SCT/Pixel Mapping memo

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1 Introduction

This is a note to organize what I learned from the Pixel and SCT mapping database files [1, 2]. To analyze these mapping files, I used a software that I developed for my private use [3].

The detector geometry is shown in the Figure 1.

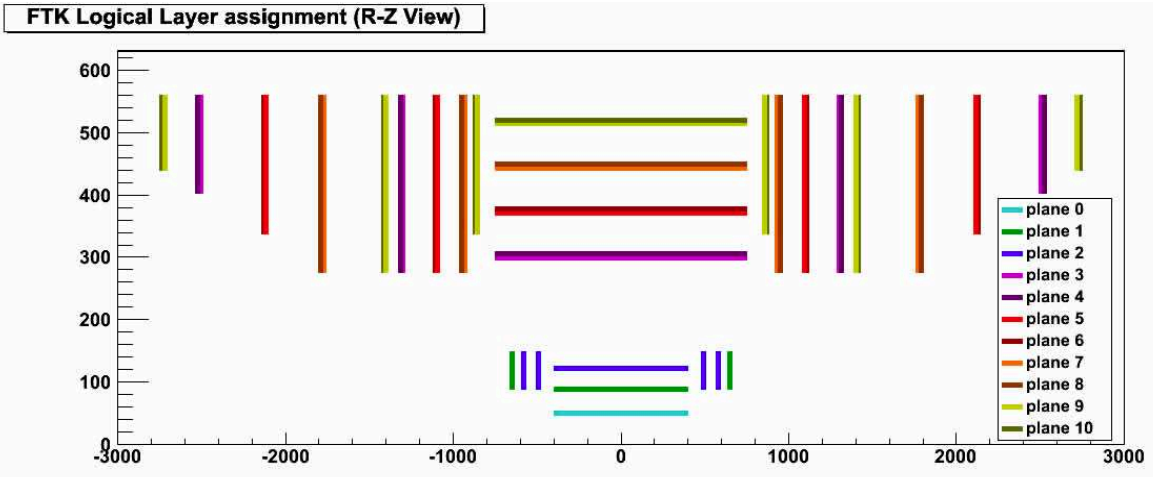


Figure 1: Detector Geometry of inner detectors. It consists of 3 cylindrical barrel layers of Pixel (**Pixel Barrel**), 3 disks of Pixel in the both Endcaps (**Pixel Endcap**), 4 cylindrical barrel layers of SCT (**SCT Barrel**, and 9 disks of SCT in the both Endcaps (**SCT Endcap**).)

2 Number of fibers

Numbers of input signals for RODs (i.e. numbers of input fibers for RODs) are summarized. Those for Pixel and SCT readout systems are summarized in Figure 2 and Figure 3 respectively.

Barrel					
1456					
A			C		
728			728		
L1	L2	L3	L1	L2	L3
143	247	338	143	247	338
Endcap					
288					
A			C		
144			144		
L1	L2	L3	L1	L2	L3
48	48	48	48	48	48
Total					
1744					

Figure 2: Number of fibers are summarized for Pixel readout. They are the inputs of RODs.

Barrel							
4224							
A				C			
2112				2112			
L1	L2	L3	L4	L1	L2	L3	L1
384	480	576	672	384	480	576	672
Endcap							
3952							
A (C; identical)							
1976							
L1	L2	L3	L4	L5	L6	L7	L8	L9
184	264	264	264	264	264	184	184	104
Total							
8176							

Figure 3: Number of fibers are summarized for Pixel readout. They are the inputs of SCT.

3 *Eta* and *Phi* division in readout

The divides of readout systems for *Eta* direction and *Phi* directions are summarized. **Note One Readout block is corresponding to one Readout fibers** (see Section 2). The following tables show the summary for Pixel Barrel, Pixel Endcap, SCT Barrel, and SCT Endcap respectively.

	L1	L2	L3
Eta	13	13	13
Phi	22	38	52
total	286	494	676

Figure 4: **PIXEL Barrel** readout system divide for *Eta* and *Phi* direction. **Note this table is inclusive for A and C sides.** The *Eta* division of 13 is corresponding to 6 (A-side) + 7 (C-side) or 7 (A-side) + 6 (C-side), depending on the phi.

	L1	L2	L3
Eta	1	1	1
Phi	48	48	48
total	48	48	48

(a)

	L1	L2	L3
Eta	1	1	1
Phi	48	48	48
total	48	48	48

(b)

Figure 5: **PIXEL Endcap** readout system divide for *Eta* and *Phi* direction for (a) A-side and (c) C-side. Note, the numbers for both sides are exactly identical.

