

Gene H Barbee
Feb 22 2015

Title: Baryon and Meson Mass and Decay Time Correlations

Abstract

Experiments at high energy labs have resulted in a large volume of data regarding 197 unstable baryon and meson particles (as of 2014). Experimenters gather this information with the goal of understanding the basic principles that give these particles their masses, decay times and other properties.

This paper extends a theory that accurately matches the neutron and proton mass to the remainder of the baryons and mesons. It is shown that baryons and mesons are composed of quarks and kinetic energy components similar to the proton and neutron. Energy from particle accelerator induced collisions is turned into quarks and kinetic energy inside mesons before they quickly decay into electrons/positrons, neutrinos and kinetic energy. Baryons also decay but neutrons and protons are in their decay products. Three quarks express themselves as a baryon while one quark and one anti-quark express themselves as mesons. The goals of this study are to:

- Calculate the meson and baryon masses using rules that accurately simulate the proton and neutron.
- Explain the basic energies that form mesons and baryons and show that they form a series.
- Show diagrams of the baryons and mesons.
- Explain the process that allows transition to new combinations of mesons and baryons and ultimately to protons, neutrons, electrons, neutrinos and energy.
- Explain the mechanism for decay and correlate all the particle decay times using the approach that accurately simulates neutron decay time.
- Identify the quarks in the mesons and baryons and compare their properties with Particle Data Group iso-spin, spin and charge.
- Suggest a mechanism for decay modes and correlate branching for a few example particles.

Results: All mesons and baryons masses and decay times are matched within measurement limits with the exception of the mu and pi (mass out by 0.003 MeV). In addition, all meson and baryon iso-spins are accurately matched. Most spins are matched except those with spins greater than 1.0. Branching ratio examples are shown.

Quad Energies

Reference 1 describes four natural logarithms (labeled N1 through N4 below) that appear to anchor nature's basic energy values (see topic below entitled "Particle Data Group..."). Energy (E) values are related to N by the equation: $E=e_0*\exp(N)$, where $e_0=2.02e-5$ MeV. The interaction involves exchanging the natural logarithm N=2 in a way that the entering N total 25.86 (13.43+12.43) shifts to (15.43+10.43). The exchange creates a quark of mass $E=e_0*\exp(13.43)=13.8$ MeV with kinetic energy orbiting two central fields. The total mass plus kinetic energy for this transition is called the quad energy and is 102.63 MeV.

N1	E1 mass	N3	E3 field1
N2	E2 ke	N4	E4 field2
	MeV		MeV
13.432	13.797	15.432	101.947
12.432	5.076	10.432	0.687

Result of Energy Interaction					
		ke (difference ke)		E3 field1	
E1 mass	E3+E4-E1-E2		E2 ke		E4 field2
MeV	MeV	MeV	MeV	MeV	MeV
13.797	83.761	5.076	-101.947		
					-0.687
E1+difference ke+E2			102.634	E3+E4	-102.634
Energy is conserved since 102.634=102.634					

The above table shows that the exchange 2 interaction gives zero net energy considering the fields to be negative. Three other quads are involved in mesons and baryons. The mass plus kinetic energy value for the first quad totals 14.48 MeV (13.87 + 0.69), the second quad is reviewed above (102.634 MeV) and the third and fourth quad energies are 753.98 and 5566.9 MeV respectively. Multiples of quad energy are the basic components of all mesons and baryons. The quark energies in this approach are 1.87 MeV for the up quark, 13.8 MeV for the down quark, 101.95 MeV for the strange quark, 753.3 for the charm quark and 5556 for the bottom quark.

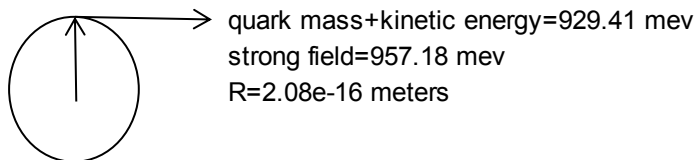
mesonbaryon cell h6						mev	Quad Energy
N	energy	N	energy	charge	quark	mev	ke of quark
11.43	1.87	13.43	13.80				
12.43	5.08	10.43	0.69	0.666667	1.87 up	7.5	11.9 14.48
13.43	13.80	15.43	101.95				
12.43	5.08	10.43	0.687	-0.333333	13.8 down	83.8	88.1 102.63
15.43	101.95	17.43	753.3				
12.43	5.08	10.43	0.69	-0.333333	101.9 strange	647	651.3 753.98
17.43	753.3	19.43	5566				
12.43	5.08	10.43	0.69	0.666667	753 charm	4808	4812.8 5566.80
	4059.5						
19.43	5566.1	21.43	41128		bottom		

Balancing Field Energy

anti-particle after	field part1	field part2
14.48	13.80	0.69 dn
102.63	101.95	0.69 up
753.98	753.29	0.69 S
5566.80	5566.11	0.69 C

The portion of the table above indicates that the 13.8 MeV quark is embedded in a strong field (-101.95 MeV). The quark with its kinetic energy orbiting in a strong field will be called a quark bundle, diagrammed below. Most of the mass and kinetic energy in the baryon or meson is concentrated in this orbit. For the proton, this orbit has radius 2.08e-16 meters.

quark bundle



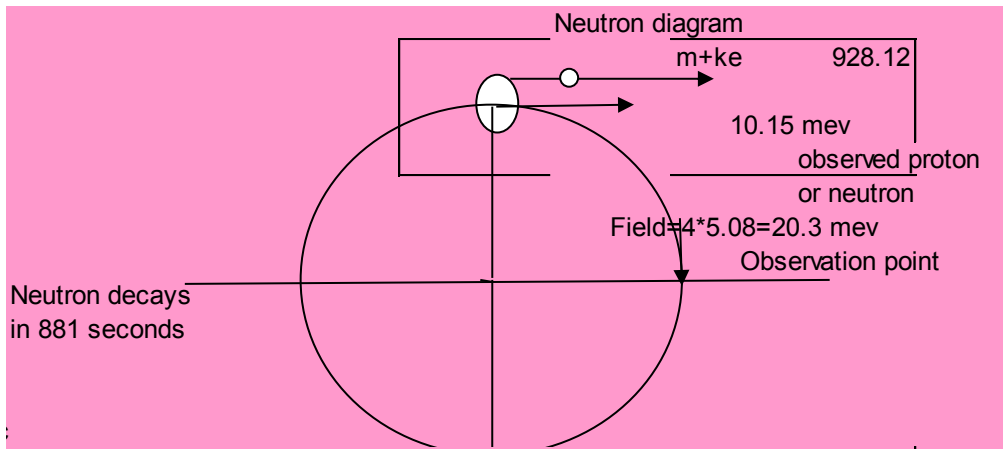
$$R = (HC/2\pi) / (\text{mass}/\gamma * \text{field})^{0.5} = 1.973e-13 / (129.54/0.14 * 957.18) = 2.08e-16 \text{ meters}$$

Where $HC/2\pi = 1.973e-13 \text{ MeV-meters}$

Neutron and proton diagram

All baryons and mesons follow rules found for the neutron and proton. The diagram below describes the neutron (typical for baryons). The small circle represents the quark bundle with its kinetic energy orbiting in a strong field. The total mass plus kinetic energy of the quark bundle in the neutron is 928.12 MeV.

The larger circle below is a second orbit. The quark bundle orbits in a 20.3 MeV weak field with kinetic energy 10.15 MeV. The weak field is related to 4 units of energy 5.08 MeV leaving an energy deficit.



Series for the total energy of mesons and baryons

The masses of the neutron and proton are 939.57 and 938.27 MeV respectively. The procedure for calculating mass involves adding quad energies to arrive at a base energy that is modified by the formation of weak fields and the loss of electrons and neutrinos. The additions are similar to a base 10 number sequence. Refer to the number positions as 100's, 10's and 1's. The 100's position is 753.98 MeV, the 10's position is 102.6 MeV and the 1's position is 14.48 MeV. In the table below 1,2,0 means $1*753.98+2*102.6+0*14.48$.

				100's position	10's position	1's position		
				754 mev	102.6 mev	14.48 mev		
						1		
	Series							
data (mev)	Sum of Quad Energy			Quad energies				sum quads
	MEV -->	5.08	5580.59	N Energy	17.43	15.43	13.43	###
938.272013	938.942946	-20.30	1x		753.98	102.63	14.48	
939.565346	938.942946	-20.30	1x		1	2	0	b 3
					1	2	0	b 3

Total Quad Energy of Neutron
753.98
205.2675
<hr/>
959.25 MeV
-20.3025 (4*5.08)
<hr/>
938.94 MeV

Appendix 2 contains the quad energy for all 198 mesons and baryons. The numbers form an incomplete series.

Neutron and proton masses

Neutrons are made of the quad energies shown above. Neutrons in turn, decay into protons and electrons. The mass predictions for the neutron and proton are displayed below to help understand the components involved. Reference 1 contains details of the components totaling 938.27 MeV for the proton and 939.56 MeV for the neutron. In the diagram below the values 101.945, 13.8 and 13.8 MeV are quarks. Refer to the topic above entitled “Quad Energies” where the quark kinetic energies are listed at 647, 83.8 and 83.8 MeV respectively.

	Mass and Kinetic Energy		Field energy	
	Mass	ke	Strong field ener	Gravitational Energy
	MeV	MeV	MeV	MeV
Quark S	101.947	631.729	-753.291	-0.687
Quark D	13.797	83.761	-101.947	-0.687
Quark D	13.797	83.761	-101.947	-0.687
	129.541	799.251	-957.185	-2.061
	129.541	799.251	0.622	
		10.151		
Neutron		939.565	Mev	

Combining the quarks into one total mass gives 129.541 MeV. In addition, there is an energy that comes from the electron quad diagrammed in the topic below entitled “The Electron Quad”. With this included, the mass totals 129.541+0.622=130.16 MeV. This “quark bundle” has 799.25 MeV of kinetic energy and is contained by a strong field of 957.18 MeV. The quark bundle, in turn, orbits in a weak field (20.3 for the proton and neutron) caused by the loss of 4*5.08 MeV of kinetic energy. For the proton, the weak orbital radius is 1.43e-15 meters based on 928.12 MeV orbiting in a 20.3 MeV weak

field. Reference 2 shows that this weak field almost exactly correlates the binding energy curve for atoms.

Simple neutron model				
r20 uc2				
Mass and Kinetic Energy			Field energy	
Mass	KE	Strong	Strong	Gravitational
Quarks		Residual	field energy	Energy
MeV	MeV	Field	MeV	MeV
Strong	130.16	799.25	-957.18	-2.73
Strong Residual KE		10.15		
Neutron		939.57 (-20.30)		-959.92
neutrinos		0.05		
Gravitational ke		10.15		
Gravitational pe		10.15		
Total		959.92		

The diagram below shows decay of the neutron into a proton. The decay is related to the electron quad that subtracts two energy values (0.622 MeV and 0.671 MeV) from the neutron total, giving the proton 939.57 MeV minus 1.293 MeV=938.27 MeV. The value 0.622 MeV is the electron 0.511 + 0.111 MeV of kinetic energy (a gamma ray).

Mass and Kinetic Energy			Field energy	
Mass	KE	Strong	Strong	Gravitational
		Residual	field energy	Energy
MeV	MeV		MeV	MeV
Strong	130.16	799.25	-957.18	-2.73
Strong Residual		10.15		
Neutron		939.57 (-20.3)		-959.92
below, the Neutron decays to a proton, electron and neutrino				
neutrinos		0.05		
Proton		938.27	2.72E-05	
ejected neutrino		0.67	E/M charge splits	
Electron	0.51	0.11	-2.72E-05	
Gravitational ke		10.15		10.11
Gravitational pe		10.15		10.19
Total		959.92		

The Electron and Neutrino Quads

Quads 4 and 5 use the same position identifiers and mass+ke is equal and opposite field energy like the other quads. All energies are MeV.

			Difference KE
E1 mass	E3 field		KE=E3+E4-E1-E2
E2 ke	E4 field		

	N	E (MeV)	N	E (MeV)	E (MeV)	E (MeV)
			-0.296	E 27.2e-5		
				equal and opposite charge		
Quad 4	-10.333	E1 -0.622	-10.333	E3 -0.622		
	10.408	E2 0.671	10.408	E4 0.671		
	The electron separates here					
Quad 5	10.333	E1 0.622	10.333	E3 0.622	0.622	0.511
	0.000	E2 2.4e-5	0.296	E4 2.72e-5		ELECTRON

E1 for quad 4 is 0.622 and adds to the neutron mass and $0.671 - 0.622 = 0.0485$ is a neutrino.

