

A Comparison of the E852 and Indiana Partial Wave Analysis Programs *

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Abstract

Two partial wave analysis (PWA) programs have been developed to analyze E852 data, one written by the group at Brookhaven National Laboratory (BNL), another by Maciej Swat and others at Indiana University. This note describes a comparison of results produced by these two programs. It is found that the two programs produce identical output given identical input and well behaved fits.

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1 Introduction

Partial wave analyses of the E852 data to date have been performed using a set of programs developed at Brookhaven National Lab. Another set of programs has been developed at Indiana University with a mind toward exploiting the currently available computer resources and providing an independent method of analysis for verification purposes. A comparison of the two programs is presented here.

Both programs require certain input and, for this comparison and where possible, all inputs were identical. In particular, the programs required a data file, a "key" file which specifies the partial waves to be used and Monte-Carlo files to describe the acceptance. As part of the PWA programs, isobar parameters and the method used by MINUIT to maximize the likelihood are also specified. These are all either identical files or operationally identical. The normalization integrals used by the two programs were identical.

The Indiana program does not require "amplitude" files to be prepared from the data, rather, the amplitudes are calculated during execution. The data file used by the the Indiana program was the same used to prepare the amplitudes for the BNL program. This modification is an example of re-allocation of computer resources, when the E852 programs were written, storage was less expensive than CPU, a situation now reversed. It is faster to compute the amplitudes as needed than to fetch them from disk. The IU program also exploits the MPI (message passing interface) framework to allow execution on more than one processor. Details of the PWA formalism are given in ref. [1], the IU implementation of this formalism in ref. [2], the Monte Carlo and its use in the analysis in ref. [3] and of MPI in ref. [4].

Two different key files were used and compared. Table 1 lists the partial waves used in these analyses. These inputs to both programs are referred to as the "26-wave" and "37-wave" keys. It was found that for both the 26 and 37-wave analyses, the results are consistent, if not identical, for both analyses.

Figures 1 through 7 show a comparison of the results from the 26-wave analysis, figures 8 through 17 from the 37-wave analysis.

References

- [1] IU technical memo 006
- [2] IU technical memo 003
- [3] IU technical memo 005
- [4] <http://www-unix.mcs.anl.gov/mpi/>

$J^{PC} M^{\epsilon} Lisobar$	26wv	37wv
$1^{-+}0^{-} P \rho\pi$	•	•
$1^{-+}1^{-} P \rho\pi$	•	•
$1^{++}1^{-} S \rho\pi$	•	•
$2^{-+}1^{-} S f_2\pi$	•	
$2^{++}0^{-} D \rho\pi$	•	•
$2^{++}1^{-} D \rho\pi$		•
$0^{-+}0^{+} S AMP \pi$	•	•
$0^{-+}0^{+} P \rho\pi$	•	•
$0^{-+}0^{+} D f_2(1275)\pi$		•
$1^{-+}1^{+} P \rho\pi$	•	•
$1^{++}0^{+} S \rho\pi$	•	•
$1^{++}0^{+} P f_2(1275)\pi$		•
$1^{++}0^{+} P AMP \pi$	•	•
$1^{++}0^{+} D \rho\pi$	•	•
$1^{++}1^{+} S \rho\pi$	•	•
$1^{++}1^{+} P f_2(1275)\pi$		•
$1^{++}1^{+} D \rho\pi$		•
$2^{-+}0^{+} S f_2\pi$	•	•
$2^{-+}0^{+} P \rho\pi$	•	•
$2^{-+}0^{+} P \rho_3\pi$		•
$2^{-+}0^{+} D AMP \pi$	•	•
$2^{-+}0^{+} D f_2\pi$	•	•
$2^{-+}0^{+} F \rho\pi$	•	•
$2^{-+}1^{+} S f_2\pi$	•	•
$2^{-+}1^{+} D AMP \pi$		•
$2^{-+}1^{+} D f_2\pi$	•	•
$2^{-+}1^{+} F \rho\pi$		•
$2^{++}1^{+} D \rho\pi$	•	•
$3^{++}0^{+} S \rho_3\pi$	•	•
$3^{++}0^{+} P f_2(1275)\pi$	•	•
$3^{++}0^{+} D \rho\pi$	•	•
$4^{-+}0^{+} P \rho_3\pi$		•
$4^{-+}0^{+} D f_2(1275)\pi$		•
$4^{-+}0^{+} F \rho\pi$		•
$4^{++}0^{+} D \rho_3\pi$		•
$4^{++}0^{+} F f_2(1275)\pi$	•	•
$4^{++}0^{+} G \rho\pi$	•	•
background	•	•

Table 1: The wave sets used in the comparisons.