	L1	L2	L3	L4
Eta	6	6	6	6
Phi	32	40	48	56
Side	2	2	2	2
total	384	480	576	672

(a)

	L1	L2	L3	L4
Eta	6	6	6	6
Phi	32	40	48	56
Side	2	2	2	2
total	384	480	576	672

(b)

Figure 6: **SCT Barrel** readout system divide for *Eta* and *Phi* direction for (a) A-side and (c) C-side. Note, the numbers for both sides are exactly identical.

	L1	L2	L3	L4	L5	L6	L7	L8	L9
Eta	2	3	3	3	3	3	2	2	1
Phi (E1)	52	52	52	52	52	52	52	52	52
Phi (E2)	40	40	40	40	40	40	40	40	
Phi (E3)		40	40	40	40	40			
Side	2	2	2	2	2	2	2	2	2
total	184	264	264	264	264	264	184	184	104

Figure 7: **SCT Endcap A-side** readout system divide for *Eta* and *Phi* direction. Note, the numbers for both sides are exactly identical. The number of divides for *Phi* coordinates depends on the *Eta* as shown in the Table. E1 is corresponding to the smallest η units (i.e. most outer of the Endcap disks), and the E3 is corresponding to the largest η. For Disk1, 7, 8, and 9, there are empty columns according to absence of E2 or E3 readout units.

	L1	L2	L3	L4	L5	L6	L7	L8	L9
Eta	2	3	3	3	3	3	2	2	1
Phi (E1)	52	52	52	52	52	52	52	52	52
Phi (E2)	40	40	40	40	40	40	40	40	
Phi (E3)		40	40	40	40	40			
Side	2	2	2	2	2	2	2	2	2
total	184	264	264	264	264	264	184	184	104

Figure 8: **SCT Endcap C-side** readout system divide for *Eta* and *Phi* direction. Note, the numbers for both sides are exactly identical.

4 Number of RODs

The numbers of RODs are summarized.

	Barrel-A	Barrel-C	Endcap-A	Endcap-C
Layer1	22	22	8	8
Layer2	19	19	4	4
Layer3	13	13		
total	54	54	12	12

Figure 9: Number of RODs for **Pixel** readout system. The RODs readout units are corresponding to the *Phi* units in the Table 4 and Table 5. (i.e.) At Barrel region, 1 ROD board reads data from 1 *Phi*, 2 *Phi*s, and 4 *Phi*s in Layer 1, 2, and 3, respectively. **At the Endcap region, the Layer 1 and 3 at the same** *Phi* **region is read-out by the same boards and Layer 2 is readout separately.** (This is the reason why the columns for Layer 3 is blank at Endcap regions.) Taking this into account, at Endcap region, 1 ROD board reads data from 3 *Phi*$\times$ 2 Layers for Layer 1 and 3, and 6 *Phi*s for Layer 2 respectively.

Barrel-A	Barrel-C	Endcap-A	Endcap-C
22	22	23	23

Figure 10: Number of RODs for **SCT** readout system. At Barrel region, the RODs readout units are corresponding to the *Phi* units in the Table 15. **Differently from PIXEL case, readout system of each layer system is not isolated**. At Endcap region, the 23 RODs readout 9 disks at Endcap. The first 4 ROD boards readout the Disk 1, 2, and 3. The second 8 ROD boards readout the Disk 2, 3, 4, and 5. The third 4 ROD boards readout the Disk 4, 5, 6, and 7. The forth 4 ROD boards readout the Disk 6, 7, and 8. The last 3 ROD boards readout the Disk 8 and 9. The grouping is corresponding to $Eta - Phi$ tower of the SCT. See the Figure 1 and Figure 11.

