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ECAL end-cap geometry in CMS

In this note we propose a geometry for the CMS ECAL end-cap which fulfills the requirements indicated below. It tries to incorporate the principles used in the IHEP-Protvino design and to comply with the trigger needs. In figure 1 we show a sketch of one end-cap sector and in table 1 we give an estimation of the crystal parameters.

Physics requirements:

- The crystals have typical size 2 to 2.5 cm, for $\eta<2.54$, suitable for the reconstruction of e.m. clusters.
- The dimensions $\Delta\eta.\Delta\phi$ of the HCAL cells are of the order of 0.1x0.1 up to $\eta=2.38$, and of the order 0.2x0.1 up to $\eta=2.98$, suitable for jet reconstruction and for the implementation of isolation criteria to electrons and photons.

Sector geometry:

- Organization in 18 sectors of 20˚, in order to match the barrel geometry.
- The ECAL end-cap covers the rapidity domain from 1.53 to 2.98.
- The start of the end-cap is located at z=317 cm.

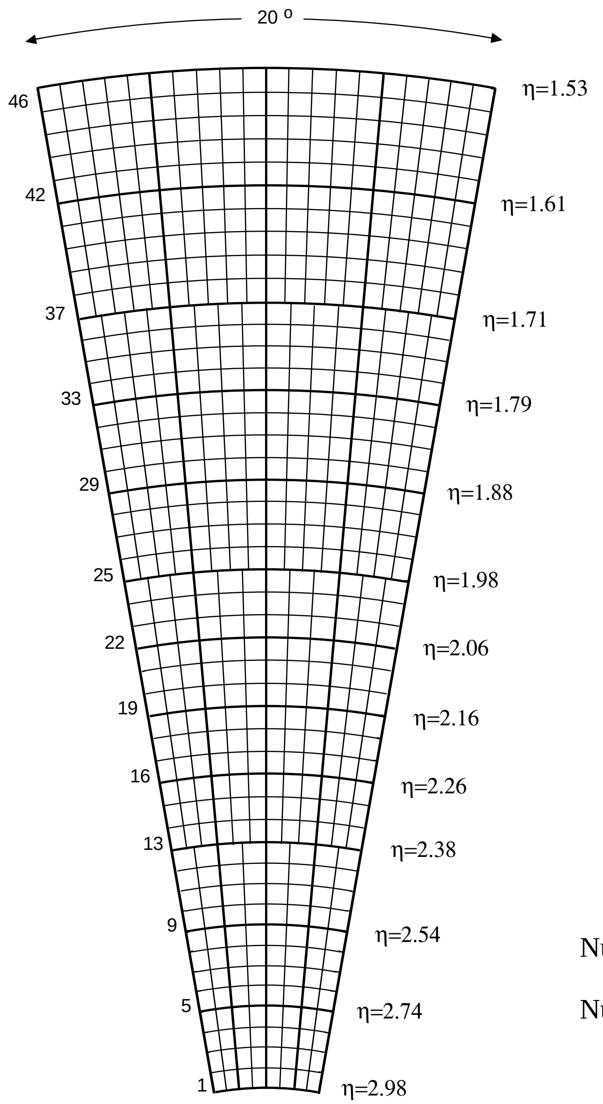
Trigger requirements:

- The electron/photon trigger covers rapidities up to $\eta=2.98$.
- The number of crystals per row in a sector is divisible by 4, in order to form 72 trigger towers along ϕ for every η.
- The trigger towers have dimensions $\Delta\eta.\Delta\phi$ of the order 0.1x0.1 up to $\eta=2.38$, and of the order 0.2x0.1 up to $\eta=2.98$.
- The dimension of the ECAL trigger towers matches the HCAL towers.

Crystals requirements:

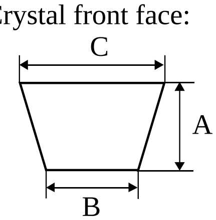
- The crystal front face dimensions A, B or C (see figure 1) do not exceed 2.6 cm.
- The number of crystal per end-cap is of the order of 11000.

