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## COMPILATION OF HIGH ENERGY PHYSICS REACTION DATA: INVENTORY OF THE PARTICLE DATA GROUP HOLDINGS 1980

G. C. Fox and F. R. Stevens  
Cal-Tech Particle Data Group  
California Institute of Technology  
Pasadena, California 91109, USA

B. J. Reed and F. D. Gook  
U. K. Particle Data Group  
University of Durham  
Durham City DH1 3LE, England

A. Rittenberg, M. S. Hutchinson, C. P. Horne, R. L. Kelly,  
F. E. Armstrong, D. R. Richards, T. G. Trippe, and G. F. Yost  
Berkeley Particle Data Group  
Lawrence Berkeley Laboratory  
Berkeley, California 94720, USA

R. G. Roberts  
U. K. Particle Data Group  
Rutherford and Appleton Laboratories  
Chilton, Didcot, Oxon. OX11 0QX, England

R. L. Crawford  
U. K. Particle Data Group  
University of Glasgow  
Glasgow G12 8QQ, Scotland



LAWRENCE BERKELEY LABORATORY  
University of California

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G. C. Fox and P. R. Stevens\*  
Cal-Tech Particle Data Group  
California Institute of Technology  
Pasadena, California 91125, USA

B. J. Read and F. D. Gault  
U. K. Particle Data Group  
University of Durham  
Durham City DH1 3LE, England

A. Rittenberg, M. S. Hutchinson, †C. P. Horne, R. L. Kelly,  
F. E. Armstrong, D. R. Richards, †T. G. Trippe, and G. F. Yost  
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Rutherford and Appleton Laboratories  
Chilton, Didcot, Oxon. OX11 0QX, England

R. L. Crawford  
U. K. Particle Data Group  
University of Glasgow  
Glasgow G12 8QQ, Scotland

\*Present address: Hughes Aircraft Co., Culver City, CA 90230, USA  
†Present address: Stanford University, Stanford, CA 94305, USA

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ABSTRACT

We present a compilation of reaction data taken from experimental high energy physics journal articles, reports, preprints, theses, and other sources. Listings of all the data are given, and the data points are indexed by reaction and momentum, as well as by their source document. Much of the original compilation was done by others working in the field. The data presented also exist in the form of a computer-readable and searchable database; primitive access facilities for this database are available.

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**PART I**  
**DESCRIPTIVE TEXT**

#### A. INTRODUCTION

The Berkeley Particle Data Group (BPDG) began publishing compilations of reaction (scattering) data in 1969. In the ensuing years, several groups, including the BPDG, have published a considerable number of reaction-data compilations. These compilations, however, have generally not been able to keep up with the explosive growth in volume and variety of reaction data.

In 1971, in an attempt to consolidate and standardize the results of many compilations and make it more likely that such efforts would continue, the BPDG began studying how to organize all reaction data in a comprehensive manner. In the years since then, an expanded version of the Particle Data Group (including contingents from Cal-Tech and the United Kingdom) has designed and implemented, and is now utilizing on a limited basis, a unified system of encoding procedures and computer programs capable of handling most reaction data and related bibliographical information. Key elements of this system are a series of interrelated databases, powerful and flexible encoding languages,<sup>1</sup> a single generalized database management system for handling the data in all databases (the Berkeley Database Management System, BDMS<sup>2</sup>), and a system of specialized programs interfacing to BDMS which service users' needs such as graphics, fitting, generating special format reports, etc.

There are three main databases: The Document File contains bibliographic information and experiment descriptions for all experimental papers issued since 1969, and for some earlier papers (about 20,000 documents in all). The contents of this file, as of mid-1978, were published as LBL-90.<sup>3</sup> The Proposal File contains descriptions of all current, approved experiment proposals. Its contents were last published in mid-1980 as LBL-91 Revised.<sup>4</sup> The third file is the Reaction-Data File described in this report. While we plan to publish the contents of each database only periodically, we hope eventually to keep the databases themselves up-to-date on a steady-state basis.

This report contains Indices to and Listings of all reaction data so far entered into the Reaction-Data File. This compilation is, unfortunately, not complete or current in all areas, and has not been thoroughly checked. Nevertheless, it is by far the largest compilation of reaction data so far published; it contains in one place, in one uniform

presentation, data previously available only from different sources in differing formats. In a few areas, it contains new data, never before published. The main purpose of this report, however, is not the presentation of these data, but the announcement of this new reaction-data compilation effort. The motivation for publishing the reaction compilation in such an incomplete state is to solicit user response to this effort, both to help correct errors and omissions and also to suggest ways in which we can develop this system to be of maximum value to the user community. Even with substantially more manpower, we could not hope to encode the backlog of all old data, establish steady-state encoding of all new data, and provide services which one would hope to have. We expect user response to help guide us in establishing priorities in these areas. Our hope is to make the data in our databases directly and easily accessible to users (by either phone link or tape exchange), providing various support packages (e.g., graphics) to accomplish this goal; such direct access is already possible in a somewhat rudimentary fashion.

## B. DATA COVERAGE

### 1. Existing Compilations

The bulk of the data in the Reaction-Data File was obtained from existing compilations, both of the BPDG and of outside sources. Some of these compilations have appeared in print and some have not. In the Data Listings (on microfiche), most data sets are labeled by the name of the compilation from which the data were obtained. The list of such compilations, and guides thereto, is as follows (the compilation short code, and, where different, the label used on the fiche for the compilation, is given in square brackets):

O. Benary et al., 'A Compilation of YN Reactions,' UCRL-20000 YN (Jan. 1970) [BENARY 70B, referred to on fiche with special code PDG3].

O. Benary et al., 'NN and ND Interactions Above 0.5 GeV/c - A Compilation,' UCRL-20000 NN (Aug. 1970) [BENARY 70, referred to on fiche with special code PDG3].

E. Bracci et al., 'Compilation of Cross Sections. I -  $\pi^+$  and  $\pi^-$  Induced Reactions,' CERN/MERA 72-1 (May 1972) [BRACCI 72].

E. Bracci et al., 'Compilation of Cross Sections. II -

- $K^-$  and  $K^+$  Induced Reactions," CERN/HERA 72-2 (Oct. 1972) [BRACCI 72B].
- E. Bracci et al., "Compilation of Cross Sections. III - p and  $\bar{p}$  Induced Reactions," CERN/HERA 73-1 (June 1973) [BRACCI 73].
- J. Bystricky et al., "Elastic Nucleon-Nucleon Scattering Data 270-3000 MeV," CEA-N-1547-E (1972) [BYSTRICKY 72].
- D. M. Chew et al., " $n^+p$ ,  $n^+n$ , and  $n^+d$  Interactions - A Compilation," LBL-53 (May 1973) [CHEW 73B].
- R. L. Crawford, unpublished  $\bar{N}N$  data compilation [referred to on fiche as CRAWFORD 77, although never published; superseded by Glasgow photoproduction compilation (see 'New Compilations' section immediately below)].
- J. E. Enstrom et al., " $\bar{N}N$  and  $\bar{p}D$  Interactions - A Compilation," LBL-58 (May 1972) [ENSTROM 72, referred to on fiche with special code PDG3].
- G. C. Fox et al., "Compilation of Elastic Data," UCRL-20001 (Jan. 1970), and unpublished data compilation [referred to on fiche with special codes FOX1, FOX2, FOX5-FOX8, AND LST1-LST7].
- G. Giacomelli, "A Compilation of Pion-Nucleon Scattering Data," CERN/HERA 69-1 (1969) [GIACOMELLI 69, referred to on fiche with special codes FOX3 and FOX4].
- M. L. Gupta et al., "A Computerized Compilation of  $K^-\bar{N}$  Scattering Data for Two Body Final States up to 3.0 GeV/C," VPURNA-2-70 (1970) [GUPTA 70].
- J. Kasman, unpublished inclusive data compilation.
- R. L. Kelly, unpublished  $n\bar{N}$  data compilation.
- C. Lovelace et al., " $n\bar{N}$  Two-Body Scattering Data: I. A User's Guide to the Lovelace-Almehed Data Tape," LBL-63 (Apr. 1973), and unpublished data compilation [LOVELACE 73, incorrectly referred to on fiche as LOVELACE 71].
- M. H. MacGregor et al., "(p,p) and (n,p) Data Listings 0 to 750 Mev," UCRL-50426 (1968) [MACREGOR 68].
- L. R. Price et al., "A Compilation of  $K^-\bar{N}$  Reactions," UCRL-20000  $K^-\bar{N}$  (Sept. 1969) [PRICE 69, referred to on fiche with special code PDG3].
- J. L. Schonfelder, "A Data-handling System for  $\bar{N}N$  Scattering Data," Univ. of Birmingham, England preprint (1972) [referred to on fiche as SCHONFELDER 70?].
- F. Uchiyama et al., " $K^0_N$  Interactions - A Compilation," LBL-55 (Mar. 1972) [UCHIYAMA 72].
- F. Wagner, unpublished data compilation [referred to on fiche as WAGNER 71B, although never published].

Each of these compilations has different standards and different coverage as to data types and period of time. No effort has yet been made to remove duplication due to the same data appearing in different compilations. Most data have not been checked by us against the original source documents and so should be used with care.

### 1. New Compilations

Data from five ongoing, steady-state compilations being carried out by the U. K. contingent of the PDG are also included. These are: 1) the Durham 2-body compilation; 2) the Glasgow photoproduction compilation; 3) the Rutherford hadron-induced inclusive compilation; 4) the Rutherford lepton-induced inclusive compilation; and 5) the Durham  $e^+e^-$  compilation. While the encoding of data by this group is an ongoing process, so that the Reaction-Data File is always current in these areas, the Listings included here cover only the period up to late 1979.

### 3. Limitations

Again we repeat that data from the present compilation should be used with great care. The data presented here were not checked systematically against the source documents by us.

In no area is coverage complete and in only a few cases is it up-to-date. For certain classes of data, there is considerable duplication and thus the possibility of inconsistencies exists.

The handling of systematic errors is especially uneven. The five steady-state compilations mentioned above quote them uniformly and unambiguously. Most older compilations do not quote them at all, and some quote them ambiguously. Thus, except in the case of the steady-state compilations, the systematic errors should be checked out against the source document. Another problem is the handling of binned data; for instance, a  $d\sigma/dt$  measurement in a  $t$  bin between 0 and  $-.05$  (GeV/c)<sup>2</sup> will in some compilations be recorded as a measurement at  $t = -.025$  (GeV/c)<sup>2</sup> without indication of the averaging. Although most data have been recorded in the form in which they were presented in the original papers, some have been converted into a different form, e.g., from  $d\sigma/dQ$  to  $d\sigma/dt$ , before being compiled.

Although the accelerator and detector used by an experiment are sometimes given in comments in this compilation, this information is

spotty; for a more complete specification of such details, see LBL-90.<sup>3</sup>

#### C. REQUESTS FOR DATA

Within reason, we will try to answer personal requests for data. Although initially we would expect to send printed listings in response to such requests, as time goes on we want to encourage more and more users to access our databases directly. For physicists in Britain, or at CERN or DESY, this has been possible since 1978, using the U. K. SRC network.<sup>5</sup> It is hoped that a telephone link will be available soon in the U. S. See the list of contacts below if you are interested in this kind of access.