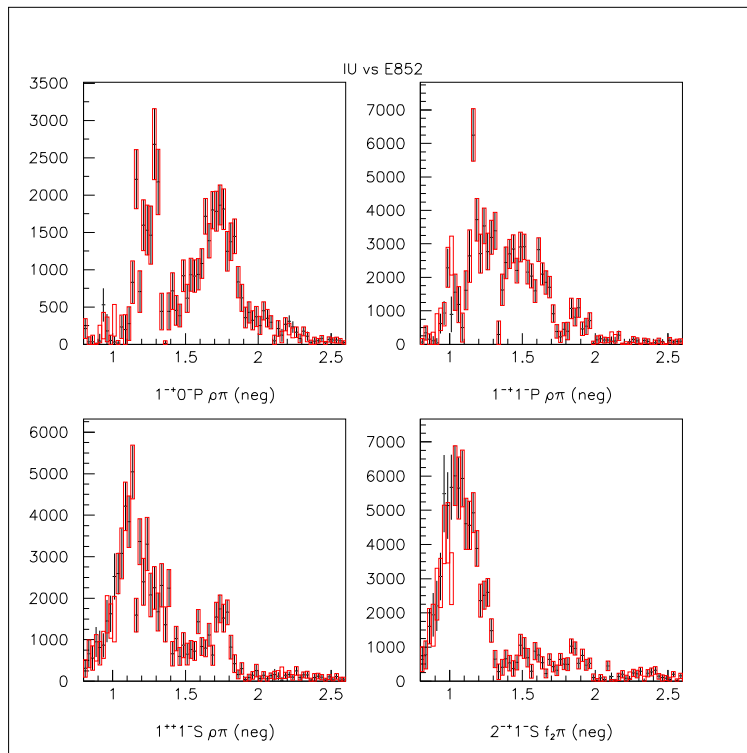


Figure 1: Intensities from the E852 26-wave PWA (points with error bars) and the IU PWA (boxes)

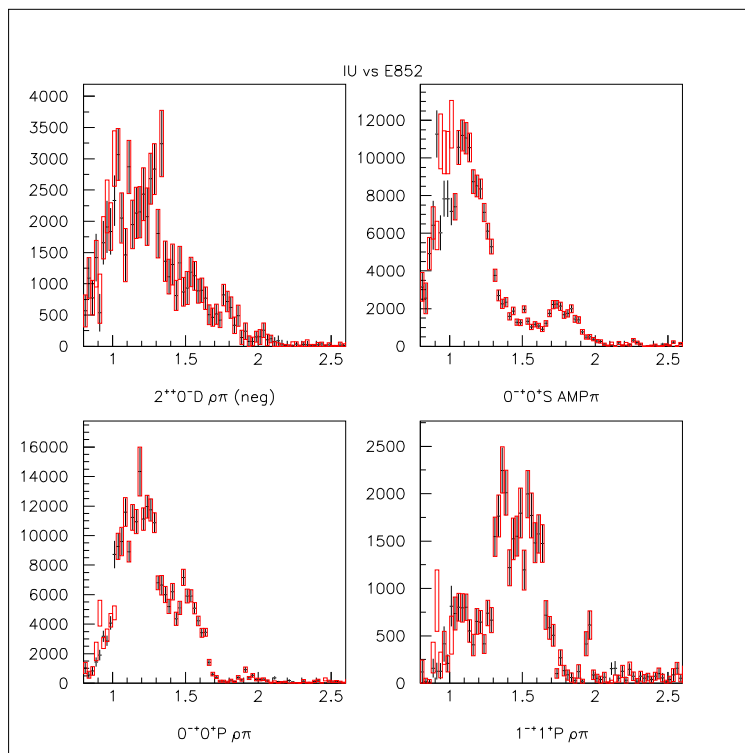


Figure 2: Intensities from the E852 26-wave PWA (points with error bars) and the IU PWA (boxes), continued

