The Importance of $\pi N \rightarrow K\Lambda$ Process for the Pole Structure of the P_{11} Partial Wave T-matrix in the Coupled-Channel Pion-Nucleon Partial Wave Analysis

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Outline

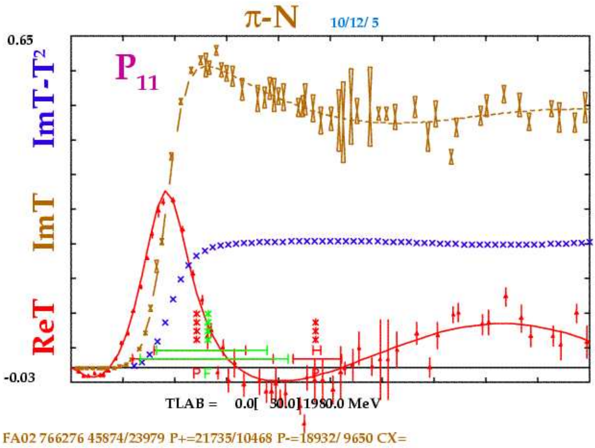
Toolbox

Cutkosky unitary, coupled channel multi resonance model

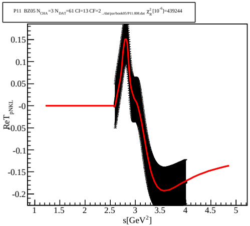
$$T = \sqrt{\mathrm{Im}\Phi}\,\gamma^T G\,\gamma\,\sqrt{\mathrm{Im}\Phi} \qquad \mathrm{Im}\phi = \frac{q^{2L+1}}{\sqrt{s}\cdot(Q_1+\sqrt{Q_2^2+q^2})^{2L}} \tag{1}$$

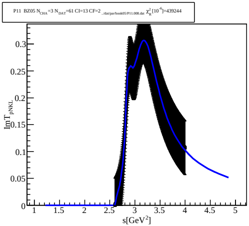
$$G = (s_{bare} - s - \gamma\,\Phi\gamma^T)^{-1} \qquad \phi(s) = \frac{s-s_o}{\pi}\int_{s_o}^{\infty}\frac{\mathrm{Im}\phi(s')}{(s'-s_o)(s'-s)} \tag{2}$$

SES from Arndt et al. FA02.



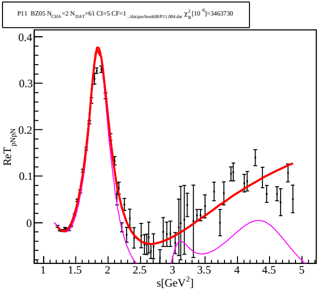
T-matrix $\pi N \longrightarrow K\Lambda$ *ZG05*

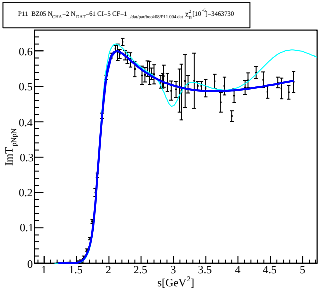




- We obtained this T-matrix in a single channel partial wave analysis from experimental data.
- We fitted data to three partial waves - S_{11},P_{11} and P_{13}.
- We had a single resonance per wave, except in P_{11}, where we allowed for two.
- Error bars were put a posteriori, in order to make statistical weight of this PWD smaller.

Two channel single resonance fit.





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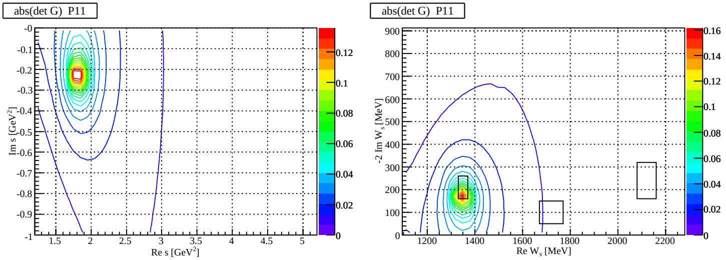
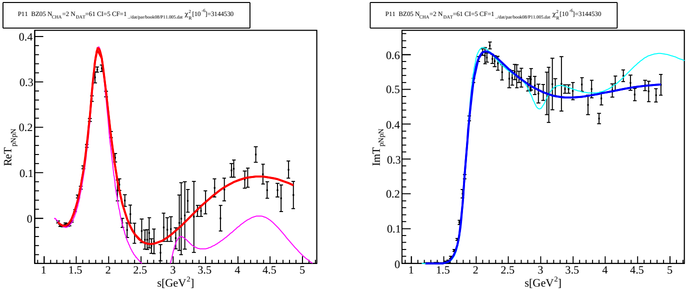


Two channel two resonance fit.