E3 is zero for quads 4 and 5 together ($0 = 0.62 - 0.62$).

E4 for the 4th quad contributes gravitational field energy component -0.671 MeV.

Difference $KE = E3 + E4 - E1 - E2 = 0$.

E1 for quad 5 contributes 0.622 MeV ($0.511 + 0.111$). E4 separates and creates the electromagnetic charge difference between the proton and electron.

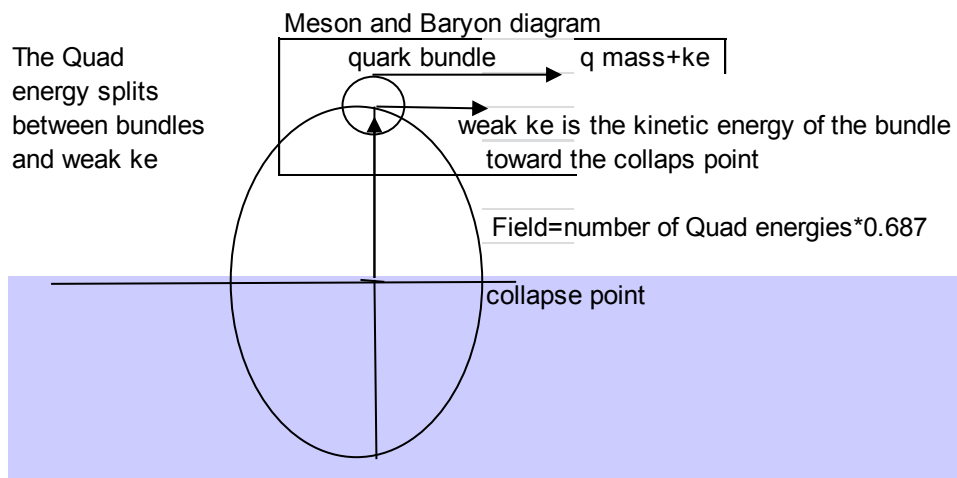
Values from the electron quad(s) are active for each quad involved in mesons and baryons.

Extension of the above procedure to mesons and baryons

Because the neutron and proton were formed in the big bang and are fundamental to cosmology there are two differences between them and the remainder of the mesons and baryons. For neutrons and protons, the field represented by 0.687 MeV and totaling -2.73 MeV for the four quads involved shrinks by $\exp(90)$ and forms a long range gravitational field not important for mesons and other baryons. Also, the neutron and proton are based on total $N=90$ and the weak field is a “missing energy” field totaling 20.3 MeV above.

For the other mesons and baryons, the quark bundle is attracted to a **weak** field related to $N=10.431$ ($E=0.687$ MeV). (refer to the topic entitled “Quad Energies” to see the source of this field). The quark bundles orbit (the large circle below) with weak kinetic energy that develops as the meson or baryon forms. The weak kinetic energy, like the proton and neutron is multiples of 5.08 MeV (related to $N=12.431$ by the equation $E=e0*\exp(12.43)$ where $e0=2.02e-5$ MeV).

The following diagram describes the mesons and baryons.



Meson and Baryon Energy

The question related to baryon and meson masses is: “why do we see a response in particle detectors as the accelerator energy is increased through a specific level?” This paper proposes that there is an energy match at multiples of quad energy. The quad energies form a series that underlie the meson and baryon masses. For the quark of mass 13.8 MeV, the mass plus kinetic energy is the quad total energy value 102.63 MeV. For the second quad shown above, the higher energy 101.95 MeV quark quad energy total is 754.0 MeV. When the total energy is matched by the experiment, the quarks and their kinetic energy will be expressed as a meson or baryon. For a brief time, experimenters are able to infer its spin and charge before decay products are produced. Decay times are measured by velocities and length of tracks in particle detectors.

Mesons are classified by the quarks that they may be composed of. According to the standard model for particles (reference 6 and 7) mesons contain quarks and anti-quarks that are labeled up, down, strange, charm, and bottom quarks. Also according to this classification, baryons contain combinations of three quarks.

Particle Data group quark listings

Quark charges, spins and tentative masses are listed at the PDG website (reference 6). The PDG quark masses have changed between 2008, 2012 and 2014. The measurement method accepted by PDG involves chirality (spin along its axis of travel) and in my opinion may include some kinetic energy since single quarks have not been observed independently.

Particle Data Group	2008	(I J)	2012		2014	Guess of what they measure		
	pdg mass (mev)	properties charge	PDG	PDG		see plus and minus	plus/minus	→
pdg quark: up	1.5-3.3	.5 .5+	0.667	2.4	2.3	1.87		
pdg quark: down	3.5-6	.5 .5+	-0.333	4.9	4.8	1.87		
pdg quark: strange -1 104 +26/-34		0 .5+	-0.333	100	95	103		
pdg quark: charm +1 1250+/-90		0 .5+	0.667	1290	1275	1316	← 753.3	647.0 -83.8
pdg quark: bottom=-1 4200 +170/-7		0 .5+	-0.333	4190	4180	4188	← 5566	-1293.9 -83.8
new bottom					4660	4668	← 5566.1	-647.0 -251.3
Particle Data Group at Berkeley (PDG) data is used								

Reference 1 contained a chart, reproduced below, that helps to identify the N values that anchor the quark masses.

unifying concepts.xls cell aw48		Proposed IS Hughes		
		Particle Data	Energy	Bergstrom
		Group energy	E=e0*exp	Randall
Identifier	N	(Mev)	(Mev)	energy
			e0=2.02e-	(Mev)
0.0986	0.0986			
e neutrino	0.197	2.00E-06	2.47E-05	3.00E-06
E/M Field	0.296	0.0000272	2.72E-05	
	(3*.0986=.296)			
ELECTRO	10.136	0.51099891	0.511	
mu neutrino	10.408	0.19	0.671	less than 0.2
Graviton*		1.75E-26	2.732	
Up Quark	11.432	1.5 to 3	1.867	1.5 to 4.5
E Op	12.432		5.076	
Down Quark	13.432	3 to 7	13.797	5 to 8.5
Strange quark	15.432	95+/-25	101.947	80 to 155
Charmed	17.432	1200+/-90	753.29	1000 to 1400
Bottom Quark	19.432	4200+/-70	5566.11	4220
Top Quark	21.432		41128.30	40000
W+,w- boson	22.099	80399	80106.98	81000
Z	22.235	91188	91787.1	91182
HIGGS	22.575	125300	128992.0	105000
* sum of 3 Ns of 10.431+10.408 (2.73/exp(60)=2.4e-26 mev)				
Mw/Mz	Weinberg radians	sin^2 theta		
0.87275	0.509993	0.48817152	0.23831	

Based on the sequence in the above table the quarks important to mesons and baryons are associated with a logarithmic sequence. These are identified as a 1.87 MeV up quark, a 13.8 MeV down quark, a 101.95 MeV strange quark, a 753.3 MeV charmed quark and a 5566 MeV bottom quark.

Eventually all mesons decay to electrons and neutrinos. This is made possible by the 1.87 MeV quarks that decays to 0.622 energies (1.87 MeV/3=0.622 MeV) that further decay to electrons and kinetic energy.

Application of Quad Energies to the Baryons and Mesons

An excel® spreadsheet entitled mesonbaryon2015.xls was developed. The spreadsheet contains calculations for the 198 mesons and baryons (including the mu and tao). Each line of the spreadsheet contains the Particle Data Group (PDG) data for the particle plus calculations that show its mass and calculated decay time. Data and calculations for many of the decay products and their branching ratios are also included.

An excerpt from the spreadsheet (below) shows where the quarks are located in the proton and neutron. The total quad energy in this case is converted to 3 quarks and kinetic energy.

difference ke 101.9-13.8 bundle ke														difference ke 13.8-1.87				
anti-quarks are -1 quarks are 1														anti-quarks are -1 quarks are 1				
pairs of quark annihilate becomes part of bundle kinetic energy														pairs of quarks annihilate becomes part of bundle kinetic energy				
Energy	quads x 0.687	KE	strange	strange	down	ke	anhil	ke	down	down	up	ke	anhil	ke	up	up	anhil	ke
MEV	0.687	651.3	101.9	101.9	88.1	13.8	13.80	13.80	11.93	1.87	1.87	1.87	1.87	0.62				
938.27	2.06	1.00	1	2.00	0.00				2.00	0		2		0				
939.57	2.06	1.00	2	1.00	0.00			1	0.00	0				0				

Electrons, neutrinos and weak kinetic energy subtract from Meson or Baryon mass										
Energy	elect	neut	neut	neut	ke			2013 pdg	Data	DecayTime
MEV	0.51	0.671	0.62	5.0756	0.11	Eaccracy	E meas	(mev)	accuracy	
938.27	-1	-1	1	-4	-1	b	0.00	0.00	938.27	
939.57			1	-4		b	0.00	0.00	939.57	1.14

The columns above labelled “Electron, neutrinos and weak kinetic energy” show how the quad energy is modified by the formation of weak fields and the loss of electrons and neutrinos during baryon formation. Four energies of value 5.08 MeV (N=12.431) exit the proton and neutron and form a “missing energy” field of 20.3 MeV. The proton (top line) has a 0.622 MeV energy ejected in the form of an electron of energy 0.511 MeV and kinetic energy 0.111 MeV. In addition it loses 0.671 MeV. These energy losses are the difference between the proton and neutron (1.293 MeV). After the decay the proton takes on the mass 938.27 MeV, while the neutron is 939.57 MeV. The column labelled Eaccracy shows the difference between the calculated mass on the left and the PDG mass data on the right, labelled Emeasured. The last column on the right is labelled Decay Time accuracy. This is the decay prediction minus measured decay time divided by the measurement accuracy. Everything is expressed as percentages. A number of 1.0 means the prediction is just as accurate as the measurement.

Since all 198 particles (Appendix 1) use the same format (one line of the spreadsheet per particle) the total mass prediction for the neutron will be used as an example.

Total Mass of Neutron	
2.06073753	(3*0.687)
651.3	quark ke
203.9	(2*101.9 quarks)
88.1498492	quark ke
13.80	(1*13.8 quark)
0.62	neutrino
-20.30	weak field
<u>939.57</u>	MeV

Hierarchy Transitions

As indicated above [and reference 1], neutrons and protons start with a 101.95 MeV quark and two 13.8 MeV quarks but can move to different energies. The proton and neutron iso-spin, matches the PDG value 0.5 when it contains one 753.3 MeV quark plus two 13.8 MeV quarks. This is possible because the quad energies occur in a hierarchy allowing transition to different states. Note below that the 753.3 quark can become a 13.8 quark plus 651.3 MeV of kinetic energy and a 13.8 quark can become a 1.87 MeV quark plus 11.93 MeV of kinetic energy. These changes will be called hierarchy transitions. Four energies of 5.076 MeV each exit the neutron and leave a deficit. This deficit is the weak energy that binds protons and neutron into atoms. Also, reference 1 indicated that there are contributions from the electron quad associated with the energies 0.622 and 0.671 MeV. The decay $1.87/3=0.622 \rightarrow 0.511+.114$ provides a path for meson decay into electrons and kinetic energy.

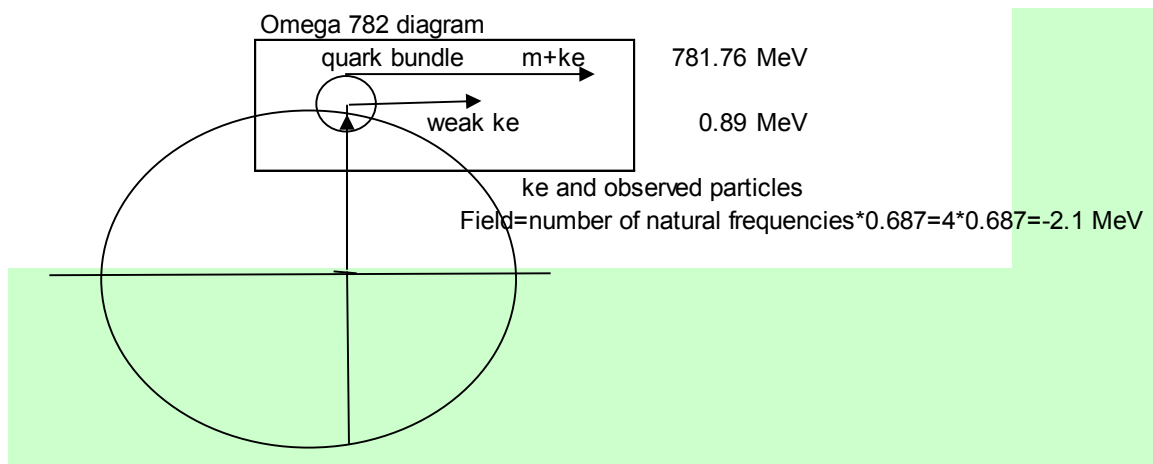
The following table summarizes the discussion above for the neutron. The quarks are labeled according to their energy in MeV.

