

*EtaMAID2019-DR for η photoproduction on nucleons.
Dispersion relations at fixed t .*

V. L. Kashevarov (Mainz University) for Mainz – Tuzla – Zagreb Collaboration



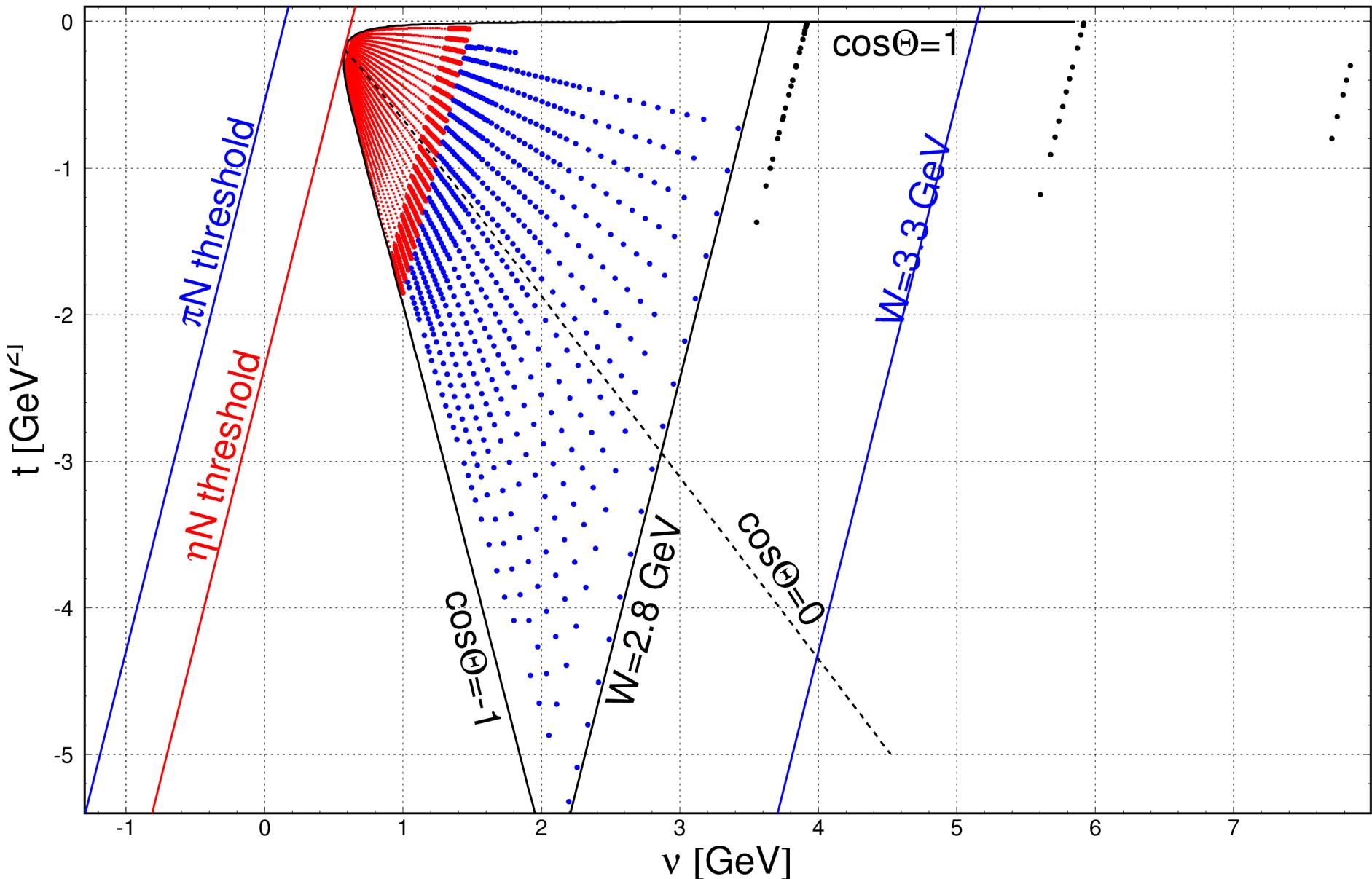
Details of the fit

1. Model: EtaMAID2018 for resonance contribution in s channel,
JPACphi version from our Regge paper for background
contribution in t channel,
no Born terms;
2. Initial solution is Fit7_DR (best solution from Kirill's dissertation);
3. All data sets available for $\gamma p \rightarrow \eta p$ and $\gamma n \rightarrow \eta n$ reactions
are included in the fit;
4. Number of resonances is increased from 14 to 21, as for EtaMAID2018;
5. Damping factor for phases below ηN threshold is added:

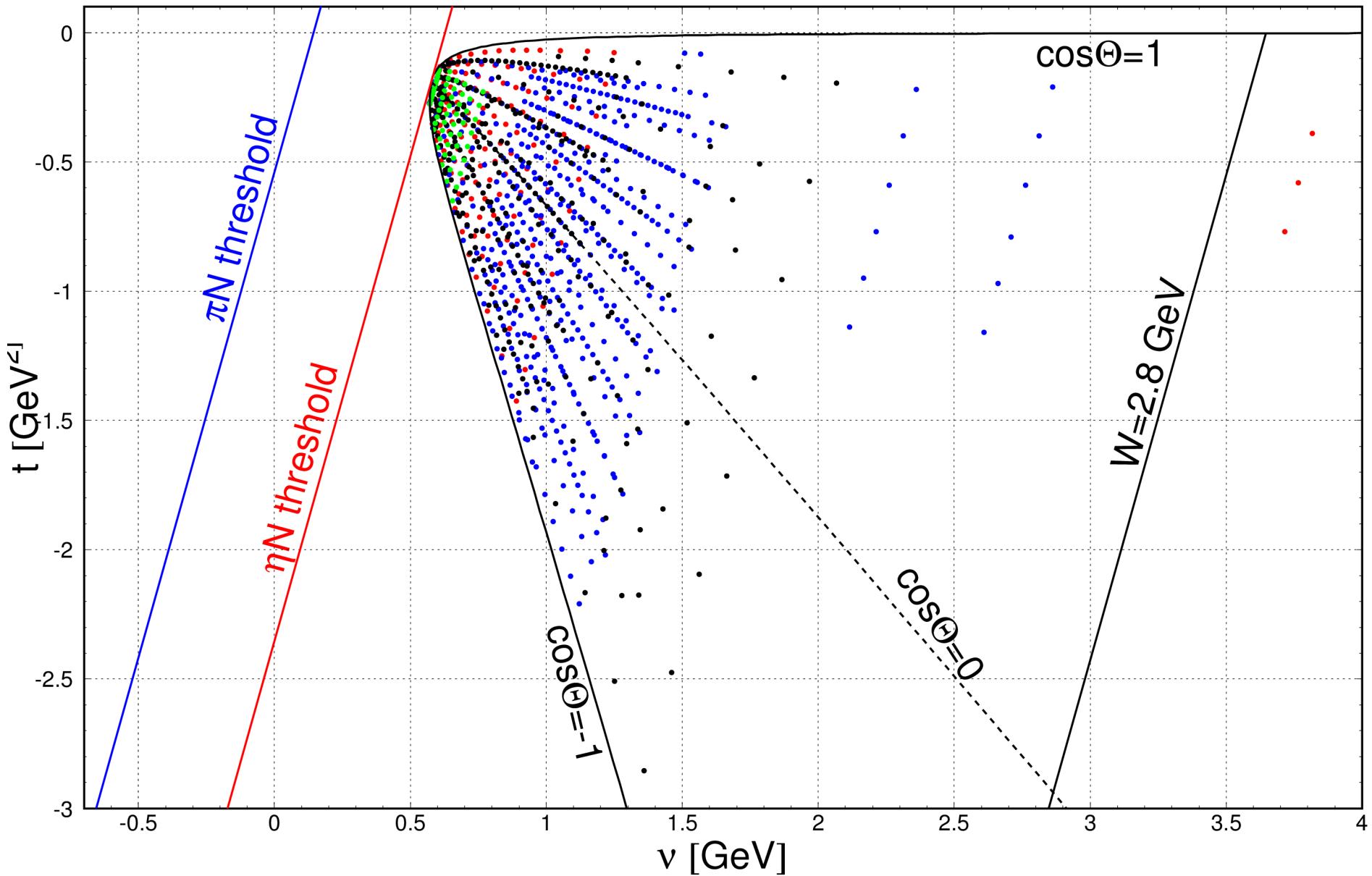
$$DF = (q/q_0)^4,$$

- where q is pion momentum and q_0 is pion momentum at ηN threshold;
6. Fixed parameters (branching ratios for πN , $K\Lambda$, $K\Sigma$, ωN , and $\eta' N$
resonance decays) were updated according to PDG-2018;
 7. Real parts of invariant amplitudes are calculated from imaginary parts
by integration separately for resonance and background contributions:
resonances – from πN threshold up to $v = (\pi N_{thr} + 5 \text{ GeV})$,
background – from ηN threshold up to $v = 200 \text{ GeV}$ and for $t > -2$.

