Jefferson Lab

GLUEX citations periment

Unused Showers/Energy

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Final states with photons

Why is it important to separate events with more than the required number of photons from the rest?
In the **DSelector**, in order to get the total number of reconstructed photons for a given event as seen by the reaction filter from the REST file one has to use the **ComboWrapper** method `Get_NumUnusedShowers()` and add this number to the total number of photons defined by the reaction. In the case of the reaction:

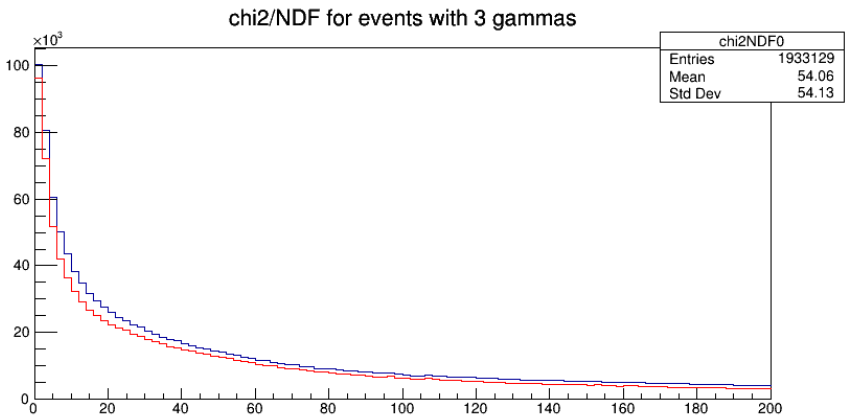
$$\begin{aligned}\gamma + p &\to \eta' + p \to \pi^+ + \pi^- + \eta + p \\ &\to \pi^+ + \pi^- + \pi^0 + \pi^0 + \pi^0 + p \\ &\to \pi^+ + \pi^- + \gamma + \gamma + \gamma + \gamma + \gamma + \gamma + p\end{aligned}$$

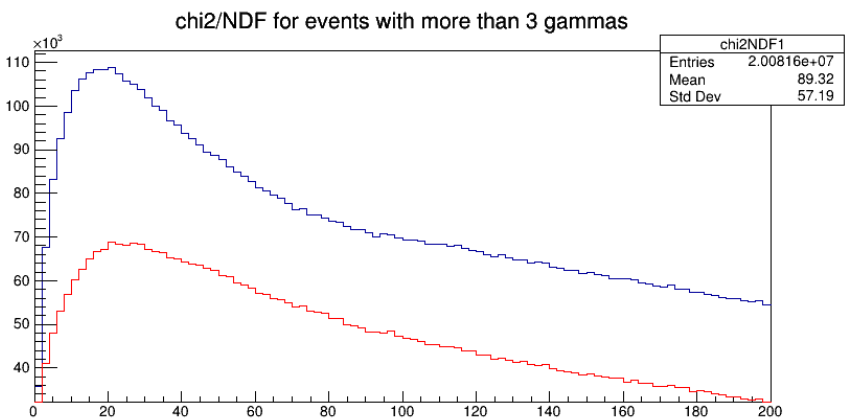
the total number of reconstructed photons in a given event is
6 + `dComboWrapper->Get_NumUnusedShowers()`

Chi2 distribution

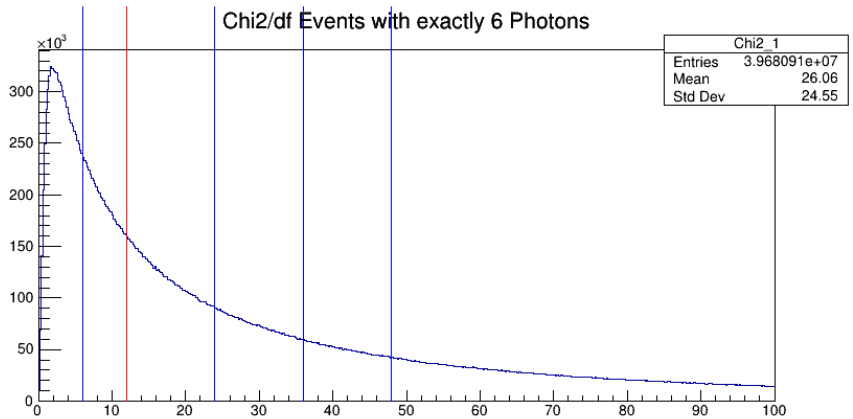
How does the Chi2/NDF changes depending on the number of reconstructed photons in the event:

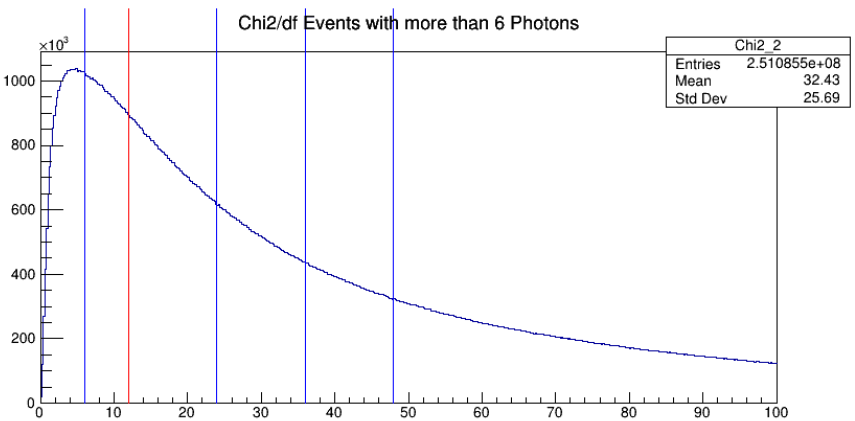
Chi2/NDF $\omega \to \gamma\pi^0$:





