Modification of XML geometry baseline according to comparison with CATIA reference

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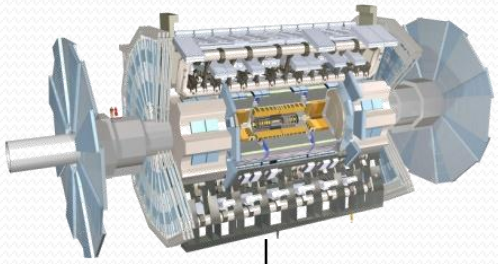
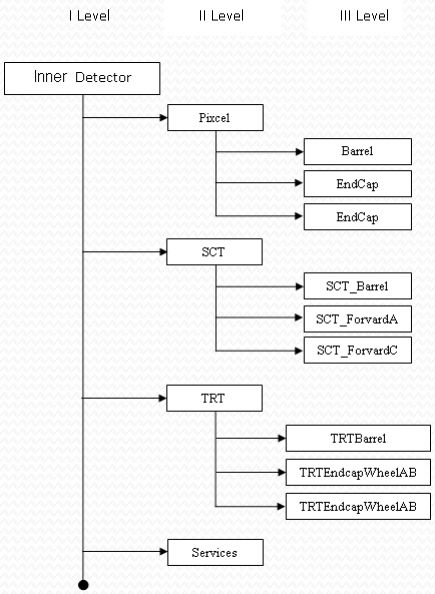
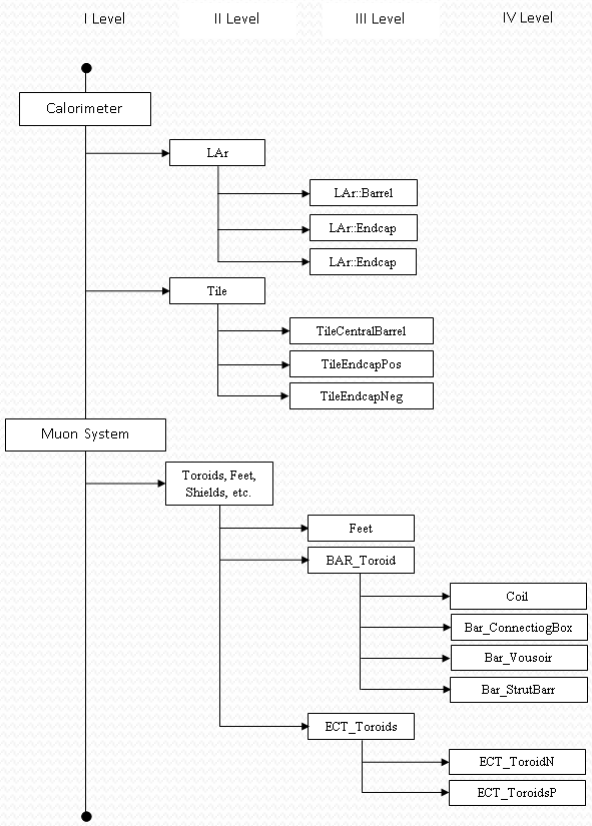
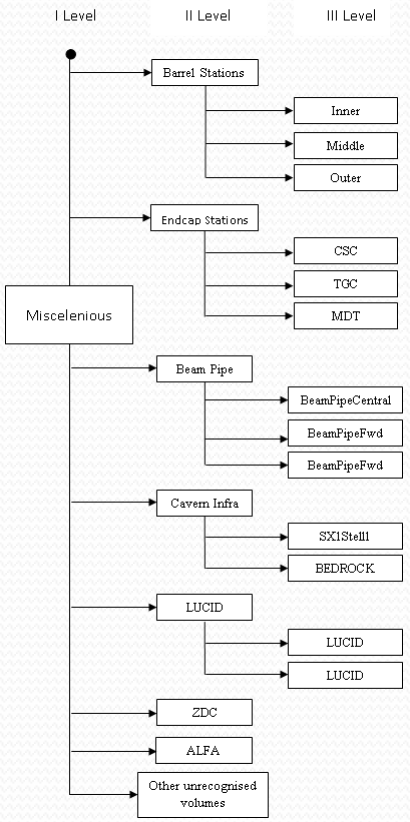
Reconstruction and Simulation



