

# Topology Analysis <sup>\*†‡§</sup>

(v2.12.3)

July 13, 2023

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<sup>†</sup>This package is implemented referring to a program called TOPO, which is first developed by Prof. Shuxian Du from Zhengzhou University and later extended and maintained by Prof. Gang Li from Institute of High Energy Physics, Chinese Academy of Sciences. The TOPO program has been widely used by colleagues in BESIII collaboration. Several years ago, when I was a Ph.D. student working on the BESIII experiment, I learned the idea of topology analysis and a lot of programming techniques from the TOPO program. So, I really appreciate the original works of Prof. Du and Prof. Li very much. To meet my own needs and to practice developing analysis tools with C++, ROOT, and LaTeX, I wrote the package from scratch. At that time, the package functioned well but was relatively simple. At the end of 2017, when I just started my post-doctoral research at Beihang University, my co-supervisor Prof. Chengping Shen reminded me that it could be a useful tool for the Belle II experiment as well. So, I revised and extended it, making it more well-rounded and suitable for the Belle II experiment. Now, it also applies to many other similar high energy physics experiments. Here, I would like to thank Prof. Du and Prof. Li for their original works, and Prof. Shen for his suggestion, guidance, support, and encouragement.

<sup>‡</sup>Besides, I would like to thank all of the people who have helped me in the development of the program. I am particularly grateful to Prof. Xingtao Huang for his comments on the principles and styles of the program, to Remco de Boer for his suggestions on the tex output and the use of GitHub, and to Xi Chen for his discussions on the core algorithms. I am especially indebted to Prof. Xiqing Hao, Longke Li, Xiaoping Qin, Ilya Komarov, Yubo Li, Guanda Gong, Suxian Li, Junhao Yin, Prof. Xiaolong Wang, Yeqi Chen, Hannah Wakeling, Hongrong Qi, Hui Li, Ning Cao, Sanjeeda Bharati Das, Kazuki Kojima, Tingting Han, Fang Yan, Lin Wang, Meiru An, and Noreen Rauls for their advice in extending and perfecting the program. Also, I thank Xi'an Xiong, Runqiu Ma, Wencheng Yan, Sen Jia, Lu Cao, Dong Liu, Hongpeng Wang, Jiawei Zhang, Jiajun Liu, Maoqiang Jing, Yi Zhang, Wei Shan, and Yadi Wang for their efforts in helping me test the program.

<sup>§</sup>The paper on the tool has been published by *Computer Physics Communications*. You can find this paper and the preprint corresponding to it in the links [Comput. Phys. Commun. 258 \(2021\) 107540](#) and [arXiv:2001.04016](#), respectively. If the tool really helps your researches, we would appreciate it very much if you could cite the paper in your publications.

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Table 1: Decay trees and their respective initial-final states.

rowNo	decay tree (decay initial-final states)	iDcyTr	nEtr	nCEtr
1	$\Upsilon(4S) \rightarrow B^0 \bar{B}^0, B^0 \rightarrow \pi^0 K^+ K^-, B^0 \rightarrow \pi^0 K^+ K^-$ ( $\Upsilon(4S) \rightarrow \pi^0 \pi^0 K^+ K^+ K^- K^-$ )	44	6640	6640
2	$\Upsilon(4S) \rightarrow B^0 \bar{B}^0, B^0 \rightarrow \pi^0 K^+ K^-, B^0 \rightarrow \pi^0 K^+ K^- \gamma^F$ ( $\Upsilon(4S) \rightarrow \pi^0 \pi^0 K^+ K^+ K^- K^- \gamma^F$ )	20	2130	8770
3	$\Upsilon(4S) \rightarrow B^0 \bar{B}^0, B^0 \rightarrow \pi^0 K^+ K^-, \bar{B}^0 \rightarrow e^- \bar{\nu}_e D^{*+}, D^{*+} \rightarrow \pi^+ D^0, D^0 \rightarrow \pi^0 \pi^+ K^-$ ( $\Upsilon(4S) \rightarrow e^- \bar{\nu}_e \pi^0 \pi^0 \pi^+ \pi^+ K^+ K^- K^-$ )	800	330	9100
4	$\Upsilon(4S) \rightarrow B^0 \bar{B}^0, B^0 \rightarrow \pi^0 K^+ K^-, \bar{B}^0 \rightarrow \mu^- \bar{\nu}_\mu D^{*+}, D^{*+} \rightarrow \pi^+ D^0, D^0 \rightarrow \pi^0 \pi^+ K^-$ ( $\Upsilon(4S) \rightarrow \mu^- \bar{\nu}_\mu \pi^0 \pi^0 \pi^+ \pi^+ K^+ K^- K^-$ )	93	223	9323
5	$\Upsilon(4S) \rightarrow B^0 \bar{B}^0, B^0 \rightarrow \pi^0 K^+ K^-, B^0 \rightarrow \pi^0 K^+ K^- \gamma^F \gamma^F$ ( $\Upsilon(4S) \rightarrow \pi^0 \pi^0 K^+ K^+ K^- K^- \gamma^F \gamma^F$ )	688	210	9533
