Monte Carlo Realization Files for J/ψ of BESII

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Abstract

It is presented how Monte Carlo dead channel and realization files dcl_xxx.so_becons and brl_xxx.sobecons (xxx=021,022,023) for three cycles of J/ψ of BES II are produced.

1. Introduction

The Monte Carlo dead channel and realization files include two files dcl_xxx.sobecons and brl_xxx.sobecons, where xxx denotes a version number. The first file is for the dead and hot channels of MDC, BSC and ESC. The second file is for MDC wires' spatial resolutions and hit efficiencies, TOF time resolutions, the distribution of primary vertices and BSC forty parameters.

J/ψ collection of BESII is divided into three cycles according to change in MDC voltage between Dec. 25th, 1990 and May 8th, 2000. The run numbers for three cycles are 1. 13691–15797 2.15798–16242 3. 16243–16835. The version numbers of the files corresponding to them are 021, 022 and 023 respectively based on BES convention. If one is going to simulate, for example, J/ψ of run 13691–15797, the sentences

dead_cnl 021;
real_sim 021;

should be put in his .sobcard file.

2. Dead Wires and Hot Wires for MDC and BSC

The files dcl_xxx.sobecons (xxx=021,022,023) include the numbers of the dead wires and hot wires for MDC, BSC and EBC. The wires for MDC and BSC are found out by analyzing Bhabha events. The wires for EBC are found out by analyzing all events. However ESC information is not used in the practical Monte Carlo simulation of BES up to now, thought it is included in the files.

2.1) MDC dead wires and bad wires:

A hit is defined as a signal of $5 < ADC < 4096$ and $5 < TDC < 4096$. If

$$nhit(i,l)/\overline{nhit}(l) < 0.01,$$

nhit(i,l)=number of hits for wire(i) in layer(l) and $\overline{nhit}(l)$=number of hits for layer(l)/number of wires in layer(l), wire(i) is regarded as a dead wire.If

$$nhit(i,l)/\overline{nhit}(l) > 5,$$

wire(i) is regarded as a hot wire.
2.2) BSC dead wires and hot wires :

A hit is defined a signal of $ADC > 0$ for BSC. Both west end and east end of a wire in BSC can give signals. Let

$$ratiowest(i,l) = nhitwest(i,l)/\overline{nhit}(l)$$

$$ratioeast(i,l) = nhiteast(i,l)/\overline{nhit}(l).$$

where nhitwest(i,l) is number of signals come from the west end of wire(i) in layer(l), nhiteast(i,l) from the east, $\overline{nhit}(l) = 0.5 \times (tothitwest(l) + tothiteast(l))/560$, and tothitwest(l) is total number of signals coming from the west ends of all wires in layer(l), tothiteast(l) is total number of signals coming from the east ends of all wires in layer(l), 560 is number of wires for every layer.

If ($ratiowest(i,l) < 0.01$ or $ratiowest(i,l) > 5$) and ($ratioeast(i,l) < 0.01$ or $ratioeast(i,l) > 5$), wire(i) is regarded as a dead wire.

if ($ratiowest(i,l) < 0.01$ or $ratiowest(i,l) > 5$) or ($ratioeast(i,l) < 0.01$ or $ratioeast(i,l) > 5$), wire(i) is regarded as a bad wire.

Fig.1, Fig.2 and Fig.3 shows the dead and hot (or bad) wires of MDC and BSC described in *dcl_021*.sobecons, *dcl_022.sobecons* and *dcl_021.sobecons* respectively.

3 Realization

3.1) Vertex position distribution:

A vertex position distribution is obtained by analyzing hadron events. x=trk(vrtsub(2,1)+5), y=trk(vrtsub(2,1)+6), z=trk(vrtsub(2,1)+7), which are primary vertex coordinates.

Table 1,2,3 shows vertex position distributions described in *brl_021.sobcons*, *brl_022.sobcons* and *brl_023.sobcons* respectively.