Detector Structure in XML



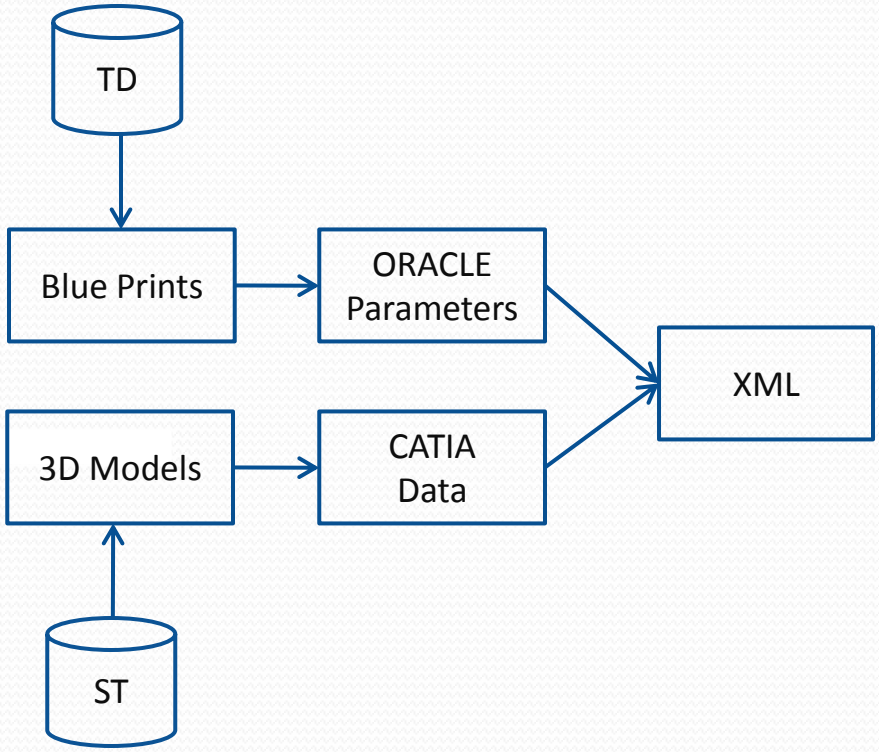




XML Models Preparation

New Method Force:

- Extraction of Models from Smarteam Engineering Database
- Import of XML models in CATIA
- Compare Analysis
- Modification of Component Geometry
- XML conflicts checking



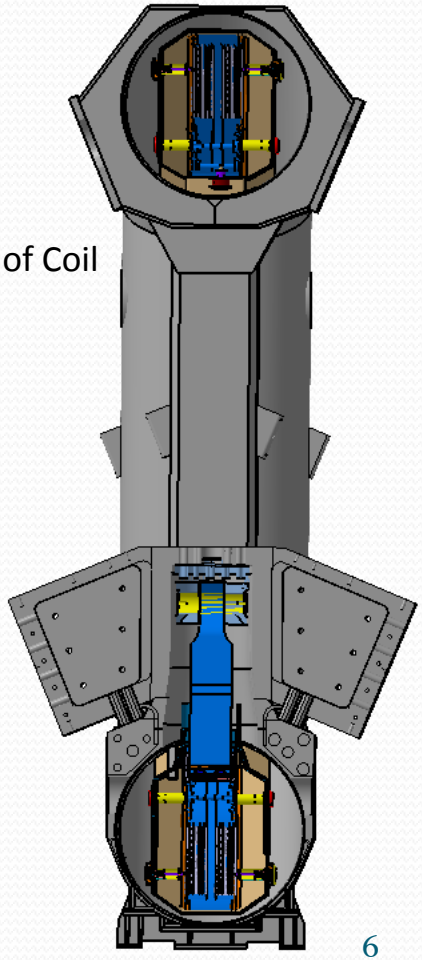
Research Map of Coil Project

1. Reproduction of Coils Engineering Model in CATIA
2. Segmentation and Definition of Mass Properties
3. Compare Analysis of Engineering and XML Models
4. Simplification of Geometry
5. Generation of XML Codes

