


UNIVERSITY of York

# $\Omega^-$ production $K_L$-Facility

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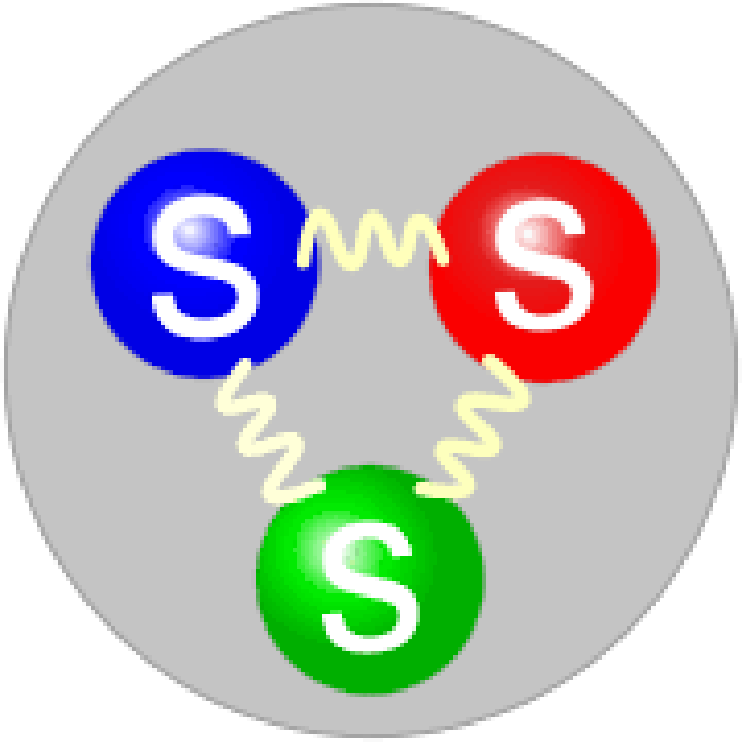
# Why Omega



