Study of D_{sJ} mesons decays to $D^{*+}K^0_S$ and $D^{*0}K^+$ final states in pp collisions.

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- Analysis signed off from RC and WG.
- Approval scheduled for October 20.
- Paper Draft at V3.

Dalitz plot analysis of $B^- \to D^{*+}\pi^-\pi^-$.

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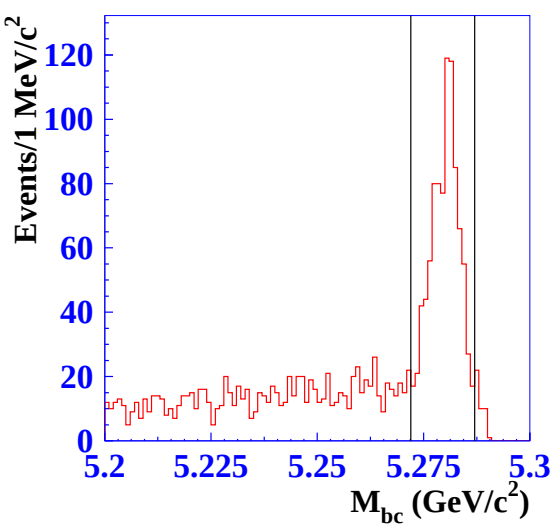
Physics motivations.

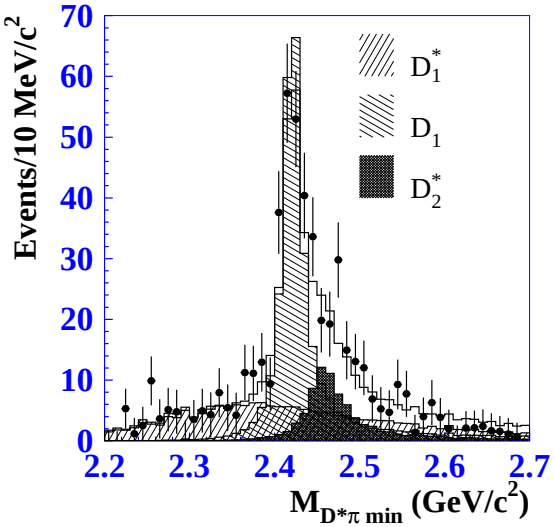
□ Several new D_J mesons have been discovered in inclusive e^+e^- and pp interactions by BaBar and LHCb.

□ B decays could help in defing better their properties.

□ The wide $D_1(2430)$ meson has been studied only by Belle experiment (K. Abe et al., PR D69 112002) in a Dalitz analysis of $B^- \to D^{*+}\pi^-\pi^-$.

$$m(D_1) = 2427 \pm 26 \pm 25, \qquad \Gamma(D_1) = 384^{+107}_{-75} \pm 74\ MeV$$

