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The Monte - Carlo - Code DECAY to simulate
the decay of Baryon and Meson resonances

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The purpose of the code DECAY:

The code DECAY samples the decay of Baryon and Meson resonances in the laboratory frame. DECAY treats some 80 resonances among these all Baryon resonances of the $3/2^+$ -Decuplet and all Meson resonances of the 1^- -Nonet. Only decay modes with a branching ratio greater than 1% are considered. A given resonance decays via two or three particle decay steps until all decay products are stable particles.

1. Kinematics of two and three particle decay

All resonances decay in the code isotropically in their rest frame.

a) Kinematics of two particle decay in the rest frame of the resonance

We use $i=1,2$ as the indices of the secondary particles. E_i^* is the energy of the secondary particle i in the rest frame

$$E_1^* = \frac{M^2 + m_1^2 - m_2^2}{2M}, \quad E_2^* = M - E_1^* \quad (\text{GeV}).$$

$\vec{p}_i^*$ is the momentum of a secondary particle in the rest frame:

$$|\vec{p}_i^*| = (E_i^{*2} - m_i^2)^{0.5} \quad (\text{GeV}/c),$$

and M is the mass of the decaying particle in GeV/c^2 .

θ_i^* and φ_i^* are polar and azimuthal angles in the rest frame. $\cos \theta_i^*$ and φ_i^* are chosen from uniform distributions in the intervalls $-1 \leq \cos \theta_i^* \leq 1$ and $0 \leq \varphi_i^* < 2\pi$.

Because of momentum conservation we have:

$$\begin{aligned} \cos \theta_2^* &= -\cos \theta_1^* \\ \cos \varphi_2^* &= -\cos \varphi_1^* \\ \sin \varphi_2^* &= -\sin \varphi_1^* \end{aligned}$$

b) Kinematics of three particle decay in the rest frame of the resonance

We consider the three particles in a given plane:

At first we must choose the squares of three invariant masses:

$$\begin{aligned} s_{12} &\equiv s_1 = (\vec{p}_1^* + \vec{p}_2^*)^2 \\ s_{23} &\equiv s_2 = (\vec{p}_2^* + \vec{p}_3^*)^2 \\ s_{31} &\equiv s_3 = (\vec{p}_3^* + \vec{p}_1^*)^2 . \end{aligned}$$

The square of the invariant mass s_1 is uniform distributed and will be sampled between s^+ and s^- with

$$s^{\pm} = m_1^2 + m_2^2 + \frac{1}{2s_2} \left\{ (s_2 - M^2 + m_1^2)(s_2 + m_2^2 - m_3^2) \pm \lambda^{1/2}(s_2, M^2, m_1^2) \lambda^{1/2}(s_2, m_2^2, m_3^2) \right\} .$$

λ is the kinematical function $\lambda(x, y, z) = (x - y - z)^2 - 4yz$. s_2 is distributed according

$$g(s_2) = \frac{dR_3}{ds_2} = \frac{\pi^2}{4M^2 s_2} \lambda^{1/2}(s_2, M^2, m_1^2) \lambda^{1/2}(s_2, m_2^2, m_3^2) .$$

R_3 is the invariant three particle phase space /2/.

s_3 can be calculated from $M^2 = s_1 + s_2 + s_3$.

From the squares of the invariant masses s_i we get the energies and momenta of the three particles as follows:

$$\begin{aligned} E_1^* &= \frac{1}{2M} (M^2 + m_1^2 - s_2) & |\vec{p}_1^*| &= \frac{1}{2M} \lambda^{1/2}(M^2, m_1^2, s_2) \\ E_2^* &= \frac{1}{2M} (M^2 + m_2^2 - s_3) & |\vec{p}_2^*| &= \frac{1}{2M} \lambda^{1/2}(M^2, m_2^2, s_3) \\ E_3^* &= \frac{1}{2M} (M^2 + m_3^2 - s_1) & |\vec{p}_3^*| &= \frac{1}{2M} \lambda^{1/2}(M^2, m_3^2, s_1) . \end{aligned}$$

The angle θ_{12}^* between the directions of particles 1 and 2 is obtained as

$$\cos \theta_{12}^* = \frac{(M^2 + m_1^2 - s_2)(M^2 + m_2^2 - s_3) + 2M^2(m_1^2 + m_2^2 - s_1)}{\lambda(M^2, m_1^2, s_2) \lambda(M^2, m_2^2, s_3)} .$$

Now we have energies, momenta and the relative directions of the three particles. To complete the calculation we have to sample the direction of particle 3 and a rotation angle of particles 1 and 2 around the direction of particle 3, from this we can calculate the angles $\theta_1^*, \theta_2^*, \theta_3^*$ and $\varphi_1^*, \varphi_2^*, \varphi_3^*$ or the direction cosines of the particles.

2. Description of

SUBROUTINE DECAY(ITT,NSTAB,ELAB,PLAB,CX,CY,CZ,AMSS)

purpose:

The user calls the subroutine DECAY, if he wants to simulate the decay of a given resonance. The resonance may have a given momentum and given direction cosines in the laboratory frame. The result is a table of stable decay products with their energies, momenta and direction cosines.

input variables:

ITT	- label of the resonance (see Tab. 1)	
NSTAB	- label of the last stable particle (see Tab.1, i.g. NSTAB=30)	
ELAB	- lab energy (GeV)	} of the resonance (ITT)
PLAB	- lab momentum (GeV/c)	
CX, CY, CZ	- direction cosines	
AMSS	- mass (GeV/c ²)	

The user is allowed to specify a resonance mass different from the average one, however AMSS should be greater then XMMIN(ITT) (see section 3).

output variables:

The output parameters of the decay products are stored in in COMMON-block /FINLSP/ (see section 3).

COMMON-blocks used:

/PART/, /DEAY/, /METLSP/, /FINLSP/, /GAMRED/ (see section 3)

DECAY calls:

CHANWT, AMGA, THREPD, TWOPAD, TRAFO (see section 4)

description:

A flow diagram of DECAY is given in Fig.1.

At first DECAY tests whether the particle (ITT) is stable or unstable. If it is stable, the particle characteristics are taken into the final state particle list. If not, a random choice provides the decay channel (IIK). The decay channel defines the two or three decay products. Two and three body resonance decay is done using the codes TWOPAD and THREPD. The decay products of the resonance are also transformed into the laboratory system using the code TRAF0. Resonances among the decay products are immediately treated in the same way as the primary resonance. For $NSTAB \leq 24$ the K^0 and $\bar{K}^0$ mesons will decay. They are randomly transformed into K_S^0 and K_L^0 respectively.

An example of the call of DECAY and a part of a test - output is given in Fig.2a, 2b.

Applications of the routine DECAY are discussed in /3/.

3. Explanation of COMMON-blocks

COMMON/PART/ANAME(173),AM(173),GA(173),TAU(173),ICH(173),
IBAR(173),K1(173),K2(173),XMMIN(173)

I is used as a label to characterize a given particle or resonance (see Tab.1).

ANAME(I)	- name	} of the particle (I)
AM(I)	- mass (GeV/c^2)	
TAU(I)	- mean life time (s)	
GA(I)	- full width (GeV/c^2)	
ICH(I)	- electric charge	
IBAR(I)	- baryonic number	
K1(I)	- number of the first decay channel	
K2(I)	- number of the last decay channel	

XMMIN(I) - minimum mass of a resonance

Most of the variables in COMMON-blocks /PART/ and /DEAY/ are defined in a BLOCK DATA - subroutine.

COMMON/DEAY/ZKNAME(378),NZK(378,3),WT(378)

The parameters in this COMMON-block define the decay channels of resonances.(see Tab.2)

ZKNAME(K) - name of the decay channel (K)
NZK(K,J) - labels of the three decay products (J=1,2,3)
 in decay channel (K)
WT(K) - weight of channel (K)

COMMON/METLSP/IS,ITS(10),CXS(10),CYS(10),CZS(10),ELS(10),PLS(10)

This COMMON-block stores all intermediate particles resulting from the decay of a given resonance which, if unstable, will decay in turn.

