LBL-55
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$K^o_L N$ INTERACTIONS – A COMPILATION

Particle Data Group

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K^0 N Kinematics

P_{lab} (MeV/c)	T_{lab} (MeV)	$E_{c.m.}$ (MeV)	$P_{c.m.}$ (MeV/c)	$4\pi\lambda^2$ (mb)
0	0	1436	0	
20	0	1436	13	28667.04
40	2	1437	26	7174.60
60	4	1438	39	3194.50
80	6	1440	52	1801.49
100	10	1443	65	1156.64
120	14	1445	78	806.94
140	19	1449	91	595.11
160	25	1452	103	457.98
180	32	1457	116	363.94
200	39	1461	128	296.69
220	46	1466	141	246.84
240	55	1471	153	206.93
260	64	1477	165	179.41
280	73	1483	177	155.96
300	83	1490	189	137.03
320	94	1496	201	121.51
340	105	1503	212	108.63
360	117	1510	224	97.83
380	128	1518	235	88.66
400	141	1525	246	80.82
420	154	1533	257	74.06
440	167	1541	268	68.18
460	180	1549	279	63.04
480	194	1557	289	58.52
500	208	1566	300	54.52
520	222	1574	310	50.96
540	237	1583	320	47.77
560	251	1592	330	44.92
580	267	1601	340	42.34
600	282	1610	350	40.01
620	297	1619	359	37.89
640	313	1628	369	35.96
660	329	1637	378	34.19
680	345	1646	388	32.57
700	361	1655	397	31.08
720	378	1665	406	29.71
740	394	1674	415	28.44
760	411	1683	424	27.26
780	428	1692	432	26.17
800	444	1702	441	25.15
820	461	1711	450	24.21
840	479	1721	458	23.32
860	496	1730	466	22.49
880	513	1739	475	21.71
900	531	1749	483	20.99
920	548	1758	491	20.30
940	566	1768	499	19.65
960	584	1777	507	19.04
980	601	1786	515	18.47
1000	619	1795	523	17.92
1020	637	1805	530	17.41
1040	655	1814	538	16.92
1060	673	1824	545	16.45
1080	691	1833	553	16.01
1100	710	1842	560	15.59
1120	728	1852	568	15.19
1140	746	1861	575	14.81
1160	765	1870	582	14.44
1180	783	1879	589	14.10
1200	801	1888	596	13.76
1220	820	1898	603	13.45
1240	838	1907	610	13.14
1260	857	1916	617	12.85
1280	876	1925	624	12.57
1300	894	1934	631	12.30
1320	913	1943	637	12.04
1340	932	1952	644	11.80
1360	950	1961	651	11.56
1380	969	1970	657	11.33
1400	988	1979	664	11.11
1420	1007	1988	670	10.89
1440	1026	1997	677	10.69
1460	1045	2006	683	10.49
1480	1064	2015	689	10.30

P_{lab} (MeV/c)	T_{lab} (MeV)	$E_{c.m.}$ (MeV)	$P_{c.m.}$ (MeV/c)	$4\pi\lambda^2$ (mb)
1500	1083	2023	696	10.11
1520	1102	2032	702	9.93
1540	1121	2041	708	9.76
1560	1140	2050	714	9.59
1580	1159	2058	720	9.43
1600	1178	2067	726	9.28
1620	1197	2076	732	9.12
1640	1216	2084	738	8.98
1660	1235	2093	744	8.84
1680	1254	2101	750	8.70
1700	1274	2110	756	.56
1720	1293	2119	762	.43
1740	1312	2127	768	8.31
1760	1331	2135	773	8.18
1780	1351	2144	779	8.06
1800	1370	2152	785	7.95
1820	1389	2161	790	7.83
1840	1408	2169	796	7.72
1860	1428	2177	801	7.62
1880	1447	2186	807	7.51
1900	1466	2194	813	7.41
1920	1486	2202	818	7.31
1940	1505	2211	823	7.22
1960	1524	2219	829	7.12
1980	1544	2227	834	7.03
2000	1563	2235	840	6.94
2020	1583	2243	845	6.85
2040	1602	2251	850	6.77
2060	1622	2259	855	6.69
2080	1641	2267	861	6.61
2100	1660	2276	866	6.53
2120	1680	2284	871	6.45
2140	1699	2292	876	6.37
2160	1719	2299	881	6.30
2180	1738	2307	886	6.23
2200	1758	2315	892	6.16
2220	1777	2323	897	6.09
2240	1797	2331	902	6.02
2260	1816	2339	907	5.95
2280	1836	2347	912	5.89
2300	1855	2355	917	5.82
2320	1875	2362	921	5.76
2340	1895	2370	926	5.70
2360	1914	2378	931	5.64
2380	1934	2385	936	5.58
2400	1953	2393	941	5.53
2420	1973	2401	946	5.47
2440	1992	2409	951	5.42
2460	2012	2416	955	5.36
2480	2032	2424	960	5.31
2500	2051	2431	965	5.26
2520	2071	2439	969	5.21
2540	2091	2446	974	5.16
2560	2110	2454	979	5.11
2580	2130	2461	983	5.06
2600	2149	2469	988	5.01
2620	2169	2476	993	4.97
2640	2189	2484	997	4.92
2660	2208	2491	1002	4.88
2680	2228	2499	1006	4.83
2700	2248	2506	1011	4.79
2720	[illegible]	2513	1015	4.75
2740	[illegible]	2521	1020	4.70
2760	[illegible]	2528	1024	4.66
2780	2326	2535	1029	4.62
2800	2346	2543	1033	4.58
2820	2366	2550	1038	4.54
2840	2386	2557	1042	4.51
2860	2405	2564	1046	4.47
2880	2425	2572	1051	4.43
2900	2445	2579	1055	4.39
2920	2464	2586	1060	4.36
2940	2484	2593	1064	4.32
2960	2504	2600	1068	4.29
2980	2524	2607	1072	4.25

P_{lab} (GeV/c)	T_{lab} (GeV)	$E_{c.m.}$ (GeV)	$P_{c.m.}$ (GeV/c)	$4\pi\lambda^2$ (mb)
3.0	2.54	2.61	1.08	4.22
3.2	2.74	2.68	1.12	3.91
3.4	2.94	2.75	1.16	3.64
3.6	3.14	2.82	1.20	3.41
3.8	3.33	2.88	1.24	3.20
4.0	3.53	2.95	1.27	3.02
4.2	3.73	3.01	1.31	2.86
4.4	3.93	3.07	1.34	2.71
4.6	4.13	3.13	1.38	2.58
4.8	4.33	3.19	1.41	2.46
5.0	4.53	3.25	1.44	2.35
5.2	4.73	3.31	1.48	2.25
5.4	4.93	3.36	1.51	2.15
5.6	5.12	3.42	1.54	2.07
5.8	5.32	3.47	1.57	1.99
6.0	5.52	3.53	1.60	1.92
6.2	5.72	3.58	1.63	1.85
6.4	5.92	3.63	1.65	1.79
6.6	6.12	3.68	1.68	1.73
6.8	6.32	3.73	1.71	1.67
7.0	6.52	3.78	1.74	1.62
7.2	6.72	3.83	1.76	1.57
7.4	6.92	3.88	1.79	1.53
7.6	7.12	3.93	1.82	1.48
7.8	7.32	3.97	1.84	1.44
8.0	7.52	4.02	1.87	1.40
8.2	7.72	4.07	1.89	1.37
8.4	7.92	4.11	1.92	1.33
8.6	8.12	4.16	1.94	1.30
8.8	8.32	4.20	1.96	1.27
9.0	8.52	4.25	1.99	1.24
9.2	8.72	4.29	2.01	1.21
9.4	8.92	4.33	2.03	1.18
9.6	9.12	4.38	2.06	1.16
9.8	9.31	4.42	2.08	1.13
10.0	9.51	4.46	2.10	1.11
10.5	10.01	4.57	2.16	1.05
11.0	10.51	4.67	2.21	1.00
11.5	11.01	4.77	2.26	.96
12.0	11.51	4.86	2.31	.91
12.5	12.01	4.96	2.36	.88
13.0	12.51	5.05	2.41	.84
13.5	13.01	5.15	2.46	.81
14.0	13.51	5.24	2.51	.78
14.5	14.01	5.32	2.55	.75
15.0	14.51	5.41	2.60	.72
16.0	15.51	5.58	2.69	.68
17.0	16.51	5.75	2.77	.64
18.0	17.51	5.91	2.86	.60
19.0	18.51	6.07	2.94	.57
20.0	19.51	6.22	3.02	.54
22.0	21.51	6.51	3.17	.49
24.0	23.51	6.80	3.31	.45
26.0	25.51	7.07	3.45	.41
28.0	27.51	7.33	3.59	.38
30.0	29.51	7.58	3.71	.35
32.0	31.51	7.82	3.84	.33
34.0	33.51	8.06	3.96	.31
36.0	35.51	8.29	4.08	.29
38.0	37.51	8.51	4.19	.28
40.0	39.51	8.73	4.30	.26
42.0	41.51	8.94	4.41	.25
44.0	43.51	9.15	4.51	.24
46.0	45.50	9.35	4.62	.23
48.0	47.50	9.55	4.72	.22
50.0	49.50	9.74	4.81	.21
55.0	54.50	10.21	5.05	.19
60.0	59.50	10.66	5.28	.18
65.0	64.50	11.10	5.50	.16
70.0	69.50	11.51	5.71	.15
80.0	79.50	12.30	6.10	.13
90.0	89.50	13.04	6.48	.12
100.0	99.50	13.74	6.83	.10
200.0	199.50	19.40	9.67	.05
500.0	499.50	30.65	15.31	.02

COMPILATION OF K_L^0N INTERACTIONS

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ABSTRACT - We compile all 13 papers reporting K_L^0N interactions. Cross sections, differential cross sections, angular distributions, forward differential cross sections, and the phase for regeneration are summarized. A brief synopsis is given for 7 experiments in progress at the time of this compilation. The cutoff date for this report was 1 January 1972.**

* The Berkeley Particle Data Group is supported by the U.S. Atomic Energy Commission, the National Science Foundation, and the Office of Standard Reference Data of the National Bureau of Standards.

** One exception is the Serpukhov experiment. Their results are displayed only in Section II.

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[1] BLUMENFELD, ET AL., PHYS. LETTERS 29B, 58 (1969)
[2] BRODY, ET AL., PHYS. REV. LETTERS 26, 1050 (1971)
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Section I.

GENERAL PROCEDURES

Introduction

This is the fourth in a continuing series of reports on cross-section type data produced by the Particle Data Group. (The previous three reports were labeled UCRL-20000, but this and subsequent reports will be labeled LBL-50 through LBL-59.) In this series we collect and display total cross sections, differential cross sections, polarizations, and other similar data. Each report covers one input channel. This one is K_L^0N (the first one was on K^+N, the second on YN, and the third on NN). In the near future we will bring out $\bar{N}N$ and π^+N. Following later will be π^-N, K^-N, etc. All reports are complete from January 1968, and also contain selected results before that date. The reports will be updated periodically, as necessary.

The system from which these reports are derived is a computerized one, having at its nucleus a computer-searchable data tape containing information encoded from various articles. Sometime in the future we hope to be able to answer specific user requests for information from our data tape.

Listed below are the names of the many physicists who are working on, or have recently worked on, these reports:

I. System Development (LBL)
- Alan Rittenberg
- Arthur Rosenfeld

II. Encoding and Verifying Data, Editing Reports, Fitting Data
- James Enstrom (LBL)
- Zaven Guiragossian (Stanford)
- Victor Henri (LBL)
- Thomas Lasinski (LBL)
- Thomas Trippe (LBL)
- Fumiyo Uchiyama (LBL)

III. Reading and Evaluating Articles, and Analyzing Compiled Data in:

π^-N Interactions
- *Alan Thorndike (BNL)
- Thomas Trippe (LBL)
- Frank Turkot (BNL)

π^+N Interactions
- Victor Henri (LBL)
- Thomas Lasinski (LBL)
- *Henry Lubatti (Univ. of Wash.)
- Thomas Trippe (LBL)
- Fred Winkelmann (SLAC)
- James Wolfson (M.I.T.)

K^-N Interactions - below 2.0 GeV/c
- *Claude Bricman (CERN)
- Thomas Lasinski (LBL)

K^-N Interactions - above 2.0 GeV/c
- J. Badier (Ecole Polytechnique)
- *Enzo Flaminio (BNL)
- G. Kayas (Ecole Polytechnique)
- Thomas Lasinski (LBL)
- Brian Musgrave (ANL)

K_L^0N Interactions
- James Loos (SLAC)
- *Fumiyo Uchiyama (LBL)

K^+N Interactions
- Odette Benary (Tel-Aviv)
- *Roger Bland (Ecole Polytechnique)
- Victor Henri (LBL)
- LeRoy Price (U.C. Irvine)
- Naomi Schmidt (Brandeis)
- Charles Wohl (Oxford)

NN Interactions
- Gideon Alexander (Tel-Aviv)
- *Odette Benary (Tel-Aviv)
- LeRoy Price (U.C. Irvine)

$\bar{N}N$ Interactions
- James Enstrom (LBL)
- *Tom Ferbel (Rochester)
- Zaven Guiragossian (Stanford)
- Paul Slattery (Rochester)
- Yoshio Sumi (Osaka)
- Barry Werner (Rochester)
- Toshihiro Yoshida (Kyoto)

YN Interactions
- Gideon Alexander (Tel-Aviv)

* "Chairman"

*Odette Benary (Tel-Aviv)

LeRoy Price (U.C. Irvine)

If you have any suggestions for improving these reports, please let us know. Our address is:

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Scope of the Compilations

1. We collect all experimental high-energy physics results that can be represented by simple tables or graphs, i.e., σ, $d\sigma/d\Omega$, polarizations, angular distributions, density matrices, etc.

We leave it to Data Summary Tape Libraries to store Dalitz plots or other ≥ 2-dimensional displays (although the presence of such data is indicated on our KEYWORDS). In any case our printed compilations should serve as a necessary "table of contents" to a DST Library.

2. The data come primarily from published journals, e.g., Physical Review, Physical Review Letters, Nuclear Physics, Physics Letters, Nuovo Cimento, etc.

We do also compile unpublished theses and conference reports — if the reports give enough information to permit a valid evaluation of the experiment and analysis.

We do not record data that appear in abstract form only, nor do we generally accept preprints unless the article has already been accepted for publication.

3. The compilation is to be complete from January 1968. Before that time we enter data that are particularly important. But the bulk of the pre-1968 papers will not be put into our system.

Data Handling

In order to make this compilation as accurate and complete as possible, a large number of steps, involving several physicists and a secretary/assistant, are necessary. The list below indicates the most important steps that every article must go through in order to have its information entered onto the DATA TAPE (the magnetic tape that contains all of our data).

a) The "reader," a physicist, finds a relevant article, reads it, marks the data to be encoded, and records on a special form certain additional information.

b) The article is logged in by the secretary/assistant, who also transcribes the bibliographic information, such as title, authors, abstract, etc., onto encoding forms.

c) A physicist, usually different from the reader, transcribes the data selected by the reader onto encoding forms. Additional data may be added at the discretion of this second physicist.

d) The encoding forms are keypunched.

e) The resulting deck is entered onto a temporary DATA TAPE by the program DATAPE. Gross errors (such as missing cards or information) are detected immediately by DATAPE. If there are such errors, the deck is corrected and processed.

f) When the data deck has been successfully processed, the temporary DATA TAPE is read by the program SKELM, which makes a listing of all the information stored for each article. This listing is examined carefully by the secretary/assistant and the encoding physicist. Any errors found are corrected and steps e) and f) repeated.

g) When no more errors can be found, the SKELM output is examined by the original reader and compared again with the article. Any further errors are corrected.

h) Finally the encoding physicist makes a last check and marks the article to indicate it has had its final verification.

* "Chairman"

i) The article is entered onto a permanent DATA TAPE.

All the above is just to get the data onto the DATA TAPE. When preparing a report such as this, many additional tasks are involved. A few typical ones are:

a) Collecting all the data on a particular set of reactions — plotting them, looking at systematic errors, removing obviously bad data from the graphs (but leaving it in the tables).

b) Ironing out normalization differences between experiments.

c) Worrying about the various ways in which different authors make resonance cuts and subtractions.

d) Deciding what types of curves (if any) should be fit to certain classes of data.

Collaboration with Other Groups

Some physicists in Europe have formed a group called HERA (High Energy Reactions Analysis) to also compile cross-section data. We are trying to keep in close contact with one another in order to minimize duplication of effort both in programming and data collection.

