XML Description of Beam Pipe - "Light" Geometry

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1   Introduction

The XML description[1] of beam pipe geometry is based on engineering drawings of beam pipe with the proposed numbers [2] regarding materials and thicknesses. Some simplification of the real design is done for complicated shapes.

2   XML File Structure

The XML description of the beam pipe can be found in the
$LHCBSOFT/Det/XmlDDDB/v*/DDDB/Pipe directory.

structure.xml file contains the *detector element* "Pipe".

The whole beam pipe is divided into 7 sections. The section 1 refers to the interface between vertex tank and vacuum chamber. For the moment no description of this section is provided.

The main geometry.xml file contains

- *reference*[3] to "BeamPipe" *logical volume*;

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[1] Consistent with Det/DetDesc/v10r*.

[2] Private communication with Gloria Corti; $LHCBSOFT/SICB/dbase/v248r0/cdf/pipe9.0.cdf.

[3] In the following LHCb XML terminology is used.

- catalog of *references* to "SectionN" catalogs (N = 2,..,7);

- definition of geometrical parameters of whole beam pipe.

The names of geometry parameters are mnemonic and always start with "Pipe∗". A full list of parameters can be found in the Appendix.

Each PipeSectN.xml file contains "/dd/Geometry/Pipe/SectionN" catalog of *logical volumes references* related to Pipe Sections and their simple elements.

The Pipe.xml file, related to XML description of beam pipe as a whole, and the XML description of pipe sections with their elements SectionN.xml are located in the $LHCBSOFT/Det/XmlDDDB/v∗/DDDB/Pipe/Sections directory.

Catalog "/dd/Materials/Pipe" of specific beam pipe materials can be found in $LHCBSOFT/Det/XmlDDDB/v∗/DDDB/materials/PipeMaterials.xml. The materials names start also with "Pipe∗".

3   Beam Pipe Sections

Each of the 6 pipe sections is defined as a *logical volume* **without shape and material**[4] with simple elements installed without clearance between them. Such simple elements are defined as Cylindrical and Conical Sections, Flanges[5] and Bellows (Figure 1). All pipe elements of a given type are numbered sequentially through the whole beam pipe.

Flanges with their specific material, are positioned "around" the conical or cylindrical tubes. Even if sometimes the tube is made of a different material than the flange, the amount of "wrong" material is negligible.

Each Bellow is simplified as a *logical volume* with 2 conical tubes and a cylindrical tube in between or in the middle. In the present configuration beam pipe contains 4 Bellows. The thickness of pipe walls varies from 1.0 mm to 4.0 mm in the various sections.

Conical or cylindrical tubes with material="Vacuum" are positioned into each section to provide vacuum filling inside the beam pipe. Outer radius of such elements is exactly the same as the corresponding inner radius of pipe vacuum chamber. Number of "VacuumSectionN" coincides with PipeSectionN".

The different sections are illustrated in Figures 2-7. The contents of "PipeSectionN" *logical volumes* with installed simple element *physical volumes* and corresponding *logical volumes* are presented in the attached tables. Reference to the engineering drawings

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[4]Following the notion of "Assembly" from GEANT4 toolkit.

[5]In XML description <tubs> and <cons> corresponding to cylindrical and conical tubes.