# Baryon summary table, PDG

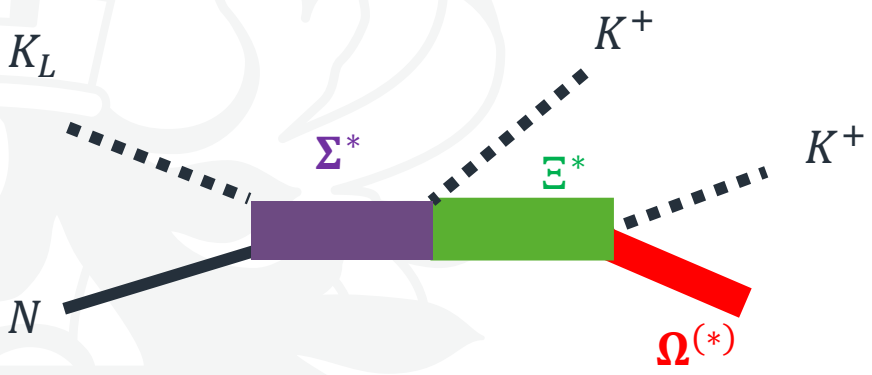
| | | | | | | | | | | | | | | |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| $p$ | $1/2^+$ | **** | $\Delta(1232)$ | $3/2^+$ | **** | $\Sigma^+$ | $1/2^+$ | **** | $\Xi^0$ | $1/2^+$ | **** | $\Lambda_c^+$ | $1/2^+$ | **** |
| $n$ | $1/2^+$ | **** | $\Delta(1600)$ | $3/2^+$ | *** | $\Sigma^0$ | $1/2^+$ | **** | $\Xi^-$ | $1/2^+$ | **** | $\Lambda_c(2595)^+$ | $1/2^-$ | *** |
| $N(1440)$ | $1/2^+$ | **** | $\Delta(1620)$ | $1/2^-$ | **** | $\Sigma^-$ | $1/2^+$ | **** | $\Xi(1530)$ | $3/2^+$ | **** | $\Lambda_c(2625)^+$ | $3/2^-$ | *** |
| $N(1520)$ | $3/2^-$ | **** | $\Delta(1700)$ | $3/2^-$ | **** | $\Sigma(1385)$ | $3/2^+$ | **** | $\Xi(1620)$ | | * | $\Lambda_c(2765)^+$ | | * |
| $N(1535)$ | $1/2^-$ | **** | $\Delta(1750)$ | $1/2^+$ | * | $\Sigma(1480)$ | | * | $\Xi(1690)$ | | *** | $\Lambda_c(2880)^+$ | $5/2^+$ | *** |
| $N(1650)$ | $1/2^-$ | **** | $\Delta(1900)$ | $1/2^-$ | ** | $\Sigma(1560)$ | | ** | $\Xi(1820)$ | $3/2^-$ | *** | $\Lambda_c(2940)^+$ | | *** |
| $N(1675)$ | $5/2^-$ | **** | $\Delta(1905)$ | $5/2^+$ | **** | $\Sigma(1580)$ | $3/2^-$ | * | $\Xi(1950)$ | | *** | $\Sigma_c(2455)$ | $1/2^+$ | **** |
| $N(1680)$ | $5/2^+$ | **** | $\Delta(1910)$ | $1/2^+$ | **** | $\Sigma(1620)$ | $1/2^-$ | * | $\Xi(2030)$ | $\geq \frac{5}{2}$? | *** | $\Sigma_c(2520)$ | $3/2^+$ | *** |
| $N(1685)$ | | * | $\Delta(1920)$ | $3/2^+$ | *** | $\Sigma(1660)$ | $1/2^+$ | *** | $\Xi(2120)$ | | * | $\Sigma_c(2800)$ | | *** |
| $N(1700)$ | $3/2^-$ | *** | $\Delta(1930)$ | $5/2^-$ | *** | $\Sigma(1670)$ | $3/2^-$ | **** | $\Xi(2250)$ | | ** | $\Xi_c^+$ | $1/2^+$ | *** |
| $N(1710)$ | $1/2^+$ | *** | $\Delta(1940)$ | $3/2^-$ | ** | $\Sigma(1690)$ | | ** | $\Xi(2370)$ | | ** | $\Xi_c^0$ | $1/2^+$ | *** |
| $N(1720)$ | $3/2^+$ | **** | $\Delta(1950)$ | $7/2^+$ | **** | $\Sigma(1730)$ | $3/2^+$ | * | $\Xi(2500)$ | | * | $\Xi_c'^+$ | $1/2^+$ | *** |
| $N(1860)$ | $5/2^+$ | ** | $\Delta(2000)$ | $5/2^+$ | ** | $\Sigma(1750)$ | $1/2^-$ | *** | | | | $\Xi_c'^0$ | $1/2^+$ | *** |
| $N(1875)$ | $3/2^-$ | *** | $\Delta(2150)$ | $1/2^-$ | * | $\Sigma(1770)$ | $1/2^+$ | * | $\Omega^-$ | $3/2^+$ | **** | $\Xi_c(2645)$ | $3/2^+$ | *** |
| $N(1880)$ | $1/2^+$ | ** | $\Delta(2200)$ | $7/2^-$ | * | $\Sigma(1775)$ | $5/2^-$ | **** | $\Omega(2250)^-$ | | *** | $\Xi_c(2790)$ | $1/2^-$ | *** |
| $N(1895)$ | $1/2^-$ | ** | $\Delta(2300)$ | $9/2^+$ | ** | $\Sigma(1840)$ | $3/2^+$ | * | $\Omega(2380)^-$ | | ** | $\Xi_c(2815)$ | $3/2^-$ | *** |