Total Mass of Neutron before transition	Total Mass of Neutron before transition	Total Mass of Neutron after transition
2.06073753 (3*0.687)	2.06073753 (3*0.687)	2.0607375 (3*0.687)
753.3 quark	651.3 quark ke	651.34418 quark ke
176.299698 (2*88.14 quark ke)	203.9 (2*101.9 quarks)	101.94686 (1*101.9 quarks)
27.5940131 (2*13.8 quark)	88.1498492 quark ke	176.2997 2*88.15 quark ke
0.62 neutrino	13.80 (1*13.8 quark)	23.85957 2*11.93 difference ke
-20.30 weak field	0.62 neutrino	3.7344436 (2*1.87 quark)
<u>939.57</u> MeV	<u>-20.30</u> weak field	0.6224067 neutrino
	939.57 MeV	<u>-20.30254</u> weak field
		939.56535 MeV

All of the remaining baryons and mesons get their total energy by adding from different combinations of the Quad energies. There are 198 baryons in the series shown in appendices 1 and 2.

Other Baryons: example Omega(782)

The accelerator excites multiple quad energies but baryons only consist of 3 quarks and kinetic energy when they are measured (only 3 quarks are expressed). A diagram is shown below for the Omega(782) baryon. The quad energies total 753.98 plus $2 * 14.45 = 782.95$ MeV.



When the collision occurs that creates the baryon the quarks are separated from each other. This allows their properties to be created from “zero”.

Baryon mass that is not a quark is kinetic energy. The kinetic energy comes from two sources. Quarks from the original quads are annihilated giving “annihilation kinetic energy” shown below. In addition, quarks can transition to lower energy quarks and “difference kinetic energy”. This provides a path for the baryon to decay. The 1.87 MeV quark equals $0.622 * 3$. The 0.622 MeV energy is a neutrino and a mass that decays to an electron. Some of the 0.622 energy can release a 0.511 electron and 0.111 MeV of kinetic energy.

Baryons often transition to different baryons and kinetic energy. Literature lists “branching fractions” describing the intermediate states but all baryons eventually decay to protons, neutrons electrons/positrons, neutrinos and kinetic energy.

The example table below (Appendix 1 contains all the mesons and baryons) show 3 quarks per baryon. They show the energy components that add to the measured baryon mass after loss of the field energy and neutrinos shown in the rightmost 5 columns. The meson or baryon charge is developed when the electron or positron leaves the developing baron. The column labeled e (0.511) conforms to the measured baryon charge. The neutrinos of value 0.671 MeV are always negative and neutrinos of value 0.622 MeV are

usually positive. This “rule” is identical to the proton. Multiples of 5.08 MeV form the weak kinetic energy. Again, this is identical to the proton.

Electrons, neutrinos and weak kinetic energy subtract from Meson or Baryon mass									
								Decay	
								Time	
					average			std dev	
					0.36			average	
					2013 pc Data			Time	
					Eaccuracy			accuracy	
					E meas (mev)				
-1					b	0.00	0.00	938.27	
					b	0.00	0.00	939.57	1.14
					m	0.01	0.12	957.78	-1.55
					m	3.14	40.00	980.00	0.35
					m	3.14	40.00	980.00	0.21
					m	-0.02	0.04	1019.46	-1.20
					b	0.00	0.01	1115.68	-1.01
					m	3.92	40.00	1170.00	-0.30
-1					b	-0.01	0.14	1189.37	-1.00
					b	0.01	0.05	1192.64	0.68
1					b	-0.02	0.06	1197.45	-0.21
					m	-2.94	6.40	1229.50	1.47
					m	1.86	80.00	1230.00	-0.13
1					b	-3.46	4.00	1232.00	1.39
					m	-0.52	14.00	1272.00	0.06

Notably, all mesons and baryons add to the measured value within the measurement error (labeled Emeas) with the additions and subtractions of the columns described above. (The mu is 0.001 high and the pi is 0.0024 MeV low).

Meson diagrams

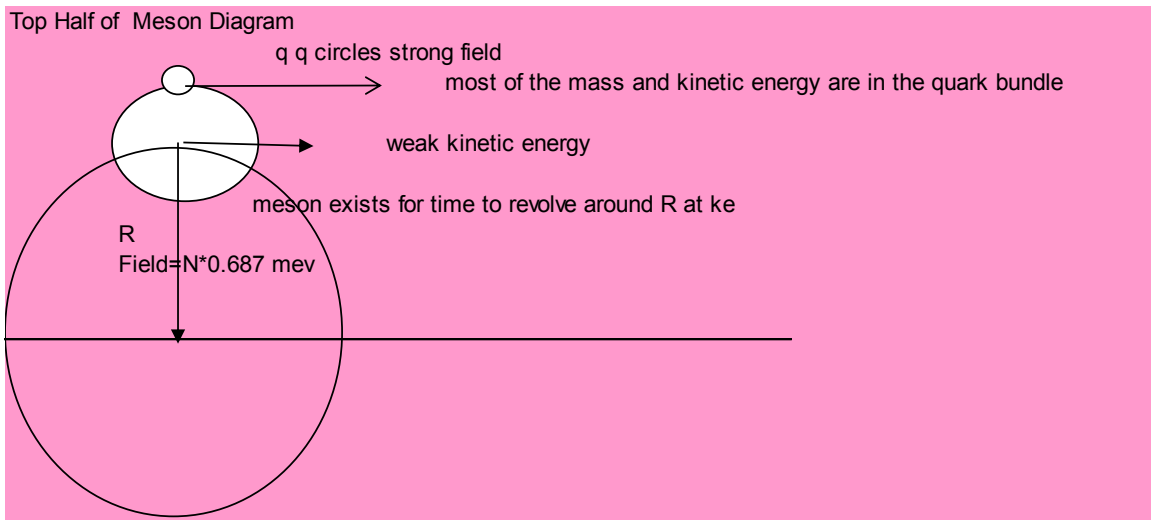
Like the baryons, mesons result from additive quad energy. The quarks are in “bundles” with their kinetic energy and form an orbit around their strong field energy (the small circles). The quark bundles are held into another orbit (the large circle) by a $n \cdot 0.687$ MeV weak field energy (n is the total number of quads from the number series based energy). The weak kinetic energy for the larger radius orbit (on the order of $1e-15$ meters) is the result of neutrinos and multiples of 5.08 MeV kinetic energy.

The concept of an anti-particle is fundamental to the understanding of mesons. Mesons are thought to be comprised of one quark and one anti-quark. Anti-particles are particles moving backward in time. Assume for the moment that time is clockwise around an Argand diagram (circle with one real axis and one imaginary axis). If the quark moves clockwise it is a particle and if it moves counter-clockwise it is an anti-particle. For

example, the $11.43+12.43=13.43+10.43$ quad has a quark at energy 1.87 MeV. When the direction is counter-clockwise, the 1.87 MeV quark is an anti-particle (moving backward in time). In the diagram below the up quark is shown in black (1.87 MeV) and the anti-down quark is shown in red (1.87 MeV). There is a third property called parity that conjugates with charge and time.

11.43195	1.9	13.43195	13.79701						
12.43195	5.1	10.43195	0.686913	0.666667	1.86722	up	7.54106	11.92978	14.4839191
11.43195	1.9	13.43195	13.79701						
12.43195	5.075635	10.43195	0.686913	0.666667	1.86722	anti-up	7.5	11.92978	14.4839191

The accelerator that produces the meson produces quarks and anti-quarks with kinetic energy. They move once around the weak radius. The decay time is predicted by the time to progress around the radius marked large R below.



Mesons decay to either other mesons or electrons/positrons and neutrinos. It is possible for simple electron or proton collisions to produce mesons and baryons that have net properties (iso-spin and spin). Charge is produced by exiting electrons or positrons.

Baryon and Meson Decay Time Correlations

The baryon decay time is correlated by the time for the quark bundle to travel one time around the meson or baryon circumference. The circumference is determined by a weak field and the meson mass. The weak field is almost always determined by the 0.687 MeV field associated with the quad. If there are 5 quads in the original series, the weak field will be $5 * 0.687 \text{ MeV}$. The circumference is $2 \pi R$, where $R = (HC / (2\pi)) / (\text{mass} * \text{field})^{.5}$.

Velocity around the circumference is determined by weak kinetic energy. It is a multiple of 5.08 MeV. If 3 units of 5.08 MeV energy exit the baryon or meson, $3 * 5.08 \text{ MeV}$ is the weak kinetic energy. Weak kinetic energy is not part of the bundle energy, instead it

propels the bundle around the circumference where the particle decays after one revolution in time around circle.

In addition there is a decay probability that multiplies the decay time. The decay probability is $P=1/\exp(\text{decay } N)$ where decay N is normally the difference between the N values for the quarks.

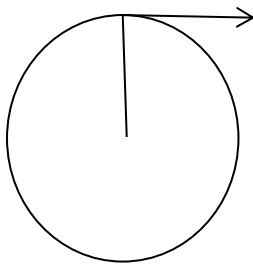
Time around circle = $2*\pi*R/\text{Velocity}$.

Velocity = $C*(1-(m/(m+ke))^{.5})^{.5}$

Weak Ke = number of 5.08 MeV neutrinos ejected * 5.08 MeV

$HC/2\pi = 1.97e-13$ MeV-meters

Decay time = time around circle * ($\exp(\text{decay } N)$).



$V = \text{function of weak kinetic energy}$

$R = (HC/(2\pi)) / (\text{mass} * \text{field})^{.5}$

Decay time = $(2*\pi*R/V) * \exp(\text{decay } N)$

The Particle Data Group lists the full width (in MeV) for some particles and the decay time in seconds for other particles. All data was translated to time by using $\text{time} = \text{Heisenberg's reduced constant} / \text{full width}$. Most of the meson and baryons decays are either accelerated or retarded by a probability equal to $\exp(1/\text{decay } N)$

Example: Neutron Decay

Decay $N = \text{sum of quark numbers for neutron plus } 12.431$.

(The proton has 3 Quad energies but has weak field energy $4*5.08$ MeV. N for the extra 5.08 MeV is 12.431)

Entropy:

15.43	N strange
15.43	N strange
13.43	N up
12.43	extra field
56.72	

$m = 939.57 - 10.15 = 929.41$

Calculate V : $V = C*(1-(929.41/(929.41+10.15))^{.5})^{.5} = 0.1466$

Calculate γ : $\gamma = m/(m+ke) = 929.41/(929.41+10.15) = 0.989$

Calculate R :

$R = 1.97e-13 * 1 / (929.41 * 10.15)^{.5} = 1.43e-15$ meters

Calculate time around circle = $2 * \pi * 1.43e-15 / (0.1466 * 3e8) = 2.04e-22$ sec

Calculate decay time= $2.04e-22 * \exp(56.72) = 884$ sec
Compare to 881. This value has been measured to within 0.17 percent.

Calculate decay accuracy ratio= $(100 * (884 - 881 / 881)) / (2 * 0.17) = 0.73$.

Baryon decay probability rule ($P = \exp(N - 52.3)$):

Decay N: Sum of quark N-52.3. ($52.3 = 17.431 * 3$)

Exception to baryon decay probability rule: When Baryon weak field contains extra 5.08 MeV, add $N = 12.431 * \text{extra}$. (usually one or two). This causes the sudden jump in decay times to values like $2e-10$ from normal values like $2e-22$ seconds.

Meson decay probability rule ($P = \exp(\text{decay N})$):

Decay N: Sum of quark N. Example $15.43 - 13.43 - 4 = -2$. The 15.43 is a quark and the -13.43 is the anti-quark.

Exception: Same as Baryon exception rule.

