPC configuration.

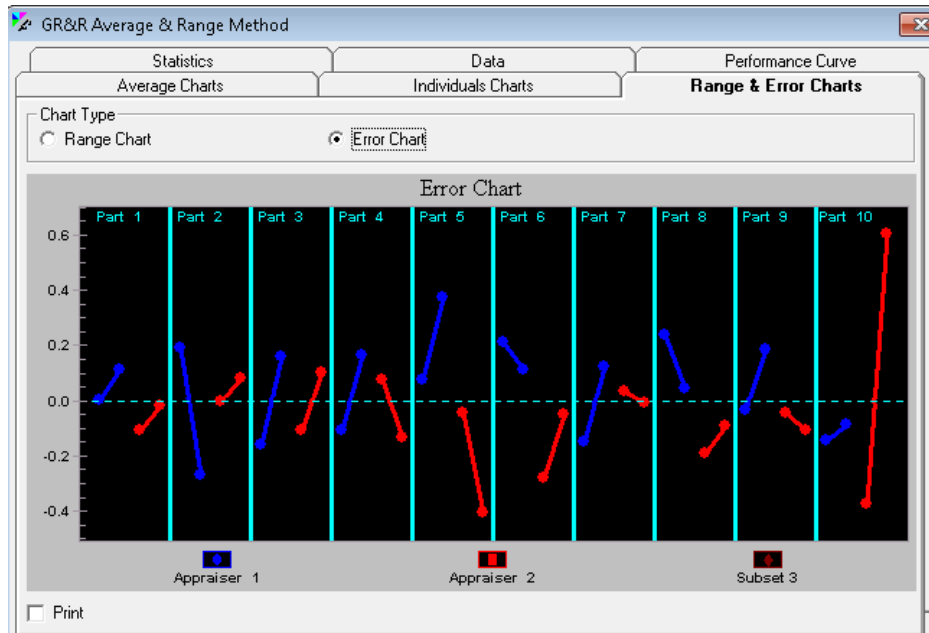


Figure 7: DataLyzer Calibration and MSA analysis

### Control Plan - SPC

When the MSA study is done we can proceed with SPC and/or FAIR. The configuration is already available in the SPC system because it is automatically created from the Control Plan.

The figure shows a software window titled "Groups / Group 1 / Part Name 1" with a sub-header "Characteristic 1". It has an "Overview" section with a search icon. The form is divided into several sections:

- Description:**
  - Characteristic Name:
  - Part Number:
  - Special Field Title:
  - Special Field Contents:
- Plant / Department:**
- Operation:**
- Comment:**
- Operator Information:**
  - Control Plan Reference:
  - Measuring Instructions:
  - Critical Characteristic
- Specifications:**
  - Upper Spec:
  - Lower Spec:
  - Target:
  - Units:
  - Subgroup Size:

At the bottom right, there are "CANCEL" and "Save" buttons.

Figure 8: SPC Chart setup from the Control Plan screen



The DataLyzr SPC is a complete system for real-time SPC. It can be used for product checks, automatic data collection from any source like historians, LIMS systems, MES systems and for example any CMM.

The system can work on premise or in the cloud so you can easily integrate suppliers as well.

