Δ BARYONS
($S = 0$, $I = 3/2$)

$\Delta^{++} = uuu$, $\Delta^{+} = uud$, $\Delta^{0} = udd$, $\Delta^{-} = ddd$

$\Delta(1232)\ 3/2^+$

$I(J^P) = \frac{3}{2}(\frac{3}{2}^+)$

Re(pole position) = 1209 to 1211 ($\approx$ 1210) MeV
-2Im(pole position) = 98 to 102 ($\approx$ 100) MeV
Breit-Wigner mass (mixed charges) = 1230 to 1234 ($\approx$ 1232) MeV
Breit-Wigner full width (mixed charges) = 114 to 120 ($\approx$ 117) MeV

$\Delta(1232)$ DECAY MODES	Fraction (Γ_i/Γ)	p (MeV/c)
$N\pi$	99.4 %	229
$N\gamma$	0.55–0.65 %	259
$N\gamma$, helicity=1/2	0.11–0.13 %	259
$N\gamma$, helicity=3/2	0.44–0.52 %	259
pe^+e^-	$(4.2\pm0.7)\times10^{-5}$	259

$\Delta(1600)\ 3/2^+$

$I(J^P) = \frac{3}{2}(\frac{3}{2}^+)$

Re(pole position) = 1470 to 1590 ($\approx$ 1520) MeV
-2Im(pole position) = 150 to 320 ($\approx$ 280) MeV
Breit-Wigner mass = 1500 to 1640 ($\approx$ 1570) MeV
Breit-Wigner full width = 200 to 300 ($\approx$ 250) MeV

$\Delta(1600)$ DECAY MODES	Fraction (Γ_i/Γ)	p (MeV/c)
$N\pi$	8–24%	492
$N\pi\pi$	58–84 %	454
$\Delta(1232)\pi$	58–82 %	276
$\Delta(1232)\pi$, P-wave	72–82%	276
$\Delta(1232)\pi$, F-wave	<2%	276
$N\rho$	(7 ±4) %	†
$N\rho$, S=1/2	(2.0±2.0) %	†
$N\rho$, S=3/2 , P-wave	(5.0±3.0) %	†
$N(1440)\pi$	17–27%	†
$N\gamma$	0.001–0.035 %	505
$N\gamma$, helicity=1/2	0.0–0.02 %	505
$N\gamma$, helicity=3/2	0.001–0.015 %	505

$\Delta(1620)\ 1/2^-$

$I(J^P) = \frac{3}{2}(\frac{1}{2}^-)$

Re(pole position) = 1590 to 1610 (≈ 1600) MeV
-2Im(pole position) = 80 to 140 (≈ 110) MeV
Breit-Wigner mass = 1590 to 1630 (≈ 1610) MeV
Breit-Wigner full width = 110 to 150 (≈ 130) MeV

$\Delta(1620)$ DECAY MODES	Fraction (Γ_i/Γ)	p (MeV/c)
$N\pi$	25–35 %	520
$N\pi\pi$	>67 %	484
$\Delta(1232)\pi$	44–72 %	311
$N\rho$	23–32%	†
$N\rho$, S=1/2	23–32%	†
$N\rho$, S=3/2	<0.04%	†
$N(1440)\pi$	<9 %	98
$N\gamma$, helicity=1/2	0.03–0.10 %	532

$\Delta(1700)\ 3/2^-$

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

Re(pole position) = 1640 to 1690 (≈ 1665) MeV
-2Im(pole position) = 200 to 300 (≈ 250) MeV
Breit-Wigner mass = 1690 to 1730 (≈ 1710) MeV
Breit-Wigner full width = 220 to 380 (≈ 300) MeV

$\Delta(1700)$ DECAY MODES	Fraction (Γ_i/Γ)	p (MeV/c)
$N\pi$	10–20 %	588
$N\pi\pi$	>31 %	557
$\Delta(1232)\pi$	9–70 %	394
$\Delta(1232)\pi$, S-wave	5–54 %	394
$\Delta(1232)\pi$, D-wave	4–16 %	394
$N\rho$	(15 ±4) %	†
$N\rho$, S=3/2, S-wave	22–32%	†
$N(1440)\pi$	(3.0±2.0) %	215
$N(1520)\pi$, P-wave	1–5 %	133
$N(1535)\pi$	0.5–1.5 %	113
$\Delta(1232)\eta$	3–7 %	†
$N\gamma$	0.22–0.60 %	598
$N\gamma$, helicity=1/2	0.12–0.30 %	598
$N\gamma$, helicity=3/2	0.10–0.30 %	598