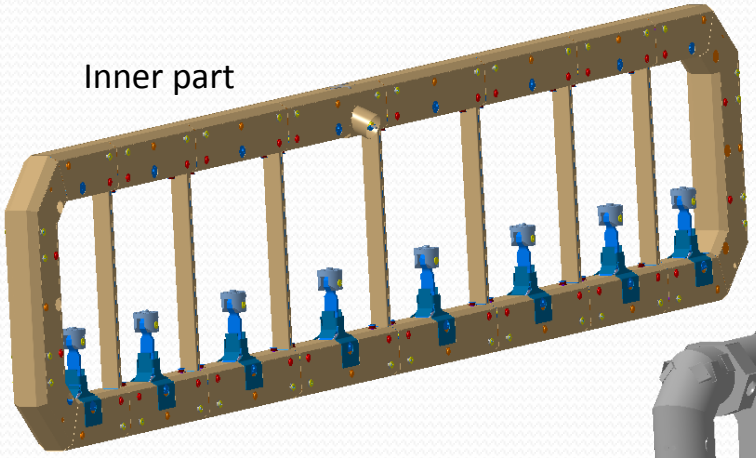
Model Reproduction in CATIA

1. Engineering Model of Coil has been extracted from SmarTEAM database
2. After, model was reproduced in CATIA by adding data from 225 CDD Drawings

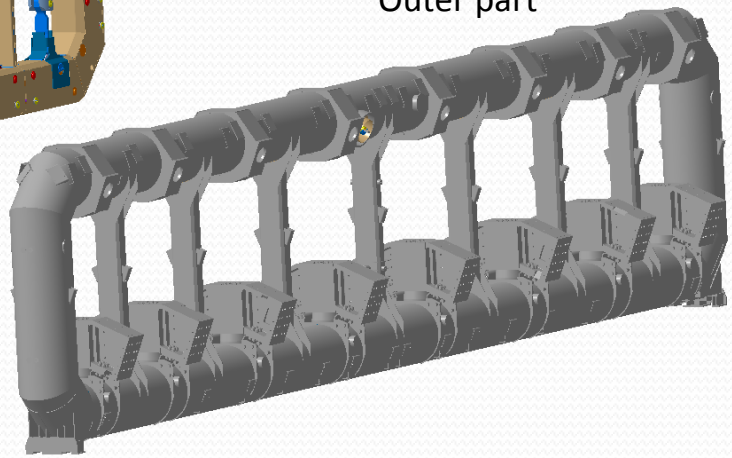
Section of Coil



Inner part



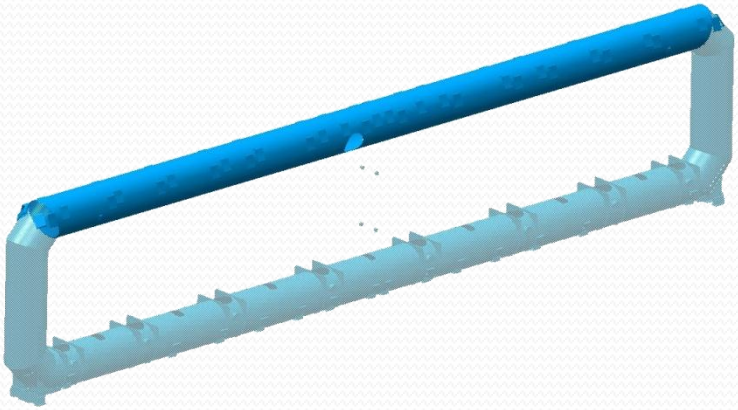
Outer part



Segmentation and Definition of Mass

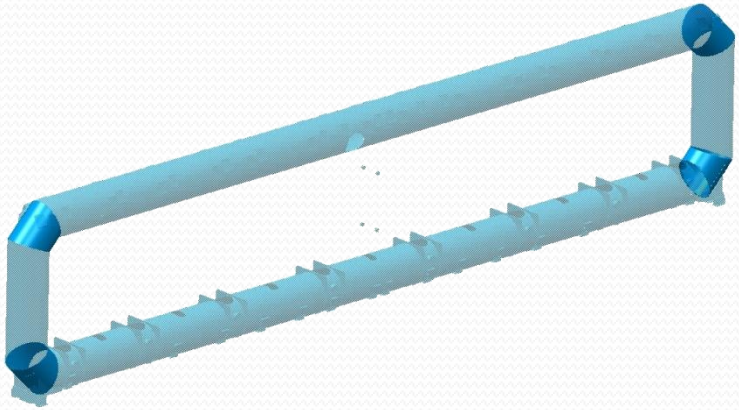
Vol.1. Cryostat Top

	Number of Items	Part Name		Material	Density (kgs/m³)	Volume (m³)	Total Volume (m³)	Total Mass (kgs)
Volume 1	1	Cryostat Top	Assembly	Stainless Steel 304L	8000	1.26	1.26	10 088
							Total Mass (kg): **10 088**	

