p PARTIAL MEAN LIVES

The "partial mean life" limits tabulated here are the limits on τ/B_i, where τ is the total mean life for the proton and B_i is the branching fraction for the mode in question.

Decaying particle: p = proton, n = bound neutron. The same event may appear under more than one partial decay mode. Background estimates may be accurate to a factor of two.

$\tau(N \to e^+\pi)$ — τ_1

LIMIT (10^{30} years)	PARTICLE	CL%	EVTS	BKGD EST	DOCUMENT ID		TECN
>550	***p***	**90**	**0**	**0.7**	[11] BECKER-SZ...	90	IMB3
>130	***n***	**90**	**0**	**<0.2**	HIRATA	89C	KAMI

• • • We do not use the following data for averages, fits, limits, etc. • • •

LIMIT (10^{30} years)	PARTICLE	CL%	EVTS	BKGD EST	DOCUMENT ID		TECN
> 70	*p*	90	0	0.5	BERGER	91	FREJ
> 70	*n*	90	0	≤ 0.1	BERGER	91	FREJ
>260	*p*	90	0	<0.04	HIRATA	89C	KAMI
>310	*p*	90	0	0.6	SEIDEL	88	IMB
>100	*n*	90	0	1.6	SEIDEL	88	IMB
> 1.3	*n*	90	0		BARTELT	87	SOUD
> 1.3	*p*	90	0		BARTELT	87	SOUD
>250	*p*	90	0	0.3	HAINES	86	IMB
> 31	*n*	90	8	9	HAINES	86	IMB
> 64	*p*	90	0	<0.4	ARISAKA	85	KAMI
> 26	*n*	90	0	<0.7	ARISAKA	85	KAMI
> 82	*p* (free)	90	0	0.2	BLEWITT	85	IMB
>250	*p*	90	0	0.2	BLEWITT	85	IMB
> 25	*n*	90	4	4	PARK	85	IMB
> 15	*p*, *n*	90	0		BATTISTONI	84	NUSX
> 0.5	*p*	90	1	0.3	[12] BARTELT	83	SOUD
> 0.5	*n*	90	1	0.3	[12] BARTELT	83	SOUD
> 5.8	*p*	90	2		[13] KRISHNA...	82	KOLR
> 5.8	*n*	90	2		[13] KRISHNA...	82	KOLR
> 0.1	*n*	90			[14] GURR	67	CNTR

[11] This BECKER-SZENDY 90 result includes data from SEIDEL 88.
[12] Limit based on zero events.
[13] We have calculated 90% CL limit from 1 confined event.
[14] We have converted half-life to 90% CL mean life.

$\tau(N \to \mu^+\pi)$ — τ_2

LIMIT (10^{30} years)	PARTICLE	CL%	EVTS	BKGD EST	DOCUMENT ID		TECN
>100	***n***	**90**	**0**	**<0.2**	HIRATA	89C	KAMI
>270	***p***	**90**	**0**	**0.5**	SEIDEL	88	IMB

• • • We do not use the following data for averages, fits, limits, etc. • • •

LIMIT (10^{30} years)	PARTICLE	CL%	EVTS	BKGD EST	DOCUMENT ID		TECN
> 81	*p*	90	0	0.2	BERGER	91	FREJ
> 35	*n*	90	1	1.0	BERGER	91	FREJ
>230	*p*	90	0	<0.07	HIRATA	89C	KAMI
> 63	*n*	90	0	0.5	SEIDEL	88	IMB
> 76	*p*	90	2	1	HAINES	86	IMB
> 23	*n*	90	8	7	HAINES	86	IMB
> 46	*p*	90	0	<0.7	ARISAKA	85	KAMI
> 20	*n*	90	0	<0.4	ARISAKA	85	KAMI
> 59	*p* (free)	90	0	0.2	BLEWITT	85	IMB
>100	*p*	90	1	0.4	BLEWITT	85	IMB
> 38	*n*	90	1	4	PARK	85	IMB
> 10	*p*, *n*	90	0		BATTISTONI	84	NUSX
> 1.3	*p*, *n*	90	0		ALEKSEEV	81	BAKS

