

Topology Analysis ^{*†‡§}

(v2.12.3)

August 1, 2023

^{*}Xingyu Zhou, Liaoning Normal University, zhouxy@lnnu.edu.cn

[†]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.

[‡]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.

[§]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.

List of Tables

1	Decay trees and their respective initial-final states.	3
---	--	---

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

rowNo	decay tree (decay initial-final states)	iDcyTr	nEtr	nCEtr
1	$\Upsilon(4S) \rightarrow B^+ B^-, B^+ \rightarrow \mu^+ \nu_\mu \bar{D}^{*0}, B^- \rightarrow \rho^- D^0, \bar{D}^{*0} \rightarrow \pi^0 \bar{D}^0, \rho^- \rightarrow \pi^0 \pi^-, D^0 \rightarrow \pi^+ K^-,$ $\bar{D}^0 \rightarrow \pi^0 \pi^- K^+$ $(\Upsilon(4S) \rightarrow \mu^+ \nu_\mu \pi^0 \pi^0 \pi^+ \pi^- \pi^- K^+ K^-)$	5654	34	34
2	$\Upsilon(4S) \rightarrow B^+ B^-, B^+ \rightarrow \rho^+ \bar{D}^0, B^- \rightarrow \mu^- \bar{\nu}_\mu D^{*0}, \rho^+ \rightarrow \pi^0 \pi^+, \bar{D}^0 \rightarrow \pi^- K^+, D^{*0} \rightarrow \pi^0 D^0,$ $D^0 \rightarrow \pi^0 \pi^+ K^-$ $(\Upsilon(4S) \rightarrow \mu^- \bar{\nu}_\mu \pi^0 \pi^0 \pi^+ \pi^+ \pi^- K^+ K^-)$	2935	32	66
3	$\Upsilon(4S) \rightarrow B^+ B^-, B^+ \rightarrow \rho^+ \bar{D}^0, B^- \rightarrow \mu^- \bar{\nu}_\mu D^0, \rho^+ \rightarrow \pi^0 \pi^+, \bar{D}^0 \rightarrow \pi^- K^+, D^0 \rightarrow \pi^0 \pi^+ K^-$ $(\Upsilon(4S) \rightarrow \mu^- \bar{\nu}_\mu \pi^0 \pi^0 \pi^+ \pi^+ \pi^- K^+ K^-)$	614	26	92
4	$\Upsilon(4S) \rightarrow B^+ B^-, B^+ \rightarrow \rho^+ \bar{D}^0, B^- \rightarrow e^- \bar{\nu}_e D^{*0}, \rho^+ \rightarrow \pi^0 \pi^+, \bar{D}^0 \rightarrow \pi^- K^+, D^{*0} \rightarrow \pi^0 D^0,$ $D^0 \rightarrow \pi^0 \pi^+ K^-$ $(\Upsilon(4S) \rightarrow e^- \bar{\nu}_e \pi^0 \pi^0 \pi^+ \pi^+ \pi^- K^+ K^-)$	3768	26	118
5	$\Upsilon(4S) \rightarrow B^+ B^-, B^+ \rightarrow \mu^+ \nu_\mu \bar{D}^0, B^- \rightarrow \rho^- D^0, \bar{D}^0 \rightarrow \pi^0 \pi^- K^+, \rho^- \rightarrow \pi^0 \pi^-, D^0 \rightarrow \pi^+ K^-$ $(\Upsilon(4S) \rightarrow \mu^+ \nu_\mu \pi^0 \pi^0 \pi^+ \pi^- \pi^- K^+ K^-)$	6529	25	143
6	$\Upsilon(4S) \rightarrow B^+ B^-, B^+ \rightarrow e^+ \nu_e \bar{D}^{*0}, B^- \rightarrow \rho^- D^0, \bar{D}^{*0} \rightarrow \pi^0 \bar{D}^0, \rho^- \rightarrow \pi^0 \pi^-, D^0 \rightarrow \pi^+ K^-,$ $\bar{D}^0 \rightarrow \pi^0 \pi^- K^+$ $(\Upsilon(4S) \rightarrow e^+ \nu_e \pi^0 \pi^0 \pi^+ \pi^- \pi^- K^+ K^-)$	6467	24	167
7	$\Upsilon(4S) \rightarrow B^+ B^-, B^+ \rightarrow \rho^+ \bar{D}^0, B^- \rightarrow \rho^- D^0, \rho^+ \rightarrow \pi^0 \pi^+, \bar{D}^0 \rightarrow \pi^- K^+, \rho^- \rightarrow \pi^0 \pi^-,$ $D^0 \rightarrow \pi^0 \pi^+ K^-$ $(\Upsilon(4S) \rightarrow \pi^0 \pi^0 \pi^0 \pi^+ \pi^+ \pi^- \pi^- K^+ K^-)$	2236	22	189
8	$\Upsilon(4S) \rightarrow B^+ B^-, B^+ \rightarrow \rho^+ \bar{D}^0, B^- \rightarrow e^- \bar{\nu}_e D^{*0}, \rho^+ \rightarrow \pi^0 \pi^+, \bar{D}^0 \rightarrow \pi^- K^+, D^{*0} \rightarrow D^0 \gamma,$ $D^0 \rightarrow \pi^0 \pi^+ K^-$ $(\Upsilon(4S) \rightarrow e^- \bar{\nu}_e \pi^0 \pi^0 \pi^+ \pi^+ \pi^- K^+ K^- \gamma)$	3908	21	210
9	$\Upsilon(4S) \rightarrow B^+ B^-, B^+ \rightarrow \mu^+ \nu_\mu \bar{D}^0, B^- \rightarrow \rho^- D^0, \bar{D}^0 \rightarrow \pi^0 \pi^- K^+, \rho^- \rightarrow \pi^0 \pi^-, D^0 \rightarrow \pi^0 \pi^+ K^-$ $(\Upsilon(4S) \rightarrow \mu^+ \nu_\mu \pi^0 \pi^0 \pi^+ \pi^- \pi^- K^+ K^-)$	1804	20	230
10	$\Upsilon(4S) \rightarrow B^+ B^-, B^+ \rightarrow \rho^+ \bar{D}^0, B^- \rightarrow \mu^- \bar{\nu}_\mu D^{*0}, \rho^+ \rightarrow \pi^0 \pi^+, \bar{D}^0 \rightarrow \pi^0 \pi^- K^+, D^{*0} \rightarrow \pi^0 D^0,$ $D^0 \rightarrow \pi^0 \pi^+ K^-$ $(\Upsilon(4S) \rightarrow \mu^- \bar{\nu}_\mu \pi^0 \pi^0 \pi^0 \pi^+ \pi^+ \pi^- K^+ K^-)$	2285	18	248
11	$\Upsilon(4S) \rightarrow B^+ B^-, B^+ \rightarrow \mu^+ \nu_\mu \bar{D}^{*0}, B^- \rightarrow \rho^- D^0, \bar{D}^{*0} \rightarrow \pi^0 \bar{D}^0, \rho^- \rightarrow \pi^0 \pi^-, D^0 \rightarrow \pi^0 \pi^+ K^-,$ $\bar{D}^0 \rightarrow \pi^0 \pi^- K^+$ $(\Upsilon(4S) \rightarrow \mu^+ \nu_\mu \pi^0 \pi^0 \pi^0 \pi^+ \pi^- \pi^- K^+ K^-)$	3201	18	266
12	$\Upsilon(4S) \rightarrow B^+ B^-, B^+ \rightarrow e^+ \nu_e \bar{D}^{*0}, B^- \rightarrow \rho^- D^0, \bar{D}^{*0} \rightarrow \bar{D}^0 \gamma, \rho^- \rightarrow \pi^0 \pi^-, D^0 \rightarrow \pi^+ K^-,$ $\bar{D}^0 \rightarrow \pi^0 \pi^- K^+$ $(\Upsilon(4S) \rightarrow e^+ \nu_e \pi^0 \pi^0 \pi^+ \pi^- \pi^- K^+ K^- \gamma)$	1494	17	283
13	$\Upsilon(4S) \rightarrow B^+ B^-, B^+ \rightarrow \rho^+ \bar{D}^0, B^- \rightarrow e^- \bar{\nu}_e D^0, \rho^+ \rightarrow \pi^0 \pi^+, \bar{D}^0 \rightarrow \pi^- K^+, D^0 \rightarrow \pi^0 \pi^+ K^-$ $(\Upsilon(4S) \rightarrow e^- \bar{\nu}_e \pi^0 \pi^0 \pi^+ \pi^+ \pi^- K^+ K^-)$	5828	17	300