Table 1

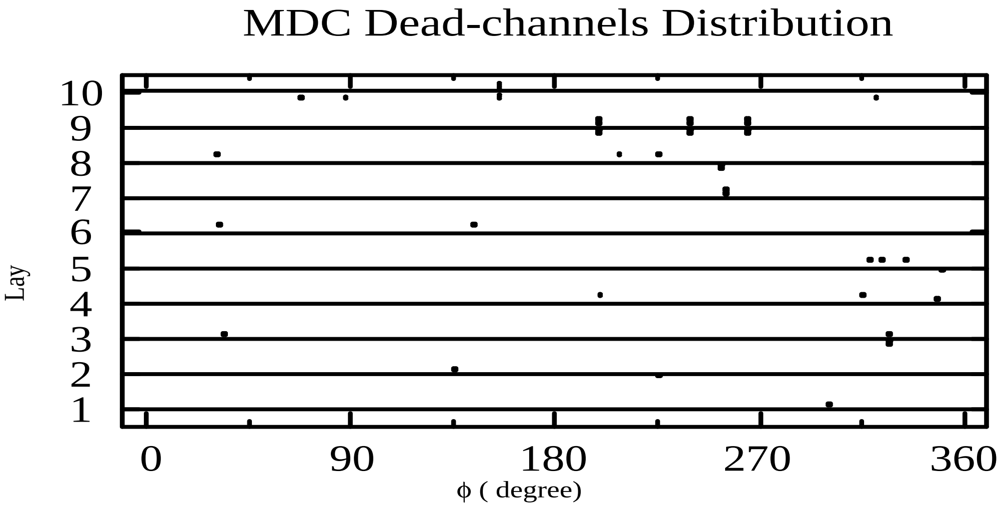
Vertex position and standard error ($\times 10^{-2}$ m)

x	y	z	σ_x	σ_y	σ_z
0.2734	-0.2065	0.1774	0.2492	0.2319	2.952

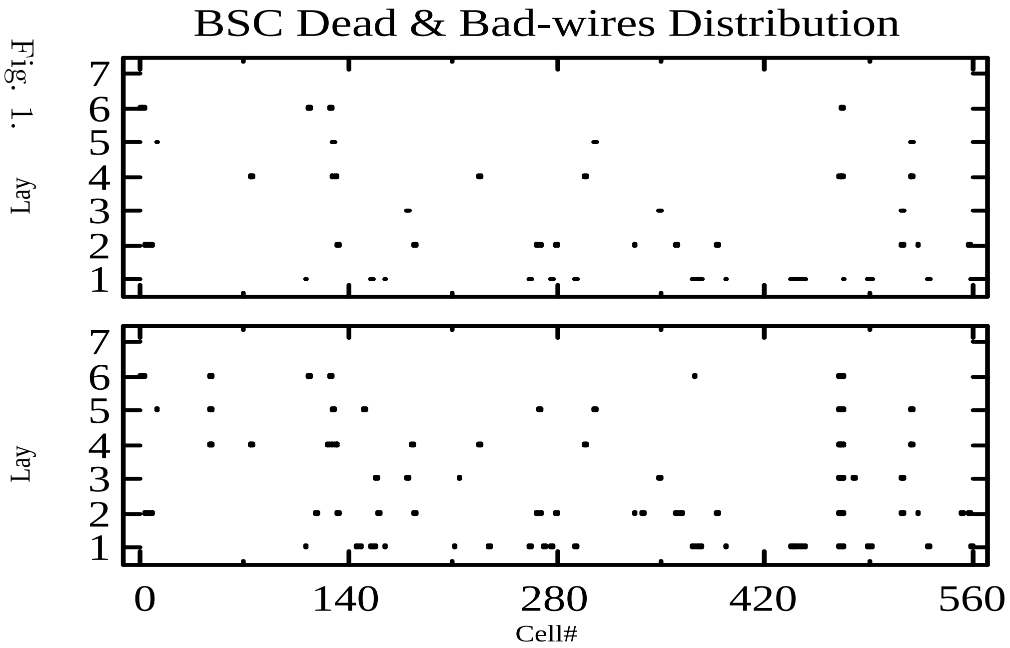
Table 2

Vertex position and standard error ($\times 10^{-2}$ m)