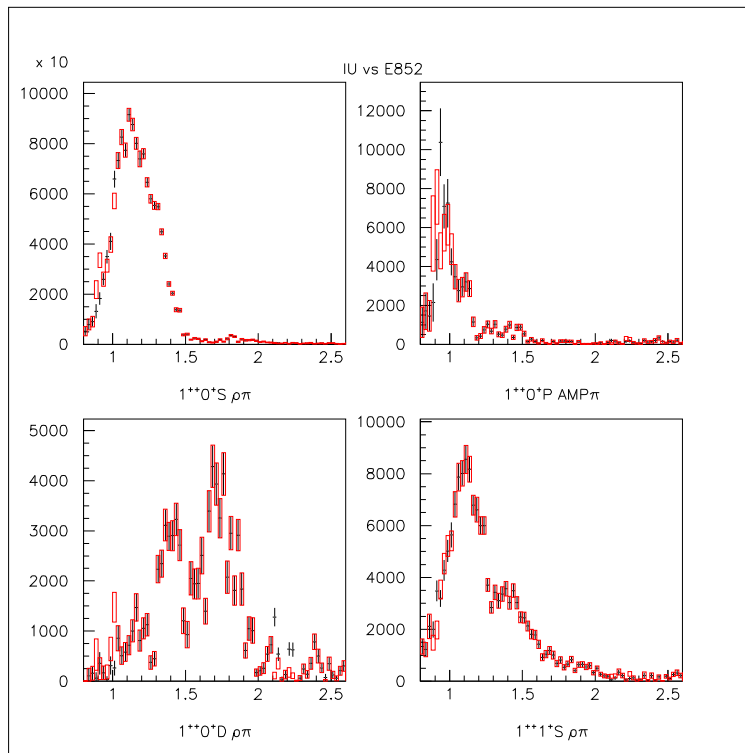


Figure 3: Intensities from the E852 26-wave PWA (points with error bars) and the IU PWA (boxes), continued

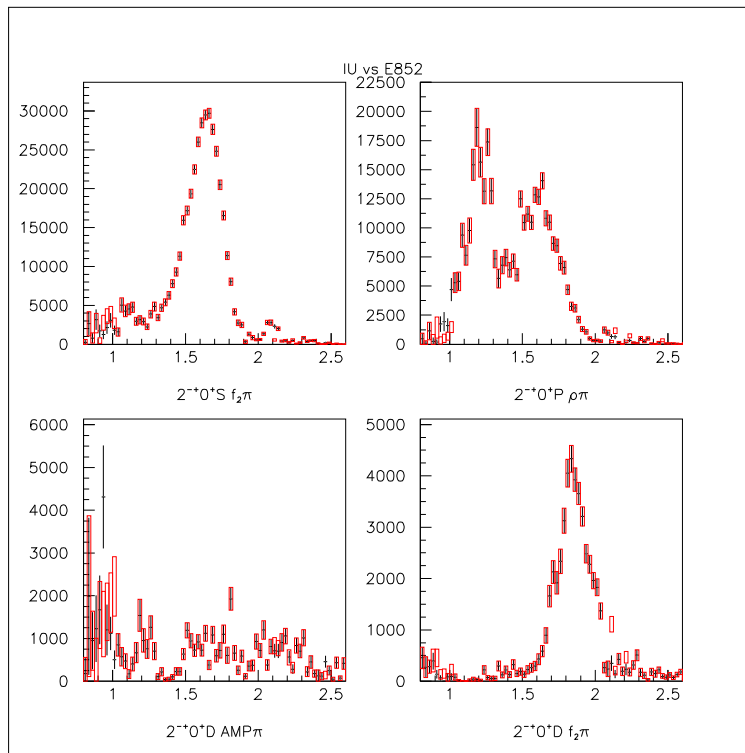


Figure 4: Intensities from the E852 26-wave PWA (points with error bars) and the IU PWA (boxes), continued

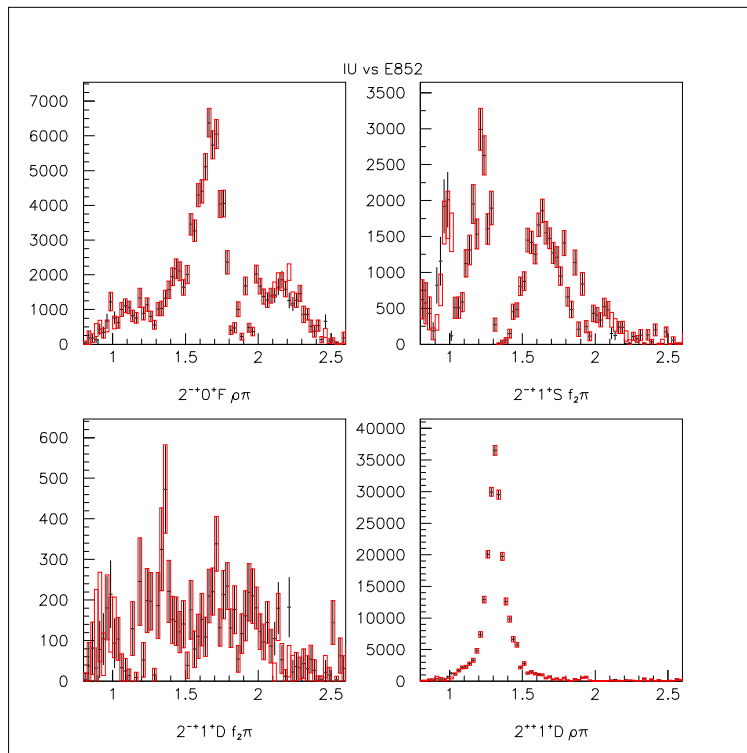


Figure 5: Intensities from the E852 26-wave PWA (points with error bars) and the IU PWA (boxes), continued