rowNo	decay tree (decay initial-final states)	iDcyTr	nEtr	nCEtr
14	$\Upsilon(4S) \rightarrow B^+ B^-, B^+ \rightarrow \rho^+ \bar{D}^0, B^- \rightarrow \mu^- \bar{\nu}_\mu D^{*0}, \rho^+ \rightarrow \pi^0 \pi^+, \bar{D}^0 \rightarrow \pi^- K^+, D^{*0} \rightarrow D^0 \gamma,$ $D^0 \rightarrow \pi^0 \pi^+ K^-$ $(\Upsilon(4S) \rightarrow \mu^- \bar{\nu}_\mu \pi^0 \pi^0 \pi^+ \pi^+ \pi^- K^+ K^- \gamma)$	1331	16	316
15	$\Upsilon(4S) \rightarrow B^+ B^-, B^+ \rightarrow e^+ \nu_e \bar{D}^0, B^- \rightarrow \rho^- D^0, \bar{D}^0 \rightarrow \pi^0 \pi^- K^+, \rho^- \rightarrow \pi^0 \pi^-, D^0 \rightarrow \pi^+ K^-$ $(\Upsilon(4S) \rightarrow e^+ \nu_e \pi^0 \pi^0 \pi^+ \pi^- \pi^- K^+ K^-)$	1897	15	331
16	$\Upsilon(4S) \rightarrow B^+ B^-, B^+ \rightarrow e^+ \nu_e \bar{D}^{*0} \gamma^F, B^- \rightarrow \rho^- D^0, \bar{D}^{*0} \rightarrow \pi^0 \bar{D}^0, \rho^- \rightarrow \pi^0 \pi^-, D^0 \rightarrow \pi^+ K^-,$ $\bar{D}^0 \rightarrow \pi^0 \pi^- K^+$ $(\Upsilon(4S) \rightarrow e^+ \nu_e \pi^0 \pi^0 \pi^0 \pi^+ \pi^- \pi^- K^+ K^- \gamma^F)$	2468	14	345
17	$\Upsilon(4S) \rightarrow B^+ B^-, B^+ \rightarrow \rho^+ \bar{D}^0, B^- \rightarrow e^- \bar{\nu}_e D^{*0} \gamma^F, \rho^+ \rightarrow \pi^0 \pi^+, \bar{D}^0 \rightarrow \pi^- K^+, D^{*0} \rightarrow \pi^0 D^0,$ $D^0 \rightarrow \pi^0 \pi^+ K^-$ $(\Upsilon(4S) \rightarrow e^- \bar{\nu}_e \pi^0 \pi^0 \pi^0 \pi^+ \pi^- K^+ K^- \gamma^F)$	4526	14	359
18	$\Upsilon(4S) \rightarrow B^+ B^-, B^+ \rightarrow \rho^+ \bar{D}^0, B^- \rightarrow e^- \bar{\nu}_e D^{*0}, \rho^+ \rightarrow \pi^0 \pi^+, \bar{D}^0 \rightarrow \pi^0 \pi^- K^+, D^{*0} \rightarrow \pi^0 D^0,$ $D^0 \rightarrow \pi^0 \pi^+ K^-$ $(\Upsilon(4S) \rightarrow e^- \bar{\nu}_e \pi^0 \pi^0 \pi^0 \pi^0 \pi^+ \pi^- K^+ K^-)$	17175	14	373
19	$\Upsilon(4S) \rightarrow B^+ B^-, B^+ \rightarrow \rho^+ \bar{D}^0, B^- \rightarrow \rho^- D^0, \rho^+ \rightarrow \pi^0 \pi^+, \bar{D}^0 \rightarrow \pi^0 \pi^- K^+, \rho^- \rightarrow \pi^0 \pi^-,$ $D^0 \rightarrow \pi^0 \pi^+ K^-$ $(\Upsilon(4S) \rightarrow \pi^0 \pi^0 \pi^0 \pi^0 \pi^+ \pi^- \pi^- K^+ K^-)$	22131	14	387
20	$\Upsilon(4S) \rightarrow B^+ B^-, B^+ \rightarrow \mu^+ \nu_\mu \bar{D}^{*0}, B^- \rightarrow \rho^- D^0, \bar{D}^{*0} \rightarrow \bar{D}^0 \gamma, \rho^- \rightarrow \pi^0 \pi^-, D^0 \rightarrow \pi^+ K^-,$ $\bar{D}^0 \rightarrow \pi^0 \pi^- K^+$ $(\Upsilon(4S) \rightarrow \mu^+ \nu_\mu \pi^0 \pi^0 \pi^+ \pi^- \pi^- K^+ K^- \gamma)$	19461	13	400
21	$\Upsilon(4S) \rightarrow B^+ B^-, B^+ \rightarrow e^+ \nu_e \bar{D}^{*0}, B^- \rightarrow \rho^- D^0, \bar{D}^{*0} \rightarrow \pi^0 \bar{D}^0, \rho^- \rightarrow \pi^0 \pi^-, D^0 \rightarrow \pi^0 \pi^+ K^-,$ $\bar{D}^0 \rightarrow \pi^0 \pi^- K^+$ $(\Upsilon(4S) \rightarrow e^+ \nu_e \pi^0 \pi^0 \pi^0 \pi^0 \pi^+ \pi^- \pi^- K^+ K^-)$	108	12	412
22	$\Upsilon(4S) \rightarrow B^+ B^-, B^+ \rightarrow \rho^+ \bar{D}^0, B^- \rightarrow \rho^- D^0, \rho^+ \rightarrow \pi^0 \pi^+, \bar{D}^0 \rightarrow \pi^0 \pi^- K^+, \rho^- \rightarrow \pi^0 \pi^-,$ $D^0 \rightarrow \pi^+ K^-$ $(\Upsilon(4S) \rightarrow \pi^0 \pi^0 \pi^0 \pi^+ \pi^+ \pi^- \pi^- K^+ K^-)$	3784	12	424
23	$\Upsilon(4S) \rightarrow B^+ B^-, B^+ \rightarrow \rho^+ \bar{D}^0, B^- \rightarrow \mu^- \bar{\nu}_\mu D^0, \rho^+ \rightarrow \pi^0 \pi^+, \bar{D}^0 \rightarrow \pi^0 \pi^- K^+, D^0 \rightarrow \pi^0 \pi^+ K^-$ $(\Upsilon(4S) \rightarrow \mu^- \bar{\nu}_\mu \pi^0 \pi^0 \pi^0 \pi^+ \pi^- K^+ K^-)$	10233	12	436
24	$\Upsilon(4S) \rightarrow B^+ B^-, B^+ \rightarrow \rho^+ \bar{D}^0, B^- \rightarrow \pi^0 \pi^- \pi^- D^{*+}, \rho^+ \rightarrow \pi^0 \pi^+, \bar{D}^0 \rightarrow \pi^- K^+, D^{*+} \rightarrow \pi^+ D^0,$ $D^0 \rightarrow \pi^0 \pi^+ K^-$ $(\Upsilon(4S) \rightarrow \pi^0 \pi^0 \pi^0 \pi^+ \pi^+ \pi^- \pi^- \pi^- K^+ K^-)$	207	11	447
25	$\Upsilon(4S) \rightarrow B^+ B^-, B^+ \rightarrow \rho^+ \bar{D}^0, B^- \rightarrow \mu^- \bar{\nu}_\mu D^{*0}, \rho^+ \rightarrow \pi^0 \pi^+, \bar{D}^0 \rightarrow K^+ K^-, D^{*0} \rightarrow \pi^0 D^0,$ $D^0 \rightarrow \pi^0 \pi^+ K^-$ $(\Upsilon(4S) \rightarrow \mu^- \bar{\nu}_\mu \pi^0 \pi^0 \pi^0 \pi^+ \pi^+ K^+ K^- K^-)$	437	11	458
26	$\Upsilon(4S) \rightarrow B^+ B^-, B^+ \rightarrow \pi^0 \pi^+ \pi^+ \pi^- \bar{D}^{*0}, B^- \rightarrow \rho^- D^0, \bar{D}^{*0} \rightarrow \pi^0 \bar{D}^0, \rho^- \rightarrow \pi^0 \pi^-, D^0 \rightarrow \pi^+ K^-,$ $\bar{D}^0 \rightarrow \pi^0 \pi^- K^+$ $(\Upsilon(4S) \rightarrow \pi^0 \pi^0 \pi^0 \pi^0 \pi^+ \pi^+ \pi^- \pi^- \pi^- K^+ K^-)$	2695	11	469