x	y	z	σ_x	σ_y	σ_z
0.2690	-0.1984	0.0382	0.2359	0.2222	3.149



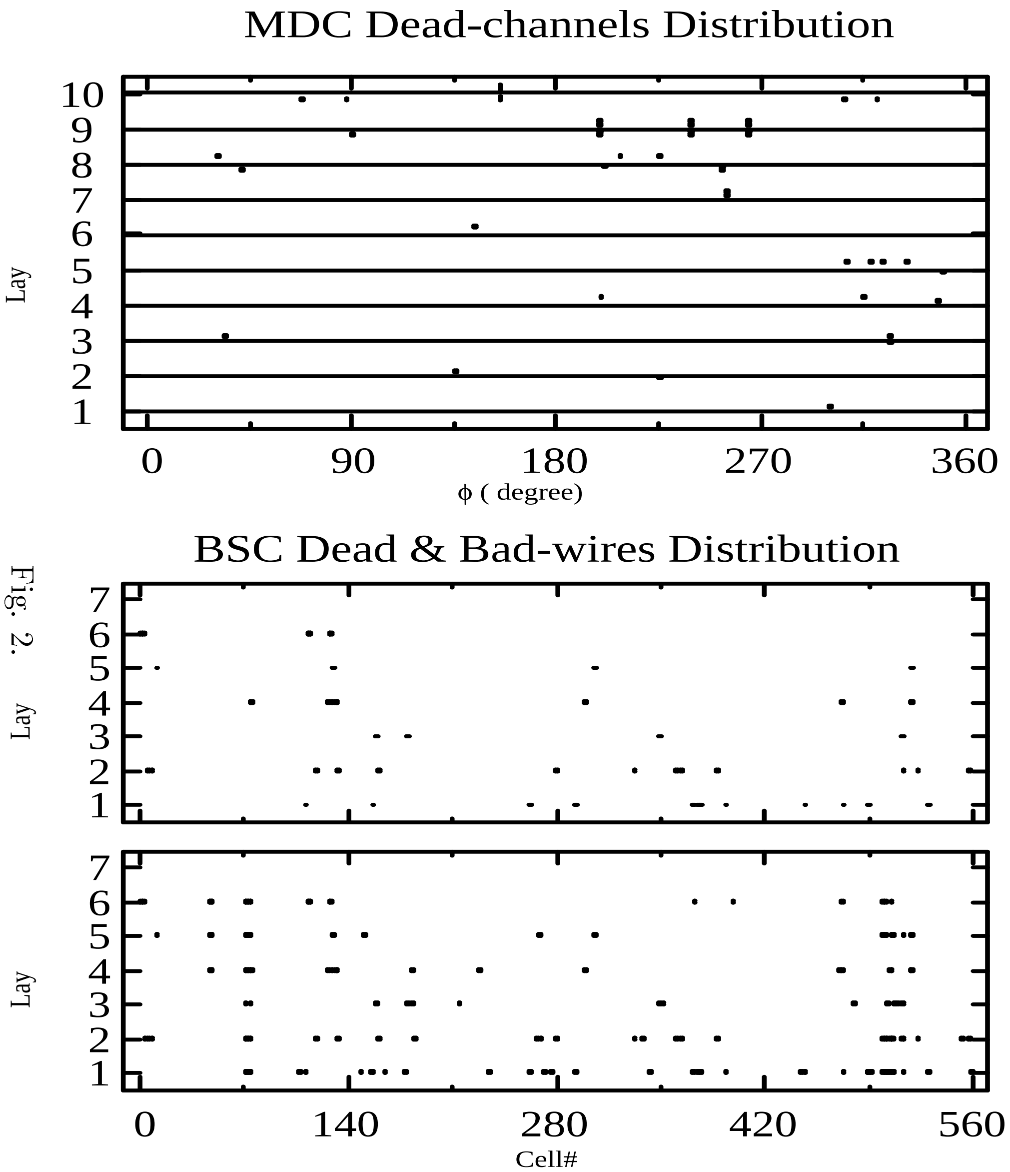
L	D-W	H-W	ALL
10	7	0	512
9	12	0	464
8	5	0	416
7	2	0	368
6	2	0	320
5	4	0	272
4	3	0	224
3	4	0	256
2	2	0	192
1	1	0	192
Tot:	42	0	3216



Lay	D-wire
6	7
5	5
4	10
3	4
2	15
1	21
Total:	62

Lay	B-wire
6	13
5	13
4	17
3	11
2	24
1	32
Total:	110

Fig. 1.

