ITk Software Geometry Requirements

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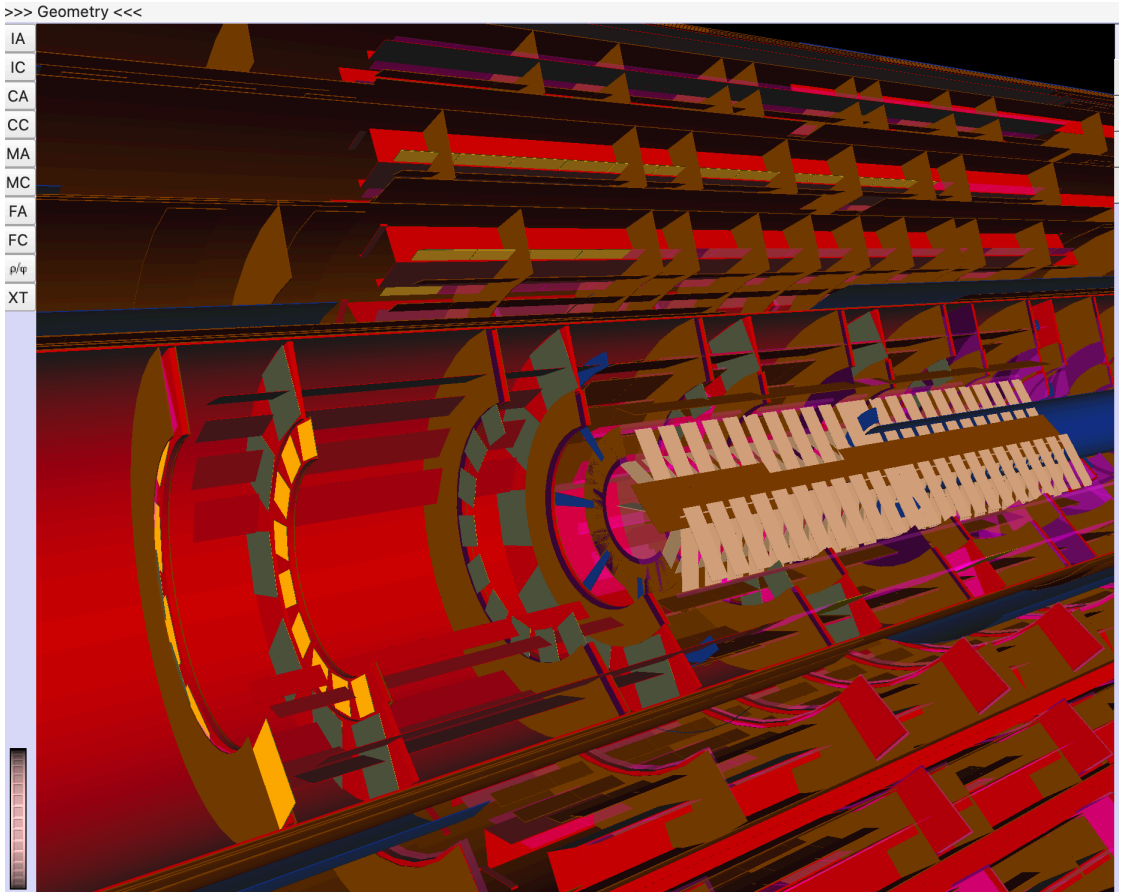
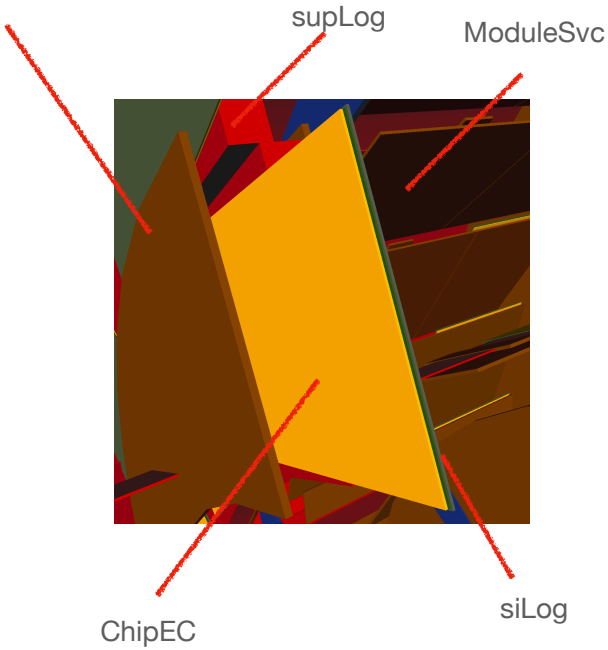
History and Status