rowNo	decay tree (decay initial-final states)	iDcyTr	nEtr	nCEtr
27	$\Upsilon(4S) \rightarrow B^+ B^-, B^+ \rightarrow e^+ \nu_e \bar{D}^{*0}, B^- \rightarrow \rho^- D^0, \bar{D}^{*0} \rightarrow \pi^0 \bar{D}^0, \rho^- \rightarrow \pi^0 \pi^-, D^0 \rightarrow K^+ K^-,$ $\bar{D}^0 \rightarrow \pi^0 \pi^- K^+$ $(\Upsilon(4S) \rightarrow e^+ \nu_e \pi^0 \pi^0 \pi^0 \pi^- \pi^- K^+ K^+ K^-)$	3443	11	480
28	$\Upsilon(4S) \rightarrow B^+ B^-, B^+ \rightarrow \rho^+ \bar{D}^0, B^- \rightarrow e^- \bar{\nu}_e D^0, \rho^+ \rightarrow \pi^0 \pi^+, \bar{D}^0 \rightarrow \pi^0 \pi^- K^+, D^0 \rightarrow \pi^0 \pi^+ K^-$ $(\Upsilon(4S) \rightarrow e^- \bar{\nu}_e \pi^0 \pi^0 \pi^0 \pi^+ \pi^- K^+ K^-)$	3277	10	490
29	$\Upsilon(4S) \rightarrow B^+ B^-, B^+ \rightarrow \mu^+ \nu_\mu \bar{D}^{*0}, B^- \rightarrow \rho^- D^0, \bar{D}^{*0} \rightarrow \bar{D}^0 \gamma, \rho^- \rightarrow \pi^0 \pi^-, D^0 \rightarrow K^+ K^-,$ $\bar{D}^0 \rightarrow \pi^0 \pi^- K^+$ $(\Upsilon(4S) \rightarrow \mu^+ \nu_\mu \pi^0 \pi^0 \pi^- \pi^- K^+ K^+ K^- \gamma)$	4553	10	500
30	$\Upsilon(4S) \rightarrow B^+ B^-, B^+ \rightarrow e^+ \nu_e \bar{D}^{*0} \gamma^F, B^- \rightarrow \rho^- D^0, \bar{D}^{*0} \rightarrow \bar{D}^0 \gamma, \rho^- \rightarrow \pi^0 \pi^-, D^0 \rightarrow \pi^+ K^-,$ $\bar{D}^0 \rightarrow \pi^0 \pi^- K^+$ $(\Upsilon(4S) \rightarrow e^+ \nu_e \pi^0 \pi^0 \pi^+ \pi^- \pi^- K^+ K^- \gamma^F \gamma)$	12577	10	510
31	$\Upsilon(4S) \rightarrow B^+ B^-, B^+ \rightarrow \mu^+ \nu_\mu \bar{D}^{*0}, B^- \rightarrow \rho^- D^0, \bar{D}^{*0} \rightarrow \pi^0 \bar{D}^0, \rho^- \rightarrow \pi^0 \pi^-, D^0 \rightarrow K^+ K^-,$ $\bar{D}^0 \rightarrow \pi^0 \pi^- K^+$ $(\Upsilon(4S) \rightarrow \mu^+ \nu_\mu \pi^0 \pi^0 \pi^0 \pi^- \pi^- K^+ K^+ K^-)$	3885	9	519
32	$\Upsilon(4S) \rightarrow B^+ B^-, B^+ \rightarrow \rho^+ \bar{D}^0, B^- \rightarrow \mu^- \bar{\nu}_\mu D^0, \rho^+ \rightarrow \pi^0 \pi^+, \bar{D}^0 \rightarrow \pi^- K^+, D^0 \rightarrow K^- a_1^+,$ $a_1^+ \rightarrow \pi^0 \rho^+, \rho^+ \rightarrow \pi^0 \pi^+$ $(\Upsilon(4S) \rightarrow \mu^- \bar{\nu}_\mu \pi^0 \pi^0 \pi^0 \pi^+ \pi^- K^+ K^-)$	7785	9	528
33	$\Upsilon(4S) \rightarrow B^+ B^-, B^+ \rightarrow \rho^+ \bar{D}^0, B^- \rightarrow \mu^- \bar{\nu}_\mu D^{*0}, \rho^+ \rightarrow \pi^0 \pi^+, \bar{D}^0 \rightarrow \pi^- K^+, D^{*0} \rightarrow \pi^0 D^0,$ $D^0 \rightarrow e^+ \nu_e K^-$ $(\Upsilon(4S) \rightarrow e^+ \nu_e \mu^- \bar{\nu}_\mu \pi^0 \pi^0 \pi^+ \pi^- K^+ K^-)$	11844	9	537
34	$\Upsilon(4S) \rightarrow B^+ B^-, B^+ \rightarrow \rho^+ \bar{D}^0, B^- \rightarrow \pi^0 \pi^+ \pi^- \pi^- D^{*0}, \rho^+ \rightarrow \pi^0 \pi^+, \bar{D}^0 \rightarrow \pi^- K^+, D^{*0} \rightarrow \pi^0 D^0,$ $D^0 \rightarrow \pi^0 \pi^+ K^-$ $(\Upsilon(4S) \rightarrow \pi^0 \pi^0 \pi^0 \pi^0 \pi^+ \pi^+ \pi^- \pi^- \pi^- K^+ K^-)$	20843	9	546
35	$\Upsilon(4S) \rightarrow B^+ B^-, B^+ \rightarrow \rho^+ \bar{D}^0, B^- \rightarrow \pi^+ \pi^- \pi^- D^0, \rho^+ \rightarrow \pi^0 \pi^+, \bar{D}^0 \rightarrow \pi^- K^+, D^0 \rightarrow \pi^0 \pi^+ K^-$ $(\Upsilon(4S) \rightarrow \pi^0 \pi^0 \pi^+ \pi^+ \pi^+ \pi^- \pi^- \pi^- K^+ K^-)$	52	8	554
36	$\Upsilon(4S) \rightarrow B^+ B^-, B^+ \rightarrow \rho^+ \bar{D}^0, B^- \rightarrow \mu^- \bar{\nu}_\mu D^{*0}, \rho^+ \rightarrow \pi^0 \pi^+, \bar{D}^0 \rightarrow \pi^- K^+, D^{*0} \rightarrow \pi^0 D^0,$ $D^0 \rightarrow \rho^+ K^{*-}, \rho^+ \rightarrow \pi^0 \pi^+, K^{*-} \rightarrow \pi^0 K^-$ $(\Upsilon(4S) \rightarrow \mu^- \bar{\nu}_\mu \pi^0 \pi^0 \pi^0 \pi^+ \pi^- K^+ K^-)$	742	8	562
37	$\Upsilon(4S) \rightarrow B^+ B^-, B^+ \rightarrow \mu^+ \nu_\mu \bar{D}^{*0}, B^- \rightarrow \rho^- D^0, \bar{D}^{*0} \rightarrow \pi^0 \bar{D}^0, \rho^- \rightarrow \pi^0 \pi^-, D^0 \rightarrow \pi^0 \pi^+ K^-,$ $\bar{D}^0 \rightarrow \pi^- K^+$ $(\Upsilon(4S) \rightarrow \mu^+ \nu_\mu \pi^0 \pi^0 \pi^0 \pi^+ \pi^- \pi^- K^+ K^-)$	743	8	570
38	$\Upsilon(4S) \rightarrow B^+ B^-, B^+ \rightarrow \rho^+ \bar{D}^0, B^- \rightarrow \mu^- \bar{\nu}_\mu D^0, \rho^+ \rightarrow \pi^0 \pi^+, \bar{D}^0 \rightarrow \pi^- K^+, D^0 \rightarrow \mu^+ \nu_\mu K^-$ $(\Upsilon(4S) \rightarrow \mu^+ \mu^- \nu_\mu \bar{\nu}_\mu \pi^0 \pi^+ \pi^- K^+ K^-)$	985	8	578
39	$\Upsilon(4S) \rightarrow B^+ B^-, B^+ \rightarrow \rho^+ \bar{D}^0, B^- \rightarrow e^- \bar{\nu}_e D^{*0}, \rho^+ \rightarrow \pi^0 \pi^+, \bar{D}^0 \rightarrow \pi^- K^+ \gamma^F, D^{*0} \rightarrow \pi^0 D^0,$ $D^0 \rightarrow \pi^0 \pi^+ K^-$ $(\Upsilon(4S) \rightarrow e^- \bar{\nu}_e \pi^0 \pi^0 \pi^0 \pi^+ \pi^- K^+ K^- \gamma^F)$	1050	8	586