We also have on hand hard copies of almost all papers for which we have encoded the data. In those cases where the source document is a preprint and is no longer generally available, we may be able to provide a copy upon request. Our limited budget does not allow us to distribute copies of published papers.

We welcome corrections to any of the data in the Listings. We would further like to encourage experimenters to send us data that are too voluminous to publish in journals or preprints.

For any of these matters concerning the Reaction-Data File, please contact one of the following:

Dr. Geoffrey C. Fox  
Physics Department  
California Institute of Technology  
Pasadena, CA 91125, USA  
Phone: (213) 356-6673

Dr. Brian J. Read  
Department of Physics  
University of Durham  
South Road  
Durham City DH1 3LE, England  
Phone: (385) 64971

Dr. Alan Rittenberg or Dr. Charles P. Horne  
Particle Data Group 50-308  
Lawrence Berkeley Laboratory  
Berkeley, CA 94720, USA  
Phone: (415) 486-5885 or FTS on-net 451-5885

#### D. USERS' GUIDE

The substantive information in this report is organized as follows: The Data Listings themselves are given only on microfiche, which accompany

this printed report as Part IV. All data from a given document are grouped together on the fiche, and the documents are ordered by their first author and year. Each Data Listing entry has some basic bibliographic information, comments, systematic error information (if encoded), and the actual data. For the most part, the format, notation, and particle, variable, and observable names are self-explanatory. However, for completeness, Vocabularies have been provided in PART III which explain the various names and abbreviations used; also, for those desiring more detailed knowledge of encoding conventions, the entire Reaction-Data File Encoding Manual has been put onto a fiche and is included with this report. Two Indices are provided to cross-reference the Data Listings; these Indices are described and presented in PART II.

#### E. LOCATING DATA IN THE DATA LISTINGS

The Data Listings, on fiche, are ordered alphabetically by the 'short code' of the document from which the data were extracted. The short code is a unique identifier assigned by us to each document. It is composed of the first author's last name, the year of issue, and a uniqueness letter or letters, if required (e.g., JONES 67). If there is more than one document with the same first author and the same issue date, the second short code would be given the letter B (e.g., JONES 67B). Since a short code must have no more than 16 characters, some long names are truncated. The short code is based on the first version of the document received (often the preprint), so the date of issue may be earlier than the date of journal publication, and in rare cases, the short code may not be based on the first author of the journal publication. All the short codes in this document should be identical to those in LBL-90.<sup>3</sup> However, we do have data from papers not yet entered into our LBL-90 database. These documents have a ? as the last character of their short codes. The bibliographical information in each record should be sufficient to locate the source document, whether or not it appeared in LBL-90.

In steady-state, all data from a given document would be encoded in one record in the database and would appear in one unit on the fiche. Here, however, because we have used data from many sources, and for other historical reasons, data from the same paper may be broken up into several units; however, these units will be contiguous on the fiche.

Two Indices have been provided to help locate data of interest:

The Short-Code/Reference Index: This Index lists the short codes and references of all documents represented in the compilation. Thus, if the first author of a document were known, either a priori or by use of the Reaction/Momentum Index described below, then this Index would be used to determine the journal or preprint reference, so that the actual paper could be located. The reference information may also be used to distinguish between different papers by the same author in the same year.

The Reaction/Momentum Index: This Index lists all reactions (and their momenta) for which data have been encoded. Thus, if data on a given reaction were desired, this Index would be used. For each reaction, every momentum at which data have been encoded is listed, and, for each reaction/momenta pair, the short codes for papers containing the relevant data are given. Beam momenta are always given as equivalent lab momentum (in GeV/c) for a stationary target, except for  $e^+e^-$  collisions, where the total center-of-mass energy in GeV is given instead. The Index is ordered as follows: in each reaction, the beam and target are given first, followed by the final state particles in a 'natural' order. Reactions are then ordered lexicographically, i.e., alphabetically by the first particle, or, if that is identical, by the second particle, etc.

The Data Listings and both Indices are preceded by 'Illustrative Keys,' giving details about the format of the presentations.

#### F. ACKNOWLEDGEMENTS

We would like to thank J. Gee for assisting with much of the data input and output at Cal-Tech; T. A. Lasinski and F. Uchiyama for participating in the early design stages of the Reaction-Data File language; and A. H. Rosemfeld for providing a great deal of inspiration at the beginning of this project.

REFERENCES

1. Particle Data Group, 'Particle Physics Data System Reaction-Data File Encoding Manual,' PDG-3200; Particle Data Group, 'Particle Physics Data System Document File Encoding Manual,' Particle Data Group, PDG-3100.
2. D. R. Richards, 'BDMS User's Manual,' LBL-4683 (Revision 1); D. R. Richards, 'BDMS Programmer's Manual,' LBL-4684.
3. C. P. Horne et al., 'An Indexed Compilation of Experimental High Energy Physics Literature,' LBL-90 (Sept. 1978).
4. C. G. Wohl et al., 'Compilation of Current High Energy Physics Experiments,' LBL-91 Revised (April 1980).
5. F. D. Gault et al., 'Guide to the Durham-Rutherford High Energy Physics Databases,' Second Edition, RL-79-094 (Dec. 1979).

**PART II  
INDICES**

SHORT-CODE/REFERENCE INDEX

This Index lists the short codes and references of all documents represented in this compilation. Thus, if the first author of a document were known, either a priori or by use of the Reaction/Momentum Index which follows, then this Index would be used to determine the journal or preprint reference, so that the actual paper could be located. The reference information may also be used to distinguish between different papers by the same author in the same year. The primary reference is given first, followed by all secondary (e.g., preprint) references. For more detailed bibliographic information than is given here, please refer to IBL-90, or, for post-1977 articles, contact the Berkeley Particle Data Group.

**ILLUSTRATIVE KEY**

DOCUMENT SHORT CODE - THE DATA FROM THIS DOCUMENT CAN BE FOUND IN THE DATA LISTINGS ON MICROFICHE	PRIMARY REFERENCE - SEE THE REFERENCE VOCABULARY FOR JOURNAL ABBREVIATIONS	SECONDARY REFERENCES(3) - SEE THE REFERENCE VOCABULARY FOR JOURNAL ABBREVIATIONS
BRAASSE 75	PL 108, 587	23, 6
BRAATENAC 54	PL 115, 917	23, 6
BRAAU 71	PL 27, 2485	23, 6
BRAAU 75	PL 895, 232	23, 6
BRAAUL 76	PL 639, 186	23, 6
BRAAUL 78B	PL 639, 184	23, 6
BRAAUL 77	PL 639, 253	23, 7
BRAAUW 70B	PL 82, 488	23, 7
BRAAUW 70C	PL 82, 1212	23, 7
BRAAUW 70E	PL 82, 703	23, 7
BRAAUW 730	PL 834, 42	23, 7
BRAAUW 75	PL 895, 485	23, 7
BRAUNSCHWEIG 66	PL 22, 305	23, 7
BRAUNSCHWEIG 68	PL 26, 405	23, 7
BRAUNSCHWEIG 70	EP 245, 272	23, 7
BRAUNSCHWEIG 70	EP 245, 251	23, 7
BRAUNSCHWEIG 71	EP 831, 157	23, 8
BRAUNSCHWEIG 73B	EP 831, 187	23, 8

**MICROFICHE LOCATION - FICHE NUMBER AND COLUMN WHERE THE DATA LISTINGS FOR THIS DOCUMENT BEGIN. AN ASTERISK MEANS THAT THIS DOCUMENT IS COMBINED WITH, AND ALPHABETIZED ACCORDING TO, ANOTHER DOCUMENT ON THE FICHE (USUALLY BECAUSE THE TWO DOCUMENTS SHARE SOME DATA).**

#### **SHORT-CODE/REFERENCE INDEX**

**SHORT-CODE/REFERENCE INDEX (CONT'D)**

#### **SHORT-CODE/REFERENCE INDEX (CONT'D)**

**SHORT-CODE/REFERENCE INDEX (CONT.)**

**SHORT-CODE/REFERENCE INDEX (CONT'D)**

REACTION/MOMENTUM INDEX

This Index lists all reactions for which data have been encoded. Thus, if data on a given reaction were desired, this Index would be used. For each reaction, every momentum at which data have been encoded is listed, and, for each reaction/momentum pair, the short codes for papers containing the relevant data are given. Beam momenta are always given as equivalent lab momentum (in GeV/c) for a stationary target, except for  $e^+e^-$  collisions, where the total center-of-mass energy in GeV is given instead.

The Index is ordered as follows: in each reaction, the beam and target are given first, followed by the final state particles in a 'natural' order. Reactions are then ordered lexicographically, i.e., alphabetically by the first particle (the beam), or, if that is identical, by the second particle (the target), etc., through all the final state particles. A list of all reactions appearing in the Index is given immediately following this discussion. The reaction numbers appearing in this list can be used to help locate the proper page in the full Index for the desired reaction, via the reaction number range given at the top of each page.

The particle names used in the reactions are given in the Particle Vocabulary in Part III of this report; these are generally the same names as used in the 'Review of Particle Properties.' However, some names, particularly those appearing in topological reactions, are somewhat ambiguous; e.g., the terms 'missing mass' and 'neutrals' are often used interchangeably. Another ambiguity arises in the case of reactions involving a deuteron target; some authors write the reaction as such (with two nucleons, one often a spectator, in the final state), while others write the reaction with a neutron target (and only one nucleon in the final state). Also, a reaction with a nuclear target might be encoded with the specific nucleus, such as BE, or with the generic name NUCLEUS if the exact nucleus is uncertain. For all of these reasons, and more, care should be exercised by the user when looking for a given reaction.

The syntax used for writing reactions is generally straightforward. As an example, the reaction  $\pi^- p \rightarrow \pi^- \Delta^+$  would be written as

$\Pi^- P \rightarrow \Pi^- \Delta L^+$ .