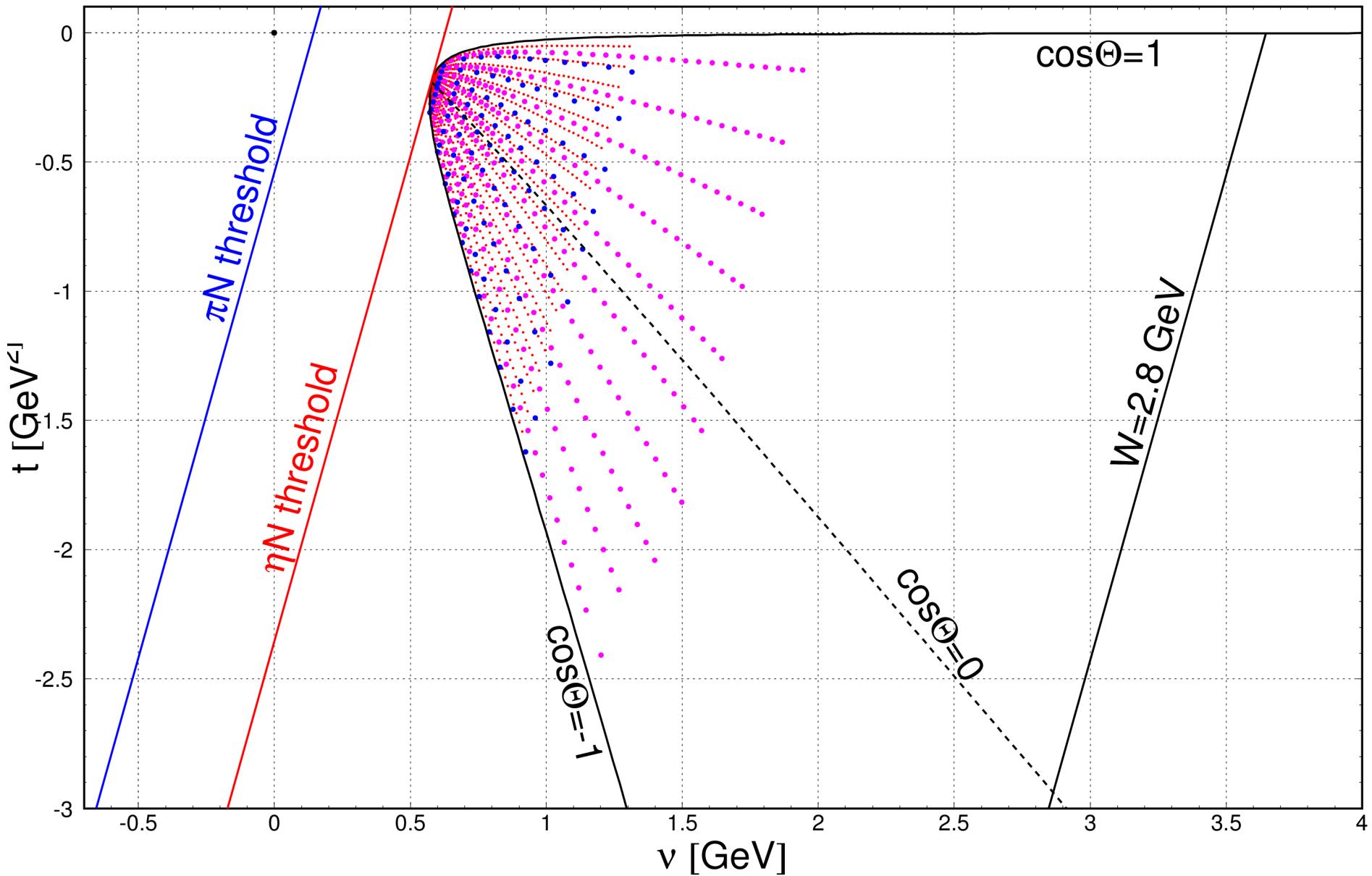
Data set for $\gamma p \rightarrow \eta p$: $d\sigma/d\Omega$, red – MAMI-17, blue - CLAS-09