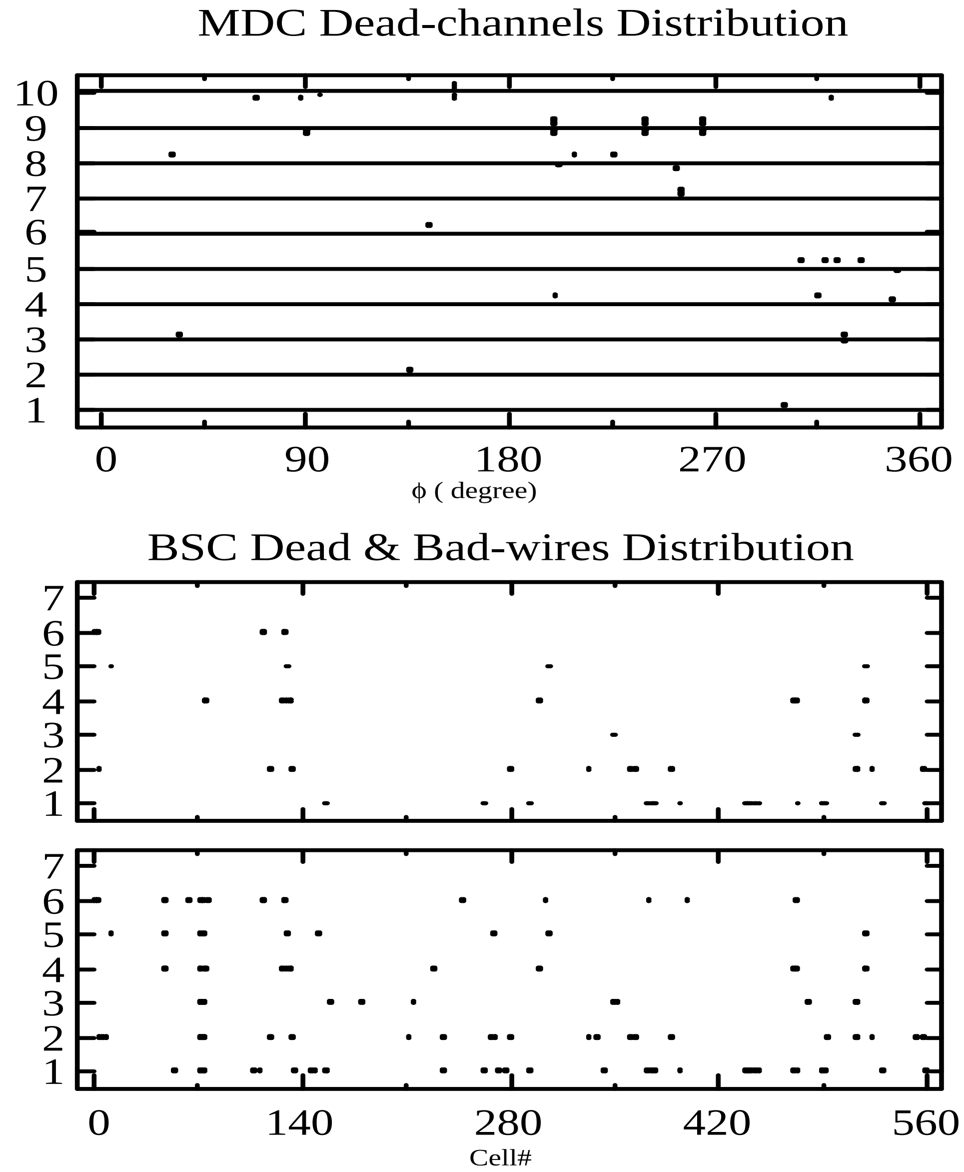


L	D-W	H-W	ALL
10	8	0	512
9	13	0	464
8	7	0	416
7	2	0	368
6	1	0	320
5	5	0	272
4	3	0	224
3	3	0	256
2	2	0	192
1	1	0	192
Tot:	45	0	3216

Lay	D-wire
6	6
5	4
4	10
3	5
2	13
1	12
Total:	50

Lay	B-wire
6	18
5	18
4	20
3	16
2	30
1	37
Total:	139

Fig. 2.