IS - number of intermediate particles

ITS(I)	- programme internal label	} of intermediate particles $1 \leq I \leq IS$
CXS(I)	} - direction cosines	
CYS(I)		
CZS(I)		
ELS(I)	- lab energy (GeV)	
PLS(I)	- lab momentum (GeV/c)	

COMMON/FINLSP/IR, ITR(20), CXR(20), CYR(20), CZR(20), ELR(20), PLR(20)

In this COMMON-block the stable decay products of a resonance are stored.

IR	- number of final state particles	
ITR(I)	- programme internal label (see Tab.1)	} of stable particles $1 \leq I \leq IR$
CXR(I)	} - direction cosines	
CYR(I)		
CZR(I)		
ELR(I)	- lab energy (GeV)	
PLR(I)	- lab momentum (GeV/c)	

COMMON/GAMRED/REDU, AMO, AMM(15)

REDU, AMO - parameters used for internal tests

AMM(15) - masses of decay products calculated in AMGA
(see section 4)

4. Description of routines called from DECAY

SUBROUTINE CHANWT

purpose:

In CHANWT the weights of the decay channels of every particle are summed.

COMMON-blocks used: /PART/, /DEAY/

called from: DECAY

description:

The weights $WT^*(J)$ of every particle (L) are summed as follows:

$$WT^*(J) = \sum_{I=K1(L)}^J WT(I) \quad K1(L) \leq J \leq K2(L)$$

According the definition of the $WT(I)$ it holds $WT^*(K2(L)) = 1$.

The $WT^*(J)$ are used to sample the decay channels.

The new weights $WT^*(J)$ are stored in the old array $WT(378)$ in COMMON-block /PART/.

In CHANWT also $XMIN(173)$ is calculated (see section 3).

remark:

CHANWT will be called only in the first call of DECAY.

FUNCTION AMGA(IT)

purpose:

Random choice of the mass of particle (IT).

input variable: IT - particle label

output variable: AMGA - mass (GeV/c^2) of the particle (IT)

COMMON-blocks used: /PART/, /GAMRED/

AMGA calls: RNDM

called from: DECAY

description:

AMGA smears randomly the mass AM(IT) (see Tab.1) between
 $AM(IT) - 1.2GA(IT) \leq AMGA \leq AM(IT) + 1.2GA(IT)$.

GA(IT) is the full width (GeV/c^2) (see Tab.1).

The Breit - Wigner - Curve is approximated by a Gaussian.

SUBROUTINE TWOPAD(UMO,ECM1,ECM2,PCM1,PCM2,COD1,COF1,SIF1,
COD2,COF2,SIF2,AM1,AM2)

purpose:

TWOPAD handles the two particle decay according the kinematics in 1a.

input variables:

UMO - mass (GeV/c^2) of the resonance

AM1,AM2 - masses (GeV/c^2) of the secondaries

output variables:

ECM1, ECM2 - c.m. energies (GeV)
PCM1, PCM2 - c.m. momenta (GeV/c)
COD1, COD2 - $\cos\theta_1^*$, $\cos\theta_2^*$
COF1, COF2 - $\cos\phi_1^*$, $\cos\phi_2^*$
SIF1, SIF2 - $\sin\phi_1^*$, $\sin\phi_2^*$

TWOPAD calls: SFECFE, RNDM

called from: DECAY

SUBROUTINE THREPD(UMO, ECM1, ECM2, ECM3, PCM1, PCM2, PCM3, COD1, COF1, SIF1, COD2, COF2, SIF2, COD3, COF3, SIF3, AM1, AM2, AM3)

purpose:

THREPD handles the three particle decay in the c.m. system according the kinematics given in 1b.

variables: similar to SUBROUTINE TWOPAD

THREPD calls: SFECFE, RNDM, XLAMB

called from: DECAY

SUBROUTINE TRAFO(GAM,BGAM,CX,CY,CZ,COD,COF,SIF,P,ECM,
PL,CXL,CYL,CZL)

purpose:

Lorentz transformation from the c.m. system into the lab system.

input variables:

GAM - Lorentz parameter $\gamma = (1-\beta^2)^{-1/2}$
 BGAM - Lorentz parameter $\beta\gamma = \beta(1-\beta^2)^{-1/2}$
 CX }
 CY } - direction cosines of a resonance in the lab system
 CZ }
 COD - $\cos\theta$
 COF - $\cos\varphi$
 SIF - $\sin\varphi$
 P - momentum (GeV/c)
 ECM - energy (GeV)

} of a particle in the rest frame
of the resonance

output variables:

PL - momentum (GeV/c)
 CXL }
 CYL } - direction cosines
 CZL } of the particle in the lab system
 EL - energy (GeV)

TRAFO calls: TRANS

called from: DECAY

description:

TRAFO calculates Lorentz-transformed energy, momentum and directions of a particle from the c.m. system into the lab system.

SUBROUTINE TRANS(X0,Y0,Z0,CDE,SDE,SFE,CFE,X,Y,Z)

purpose:

Handling of the rotation of a vector (X0,Y0,Z0) around the angles θ, φ to the new vector (X,Y,Z).

input variables:

X0, Y0, Z0

CDE, SDE - $\cos\theta, \sin\theta$

SFE, CFE - $\sin\varphi, \cos\varphi$

output variables:

X,Y,Z

called from: TRAFO

FUNCTION XLAMB(X,Y,Z)

purpose:

XLAMB is the kinematical function $\lambda^{1/2} = ((x - y - z)^2 - 4yz)^{1/2}$.

input variables: X, Y, Z

output variable: XLAMB

called from: THREPD

SUBROUTINE SFECFE(SFE,CFE)

purpose:

Choise of sine and cosine of angle φ uniformly distributed
between 0 and 2π .

output variables:

SFE - $\sin \varphi$

CFE - $\cos \varphi$

SFECFE calls: RNDM

called from: TWOPAD, THREPD

FUNCTION RNDM(V)

purpose: random generator for numbers $0 \leq \text{RNDM} \leq 1$.

called from: DECAY , TWOPAD, THREPD, SFECFE

references:

- /1/ "Particle Data Group", N. Barash-Schmidt et al.
Rev. of Mod. Phys. Vol. 48 No. 2 (1976)
- /2/ E. Byckling, K. Kajantie: "Particle Kinematics"
John Wiley & Sons, London, New York, Sydney, Toronto
- /3/ K. Hänßgen, R. Kirschner, J. Ranft, J. Wetzig: KMU-HEP-7907

tables and figures:

- Table 1a,b,c: Listing of all considered particles with their programme internal label, with names, full width, mean life time, electric and baryonic charge from /1/ and the labels of their first and last decay channels.
- Table 2a...i: Listing of all decay channels with their labels, names, weights and decay products.
- Figure 1: flow diagram of the code DECAY
- Figure 2a: test programme calling DECAY
- Figure 2b: output obtained from the test programme given in Fig. 2a

TABLE OF USED PARTICLES AND RESONANCES (I)

I = NUMBER OF PARTICLE OR RESONANCE

ANAME = NAME OF I

AM = MASS OF I (GEV)

GA = WIDTH OF I (GEV)

TAU = LIFE TIME OF I (SEC.)