rowNo	decay tree (decay initial-final states)	iDcyTr	nEtr	nCEtr
40	$\Upsilon(4S) \rightarrow B^+ B^-, B^+ \rightarrow \rho^+ \bar{D}^0, B^- \rightarrow e^- \bar{\nu}_e D^{*0}, \rho^+ \rightarrow \pi^0 \pi^+, \bar{D}^0 \rightarrow K^+ K^-, D^{*0} \rightarrow \pi^0 D^0,$ $D^0 \rightarrow \pi^0 \pi^+ K^-$ $(\Upsilon(4S) \rightarrow e^- \bar{\nu}_e \pi^0 \pi^0 \pi^0 \pi^+ \pi^+ K^+ K^- K^-)$	2551	8	594
41	$\Upsilon(4S) \rightarrow B^+ B^-, B^+ \rightarrow \mu^+ \nu_\mu \bar{D}^{*0}, B^- \rightarrow \rho^- D^0, \bar{D}^{*0} \rightarrow \pi^0 \bar{D}^0, \rho^- \rightarrow \pi^0 \pi^-, D^0 \rightarrow \pi^+ K^-,$ $\bar{D}^0 \rightarrow K^+ a_1^-, a_1^- \rightarrow \rho^0 \pi^-, \rho^0 \rightarrow \pi^+ \pi^-$ $(\Upsilon(4S) \rightarrow \mu^+ \nu_\mu \pi^0 \pi^0 \pi^+ \pi^+ \pi^- \pi^- \pi^- K^+ K^-)$	4482	8	602
42	$\Upsilon(4S) \rightarrow B^+ B^-, B^+ \rightarrow e^+ \nu_e \bar{D}^{*0}, B^- \rightarrow \rho^- D^0, \bar{D}^{*0} \rightarrow \bar{D}^0 \gamma, \rho^- \rightarrow \pi^0 \pi^-, D^0 \rightarrow \pi^0 \pi^+ K^-,$ $\bar{D}^0 \rightarrow \pi^0 \pi^- K^+$ $(\Upsilon(4S) \rightarrow e^+ \nu_e \pi^0 \pi^0 \pi^0 \pi^+ \pi^- \pi^- K^+ K^- \gamma)$	11568	8	610
43	$\Upsilon(4S) \rightarrow B^+ B^-, B^+ \rightarrow \rho^+ \bar{D}^0, B^- \rightarrow \rho^- D^0, \rho^+ \rightarrow \pi^0 \pi^+, \bar{D}^0 \rightarrow \pi^0 \pi^- K^+, \rho^- \rightarrow \pi^0 \pi^-,$ $D^0 \rightarrow K^+ K^-$ $(\Upsilon(4S) \rightarrow \pi^0 \pi^0 \pi^0 \pi^+ \pi^- \pi^- K^+ K^+ K^-)$	27356	8	618
44	$\Upsilon(4S) \rightarrow B^+ B^-, B^+ \rightarrow \rho^+ \bar{D}^0, B^- \rightarrow \pi^0 \pi^+ \pi^- \pi^- D^{*0}, \rho^+ \rightarrow \pi^0 \pi^+, \bar{D}^0 \rightarrow \pi^- K^+, D^{*0} \rightarrow D^0 \gamma,$ $D^0 \rightarrow \pi^0 \pi^+ K^-$ $(\Upsilon(4S) \rightarrow \pi^0 \pi^0 \pi^0 \pi^+ \pi^+ \pi^+ \pi^- \pi^- \pi^- K^+ K^- \gamma)$	35962	8	626
45	$\Upsilon(4S) \rightarrow B^+ B^-, B^+ \rightarrow \mu^+ \nu_\mu \bar{D}^{*0}, B^- \rightarrow \rho^- D^0, \bar{D}^{*0} \rightarrow \pi^0 \bar{D}^0, \rho^- \rightarrow \pi^0 \pi^-, D^0 \rightarrow \pi^+ K^-,$ $\bar{D}^0 \rightarrow \mu^- \bar{\nu}_\mu K^+$ $(\Upsilon(4S) \rightarrow \mu^+ \mu^- \nu_\mu \bar{\nu}_\mu \pi^0 \pi^0 \pi^+ \pi^- K^+ K^-)$	4341	7	633
46	$\Upsilon(4S) \rightarrow B^+ B^-, B^+ \rightarrow e^+ \nu_e \bar{D}^0 \gamma^F, B^- \rightarrow \rho^- D^0, \bar{D}^0 \rightarrow \pi^0 \pi^- K^+, \rho^- \rightarrow \pi^0 \pi^-, D^0 \rightarrow \pi^+ K^-$ $(\Upsilon(4S) \rightarrow e^+ \nu_e \pi^0 \pi^0 \pi^+ \pi^- \pi^- K^+ K^- \gamma^F)$	4419	7	640
47	$\Upsilon(4S) \rightarrow B^+ B^-, B^+ \rightarrow \rho^+ \bar{D}^0, B^- \rightarrow \mu^- \bar{\nu}_\mu D^{*0}, \rho^+ \rightarrow \pi^0 \pi^+, \bar{D}^0 \rightarrow \pi^0 \pi^- K^+, D^{*0} \rightarrow D^0 \gamma,$ $D^0 \rightarrow \pi^0 \pi^+ K^-$ $(\Upsilon(4S) \rightarrow \mu^- \bar{\nu}_\mu \pi^0 \pi^0 \pi^0 \pi^+ \pi^+ \pi^- K^+ K^- \gamma)$	4988	7	647
48	$\Upsilon(4S) \rightarrow B^+ B^-, B^+ \rightarrow \rho^+ \bar{D}^0, B^- \rightarrow \mu^- \bar{\nu}_\mu D^0, \rho^+ \rightarrow \pi^0 \pi^+, \bar{D}^0 \rightarrow \pi^- K^+, D^0 \rightarrow e^+ \nu_e K^-$ $(\Upsilon(4S) \rightarrow e^+ \nu_e \mu^- \bar{\nu}_\mu \pi^0 \pi^+ \pi^- K^+ K^-)$	5083	7	654
49	$\Upsilon(4S) \rightarrow B^+ B^-, B^+ \rightarrow \rho^+ \bar{D}^0, B^- \rightarrow e^- \bar{\nu}_e D^{*0}, \rho^+ \rightarrow \pi^0 \pi^+, \bar{D}^0 \rightarrow \pi^- K^+, D^{*0} \rightarrow \pi^0 D^0,$ $D^0 \rightarrow \pi^0 \pi^0 \pi^+ K^-$ $(\Upsilon(4S) \rightarrow e^- \bar{\nu}_e \pi^0 \pi^0 \pi^0 \pi^0 \pi^+ \pi^+ \pi^- K^+ K^-)$	6648	7	661
50	$\Upsilon(4S) \rightarrow B^+ B^-, B^+ \rightarrow \mu^+ \nu_\mu \bar{D}^{*0}, B^- \rightarrow \rho^- D^0, \bar{D}^{*0} \rightarrow \bar{D}^0 \gamma, \rho^- \rightarrow \pi^0 \pi^-, D^0 \rightarrow \pi^0 \pi^+ K^-,$ $\bar{D}^0 \rightarrow \pi^0 \pi^- K^+$ $(\Upsilon(4S) \rightarrow \mu^+ \nu_\mu \pi^0 \pi^0 \pi^0 \pi^+ \pi^- \pi^- K^+ K^- \gamma)$	8418	7	668
51	$\Upsilon(4S) \rightarrow B^+ B^-, B^+ \rightarrow \mu^+ \nu_\mu \bar{D}^{*0}, B^- \rightarrow \rho^- D^0, \bar{D}^{*0} \rightarrow \pi^0 \bar{D}^0, \rho^- \rightarrow \pi^0 \pi^-, D^0 \rightarrow \pi^+ K^-,$ $\bar{D}^0 \rightarrow K^+ a_1^-, a_1^- \rightarrow \pi^0 \rho^-, \rho^- \rightarrow \pi^0 \pi^-$ $(\Upsilon(4S) \rightarrow \mu^+ \nu_\mu \pi^0 \pi^0 \pi^0 \pi^+ \pi^- \pi^- K^+ K^-)$	9606	7	675
52	$\Upsilon(4S) \rightarrow B^+ B^-, B^+ \rightarrow \mu^+ \nu_\mu \bar{D}^0, B^- \rightarrow \rho^- D^0, \bar{D}^0 \rightarrow \mu^- \bar{\nu}_\mu K^+, \rho^- \rightarrow \pi^0 \pi^-, D^0 \rightarrow \pi^+ K^-$ $(\Upsilon(4S) \rightarrow \mu^+ \mu^- \nu_\mu \bar{\nu}_\mu \pi^0 \pi^+ \pi^- K^+ K^-)$	9681	7	682