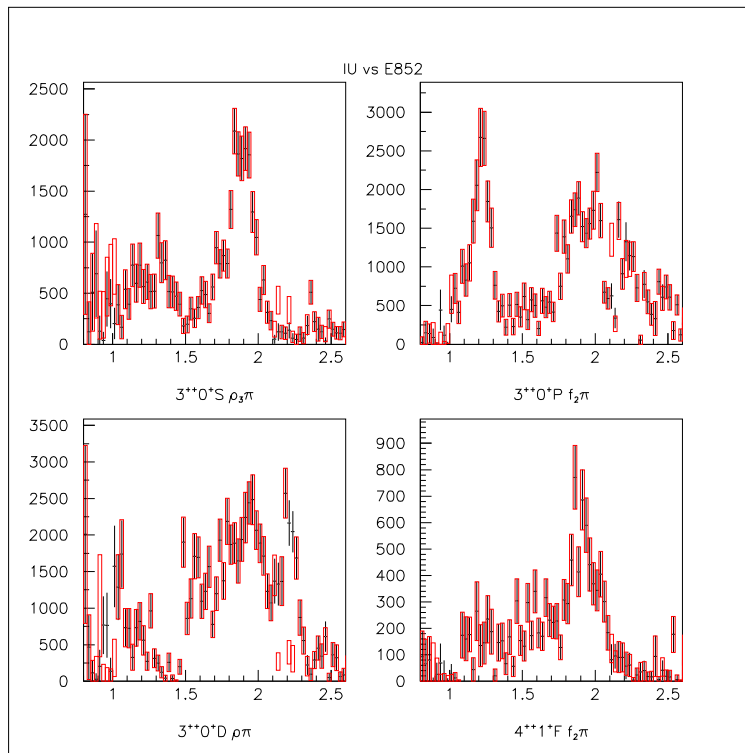


Figure 6: Intensities from the E852 26-wave PWA (points with error bars) and the IU PWA (boxes), continued

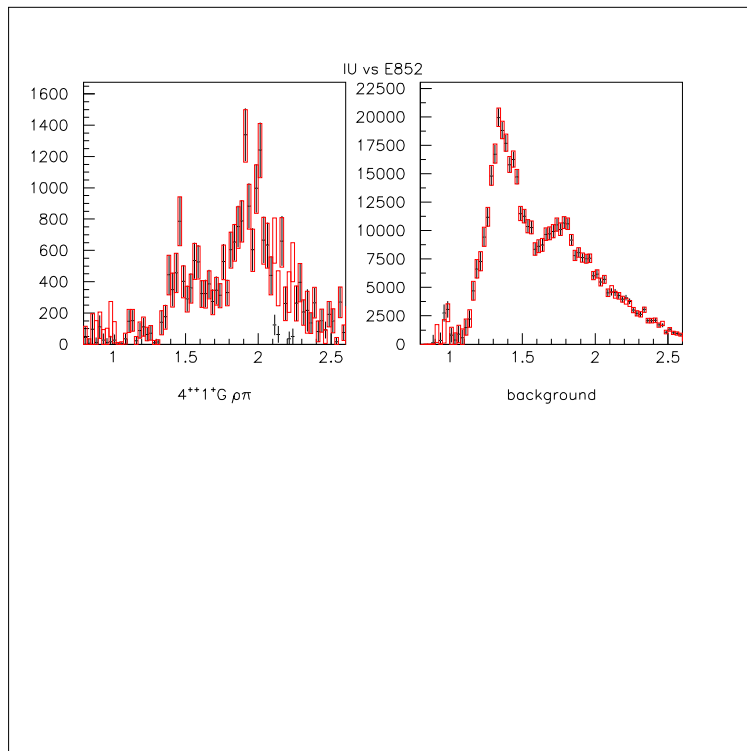


Figure 7: Intensities from the E852 26-wave PWA (points with error bars) and the IU PWA (boxes), continued