L	D-W	H-W	ALL
10	8	0	512
9	14	0	464
8	5	0	416
7	2	0	368
6	1	0	320
5	5	0	272
4	3	0	224
3	3	0	256
2	1	0	192
1	1	0	192
Tot:	43	0	3216

Lay	D-wire
6	6
5	5
4	11
3	3
2	12
1	19
Total:	56

Lay	B-wire
6	17
5	13
4	16
3	12
2	25
1	35
Total:	118

Fig. 3.

Table 3
Vertex position and standard error ($\times 10^{-2}$ m)

x	y	z	σ_x	σ_y	σ_z
0.2787	-0.1973	0.0506	0.2324	0.2175	3.017

3.2) TOF resolutions:

TOF resolutions for 48 counters are obtained by analyzing bhabha events. The resolution is defined as the standard error for the distribution of

$$res(i) = tof_{mes}(i) - tof_{exp}(i), \qquad i = 1, 2, \cdots, 48.$$

Table 4
TOF resolutions (ns)

counter	1	2	3	4	5	6	7	8
reso	178.9	201.4	171.4	177.9	174.6	189.7	192.3	190.5
counter	9	10	11	12	13	14	15	16
reso	171.3	157.1	179.0	186.6	185.1	185.0	203.1	187.4
counter	17	18	19	20	21	22	23	24
reso	213.6	173.5	186.6	158.0	198.0	171.7	204.7	170.2
counter	25	26	27	28	29	30	31	32
reso	185.8	169.5	177.0	155.5	168.2	211.3	169.2	156.7
counter	33	34	35	36	37	38	39	40
reso	167.6	188.2	179.2	201.3	177.2	187.8	173.8	200.9
conuter	41	42	43	44	45	46	47	48
reso	181.8	168.1	200.6	165.6	189.3	172.9	195.7	189.3

Table 5
TOF resolutions (ns)

counter	1	2	3	4	5	6	7	8
reso	192.9	227.6	195.8	210.4	189.1	216.6	204.8	181.3
counter	9	10	11	12	13	14	15	16
reso	194.2	185.5	197.3	187.8	196.9	175.4	204.3	194.9
counter	17	18	19	20	21	22	23	24
reso	187.1	182.9	198.5	183.8	212.6	176.3	208.3	182.8
counter	25	26	27	28	29	30	31	32
reso	213.6	190.4	203.6	175.5	193.1	227.4	183.4	176.7
counter	33	34	35	36	37	38	39	40
reso	204.3	199.6	207.1	204.4	226.2	215.7	192.8	226.0
conuter	41	42	43	44	45	46	47	48
reso	170.8	194.4	185.1	205.4	200.8	227.7	191.4	211.0

Table 6
TOF resolutions (ns)

counter	1	2	3	4	5	6	7	8
reso	175.2	215.7	169.3	189.2	172.0	210.2	191.7	184.8
counter	9	10	11	12	13	14	15	16
reso	174.4	185.9	190.9	169.6	197.5	179.2	175.5	173.3
counter	17	18	19	20	21	22	23	24
reso	216.3	186.7	193.1	187.6	196.9	171.2	202.9	174.1
counter	25	26	27	28	29	30	31	32
reso	204.1	179.5	178.5	158.6	171.8	236.4	167.4	174.1
counter	33	34	35	36	37	38	39	40
reso	190.5	190.3	188.8	191.8	195.3	168.9	177.3	204.7
conuter	41	42	43	44	45	46	47	48
reso	176.3	193.8	199.9	194.9	205.3	190.1	201.4	207.3

The time resolutions given above are the 'bare' values for the double-ended hits and include the error of the beam size. The time resolutions for the single-ended hits after subtracting beam effects are

$$tofres(i) = \sqrt{2 \times (tofres_{bare}(i) - zir/(3.0 \times 10^{-4}))}, \quad i = 1, \ldots 48.$$

where zir is beam size sigma in z direction.