We also cooperate with HERA on report distribution: LBL prints and distributes both HERA and our reports for the Western Hemisphere and Japan, and CERN does the same for the rest of the world.

Other Cross-Section Compilations

We present below (in chronological order) all of the previous large cross-section compilations that we know of. In addition to just listing data, some of them have nice reviews, perform various fits to the data, etc.

- V.S. Barashenkov and V.M. Maltsev, Cross Sections for Elementary Particle Interactions, Fortsch. Physik 9, 549 (1961).
- V.S. Barashenkov and J. Patera, Cross Sections for Antinucleon Production, Fortsch. Physik 11, 469 (1963)
- V.S. Barashenkov and J. Patera, Strange Particle Production, Fortsch. Physik 11, 479 (1963).
- M.N. Focacci and G. Giacomelli, Pion-Proton Elastic Scattering, CERN 66-18 (1966)
- J. T. Beale, S.D. Ecklund, and R.L. Walker, Pion Photoproduction Data Below 1.5 GeV, CALT-68-108 (1966).
- H. Yukawa, ed., Experimental Data on Hadron Interactions in GeV Region, Supplement of the Progress of Theoretical Physics (Kyoto), Extra Number (1967).
- P.K. Williams, D.M. Levine, J.A. Koschik, References and Some Two-Body Data for High Energy Reactions, University of Michigan, 1967 (unpublished).
- G. Alexander, O. Benary, and U. Maor, Data Compilation of Proton-Proton Interactions Between 1 and 32 GeV/c, Nucl. Phys. B5, 1 (1968).
- G. Alexander, O. Benary, and U. Maor, Data Compilation of Baryon-Baryon Interactions. (II) Proton-Neutron Collisions Between 1 and 27 GeV/c, Nucl. Phys. B7, 281 (1968).
- G. Alexander, O. Benary, U. Karshon, and U. Maor, Data Compilation of Baryon-Baryon Interactions. (III) Hyperon-Proton Collisions, Nucl. Phys. B10, 554 (1969).
- G. Giacomelli, P. Pini, and S. Stagni, A Compilation of Pion-Nucleon Scattering Data, CERN/HERA 69-1 (1969).
- B. Sadoulet, Data Compilation of Antiproton-Proton Reactions into Antihyperon-Hyperon, CERN/HERA 69-2 (1969).
- G. Giacomelli, A Compilation of Total and Total Elastic Cross Sections, CERN/HERA 69-3 (1969).
- Particle Data Group (L.R. Price, N. Barash-Schmidt, O. Benary, R. W. Bland, A.H. Rosenfeld, C.G. Wohl), A Compilation of K^+N Reactions, UCRL-20000 K^+N (1969).
- Particle Data Group (D.J. Herndon, A. Barbaro-Galtieri, A.H. Rosenfeld), πN

Partial Wave Amplitudes; A Compilation, UCRL-20 030 πN(1970).

• Particle Data Group (O. Benary, N. Barash-Schmidt, L.R. Price, A.H. Rosenfeld, G. Alexander), A Compilation of YN Reactions, UCRL-20 000 YN (1970).

• G.C. Fox and C. Quigg, Compilation of Elastic Scattering Data, UCRL-20001 (Jan. 1970).

• P. Spillantini and V. Valente, A Collection of Pion Photoproduction Data. I — From the Threshold to 1.5 GeV, CERN/HERA 70-1 (1970).

• J.D. Hansen, D.R.O. Morrison, N. Tovey, E. Flaminio, Compilation of Cross Sections. I — Proton Induced Reactions, CERN/HERA 70-2 (1970).

• E. Flaminio, J.D. Hansen, D.R.O. Morrison, N. Tovey, Compilation of Cross Sections. II — Antiproton Induced Reactions, CERN/HERA 70-3 (1970).

• E. Flaminio, J.D. Hansen, D.R.O. Morrison, N. Tovey, Compilation of Cross Sections. III — K^+ Induced Reactions, CERN/HERA 70-4 (1970).

• E. Flaminio, J.D. Hansen, D.R.O. Morrison, N. Tovey, Compilation of Cross Sections. IV — π^+ Induced Reactions, CERN/HERA 70-5 (1970).

• E. Flaminio, J.D. Hansen, D.R.O. Morrison, Compilation of Cross Sections. V — K^- Induced Reactions, CERN/HERA 70-6 (1970)

• E. Flaminio, J.D. Hansen, D.R.O. Morrison, N. Tovey, Compilation of Cross Sections. VI — π^- Induced Reactions. CERN/HERA 70-7 (1970).

• O. Benary, L.R. Price, G. Alexander, NN and ND Interactions (above 0.5 GeV/c) — A Compilation, UCRL-20 000 NN (August 1970).

• P. Joos, Compilation of Photoproduction Data above 1.2 GeV, DESY/HERA 70-1.

Acknowledgments

We would like to thank Professor A. H. Rosenfeld for useful comments. We also wish to thank Dr. Alan Rittenberg for his careful reading of this book and some of the programming, Ms. Jane Zoba for encoding the bibliographic information, Professor LeRoy Price for much of the development of the system, and Ms. Marjorie Hutchinson for her programming assistance.

Section II.

$K_L^0 p$ INTERACTIONS

A. Introduction and Discussion

We have compiled the rather scarce data on K^0_L-nucleon interactions. Very few experiments of this type have been completed although 7 are now in progress. This report includes all data published as of January 1, 1972 (13 publications on $K^0_L p$ and none on $K^0_L n$). *Note that charge symmetry may be used to equate certain final states produced by* $K^0 p$ or $\bar{K}^0 p$ with those produced by $K^+ n$ or $K^- n$ interactions, respectively, using deuterium as a target. *(for $K^+ n$ data see UCRL-20000 K^+N.)*

There are several important advantages in using neutral rather than charged K beams for studying KN interactions: (a) The isospin of the $\bar{K}^0 p$ system is purely I = 1, (b) some final states are more readily observed in $K^0 p$ or $\bar{K}^0 p$ interactions than are their charge-symmetric counterparts in $K^+ n$ or $K^- N$ interactions, (c) the K^0_L beam consists of equal components of K^0 and $\bar{K}^0$ so no relative normalization problems enter between reactions of opposite strangeness, and (d) data may be accumulated simultaneously across a wide momentum range thereby reducing normalization problems across the entire energy region.

In Part 1 we summarize the cross sections for various reactions versus laboratory momentum. The normalization of cross sections is always taken for a beam of K^0_L mesons and not K^0 or $\bar{K}^0$ mesons. [For example, we quote $\sigma(K^0_L p \to \pi^+ \Lambda)$, which is equal to $1/2\ \sigma(\bar{K}^0 p \to \pi^+ \Lambda)$.] Then differential cross sections and angular distributions are given. In general, data for P_{beam} below 1 or 2 GeV/c are plotted as $d\sigma/d\Omega$ or $dN/d(\cos\theta)$, whereas $d\sigma/dt$ is used for higher momenta. *Information is presented first for S = - 1 and then for S = + 1 final states.*

In Part 2 the reaction $K^0_L p \to K^0_S p$ is treated separately. We quote the cross section, the differential cross section, the forward differential cross section, the modified regeneration amplitude, and the phase of the forward amplitude. We give here a brief discussion of definitions and notations. The amplitude for $K^0_L p \to K^0_S p$ may be expressed as

$$A(K^0_L p \to K^0_S p) = \tfrac{1}{2}[A(K^0 p \to K^0 p) - A(\bar{K}^0 p \to \bar{K}^0 p)].$$

The phase of the forward amplitude, ϕ, is defined as:

$$\phi = \arg[A(K^0_L p \to K^0_S p)_{t=0}].$$

Note that in the literature, another phase — the regeneration phase ϕ_f — is sometimes used, where $\phi_f = \arg[iA(K^0_L p \to K^0_S p)_{t=0}]$. The above amplitude is related to total cross sections via the optical theorem in the usual convention, e.g.,

$$\sigma_{tot}(K^0 p) = \frac{4\pi}{k} \operatorname{Im}[A(K^0 p \to K^0 p)_{t=0}],$$

where k is the overall center-of-mass K^0 momentum. The modified regeneration amplitude is defined at zero degrees as:

$$F = |F| e^{i\phi} = \frac{A(K^0 p \to K^0 p)_{t=0} - A(\bar{K}^0 p \to \bar{K}^0 p)_{t=0}}{k}$$

$$= \frac{2}{k} A(K^0_L p \to K^0_S p)_{t=0}.$$

The c.m. momentum k in the denominator makes F Lorentz invariant and gives a relation between the modified regeneration amplitude and the forward differential cross section free of kinematical factors.

The relationship between the modified regeneration amplitude and the forward cross section is obtained as follows:

$$\frac{d\sigma}{dt} = \frac{d\sigma}{d\Omega}\frac{d\Omega}{dt} = \frac{\pi}{k^2} |A(K^0_L p \to K^0_S p)|^2 .$$

Substituting $A(K^0_L p \to K^0_S p)|_{t=0} = \frac{k}{2} F$ into the above equation,

$$\left(\frac{d\sigma}{dt}\right)_{t=0} = \frac{\pi}{4} |F|^2.$$

F is customarily expressed in mb while $\frac{d\sigma}{dt}$ is expressed in $mb(GeV)^{-2}$. The conversion factor is obtained from $(\hbar c)^2 = (0.624)^2\ (\mathrm{GeV})^2$ mb. Therefore the relationship between the modified regeneration amplitude and the forward differential cross section is:

$$|F|(\mathrm{mb}) = (0.624)\left[\left(\frac{4}{\pi}\right)\left(\frac{d\sigma}{dt}\right)_{t=0}(\mathrm{mb/GeV}^2)\right]^{1/2}.$$

Note that because $\frac{d\sigma}{dt}$ is proportional to $|F|^2$ the percentage errors are related as follows:

$$\frac{\delta|F|}{|F|} = \frac{1}{2}\,\frac{\delta\left(\frac{d\sigma}{dt}\right)_{t=0}}{\left(\frac{d\sigma}{dt}\right)_{t=0}}.$$

The study of $K^0_L p \rightarrow K^0_S p$ has been done both in bubble chamber experiments and in counter experiments with mutually consistent results for $\left(\frac{d\sigma}{dt}\right)_{t=0}$ and ϕ. The bubble chamber experiments measure $\left(\frac{d\sigma}{dt}\right)_{t=0}$ by extrapolation of the angular distribution to t=0, and determine ϕ by comparison to total cross-section measurements for $K^{\pm}n$. The counter experiments measure $\left(\frac{d\sigma}{dt}\right)_{t=0}$ by determining the magnitude of the K^0_S transmission (coherent) regeneration* rate from hydrogen, and measure ϕ by observing an interference between the decay $K^0_S \rightarrow \pi^+\pi^-$ and the (CP-violating) decay $K^0_L \rightarrow \pi^+\pi^-$. It is always reassuring when two such different experimental techniques provide agreement in their results.

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*See page 65 of The CP Puzzle by P. K. Kabir (1968, Academic Press) and the references given therein for the regeneration phenomena of neutral K meson.

B. Part 1

Cross Sections

a) $K_L^0 p$ total cross section

b) $K_L^0 p \to \pi^+ \Lambda$

c) $K_L^0 p \to \pi^+ \Sigma^0$

d) $K_L^0 p \to \pi^0 \Sigma^+$

e) $K_L^0 p \to Y \pi \pi$

f) $K_L^0 p \to K^+ n$.

Differential Cross Sections

a) $K_L^0 p \to \pi^+ \Lambda$

b) $K_L^0 p \to \pi^+ \Sigma^0$.

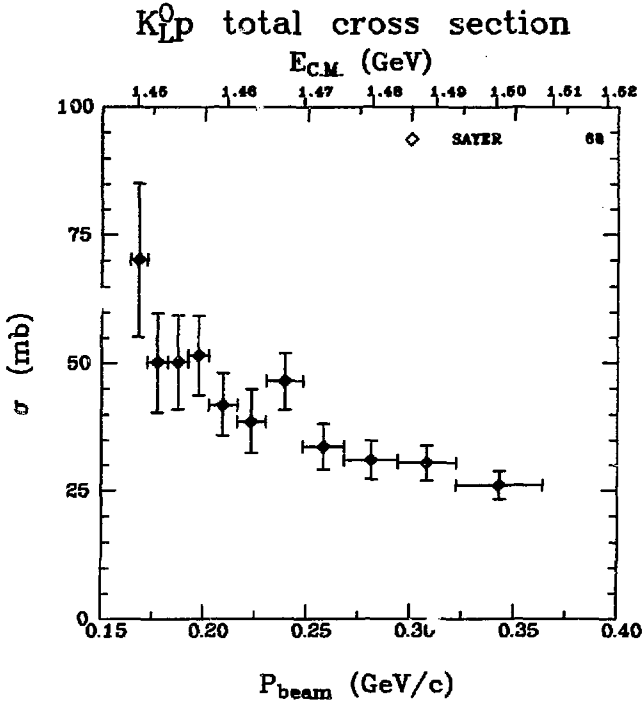


Fig. 1. K_L^0p total cross section over full energy range of existing measurements.

P_{beam} (GeV/c)		S (GeV^2)	σ (mb)		
.168	±.004	2.103	70.1	±15.0	$
.177	.005	2.109	50.1	9.7	$
.187	.005	2.115	50.2	9.2	$
.197	.005	2.122	51.5	7.8	$
.209	.007	2.130	41.9	6.1	$
.223	.007	2.141	38.6	6.2	$
.239	.009	2.154	46.4	5.5	$
.258	.010	2.170	33.7	4.6	$
.281	.013	2.190	31.0	3.9	$
.308	.014	2.216	30.4	3.5	$
.343	.021	2.252	26.0	2.9	$

$ SEE DATA LISTING FOR POSSIBLE SYSTEMATIC ERRORS

SAYER 68.....PR 169 1045 CNTR

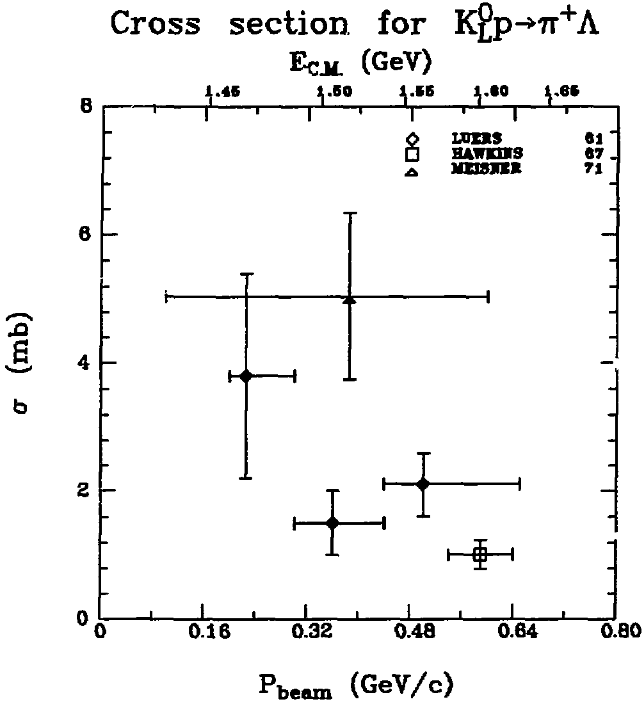


Fig. 2. Cross section for $K_L^0 p \to \pi^+ \Lambda$ over full energy range of existing measurements.

P_{beam} (GeV/c)		S (GeV^2)	σ (mb)			references		
.225	+.075 -.025	2.143	3.80	±1.60	*†#	LUERS	61	AIX CONF 235
.360	+.080 -.060	2.271	1.50	.50	*†#	LUERS	61	AIX CONF 235
.385	+.215 -.285	2.299	5.40	1.21		MEISNER	71	PR D 3 2553
.500	+.150 -.060	2.443	2.10	.50	*†#	LUERS	61	AIX CONF 235
.590	±.050	2.568	1.02	.23	†#	HAWKINS	67	PR 156 1444

* DATA READ FROM GRAPH
† SEE DATA LISTING FOR ADDITIONAL COMMENTS
# CROSS SECTIONS ARE RENORMALIZED USING UP-DATED K0L LIFE TIME (5.17X10**-8)

LUERS	61.....AIX CONF 235	HBC
HAWKINS	67.....PR 156 1444	HBC
MEISNER	71.....PR D 3 2553	HBC

(PAGE 26)

LABORATORY BEAM MOMENTUM = 8.49 +- .06 GEV/C.

