

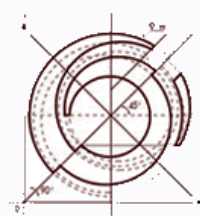
May 30, 2006

ALSTOM

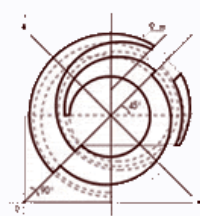
Plant Design in CATIA V5

Christian Nilsson

ALSTOM



- Alstom
 - World-ECS-Växjö-Products-Customer
- CATIA V5
 - Basic Strategy
 - Design of an ElectroStatic Presipitator
 - Layout examples



- Alstom
 - World-ECS-Växjö-Products-Customer
- CATIA V5
 - Basic Strategy
 - Design of an ElectroStatic Presipitator
 - Layout examples

Power



- Sales of around 13.7 billion euros
- Order backlog of 27.2 billion euros
- Employs approximately 70,000 people in over 70 countries
- Listed on Paris stock exchange market

Transport



Marine





Power Turbo-Systems



Power Environment



Power Service



Utility Boilers



Environmental Control System



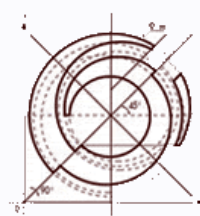
ECS Locations



Total: approx. 1000 employees

★ ECS Corporate Headquarters + French Unit, Paris, France

- Sulphur oxide reduction
 - Dry FGD - NID
 - Wet FGD
 - FLOWPAC
- Nitrogen oxide reduction
 - SCR
- Partikelfilter
 - ESP
 - Fabric Filters
- Customer
 - Power generation (oil, coal)
 - Waste
 - Industrial (cement, paper, aluminium, steel etc.)



- Alstom
 - World-ECS-Växjö-Products-Customer
- **CATIA V5**
 - **Basic Strategy**
 - Design of an ElectroStatic Presipitator
 - Layout examples

- Fully Parametric products
- Quick tools for layout (concept)
 - Ducting
 - Stairs & Gangways
 - Support structures
 - Piping
 - Equipment catalogs
- SmarTeam
 - Archive
 - Workflows
 - Multi disciplines/sites/sub-suppliers/customers
- Process Design (P&ID and HVAC Diagrams)
- FEM
- Electrical

Exterior detail design is not core competence!
Outsourcing to LCE



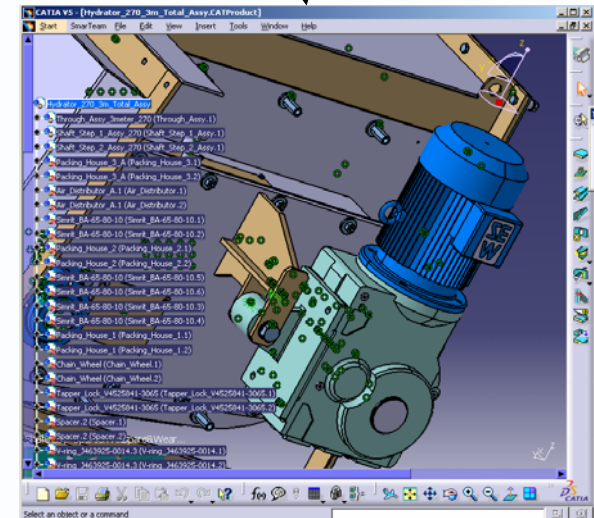
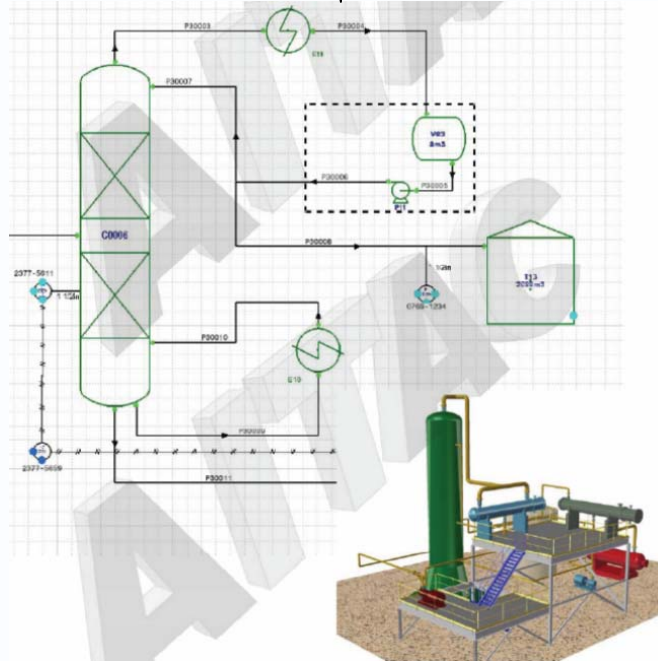


Microsoft Excel - KOREA Pumpade [Read-Only]