| $N(1900)$ | $3/2^+$ | *** | $\Delta(2350)$ | $5/2^-$ | * | $\Sigma(1880)$ | $1/2^+$ | ** | $\Omega(2470)^-$ | | ** | $\Xi_c(2930)$ | | * |
| $N(1990)$ | $7/2^+$ | ** | $\Delta(2390)$ | $7/2^+$ | * | $\Sigma(1900)$ | $1/2^-$ | * | | | | $\Xi_c(2980)$ | | *** |
| $N(2000)$ | $5/2^+$ | ** | $\Delta(2400)$ | $9/2^-$ | ** | $\Sigma(1915)$ | $5/2^+$ | **** | | | | $\Xi_c(3055)$ | | ** |
| $N(2040)$ | $3/2^+$ | * | $\Delta(2420)$ | $11/2^+$ | **** | $\Sigma(1940)$ | $3/2^+$ | * | | | | $\Xi_c(3080)$ | | *** |
| $N(2060)$ | $5/2^-$ | ** | $\Delta(2750)$ | $13/2^-$ | ** | $\Sigma(1940)$ | $3/2^-$ | *** | | | | $\Xi_c(3123)$ | | * |
| $N(2100)$ | $1/2^+$ | * | $\Delta(2950)$ | $15/2^+$ | ** | $\Sigma(2000)$ | $1/2^-$ | * | | | | $\Omega_c^0$ | $1/2^+$ | *** |
| $N(2120)$ | $3/2^-$ | ** | | | | $\Sigma(2030)$ | $7/2^+$ | **** | | | | $\Omega_c(2770)^0$ | $3/2^+$ | *** |
| $N(2190)$ | $7/2^-$ | **** | $\Lambda$ | $1/2^+$ | **** | $\Sigma(2070)$ | $5/2^+$ | * | | | | | | |
| $N(2220)$ | $9/2^+$ | **** | $\Lambda(1405)$ | $1/2^-$ | **** | $\Sigma(2080)$ | $3/2^+$ | ** | | | | $\Xi_{cc}^+$ | | * |
| $N(2250)$ | $9/2^-$ | **** | $\Lambda(1520)$ | $3/2^-$ | **** | $\Sigma(2100)$ | $7/2^-$ | * | | | | | | |
| $N(2300)$ | $1/2^+$ | ** | $\Lambda(1600)$ | $1/2^+$ | *** | $\Sigma(2250)$ | | *** | | | | $\Lambda_b^0$ | $1/2^+$ | *** |
| $N(2570)$ | $5/2^-$ | ** | $\Lambda(1670)$ | $1/2^-$ | **** | $\Sigma(2455)$ | | ** | | | | $\Lambda_b(5912)^0$ | $1/2^-$ | *** |
| $N(2600)$ | $11/2^-$ | *** | $\Lambda(1690)$ | $3/2^-$ | **** | $\Sigma(2620)$ | | ** | | | | $\Lambda_b(5920)^0$ | $3/2^-$ | *** |
| $N(2700)$ | $13/2^+$ | ** | $\Lambda(1710)$ | $1/2^+$ | * | $\Sigma(3000)$ | | * | | | | $\Sigma_b$ | $1/2^+$ | *** |
| | | | $\Lambda(1800)$ | $1/2^-$ | *** | $\Sigma(3170)$ | | * | | | | $\Sigma_b^*$ | $3/2^+$ | *** |
| | | | $\Lambda(1810)$ | $1/2^+$ | *** | | | | | | | $\Xi_b^0, \Xi_b^-$ | $1/2^+$ | *** |
| | | | $\Lambda(1820)$ | $5/2^+$ | **** | | | | | | | $\Xi_b(5945)^0$ | $3/2^+$ | *** |
| | | | $\Lambda(1830)$ | $5/2^-$ | **** | | | | | | | $\Omega_b^-$ | $1/2^+$ | *** |
| | | | $\Lambda(1890)$ | $3/2^+$ | **** | | | | | | | | | |
| | | | $\Lambda(2000)$ | | * | | | | | | | | | |
| | | | $\Lambda(2020)$ | $7/2^+$ | * | | | | | | | | | |
| | | | $\Lambda(2050)$ | $3/2^-$ | * | | | | | | | | | |
| | | | $\Lambda(2100)$ | $7/2^-$ | **** | | | | | | | | | |
| | | | $\Lambda(2110)$ | $5/2^+$ | *** | | | | | | | | | |
| | | | $\Lambda(2325)$ | $3/2^-$ | * | | | | | | | | | |
| | | | $\Lambda(2350)$ | $9/2^+$ | *** | | | | | | | | | |
| | | | $\Lambda(2585)$ | | ** | | | | | | | | | |