21.9 Geometry exported from simulation

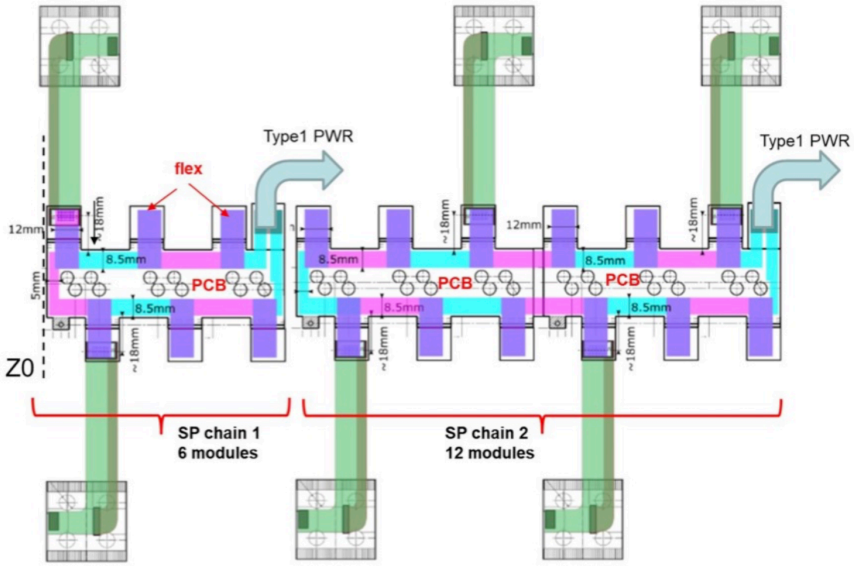


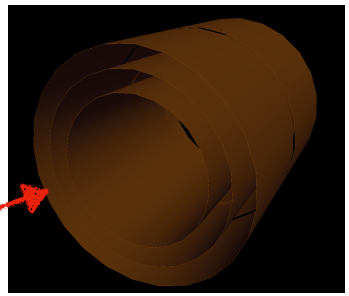
ISM233A_SvcEcT0AwayBS_150_RadL_L77

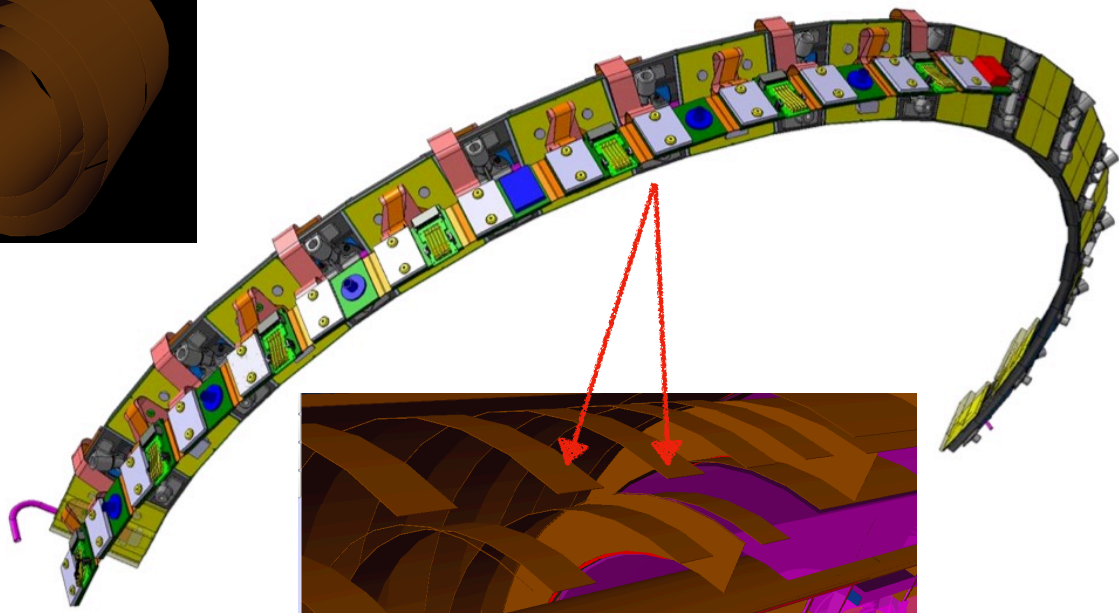


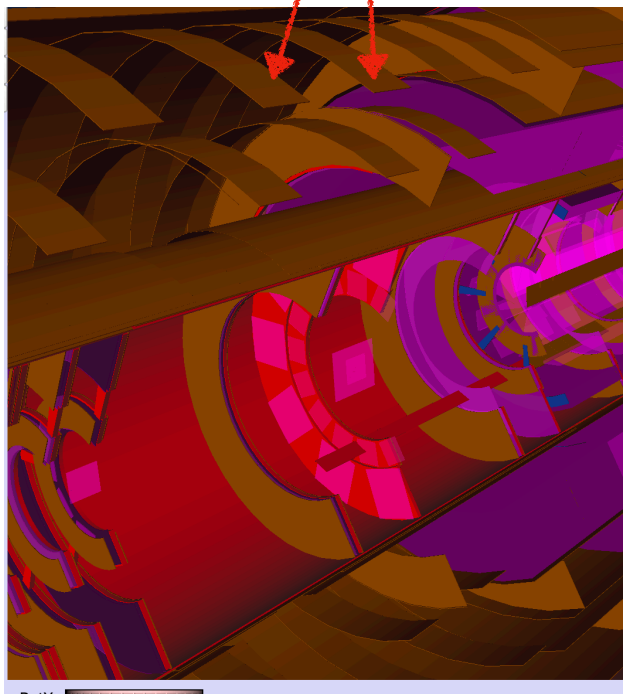
Zoom-in ≠ increased detail

Drawings
EDMS cf. 21.9









Level of simplification is apparent : Memory and CPU are not an infinite resource

Acceptable Accuracy (looking back)

