$K_L \to e^+e^-\gamma$

and

$K_L \to e^+e^-e^+e^-$

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KTeV Collaboration Meeting

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Outline

- Jason's Results
- Reconstructing Jason's Results
- My Results
- Future Work

Publicly Shown Results

- $K_L \to e^+e^-e^+e^-$

$$BR = (4.16 \pm 0.13\ (stat) \pm 0.13\ (syst) \pm 0.17\ (ext.\ syst)) \times 10^{-8}$$

$$\alpha_{K^*} = -0.03 \pm 0.13\ (stat) \pm 0.04\ (syst)$$

- $K_L \to e^+e^-\gamma$

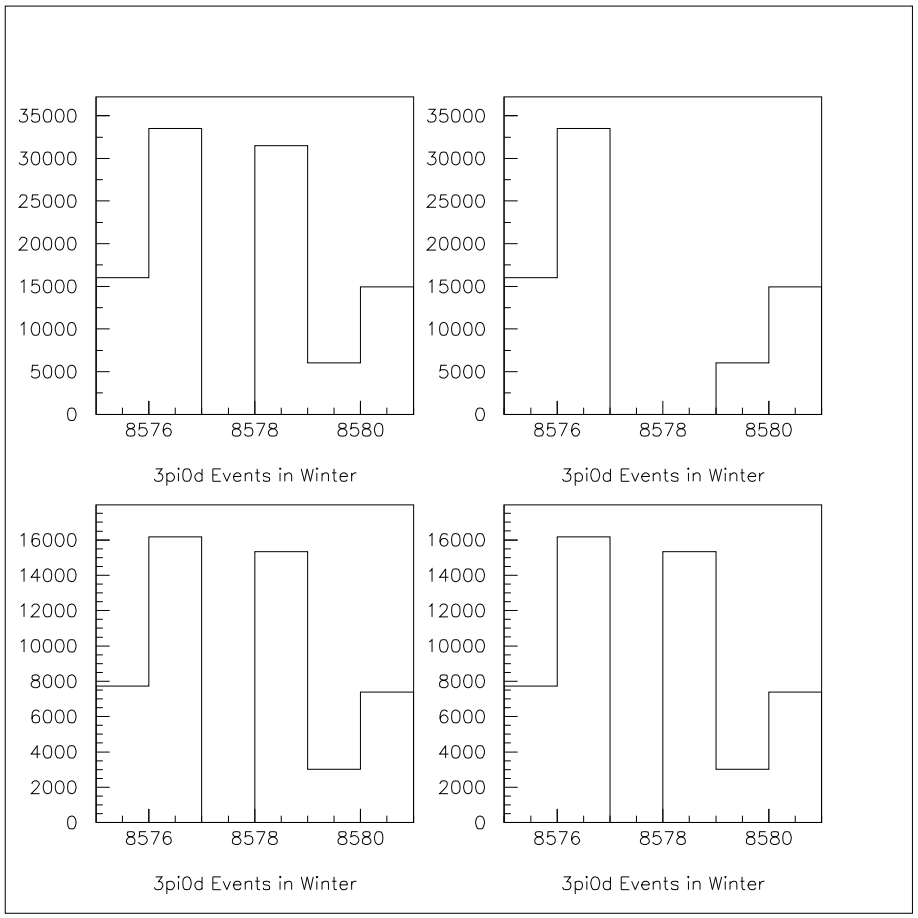
$$BR = (10.19 \pm 0.04\ (stat) \pm 0.07\ (syst) \pm 0.29\ (ext.\ syst)) \times 10^{-6}$$

$$\alpha_{K^*} = -0.186 \pm 0.011\ (stat) \pm 0.009\ (syst)$$

Problem With Publicly Shown Result

The $K_L \to e^+e^-\gamma$ branching ratio measurement excludes a run in the normalization mode data.