6	$\Upsilon(4S) \rightarrow B^0 \bar{B}^0, B^0 \rightarrow \pi^0 K^+ K^- \gamma^F, B^0 \rightarrow \pi^0 K^+ K^- \gamma^F$ ( $\Upsilon(4S) \rightarrow \pi^0 \pi^0 K^+ K^+ K^- K^- \gamma^F \gamma^F$ )	32	178	9711
7	$\Upsilon(4S) \rightarrow B^0 \bar{B}^0, B^0 \rightarrow \pi^0 K^+ K^-, B^0 \rightarrow \pi^0 K^+ K^-, \pi^0 \rightarrow e^+ e^- \gamma^F$ ( $\Upsilon(4S) \rightarrow e^+ e^- \pi^0 K^+ K^+ K^- K^- \gamma^F$ )	535	170	9881
8	$\Upsilon(4S) \rightarrow B^0 \bar{B}^0, B^0 \rightarrow \pi^0 K^+ K^-, \bar{B}^0 \rightarrow e^- \bar{\nu}_e D^{*+} \gamma^F, D^{*+} \rightarrow \pi^+ D^0, D^0 \rightarrow \pi^0 \pi^+ K^-$ ( $\Upsilon(4S) \rightarrow e^- \bar{\nu}_e \pi^0 \pi^0 \pi^+ \pi^+ K^+ K^- K^- \gamma^F$ )	235	162	10043
9	$\Upsilon(4S) \rightarrow B^0 \bar{B}^0, B^0 \rightarrow \pi^0 K^+ K^-, \bar{B}^0 \rightarrow e^- \bar{\nu}_e D^{*+}, D^{*+} \rightarrow \pi^+ D^0, D^0 \rightarrow \pi^+ K^-$ ( $\Upsilon(4S) \rightarrow e^- \bar{\nu}_e \pi^0 \pi^0 \pi^+ \pi^+ K^+ K^- K^-$ )	74	104	10147
10	$\Upsilon(4S) \rightarrow B^0 \bar{B}^0, B^0 \rightarrow \pi^0 K^+ K^-, \bar{B}^0 \rightarrow e^- \bar{\nu}_e D^{*+}, D^{*+} \rightarrow \pi^0 D^+, D^+ \rightarrow \pi^+ \pi^+ K^-$ ( $\Upsilon(4S) \rightarrow e^- \bar{\nu}_e \pi^0 \pi^0 \pi^+ \pi^+ K^+ K^- K^-$ )	1744	96	10243
11	$\Upsilon(4S) \rightarrow B^0 \bar{B}^0, B^0 \rightarrow \pi^0 K^+ K^-, \bar{B}^0 \rightarrow \pi^0 \pi^+ \pi^- \pi^- D^{*+}, D^{*+} \rightarrow \pi^+ D^0, D^0 \rightarrow \pi^0 \pi^+ K^-$ ( $\Upsilon(4S) \rightarrow \pi^0 \pi^0 \pi^0 \pi^+ \pi^+ \pi^- \pi^- K^+ K^- K^-$ )	440	95	10338
12	$\Upsilon(4S) \rightarrow B^0 \bar{B}^0, B^0 \rightarrow \pi^0 K^+ K^-, \bar{B}^0 \rightarrow \mu^- \bar{\nu}_\mu D^+, D^+ \rightarrow \pi^0 K_L^0 \pi^+$ ( $\Upsilon(4S) \rightarrow \mu^- \bar{\nu}_\mu \pi^0 \pi^0 K_L^0 \pi^+ K^+ K^-$ )	170	88	10426
13	$\Upsilon(4S) \rightarrow B^0 \bar{B}^0, B^0 \rightarrow \pi^0 K^+ K^-, \bar{B}^0 \rightarrow \mu^- \bar{\nu}_\mu D^+, D^+ \rightarrow \pi^+ \pi^+ K^-$ ( $\Upsilon(4S) \rightarrow \mu^- \bar{\nu}_\mu \pi^0 \pi^+ \pi^+ K^+ K^- K^-$ )	130	85	10511
14	$\Upsilon(4S) \rightarrow B^0 \bar{B}^0, B^0 \rightarrow \pi^0 K^+ K^-, \bar{B}^0 \rightarrow e^- \bar{\nu}_e D^{*+}, D^{*+} \rightarrow \pi^+ D^0, D^0 \rightarrow \mu^+ \nu_\mu K^-$ ( $\Upsilon(4S) \rightarrow e^- \bar{\nu}_e \mu^+ \nu_\mu \pi^0 \pi^+ K^+ K^- K^-$ )	810	85	10596
15	$\Upsilon(4S) \rightarrow B^0 \bar{B}^0, B^0 \rightarrow \pi^0 K^+ K^-, \bar{B}^0 \rightarrow e^- \bar{\nu}_e D^{*+}, D^{*+} \rightarrow \pi^0 D^+, D^+ \rightarrow \pi^0 K_L^0 \pi^+$ ( $\Upsilon(4S) \rightarrow e^- \bar{\nu}_e \pi^0 \pi^0 \pi^0 K_L^0 \pi^+ K^+ K^-$ )	228	82	10678
16	$\Upsilon(4S) \rightarrow B^0 \bar{B}^0, B^0 \rightarrow \pi^0 K^+ K^-, \bar{B}^0 \rightarrow e^- \bar{\nu}_e D^{*+}, D^{*+} \rightarrow \pi^+ D^0, D^0 \rightarrow K^- a_1^+, a_1^+ \rightarrow \rho^0 \pi^+, \rho^0 \rightarrow \pi^+ \pi^-$ ( $\Upsilon(4S) \rightarrow e^- \bar{\nu}_e \pi^0 \pi^+ \pi^+ \pi^+ \pi^- K^+ K^- K^-$ )	1071	77	10755
17	$\Upsilon(4S) \rightarrow B^0 \bar{B}^0, B^0 \rightarrow \pi^0 K^+ K^-, \bar{B}^0 \rightarrow \mu^- \bar{\nu}_\mu D^{*+}, D^{*+} \rightarrow \pi^0 D^+, D^+ \rightarrow \pi^+ \pi^+ K^-$ ( $\Upsilon(4S) \rightarrow \mu^- \bar{\nu}_\mu \pi^0 \pi^0 \pi^+ \pi^+ K^+ K^- K^-$ )	357	74	10829

rowNo	decay tree (decay initial-final states)	iDcyTr	nEtr	nCEtr
18	$\Upsilon(4S) \rightarrow B^0 \bar{B}^0, B^0 \rightarrow \pi^0 K^+ K^-, \bar{B}^0 \rightarrow e^- \bar{\nu}_e D^+, D^+ \rightarrow \pi^+ \pi^+ K^-$ ( $\Upsilon(4S) \rightarrow e^- \bar{\nu}_e \pi^0 \pi^+ \pi^+ K^+ K^- K^-$ )	785	71	10900
19	$\Upsilon(4S) \rightarrow B^0 \bar{B}^0, B^0 \rightarrow \pi^0 K^+ K^- \gamma^F, \bar{B}^0 \rightarrow e^- \bar{\nu}_e D^{*+}, D^{*+} \rightarrow \pi^+ D^0, D^0 \rightarrow \pi^0 \pi^+ K^-$ ( $\Upsilon(4S) \rightarrow e^- \bar{\nu}_e \pi^0 \pi^0 \pi^+ \pi^+ K^+ K^- K^- \gamma^F$ )	798	68	10968
20	$\Upsilon(4S) \rightarrow B^0 \bar{B}^0, B^0 \rightarrow \pi^0 K^+ K^-, \bar{B}^0 \rightarrow e^- \bar{\nu}_e D^{*+}, D^{*+} \rightarrow \pi^+ D^0, D^0 \rightarrow e^+ \nu_e K^-$ ( $\Upsilon(4S) \rightarrow e^+ e^- \nu_e \bar{\nu}_e \pi^0 \pi^+ K^+ K^- K^-$ )	1009	66	11034