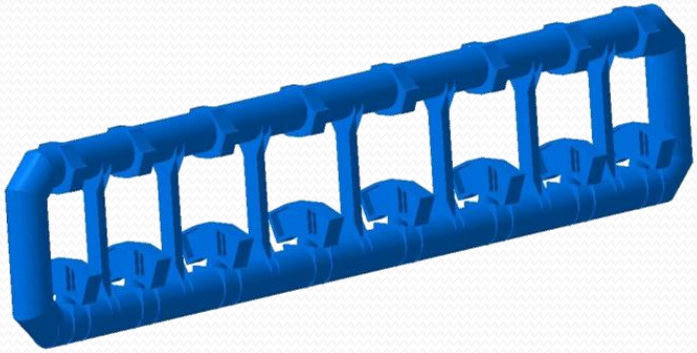


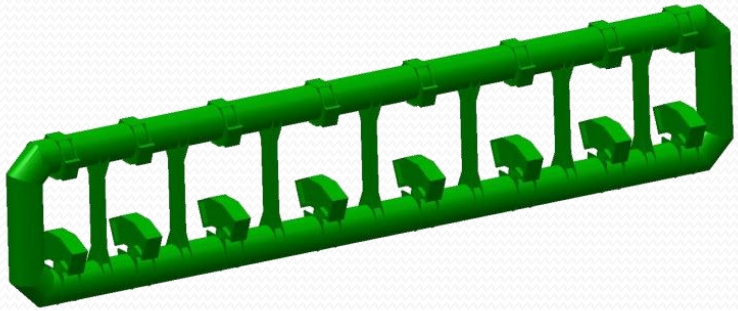
Vol.2, 4, 6, 8. Cryostat Corner

	Number of Items	Part Name		Material	Density (kgs/m³)	Volume (m³)	Total Volume (m³)	Total Mass (kgs)
Volume 2,4,6,8	4	Cryostat Corner	Assembly	Stainless Steel 304L	8000	0.04	0.16	1 344
							Total Mass (kg): **1 344**	



Compare Analysis





Reproduced Model VS XML Model

$\Delta_v = \Delta_{v1} + \Delta_{v2} + \Delta_{v3} + \Delta_{v4} + \Delta_{v5} + \Delta_{v6} + \Delta_{v7} + \Delta_{v8} = 0.124\ m^3 - 0.001\ m^3 + 0.176\ m^3 + 0.198\ m^3 - 0.157\ m^3 + 0.088\ m^3 + 0.149\ m^3 + 2.327\ m^3 = 2.9\ m^3$

$\Delta_v = \Delta_{m1} + \Delta_{m2} + \Delta_{m3} + \Delta_{m4} + \Delta_{m5} + \Delta_{m6} + \Delta_{m7} + \Delta_{m8} = 1138\ kg + 14\ kg + 158\ kg + 1738\ kg - 911\ kg + 778\ kg + 1248\ kg + 7517.9\ kg = 11\ 680.9\ kg$

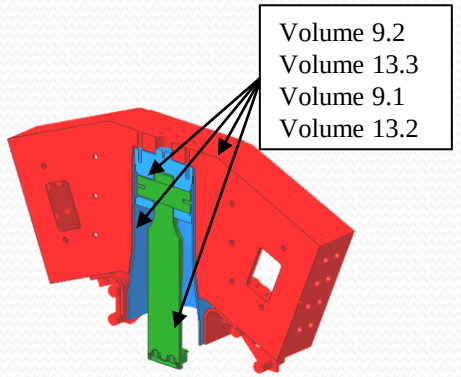
Simplification of Geometry

2 Standard Phases of Synthesis:

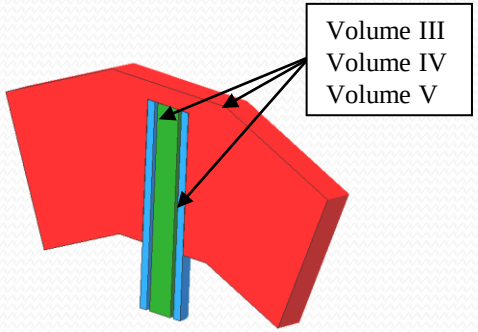
- Grouping of components with same materials and density
- Unify groups with kindred materials and density