Example: Decay of Meson K(1)1270

Field energy: This meson has $1 * 753 + 5 * \text{quad energy } 102$ and $1 * \text{quad number } 14.5$, giving a total of 7 quad numbers. The field is formed by the negative 0.69 MeV fields. Since there are 8 of them the total is $7 * 0.69 = 4.8$ MeV

Decay N = sum of quark numbers = $-15.431 + 15.431 - 4 = -4$

Weak kinetic energy = 10.15 MeV

Mass = 1272 MeV

Calculate V: $V = C * (1 - 1272 / (1272 + 10.15))^{.5} = 0.1256$

Calculate gamma: $g = m / (m + ke) = 1272 / (1272 + 10.15) = 0.992$

Calculate R:

$R = 1.97e-13 * 1 / (1272 * 10.15)^{.5} = 2.51e-15$ meters

Calculate time around circle = $2 \pi * 2.51e-15 / (0.1256 * 3e8) = 4.19e-22$ sec

Calculate decay time = $4.19e-22 * \exp(-4) = 7.6e-24$ sec

Compare to $7.31e-24$. This value has been measured to within 44 percent.

Calculate decay accuracy ratio = $(100 * (7.31 - 7.6 / 7.31)) / (2 * 44) = 0.06$.

Almost perfect!

Decay Time Results

All mesons and baryon decay times are accurately predicted within average 0.4 decay accuracy ratio and standard deviation 2.3. (Number less than 1 means the predictions are

within the measurement accuracy). The mu and pions are slight exceptions and they have been measured very accurately. The results are shown in the rightmost column of the tables listed in section entitled “mass and decay times for the remaining mesons and baryons”.

Identifying the quarks involved in the baryons and mesons

Decay N is a good tool to determine which quarks are involved in each baryon or meson. For mesons, decay N is simply the subtraction of the quark N values and quark N’s give quarks masses ($E=e0*\exp(N)$). This is not a trial and error procedure because decay N is a large effect.

Comparison of Charge, Iso-spin and Spin with PDG values

The charge values for the mesons and baryons follow a simple rule. If an electron leaves the meson will be positive and negative if a positron leaves the meson. The proton charge is 1 because an electron is ejected during neutron decay. The remainder of the baryons and mesons follow the same rule.

The PDG particle listings are sorted by iso-spin and spin. A given series (for example the mesons and baryons made up of light mesons (up and down) all have a given iso-spin and spin. To match the PDG iso-spin and spin, the quarks must occupy a given position so that the spins add and subtract to the PDG values.

The following quark spin and iso-spin values are used in this work:

iso-spin	0.5	-0.5	0.5		0	0			-0.5	0.5			0.5	0.5	
Charge															
spin	0.5	0.5	0.5		-0.5	0.5			0.5	0.5			-0.5	0.5	
	19.43	17.43	17.43	difference	15.43	15.43	difference		13.43	13.43			11.43	11.43	10.3
x 0.687	bottom	charm	charm	KE	strang	strang	down ke	anhil ke	down	down	up ke	anhil ke	up	up	anhil k
	0.687	5566	753.3	753.3	651.3	101.9	101.9	88.1	13.8	13.80	13.80	11.93	1.87	1.87	0.62

All the meson and baryon PDG iso-spin values are matched when quarks are positioned in the respective columns labelled with the quark iso-spin values above. This is not a trivial matter. The quark positions must also give the spin and decay N. Recall that decay N is directly related to the quark N. An out of position quark either gives a faulty iso-spin or an incorrect decay time.

The PDG spin values are matched in most cases however there are mesons that have spins 2, 3 and 4. There are other spin values in the meson that are apparently not associated with the native spin of the quarks.

Decay modes

All mesons eventually decay to pi mesons and muons, although there are several intermediate combinations. The pi mesons and muons decay to electrons, gamma rays and neutrinos. The particle data group lists decay modes for the mesons. A small sample of the modes and the prevalent decays within the mode is listed below.

Pi+/- decay modes

Pi0 decay modes

Eta decay modes

Neutral mode

Charged mode

Mesons up to 980 MeV

Double pi mode

Triple pi mode

Neutrals

Mesons from 980 on up

Kaons/anti-kaons

Pi pi

Combinations of lighter mesons with one, two or three pi mesons plus photons.

Heavier particles

Leptonic

Semi-leptonic

Hadronic

The topic above entitled “Hierarchy Transitions” explains decay modes. Transitions simply do not completely annihilate the original kinetic energy and transition to new combinations of quarks and kinetic energy. The path downward is left incomplete and new mesons appear while some of the kinetic energy is turned into gamma rays. Pi mesons and lower energy “light un-flavored mesons” are prevalent in decays because there are many ways for the quad energies to cascade down to these particles. Some decay modes are more prevalent because they have a higher probability as explained below.

Branching Ratios

Branching Percentage= (mass involved in decay*Probability of decay)/(sum M*P)*100%

Where Probability of decay=exp(dominant N).

Appendix 4 contains example calculations for branching ratio. The results compared with measured values show that the particle N again gives a probability involved in determining which decay particles are more prevalent in decay fragments. Each meson or baryon has a dominant N determined by the highest N in the particle.

Highest Particle	Dominant N
up	11.431
down	13.431
strange	15.431
charm	17.431
bottom	19.431

Each meson and baryon is assigned a dominant N based on its highest particle. For example, the pi+ mesons has a dominant N value of 13.43. When it appears in decay products 13.43 is used. The probability of decay is $P = \exp(\text{Dominant } N)$. Mass for the calculation is simply the sum of the decay product mass. If the decay is pi-pi+ the mass is 139+139=278 MeV. The branching percentage is $278 * \exp(13.431) / (\sum M * P) * 100\%$ for the pi+ meson. The N value associated with electrons is zero. The value $(\sum M * P)$ includes all the mesons that decay across the various modes.

Allowed combinations

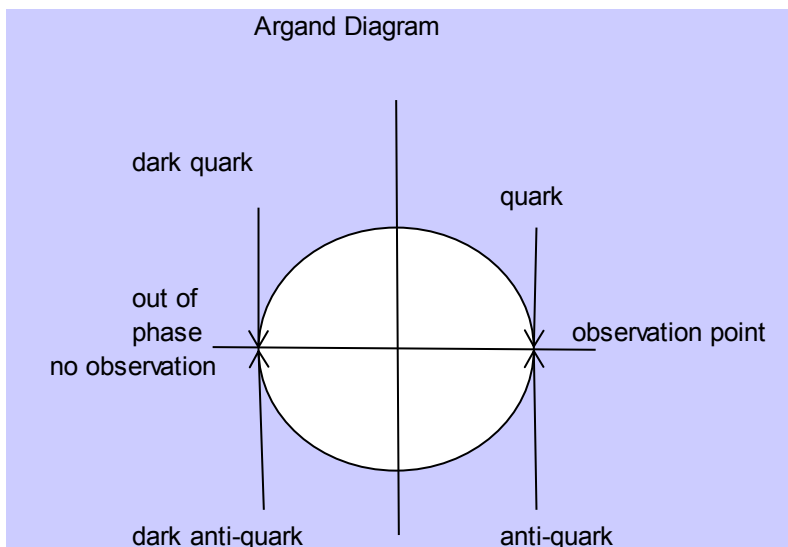
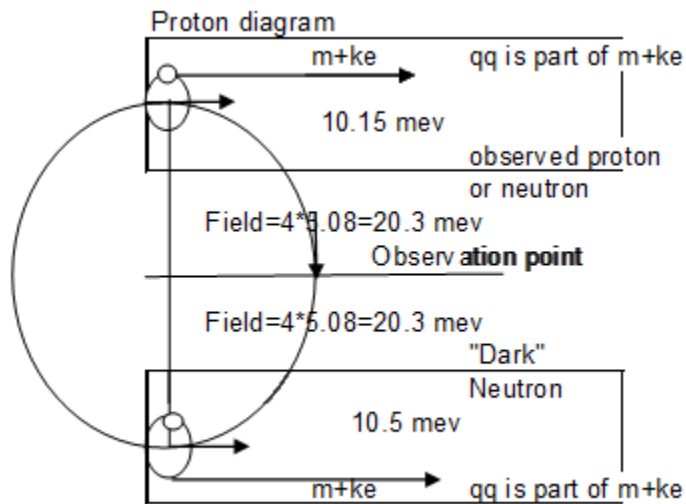
This paper indicates that mesons are combinations of quarks and kinetic energy. The quarks that remain in each meson and baryon are determined by matching experimental values for energy, charge, and decay time and iso-spin simultaneously. The quark masses and decay times are those published by the Particle Data Group. There are 198 mesons and baryons in the 2014 listings as of 2014. The meson and baryon energies appear at first to be rather random. However, the author was able to find an energy sequence based on the number of quad energies they contain that fits all the mesons and baryons in one series. The entire advancing energy sequence is placed in the Appendix 2. The series has a few gaps especially at the lower and higher end but work continues.

What is Dark Matter?

It is clear from cosmology that the light and dark matter separate (dark matter has been inferred from gravitational lensing, velocity profiles of galaxies and WMAP analysis). This is reminiscent of the neutrino that is inferred by energy and property transitions that are “absent” but required for energy balances and property (spin, iso-spin, etc.) conservation. Reference 3, *Application of the proton model to cosmology*, contains a re-analysis of the WMAP data. The original analysis, reference 8, concluded that dark matter was a significant component of our universe. The author explored the possibility that the light matter and dark matter were approximately equal. This suggests the

possibility that there may have been another 939 MeV of “dark” energy and that the total energy was double 938 or approximately 1918 MeV when the universe was formed. Quantum mechanics and the acceptance of anti-particles also provide a conceptual basis for energy that exists but is not observable in the same way as commonly accepted observations. It is possible that dark and light components of particles are “out of phase” from the standpoint of the quantum mechanical “observation point”. (An observation is the collapse of a wave function consisting of real and imaginary components.) It is possible that each the neutron and “dark” neutron came from separation of zero into mass plus kinetic energy and opposite energy fields.

The following diagram might apply:



Summary

Baryon and meson masses, with only the mu and neutral pi as exceptions, were simulated within experimental error using the concept of quad energies. The overall averages and standard deviations were well within the accuracy of measurements. In addition, all decay times were simulated with reasonable accuracy, although a few individual particle decay times fell slightly outside of experimental error. The average ratio of predicted decay time/actual decay time for all the mesons and baryons was 0.2 where 1.0 represents experimental error. Decay N helps identify the quarks inside the baryons and mesons. Another feature of the theory is that it may indicate how mesons decay and why there are numerous decay modes. In addition, the iso-spin and most spin properties were matched.

Overall, consideration of meson and baryon properties supports the theme of reference 1.

References

1. Barbee, E. H., *A Top-Down Approach to Fundamental Interactions*, viXra:1307.0082, Nov 2014.
2. Barbee, E. H., *A Simple Model of atomic Binding Energy*, viXra:1307.0102, Feb 2014.
3. Barbee, E. H., *Application of the Proton Model to Cosmology*, viXra:1307.0090, Nov 2014.
4. Feynman, R.P., Leighton, R.B., Sands, M., *The Feynman Lectures on Physics*, Addison-Wesley, 1965.
5. Bergstrom, L., Goobar, A., *Cosmology and Particle Astrophysics*, Second Edition, Praxis Publishing, Ltd, 2004.
6. D. E. Groom et al. (Particle Data Group). Eur. Phys. Jour. C15, (2000) (URL: <http://pdg.lbl.gov>)
7. I.S. Hughes, *Elementary Particles, 3rd Edition*, Cambridge University Press, 1991.
8. Bennett, C.L. et al. *First Year Wilkinson Microwave Anisotropy Probe (WMAP) Observations: Preliminary Maps and Basic Data*, Astrophysical Journal, 2001

Appendix 1 Mass and Decay Time Results

The following 3 pages are from spreadsheet mesonbaryon2015.xls. The boxes in the table below give “Dominant N” for branching. Quarks are listed as plus or minus 1 for particle and anti-particle.