Figura 1 - ECAL End-cap Sector



Start of ECAL End-cap: z=317 cm

Crystal front face:



$\eta<2.16$:

A $\in$ [2.31, 2.48] cm
B $\in$ [1.95, 2.53] cm
C $\in$ [2.00, 2.59] cm

$\eta>2.16$:

A $\in$ [2.25, 2.51] cm
B $\in$ [1.41, 2.48] cm
C $\in$ [1.51, 2.58] cm

Number of crystals per sector: 632

Number of crystals per end-cap: 11376

Crystal boundary

Trigger tower boundary

Table 1 - Parameters of ECAL end-cap

Row number	# crystals per row	R (cm) (low edge)	η (low edge)	$\Delta\eta$	A (cm)	B (cm)	C (cm)
1	8	32.3	2.98	0.067	2.30	1.41	1.51
2	8	34.5	2.91	0.063	2.30	1.51	1.60
3	8	36.8	2.85	0.059	2.29	1.60	1.70
4	8	39.0	2.79	0.055	2.29	1.70	1.80
5	8	41.3	2.74	0.052	2.28	1.80	1.90
6	8	43.5	2.68	0.050	2.28	1.90	2.00
7	8	45.7	2.63	0.047	2.27	2.00	2.09
8	8	48.0	2.59	0.045	2.27	2.09	2.19
9	8	50.2	2.54	0.043	2.26	2.19	2.29
10	8	52.5	2.50	0.041	2.26	2.29	2.39
11	8	54.7	2.46	0.040	2.25	2.39	2.48
12	8	56.9	2.42	0.038	2.25	2.48	2.58
13	12	59.2	2.38	0.041	2.51	1.72	1.79
14	12	61.7	2.34	0.039	2.51	1.79	1.87
15	12	64.2	2.30	0.037	2.50	1.87	1.94
16	12	66.7	2.26	0.036	2.49	1.94	2.01
17	12	69.2	2.23	0.035	2.49	2.01	2.09
18	12	71.7	2.19	0.033	2.48	2.09	2.16
19	12	74.2	2.16	0.032	2.48	2.16	2.23
20	12	76.7	2.13	0.031	2.47	2.23	2.30
21	12	79.2	2.10	0.030	2.47	2.30	2.38
22	12	81.7	2.06	0.029	2.46	2.38	2.45
23	12	84.2	2.04	0.028	2.45	2.45	2.52
24	12	86.7	2.01	0.027	2.45	2.52	2.60
25	16	89.2	1.98	0.026	2.38	1.95	2.00
26	16	91.7	1.95	0.025	2.37	2.00	2.05
27	16	94.1	1.93	0.025	2.37	2.05	2.11
28	16	96.6	1.90	0.024	2.36	2.11	2.16
29	16	99.0	1.88	0.023	2.36	2.16	2.21
30	16	101.4	1.86	0.023	2.35	2.21	2.27
31	16	103.9	1.83	0.022	2.35	2.27	2.32
32	16	106.3	1.81	0.022	2.34	2.32	2.37
33	16	108.8	1.79	0.021	2.33	2.37	2.43
34	16	111.2	1.77	0.020	2.33	2.43	2.48
35	16	113.7	1.75	0.020	2.32	2.48	2.53
36	16	116.1	1.73	0.020	2.31	2.53	2.59
37	20	118.5	1.71	0.020	2.41	2.07	2.11
38	20	121.1	1.69	0.019	2.40	2.11	2.16
39	20	123.6	1.67	0.019	2.40	2.16	2.20
40	20	126.2	1.65	0.019	2.39	2.20	2.25
41	20	128.7	1.63	0.018	2.38	2.25	2.29
42	20	131.3	1.61	0.018	2.37	2.29	2.34
43	20	133.8	1.60	0.017	2.37	2.34	2.38
44	20	136.4	1.58	0.017	2.36	2.38	2.42
45	20	138.9	1.56	0.017	2.35	2.42	2.47
46	20	141.5	1.55	0.016	2.35	2.47	2.51