Simplification of Voussoirs

	Name	Material	Density	Volume	Weight	
Volume 9	Vossuoir	Aluminium	2650	0.537	1423	Volume 9.1
	Vossuoir	SSTEEL	8000	0.015	120	Volume 9.2
Volume 13	Tie rod	TA5E-ELI	4480	0.016	72	Volume 13.2
	Lug	Z3 CN18-10	8000	0.028	224	
	Shouldered axis	TA5E-ELI	4480	0.005	22	
	Small bar support	Z3 CN18-10	8000	0.0003	2	Volume 13.3
	Piston	Z3 CN18-10	8000	0.0001	1	
	Convex bar	Z3 CND 17-12 Az	8000	0.0001	1	
	Concave bar	Z3 CND 17-12 Az	8000	0.0002	1	
	Tie-Rod Therm. Plate	Al 1050 H22	2705	0.015	41	Volume 13.1

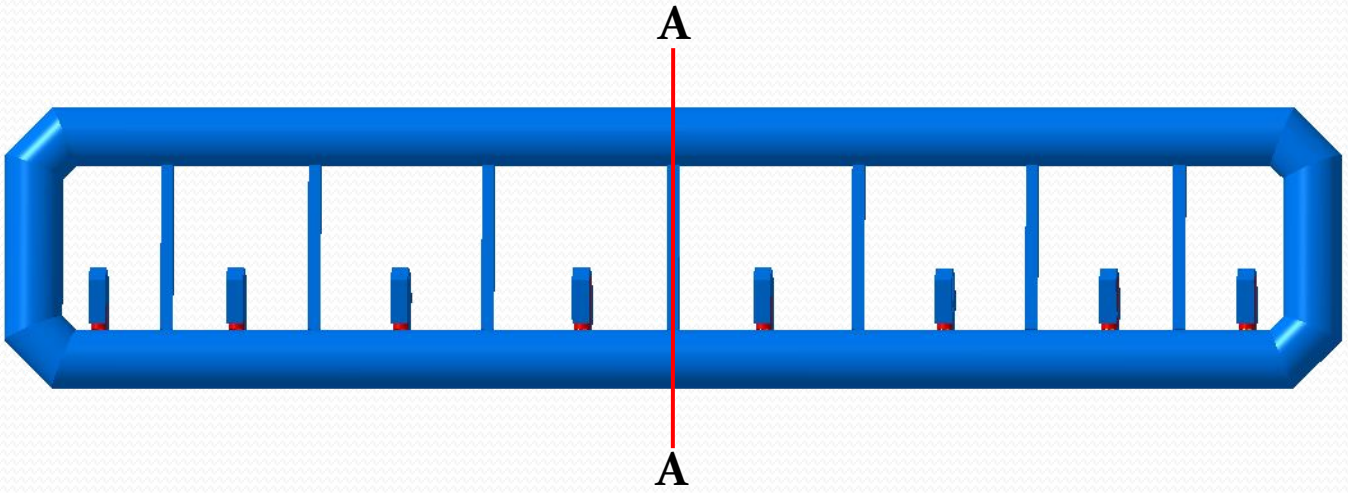


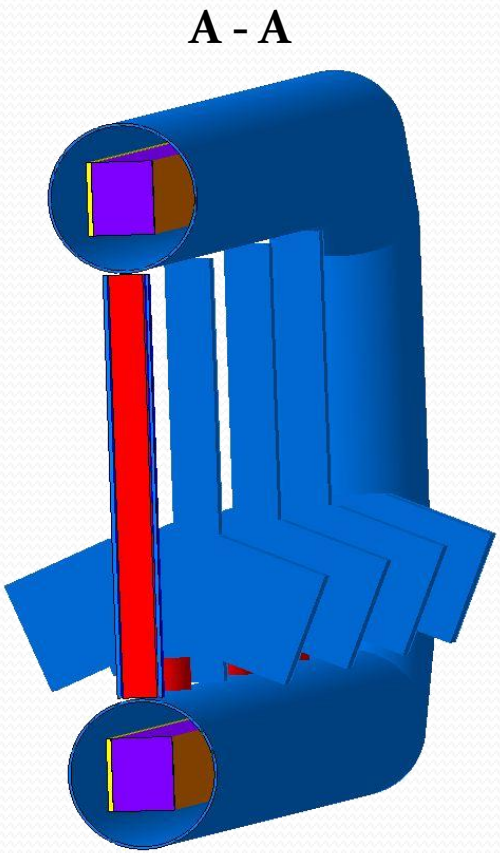
1st Phase



2nd Phase

Simplified Geometry in CATIA





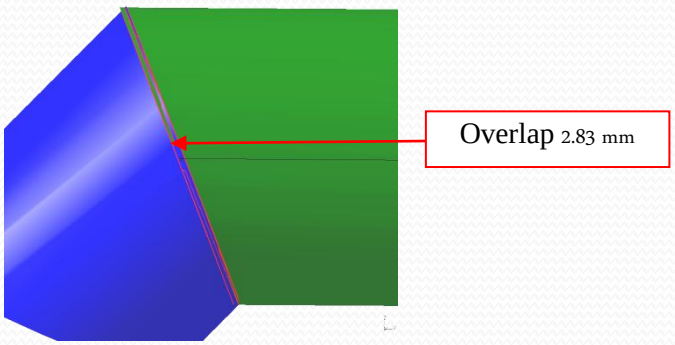
Discrepancies in Volume = 0.05 m^3

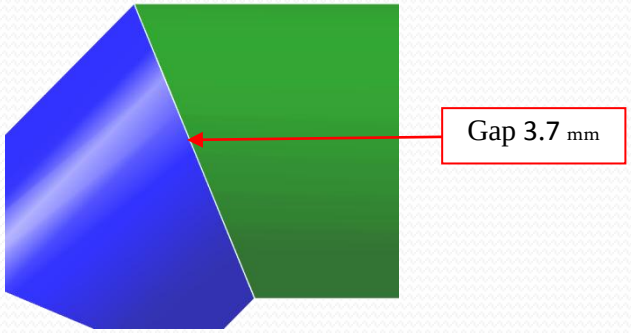
in Mass = 15Kg

Generation of XML Codes

XML causes:

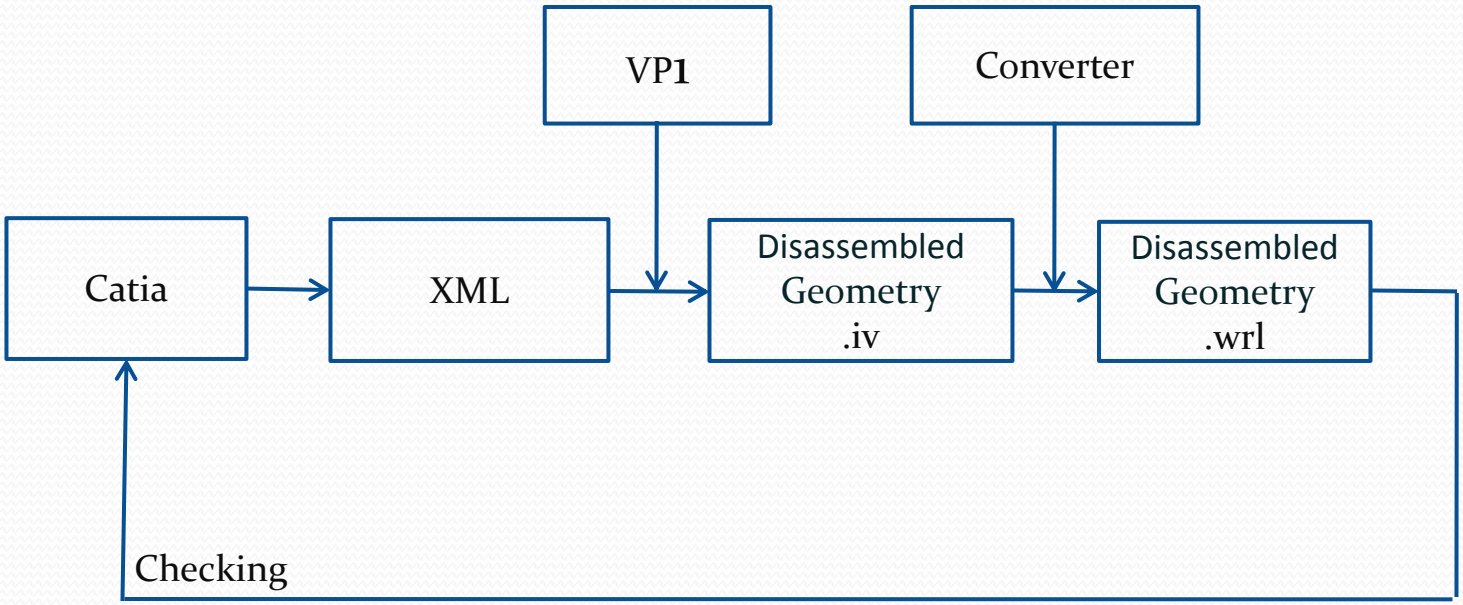
- Necessity for additional detalization of Geometry
- Programming in Z0 position
- Necessity in additional geometrical transactions for final positioning
- Creation of Overlaps and Gaps