3.3) Hit efficiencies for the layers of MDC

The efficiencies are obtained by analyzing bhabha events.

$$eff(i) = nhit_{mea}(i)/nhit_{exp}(i), \qquad i = 1, \cdots, 40.$$

where $nhit_{mea}(i)$ is measured number of hit times of layer(i) for the analyzed bhabha events, $nhit_{exp}(i)$ is expected number of hit times based on the polar angles of the bhabha events. Table 7, Table 8 and Table 9 shows the efficiencies described in $brl\_021.sobecons$, $brl\_022.sobecons$ and $brl\_023.sobecons$.

Table 7
Hit efficiencies of MDC

counter	1	2	3	4	5	6	7	8
eff	0.9843	0.9811	0.9611	0.9620	0.9875	0.9681	0.9720	0.9603
counter	9	10	11	12	13	14	15	16
eff	0.9668	0.9669	0.9537	0.9731	0.9893	0.9908	0.9703	0.9484
counter	17	18	19	20	21	22	23	24
eff	0.9863	0.9461	0.9645	0.9266	0.9735	0.9816	0.9786	0.9606
counter	25	26	27	28	29	30	31	32
eff	0.9902	0.9808	0.9707	0.9633	0.9647	0.9800	0.9791	0.9297
counter	33	34	35	36	37	38	39	40
eff.	0.9428	0.9412	0.9353	0.9414	0.9153	0.9472	0.9474	0.8953

Table 8
Hit efficiencies of MDC

counter	1	2	3	4	5	6	7	8
eff.	0.9857	0.9833	0.9633	0.9625	0.9897	0.9716	0.9709	0.9688
counter	9	10	11	12	13	14	15	16
eff.	0.9854	0.9734	0.9574	0.9895	0.9639	0.9616	0.9393	0.9123
counter	17	18	19	20	21	22	23	24
eff.	0.9877	0.9649	0.9787	0.9138	0.9775	0.9861	0.9826	0.9622
counter	25	26	27	28	29	30	31	32
eff	0.9917	0.9827	0.9744	0.9731	0.9589	0.9727	0.9814	0.9388
counter	33	34	35	36	37	38	39	40
eff.	0.9387	0.9499	0.9457	0.9448	0.9176	0.9558	0.9530	0.9128

Table 9
Hit efficiencies of MDC

counter	1	2	3	4	5	6	7	8
eff.	0.9874	0.9866	0.9704	0.9668	0.9911	0.9949	0.9734	0.9727
counter	9	10	11	12	13	14	15	16
eff.	0.9888	0.9747	0.9581	0.9901	0.9715	0.9683	0.9469	0.9206
counter	17	18	19	20	21	22	23	24
eff.	0.9887	0.9604	0.9735	0.9258	0.9746	0.9846	0.9810	0.9557
counter	25	26	27	28	29	30	31	32
eff.	0.9928	0.9870	0.9758	0.9733	0.9690	0.9717	0.9817	0.9377
counter	33	34	35	36	37	38	39	40
eff.	0.9368	0.9455	0.9483	0.9393	0.9224	0.9582	0.9552	0.9170

3.4) Spatial resolutions of MDC

MDC consists of 10 layers and each layer consists of 4 sublayers. A spatial resolution of MDC is defined as the standard error of the distribution of

$$d_i^m - d_i(\alpha), \qquad i = 1, \cdots, 40,$$

where d_i is measured drift distance between the firing point and the wire(i) and $d_i(\alpha)$ is theoretical distance from the wire(i) to the corresponding point in the theoretical trajectory which depends on the parameter α ($\alpha_1 = \phi$, $\alpha_2 = k$, $\alpha = tg\lambda$, $\alpha_4 = \zeta$, $\alpha_5 = \eta$). The parameter α does not include the information of wire(i). In practice, in order to save time, we calculate the resolutions of five wires(n,n+8,n+16,n+24,n+32,n=1,2,$\cdots$8.) for one time, so the parameter α does not include the information from the five wires. Table 10, Table 11 and Table 12 shows the resolutions described in $brl\_021.sobecons$, $brl\_022.sobecons$ and $brl\_023.sobecons$.