## Number of 3- and 4-star Resonances

| Baryon | 2004 | 2020 |
|---|---|---|
| $N^*$ | 15 | 21 |
| $\Delta$ | 10 | 12 |
| $\Lambda$ | 14 | 14 |
| $\Sigma$ | 10 | 9* |
| $\Xi$ | 6 | 6 |
| $\Omega$ | 2 | 2 |

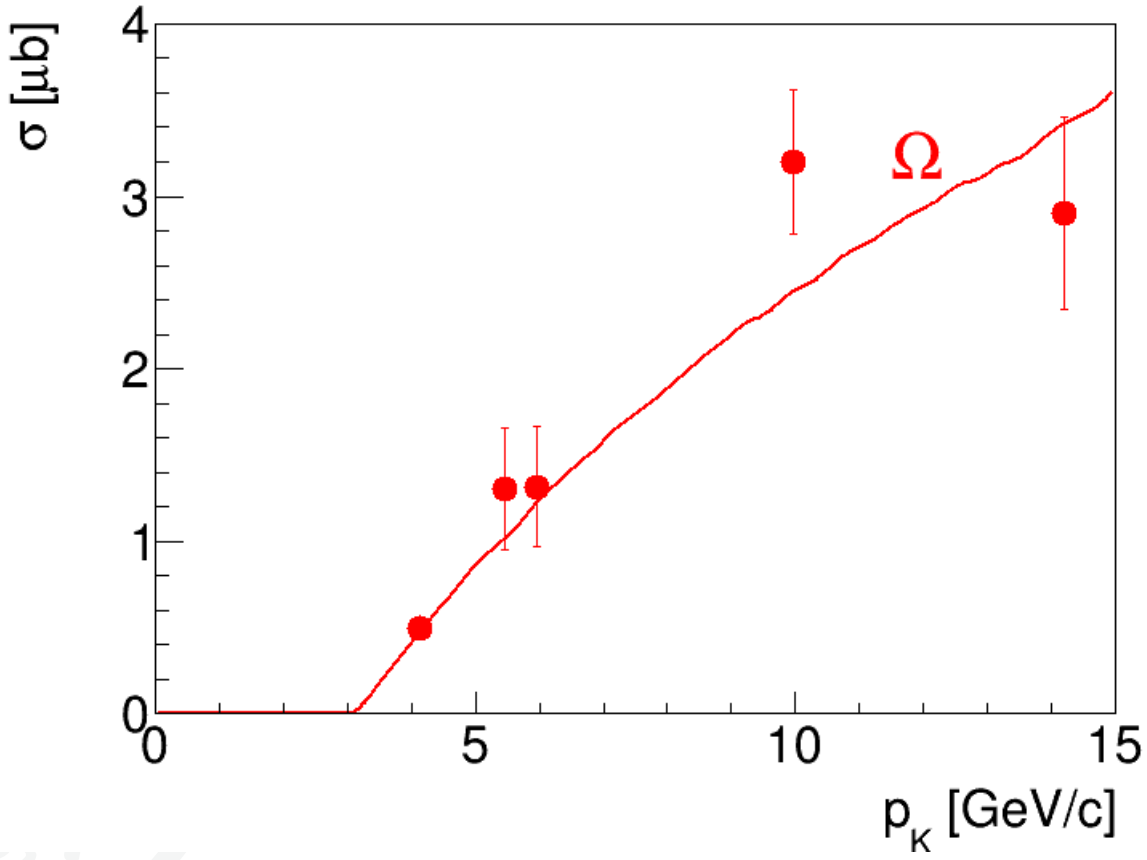
*$\Sigma(2250)$ was downgraded

# Omega production



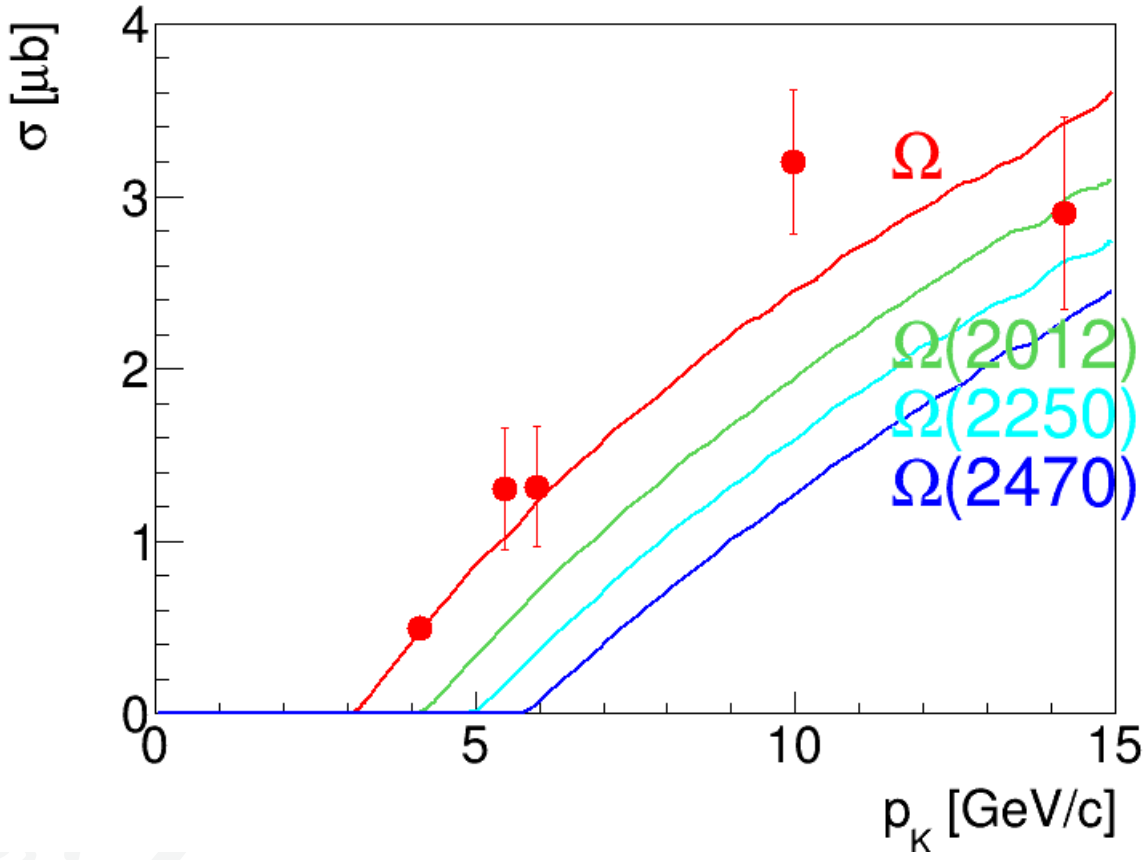

$$\sigma(K^- p \to \Omega X) = \sigma(K^0 p \to \Omega X)$$

# Omega Cross section



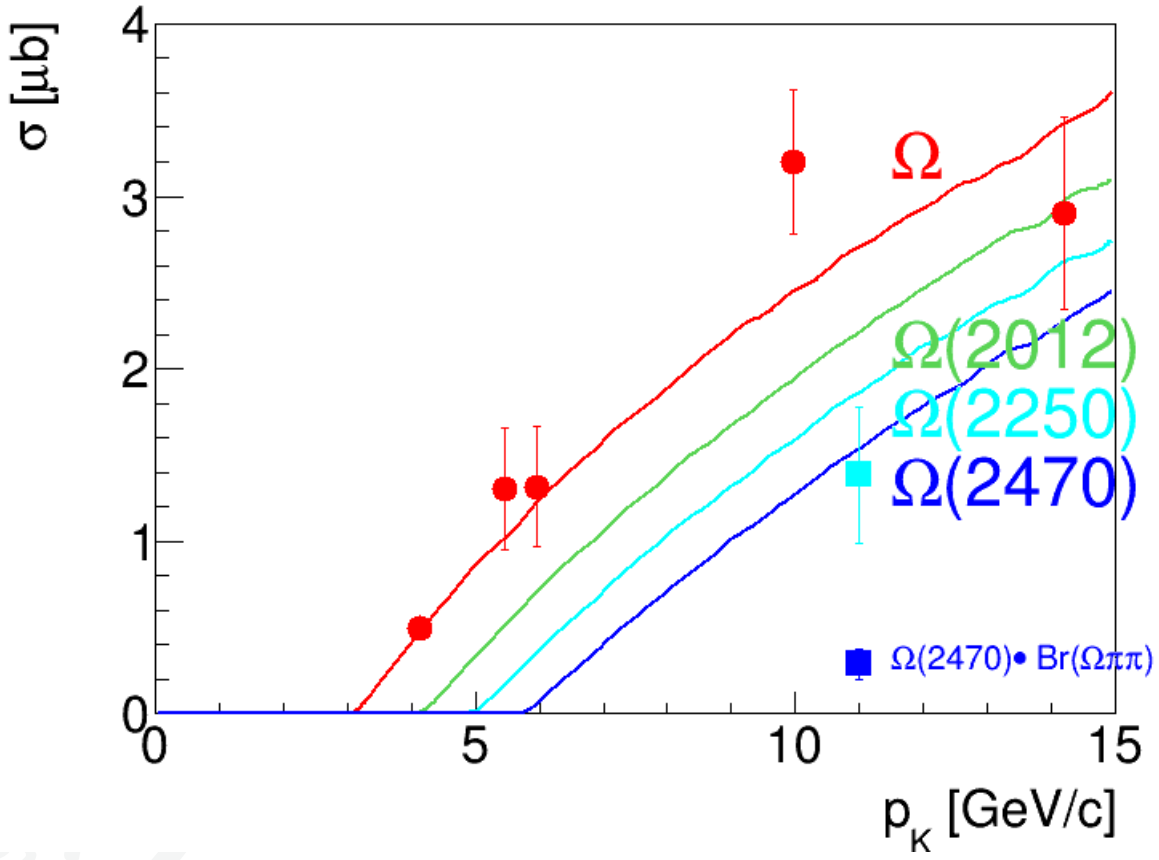