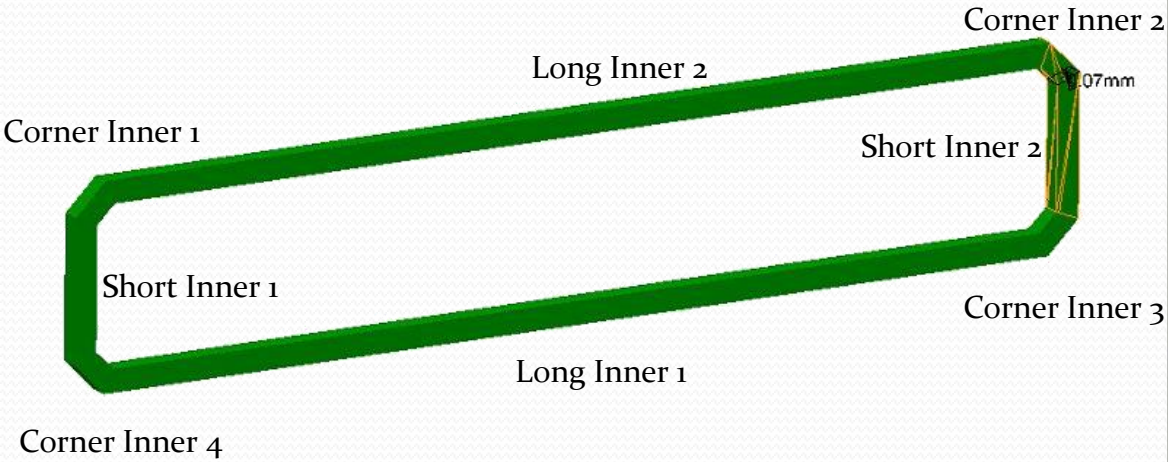


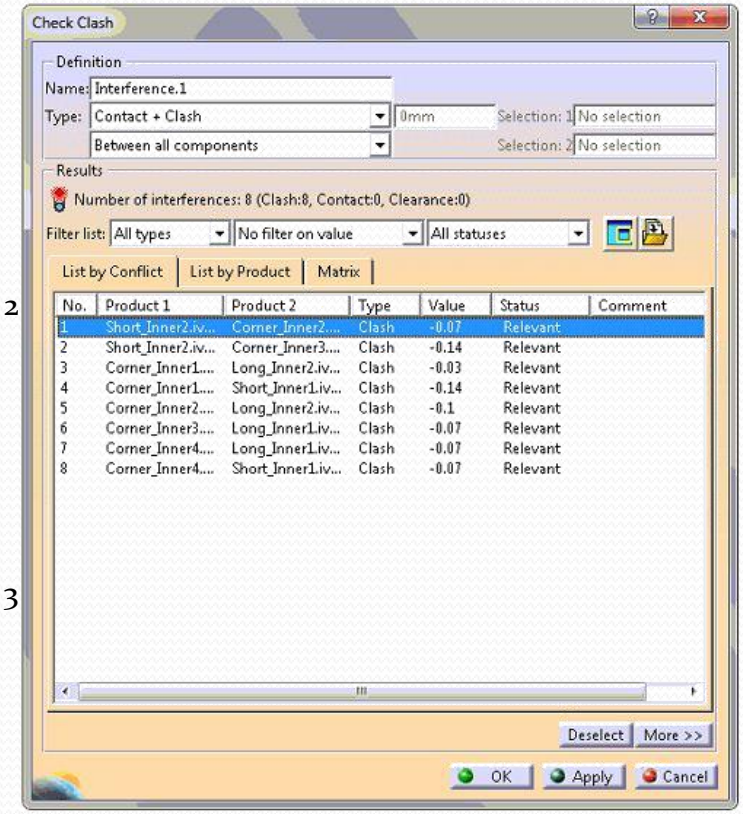
Generation of XML Codes

- Method for XML conflicts detection and evaluation in CATIA



Generation of XML Codes





Generation of XML Codes

1
```
<tubs name="CryoLong_Tube"   material="Iron" Rio_Z="529.4814; 550.; 23648.36"     nbPhi="32" />
<tubs name="CryoShort_Tube"  material="Iron" Rio_Z="529.4814; 550.; 3708.36"      nbPhi="32" />
<tubs name="CryoCorner_Tube" material="Iron" Rio_Z="529.4814; 550.; 1470.436"     nbPhi="32" />
<box  name="CryoCutBox"      material="Iron" X_Y_Z="1600.; 1600.; 600. " />
```

2
```
<subtraction  name="CryoLong_Tube_Up" >
  <posXYZ  volume="CryoLong_Tube" />
  <posXYZ  volume="CryoCutBox"      X_Y_Z=" 0. ; 0. ; -11824.18 "  rot=" -22.5 ;  0 ; 0. "/>
  <posXYZ  volume="CryoCutBox"      X_Y_Z=" 0. ; 0. ; 11824.18 "  rot=" 22.5 ;  0 ; 0. "/>
</subtraction>
<subtraction  name="CryoShort_Tube_Side" >
  <posXYZ  volume="CryoShort_Tube" />
  <posXYZ  volume="CryoCutBox"       X_Y_Z=" 0. ; 0. ; 1854.18"   rot=" 22.5 ; 0 ; 0. "/>
  <posXYZ  volume="CryoCutBox"       X_Y_Z=" 0. ; 0. ; -1854.18 " rot=" -22.5 ; 0 ; 0. "/>
</subtraction>
<subtraction  name="CryoCorner_Tube_4" >
  <posXYZ  volume="CryoCorner_Tube" />
  <posXYZ  volume="CryoCutBox"      X_Y_Z=" 0. ; 0. ; 735.218"    rot=" 22.5 ; 0 ; 0. "/>
  <posXYZ  volume="CryoCutBox"      X_Y_Z=" 0. ; 0. ; -735.218"   rot=" -22.5 ; 0 ; 0. "/>
</subtraction>
```

3
```
<composition  name="CryoTub_Sector" >
  <posXYZ  volume="CryoLong_Tube_Up"       X_Y_Z="0. ; 2110.  ; 0. "          rot=" 0. ; 0. ; 0. " />
