KINK SEARCHES
IN THE 203 DATA SET

Regina Rameika

December 4, 2000

ABSTRACT

A list of kink candidates found in the ”203” data set has been presented by the Nagoya group. An independent analysis has been performed on the same events. The two analyses are compared and an explaination for the differences is presented.

1 Introduction

There are three components to the decay search performed for the DONUT experiment, characterized by the parent decay length and the daughter kink angle. The short decay search (S) is not relevant to the present discussion. The long-large (LL) and long-small (LS) searches are the subject of this report.

The selection of tau candidates from a decay search of the ”203” data set has been made by the Nagoya group. The results of the LL and LS searches have been presented in two separate reports.[1,2] As an independent check of the candidate selection, a similar search on the same 203 events was done by Rameika. The results of this independent analysis showed that all interesting candidates were selected by the independent check, however, a significantly more number of kinks in the region $10mrad \leq \theta_{kink} \leq 40mrad$ were also selected by the independent analysis. The reason for this difference is easy to understand and can be traced to the way the Nagoya kink searches were applied to the data sets which are described in the next section.

2 The Data Sets

Tracks are created by linking segments together. In DONUT there are two versions of the linking code. The difference between *ecfsal2.3* and *ecfsal3.2*, which is relevant to the present discussion, is the ”loosness” with which segments are linked into tracks. Though the exact linking criteria can be documented, for now, *ecfsal2.3* can be described as ”loose” linking, whereas *ecfsal3.2* can be described as ”tight” linking. The later change results in tracks which may be low momentum, and subject to scattering, getting ”broken” into two or more independent tracks. An efficient kink search can be performed using either version of linking, however, it is essential that the LS and LL searches be performed with all events having been processed by the same version of the linking code.

The data sets used for each of the Nagoya searchs are listed in Table 1, and designated as Sets A, B, C. The key feature to note is that for the LL search, 150 events were processed by the ”loose” linking code of *ecfsal2.3*, and then had the LL search applied. In this way, smaller kinks have been absorbed into the track and are not picked up by the LL search. These same events were then reprocessed using the *ecfsal3.2*, but the LL search was not repeated. The LS search which was applied to these events would not find the smaller kinks, because the ”loose” tracks had been broken.

	Set A	Set B	Set C
	20000131	20000214	20000215
	ecfsal 2.3	*ecfsal 3.2*	*ecfsal 3.2*
LL	150	38	15
LS		188	15

Table 1. Data Sets used in Nagoya LL and LS kink searchs

3 Results of Nagoya Kink Search

3.1 The LL Search

The kinks found by the LL search are listed in Table 2.

RUN	EVENT	Kink(rad)
3339	28485	0.0054
3284	04224	0.0065
3185	00698	0.0067
3299	09529	0.0079
3230	13227	0.0123
3276	22046	0.0124
2879	00907	0.0206
2879	00907	0.0331
3039	01910	0.0894
3024	30175	0.0929
3130	28864	0.0969

Table 2. Kinks from the Nagoya LL Search (Kodama and Jikou 24May2000)

3.2 The LS Search

The kinks found by the LS search are listed in Table 3.

4 The US Search

The result of processing all events through *ecfsal3.2* caused many tracks to ”break”, including some important daughter tracks from the interesting events. After this effect

RUN	EVENT	Kink(rad)
2987	00839	0.0050
3095	27275	0.0052
3336	26486	0.0052
3333	17665	0.0053
3349	06094	0.0053
3110	11886	0.0054
3232	03434	0.0055
3261	22883	0.0056
2893	01321	0.0058
2899	27779	0.0058
3145	02156	0.0058
2987	00839	0.0062
3076	01663	0.0065
3174	07423	0.0066
3264	17219	0.0066
3102	09454	0.0067
3299	09529	0.0073
3352	23387	0.0074
3174	07423	0.0080
2884	18223	0.0082
3185	00698	0.0096
2895	08839	0.0109
2879	00907	0.0202

Table 3. Kinks from the Nagoya LS Search (Komatsu and Jikou 19April2000)

was observed, a re-linking program was written by J. Sielaff which was used to ”re-store” tracks to a linking criteria very similar to *ecfsal2.3*. These re-linked events were called the ”root” events. Both an LL and LS kink search was then done on this set of events.