Calculated Particle Mass Meson Energy MEV	numb quads	anti-quarks are -1												anti-quarks are -1												anti-quarks are -1												Electrons, neutrinos and weak kinetic energy												Decay	
		quarks are 1				quarks are 1				quarks are 1				quarks are 1				quarks are 1				quarks are 1				quarks are 1				quarks are 1				Time																	
		iso-spin	Charge	0.5	-0.5	0.5	0	0	15.43	15.43	difference	-0.5	0.5	13.43	13.43	difference	0.5	0.5	11.43	11.43	difference	-0.5	0.5	10.3	10.3	difference	0.50	0.5	10.4	10.33	12.43	0 weak	0 kinetic energy	average	std dev	Time															
		x 0.687	bottom	charm	charm	KE	strang	strang	down	kt	anil	ke	down	down	up	ke	anil	ke	up	up	anil	elect	neut	neut	neut	ke	0.62	0.51	0.671	0.62	5.076	0.11	0.36	2013 pc	Data	Time															
0.687	5566	753.3	753.3	651.3	101.9	101.9	88.1	13.8	13.80	13.80	11.93	1.87	1.87	1.87	0.82	0.51	0.671	0.62	5.076	0.11	0.36	2013 pc	Data	Time																											
1711.31	10			2	0.00			1.00	7.00			1.00	0			1	0											b	1.31	60.00	1710.00	-0.12																			
1717.56	5				2.00			3.00	3.00			0.00	0			1	0										m	0.56	54.00	1717.00	-0.29																				
1722.63	5			2	0.00			2.00	2.00			1.00	0			1	0										b	2.63	40.00	1720.00	-0.21																				
1727.04	5				2.00			4.00	3.00			1.00	0			1	0										b	7.04	12.00	1720.00	-0.09																				
1722.63	5				2.00			4.00	3.00			1.00	0			1	0										m	2.63	50.00	1720.00	-0.17																				
1752.11	7			1	1.00			2.00	4.00			1.00	0			1	0										b	2.11	70.00	1750.00	-0.36																				
1770.60	8				2.00			3.00	6.00			1.00	0			1	0										m	-2.40	16.00	1773.00	-0.04																				
1776.00	9			1	1.00			2.00	6.00			1.00	0			1	0										b	1.00	10.00	1775.00	-1.67																				
1775.49	9				2.00			2.00	7.00			0.00	0			1	0										m	-0.51	14.00	1776.00	1.20																				
1776.63	9			1	-1	0.00		2.00	7.00			0.00	0			1	0										m	-0.19	0.32	1776.82	1.53																				
1799.46	10			1	1.00			2.00	7.00			1.00	0			1	0										b	-0.54	130	1800.00	0.40																				
1809.54	11			1	1.00			2.00	8.00			1.00	0			1	0										b	-0.46	100	1810.00	-0.27																				
1814.63	5				2.00			5.00	3.00			-1	0.00	0			1	0									m	2.63	24.00	1812.00	0.11																				
1814.63	5				2.00			4.00	3.00			1	0.00	0			1	0									m	-1.37	26.00	1816.00	0.71																				
1818.94	12			1	1.00			2.00	9.00			1.00	0			1	0										b	-1.06	10.00	1820.00	-0.81																				
1825.78	6			-1	1	0.00		3.00	4.00			0.00	0			1	0										m	-2.78	10.00	1823.00	-0.27																				
1829.77	12			1	1.00			2.00	9.00			1.00	0			1	0										b	0.23	20.00	1830.00	-0.53																				
1855.48	8				2.00			5.00	6.00			-1	0.00	0			1	0									m	1.48	14.00	1854.00	-0.70																				
1864.89	9				2.00			3.00	7.00			0.00	0			1	0										m	0.09	0.26	1864.80	2.37																				
1869.45	9			-1	1	0.00		3.00	7.00			0.00	0			1	0										m	-0.12	0.30	1869.57	-0.01																				
1883.71	10			1	1.00			3.00	7.00			1.00	0			1	0										b	3.71	55.00	1880.00	-0.49																				
1902.60	11			2	0.00			3.00	8.00			1.00	0			1	0										b	-2.40	50.00	1905.00	0.43																				
1913.42	6			2	0.00			4.00	3.00			1.00	0			1	0										b	3.42	60.00	1910.00	0.28																				
1919.11	6			1	1.00			4.00	3.00			1.00	0			1	0										b	4.11	35.00	1915.00	0.71																				
1918.33	6			2	0.00			4.00	3.00			1.00	0			1	0										b	-1.67	70.00	1920.00	0.78																				
1932.82	7			2	0.00			4.00	4.00			1.00	0			1	0										b	2.82	35.00	1930.00	1.00																				
1942.89	8			1	1.00			4.00	5.00			1.00	0			1	0										b	2.89	50.00	1940.00	-0.40																				
1944.10	8				2.00			6.00	6.00			-1	0.00	0			1	0									m	0.10	24.00	1944.00	1.38																				
1952.30	9			2	0.00			4.00	6.00			1.00	0			1	0										b	2.30	100	1950.00	-0.32																				
1948.08	8				2.00			6.00	6.00			-1	0.00	0			1	0									m	-1.92	30.00	1950.00	-0.12																				
1968.35	10				2.00			4.00	8.00			0.00	0			1	0										m	-0.10	0.64	1968.45	2.41																				
1995.24	12				2.00			6.00	10.00			-1	0.00	0			1	0									m	-0.76	19.00	1996.00	-0.70																				
2007.14	7				2.00			6.00	5.00			1.00	0			1	0										m	0.15	0.30	2006.99																					
2010.97	7				2.00			7.00	5.00			-1	0.00	0			1	0									m	0.97	140	2010.00	-0.57																				
2010.46	7			1	1.00			5.00	5.00			0.00	0			1	0										m	0.17	0.26	2010.29	-1.08																				
2019.78	7				2.00			7.00	5.00			-1	0.00	0			1	0									m	1.78	22.00	2018.00	0.09																				
2031.04	8				2.00			7.00	6.00			2.00	0			-1	1	0									m	1.04	10.00	2030.00	-0.35																				
2045.53	9				2.00			6.00	7.00			1.00	0			1	0										m	0.53	15.00	2045.00	-1.16																				
2097.88	13			1	1.00			1.00	10.00			1.00	0			1	0										b	-2.12	18.00	2100.00	-1.27																				
2107.36	13			1	1.00			1.00	10.00			1.00	0			1	0										b	-2.64	20.00	2110.00	-0.07																				
2107.36	13			1	1.00			1.00	10.00			1.00	0			1	0										b	-2.64	50.00	2110.00	-0.10																				
2113.10	8			-1	1	0.00		7.00	6.00			1.00	0			1	0										m	0.80	1.00	2112.30																					
2191.10	13			2	1.00			6.00	10.00			1.00	0			1	0										b	1.10	100	2190.00	-0.11																				
2252.29	3				3.00			0.00	0.00			0.00	0			1	0										b	0.29	18.00	2252.00	-0.66																				
2286.56	5			2	1.00			0.00	2.00			0.00	0			1	0										b	0.10	0.28	2286.46	-1.25																				
2300.31	6				3.00			3.00	4.00			-1	0.00	0			1	0									m	3.31	56.00	2297.00	-0.60																				
2318.69	7				3.00			1.00	5.00			0.00	0			1	0										m	0.89	1.20	2317.80																					
2318.53	7				3.00			2.00	5.00			1.00	0			1	0										m	0.53	58.00	2318.00	0.29																				
2343.76	9				3.00			3.00	7.00			-1	0.00	0			1	0									m	3.76	120	2340.00	-0.40																				
2422.39	8				3.00			3.00	6.00			1.00	0			1	0										m	1.09	1.20	2421.30	-1.68																				
2452.32	10			2	1.00			2.00	7.00			1.00	0			1	0										b	-0.58	0.80	2452.90																					
2453.45	10				2.00			1.00	7.00			0.00	0			1	0										b	-0.29	0.32	2453.74	1.01																				
2453.67	10			2	1.00			1.00	7.00			0.00	0			1	0										b	-0.31	0.32	2453.98	1.25																				
2460.37	11			-1	1	0.00		2.00	9.00			0.00	0			1	0										m	0.87	1.20	2459.50																					
2463.58	11			-1	2.00			2.00	9.00			0.00	0			1	0										m	0.98	1.20	2462.60	-3.88																				
2464.77	11				3.00			3.00	9.00			1.00	0			1	0										m	0.37	3.20	2464.40	-1.26																				
2466.80	5			-1	2.00			4.00	3.00			1.00	0			1	0										m	-1.00	1.00	2467.80	-3.67																				
2471.53	6			1	-1	1.00		3.00	4.00			0.00	0			1	0										m																								

Calculated	numb quads				anti-quarks are -1 quarks are 1				anti-quarks are -1 quarks are 1				anti-quarks are -1 quarks are 1				Electrons, neutrinos and weak kinetic energy subtract from Meson or Baryon mass							Decay Time						
	iso-spin	Charge	spin	difference	strang	strang	down	kt	anil	ke	down	down	up	ke	up	up	anil	elect	neut	neut	neut	ke	0 weak kinetic energy	average	std dev	Time				
Particle Mass	0.5	-0.5	0.5	17.43	15.43	15.43	difference	13.43	13.43	11.43	11.43	10.3	10.4	10.33	12.43	10.3	0.50	0.5	0.36	0.36	0.36	0.11	0.36	0.36	0.36	0.36				
Calculated Meson Energy	x 0.687	bottom	charm	charm	KE	strang	strang	down	kt	anil	ke	down	down	up	ke	up	up	anil	elect	neut	neut	neut	ke	0.36	0.36	0.36				
MEV	0.687	5566	753.3	753.3	651.3	101.9	101.9	88.1	13.8	13.80	13.80	11.93	1.87	1.87	1.87	1.87	0.62	0.51	0.671	0.62	5.076	0.11	0.36	0.36	0.36	2013 pc Data				
3641.12	11		-1	1	2.00			8.00	9.00			0.00	0													1.72	2.60	3639.40	-0.79	
3686.11	14			1	3.00			9.00	12.00			1.00	0														0.00	0.03	3686.11	3.57
3772.49	5				5.00			5.00	3.00			-1.00	0														-0.66	0.66	3773.15	-3.51
3929.90	10		-1	1	3.00			4.00	8.00			0.00	0														2.70	5.20	3927.20	-0.16
4037.43	12		-1	1	3.00			5.00	10.00			0.00	0														-1.57	2.00	4039.00	-0.58
4155.05	9		-1	1	3.00			7.00	7.00			0.00	0														2.05	6.00	4153.00	-1.06
4187.20	0	1			-2.00			-1.00	0.00			-1.00	0														7.20	60.00	4180.00	
4420.86	14		-1	1	3.00			9.00	12.00			0.00	0														-0.14	8.00	4421.00	-0.38
5278.93	7		-1	1	5.00			5.00	5.00			0.00	0														-0.33	0.34	5279.26	-0.62
5279.84	7		1	-1	5.00			5.00	5.00			0.00	0														0.26	0.34	5279.58	-2.46
5325.63	11			1	6.00			5.00	9.00			0.00	0														0.43	0.80	5325.20	
5366.57	13		-1	1	5.00			5.00	11.00			0.00	0														-0.20	0.48	5366.77	-0.63
5411.31	10			1	6.00			6.00	8.00			0.00	0														-4.09	4.50	5415.40	
5618.80	5	1		2	-2.00			-2.00	3.00			0.00	0														-0.60	1.20	5619.40	0.45
5751.07	2	1		-1	-1.00			1.00	1.00			0.00	0														8.07	10.00	5743.00	1.17
5780.04	4	1		-1	-1.00			1.00	3.00			0.00	0														-7.96	10.00	5788.00	2.45
5790.70	4	1		-1	-1.00			1.00	3.00			0.00	0														-0.40	4.40	5791.10	3.00
5809.24	5	1		1	-1.00			1.00	3.00		1	0.00	0														-2.06	3.80	5811.30	0.28
5814.60	6	1		1	-1.00			1.00	4.00		1	0.00	0														-0.60	3.60	5815.20	-0.27
5833.25	7	1		1	-1.00			1.00	5.00		1	0.00	0														1.15	3.80	5832.10	-0.02
5836.76	7	1		1	-1.00			1.00	5.00		1	0.00	0														1.66	3.80	5835.10	-0.29
5839.97	7	1		1	0.00			2.00	6.00		-1	0.00	0														0.01	0.40	5839.96	3.03
6068.50	11	1		2	-2.00			2.00	9.00			0.00	0														-1.50	80.00	6070.00	0.84
6273.88	7		-1	1	-1.00			6.00	6.00			0.00	0														-0.62	3.60	6277.00	-1.15
9459.94	8	1			5.00			6.00	7.00		-1	0.00	0														-0.36	0.52	9460.30	-0.65
9858.58	11	1		-1	4.00			9.00	10.00			0.00	0														-0.82	1.00	9859.40	
9892.62	13	1		-1	4.00			9.00	12.00			0.00	0														-0.18	0.80	9892.80	
9897.58	14	1		-1	4.00			9.00	13.00			0.00	0														-1.72	2.00		
9911.44	15	1			5.00			10.00	14.00		-1	0.00	0														-0.76	0.80	9912.20	
10023.66	16	1			5.00			11.00	15.00		-1	0.00	0														0.40	0.62	10023.26	-1.97
10162.40	11	1			6.00			6.00	10.00		-1	0.00	0														-1.30	2.80	10163.70	
10232.23	10	1			6.00			7.00	9.00		-1	0.00	0														-0.27	1.20	10232.50	
10254.88	12	1			6.00			7.00	11.00		-1	0.00	0														-0.62	1.00	10255.50	
10354.54	12	1			6.00			8.00	11.00		-1	0.00	0														-0.66	1.00	10355.20	-0.81
10577.26	16	1		-1	5.00			9.00	15.00			0.00	0														-2.14	2.40	10579.40	0.34
10877.26	10	1		-1	6.00			6.00	9.00			0.00	0														1.26	22.00	10876.00	1.45
11019.12	13		-1	1	6.00			7.00	12.00			0.00	0														0.12	16.00	11019.00	-0.16

Appendix 2 Quad Energy Series

The following three pages from spreadsheet mesonbaryon2015.xls. This appendix shows the quad energy series for all the mesons and baryons.