File Edit View Insert Format Tools Data ShowTeam Window Help

Calculation Sheet1001

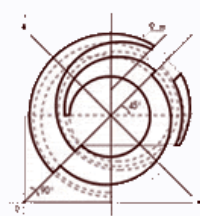
Case REVISION DATE			Oil: 115 % / meanSO2	
No safety margin in the calculations				
PLANT DATA				
Density wet in	1,2088 kg/m ³	0,081 t/m ³	1,2088 kg/m ³	0,081 t/m ³
Density wet out	1,2457 kg/m ³	0,079 t/m ³	1,2457 kg/m ³	0,079 t/m ³
SO ₂ oxidation	2,39	2,39	2,39	2,39
U ₂ O man	29,31 dm ³ /m ³	204 gal/m ³	29,31 dm ³ /m ³	204 gal/m ³
U ₂ O quencher	4,65 dm ³ /m ³	31 gal/m ³	4,65 dm ³ /m ³	31 gal/m ³
Total pressure drop quencher tray bed	4,71 kPa	10,903 inch H ₂ O	4,71 kPa	10,903 inch H ₂ O
Pressure drop fan in position C	6,87 kPa	27,33 inch H ₂ O	6,87 kPa	27,33 inch H ₂ O
Pressure drop quencher	0,59 kPa	2,37 inch H ₂ O	0,59 kPa	2,37 inch H ₂ O
Pressure drop sieve tray	1,04 kPa	4,16 inch H ₂ O	1,04 kPa	4,16 inch H ₂ O
Pressure drop bed	3,08 kPa	12,37 inch H ₂ O	3,08 kPa	12,37 inch H ₂ O
Total area sieve tray	38,3 m ²	413 ft ²	38,3 m ²	413 ft ²
Area gas inlet quencher	4,2 m ²	45 ft ²	4,2 m ²	45 ft ²
Area main airfit	1,40 m ²	15,0 ft ²	1,40 m ²	15,0 ft ²
Area quencher airfit calculated 1	0,10 m ²	1,1 ft ²	0,10 m ²	1,1 ft ²
Area quencher airfit calculated 2	0,217 m ²	2,33 ft ²	0,217 m ²	2,33 ft ²
Air flow main airfit	1,500 Nm ³ /h	953 acfm	1,500 Nm ³ /h	953 acfm
Air flow quencher airfit	111 Nm ³ /h	70 acfm	111 Nm ³ /h	70 acfm
Needed P ₁₀ (P ₁₀ Flow) (extra inhibited)	0,042 bar	13 psi	0,042 bar	13 psi
Needed volume for 12h residence time	111 m ³	3,909 ft ³	111 m ³	3,909 ft ³
Rough volume estimation	242 m ³	8,564 ft ³	242 m ³	8,564 ft ³
Tank single estimation	96 m ³	3,400 ft ³	96 m ³	3,400 ft ³
Rough residence time estimation	26 h	26 h	26 h	26 h
Approximate evaporated water	13,628 kg/h	501 lb/m	13,628 kg/h	501 lb/m
Amount of water for sieve tray under spray	1,534 dm ³ /h	6,8 gpm	1,534 dm ³ /h	6,8 gpm
Amount of water for quencher fan spray	2,376 dm ³ /h	13,1 gpm	2,376 dm ³ /h	13,1 gpm
ABSORBER DIMENSIONS				
L ₁ height quencher zone height	0,350 m	1,148 feet	0,350 m	1,148 feet
L ₂ height sieve tray 1 of 4	2,976 m	9,765 feet	2,976 m	9,765 feet
W ₁ width sieve tray 1 of 4	3,923 m	12,871 feet	3,923 m	12,871 feet
W ₂ width of flow gas inlet	0,757 m	2,485 feet	0,757 m	2,485 feet
H ₁ height of main airfit	8,000 m	26,247 feet	8,000 m	26,247 feet
H ₂ height of main airfit	0,217 m	0,711 feet	0,217 m	0,711 feet



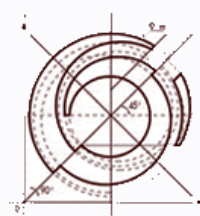
Process Calculation

Detailed Design

- Layout (piping, structural, stairs & WW)
- Structural (FEM)
- Electrical (Ei Cad)



- Alstom
 - World-ECS-Växjö-Products-Customer
- CATIA V5
 - Basic Strategy
 - **Design of an ElectroStatic Presipitator**
 - Layout example