The following cuts were applied to the kink selection :

- $0. \leq FlightLength \leq 10000.\mu$
- $I.P._{primary} \leq 5\mu$
- $I.P._{kink} \leq 5\mu$
- $\theta_{emission} \leq 2 \times \theta_{kink} + 0.100$
- $\theta_{kink} \geq 10mrad$

The results, for angles between 5 and 10 mrad are listed in Table 4and Table tab:root1b. Kinks greater than 10 mrad are listed in Table 6 It can be seen that there are a significant number of kinks that are not selected by the Nagoya method. The majority of these kinks are from the 150 events that missed the LS search before being reprocessed by *ecfsal3.2*.

5 Conclusion

The distribution of kink angles from the various search methods described in this paper are plotted in Figure 1. The kink angles from Figure 1 are superimposed on each other in Figure 2. In Figure 3 only the kinks less than 50 mrad are shown.

The discrepency between the two analysis, i.e. the excess of small angle kinks in the US search, (or deficit in the Nagoya kinks), is possibly explained by the fact that the Nagoya LL search was done predominantly on events in Set A, which have a loose linking criteria, and therefore, the small angle kinks would have to be picked up by an LS search. The LS search, however, was performed *after* the events were reprocessed with *ecfsal3.2*, and the loose links which existed in Set A were broken.

There are two possible methods which can be used to fix this deficiency, which should produce equivalent results. The first would be to apply the LS search on Set A or the LL search on the events in Set B which were only processed by *ecfsal3.2*.

RUN	EVENT	PL	ID	Kink(rad)
2811	21998	301	5320	0.0089
2841	723	231	3921	0.0094
2879	10407	211	3110	0.0060
2881	6129	211	5980	0.0069
2893	1321	411	3484	0.0065
2929	18912	152	5373	0.0053
2929	18912	172	5244	0.0055
2934	10294	301	3162	0.0063
3020	18094	151	7887	0.0061
3020	18094	151	7906	0.0087
3020	24151	271	3063	0.0053
3062	19671	231	5272	0.0059
3072	18804	561	4327	0.0066
3072	18804	561	4343	0.0054
3076	1663	81	4510	0.0053
3076	1663	81	4891	0.0066
3095	27275	481	3989	0.0060
3102	9454	401	6466	0.0096
3102	9454	401	6467	0.0085
3110	11886	501	20153	0.0064
3117	10279	251	4175	0.0055
3130	23388	441	7224	0.0052
3145	2156	271	4166	0.0060
3171	13759	552	3389	0.0086
3174	7423	81	3969	0.0065
3185	698	431	19315	0.0074
3185	698	431	19621	0.0080
3188	14253	401	19868	0.0071
3202	6688	241	27454	0.0056

Table 4. Small angle kinks from the US-LS Search

RUN	EVENT	PL	ID	Kink(rad)
3230	13227	391	6282	0.0054
3232	3434	461	4807	0.0061
3235	17215	481	5227	0.0052
3245	25887	482	10558	0.0087
3246	16223	221	3094	0.0056
3246	16223	221	3128	0.0064
3257	13542	191	6533	0.0079
3261	22883	521	6225	0.0058
3262	24891	541	7715	0.0097
3264	17219	351	6383	0.0057
3284	4224	81	5451	0.0052
3291	18579	441	6818	0.0064
3297	25222	501	3075	0.0095
3298	17712	221	7473	0.0054
3299	9529	331	5569	0.0069
3331	11197	461	5543	0.0067
3336	26486	441	7321	0.0051
3339	28485	422	6110	0.0054
3345	23003	521	15187	0.0053
3349	6094	512	7024	0.0070
3350	8796	171	6001	0.0055
3352	3466	511	6745	0.0075
3352	3466	511	6799	0.0064
3358	13933	291	4867	0.0051

Table 5. Small angle kinks from the US-LS Search

RUN	EVENT	SP	TKNO	Kink(rad)
2879	907	241	4471	0.0198
2881	6129	211	5906	0.0107
2895	8839	211	4631	0.0102
2931	1401	151	4455	0.0307
3072	18804	561	4245	0.0150
3096	12697	221	11517	0.0104
3113	7228	352	22414	0.0254
3134	11421	81	22974	0.0174
3137	23878	161	5744	0.0147
3185	698	431	19732	0.0101
3230	13227	391	6509	0.0138
3267	22046	691	3585	0.0145
3299	9529	341	4922	0.0127
3333	17665	561	4110	0.0133
3358	7808	251	4365	0.0219
3358	13933	301	4882	0.0100