Survey previous SCT estimates, comparing with (early) data:

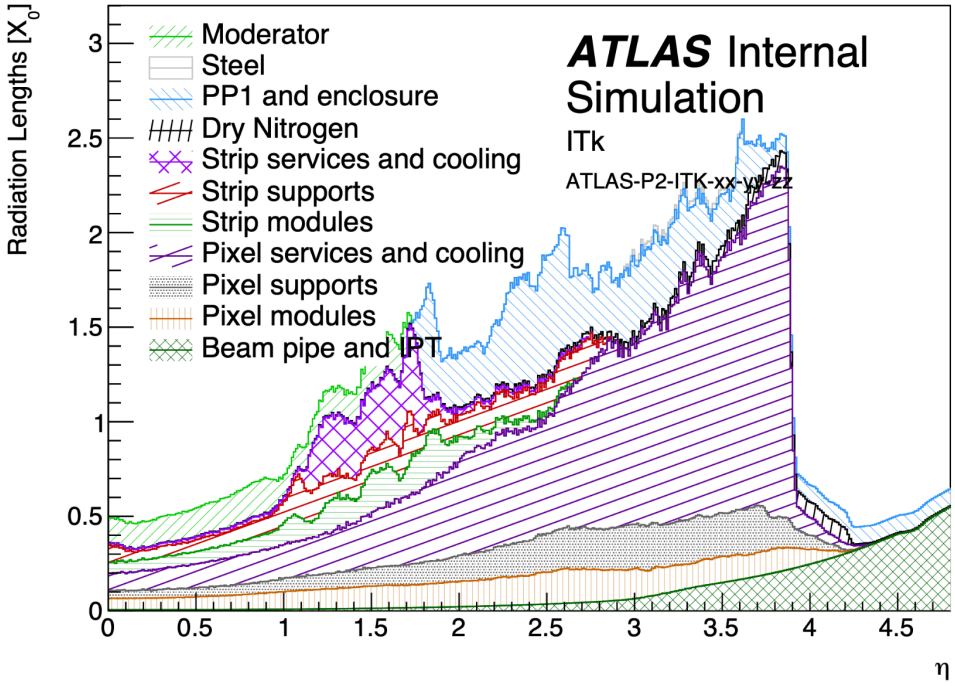
> and 49%, respectively, at the five material layers listed in the table.[4] In general, the agreement is very good, i.e., at the 7% level of the systematic uncertainty. The beam pipe envelope contains beryllium, layers of aerogel, kapton tape and coatings, and the pixel detector and SCT regions include supports, cables, and services.