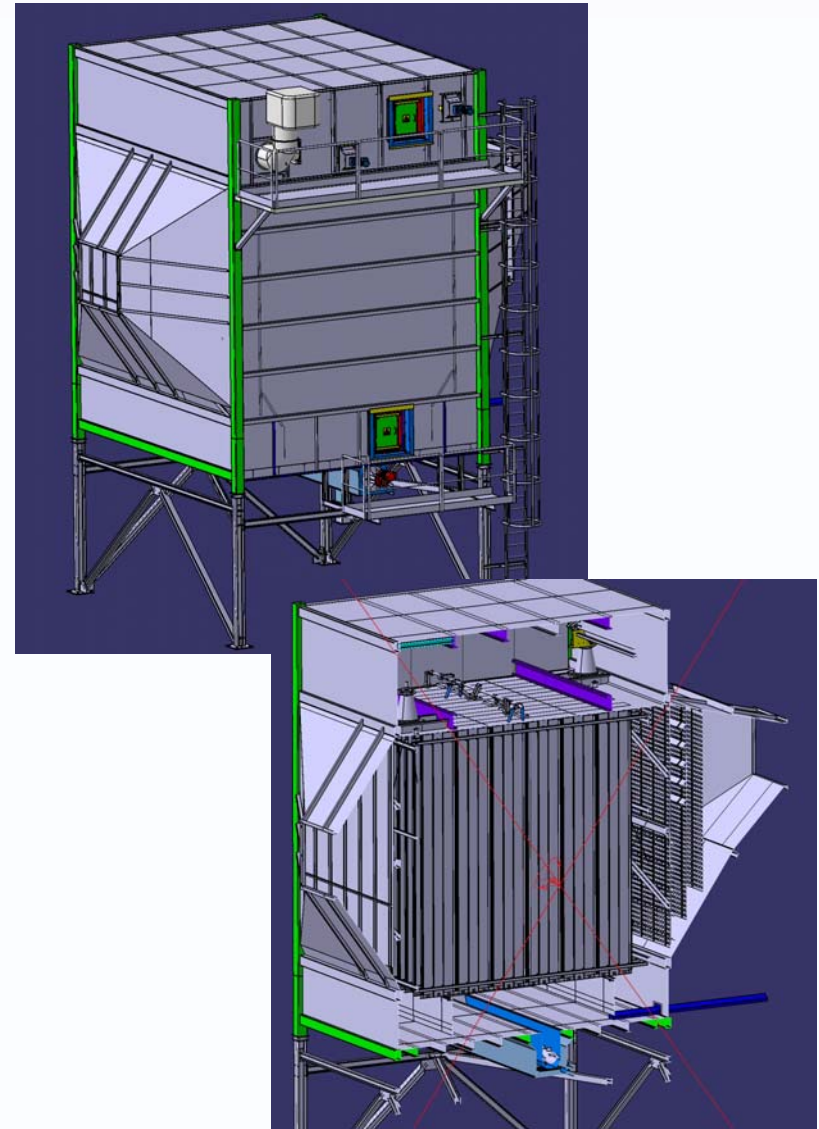
Product Example

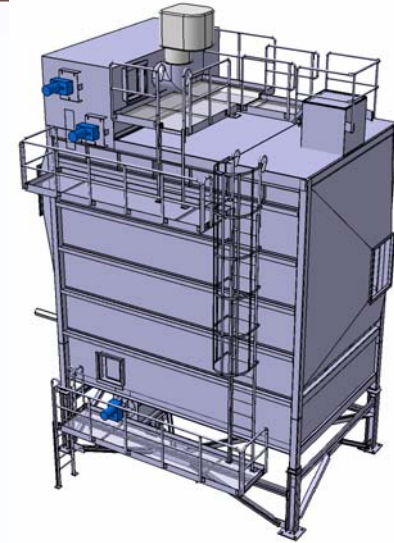
EIPac

- Completely parametric modules (casing, internal equipment, support structure, stairs&ladders, hatches)
- Modules can be added together
- ~50 parameters (sizes, choices etc)
- ~250 production drawings
- BOM
- Delivery List
- Only a few days engineering for the whole product!!!

Elpac 2.0 a parametric product.

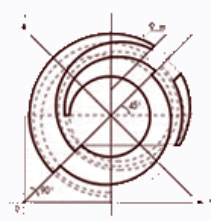
- With Elpac 2.0 parametric design was introduced. (2000-2001)
 - It covered all from small to large sizes dynamically with a compact set of parametric 3D models and attached drawings.
 - Used CAD system was Catia V4 with a database CDM to manage product structures and all Catia documents.
 - Around two weeks of engineering.
 - Sizing and estimation tool in Excel was introduced.





- At 2004 Elpac 2.0 was migrated to Catia V5 and Smarteam and 2005 we improved the product to Elpac 2.1 to a even more efficient parametric solution.
 - Detail drawings of a flange to flange product engineered in one week.
 - All Internals
 - Casing
 - In and outlet funnel
 - Support structure
 - Walkways





Workflow

Pricing and estimation tool in Excel



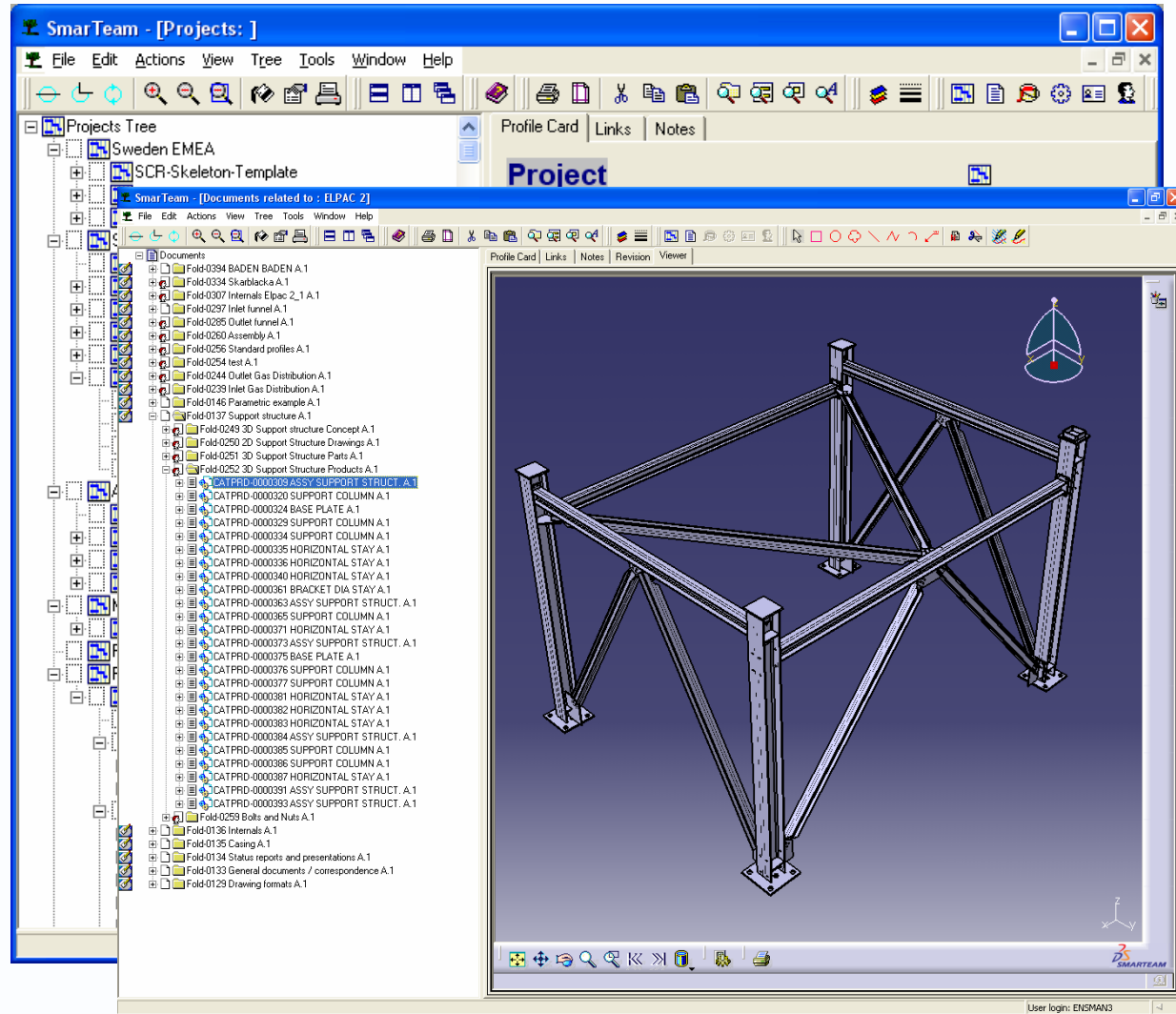
- Key in the product sizing code
- Select the support structure sheet and get your beam sizes.