21	$\Upsilon(4S) \rightarrow B^0 \bar{B}^0, B^0 \rightarrow \pi^0 K^+ K^-, \bar{B}^0 \rightarrow e^- \bar{\nu}_e D^{*+}, D^{*+} \rightarrow \pi^+ D^0, D^0 \rightarrow K^- a_1^+, a_1^+ \rightarrow \pi^0 \rho^+, \rho^+ \rightarrow \pi^0 \pi^+$ ( $\Upsilon(4S) \rightarrow e^- \bar{\nu}_e \pi^0 \pi^0 \pi^0 \pi^+ \pi^+ K^+ K^- K^-$ )	166	65	11099
22	$\Upsilon(4S) \rightarrow B^0 \bar{B}^0, B^0 \rightarrow \pi^0 K^+ K^-, \bar{B}^0 \rightarrow e^- \bar{\nu}_e D^{*+}, D^{*+} \rightarrow \pi^+ D^0, D^0 \rightarrow K_L^0 \pi^+ \pi^-$ ( $\Upsilon(4S) \rightarrow e^- \bar{\nu}_e \pi^0 K_L^0 \pi^+ \pi^+ \pi^- K^+ K^-$ )	2125	65	11164
23	$\Upsilon(4S) \rightarrow B^0 \bar{B}^0, B^0 \rightarrow \pi^0 K^+ K^-, \bar{B}^0 \rightarrow e^- \bar{\nu}_e D^+, D^+ \rightarrow \pi^0 K_L^0 \pi^+$ ( $\Upsilon(4S) \rightarrow e^- \bar{\nu}_e \pi^0 \pi^0 K_L^0 \pi^+ K^+ K^-$ )	2791	60	11224
24	$\Upsilon(4S) \rightarrow B^0 \bar{B}^0, B^0 \rightarrow \pi^0 K^+ K^-, \bar{B}^0 \rightarrow \mu^- \bar{\nu}_\mu D^{*+}, D^{*+} \rightarrow \pi^+ D^0, D^0 \rightarrow \pi^+ K^-$ ( $\Upsilon(4S) \rightarrow \mu^- \bar{\nu}_\mu \pi^0 \pi^+ \pi^+ K^+ K^- K^-$ )	2160	57	11281
25	$\Upsilon(4S) \rightarrow B^0 \bar{B}^0, B^0 \rightarrow \pi^0 K^+ K^-, \bar{B}^0 \rightarrow e^- \bar{\nu}_e D^{*+}, D^{*+} \rightarrow \pi^+ D^0, D^0 \rightarrow \pi^0 \pi^0 \pi^+ K^-$ ( $\Upsilon(4S) \rightarrow e^- \bar{\nu}_e \pi^0 \pi^0 \pi^0 \pi^+ \pi^+ K^+ K^- K^-$ )	1036	56	11337
26	$\Upsilon(4S) \rightarrow B^0 \bar{B}^0, B^0 \rightarrow \pi^0 K^+ K^-, \bar{B}^0 \rightarrow \mu^- \bar{\nu}_\mu D^{*+}, D^{*+} \rightarrow \pi^0 D^+, D^+ \rightarrow \pi^0 K_L^0 \pi^+$ ( $\Upsilon(4S) \rightarrow \mu^- \bar{\nu}_\mu \pi^0 \pi^0 \pi^0 K_L^0 \pi^+ K^+ K^-$ )	4475	55	11392
27	$\Upsilon(4S) \rightarrow B^0 \bar{B}^0, B^0 \rightarrow \pi^0 K^+ K^-, \bar{B}^0 \rightarrow \mu^- \bar{\nu}_\mu D^+, D^+ \rightarrow \pi^0 \pi^+ K_S^0, K_S^0 \rightarrow \pi^+ \pi^-$ ( $\Upsilon(4S) \rightarrow \mu^- \bar{\nu}_\mu \pi^0 \pi^0 \pi^+ \pi^+ \pi^- K^+ K^-$ )	2751	54	11446
28	$\Upsilon(4S) \rightarrow B^0 \bar{B}^0, B^0 \rightarrow \pi^0 K^+ K^-, \bar{B}^0 \rightarrow e^- \bar{\nu}_e D^{*+} \gamma^F, D^{*+} \rightarrow \pi^0 D^+, D^+ \rightarrow \pi^+ \pi^+ K^-$ ( $\Upsilon(4S) \rightarrow e^- \bar{\nu}_e \pi^0 \pi^0 \pi^+ \pi^+ K^+ K^- K^- \gamma^F$ )	133	53	11499
29	$\Upsilon(4S) \rightarrow B^0 \bar{B}^0, B^0 \rightarrow \pi^0 K^+ K^-, \bar{B}^0 \rightarrow \mu^- \bar{\nu}_\mu D^+, D^+ \rightarrow \mu^+ \nu_\mu \bar{K}^0, \bar{K}^0 \rightarrow K_L^0$ ( $\Upsilon(4S) \rightarrow \mu^+ \mu^- \nu_\mu \bar{\nu}_\mu \pi^0 K_L^0 K^+ K^-$ )	1111	52	11551
30	$\Upsilon(4S) \rightarrow B^0 \bar{B}^0, B^0 \rightarrow \pi^0 K^+ K^-, \bar{B}^0 \rightarrow e^- \bar{\nu}_e D^{*+}, D^{*+} \rightarrow \pi^+ D^0, D^0 \rightarrow \rho^+ K^{*-}, \rho^+ \rightarrow \pi^0 \pi^+, K^{*-} \rightarrow \pi^0 K^-$ ( $\Upsilon(4S) \rightarrow e^- \bar{\nu}_e \pi^0 \pi^0 \pi^0 \pi^+ \pi^+ K^+ K^- K^-$ )	3039	52	11603
31	$\Upsilon(4S) \rightarrow B^0 \bar{B}^0, B^0 \rightarrow \pi^0 K^+ K^-, \bar{B}^0 \rightarrow e^- \bar{\nu}_e D^{*+}, D^{*+} \rightarrow \pi^+ D^0, D^0 \rightarrow \rho^+ K^{*-}, \rho^+ \rightarrow \pi^0 \pi^+, K^{*-} \rightarrow \pi^- \bar{K}^0, \bar{K}^0 \rightarrow K_L^0$ ( $\Upsilon(4S) \rightarrow e^- \bar{\nu}_e \pi^0 \pi^0 K_L^0 \pi^+ \pi^+ \pi^- K^+ K^-$ )	986	51	11654
32	$\Upsilon(4S) \rightarrow B^0 \bar{B}^0, B^0 \rightarrow \pi^0 K^+ K^-, \bar{B}^0 \rightarrow e^- \bar{\nu}_e D^{*+}, D^{*+} \rightarrow \pi^0 D^+, D^+ \rightarrow \pi^0 \pi^+ K_S^0, K_S^0 \rightarrow \pi^+ \pi^-$ ( $\Upsilon(4S) \rightarrow e^- \bar{\nu}_e \pi^0 \pi^0 \pi^0 \pi^+ \pi^+ \pi^- K^+ K^-$ )	2863	51	11705
33	$\Upsilon(4S) \rightarrow B^0 \bar{B}^0, B^0 \rightarrow \pi^0 K^+ K^-, \bar{B}^0 \rightarrow \mu^- \bar{\nu}_\mu D^{*+}, D^{*+} \rightarrow \pi^+ D^0, D^0 \rightarrow K^- a_1^+, a_1^+ \rightarrow \pi^0 \rho^+, \rho^+ \rightarrow \pi^0 \pi^+$ ( $\Upsilon(4S) \rightarrow \mu^- \bar{\nu}_\mu \pi^0 \pi^0 \pi^0 \pi^+ \pi^+ K^+ K^- K^-$ )	2250	50	11755

rowNo	decay tree (decay initial-final states)	iDcyTr	nEtr	nCEtr
34	$\Upsilon(4S) \rightarrow B^0 \bar{B}^0, B^0 \rightarrow \pi^0 K^+ K^-, \bar{B}^0 \rightarrow \mu^- \bar{\nu}_\mu D^{*+} \gamma^F, D^{*+} \rightarrow \pi^+ D^0, D^0 \rightarrow \pi^0 \pi^+ K^-$ ( $\Upsilon(4S) \rightarrow \mu^- \bar{\nu}_\mu \pi^0 \pi^0 \pi^+ \pi^+ K^+ K^- K^- \gamma^F$ )	585	49	11804