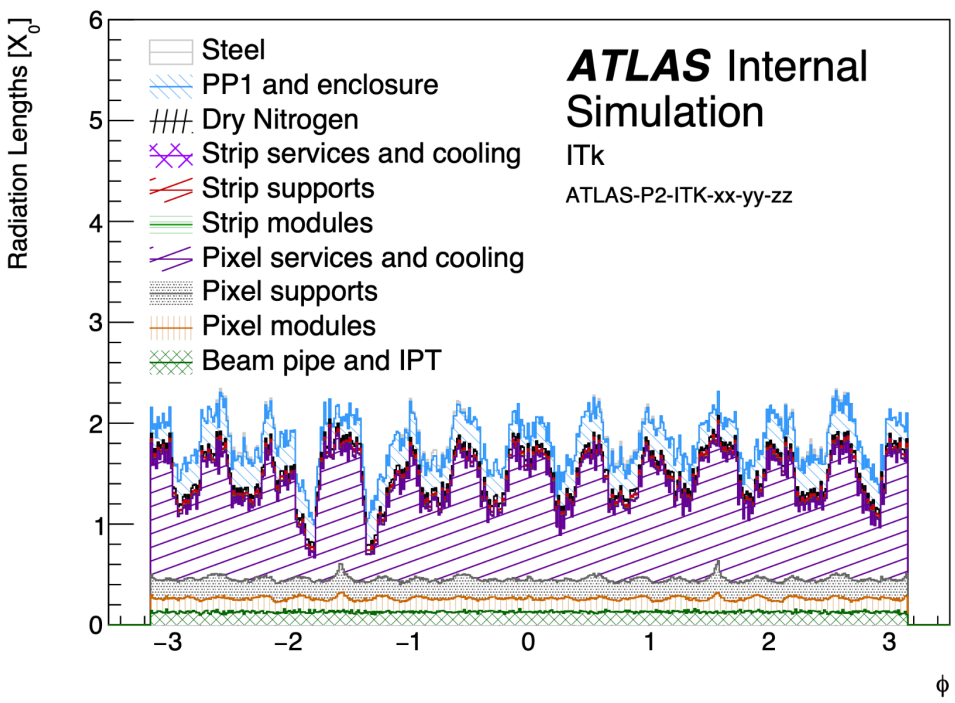
Uses a variety of methods
(Hadronic) Secondary vertex reconstruction
Photon conversions

=> at this time, precision to ~10% would already be an achievement
=> validation required
=> eventually aim for ~5% accuracy on X_0

How do we look?

(From recent code merges: Internal, not for distribution)





https://gitlab.cern.ch/Atlas-Inner-Tracking/ITKLayouts/-/merge_requests?scope=all&state=merged

How do we insert materials, and check?

Validation tasks

https://indico.cern.ch/event/1186442/contributions/4986281/attachments/2487376/4271077/Offline SW meeting - July29.pdf