The screenshot displays a Microsoft Excel spreadsheet used for pricing and estimation. The main data table is organized as follows:

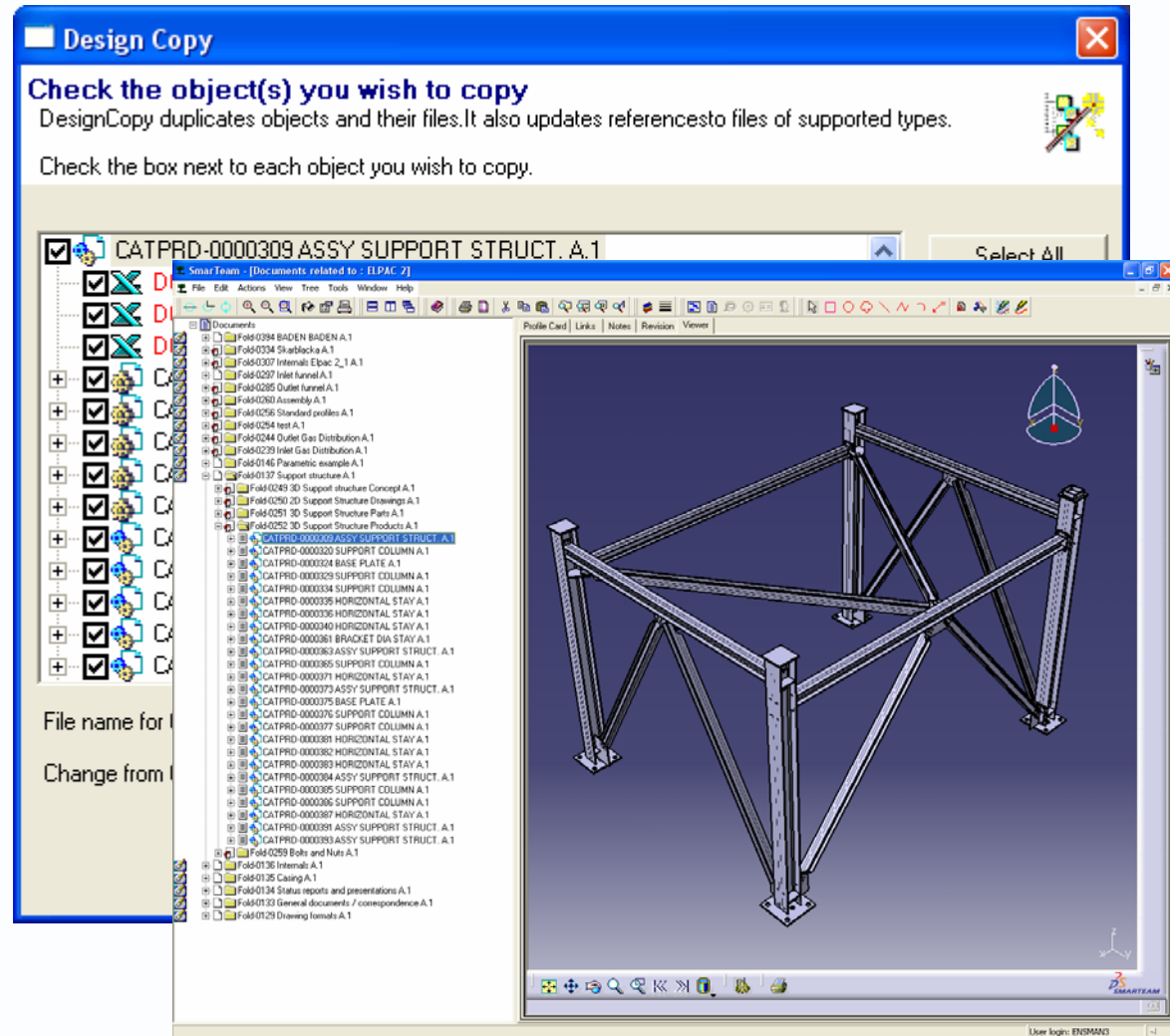
1	2	3	4	5	6	7	8	9	10	11	12	13	14	15	16	17	18	19	20	21	22	23	24	25	26	27	28	29	30	31	32	33	34	35
INDATA																																		
Customer name																																		
No. of ELPAC II	1	FTA																																
Customer name	2	FTA																																
Collecting electrodes	1	FTA																																
Collecting electrodes plate																																		
Airflush -/without = 0 ; W																																		
Eye bolt -/without = 0 ; W																																		
Height of concrete plinth																																		
Height of concrete plinth																																		
Thickness of Thermo																																		
Height of Max																																		
Welding of Stiffeners at																																		
Heating of screw conve																																		
Welding of Stiffeners (De																																		
Currencies																																		
SEK	1,000																																	
DKK	1,200																																	
DEM	4,500																																	
USD	9,800																																	
FIM	1,400																																	
ESP	0,005																																	
EUR	9,650																																	
NNN	1,000																																	
Price																																		