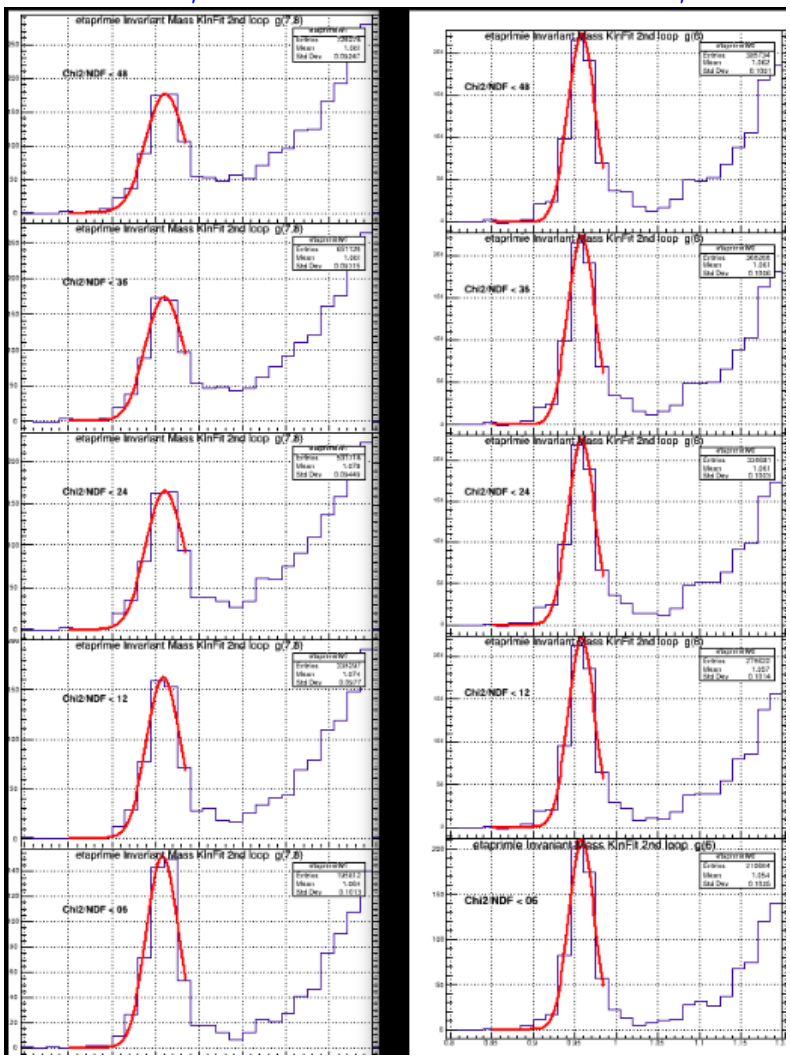
Chi2/NDF $\eta' \to \pi^+\pi^-\pi^0\pi^0\pi^0$:





Fit of η'

left: $N_\gamma = 7 or 8$, **right:** $N_\gamma = 6$



χ^2/NDF dep. of M(η')

Event topology (Nγ) effects:

- η' peak position shift
- η' peak width change
- η' background change

Statistics consequences

As a consequence the yield in the η' peak varies differently for events with exately 6 FS photons and more than 6 FS photons respectively!

χ^2 / *NDF*	Weight	pos(6)	σ(6)	I(6)	pos(7,8)	σ(7,8)	I(7,8)
Chi2/NDF < 48	0	0.958	0.017	696.1	0.961	0.022	768.0
Chi2/NDF < 48	1	0.958	0.017	696.6	0.961	0.023	770.4
Chi2/NDF < 48	2	0.958	0.017	694.9	0.961	0.023	771.4
Chi2/NDF < 36	0	0.958	0.017	685.5	0.960	0.022	734.8
Chi2/NDF < 36	1	0.958	0.017	685.7	0.960	0.022	735.2
Chi2/NDF < 36	2	0.958	0.016	684.2	0.960	0.022	734.5
Chi2/NDF < 24	0	0.958	0.016	678.3	0.961	0.022	667.1
Chi2/NDF < 24	1	0.958	0.016	678.7	0.960	0.021	667.0
Chi2/NDF < 24	2	0.958	0.016	677.7	0.960	0.022	664.8
Chi2/NDF < 12	0	0.958	0.016	647.1	0.959	0.019	560.1
Chi2/NDF < 12	1	0.958	0.016	647.4	0.959	0.019	559.4
Chi2/NDF < 12	2	0.958	0.016	646.6	0.959	0.019	555.8
Chi2/NDF < 06	0	0.958	0.015	566.6	0.958	0.018	490.2
Chi2/NDF < 06	1	0.958	0.015	566.6	0.958	0.018	490.1
Chi2/NDF < 06	2	0.958	0.015	565.5	0.958	0.018	488.9