$\sigma(K^- p \to \Omega X) \sim \frac{PhaseSpace}{Q}$ (fit curve)

# Omega Cross section



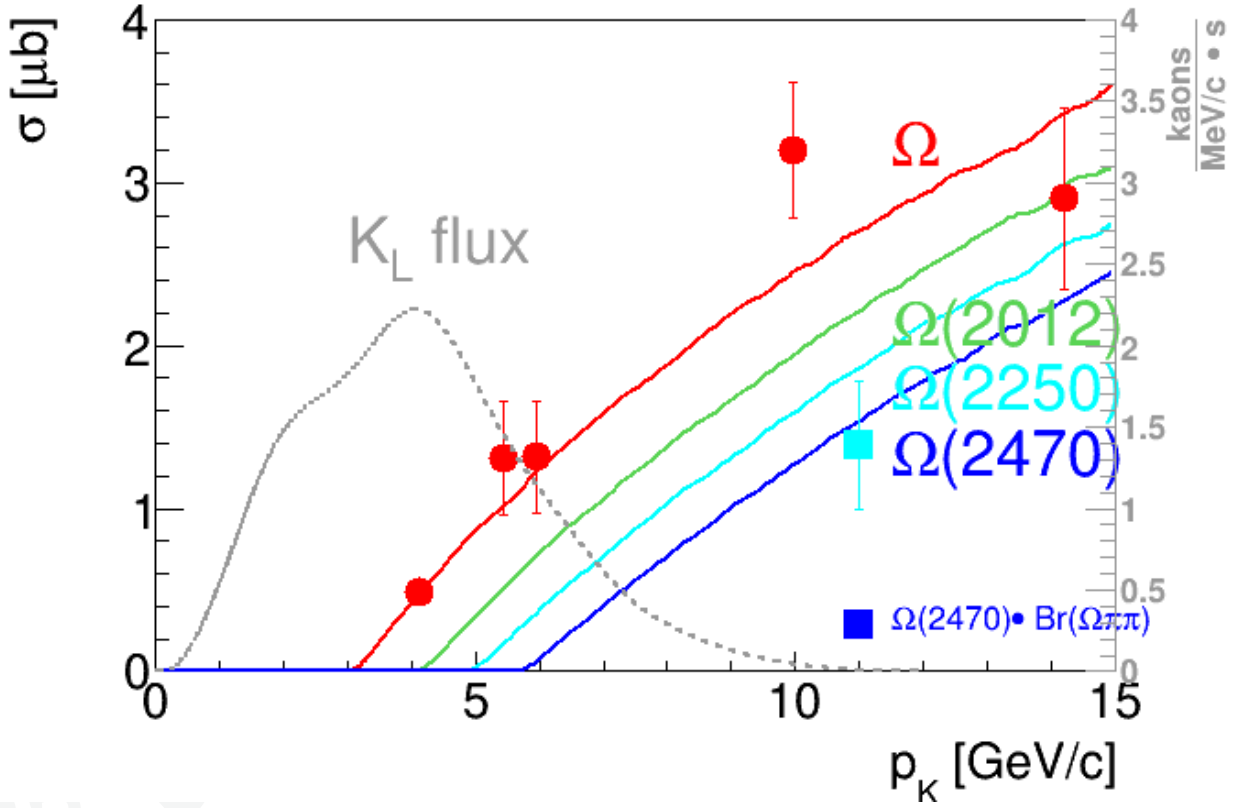

$\sigma(K^- p \to \Omega X) \sim \frac{PhaseSpace}{Q}$ (fit curve)