names of the pipe fragments are included in the tables, since they are differ from XML ones.
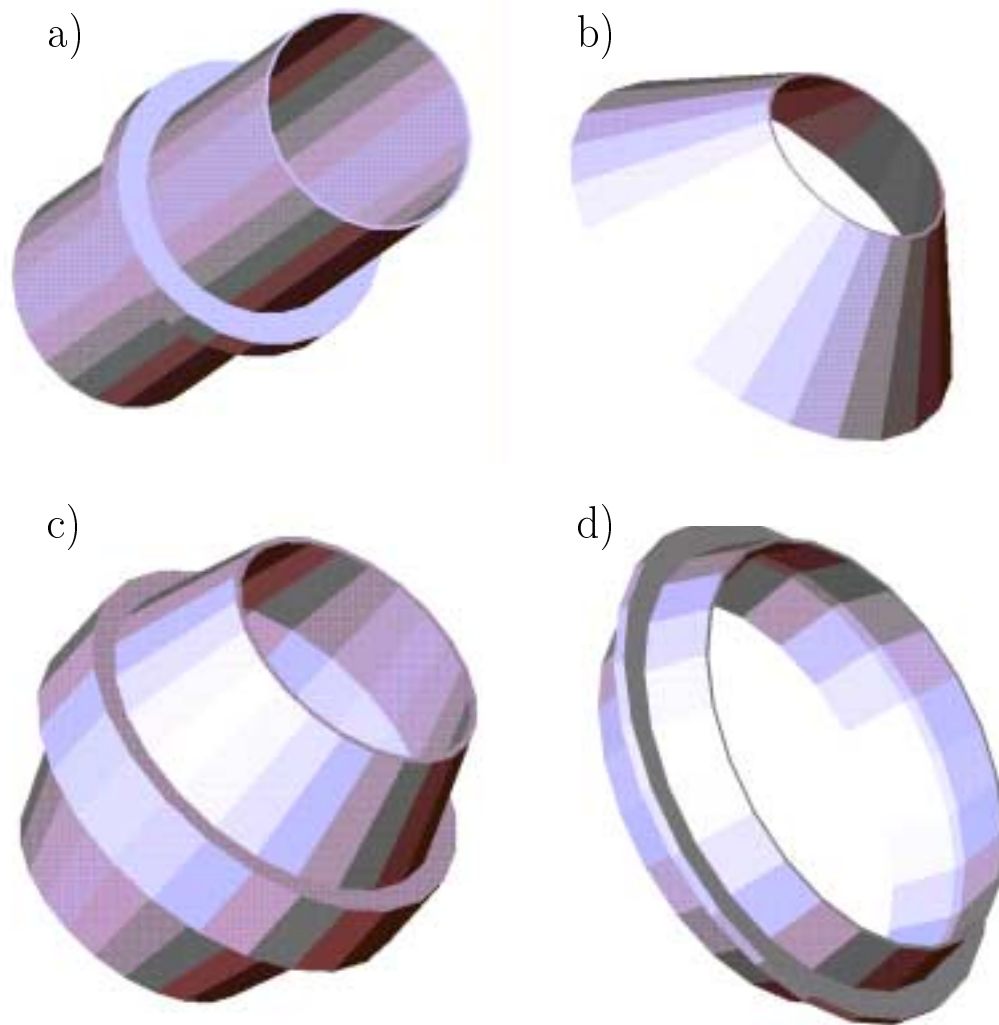

Figure 1: Example of simple elements of Pipe Sections: a) Cylindrical Section with Ring; b) Conical Section (-37^0); c),d) Bellow Sections.

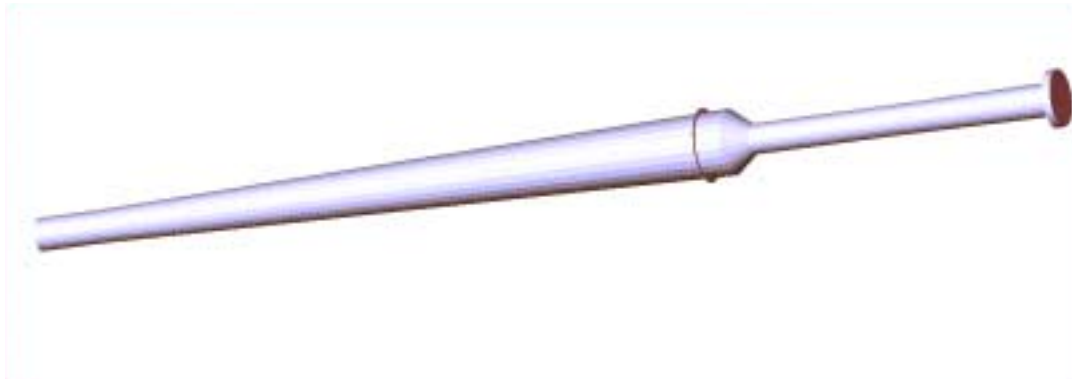| "Pipe Section 2" (*Engineering Drawings: "RB84-1"*)				
physical volumes	*logical volume*	solid	material	angle
"CylindricalSection1"	"CylSect1"	\<tubs\>	"PipeBe"	
"VacuumSection2a"	"VacuumSect2a"	\<tubs\>	"Vacuum"	
"ConicalSection1"	"ConSect1"	\<cons\>	"PipeBe"	25 mrad
"ConSect1Flange1"	"Flange1"	\<cons\>	"PipeAlCu"	
"VacuumSection2b"	"VacuumSect2b"	\<cons\>	"Vacuum"	25 mrad
"ConicalSection2"	"ConSect2"	\<cons\>	"PipeBe"	(-37^0)
"VacuumSection2c"	"VacuumSect2c"	\<cons\>	"Vacuum"	(-37^0)
"CylindricalSection2"	"CylSect2"	\<tubs\>	"PipeBe"	
"VacuumSection2d"	"VacuumSect2d"	\<tubs\>	"Vacuum"	
"ConicalSection3a"	"ConSect3a"	\<cons\>	"PipeBe"	10 mrad
"ConicalSection3b"	"ConSect3b"	\<cons\>	"PipeBe"	10 mrad
"ConSect3Flange2"	"Flange2"	\<cons\>	"PipeAl"	
"VacuumSection2e"	"VacuumSect2e"	\<cons\>	"Vacuum"	10 mrad

Figure 2: Beam Pipe Section 2 starts at z $\sim$ 1m, length $\sim$1.8m.