Table 6. $>$10 mrad Kinks from the FNAL LS Search

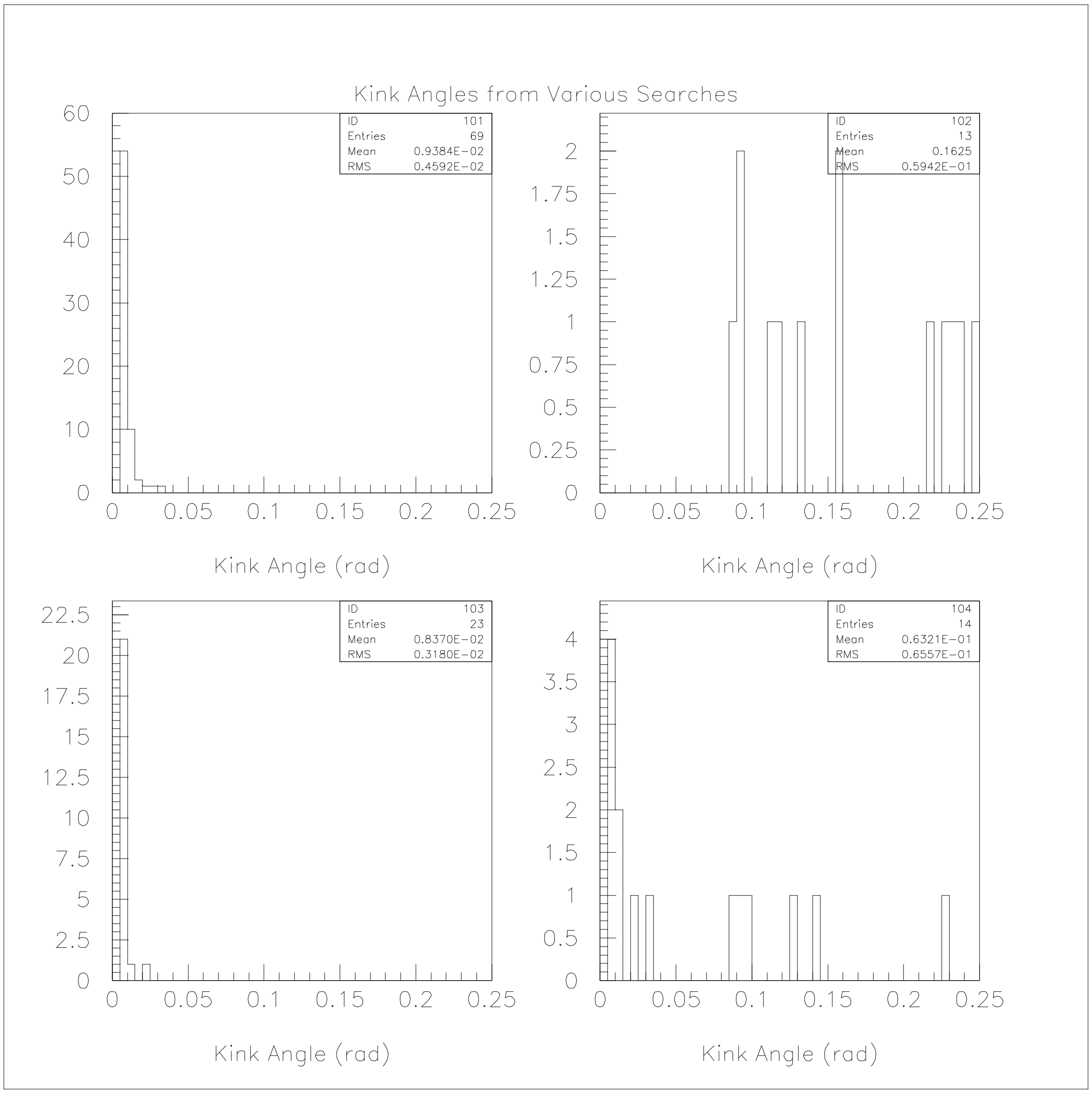

Fig. 1. Distribution of kinks found in each of the kink searches discussed in this report. The upper left are from the US-LS, upper right from US-LL; lower left from Nagoya LS and lower right from Nagoya LL.