REACTION	FRACTION PER CENT (1)	
PI+ PROTON →		
DELTA(1236)++ PI+ PI+ PI+ PI- PI- PI- PIO (2)	10.0 +-	10.0
DELTA(1236)++ → PROTON PI+		
OMEGA(783) PROTON PI+ PI+ PI+ PI- PI- (2)	43.5	14.0
OMEGA(783) → PI+ PI- PIO (3)		
ETA(548) PROTON PI+ PI+ PI+ PI- PI- (2)	7.8	6.8
ETA(548) → PI+ PI- PIO (3)		

(1) THESE FRACTIONS SHOULD BE MULTIPLIED BY 111. +- 16. TO GET CROSS SECTIONS IN MICROBARNS.
(2) INCLUDES EVENTS WHERE SOME OF THE PARTICLES OR RESONANCES LISTED MAY BE RESONATING WITH EACH OTHER.
(3) FITTED FOR MASS AND/OR WIDTH, AND THEN TOOK ONLY EVENTS ABOVE (FITTED) BACKGROUND.

218 DOUBLE-REGGE ANALYSIS OF THE REACTION PI+ P → PI+ RHO0 P AT 13.1 GEV/C. (PHYS. REV. D1, 3051 (1970))

J.W.LAMSA, J.A.GAIDOS, R.B.WILLMANN, C.EZELL (PURDUE UNIV., LAFAYETTE, IND., USA)

ABSTRACT A DOUBLE-REGGE-EXCHANGE MODEL IS COMPARED TO THE REACTION PI+ P → PI+ RHO0 P AT 13.1 GEV/C. THE REACTION IS WELL DESCRIBED IF TWO DIAGRAMS (PI-POMERANCHUKON EXCHANGE AND RHO-POMERANCHUKON EXCHANGE) ARE ADDED INCOHERENTLY.

BEAM IS PI+ ON PROTON AT 13.1 GEV/C.
THIS EXPERIMENT USES THE SLAC 82 IN. HYDROGEN BUBBLE CHAMBER. A TOTAL OF 230000 PICTURES ARE REPORTED ON.
KEY WORDS → DOUBLE REGGE-POLE MODEL

NO DATA PUNCHED FOR THIS ARTICLE

219 TEST OF C INVARIANCE IN THE 3 PI DECAY MODE OF THE ETA MESON. (PHYS. LETTERS 23, 593 (1966))

A.LARRIBE, A.LEVEQUE, A.MULLER, E.PAULI, D.REVEL, T.TALLINI (CENTR. D'ETUDES NUC. SACLAY, GIF-SUR-YVETTE, FRANCE)
R.J.LITCHFIELD, L.K.RANGAN, A.M.SEGAR, J.R.SMITH, P.J.FINNEY, C.M.FISHER, E.PICKUP (RUTHERFORD HIGH EN. LAB., CHILTON,DID.BERK,ENGLAND)

ABSTRACT ETA → 3 PI DECAYS HAVE BEEN STUDIED IN A D(2)-FILLED BUBBLE CHAMBER AND THEIR DALITZ PLOT SHOWS A RIGHT LEFT ASYMMETRY A = -0.001 +/- 0.040 CONSISTENT WITH C INVARIANCE.

BEAM IS PI+ ON DEUTERON AT .82 GEV/C.
THIS EXPERIMENT USES THE SACLAY 82 CM DEUTERIUM BUBBLE CHAMBER. A TOTAL OF 400000 PICTURES ARE REPORTED ON.
KEY WORDS → ETA(548) CHARGE CONJUGATION INVARIANCE DALITZ PLOT

NO DATA PUNCHED FOR THIS ARTICLE

220 STUDY OF THE DECAY MODE ETA → PI+ PI- GAMMA. (PHYS. LETTERS 24B, 486 (1967))

R.J.LITCHFIELD, L.K.RANGAN, A.M.SEGAR, J.R.SMITH (RUTHERFORD HIGH EN. LAB., CHILTON,DID.BERK,ENGLAND)
A.LARRIBE, A.LEVEQUE, A.MULLER, E.PAULI, D.REVEL, B.TALLINI (CENTR. D'ETUDES NUC. SACLAY, GIF-SUR-YVETTE, FRANCE)

ABSTRACT 180 ETA → PI+ PI- GAMMA DECAYS HAVE BEEN EXTRACTED FROM THE SAME ETA SAMPLE IN WHICH ETA → PI+ PI- PIO DECAYS HAD BEEN STUDIED PREVIOUSLY (PHYSICS LETTERS 23, 600, 1966). THE BRANCHING RATIO R(ETA → PI+ PI- GAMMA / ETA → PI+ PI- PIO) IS 0.25 +/- 0.035. THE DATA ARE ALSO CONSISTENT WITH C INVARIANCE, THE CHARGE ASYMMETRY BEING A = +0.06 +/- 0.05.

CLOSELY RELATED REFERENCES
SEE ALSO PHYS. LETTERS 23, 600 (1966).

BEAM IS PI+ ON DEUTERON AT .82 GEV/C.
THIS EXPERIMENT USES THE SACLAY 82 CM DEUTERIUM BUBBLE CHAMBER. A TOTAL OF 400000 PICTURES ARE REPORTED ON.
KEY WORDS → ETA(548) CHARGE CONJUGATION INVARIANCE BRANCHING RATIO

NO DATA PUNCHED FOR THIS ARTICLE

221 THE DECAY ETA → PI+ PI- PIO AND THE S-WAVE PI PI PHASE SHIFT. [illegible]

R.J.LITCHFIELD (RUTHERFORD HIGH EN. LAB., CHILTON,DID.BERK,ENGLAND)

ABSTRACT THE STRUCTURE IN THE DECAY ETA → PI+ PI- PIO HAS BEEN INVESTIGATED [illegible] SAMPLE [illegible] ASSUMPTION THAT ONLY A SINGLE PI PI SCATTERING IN THE FINAL STATE IS IMPORTANT, THE ETA [illegible] THE LOWEST S-WAVE STATE OF THE THREE PIONS IS DOMINANT. THE SIGMA-RESONANCE [illegible] INCONSISTENT WITH OTHER EVIDENCE ON THE LOW-ENERGY PI PI SYSTEM. THE STRUCTURE IS WELL FITTED BY AN S-WAVE PI PI PHASE SHIFT THAT RISES APPROXIMATELY LINEARLY FROM THRESHOLD TO 30 DEGREES AT A PI PI MASS OF 400 MEV/C [illegible].

BEAM IS PI+ ON DEUTERON AT .825 GEV/C.
THIS EXPERIMENT USES THE SACLAY 82 CM DEUTERIUM BUBBLE CHAMBER.
KEY WORDS → ETA(548) PHASE SHIFT SIGMA(410)

NO DATA PUNCHED FOR THIS ARTICLE

Cross section for $K^0_L p \to \pi^0 \Sigma^+$

P_{beam}(GeV/c)	σ(mb)	Reference
$0.385 \begin{smallmatrix} +0.215 \\ -0.385 \end{smallmatrix}$	1.94 ± 0.8	Meisner

Meisner	71	PR D3 2553	HBC

Cross section for $K^0_L p \to Y\pi\pi$

Reaction	P_{beam}	σ(mb)	Reference
$\Lambda\pi^+\pi^0$	0.59 ± 0.05	0.07 ± 0.03	Hawkins
$\Sigma^-\pi^+\pi^+$	0.59 ± 0.05	0.03 ± 0.02	Hawkins

Hawkins	67	PR 156 1444	HBC

Cross section for $K^0_L p \to K^+ n$

P_{beam}(GeV/c)	σ(mb)	Reference
0.300 ± 0.300	1.61 ± 0.72	Meisner

Meisner	71	PR D3 2553	HBC

Angular distribution for $K^0_L p \to \pi^+ \Lambda$

P_{beam} = .16

cos θ min	cos θ max	Number of events		
-1.000	-.800	7.000	±2.[illegible]	*
-.800	-.600	9.000	3.[illegible]	*
-.600	-.400	8.000	2.828	*
-.400	-.200	18.000	4.243	*
-.200	-.000	8.000	2.828	*
.000	.200	16.000	4.000	*
.200	.400	14.000	3.742	*
.400	.600	20.000	4.472	*
.600	.800	19.000	4.359	*
.800	1.000	19.000	4.359	*

* DATA READ FROM GRAPH

KADYK 66.....PRL 17 599 HBC

P_{beam} = .225

cos θ min	cos θ max	Number of events		
-1.000	-.800	10.000	±3.162	*
-.800	-.600	3.000	1.732	*
-.600	-.400	5.000	2.236	*
-.400	-.200	7.000	2.646	*
-.200	-.000	10.000	3.162	*
.000	.200	11.000	3.317	*
.200	.400	13.000	3.606	*
.400	.600	26.000	5.099	*
.600	.800	33.000	5.745	*
.800	1.000	23.000	4.796	*

* DATA READ FROM GRAPH

KADYK 66.....PRL 17 599 HBC

P_{beam} = .275

cos θ min	cos θ max	Number of events		
-1.000	-.800	2.000	±1.414	*
-.800	-.600	2.000	1.414	*
-.600	-.400	5.000	2.236	*
-.400	-.200	4.000	2.000	*
-.200	-.000	2.000	1.414	*
.000	.200	7.000	2.646	*
.200	.400	19.000	4.359	*
.400	.600	12.000	3.464	*
.600	.800	17.000	4.123	*
.800	1.000	13.000	3.606	*

* DATA READ FROM GRAPH

KADYK 66.....PRL 17 599 HBC

P_{beam} = .34

cos θ min	cos θ max	Number of events		
-1.000	-.800	3.000	±1.732	*
-.800	-.600	6.000	2.449	*
-.600	-.400	4.000	2.000	*
-.400	-.200	4.000	2.000	*
-.200	-.000	9.000	3.000	*
.000	.200	2.000	1.414	*
.200	.400	11.000	3.317	*
.400	.600	10.000	3.162	*
.600	.800	25.000	5.000	*
.800	1.000	18.000	4.243	*

* DATA READ FROM GRAPH

KADYK 66.....PRL 17 599 HBC

P_{beam} = .46

cos θ min	cos θ max	Number of events		
-1.000	-.800	7.000	±2.646	*
-.800	-.600	1.000	1.000	*
-.600	-.400	0.		*
-.400	-.200	0.		*
-.200	-.000	3.000	1.732	*
.000	.200	6.000	2.449	*
.200	.400	5.000	2.236	*
.400	.600	5.000	2.236	*
.600	.800	12.000	3.464	*
.800	1.000	20.000	4.472	*

* DATA READ FROM GRAPH

KADYK 66.....PRL 17 599 HBC

P_{beam} = .59 ± .05

cos θ min	cos θ max	Number of events		
-1.000	-.900	1.000	±1.000	*
-.900	-.800	1.000	1.000	*
-.800	-.700	0.		*
-.700	-.600	1.000	1.000	*
-.600	-.500	2.000	1.414	*
-.500	-.400	0.		*
-.400	-.300	2.000	1.414	*
-.300	-.200	1.000	1.000	*
-.200	-.100	2.000	1.414	*
-.100	0.	2.000	1.414	*
0.	.100	5.000	2.236	*
.100	.200	4.000	2.000	*
.200	.300	1.000	1.000	*
.300	.400	0.		*
.400	.500	4.000	2.000	*
.500	.600	1.000	1.000	*
.600	.700	4.000	2.000	*
.700	.800	5.000	2.236	*
.800	.900	0.		*
.900	1.000	0.		*

* DATA READ FROM GRAPH

HAWKINS 67.....PR 156 1444 HBC

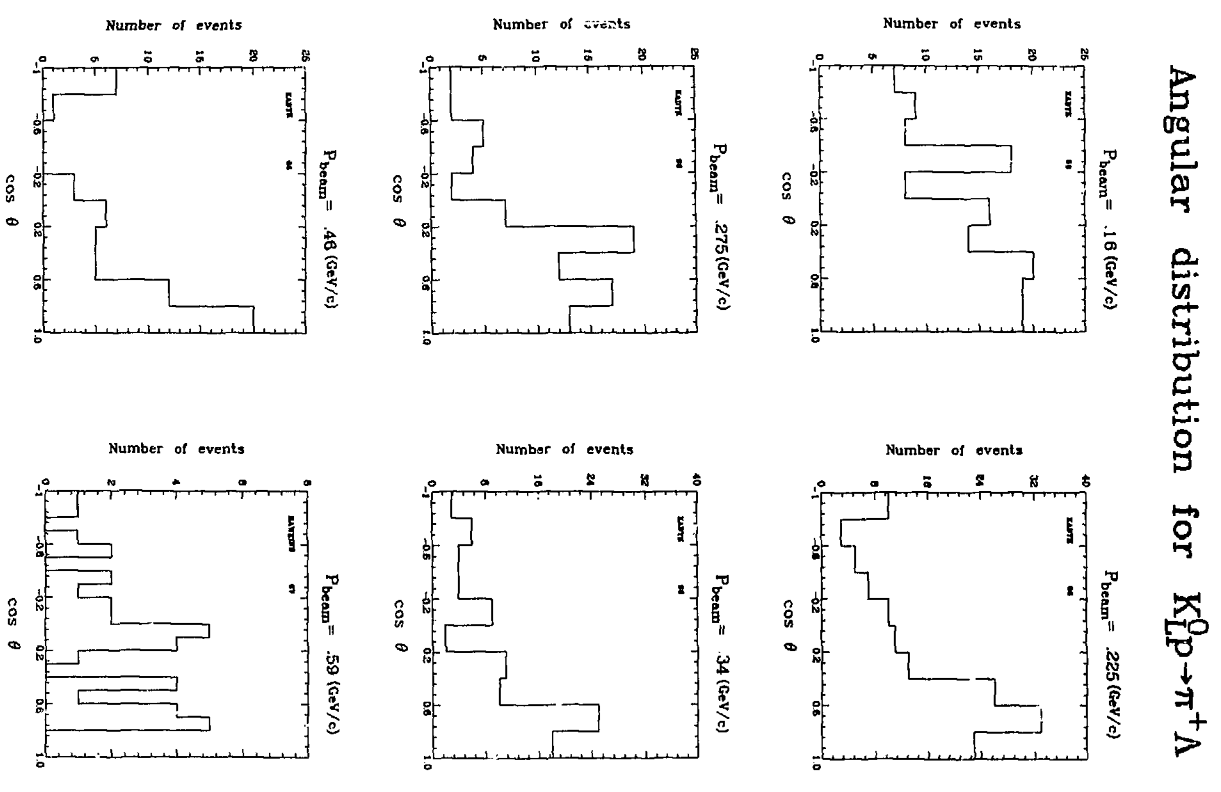


Fig. 4. Angular distribution for $K_L^0 p \to \pi^+\Lambda$. The scattering angle θ is defined in the overall c.m. system as $\cos\theta = \hat{K}\cdot\hat{\pi}$.

Angular distribution for $K_L^0 p \rightarrow \pi^+ \Sigma^0$

$P_{beam} = .59 \pm .05$

cos θ min	cos θ max	Number of events		
-1.000	-.800	2.000	±1.414	*
-.800	-.600	3.000	1.732	*
-.600	-.400	0.		*
-.400	-.200	0.		*
-.200	0.	1.000	1.000	*
0.	.200	0.		*
.200	.400	2.000	1.414	*
.400	.600	0.		*
.600	.800	2.000	1.414	*
.800	1.000	2.000	1.414	*

* DATA READ FROM GRAPH

HAWKINS 67.....PR 156 1444 HBC

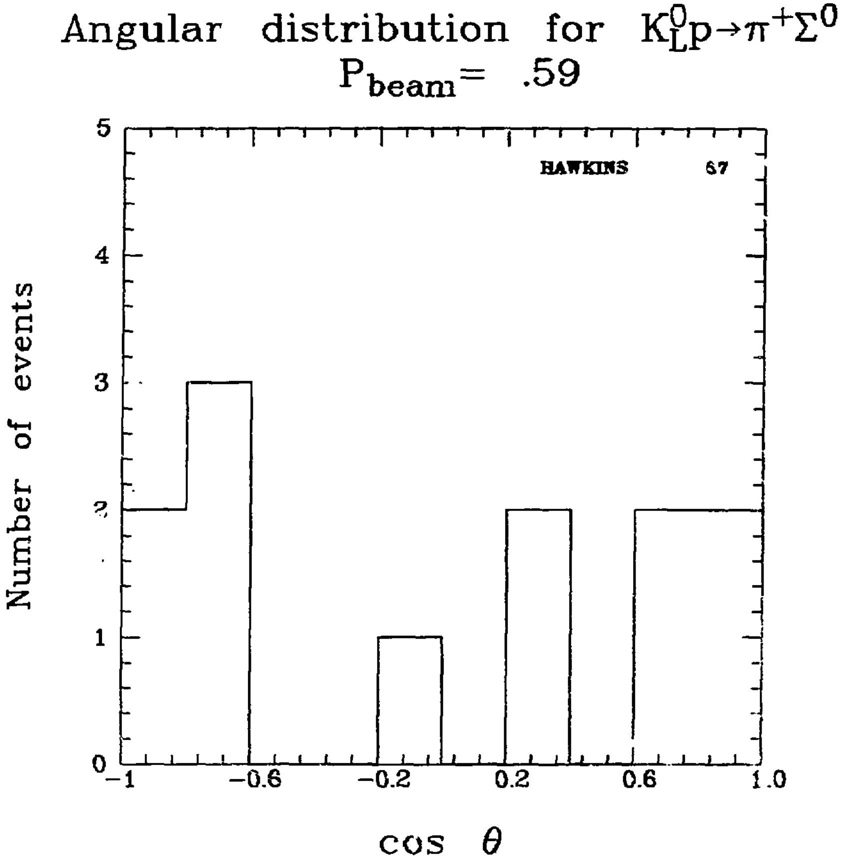


Fig. 5. Angular distributions for $K_L^0 p \to \pi^+ \Sigma^0$. The scattering angle θ is defined in the overall c.m. system as $\cos\theta = \hat{K} \cdot \hat{\pi}$.