ICH = ELECTRIC CHARGE OF I, IBAR = BARYONIC CHARGE OF I

K1 = FIRST DECAY CHANNEL NUMBER, K2 = LAST DECAY CHANNEL NUMBER OF I

I	ANAME	AM	GA	TAU	ICH	IBAR	K1	K2
1	P	0.9380E 00	0.0	0.1000E 19	1	1	1	1
2	AP	0.9380E 00	0.0	0.1000E 19	-1	-1	2	2
3	E-	0.5000E-03	0.0	0.1000E 19	-1	0	3	3
4	E+	0.5000E-03	0.0	0.1000E 19	1	0	4	4
5	NUE	0.0	0.0	0.1000E 19	0	0	5	5
6	ANUE	0.0	0.0	0.1000E 19	0	0	6	6
7	GAM	0.0	0.0	0.1000E 19	0	0	7	7
8	NEU	0.9400E 00	0.0	0.9180E 03	0	1	8	8
9	ANEU	0.9400E 00	0.0	0.9180E 03	0	-1	9	9
10	MUE+	0.1060E 00	0.0	0.2200E-05	1	0	10	10
11	MUE-	0.1060E 00	0.0	0.2200E-05	-1	0	11	11
12	KOL	0.4970E 00	0.0	0.5200E-07	0	0	12	15
13	PI+	0.1390E 00	0.0	0.2600E-07	1	0	16	16
14	PI-	0.1390E 00	0.0	0.2600E-07	-1	0	17	17
15	K+	0.4940E 00	0.0	0.1200E-07	1	0	18	23
16	K-	0.4940E 00	0.0	0.1200E-07	-1	0	24	29
17	LAM	0.1115E 01	0.0	0.2600E-09	0	1	30	31
18	ALAM	0.1115E 01	0.0	0.2600E-09	0	-1	34	35
19	KOS	0.4970E 00	0.0	0.9000E-10	0	0	38	39
20	SIGM-	0.1197E 01	0.0	0.1500E-09	-1	1	40	40
21	SIGM+	0.1189E 01	0.0	0.8000E-10	1	1	41	42
22	SIGMO	0.1193E 01	0.0	0.5000E-14	0	1	43	43
23	PIO	0.1340E 00	0.0	0.8000E-16	0	0	44	45
24	K0	0.4970E 00	0.0	0.0	0	0	136	137
25	AK0	0.4970E 00	0.0	0.0	0	0	138	139
26	BLANK	0.0	0.0	0.0	0	0	330	330
27	BLANK	0.0	0.0	0.0	0	0	330	330
28	BLANK	0.0	0.0	0.0	0	0	330	330
29	BLANK	0.0	0.0	0.0	0	0	330	330
30	BLANK	0.0	0.0	0.0	0	0	330	330
31	ETA550	0.4800E 00	0.8500E-06	0.0	0	0	46	50
32	RHO+77	0.7730E 00	0.1520E 00	0.0	1	0	51	51
33	RHO077	0.7730E 00	0.1520E 00	0.0	0	0	52	52
34	RHO-77	0.7730E 00	0.1520E 00	0.0	-1	0	54	54
35	OM0783	0.7830E 00	0.1000E-01	0.0	0	0	55	57
36	K*+892	0.8920E 00	0.7900E-01	0.0	1	0	58	59
37	K*0892	0.8920E 00	0.7900E-01	0.0	0	0	60	61
38	K*-892	0.8920E 00	0.7900E-01	0.0	-1	0	62	63
39	AK*089	0.8920E 00	0.7900E-01	0.0	0	0	64	65
40	KA+125	0.1250E 01	0.4500E 00	0.0	1	0	66	67
41	KA0125	0.1250E 01	0.4500E 00	0.0	0	0	68	69
42	KA-125	0.1250E 01	0.4500E 00	0.0	-1	0	70	71
43	AKA012	0.1250E 01	0.4500E 00	0.0	0	0	72	73
44	K**142	0.1421E 01	0.1080E 00	0.0	1	0	74	81

I	ANAME	AM	GA	TAU	ICH	IBAR	K1	K2
45	K*0142	0.1421E	01	0.1080E	00	0.0	82	89
46	K*-142	0.1421E	01	0.1080E	00	0.0	90	97
47	AK*014	0.1421E	01	0.1080E	00	0.0	98	105
48	S+1385	0.1382E	01	0.5000E	-01	0.0	106	108
49	S01385	0.1382E	01	0.5000E	-01	0.0	109	111
50	S-1385	0.1382E	01	0.5000E	-01	0.0	112	113
51	L01820	0.1820E	01	0.3500E	-01	0.0	114	122
52	L02030	0.2030E	01	0.1800E	00	0.0	123	135
53	N*++12	0.1230E	01	0.1150E	00	0.0	140	140
54	N*+ 12	0.1230E	01	0.1150E	00	0.0	141	142
55	N*012	0.1230E	01	0.1150E	00	0.0	143	144
56	N*-12	0.1230E	01	0.1150E	00	0.0	145	145
57	N*++16	0.1675E	01	0.2000E	00	0.0	146	149
58	N*+16	0.1675E	01	0.2000E	00	0.0	150	156
59	N*016	0.1675E	01	0.2000E	00	0.0	157	163
60	N*-16	0.1675E	01	0.2000E	00	0.0	164	167
61	N*+14	0.1430E	01	0.2000E	00	0.0	168	173
62	N*014	0.1430E	01	0.2000E	00	0.0	174	179
63	N*+15	0.1515E	01	0.1000E	00	0.0	180	186
64	N*015	0.1515E	01	0.1000E	00	0.0	187	193
65	N*+18	0.1775E	01	0.2000E	00	0.0	194	201
66	N*018	0.1775E	01	0.2000E	00	0.0	202	209
67	AN--12	0.1230E	01	0.1150E	00	0.0	210	210
68	AN*-12	0.1230E	01	0.1150E	00	0.0	211	212
69	AN*012	0.1230E	01	0.1150E	00	0.0	213	214
70	AN*+12	0.1230E	01	0.1150E	00	0.0	215	215
71	AN--16	0.1675E	01	0.2000E	00	0.0	216	219
72	AN*-16	0.1675E	01	0.2000E	00	0.0	220	226
73	AN*016	0.1675E	01	0.2000E	00	0.0	227	233
74	AN*+16	0.1675E	01	0.2000E	00	0.0	234	237
75	AN*-15	0.1515E	01	0.1000E	00	0.0	238	244
76	AN*015	0.1515E	01	0.1000E	00	0.0	245	251
77	DE*=24	0.2400E	01	0.2000E	00	0.0	252	253
78	RPI+49	0.4890E	00	0.1000E	00	0.0	254	254
79	RPI049	0.4890E	00	0.1000E	00	0.0	255	255
80	RPI-49	0.4890E	00	0.1000E	00	0.0	256	256
81	PIN++	0.1300E	01	0.1000E	00	0.0	257	258
82	PIN+0	0.1300E	01	0.1000E	00	0.0	259	261
83	PIN+-	0.1300E	01	0.1000E	00	0.0	262	264
84	PIN-0	0.1300E	01	0.1000E	00	0.0	265	266
85	PPPI	0.2200E	01	0.2000E	00	0.0	267	268
86	PNPI	0.2200E	01	0.2000E	00	0.0	269	271
87	APPI	0.2200E	01	0.2000E	00	0.0	272	275
88	APNPI	0.2200E	01	0.2000E	00	0.0	276	278
89	K+PPI	0.1700E	01	0.1500E	00	0.0	279	281
90	K-PPI	0.1700E	01	0.1500E	00	0.0	282	285
91	K+NPI	0.1700E	01	0.1500E	00	0.0	286	289
92	K-NPI	0.1700E	01	0.1500E	00	0.0	290	292
93	S+1820	0.1820E	01	0.3500E	-01	0.0	293	298
94	S-2030	0.2030E	01	0.1800E	00	0.0	299	307
95	ETA*	0.9580E	00	0.2000E	-02	0.0	331	334
96	PHI	0.1019E	01	0.4000E	-02	0.0	335	338
97	TETA0	0.1315E	01	0.0	0.3000E	-09	339	339
98	TETA-	0.1321E	01	0.0	0.1700E	-09	340	340
99	ASIG-	0.1189E	01	0.0	0.8000E	-10	341	342
100	ASIG0	0.1192E	01	0.0	0.1000E	-13	343	343
101	ASIG+	0.1197E	01	0.0	0.1500E	-09	344	344
102	ATETA0	0.1315E	01	0.0	0.3000E	-09	345	345
103	ATETA+	0.1321E	01	0.0	0.1700E	-09	346	346