In this reaction, since no specific decay mode for the  $\Delta^+$  is indicated, it is understood that the measured quantity, e.g. the cross section, is for all decay modes, that is, for all  $\Delta^+$ . If the quantity measured applied only to a particular decay mode,  $\Delta^+_0$ , say, then the reaction would be written as



That is, angular brackets are used to indicate specific decay modes of the preceding particle. Also, sometimes a compound final state may have been detected; in this case, the two (or more) final states are written separated with a '+' (or '-' in the case of subtraction) surrounded by blanks; e.g.,



### ILLUSTRATIVE KEY

**INITIAL STATE OF THE REACTION**  
SEE THE PARTICLE VOCABULARY  
FOR NOMENCLATURE

CHINA, SHIJI --->

-MUTING

1.243-4, 22 ARMSTRONG 72  
1.09-4, 09 ARMSTRONG 72  
1.09-9, 51 HEDBERG 72  
3.70-1, 7, 8 CALDWELL 73  
4.07-1, 5, 4 CALDWELL 73  
6.36 EISBERG 70  
7.30 ALEXANDER 74E

DOCUMENT SHORT CODE: THE  
REFERENCE FOR THIS DOCUMENT  
CAN BE FOUND IN THE SHORT-  
CODE REFERENCE AND IN THE  
DATA LISTINGS ON MICROFICHE

**FINAL STATE OF THE REACTION**  
SEE THE PARTICLE VOCABULARY  
FOR NOMENCLATURE

-SF, SHIJI

-DMT PI+ PI-  
3.00 RAPO 77  
[ 6.36 ] EISBERG 70  
7.30 ALEXANDER 74E  
-DMT PI+ PI-  
7.30 ALEXANDER 74E

LAB MOMENTUM in GEV/C  
EXCEPT FOR  $\pi^+$  and  $\pi^-$   
TOTAL CENTER OF MASS  
ENERGY in GEV

**REACTION/MOMENTUM INDEX - LIST OF REACTIONS**

**REACTION/MOMENTUM INDEX - LIST OF REACTIONS (CONT'D)**

**REACTION/MOMENTUM INDEX = LIST OF REACTIONS (CONT'D)**

**REACTION/MOMENTUM INDEX - LIST OF REACTIONS (CONT'D)**

**REACTION/MENTUM INDEX - LIST OF REACTIONS (CONT'D)**

**REACTION/MOMENTUM INDEX - LIST OF REACTIONS (CONT'D)**

**REACTION/MOMENTUM INDEX - LIST OF REACTIONS (CONT'D)**

**REACTION/MOMENTUM INDEX - LIST OF REACTIONS (CONT'D)**

#### REACTION/MICENTUM INDEX

**REACTION/MOMENTUM INDEX (CONT'D)**

**REACTION/MOMENTUM INDEX (CONT'D)**

第10章

**REACTION/PRECIPITATION INDEX (CONT'D)**



**REACTION/POTENTIAL INDEX (CONT'D)**

**REACTION/MOMENTUM INDEX (CONT'D)**

第10章

**REACTION/MOMENTUM INDEX (CONT'D)**

**REACTION/MOMENTUM INDEX (CONT'D)**

暖通空调 65-79

**REACTION/MOMENTUM INDEX (CONT'D)**

**REACTION/MOMENTUM INDEX (CONT'D)**

1470 郭敬明

第二部分

**REACTION/POTENTIAL INDEX (CONT'D)**

**REACTION/MOMENTUM INDEX (CONT'D)**

第十一章

**REACTION/MOMENTUM INDEX (CONT'D)**

**REACTION/MOMENTUM INDEX (CONT'D)**

第二部分

## REACTION/MOMENTUM INDEX (CONT'D)

REACTIONS 947 TO 1000

RXN #	NAME	REACTANT	PRODUCT	RXN #	NAME	REACTANT	PRODUCT	RXN #	NAME	REACTANT	PRODUCT
947	CHLORINE			948	CHLORINE			949	CHLORINE		
949	CHLORINE			950	CHLORINE			951	CHLORINE		
950	CHLORINE			951	CHLORINE			952	CHLORINE		
952	CHLORINE			953	CHLORINE			954	CHLORINE		
954	CHLORINE			955	CHLORINE			956	CHLORINE		
956	CHLORINE			957	CHLORINE			958	CHLORINE		
958	CHLORINE			959	CHLORINE			960	CHLORINE		
960	CHLORINE			961	CHLORINE			962	CHLORINE		
962	CHLORINE			963	CHLORINE			964	CHLORINE		
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CHAPTER 10

REACTION/MOMENTUM INDEX (CONT'D)

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**PART III**  
**VOCABULARIES**

## PARTICLE VOCABULARY

### Classification

There are about 300 distinct particle names appearing in this report, counting all charge states. In this vocabulary we provide lists of the names of these particles, ordered both alphabetically and by particle type.

Particle-type order is as follows: photons, leptons, non-strange-leptons, strange leptons, charmed leptons, a few generic names, baryons in the order  $\Sigma^0$ ,  $-1$ ,  $-2$ ,  $-3$ ,  $+1$ ,  $+2$ , some special baryons, nuclei, and finally, some other special particles, such as  $\Lambda C$ . $\Lambda\bar{K}N\bar{O}$ . Within each category, particles are ordered by increasing mass.

Most particle names are as used in the Review of Particle Properties (Review of Modern Physics 51, No. 2, Part II, April 1979) and require no special explanation. For baryon names, we have a convention:  $\Lambda\Lambda\Lambda\Lambda\Lambda\Lambda\Lambda$  is  $10^{10} \text{ FERMILAB}$  where "FIRMIN" is equal to 1 for integral baryons and 2 for otherwise, e.g.,  $\Lambda\Lambda\Lambda\Lambda(10^{10})=1$ ; if none of the quantum numbers are uncertain, a 3 (bar bump) may follow the name, e.g.,  $\Lambda\Lambda\Lambda(10^{10})3=1$ . Reasons are given their vernacular names. If the particle has only a neutral state (e.g.,  $\Lambda\Lambda\Lambda\Lambda\Lambda$ ) or the charge is unspecified (e.g.,  $\Lambda\Lambda\Lambda\Lambda$ ), no charge is given. The antiparticles of all baryons, neutral leptons, and neutral strange or charmed mesons are formed by prefixing the particle name with an "a". The charge is that of the antiparticle, so that, for example,  $a\Lambda\Lambda$  is the antiparticle for  $\Lambda\Lambda\Lambda$ .

If there is more than one occurrence of a particle in a final state, the number of occurrences is prefixed to the particle name (e.g.,  $2\Lambda\Lambda$ ). Where the exact number of such particles is unknown, but a lower limit to the number is given, our convention, illustrated for  $\pi^0$ 's, is as follows:  $(100)$  means "0 or more  $\pi^0$ 's";  $(100)$ , "1 or more  $\pi^0$ 's";  $(100)$ , "2 or more  $\pi^0$ 's".

The "particle" ANYTHING is used to mean "the particles listed plus anything else". For example,  $\pi\pi$  ANYTHING refers to inclusive  $\pi^+$  channels, while just ANYTHING is the final state refers to total cross-section measurements.

The special "particles" DD and NON-RES are accompanied, when written in reactions, by angular brackets containing the diffractively dissociated

or non-resonant final states. For example,  $\pi^+ p \rightarrow p DD <\!\! (\pi^+\pi^-) \!\!> p \rightarrow$  means that the  $\pi^+$  beam dissociates diffractively into  $\pi^+\pi^-$ ;  $\pi^+ p \rightarrow$  NON-RES < $\pi^+\pi^-$ > indicates the non-resonant part of the reaction  $\pi^+ p \rightarrow$  < $\pi^+\pi^-$ >.

### Ambiguities

There are ambiguities in our particle names, especially for generic names. For example,  $\Lambda\Lambda\Lambda\Lambda\Lambda$  and  $\Lambda\Lambda$  can be ambiguous; in principle, the first refers to neutral strange particles, detected or not, while the second refers only to those detected as one decays in track-sensitive detectors. Some ambiguities are historical in origin, caused by changes in nomenclature as particle properties become better determined. For example, the early searches for heavy leptons were encoded using the generic name  $HV-LEPTON$ , but some recent papers are encoded using  $TAU$ ; what one paper refers to as  $\Delta L(10^{10})0=1$  might be referred to in other papers as  $\Delta L(10^{10})3=1$ , and so on. Ambiguous names usually appear close together in the type-ordered vocabulary list, and it is suggested that this list be consulted if an ambiguity could exist.

**PARTICLES ORDERED ALPHABETICALLY**

ADEL0 C= ADEL(1212P1110)  
 ADEL+ C= ADEL(1212P111)+  
 ADEL- C= ADEL(1212P111)-  
 ADEL-- C= CHARMED PARTICLE CANDIDATE  
 AG C= SILVER NUCLEUS  
 ANTIPRON C= GENERAL ANTI-ANTIPRON  
 ARKPA(12340) C= KPI S-WAVE  
 ARS(160010 C= KPI S-WAVE  
 AKT(3301-- C= KPI D-SHIFT  
 ARPNDE(140010 C= JP=0- STATE SEEN IN PWA BY BRANDENBURG &  
               DECAYING PREDOMINANTLY INTO EPSILON 60  
 ARU C= KPI(143010  
 ARU(092)0 C= ALUMINUM NUCLEUS  
 AL C= ALUMINUM NUCLEUS  
 ALA0056  
 ALA011401601  
 ALA011530001  
 AL(1770)0 C= ANTI-L(1770)0  
 AM C= ANTI-NEUTRON  
 ANR(140) C= ANTI-NUCLEON NUCLEON I=0 INITIAL STATE (AND  
               ELASTIC FINAL STATE)  
 ANR(1905)0 C= NARROW N AS STATE  
 ANU C= KPI D-SHIFT  
 ANTPRNSG C= FOR USE IN INCLUSIVE REACTIONS; ALSO FOR  
               CROSS-SECTION DATA, AS IN E- P --> ANYTHING  
 AR(1470)=  
 ARD004+  
 AP C= PI0 STATE  
 APR004(1800)+ C= PI0 STATE  
 APR004(1800)-  
 AR(1240-1400)0  
 AR30948 AR30948 C= GOLD NUCLEUS  
 AR30948(1385P1)0 AR30948(1385P1)+ C= GOLD(1385P1)+  
 ARU C= GOLD NUCLEUS  
 AXE 0 AXE+  
 AX(1100)0 AX(1100)+ C= AL(1100)+  
 AX(11170)+ AX(11170)+ C= AL(11170)+  
 AX(1310)0 AX(1310)+ C= AL(1310)+  
 AX(1460)0 AX(1460)+ C= AL(1460)+  
 AX(1900)+ AX(1900)-  
 A-BECM C= REGION AROUND AL AND AZ  
 BE C= BERYLLIUM NUCLEUS  
 BI(1235)0 BI(1235)+ C= CARBON NUCLEUS  
 C C= CHARGE CONJUGATE REACTION  
 CHARGES C= A CHARGED TRACE ORIGINATING FROM THE PRIMARY  
               INTERACTION. ANIRES ORIGINATED OR UNOBSERVED  
               NEUTRALS MAY BE PRESENT, BUT ARE IGNORED UNLESS  
               SPECIFICALLY MENTIONED  
 CHARGED+ C= POSITIVE CHARGED PARTICLE  
 CHARGED- C= NEGATIVE CHARGED PARTICLE  
 CU C= COPPER NUCLEUS