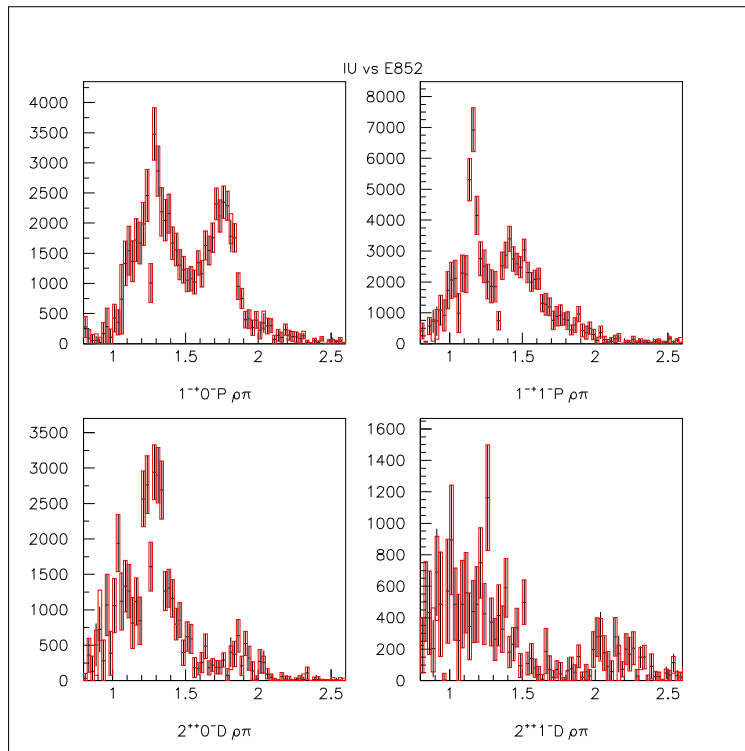


Figure 8: Intensities from the E852 37-wave PWA (points with error bars) and the IU PWA (boxes)

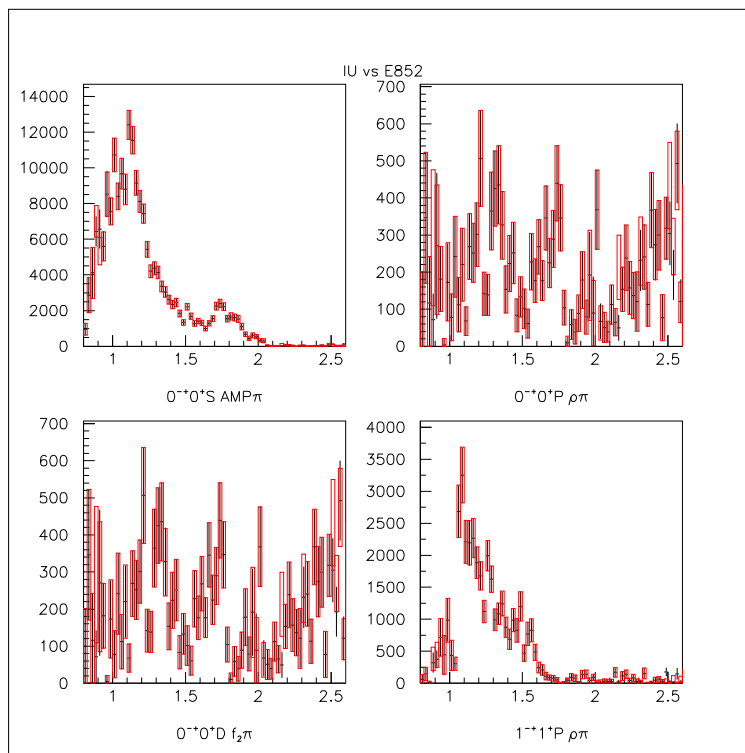


Figure 9: Intensities from the E852 37-wave PWA (points with error bars) and the IU PWA (boxes), continued.

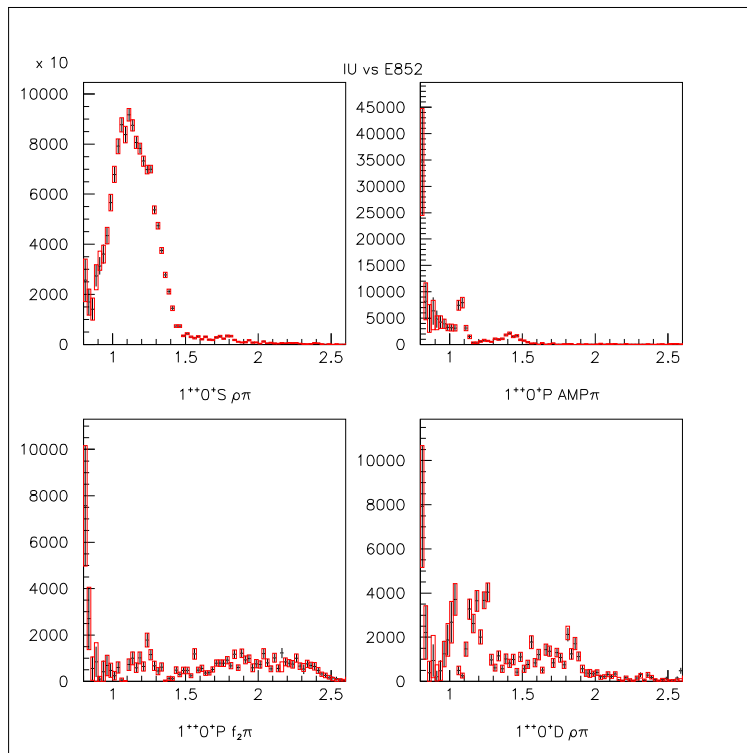


Figure 10: Intensities from the E852 37-wave PWA (points with error bars) and the IU PWA (boxes), continued.