$\tau(N \to \nu\pi)$ — τ_3

LIMIT (10^{30} years)	PARTICLE	CL%	EVTS	BKGD EST	DOCUMENT ID		TECN
> 25	***p***	**90**	**32**	**32.8**	HIRATA	89C	KAMI
>100	***n***	**90**	**1**	**3**	HIRATA	89C	KAMI

• • • We do not use the following data for averages, fits, limits, etc. • • •

LIMIT (10^{30} years)	PARTICLE	CL%	EVTS	BKGD EST	DOCUMENT ID		TECN
> 13	*n*	90	1	1.2	BERGER	89	FREJ
> 10	*p*	90	11	14	BERGER	89	FREJ
> 6	*n*	90	73	60	HAINES	86	IMB
> 2	*p*	90	16	13	KAJITA	86	KAMI
> 40	*n*	90	0	1	KAJITA	86	KAMI
> 7	*n*	90	28	19	PARK	85	IMB
> 7	*n*	90	0		BATTISTONI	84	NUSX
> 2	*p*	90	≤ 3		BATTISTONI	84	NUSX
> 5.8	*p*	90	1		[15] KRISHNA...	82	KOLR
> 0.3	*p*	90	2		[16] CHERRY	81	HOME
> 0.1	*p*	90			[17] GURR	67	CNTR

[15] We have calculated 90% CL limit from 1 confined event.
[16] We have converted 2 possible events to 90% CL limit.
[17] We have converted half-life to 90% CL mean life.

$\tau(p \to e^+\eta)$ — τ_4

LIMIT (10^{30} years)	PARTICLE	CL%	EVTS	BKGD EST	DOCUMENT ID		TECN
>140	***p***	**90**	**0**	**<0.04**	HIRATA	89C	KAMI

• • • We do not use the following data for averages, fits, limits, etc. • • •

LIMIT (10^{30} years)	PARTICLE	CL%	EVTS	BKGD EST	DOCUMENT ID		TECN
> 44	*p*	90	0	0.1	BERGER	91	FREJ
>100	*p*	90	0	0.6	SEIDEL	88	IMB
>200	*p*	90	5	3.3	HAINES	86	IMB
> 64	*p*	90	0	<0.8	ARISAKA	85	KAMI
> 64	*p* (free)	90	5	6.5	BLEWITT	85	IMB
>200	*p*	90	5	4.7	BLEWITT	85	IMB
> 1.2	*p*	90	2		[18] CHERRY	81	HOME

[18] We have converted 2 possible events to 90% CL limit.

$\tau(p \to \mu^+\eta)$ — τ_5

LIMIT (10^{30} years)	PARTICLE	CL%	EVTS	BKGD EST	DOCUMENT ID		TECN
>69	***p***	**90**	**1**	**<0.08**	HIRATA	89C	KAMI

• • • We do not use the following data for averages, fits, limits, etc. • • •

LIMIT (10^{30} years)	PARTICLE	CL%	EVTS	BKGD EST	DOCUMENT ID		TECN
>26	*p*	90	1	0.8	BERGER	91	FREJ
> 1.3	*p*	90	0	0.7	PHILLIPS	89	HPW
>34	*p*	90	1	1.5	SEIDEL	88	IMB
>46	*p*	90	7	6	HAINES	86	IMB
>26	*p*	90	1	<0.8	ARISAKA	85	KAMI
>17	*p* (free)	90	6	6	BLEWITT	85	IMB
>46	*p*	90	7	8	BLEWITT	85	IMB