1. Get material information from engineers

PART NUMBER	TITLE	Status	Old Number	Posn	MATERIAL	QTY	Density [m^3]
TD-1281-1062	SWAGELOK SS-4-VCR-1	S		P	STAIN. S, 316	2	7930
TD-1281-1098/9255	CAPILLARY MANIFOLD - 9 WAY	U		T	TITANIUM, GRADE 2	1	4510
TD-1281-1099**	CAPILLARY (0.8mm)	M		T/G	TITANIUM, GRADE 2	9	4510
TD-1281-1384	MTP BULKHEAD ADAPTOR 12226	U		P	ABS PLASTIC, HIGH IMPACT	5	1270
TD-1281-1414	EXHAUST PIPE (3/8")	M		T	TITANIUM, GRADE 2	1	4510
TD-1281-3019	INLET BENT PIPE	U	1416	T	TITANIUM, GRADE 2	1	4510
TD-1281-1424	SERVICES CONTROL PILLAR	U		T	AL ALLOY, 6082-T6	12	2690
TD-1281-1461**	CABLES TO SERVICE GAP 9 8X50mm BEND R & 2 TIER	M		P/T/G	SEE NOTE	1	
TD-1281-3491	OPTO-DCS BULKHEAD	U	1568	P	AL ALLOY, 5251	1	2690
TD-1281-3497	OPTO-DCS COVER	U	1569	P	AL ALLOY, 5251	1	2690
TD-1281-3495	OPTO-DCS TRAY TOP	U	1571	P	AL ALLOY, 5251	1	2690
TD-1281-1583	OPTIC FIBRE GUIDE	X					
TD-1281-1585	MAIN OPTIC FIBRE GUIDE	X					
TD-1281-1647**	VAC SECTION PIPE (3/8")	S		P/B/T	TITANIUM, GRADE 2	2	4510
TD-1281-1649**	VAC SECTION PIPE (5/8")	S		P/B/T	TITANIUM, GRADE 2	2	4510
TD-1281-1650	BRAZE COLLAR (3/8" - 5/8")	S		T	TITANIUM, GRADE 2	2	4510
TD-1281-1657	CABLE CLAMP BAR	U		T	AL ALLOY, 5251	9	2690
TD-1281-1732	GLENAIR MRM 19019 [PP1 - PANEL MOUNT CONNECTOR MRM19019]	C		P		5	
TD-1281-1755	PIN BLOCK	S		T	AL ALLOY, 6082-T6	2	2690
TD-1281-1853	G&S FOIL - NO.1	X					
TD-1281-1854	G&S FOIL - NO.2	X					
TD-1281-1859	G&S FOIL - NO.3	X					
TD-1281-1871	KF ANGLE CONNECTOR	S		p	TITANIUM, GRADE 2	2	4510
TD-1281-1953	CABLE HEAT SINK	S		T	AL ALLOY, AW 1050A-O	1	2690
TD-1281-2970	ELECTRICAL BOX	U	2057	P	AL ALLOY, 5251	1	2690
TD-1281-2058	SHIELD CLAMP LOWER	S		P	AL ALLOY, 6082-T6	1	2690
TD-1281-2971	ELECTRICAL BOX LID	U	2061	P	AL ALLOY, 5251	1	2690
TD-1281-2064	BELLOWS SUPPORT BRACKET	S		P	AL ALLOY, 5251	1	2690
TD-1281-2069	SHIELD CLAMP - THIN	S		P	AL ALLOY, 5251	1	2690
TD-1281-2077	OPTO-DCS BOX STRAP	S		P	AL ALLOY, 5251	3	2690
TD-1281-3113	ELBOW	U	TD-1281-2126	P	TITANIUM, GRADE 2	2	4510
TD-1281-3458	FEED THROUGH BODY	U	2256	B	ULTEM PEI 9048/1000	1	1270