I	ANAME	AM	GA	TAU	ICH	IBAR	K1	K2
104	SIG**	0.1385E 01	0.3400E-01	0.0	1	1	347	349
105	SIG*0	0.1385E 01	0.3400E-01	0.0	0	1	350	352
106	SIG**	0.1385E 01	0.3600E-01	0.0	-1	1	353	355
107	TETA*0	0.1531E 01	0.9000E-02	0.0	0	1	356	357
108	TETA*	0.1531E 01	0.9000E-02	0.0	-1	1	358	359
109	OMEGA-	0.1675E 01	0.0	0.1000E-09	-1	1	360	362
110	ASIG**	0.1385E 01	0.3400E-01	0.0	-1	-1	363	365
111	ASIG*0	0.1385E 01	0.3400E-01	0.0	0	-1	366	368
112	ASIG**	0.1385E 01	0.3600E-01	0.0	1	-1	369	371
113	ATET*0	0.1531E 01	0.9000E-02	0.0	0	-1	372	373
114	ATET**	0.1531E 01	0.9000E-02	0.0	1	-1	374	375
115	OMEGA+	0.1675E 01	0.0	0.1000E-09	1	-1	376	378

RAY CHANNELS OF PARTICLES AND RESONANCES

NAME = PARTICLE AND RESONANCE NAME

NAME = DECAY CHANNEL NAME

RECY CHANNEL NUMBER

NUMBER OF DECAYING PARTICLE

2 = SUM OF DECAY CHANNEL WEIGHTS FROM K1(I) UP TO J

PROGRAM INTERNAL NUMBERS OF DECAY PRODUCTS

J	ANAME	DNAME	DECAY PRODUCTS	WT	NZK
1	P	P	TO	1.0000	1
2	AP	AP	TO	1.0000	2
3	E-	E-	TO	1.0000	3
4	E+	E+	TO	1.0000	4
5	NUE	NUE	TO	1.0000	5
6	ANUE	ANUE	TO	1.0000	6
7	GAM	GAM	TO	1.0000	7
8	NEU	PE-NUE	TO	1.0000	3
9	ANEU	APEANU	TO	1.0000	4
10	MUE+	AANUN	TO	1.0000	4
11	MUE-	E-NUAN	TO	1.0000	5
12	KOL	E-PIO	TO	0.2100	23
13	KOL	SPIO	TO	0.1200	14
14	KOL	PI+-O	TO	0.2700	11
15	KOL	PI-MUNU	TO	0.4000	3
16	PI+	PIE-NU	TO	1.0000	5
17	PI-	MU+NU	TO	1.0000	5
18	K+	MU+NU	TO	0.6400	5
19	K+	MU+NU	TO	0.2100	23
20	K+	PI+PIO	TO	0.0600	13
21	K+	PI+-	TO	0.0200	13
22	K+	PI+O	TO	0.0300	23
23	K+	M+PONU	TO	0.0400	23
24	K-	E+PONU	TO	0.6400	5
25	K-	MU-NU	TO	0.2100	23
26	K-	PI-O	TO	0.0600	13
27	K-	PI+-	TO	0.0200	14
28	K-	PI-O	TO	0.0200	14

I	J	ANAME	DNAME	DECAY PRODUCTS	WT	NZK	
16	28	DECAY OF K-	(CHANNEL: M-PONU)	TO MUE-	0.0300	11	23
16	29	DECAY OF K-	(CHANNEL: E-PONU)	TO E-	0.0400	3	23
17	30	DECAY OF LAM	(CHANNEL: PPI-)	TO P	0.6400	1	14
17	31	DECAY OF LAM	(CHANNEL: NPIO)	TO NEU	0.3600	8	23
18	34	DECAY OF ALAM	(CHANNEL: APPI+)	TO AP	0.6400	2	13
18	35	DECAY OF ALAM	(CHANNEL: ANPIO)	TO ANEU	0.3600	9	23
19	38	DECAY OF KOS	(CHANNEL: PI+PI-)	TO PI+	0.6900	13	14
19	39	DECAY OF KOS	(CHANNEL: PIOPIO)	TO PIO	0.3100	23	23
20	40	DECAY OF SIGM-	(CHANNEL: NPI-)	TO NEU	1.0000	8	14
21	41	DECAY OF SIGM+	(CHANNEL: PPIO)	TO P	0.5200	1	23
21	42	DECAY OF SIGM+	(CHANNEL: NPI+)	TO NEU	0.4800	8	13
22	43	DECAY OF SIGMO	(CHANNEL: LAGA)	TO LAM	1.0000	17	7
23	44	DECAY OF PIO	(CHANNEL: GAGA)	TO GAM	0.9900	7	7
23	45	DECAY OF PIO	(CHANNEL: GAETE-)	TO GAM	0.0100	7	4
24	136	DECAY OF KO	(CHANNEL: KOS)	TO KOS	0.5000	19	29
24	137	DECAY OF KO	(CHANNEL: KOL)	TO KOL	0.5000	12	29
25	138	DECAY OF AKO	(CHANNEL: KOS)	TO KOS	0.5000	19	29
25	139	DECAY OF AKO	(CHANNEL: KOL)	TO KOL	0.5000	12	29
26	330	DECAY OF BLANK	(CHANNEL: BLANC)	TO BLANC	1.0000	29	29
27	330	DECAY OF BLANK	(CHANNEL: BLANC)	TO BLANC	1.0000	29	29
28	330	DECAY OF BLANK	(CHANNEL: BLANC)	TO BLANC	1.0000	29	29
29	330	DECAY OF BLANK	(CHANNEL: BLANC)	TO BLANC	1.0000	29	29
30	330	DECAY OF BLANK	(CHANNEL: BLANC)	TO BLANC	1.0000	29	29
31	46	DECAY OF ETA550	(CHANNEL: GAGA)	TO GAM	0.3800	7	7
31	47	DECAY OF ETA550	(CHANNEL: GAGAPO)	TO PIO	0.0300	23	7
31	48	DECAY OF ETA550	(CHANNEL: PIOO)	TO PIO	0.3000	23	23
31	49	DECAY OF ETA550	(CHANNEL: PI+-O)	TO PI+	0.2400	13	14
32	50	DECAY OF ETA550	(CHANNEL: PI+-GA)	TO PI+	0.0500	13	14
32	51	DECAY OF RHO+77	(CHANNEL: PI+O)	TO PI+	1.0000	13	23
33	52	DECAY OF RHO+77	(CHANNEL: PI+-)	TO PI+	1.0000	13	14
33	54	DECAY OF RHO+77	(CHANNEL: PI=O)	TO PI-	1.0000	14	23
34	55	DECAY OF OM0783	(CHANNEL: PI+-O)	TO PI+	0.9000	13	14
34	56	DECAY OF OM0783	(CHANNEL: PI+-)	TO PI+	0.0100	13	14
35	57	DECAY OF OM0783	(CHANNEL: PIOGA)	TO PIO	0.0900	23	7
35	58	DECAY OF K*+892	(CHANNEL: K+PIO)	TO K+	0.3300	15	23
36	59	DECAY OF K*+892	(CHANNEL: KOPI+)	TO KO	0.6700	24	13
37	60	DECAY OF K*0892	(CHANNEL: KOPIO)	TO KO	0.3300	24	23
37	61	DECAY OF K*0892	(CHANNEL: K+PI-)	TO K+	0.6700	15	14
38	62	DECAY OF K*-892	(CHANNEL: K-PIO)	TO K-	0.3300	16	23