35	$\Upsilon(4S) \rightarrow B^0 \bar{B}^0, B^0 \rightarrow \pi^0 K^+ K^-, \bar{B}^0 \rightarrow e^- \bar{\nu}_e D^{*+}, D^{*+} \rightarrow \pi^+ D^0, D^0 \rightarrow \pi^+ \pi^- \bar{K}^*, \bar{K}^* \rightarrow \pi^+ K^-$ ( $\Upsilon(4S) \rightarrow e^- \bar{\nu}_e \pi^0 \pi^0 \pi^+ \pi^+ \pi^- K^+ K^- K^-$ )	2456	49	11853
36	$\Upsilon(4S) \rightarrow B^0 \bar{B}^0, B^0 \rightarrow \pi^0 K^+ K^-, \bar{B}^0 \rightarrow e^- \bar{\nu}_e D^{*+} \gamma^F \gamma^F, D^{*+} \rightarrow \pi^+ D^0, D^0 \rightarrow \pi^0 \pi^+ K^-$ ( $\Upsilon(4S) \rightarrow e^- \bar{\nu}_e \pi^0 \pi^0 \pi^+ \pi^+ K^+ K^- K^- \gamma^F \gamma^F$ )	991	48	11901
37	$\Upsilon(4S) \rightarrow B^0 \bar{B}^0, B^0 \rightarrow \pi^0 K^+ K^-, \bar{B}^0 \rightarrow e^- \bar{\nu}_e D^+ \gamma^F, D^+ \rightarrow \pi^+ \pi^+ K^-$ ( $\Upsilon(4S) \rightarrow e^- \bar{\nu}_e \pi^0 \pi^+ \pi^+ K^+ K^- K^- \gamma^F$ )	1162	47	11948
38	$\Upsilon(4S) \rightarrow B^0 \bar{B}^0, B^0 \rightarrow \pi^0 K^+ K^- \gamma^F, \bar{B}^0 \rightarrow \mu^- \bar{\nu}_\mu D^{*+}, D^{*+} \rightarrow \pi^+ D^0, D^0 \rightarrow \pi^0 \pi^+ K^-$ ( $\Upsilon(4S) \rightarrow \mu^- \bar{\nu}_\mu \pi^0 \pi^0 \pi^+ \pi^+ K^+ K^- K^- \gamma^F$ )	1610	47	11995
39	$\Upsilon(4S) \rightarrow B^0 \bar{B}^0, B^0 \rightarrow \pi^0 K^+ K^-, \bar{B}^0 \rightarrow e^- \bar{\nu}_e D^{*+}, D^{*+} \rightarrow \pi^+ D^0, D^0 \rightarrow \pi^0 \pi^+ K^- \gamma^F$ ( $\Upsilon(4S) \rightarrow e^- \bar{\nu}_e \pi^0 \pi^0 \pi^+ \pi^+ K^+ K^- K^- \gamma^F$ )	344	45	12040
40	$\Upsilon(4S) \rightarrow B^0 \bar{B}^0, B^0 \rightarrow \pi^0 K^+ K^-, \bar{B}^0 \rightarrow e^- \bar{\nu}_e D^{*+}, D^{*+} \rightarrow \pi^+ D^0, D^0 \rightarrow \pi^+ \pi^- K_S^0, K_S^0 \rightarrow \pi^+ \pi^-$ ( $\Upsilon(4S) \rightarrow e^- \bar{\nu}_e \pi^0 \pi^+ \pi^+ \pi^- \pi^- K^+ K^-$ )	705	45	12085
41	$\Upsilon(4S) \rightarrow B^0 \bar{B}^0, B^0 \rightarrow \pi^0 K^+ K^-, \bar{B}^0 \rightarrow e^- \bar{\nu}_e D^{*+} \gamma^F, D^{*+} \rightarrow \pi^+ D^0, D^0 \rightarrow \mu^+ \nu_\mu K^-$ ( $\Upsilon(4S) \rightarrow e^- \bar{\nu}_e \mu^+ \nu_\mu \pi^0 \pi^+ K^+ K^- K^- \gamma^F$ )	1499	45	12130
42	$\Upsilon(4S) \rightarrow B^0 \bar{B}^0, B^0 \rightarrow \pi^0 K^+ K^-, \bar{B}^0 \rightarrow e^- \bar{\nu}_e D^{*+}, D^{*+} \rightarrow \pi^0 D^+, D^+ \rightarrow \mu^+ \nu_\mu \bar{K}^0, \bar{K}^0 \rightarrow K_L^0$ ( $\Upsilon(4S) \rightarrow e^- \bar{\nu}_e \mu^+ \nu_\mu \pi^0 \pi^0 K_L^0 K^+ K^-$ )	21	42	12172
43	$\Upsilon(4S) \rightarrow B^0 \bar{B}^0, B^0 \rightarrow \pi^0 K^+ K^-, \bar{B}^0 \rightarrow \mu^- \bar{\nu}_\mu D^{*+}, D^{*+} \rightarrow \pi^+ D^0, D^0 \rightarrow \mu^+ \nu_\mu K^-$ ( $\Upsilon(4S) \rightarrow \mu^+ \mu^- \nu_\mu \bar{\nu}_\mu \pi^0 \pi^+ K^+ K^- K^-$ )	683	42	12214
44	$\Upsilon(4S) \rightarrow B^0 \bar{B}^0, B^0 \rightarrow \pi^0 K^+ K^-, \bar{B}^0 \rightarrow \mu^- \bar{\nu}_\mu D^{*+}, D^{*+} \rightarrow \pi^+ D^0, D^0 \rightarrow K_L^0 \pi^+ \pi^-$ ( $\Upsilon(4S) \rightarrow \mu^- \bar{\nu}_\mu \pi^0 K_L^0 \pi^+ \pi^+ \pi^- K^+ K^-$ )	2589	41	12255
45	$\Upsilon(4S) \rightarrow B^0 \bar{B}^0, B^0 \rightarrow \pi^0 K^+ K^-, \bar{B}^0 \rightarrow e^- \bar{\nu}_e D^{*+}, D^{*+} \rightarrow \pi^0 D^+, D^+ \rightarrow \pi^0 \pi^+ \bar{K}^*, \bar{K}^* \rightarrow \pi^+ K^-$ ( $\Upsilon(4S) \rightarrow e^- \bar{\nu}_e \pi^0 \pi^0 \pi^+ \pi^+ K^+ K^- K^-$ )	3055	41	12296
46	$\Upsilon(4S) \rightarrow B^0 \bar{B}^0, B^0 \rightarrow \pi^0 K^+ K^-, \bar{B}^0 \rightarrow \pi^0 K^+ K^- \gamma^F, \pi^0 \rightarrow e^+ e^- \gamma^F$ ( $\Upsilon(4S) \rightarrow e^+ e^- \pi^0 K^+ K^+ K^- K^- \gamma^F \gamma^F$ )	1648	40	12336
47	$\Upsilon(4S) \rightarrow B^0 \bar{B}^0, B^0 \rightarrow \pi^0 K^+ K^-, \bar{B}^0 \rightarrow \mu^- \bar{\nu}_\mu D^{*+}, D^{*+} \rightarrow \pi^+ D^0, D^0 \rightarrow \rho^+ K^{*-}, \rho^+ \rightarrow \pi^0 \pi^+, K^{*-} \rightarrow \pi^0 K^-$ ( $\Upsilon(4S) \rightarrow \mu^- \bar{\nu}_\mu \pi^0 \pi^0 \pi^0 \pi^+ \pi^+ K^+ K^- K^-$ )	31	39	12375
48	$\Upsilon(4S) \rightarrow B^0 \bar{B}^0, B^0 \rightarrow \pi^0 K^+ K^-, \bar{B}^0 \rightarrow e^- \bar{\nu}_e D^{*+} \gamma^F, D^{*+} \rightarrow \pi^+ D^0, D^0 \rightarrow e^+ \nu_e K^-$ ( $\Upsilon(4S) \rightarrow e^+ e^- \nu_e \bar{\nu}_e \pi^0 \pi^+ K^+ K^- K^- \gamma^F$ )	525	39	12414