Name	(neutrinos)				19.43 N	17.43	15.43	13.43	quads
PDG		MEV ->	5.08	5566.80	Energy	753.98	102.63	14.48	
mu	0.06171582	105.658367	105.720083	2.00				8	m 8
pi0	-0.2886789	134.9766	134.687921	2.00				10	m 10
pi	0.19337614	139.57018	139.763556	1.00				10	m 10
f(0)(500)	2.87903396	475	477.879034	1.00			4	5	m 9
K	-1.3140469	493.677	492.362953	1.00			4	6	m 10
K(L)0	-0.1754118	497.614	497.438588	0.00			4	6	m 10
K(S)0	-0.1754118	497.614	497.438588	0.00			4	6	m 10
K0	-0.1754118	497.614	497.438588	0.00			4	6	m 10
eta0	-2.6300055	547.853	545.222994	2.00			4	10	m 14
rho(770)	-2.6954825	775.49	772.794518	2.00		1	0	2	m 3
omega(782)	0.29578771	782.65	782.945788	0.00		1	0	2	b 3
K*(892)	-1.747795	891.66	889.912205	2.00		1	1	3	m 5
K*(892)	-0.8221599	895.81	894.98784	1.00		1	1	3	m 5
proton	0.67093285	938.272013	938.942946	4.00		1	2	0	b 3
neutron	-0.6224001	939.565346	938.942946	4.00		1	2	0	b 3
eta'(958)	1.46548618	957.78	959.245486	0.00		1	2	0	m 3
a(0)(980)	3.13768934	980	983.137689	1.00		1	2	2	m 5
f(0)(980)	3.13768934	980	983.137689	1.00		1	2	2	m 5
phi(1020)	-3.0168235	1019.455	1016.43818	3.00		1	2	5	m 8
Lambda	4.13193103	1115.683	1119.81493	0.00		1	3	4	b 8
h(1)(1170)	3.92130693	1170	1173.92131	1.00		1	4	1	m 6
Sigma	-0.9647739	1189.37	1188.40523	1.00		1	4	2	b 7
Sigma	0.83886114	1192.642	1193.48086	0.00		1	4	2	b 7
Sigma	0.3645101	1197.449	1197.81351	2.00		1	4	3	b 8
b(1)(1235)	2.35698342	1229.5	1231.85698	1.00		1	4	5	m 10
a(1)(1260)	1.85698342	1230	1231.85698	1.00		1	4	5	m 10
Delta(1232)	-0.1430166	1232	1231.85698	1.00		1	4	5	b 10
K(1)(1270)	-0.5205598	1272	1271.47944	2.00		1	5	1	m 7
f(2)(1270)	1.45507529	1275.1	1276.55508	1.00		1	5	1	m 7
f(1)(1285)	-0.1692896	1281.8	1281.63071	0.00		1	5	1	m 7
eta(1295)	2.1146295	1294	1296.11463	0.00		1	5	2	m 8
pi(1300)	0.44727845	1300	1300.44728	2.00		1	5	3	m 9
Xi	0.07119758	1314.86	1314.9312	2.00		1	5	4	m 10
a(2)(1320)	1.70683266	1318.3	1320.00683	1.00		1	5	4	m 10
Xi	-1.7031673	1321.71	1320.00683	1.00		1	5	4	m 10
f(0)(1370)	4.55365436	1350	1354.55365	3.00		1	6	0	m 7
pi(1)(1400)	10.7049245	1354	1364.70492	1.00		1	6	0	m 7
Sigma(138)	1.46447873	1382.8	1384.26448	0.00		1	6	1	b 8
Sigma(138)	0.56447873	1383.7	1384.26448	0.00		1	6	1	b 8
Sigma(138)	1.39712769	1387.2	1388.59713	2.00		1	6	2	b 9
K(1)(1400)	0.08104681	1403	1403.08105	2.00		1	6	3	m 10
Lambda(14)	3.05668189	1405.1	1408.15668	1.00		1	6	3	b 10
eta(1405)	3.43231698	1409.8	1413.23232	0.00		1	6	3	m 10
K*(1410)	-0.767683	1414	1413.23232	0.00		1	6	3	m 10
omega(142)	2.7162361	1425	1427.71624	0.00		1	6	4	b 11
K(2)*(1430)	2.1162361	1425.6	1427.71624	0.00		1	6	4	m 11
f(1)(1420)	1.3162361	1426.4	1427.71624	0.00		1	6	4	m 11
K(0)*(1430)	-2.2837639	1430	1427.71624	0.00		1	6	4	m 11
K(2)*(1430)	-0.3511149	1432.4	1432.04889	2.00		1	6	5	m 12
N(1440)	2.20015522	1440	1442.20016	0.00		1	6	5	b 12
rho(1450)	2.33869288	1465	1467.33869	1.00		1	7	0	m 8
a(0)(1450)	2.74697692	1474	1476.74698	2.00		1	7	1	m 9
eta(1475)	0.74697692	1476	1476.74698	2.00		1	7	1	m 9
f(0)(1500)	-7.1953712	1505	1497.80463	2.00		2	0	0	m 2
Lambda(15)	-2.135817	1519.5	1517.36418	1.00		2	0	1	b 3
N(1520)	-2.635817	1520	1517.36418	1.00		2	0	1	b 3
f(2)(1525)	6.84810209	1525	1531.8481	1.00		2	0	2	m 4
Xi(1530)	0.04810209	1531.8	1531.8481	1.00		2	0	2	m 4
Xi(1530)	6.25638613	1535	1541.25639	2.00		2	0	3	m 5
Xi(1530)	1.18075105	1535	1536.18075	3.00		2	0	3	m 5
Delta(1600)	10.5896673	1600	1610.58967	0.00		2	1	0	b 3
Lambda(16)	10.5896673	1600	1610.58967	0.00		2	1	0	b 3
eta(2)(1645)	-6.4103327	1617	1610.58967	0.00		2	1	0	m 3
Delta(1620)	-0.5937646	1630	1629.40624	2.00		2	1	2	b 5
N(1650)	-0.9585753	1655	1654.04142	0.00		2	1	3	b 6
Sigma(166)	-1.6259264	1660	1658.37407	2.00		2	1	4	b 7
pi(1)(1600)	1.4497087	1662	1663.44971	1.00		2	1	4	m 7
omega(3)(16)	1.52534378	1667	1668.52534	0.00		2	1	4	b 7
omega(165)	-1.4746562	1670	1668.52534	0.00		2	1	4	b 7

Name	(neutrinos)			19.43 N	17.43	15.43	13.43	quads
PDG		MEV -->	5.08	5566.80 Energy	753.98	102.63	14.48	
omega(3)	1.52534378	1667	1668.52534	0.00		2	1	4 b 7
omega(167)	-1.4746562	1670	1668.52534	0.00		2	1	4 b 7
Lambda(167)	-1.4746562	1670	1668.52534	0.00		2	1	4 b 7
Sigma(167)	-1.4746562	1670	1668.52534	0.00		2	1	4 b 7
pi(2)(1670)	0.65799274	1672.2	1672.85799	2.00		2	1	5 m 8
Omega	0.40799274	1672.45	1672.85799	2.00		2	1	5 b 8
N(1675)	-2.1420073	1675	1672.85799	2.00		2	1	5 b 8
phi(1680)	-2.0663722	1680	1677.93363	1.00		2	1	5 m 8
N(1680)	2.34191186	1685	1687.34191	2.00		2	1	6 b 9
rho(3)(1690)	-1.4580881	1688.8	1687.34191	2.00		2	1	6 m 9
Lambda(1690)	2.41754694	1690	1692.41755	1.00		2	1	6 b 9
Xi(1690)	2.41754694	1690	1692.41755	1.00		2	1	6 m 9
N(1700)	-7.5824531	1700	1692.41755	1.00		2	1	6 b 9
Delta(1700)	-2.506818	1700	1697.49318	0.00		2	1	6 b 9
N(1710)	1.97710114	1710	1711.9771	0.00		2	1	7 b 10
K*(1680)	0.5560846	1717	1717.55608	2.00		2	2	1 m 5
N(1720)	2.63171969	1720	1722.63172	1.00		2	2	1 b 5
rho(1700)	2.63171969	1720	1722.63172	1.00		2	2	1 m 5
f(0)(1710)	2.63171969	1720	1722.63172	1.00		2	2	1 m 5
Sigma(175)	1.59955793	1750	1751.59956	1.00		2	2	3 b 7
K(2)(1770)	-1.8408879	1773	1771.15911	0.00		2	2	4 m 8
Sigma(177)	0.49176109	1775	1775.49176	2.00		2	2	5 b 9
K(3)*(1780)	-0.5082389	1776	1775.49176	2.00		2	2	5 m 9
	-1.3282389	1776.82	1775.49176	2.00		2	2	5 m 9
Lambda(1800)	0.12695038	1800	1800.12695	0.00		2	2	6 b 10
Lambda(1800)	-0.4647656	1810	1809.53523	1.00		2	2	7 b 11
pi(1800)	3.857204	1812	1815.8572	0.00		2	3	0 m 5
K(2)(1820)	-0.142796	1816	1815.8572	0.00		2	3	0 m 5
Lambda(1820)	-1.0564815	1820	1818.94352	2.00		2	2	8 b 12
Xi(1820)	2.26548804	1823	1825.26549	1.00		2	3	1 m 6
Lambda(1830)	-0.9052114	1830	1829.09479	0.00		2	2	8 b 12
phi(3)(1850)	0.23332629	1854	1854.23333	1.00		2	3	3 m 8
D	-1.1583897	1864.8	1863.64161	2.00		2	3	4 m 9
D	-0.8527546	1869.57	1868.71725	1.00		2	3	4 m 9
Lambda(1880)	3.20116453	1880	1883.20116	1.00		2	3	5 b 10
Delta(1905)	-2.2392813	1905	1902.76072	0.00		2	3	6 b 11
Delta(1910)	3.41533728	1910	1913.41534	1.00		2	4	0 b 6
Sigma(191)	3.49097236	1915	1918.49097	0.00		2	4	0 b 6
Delta(1920)	-1.5090276	1920	1918.49097	0.00		2	4	0 b 6
Delta(1930)	2.97489148	1930	1932.97489	0.00		2	4	1 b 7
Sigma(194)	2.38317552	1940	1942.38318	1.00		2	4	2 b 8
f(2)(1950)	3.4588106	1944	1947.45881	0.00		2	4	2 m 8
Delta(1950)	1.79145956	1950	1951.79146	2.00		2	4	3 b 9
Xi(1950)	-2.5411894	1950	1947.45881	0.00		2	4	2 m 8
D(s)	-2.1746213	1968.45	1966.27538	2.00		2	4	4 m 10
a(4)(2040)	-0.7567831	1996	1995.24322	2.00		2	4	6 m 12
D*(2007)	-1.0921645	2006.99	2005.89784	3.00		2	5	0 m 7
f(2)(2010)	0.97347055	2010	2010.97347	2.00		2	5	0 m 7
D*(2010)	0.68347055	2010.29	2010.97347	2.00		2	5	0 m 7
f(4)(2050)	3.12474072	2018	2021.12474	0.00		2	5	0 m 7
Sigma(203)	0.53302476	2030	2030.53302	1.00		2	5	1 m 8
K(4)*(2045)	0.01694388	2045	2045.01694	1.00		2	5	2 m 9
Lambda(2100)	-2.1230147	2100	2097.87699	2.00		2	5	6 b 13
Lambda(2100)	-1.9717445	2110	2108.02826	0.00		2	5	6 b 13
Lambda(2100)	-1.9717445	2110	2108.02826	0.00		2	5	6 b 13
D(s)*	1.30723891	2112.3	2113.60724	2.00		2	6	0 m 8
N(2190)	1.1024696	2190	2191.10247	1.00		2	6	5 b 13
Omega(2200)	-0.2174218	2252	2251.78258	2.00		3	0	b 3
Lambda(c)	-0.6339484	2286.46	2285.82605	1.00		3	0	2 b 5
f(2)(2300)	3.30997068	2297	2300.30997	1.00		3	0	3 m 6
D(s0)*(231)	2.06952489	2317.8	2319.86952	0.00		3	0	4 m 7
D(0)*(2400)	1.86952489	2318	2319.86952	0.00		3	0	4 m 7
f(2)(2340)	3.76172805	2340	2343.76173	1.00		3	0	6 m 9
D(1)(2420)	1.20329324	2421.3	2422.50329	0.00		3	1	4 m 8
Sigma(c)(2)	-1.4288685	2452.9	2451.47113	0.00		3	1	6 b 10
Sigma(c)(2)	-2.2688685	2453.74	2451.47113	0.00		3	1	6 b 10
Sigma(c)(2)	-2.5088685	2453.98	2451.47113	0.00		3	1	6 b 10
D(s1)(2460)	1.37941553	2459.5	2460.87942	1.00		3	1	7 m 11
D(2)*(2460)	-1.7205845	2462.6	2460.87942	1.00		3	1	7 m 11
D(2)*(2460)	1.55505061	2464.4	2465.95505	0.00		3	1	7 m 11
Xi(c)	-0.5986149	2467.8	2467.20139	0.00		3	2	0 m 5