$\Delta(1900)\ 1/2^-$

$I(J^P) = \frac{3}{2}(\frac{1}{2}^-)$

Re(pole position) = 1830 to 1900 ($\approx$ 1865) MeV
-2Im(pole position) = 180 to 300 ($\approx$ 240) MeV
Breit-Wigner mass = 1840 to 1920 ($\approx$ 1860) MeV
Breit-Wigner full width = 180 to 320 ($\approx$ 250) MeV

$\Delta(1900)$ DECAY MODES	Fraction (Γ_i/Γ)	p (MeV/c)
$N\pi$	4–12%	685
ΣK	seen	367
$N\pi\pi$	$>$ 52%	660
$\Delta(1232)\pi$	30–70%	509
$N\rho$	22–60 %	361
$N\rho$, S=1/2	11–35%	361
$N\rho$, S=3/2	11–25%	361
$N(1440)\pi$	3–32%	353
$N(1520)\pi$	2–10%	288
$\Delta(1232)\eta$	$<$ 2%	251
$N\gamma$, helicity=1/2	0.06–0.43 %	693

$\Delta(1905)\ 5/2^+$

$I(J^P) = \frac{3}{2}(\frac{5}{2}^+)$

Re(pole position) = 1750 to 1800 ($\approx$ 1770) MeV
-2Im(pole position) = 260 to 340 ($\approx$ 300) MeV
Breit-Wigner mass = 1855 to 1910 ($\approx$ 1880) MeV
Breit-Wigner full width = 270 to 400 ($\approx$ 330) MeV

$\Delta(1905)$ DECAY MODES	Fraction (Γ_i/Γ)	p (MeV/c)
$N\pi$	9–15%	698
$N\pi\pi$	$>$65%	673
$\Delta(1232)\pi$	$>$48%	524
$\Delta(1232)\pi$, P-wave	8–43%	524
$\Delta(1232)\pi$, F-wave	40–58%	524
$N\rho$	(25$\pm$10) %	385
$N\rho$, S=3/2, P-wave	17–35%	385
$N(1535)\pi$	$<$ 1 %	293
$N(1680)\pi$, P-wave	5–15%	133
$\Delta(1232)\eta$	2–6%	282
$N\gamma$	0.012–0.036 %	706
$N\gamma$, helicity=1/2	0.002–0.006 %	706
$N\gamma$, helicity=3/2	0.01–0.03 %	706

$\Delta(1910)\ 1/2^+$

$I(J^P) = \frac{3}{2}(\frac{1}{2}^+)$

Re(pole position) = 1800 to 1900 (≈ 1850) MeV
−2Im(pole position) = 200 to 500 (≈ 350) MeV
Breit-Wigner mass = 1850 to 1950 (≈ 1900) MeV
Breit-Wigner full width = 200 to 400 (≈ 300) MeV

$\Delta(1910)$ DECAY MODES	Fraction (Γ_i/Γ)	p (MeV/c)
$N\pi$	10–30%	710
ΣK	4–14%	410
$\Delta(1232)\pi$	34–66%	539
$N\rho$	(10 ±4) %	409
$N\rho$, S=1/2	(5.0±3.0) %	409
$N\rho$, S=3/2	(5.0±3.0) %	409
$N(1440)\pi$	3–45%	386
$N(1535)\pi$	(4.0±2.0) %	311
$\Delta(1232)\eta$	5–13%	310
$N\gamma$, helicity=1/2	0.0–0.02 %	718

$\Delta(1920)\ 3/2^+$

$I(J^P) = \frac{3}{2}(\frac{3}{2}^+)$

Re(pole position) = 1850 to 1950 (≈ 1900) MeV
−2Im(pole position) = 200 to 400 (≈ 300) MeV
Breit-Wigner mass = 1870 to 1970 (≈ 1920) MeV
Breit-Wigner full width = 240 to 360 (≈ 300) MeV

$\Delta(1920)$ DECAY MODES	Fraction (Γ_i/Γ)	p (MeV/c)
$N\pi$	5–20 %	723
ΣK	2–6 %	431
$N\pi\pi$	>46 %	699
$\Delta(1232)\pi$	(38±15) %	553
$\Delta(1232)\pi$, P-wave	2–28 %	553
$\Delta(1232)\pi$, F-wave	44–72 %	553
$N\rho$	(57± 8) %	432
$N\rho$, S=1/2	(8± 4) %	432
$N\rho$, S=3/2 , P-wave	(14± 5) %	432
$N\rho$, S=3/2 , F-wave	(35± 6) %	432
$N(1440)\pi$, P-wave	4–86 %	403
$N(1520)\pi$, S-wave	< 5 %	341
$N(1535)\pi$	< 2 %	328
$N\,a_0(980)$	seen	41
$\Delta(1232)\eta$	5–17 %	336