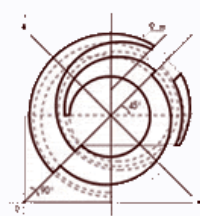
Locate the product template.

- All CAD data are stored in Smarteam database.
- Select the Elpac 2.1 project.
- Locate the Support structure folder and select the template.
- With a built in viewer I can view the 3D model ensuring that I selected the right one.



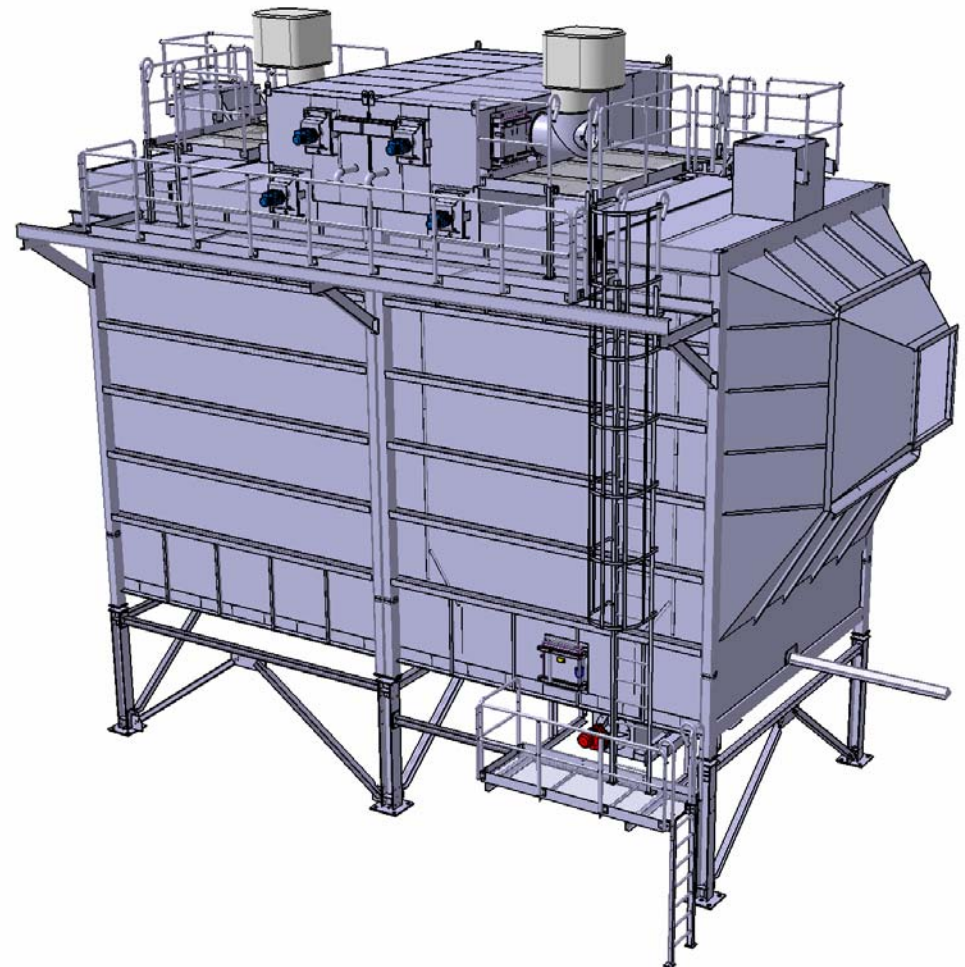
- Design copy
 - Select the parts who should be uniquely copied for the project
 - Attached drawings are copied at the same time
- The result is a new project specific product structure including all 3D components and its attached new drawings
- Next step is to modify the 3D model and update the drawings





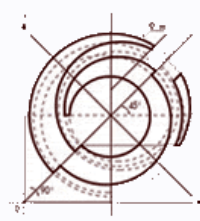
Example project : Älvsbyn ,Sweden

- Support structure
 - 14 Drawings
- Casing bottom
 - 24 Drawings
- Casing top
 - 21 Drawings
- Internals
 - 86 Drawings
- Insulator housing
 - 36 Drawings
- In and outlet funnels
 - 19 + 8 Drawings
- Walkways
 - 67 Drawings
- Assembly drawings and Misc
 - 48 Drawings
- Total 323 drawings