Name	(neutrinos)			19.43 N	17.43	15.43	13.43	quads
PDG		MEV →	5.08	5566.80 Energy	753.98	102.63	14.48	
Lambda(21)	-2.1230147	2100	2097.87699	2.00		2	5	6 b 13
Lambda(21)	-1.9717445	2110	2108.02826	0.00		2	5	6 b 13
Lambda(21)	-1.9717445	2110	2108.02826	0.00		2	5	6 b 13
D(s)*	1.30723891	2112.3	2113.60724	2.00		2	6	0 m 8
N(2190)	1.1024696	2190	2191.10247	1.00		2	6	5 b 13
Omega(22)	-0.2174218	2252	2251.78258	2.00		3	0	b 3
Lambda(c)	-0.6339484	2286.46	2285.82605	1.00		3	0	2 b 5
f(2)(2300)	3.30997068	2297	2300.30997	1.00		3	0	3 m 6
D(s)*(231)	2.06952489	2317.8	2319.86952	0.00		3	0	4 m 7
D(0)*(2400)	1.86952489	2318	2319.86952	0.00		3	0	4 m 7
f(2)(2340)	3.76172805	2340	2343.76173	1.00		3	0	6 m 9
D(1)(2420)	1.20329324	2421.3	2422.50329	0.00		3	1	4 m 8
Sigma(c)(2)	-1.4288685	2452.9	2451.47113	0.00		3	1	6 b 10
Sigma(c)(2)	-2.2688685	2453.74	2451.47113	0.00		3	1	6 b 10
Sigma(c)(2)	-2.5088685	2453.98	2451.47113	0.00		3	1	6 b 10
D(s1)(2460)	1.37941553	2459.5	2460.87942	1.00		3	1	7 m 11
D(2)*(2460)	-1.7205845	2462.6	2460.87942	1.00		3	1	7 m 11
D(2)*(2460)	1.55505061	2464.4	2465.95505	0.00		3	1	7 m 11
Xi(c)	-0.5986149	2467.8	2467.20139	0.00		3	2	0 m 5
Xi(c)	0.65403407	2470.88	2471.53403	2.00		3	2	1 m 6
Sigma(c)(2)	2.56142652	2517.5	2520.06143	1.00		3	2	4 b 9
Sigma(c)(2)	2.16142652	2517.9	2520.06143	1.00		3	2	4 b 9
Sigma(c)(2)	1.66142652	2518.4	2520.06143	1.00		3	2	4 b 9
D(s1)(2536)	-0.5746544	2535.12	2534.54535	1.00		3	2	5 m 10
D(s2)*(257)	-2.0648465	2571.9	2569.83515	0.00		3	3	0 m 6
Xi(c')	3.54343751	2575.7	2579.24344	1.00		3	3	1 m 7
Xi(c')	1.34343751	2577.9	2579.24344	1.00		3	3	1 m 7
Lambda(c)	-1.5226434	2595.25	2593.72736	1.00		3	3	2 b 8
Xi(c)(2645)	-0.33917	2628.11	2627.77083	0.00		3	3	4 m 10
Xi(c)(2645)	0.68739804	2645.9	2646.5874	2.00		3	3	6 m 12
Xi(c)(2645)	0.68739804	2645.9	2646.5874	2.00		3	3	6 m 12
Omega(c)	1.16112499	2695.2	2696.36112	1.00		3	4	2 b 9
Omega(c)	-0.94858	2765.9	2764.95142	2.00		3	5	0 b 8
Omega(c)	0.4866093	2789.1	2789.58661	0.00		3	5	1 b 9
Xi(c)(2790)	-2.2133907	2791.8	2789.58661	0.00		3	5	1 m 9
Xi(c)(2790)	1.95444755	2816.6	2818.55445	0.00		3	5	3 m 11
Xi(c)(2815)	-1.0455525	2819.6	2818.55445	0.00		3	5	3 m 11
Xi(c)(2815)	0.5391075	2881.53	2882.06911	2.00		3	6	1 m 10
Lambda(c)	1.00287585	2983.7	2984.70288	2.00		3	7	1 m 11
J/psi(1S)	0.82367751	3096.916	3097.73968	1.00		4	0	6 m 10
chi(c0)(1P)	1.54560113	3414.75	3416.2956	2.00		4	0	0 m 8
chi(c1)(1P)	-1.8819007	3510.66	3508.7781	4.00		4	5	0 m 9
h(c)(1P)	-2.1179816	3525.38	3523.26202	4.00		4	5	1 m 10
chi(c2)(1P)	1.84847789	3556.2	3558.04848	0.00		4	5	2 m 11
eta(c)(2S)	1.72269204	3639.4	3641.12269	1.00		4	6	1 m 11
psi(2S)	-1.5345506	3686.109	3684.57445	1.00		4	6	4 m 14
psi(3770)	-3.2602527	3773.15	3769.88975	0.00		5	0	0 m 5
chi(c2)(2P)	3.25919217	3927.2	3930.45919	0.00		5	1	4 m 10
psi(4040)	-1.5743905	4039	4037.42561	2.00		5	2	5 m 12
psi(4160)	2.04664535	4153	4155.04665	5.00		5	4	0 m 9
b	0.42482075	4180	4180.42482	0.00		5	4	0 m 9
psi(4415)	-2.0071553	4421	4418.99284	2.00		5	6	3 m 14
B	-1.4143537	5279.26	5277.84565	0.00		7	0	0 m 7
B	-1.7343537	5279.58	5277.84565	0.00		7	0	0 m 7
B*	0.43005258	5325.2	5325.63005	2.00		7	0	4 m 11
B(s)	-2.020839	5366.77	5364.74916	0.00		7	0	6 m 13
B(s)*	-1.6200982	5415.4	5413.7799	2.00		7	1	3 m 11
Lambda(b)	-0.4863013	5619.4	5618.9137	4.00	1			5 b 5
B(2)*(5747)	8.76163977	5743	5751.76164	4.00	1	0	2	0 m 2
Xi(b)	2.88074818	5788	5790.88075	2.00	1	0	2	2 m 4
Xi(b)	-0.2192518	5791.1	5790.88075	2.00	1	0	2	2 m 4
Sigma(b)	-0.8596976	5811.3	5810.4403	1.00	1		2	3 b 5
Sigma(b)	-0.4270487	5815.2	5814.77295	3.00	1		2	4 b 6
Sigma(b)*	2.23250555	5832.1	5834.33251	2.00	1		2	5 b 7
Sigma(b)*	-0.7674945	5835.1	5834.33251	2.00	1		2	5 b 7
B(s2)*(584)	-0.5518594	5839.96	5839.40814	1.00	1	0	2	5 m 7
Omega(b)	-1.4321195	6070	6068.56788	2.00	1		4	7 b 11
B(c)	0.58175172	6274.5	6275.08175	2.00	1	0	7	0 m 7
Upsilon(1S)	-2.1632729	9460.3	9458.13673	2.00	1	5	1	2 m 8
chi(b0)(1P)	-0.1364835	9859.4	9859.26352	1.00	1	5	5	1 m 11
chi(b1)(1P)	0.50698986	9892.8	9893.30699	0.00	1	5	5	3 m 13
h(b)(1P)	-1.6603612	9899.3	9897.63964	2.00	1	5	5	4 0 14
chi(b2)(1P)	-0.0764421	9912.2	9912.12356	2.00	1	5	5	5 m 15
Upsilon(2S)	1.64859647	10023.26	10024.9086	0.00	1	5	6	5 m 16
Upsilon(1D)	-0.6160642	10163.7	10163.0839	0.00	1	6	0	5 m 11
chi(b0)(2P)	-0.8257692	10232.5	10231.6742	1.00	1	6	1	3 m 10
chi(b1)(2P)	0.06643398	10255.5	10255.5664	2.00	1	6	1	5 m 12
Upsilon(3S)	-1.3324466	10355.2	10353.8676	0.00	1	6	2	4 m 12
Upsilon(4S)	-1.4483418	10579.4	10577.9517	2.00	1	6	4	6 m 16
Upsilon(10)	1.94277684	10876	10877.9428	2.00	1	7	0	3 m 10
Upsilon(11)	0.69565361	11019	11019.6957	0.00	1	7	1	5 m 13

Appendix 3 Example calculations for decay time.