I	J	ANAME	DNAME	DECAY PRODUCTS	WT-	NZK
38	63	DECAF OF K*-892	(CHANNEL: AKOPI-)	TO AKO	0.6700	25
39	64	DECAF OF AK*089	(CHANNEL: AKOPI0)	TO AKO	0.3300	25
40	65	DECAF OF AK*089	(CHANNEL: K-PI+)	TO K-	0.6700	16
41	66	DECAF OF KA+125	(CHANNEL: K+PI0)	TO K+	0.3300	15
42	67	DECAF OF KA+125	(CHANNEL: KOPI+)	TO KO	0.6700	24
43	68	DECAF OF KA0125	(CHANNEL: KOPI0)	TO KO	0.3300	24
44	69	DECAF OF KA0125	(CHANNEL: K+PI-)	TO K+	0.6700	15
45	70	DECAF OF KA-125	(CHANNEL: K-PI0)	TO K-	0.3300	16
46	71	DECAF OF KA-125	(CHANNEL: KOPI-)	TO KO	0.6700	24
47	72	DECAF OF AK*012	(CHANNEL: AKOPI0)	TO AKO	0.3300	25
48	73	DECAF OF AK*012	(CHANNEL: K-PI+)	TO K-	0.6700	16
49	74	DECAF OF K*+142	(CHANNEL: K+PI0)	TO K+	0.1900	15
50	75	DECAF OF K*+142	(CHANNEL: KOPI+)	TO KO	0.3800	24
51	76	DECAF OF K*+142	(CHANNEL: K+89P0)	TO K*+8	0.0900	36
52	77	DECAF OF K*+142	(CHANNEL: K08PI+)	TO K*08	0.2000	37
53	78	DECAF OF K*+142	(CHANNEL: K+RC077)	TO K+	0.0300	15
54	79	DECAF OF K*+142	(CHANNEL: K0RO+7)	TO KO	0.0400	24
55	80	DECAF OF K*+142	(CHANNEL: K+OM07)	TO K+	0.0500	15
56	81	DECAF OF K*+142	(CHANNEL: K+E055)	TO K+	0.0200	15
57	82	DECAF OF K*0142	(CHANNEL: KOPI0)	TO KO	0.1900	24
58	83	DECAF OF K*0142	(CHANNEL: K+PI+)	TO K+	0.3800	15
59	84	DECAF OF K*0142	(CHANNEL: K089P0)	TO K*08	0.0900	37
60	85	DECAF OF K*0142	(CHANNEL: K+8PI-)	TO K*+8	0.2000	36
61	86	DECAF OF K*0142	(CHANNEL: K0R077)	TO KO	0.0300	24
62	87	DECAF OF K*0142	(CHANNEL: K+R-77)	TO K+	0.0400	15
63	88	DECAF OF K*0142	(CHANNEL: K+R-77)	TO KO	0.0500	24
64	89	DECAF OF K*0142	(CHANNEL: K0OM07)	TO KO	0.0200	24
65	90	DECAF OF K*--142	(CHANNEL: K0E055)	TO K-	0.1900	16
66	91	DECAF OF K*--142	(CHANNEL: K-PI0)	TO KO	0.3800	24
67	92	DECAF OF K*--142	(CHANNEL: KOPI-)	TO K*+8	0.0900	38
68	93	DECAF OF K*--142	(CHANNEL: K-89P0)	TO AK*0	0.2000	39
69	94	DECAF OF K*--142	(CHANNEL: AK08P-)	TO K-	0.0300	16
70	95	DECAF OF K*--142	(CHANNEL: K-R077)	TO AKO	0.0400	25
71	96	DECAF OF K*--142	(CHANNEL: AKOR-7)	TO K-	0.0500	16
72	97	DECAF OF K*--142	(CHANNEL: K-OM07)	TO K-	0.0200	16
73	98	DECAF OF AK*014	(CHANNEL: K-E055)	TO AKO	0.1900	25
74	99	DECAF OF AK*014	(CHANNEL: AKOPI0)	TO K-	0.3800	16
75	100	DECAF OF AK*014	(CHANNEL: K-PI+)	TO AK*0	0.0900	39
76	101	DECAF OF AK*014	(CHANNEL: AK08P0)	TO K*+8	0.2000	38

I	J	ANAME	DNAME	DECAY PRODUCTS	WT	NZK	
47	102	OF AK*014	(CHANNEL: K-8PI+)	TO AKO	BLAN	0.0300	29
47	103	OF AK*014	(CHANNEL: AKOR07)	TO K-	BLAN	0.0400	29
47	104	OF AK*014	(CHANNEL: AKOQM7)	TO AKO	BLAN	0.0500	29
47	105	OF AK*014	(CHANNEL: AKOE05)	TO AKO	BLAN	0.0200	29
48	106	OF S+1385	(CHANNEL: LAOP1+)	TO LAM	BLAN	0.8800	29
48	107	OF S+1385	(CHANNEL: SIOP1+)	TO SIGM	BLAN	0.0600	29
48	108	OF S+1385	(CHANNEL: SI+PIO)	TO SIGM	BLAN	0.0600	29
49	109	OF S01385	(CHANNEL: LAOP10)	TO LAM	BLAN	0.8800	29
49	110	OF S01385	(CHANNEL: SI+PI-)	TO SIGM	BLAN	0.0600	29
49	111	OF S01385	(CHANNEL: SI-PI+)	TO SIGM	BLAN	0.0600	29
50	112	OF S-1385	(CHANNEL: LAOP1-)	TO LAM	BLAN	0.8800	29
50	113	OF S-1385	(CHANNEL: SIOP1-)	TO SIGM	BLAN	0.1200	29
51	114	OF L01820	(CHANNEL: NEUAKO)	TO NEU	BLAN	0.1900	29
51	115	OF L01820	(CHANNEL: PK-)	TO P	BLAN	0.1900	29
51	116	OF L01820	(CHANNEL: SI+PI-)	TO SIGM	BLAN	0.1600	29
51	117	OF L01820	(CHANNEL: SIOP10)	TO SIGM	BLAN	0.1600	29
51	118	OF L01820	(CHANNEL: SI-PI+)	TO SIGM	BLAN	0.1700	29
51	119	OF L01820	(CHANNEL: LAOET0)	TO LAM	BLAN	0.0300	29
51	120	OF L01820	(CHANNEL: S+1PI-)	TO S+13	BLAN	0.0300	29
51	121	OF L01820	(CHANNEL: S-1PI+)	TO S-13	BLAN	0.0300	29
51	122	OF L01820	(CHANNEL: SO1PIO)	TO SO13	BLAN	0.0400	29
52	123	OF L02030	(CHANNEL: NEUAKO)	TO NEU	BLAN	0.1000	29
52	124	OF L02030	(CHANNEL: PK-)	TO P	BLAN	0.1000	29
52	125	OF L02030	(CHANNEL: LAOP10)	TO LAM	BLAN	0.2000	29
52	126	OF L02030	(CHANNEL: LAOQMO)	TO LAM	BLAN	0.1200	29
52	127	OF L02030	(CHANNEL: LAOR00)	TO LAM	BLAN	0.1000	29
52	128	OF L02030	(CHANNEL: SI+RO-)	TO SIGM	BLAN	0.0400	29
52	129	OF L02030	(CHANNEL: SI-RO+)	TO SIGM	BLAN	0.0400	29
52	130	OF L02030	(CHANNEL: SIOR00)	TO SIGM	BLAN	0.0500	29
52	131	OF L02030	(CHANNEL: LAOET0)	TO LAM	BLAN	0.0750	29
52	132	OF L02030	(CHANNEL: SIOET0)	TO SIGM	BLAN	0.0750	29
52	133	OF L02030	(CHANNEL: SI+PI-)	TO SIGM	BLAN	0.0300	29
52	134	OF L02030	(CHANNEL: SI-PI+)	TO SIGM	BLAN	0.0300	29
52	135	OF L02030	(CHANNEL: SIOPIO)	TO SIGM	BLAN	0.0400	29
53	140	OF N**+12	(CHANNEL: P PI+)	TO P	BLAN	1.0000	29
54	141	OF N**+ 12	(CHANNEL: P PIO)	TO P	BLAN	0.6700	29
54	142	OF N**+ 12	(CHANNEL: N PI+)	TO NEU	BLAN	0.3300	29
55	143	OF N*012	(CHANNEL: P PI-)	TO P	BLAN	0.3300	29
55	144	OF N*012	(CHANNEL: N PIO)	TO NEU	BLAN	0.6700	29