"Pipe Section 3" (Engineering Drawings: "Transition 1")				
physical volumes	logical volume	solid	material	angle
"ConSect4Flange3"	"Flange3"	<cons>	"PipeAl"	
"ConicalSection4a"	"ConSect4a"	<cons>	"PipeAlCu"	10 mrad
"ConSect4Bellow1"	"BellowSect1"			
"ConicalSection4b"	"ConSect4b"	<cons>	"PipeAlCu"	10 mrad
"ConSect4Bellow2"	"BellowSect2"			
"ConicalSection4c"	"ConSect4c"	<cons>	"PipeAlCu"	10 mrad
"ConSect4Flange4"	"Flange4"	<cons>	"PipeAlCu"	
"VacuumSection3"	"VacuumSect3"	<cons>	"Vacuum"	10mrad
"BellowSect1", "BellowSect2"				
"Bellow1_Front_Part"	"Bellow1Front"	<cons>	"PipeAlCu"	
"Bellow1_Center_Part"	"Bellow1Center"	<tubs>	"PipeAlCu"	
"Bellow1_Back_Part"	"Bellow1Back"	<cons>	"PipeAlCu"	
"Bellow2_Front_Part"	"Bellow2Front"	<cons>	"PipeAlCu"	
"Bellow2_Center_Part"	"Bellow2Center"	<tubs>	"PipeAlCu"	
"Bellow_Back_Part2"	"Bellow2Back"	<cons>	"PipeAlCu"	

Figure 3: Beam Pipe Section 3 starts at z ∼2.8m, length ∼0.4m.

"Pipe Section 4" (Engineering Drawings: "RB84-2")				
physical volumes	*logical volume*	solid	material	angle
"ConSect5Flange5"	"Flange5"	<cons>	"PipeAl"	
"ConicalSection5a"	"ConSect5a"	<cons>	"PipeAlBe"	10 mrad
"ConicalSection5b"	"ConSect5b"	<cons>	"PipeAlBe"	10 mrad
"ConicalSection6"	"ConSect6"	<cons>	"PipeAlBe"	10 mrad
"ConicalSection7"	"ConSect7"	<cons>	"PipeAlBe"	10 mrad
"ConicalSection8"	"ConSect8"	<cons>	"PipeAlBe"	10 mrad
"ConicalSection9"	"ConSect9"	<cons>	"PipeAlBe"	10 mrad
"ConicalSection10"	"ConSect10"	<cons>	"PipeAlBe"	10 mrad
"ConicalSection11a"	"ConSect11a"	<cons>	"PipeAlBe"	10 mrad
"ConicalSection11b"	"ConSect11b"	<cons>	"PipeAlBe"	10 mrad
"ConSect11Flange6" (*Engineering Drawings: left part of "Transition 2"*)	"Flange6"	<cons>	"PipeAl"	
"VacuumSection4"	"VacuumSect4"	<cons>	"Vacuum"	10mrad

Figure 4: Beam Pipe Sections 4 starts at z ∼3.2m, length ∼3.9m

"Pipe Section 5" (*Engineering Drawings: "RB84-3"*)				
physical volumes	*logical volume*	solid	material	angle
"ConSect12Flange7" (*Engineering Drawings: right part of "Transition 2"*)	"Flange7"	\<cons\>	"PipeAl"	
"ConicalSection12a"	"ConSect12a"	\<cons\>	"PipeAlBe"	10 mrad
"ConicalSection12b"	"ConSect12b"	\<cons\>	"PipeAlBe"	10 mrad
"ConicalSection13"	"ConSect13"	\<cons\>	"PipeAlBe"	10 mrad
"ConicalSection14"	"ConSect14"	\<cons\>	"PipeAlBe"	10 mrad
"ConicalSection15"	"ConSect15"	\<cons\>	"PipeAlBe"	10 mrad
"ConicalSection16"	"ConSect16"	\<cons\>	"PipeAlBe"	10 mrad
"ConicalSection17"	"ConSect17"	\<cons\>	"PipeAlBe"	10 mrad
"ConicalSection18"	"ConSect18"	\<cons\>	"PipeAlBe"	10 mrad
"ConicalSection19"	"ConSect19"	\<cons\>	"PipeAlBe"	10 mrad
"ConicalSection20"	"ConSect20"	\<cons\>	"PipeAlBe"	10 mrad
"ConicalSection21a"	"ConSect21a"	\<cons\>	"PipeAlBe"	10 mrad
"ConicalSection21b"	"ConSect21b"	\<cons\>	"PipeAlBe"	10 mrad
"ConSect21Flange8"	"Flange8"	\<cons\>	"PipeAl"	
"VacuumSection5"	"VacuumSect5"	\<cons\>	"Vacuum"	10mrad