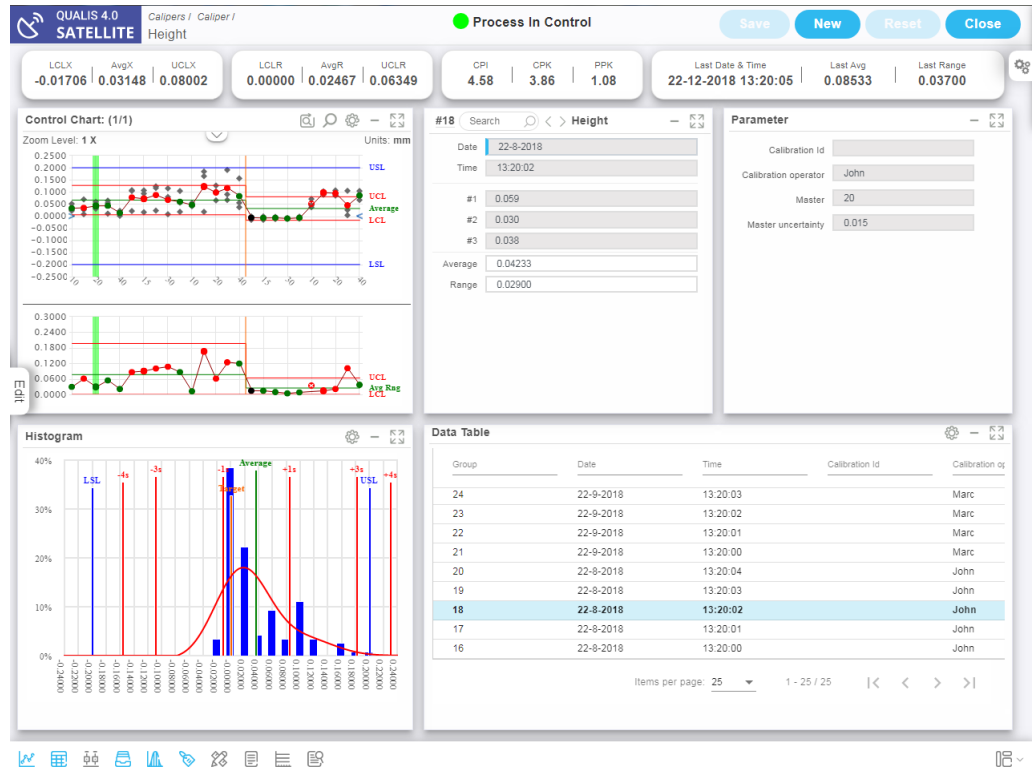


Figure 9: DataLyzr Qualis SPC screen

To produce APQP reports like capability results you need to have maximum flexibility. Data can come from processes through PLC, from different CMMs like PC DMIS, Mitutoyo, Zeiss, Faro etc, from gages, from visual inspection, from camera systems etc etc. Way too much time is lost collecting this data from different sources and producing the internal documents to improve the process and the APQP documents to satisfy customer requirements. With DataLyzr SPC we can collect data from any source. We can integrate with any system like ERP or MES using our API and we offer maximum import flexibility by providing various adaptors and even allowing to run your own Python script.

Because data is collected from any source we can instantly print FAIR reports because all data is available in the DataLyzr database.





AS9102 First Article Inspection									
FORM 3: CHARACTERISTIC ACCOUNTABILITY, VERIFICATION AND COMPATIBILITY EVALUATION									
1. Part Number		2. Part Name			3. Serial Number (see note below)		4. FAI Report		
Characteristic Accountability				Inspection / Test Results					
5. Char Num	6. Ref Location (see note below)	7. Characteristic Designator	8. Requirement	9. Results	10. Designed Tooling/Gauging used to accept product	14.1 Measuring Equipment utilized for FAI	14.2 Acceptance Plan	14.3 Justification for <100% Evaluation	
10	A3	Critical	22.4 0.2 0	22.4					
11	A3		0.5 0.2 -0.2	0.5					
12	A3	Critical	0.5 0.2 -0.2	0.5					
13	B2		3.9 0.2 0	4					
14	B2		10 0.2 -0.2	10					
15			20 0.3 -0.3	20					
16			74.2 0.05 -0.05	74.2					
17			44.6 0.054	44.66					
18			135 0.3 -0.3	135					
19	C2	Critical	78.5 0.3 -0.3	78.5					
20			40 0.025 0	40					
21			60 0.3 -0.3	60					
22	D1		70 0.3 -0.3	70					
23			28 0.2 -0.2	28					
24			2 0.1 -0.1	2					
25			3 0 -0.2	3					
26			7 0.2 -0.2	7					
27			6 0.012 0	6					
28			3 0.2 -0.2	3					
29			1.5 0.2 -0.2	1.5					
3			11.3 0.2 -0.2	11.3					
30			55 0.3 -0.3	55					

Reference location shall include drawing zone, sheet number or section number as applicable.

Signature indicates that all characteristics are accounted for, meet drawing requirements or are properly documented for disposition.