I	J	ANAME	DNAME	DECAY PRODUCTS	WT	NZK	
56	145	OF N*-12	(CHANNEL: N PI-	NEU	1.0000	8	14
57	146	OF N**+16	(CHANNEL: P PI+	P	0.2500	1	13
57	147	OF N**+16	(CHANNEL: N*#PI0	N**+	0.2700	53	23
57	148	OF N**+16	(CHANNEL: N**+PI+	N**+	0.1800	54	13
57	149	OF N**+16	(CHANNEL: PRHO+	P	0.3000	1	78
58	150	OF N**+16	(CHANNEL: P PI0	P	0.1700	1	23
58	151	OF N**+16	(CHANNEL: N PI+	NEU	0.0800	8	13
58	152	OF N**+16	(CHANNEL: N*#PI-	N**+	0.1800	53	14
58	153	OF N**+16	(CHANNEL: N**+PI0	N**+	0.0300	54	23
58	154	OF N**+16	(CHANNEL: N*OPI+	N*01	0.2400	55	13
58	155	OF N**+16	(CHANNEL: PRHO0	P	0.2000	1	79
58	156	OF N**+16	(CHANNEL: NRHO+	NEU	0.1000	8	78
59	157	OF N*016	(CHANNEL: P PI-	P	0.0800	1	14
59	158	OF N*016	(CHANNEL: N PI0	NEU	0.1700	8	23
59	159	OF N*016	(CHANNEL: N*PI-	N**+	0.2400	54	14
59	160	OF N*016	(CHANNEL: N*OPI0	N*01	0.0300	55	23
59	161	OF N*016	(CHANNEL: N*PI+	N*-1	0.1800	56	13
59	162	OF N*016	(CHANNEL: PRHO-	P	0.1000	1	80
59	163	OF N*016	(CHANNEL: NRHO0	NEU	0.2000	8	79
60	164	OF N*-16	(CHANNEL: N PI-	NEU	0.2500	8	14
60	165	OF N*-16	(CHANNEL: N*OPI-	N*01	0.1800	55	14
60	166	OF N*-16	(CHANNEL: N*-PI0	N*-1	0.2700	56	23
60	167	OF N*-16	(CHANNEL: NRHO-	NEU	0.3000	8	80
61	168	OF N**+14	(CHANNEL: PETAO	P	0.4000	1	31
61	169	OF N**+14	(CHANNEL: N*PI-	N**+	0.2000	53	14
61	170	OF N**+14	(CHANNEL: N**+PI0	N**+	0.1250	54	23
61	171	OF N**+14	(CHANNEL: N*OPI+	N*01	0.0750	55	13
61	172	OF N**+14	(CHANNEL: PRHO0	P	0.0750	1	79
61	173	OF N**+14	(CHANNEL: NRHO+	NEU	0.1250	8	78
62	174	OF N*014	(CHANNEL: NETAO	NEU	0.4000	8	31
62	175	OF N*014	(CHANNEL: N*PI-	N*01	0.0750	54	14
62	176	OF N*014	(CHANNEL: N*OPI0	N*-1	0.1250	55	23
62	177	OF N*014	(CHANNEL: N**+PI+	N*-1	0.2000	56	13
62	178	OF N*014	(CHANNEL: PRHO-	P	0.1250	1	80
62	179	OF N*014	(CHANNEL: NRHO0	NEU	0.0750	8	79
63	180	OF N**+15	(CHANNEL: P PI0	P	0.1800	1	23
63	181	OF N**+15	(CHANNEL: N PI+	NEU	0.3700	8	13
63	182	OF N**+15	(CHANNEL: N*#PI-	N**+	0.1300	53	14
63	183	OF N**+15	(CHANNEL: N**+PI0	N**+	0.0800	54	23

I	J	ANAME	DNAME	DECAY PRODUCTS	WT	NZK	
63	184	DE	OF	DE	PI+	0.0400	55
63	185	DE	OF	DE	PI+	0.0700	13
63	186	DE	OF	DE	PI+	0.1300	79
64	187	DE	OF	DE	PI-	0.3700	78
64	188	DE	OF	DE	PI-	0.1800	14
64	189	DE	OF	DE	PI-	0.0400	23
64	190	DE	OF	DE	PI-	0.0800	14
64	191	DE	OF	DE	PI-	0.1300	23
64	192	DE	OF	DE	PI-	0.1300	13
64	193	DE	OF	DE	PI-	0.1300	80
65	194	DE	OF	DE	PI-	0.0700	79
65	195	DE	OF	DE	PI-	0.0700	23
65	196	DE	OF	DE	PI-	0.1300	13
65	197	DE	OF	DE	PI-	0.2300	33
65	198	DE	OF	DE	PI-	0.4700	32
65	199	DE	OF	DE	PI-	0.0500	15
65	200	DE	OF	DE	PI-	0.0200	24
65	201	DE	OF	DE	PI-	0.0100	15
65	202	DE	OF	DE	PI-	0.0200	31
66	203	DE	OF	DE	PI-	0.1300	14
66	204	DE	OF	DE	PI-	0.0700	23
66	205	DE	OF	DE	PI-	0.4700	34
66	206	DE	OF	DE	PI-	0.2300	33
66	207	DE	OF	DE	PI-	0.0500	24
66	208	DE	OF	DE	PI-	0.0100	24
66	209	DE	OF	DE	PI-	0.0200	15
66	210	DE	OF	DE	PI-	0.0200	31
67	211	DE	OF	DE	PI-	1.0000	14
68	212	DE	OF	DE	PI-	0.6700	23
68	213	DE	OF	DE	PI-	0.3300	14
69	214	DE	OF	DE	PI-	0.3300	13
69	215	DE	OF	DE	PI-	0.6700	23
70	216	DE	OF	DE	PI-	1.0000	13
71	217	DE	OF	DE	PI-	0.2500	14
71	218	DE	OF	DE	PI-	0.2700	23
71	219	DE	OF	DE	PI-	0.1800	14
72	220	DE	OF	DE	PI-	0.3000	80
72	221	DE	OF	DE	PI-	0.1700	23
72	222	DE	OF	DE	PI-	0.0800	14
					0.1800	67	13