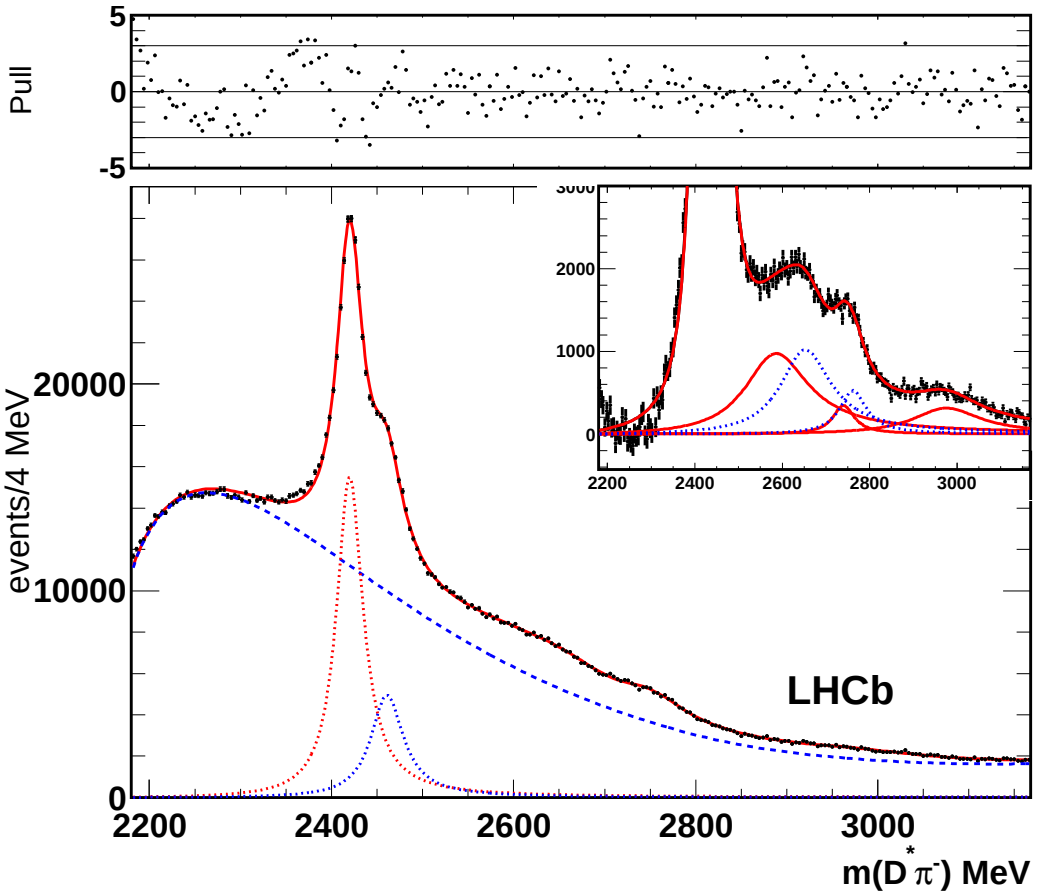




□ Used 273 ± 21 events from $D^0 \to K^-\pi^+$ and 287 ± 22 events from $D^0 \to K^-\pi^+\pi^+\pi^-$.

Physics motivations.

□ Four new D_J mesons have been found by BaBar and LHCb decaying also to $D^*\pi$.



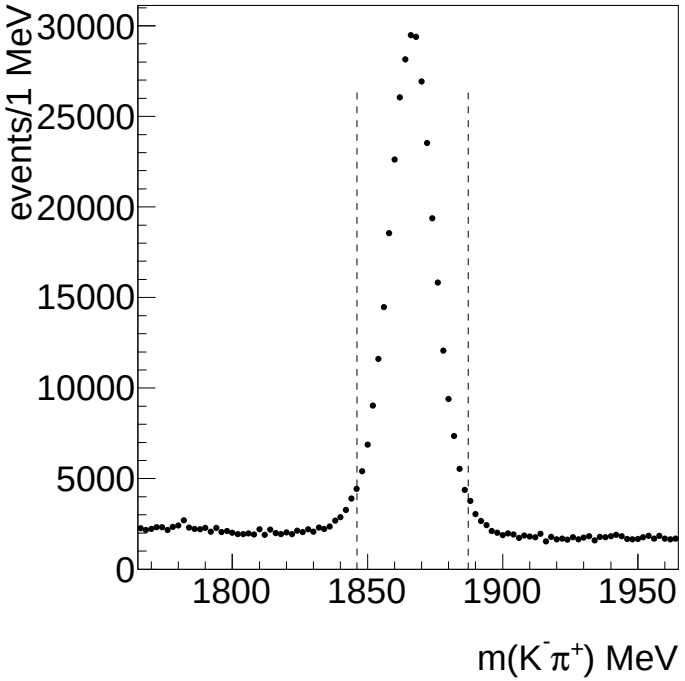
□ In addition to $D_1(2420)$ and $D_2^*(2460)$ we observe $D_J(2580)$, $D_J^*(2650)$, $D_J(2740)$ and $D_J^*(2760)$.