Data set for $\gamma p \rightarrow \eta p$: $d\sigma/d\Omega$, T, F, Σ , E

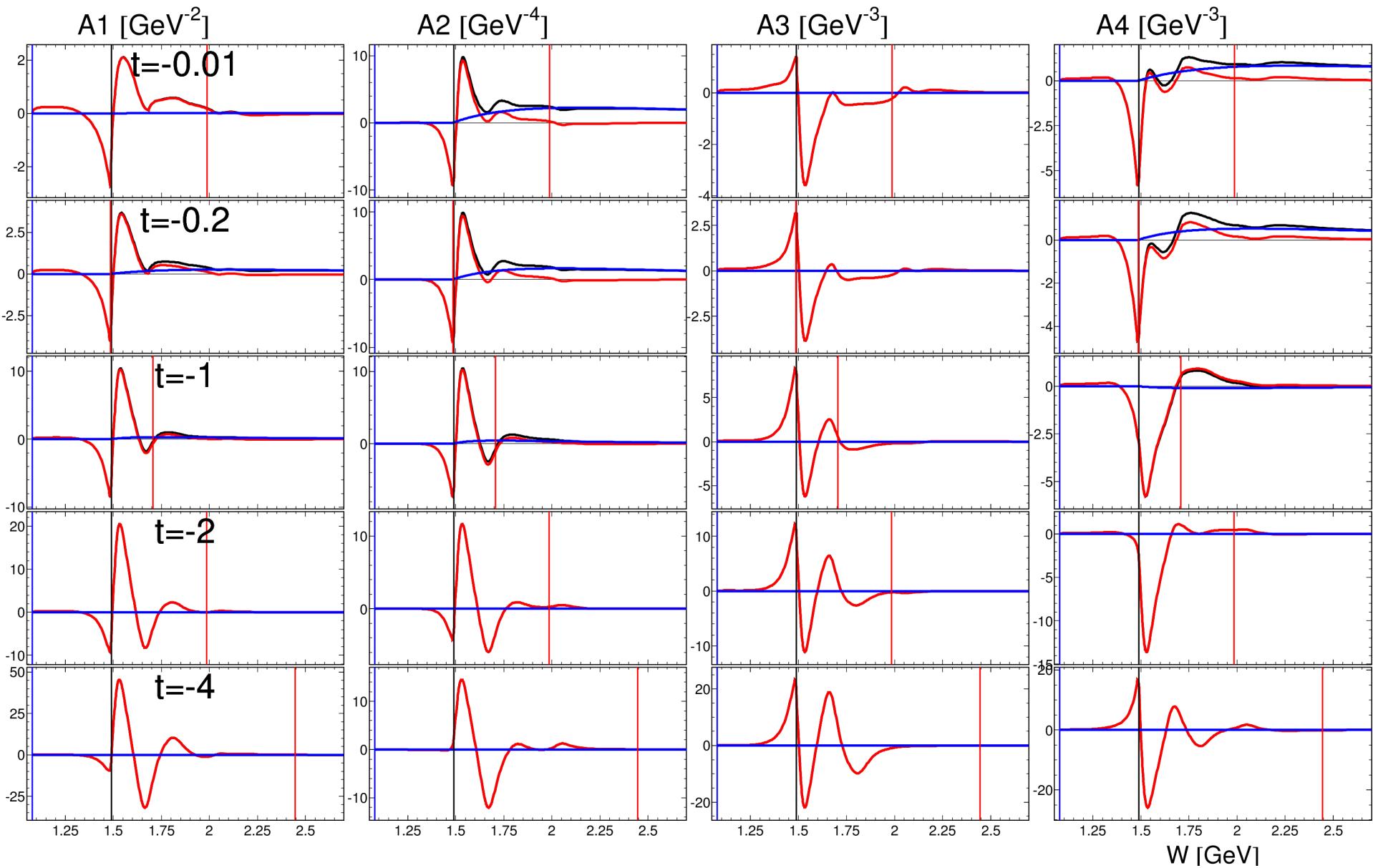


Data set for $\gamma n \rightarrow \eta n$: $d\sigma/d\Omega$, Σ , E



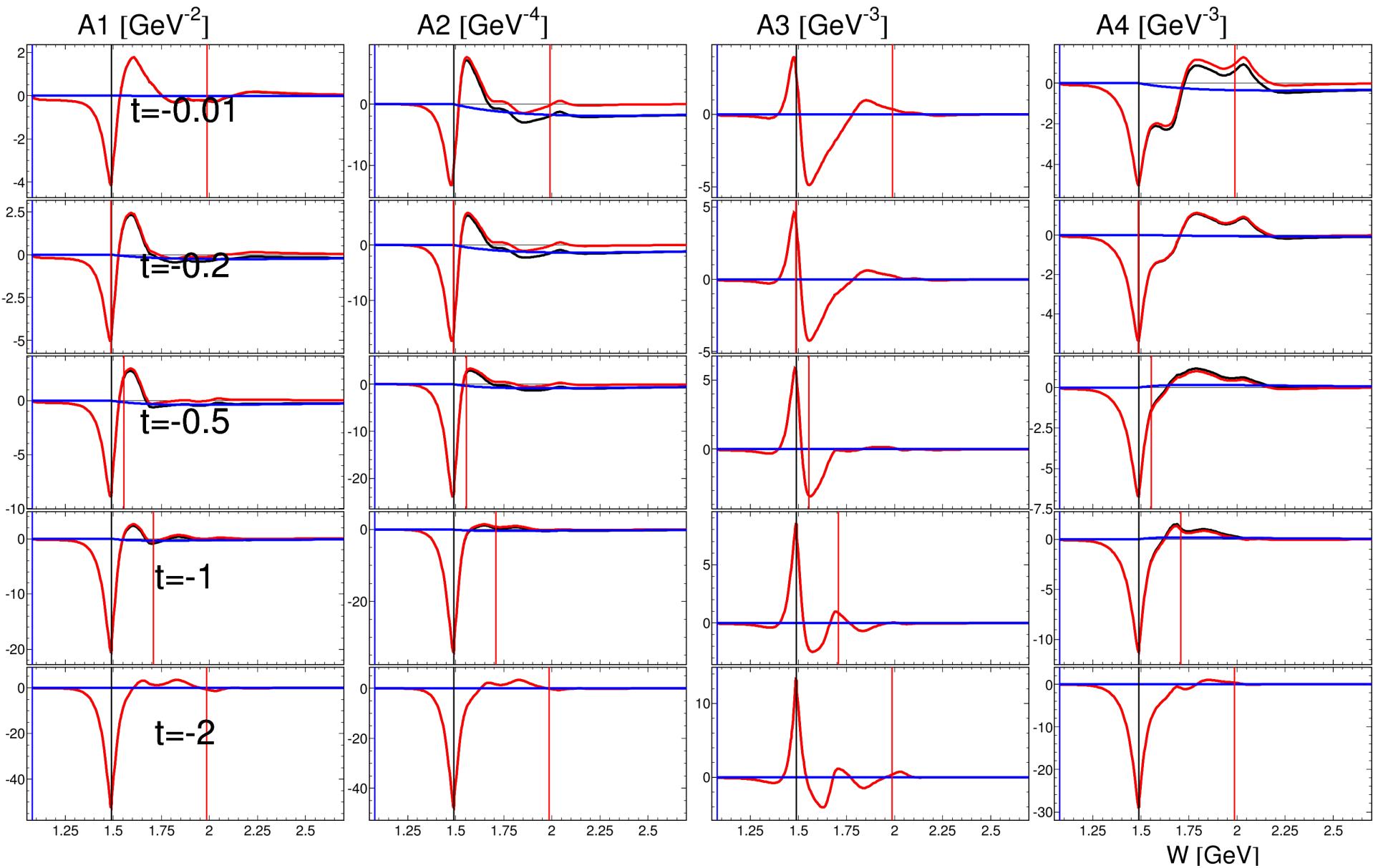
γ p → η p

Invariant amplitudes, imaginary part
 Black: full, red: resonances, blue: background



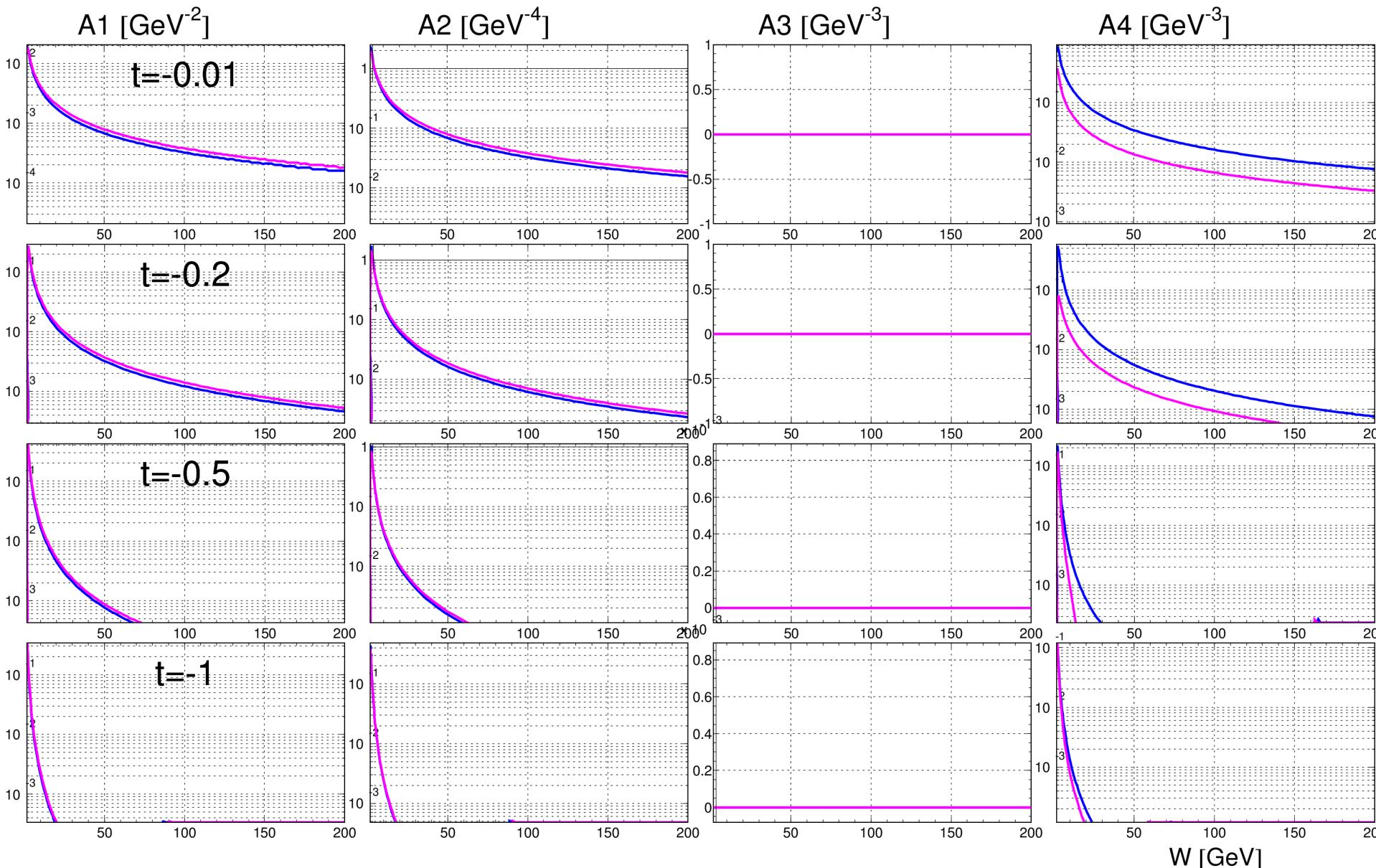


Invariant amplitudes, imaginary part
 Black: full, red: resonances, blue: background