B. Part 2

Regeneration, $K_L p \rightarrow K_S^0 p$

a) Cross section

b) Differential cross section

c) Forward differential cross section; magnitude of modified regeneration amplitude

d) Phase of forward amplitude.

Cross section for $K^0_L p \to K^0_S p$

P_{beam} (GeV/c)		S (GeV^2)	σ (mb)			references		
.225	+.075 −.025	2.143	7.500	±2.400	*†#	LUERS	61	AIX CONF 235
.360	+.080 −.060	2.271	3.400	.700	*†#	LUERS	61	AIX CONF 235
.385	+.215 −.385	2.299	5.040	1.300		MEISNER	71	PR D 3 2553
.500	+.150 −.060	2.443	2.800	.500	*†#	LUERS	61	AIX CONF 235
.590	±.050	2.568	1.083	.260	†#	HAWKINS	67	PR 156 1444
1.000	.300	3.217	2.700	.400	†X	LEIPUNER	63	PR 132 2285
1.450	.150	3.999	.627	.080	†	BRODY	71	PRL 26 1050
1.700	.100	4.446	.722	.085	†	BRODY	71	PRL 26 1050
1.900	.100	4.808	.411	.060	†	BRODY	71	PRL 26 1050
2.100	.100	5.172	.420	.055	†	BRODY	71	PRL 26 1050
2.300	.100	5.539	.277	.045	†	BRODY	71	PRL 26 1050
2.500	.100	5.906	.287	.045	†	BRODY	71	PRL 26 1050
2.700	.100	6.275	.250	.040	†	BRODY	71	PRL 26 1050
2.900	.100	6.644	.171	.035	†	BRODY	71	PRL 26 1050
3.200	.200	7.200	.146	.022	†	BRODY	71	PRL 26 1050
3.600	.200	7.943	.086	.018	†	BRODY	71	PRL 26 1050
4.000	.200	8.687	.115	.021	†	BRODY	71	PRL 26 1050
4.600	.400	9.806	.077	.014	†	BRODY	71	PRL 26 1050
5.000	+2.000 −3.000	10.552	.069	.015	†	FIRESTONE	66	PRL 16 556
5.500	±.500	11.487	.054	.012	†	BRODY	71	PRL 26 1050
7.000	±1.000	14.292	.028	.008	†	BRODY	71	PRL 26 1050

* DATA READ FROM GRAPH
† SEE DATA LISTING FOR ADDITIONAL COMMENTS
\# CROSS SECTIONS ARE RENORMALIZED USING UP-DATED KOL LIFE TIME (5.17X10**-8)
X DATA ARE DERIVED BY THE READER FROM GRAPH

LUERS	61.....AIX CONF 235	HBC
LEIPUNER	63.....PR 132 2285	HBC
FIRESTONE	66.....PRL 16 556	HBC
HAWKINS	67.....PR 156 1444	HBC
BRODY	71.....PRL 26 1050	HBC
MEISNER	71.....PR D 3 2553	HBC

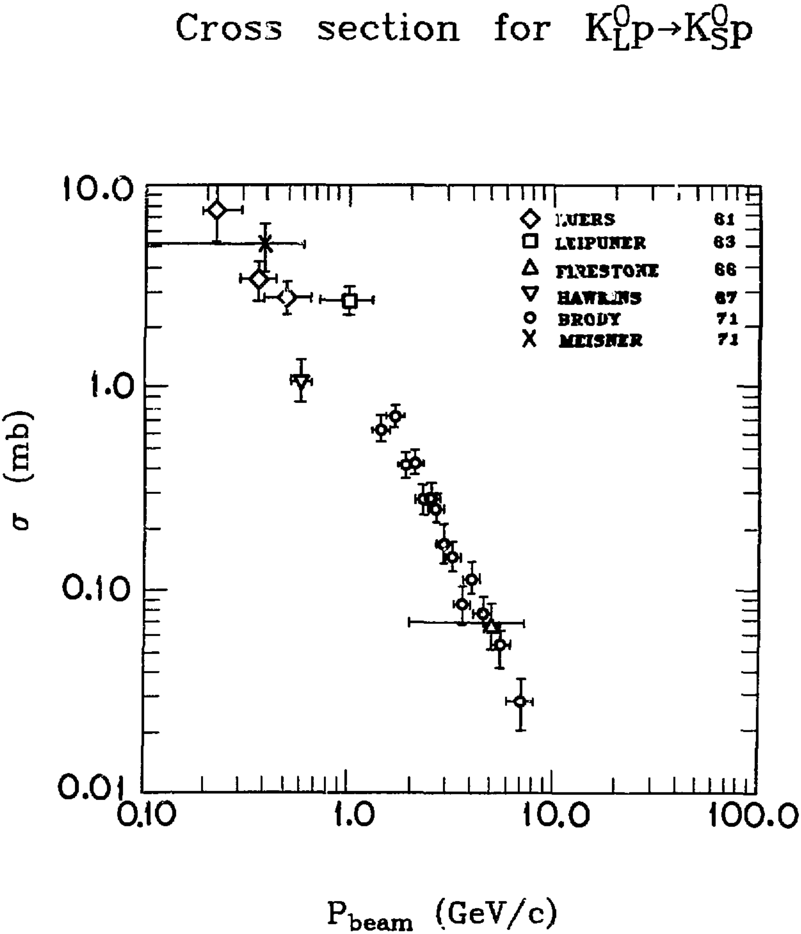


Fig. 6. Cross section for $K_L^0 p \rightarrow K_S^0 p$ over full energy range of measurement.

Differential cross section for $K^0_Lp \rightarrow K^0_Sp$

P_{beam} = .59 ± .05

|t| (GeV/c)² min	max	dσ/dt [mb/(GeV/c)²]		
.024	.048	3.25	±1.63	*†
.048	.095	2.44	1.41	*†
.095	.143	3.25	1.63	*†
.143	.190	1.62	1.15	*†
.190	.238	2.44	1.41	*†
.238	.286	1.62	1.15	*†
.286	.333	2.44	1.41	*†
.333	.381	1.62	1.15	*†

* DATA READ FROM GRAPH
† SEE DATA LISTING FOR ADDITIONAL COMMENTS

HAWKINS 67.....PR 156 1444 HBC

P_{beam} = 1. ± .3

|t| (GeV/c)² min	max	dσ/dt [mb/(GeV/c)²]		
.027	.175	5.746	±1.494	*
.175	.366	2.873	.919	*
.366	.547	2.873	.919	*
.547	.727	1.494	.690	*
.727	.918	2.069	.804	*

* DATA READ FROM GRAPH

LEIPUNER 63.....PR 132 2285 HBC

P_{beam} = 1.65 ± .35

|t| (GeV/c)² min	max	dσ/dt [mb/(GeV/c)²]		
.050	.100	.660	±.210	†
.100	.200	.443	.110	†
.200	.300	.241	.085	†
.300	.400	.296	.096	†
.400	.500	.258	.082	†
.500	.600	.517	.125	†
.600	.700	.273	.083	†
.700	.800	.378	.095	†
.800	1.000	.172	.045	†
1.000	1.200	.215	.055	†
1.200	1.400	.147	.044	†
1.400	1.600	.332	.076	†
1.600	1.800	.188	.054	†

† SEE DATA LISTING FOR ADDITIONAL COMMENTS

BRODY 71.....PRL 26 1050 HBC

P_{beam} = 3. ± 1.

|t| (GeV/c)² min	max	dσ/dt [mb/(GeV/c)²]		
.050	.100	368	±.075	†
.100	.200	.196	.035	†
.200	.300	.107	.025	†
.300	.400	.112	.026	†
.400	.500	.107	.025	†
.500	.600	.073	.021	†
.600	.700	.123	.028	†
.700	.800	.089	.024	†
.800	1.000	.071	.015	†
1.000	1.200	.047	.012	†
1.200	1.400	.033	.010	†
1.400	1.800	.016	.004	†

† SEE DATA LISTING FOR ADDITIONAL COMMENTS

BRODY 71.....PRL 26 1050 HBC

P_{beam} = 5. + 2. , − 3.

|t| (GeV/c)² min	max	dσ/dt [mb/(GeV/c)²]		
0.	.200	.091	±.021	*†
.200	.400	.046	.016	*†
.400	.600	.023	.011	*†
.600	.800	.017	.010	*†
.900	1.000	.011	.008	*†
1.000	1.200	.006	.006	*†
1.200	1.400	.006	.006	*†

* DATA READ FROM GRAPH
† SEE DATA LISTING FOR ADDITIONAL COMMENTS

FIRESTONE 66.....PRL 16 556 HBC

P_{beam} = 6. ± 2.

|t| (GeV/c)² min	max	dσ/dt [mb/(GeV/c)²]		
.050	.100	.177	±.043	†
.100	.200	.073	.018	†
.200	.300	.035	.012	†
.300	.400	.032	.012	†
.400	.600	.016	.007	†
.600	.800	.019	.005	†
.800	1.200	.011	.003	†
1.200	1.800	.001	.001	†

† SEE DATA LISTING FOR ADDITIONAL COMMENTS

BRODY 71.....PRL 26 1050 HBC

Differential cross section for $K^0_L p \rightarrow K^0_S p$

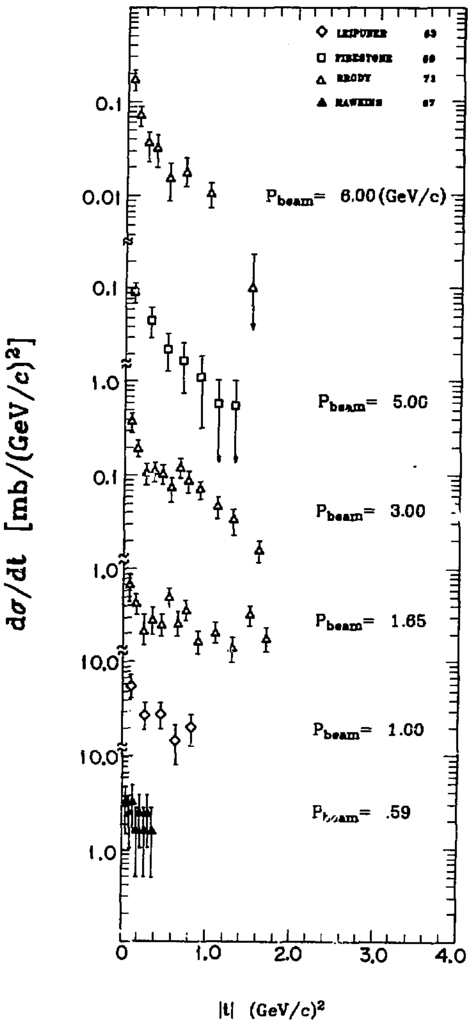


Fig. 7. Differential cross section for $K^0_L p \rightarrow K^0_S p$. Note the breaks in the ordinate scale.

Forward Differential Cross Section for $K^0_L p \rightarrow K^0_S p$; Magnitude of Modified Regeneration Amplitude

P_{beam} (GeV/c) Min	Max	$d\sigma/dt\|_{t=0}$ [mb/(GeV/c)^2]		$\|F\|$[a] (mb)		References
1.0	2.0	1.40 ±	0.50	0.84 ±	0.15[b]	Brody 71
2.0	3.0	0.88	0.24	0.66	0.09[b]	
3.0	4.0	0.62	0.16	0.55	0.07[b]	
4.0	5.0	0.47	0.13	0.49	0.07[b]	
5.0	6.0	0.37	0.11	0.43	0.07[b]	
6.0	8.0	0.28	0.10	0.37	0.07[b]	
3.0	10.0	0.38	0.19	0.43	0.11	Buchanan 71
2.0	3.0	1.42	0.54[c]	0.84	0.16	Darriulat 70
3.0	4.0	0.63	0.25[c]	0.56	0.11	
4.0	5.0	0.63	0.32[c]	0.56	0.14	
5.0	7.0	1.23	0.82[c]	0.78	0.26	
2.0	7.0	0.12	0.044	0.25	0.045[b]	Firestone 66
0.7	1.3	7.6	1.9	2.0	0.3[b]	Leipuner 63
14.0	18.0	0.081	0.024[c]	0.2	0.030[d]	V. K. Birulev 72
18.0	22.0	0.058	0.023[c]	0.170	0.035[d]	
22.0	26.0	0.070	0.027[c]	0.185	0.035[d]	
26.0	30.0	0.040	0.017[c]	0.140	0.030[d]	
30.0	34.0	0.027	0.014[c]	0.115	0.030[d]	
34.0	42.0	0.029	0.015[c]	0.120	0.030[d]	

[a] See the discussion in Section II-A for definition of F, the modified regeneration amplitude.

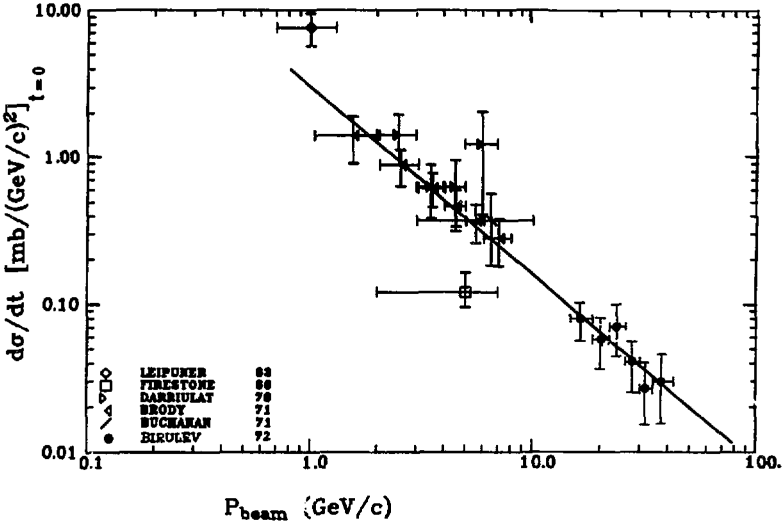
[b] Data converted from forward differential cross section by readers.

[c] Data converted from modified regeneration amplitude by readers.

[d] Data read from graph.

Brody	71	PRL 26	1050	HBC
Buchanan	71	PL 37B	213	SPRK
Darriulat	70	PL 33B	433	SPRK
Firestone	66	PRL 16	556	HBC
Leipuner	63	PR 132	2285	HBC
Birulev	72	PL 38B	452	SPRK

Forward differential cross section for $K_L^0 p \to K_S^0 p$



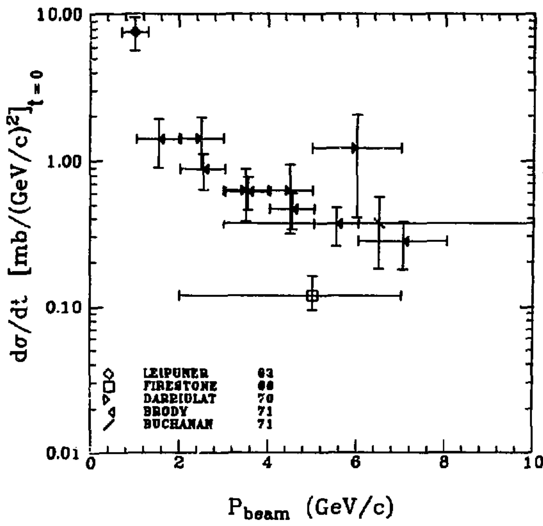


Fig. 8(a) Forward differential cross section for $K_L^0 p \to K_S^0 p$. The data of Leipuner *et al.*, Firestone *et al.*, and Brody *et al.*, have been determined by extrapolation of the differential cross section to t = 0. The data of Darriulat *et al.*, Buchanan *et al.*, and Birulev *et al.*, have been measured by transmission regeneration of the K_S^0 mesons in hydrogen. The curve is a fit of the form $\left(\frac{d\sigma}{dt}\right)_{t=0} \propto P_{beam}^{-n}$, where n = 1.28 ± 0.10, excluding the data point of Leipuner and the data point of Firestone.

