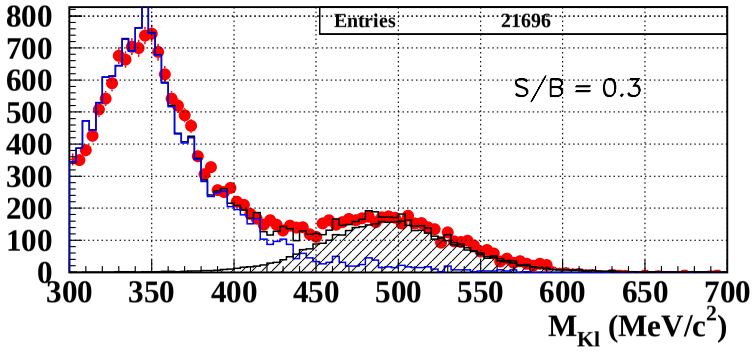
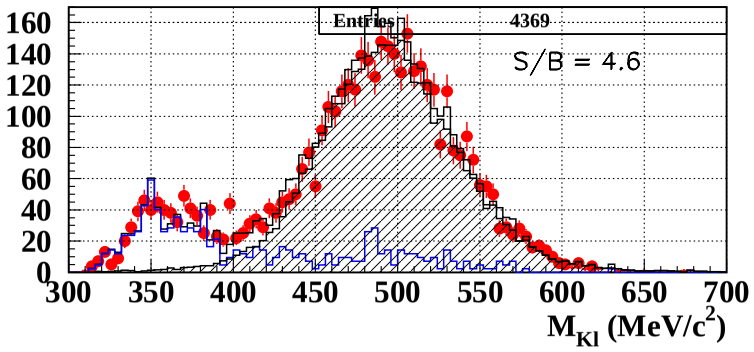
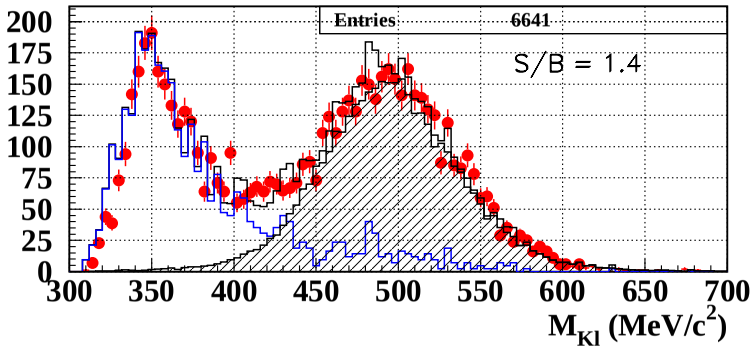
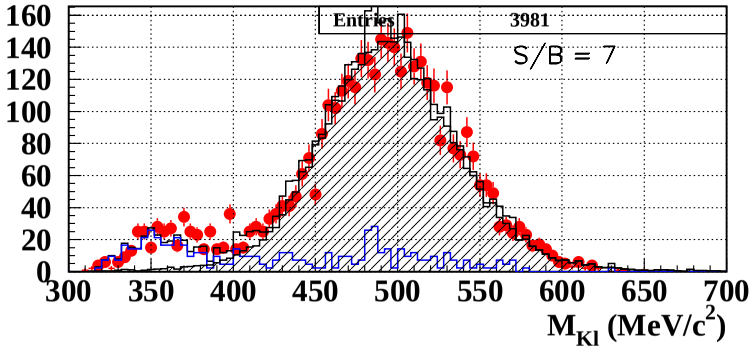
Analysis of $K_L \to \gamma\gamma$: selection

We can use as control variable the Invariant Mass M_K:









- after preselection (top);
- after cut on $E^*_{tot}(lab)$ (bottom)

- after veto on third cluster (top);
- after cut on α (bottom)

Analysis of $K_L \to \gamma\gamma$: efficiencies and background

- Efficiencies re-evaluated using **60 pb^{-1}** and **new tag.**
- S/B ratio re-evaluated using $\sim$ **23 pb^{-1} of Monte Carlo** ($\times$ **4** the Monte Carlo that we had in december).