DE C= DIFFRACTION DISSOCIATION. TO BE FOLLOWED BY  
               NAME OF PARTICLES WHICH WERE PRODUCED VIA  
               DIFFRACTION DISSOCIATION. E.G. DD <F F2>  
 DELTA(980)0 DELTA(980)+ C= DELTA(980)+  
 DEL0 C= DEL(1232P310)  
 DEL+ C= DEL(1232P310)+  
 DEL- C= DEL(1232P310)-  
 DEL-- C= DEL(1232P310)--  
 DEL(0NSPEC)++ C= 1&1/2 S-PAIRS OF UNSPECIFIED MASS, USE PRIMARILY  
               IN PROF, ETC., CTRF  
 DEL(1850)010  
 DEL(1870)010  
 DEL(1900)111++ C= BUMP IN PRODUCTION CROSS-SECTION  
 DEL(1900)111+-  
 DEL(1950)0  
 DEL(1950)1+-  
 DEL(2420)0++  
 DEL(2430)0++  
 DELT C= DELT(12170)0  
 DELT\*(12170)+ DELT\*(12170)=  
 DS C= CHARMED PARTICLE CANDIDATE  
 DS+ C= CHARMED PARTICLE CANDIDATE  
 DS- C= CHARMED PARTICLE CANDIDATE  
 D13200  
 EPSILON(700) C= PEPI S-WAVE (NEAR 700 MEV)  
 Eta C= Eta  
 EXPDRE C= POSITION  
 E+ C= ELECTRON  
 E(1420) F C= F(1230) RESONANCE  
 FE C= FEW NUCLEUS  
 FFONE F(11540)0  
 GAMM C= VIRTUAL GAMMA  
 GAMM0  
 GAMM00 C= SINGLE NUCLEON, ANY CHARGE OR MASS  
 GAMM000 C= TWO OR MORE NUCLEONS  
 GAMM0+- C= CHARGE + NUCLEON  
 GAMM0- C= CHARGE - NUCLEON  
 GE C= HELION-4 NUCLEUS  
 HYPD000 C= GENERAL HYPERON  
 HYPD0000 C= GENERAL HYPERON OF CHARGE 0  
 H(1240)0 C= LIO, JP=1/2+ RESONANCE  
 H(1990)0  
 INELASTIC C= SAME AS ANYTHING, EXCEPT ELASTIC ENCLOSED  
 JET C= JET DETECTED AS A WHOLE  
 JPSI(3100)0 JPSI(3100)+ C= EXACTLY ONE RADS OR ANIRES OF UNSPECIFIED CHARGE  
 KADM KADM0 C= TWO OR MORE UNSPEC RADS  
 KAPPA(1230)0 C= KPI S-WAVE  
 KAPPAC(1230)0 C= EPI S-WAVE

RAPPA(1250)-	C= ARCTI S-NAME		
RE	C= E LONG		
RE(1=0)	C= E NUCLEON 1=0 INITIAL STATE (AND ELASTIC FINAL STATE)		
RE(18900)	RE(1890)+	RE(1890)-	
RE	C= E SHORT		
RE	E-		
RE(897)	C= E*(897) OF UNSPECIFIED CHARGE		
RE(12250)	RE(1225)+		
RE(14300)	RE(1430)+	RE(1430)-	
RE(1850)+	C= POSSIBLE E- OMEGA STATE		
RE(892)+	RE(892)+	RE(892)-	
LAMDA			
LAMDA(1405001)			
LAMDA(1510003)			
LAMDA(1600033)			
LAMDA(1810033)			
LAMDA(2100037)			
L(1770)-			
MESON	C= SINGLE MESON OF UNSPEC TYPE		
MESONS	C= TWO OR MORE MESONS		
MESON(1375)+	C= BARYON SEEN IN AN F-0 INDUCED INTERACTION		
MES-0,-2	C= TWO OR MORE UNIDENTIFIED NEUTRAL PARTICLES		
MES			
MES(940)	C= NON-STRANGE, 1=0 MESON RESONANCE		
M	C= NEUTRON		
ME	C= NEUTRINO NUCLEUS		
NEUTRALS	C= TWO OR MORE NEUTRAL PARTICLES -- DO NOT USE FOR NN-0,1		
NEUTRAL(S)	C= ONE OR MORE NEUTRAL PARTICLES -- DO NOT USE FOR NN-0,1		
RE(1=0)	C= NUCLEON NUCLEON 1=0 INITIAL STATE (AND ELASTIC FINAL STATE)		
NON-RES	C= NON-RESONANT STATE. TO BE FOLLOWED BY NAMES OF PARTICLES WHICH WERE PRODUCED IN A NON-RESONANT STATE. E.G. NON-RES OF PI++		
N2			
NUCLEON			
NUCLEONS	C= TWO OR MORE UNSPEC NUCLEONS		
NUCLEUS	C= GENERAL NUCLEON. USE ONLY WHEN THE EXACT NUCLEUS OR NUCLEON IS NOT SPECIFIED. E-G., USE FOR TARGET WHEN DETECTOR IS EMULSION.		
RE(1/2)(NNSPEC)***	C= 1=1/2, THE BARYON OF UNSPEC MASS, FOR USE PRINCIPALLY IN PROP, RVAL, CDFP		
NO(CHARGED)	C= CHARGED PARTICLE, FOR MULTIPARTICLE DISTRIBUTION ONLY		
NUCLECT	C= SPECTATOR NEUTRON (NOT NUMBER OF SPECTATORS)		
NUCNPFC*	C= 1=1/2, THE BARYON OF UNSPEC MASS		
RE(14700)	RE(1470)+		
RE(1470P110)	RE(1470P11)+		
RE(15200)	RE(1520)+		
RE(1520D110)	RE(1520D11)+		
RE(15900)*			
RE(1670D150)	RE(1670D15)+		
	SC(1488F15)0	SC(1488F15)+	
	SC(17080)0	SC(17080)+	
	SC(1860)0	SC(1860)+	
	SC(1908)0+		
	SC(190617)0		
	SC(1908)0+		
	OMEGA	C= RESON RESONANCE	
	OMEGA+	C= THE S-1 BARTON	
	OMEGA(1470)	C= RESON RESONANCE	
	P		
	PI	C= LEAD NUCLEUS	
	PI0		
	PI0*	C= EXACTLY ONE PION OF UNSPECIFIED CHARGE	
	PI0S	C= TWO OR MORE PI0S	
	PI0S(0)	C= ONE OR MORE PI0S	
	PI0P(1420)---		
	PI0P(5-4WAVE)0		
	PI0S		
	PI0S	C= 2 OR MORE PI0S	
	PI0S(5)	C= 1 OR MORE PI0S	
	PI+		
	PI0S0	C= TWO OR MORE PI0S	
	PI1(3685)0		
	PI1(13770)		
	PI0P(CT)	C= SPECTATOR PHOTON	
	Q(11280)0	Q(11280)+	Q(11280)-
	Q(14080)	Q(14080)+	Q(14080)-
	Q(1240-1400)0	Q(1240-1400)+	Q(1240-1400)-
	Q(1340)++	C= DOUBLY CHARGED PARTNER OF Q	
	RE0	C= UNSPECIFIED RE0(1770) RESON	
	RE0P(NKE)12500		
	RE0P(NKE)14000	RE0P(NKE)1400+- RE0P(NKE)1400)-	
	RE0N	RE0-	
	S1	C= SILICON NUCLEUS	
	SIGMA	C= SIGNAL(140) OF UNSPECIFIED CHARGE	
	SIGMA+	SIGMA+	
	SIG(1385P13)0	SIG(1385P13)+	SIG(1385P13)-
	SIG(1480)0+	C= 1=1, TWO SIGNS	
	SIG(1512)0+-	C= 1=1, TWO SIGNS	
	SIG(1570)0	C= 1=1, TWO SIGNS	
	SIG(1573)0+-	C= 1=1, TWO SIGNS	
	SIG(1578)0	C= 1=1, TWO SIGNS	
	SIG(1670)0+-	C= 1=1, TWO SIGNS	
	SIG(1670P13)0	SIG(1670P13)+	SIG(1670P13)-
	SIG(1680P11)0	C= 1=1, TWO SIGNS	
	SIG(1915P15)0	C= 1=1, TWO SIGNS	
	SIG(1915P15)0+	SIG(1915P15)0+	
	SIG(2030P17)0	C= 1=1, TWO SIGNS	
	SIG(2627)0	C= 1=1, TWO SIGNS	
	SI	C= TDS NUCLEUS	
	STRANGE	C= UNSPECIFIED STRANGE PARTICLE	
	STRANGES	C= TWO OR MORE UNSPECIFIED STRANGE PARTICLES	
	STRANGES	C= NEUTRAL STRANGE PARTICLE C= SAME AS STRANGE	

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STRANGE(5)          EXCEPT CHARGE IS SPECIFIED
$*(9985)           C= ONE OR MORE UNSPECIFIED STRANGE PARTICLES
$*(1935)*          C= PIPE OR KEDAR S-WAVE

T1
T1(1935)*          C= TITANIUM NUCLEUS

U
Upsilon(10350)      C= URANIUM NUCLEUS
Upsilon(19440)      C= UPSILON(10350)
Upsilon(19460)      C= UPSILON(19440)

V1(2460)*          C= SEEN UNSPECIFIED NEUTRAL STRANGE PARTICLE DECAY

V-E
V1(18180)          C= VECTOR MESON SEEN IN PSEUDO-REPRODUCTION
V+                   C= INTERMEDIATE VECTOR BOSON
V-T
V-Tungsten(19460)  C= TUNGSTEN NUCLEUS -- SAME NAME IS NOT SAME AS
                     CHEMICAL SYMBOL

X2
X2(1321)*          C= X(1.321) OF UNSPECIFIED CHARGE

X3
X3(208100C)        C= Y=1 BARION OF UNSPECIFIED MASS, I
X3(208100C)        C= 1<=I<=2, Y=1 BARION OF UNSPECIFIED MASS

X3(153091310)      C= (153091310)-

X3(163039)          C= (163039)-
X3(182039)          C= (182039)-
X3(194039)          C= (194039)-
X3(210309)          C= (210309)-
X3(210309-34600)    C= ANY MESON BUMP SEEN IN PRODUCTION EXPERIMENTS IN
                     THAT MASS REGION (EXCEPT THOSE ASSOCIATED WITH
                     J/Psi, ETC., ETC.)