Figure 5: Beam Pipe Sections 5 starts at z ∼7.1m, length ∼6.0m.

"Pipe Section 6" (Engineering Drawings: "Transition 3")				
physical volumes	logical volume	solid	material	angle
"ConSect22aFlange9"	"Flange9"	<cons>	"PipeSteel"	
"ConicalSection22a "	"ConSect22a"	<cons>	"PipeSteel"	10 mrad
"ConSect22Bellow3"	"BellowSect3"			
"ConicalSection22b "	"ConSect22b"	<cons>	"PipeSteel"	10 mrad
"ConSect22Bellow4"	"BellowSect4"			
"ConicalSection22c "	"ConSect22c"	<cons>	"PipeSteel"	10 mrad
"ConSect22cFlange10"	"Flange10"	<cons>	"PipeSteel"	
"VacuumSection6"	"VacuumSect6"	<cons>	"Vacuum"	10mrad
"BellowSect3", "BellowSect4"				
"Bellow3_Front_Part"	"Bellow3Front"	<cons>	"PipeSteel"	
"Bellow3_Center_Part"	"Bellow3Center"	<tubs>	"PipeSteel"	
"Bellow3_Back_Part"	"Bellow3Back"	<cons>	"PipeSteel"	
"Bellow4_Front_Part"	"Bellow4Front"	<cons>	"PipeSteel"	
"Bellow4_Center_Part"	"Bellow4Center"	<tubs>	"PipeSteel"	
"Bellow_Back_Part2"	"Bellow4Back"	<cons>	"PipeSteel"	
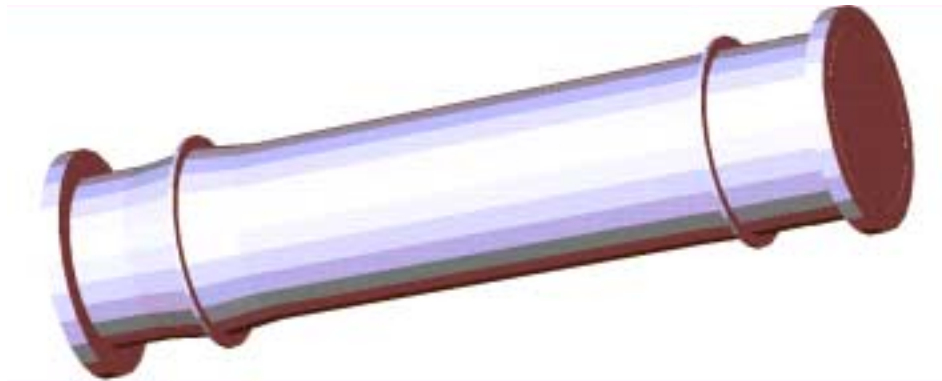
Figure 6: Beam Pipe Section 6 starts at z ~13.1m, length ~1.3m