49	$\Upsilon(4S) \rightarrow B^0 \bar{B}^0, B^0 \rightarrow \pi^0 K^+ K^-, \bar{B}^0 \rightarrow \mu^- \bar{\nu}_\mu D^{*+}, D^{*+} \rightarrow \pi^+ D^0, D^0 \rightarrow \pi^0 \pi^0 \pi^+ K^-$ ( $\Upsilon(4S) \rightarrow \mu^- \bar{\nu}_\mu \pi^0 \pi^0 \pi^0 \pi^+ \pi^+ K^+ K^- K^-$ )	1108	39	12453
50	$\Upsilon(4S) \rightarrow B^0 \bar{B}^0, B^0 \rightarrow \pi^0 K^+ K^-, \bar{B}^0 \rightarrow e^- \bar{\nu}_e D^{*+} \gamma^F, D^{*+} \rightarrow \pi^+ D^0, D^0 \rightarrow \pi^0 \pi^0 \pi^+ K^-$ ( $\Upsilon(4S) \rightarrow e^- \bar{\nu}_e \pi^0 \pi^0 \pi^0 \pi^+ \pi^+ K^+ K^- K^- \gamma^F$ )	1132	39	12492
51	$\Upsilon(4S) \rightarrow B^0 \bar{B}^0, B^0 \rightarrow \pi^0 K^+ K^-, \bar{B}^0 \rightarrow e^- \bar{\nu}_e D^{*+} \gamma^F, D^{*+} \rightarrow \pi^0 D^+, D^+ \rightarrow \pi^0 K_L^0 \pi^+$ ( $\Upsilon(4S) \rightarrow e^- \bar{\nu}_e \pi^0 \pi^0 \pi^0 K_L^0 \pi^+ K^+ K^- \gamma^F$ )	216	38	12530

rowNo	decay tree (decay initial-final states)	iDcyTr	nEtr	nCEtr
52	$\Upsilon(4S) \rightarrow B^0 \bar{B}^0, B^0 \rightarrow \pi^0 K^+ K^-, \bar{B}^0 \rightarrow e^- \bar{\nu}_e D^{*+} \gamma^F, D^{*+} \rightarrow \pi^+ D^0, D^0 \rightarrow K_L^0 \pi^+ \pi^-$ ( $\Upsilon(4S) \rightarrow e^- \bar{\nu}_e \pi^0 K_L^0 \pi^+ \pi^+ \pi^- K^+ K^- \gamma^F$ )	315	38	12568
53	$\Upsilon(4S) \rightarrow B^0 \bar{B}^0, B^0 \rightarrow \pi^0 K^+ K^-, \bar{B}^0 \rightarrow \pi^0 \pi^- D^{*+}, D^{*+} \rightarrow \pi^+ D^0, D^0 \rightarrow \pi^0 \pi^+ K^-$ ( $\Upsilon(4S) \rightarrow \pi^0 \pi^0 \pi^0 \pi^+ \pi^+ \pi^- K^+ K^- K^-$ )	7378	37	12605
54	$\Upsilon(4S) \rightarrow B^0 \bar{B}^0, B^0 \rightarrow \pi^0 K^+ K^-, \bar{B}^0 \rightarrow \mu^- \bar{\nu}_\mu D^+, D^+ \rightarrow e^+ \nu_e \bar{K}^0, \bar{K}^0 \rightarrow K_L^0$ ( $\Upsilon(4S) \rightarrow e^+ \nu_e \mu^- \bar{\nu}_\mu \pi^0 K_L^0 K^+ K^-$ )	684	36	12641
55	$\Upsilon(4S) \rightarrow B^0 \bar{B}^0, B^0 \rightarrow \pi^0 K^+ K^-, \bar{B}^0 \rightarrow e^- \bar{\nu}_e D^{*+}, D^{*+} \rightarrow \pi^0 D^+, D^+ \rightarrow e^+ \nu_e \bar{K}^0, \bar{K}^0 \rightarrow K_L^0$ ( $\Upsilon(4S) \rightarrow e^+ e^- \nu_e \bar{\nu}_e \pi^0 \pi^0 K_L^0 K^+ K^-$ )	4805	36	12677
56	$\Upsilon(4S) \rightarrow B^0 \bar{B}^0, B^0 \rightarrow \pi^0 K^+ K^-, \bar{B}^0 \rightarrow e^- \bar{\nu}_e D^+, D^+ \rightarrow \pi^0 \pi^+ K_S^0, K_S^0 \rightarrow \pi^+ \pi^-$ ( $\Upsilon(4S) \rightarrow e^- \bar{\nu}_e \pi^0 \pi^0 \pi^+ \pi^+ \pi^- K^+ K^-$ )	776	35	12712
57	$\Upsilon(4S) \rightarrow B^0 \bar{B}^0, B^0 \rightarrow \pi^0 K^+ K^-, \bar{B}^0 \rightarrow \mu^- \bar{\nu}_\mu D^{*+}, D^{*+} \rightarrow \pi^+ D^0, D^0 \rightarrow e^+ \nu_e K^-$ ( $\Upsilon(4S) \rightarrow e^+ \nu_e \mu^- \bar{\nu}_\mu \pi^0 \pi^+ K^+ K^- K^-$ )	5144	35	12747
58	$\Upsilon(4S) \rightarrow B^0 \bar{B}^0, B^0 \rightarrow \pi^0 K^+ K^-, \bar{B}^0 \rightarrow e^- \bar{\nu}_e D^{*+}, D^{*+} \rightarrow \pi^0 D^+, D^+ \rightarrow \mu^+ \nu_\mu \bar{K}^0, \bar{K}^0 \rightarrow K_S^0,$ $K_S^0 \rightarrow \pi^+ \pi^-$ ( $\Upsilon(4S) \rightarrow e^- \bar{\nu}_e \mu^+ \nu_\mu \pi^0 \pi^0 \pi^+ \pi^- K^+ K^-$ )	405	34	12781
59	$\Upsilon(4S) \rightarrow B^0 \bar{B}^0, B^0 \rightarrow \pi^0 K^+ K^-, \bar{B}^0 \rightarrow \mu^- \bar{\nu}_\mu D^{*+}, D^{*+} \rightarrow \pi^+ D^0, D^0 \rightarrow K^- a_1^+, a_1^+ \rightarrow \rho^0 \pi^+,$ $\rho^0 \rightarrow \pi^+ \pi^-$ ( $\Upsilon(4S) \rightarrow \mu^- \bar{\nu}_\mu \pi^0 \pi^+ \pi^+ \pi^+ \pi^- K^+ K^- K^-$ )	3101	34	12815
60	$\Upsilon(4S) \rightarrow B^0 \bar{B}^0, B^0 \rightarrow \pi^0 K^+ K^-, \bar{B}^0 \rightarrow e^- \bar{\nu}_e D^{*+}, D^{*+} \rightarrow \pi^0 D^+, D^+ \rightarrow \mu^+ \nu_\mu \bar{K}^*, \bar{K}^* \rightarrow \pi^+ K^-$ ( $\Upsilon(4S) \rightarrow e^- \bar{\nu}_e \mu^+ \nu_\mu \pi^0 \pi^0 \pi^+ K^+ K^- K^-$ )	5559	34	12849
61	$\Upsilon(4S) \rightarrow B^0 \bar{B}^0, B^0 \rightarrow \pi^0 K^+ K^-, \bar{B}^0 \rightarrow e^- \bar{\nu}_e D^{*+}, D^{*+} \rightarrow \pi^+ D^0, D^0 \rightarrow \pi^+ \omega K^-, \omega \rightarrow \pi^0 \pi^+ \pi^-$ ( $\Upsilon(4S) \rightarrow e^- \bar{\nu}_e \pi^0 \pi^0 \pi^+ \pi^+ \pi^- K^+ K^- K^-$ )	3111	33	12882