14. Prepared By:  15. Date:

01.67-713-3, June 2008

Figure 10: Example FAIR report printed from DataLyzer SPC

### CMM – SPC

Part of the data might be measured using a CMM. In that case it will be helpful that data is automatically imported from the CMM. DataLyzer offers a solution that the setup of characteristics will be done automatically when importing CMM data. A special import service monitors the CMM data and imports it into the control charts. When a control chart is not existing, it will automatically create the chart based on the data in the CMM file but normally the charts are already existing based on the FMEA/CP process.

Below you see an example how Zeiss Calypso is integrated with DataLyzer SPC and data is imported automatically for 8 CMM machines in production

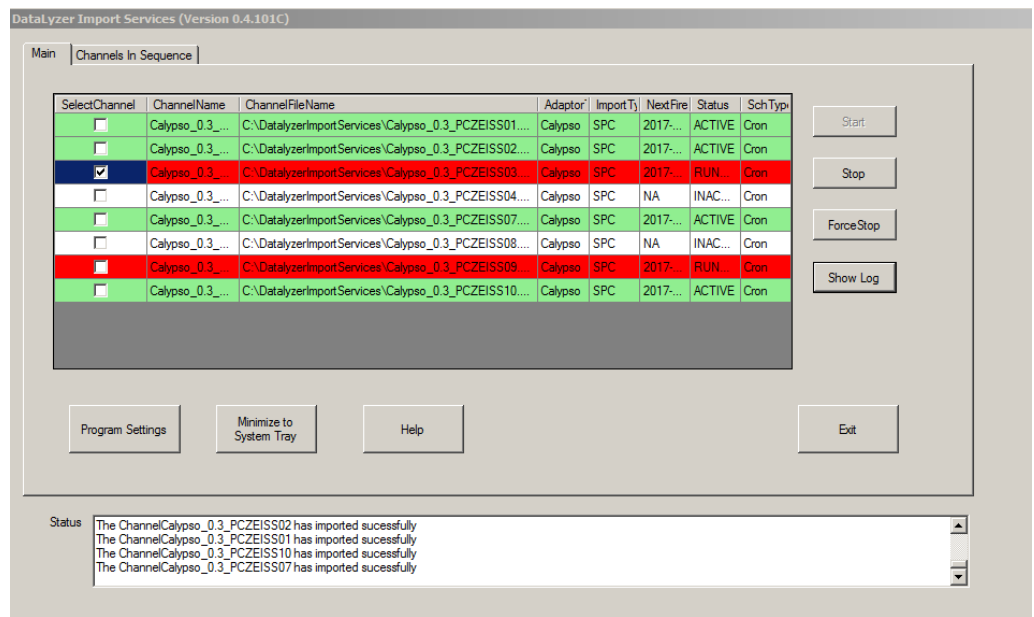


Figure 11: DataLyzer SPC import service for Zeiss Calypso CMM

## Conclusion

DataLyzer is the only supplier worldwide capable of delivering an integrated APQP solution including ballooning from 2D drawing or 3D model, Process Flow, FMEA and Control Plan, inspection sheets, MSA, Automatic import of measurement data, SPC and PPAP and FAIR reporting, CAPA and OEE.

All modules are integrated but you can start with any module depending on your priorities.

Having an integrated solution saves a large amount of time, it reduces errors during the APQP process, helps to comply with all requirements and prevents problems during audits but foremost it improves the quality of the product.

DataLyzer complies with specific APQP requirements for different industries like FMEA VDA AIAG, TS16949, AS13003, AS13004 and AS13006 etc etc