"Pipe Section 7" (*Engineering Drawings: "RB84-4"*)				
physical volumes	*logical volume*	solid	material	angle
"CylSect23Flange11"	"Flange11"	<cons>	"PipeSteel"	
"ConicalSection23 "	"ConSect23"	<cons>	"PipeSteel"	10 mrad
"ConicalSection24 "	"ConSect24"	<cons>	"PipeSteel"	10 mrad
"VacuumSection7a"	"VacuumSect7a"	<cons>	"Vacuum"	10mrad
"ConicalSection25 "	"ConSect25"	<cons>	"PipeSteel"	-15^0
"VacuumSection7b"	"VacuumSect7b"	<cons>	"Vacuum"	-15^0
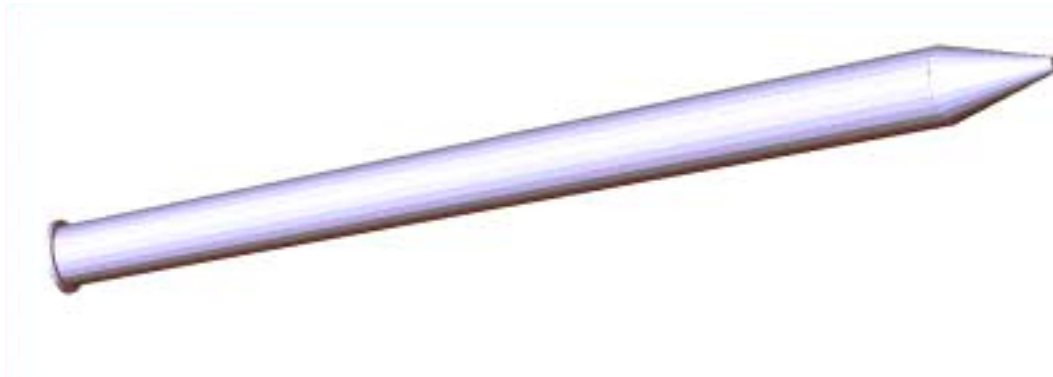
Figure 7: Beam Pipe Section 7 starts at z ~14.4m, length ~5.3m.

Appendix: Beam Pipe Geometry Parameters Definition	
Beam Pipe Section 2	
Cylindrical Section 1	
"PipeCyl1Length"	"110∗mm"
"PipeCyl1Thick"	"1.0∗mm"
"PipeCyl1InnRadius"	"27.00∗mm"
Conical Section 1	
"PipeCon1Length"	"1130∗mm"
"PipeCon1Thick"	"1.0∗mm"
"PipeCon1InnRadiusB"	"27.0∗mm"
"PipeCon1InnRadiusF"	"55.25∗mm"
Flange 1	
"PipeFlange1Offset"	"1195.5∗mm"
"PipeFlange1Length"	"1∗mm"
"PipeFlange1Radius"	"63.13∗mm"
"PipeFlange1InnRadiusB"	"54.13∗mm+PipeCon1Thick"
"PipeFlange1InnRadiusF"	"54.16∗mm+PipeCon1Thick"
Conical Section 2	
"PipeCon2Length"	"40∗mm"
"PipeCon2Thick"	"1.0∗mm"
"PipeCon2InnRadiusB"	"55.25∗mm"
"PipeCon2InnRadiusF"	"25∗mm"
Cylindrical Section 2	
"PipeCyl2Length"	"250∗mm"
"PipeCyl2Thick"	"1.0∗mm"
"PipeCyl2InnRadius"	"25∗mm"
Conical Section 3a	
"PipeCon3aLength"	"266∗mm"
"PipeCon3aThick"	"1.0∗mm"
"PipeCon3aInnRadiusB"	"25∗mm"
"PipeCon3aInnRadiusF"	"27.66∗mm"
Conical Section 3b	
"PipeCon3bLength"	"34∗mm"
"PipeCon3bThick"	"1.0∗mm"
"PipeCon3bInnRadiusB"	"27.66∗mm"
"PipeCon3bInnRadiusF"	"28∗mm"
Flange 2	
"PipeFlange2Length"	"14∗mm"
"PipeFlange2Radius"	"49∗mm"
"PipeFlange2InnRadiusB"	"27.86∗mm+PipeCon1Thick"
"PipeFlange2InnRadiusF"	"28∗mm+PipeCon1Thick"
"PipeSection2Length"	"PipeCyl1Length + PipeCon1Length + PipeCon2Length + PipeCyl2Length + PipeCon3aLength + PipeCon3bLength"

