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SOLENOIDAL DETECTOR NOTES

MUON CHANNEL COUNT FOR EOI TYPE S DETECTOR

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Files:

CSA::DISK$PHYSICS03:[SDCUSER.DOCS]SDC-90-00049.TXT
CSA::DISK$PHYSICS03:[SDCUSER.DOCS]SDC-90-00049.IGESFLD1
CSA::DISK$PHYSICS03:[SDCUSER.DOCS]SDC-90-00049.IGESFLD2

We have performed an initial count of for the muon system described for the EOI Type S Detector. Using the overall dimensions as provided in the EOI we have divided up the muon system into 'fiducial' chambers in order to estimate the total number of wires. We find the channel count reported in the EOI to be underestimated for 43%, given the assumptions as discussed in the EOI.

We use the following layout and notation to label the chambers:
(For additional information please referS to Drawing Nr. LBL-22d0016a an IGES fileS located at:

CSA::DISK$PHYSICS03:[SDCUSER.DOCS]SDC-90-00049.IGESFLD1
CSA::DISK$PHYSICS03:[SDCUSER.DOCS]SDC-90-00049.IGESFLD2

This includes the over all layout of the chamber fiducial areas.
Access to the CSA cluster can be had via user id: sdcuser
(password:SDC_GENERAL)

1) The muon chambers around the barrel toroids are labeled CMU (Cental Muon). The stations are numbered 1-4 from the inside to the outside. The chambers CMU3 and CMU4 are further subdivided into type Z (for measurement of the r-Z coordinate) and type P (for measurement of the r-phi coordinate)

2) The muon chambers around the intermediate iron toroids are labeled IMU (Intermediate Muon). The stations are numbered 1-4 from the inside to the outside. IMU1 and IMU2 are small enough in both directions that the fiducial volumes for the r-z planes and r-phi planes are identical. The chambers IMU3 and IMU4 are further subdivided into type z (for measurement of the r-Z coordinate) and type P (for measurement of the r-phi coordinate). Division of the solid angle subtended by IMU chambers is arbitrary in that it does not effect the channel counts reported here. This is because the area to be covered is small enough that the chambers need to be tiled in only a linear array, rather than a two dimensional array. (The chambers CMU4Z are tiled in a 4 x 4 array, for example, to cover a 9m x 28m long area). Assuming a maximum drift distance parallel to a coordinate and the total interval over which a coordinated is to be measured yields the number of wires, independent of how the wires are divided into chambers. Hence our drawing does not show different z and p chambers in this area.

3) The muon chambers around the Air Core toroids are labeled ACT. The stations are numbered 1-4 from the inside to the outside. We have indicated both Type Z and P chambers in this angular region. These chamber divisions are not shown in the drawing due to the same reason cited above for the IMU chambers.

The following assumptions are taken from the EOI:

1) The Drift cell in 10 cm wide (+/- 5 cm drift) for solid angle subtended by the Iron toroids. There are 8 measurements per station in the CMU and IMU chamber planes; four in the r-z plane and four in

r-phi plane.

2) The drift cell is 5 cm wide (+/- 2.5 cm drift) for the solid angle subtended by the ACT system. There are 4 stations of 6 wires each for measuring the r-z plane. There are 2 stations of 4 wires each for measuring in r-phi.

3) maximum wire length is 9 meters.

Additional assumptions:

1) The r-phi chambers for the ACT system are assumed to be those located in the two stations closest to the interaction point. This reduces the wire count and allows a measurement of phi while the detector is still phi symmetric.

2) The chambers should be able to fit reasonably inside a standard container. The chamber areas listed on the drawing are fiducial areas only. The effective chamber dimensions will be larger to allow for overlaps, wire supports, dead regions near the end of a cell and electronics, as well as packing material around the chambers when they are acutally transported in a container. Hence the fiducial sizes are significantly smaller than an actual container dimensions.

3) We admit a preference for an even (vs odd) number of chambers.

4) For the chamber systems on the outside of the muon steel, there is plenty of room to have independent chambers for the r-z measurements and the r-phi measurements. This is not the case inside the muon steel where space is a premium and access to the calorimeter must be provided in a straightforward way. Hence for CMU1 chambers we have assumed that the r-phi and r-z chambers are combined into a single monolithic unit. This increases the channel count, unless chambers are bussed together. Bussing chambers together may not be compatible with easy access to the calorimeter. A similar argument holds for the CMU2 chambers.

Results

Channel counts for the individual chamber types can be found below. The total number of channels is as follows

Barrel toroids:		83,328
Endcap toroids:	2 x 12,704	25,408
Air Core Toroids:	2 x 17,120	34,240
Grand Total		142,967

It might be presumed that the channel count could be reduced by measuring r-phi coordinate in the CMU3Z and CMU4Z chambers by charge division, time division, pad readout, etc. However, most of these techniques require two additional electronics channels per wire, and actually lead to more electronics channels, although fewer chambers are built with a more complicated internal structure. One method to reduce the channel count would be to eliminate all phi chambers except CMU1,IMU1, ACT1P and ACT2P. This would probably not substantially reduce the momentum resolution of the system. The total number of channels saved is 53,720.

channel counts

CMU1 8 octants
10 Chambers per octant
18 Wires in r-z

	+ 46 Wires in r-phi per chamber	
	4 Measurements per dimension	20480
CMU2	8 octants	
	10 Chambers per octant	
	21 Wires in r-z	
	+ 57 Wires in r-phi per chamber	
	4 Measurements per dimension	24960
CMU3Z	8 octants	
	12 Chambers per octant	
	20 Wires in r-z	
	4 Measurements per dimension	7680
CMU3P	8 octants	
	16 Chambers per octant	
	18 Wires in r-phi	
	4 Measurements per dimension	9216
CMU4Z	8 octants	
	16 Chambers per octant	
	18 Wires in r-z	
	4 Measurements per dimension	9216
CMU4P	8 octants	
	16 Chambers per octant	
	23 Wires in r-phi	
	4 Measurements per dimension	11,776
IMU1	8 octants	
	1 Chamber per octant	
	18 Wires in r-z	
	+ 43 Wires in r-phi per chamber	
	4 Measurements per dimension	1952
IMU2	8 octants	
	1 Chambers per octant	
	25 Wires in r-z	
	+ 54 Wires in r-phi per chamber	
	4 Measurements per dimension	2528
IMU3	8 octants	
	1 chamber assy/octant	
	41 Wires in r-z	
	+74 wires in r-phi	
	4 Measurements per dimension	3680
IMU4	8 octants	
	1 Chamber assy/octant	
	52 Wires in r-phi	
	+ 90 wires in r-z	
	4 Measurements per dimension	4544
ACT1Z	8 octants	
	1 Assy of chambers/octant	
	44 wires in r-z	
	6 wires per dimension	2112
ACT1P	8 octants	
	1 Assy of Chambers/octant	
	60 wires in R-phi	
	4 Wires per dimension	1920
ACT2Z	8 octants	
	1 assy of chambers/octant	

	58 wires in r-z	
	6 wires per dimension	2784
ACT2P	8 octants	
	1 assy of Chambers/octant	
	82 wires in R-phi	
	4 Wires per dimension	2624
ACT3Z	8 octants	
	1 assy of chambers/octant	
	74 wires in r-z	
	6 wires per dimension	3552
ACT4Z	8 octants	
	1 assy of chambers/octant	
	86 wires in r-z	
	6 wires per dimension	4128