rowNo	decay tree (decay initial-final states)	iDcyTr	nEtr	nCEtr
53	$\Upsilon(4S) \rightarrow B^+ B^-, B^+ \rightarrow \rho^+ \bar{D}^0, B^- \rightarrow \rho^- D^0, \rho^+ \rightarrow \pi^0 \pi^+, \bar{D}^0 \rightarrow K^+ K^-, \rho^- \rightarrow \pi^0 \pi^-,$ $D^0 \rightarrow \pi^0 \pi^+ K^-$ $(\Upsilon(4S) \rightarrow \pi^0 \pi^0 \pi^0 \pi^+ \pi^+ \pi^- K^+ K^- K^-)$	14711	7	689
54	$\Upsilon(4S) \rightarrow B^+ B^-, B^+ \rightarrow \rho^+ \bar{D}^0, B^- \rightarrow \rho^0 \pi^- D^0, \rho^+ \rightarrow \pi^0 \pi^+, \bar{D}^0 \rightarrow \pi^0 \pi^- K^+, \rho^0 \rightarrow \pi^+ \pi^-,$ $D^0 \rightarrow \pi^0 \pi^+ K^-$ $(\Upsilon(4S) \rightarrow \pi^0 \pi^0 \pi^0 \pi^+ \pi^+ \pi^- \pi^- \pi^- K^+ K^-)$	16607	7	696
55	$\Upsilon(4S) \rightarrow B^+ B^-, B^+ \rightarrow \rho^+ \bar{D}^0, B^- \rightarrow \mu^- \bar{\nu}_\mu D^{*0}, \rho^+ \rightarrow \pi^0 \pi^+, \bar{D}^0 \rightarrow e^- \bar{\nu}_e K^+ \gamma^F, D^{*0} \rightarrow \pi^0 D^0,$ $D^0 \rightarrow \pi^0 \pi^+ K^-$ $(\Upsilon(4S) \rightarrow e^- \bar{\nu}_e \mu^- \bar{\nu}_\mu \pi^0 \pi^0 \pi^0 \pi^+ \pi^+ K^+ K^- \gamma^F)$	24787	7	703
56	$\Upsilon(4S) \rightarrow B^+ B^-, B^+ \rightarrow e^+ \nu_e \bar{D}^{*0} \gamma^F, B^- \rightarrow \rho^- D^0, \bar{D}^{*0} \rightarrow \pi^0 \bar{D}^0, \rho^- \rightarrow \pi^0 \pi^-, D^0 \rightarrow K^+ K^-,$ $\bar{D}^0 \rightarrow \pi^0 \pi^- K^+$ $(\Upsilon(4S) \rightarrow e^+ \nu_e \pi^0 \pi^0 \pi^0 \pi^- \pi^- K^+ K^+ K^- \gamma^F)$	1011	6	709
57	$\Upsilon(4S) \rightarrow B^+ B^-, B^+ \rightarrow e^+ \nu_e \bar{D}^0, B^- \rightarrow \rho^- D^0, \bar{D}^0 \rightarrow \rho^- K^{*+}, \rho^- \rightarrow \pi^0 \pi^-, D^0 \rightarrow \pi^+ K^-,$ $\rho^- \rightarrow \pi^0 \pi^-, K^{*+} \rightarrow \pi^0 K^+$ $(\Upsilon(4S) \rightarrow e^+ \nu_e \pi^0 \pi^0 \pi^0 \pi^+ \pi^- \pi^- K^+ K^-)$	1069	6	715
58	$\Upsilon(4S) \rightarrow B^+ B^-, B^+ \rightarrow \rho^+ \bar{D}^0, B^- \rightarrow \mu^- \bar{\nu}_\mu D^{*0}, \rho^+ \rightarrow \pi^0 \pi^+, \bar{D}^0 \rightarrow \pi^0 \pi^- K^+, D^{*0} \rightarrow \pi^0 D^0,$ $D^0 \rightarrow \mu^+ \nu_\mu K^-$ $(\Upsilon(4S) \rightarrow \mu^+ \mu^- \nu_\mu \bar{\nu}_\mu \pi^0 \pi^0 \pi^0 \pi^+ \pi^- K^+ K^-)$	1165	6	721
59	$\Upsilon(4S) \rightarrow B^+ B^-, B^+ \rightarrow \pi^0 \pi^+ \pi^+ D^{*-}, B^- \rightarrow \rho^- D^0, D^{*-} \rightarrow \pi^- \bar{D}^0, \rho^- \rightarrow \pi^0 \pi^-, D^0 \rightarrow \pi^+ K^-,$ $\bar{D}^0 \rightarrow \pi^0 \pi^- K^+$ $(\Upsilon(4S) \rightarrow \pi^0 \pi^0 \pi^0 \pi^+ \pi^+ \pi^+ \pi^- \pi^- \pi^- K^+ K^-)$	1178	6	727
60	$\Upsilon(4S) \rightarrow B^+ B^-, B^+ \rightarrow e^+ \nu_e \bar{D}^{*0}, B^- \rightarrow \rho^- D^0, \bar{D}^{*0} \rightarrow \pi^0 \bar{D}^0, \rho^- \rightarrow \pi^0 \pi^-, D^0 \rightarrow \pi^+ K^-,$ $\bar{D}^0 \rightarrow \pi^0 \pi^0 \pi^- K^+$ $(\Upsilon(4S) \rightarrow e^+ \nu_e \pi^0 \pi^0 \pi^0 \pi^+ \pi^- \pi^- K^+ K^-)$	1244	6	733
61	$\Upsilon(4S) \rightarrow B^+ B^-, B^+ \rightarrow \mu^+ \nu_\mu \bar{D}^{*0}, B^- \rightarrow \rho^- D^0, \bar{D}^{*0} \rightarrow \pi^0 \bar{D}^0, \rho^- \rightarrow \pi^0 \pi^-, D^0 \rightarrow \pi^+ K^-,$ $\bar{D}^0 \rightarrow \pi^+ \pi^- K^*, K^* \rightarrow \pi^- K^+$ $(\Upsilon(4S) \rightarrow \mu^+ \nu_\mu \pi^0 \pi^0 \pi^+ \pi^+ \pi^- \pi^- \pi^- K^+ K^-)$	1322	6	739
62	$\Upsilon(4S) \rightarrow B^+ B^-, B^+ \rightarrow \rho^+ \bar{D}^0, B^- \rightarrow \mu^- \bar{\nu}_\mu D^0, \rho^+ \rightarrow \pi^0 \pi^+, \bar{D}^0 \rightarrow \pi^- K^+, D^0 \rightarrow \rho^+ K^{*-},$ $\rho^+ \rightarrow \pi^0 \pi^+, K^{*-} \rightarrow \pi^0 K^-$ $(\Upsilon(4S) \rightarrow \mu^- \bar{\nu}_\mu \pi^0 \pi^0 \pi^0 \pi^+ \pi^+ \pi^- K^+ K^-)$	1394	6	745
63	$\Upsilon(4S) \rightarrow B^+ B^-, B^+ \rightarrow \rho^+ \bar{D}^0, B^- \rightarrow \mu^- \bar{\nu}_\mu D^{*0} \gamma^F, \rho^+ \rightarrow \pi^0 \pi^+, \bar{D}^0 \rightarrow \pi^- K^+, D^{*0} \rightarrow \pi^0 D^0,$ $D^0 \rightarrow \pi^0 \pi^+ K^-$ $(\Upsilon(4S) \rightarrow \mu^- \bar{\nu}_\mu \pi^0 \pi^0 \pi^0 \pi^+ \pi^+ \pi^- K^+ K^- \gamma^F)$	1985	6	751
64	$\Upsilon(4S) \rightarrow B^+ B^-, B^+ \rightarrow e^+ \nu_e \bar{D}^{*0} \gamma^F, B^- \rightarrow \rho^- D^0, \bar{D}^{*0} \rightarrow \pi^0 \bar{D}^0, \rho^- \rightarrow \pi^0 \pi^-, D^0 \rightarrow \pi^+ K^-,$ $\bar{D}^0 \rightarrow \pi^- K^+$ $(\Upsilon(4S) \rightarrow e^+ \nu_e \pi^0 \pi^0 \pi^+ \pi^- \pi^- K^+ K^- \gamma^F)$	2419	6	757