# Omega Cross section



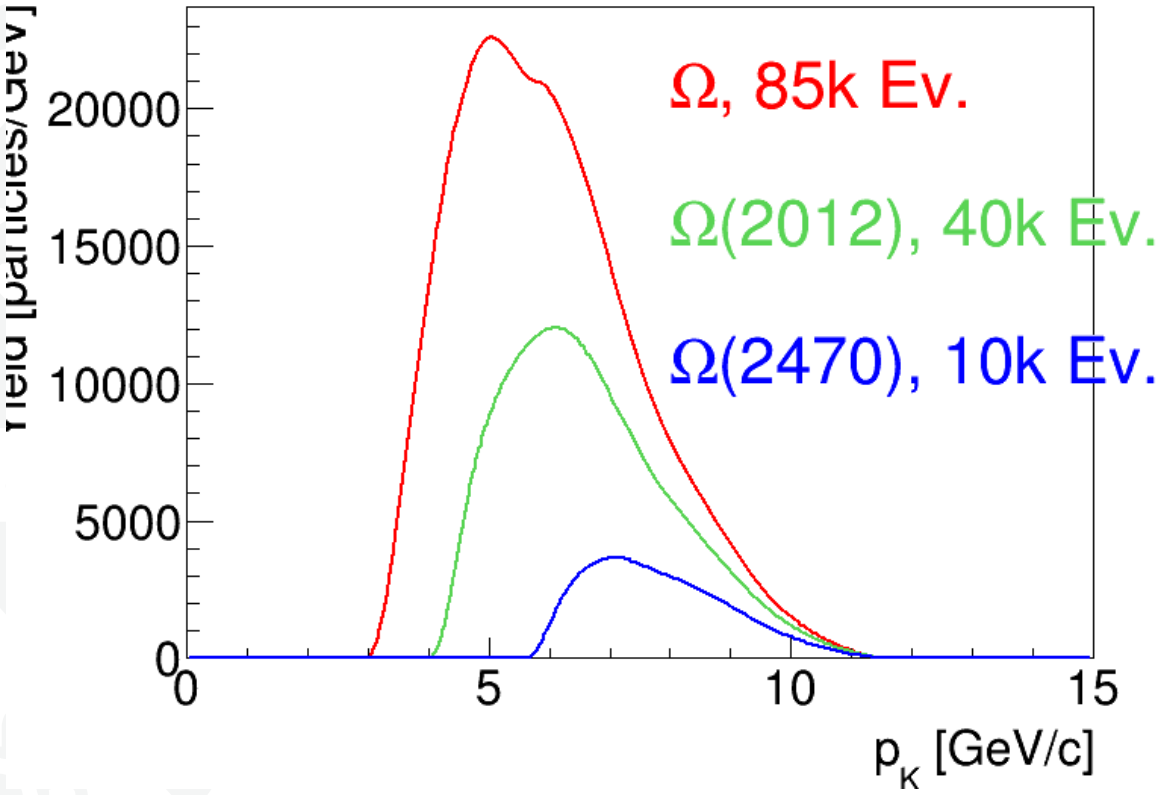

$\sigma(K^- p \to \Omega X) \sim \frac{PhaseSpace}{Q}$ (fit curve)

# Omega Yield




$\sigma(K^- p \to \Omega X) \sim \frac{PhaseSpace}{Q}$ (fit curve)

# Omega Yield




$\sigma(K^- p \to \Omega X) \sim \frac{PhaseSpace}{Q}$ (fit curve)

# Conclusion

- Omega at KLF is measurable
  - decent statistics
- Require further simulations (acceptance/efficiency)
- 22 GeV JLab might be advantageous
  - Can run with 32ns or even 16ns bunch spacing