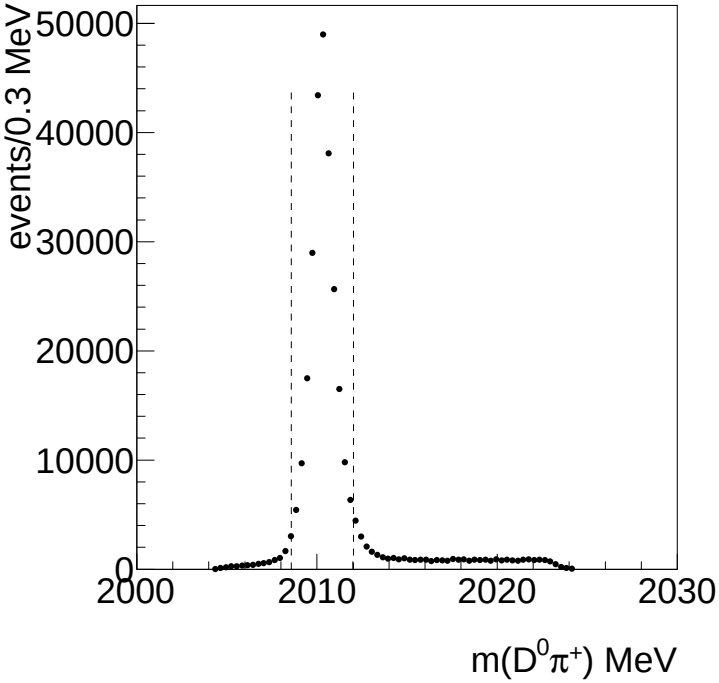
Dataset.

- The analysis is based on data recorded in 2011 and 2012, corresponding to a total integrated luminosity of 3 fb^{-1}.
- The software reconstruction version is `Reco14`.
- The data is pre-selected by the stripping line `B2D0PiPiPiD2HHPIDBeauty2CharmLine` in the `Stipping21` framework.
- Select the final state $D^{*+}\pi^-\pi^-$ with $D^{*+} \to D^0\pi^+$ and $D^0 \to K^-\pi^+$.
- Use of DecayTreeFitter and Momentum Scale Calibration.
- Decay tree constrained to originate from a primary vertex.
- Performed an additional events reconstruction with mass constrained D^0 and D^{*+}.
- For the Dalitz analysis we may want to use L0Hadron TOS only for better understanding the efficiency.

The D^0 and D^{*+} signals.

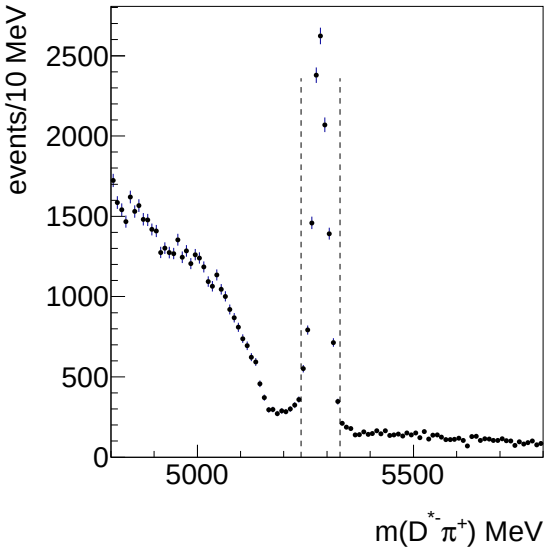
- Preliminary selections.
- The DecayTreeFitter vertex is required to be $\chi^2_{\rm Vtx}/{\rm n_{dof}} < 6$.
- Very poor soft pion candidates are removed by requiring the ghost and electron identification probability from neural network ProbNNgh(e) < 0.5.