2. Put information into ConsolidX

https://gitlab.cern.ch/hessey/ConsolidX/-/tree/master/

```
<logvol name="SWAGELOK_SS_4_VCR_1"                shape="shSWAGELOK_SS_4_VCR_1"                material="SS316"/>
<logvol name="MTP_BULKHEAD_ADAPTOR_12226"         shape="shMTP_BULKHEAD_ADAPTOR_12226"         material="PEI"/>
<logvol name="OPTO_DCS_BULKHEAD"                  shape="shOPTO_DCS_BULKHEAD"                  material="AA5251"/>
<logvol name="OPTO_DCS_COVER"                     shape="shOPTO_DCS_COVER"                     material="AA5251"/>
<logvol name="OPTO_DCS_TRAY_TOP"                  shape="shOPTO_DCS_TRAY_TOP"                  material="AA5251"/>
<logvol name="VAC_SECTION_PIPE_3EIGHTHS"          shape="shVAC_SECTION_PIPE_3EIGHTHS"          material="TiG2"/>
<logvol name="VAC_SECTION_PIPE_5EIGHTHS"          shape="shVAC_SECTION_PIPE_5EIGHTHS"          material="TiG2"/>
<logvol name="GLENAIR_MRM_19019"                  shape="shGLENAIR_MRM_19019"                  material="PP1PanelMountConnector"/>
<logvol name="KF_ANGLE_CONNECTOR"                 shape="shKF_ANGLE_CONNECTOR"                 material="TiG2"/>
<logvol name="ELECTRICAL_BOX"                     shape="shELECTRICAL_BOX"                     material="AA5251"/>
<logvol name="SHIELD_CLAMP_LOWER"                 shape="shSHIELD_CLAMP_LOWER"                 material="AA6082T6"/>
<logvol name="ELECTRICAL_BOX_LID"                 shape="shELECTRICAL_BOX_LID"                 material="AA5251"/>
<logvol name="BELLOWS_SUPPORT_BRACKET"            shape="shBELLOWS_SUPPORT_BRACKET"            material="AA5251"/>
<logvol name="SHIELD_CLAMP_THIN"                  shape="shSHIELD_CLAMP_THIN"                  material="AA5251"/>
<logvol name="OPTO_DCS_BOX_STRAP"                 shape="shOPTO_DCS_BOX_STRAP"                 material="AA5251"/>
<logvol name="ELBOW"                              shape="shELBOW"                              material="TiG2"/>
<logvol name="PP1_FRAME"                          shape="shPP1_FRAME"                          material="AA5251"/>
<logvol name="VACUUM_PIPE_CLAMP"                  shape="shVACUUM_PIPE_CLAMP"                  material="PEI"/>
<!-- <logvol name="OPTIC_FIBRES_x2"                shape="shOPTIC_FIBRES_x2"                    material=""/> -->
<!-- <logvol name="OPTIC_FIBRES_x3"                shape="shOPTIC_FIBRES_x3"                    material=""/> -->
<logvol name="THREADED_ROD_M4_1"                  shape="shTHREADED_ROD_M4_1"                  material="AA6101"/>
```

Spreadsheet -> code

3. Retrieve smeared material information

```
<materials>

  <material name='matB_PP1' density='0.523594'>
    <elementref ref='Aluminium' fraction='0.538511'/>
    <elementref ref='Berylium'  fraction='0.000133'/>
    <elementref ref='Carbon'    fraction='0.174909'/>
    <elementref ref='Chromium'  fraction='0.004036'/>
    <elementref ref='Cobalt'    fraction='0.000014'/>
    <elementref ref='Copper'    fraction='0.081694'/>
    <elementref ref='Gold'      fraction='0.000343'/>
    <elementref ref='Hydrogen'  fraction='0.008885'/>
    <elementref ref='Iron'      fraction='0.014767'/>
    <elementref ref='Lead'      fraction='0.000047'/>
    <elementref ref='Magnesium' fraction='0.002301'/>
    <elementref ref='Manganese' fraction='0.001497'/>
    <elementref ref='Molybdenum' fraction='0.000520'/>
    <elementref ref='Nickel'    fraction='0.007036'/>
    <elementref ref='Nitrogen'  fraction='0.043163'/>
    <elementref ref='Oxygen'    fraction='0.030703'/>
    <elementref ref='Phosphorous' fraction='0.000013'/>
    <elementref ref='Silicon'   fraction='0.00
    <elementref ref='Silver'    fraction='0.00
    <elementref ref='Sodium'    fraction='0.000420'/>
    <elementref ref='Sulphur'   fraction='0.000064'/>
    <elementref ref='Titanium'  fraction='0.081030'/>
    <elementref ref='Zinc'      fraction='0.006887'/>
  </material>

</materials>
```

Screenshot

“Requirements” from Software (Simulation)

we need to work defining this

* Description in terms of ‘simple’ solids, and not *too many* of them
* Masses correct to better than 10%*
* Phi structure not as important as eta structure*
* Validation between ‘as drawn’ and ‘as simulated’ should be possible
* Eventual validation against ‘as built’ should be possible

*These requirements will evolve