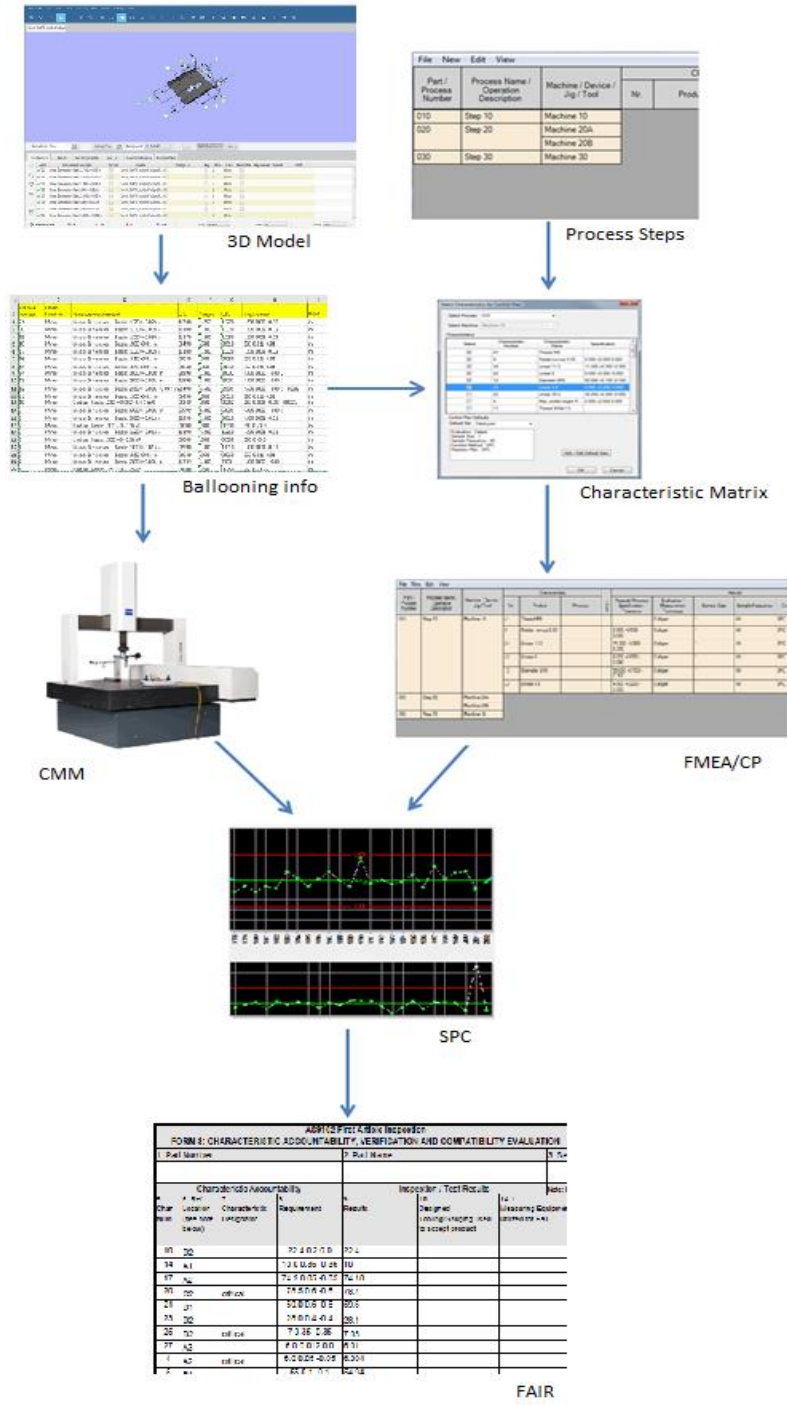


Figure 12: Integrated solution 2D/3D Model - Ballooning – PFD/FMEA/Control Plan – MSA-CMM – SPC - FAIR



## Contact

For further information, please contact DataLyzer International:

### Europe

DataLyzer International bv  
Eindhoven  
Netherlands  
Tel : +31-40-2940980  
Email: [sales@datalyzer.com](mailto:sales@datalyzer.com)  
<https://www.datalyzer.com>

### USA

DataLyzer International Inc.  
Wixom, MI 48393, USA  
Tel : +1-248-960-3535  
Tel : +1 800-553-4772 USA only  
Email: [sales@datalyzer.com](mailto:sales@datalyzer.com)

### Asia

DataLyzer India  
Bangalore  
India  
Tel: + 91 8026615292  
Email: [salesindia@datalyzer.com](mailto:salesindia@datalyzer.com)

For more offices or your local distributor check our website