rowNo	decay tree (decay initial-final states)	iDcyTr	nEtr	nCEtr
65	$\Upsilon(4S) \rightarrow B^+ B^-, B^+ \rightarrow \pi^+ \pi^+ \pi^+ \pi^- \pi^- \bar{D}^{*0}, B^- \rightarrow \rho^- D^0, \bar{D}^{*0} \rightarrow \bar{D}^0 \gamma, \rho^- \rightarrow \pi^0 \pi^-, D^0 \rightarrow \pi^+ K^-,$ $\bar{D}^0 \rightarrow \pi^0 \pi^- K^+$ $(\Upsilon(4S) \rightarrow \pi^0 \pi^0 \pi^+ \pi^+ \pi^+ \pi^- \pi^- \pi^- \pi^- K^+ K^- \gamma)$	2570	6	763
66	$\Upsilon(4S) \rightarrow B^+ B^-, B^+ \rightarrow \rho^+ \bar{D}^0, B^- \rightarrow \mu^- \bar{\nu}_\mu D^{*0}, \rho^+ \rightarrow \pi^0 \pi^+, \bar{D}^0 \rightarrow \pi^- K^+ \gamma^F, D^{*0} \rightarrow \pi^0 D^0,$ $D^0 \rightarrow \pi^0 \pi^+ K^-$ $(\Upsilon(4S) \rightarrow \mu^- \bar{\nu}_\mu \pi^0 \pi^0 \pi^0 \pi^+ \pi^- K^+ K^- \gamma^F)$	4438	6	769
67	$\Upsilon(4S) \rightarrow B^+ B^-, B^+ \rightarrow \rho^+ \bar{D}^0, B^- \rightarrow e^- \bar{\nu}_e D^{*0}, \rho^+ \rightarrow \pi^0 \pi^+, \bar{D}^0 \rightarrow \pi^- K^+, D^{*0} \rightarrow \pi^0 D^0,$ $D^0 \rightarrow \pi^+ K^-$ $(\Upsilon(4S) \rightarrow e^- \bar{\nu}_e \pi^0 \pi^0 \pi^+ \pi^- K^+ K^-)$	4869	6	775
68	$\Upsilon(4S) \rightarrow B^+ B^-, B^+ \rightarrow \pi^0 \rho^+ \bar{D}^0, B^- \rightarrow \rho^- D^0, \rho^+ \rightarrow \pi^0 \pi^+, \bar{D}^0 \rightarrow \pi^0 \pi^- K^+, \rho^- \rightarrow \pi^0 \pi^-,$ $D^0 \rightarrow \pi^+ K^-$ $(\Upsilon(4S) \rightarrow \pi^0 \pi^0 \pi^0 \pi^0 \pi^+ \pi^- K^+ K^-)$	4870	6	781
69	$\Upsilon(4S) \rightarrow B^+ B^-, B^+ \rightarrow \mu^+ \nu_\mu \bar{D}^{*0} \gamma^F, B^- \rightarrow \rho^- D^0, \bar{D}^{*0} \rightarrow \pi^0 \bar{D}^0, \rho^- \rightarrow \pi^0 \pi^-, D^0 \rightarrow \pi^+ K^-,$ $\bar{D}^0 \rightarrow \pi^0 \pi^- K^+$ $(\Upsilon(4S) \rightarrow \mu^+ \nu_\mu \pi^0 \pi^0 \pi^0 \pi^+ \pi^- K^+ K^- \gamma^F)$	5019	6	787
70	$\Upsilon(4S) \rightarrow B^+ B^-, B^+ \rightarrow \rho^+ \bar{D}^0, B^- \rightarrow \mu^- \bar{\nu}_\mu D^{*0}, \rho^+ \rightarrow \pi^0 \pi^+, \bar{D}^0 \rightarrow \pi^- K^+, D^{*0} \rightarrow \pi^0 D^0,$ $D^0 \rightarrow \pi^+ K^-$ $(\Upsilon(4S) \rightarrow \mu^- \bar{\nu}_\mu \pi^0 \pi^0 \pi^+ \pi^- K^+ K^-)$	6243	6	793
71	$\Upsilon(4S) \rightarrow B^+ B^-, B^+ \rightarrow \mu^+ \nu_\mu \bar{D}^{*0}, B^- \rightarrow \rho^- D^0, \bar{D}^{*0} \rightarrow \pi^0 \bar{D}^0, \rho^- \rightarrow \pi^0 \pi^-, D^0 \rightarrow \pi^+ K^-,$ $\bar{D}^0 \rightarrow \rho^- K^{*+}, \rho^- \rightarrow \pi^0 \pi^-, K^{*+} \rightarrow \pi^0 K^+$ $(\Upsilon(4S) \rightarrow \mu^+ \nu_\mu \pi^0 \pi^0 \pi^0 \pi^+ \pi^- \pi^- K^+ K^-)$	8299	6	799
72	$\Upsilon(4S) \rightarrow B^+ B^-, B^+ \rightarrow e^+ \nu_e \bar{D}^0, B^- \rightarrow \rho^- D^0, \bar{D}^0 \rightarrow e^- \bar{\nu}_e K^+, \rho^- \rightarrow \pi^0 \pi^-, D^0 \rightarrow \pi^+ K^-$ $(\Upsilon(4S) \rightarrow e^+ e^- \nu_e \bar{\nu}_e \pi^0 \pi^+ \pi^- K^+ K^-)$	8791	6	805
73	$\Upsilon(4S) \rightarrow B^+ B^-, B^+ \rightarrow e^+ \nu_e \bar{D}^0, B^- \rightarrow \rho^- D^0, \bar{D}^0 \rightarrow \pi^0 \pi^- K^+, \rho^- \rightarrow \pi^0 \pi^-, D^0 \rightarrow \pi^0 \pi^+ K^-$ $(\Upsilon(4S) \rightarrow e^+ \nu_e \pi^0 \pi^0 \pi^0 \pi^+ \pi^- \pi^- K^+ K^-)$	9457	6	811
74	$\Upsilon(4S) \rightarrow B^+ B^-, B^+ \rightarrow \rho^+ \bar{D}^0, B^- \rightarrow e^- \bar{\nu}_e D^{*0}, \rho^+ \rightarrow \pi^0 \pi^+, \bar{D}^0 \rightarrow \pi^- K^+, D^{*0} \rightarrow \pi^0 D^0,$ $D^0 \rightarrow \mu^+ \nu_\mu K^-$ $(\Upsilon(4S) \rightarrow e^- \bar{\nu}_e \mu^+ \nu_\mu \pi^0 \pi^0 \pi^+ \pi^- K^+ K^-)$	10002	6	817
75	$\Upsilon(4S) \rightarrow B^+ B^-, B^+ \rightarrow e^+ \nu_e \bar{D}^{*0} \gamma^F, B^- \rightarrow \rho^- D^0, \bar{D}^{*0} \rightarrow \pi^0 \bar{D}^0, \rho^- \rightarrow \pi^0 \pi^-, D^0 \rightarrow \pi^0 \pi^+ K^-,$ $\bar{D}^0 \rightarrow \pi^0 \pi^0 \pi^- K^+$ $(\Upsilon(4S) \rightarrow e^+ \nu_e \pi^0 \pi^0 \pi^0 \pi^0 \pi^+ \pi^- \pi^- K^+ K^- \gamma^F)$	10820	6	823
76	$\Upsilon(4S) \rightarrow B^+ B^-, B^+ \rightarrow \rho^+ \bar{D}^0, B^- \rightarrow \rho^- D^{*0}, \rho^+ \rightarrow \pi^0 \pi^+, \bar{D}^0 \rightarrow \pi^0 \pi^- K^+, \rho^- \rightarrow \pi^0 \pi^-,$ $D^{*0} \rightarrow \pi^0 D^0, D^0 \rightarrow \pi^0 \pi^+ K^-$ $(\Upsilon(4S) \rightarrow \pi^0 \pi^0 \pi^0 \pi^0 \pi^+ \pi^+ \pi^- \pi^- K^+ K^-)$	13901	6	829
77	$\Upsilon(4S) \rightarrow B^+ B^-, B^+ \rightarrow \rho^+ \bar{D}^0, B^- \rightarrow e^- \bar{\nu}_e D^{*0}, \rho^+ \rightarrow \pi^0 \pi^+, \bar{D}^0 \rightarrow \pi^- K^+, D^{*0} \rightarrow D^0 \gamma,$ $D^0 \rightarrow \mu^+ \nu_\mu K^-$ $(\Upsilon(4S) \rightarrow e^- \bar{\nu}_e \mu^+ \nu_\mu \pi^0 \pi^+ \pi^- K^+ K^- \gamma)$	15605	6	835