62	$\Upsilon(4S) \rightarrow B^0 \bar{B}^0, B^0 \rightarrow \pi^0 K^+ K^- \gamma^F, B^0 \rightarrow \pi^0 K^+ K^- \gamma^F \gamma^F$ ( $\Upsilon(4S) \rightarrow \pi^0 \pi^0 K^+ K^+ K^- K^- \gamma^F \gamma^F \gamma^F$ )	466	32	12914
63	$\Upsilon(4S) \rightarrow B^0 \bar{B}^0, B^0 \rightarrow \pi^0 K^+ K^-, \bar{B}^0 \rightarrow \mu^- \bar{\nu}_\mu D^{*+}, D^{*+} \rightarrow \pi^+ D^0, D^0 \rightarrow \pi^+ \omega K^-, \omega \rightarrow \pi^0 \pi^+ \pi^-$ ( $\Upsilon(4S) \rightarrow \mu^- \bar{\nu}_\mu \pi^0 \pi^0 \pi^+ \pi^+ \pi^- K^+ K^- K^-$ )	1661	32	12946
64	$\Upsilon(4S) \rightarrow B^0 \bar{B}^0, B^0 \rightarrow \pi^0 K^+ K^-, \bar{B}^0 \rightarrow \mu^- \bar{\nu}_\mu D^+, D^+ \rightarrow \mu^+ \nu_\mu \bar{K}^0, \bar{K}^0 \rightarrow K_S^0, K_S^0 \rightarrow \pi^+ \pi^-$ ( $\Upsilon(4S) \rightarrow \mu^+ \mu^- \nu_\mu \bar{\nu}_\mu \pi^0 \pi^+ \pi^- K^+ K^-$ )	1797	32	12978
65	$\Upsilon(4S) \rightarrow B^0 \bar{B}^0, B^0 \rightarrow \pi^0 K^+ K^-, \bar{B}^0 \rightarrow e^- \bar{\nu}_e D^{*+} \gamma^F, D^{*+} \rightarrow \pi^+ D^0, D^0 \rightarrow \pi^+ K^-$ ( $\Upsilon(4S) \rightarrow e^- \bar{\nu}_e \pi^0 \pi^+ \pi^+ K^+ K^- K^- \gamma^F$ )	2510	32	13010
66	$\Upsilon(4S) \rightarrow B^0 \bar{B}^0, B^0 \rightarrow \pi^0 K^+ K^-, \bar{B}^0 \rightarrow \rho^- D^+, \rho^- \rightarrow \pi^0 \pi^-, D^+ \rightarrow \pi^+ \pi^+ K^-$ ( $\Upsilon(4S) \rightarrow \pi^0 \pi^0 \pi^+ \pi^+ \pi^- K^+ K^- K^-$ )	3180	32	13042
67	$\Upsilon(4S) \rightarrow B^0 \bar{B}^0, B^0 \rightarrow \pi^0 K^+ K^-, \bar{B}^0 \rightarrow \mu^- \bar{\nu}_\mu D^+, D^+ \rightarrow \mu^+ \nu_\mu \bar{K}^*, \bar{K}^* \rightarrow \pi^+ K^-$ ( $\Upsilon(4S) \rightarrow \mu^+ \mu^- \nu_\mu \bar{\nu}_\mu \pi^0 \pi^+ K^+ K^- K^-$ )	3570	32	13074
68	$\Upsilon(4S) \rightarrow B^0 \bar{B}^0, B^0 \rightarrow \pi^0 K^+ K^-, \bar{B}^0 \rightarrow e^- \bar{\nu}_e D^{*+} \gamma^F, D^{*+} \rightarrow \pi^0 D^+, D^+ \rightarrow \pi^0 \pi^+ K_S^0, K_S^0 \rightarrow \pi^+ \pi^-$ ( $\Upsilon(4S) \rightarrow e^- \bar{\nu}_e \pi^0 \pi^0 \pi^0 \pi^+ \pi^+ \pi^- K^+ K^- \gamma^F$ )	4644	32	13106

rowNo	decay tree (decay initial-final states)	iDcyTr	nEtr	nCEtr
69	$\Upsilon(4S) \rightarrow B^0 \bar{B}^0, B^0 \rightarrow \pi^0 K^+ K^-, \bar{B}^0 \rightarrow \mu^- \bar{\nu}_\mu D^{*+}, D^{*+} \rightarrow \pi^+ D^0, D^0 \rightarrow \rho^+ K^{*-}, \rho^+ \rightarrow \pi^0 \pi^+,$ $K^{*-} \rightarrow \pi^- \bar{K}^0, \bar{K}^0 \rightarrow K_L^0$ $(\Upsilon(4S) \rightarrow \mu^- \bar{\nu}_\mu \pi^0 \pi^0 K_L^0 \pi^+ \pi^+ \pi^- K^+ K^-)$	30	31	13137
70	$\Upsilon(4S) \rightarrow B^0 \bar{B}^0, B^0 \rightarrow \pi^0 K^+ K^-, \bar{B}^0 \rightarrow e^- \bar{\nu}_e D^{*+}, D^{*+} \rightarrow \pi^+ D^0, D^0 \rightarrow \pi^0 \pi^+ \pi^- \bar{K}^*, \bar{K}^* \rightarrow \pi^+ K^-$ $(\Upsilon(4S) \rightarrow e^- \bar{\nu}_e \pi^0 \pi^0 \pi^+ \pi^+ \pi^- K^+ K^- K^-)$	245	31	13168
71	$\Upsilon(4S) \rightarrow B^0 \bar{B}^0, B^0 \rightarrow \pi^0 K^+ K^-, \bar{B}^0 \rightarrow \mu^- \bar{\nu}_\mu D^{*+}, D^{*+} \rightarrow \pi^0 D^+, D^+ \rightarrow \pi^0 \pi^+ K_S^0, K_S^0 \rightarrow \pi^+ \pi^-$ $(\Upsilon(4S) \rightarrow \mu^- \bar{\nu}_\mu \pi^0 \pi^0 \pi^+ \pi^+ \pi^- K^+ K^-)$	7075	31	13199
72	$\Upsilon(4S) \rightarrow B^0 \bar{B}^0, B^0 \rightarrow \pi^0 K^+ K^-, \bar{B}^0 \rightarrow e^- \bar{\nu}_e D^{*+}, D^{*+} \rightarrow \pi^+ D^0, D^0 \rightarrow \pi^0 K_L^0$ $(\Upsilon(4S) \rightarrow e^- \bar{\nu}_e \pi^0 \pi^0 K_L^0 \pi^+ K^+ K^-)$	2333	30	13229
73	$\Upsilon(4S) \rightarrow B^0 \bar{B}^0, B^0 \rightarrow \pi^0 K^+ K^-, \bar{B}^0 \rightarrow e^- \bar{\nu}_e D^{*+}, D^{*+} \rightarrow \pi^+ D^0, D^0 \rightarrow \pi^+ \pi^+ \pi^- K^-$ $(\Upsilon(4S) \rightarrow e^- \bar{\nu}_e \pi^0 \pi^+ \pi^+ \pi^- K^+ K^- K^-)$	2797	30	13259
74	$\Upsilon(4S) \rightarrow B^0 \bar{B}^0, B^0 \rightarrow \pi^0 K^+ K^-, \bar{B}^0 \rightarrow e^- \bar{\nu}_e D^{*+} \gamma^F, D^{*+} \rightarrow \pi^+ D^0, D^0 \rightarrow \rho^+ K^{*-}, \rho^+ \rightarrow \pi^0 \pi^+,$ $K^{*-} \rightarrow \pi^- \bar{K}^0, \bar{K}^0 \rightarrow K_L^0$ $(\Upsilon(4S) \rightarrow e^- \bar{\nu}_e \pi^0 \pi^0 K_L^0 \pi^+ \pi^- K^+ K^- \gamma^F)$	3183	30	13289