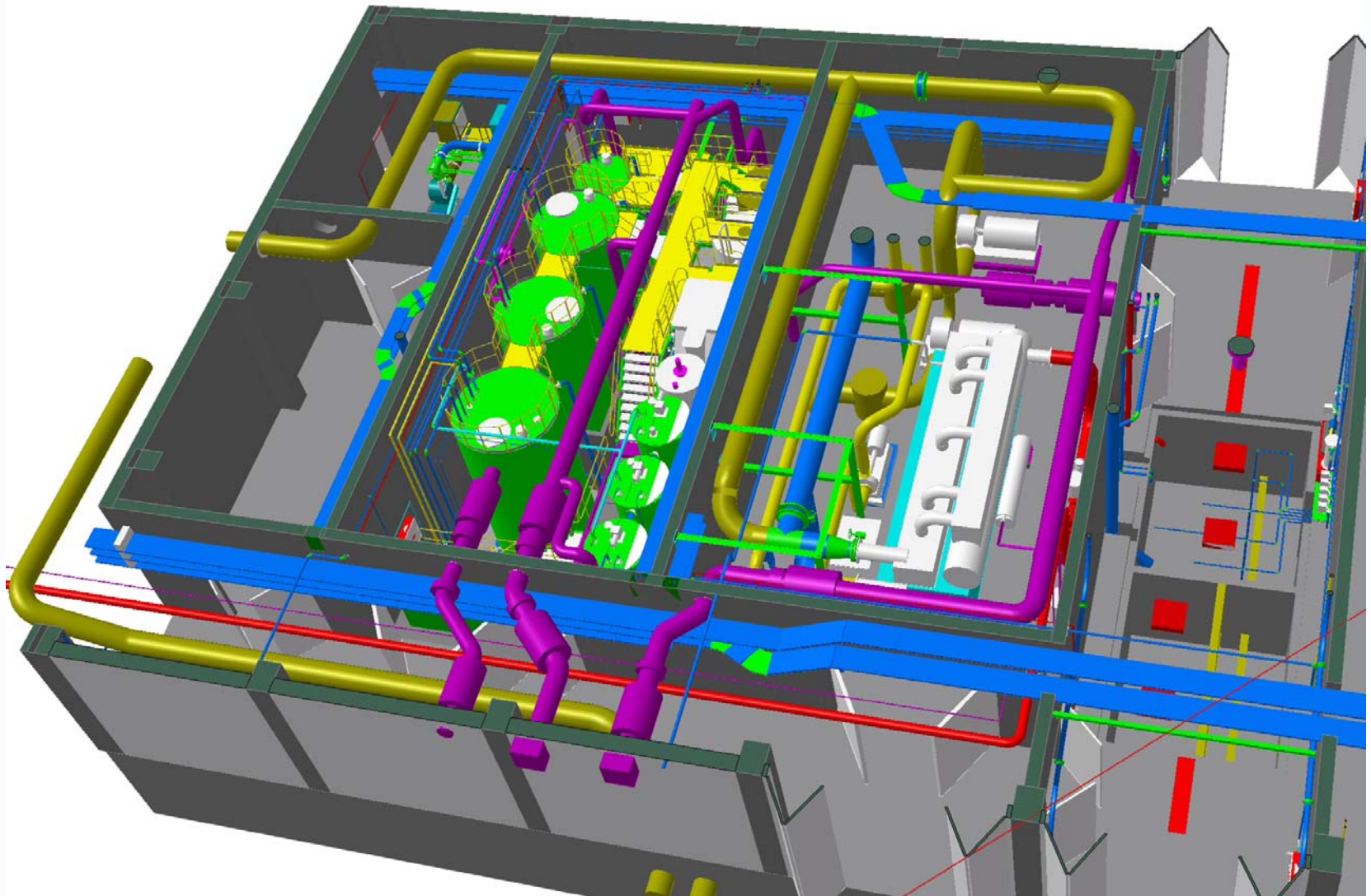
- Major steps

- Excel is used for the sizing; indata from process and customer used for the Elpac size configuration.
- The design template is stored in Smarteam
- Run design copy on the template to get a project specific copy out of the template.
- The copied template is opened in Catia V5.
- New parameters are applied and an update of the 3D model are made
- The drawings and (Bill Of Material) BOM connected to the models are updated
- If needed (customer requirments) a conversion of the drawings to Autocad or PDF format is made