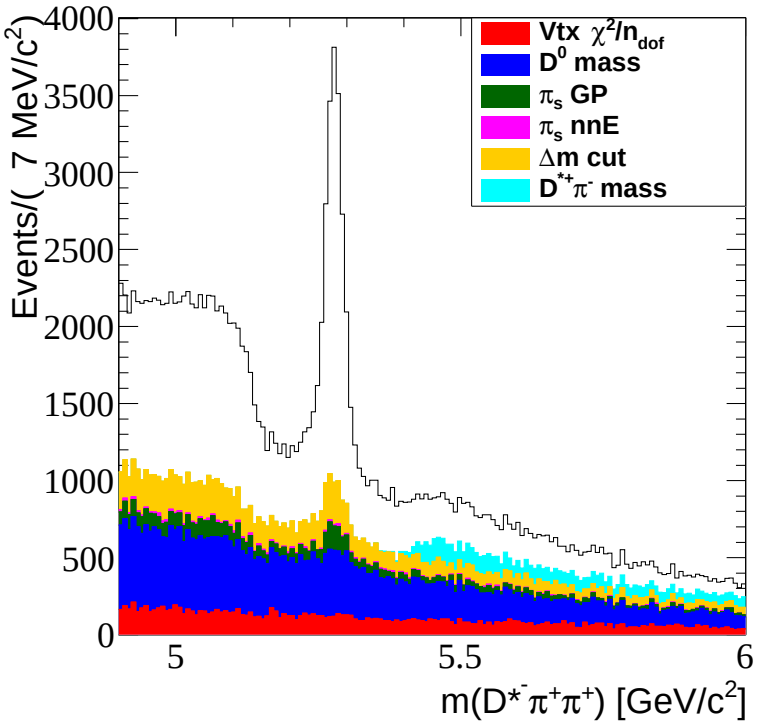




The B^- signal.

- Remove peaking background from $B^0 \to D^{*+}\pi^-$.
- $\mathcal{B}(B^- \to D^{*+}\pi^-\pi^-) = 1.35 \pm 0.22\ 10^{-3}$.
- $\mathcal{B}(B^- \to D^{*+}\pi^-\pi^-\pi^0) = 1.5 \pm 0.7\%$.
- The B^- signal and effects of the different selections.





Multivariate Analysis.

□ Multivariate selection (Boosted Decision Trees).

□ Signal Monte Carlo for describing the B decays and combinatorial background from the upper sideband ($5.5 < m(D^{*+}\pi^-\pi^-) < 6.0 GeV/c^2$).

□ Number of signal and background events in the signal region, defined as 2.5σ around the mass peak.

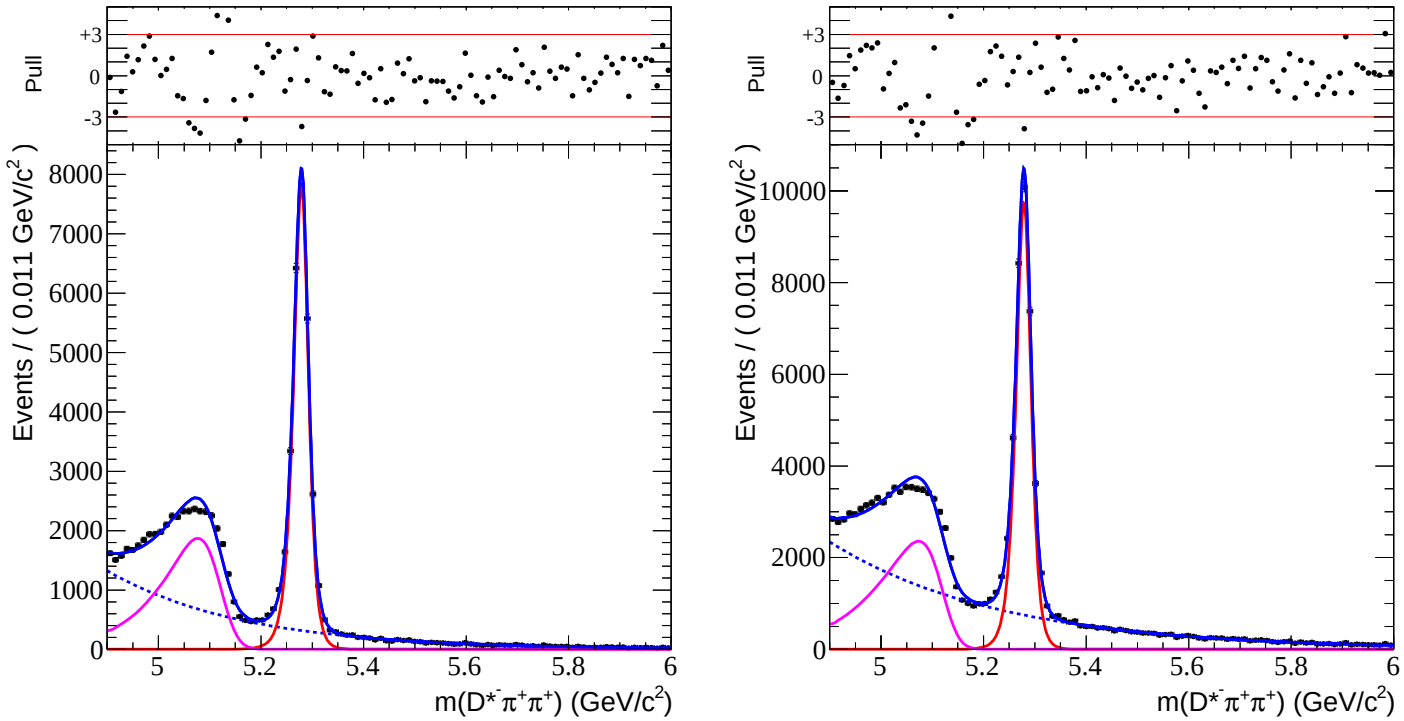
$$N_{\text{sig}} = 37281 \pm 227$$
$$N_{\text{bkg}} = 16196 \pm 56$$