(b) Same as (a), for the momentum region less than 10 GeV/c, except that the beam momentum is placed on a linear scale.

Phase of Forward Amplitude for $K^0_L p \rightarrow K^0_S p$

P_{beam} (GeV/c)		S (GeV²)	Phase (deg)			references		
1.65	±.35	4.356	-132	±14	*	BRODY	71	PRL 26 1050
2.65	.65	6.183	-129	13	*	BRODY	71	PRL 26 1050
6.00	1.00	12.421	-123	18	*	BRODY	71	PRL 26 1050
8.00	1.00	16.165	-152	19	*	BRODY	71	PRL 26 1050
6.50	3.50	13.357	-101	42		BUCHANAN	71	PL 37B 213
4.50	2.50	9.619	-132	17	*	DARRIULAT	70	PL 33B 433
28.0	14.0	53.668	-118	13		BIRULEV	72	PL 38B 452

* SEE DATA LISTING FOR ADDITIONAL COMMENTS

DARRIULAT 70.....PL 33B 433 SPRK
BRODY 71.....PRL 26 1050 HBC
BUCHANAN 71.....PL 37B 213 SPRK
BIRULEV 72.....PL 38B 452 SPRK

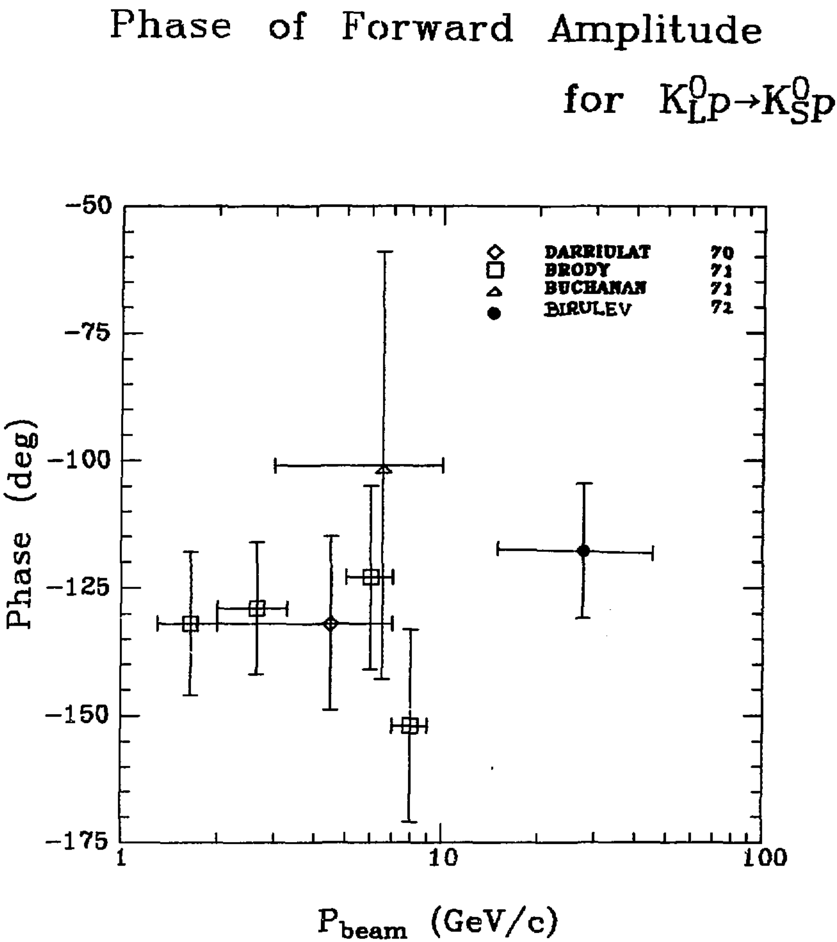


Fig. 9. Phase of forward amplitude for $K_L^0 p \rightarrow K_S^0 p$. The data of Brody et al. have been determined by comparing the forward differential cross section to the total cross sections for K^+n and K^-n. The data of Darriulat et al. and Buchanan et al. have been determined by observing the interference between the decay of the K_L^0 beam and the K_S^0 mesons regenerated in hydrogen in the forward direction.

Section III.

DATA TAPE LISTINGS

In this section we present a listing of all the K_L^0p articles on our DATA TAPE. These are the actual data used in forming the graphs and tables in Section II. The information is presented article-by-article, just *as we store it.*

We debated for some time whether or not we should give these listings because they are somewhat repetitious of Section II. We decided to include them, however, because they do contain a certain amount of information not included in the previous section.

In particular there are a few articles for which we have punched no data but have punched the bibliographic information, keywords, and some comments. The following papers are in this category: the phase shift analysis paper of Kim (Ref. 9), the resonance formation paper of Blumenfeld et al. (Ref. 1), and the regeneration paper of Christenson et al. (Ref. 4). A person interested in K_L^0 interactions may find them useful. (These papers are not referred to in any way in Section II.)

- In addition we have also punched the title and abstract for every article, to assist you in your selection of articles for further reading.
- Also in this section you will find comments on many pieces of data — it is in general not practical to present these comments in Section II.
- Many articles give data that we feel we cannot meaningfully compile at present (only partially corrected, integrated only over a certain interval, etc). These data have in many cases been punched and will be found in this section.
- You will also find in this section, data reported as upper and lower limits, approximate values, etc.
- Occasionally we do not use the data as originally given in the article. This section tells exactly where our data came from (private communications, unpublished companion report, etc.).
- The size of an experiment is frequently indicated by the total number of pictures taken, or by the number of events in various distributions.
- To give you an idea of the scope of a particular article, KEYWORDS are included for each article. These words can also be used to form classified indices (see Section IV).

To repeat, the above items are some of the things you will find in this section that are not presented in Section II.

We have also found that theses are frequently hard to come by. Thus we feel that our listing of theses may help give their data greater distribution than they might otherwise have. We would like to make the general appeal that a copy of all experimental particle physics theses be sent to us.

Finally, this section may serve the useful function of permitting the reader to easily check on the accuracy of our input data. The data is arranged article-by-article, and in most cases we have indicated [in square brackets] the exact location of the data in the article (i.e., the figure, table, or page number). If you find any errors or misinterpretations, please let us know as soon as possible.

As for the organization of the information in this section, we should mention that the order of the articles is alphabetical by first author.

Above the double dotted line in each article you will find the title, authors and institutions, abstract (if the article had one), related citations, beam information, comments, KEYWORDS, etc.

Below the double line in each article appear the data. We generally enter the data in exactly the same units as given by the authors. (This is done primarily to facilitate the verification of the data.) If we do alter the data in any way, we indicate this fact by an appropriate comment.

Occasionally authors give the same data in two different forms. We punch both, if we feel that both forms are useful, and display them side-by-side in the listings that follow.

We have tried to be particularly careful about including systematic errors, whenever given by the authors. In some cases it is quite unclear from the original article and we have had to contact the authors directly.

Another reason for contacting authors has been to get tables of data that correspond to the unpublished graphs. If we are unable to get tables from an author, or if the article is more than a couple of years old, we read the data off the published graph, and then include the warning that "these data were read from a graph." (In some cases the tables we received have been more up to date than the published graphs.)

1 FORMATION OF THE Y*1(1616) AND Y*1(1700) IN KOL P INTERACTIONS. (PHYS. LETTERS 29B, 58 (1969))

B.J.BLUMENFELD, G.R.KALBFLEISCH (BROOKHAVEN NAT. LAB., UPTON, L.I., N. Y., USA)

ABSTRACT THE RECENTLY DISCOVERED Y*1(1616) AND Y*1(1700) RESONANCES HAVE BEEN OBSERVED IN THE FORMATION REACTIONS KOL P + LAMBDA PI+ AND KOL P + LAMBDA PI+ PI0. THE MASS VALUES OBSERVED ARE IN AGREEMENT WITH PREVIOUS EXPERIMENTS BUT THE WIDTHS ARE NARROWER.

ARTICLE READ BY FUMIYO UCHIYAMA IN 9/71, AND VERIFIED BY JAMES S. LOOS.
BEAM IS KOL ON PROTON FROM .3 TO 7.5 GEV/C.
THIS EXPERIMENT USES THE BNL 80 IN. HYDROGEN BUBBLE CHAMBER. A TOTAL OF 190000 PICTURES ARE REPORTED ON.
GENERAL COMMENTS ON THIS ARTICLE
1 THOUGH THE FLUX SPECTRUM IS KNOWN TO BE LINEAR, IT IS NOT KNOWN. NO CROSS SECTION IS GIVEN. A MAXIMUM LIKELIHOOD FIT HAS DETERMINED THE MASSES M AND WIDTH G TO BE M = 1618 +- 3, G = 30 +- 10 FOR THE Y*1(1616) AND M = 1682 +- 2, G = 25 +- 10 MEV/C**2 FOR THE Y*1(1700). IN THE MAXIMUM LIKELIHOOD CALCULATION THE MASSES AND WIDTHS WERE VARIED. A LINEAR FLUX SPECTRUM STARTING FROM ZERO AT E*(CENTER OF MASS ENERGY) = 1.51 GEV MULTIPLIED THE TWO S-WAVE BREIT WIGNER CURVES. THE RANGE OF THE SPECTRUM INCLUDED WAS FROM E* = 1.55 TO 1.72 GEV.
KEY WORDS + HYPERON PRODUCTION Y*1(1616) Y*1(1700)
COMPOUND KEY WORDS + HYPERON PRODUCTION

NO DATA PUNCHED FOR THIS ARTICLE

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2 REACTION KOL P + KOS P FROM 1.3 TO 8.0 GEV/C. (PHYS. REV. LETTERS 26, 1053 (1971))

A.D.BRODY, W.B JOHNSON, B.KEHOE, D.W.G.S.LEITH, J.S.LOOS, G.J.LUSTE, K.MORIYASU, B.S.SHEN, W.M.SMART F.C.WINKELMANN, R.J.YAMARTINO (STANFORD LINEAR ACCEL. CNTR., STANFORD,CALIF., USA)

ABSTRACT TOTAL AND DIFFERENTIAL CROSS SECTIONS ARE PRESENTED FOR THE REACTION KOL + KOS P FROM 1.3 TO 8.0 GEV/C AS MEASURED IN AN EXPOSURE OF THE STANFORD LINEAR ACCELERATOR CENTER 40-IN. HYDROGEN BUBBLE CHAMBER TO A NEUTRAL BEAM. THE FORWARD POINTS OF DSIGMA (KOL P + KOS P) / DT TOGETHER WITH K+ N AND K- N TOTAL CROSS SECTIONS ARE USED TO DETERMINE THE INTERCEPT OF THE EFFECTIVE REGGE TRAJECTORY, ALPHA(0) = 0.47 +- 0.09, AND THE REGENERATION PHASE PHI(F) = -43 +- 8 DEGREES.

CLOSELY RELATED REFERENCES
THIS ARTICLE SUPERSEDES PART OF STANF.LIN.ACCEL.CNTR., REPORT NO.SLAC- PUB-823 (1970).
ANALYSIS OF THESE DATA IN PHYS. REV. LETTERS 26, 1053 (1971).

ARTICLE READ BY JAMES S. LOOS IN 8/71, AND VERIFIED BY FUMIYO UCHIYAMA.
BEAM IS KOL ON PROTON FROM 1.3 TO 8.0 GEV/C.
THIS EXPERIMENT USES THE SLAC 40 IN. HYDROGEN BUBBLE CHAMBER. A TOTAL OF 200000 PICTURES ARE REPORTED ON.
GENERAL COMMENTS ON THIS ARTICLE
1 THE PHASE OF THE FORWARD AMPLITUDE IS DETERMINED BY COMPARING TO THE OPTICAL POINTS FOUND FROM MEASUREMENTS OF DSIGMA = SIGMA(T)(K+ N) - SIGMA(T)(K- N) AT MOMENTUM VALUES WHERE DSIGMA HAS BEEN MEASURED.
KEY WORDS + CROSS SECTION DIFFERENTIAL CROSS SECTION HYDROGEN REGENERATION AMPLITUDE PHASE
COMPOUND KEY WORDS + HYDROGEN REGENERATION AMPLITUDE HYDROGEN REGENERATION PHASE

CROSS SECTION FOR KOL PROTON + PROTON KOS. (FIGURE 1)

THESE NUMBERS ARE FROM SLAC-PUB-888, MARCH 1971; THE NUMBERS QUOTED ARE IDENTICAL TO THOSE GIVEN IN THE ABOVE PUBLICATION.

LABORATORY BEAM MOMENTUM GEV/C MIN	MAX	MILLIBARNS (1)		NO. EVENTS
1.3	1.6	.627	+- .080	74
1.6	1.8	.722	.085	75
1.8	2.0	.411	.060	49
2.0	2.2	.420	.055	57
2.2	2.4	.277	.045	38
2.4	2.6	.287	.045	44
2.6	2.8	.250	.040	40
2.8	3.0	.171	.035	27
3.0	3.4	.146	.022	45
3.4	3.8	.086	.018	23
3.8	4.2	.115	.021	31
4.2	5.0	.077	.014	34
5.0	6.0	.054	.012	21
6.0	8.0	.028	.008	13

(1) ERRORS ARE STATISTICAL ONLY.

DIFFERENTIAL CROSS SECTION FOR KOL PROTON + KOS PROTON. (FIGURE 2)

DATA ARE AVERAGED OVER LABORATORY BEAM MOMENTUM FROM 1.3 TO 2.0 GEV/C.

THESE NUMBERS ARE FROM SLAC-PUB-888, MARCH 1971; THE NUMBERS QUOTED ARE IDENTICAL TO THOSE GIVEN IN THE ABOVE PUBLICATION.

-T (GEV/C)**2 MIN	MAX	D-SIGMA/D-T UB/(GEV/C)**2 (1)		NO. EVENTS
.05	.10	660.	+- 210.	10
.10	.20	443.	110.	16
.20	.30	241.	85.	8
.30	.40	296.	96.	11
.40	.50	258.	82.	10
.50	.60	517.	125.	17
.60	.70	273.	83.	11
.70	.80	373.	95.	16
.80	1.00	172.	45.	15
1.00	1.20	215.	55.	15
1.20	1.40	147.	44.	11
1.40	1.60	332.	76.	19
1.60	1.80	188.	54.	12

T IS THE SQUARE OF THE INVARIANT MOMENTUM TRANSFER BETWEEN THE (INCOMING KOL) AND THE (KOS).

(1) ERRORS ARE STATISTICAL ONLY.

DIFFERENTIAL CROSS SECTION FOR KOL PROTON → KOS PROTON. (FIGURE 2)

DATA ARE AVERAGED OVER LABORATORY BEAM MOMENTUM FROM 2. TO 4. GEV/C.

THESE NUMBERS ARE FROM SLAC-PUB-888, MARCH 1971; THE NUMBERS QUOTED ARE IDENTICAL TO THOSE GIVEN IN THE ABOVE PUBLICATION.

-T (GEV/C)**2 MIN	MAX	D-SIGMA/D-T UB/(GEV/C)**2 (1)		NO. EVENTS
.05	.10	368. +-	75.	25
.10	.20	196.	35.	32
.20	.30	107.	25.	18
.30	.40	112.	26.	19
.40	.50	107.	25.	18
.50	.60	73.	21.	12
.60	.70	123.	28.	20
.70	.80	89.	24.	14
.80	1.00	71.	15.	25
1.00	1.20	47.	12.	17
1.20	1.40	33.	10.	11
1.40	1.80	16.	4.	11

T IS THE SQUARE OF THE INVARIANT MOMENTUM TRANSFER BETWEEN THE (INCOMING KOL) AND THE (KOS).

(1) ERRORS ARE STATISTICAL ONLY.