$\tau(n \to \nu\eta)$ — τ_6

LIMIT (10^{30} years)	PARTICLE	CL%	EVTS	BKGD EST	DOCUMENT ID		TECN
>54	***n***	**90**	**2**	**0.9**	HIRATA	89C	KAMI

• • • We do not use the following data for averages, fits, limits, etc. • • •

LIMIT (10^{30} years)	PARTICLE	CL%	EVTS	BKGD EST	DOCUMENT ID		TECN
>29	*n*	90	0	0.9	BERGER	89	FREJ
>16	*n*	90	3	2.1	SEIDEL	88	IMB
>25	*n*	90	7	6	HAINES	86	IMB
>30	*n*	90	0	0.4	KAJITA	86	KAMI
>18	*n*	90	4	3	PARK	85	IMB
> 0.6	*n*	90	2		[19] CHERRY	81	HOME

[19] We have converted 2 possible events to 90% CL limit.

$\tau(N \to e^+\rho)$ — τ_7

LIMIT (10^{30} years)	PARTICLE	CL%	EVTS	BKGD EST	DOCUMENT ID		TECN
>75	***p***	**90**	**2**	**2.7**	HIRATA	89C	KAMI
>58	***n***	**90**	**0**	**1.9**	HIRATA	89C	KAMI

• • • We do not use the following data for averages, fits, limits, etc. • • •

LIMIT (10^{30} years)	PARTICLE	CL%	EVTS	BKGD EST	DOCUMENT ID		TECN
>29	*p*	90	0	2.2	BERGER	91	FREJ
>41	*n*	90	0	1.4	BERGER	91	FREJ
>38	*n*	90	2	4.1	SEIDEL	88	IMB
> 1.2	*p*	90	0		BARTELT	87	SOUD
> 1.5	*n*	90	0		BARTELT	87	SOUD
>17	*p*	90	7	7	HAINES	86	IMB
>14	*n*	90	9	4	HAINES	86	IMB
>12	*p*	90	0	<1.2	ARISAKA	85	KAMI
> 6	*n*	90	2	<1	ARISAKA	85	KAMI
> 6.7	*p* (free)	90	6	6	BLEWITT	85	IMB
>17	*p*	90	7	7	BLEWITT	85	IMB
>12	*n*	90	4	2	PARK	85	IMB
> 0.6	*n*	90	1	0.3	[20] BARTELT	83	SOUD
> 0.5	*p*	90	1	0.3	[20] BARTELT	83	SOUD
> 9.8	*p*	90	1		[21] KRISHNA...	82	KOLR
> 0.8	*p*	90	2		[22] CHERRY	81	HOME

[20] Limit based on zero events.
[21] We have calculated 90% CL limit from 0 confined events.
[22] We have converted 2 possible events to 90% CL limit.

$\tau(N \to \mu^+\rho)$ — τ_8

LIMIT (10^{30} years)	PARTICLE	CL%	EVTS	BKGD EST	DOCUMENT ID		TECN
>110	***p***	**90**	**0**	**1.7**	HIRATA	89C	KAMI
> 23	***n***	**90**	**1**	**1.8**	HIRATA	89C	KAMI

• • • We do not use the following data for averages, fits, limits, etc. • • •

LIMIT (10^{30} years)	PARTICLE	CL%	EVTS	BKGD EST	DOCUMENT ID		TECN
> 12	*p*	90	0	0.5	BERGER	91	FREJ
> 22	*n*	90	0	1.1	BERGER	91	FREJ
> 4.3	*p*	90	0	0.7	PHILLIPS	89	HPW
> 30	*p*	90	0	0.5	SEIDEL	88	IMB
> 11	*n*	90	1	1.1	SEIDEL	88	IMB
> 16	*p*	90	4	4.5	HAINES	86	IMB
> 7	*n*	90	6	5	HAINES	86	IMB
> 12	*p*	90	0	<0.7	ARISAKA	85	KAMI
> 5	*n*	90	1	<1.2	ARISAKA	85	KAMI
> 5.5	*p* (free)	90	4	5	BLEWITT	85	IMB
> 16	*p*	90	4	5	BLEWITT	85	IMB
> 9	*n*	90	1	2	PARK	85	IMB