□ Good discriminating variables are found to be:

- DTF: Vertex $\chi^2/\text{n}_{\text{dof}}$;
- PV: Vertex χ^2;
- B: $\log \text{IP}_{\chi^2}$;
- D^{*+}: $\log \text{IP}_{\chi^2}$, transverse momentum (p_T), Vertex $\chi^2/\text{n}_{\text{dof}}$;
- D^0: decay length significance, absolute momentum (p), Vertex $\chi^2/\text{n}_{\text{dof}}$.

Optimization.

□ Two methods: Purity and Significance:



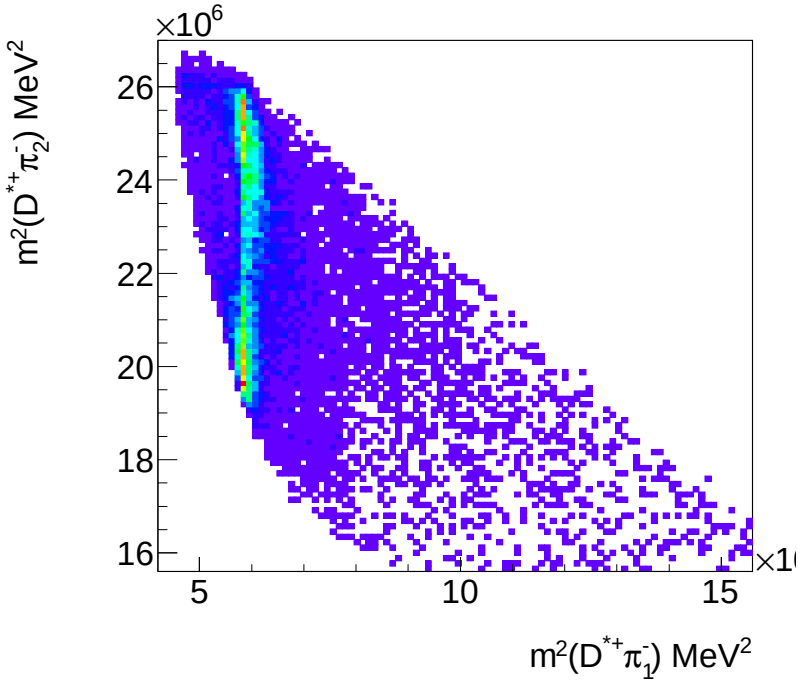
$$N_S(\text{purity} = 95\%) = 27803 \pm 193$$

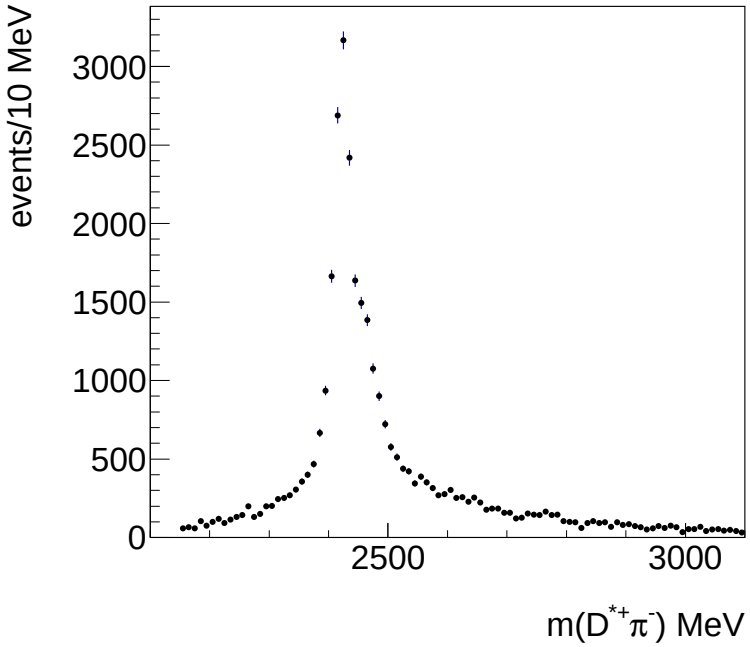
$$N_S(\text{max significance}) = 34779 \pm 236.$$