  <posXYZ  volume="CryoLong_Tube_Up"       X_Y_Z="0. ; -2110. ; 0. "          rot=" 0. ; 0. ; 180. " />
  <posXYZ  volume="CryoShort_Tube_Side"    X_Y_Z=" 0.; 0.; 12080."            rot=" 90. ; 0 ; 0 " />
  <posXYZ  volume="CryoShort_Tube_Side"    X_Y_Z=" 0.; 0.; -12080."           rot=" -90 ; 0 ; 0 " />
  <posXYZ  volume="CryoCorner_Tube_4"      X_Y_Z=" 0; 1819.732; 11789.731"    rot=" 45. ; 0. ; 0 " />
  <posXYZ  volume="CryoCorner_Tube_4"      X_Y_Z=" 0; 1819.732; -11789.731"   rot=" -45. ; 0. ; 0 " />
  <posXYZ  volume="CryoCorner_Tube_4"      X_Y_Z=" 0; -1819.732; -11789.731"  rot=" -135. ; 0. ; 0 " />
  <posXYZ  volume="CryoCorner_Tube_4"      X_Y_Z=" 0; -1819.732; 11789.731"   rot=" 135. ; 0. ; 0 " />
</composition>
```

- According to Given Structure it was generated XML code for the full Coil
- Code consists of 200 programming strings

Conclusions

1. Creation of precise descriptions of ATLAS detector components on the base of engineering data is actual task for the Reconstruction and Simulation
2. Implementation of CATIA provides efficient way for the comparison of XML descriptions with Engineering models
3. Compare analysis should be done by CATIA DMU algorithms
4. Geometry export from XML to CATIA should be done on the base of facet representation of geometry (*.wrl* file)
5. New method of visualisation and calculation of XML overlaps and Gaps on the base of CATIA, was developed
6. For the ATLAS detector Coils – New models reproduction, Compare analysis, Simplification and XML code generation have been done

Thank you for Attention