I	J	ANAME	CHANNEL:	DNAME	DECAY PRODUCTS	WT	NZK	
72	223	OF AN*-10	(CHANNEL: AN*-PO	TO AN*-	PI0	0.0300	68	29
72	224	OF AN*-16	(CHANNEL: AN*OP-	TO AN*0	PI-	0.2400	69	29
72	225	OF AN*-16	(CHANNEL: APRHO-	TO AP	RPI0	0.2000	2	29
72	226	OF AN*-16	(CHANNEL: ANRHO-	TO ANEU	RPI-	0.1000	9	29
73	227	OF AN*016	(CHANNEL: APPI+	TO AP	PI+	0.0800	2	29
73	228	OF AN*016	(CHANNEL: ANPIO	TO ANEU	PI0	0.1700	9	29
73	229	OF AN*016	(CHANNEL: AN*-P+	TO AN*-	PI+	0.2400	68	29
73	230	OF AN*016	(CHANNEL: AN*OPO	TO AN*0	PI0	0.0300	69	29
73	231	OF AN*016	(CHANNEL: AN*P-	TO AN*+	PI-	0.1800	70	29
73	232	OF AN*016	(CHANNEL: APRHO+	TO AP	RPI+	0.1000	2	29
73	233	OF AN*016	(CHANNEL: ANRHO	TO ANEU	RPI0	0.2000	9	29
74	234	OF AN*+16	(CHANNEL: ANPI+	TO ANEU	PI+	0.2500	9	29
74	235	OF AN*+16	(CHANNEL: AN*OP+	TO AN*0	PI+	0.1800	69	29
74	236	OF AN*+16	(CHANNEL: AN*PO	TO AN*+	PI0	0.2700	70	29
74	237	OF AN*+16	(CHANNEL: ANRHO+	TO ANEU	RPI+	0.3000	9	29
75	238	OF AN*-15	(CHANNEL: APPI0	TO AP	PI0	0.1800	2	29
75	239	OF AN*-15	(CHANNEL: ANPI-	TO ANEU	PI-	0.3700	9	29
75	240	OF AN*-15	(CHANNEL: AN*=P+	TO AN*-	PI+	0.1300	67	29
75	241	OF AN*-15	(CHANNEL: AN*-PO	TO AN*-	PI0	0.0800	68	29
75	242	OF AN*-15	(CHANNEL: AN*OP-	TO AN*0	PI-	0.0400	69	29
75	243	OF AN*-15	(CHANNEL: APRHO	TO AP	RPI0	0.0700	2	29
75	244	OF AN*-15	(CHANNEL: ANRHO+	TO ANEU	RPI-	0.1300	9	29
75	245	OF AN*015	(CHANNEL: APPI+	TO AP	PI+	0.3700	2	29
76	246	OF AN*015	(CHANNEL: ANPIO	TO ANEU	PI0	0.1800	9	29
76	247	OF AN*015	(CHANNEL: AN*-P+	TO AN*-	PI+	0.0400	68	29
76	248	OF AN*015	(CHANNEL: AN*OPO	TO AN*0	PI0	0.0800	69	29
76	249	OF AN*015	(CHANNEL: AN*P-	TO AN*+	PI-	0.1300	70	29
76	250	OF AN*015	(CHANNEL: APRHO+	TO AP	RPI+	0.1300	2	29
76	251	OF AN*015	(CHANNEL: ANRHO	TO ANEU	RPI0	0.0700	9	29
77	252	OF DE*=24	(CHANNEL: PN*014	TO P	N*01	0.5000	1	29
77	253	OF DE*=24	(CHANNEL: NN*=14	TO NEU	N*+1	0.5000	8	29
77	254	OF RPI+49	(CHANNEL: PI+0	TO PI+	PI0	1.0000	13	29
78	255	OF RPI049	(CHANNEL: PI+-	TO PI+	PI-	1.0000	13	29
79	256	OF RPI-49	(CHANNEL: PI-0	TO PI-	PI0	1.0000	14	29
80	257	OF PIN++	(CHANNEL: P+0	TO P	PI+	0.8000	1	23
81	258	OF PIN++	(CHANNEL: N++	TO NEU	PI+	0.2000	8	13
81	259	OF PIN+0	(CHANNEL: P+-	TO P	PI-	0.6000	1	14
82	260	OF PIN+0	(CHANNEL: P00	TO P	PI0	0.3000	1	23
82	261	OF PIN*0	(CHANNEL: N+0	TO NEU	PI+	0.1000	8	23

I	J	ANAME	CHANEL	DNAME	DECAY PRODUCTS	WT	NZK	
83	262	DECAY OF PIN+-	(CHANEL: N+-	)	TO	PI-	0.6000	8
83	263	DECAY OF PIN+-	(CHANEL: N00	)	TO	PI0	0.3000	13
83	264	DECAY OF PIN+-	(CHANEL: P-0	)	TO	PI-	0.1000	23
84	265	DECAY OF PIN-0	(CHANEL: N-0	)	TO	PI-	0.8000	14
84	266	DECAY OF PIN-0	(CHANEL: P--	)	TO	PI-	0.2000	14
85	267	DECAY OF PPPI	(CHANEL: PPPI0	)	TO	P	0.3300	1
85	268	DECAY OF PPPI	(CHANEL: PNPI+	)	TO	NEU	0.6700	1
86	269	DECAY OF PNPI	(CHANEL: PNPI0	)	TO	NEU	0.6600	8
86	270	DECAY OF PNPI	(CHANEL: PPPI-	)	TO	P	0.1700	1
86	271	DECAY OF PNPI	(CHANEL: NNPI+	)	TO	NEU	0.1700	8
87	272	DECAY OF APPPI	(CHANEL: APPI0	)	TO	P	0.3200	1
87	273	DECAY OF APPPI	(CHANEL: APPI+	)	TO	NEU	0.1700	2
87	274	DECAY OF APPPI	(CHANEL: ANPI0	)	TO	NEU	0.3200	8
87	275	DECAY OF APPPI	(CHANEL: ANPI-	)	TO	P	0.1900	9
88	276	DECAY OF APNPI	(CHANEL: APNPI0	)	TO	NEU	0.3300	1
88	277	DECAY OF APNPI	(CHANEL: APPI-	)	TO	P	0.3300	8
88	278	DECAY OF APNPI	(CHANEL: ANPI-	)	TO	NEU	0.3400	9
89	279	DECAY OF K+PPI	(CHANEL: K+PPI0	)	TO	P	0.3000	15
89	280	DECAY OF K+PPI	(CHANEL: K+PPI+	)	TO	NEU	0.0500	15
89	281	DECAY OF K+PPI	(CHANEL: KOPPI0	)	TO	P	0.6500	24
90	282	DECAY OF K-PPI	(CHANEL: K-PPI0	)	TO	P	0.3800	16
90	283	DECAY OF K-PPI	(CHANEL: K-NPI+	)	TO	NEU	0.1200	16
90	284	DECAY OF K-PPI	(CHANEL: AKPPI-	)	TO	P	0.3800	25
90	285	DECAY OF K-PPI	(CHANEL: AKNPI0	)	TO	NEU	0.1200	25
91	286	DECAY OF K+NPI	(CHANEL: K+NPI0	)	TO	NEU	0.3800	15
91	287	DECAY OF K+NPI	(CHANEL: K+PPI-	)	TO	P	0.1200	15
91	288	DECAY OF K+NPI	(CHANEL: KOPPI0	)	TO	P	0.3800	24
91	289	DECAY OF K+NPI	(CHANEL: KONPI+	)	TO	NEU	0.1200	24
92	290	DECAY OF K-NPI	(CHANEL: K-NPI0	)	TO	NEU	0.3000	16
92	291	DECAY OF K-NPI	(CHANEL: K-PPI-	)	TO	P	0.0500	16
92	292	DECAY OF K-NPI	(CHANEL: AKNPI-	)	TO	NEU	0.6500	25
93	293	DECAY OF S+1820	(CHANEL: PAKO	)	TO	AKO	0.3800	1
93	294	DECAY OF S+1820	(CHANEL: SI+PPI0	)	TO	PI0	0.2500	21
93	295	DECAY OF S+1820	(CHANEL: SIOPPI+	)	TO	PI+	0.2500	22
93	296	DECAY OF S+1820	(CHANEL: SI+ETA	)	TO	ETAS	0.0200	21
93	297	DECAY OF S+1820	(CHANEL: S+1PPI0	)	TO	PI0	0.0500	48
93	298	DECAY OF S+1820	(CHANEL: S01PPI+	)	TO	PI+	0.0500	49
94	299	DECAY OF S-2030	(CHANEL: NEUK-	)	TO	K-	0.2000	8
94	300	DECAY OF S-2030	(CHANEL: LAOPPI-	)	TO	PI-	0.2000	17

