$\Delta(1940)$ D_{33}

$I(J^P) = \frac{3}{2}(\frac{3}{2}^-)$ Status: $*$

OMITTED FROM SUMMARY TABLE

Δ(1940) BREIT-WIGNER MASS

VALUE (MeV)	*DOCUMENT ID*		*TECN*	*COMMENT*
≈ 1940 OUR ESTIMATE				
2057 ±110	MANLEY	92	IPWA	$\pi N \rightarrow \pi N$ & $N\pi\pi$
2058.1± 34.5	CHEW	80	BPWA	$\pi^+ p \rightarrow \pi^+ p$
1940 ±100	CUTKOSKY	80	IPWA	$\pi N \rightarrow \pi N$

Δ(1940) BREIT-WIGNER WIDTH

VALUE (MeV)	*DOCUMENT ID*		*TECN*	*COMMENT*
460 ±320	MANLEY	92	IPWA	$\pi N \rightarrow \pi N$ & $N\pi\pi$
198.4± 45.5	CHEW	80	BPWA	$\pi^+ p \rightarrow \pi^+ p$
200 ±100	CUTKOSKY	80	IPWA	$\pi N \rightarrow \pi N$

Δ(1940) POLE POSITION

REAL PART

VALUE (MeV)	*DOCUMENT ID*		*TECN*	*COMMENT*
1900±100	CUTKOSKY	80	IPWA	$\pi N \rightarrow \pi N$
1915 or 1926	[1] LONGACRE	78	IPWA	$\pi N \rightarrow N\pi\pi$

−2×IMAGINARY PART

VALUE (MeV)	*DOCUMENT ID*		*TECN*	*COMMENT*
200±60	CUTKOSKY	80	IPWA	$\pi N \rightarrow \pi N$
190 or 186	[1] LONGACRE	78	IPWA	$\pi N \rightarrow N\pi\pi$

Δ(1940) ELASTIC POLE RESIDUE

MODULUS $|r|$

VALUE (MeV)	*DOCUMENT ID*		*TECN*	*COMMENT*
8±3	CUTKOSKY	80	IPWA	$\pi N \rightarrow \pi N$

PHASE θ

VALUE (°)	*DOCUMENT ID*		*TECN*	*COMMENT*
135±45	CUTKOSKY	80	IPWA	$\pi N \rightarrow \pi N$

$\Delta(1940)$ DECAY MODES

	Mode
Γ_1	$N\pi$
Γ_2	ΣK
Γ_3	$N\pi\pi$
Γ_4	$\Delta(1232)\pi$, S-wave
Γ_5	$\Delta(1232)\pi$, D-wave
Γ_6	$N\rho$, S=3/2, S-wave
Γ_7	$N\gamma$, helicity=1/2
Γ_8	$N\gamma$, helicity=3/2

$\Delta(1940)$ BRANCHING RATIOS

$\Gamma(N\pi)/\Gamma_{\text{total}}$ — Γ_1/Γ

VALUE	*DOCUMENT ID*		*TECN*	*COMMENT*
0.18 ± 0.12	MANLEY	92	IPWA	$\pi N \rightarrow \pi N$ & $N\pi\pi$
0.18	CHEW	80	BPWA	$\pi^+ p \rightarrow \pi^+ p$
0.05 ± 0.02	CUTKOSKY	80	IPWA	$\pi N \rightarrow \pi N$

$(\Gamma_i\Gamma_f)^{1/2}/\Gamma_{\text{total}}$ in $N\pi \rightarrow \Delta(1940) \rightarrow \Sigma K$ — $(\Gamma_1\Gamma_2)^{1/2}/\Gamma$

VALUE	*DOCUMENT ID*		*TECN*	*COMMENT*
<0.015	CANDLIN	84	DPWA	$\pi^+ p \rightarrow \Sigma^+ K^+$

$(\Gamma_i\Gamma_f)^{1/2}/\Gamma_{\text{total}}$ in $N\pi \rightarrow \Delta(1940) \rightarrow \Delta(1232)\pi$, S-wave — $(\Gamma_1\Gamma_4)^{1/2}/\Gamma$

VALUE	*DOCUMENT ID*		*TECN*	*COMMENT*
$+0.11\pm0.10$	MANLEY	92	IPWA	$\pi N \rightarrow \pi N$ & $N\pi\pi$

$(\Gamma_i\Gamma_f)^{1/2}/\Gamma_{\text{total}}$ in $N\pi \rightarrow \Delta(1940) \rightarrow \Delta(1232)\pi$, D-wave — $(\Gamma_1\Gamma_5)^{1/2}/\Gamma$

VALUE	*DOCUMENT ID*		*TECN*	*COMMENT*
$+0.27\pm0.16$	MANLEY	92	IPWA	$\pi N \rightarrow \pi N$ & $N\pi\pi$

$(\Gamma_i\Gamma_f)^{1/2}/\Gamma_{\text{total}}$ in $N\pi \rightarrow \Delta(1940) \rightarrow N\rho$, S=3/2, S-wave — $(\Gamma_1\Gamma_6)^{1/2}/\Gamma$

VALUE	*DOCUMENT ID*		*TECN*	*COMMENT*
$+0.25\pm0.10$	MANLEY	92	IPWA	$\pi N \rightarrow \pi N$ & $N\pi\pi$

$\Delta(1940)$ PHOTON DECAY AMPLITUDES

$\Delta(1940) \rightarrow N\gamma$, helicity-1/2 amplitude $A_{1/2}$

VALUE (GeV$^{-1/2}$)	*DOCUMENT ID*		*TECN*	*COMMENT*
-0.036 ± 0.058	AWAJI	81	DPWA	$\gamma N \rightarrow \pi N$

$\Delta(1940) \rightarrow N\gamma$, helicity-3/2 amplitude $A_{3/2}$

VALUE (GeV$^{-1/2}$)	*DOCUMENT ID*		*TECN*	*COMMENT*
-0.031 ± 0.012	AWAJI	81	DPWA	$\gamma N \rightarrow \pi N$

Δ(1940) FOOTNOTES

[1] LONGACRE 78 values are from a search for poles in the unitarized T-matrix. The first (second) value uses, in addition to $\pi N \rightarrow N\pi\pi$ data, elastic amplitudes from a Saclay (CERN) partial-wave analysis.

Δ(1940) REFERENCES

MANLEY	92	PR D45 4002	D.M. Manley, E.M. Saleski	(KENT) IJP
Also	84	PR D30 904	D.M. Manley *et al.*	(VPI)
CANDLIN	84	NP B238 477	D.J. Candlin *et al.*	(EDIN, RAL, LOWC)
AWAJI	81	Bonn Conf. 352	N. Awaji, R. Kajikawa	(NAGO)
Also	82	NP B197 365	K. Fujii *et al.*	(NAGO)
CHEW	80	Toronto Conf. 123	D.M. Chew	(LBL) IJP
CUTKOSKY	80	Toronto Conf. 19	R.E. Cutkosky *et al.*	(CMU, LBL) IJP
Also	79	PR D20 2839	R.E. Cutkosky *et al.*	(CMU, LBL)
LONGACRE	78	PR D17 1795	R.S. Longacre *et al.*	(LBL, SLAC)