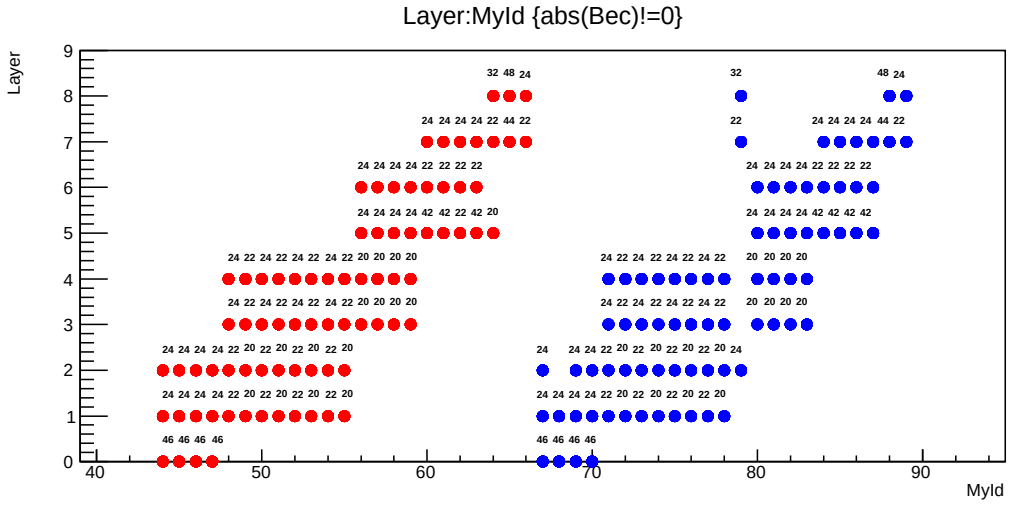
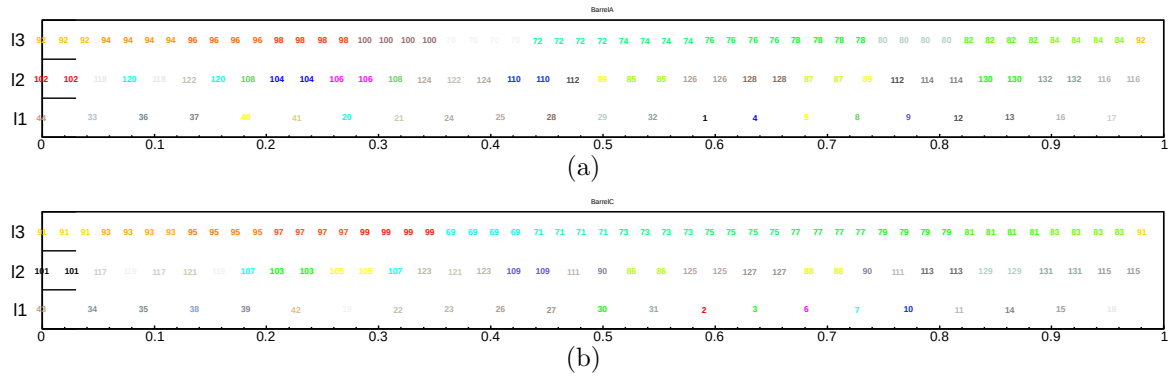


Figure 11: The layer vs the corresponding ROD ID (the number is arbitrary) in the SCT Endcap Disk readout. The first 23 ROD boards read the A-Side disks (red points) and he last 23 ROD boards read the C-Side disks (blue points).

5 Mapping between FE Module (i.e. Fibers) and RODs

The mapping between the FE Module (fibers) and RODs are summarized in the Figures. The x-axis shows the ϕ (normalized from 0. - 1., the origin of the coordinate is arbitrary), the y-axis

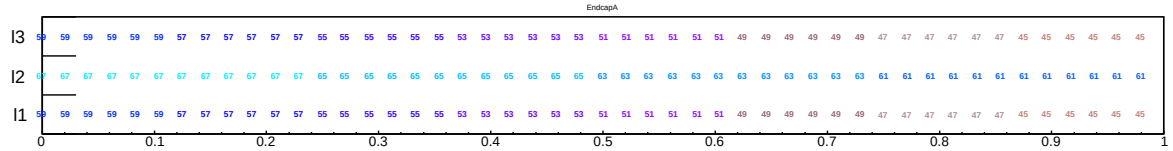
shows the Layers (Layers and *Eta* readout units for SCT Endcap region). The numbers on the figures shows the ROD ID (the number is arbitrary and not official ones) of which corresponds to the detector region. In the same *Phi* region, all the *Eta* blocks read in the same RODs for all regions of Pixel and Barrel of SCT. Only for the Endcap of the SCT, the ROD IDs are shown as a function of *Phi* and *Eta*.



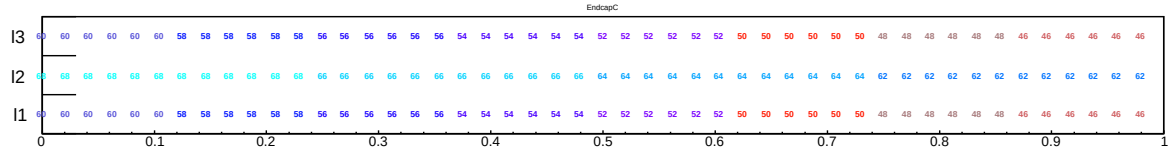
(a)

(b)

Figure 12: FE-Module (fiber) and ROD mapping of **Pixel Barrel** readout system for (a) A-side and (c) C-side.



(a)



(b)

Figure 13: FE-Module (fiber) and ROD mapping of **Pixel Endcap** readout system for (a) A-side and (c) C-side.