75	$\Upsilon(4S) \rightarrow B^0 \bar{B}^0, B^0 \rightarrow \pi^0 K^+ K^-, \bar{B}^0 \rightarrow e^- \bar{\nu}_e D^+, D^+ \rightarrow e^+ \nu_e \bar{K}^0, \bar{K}^0 \rightarrow K_L^0$ $(\Upsilon(4S) \rightarrow e^+ e^- \nu_e \bar{\nu}_e \pi^0 K_L^0 K^+ K^-)$	4312	30	13319
76	$\Upsilon(4S) \rightarrow B^0 \bar{B}^0, B^0 \rightarrow \pi^0 K^+ K^-, \bar{B}^0 \rightarrow \rho^0 \pi^- D^{*+}, \rho^0 \rightarrow \pi^+ \pi^-, D^{*+} \rightarrow \pi^+ D^0, D^0 \rightarrow \pi^0 \pi^+ K^-$ $(\Upsilon(4S) \rightarrow \pi^0 \pi^0 \pi^+ \pi^+ \pi^- \pi^- K^+ K^- K^-)$	10432	29	13348
77	$\Upsilon(4S) \rightarrow B^0 \bar{B}^0, B^0 \rightarrow \pi^0 K^+ K^-, \bar{B}^0 \rightarrow e^- \bar{\nu}_e D^+, D^+ \rightarrow \mu^+ \nu_\mu \bar{K}^*, \bar{K}^* \rightarrow \pi^+ K^-$ $(\Upsilon(4S) \rightarrow e^- \bar{\nu}_e \mu^+ \nu_\mu \pi^0 \pi^+ K^+ K^- K^-)$	384	28	13376
78	$\Upsilon(4S) \rightarrow B^0 \bar{B}^0, B^0 \rightarrow \pi^0 K^+ K^-, \bar{B}^0 \rightarrow e^- \bar{\nu}_e D^{*+}, D^{*+} \rightarrow \pi^+ D^0, D^0 \rightarrow \rho^+ K^{*-}, \rho^+ \rightarrow \pi^0 \pi^+,$ $K^{*-} \rightarrow \pi^- \bar{K}^0, \bar{K}^0 \rightarrow K_S^0, K_S^0 \rightarrow \pi^+ \pi^-$ $(\Upsilon(4S) \rightarrow e^- \bar{\nu}_e \pi^0 \pi^0 \pi^+ \pi^+ \pi^- \pi^- K^+ K^-)$	892	28	13404
79	$\Upsilon(4S) \rightarrow B^0 \bar{B}^0, B^0 \rightarrow \pi^0 K^+ K^-, \bar{B}^0 \rightarrow e^- \bar{\nu}_e D^{*+}, D^{*+} \rightarrow \pi^0 D^+, D^+ \rightarrow \pi^0 \pi^+ K_S^0, K_S^0 \rightarrow \pi^0 \pi^0$ $(\Upsilon(4S) \rightarrow e^- \bar{\nu}_e \pi^0 \pi^0 \pi^0 \pi^0 \pi^+ K^+ K^-)$	998	28	13432
80	$\Upsilon(4S) \rightarrow B^0 \bar{B}^0, B^0 \rightarrow \pi^0 K^+ K^-, \bar{B}^0 \rightarrow \pi^0 \pi^+ \pi^- \pi^- D^{*+}, D^{*+} \rightarrow \pi^+ D^0, D^0 \rightarrow \pi^+ K^-$ $(\Upsilon(4S) \rightarrow \pi^0 \pi^0 \pi^+ \pi^+ \pi^- \pi^- K^+ K^- K^-)$	1301	28	13460
81	$\Upsilon(4S) \rightarrow B^0 \bar{B}^0, B^0 \rightarrow \pi^0 K^+ K^-, \bar{B}^0 \rightarrow \pi^+ \pi^+ \pi^- \pi^- \pi^- D^{*+}, D^{*+} \rightarrow \pi^+ D^0, D^0 \rightarrow \pi^0 \pi^+ K^-$ $(\Upsilon(4S) \rightarrow \pi^0 \pi^0 \pi^+ \pi^+ \pi^+ \pi^- \pi^- \pi^- K^+ K^- K^-)$	2638	28	13488
82	$\Upsilon(4S) \rightarrow B^0 \bar{B}^0, B^0 \rightarrow \pi^0 K^+ K^-, \bar{B}^0 \rightarrow e^- \bar{\nu}_e D^{*+} \gamma^F, D^{*+} \rightarrow \pi^+ D^0, D^0 \rightarrow \rho^+ K^{*-}, \rho^+ \rightarrow \pi^0 \pi^+,$ $K^{*-} \rightarrow \pi^0 K^-$ $(\Upsilon(4S) \rightarrow e^- \bar{\nu}_e \pi^0 \pi^0 \pi^0 \pi^+ \pi^+ K^+ K^- K^- \gamma^F)$	3295	28	13516
83	$\Upsilon(4S) \rightarrow B^0 \bar{B}^0, B^0 \rightarrow \pi^0 K^+ K^-, \bar{B}^0 \rightarrow e^- \bar{\nu}_e D^{*+} \gamma^F, D^{*+} \rightarrow \pi^+ D^0, D^0 \rightarrow K^- a_1^+, a_1^+ \rightarrow \pi^0 \rho^+,$ $\rho^+ \rightarrow \pi^0 \pi^+$ $(\Upsilon(4S) \rightarrow e^- \bar{\nu}_e \pi^0 \pi^0 \pi^0 \pi^+ \pi^+ K^+ K^- K^- \gamma^F)$	3301	28	13544
84	$\Upsilon(4S) \rightarrow B^0 \bar{B}^0, B^0 \rightarrow \pi^0 K^+ K^-, \bar{B}^0 \rightarrow \mu^- \bar{\nu}_\mu D^{*+}, D^{*+} \rightarrow \pi^+ D^0, D^0 \rightarrow \pi^0 K_L^0$ $(\Upsilon(4S) \rightarrow \mu^- \bar{\nu}_\mu \pi^0 \pi^0 K_L^0 \pi^+ K^+ K^-)$	25	27	13571

rowNo	decay tree (decay initial-final states)	iDcyTr	nEtr	nCEtr
85	$\Upsilon(4S) \rightarrow B^0 \bar{B}^0, B^0 \rightarrow \pi^0 K^+ K^-, \bar{B}^0 \rightarrow \mu^- \bar{\nu}_\mu D^{*+}, D^{*+} \rightarrow \pi^0 D^+, D^+ \rightarrow \mu^+ \nu_\mu \bar{K}^0, \bar{K}^0 \rightarrow K_L^0$ ( $\Upsilon(4S) \rightarrow \mu^+ \mu^- \nu_\mu \bar{\nu}_\mu \pi^0 \pi^0 K_L^0 K^+ K^-$ )	755	27	13598
86	$\Upsilon(4S) \rightarrow B^0 \bar{B}^0, B^0 \rightarrow \pi^0 K^+ K^-, \bar{B}^0 \rightarrow e^- \bar{\nu}_e D^{*+}, D^{*+} \rightarrow \pi^0 D^+, D^+ \rightarrow e^+ \nu_e \bar{K}^0, \bar{K}^0 \rightarrow K_S^0,$ $K_S^0 \rightarrow \pi^+ \pi^-$ ( $\Upsilon(4S) \rightarrow e^+ e^- \nu_e \bar{\nu}_e \pi^0 \pi^+ \pi^- K^+ K^-$ )	1092	27	13625
87	$\Upsilon(4S) \rightarrow B^0 \bar{B}^0, B^0 \rightarrow \pi^0 K^+ K^-, \bar{B}^0 \rightarrow e^- \bar{\nu}_e D^{*+} \gamma^F, D^{*+} \rightarrow \pi^0 D^+, D^+ \rightarrow \mu^+ \nu_\mu \bar{K}^0, \bar{K}^0 \rightarrow K_L^0$ ( $\Upsilon(4S) \rightarrow e^- \bar{\nu}_e \mu^+ \nu_\mu \pi^0 \pi^0 K_L^0 K^+ K^- \gamma^F$ )	2906	27	13652