DIFFERENTIAL CROSS SECTION FOR KOL PROTON → KOS PROTON. (FIGURE 2)

DATA ARE AVERAGED OVER LABORATORY BEAM MOMENTUM FROM 4. TO 8. GEV/C.

THESE NUMBERS ARE FROM SLAC-PUB-888, MARCH 1971; THE NUMBERS QUOTED ARE IDENTICAL TO THOSE GIVEN IN THE ABOVE PUBLICATION.

-T (GEV/C)**2 MIN	MAX	D-SIGMA/D-T UB/(GEV/C)**2 (1)		NO. EVENTS
.05	.10	177.0 +-	43.0	17
.10	.20	73.0	18.0	17
.20	.30	35.0	12.0	8
.30	.40	32.0	12.0	7
.40	.60	16.0	7.0	6
.60	.80	19.0	6.0	10
.80	1.20	10.7	3.2	11
1.20	1.80	1.0	1.0	2

T IS THE SQUARE OF THE INVARIANT MOMENTUM TRANSFER BETWEEN THE (INCOMING KOL) AND THE (KOS).

(1) ERRORS ARE STATISTICAL ONLY.

DIFFERENTIAL CROSS SECTION AT FIXED ANGLE FOR KOL PROTON → KOS PROTON. (FIGURE 3)

T = 0. +- 0. (GEV/C)**2. T IS THE SQUARE OF THE INVARIANT MOMENTUM TRANSFER BETWEEN THE (INCOMING KOL) AND THE (KOS).

LABORATORY BEAM MOMENTUM GEV/C		D-SIGMA/D-T MB/(GEV/C)**2 (1)	
1.5 +-	.5	1.40 +-	.50
2.5	.5	.88	.24
3.5	.5	.62	.16
4.5	.5	.47	.13
5.5	.5	.37	.11
7.0	1.0	.28	.10

(1) ERRORS ARE STATISTICAL ONLY.

THE PHASE OF THE FORWARD AMPLITUDE FOR KOL PROTON → KOS PROTON. (TABLE 1)

ISOSPIN INVARIANCE AND THE OPTICAL THEOREM ARE USED TO GET THE IMAGINARY PART OF THE AMPLITUDE TO CALCULATE THE PHASE.

LABORATORY BEAM MOMENTUM GEV/C		PHASE DEGREES	
1.65 +-	.35	-132. +-	14.
2.65	.65	-129.	13.
6.00	1.00	-123.	18.
8.00	1.00	-152.	19.

3 COHERENT REGENERATION IN HYDROGEN FROM 3 TO 10 GEV/C. (PHYS. LETTERS 37B, 213 (1971))

C.D.BUCHANAN, D.J.DRICKEY, F.D.RUDNICK, P.F.SHEPARD, D.H.STORK, H.K.TICHO (UNIV. OF CALIF., LOS ANGELES, CALIF., USA)
C.-Y.CHIEN, B.COX, L.ETTLINGER, L.RESVANIS, R.A.ZDANIS (JOHNS HOPKINS UNIV., BALTIMORE, MD., USA)
E.DALLY, E.SEPPI, P.INNOCENTI (STANFORD LINEAR ACCEL. CNTR., STANFORD,CALIF., USA)

ABSTRACT WE HAVE STUDIED THE PROPER TIME DISTRIBUTION OF COHERENT PI+ PI- DECAYS FROM A 3 - 10 GEV/C KOL BEAM INCIDENT ON A ONE METER LIQUID HYDROGEN TARGET USING A WIRE SPARK CHAMBER SPECTROMETER IN THE 3 DEGREE NEUTRAL BEAM AT SLAC. WE FIND (F(0)-FBAR(0)/K) = 0.43 +- 0.11 MB, PHI(F(0)-FBAR(0)) = -101 DEGREES +- 42 DEGREES.

ARTICLE READ BY FUMIYO UCHIYAMA IN 10/71, AND VERIFIED BY JAMES S. LOOS.
BEAM IS KOL ON PROTON FROM 3 TO 10 GEV/C.
THIS EXPERIMENT USES SPARK CHAMBERS.
KEY WORDS • HYDROGEN REGENERATION AMPLITUDE PHASE COHERENT
COMPOUND KEY WORDS • HYDROGEN REGENERATION AMPLITUDE HYDROGEN REGENERATION PHASE

THE MAGNITUDE OF THE MODIFIED REGENERATION AMPLITUDE, ABS(F), FOR KOL PROTON + PROTON KOS. (PAGE 5)

DATA ARE AVERAGED OVER THETA FROM .0000 TO .0028 RADIANS. THETA IS THE ANGLE THAT THE KOS MAKES WITH THE BEAM IN THE LAB.

LABORATORY BEAM MOMENTUM GEV/C MIN	MAX	ABS(F) MB
3.	10.	.43 +- .11

THE PHASE OF THE FORWARD AMPLITUDE FOR KOL PROTON + PROTON KOS. (PAGE 5)

DATA ARE AVERAGED OVER THETA FROM .0000 TO .0028 RADIANS. THETA IS THE ANGLE THAT THE KOS MAKES WITH THE BEAM IN THE LAB.

LABORATORY BEAM MOMENTUM GEV/C MIN	MAX	PHASE DEGREES
3.	10.	-101. +- 42.

4 REGENERATION OF KO1 MESONS AND THE KO1-KO2 MASS DIFFERENCE. (PHYS. REV. 140, B 74 (1965))

J.H.CHRISTENSON, J.W.CRONIN, V.L.FITCH, R.TURLAY (PRINCETON UNIV., PRINCETON, N. J., USA)

ABSTRACT WE HAVE STUDIED THE REGENERATION OF KO1 MESONS USING A BEAM OF KO2 MESONS PRODUCED AT THE BROOKHAVEN AGS. THE KO1 MESONS WERE DETECTED WITH A PAIR OF MAGNET-SPARK-CHAMBER SPECTROMETERS THAT MOMENTUM-ANALYZED THE TWO DECAY PIONS. A TEST OF THE COHERENCE OF THE TRANSMISSION REGENERATION IS MADE BY COMPARING THE YIELDS FROM HALF- AND FULL-DENSITY COPPER REGENERATORS. THE KO1-KO2 MASS DIFFERENCE WAS MEASURED WITH A REGENERATOR CONSISTING OF TWO PIECES OF COPPER SEPARATED BY A VARIABLE AIR GAP. THIS METHOD IS INDEPENDENT OF ALL NUCLEAR SCATTERING PARAMETERS AND YIELDS A MASS DIFFERENCE OF 0.50 +- 0.10 IN UNITS OF H/TAU(1) (WHERE TAU(1) IS THE KO1 MEAN LIFE). DATA TAKEN WITH SINGLE COPPER REGENERATORS OF VARIOUS THICKNESSES YIELD MASS DIFFERENCES CONSISTENT WITH THIS MEASUREMENT. MASS DIFFERENCES LARGER THAN 1.0 ARE STRONGLY REJECTED BY OUR DATA. THE FORWARD REGENERATION CROSS SECTIONS FOR C, CU, FE, AND W WERE MEASURED AND FOUND TO AGREE WITH OPTICAL-MODEL CALCULATIONS. REGENERATION IN LIQUID HYDROGEN WAS ALSO INVESTIGATED AND THE RESULTS COMPARED WITH THEORETICAL PREDICTIONS.

ARTICLE READ BY JAMES S. LOOS IN 8/71, AND VERIFIED BY FUMIYO UCHIYAMA.
BEAM IS KOL ON PROTON FROM .7 TO 1.4 GEV/C.
THIS EXPERIMENT USES SPARK CHAMBERS. A TOTAL OF 140000 PICTURES ARE REPORTED ON.
GENERAL COMMENTS ON THIS ARTICLE
1 THE FORWARD AMPLITUDE FOR HYDROGEN OBTAIND IS (0.35 +- 0.16) FERMI < 1/2*(F+(0) - F-(0))< (1.6 +- 0.2) FERMI FOR THE MOMENTUM K= 1.0 +0.4, -0.3 GEV/C. THE MODIFIED REGENERATION AMPLITUDE , F = (F+(0)-F-(0))/K
KEY WORDS + COHERENT HYDROGEN REGENERATION AMPLITUDE MASS DIFFERENCE NUCLEAR
COMPOUND KEY WORDS + HYDROGEN REGENERATION AMPLITUDE MASS DIFFERENCE NUCLEAR REGENERATION

NO DATA PUNCHED FOR THIS ARTICLE

5 OBSERVATION OF K(L)-K(S) REGENERATION FROM LIQUID HYDROGEN. (PHYS. LETTERS 33B, 433 (1970))

P.DARRIULAT, C.GROSSO, M.HOLDER, J.PILCHER, E.RADERMACHER, C.RUBBIA, M.SCIRE, A.STAUDE, K.TITTEL (PHYS.INST.DER TECH.HOCHSCHULE, AACHEN, W.GERMANY, AND EUROPEAN ORG. FUR NUC. RES., GENEVA, SWITZERLAND, AND UNIV. DI TORINO, TORINO, ITALY)

ABSTRACT THE K(L)-K(S) TRANSMISSION REGENERATION OF A K(L) BEAM TRAVERSING A LIQUID HYDROGEN TARGET HAS BEEN OBSERVED OVER THE MOMENTUM INTERVAL 3.0-6.0 GEV/C. RESULTS ARE IN GOOD AGREEMENT WITH PREDICTIONS BASED ON DISPERSION RELATIONS.

ARTICLE READ BY FUMIYO UCHIYAMA IN 8/71, AND VERIFIED BY JAMES S. LOOS.
BEAM IS KOL ON PROTON FROM 3 TO 6 GEV/C.
THIS EXPERIMENT USES SPARK CHAMBERS.
GENERAL COMMENTS ON THIS ARTICLE
1 A (K(L) + PI+ PI-) / A (K(S) + PI+ PI-) = (1.95 +- 0.06)*10**-3 * EXP(I*(45 +- 4 DEGREES)) IS USED TO SEPARATE NON-REGENERATION 2 PI DECAY.
KEY WORDS + HYDROGEN REGENERATION AMPLITUDE PHASE COHERENT
COMPOUND KEY WORDS + HYDROGEN REGENERATION AMPLITUDE HYDROGEN REGENERATION PHASE

THE MAGNITUDE OF THE MODIFIED REGENERATION AMPLITUDE, ABS(F), FOR KOL PROTON + PROTON KOS. (TABLE 1)

DATA ARE AVERAGED OVER THETA FROM .00000 TO .00316 RADIANS. THETA IS THE ANGLE THAT THE KOS MAKES WITH THE BEAM IN THE LAB.

LABORATORY BEAM MOMENTUM GEV/C MIN	MAX	ABS(F) MB
2.	3.	.84 +- .16
3.	4.	.56 .11
4.	5.	.56 .14
5.	7.	.78 .26

THE PHASE OF THE FORWARD AMPLITUDE FOR KOL PROTON + PROTON KOS. (TABLE 1)

DATA ARE AVERAGED OVER THETA FROM .00000 TO .00316 RADIANS. THETA IS THE ANGLE THAT THE KOS MAKES WITH THE BEAM IN THE GRAND C.M.

A COMMON REGENERATION PHASE OF -42 DEGREES WAS USED BY EXPERIMENTERS TO FIT ALL MOMENTUM INTERVALS. THE PHASE OF THE FORWARD AMPLITUDE IS EQUAL TO THE REGENERATION PHASE MINUS 90 DEGREES.

LABORATORY BEAM MOMENTUM GEV/C MIN	MAX	PHASE DEGREES
2.	7.	-132. +- 17.

6 K(S) REGENERATION AND K(L) → PI+ + PI- DECAY IN THE 80-INCH HYDROGEN BUBBLE CHAMBER. (PHYS. REV. LETTERS 16, 556 (1966))

A.FIRESTONE, J.K.KIM, J.LACH, J.SANDWEISS, H.D.TAFT (YALE UNIV., NEW HAVEN, CONN., USA)
V.BARNES, H.W.J.FOELSCHE, T.MORRIS, Y.OREN, M.WEBSTER (BROOKHAVEN NAT. LAB., UPTON, L.I., N. Y., USA)

ARTICLE READ BY FUMIYO UCHIYAMA IN 8/71, AND VERIFIED BY JAMES S. LOOS.
BEAM IS KOL ON PROTON FROM 2 TO 7 GEV/C.
THIS EXPERIMENT USES THE BNL 80 IN. HYDROGEN BUBBLE CHAMBER. A TOTAL OF 127000 PICTURES ARE REPORTED ON.
GENERAL COMMENTS ON THIS ARTICLE
1 SEE ALSO HYDROGEN BUBBLE CHAMBER STUDY OF K(L) DECAYS AND K(S) REGENERATION BY A. FIRESTONE, PH.D. THESIS, YALE UNIVERSITY.
2 BEAM SPECTRUM PEAKS NEAR 5 GEV/C.
KEY WORDS = CROSS SECTION DIFFERENTIAL CROSS SECTION WEAK INTERACTION MEASUREMENT HYDROGEN REGENERATION AMPLITUDE
COMPOUND KEY WORDS = HYDROGEN REGENERATION AMPLITUDE

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....

DIFFERENTIAL CROSS SECTION FOR KOL PROTON → PROTON KOS. (FIGURE 2)
KOS → PI+ PI- (1)

LABORATORY BEAM MOMENTUM = 5. (+) 2. (-) 3. GEV/C.

THESE DATA WERE READ FROM A GRAPH

-T (GEV/C)**2		D-SIGMA/D-T UB/(GEV/C)**2	
.1 +-	.1	60.50 +-	14.00
.3	.1	31.00	11.00
.5	.1	15.50	7.00
.7	.1	11.50	6.50
.9	.1	7.50	5.50
1.1	.1	3.90	3.90
1.3	.1	3.75	3.75

T IS THE SQUARE OF THE INVARIANT MOMENTUM TRANSFER BETWEEN THE (INCOMING KOL) AND THE (KOS).

(1) SELECTED ON THE BASIS OF KINEMATIC FITTING.

....

DIFFERENTIAL CROSS SECTION FOR KOL PROTON → PROTON KOS. (PAGE 2)
KOS → PI+ PI- (1)

LABORATORY BEAM MOMENTUM = 5. (+) 2. (-) 3. GEV/C.

T (GEV/C)**2	D-SIGMA/D-T UB/(GEV/C)**2
0.(2)	77. + 29. - 24.

T IS THE SQUARE OF THE INVARIANT MOMENTUM TRANSFER BETWEEN THE (INCOMING KOL) AND THE (KOS).

(1) SELECTED ON THE BASIS OF KINEMATIC FITTING.
(2) EXTRAPOLATED POINT.

....

CROSS SECTION FOR KOL PROTON → PROTON KOS. (PAGE 557)
KOS → PI+ PI- (1)

LABORATORY BEAM MOMENTUM GEV/C	MICROBARNS
5. + 2. - 3.	46.0 +- 10.4

(1) SELECTED ON THE BASIS OF KINEMATIC FITTING.

....
....

7 KO2 INTERACTIONS, DECAYS AND REGENERATIVE PROPERTIES AT 590 MEV/C IN LIQUID HYDROGEN. (PHYS. REV. 156, 1444 (1967))

C.J.B.HAWKINS (YALE UNIV., NEW HAVEN, CONN., USA)

ABSTRACT AN EARLIER EXPERIMENT HAS REPORTED AN 'ANOMALOUS' COHERENT REGENERATIVE PRODUCTION OF KO1 MESONS IN LIQUID HYDROGEN. THE EFFECT IS REINTERPRETED IN TERMS OF A CONSTRUCTIVE INTERFERENCE BETWEEN CONVENTIONAL REGENERATIVE AMPLITUDES AND THE CP-VIOLATING DECAY KO2 → 2PI. EXPERIMENTAL SUPPORT IS GIVEN. FROM NEW DATA, THE KO2 BRANCHING RATIO (KO2 → PI MU NU)/(KO2 → PI E NU) HAS BEEN MEASURED TO BE 0.7 +- 0.2. RESULTS ARE PRESENTED ON THE DECAY KO2 → PI+ PI- PI0 AND ON THE STRONG-INTERACTION REACTIONS BETWEEN KO2 MESONS AND PROTONS AT 590 MEV/C.