My Results Jason's Results



(Data on top, MC on bottom)

Effect on Branching Ratio

- Jason measured the branching ratio is the winter and summer 1997 runs separately and found:
  - $(10.174 \pm 0.049) \times 10^{-6}$ in the winter
  - $(10.232 \pm 0.054) \times 10^{-6}$ in the summer
- The results I get are now:
  - $(10.060 \pm 0.049) \times 10^{-6}$ in the winter
  - $(10.231 \pm 0.054) \times 10^{-6}$ in the summer
- The central value of Jason's measurement of moves from 10.192×10^{-6} to 10.125×10^{-6}, which is 1.86 σ_{stat}

Work Required for Publications

$(K_L \to e^+e^-\gamma\ )$

- $K_L \to e^+e^-\gamma$ branching ratio
  - The difference between the summer and winter branching ratios must be addressed
  - A trigger systematic study must be conducted (the signal mode is from trigger 3 and the normalization mode is from trigger 1).
- $K_L \to e^+e^-\gamma$ form factor
  - The analysis is completed in the form of a shape χ^2 fit.

Work Required for Publications

$(K_L \to e^+e^-e^+e^-$)

- $K_L \to e^+e^-e^+e^-$ branching ratio
  - Complete.

- $K_L \to e^+e^-e^+e^-$ form factor
  - Jason began a log likelihood fit method to measure $\alpha_{K^*}\alpha_{DIP}$and β_{DIP}.
  - Pat's fitting code for the $\pi^0 \to e^+e^-e^+e^-$ form factor can be modifed in a straight forward way to be used for $K_L \to e^+e^-e^+e^-$

My Future Plans

- In order to graduate one day, I have joined the MiniBooNE collaboration.
- I will be at Fermilab all summer working on both MiniBooNE and KTeV.
- After the summer, the amount of time I have for KTeV will begin to diminish.
- Therefore, I hope to be done with any major studies (and possibly have a paper submitted to the collaboration) by the end of August.

Backup Slides

$K_L \to e^+e^-\gamma$ Branching Ratio Systematics

Uncertainty Source	% of BR
Statistical	0.36%
BR($K_L \to \pi^0\pi^0\pi^0_D$) Uncertainty	2.85%
γ Inefficiency	0.43%
DC Inefficiency	0.37%
Cut Variations	0.33%
Energy Slope	0.23%
Energy Resolution	0.14%
Backgrounds	0.08%
Upstream Material	0.07%
DC Hit Resolution	0.04%
Radiative Corrections	0.03%
Form Factor Dependence	0.03%
Total Systematic	0.72%

$K_L \to e^+e^-e^+e^-$ Form Factor Systematics

Uncertainty Source	$\Delta\ \alpha_{K^*}$	$\Delta\ \alpha_{DIP}$
Statistical	0.0109	0.038
Cut Variations	0.0052	0.016
Energy Slope	0.0045	0.014
DC Inefficiency	0.0036	0.011
Radiative Corrections	0.0030	0.009
Upstream Material	0.0030	0.009
DC Hit Resolution	0.0008	0.003
Energy Resolution	0.0003	0.001
Total Systematic	0.0089	0.028

$K_L \to e^+e^-e^+e^-$ Branching Ratio Systematics

Uncertainty Source	% of BR
Statistical	3.1%
BR($K_L \to \pi^0\pi^0\pi^0_D$) Uncertainty	5.5%
Cut Variations	2.1%
DC Inefficiency	1.3%
Form Factor Dependence	0.9%
Radiative Corrections	0.9%
Energy Slope	0.8%
Energy Resolution	0.8%
Upstream Material	0.6%
DC Hit Resolution	0.4%
γ Inefficiency	0.4%
Total Systematic	3.1%

$K_L \to e^+e^-e^+e^-$ Form Factor Systematics

Uncertainty Source	$\Delta\alpha_{DIP}$	$\Delta\alpha_{K^*}$	$\Delta\beta_{DIP}$
Statistical	0.41	0.132	54
Cut Variations	0.11	0.035	32
DC Inefficiency	0.05	0.016	1
Radiative Corrections	0.04	0.013	2
Upstream Material	0.03	0.010	2
DC Hit Resolution	0.02	0.006	29
Energy Resolution	0.01	0.003	1
Total Systematic	0.13	0.043	43