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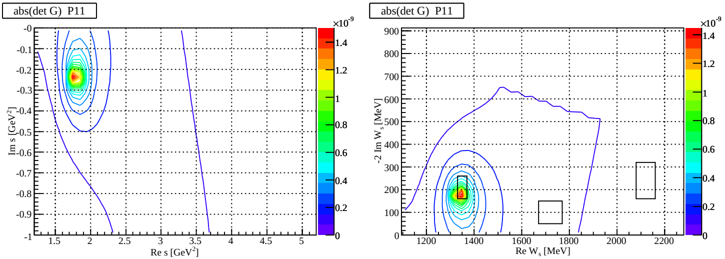
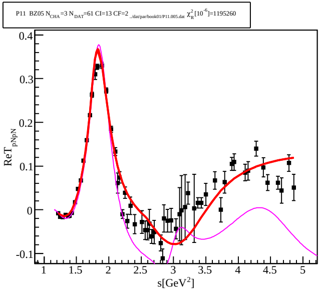
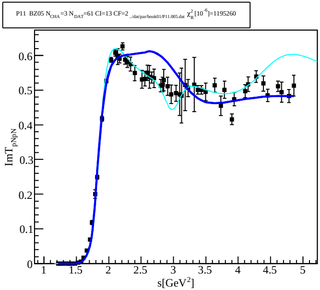


Fitting FA02 and $\pi N \to K\Lambda$ data on three channels and a single resonance.





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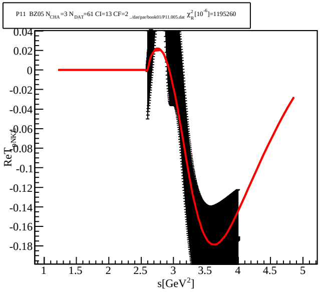

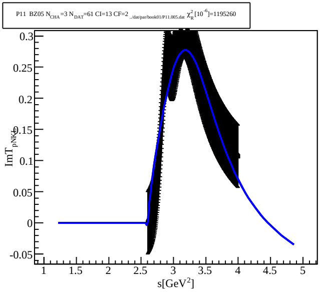

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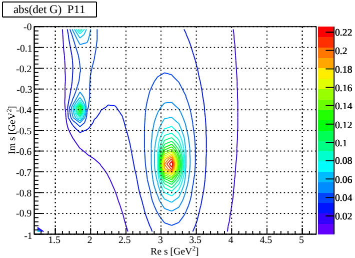
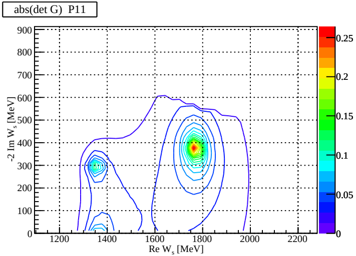
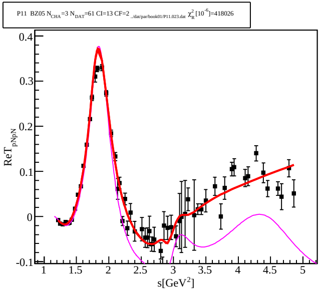
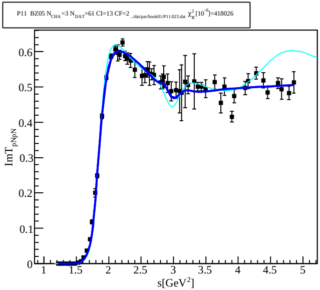




Fitting FA02 and $\pi N \longrightarrow K\Lambda$ data on three channels and four resonances.