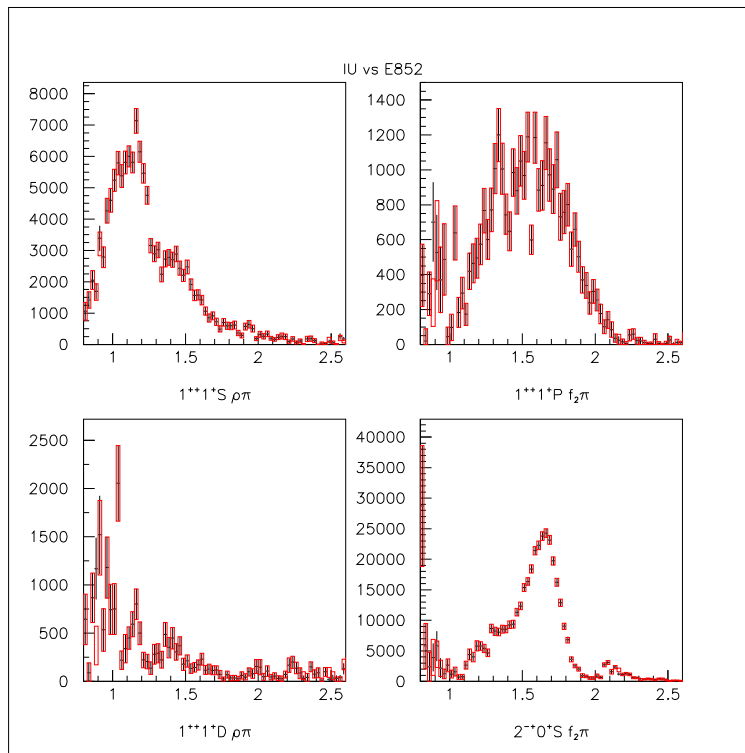


Figure 11: Intensities from the E852 37-wave PWA (points with error bars) and the IU PWA (boxes), continued.

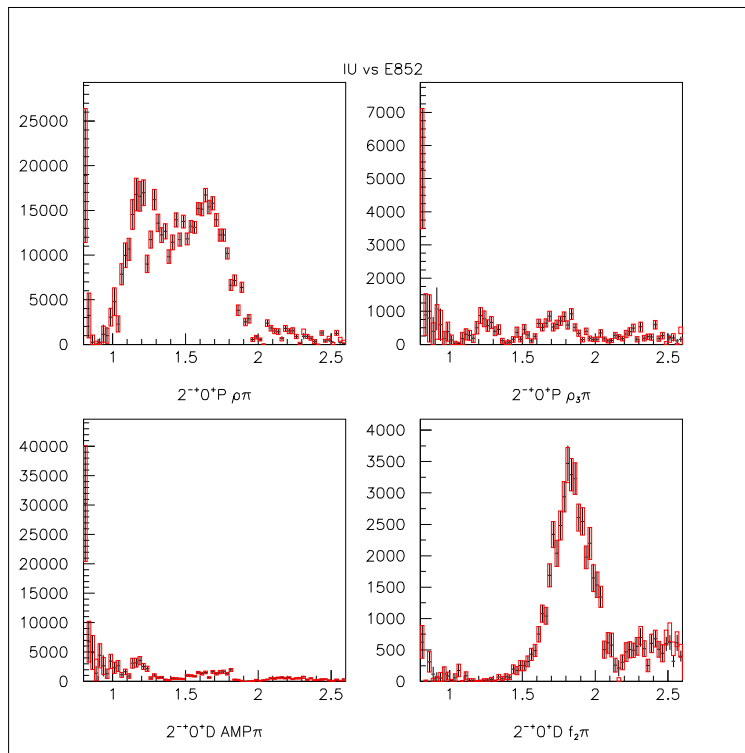


Figure 12: Intensities from the E852 37-wave PWA (points with error bars) and the IU PWA (boxes), continued.