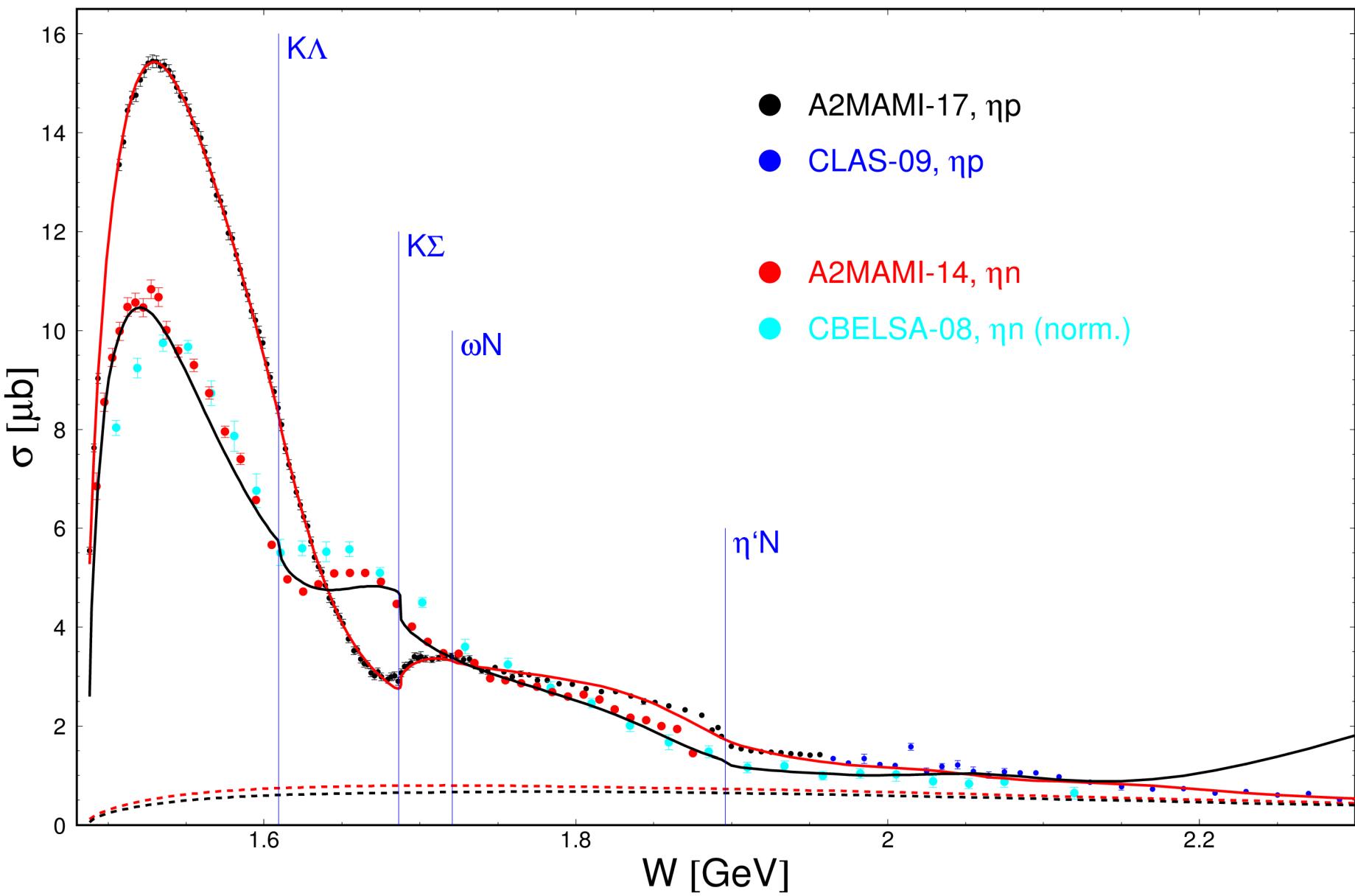


Invariant amplitudes, imaginary part
 Blue lines: $\gamma p \rightarrow \eta p$, magenta lines: $\gamma n \rightarrow \eta n$



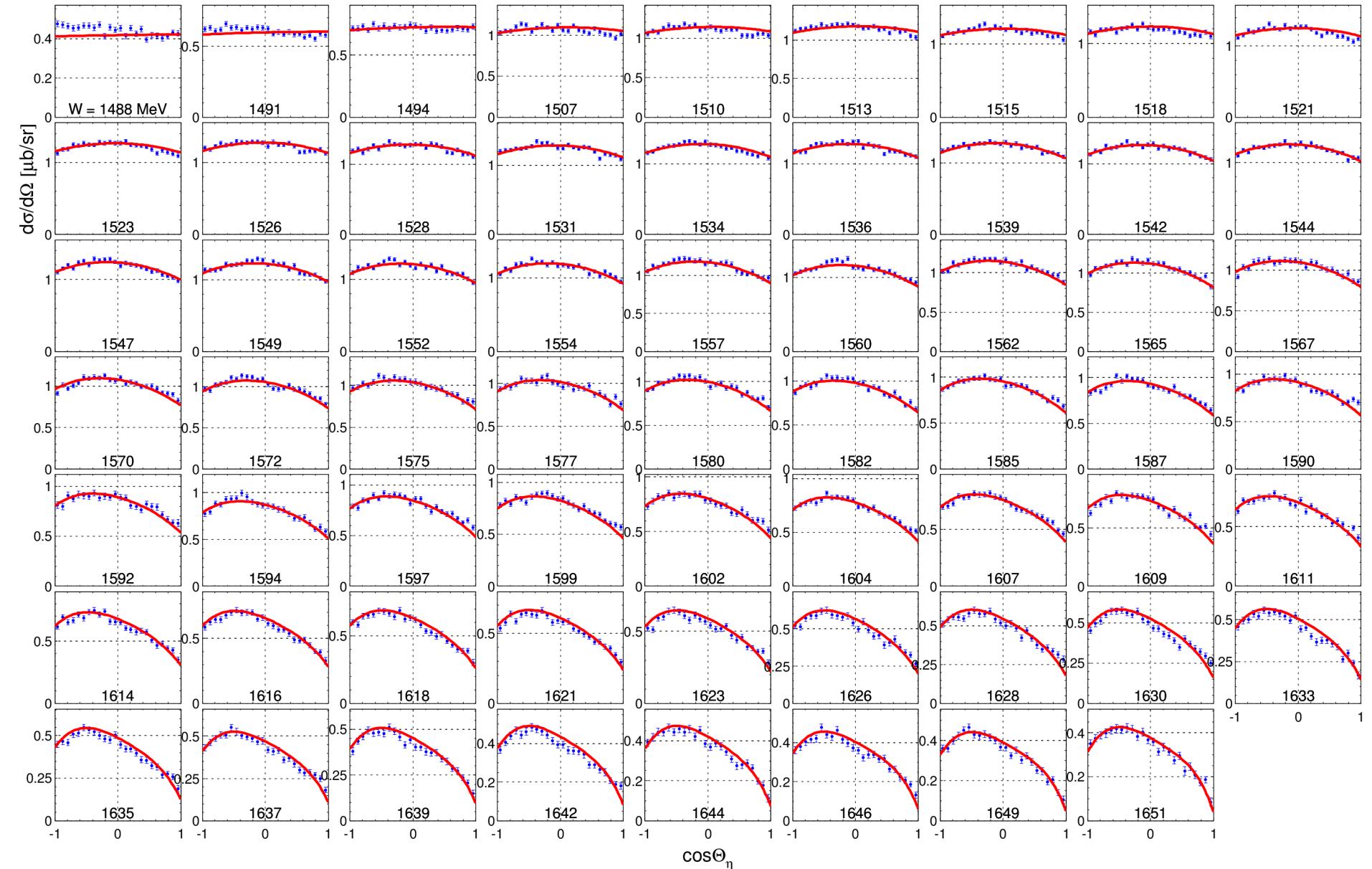
Total cross sections

solid (dashed) – full solution (background)