rowNo	decay tree (decay initial-final states)	iDcyTr	nEtr	nCEtr
78	$\Upsilon(4S) \rightarrow B^+ B^-, B^+ \rightarrow \rho^+ \bar{D}^0, B^- \rightarrow e^- \bar{\nu}_e D^{*0} \gamma^F, \rho^+ \rightarrow \pi^0 \pi^+, \bar{D}^0 \rightarrow K^+ K^-, D^{*0} \rightarrow \pi^0 D^0,$ $D^0 \rightarrow \pi^0 \pi^+ K^-$ $(\Upsilon(4S) \rightarrow e^- \bar{\nu}_e \pi^0 \pi^0 \pi^0 \pi^+ \pi^+ K^+ K^- K^- \gamma^F)$	16334	6	841
79	$\Upsilon(4S) \rightarrow B^+ B^-, B^+ \rightarrow \rho^+ \bar{D}^0, B^- \rightarrow \rho^- D^{*0}, \rho^+ \rightarrow \pi^0 \pi^+, \bar{D}^0 \rightarrow \pi^- K^+, \rho^- \rightarrow \pi^0 \pi^-,$ $D^{*0} \rightarrow \pi^0 D^0, D^0 \rightarrow \pi^0 \pi^+ K^-$ $(\Upsilon(4S) \rightarrow \pi^0 \pi^0 \pi^0 \pi^0 \pi^+ \pi^- \pi^- K^+ K^-)$	19613	6	847
80	$\Upsilon(4S) \rightarrow B^+ B^-, B^+ \rightarrow \rho^+ \bar{D}^0, B^- \rightarrow \mu^- \bar{\nu}_\mu D^{*0}, \rho^+ \rightarrow \pi^0 \pi^+, \bar{D}^0 \rightarrow \pi^- K^+, D^{*0} \rightarrow D^0 \gamma,$ $D^0 \rightarrow \pi^0 \pi^0 \pi^+ K^-$ $(\Upsilon(4S) \rightarrow \mu^- \bar{\nu}_\mu \pi^0 \pi^0 \pi^0 \pi^+ \pi^- K^+ K^- \gamma)$	24993	6	853
81	$\Upsilon(4S) \rightarrow B^+ B^-, B^+ \rightarrow \mu^+ \nu_\mu \bar{D}^0, B^- \rightarrow \rho^- D^0, \bar{D}^0 \rightarrow K^+ a_1^-, \rho^- \rightarrow \pi^0 \pi^-, D^0 \rightarrow \pi^+ K^-,$ $a_1^- \rightarrow \pi^0 \rho^-, \rho^- \rightarrow \pi^0 \pi^-$ $(\Upsilon(4S) \rightarrow \mu^+ \nu_\mu \pi^0 \pi^0 \pi^0 \pi^+ \pi^- \pi^- K^+ K^-)$	27901	6	859
82	$\Upsilon(4S) \rightarrow B^+ B^-, B^+ \rightarrow \rho^+ \bar{D}^0, B^- \rightarrow \mu^- \bar{\nu}_\mu D^{*0}, \rho^+ \rightarrow \pi^0 \pi^+, \bar{D}^0 \rightarrow \pi^- K^+, D^{*0} \rightarrow D^0 \gamma,$ $D^0 \rightarrow \mu^+ \nu_\mu K^-$ $(\Upsilon(4S) \rightarrow \mu^+ \mu^- \nu_\mu \bar{\nu}_\mu \pi^0 \pi^+ \pi^- K^+ K^- \gamma)$	118	5	864
83	$\Upsilon(4S) \rightarrow B^+ B^-, B^+ \rightarrow \rho^+ \bar{D}^0, B^- \rightarrow e^- \bar{\nu}_e D^{*0}, \rho^+ \rightarrow \pi^0 \pi^+, \bar{D}^0 \rightarrow \pi^- K^+, D^{*0} \rightarrow \pi^0 D^0,$ $D^0 \rightarrow \pi^+ \omega K^-, \omega \rightarrow \pi^0 \pi^+ \pi^-$ $(\Upsilon(4S) \rightarrow e^- \bar{\nu}_e \pi^0 \pi^0 \pi^0 \pi^+ \pi^+ \pi^- \pi^- K^+ K^-)$	359	5	869
84	$\Upsilon(4S) \rightarrow B^+ B^-, B^+ \rightarrow \rho^+ \bar{D}^0, B^- \rightarrow \mu^- \bar{\nu}_\mu D^{*0}, \rho^+ \rightarrow \pi^0 \pi^+, \bar{D}^0 \rightarrow \pi^0 \pi^- K^+, D^{*0} \rightarrow \pi^0 D^0,$ $D^0 \rightarrow \rho^+ K^{*-}, \rho^+ \rightarrow \pi^0 \pi^+, K^{*-} \rightarrow \pi^0 K^-$ $(\Upsilon(4S) \rightarrow \mu^- \bar{\nu}_\mu \pi^0 \pi^0 \pi^0 \pi^0 \pi^+ \pi^- K^+ K^-)$	409	5	874
85	$\Upsilon(4S) \rightarrow B^+ B^-, B^+ \rightarrow \rho^+ \bar{D}^0, B^- \rightarrow e^- \bar{\nu}_e D^{*0}, \rho^+ \rightarrow \pi^0 \pi^+, \bar{D}^0 \rightarrow \pi^- K^+, D^{*0} \rightarrow \pi^0 D^0,$ $D^0 \rightarrow \rho^+ K^{*-}, \rho^+ \rightarrow \pi^0 \pi^+, K^{*-} \rightarrow \pi^0 K^-$ $(\Upsilon(4S) \rightarrow e^- \bar{\nu}_e \pi^0 \pi^0 \pi^0 \pi^0 \pi^+ \pi^+ \pi^- K^+ K^-)$	836	5	879
86	$\Upsilon(4S) \rightarrow B^+ B^-, B^+ \rightarrow \pi^0 \pi^+ \pi^+ D^{*-}, B^- \rightarrow \rho^- D^0, D^{*-} \rightarrow \pi^0 D^-, \rho^- \rightarrow \pi^0 \pi^-, D^0 \rightarrow \pi^+ K^-,$ $D^- \rightarrow \mu^- \bar{\nu}_\mu K^*, K^* \rightarrow \pi^- K^+$ $(\Upsilon(4S) \rightarrow \mu^- \bar{\nu}_\mu \pi^0 \pi^0 \pi^0 \pi^+ \pi^+ \pi^- \pi^- K^+ K^-)$	2158	5	884
87	$\Upsilon(4S) \rightarrow B^+ B^-, B^+ \rightarrow \mu^+ \nu_\mu \bar{D}^{*0}, B^- \rightarrow \rho^- D^0, \bar{D}^{*0} \rightarrow \pi^0 \bar{D}^0, \rho^- \rightarrow \pi^0 \pi^-, D^0 \rightarrow K^+ K^-,$ $\bar{D}^0 \rightarrow \pi^- K^+$ $(\Upsilon(4S) \rightarrow \mu^+ \nu_\mu \pi^0 \pi^0 \pi^- \pi^- K^+ K^+ K^-)$	2335	5	889
88	$\Upsilon(4S) \rightarrow B^+ B^-, B^+ \rightarrow e^+ \nu_e \bar{D}^{*0} \gamma^F, B^- \rightarrow \rho^- D^0, \bar{D}^{*0} \rightarrow \bar{D}^0 \gamma, \rho^- \rightarrow \pi^0 \pi^-, D^0 \rightarrow \pi^0 \pi^+ K^-,$ $\bar{D}^0 \rightarrow \pi^0 \pi^- K^+$ $(\Upsilon(4S) \rightarrow e^+ \nu_e \pi^0 \pi^0 \pi^0 \pi^+ \pi^- \pi^- K^+ K^- \gamma^F \gamma)$	2774	5	894
89	$\Upsilon(4S) \rightarrow B^+ B^-, B^+ \rightarrow \rho^+ \bar{D}^0, B^- \rightarrow e^- \bar{\nu}_e D^{*0}, \rho^+ \rightarrow \pi^0 \pi^+, \bar{D}^0 \rightarrow \pi^- K^+, D^{*0} \rightarrow D^0 \gamma,$ $D^0 \rightarrow \pi^0 \pi^0 \pi^+ K^-$ $(\Upsilon(4S) \rightarrow e^- \bar{\nu}_e \pi^0 \pi^0 \pi^0 \pi^+ \pi^+ \pi^- K^+ K^- \gamma)$	3032	5	899

