since there are 2 charged masses we duplicate all tracks,

the resulting set is: (subscript denotes the mass)

$$\text{Track vect}\left[C^{+}_{1\pi}, C^{-}_{2\pi}, C^{+}_{3\pi}, C^{-}_{4\pi}, C^{+}_{5k}, C^{-}_{6k}, C^{+}_{7k}, C^{-}_{8k}\right]$$

to agree with implementation of reducing combinatorics, w add a parallel vector with PDG codes (so ϕ isn't fit with π^+, π^-) (and ϕ isn't fit with π^-, k^-)

$$\text{Track pdg}\left[211, -211, 211, -211, 321, -321, 321, -321\right]$$

So the reconstructed set now consists of 8 tracks and 3 photons

For the root constraints the combinatorics to fit are $\binom{11}{6}$

However it is most important to reduce combinatorics at this step so by seperating the choice into two subsets charged & neutral we get $\binom{8}{4}$ and $\binom{3}{2}$,

Rules to reduce combinatorics at the Top Level

(1) For the chosen tracks $\sum_{\text{tracks}} q_i = q_{\text{parent}}$

(2) We can not chose total pdgs inconsistent with parent

i.e $[C^{+}_{1\pi}, C^{-}_{2\pi}, C^{+}_{3\pi}, C^{-}_{4\pi}] \Rightarrow$ is not allowed we require

$\times$ [211 −211 211 −211] 211×2 and 321×2

✓ [211 −211, 321, −321]

(3) Duplicated tracks are not allowed, (with different masses)

$E^{+}_{C1}, P^{+}_{C1} \equiv E^{+}_{C5}, P^{+}_{C5}$ but $m_{C5} \neq m_{C1}$

These two tracks can not be picked together