γ p → η p

Differential cross sections

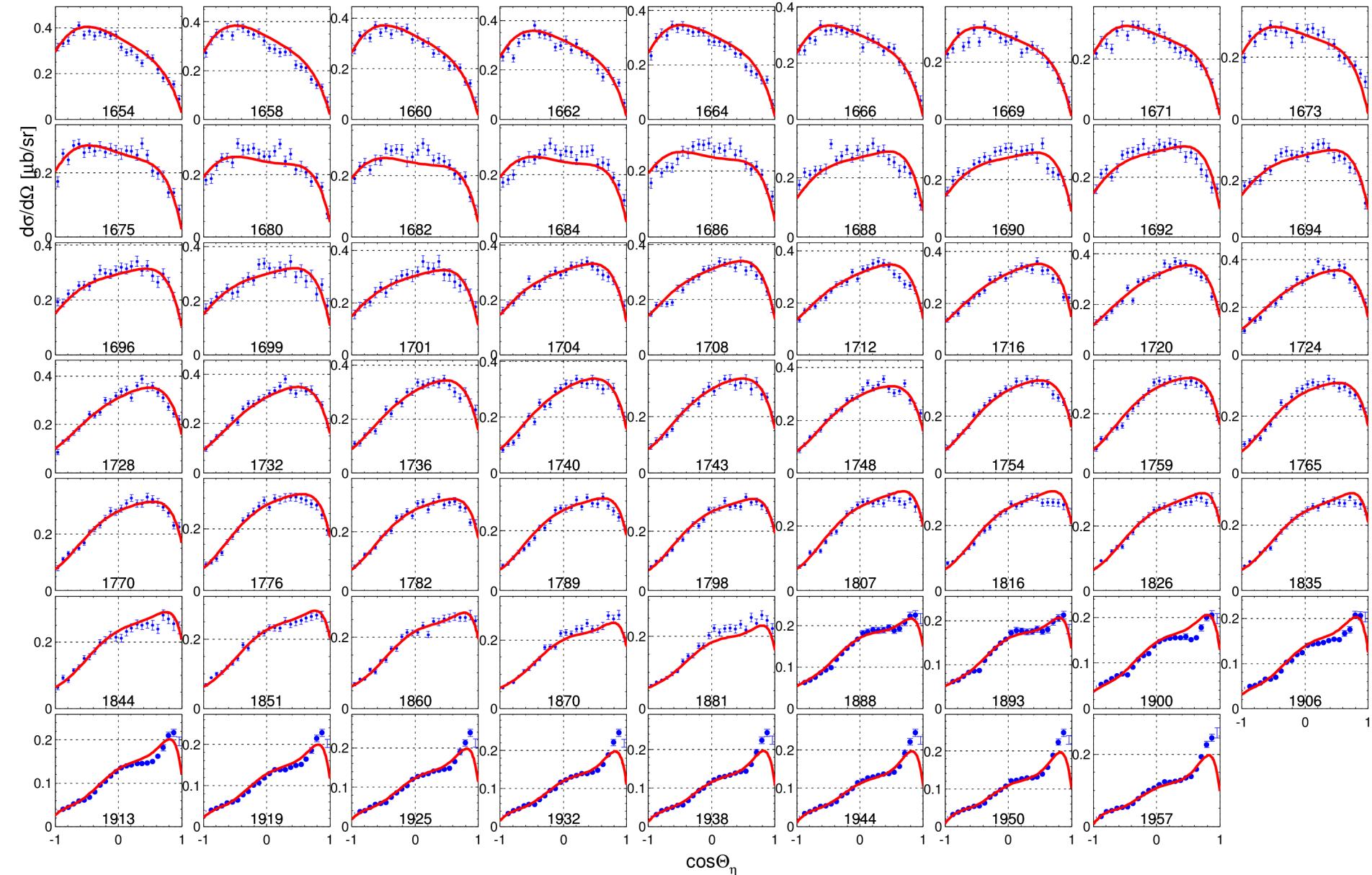


Data: A2MAMI-17;