$N\gamma$	0.01–0.84 %	731
$N\gamma$, helicity=1/2	0.0–0.42 %	731
$N\gamma$, helicity=3/2	0.01–0.42 %	731

$\Delta(1930)\ 5/2^-$

$I(J^P) = \frac{3}{2}(\frac{5}{2}^-)$

Re(pole position) = 1820 to 1880 (≈ 1850) MeV
−2Im(pole position) = 300 to 450 (≈ 320) MeV
Breit-Wigner mass = 1900 to 2000 (≈ 1950) MeV
Breit-Wigner full width = 200 to 400 (≈ 300) MeV

$\Delta(1930)$ DECAY MODES	Fraction (Γ_i/Γ)	p (MeV/c)
$N\pi$	5–15 %	742
$\Delta(1232)\pi$	(33 ±9) %	575
$\Delta(1232)\pi$, D-wave	(28 ±7) %	575
$\Delta(1232)\pi$, G-wave	(5 ±5) %	575
$N\rho$	(33 ±8) %	464
$N\rho$, S=1/2	(3.0±2.0) %	464
$N\rho$, S=3/2 , G-wave	(30 ±8) %	464
$N\gamma$	0.0–0.01 %	749
$N\gamma$, helicity=1/2	0.0–0.005 %	749
$N\gamma$, helicity=3/2	0.0–0.004 %	749

$\Delta(1950)\ 7/2^+$

$I(J^P) = \frac{3}{2}(\frac{7}{2}^+)$

Re(pole position) = 1870 to 1890 (≈ 1880) MeV
−2Im(pole position) = 220 to 260 (≈ 240) MeV
Breit-Wigner mass = 1915 to 1950 (≈ 1930) MeV
Breit-Wigner full width = 235 to 335 (≈ 285) MeV

$\Delta(1950)$ DECAY MODES	Fraction (Γ_i/Γ)	p (MeV/c)
$N\pi$	35–45 %	729
ΣK	0.3–0.5 %	441
$N\pi\pi$	37–77 %	706
$\Delta(1232)\pi$	(4.0±3.0) %	560
$\Delta(1232)\pi$, F-wave	1–9 %	560
$N\rho$	(10 ±5) %	443
$N\rho$, S=1/2	(10 ±5) %	443
$N(1680)\pi$, P-wave	3–9 %	191
$\Delta(1232)\eta$	< 0.6 %	349

$N\gamma$	0.06–0.14 %	737
$N\gamma$, helicity=1/2	0.03–0.05 %	737
$N\gamma$, helicity=3/2	0.04–0.09 %	737

$\Delta(2200)\ 7/2^-$

$I(J^P) = \frac{3}{2}(\frac{7}{2}^-)$

Re(pole position) = 2050 to 2150 ($\approx$ 2100) MeV
-2Im(pole position) = 260 to 420 ($\approx$ 340) MeV
Breit-Wigner mass = 2150 to 2250 ($\approx$ 2200) MeV
Breit-Wigner full width = 200 to 500 ($\approx$ 350) MeV

$\Delta(2200)$ DECAY MODES	Fraction (Γ_i/Γ)	p (MeV/c)
$N\pi$	2–8 %	894
ΣK	1–7 %	672
$N\pi\pi$	>45 %	876
$\Delta\pi$	>45 %	747
$\Delta\pi$, D-wave	(70$\pm$30) %	747
$\Delta\pi$, G-wave	5–25 %	747
$\Delta\eta$, D-wave	seen	614

$\Delta(2420)\ 11/2^+$

$I(J^P) = \frac{3}{2}(\frac{11}{2}^+)$

Re(pole position) = 2300 to 2500 ($\approx$ 2400) MeV
-2Im(pole position) = 350 to 550 ($\approx$ 450) MeV
Breit-Wigner mass = 2300 to 2600 ($\approx$ 2450) MeV
Breit-Wigner full width = 300 to 700 ($\approx$ 500) MeV

$\Delta(2420)$ DECAY MODES	Fraction (Γ_i/Γ)	p (MeV/c)
$N\pi$	5–10 %	1040