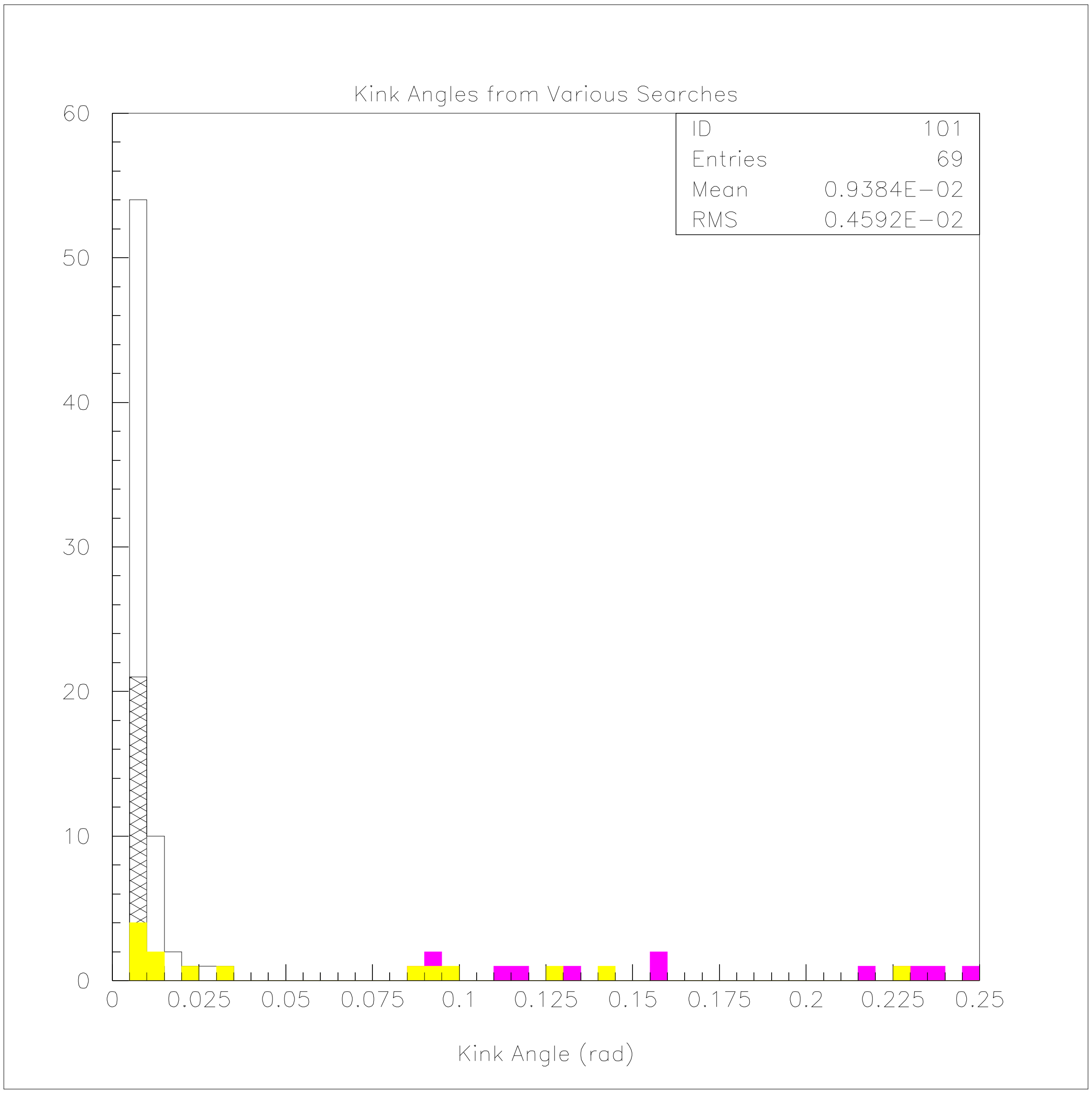

Fig. 2. The kinks from each of the searches are super imposed.The open histogram are the US-LS, hatched are Nagoya-LS; dark solid are US-LL and the light solid are the Nagoya-LL.