the quark bundle including the ke of the quarks in the bundle										Radius of the meson held by the weak field energy									
weak kinetic energy										The decay is slowed by decay N made up of difference in quark N's									
Decay Time	Planck's reduced h	Time =h/full width	time-seconds	weak ke	V/C	gamma	cons/(m*f)^.5	t=2 pi R/(V)	Decay N	Decay Time	Decay N	Decay =t/P	1 slows decay	5.08	0.69	Field mev			
Time accuracy	Particle	PDG Data percent	PDG Data sec	mev	mass in q	weak ke	V/C	gamma	cons/(m*f)^.5	t=2 pi R/(V)	Decay N	Decay Time	Decay N	Decay =t/P	1 slows decay	5.08	0.69	Field mev	
-1.22	mu	0.00	2.20E-06	105.66	12.30	0.4446	0.896	2.19E-14	1.03E-21	35.29	2.20E-06	35.29	8	-7.00	0.687				
0.35	pi0	4.40	8.515E-17	134.98	10.49	0.3728	0.928	6.24E-15	3.51E-22	12.40	8.78E-17	12.43	10		6.9E+00				
0.90	pi	0.04	2.60E-08	139.57	2.81	0.1977	0.980	6.31E-15	6.69E-22	31.29	2.61E-08	31.29	10		6.9E+00				
0.08	f(0)(500)	54.55	1.20E-24	475.00	5.08	0.1450	0.989	3.62E-15	5.23E-22	-6.08	1.30E-24	-6.00	9		6.2E+00				
2.73	K	0.34	1.24E-08	493.68	5.86	0.1527	0.988	2.36E-15	3.24E-22	31.27	1.26E-08	31.29	10	1.00	3.00	1.4E+01			
	K(L)0			497.61	0.22	0.0299	1.000	3.37E-15	2.36E-21		5.86E-24	-6.00	10		6.9E+00				
-5.70	K(S)0	0.08	8.95E-11	497.61	0.62	0.0500	0.999	3.37E-15	1.41E-21	24.87	8.87E-11	24.86	10	12.43	10	6.9E+00			
2.41	K0	0.78	5.11E-08	497.61	0.67	0.0519	0.999	3.37E-15	1.36E-21	31.26	5.31E-08	31.29	10	31.29	10	6.9E+00			
-3.17	eta0	7.63	5.02E-19	547.85	5.13	0.1359	0.991	2.71E-15	4.17E-22	7.09	2.59E-19	6.43	14		9.6E+00				
-0.56	rho(770)	1.07	4.41E-24	775.49	1.34	0.0587	0.998	4.93E-15	1.76E-21	-5.99	4.36E-24	-6.00	3		2.1E+00				
0.52	omega(782)	1.88	7.75E-23	782.65	0.22	0.0239	1.000	4.91E-15	4.32E-21	-4.02	7.91E-23	-4.00	3		2.1E+00				
-0.12	K*(892)	3.54	1.30E-23	891.66	5.08	0.1062	0.994	3.56E-15	7.01E-22	-3.99	1.28E-23	-4.00	5		3.4E+00				
-1.48	K*(892)	2.53	1.39E-23	895.81	5.08	0.1060	0.994	3.56E-15	7.01E-22	-3.92	1.28E-23	-4.00	5		3.4E+00				
	proton			938.27	10.15	0.1459	0.989	1.42E-15	2.04E-22		6.87E+09	90.00	3	4.00	2.0E+01				
1.14	neutron	0.19	8.80E+02	939.57	10.15	0.1458	0.989	1.42E-15	2.04E-22	56.72	8.84E+02	56.73	3	4.00	2.0E+01				
-1.55	eta(958)	9.09	3.32E-21	957.78	0.73	0.0389	0.999	4.44E-15	2.39E-21	0.33	2.39E-21	0.00	3		2.1E+00				
0.35	a(0)(980)	66.67	8.78E-24	980.00	5.08	0.1014	0.995	3.39E-15	7.01E-22	-4.38	1.28E-23	-4.00	5		3.4E+00				
0.21	f(0)(980)	85.71	9.40E-24	980.00	5.08	0.1014	0.995	3.39E-15	7.01E-22	-4.31	1.28E-23	-4.00	5		3.4E+00				
-1.20	phi(1020)	1.88	1.55E-22	1019.46	15.34	0.1715	0.985	1.21E-15	1.48E-22	0.05	1.48E-22	0.00	8	4.00	2.6E+01				
-1.01	Lambda	1.52	2.63E-10	1115.68	0.22	0.0200	1.000	2.52E-15	2.64E-21	25.32	2.55E-10	25.29	8	31.30	8	5.5E+00			
-0.30	h(1)(1170)	22.22	1.83E-24	1170.00	5.08	0.0928	0.996	2.84E-15	6.40E-22	-5.86	1.59E-24	-6.00	6		4.1E+00				
-1.00	Sigma	0.66	8.02E-11	1189.37	2.65	0.0666	0.998	2.61E-15	8.20E-22	25.31	7.91E-11	25.29	7	31.30	7	4.8E+00			
0.68	Sigma	19.10	7.40E-20	1192.64	1.45	0.0493	0.999	2.60E-15	1.11E-21	4.20	9.31E-20	4.43	7	10.43	7	4.8E+00			
-0.21	Sigma	1.44	1.48E-10	1197.45	0.67	0.0335	0.999	2.43E-15	1.52E-21	25.30	1.47E-10	25.29	8	31.30	8	5.5E+00			
1.47	b(1)(1235)	12.68	4.64E-24	1229.50	10.37	0.1291	0.992	2.14E-15	3.47E-22	-4.32	6.36E-24	-4.00	10		6.9E+00				
-0.13	a(1)(1260)	85.71	1.57E-24	1230.00	5.08	0.0906	0.996	2.14E-15	4.96E-22	-5.76	1.23E-24	-6.00	10		6.9E+00				
1.39	Delta(1232)	5.13	5.63E-24	1232.00	10.15	0.1276	0.992	2.14E-15	3.51E-22	-4.13	6.43E-24	-4.00	10		6.9E+00				
0.06	K(1)(1270)	44.44	7.31E-24	1272.00	10.15	0.1256	0.992	2.51E-15	4.19E-22	-4.05	7.68E-24	-4.00	7		4.8				
0.89	f(2)(1270)	2.86	3.56E-24	1275.10	0.78	0.0350	0.999	2.52E-15	1.51E-21	-6.05	3.74E-24	-6.00	7		4.8E+00				
0.53	f(1)(1285)	9.09	2.72E-23	1281.80	0.67	0.0323	0.999	2.51E-15	1.63E-21	-4.09	2.98E-23	-4.00	7		4.8E+00				
-1.88	eta(1295)	18.18	1.20E-23	1294.00	0.67	0.0322	0.999	2.34E-15	1.52E-21	-4.85	3.78E-24	-6.00	8		5.5E+00				
-0.22	pi(1300)	100.00	1.65E-24	1300.00	10.15	0.1242	0.992	2.19E-15	3.70E-22	-5.42	9.17E-25	-6.00	9		6.2E+00				
-3.56	Xi	6.17	2.90E-10	1314.86	10.15	0.1235	0.992	2.07E-15	3.51E-22	27.44	1.63E-10	26.86	10	24.86	10	6.9E+00			
0.06	a(2)(1320)	9.35	6.15E-24	1318.30	10.82	0.1274	0.992	2.07E-15	3.40E-22	-4.01	6.22E-24	-4.00	10		6.9E+00				
-0.17	Xi	1.99	1.64E-10	1321.71	10.15	0.1232	0.992	2.06E-15	3.51E-22	26.87	1.63E-10	26.86	10	24.86	10	6.9E+00			
-0.32	f(0)(1370)	85.71	1.88E-24	1350.00	15.23	0.1489	0.989	2.44E-15	3.43E-22	-5.21	8.50E-25	-6.00	7		4.8E+00				
-0.64	pi(1)(1400)	21.21	1.99E-24	1354.00	5.19	0.0873	0.996	2.44E-15	5.86E-22	-5.68	1.45E-24	-6.00	7		4.8E+00				
-6.34	Sigma(1385)	3.89	1.83E-23	1382.80	0.11	0.0127	1.000	2.26E-15	3.74E-21	-5.32	9.27E-24	-6.00	8		5.5E+00				
-1.46	Sigma(1385)	27.78	1.83E-23	1383.70	0.78	0.0336	0.999	2.26E-15	1.41E-21	-4.35	3.50E-24	-6.00	8		5.5E+00				
-2.24	Sigma(1385)	10.66	1.67E-23	1387.20	0.11	0.0127	1.000	2.13E-15	3.52E-21	-5.35	8.74E-24	-6.00	9		6.2E+00				
0.89	K(1)(1400)	14.94	3.78E-24	1403.00	0.33	0.0218	1.000	2.01E-15	1.93E-21	-6.23	4.78E-24	-6.00	10		6.9E+00				
-5.67	Lambda(140)	8.00	1.32E-23	1405.10	5.19	0.0857	0.996	2.00E-15	4.90E-22	-3.62	1.22E-24	-6.00	10		6.9E+00				
1.61	eta(1405)	11.37	1.29E-23	1409.80	1.34	0.0436	0.999	2.00E-15	9.63E-22	-4.31	1.76E-23	-4.00	10		6.9E+00				
0.53	K*(1410)	18.10	2.84E-24	1414.00	0.67	0.0308	1.000	2.00E-15	1.36E-21	-6.17	3.38E-24	-6.00	10		6.9E+00				

Appendix 4 Branching Ratios

Example calculations for branching percentages. First two modes are shown below with the next two modes shown in the table below this one *for the same particles*. The table continues in the third page for the same particles.

			Leptonic														
			neutral mode														
			Measured				Calculated			Measure				Calculated			
			Decay	Branching	Branchi	Mass	M*P	N	delta	P	Decay	Branchin	Branching	Mass	M*P	N	to m _e P
Dominant N																	
boxes in columns au-bi																	
13.431	mu	e gg	105.65837	e gg													
11.431	pi0	eeg	134.9766	gg	98.8	99.6	120	8.E+07	13.4	7.E+05	eeg	1.20	0.4	12	3.E+05	10.1	3.E+04
13.431	pi	mu v	139.57018	mu wu	99.98	100.0	105	7.E+07	13.4	7.E+05	e ve	1.E-04	2.E-02	1	1.E+04	10.1	3.E+04
15.431	K	mus- v	493.677		64	58	105	5.E+08	15.4	5.E+06	pi0 e+ ve	5	10	135	9.E+07	13.4	7.E+05
15.431	K(L)0	0	497.614														
15.431	K(S)0	pi+pi-	497.614	pi+pi-	69	73	274	5.E+08	14.4	2.E+06	pi0pi0pi0	3.E-05	6.E-05	405	4.E+02	0.0	1.E+00
15.431	K0	pi0pi0pi0	497.614														
13.431	eta0	pi+pi-pi0	547.853	2g	39	36	547	5.E+07	11.4	9.E+04	pi0pi0pi0	32	27	405	4.E+07	11.4	9.E+04
13.431	rho(770)																
17.431	omega(782)	pi+pi-pi0	782.65	pi+pi-pi0	89	92	413	3.E+08	13.4	7.E+05	pi0g	9	4	135	1.E+07	11.4	9.E+04
15.431	K*(892)	493pi	891.66	Kpi	100.0	100.0	632	4.E+08	13.4	7.E+05	K0 g	2.E-03	1.E-04	497	497	0.0	1
			895.81														
17.431	eta'(958)	pi+pi-eta	957.78	pi pi eta	45	37	825	6.E+08	13.4	7.E+05	rho g	29	34	775	5.E+08	13.4	680784
15.431	f(0)(980)	pi pi	980														
17.431	phi(1020)	493 493	1019.455	pipi	49	59	278	2.E+08	13.4	7.E+05	KK	34	29	986	9.E+07	11.4	92134
17.431	Lambda	n pi0	1115.683	p pi-	64	62	139	1.E+09	15.9	8.E+06	n pi0	36	38	139	7.E+08	15.4	5.E+06

			Hadronic														
			charged mode														
			Measured				Calculated			Measured				Calculated			
			Decay	Branching	Branching	Mass	M*P	N	to m _e P	P	Decay	Branching	Branching	Mass	M*P	N	to m _e P
Dominant N																	
boxes in columns au-bi																	
13.431	mu	e gg	105.65837	e ve auw													
11.431	pi0	eeg	134.9766	e+e+e-e+	3.E-05	3.E-06	2	2	0.0	1	e+e-	6.E-08	1.E-06	1	1	0	1
13.431	pi	mu v	139.57018	e ve pi0op	1.E-08	7.E-07	1	1	0.0	1	e ve e+e-	3.E-09	7.E-07	1	1	0	1
15.431	K	mus- v	493.677	pi0 mu+ v	3	2	244	2.E+07	11.4	9.E+04	pi+pi0	21	21	274	2.E+08	13.4	680784
15.431	K(L)0	0	497.614														
15.431	K(S)0	pi+pi-	497.614	pi+pi-	31	27	278	2.E+08	13.4	7.E+05							
15.431	K0	pi0pi0pi0	497.614														
13.431	eta0	pi+pi-pi0	547.853	pipip0	23	27	412	4.E+07	11.4	9.E+04	pipig	5	9	139	1.E+07	11.4	92134
13.431	rho(770)																
17.431	omega(782)	pi+pi-pi0	782.65	pipi0	2	4	139	1.E+07	11.4	9.E+04	g	7.E-04	3.E-02	1	9.E+04	11.4	92134
15.431	K*(892)	493pi	891.66														
			895.81														
17.431	eta'(958)	pi+pi-eta	957.78	pi0pi0eta	21	24	547	4.E+08	13.4	7.E+05	omega	3	4.7	782	7.E+07	11.4	92134
15.431	f(0)(980)	pi pi	980														
17.431	phi(1020)	493 493	1019.455	pi pi p0	16	12	417	4.E+07	11.4	9.E+04							
17.431	Lambda	n pi0	1115.683	ng	2.E-03	6.E-04	0	10264	11	9.E+04							

Remaining modes are shown below for the same particles. The sum(M*P) is shown on the right. Dividing all the M*P values in the table by sum(M*P) and multiplying by 100 makes all the calculated branching ratios percentages like the data.

			Measured						Calculated						Total				
			Decay	Branching	Branching	Mass	M*P	N to m	P	Decay	Branching	Branching	Mass	M*P	N to m	P	perce	sum(M*P)	
Dominant N																			
boxes in columns au-bi																			
13.431 mu	e gg	105.65837	which pi?																
11.431 pi0	eeg	134.9766	4g	2.E-08	3.E-06	2	2	0	1	w	8.E-08	1.E-05	10	10	0	1	100	8.E+07	
13.431 pi	mu v	139.57018	e+ve w	5.E-06	7.E-07	1	1	0	1	mu ve	2.E-03	2.E-04	110	110	0	1	100	7.E+07	
15.431 K	mus- v	493.677	pi+pi+p	6	4	417	4.E+07	11	92134	pi+pi0 p	2	4	409	#####	11	92134	100	9.E+08	
15.431 K(L)0	0	497.614																	
15.431 K(S)0	pi+pi-	497.614																100	7.E+08
15.431 K0	pi0pi0pi0	497.614																	
13.431 eta0	pi+pi-pi0	547.853																100	1.E+08
13.431 rho(770)																			
17.431 omega(782)	pi+pi-pi0	782.65																100	3.E+08
15.431 K*(892)	493pi	891.66																100	4.E+08