□ Signal efficiency of about 75% (93%) when targeting a purity of 95% (for maximum significance).

B^- Dalitz plot.

- No background subtraction.
- Combinatorial $D^{*+}\pi_1^-$ vs $D^{*+}\pi_2^-$.

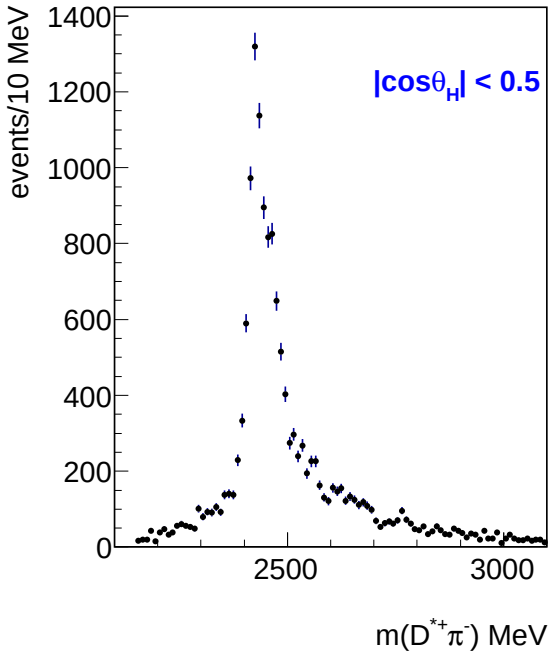


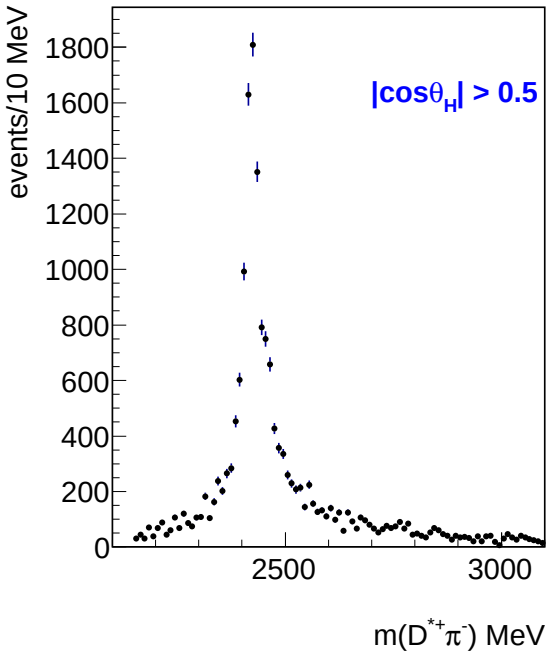


- Combinatorial $m(D^{*+}\pi^-)$ in the resonances region.
- Signals of $D_1(2420)$ and $D_2^*(2460)$.

$D^{*+}\pi^-$ helicity angle.

- Compute the $D^{*+}\pi^-$ helicity angle.
- Plot the $m(D^{*+}\pi^-)$ for $|cos\theta_H| < 0.5$ (enhanced Natural Parity) and $|cos\theta_H| > 0.5$ (enhanced Unnatural Parity).





- Enhanced $D_2^*(2460)$ for $|cos\theta_H| < 0.5$.

In progress.

- Produce at least 200K MC phase-space events for $B^- \to D^{*+}\pi^-\pi^-$.
- These events will be used for normalizing the amplitudes in the Dalitz analysis.
- Perform an isobar-model Dalitz analysis using Zemach tensors and covariant amplitudes.
- Perform a model-independent partial wave analysis for the extraction of the $J^P = 1^+$ amplitude and phase.