Lines: red – EtaMAID2019_DR

γ p → η p

Differential cross sections

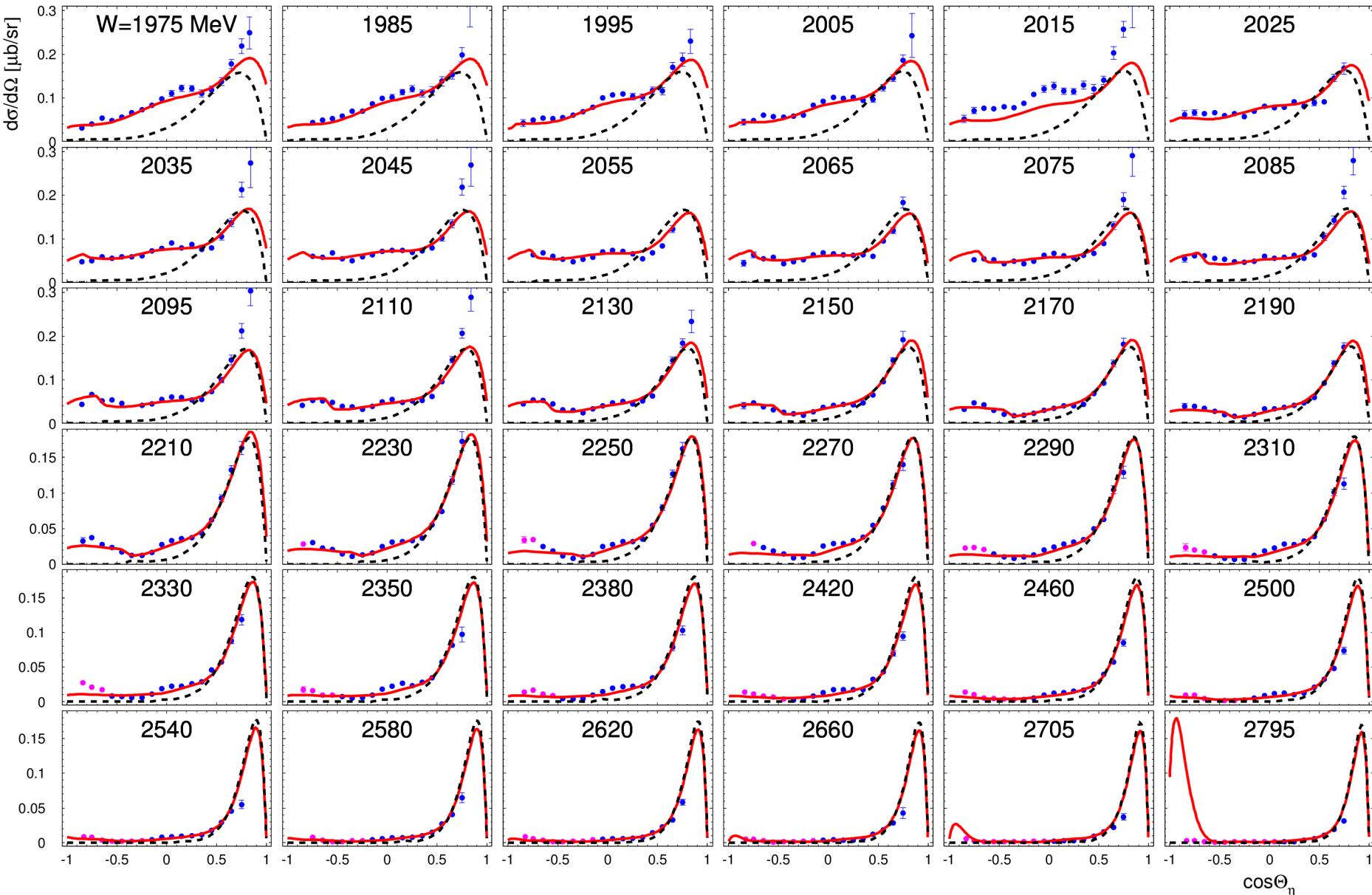


Data: A2MAMI-17

Lines: red – EtaMAID2019_DR

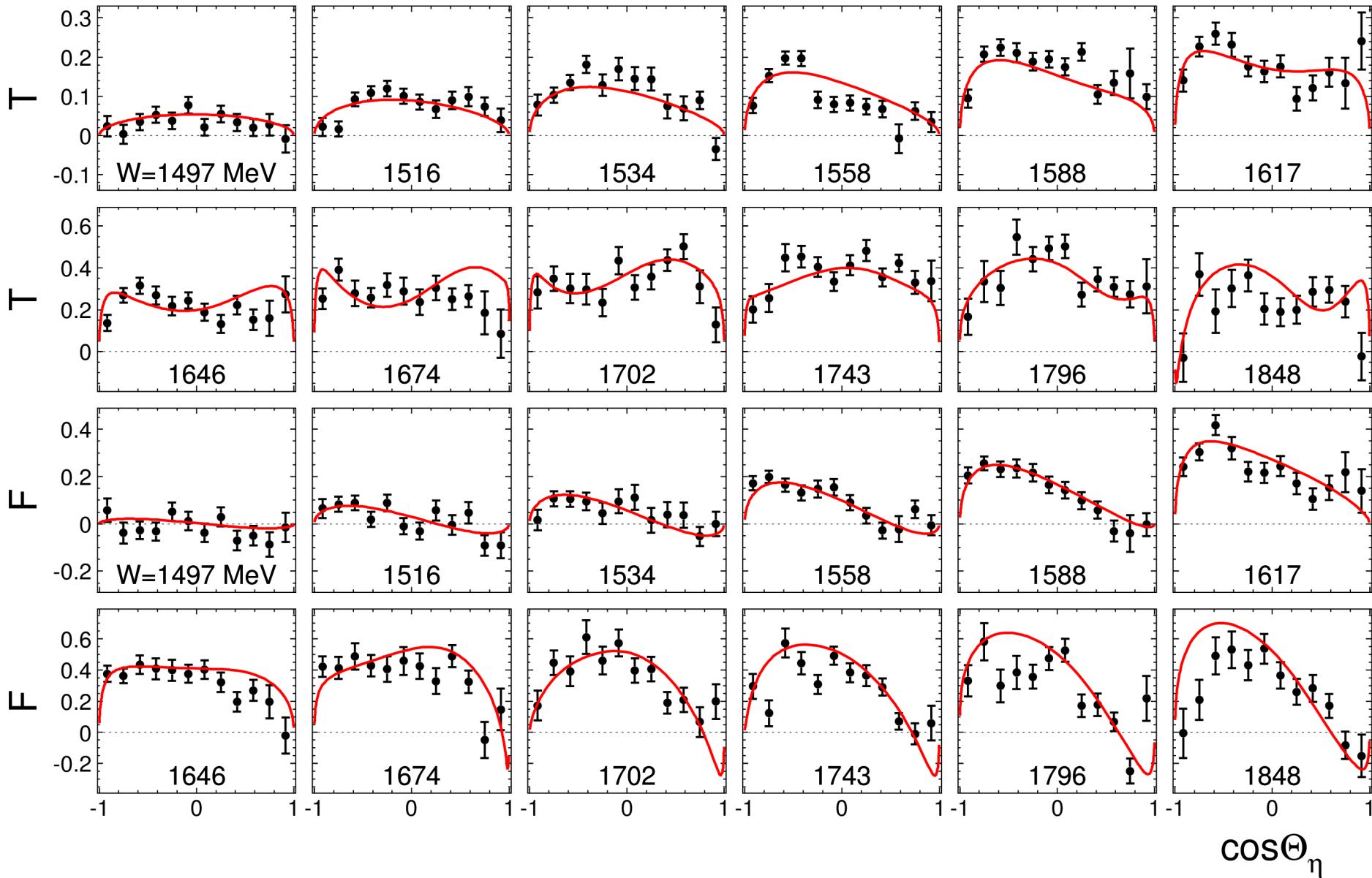
γ P → η P

Differential cross sections