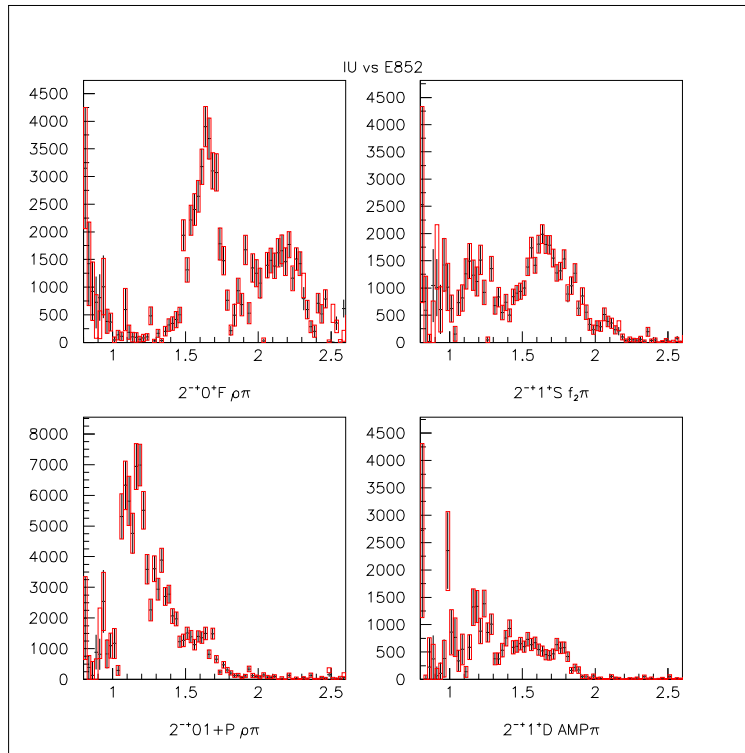


Figure 13: Intensities from the E852 37-wave PWA (points with error bars) and the IU PWA (boxes), continued.

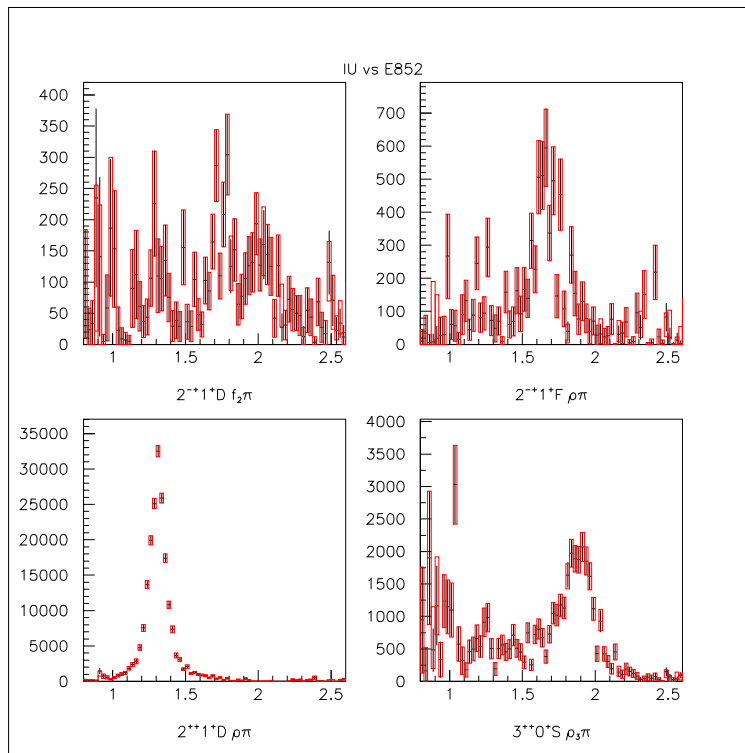


Figure 14: Intensities from the E852 37-wave PWA (points with error bars) and the IU PWA (boxes), continued.