Beam Pipe Section 3	
"PipeSection3Length"	"424*mm"
Conical Section 4a	
"PipeCon4aLength"	"60*mm"
"PipeCon4aThick"	"1.5*mm"
"PipeCon4aInnRadiusB"	"28.0*mm"
"PipeCon4aInnRadiusF"	"28.6*mm"
Flange 3	
"PipeFlange3Length"	"14*mm"
"PipeFlange3Radius"	"49.00*mm"
"PipeFlange3InnRadiusB"	"28*mm+PipeCon4aThick"
"PipeFlange3InnRadiusF"	"28.14*mm+PipeCon4aThick"
Bellow 1	
"PipeBellow1Length"	"69*mm"
Bellow 1 Back part	
"PipeBellow1BLength"	"25.5*mm"
"PipeBellow1BThick"	"1.5*mm"
"PipeBellow1BInnRadiusB"	"28.06*mm"
"PipeBellow1BInnRadiusF"	"34.5*mm"
Bellow 1 Center part	
"PipeBellow1CLength"	"18*mm"
"PipeBellow1CThick"	"6.5*mm"
"PipeBellow1CInnRadius"	"34.5*mm"
Bellow 1 Front part	
"PipeBellow1FLength"	"25.5*mm"
"PipeBellow1FThick"	"1.5*mm"
"PipeBellow1FInnRadiusB"	"34.5*mm"
"PipeBellow1FInnRadiusF"	"29.29*mm"
Conical Section 4b	
"PipeCon4bLength"	"166*mm"
"PipeCon4bThick"	"1.5*mm"
"PipeCon4bInnRadiusB"	"29.29*mm"
"PipeCon4bInnRadiusF"	"30.95*mm"
Bellow 2	
"PipeBellow2Length"	"69*mm"
Bellow 2 Back part	
"PipeBellow2BLength"	"25.5*mm"
"PipeBellow2BThick"	"1.5*mm"
"PipeBellow2BInnRadiusB"	"30.95*mm"
"PipeBellow2BInnRadiusF"	"34.5*mm"
Bellow 2 Center part	
"PipeBellow2CLength"	"18*mm"
"PipeBellow2CThick"	"6.5*mm"
"PipeBellow2CInnRadius"	"34.5*mm"

Bellow 2 Front part	
"PipeBellow2FLength"	"25.5∗mm"
"PipeBellow2FThick"	"1.5∗mm"
"PipeBellow2FInnRadiusB"	"34.5∗mm"
"PipeBellow2FInnRadiusF"	"31.64∗mm"
Conical Section 4c	
"PipeCon4cLength"	"60∗mm"
"PipeCon4cThick"	"1.5∗mm"
"PipeCon4cInnRadiusB"	"31.64∗mm"
"PipeCon4cInnRadiusF"	"32.24∗mm"
Flange 4	
"PipeFlange4Length"	"14∗mm"
"PipeFlange4Radius"	"49.00∗mm"
"PipeFlange4InnRadiusB"	"32.1∗mm+PipeCon4cThick"
"PipeFlange4InnRadiusF"	"32.24∗mm+PipeCon4cThick"
Beam Pipe Section 4	
Conical Section 5a	
"PipeCon5aLength"	"34∗mm"
"PipeCon5aThick"	"1∗mm"
"PipeCon5aInnRadiusB"	"32.24∗mm"
"PipeCon5aInnRadiusF"	"32.28∗mm"
Conical Section 5b	
"PipeCon5bLength"	"466∗mm"
"PipeCon5bThick"	"1∗mm"
"PipeCon5bInnRadiusB"	"32.38∗mm"
"PipeCon5bInnRadiusF"	"37.24∗mm"
Flange 5	
"PipeFlange5Length"	"14∗mm"
"PipeFlange5Radius"	"49.00∗mm"
"PipeFlange5InnRadiusB"	"32.24∗mm + PipeCon5aThick"
"PipeFlange5InnRadiusF"	"32.38∗mm + PipeCon5aThick"
Conical Section 6	
"PipeCon6Length"	"400∗mm"
"PipeCon6Thick"	"1.1∗mm"
"PipeCon6InnRadiusB"	"37.24∗mm"
"PipeCon6InnRadiusF"	"41.24∗mm"
Conical Section 7	
"PipeCon7Length"	"800∗mm"
"PipeCon7Thick"	"1.2∗mm"
"PipeCon7InnRadiusB"	"41.24∗mm"
"PipeCon7InnRadiusF"	"49.24∗mm"