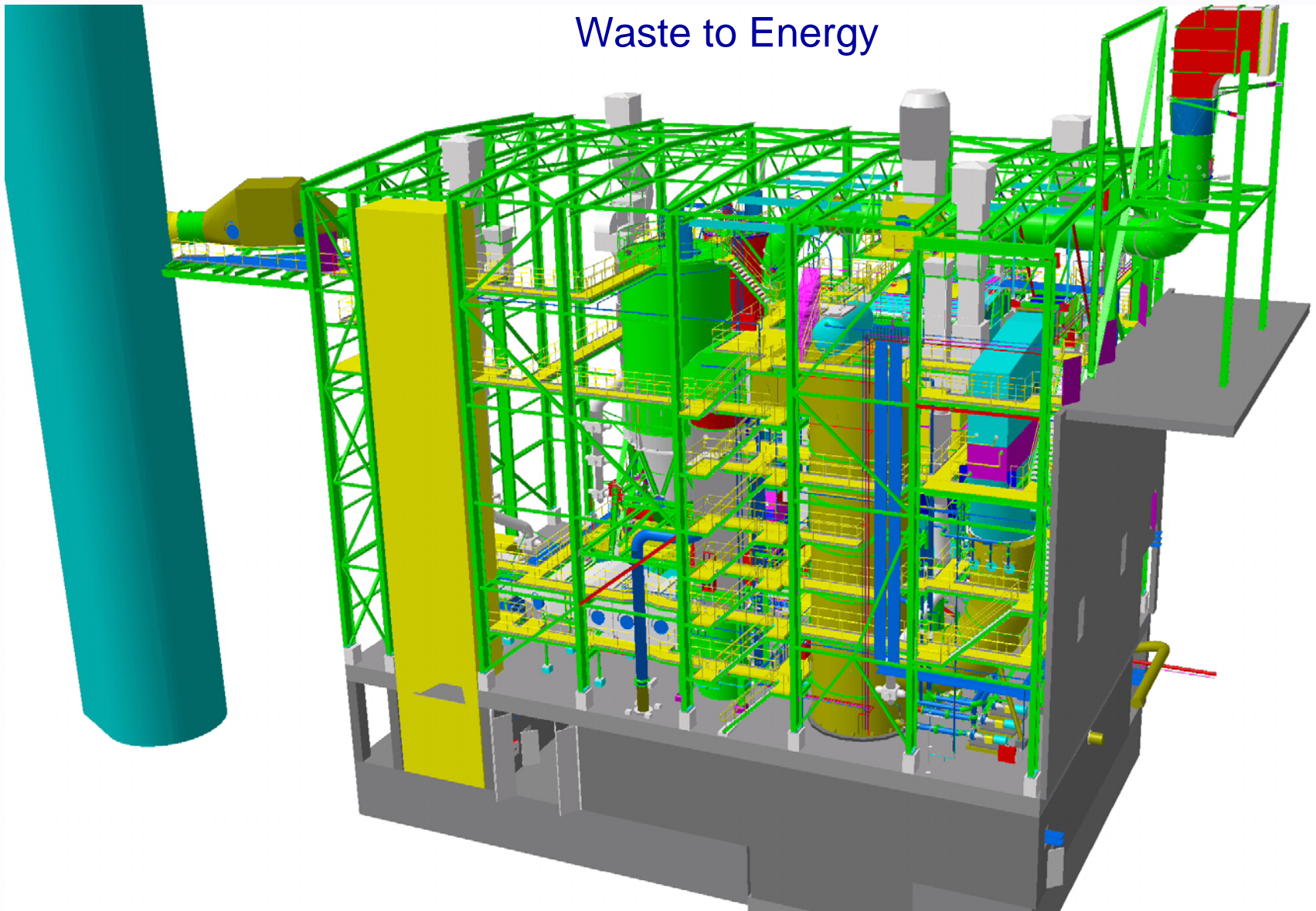
Plants / Projects

Plant Example Jönköping Piping

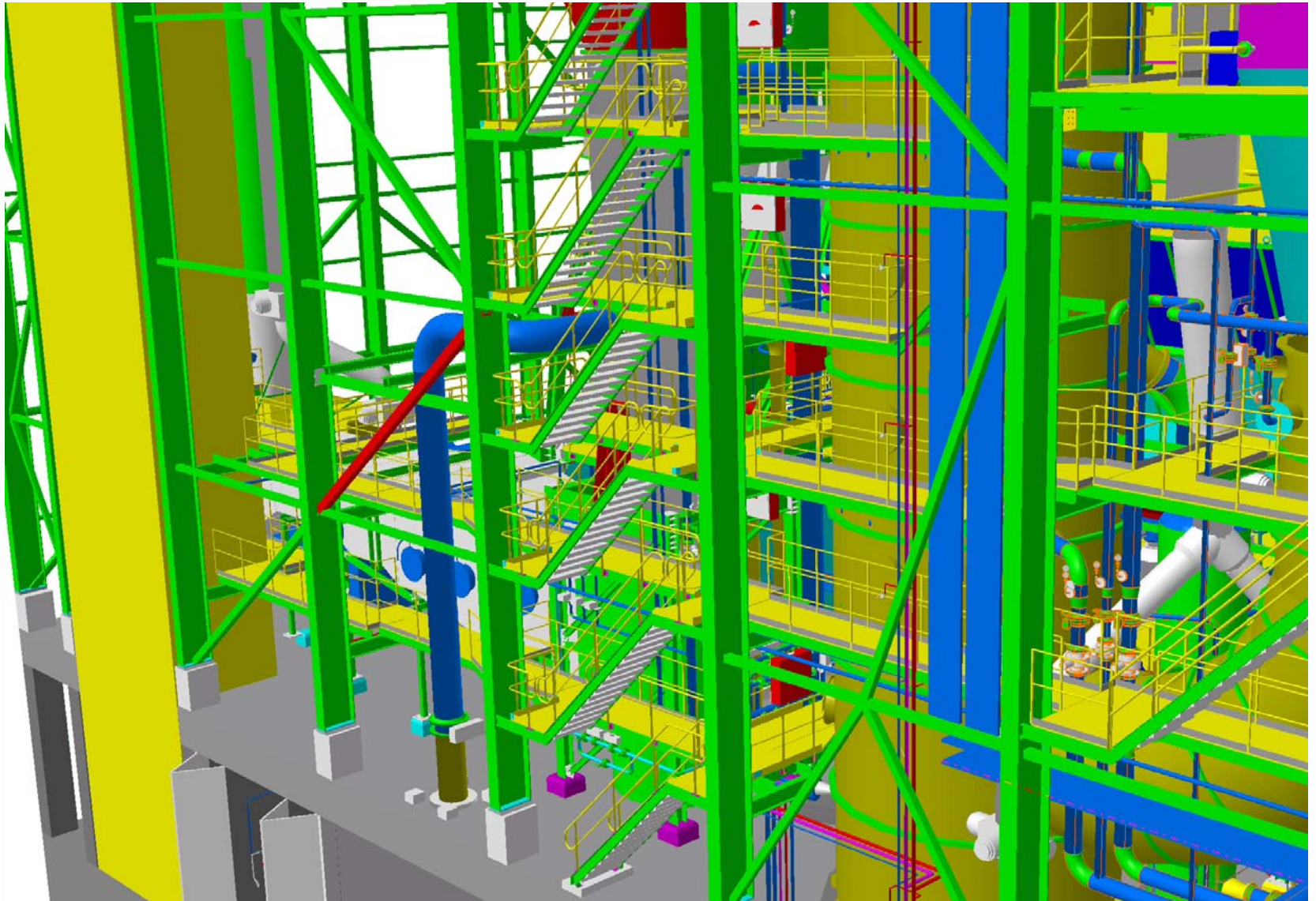


Plant Example Jönköping Layout

Waste to Energy



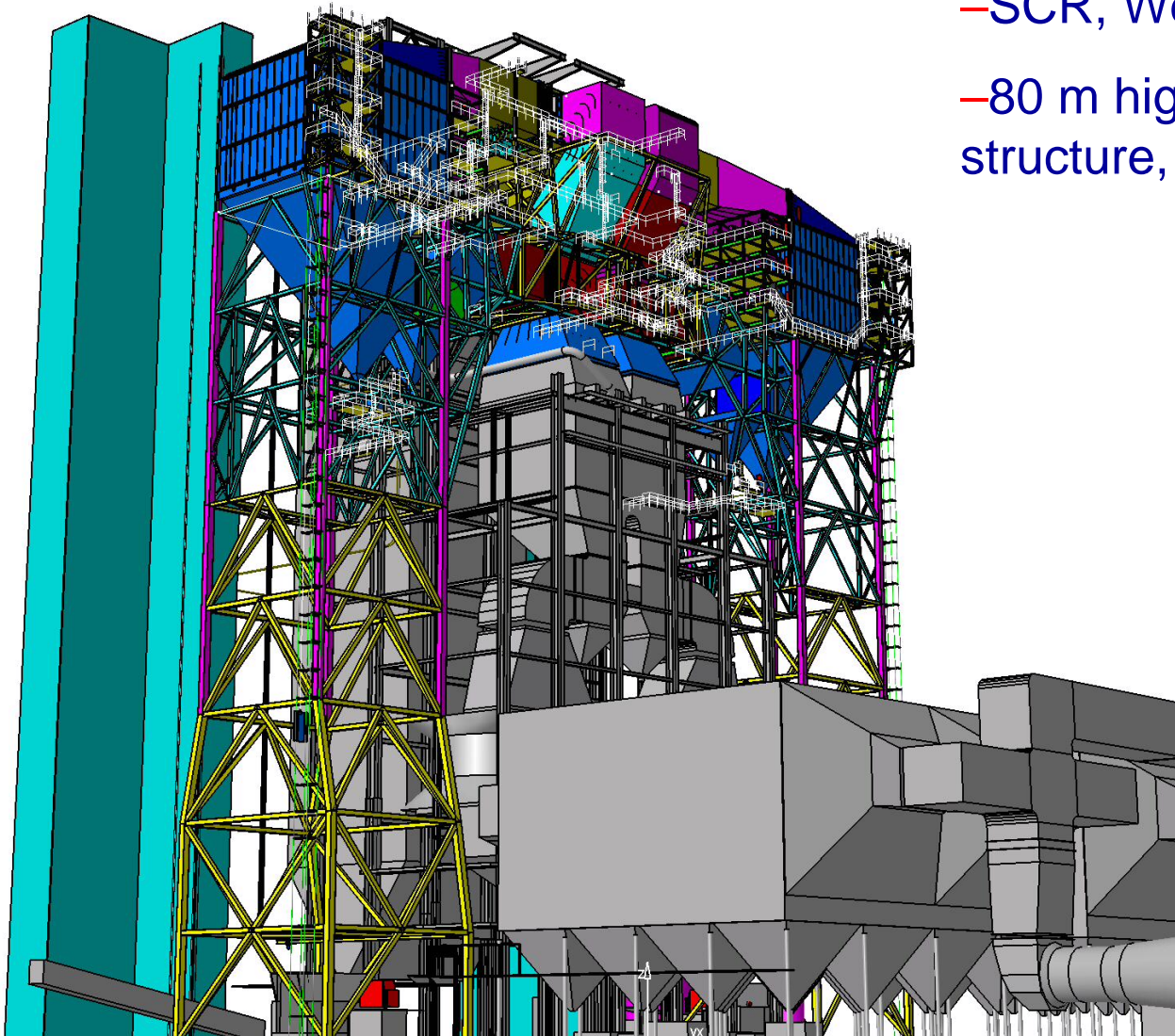
Plant Example Jönköping Stairs & Gangways



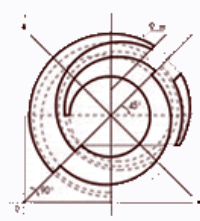
Plant Example EDF

Layout and Support structures

- SCR, Wet FGD
- 80 m high support structure, 1000 tons







Thanks for your attention!
/Christian

christian.nilsson@power.alstom.com