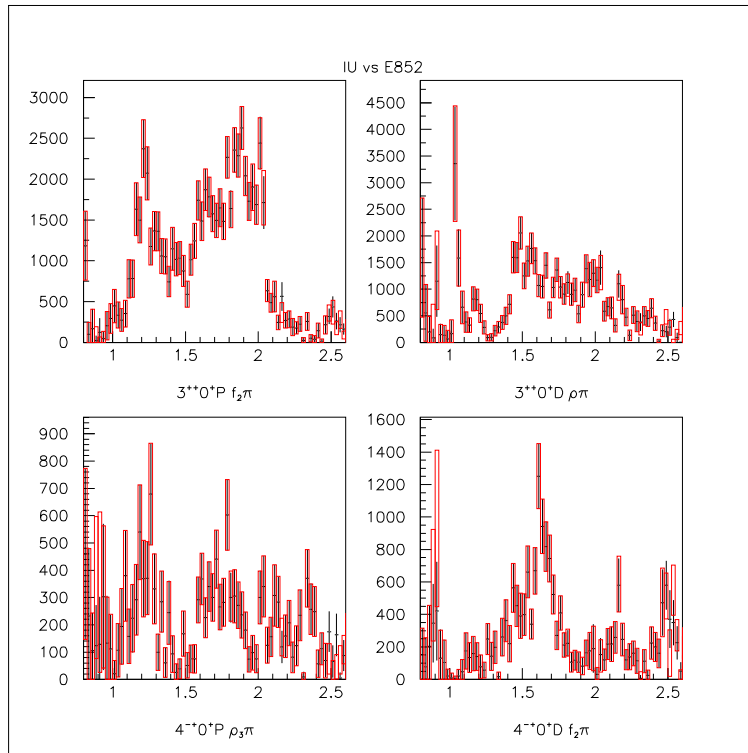


Figure 15: Intensities from the E852 37-wave PWA (points with error bars) and the IU PWA (boxes), continued.

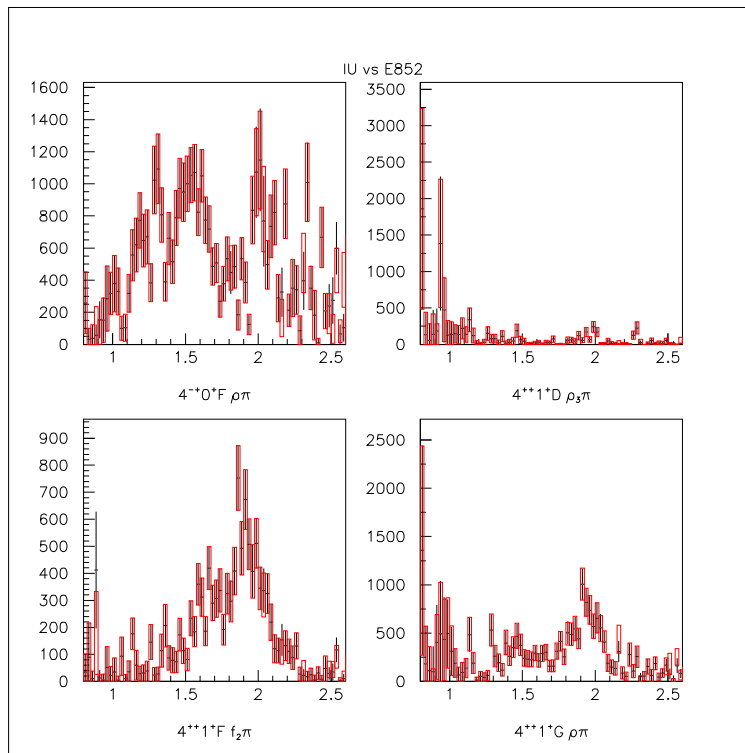


Figure 16: Intensities from the E852 37-wave PWA (points with error bars) and the IU PWA (boxes), continued.

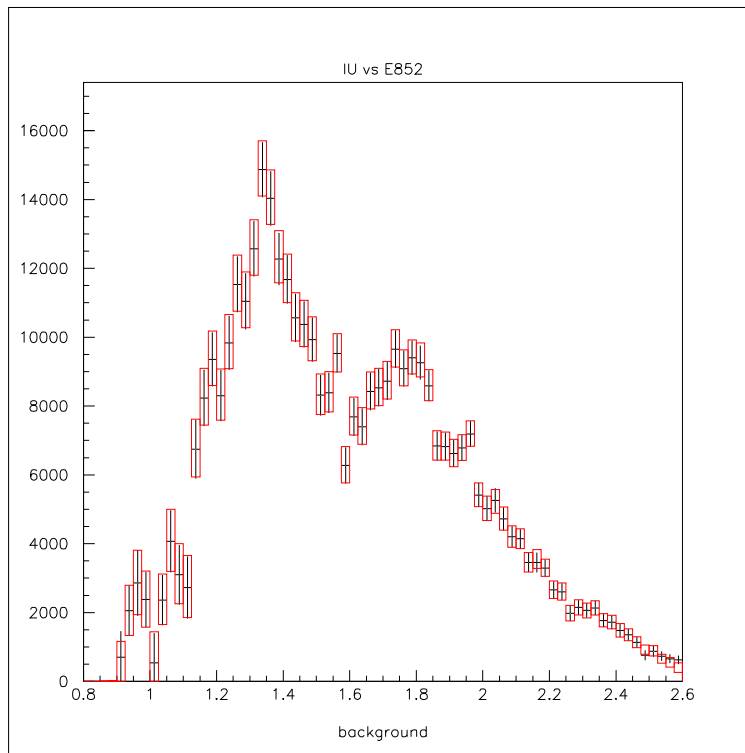


Figure 17: The background intensity from the E852 37-wave PWA (points with error bars) and the IU PWA (boxes).