Conical Section 8	
”PipeCon8Length”	”800∗mm”
”PipeCon8Thick”	”1.3∗mm”
”PipeCon8InnRadiusB”	”49.24∗mm”
”PipeCon8InnRadiusF”	”57.24∗mm”
Conical Section 9	
”PipeCon9Length”	”400∗mm”
”PipeCon9Thick”	”1.4∗mm”
”PipeCon9InnRadiusB”	”57.24∗mm”
”PipeCon9InnRadiusF”	”61.24∗mm”
Conical Section 10	
”PipeCon10Length”	”800∗mm”
”PipeCon10Thick”	”1.5∗mm”
”PipeCon10InnRadiusB”	”61.24∗mm”
”PipeCon10InnRadiusF”	”69.24∗mm”
Conical Section 11a	
”PipeCon11aLength”	”134∗mm”
”PipeCon11aThick”	”1.7∗mm”
”PipeCon11aInnRadiusB”	”69.24∗mm”
”PipeCon11aInnRadiusF”	”70.58∗mm”
Conical Section 11b	
”PipeCon11bLength”	”42∗mm”
”PipeCon11bThick”	”1.7∗mm”
”PipeCon11bInnRadiusB”	”70.58∗mm”
”PipeCon11bInnRadiusF”	”71.00∗mm”
Flange 6	
”PipeFlange6Length”	”22∗mm”
”PipeFlange6Radius”	”95.00∗mm”
”PipeFlange6InnRadiusB”	”70.78∗mm + PipeCon11bThick”
”PipeFlange6InnRadiusF”	”71.00∗mm + PipeCon11bThick”
”PipeSection4Length”	”PipeCon5aLength+PipeCon5bLength+PipeCon6Length+ PipeCon7Length+PipeCon8Length+PipeCon9Length+ PipeCon10Length+PipeCon11aLength+PipeCon11bLength”
Beam Pipe Section 5	
Conical Section 12a	
”PipeCon12aLength”	”42∗mm”
”PipeCon12aThick”	”1.7∗mm”
”PipeCon12aInnRadiusB”	”71.00∗mm”
”PipeCon12aInnRadiusF”	”71.42∗mm”
Conical Section 12b	
”PipeCon12bLength”	”380∗mm”
”PipeCon12bThick”	”1.7∗mm”
”PipeCon12bInnRadiusB”	”71.42∗mm”
”PipeCon12bInnRadiusF”	”75.22∗mm”

Flange 7	
"PipeFlange7Length"	"22*mm"
"PipeFlange7Radius"	"95*mm"
"PipeFlange7InnRadiusB"	"71.00*mm + PipeCon12aThick"
"PipeFlange7InnRadiusF"	"71.22*mm + PipeCon12aThick"
Conical Section 13	
"PipeCon13Length"	"800*mm"
"PipeCon13Thick"	"1.8*mm"
"PipeCon13InnRadiusB"	"75.22*mm"
"PipeCon13InnRadiusF"	"83.22*mm"
Conical Section 14	
"PipeCon14Length"	"400*mm"
"PipeCon14Thick"	"1.9*mm"
"PipeCon14InnRadiusB"	"83.22*mm"
"PipeCon14InnRadiusF"	"87.22*mm"
Conical Section 15	
"PipeCon15Length"	"800*mm"
"PipeCon15Thick"	"2.0*mm"
"PipeCon15InnRadiusB"	"87.22*mm"
"PipeCon15InnRadiusF"	"95.22*mm"
Conical Section 16	
"PipeCon16Length"	"800*mm"
"PipeCon16Thick"	"2.1*mm"
"PipeCon16InnRadiusB"	"95.22*mm"
"PipeCon16InnRadiusF"	"103.22*mm"
Conical Section 17	
"PipeCon17Length"	"400*mm"
"PipeCon17Thick"	"2.2*mm"
"PipeCon17InnRadiusB"	"103.22*mm"
"PipeCon17InnRadiusF"	"107.22*mm"
Conical Section 18	
"PipeCon18Length"	"800*mm"
"PipeCon18Thick"	"2.3*mm"
"PipeCon18InnRadiusB"	"107.22*mm"
"PipeCon18InnRadiusF"	"115.22*mm"
Conical Section 19	
"PipeCon19Length"	"800*mm"
"PipeCon19Thick"	"2.4*mm"
"PipeCon19InnRadiusB"	"115.22*mm"
"PipeCon19InnRadiusF"	"123.22*mm"
Conical Section 20	
"PipeCon20Length"	"400*mm"
"PipeCon20Thick"	"2.5*mm"
"PipeCon20InnRadiusB"	"123.22*mm"
"PipeCon20InnRadiusF"	"127.22*mm"