I	J	NAME	DNAME	DECAY PRODUCTS	WT	NZK	
94	301	DECAY OF S-2030	SI-OMO	TO	0.1200	20	35
94	302	DECAY OF S-2030	LAORO-	TO	0.1000	17	34
94	303	DECAY OF S-2030	SIORO-	TO	0.0700	22	34
94	304	DECAY OF S-2030	SI-ROO	TO	0.0700	20	33
94	305	DECAY OF S-2030	SI-ETO	TO	0.1400	20	31
94	306	DECAY OF S-2030	SIOP1-	TO	0.0500	22	14
94	307	DECAY OF S-2030	SI-O	TO	0.0500	20	23
95	331	DECAY OF ETA*	EPI+-	TO	0.4800	31	13
95	332	DECAY OF ETA*	EPI00	TO	0.2400	31	23
95	333	DECAY OF ETA*	GAPI+-	TO	0.2600	13	14
95	334	DECAY OF ETA*	GAGA*	TO	0.0200	7	7
96	335	DECAY OF PHI	K+-	TO	0.4700	15	16
96	336	DECAY OF PHI	KLKS	TO	0.3500	12	19
96	337	DECAY OF PHI	PI+-O	TO	0.1500	13	14
96	338	DECAY OF PHI	EGA	TO	0.0300	31	7
97	339	DECAY OF TETA0	LPI0	TO	1.0000	17	23
98	340	DECAY OF TETA-	LPI	TO	1.0000	17	14
99	341	DECAY OF ASIG-	APPI0	TO	0.5200	2	23
99	342	DECAY OF ASIG-	ANPI-	TO	0.4800	9	14
100	343	DECAY OF ASIGO	ALAGA	TO	1.0000	18	7
101	344	DECAY OF ASIG+	ANPI	TO	1.0000	9	13
102	345	DECAY OF ATETA0	ALPI0	TO	1.0000	18	23
103	346	DECAY OF ATETA+	ALPI+	TO	1.0000	18	13
104	347	DECAY OF SIG**	LAPI+	TO	0.9000	17	13
104	348	DECAY OF SIG**	SI+PI0	TO	0.0500	21	23
104	349	DECAY OF SIG**	SIOP1+	TO	0.0500	22	13
105	350	DECAY OF SIG*0	LAP10	TO	0.9000	17	23
105	351	DECAY OF SIG*0	SI+PI-	TO	0.0500	21	14
105	352	DECAY OF SIG*0	SI-PI+	TO	0.0500	20	13
106	353	DECAY OF SIG*-	LAPI-	TO	0.9000	17	14
106	354	DECAY OF SIG*-	SI-PI0	TO	0.0500	20	23
106	355	DECAY OF TETA*0	SIOP1-	TO	0.0500	22	14
107	356	DECAY OF TETA*0	TEOP10	TO	0.3300	97	23
107	357	DECAY OF TETA*0	TE-PI+	TO	0.6700	98	13
108	358	DECAY OF TETA*	TEOP1-	TO	0.6700	97	14
108	359	DECAY OF TETA*	TE-PI0	TO	0.3300	98	23
109	360	DECAY OF OMEGA-	TEOP1	TO	0.2500	97	14
109	361	DECAY OF OMEGA-	TE-PI	TO	0.2500	98	23
109	362	DECAY OF OMEGA-	LAK-	TO	0.5000	17	16

Fig. 1

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C PROGRAM TEST
C TEST OF DECAY
COMMON/PART/ANAME(173),AM(173),GA(173),TAU(173),ICH(173),IBAR(173)
*,K1(173),K2(173)
COMMON/FINLSP/IR,ITR(20),          CXR(20),CYR(20),
*CZR(20),ELR(20),PLR(20)
REAL ANAME * 8
CX=0.
CY=0.
CZ=1.
NSTAB =30
DO 1 ITR=31,111
DO 2 IP=1,10
PLAB=0.3*JP
AMASS=AMGA(ITR)
ELAB=SQRT(PLAB**2+AMASS **2)
CALL DECAY(ITR,NSTAB,ELAB,PLAB,CX,CY,CZ,AMASS )
PRINT 3,ANAME(ITR),ELAB,PLAB,CX,CY,CZ,AMASS
PRINT 5
E=0.
DPX=0.
DPY=0.
DPZ=0.
DO 4 I=1,IR
PRINT 6,ANAME(ITR(I)),CXR(I),CYR(I),CZR(I),ELR(I),PLR(I)
6 FORMAT(1X,1A6,5F12.6)
E=E+ELR(I)
DPX=DPX+CXR(I)*PLR(I)
DPY=DPY+CYR(I)*PLR(I)
DPZ=DPZ+CZR(I)*PLR(I)
4 CONTINUE
E=E-ELAB
DPX=CX*PLAB-DPX
DPY=CY*PLAB-DPY
DPZ=CZ*PLAB-DPZ
IF((ABS(E)+ABS(DPX)+ABS(DPY)+ABS(DPZ)).LT.0.001) GO TO 2
PRINT 7,E,DPX,DPY,DPZ
2 CONTINUE
1 CONTINUE
3 FORMAT(/' DECAY OF ',1A6,/' ELAB,PLAB,CX,CY,CZ,M',6F 7.2)

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5 FORMAT( /' DECAY PRODUCTS  CX,CY,CZ,ELR,PLR' / )
7 FORMAT(' DE,DPX,DPY,DPZ ',4F12.6)
RETURN
END

```

Fig. 2b

DECAY OF N^{*-12}

ELAB, PLAB, CX, CY, CZ, M 2.69 2.40 0.0 0.0 1.00 1.21

DECAY PRODUCTS CX, CY, CZ, ELR, PLR

PI-	0.530053	0.489928	0.692108	0.210316	0.157828
NEU	-0.036473	-0.033712	0.998766	2.478744	2.293594

DECAY OF N^{*-12}

ELAB, PLAB, CX, CY, CZ, M 2.93 2.70 0.0 0.0 1.00 1.13

DECAY PRODUCTS CX, CY, CZ, ELR, PLR

PI-	0.168266	-0.081539	0.982363	0.573465	0.556363
NEU	-0.043421	0.021041	0.998835	2.351966	2.155957

DECAY OF N^{*-12}

ELAB, PLAB, CX, CY, CZ, M 3.23 3.00 0.0 0.0 1.00 1.20

DECAY PRODUCTS CX, CY, CZ, ELR, PLR

PI-	0.172470	-0.075122	0.982146	0.893318	0.882436
NEU	-0.071125	0.030980	0.996986	2.337133	2.139766

DECAY OF N^{*+16}

ELAB, PLAB, CX, CY, CZ, M 1.85 0.30 0.0 0.0 1.00 1.82

DECAY PRODUCTS CX, CY, CZ, ELR, PLR

PI+	-0.334431	0.767634	-0.546711	0.441884	0.419451
PIO	0.724185	0.286820	0.635895	0.325465	0.296598
P	-0.140185	-0.754639	0.640989	1.078135	0.531543

DECAY OF N^{*+16}

ELAB, PLAB, CX, CY, CZ, M 1.86 0.60 0.0 0.0 1.00 1.76

DECAY PRODUCTS CX, CY, CZ, ELR, PLR

PIO	-0.761070	-0.022458	0.648281	0.423892	0.402153
PI+	0.086271	0.623249	0.777250	0.425084	0.401714
P	0.745230	-0.662655	0.074297	1.006222	0.364196

DECAY OF N^{*+16}

ELAB, PLAB, CX, CY, CZ, M 1.89 0.90 0.0 0.0 1.00 1.66

DECAY PRODUCTS CX, CY, CZ, ELR, PLR

PI+	-0.561677	-0.073782	0.824060	0.820135	0.808268
P	0.882922	0.115081	0.454970	1.069685	0.514185

DECAY OF N^{*+16}

ELAB, PLAB, CX, CY, CZ, M 2.19 1.20 0.0 0.0 1.00 1.83

DECAY PRODUCTS CX, CY, CZ, ELR, PLR

PIO	0.563818	0.102807	0.819475	0.245477	0.205675
PI+	-0.257173	0.005242	0.966351	0.987943	0.978116
P	0.832692	-0.161354	0.529706	0.952027	0.162825