X3(1808)            C= JP=0+ CHARM-BARRIER STATE
X3(19905*)          C= ERGOTIC [1]+, Y=2 BARTON
...GL-SP108          C= 6 PIONS OR MORE
...GL-SP108          C= 8 PIONS OR MORE
...GT-SPR080          C= MORE THAN 3 PIONS/CS
...GT-SPR080          C= MORE THAN 5 PIONS/CS
...GT-SPR080          C= MORE THAN 7 PIONS/CS
...GT-SPR080          C= MORE THAN 9 PIONS/CS

```

**PARTICLES ORDERED BY TYPE**

<b>CAPPA</b>	<b>C= VIRTUAL CAPPA</b>
<b>CAPRA*</b>	
<b>NU</b>	
<b>AKS</b>	
<b>E</b>	<b>C= ELECTRON</b>
<b>E+</b>	<b>C= POSITION</b>
<b>H+</b>	
<b>-GE, RP108</b>	<b>C= 8 OR MORE PIONS</b>
<b>-GE, RP1208</b>	<b>C= 8 OR MORE PIONS</b>
<b>F1016(1)</b>	<b>C= ONE OR MORE PIONS</b>
<b>F1016</b>	<b>C= TWO OR MORE PIONS</b>
<b>F1016</b>	<b>C= EXACTLY ONE PION OF UNSPECIFIED CHARGE</b>
<b>F1016(3)</b>	<b>C= 1 OR MORE PIOS</b>
<b>F1016</b>	<b>C= 2 OR MORE PIOS</b>
<b>F1+</b>	<b>F1+</b>
<b>ETB</b>	
<b>EPSILON(700)</b>	<b>C= PIPI S-WAVE (NEAR 700 MEV)</b>
<b>KK0+</b>	<b>KK0+</b>
<b>KK0</b>	<b>C= UNSPECIFIED KK0(770) MESON</b>
<b>Omega</b>	<b>C= HEAVY RESONANCE</b>
<b>N(1440)</b>	<b>C= NON-STRANGE, 1=0 MESON RESONANCE</b>
<b>ETA PRIME</b>	
<b>DELTA(980)+</b>	<b>DELTA(980)+</b>
<b>SP(980)+</b>	<b>C= PIPI OR KKKK S-WAVE</b>
<b>SP(980)</b>	
<b>PK</b>	
<b>A1(1380)*</b>	<b>A1(1100)0</b>
<b>A-RESON</b>	<b>A1(1380)-</b>
<b>V(1111)0</b>	<b>C= REGION AROUND A1 AND A2</b>
<b>A1(1111)0+</b>	<b>C= VECTOR MESON SEEN IN PHOTOPRODUCTION</b>
<b>K1235(0)</b>	<b>A1(11170)-</b>
<b>KK0PRIM(1250)0</b>	<b>K1235(0)</b>
<b>F</b>	<b>K1235(0)-</b>
<b>D(1235)</b>	<b>C= F112700 MESON RESONANCE</b>
<b>A2(1310)+</b>	<b>A2(1303)0</b>
<b>K1440</b>	<b>A2(1310)-</b>
<b>F1(1340)0+</b>	
<b>KK0PRIM(1400)0</b>	<b>F1(1340)0</b>
<b>A1(1440)*</b>	<b>KK0PRIM(1400)0</b>
<b>Omega(1470)</b>	<b>A1(1440)0</b>
<b>G(1700)*</b>	<b>C= MESON RESONANCE</b>
<b>APR20(15800)*</b>	<b>G(1700)0</b>
<b>APR20(15800)-</b>	<b>G(1700)-</b>
<b>AA(1900)*</b>	<b>C= 3PI STATE</b>
<b>EC(1935)*</b>	<b>C= 3PI STATE</b>
<b>AM(1119)0</b>	<b>A4(1992)-</b>
<b>EC(2048)</b>	<b>C= NARROW N AN STATE</b>
<b>T1(2160)*</b>	<b>C= 1=0, JPC+= MESON RESONANCE</b>
<b>U1(2400)*</b>	
<b>3G(2500-3600)</b>	<b>U1(2400)0</b>
	<b>C= ANY MESON BUMP SEEN IN PRODUCTION EXPERIMENTS IN THAT MASS REGION EXCEPT THOSE ASSOCIATED WITH J/PSI, ETC.</b>

```

AE          C= AEST-HE2202K
AF
SOC1200E
SOC1200S      C= TWO OR MORE UNSPEC NUCLEONS
SI(1470P11)++  SI(1470P11)0
SI(1470B)0
AB(1470B)-
SI(1520B13)++  SI(1520B13)0
SI(1520B)0
SI(1590B)+
SI(1670B13)++  SI(1670B13)0
SI(1680B13)++  SI(1680B13)0
SI(1700B)0
SI(1880B)-
SI(2190K13)++  SI(2190K13)0
SI(2190B)-
SI(2490B)-
HSUSPEC+-      C= 1+0/1, T+1 BARRIER OF UNSPEC MASS
DEL+-        C= DEL(1232P33)+-
DEL+-        C= DEL(1232P33)-
DEL0         C= DEL(1232P33)0
DEL-         C= DEL(1232P33)-_
ADEL0        C= ADEL(1232P33)0
ADEL-        C= ADEL(1232P33)+_
ADEL--       C= ADEL(1232P33)--_
DEL(1850S31)0
DEL(1870D33)++  DEL(1870D33)+   DEL(1870D33)0
DEL(1880P33)++  C= SIGN OF PRODUCTION EXPERIMENT
DEL(1880B33)++  C= SIGN OF PRODUCTION EXPERIMENT
DEL(1950F37)++  DEL(1950F37)+_
DEL(1950B)++    DEL(1950B)+   DEL(1950B)0
DEL(2430B)++_
DEL(2450B)++_
DEL(2510B)++_
DEL(2700SPEC)++  C= 1+0/2 BARRIER OF UNSPECIFIED MASS, USE PRIMARILY
                  IN PROP, KREL, CORR
SP5/2(UNSPEC)++  C= 1+5/2, THI BARRIER OF UNSPEC MASS, FOR USE
                  PRIMARILY IN PROP, KREL, CORR
LAPR00A
LAPR00B
LAPR14070001)
LAPR0114501013
LAPR1152001013
LAPR1152001033
LAPR1890B0103)
LAPR18901013)
LAPR2100B0103)
LAPR2100B0103)
SIGKA+-      SDKA+-      SDKA+-_
AB13KA0       AB13KA0       AB13KA0
SIGKA         C= SIGKA(1180) OF UNSPECIFIED CHARGE
SIG(1365P13)++  SIG(1365P13)0   SIG(1365P13)-
SIG(1365P13)0   ABIG(1365P13)0  ABIG(1365P13)=
SIG(1480B)++    C= 1+, TWO BURNS
SIG(1620B)++    C= 1+, TWO BURNS

```



### KINEMATIC VARIABLE VOCABULARY

The following material is a modified form of Appendix IX from the "Particle Physics Data System Reaction-Data File Recording Manual"; the entire manual can be found on a special file included with this report.

A word on notations: Angular brackets, < and >, are used below to enclose any variable which may take on various literal values; the brackets themselves are not actually encoded. Also, values written in all capital letters are literals which are encoded just as they appear.

#### Introduction

The names of independent kinematic variables are referred to as *x-names*. These appear in various places throughout each Data Listing entry:

1) To define each data point in an entry, in addition to the dependent variable name (*y-name*) and reaction, at least one independent variable must be specified.

2) *X-names* (and more often *y-names*) are also used to define what variable a systematic error applies to or under what conditions it applies.

3) Finally, the names of some dependent variables (*y-names*) are constructed using *x-names* as some of their components (see the Observable Vocabulary).

The number of independent variables that have been used to describe high energy physics experimental data is very large. To cope with this diversity, we have defined a syntax for constructing *x-names*.

The *grange xnames* consists of the following elements and rules for combining elements:

1) There is a list of *basic xnames* around which all *x-names* are built; examples from this list include *THETA*, *T*, *E*, *P*, etc. (the full list is given below).

2) For each *basic x-name*, there are defined a number of *arguments* (the number differs for different *basic x-name*), which are used to specify the variable precisely (the structure and functions of arguments are discussed in detail below).

3) *X-names* of variables which are simply related to those constructed using elements 1) and 2) can be formed using *FORTRAN-like operators* such as *SIN*, *COS*, *SQRT*, etc. (a full list is given below).

4) *X-names* of even more complex variables may be created by the use of *operators* such as *\**, *-*, *\**, */*, *\*\**, etc. as in *FORTRAN* (the full list of operators is given below).

5) Finally, *constants* may be combined with *x-names* constructed from rules 1) - 4) above by using any of the operators defined in 3) and 4).

If an *x-name* cannot be constructed from the *x-name* system, then that *x-name* is written in free format. This has the following form: *free format*. This form is to be used whether the *x-name* which cannot be encoded in the *x-name* syntax is the entire name or just part of it, as in, say, a *y-name*. In the latter case, the entire *y-name* must be written in free format.

In the remainder of this Vocabulary, we discuss the *x-name* syntax in much greater detail, presenting complete lists of basic *x-names*, all possible arguments, and operators, and finally we give examples to illustrate how the syntax is used.

#### *X-name Argument Structure*

The simplest form of an *x-name* with arguments is the following:

```
<basic-x-name>(<arg-name>=<arg-value>,
                  <arg-name>=<arg-value>2,...)
```

Where:

1) *basic-x-name* is one of the names from the Table of Basic *X-names* presented below.

2) *arg-name* is the name of any argument permitted for this particular *basic x-name*; the permissible arguments and their defaults (if any) are given in the Table of Basic *X-names*. The list of all possible argument names and their meanings is given in a separate section below.

3) *arg-value* is the value of the argument. The form depends on the argument type and is discussed in the section in which all argument types are presented.

The following general remarks apply to arguments:

- 1) Arguments may appear in *any order*.
- 2) Any argument for which a *default value* is given in the Basic *X-name* Table below may be omitted if the default is applicable, e.g., *D(SIG/DT)* may appear instead of *D(SIG/DT=0,T=1)*.
- 3) If all arguments have been omitted, then the left and right

parentheses may have been dropped also.

The purpose of arguments to basic *x-names* is to supply information which, when combined with the basic name, completely specifies the independent variable.

#### The Types of Arguments and Their Semantics

1) *P*: The form *P*... is used to specify: a) the particle (or system of particles) whose property (momentum, energy, angle, etc.) is being reported; or b) the momentum, or momentum direction, of a particle (or system of particles) needed in the definition of a variable.

2) *X,Y,Z*: These three arguments are needed for some variables to define a right-handed system of coordinate axes for reference. The values of these arguments are the particles (or systems of particles) whose momentum vectors define the appropriate directions (see below for how these values are encoded). For certain coordinate axes, *X,Y,Z* may be replaced by *XYZ*; see next.

3) *XYZ*: This single argument is used instead of the three *X,Y,Z* arguments for those cases for which we have defined an abbreviation to specify some of the more common coordinate systems; see the 'Special Coordinate Systems' section below.

4) *RF*: This argument indicates the particle (or system of particles) in which *next frame* the measured quantity is reported.

To understand how *P*, *X,Y,Z*, *XYZ* and *RF* are encoded, see the 'Specifying Particles and Directions' section below.

5) *NAME*: Occasionally, a variable has an accepted name which can be given. This arises more often with *y-names*.

6) *DEF*: This argument can be used to define unambiguously a variable (such as *M*) which has more than one definition in common use.

7) *Q*: This qualifier is a special, rarely used, "labeling" or "linking" argument. Its use is confined to the following circumstance: When a *y-name* is composed of more than one basic *y-name*, and there is ambiguity as to which *x-name* values are associated with which basic *y-name*, this ambiguity is resolved by giving the basic *y-name* and relevant *x-name* the same, arbitrary (possibly nonmonic) value for the *Q* argument. An example might be:

(4M(*b*=*HC<sup>2</sup>*)/*d*)/(4M(*b*=*HC<sup>2</sup>*)/*d*) .

This is encoded (suppressing arguments and variables not relevant to this discussion) as follows:

*xname1* = THETA(*Q*=1) IN DEC,    *x-value1* = 90,  
*xname2* = THETA(*Q*=2) IN DEC,    *x-value2* = 0,  
*yname* = (4M(*b*=*HC<sup>2</sup>*)/*d*)/(4M(*b*=*HC<sup>2</sup>*)/*d*) .

The *Q* argument is only used in cases where there is ambiguity, and for such each ambiguity a different *Q* value is required. Any convenient character(s) may be used for the value of *Q*.

This argument is used also in the situation where more than one reaction is needed to characterize a measurement, as in the case of ratios of cross sections of reactions, and there is ambiguity as to which reaction the *y-name* in question applies to. E.g.:

*xname1* = RHO(*Q*=1),    *x-value1* = P P --> P P,  
*xname2* = RHO(*Q*=2),    *x-value2* = P P --> ARTHIR,  
*yname* = (RHO(*Q*=1))/RHO(*Q*=2)) IN GEN=2 .

#### Specifying Particles and Directions

*P,X,Y,Z,RF*: The value of any one of these arguments specifies a particle (or system of particles) in the reaction, or the direction of the motion of the particle (or system of particles), or the momentum itself. In all these cases, the particle (or system of particles) is encoded in the same way: each particle (or its momentum) is represented by a number corresponding to the position of the particle in the reaction (see below), and each system of particles is represented by the sequence of numbers assigned to the particles which comprise the system. Directions not expressible directly in terms of a particle's (or system of particles') momentum are expressed using rotation and/or by construction of appropriate cross products as discussed below. The rules for constructing any value for the above-listed arguments are given, in more detail, by the following:

a) **Particles are numbered** from left to right as written in the reaction (starting with the beam), with every different particle given one successively higher number without regard to whether the particle is a primary particle in the reaction or is a decay product. Multiply occurring particles encoded with a number preceding the name (e.g., *ZIMMA*) are treated as the corresponding number of single particles for

the purpose of numbering.

In the reaction-data file "reaction syntax" (see the guide at the beginning of the Reaction/Momentum Index), it is possible to encode an a single reaction occurrence, reactions which consist of a sum or difference over particles in the final state. In these cases, all particles are numbered from left to right regardless of whether there are sums or not. Thus the reaction



is numbered as



1 2 3 4 5 6

In this scheme, the independent variable arguments contain the information about the sum over states and are written, e.g., as  $T(0^+ + 3^- 6, P(0))$  for the momentum transfer from the proton to the final  $S00000$  or  $L00000$  P(0) system.

b) A **single particle**, or the direction defined by its momentum in some frame (specified by RF), or its momentum, is encoded simply by giving the number corresponding to its order in the reaction (see a) above).

c) A **grating of particles** is specified by writing the sequence of numbers corresponding to all the particles in the system, the numbers being separated by blanks.

d) The **negative of any direction** is specified by preceding the particle number by a minus. If a system of particles is involved, the sequence of numbers specifying the system will be preceded by a minus sign.

e) **Cross products:** In specifying an axis, it may be necessary to refer to a direction which is a cross product of the directions of two particles (or systems of particles); in such a case the cross product is expressed by a \*. Thus the direction defined by the cross product of particles 1 and 3 (i.e., the normal to the production plane) is given by P(1). The cross product of particle 1 and the species 3-4 is written P(1)\*4 (or P(1) 4 if desired, for readability). The negative of the preceding direction is encoded -(\*) 4. A triple cross product is assumed to be evaluated from the left. Thus P(1) 4\*3 5 is assumed to be (P(1) 4)\*3 5 = (1\*G(4) 3)\*3 5.

f) **Special cases for RF:** Since the beam and target are always

numbered 1 and 2, respectively, the lab and CM frames are given in terms of particle numbers as RF=2 and RF=1 2, respectively. For these cases, the forms RF=LAB and RF=CM, respectively, are also allowed.

g) **Spin direction:** The direction of spin of a particle is specified by preceding the particle number by S; e.g., S2 represents the direction of spin of particle 2. If a system of particles is involved, as in the case of the direction of spin of, say, a  $\pi\pi$  system, the particle number of each particle will be preceded by S.

#### Special Coordinate Systems

The following is a list of special coordinate systems, their abbreviations, and their definitions, which have been defined for the RY2 arguments:

RR = SR	s-channel helicity frame
TR	t-channel helicity frame (Gottfried-Jackson)
ST	u-channel transversity frame
TT	t-channel transversity frame
ADAIR	Adair frame

#### FORTRAN-like Operations

In the following, `argp` is any valid x-name or y-name, either basic or concatenated following the x-name or y-name syntax:

OPERATOR	Meaning
SIN( <code>argp</code> )	trigonometric sine
COS( <code>argp</code> )	trigonometric cosine
ABS( <code>argp</code> )	absolute value or modulus
LN( <code>argp</code> )	natural logarithm
LOG( <code>argp</code> )	common logarithm
ATRN( <code>argp</code> )	arc tangent, defined to be in the range $(-\pi/2, \pi/2)$
RE( <code>argp</code> )	the real part of a complex argument (Note, usage differs from FORTRAN.) (Does not apply to x-name, may apply to y-name.)
IM( <code>argp</code> )	the imaginary part of a complex argument (Note, usage differs from FORTRAN.) (Does not apply to x-name, may apply to

	y=name.)
+	addition
-	subtraction
*	multiplication
/	division
**	exponentiation
EXP(carg>)	exponentiation

"pi" may appear as a constant; e.g., 2\*PI\*COS(THETA).

Table of Basic X-names

Basic Variable Name	Arguments with Default Values (! means no default defined)	Meaning
P		momentum
E	(P=1, RF=LAB)	energy
EKIN		kinetic energy
S		$S = (P)^2$ invariant mass squared
N or N	{(P=1, 2)}	$S = \sqrt{s}$ energy of system of particles or invariant mass of single particles
THETA		$\theta = \text{polar angle } (0^\circ \text{ to } 180^\circ)$
OMEGA	(P=1, P=1, RF=CM)	$d\Omega = 2\pi d(\cos\theta)$
PHI	(P=1, 1=1*)*, 2=1*	$\phi = \text{azimuthal angle}$
T		$t = (P_3 - P_1)^2$ invariant momentum transfer squared
TP	(P=1, P=1)	$t' = t - u \sin^2 \theta_{\text{min}} \text{ in RDS}(+t)$
U		$u = (P_3 - P_2)^2$
UP	(P=1, P=2)	$u' = u - u \sin^2 \theta_{\text{min}} \text{ in RDS}(-u)$
		$(t, t', u, u' \text{ are all mostly negative})$

Table of Basic X-names (cont'd)

Basic Variable Name	Arguments with Default Values (! means no default defined)	Meaning
ME		Lepton scattering variables whose default definitions are given by the formulae:
X		$x = E - E'$
Q2	$q^2$	$E = \frac{E^2 + q^2}{2E} = v + \frac{q^2}{2E}$
EPS	$\epsilon$	$v^2 = -q^2 = 4E'E'' \sin^2(\frac{\theta}{2})$
OM	$v$	$v = (1 + 2(Ev^2/Q^2) \tan^2(\frac{\theta}{2}))^{-1}$
ONP	$v'$	$v' = 2ev^2/Q^2$
X	$x'$	$v'^2 = 1 + v^2/Q^2 = v + \frac{q^2}{Q^2}$
EP	$x'$	$x = (x)^{-1} \quad x' = (x')^{-1}$
PL		$P_L = \text{longitudinal momentum}$
PT	$(P=1, RF=ON)$	$P_T = \text{transverse momentum}$
M		$\sqrt{s_{\text{NN}}} = \text{transverse mass}$
XL	$(P=1, RF=ON, DEF=2*PL/ME)$	$2P_L/\sqrt{s} = \text{Feynman x (XL)}^*$
Some other possible definitions are:		
DEF=PL/(P=1, RF=ON)		$P_L/P_1 = (X2)^*$
DEF=PL/PTMAX		$P_L/P_{\text{max}}^2 = (X3)^*$
DEF=PL/SQRT(PMAX^2+PT^2)		$P_L/(1 + \frac{PT}{P_{\text{max}}^2})^{1/2} = (X4)^*$
DEF=2*PL/SIMPLOUT		$2P_L/(1)P_L = (X5)^*$
DEF=(1-PT^2)/5		
DEF=2*PL/ME		$2P_L/\sqrt{s} = (X6)^*$

\* Alternate and obsolete abbreviations.

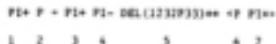
Table of Basic X-names (cont'd)

Basic Variable Name	Arguments with Default Values (! means no default defined)	Meaning
ET	$(P=3, RF=ON, DEF=2*PT/ME)$	$x = \text{transverse } \frac{PT}{\sqrt{s}}$
ER	$(P=3, RF=ON, DEF=P/PMAX)$	$x = \text{radial}$
TRAP	$(P=3, RF=ON)$	$y = \text{rapidity}$
STRAP	$(P=3, P=1, RF=ON)$	$dy = p_1/p_2$
TRAPIC		$(x-p_2)/(p_1-p_2)$
ETRAP	$(P=3, DEF=?)$	pseudorapidity
Where possible values are:		
DEF=LN(TAN(THETA))		$\ln(\tan(\theta))$ implies RF=LAR (ETRAP1)*
DEF=LN(TAN(THETA/2))		$\ln(\tan(\frac{\theta}{2}))$ implies RF=CM (ETRAP2)*
DEF=LOG(TAN(THETA))		$\log(\tan(\theta))$ implies RF=LAR (ETRAP3)*
DEF=LOG(TAN(THETA/2))		$\log(\tan(\frac{\theta}{2}))$ implies RF=CM (ETRAP4)*
CORR	$(P=3, P=1)$	$C(r_3, r_4)$
		$= \left( \frac{d^2r_3}{dr_1 dr_2} + \frac{1}{r_{10}} \frac{dr_3}{dr_1} \frac{dr_3}{dr_2} \right)$
RCORR	$(P=3, P=1)$	$R(r_3, r_4)$
		$= \left( r_{10} \frac{d^2r_3}{dr_1 dr_2} / \frac{dr_3}{dr_1} \frac{dr_3}{dr_2} \right) - 1$

\* Alternate and obsolete abbreviations.

Frame Examples

Consider the reaction:



where the particle number is given below each particle in the reaction. Then

use

$\text{P}(\text{P}=1,\text{RF}=\text{LAB})$	for beam momentum in the lab frame
$\pm \text{P}$	
$\text{P}(\text{P}=2,\text{RF}=\text{S})$	for the momentum of $\pi^+$ from $\pi^+\pi^-$ to $\pi^+\pi^-$ frame
$S(\text{P}=3,4)$	for invariant mass squared of $(\pi^+\pi^-)$ system
$S(\text{P}=1,2)$	for overall CM energy squared
$\pm S$	
$\text{COS}(\text{THETA}[\text{P}=3,4,\text{P}=1,\text{RF}=\text{CM}])$	for cosine of polar angle between the $\pi^+\pi^-$ state and the incoming $\pi^+$
$\text{T}(\text{P}=\star,\text{P}=\star)$	for the momentum transfer from $\pi^+$ to $\pi^+$
$\pm T$	
$\text{-T}(\text{P}=3,4,\text{P}=1)$	for $-t'$ between initial $\pi^+$ and outgoing $\pi^+\pi^-$ system
$\text{SQRT}(-\text{T}(\text{P}=3,\text{P}=1))$	for $(-t)^{1/2}$ between beam and outgoing $\pi^+$
$\text{SQRT}(-T)$	
$T(\text{P}=3,\text{P}=1)/.02$	for $t/.02$

## OBSEVABLE VOCABULARY

The following material is a modified form of Appendix 19 from the "Particle Physics Data System Reaction-Data File Encoding Manual;" the entire manual can be found on a special file included with this report.

A word on notation: Angular brackets,  $\langle$  and  $\rangle$ , are used below to enclose any variable which may take on various literal values; the brackets themselves are not actually encoded. Also, values written in all-caps, e.g., `ETOT`, others are literally what are encoded just as they appear.

### 1. Y-NAME

The name of the dependent variable, or "observable", is referred to as a y-name.

From the number of "basic" y-names, i.e., the classes of observables such as cross sections, polarizations, correlations, etc., is very large. The number of y-names actually used is overwhelmingly large since, in general, the basic observables may be reported in different reference frames and for different particles or combinations of particles. Furthermore, they are often differentiated or integrated with respect to the various independent variables on which they depend. Finally, an innumerable number of y-names may be constructed from those just described by combining them using operations such as SQRT, SIN,  $+$ ,  $-$ ,  $*$ ,  $/$ ,  $**$ , or with any of the constants defined for that observable, or with constants. In actual practice, all these variations are used. To cope with this diversity, we have defined a syntax for constructing y-names. This syntax contains all the elements of the y-name system (see the Kinematic Variable Vocabulary), plus some additional elements resulting from the much greater variety and complexity encountered in y-names.

In what follows we give the following elements and rules for defining y-names:

1) There is a list of basic y-names which defines classes of observables and around which all actual y-names are built; examples from the list include `SIG`, `GAM`, `RHO`, etc. (the full list is given below).

2) For each basic y-name, there are defined a number of arguments (the number differs for different basic y-names), which together with the basic y-name are sufficient to completely specify some of the more simple y-names (the structure and functions of arguments are discussed in detail

below).

3) A large class of additional y-names can be constructed from the simple y-names obtained using elements 1) and 2) by the use of FORTAN-like operators such as `SIN`, `COS`, `SQRT`, `RE`, `IM` (a full list was given in the Kinematic Variable Vocabulary).

4) In addition to the FORTAN-like operations defined in 3), the y-name syntax also includes a notation for expressing differentiation and integration. The details of how these are encoded are given below.

5) Other variations of y-names may be obtained from those which can be constructed using 1) - 4) by combining them with arguments, i.e., independent variable names (such as `THETA`, `E`, `P`, `T`, etc.), by using operators such as `+`, `-`, `*`, `/`, `**`, etc., and parentheses, as in FORTAN (the full list of operators was given in the Kinematic Variable Vocabulary).

6) Other variations may be obtained by combining consistently in the same manner as described in 5).

7) Finally, some y-names may be obtained by taking products, sums, differences, or ratios of y-names as defined to exclude all y-name features described in 1) - 6) above.

In the remainder of this vocabulary, we discuss the y-name syntax in much greater detail. Whenever appropriate, we refer to the x-name system, all of which comprises part of the y-name syntax. We present a complete list of basic y-names, their argument structure, and default argument values; we also discuss the general rules for argument construction and for the combination of x-names, y-names, constants, and operators to construct the great variety of y-names used in practice in describing reaction data.

### 2. X-NAME ARGUMENT LANGUAGE

The simplest type of y-name consists of a basic y-name with (possibly) arguments. This has the following form:

```
basic-y-name((arg-name1=arg-value1),  
            arg-name2=arg-value2),...,  
            arg-nameN=arg-valueN)/?  
            arg-nameD=arg-value2D),...)
```

#### More:

- 1) `basic-y-name`: is one of the names from the Table of basic Y-names presented below.
  - 2) `arg-name`: is the name of any argument permitted for this particular basic `y-name`; the permissible arguments and their defaults (if any) are given in the Table of basic Y-names. The list of all possible argument names and their meanings is given in a separate section below.
  - 3) `arg-value`: is the value of the argument. The form depends on the argument type and is discussed in the section in which all argument types are presented.
- 4) `ff`: for some `y-names`, the same set of arguments needs to be specified for more than one particle (or particle system), as in the case of point density matrix elements and correlations. In these cases, the argument names and values for each system have a similar structure, but are separated by `ff`. The order of arguments within a group is dictated to be not significant, but the order in which the argument groups are encoded may be significant, affecting such things as sign conventions.

Any argument for which a default value is defined in the basic Y-name Table below may be omitted if the default value is applicable. If the arguments are divided into groups by `ff`, the defaults are applied separately for each group; if the entire first group is defaulted but not the second, the following form is used:

```
basic-y-name((/arg-name1=arg-value1),  
             arg-name2=arg-value2),...)
```

The purpose of arguments to basic `y-names` is to supply information which, when combined with the basic name, completely specifies the dependent variable (at least, in those cases where the dependent variable is simple, i.e., it does not involve combinations of basic `y-names` with other basic `y-names`, with `x-names`, or with constants).

#### The Types of Arguments and Their Meanings

All argument types defined for `x-names` are also used as `y-names`. These arguments have the same meanings as already discussed in the Kinematic Variable Vocabulary and are also encoded in the same way. In particular, see the Kinematic Variable Vocabulary for a detailed discussion of the arguments `P`, `X`, `Y`, `Z`, `RTZ`, `RF`, `NAME`, `REF`, and `Q`.

In the following, we list the additional argument types which are defined for `y-names`, their meanings, and how their values are encoded.

- 1) `L` and `Jz`: These are angular momentum arguments. Only non-negative integer values are possible. `L` is used, for example, in legendre polynomial expansion coefficients.

2) `M`: This argument represents the z-component of angular momentum; it is double the z-component if the particle has half odd-integer spin, and is thus always integer valued. `M` is usually used in pairs, as in density matrix elements; e.g., `REF(RHO00#03-1,P4,X3L#0)` for  $c_{3-1} \langle Q^{10} \rangle$ . Note the spin of a particle (system) is not determined precisely by this name. `J` is encoded also; e.g., `RHO(3J=10,MN=10,P4,3,X3L#0)` for the S-P wave interference density matrix element  $c_{10} = c_{10}^{10} \langle \pi^+ \pi^- \rangle$  in the p meson region.

#### Differentiation Syntax

In the following, `arg` is any valid `y-name`, either basic or constructed following the rules given above. `c-name` is any valid `x-name`.

- 1) single differentiation: `D(arg)`/`c-name`
- 2) multiple differentiation (in example, double):
  - a) `D(D(arg))`/`c-name1`/`c-name2`, or equivalently
  - b) `D(D(arg))`/`c-name1`/`c-name2`

For example, `D(D(X))/T` for  $d\dot{X}/dt$ .

#### Integration Syntax

In the following, `arg` is any valid `y-name`, either basic or constructed following the rules given above. `c-name` is any valid `x-name`.

- 1) single integration: `INT(arg)`/`c-name`
- 2) multiple integration (in example, double):
  - a) `INT(INT(arg))`/`c-name1`/`c-name2`, or equivalently
  - b) `INT(INT(arg))`/`c-name1`/`c-name2`

Note that the integration syntax is not always needed. For example,

$$\int_1^2 \frac{dx}{dt}$$

may be encoded as

$x\text{-name} = T$  18 GEV $^2$ ,  
 $xval=0$  TO  $0.1^2$ ,  
 $y\text{-name} = S12$  18 KB.

Table of Basic Y-names

Basic Variable Name	Arguments with Default Values (Y means no deficit defined)	Meaning
SIG		$\sigma$ = cross section
N		number of events
SLOPE		from $\frac{dN}{dt} \sim e^{(SLOPE)t}$
L1G	(L=1, P=3, P=1, RP=0)	$A_L$
L1GS	(L=1, P=3, P=1, RP=0)	$A_L/A_0$
L1GP	(L=1, P=3, P=1, RP=0)	$A_L$
L1GSP	(L=1, P=3, P=1, RP=0)	$A_L/A_0$
AMP	Default is spin non-flip forward amplitude in LAB	amplitude
ALPHA		$RE(AMP)/IM(AMP)$
PHASE		phase of AMP
POL	(P=3, Z=1*3, RP=0)	polarizations of particle P along Z
RHO	(Z,Z=77, MM=77, P=3, XD=1)	$\rho_{MM}^{ZZ}$ , density matrix element
POL_RHO	(ALPHA=0, P=1/MM=77, P=3, XD=1)	density matrix element with polarized photon base
RHO_RHO	(MM=77, P=3, XD=1/MM=77, P=3, XD=1)	joint decay density matrix element
TRK	(ID=77, P=3, XD=1)	$T_L^R$ moment of particle P
STER	(ID=77, P=3, XD=1)	statistical tensor

### Examples of Polarization Observable Names

$\pi N \rightarrow \pi N$

POL "polarization" = recoil or target asymmetry  
 POL,POL (NAME=?) , DIF(?) double polarization measurement, e.g., NAME=s or R, spin-rotation parameters

$p p \rightarrow p p$

"polarization" = recoil polarization asymmetry, or a logically equivalent polarization measurement for a double polarization measurement, e.g., NAME=CNW, CSE, CLL, KWW, KLS, DSW or D, DSS or R, DLS or A  
 POL,POL,POL (NAME=?) for a triple polarization measurement, e.g., NAME=HSS, etc.

$N \bar{N} \rightarrow \pi \pi$

POL (NAME=  
 {  
 TARGET  
 PHOTON  
 RECOIL  
 PARITY  
 } )  
 target asymmetry  
 linearly polarized photon  $\frac{\tau_0 - \tau_1}{\tau_0 + \tau_1}$   
 recoil asymmetry  
 (even if actually deduced from polarized beam and target measurement)  
 $\tau_0 = \frac{\tau_0 - \tau_1}{\tau_0 + \tau_1}$   
 POL,POL (NAME= $\frac{C}{S}$ ) double polarization measurement

### Examples of How Basic V-frames Are Used to Handle Special Cases

D(SIG)/D(MEGA/DE(P=3))  
 2\*MEGA(DIF(0))  
 MEWA  
 $\left. \begin{array}{c} \frac{d^2\sigma}{dM^2} \\ 2\omega_1 \\ \omega_2 \end{array} \right\}$  inelastic electron scattering  
 $\omega_1 = \omega' = \dots$

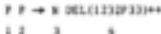
D(SIG(NAME=  
 {  
 L  
 P  
 T  
 } ))/DT  
 $\frac{ds}{dt} = \frac{ds^L}{dt} + c \frac{ds^P}{dt} + \cos(2\alpha) \frac{ds^T}{dt}$   
 $+ \sqrt{\frac{1}{2}(c+1)} \cos(\frac{ds^L}{dt})$

POL\_EWD(ALPHA=04/0B=00,RS2=98,NAME=R)  $\frac{ds}{dt} \text{ as in } \pi^0$   
 electroproduction (polarized virtual  $\pi$ )  
 SIG(PARITY= $\frac{N}{S}$ ) where natural and unnatural parity exchange contributions are separated

AMP(341=mlm,HT=ST)  
 amplitude  $T_{lm}^R$  (forward direction, s-channel transversity frame)  
 D(SIG(S1=1,S2=1))/D(MEGA)  
 ds/(s\*ds) for  $p p \rightarrow p p$   
 ABS(AMP(NAME=REISEN))  
 PHASE(NAME=REGIS)  