Polarization observables: T and F

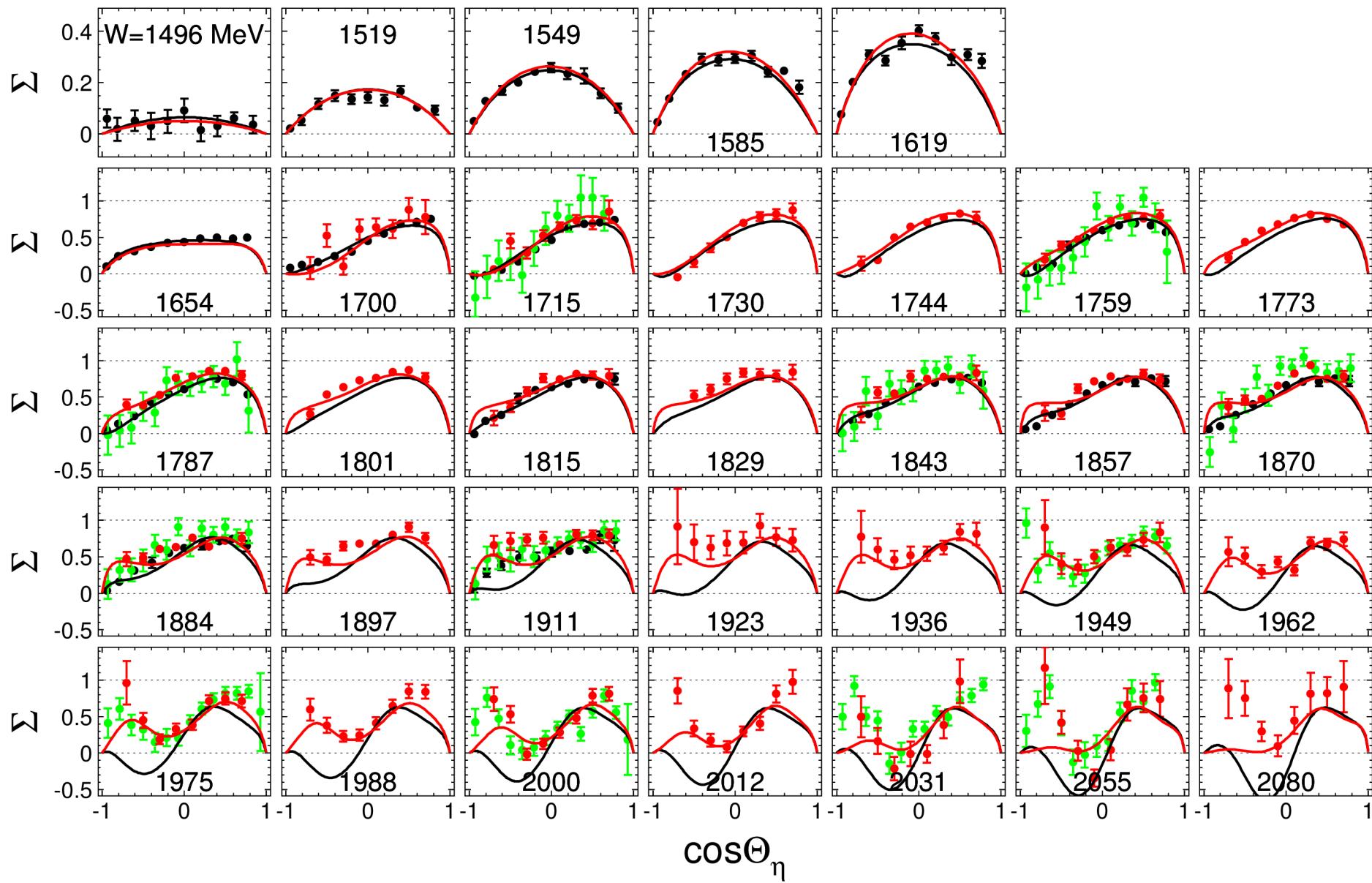


Red line: full solution

Data: A2MAMI-14

γ p → η p

Polarization observables: Σ



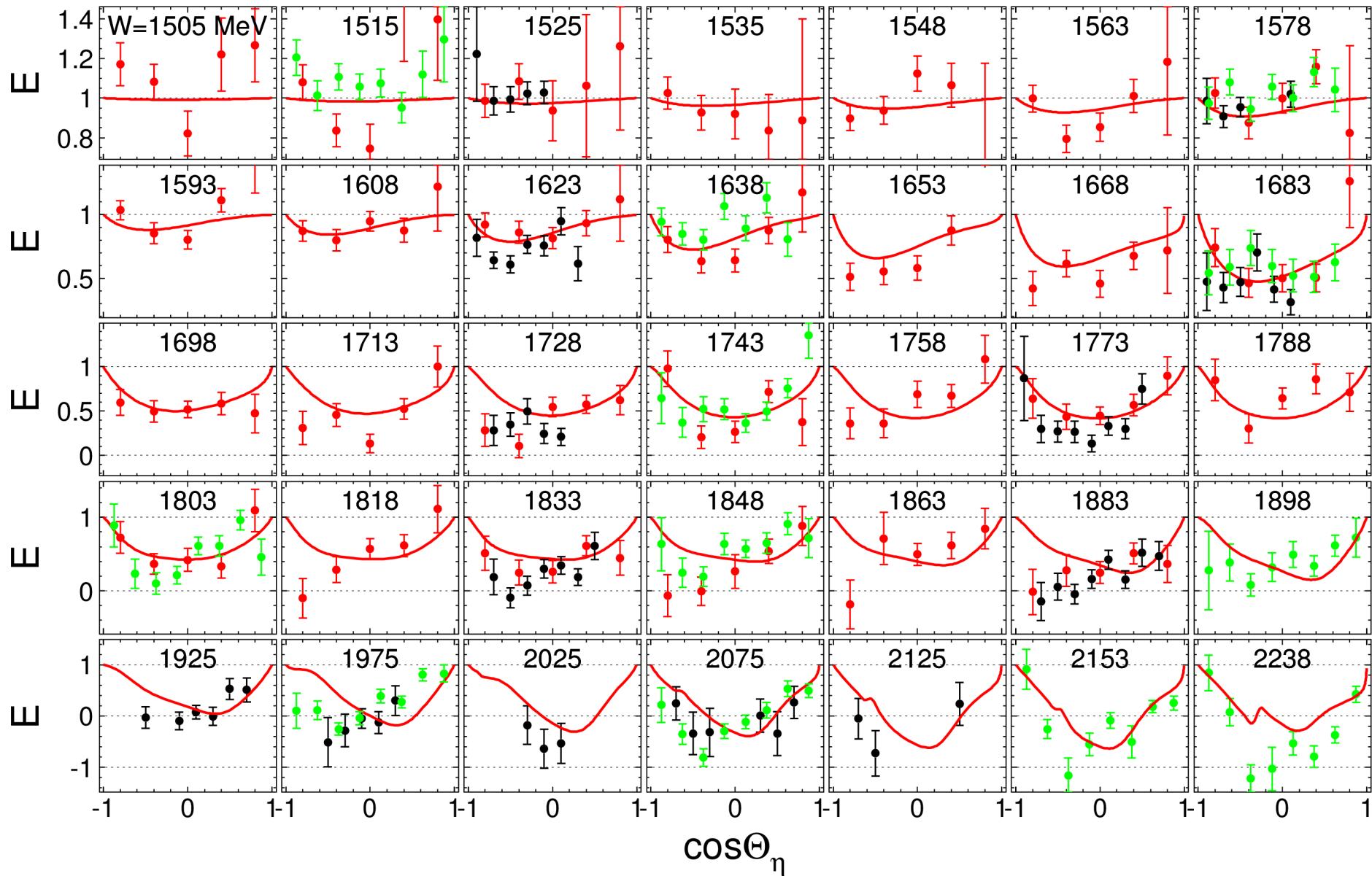
Data: black – GRAAL-07;

red – CLAS-17;