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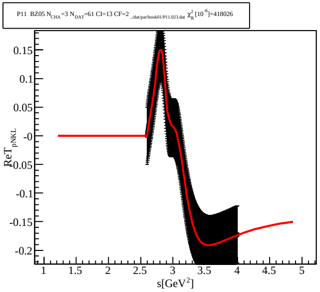

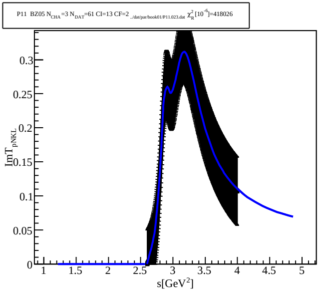

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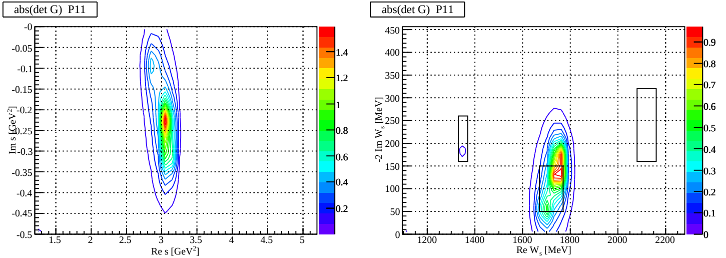

Summary

- The P_{11} partial wave T-matrix from FA02 needs only Roper resonance.
- When we incorporate the $\pi N \to K\Lambda$ data, N(1710) appears.
- That means that, although FA02 has no need for any resonances except Roper, it does not forbid them to exist, and in this case, N(1710) is direct consequence of incorporation of $\pi N \to K\Lambda$ channel.
- Outlook
  - Inclusion of $\pi N \to K\Lambda$ experimental data into a full coupled channel partial wave analysis.
  - To be able to that, we need more, and more accurate experimental data. (πN to $K\Lambda$ and $K\Sigma$ differential cross sections)

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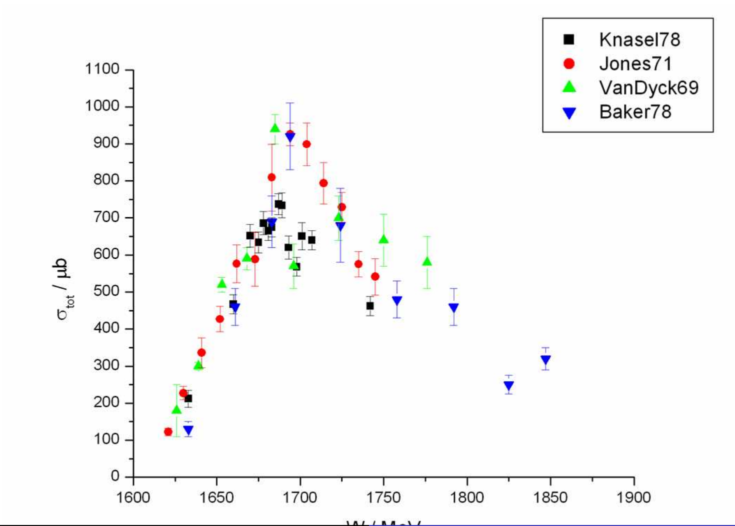
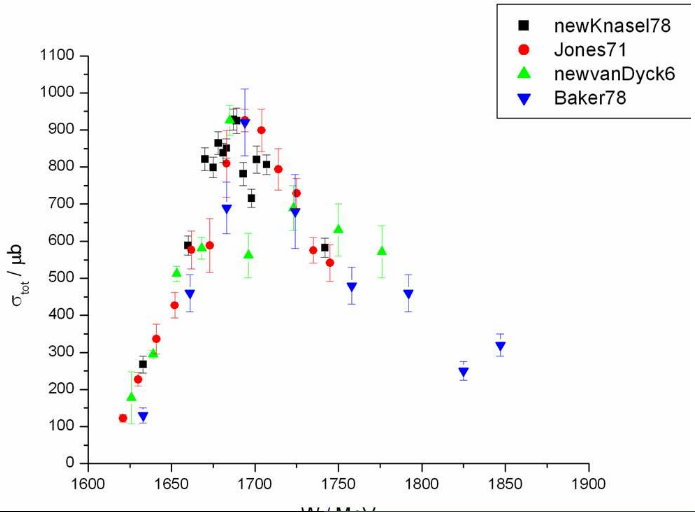
Total cross section data for $\pi N \rightarrow K\Lambda$



First step in amalgamation of $\pi N \to K\Lambda$ data



Second step in amalgamation of $\pi N \to K\Lambda$ data