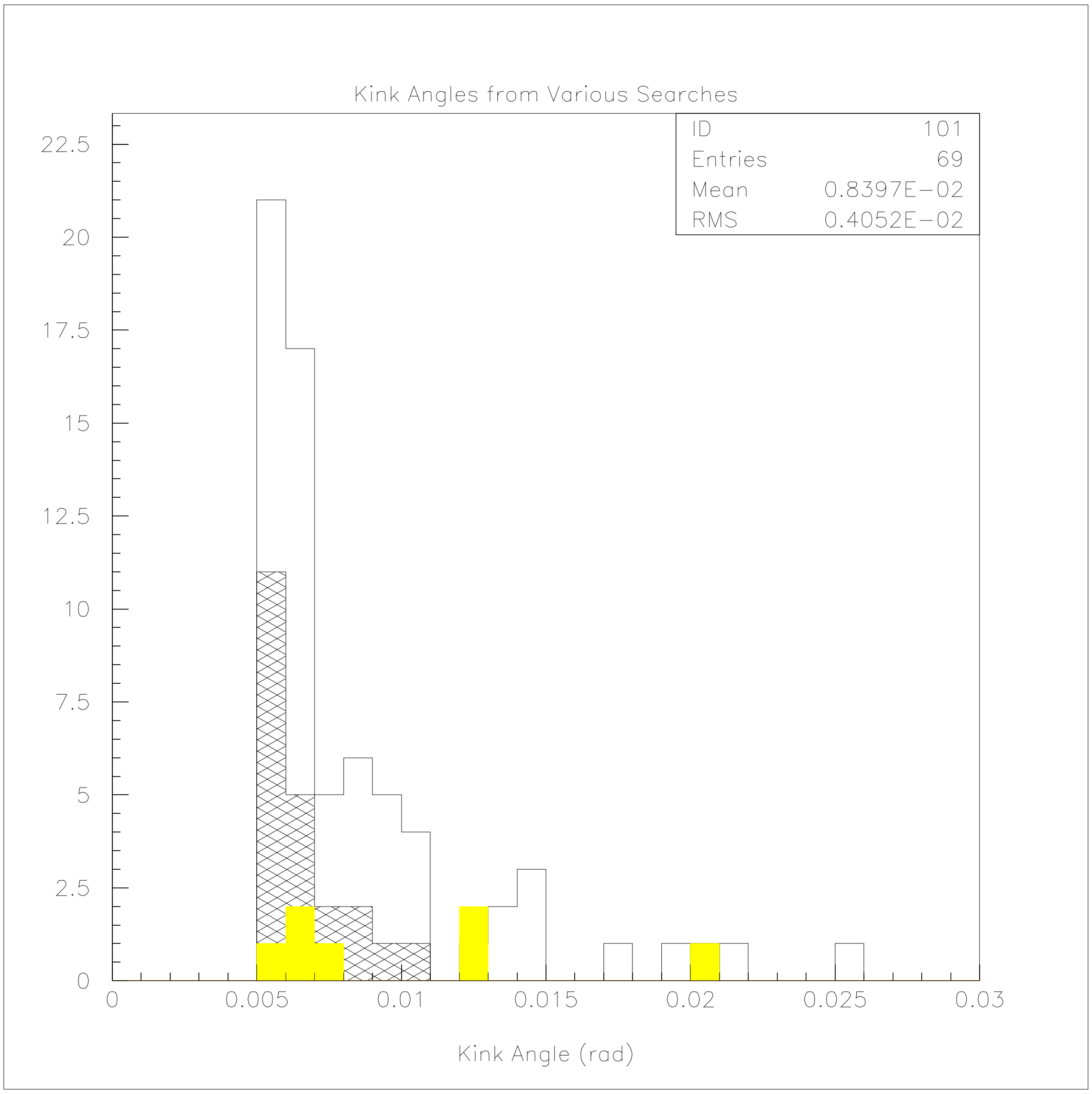

Fig. 3. The solid line includes the kinks from the Nagoya-LS search; the filled regions are the kinks ($\leq 100mrad$) from the Nagoya LL search; the hatch regions are the kinks from the US-LS/LL($\leq 100mrad$).

References

[1] ”Summary of Long Large Decay Search in E872”, H. Jiko and K. Kodama, May 24,2000.

[2] ” DONUT LS,2RY and Vee Search, H.Jikou and M. Komatsu, April 19,2000.