ARTICLE READ BY FUMIYO UCHIYAMA IN 10/71, AND VERIFIED BY JAMES S. LOOS.
BEAM IS KOL ON PROTON AT .59 GEV/C.
THIS EXPERIMENT USES THE BNL 14 IN. HYDROGEN BUBBLE CHAMBER. A TOTAL OF 256000 PICTURES ARE REPORTED ON.
GENERAL COMMENTS ON THIS ARTICLE
1 R(K)---BISWAS RATIO ; E(K)---HYPERON RATIO ; K---KOL MOMENTUM IN MEV/C R(225)=0.67+-0.25,R(360)=0.44+-0.14, R(500)=0.46+-0.16 , E(225)=0.33+-0.14E(360)=0.19+-0.07,E(500)=0.32+-0.08 ,READ FROM FIG. 3 AND 4 . PAGE 238. SEE ALSO P.L.7,225(1961)
KEY WORDS = CROSS SECTION ANGULAR DISTRIBUTION HYPERON PRODUCTION HYDROGEN REGENERATION AMPLITUDE WEAK INTERACTION MEASUREMENT
COMPOUND KEY WORDS = HYPERON PRODUCTION HYDROGEN REGENERATION AMPLITUDE

....
....

(TABLE 1)

LABORATORY BEAM MOMENTUM = .59 +- .05 GEV/C.

REACTION	MILLIBARNS		NO. EVENTS
KOL PROTON →			
PROTON KOS	1.08 +-	.26 (1)	22
LAMBDA PI+	1.02	.23 (1)	36
SIGMA0 PI+	.33	.13 (1)	12
LAMBDA PI+ PI0	.07	.03 (1)	
SIGMA- PI+ PI+	.03	.02 (2)	2

(1) THE CROSS SECTIONS ARE RECALCULATED BY READER USING UP-DATED KOL LIFE TIME 5.17X10**(-8)SEC.
(2) THE CROSS SECTIONS ARE RECALCULATED BY READER USING UP-DATED KOL LIFE TIME 5.17X10**(-8)SEC. THE STATISTICAL ERROR IS CALCULATED BY READER.

DIFFERENTIAL CROSS SECTION FOR KOL PROTON + LAMBDA PI+. (FIGURE 5)

LABORATORY BEAM MOMENTUM = .59 +- .05 GEV/C.
NUMBER OF EVENTS = 36.

THESE DATA WERE READ FROM A GRAPH

COS(THETA) MIN	MAX	D-SIGMA/D-COS(THETA) MB [1]		NO. EVENTS
-1.0	-.9	.3	+- .3	1
-.9	-.8	.3	.3	1
-.8	-.7	.0	.3	0
-.7	-.6	.3	.3	1
-.6	-.5	.6	.4	2
-.5	-.4	.0	.3	0
-.4	-.3	.6	.4	2
-.3	-.2	.3	.3	1
-.2	-.1	.6	.4	2
-.1	.0	.6	.4	2
.0	.1	1.4	.6	5
.1	.2	1.1	.6	4
.2	.3	.3	.3	1
.3	.4	.0	.3	0
.4	.5	1.1	.6	4
.5	.6	.3	.3	1
.6	.7	1.1	.6	4
.7	.8	1.4	.6	5
.8	.9	.0	.3	0
.9	1.0	.0	.3	0

THETA IS THE ANGLE THAT THE PI+ MAKES WITH THE BEAM IN THE GRAND C.M.

[1] COUNTS WERE MULTIPLIED BY .283 TO GET THESE.

DIFFERENTIAL CROSS SECTION FOR KOL PROTON + SIGMAO PI+. (FIGURE 5)

LABORATORY BEAM MOMENTUM = .59 +- .05 GEV/C.
NUMBER OF EVENTS = 12.

THESE DATA WERE READ FROM A GRAPH

COS(THETA) MIN	MAX	D-SIGMA/D-COS(THETA) MB [1]		NO. EVENTS
-1.0	-.8	.3	+- .2	2
-.8	-.6	.4	.2	3
-.6	-.4	.0	.1	0
-.4	-.2	.0	.1	0
-.2	.0	.1	.1	1
.0	.2	.0	.1	0
.2	.4	.3	.2	2
.4	.6	.0	.1	0
.6	.8	.3	.2	2
.8	1.0	.3	.2	2

THETA IS THE ANGLE THAT THE PI+ MAKES WITH THE BEAM IN THE GRAND C.M.

[1] COUNTS WERE MULTIPLIED BY .137 TO GET THESE.

DIFFERENTIAL CROSS SECTION FOR KOL PROTON + PROTON KOS. (FIGURE 38)

LABORATORY BEAM MOMENTUM = .59 +- .05 GEV/C.

THE ANGULAR DISTRIBUTION HAS BEEN EXTRAPOLATED AS A CONSTANT FOR THE FORWARD AND BACKWARD REGIONS IN ORDER TO OBTAIN THE NORMALIZATION. THE TOTAL NUMBER OF EVENTS IS 28.

THESE DATA WERE READ FROM A GRAPH

COS(THETA) MIN	MAX	D-SIGMA/D-COS(THETA) MB [1]		NO. EVENTS
-.6	-.4	.4	+- .3	2
-.4	-.2	.6	.5	3
-.2	.0	.4	.3	2
.0	.2	.6	.3	3
.2	.4	[illegible]	.3	2
.4	.6	.8	.4	4
.6	.8	[illegible]	.3	3
.8	.9	.4	.3	2

THETA IS THE ANGLE THAT THE KOS MAKES WITH THE BEAM IN THE GRAND C.M.

[1] COUNTS WERE MULTIPLIED BY .190 TO GET THESE.

8 KO2 P INTERACTIONS AT LOW MOMENTUM. (PHYS. REV. LETTERS 17, 599 (1966))

J.A.KADYK, Y.OREN, G.GOLDHABER, S.GOLDHABER, G.H.TRILLING (U.C. LAWRENCE RAD. LAB., BERKELEY, CALIF., USA)

ABSTRACT AN ANALYSIS IS GIVEN OF ABOUT 1200 KO2 P INTERACTIONS OF THE TYPES LAMBDAO PI+, SIGMAO PI+, AND KOL P AT A MEAN KO2 MOMENTUM OF 300 MEV/C. THE RELATION BETWEEN THESE REACTIONS AND THE SCATTERING LENGTHS FROM K+ AND K- EXPERIMENTS IS DISCUSSED, AND A SUBSTANTIAL P WAVE IS REPORTED IN THE LAMBDAO PI+ REACTION.

ARTICLE READ BY FUMIYO UCHIYAMA IN 9/71, AND VERIFIED BY JAMES S. LOOS.
BEAM IS KOL ON PROTON AT .3 GEV/C.
THIS EXPERIMENT USES THE LRL 25 IN. HYDROGEN BUBBLE CHAMBER.
GENERAL COMMENTS ON THIS ARTICLE
 1 WAITING FOR THE PUBLICATION WITH HIGHER STATISTICS.
 2 R(K)---BISWAS RATIO ; E(K)---HYPERON RATIO ; K---KOL MOMENTUM IN MEV/C R(0-200)=0.19+-0.03,R(200-250)=0.25+-0.04, R(250-300)=0.35+-0.05,R(300-400)=0.40+-0.05,R(>400)=0.55+-0.1 , E(0-200)=0.35+-0.03,E(200-250)=0.34+-0.03, E(250-300)=0.32+-0.04,E(300-400)=0.34+-0.04,E(>400)=0.41+-0.06. TAKEN FROM TABLE I PAGE 601.

KEY WORDS = ANGULAR DISTRIBUTION HYPERON PRODUCTION BISWAS RATIO PARTIAL WAVE ANALYSIS
COMPOUND KEY WORDS = HYPERON PRODUCTION HYPERON RATIO

....

DIFFERENTIAL CROSS SECTION FOR KOL PROTON - LAMBDA PI+. (FIGURE 3)

LABORATORY BEAM MOMENTUM = .16 GEV/C (MEAN VALUE).
NUMBER OF EVENTS = 128.

THESE DATA WERE READ FROM A GRAPH

COS(THETA) MIN	MAX	NO. EVENTS
-1.0	-.8	19
-.8	-.6	19
-.6	-.4	20
-.4	-.2	14
-.2	.0	16
.0	.2	8
.2	.4	13
.4	.6	6
.6	.8	9
.8	1.0	9

THETA IS THE ANGLE THAT THE LAMBDA MAKES WITH THE BEAM IN THE GRAND C.M.

....

DIFFERENTIAL CROSS SECTION FOR KOL PROTON - LAMBDA PI+. (FIGURE 3)

LABORATORY BEAM MOMENTUM = .225 GEV/C (MEAN VALUE).
NUMBER OF EVENTS = 130.

THESE DATA WERE READ FROM A GRAPH

COS(THETA) MIN	MAX	NO. EVENTS
-1.0	-.8	23
-.8	-.6	13
-.6	-.4	26
-.4	-.2	13
-.2	.0	11
.0	.2	10
.2	.4	7
.4	.6	5
.6	.8	3
.8	1.0	10

THETA IS THE ANGLE THAT THE LAMBDA MAKES WITH THE BEAM IN THE GRAND C.M.

....

DIFFERENTIAL CROSS SECTION FOR KOL PROTON - LAMBDA PI+. (FIGURE 3)

LABORATORY BEAM MOMENTUM = .275 GEV/C (MEAN VALUE).
NUMBER OF EVENTS = 80.

THESE DATA WERE READ FROM A GRAPH

COS(THETA) MIN	MAX	NO. EVENTS
-1.0	-.8	13
-.8	-.6	17
[illegible]	-.4	12
-.4	-.2	19
-.2	.0	7
.0	.2	2
.2	.4	4
.4	.6	4
.6	.8	2
.8	1.0	2

THETA IS THE ANGLE THAT THE LAMBDA MAKES WITH THE BEAM IN THE GRAND C.M.

....

DIFFERENTIAL CROSS SECTION FOR KOL PROTON - LAMBDA PI+. (FIGURE 3)

LABORATORY BEAM MOMENTUM = .34 GEV/C (MEAN VALUE).
NUMBER OF EVENTS = 90.

THESE DATA WERE READ FROM A GRAPH

COS(THETA) MIN	MAX	NO. EVENTS
-1.0	-.8	18
-.8	-.6	25
-.6	-.4	10
-.4	-.2	11
-.2	.0	2
.0	.2	9
.2	.4	4
.4	.6	4
.6	.8	4
.8	1.0	3

THETA IS THE ANGLE THAT THE LAMBDA MAKES WITH THE BEAM IN THE GRAND C.M.

DIFFERENTIAL CROSS SECTION FOR KOL PROTON + LAMBDA PI+. [FIGURE 3]

LABORATORY BEAM MOMENTUM = .46 GEV/C (MEAN VALUE).
NUMBER OF EVENTS = 53.

THESE DATA WERE READ FROM A GRAPH

COS(THETA) MIN	MAX	NO. EVENTS
-1.0	-.8	20
-.8	-.6	12
-.6	-.4	5
-.4	-.2	5
-.2	.0	6
.0	.2	3
.2	.4	-0
.4	.6	-0
.6	.8	1
.8	1.0	7

THETA IS THE ANGLE THAT THE LAMBDA MAKES WITH THE BEAM IN THE GRAND C.M.

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9 MULTICHANNEL PHASE-SHIFT ANALYSIS OF KBAR N INTERACTION IN THE REGION 0 TO 550 MEV/C. [PHYS. REV. LETTERS 19, 1074 (1967)]

J.K.KIM (YALE UNIV., NEW HAVEN, CONN., USA)

THIS IS AN ANALYSIS OF PREVIOUSLY PUBLISHED DATA.

ARTICLE READ BY FUMIYO UCHIYAMA IN 9/71, AND VERIFIED BY JAMES S. LOOS.
BEAM NO. 1 IS KOL ON PROTON FROM .0 TO .5 GEV/C.
NO. 2 IS K- ON PROTON FROM .0 TO .5 GEV/C.
THIS EXPERIMENT USES BUBBLE CHAMBERS.
GENERAL COMMENTS ON THIS ARTICLE
1 A PHASE SHIFT ANALYSIS IS PERFORMED FOR THE DATA OBTAINED BY WATSON, ET AL.,(PHYS. REV. 131, 2248 (63)) AND ADYK, ET AL. (PHYS. REV. LETTERS 17,599 (66)), USING THE MULTICHANNEL EFFECTIVE RANGE PARAMETRIZATION OF ROSS AND SHAW.
KEY WORDS + PARTIAL WAVE ANALYSIS

NO DATA PUNCHED FOR THIS ARTICLE

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10 ANOMALOUS REGENERATION OF KOL MESONS FROM KO2 MESONS. [PHYS. REV. 132, 2285 (1963)]

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R.ADAIR, B.MUSGRAVE, F.T.SHIVELY (YALE UNIV., NEW HAVEN, CONN., USA)

ABSTRACT A BEAM OF 1.0-BEV/C KO2 MESONS PASSING THROUGH LIQUID HYDROGEN IN A BUBBLE CHAMBER WAS SEEN TO GENERATE KO1 MESONS WITH THE MOMENTUM AND DIRECTION OF THE ORIGINAL BEAM. THE INTENSITY OF KO1 PRODUCTION WAS FAR GREATER THAN THAT ANTICIPATED FROM CONVENTIONAL MECHANISMS, AND THE SUGGESTION IS MADE THAT THE KO1 MESONS ARE PRODUCED BY COHERENT REGENERATION RESULTING FROM A NEW WEAK LONG-RANGE INTERACTION BETWEEN PROTONS AND K MESONS.

ARTICLE READ BY JAMES S. LOOS IN 9/71, AND VERIFIED BY FUMIYO UCHIYAMA.
BEAM IS KOL ON PROTON FROM .7 TO 1.3 GEV/C.
THIS EXPERIMENT USES A HYDROGEN BUBBLE CHAMBER. A TOTAL OF 90000 PICTURES ARE REPORTED ON.
KEY WORDS + CROSS SECTION DIFFERENTIAL CROSS SECTION HYDROGEN REGENERATION AMPLITUDE COHERENT
COMPOUND KEY WORDS + HYDROGEN REGENERATION AMPLITUDE

DIFFERENTIAL CROSS SECTION FOR KOL PROTON + PROTON KOS. [FIGURE 2]

LABORATORY BEAM MOMENTUM = 1.0 +- .3 GEV/C.
NUMBER OF EVENTS = 47.

THESE DATA WERE READ FROM A GRAPH

COS(THETA) MAX	MIN	D-SIGMA/D-OMEGA MB/SR	NO. EVENTS
.95	.68	.50 +- .13	15
.68	.33	.25 .08	10
.33	.00	.25 .08	10
.00	-.33	.15 .06	5
-.33	-.68	.18 .07	7

THETA IS THE ANGLE THAT THE KOS MAKES WITH THE BEAM IN THE GRAND C.M.

CROSS SECTION FOR KOL PROTON + PROTON KOS. [1]

THIS IS DERIVED BY THE READER FROM FIG. 2. THE STATISTICAL ERROR IS BASED ON 47 OBSERVED EVENTS.

LABORATORY BEAM MOMENTUM GEV/C	MILLIBARNS	NO. EVENTS
1.0 +- .3	2.7 +- .4	47

[1] CALCULATED BY US FROM DATA IN THIS ARTICLE.

DIFFERENTIAL CROSS SECTION FOR KOL PROTON + PROTON KOS. [PAGE 2285]

LABORATORY BEAM MOMENTUM = 1.0 +- .3 GEV/C.

THETA DEGREES	D-SIGMA/D-OMEGA MB/SR
0.[1]	.67 +- .17

THETA IS THE ANGLE THAT THE KOS MAKES WITH THE BEAM IN THE GRAND C.M.

[1] EXTRAPOLATED POINT.

11 KO INTERACTIONS. (INT'L. CONF. ON ELEM. PARTICLES, AIX-EN-PROVENCE, 235 (1961))

D.LUERS, I.S.MITTRA, W.J.WILLIS, S.S.YAMAMOTO (BROOKHAVEN NAT. LAB., UPTON, L.I., N. Y., USA)

ARTICLE READ BY FUMIYO UCHIYAMA IN 9/71, AND VERIFIED BY JAMES S. LOOS.
BEAM IS KOL ON PROTON FROM .20 TO .65 GEV/C.
THIS EXPERIMENT USES THE BNL 20 IN. HYDROGEN BUBBLE CHAMBER.
KEY WORDS = CROSS SECTION HYPERON PRODUCTION BISWAS RATIO RATIO
COMPOUND KEY WORDS = *HYPERON PRODUCTION HYPERON RATIO*

* * *

CROSS SECTION FOR KOL PROTON = SIGMAO PI+. (FIGURE 1)
NUMBER OF EVENTS = 36.

THE CROSS SECTIONS ARE RECALCULATED BY READER USING UP-DATED KOL LIFE TIME 5.17X10**(-8)SEC.