The spatial resolutions given above are the 'bare' values for 40 sublayers, which are not input into $brl\_xxx.sobeons$ directly. The spatial resolutions for 10 layers after subtracting the effects of the materials before MDC, which appear in in $brl\_xxx.sobeons$ finally, are

$$mdcres(i) = \sqrt{\overline{mdcres}(i)^2 - 0.05^2)}, \quad i = 1, 2 \ldots 10,$$

where $\overline{mdcres}(i) = (\sum_{j=1}^{4} mdcres_{bare}(i+j))/4$.

Table 10
Spatial Resolutions of MDC (mm)

counter	1	2	3	4	5	6	7	8
res.	0.3023	0.2878	0.2874	0.2956	0.2879	0.2785	0.2758	0.3178
counter	9	10	11	12	13	14	15	16
res.	0.2687	0.2456	0.2537	0.2860	0.2391	0.2363	0.2487	0.2514E
counter	17	18	19	20	21	22	23	24
res.	0.2483	0.2443	0.2533	0.2669	0.2374	0.2342	0.2422	0.2571
counter	25	26	27	28	29	30	31	32
res.	0.2429	0.2428	0.2525	0.2611	0.2243	0.2292	0.2255	0.2499
counter	33	34	35	36	37	38	39	40
res.	0.2569	0.2428	0.2551	0.2795	0.2467	0.2578	0.2592	0.2672

Table 11
Spatial Resolutions of MDC (mm)

counter	1	2	3	4	5	6	7	8
res.	0.2852	0.2769	0.2734	0.2795	0.2787	0.2688	0.2726	0.3041
counter	9	10	11	12	13	14	15	16
res.	0.2517	0.2281	0.2365	0.2686	0.2428	0.2418	0.2500	0.2595
counter	17	18	19	20	21	22	23	24
res.	0.2370	0.2350	0.2468	0.2597	0.2285	0.2244	0.2309	0.2517
counter	25	26	27	28	29	30	31	32
res.	0.2346	0.2342	0.2436	0.2495	0.2209	0.2175	0.2191	0.2399
counter	33	34	35	36	37	38	39	40
res.	0.2467	0.2409	0.2461	0.2715	0.2385	0.2471	0.2470	0.2554

Table 12
Spatial Resolutions of MDC (mm)

counter	1	2	3	4	5	6	7	8
res.	0.2721	0.2616	0.2556	0.2682	0.2778	0.2684	0.2678	0.3092
counter	9	10	11	12	13	14	15	16
res.	0.2476	0.2262	0.2329	0.2602	0.2549	0.2546	0.2538	0.2642
counter	17	18	19	20	21	22	23	24
res.	0.2360	0.2333	0.2398	0.2546	0.2359	0.2335	0.2412	0.2574
counter	25	26	27	28	29	30	31	32
res.	0.2370	0.2397	0.2401	0.2477	0.2215	0.2186	0.2178	0.2369
counter	33	34	35	36	37	38	39	40
res.	0.2459	0.2339	0.2427	0.2657	0.2326	0.2430	0.2407	0.2497

3.5) Barrel of Shower Counter

40 parameters for BSC are showed in table 13 for all versions.

Table 13
BSC parameters

1 5	2 150.0	3 170.0	4 190.0	5 0	6 0	7 0	8 0
9 0	10 0	11 0.96	12 0.96	13 0.94	14 0.94	15 0.94	16 0.94
17 0.89	18 0.89	19 0.89	20 0.84	21 0.84	22 0.84	23 0.80	24 0.80
25 0.80	26 0.80	27 0.80	28 0.80	29 0.80	30 0.80	31 0.80	32 0.80
33 0.80	34 0.80	35 0.85	36 0.20	37 0.75	38 1.20	39 0.0645	40 0.945

note:
1 pedestal.
2,3,4 ADC for $cos\theta \leq 0.4$, $0.4 < cos\theta \leq 0.8$, $cos\theta > 0.8$.
5-10 unused.
11-34 efficiencies for 24 layers.
35 fraction of ADC.
36 σ_1 for 1st peak of ADC.
37 proportion of 1th peak
38 σ_2 for 2nd peak of ADC.
39 BCCONV.
40 ECALIB.