 LEGN(L=T), RE(BED(DB=10,BED=90))  
 for  $(I-T) \text{ in } k_{LP}^0 + k_{SP}^0$   
 for Legendre coefficients of  $\partial \sigma_{pp}/\partial t$

Example

Consider the reaction:



where the particle number is given below each particle. Then use

$$\frac{d(\text{SIG})/dt}{dt} (t=1, p=1) \text{ in nb/GeV}^{n+2}$$

or  $\frac{d(\text{SIG})/dt}{dt} \text{ in nb/GeV}^{n+2}$  for  $d\sigma/dt$  for  $A_{n,p}$  in  $\text{nb/GeV}^2$ 

Consider the reaction:



Then use:

POL	for polarization $P$
POL( $\frac{d(\text{SIG})/dt}{dt}$ in nb/GeV $^{n+2}$ )	for $\frac{d\sigma}{dt}$
DEL( $t=0$ )	for $A_3$ in $\frac{d\sigma}{dt} = k^2 A_3 F_1$ in $\text{nb/sr}$
DEL( $t=0$ )	for $\frac{d\sigma}{dt}$

Also, for the reaction



use

$$\text{SIG in nb} \quad \text{for dipole total, in nb}$$

and for the reaction



use

$$\text{SIG in nb} \quad \text{for dipole inelastic, in nb}$$

REFERENCE VOCABULARY

## JOURNAL ABBREVIATIONS

AF	AKADEMIE FÜR PHYSIK
APNT	ANNALS OF PHYSICS (NEW YORK)
APP	ACTA PHYSICA POLONICA
ARPF	ACADEMIA REPUBLICII POPULARE ROMANE, STU. CERCET. PHYSICA
AJOP	AUSTRALIAN JOURNAL OF PHYSICS
BAPS	BULLETIN OF THE AMERICAN PHYSICAL SOCIETY
CRAS	COMPTES RENDUS HERBOMAGISTRARUM DES SEANCES DE L'ACADEMIE DES SCIENCES
DANS	DOGLADY AKADEMII NAEK DSSR
FP	FORSCHERSCHEITE DER PHYSIK
RPA	REHETICA PHYSICA ACTA
SANFS	SEVENTEEN AKADEMII NAEK SSRR, SFRSA FIZICHESKAIA
DET	INSTRUMENTS AND EXPERIMENTAL TECHNIQUES
JETP	SOVIET PHYSICS JETP
JETPL	JETP LETTERS
JP	JOURNAL DE PHYSIQUE
JPPJ	JOURNAL OF THE PHYSICAL SOCIETY OF JAPAN
NC	NUOVO CIMENTO
NCL	LETTERE AL NUOVO CIMENTO
NCS	NUOVO CIMENTO, SUPPLEMENTO
NP	NUCLEAR PHYSICS
NUCL	NUCLEONICA
PL	PHYSICS LETTERS
PM	PHYSICO-MATHEMATICAL MAGAZINE
PN	PARTICLES AND NUCLEI
PSPL	PROCEEDINGS OF THE PHYSICAL SOCIETY OF LONDON
PR	PHYSICAL REVIEW
PRL	PHYSICAL REVIEW LETTERS
PRSE	PROCEEDINGS OF THE ROYAL SOCIETY OF EDINBURGH
PRSL	PROCEEDINGS OF THE ROYAL SOCIETY OF LONDON
PTP	PROGRESS OF THEORETICAL PHYSICS
RMP	REVIEWS OF MODERN PHYSICS
SJNP	SOVIET JOURNAL OF NUCLEAR PHYSICS
SPD	SOVIET PHYSICS DOKLADY
TF	TADERNATA FIZIKA
ZP	ZEITSCHRIFT FÜR PHYSIK

**PART IV**  
**DOCUMENT SUMMARY LISTINGS**

DATA LISTINGS

The Data Listings, on 65 microfiche which are included with this report, contain essentially all the information which is in our Reaction-Data database. The Listings are ordered alphabetically by the 'short code' of the document from which the data were extracted. The short code is a unique identifier assigned by us to each document; it is composed of the first author's last name, the year of issue, and a uniqueness letter or letters, if required (e.g., JONES 67). For a more complete discussion of short codes, see the text at the beginning of this report.

In steady-state, all data from a given document would be encoded in one record in the database and would appear in one unit on the fiche. Here, however, because we have used data from many sources, and for other historical reasons, data from the same paper may be broken up into several units; however, these units will be contiguous on the fiche.

For ease of reference, the first and last short codes contained on each fiche appear dictionary-style at the top of the fiche. An illustrative key to the Data Listings is given on the next page, showing the information available and the format used.

# ILLUSTRATIVE KEY

DOCUMENT SHORT CODE	<b>DEB90176</b>	REF ID: INF C1976 11-2028	REFERENCE(S) AND PUBLICATION TYPE(S): SEE THE REFERENCE VOCABULARY FOR JOURNAL ABBREVIATIONS	
MISCELLANEOUS OVERALL COMMENTS	<b>SYMMETRICAL PROTON SPECTROMETER, POLARIZED TARGET, DOUBLE SCATTERING</b>			
COMMENTS	<p>"<math>\alpha</math>"      ONE IS ANGLE BETWEEN MAGNETIC FIELD AND BEAM DIRECTIONS          "B"      SPIN INJECTION C-PARAM = B-PARAM(POLEFIELD) + AP-PARAM(POLEFIELD)          "C"      NUMBER OF DATA IN DEB90176 BY NO.: PD 439, 108 (1976)          "D"      ENR = 86.000          "E"      ENR = 87.000          "F"      CP-PARAM = CP-PARAM(POLEFIELD) + AP-PARAM(POLEFIELD)</p>			
SYSTEMATIC ERRORS, WHERE KNOWN	REL. RATE SYSTEMATIC ERROR = 1 PCT			
REACTION SEE THE REACTION/INSTRUMENT/USER AND THE PARTICLE VOCABULARY FOR DEFINITIONS AND ABBREVIATIONS	POLARIZED TARGET ASYMMETRY EQUALS SYMMETRICAL PROTON POLARIZATION AT TARGET REVERSAL			
VARYING KINETIC VARIABLES SEE THE KINETIC VARIABLE VOCABULARY FOR DEFINITIONS	<b>-E IN GEV/SEC</b>	<b>THETA IN RAD</b>	<b>POL</b>	COMMENT APPLYING TO THE FOLLOWING TABLE OF DATA
	0.184	36.3	0.19	DEPENDENT VARIABLE SEE THE OBSERVABLE VOCABULARY FOR DEFINITIONS
	0.185	35.3	0.18	
	0.186	35.3	0.18	
	0.188	35.3	0.18	
	0.190	35.3	0.18	
	0.192	35.3	0.18	
	0.194	35.3	0.18	
	0.196	35.3	0.18	
	0.198	35.3	0.18	
	0.200	35.3	0.18	
	0.202	35.3	0.18	
	0.204	35.3	0.18	
	0.206	35.3	0.18	
	0.208	35.3	0.18	
	0.210	35.3	0.18	
	0.212	35.3	0.18	
	0.214	35.3	0.18	
	0.216	35.3	0.18	
	0.218	35.3	0.18	
	0.220	35.3	0.18	
	0.222	35.3	0.18	
	0.224	35.3	0.18	
	0.226	35.3	0.18	
	0.228	35.3	0.18	
	0.230	35.3	0.18	
	0.232	35.3	0.18	
	0.234	35.3	0.18	
	0.236	35.3	0.18	
	0.238	35.3	0.18	
	0.240	35.3	0.18	
	0.242	35.3	0.18	
	0.244	35.3	0.18	
	0.246	35.3	0.18	
	0.248	35.3	0.18	
	0.250	35.3	0.18	
COMMENTS APPLYING TO THE FOLLOWING TABLE OF DATA - SEE SECTION AT TOP OF ENTRY FOR DEFINITION	<b>COMPARISON</b> <b>COMPARISON</b> <b>COMPARISON</b> <b>REACTION</b> $E \rightarrow E$ <b>POL</b> 0.00 ± 0.00			DATA VALUES
NAMES AND VALUES OF KINETIC VARIABLE AND HELD CONSTANT FOR THE FOLLOWING DATA TABLE SEE THE KINETIC VARIABLE VOCABULARY FOR DEFINITIONS	<b>-E IN GEV/SEC</b>	<b>THETA IN RAD</b>	<b>POL (POLARIMETER B-PARAM)</b>	INDICATES START OF NEW DATA TABLE
	0.237	35.3	0.18	
	0.238	35.3	0.18	
	0.239	35.3	0.18	
	0.240	35.3	0.18	
	0.241	35.3	0.18	
	0.242	35.3	0.18	
	0.243	35.3	0.18	
	0.244	35.3	0.18	
	0.245	35.3	0.18	
	0.246	35.3	0.18	
	0.247	35.3	0.18	
	0.248	35.3	0.18	
	0.249	35.3	0.18	
	0.250	35.3	0.18	
	0.251	35.3	0.18	
	0.252	35.3	0.18	
	0.253	35.3	0.18	
	0.254	35.3	0.18	
	0.255	35.3	0.18	
	0.256	35.3	0.18	
	0.257	35.3	0.18	
	0.258	35.3	0.18	
	0.259	35.3	0.18	
	0.260	35.3	0.18	
	0.261	35.3	0.18	
	0.262	35.3	0.18	
	0.263	35.3	0.18	
	0.264	35.3	0.18	
	0.265	35.3	0.18	
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	0.288	35.3	0.18	
	0.289	35.3	0.18	
	0.290	35.3	0.18	
	0.291	35.3	0.18	
	0.292	35.3	0.18	
	0.293	35.3	0.18	
	0.294	35.3	0.18	
	0.295	35.3	0.18	
	0.296	35.3	0.18	
	0.297	35.3	0.18	
	0.298	35.3	0.18	
	0.299	35.3	0.18	
	0.300	35.3	0.18	
	0.301	35.3	0.18	
	0.302	35.3	0.18	
	0.303	35.3	0.18	
	0.304	35.3	0.18	
	0.305	35.3	0.18	
	0.306	35.3	0.18	
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	0.308	35.3	0.18	
	0.309	35.3	0.18	
	0.310	35.3	0.18	
	0.311	35.3	0.18	
	0.312	35.3	0.18	
	0.313	35.3	0.18	
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	0.315	35.3	0.18	
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	0.317	35.3	0.18	
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	0.325	35.3	0.18	
	0.326	35.3	0.18	
	0.327	35.3	0.18	
	0.328	35.3	0.18	
	0.329	35.3	0.18	
	0.330	35.3	0.18	
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