rowNo	decay tree (decay initial-final states)	iDcyTr	nEtr	nCEtr
90	$\Upsilon(4S) \rightarrow B^+ B^-, B^+ \rightarrow e^+ \nu_e \bar{D}^{*0} \gamma^F, B^- \rightarrow \rho^- D^0, \bar{D}^{*0} \rightarrow \pi^0 \bar{D}^0, \rho^- \rightarrow \pi^0 \pi^-, D^0 \rightarrow \mu^+ \nu_\mu K^-,$ $\bar{D}^0 \rightarrow \pi^0 \pi^- K^+$ $(\Upsilon(4S) \rightarrow e^+ \nu_e \mu^+ \nu_\mu \pi^0 \pi^0 \pi^0 \pi^- \pi^- K^+ K^- \gamma^F)$	3132	5	904
91	$\Upsilon(4S) \rightarrow B^+ B^-, B^+ \rightarrow \rho^+ \bar{D}^0, B^- \rightarrow e^- \bar{\nu}_e D^{*0} \gamma^F, \rho^+ \rightarrow \pi^0 \pi^+, \bar{D}^0 \rightarrow \pi^0 \pi^- K^+, D^{*0} \rightarrow \pi^0 D^0,$ $D^0 \rightarrow \pi^0 \pi^+ K^-$ $(\Upsilon(4S) \rightarrow e^- \bar{\nu}_e \pi^0 \pi^0 \pi^0 \pi^+ \pi^- K^+ K^- \gamma^F)$	3743	5	909
92	$\Upsilon(4S) \rightarrow B^+ B^-, B^+ \rightarrow \rho^+ \bar{D}^{*0}, B^- \rightarrow \rho^- D^0, \rho^+ \rightarrow \pi^0 \pi^+, \bar{D}^{*0} \rightarrow \pi^0 \bar{D}^0, \rho^- \rightarrow \pi^0 \pi^-,$ $D^0 \rightarrow \pi^+ K^-, \bar{D}^0 \rightarrow \pi^0 \pi^- K^+$ $(\Upsilon(4S) \rightarrow \pi^0 \pi^0 \pi^0 \pi^+ \pi^- \pi^- K^+ K^-)$	3867	5	914
93	$\Upsilon(4S) \rightarrow B^+ B^-, B^+ \rightarrow \rho^+ \bar{D}^0, B^- \rightarrow \rho^- D^0, \rho^+ \rightarrow \pi^0 \pi^+, \bar{D}^0 \rightarrow \pi^0 \pi^- K^+, \rho^- \rightarrow \pi^0 \pi^-,$ $D^0 \rightarrow \mu^+ \nu_\mu K^-$ $(\Upsilon(4S) \rightarrow \mu^+ \nu_\mu \pi^0 \pi^0 \pi^0 \pi^+ \pi^- \pi^- K^+ K^-)$	4685	5	919
94	$\Upsilon(4S) \rightarrow B^+ B^-, B^+ \rightarrow \rho^0 \pi^+ \omega \bar{D}^0, B^- \rightarrow \rho^- D^0, \rho^0 \rightarrow \pi^+ \pi^-, \omega \rightarrow \pi^0 \pi^+ \pi^-, \bar{D}^0 \rightarrow \pi^0 \pi^- K^+,$ $\rho^- \rightarrow \pi^0 \pi^-, D^0 \rightarrow \pi^+ K^-$ $(\Upsilon(4S) \rightarrow \pi^0 \pi^0 \pi^0 \pi^+ \pi^+ \pi^+ \pi^- \pi^- \pi^- K^+ K^-)$	4906	5	924
95	$\Upsilon(4S) \rightarrow B^+ B^-, B^+ \rightarrow \rho^+ \bar{D}^0, B^- \rightarrow \mu^- \bar{\nu}_\mu D^0, \rho^+ \rightarrow \pi^0 \pi^+, \bar{D}^0 \rightarrow \pi^- K^+, D^0 \rightarrow \pi^0 \pi^0 \pi^+ K^-$ $(\Upsilon(4S) \rightarrow \mu^- \bar{\nu}_\mu \pi^0 \pi^0 \pi^0 \pi^+ \pi^- K^+ K^-)$	5282	5	929
96	$\Upsilon(4S) \rightarrow B^+ B^-, B^+ \rightarrow \rho^+ \bar{D}^0, B^- \rightarrow \pi^0 \pi^+ \pi^- \pi^- D^{*0} \gamma^F, \rho^+ \rightarrow \pi^0 \pi^+, \bar{D}^0 \rightarrow \pi^- K^+, D^{*0} \rightarrow \pi^0 D^0,$ $D^0 \rightarrow \pi^0 \pi^+ K^-$ $(\Upsilon(4S) \rightarrow \pi^0 \pi^0 \pi^0 \pi^0 \pi^+ \pi^+ \pi^- \pi^- K^+ K^- \gamma^F)$	5331	5	934
97	$\Upsilon(4S) \rightarrow B^+ B^-, B^+ \rightarrow \rho^+ \bar{D}^0, B^- \rightarrow \rho^- D^0, \rho^+ \rightarrow \pi^0 \pi^+, \bar{D}^0 \rightarrow \pi^0 \pi^- K^+, \rho^- \rightarrow \pi^0 \pi^-,$ $D^0 \rightarrow \pi^+ K^- \gamma^F$ $(\Upsilon(4S) \rightarrow \pi^0 \pi^0 \pi^0 \pi^+ \pi^+ \pi^- \pi^- K^+ K^- \gamma^F)$	6433	5	939
98	$\Upsilon(4S) \rightarrow B^+ B^-, B^+ \rightarrow \rho^+ \bar{D}^0, B^- \rightarrow \pi^- \omega \omega D^0, \rho^+ \rightarrow \pi^0 \pi^+, \bar{D}^0 \rightarrow \pi^0 \pi^- K^+, \omega \rightarrow \pi^0 \pi^+ \pi^-,$ $\omega \rightarrow \pi^0 \pi^+ \pi^-, D^0 \rightarrow \pi^0 \pi^+ K^-$ $(\Upsilon(4S) \rightarrow \pi^0 \pi^0 \pi^0 \pi^0 \pi^+ \pi^+ \pi^+ \pi^- \pi^- \pi^- K^+ K^-)$	7328	5	944
99	$\Upsilon(4S) \rightarrow B^+ B^-, B^+ \rightarrow \rho^+ \bar{D}^0, B^- \rightarrow \mu^- \bar{\nu}_\mu D^{*0}, \rho^+ \rightarrow \pi^0 \pi^+, \bar{D}^0 \rightarrow \pi^0 \pi^- K^+, D^{*0} \rightarrow \pi^0 D^0,$ $D^0 \rightarrow \pi^+ K^-$ $(\Upsilon(4S) \rightarrow \mu^- \bar{\nu}_\mu \pi^0 \pi^0 \pi^0 \pi^+ \pi^- K^+ K^-)$	7483	5	949
100	$\Upsilon(4S) \rightarrow B^+ B^-, B^+ \rightarrow \rho^+ \bar{D}^0, B^- \rightarrow e^- \bar{\nu}_e D^0 \gamma^F, \rho^+ \rightarrow \pi^0 \pi^+, \bar{D}^0 \rightarrow \pi^0 \pi^- K^+, D^0 \rightarrow \pi^0 \pi^+ K^-$ $(\Upsilon(4S) \rightarrow e^- \bar{\nu}_e \pi^0 \pi^0 \pi^0 \pi^+ \pi^- K^+ K^- \gamma^F)$	7519	5	954
rest	$\Upsilon(4S) \rightarrow \text{others (76062 in total)}$ $(\Upsilon(4S) \rightarrow \text{corresponding to others})$	—	81836	82790