88	$\Upsilon(4S) \rightarrow B^0 \bar{B}^0, B^0 \rightarrow \pi^0 K^+ K^-, \bar{B}^0 \rightarrow e^- \bar{\nu}_e D^{*+}, D^{*+} \rightarrow \pi^+ D^0, D^0 \rightarrow \pi^0 \pi^+ \pi^-$ ( $\Upsilon(4S) \rightarrow e^- \bar{\nu}_e \pi^0 \pi^0 \pi^+ \pi^- K^+ K^-$ )	3150	27	13679
89	$\Upsilon(4S) \rightarrow B^0 \bar{B}^0, B^0 \rightarrow \pi^0 K^+ K^- \gamma^F, \bar{B}^0 \rightarrow e^- \bar{\nu}_e D^{*+} \gamma^F, D^{*+} \rightarrow \pi^+ D^0, D^0 \rightarrow \pi^0 \pi^+ K^-$ ( $\Upsilon(4S) \rightarrow e^- \bar{\nu}_e \pi^0 \pi^0 \pi^+ \pi^- K^+ K^- K^- \gamma^F \gamma^F$ )	5952	27	13706
90	$\Upsilon(4S) \rightarrow B^0 \bar{B}^0, B^0 \rightarrow \pi^0 K^+ K^-, \bar{B}^0 \rightarrow e^- \bar{\nu}_e D^+, D^+ \rightarrow \pi^0 \pi^+ \bar{K}^*, \bar{K}^* \rightarrow \pi^+ K^-$ ( $\Upsilon(4S) \rightarrow e^- \bar{\nu}_e \pi^0 \pi^0 \pi^+ \pi^- K^+ K^- K^-$ )	6224	27	13733
91	$\Upsilon(4S) \rightarrow B^0 \bar{B}^0, B^0 \rightarrow \pi^0 K^+ K^-, \bar{B}^0 \rightarrow e^- \bar{\nu}_e D^{*+}, D^{*+} \rightarrow \pi^+ D^0, D^0 \rightarrow \rho^0 \bar{K}^*, \rho^0 \rightarrow \pi^+ \pi^-,$ $\bar{K}^* \rightarrow \pi^+ K^-$ ( $\Upsilon(4S) \rightarrow e^- \bar{\nu}_e \pi^0 \pi^+ \pi^+ \pi^- K^+ K^- K^-$ )	16	26	13759
92	$\Upsilon(4S) \rightarrow B^0 \bar{B}^0, B^0 \rightarrow \pi^0 K^+ K^-, \bar{B}^0 \rightarrow e^- \bar{\nu}_e D^{*+}, D^{*+} \rightarrow \pi^+ D^0, D^0 \rightarrow \pi^0 \pi^0 K_L^0$ ( $\Upsilon(4S) \rightarrow e^- \bar{\nu}_e \pi^0 \pi^0 \pi^0 K_L^0 \pi^+ K^-$ )	117	26	13785
93	$\Upsilon(4S) \rightarrow B^0 \bar{B}^0, B^0 \rightarrow \pi^0 K^+ K^-, \bar{B}^0 \rightarrow D^{*+} a_1^-, D^{*+} \rightarrow \pi^+ D^0, a_1^- \rightarrow \pi^0 \rho^-, D^0 \rightarrow \pi^0 \pi^+ K^-,$ $\rho^- \rightarrow \pi^0 \pi^-$ ( $\Upsilon(4S) \rightarrow \pi^0 \pi^0 \pi^0 \pi^+ \pi^- K^+ K^- K^-$ )	635	26	13811
94	$\Upsilon(4S) \rightarrow B^0 \bar{B}^0, B^0 \rightarrow \pi^0 K^+ K^-, \bar{B}^0 \rightarrow e^- \bar{\nu}_e D^{*+}, D^{*+} \rightarrow \pi^+ D^0, D^0 \rightarrow e^+ \nu_e K^- \gamma^F$ ( $\Upsilon(4S) \rightarrow e^+ e^- \nu_e \bar{\nu}_e \pi^0 \pi^+ K^+ K^- K^- \gamma^F$ )	2316	26	13837
95	$\Upsilon(4S) \rightarrow B^0 \bar{B}^0, B^0 \rightarrow \pi^0 K^+ K^-, \bar{B}^0 \rightarrow e^- \bar{\nu}_e D^{*+}, D^{*+} \rightarrow \pi^0 D^+, D^+ \rightarrow e^+ \nu_e \bar{K}^*, \bar{K}^* \rightarrow \pi^+ K^-$ ( $\Upsilon(4S) \rightarrow e^+ e^- \nu_e \bar{\nu}_e \pi^0 \pi^+ K^+ K^- K^-$ )	3968	26	13863
96	$\Upsilon(4S) \rightarrow B^0 \bar{B}^0, B^0 \rightarrow \pi^0 K^+ K^-, \bar{B}^0 \rightarrow \rho^- D^{*+}, \rho^- \rightarrow \pi^0 \pi^-, D^{*+} \rightarrow \pi^+ D^0, D^0 \rightarrow \pi^0 \pi^+ K^-$ ( $\Upsilon(4S) \rightarrow \pi^0 \pi^0 \pi^0 \pi^+ \pi^- K^+ K^- K^-$ )	4302	26	13889
97	$\Upsilon(4S) \rightarrow B^0 \bar{B}^0, B^0 \rightarrow \pi^0 K^+ K^-, \bar{B}^0 \rightarrow e^- \bar{\nu}_e D^+ \gamma^F, D^+ \rightarrow \pi^0 K_L^0 \pi^+$ ( $\Upsilon(4S) \rightarrow e^- \bar{\nu}_e \pi^0 \pi^0 K_L^0 \pi^+ K^+ K^- \gamma^F$ )	4412	26	13915
98	$\Upsilon(4S) \rightarrow B^0 \bar{B}^0, B^0 \rightarrow \pi^0 K^+ K^-, \bar{B}^0 \rightarrow e^- \bar{\nu}_e D^{*+}, D^{*+} \rightarrow \pi^+ D^0, D^0 \rightarrow \pi^0 \pi^0 \pi^0 K_L^0$ ( $\Upsilon(4S) \rightarrow e^- \bar{\nu}_e \pi^0 \pi^0 \pi^0 \pi^0 K_L^0 \pi^+ K^-$ )	774	25	13940
99	$\Upsilon(4S) \rightarrow B^0 \bar{B}^0, B^0 \rightarrow \pi^0 K^+ K^-, \bar{B}^0 \rightarrow e^- \bar{\nu}_e D^{*+} \gamma^F, D^{*+} \rightarrow \pi^+ D^0, D^0 \rightarrow \pi^+ \omega K^-, \omega \rightarrow \pi^0 \pi^+ \pi^-$ ( $\Upsilon(4S) \rightarrow e^- \bar{\nu}_e \pi^0 \pi^0 \pi^+ \pi^+ \pi^- K^+ K^- K^- \gamma^F$ )	1434	25	13965
100	$\Upsilon(4S) \rightarrow B^0 \bar{B}^0, B^0 \rightarrow \pi^0 K^+ K^-, \bar{B}^0 \rightarrow e^- \bar{\nu}_e D^{*+} \gamma^F, D^{*+} \rightarrow \pi^+ D^0, D^0 \rightarrow K^- a_1^+, a_1^+ \rightarrow \rho^0 \pi^+,$ $\rho^0 \rightarrow \pi^+ \pi^-$ ( $\Upsilon(4S) \rightarrow e^- \bar{\nu}_e \pi^0 \pi^+ \pi^+ \pi^- K^+ K^- K^- \gamma^F$ )	6257	25	13990



rowNo	decay tree (decay initial-final states)	iDcyTr	nEtr	nCEtr
rest	$\Upsilon(4S) \rightarrow$ others (73179 in total) $(\Upsilon(4S) \rightarrow \rightarrow$ corresponding to others)	—	86010	100000