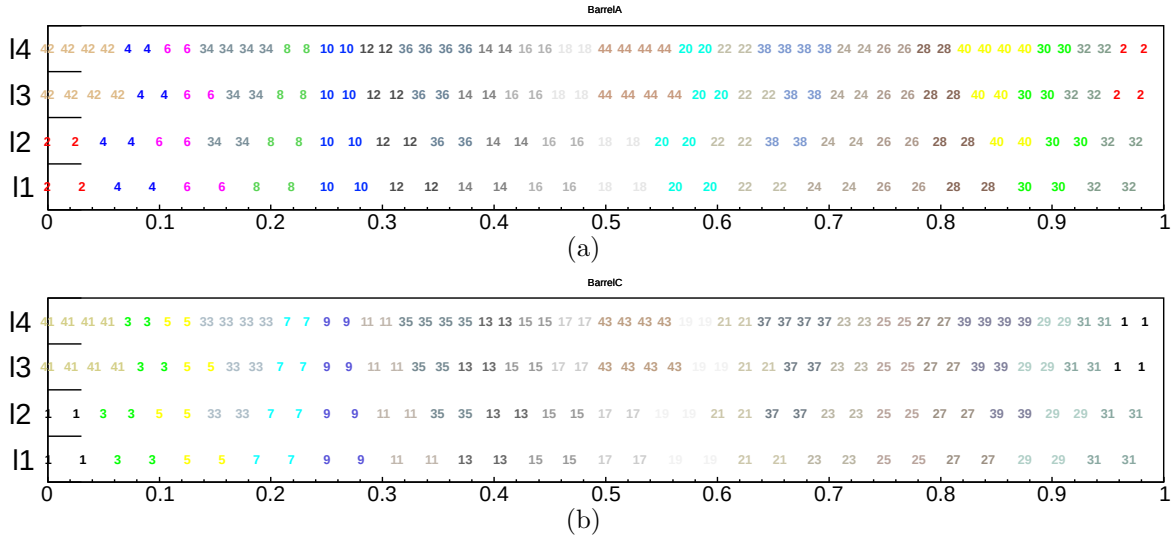


Figure 14: FE-Module (fiber) and ROD mapping of **SCT Barrel** readout system for (a) A-side and (c) C-side.

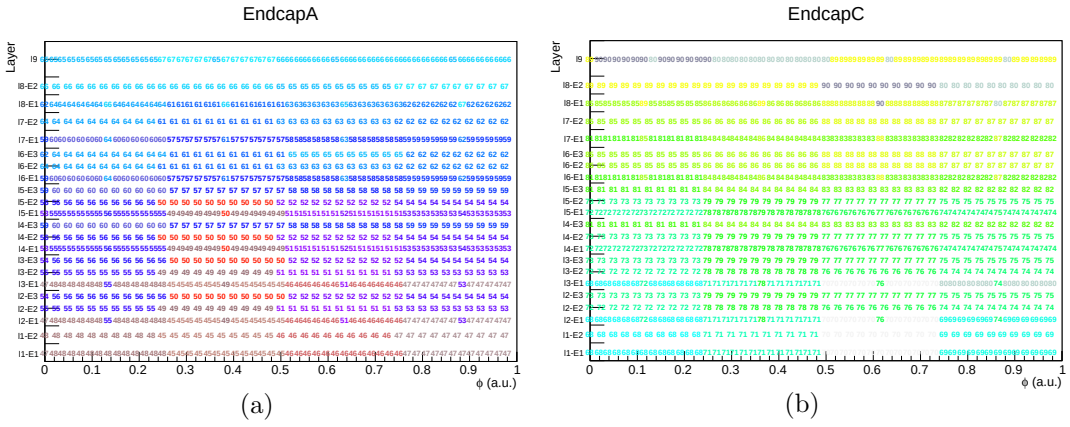


Figure 15: FE-Module (fiber) and ROD mapping of **SCT Endcap** readout system for (a) A-side and (c) C-side.

References

[1] *Pixel Mapping Database file (on ATLAS SVN)*
`https://svnweb.cern.ch/trac/atlasoff/browser/InnerDetector/InDetDetDescr/PixelCabling/trunk/share/Pixels_Atlas_IdMapping_May08.dat`

[2] *SCT Mapping Database file (on ATLAS SVN)*
`https://svnweb.cern.ch/trac/atlasoff/browser/InnerDetector/InDetDetDescr/SCT_Cabling/trunk/share/SCT_Sept08Cabling_svc.dat`

[3] *Mapping file dumper (private tool) (on SVN)*
`https://svnweb.cern.ch/trac/atlasusr/browser/okumura/ftk/myPackages/id_mapping`