THESE DATA WERE READ FROM A GRAPH

LABORATORY BEAM MOMENTUM GEV/C	MILLIBARNS
.225 + .075 - .025	3.6 +- 1.5
.360 + .080 - .060	3.0 .8
.500 + .150 - .060	2.1 .5

* * *

CROSS SECTION FOR KOL PROTON = LAMBDA PI+. (FIGURE 1)
NUMBER OF EVENTS = 27.

THE CROSS SECTIONS ARE RECALCULATED BY READER USING UP-DATED KOL LIFE TIME 5.17X10**(-8)SEC.

THESE DATA WERE READ FROM A GRAPH

LABORATORY BEAM MOMENTUM GEV/C	MILLIBARNS
.225 + .075 - .025	3.8 +- 1.6
.360 + .080 - .060	1.5 .5
.500 + .150 - .060	2.1 .5

* * *

CROSS SECTION FOR KOL PROTON = PROTON KOS. (FIGURE 1)
NUMBER OF EVENTS = 48.

THE CROSS SECTIONS ARE RECALCULATED BY READER USING UP-DATED KOL LIFE TIME 5.17X10**(-8)SEC.

THESE DATA WERE READ FROM A GRAPH

LABORATORY BEAM MOMENTUM GEV/C	MILLIBARNS
.225 + .075 - .025	7.5 +- 2.4
.360 + .080 - .060	3.4 .7
.500 + .150 - .060	2.8 .5

* * *

12 INTERACTIONS OF NEUTRAL K MESONS IN HYDROGEN. (PHYS. REV. D 3, 2553 (1971))

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ABSTRACT THE REACTION PI- + P = LAMBDA + KO IN THE 72-IN. HYDROGEN CHAMBER WAS USED TO PRODUCE 7220 KO MESONS ASSOCIATED WITH A VISIBLE DECAY LAMBDA = P + PI-. THE TIME DEPENDENCE AND ABSOLUTE YIELD OF THE SUBSEQUENT STRONG INTERACTIONS OF KO AND KBARO IN HYDROGEN WERE USED TO DETERMINE ALL THE PARAMETERS OF THE NEUTRAL K SYSTEM, WITHOUT THE ASSUMPTION OF CPT INVARIANCE OR OTHER ASSUMPTIONS ABOUT THE WEAK INTERACTIONS OF NEUTRAL K'S. FROM THE TIME DISTRIBUTION OF 59 EVENTS OF THE TYPE KBARO + P = HYPERON, WE FIND THE MAGNITUDE OF THE KOS-KOL MASS DIFFERENCE. WE THEN DETERMINE THE MIXING PARAMETERS P,Q,P',Q' OF THE NEUTRAL K SYSTEM BY MEANS OF THE ABSOLUTE YIELD OF 11 CHARGE EXCHANGE EVENTS KO + P = K+ + N AND THE ABSOLUTE YIELD OF 49 TWO-BODY INTERACTIONS, KBARO + P = HYPERON + PION. THE RESULTS ARE CONSISTENT WITH CPT INVARIANCE AND WITH VALUES OF THE MIXING PARAMETERS DETERMINED BY MEANS OF WEAK INTERACTIONS. WE FIND THE BISWAS RATIO R IDENTICAL TO SIGMA(K(L)P = K(S)P) / SIGMA(K(L)P = HYPERON) TO BE R = 0.41 +- 0.13 AVERAGED OVER K(L) MOMENTA FROM ABOUT 200 TO 600 MEV/C. THIS AGREES WITH SOLUTION I OF KIM AND WITH THE RESULTS OF KADYK, ET AL. OUR ABSOLUTE YIELDS FOR KBARO + P = HYPERON + PION ARE IN GOOD AGREEMENT WITH THE PREDICTIONS OF CHARGE *INDEPENDENCE AND THE MEASURED DATES FOR* K- + P = HYPERON + PION. FOR THE FRONT-BACK ASYMMETRY OF THE LAMBDA IN KBARO + P = LAMBDA + PI+, WE FIND (F-B)/(F+B) = -0.48 +- 0.18, INDICATING THAT THE P WAVE CANNOT BE NEGLECTED RELATIVE TO THE S WAVE IN OUR MOMENTUM RANGE.

CLOSELY RELATED REFERENCES
THIS ARTICLE SUPERSEDES UCRL 20112.

ARTICLE READ BY FUMIYO UCHIYAMA AND JAMES S. LOOS IN 7/71, AND VERIFIED BY JAMES S. LOOS.
BEAM NO. 1 IS KOBAR ON PROTON FROM .0 TO .6 GEV/C.
NO. 2 IS KO ON PROTON FROM .0 TO .6 GEV/C.
NO. 3 IS KOL ON PROTON FROM .0 TO .6 GEV/C.
THIS EXPERIMENT USES THE LRL 72 IN. HYDROGEN BUBBLE CHAMBER. A TOTAL OF 390000 PICTURES ARE REPORTED ON.
KEY WORDS = CROSS SECTION HYPERON PRODUCTION BISWAS RATIO FRONT BACK ASYMMETRY
COMPOUND KEY WORDS = HYPERON PRODUCTION

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(TABLE 2)
LABORATORY BEAM MOMENTUM = .385 (+) .215 (-) .285 GEV/C.

REACTION	*MILLIBARNS*		*NO. EVENTS*
KOL PROTON =			
LAMBDA PI+	5.40	1.21	22
SIGMAO PI+	3.50	.94	18
SIGMA+ PIO	1.94	.80	9
LAMBDA PI+ + SIGMAO PI+ + SIGMA+ PIO + LAMBDA PI+ PIO + SIGMA+ PI+ PI-	12.18	1.87	59
PROTON KOS	5.04 +-	1.30	23

CROSS SECTION FOR KOL PROTON = NEUTRON K+. (PAGE 2559)

CPT INVARIANCE IS ASSUMED TO OBTAIN THIS CROSS SECTION

LABORATORY BEAM MOMENTUM GEV/C	MILLIBARNS	NO. EVENTS
.527 + .373 - .527	1.61 +- .72	11

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13 MEASUREMENTS OF TOTAL CROSS SECTIONS FOR K02 MESONS ON PROTONS AND SELECTED NUCLEI FROM 168 TO 343 MEV/C AND MEASUREMENT OF THE K02 MEAN LIFE. (PHYS. REV. 169, 1045 (1968))

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ABSTRACT WE HAVE MEASURED K02-P TOTAL CROSS SECTIONS FOR K02 LABORATORY MOMENTA BETWEEN 168 AND 343 MEV/C. FROM THESE DATA WE HAVE DETERMINED THE ISOTOPIC SPIN-1 KBAR N S-WAVE SCATTERING LENGTH TO BE (0.00 +- 0.14) +- I(0.62 +- 0.) F. THIS IS IN FAIR AGREEMENT WITH PREVIOUS DETERMINATIONS. WE HAVE ALSO MEASURED K02-NUCLEAR TOTAL CROSS SECTIONS FOR SEVEN SPECIES OF NUCLEI THAT SPAN THE PERIODIC TABLE, IN THE SAME MOMENTUM RANGE, TO STATISTICAL ACCURACIES OF TYPICALLY A FEW PERCENT IN EACH OF ELEVEN MOMENTUM INTERVALS WITHIN THE RANGE. THE DATA AT THE HIGHEST MOMENTUM DO NOT OBEY AN A2/3 LAW. WE HAVE ALSO MEASURED THE ... MEAN LIFE TO BE (5.15 +- 0.14) * 10**-8 SEC. THIS IS IN AGREEMENT WITH PREVIOUS RESULTS AND REPRESENTS AN IMPROV... IN STATISTICAL ACCURACY BY ABOUT A FACTOR OF 3. WE HAVE ALSO STUDIED K02 AND GAMMA PRODUCTION AT 93 DEGREES BY 2.8 GEV PROTONS ON 1.5-IN. PLATINUM. THE EXPERIMENT WAS PERFORMED USING A SCINTILLATION-COUNTER K02 DETECTOR. KINEMATIC IDENTIFICATION OF EACH K02 PARTICLE WAS MADE USING A TIME-OF- FLIGHT METHOD--THE BUNCHED TIME STRUCTURE OF THE INTERNAL PROTON BEAM OF THE PRINCETON-PENNSYLVANIA ACCELERATOR WAS USED TO DETERMINE K02 PRODUCTION TIMES, AND AN ELECTRONIC CHOPPING TECHNIQUE WAS USED TO ELIMINATE UNWANTED PROTON BUNCHES. DEPENDING UPON BEAM CONDITIONS, BETWEEN 10**3 AND 10**4 USEFUL K02 MESONS PER HOUR WERE DETECTED WITH MOMENTUM RESOLUTION OF A FEW PERCENT. IN CONJUNCTION WITH THE TIMING CALIBRATION OF THE SYSTEM, WE HAVE MADE A DIRECT VELOCITY MEASUREMENT OF THE RELATIVISTIC LIMITING SPEED FOR ELECTRONS. THE RESULT IS (1 -BETA(MAX)) = 0.005 +- 0.005.

ARTICLE READ BY JAMES S. LOOS IN 9/71, AND VERIFIED BY FUMIYO UCHIYAMA.
BEAM IS KOL ON PROTON FROM .168 TO .343 GEV/C.
THIS EXPERIMENT USES COUNTERS.
KEY WORDS = TOTAL CROSS SECTION NUCLEAR SCATTERING LENGTH WEAK INTERACTION MEASUREMENT
COMPOUND KEY WORDS - TOTAL CROSS SECTION NUCLEAR CROSS SECTION

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KOL PROTON TOTAL CROSS SECTION. (TABLE 9)

LABORATORY BEAM MOMENTUM GEV/C		MILLIBARNS (1,2)	
.168 +-	.004	70.1 +-	15.0
.177	.005	50.1	9.7
.187	.005	50.2	9.2
.197	.005	51.5	7.8
.209	.007	41.9	6.1
.223	.007	38.6	6.2
.239	.009	46.4	5.5
.258	.010	33.7	4.6
.281	.013	31.0	3.9
.308	.014	30.4	3.5
.343	.021	26.0	2.9

(1) ERRORS ARE STATISTICAL ONLY.
(2) PLUS POSSIBLE SYSTEMATIC ERROR OF +- 4 PER CENT.

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Section IV.

INDICES AND MISCELLANEOUS INFORMATION

K^0_L -nucleon experiments in progress

We list for the convenience of the reader the following experiments, which are either being run or are being analyzed and for which publication may be forthcoming in the near future.

Institution	Spokesman's name	P_{beam} (GEV/c)	Target	Technique	Interactions studied
SLAC[a]	D. W. G. S Leith	1-10	p	HBC	Two-body, quasi-two-body, and multiparticle production
DESY, Heidelberg, Tel-Aviv	E. Burkhardt	0.7-2.5	p	HBC	Two-body and quasi two-body emphasis on S=-1
Serpukhov, Dubna[c]	I. A. Savin	10-40	p	WSPK	Magnitude and phase of coherent regeneration, $K^0_L p \to K^0_S p$
Yale	H. D. Taft	1-10	d	DBC	Coherent regeneration of K^0_S, coherent production of K^* and Q mesons
Carnegie-Mellon, ANL, Iowa State	R. M. Edelstein	0.5-1.5	p	WSPK	$K^0_L p \to K^+ n$, $\|t\| < 0.25$ $(GeV/c)^2$
LRL[b]	J. A. Kadyk	0.1-0.5	p	HBC	I=1, S=-1 final state
Pittsburgh, Massachusetts, Northwestern, McGill	G. Engels	4-10	p	OSPK	Magnitude and phase of coherent regeneration, $K^0_L p \to K^0_S p$

[a] SLAC-PUB-823, November 1970.

[b] See reference 8 in this book for a partial report.

[c] Phys. Letters 38B, 452 (1972).

HBC: Hydrogen bubble chamber
WSPK: Wire spark chamber
DBC: Deuterium bubble chamber
OSPK: Optical spark chamber

Momentum Index

BEAM MOMENTUM	1ST AUTHOR	JOURNAL	VOLUME,PAGE	INSTITUTIONS	DETECTOR	YEAR PUBLISHED	REF.NR.
.160	KADYK	PRL	17 599	LRL	HBC	66	8
.168	SAYER	PR	169 1045	UMD PPPA	CNTR	68	13
.177	SAYER	PR	169 1045	UMD PPPA	CNTR	68	13
.187	SAYER	PR	169 1045	UMD PPPA	CNTR	68	13
.197	SAYER	PR	169 1045	UMD PPPA	CNTR	68	13
.209	SAYER	PR	169 1045	UMD PPPA	CNTR	68	13
.223	SAYER	PR	169 1045	UMD PPPA	CNTR	68	13
.225	LUERS	AIX CONF	235	BNL	HBC	61	11
.225	KADYK	PRL	17 599	LRL	HBC	66	8
.239	SAYER	PR	169 1045	UMD PPPA	CNTR	68	13
.258	SAYER	PR	169 1045	UMD PPPA	CNTR	68	13
.275	KADYK	PRL	17 599	LRL	HBC	66	8
.281	SAYER	PR	169 1045	UMD PPPA	CNTR	68	13
.300	BLUMENFELD	PL	29B 58	BNL	HBC	69	1
.308	SAYER	PR	169 1045	UMD PPPA	CNTR	68	13
.340	KADYK	PRL	17 599	LRL	HBC	66	8
.343	SAYER	PR	169 1045	UMD PPPA	CNTR	68	13
.360	LUERS	AIX CONF	235	BNL	HBC	61	11
.385	MEISNER	PR	D 3 2553	LRL UNC LRL	HBC	71	12
.460	KADYK	PRL	17 599	LRL	HBC	66	8
.500	LUERS	AIX CONF	235	BNL	HBC	61	11
.500	KIM	PRL	19 1074	YALE	HBCS	67	9
.527	MEISNER	PR	D 3 2553	LRL UNC LRL	HBC	71	12
.590	HAWKINS	PR	156 1444	YALE	HBC	67	7
.700	CHRISTENSO	PR	140 B 74	PRIN	SPRK	65	4
1.000	LEIPUNER	PR	132 2285	BNL YALE	HBC	63	10
1.400	CHRISTENSO	PR	140 B 74	PRIN	SPRK	65	4
1.450	BRODY	PRL	26 1050	SLAC	HBC	71	2
1.500	BRODY	PRL	26 1050	SLAC	HBC	71	2
1.650	BRODY	PRL	26 1050	SLAC	HBC	71	2
1.700	BRODY	PRL	26 1050	SLAC	HBC	71	2
1.900	BRODY	PRL	26 1050	SLAC	HBC	71	2
2.100	BRODY	PRL	26 1050	SLAC	HBC	71	2
2.300	BRODY	PRL	26 1050	SLAC	HBC	71	2
2.500	DARRIULAT	PL	33B 433	AACH CERN TORI	SPRK	70	5
2.500	BRODY	PRL	26 1050	SLAC	HBC	71	2
2.550	BRODY	PRL	26 1050	SLAC	HBC	71	2
2.700	BRODY	PRL	26 1050	SLAC	HBC	71	2
2.900	BRODY	PRL	26 1050	SLAC	HBC	71	2
3.000	BRODY	PRL	26 1050	SLAC	HBC	71	2
3.200	BRODY	PRL	26 1050	SLAC	HBC	71	2
3.500	DARRIULAT	PL	33B 433	AACH CERN TORI	SPRK	70	5
3.500	BRODY	PRL	26 1050	SLAC	HBC	71	2
3.600	BRODY	PRL	26 1050	SLAC	HBC	71	2
4.000	BRODY	PRL	26 1050	SLAC	HBC	71	2
4.500	DARRIULAT	PL	33B 433	AACH CERN TORI	SPRK	70	5
4.500	BRODY	PRL	26 1050	SLAC	HBC	71	2
4.600	BRODY	PRL	26 1050	SLAC	HBC	71	2
5.000	FIRESTONE	PRL	16 556	YALE BNL	HBC	66	6
5.500	BRODY	PRL	26 1050	SLAC	HBC	71	2
6.000	DARRIULAT	PL	33B 433	AACH CERN TORI	SPRK	70	5
6.000	BRODY	PRL	26 1050	SLAC	HBC	71	2
6.500	BUCHANAN	PL	37B 213	UCLA JHOP SLAC	SPRK	71	3
7.000	BRODY	PRL	26 1050	SLAC	HBC	71	2
7.500	BLUMENFELD	PL	29B 58	BNL	HBC	69	1
8.000	BRODY	PRL	26 1050	SLAC	HBC	71	2

Key Word Classification

Reference List

[All the references before January 1, 1972]

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