cut	ϵ_S^{MC}	ϵ_S^{data}	$\epsilon_{bkg}^{MC}(*)$	S/B
preselection:	$(88.7 \pm 0.2)\%$	$(88.7 \pm 0.2)\%$	$\sim 0.2\%$ (N=7533)	~ 0.27
$E^*_{tot} - \mu^*_{tot} < 3\sigma^*_{tot}$	$(98.3 \pm 0.1)\%$	$(96.3 \pm 0.4)\%$	$\sim 18\%$ (N=1343)	~ 1.4
veto on third cluster	$(96.2 \pm 0.2)\%$	$(93.9 \pm 0.6)\%$	$\sim 30\%$ (N=396)	~ 4.4
$\alpha < 20^\circ$	$(99.0 \pm 0.1)\%$	$(98.9 \pm 0.2)\%$	$\sim 66\%$ (N=263)	~ 7
$E_m - \mu_m < 3\sigma_m$	$(99.0 \pm 0.1)\%$	$(98.1 \pm 0.2)\%$	$\sim 74\%$ (N=195)	~ 9
ϵ_{tot}	$(82.2 \pm 0.3)\%$	$(77.8 \pm 0.8)\%$	$(5.3 \pm 0.4) \cdot 10^{-5}$	

Analysis of $K_L \to \gamma\gamma$: (XI)

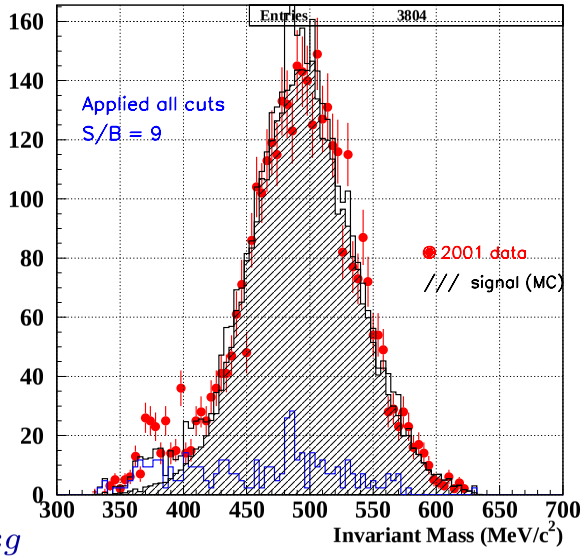
$$N_{\gamma\gamma} = \frac{N^{obs} - bkg}{\epsilon_{presel} \cdot \epsilon_{E^*} \cdot \epsilon_{\Delta t} \cdot \epsilon_{\alpha} \cdot \epsilon_{E^m}}$$

$N^{obs} = 3804$

$\delta N_{bkg}/N_{bkg} \sim 7\%$ (MC statistics)

$S/B \sim 9 \Rightarrow bkg = (380 \pm 27)$

$\epsilon = \epsilon_{presel} \cdot \epsilon_{E^*} \cdot \epsilon_{\Delta t} \cdot \epsilon_{\alpha} \cdot \epsilon_{E^m} = (77.8 \pm 0.8)\%$



$N_{\gamma\gamma} = (3424 \pm 65_{stat})/\epsilon = 4402 \pm 83_{stat}$

$(\delta N_{\gamma\gamma}/N_{\gamma\gamma})_{stat} = 1.9\%$

$(\delta N_{\gamma\gamma}/N_{\gamma\gamma})_{syst} = (\delta N_{\gamma\gamma}/N_{\gamma\gamma})_{\epsilon} \oplus (\delta N_{\gamma\gamma}/N_{\gamma\gamma})_{bkg}$

$(\delta N_{\gamma\gamma}/N_{\gamma\gamma})_{\epsilon} = 0.8/77.8 = 1.0\%$

$(\delta N_{\gamma\gamma}/N_{\gamma\gamma})_{bkg} = 27/3424 = 0.8\%$ (MC statistics)

$(\delta N_{\gamma\gamma}/N_{\gamma\gamma})_{syst} = 1.3\%$

$$N_{\gamma\gamma} = 4402 \pm 83_{stat} \pm 57_{syst}$$