Conical Section 21a	
"PipeCon21aLength"	"328*mm"
"PipeCon21aThick"	"2.6*mm"
"PipeCon21aInnRadiusB"	"127.22*mm"
"PipeCon21aInnRadiusF"	"130.5*mm"
Conical Section 21b	
"PipeCon21bLength"	"50*mm"
"PipeCon21bThick"	"2.6*mm"
"PipeCon21bInnRadiusB"	"130.5*mm"
"PipeCon21bInnRadiusF"	"131.0*mm"
Flange 8	
"PipeFlange8Length"	"30*mm"
"PipeFlange8Radius"	"177.50*mm"
"PipeFlange8InnRadiusB"	"130.70*mm+PipeCon21bThick"
"PipeFlange8InnRadiusF"	"131.00*mm+PipeCon21bThick"
"PipeSection5Length"	"PipeCon12aLength + PipeCon12bLength + PipeCon13Length + PipeCon14Length + PipeCon15Length + PipeCon16Length + PipeCon17Length + PipeCon18Length + PipeCon19Length + PipeCon20Length + PipeCon21aLength + PipeCon21bLength"
Beam Pipe Section 6	
"PipeSection6Length"	"1300*mm"
Conical Section 22a	
"PipeCon22aLength"	"120*mm"
"PipeCon22aThick"	"3.0*mm"
"PipeCon22aInnRadiusB"	"131.0*mm"
"PipeCon22aInnRadiusF"	"132.2*mm"
Flange 9	
"PipeFlange9Length"	"30*mm"
"PipeFlange9Radius"	"177.50*mm"
"PipeFlange9InnRadiusB"	"131.0*mm+PipeCon22aThick"
"PipeFlange9InnRadiusF"	"131.3*mm+PipeCon22aThick"
Bellow 3	
"PipeBellow3Length"	"182*mm"
Bellow 3 Back part	
"PipeBellow3BLength"	"87*mm"
"PipeBellow3BThick"	"3.0*mm"
"PipeBellow3BInnRadiusB"	"132.2*mm"
"PipeBellow3BInnRadiusF"	"144.00*mm"
Bellow 3 Central part	
"PipeBellow3CLength"	"8.0*mm"
"PipeBellow3CThick"	"22.0*mm"
"PipeBellow3CInnRadius"	"144.0*mm"

Bellow 3 Front part	
"PipeBellow3FLength"	"87∗mm"
"PipeBellow3FThick"	"3.0∗mm"
"PipeBellow3FInnRadiusB"	"144.0∗mm"
"PipeBellow3FInnRadiusF"	"134.02∗mm"
Conical Section 22b	
"PipeCon22bLength"	"696∗mm"
"PipeCon22bThick"	"3.0∗mm"
"PipeCon22bInnRadiusB"	"134.02∗mm"
"PipeCon22bInnRadiusF"	"140.98∗mm"
Bellow 4	
"PipeBellow4Length"	"182∗mm"
Bellow 4 Back part	
"PipeBellow4BLength"	"87∗mm"
"PipeBellow4BThick"	"3.0∗mm"
"PipeBellow4BInnRadiusB"	"140.98∗mm"
"PipeBellow4BInnRadiusF"	"144.00∗mm"
Bellow 4 Central part	
"PipeBellow4CLength"	"8.0∗mm"
"PipeBellow4CThick"	"22.0∗mm"
"PipeBellow4CInnRadius"	"144.0∗mm"
Bellow 4 Front part	
"PipeBellow4FLength"	"87∗mm"
"PipeBellow4FThick"	"3.0∗mm"
"PipeBellow4FInnRadiusB"	"144.0∗mm"
"PipeBellow4FInnRadiusF"	"142.8∗mm"
Conical Section 22c	
"PipeCon22cLength"	"120∗mm"
"PipeCon22cThick"	"3.0∗mm"
"PipeCon22cInnRadiusF"	"142.8∗mm"
"PipeCon22cInnRadiusB"	"144∗mm"
Flange 10	
"PipeFlange10Length"	"30∗mm"
"PipeFlange10Radius"	"177.50∗mm"
"PipeFlange10InnRadiusB"	"143.7∗mm+PipeCon22cThick"
"PipeFlange10InnRadiusF"	"144.0∗mm+PipeCon22cThick"

Beam Pipe Section 7	
Conical Section 23	
"PipeCon23Length"	"2353∗mm"
"PipeCon23Thick"	"3.0∗mm"
"PipeCon23InnRadiusB"	"144.00∗mm"
"PipeCon23InnRadiusF"	"167.53∗mm"
Flange 11	
"PipeFlange11Length"	"30∗mm"
"PipeFlange11Radius"	"177.50∗mm"
"PipeFlange11InnRadiusB"	"144.0∗mm+PipeCon23Thick"
"PipeFlange11InnRadiusF"	"144.3∗mm+PipeCon23Thick"
Conical Section 24	
"PipeCon24Length"	"2366∗mm"
"PipeCon24Thick"	"4.0∗mm"
"PipeCon24InnRadiusB"	"167.53∗mm"
"PipeCon24InnRadiusF"	"191.19∗mm"
Conical Section 25	
"PipeCon25Length"	"577∗mm"
"PipeCon25Thick"	"1.0∗mm"
"PipeCon25InnRadiusB"	"191.19∗mm"
"PipeCon25InnRadiusF"	"36∗mm"
"PipeSection7Length"	"PipeCon23Length + PipeCon24Length + PipeCon25Length"
"PipeLength"	"PipeSection2Length + PipeSection3Length + PipeSection4Length + PipeSection5Length + PipeSection6Length + PipeSection7Length"