green – CBELSA/TAPS preliminary

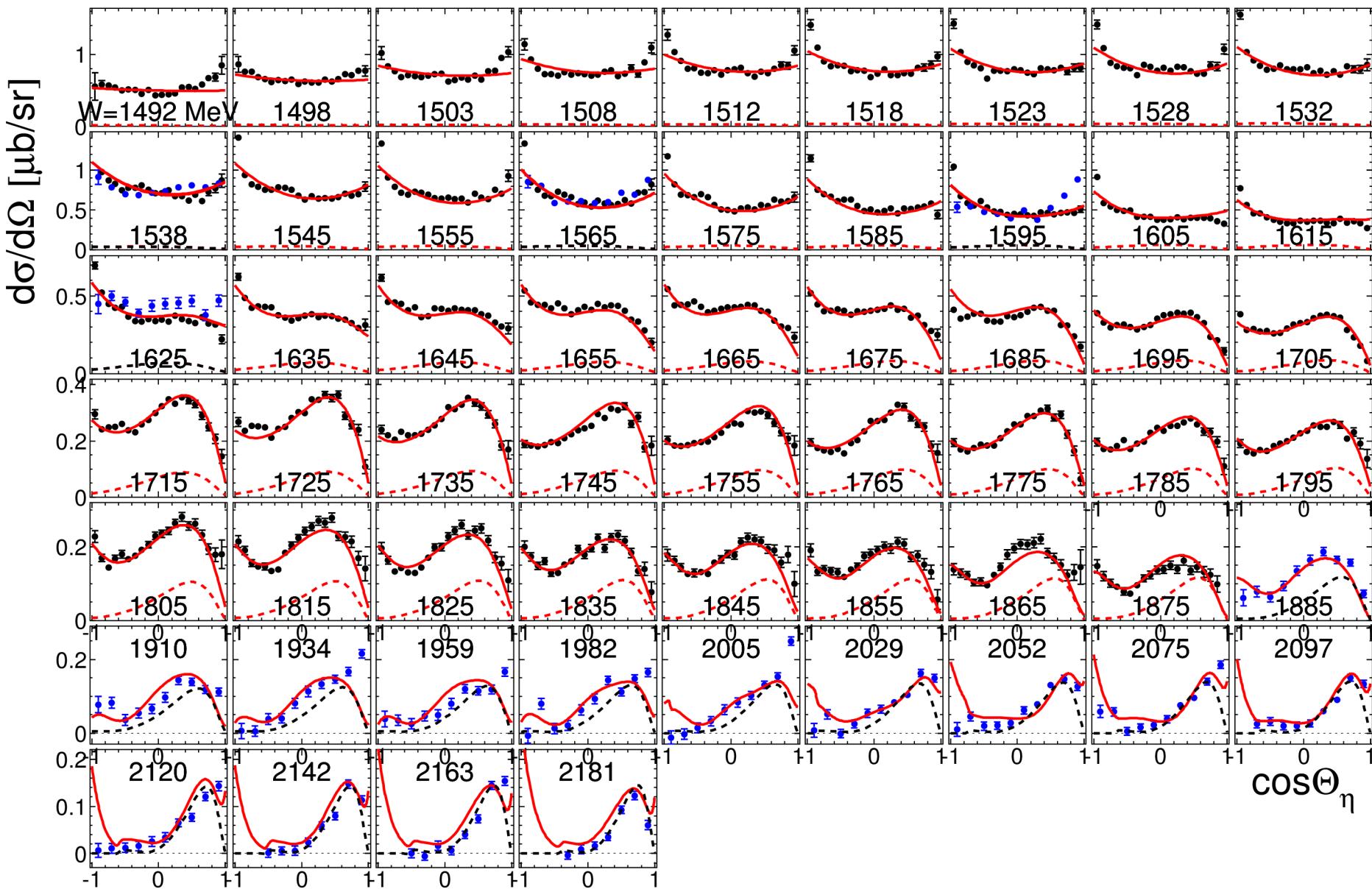
γ p \rightarrow η p

Polarization observables: E





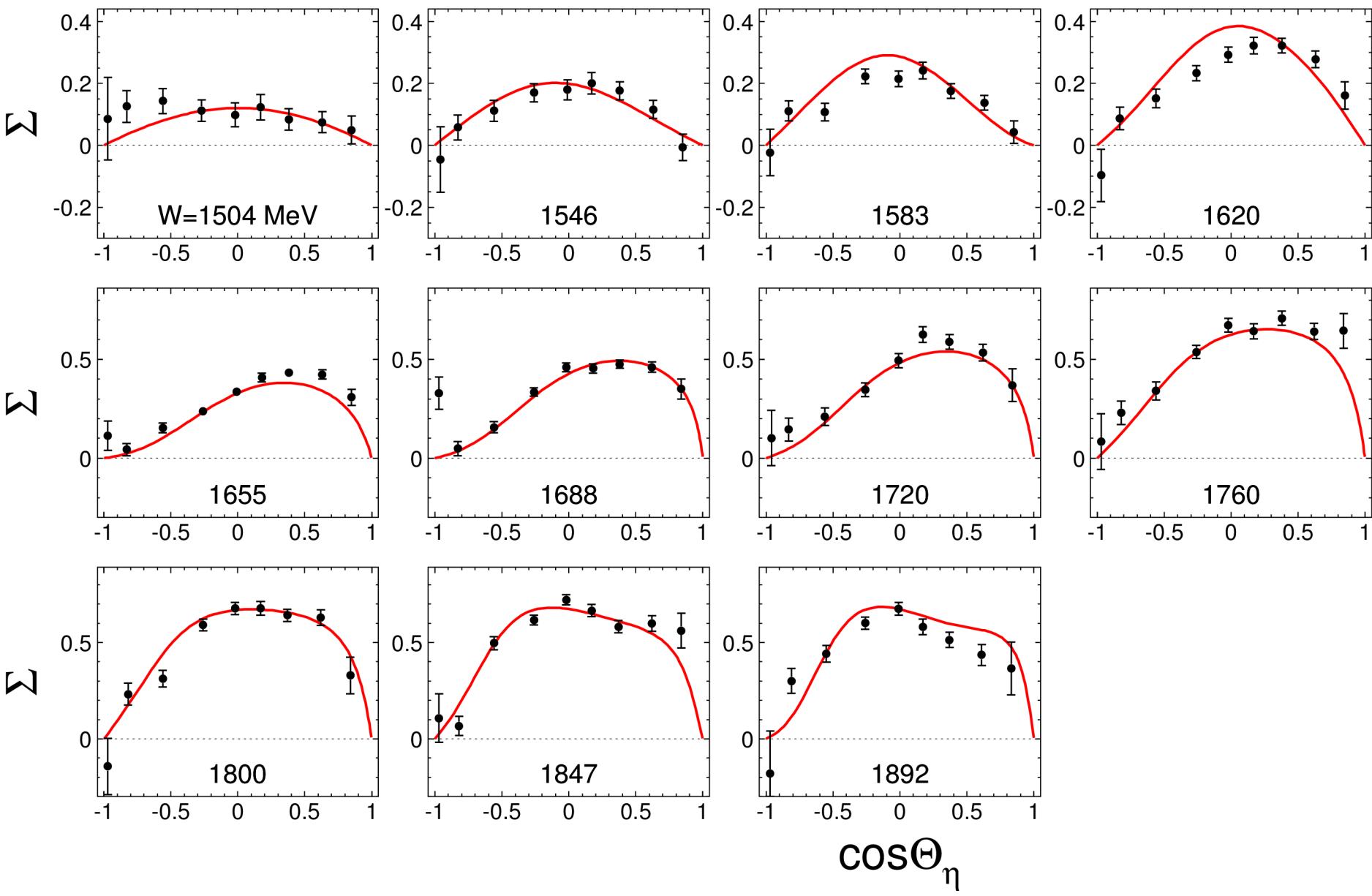
Differential cross sections



Data: black – A2MAMI-14, blue – CBELSA-08 (norm.)
 red lines – full solution, dashed – background

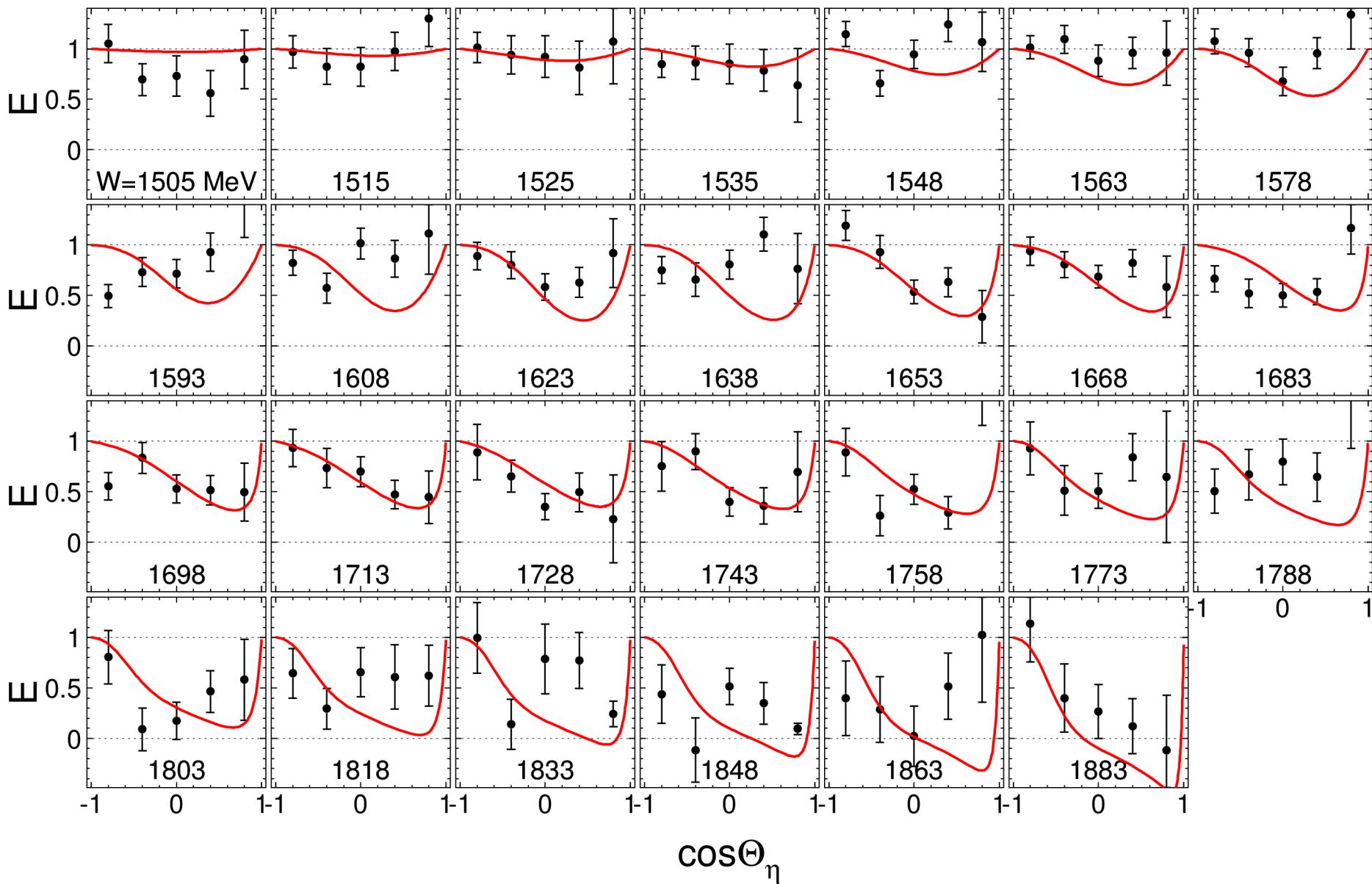


Polarization observables: Σ





Polarization observables: E

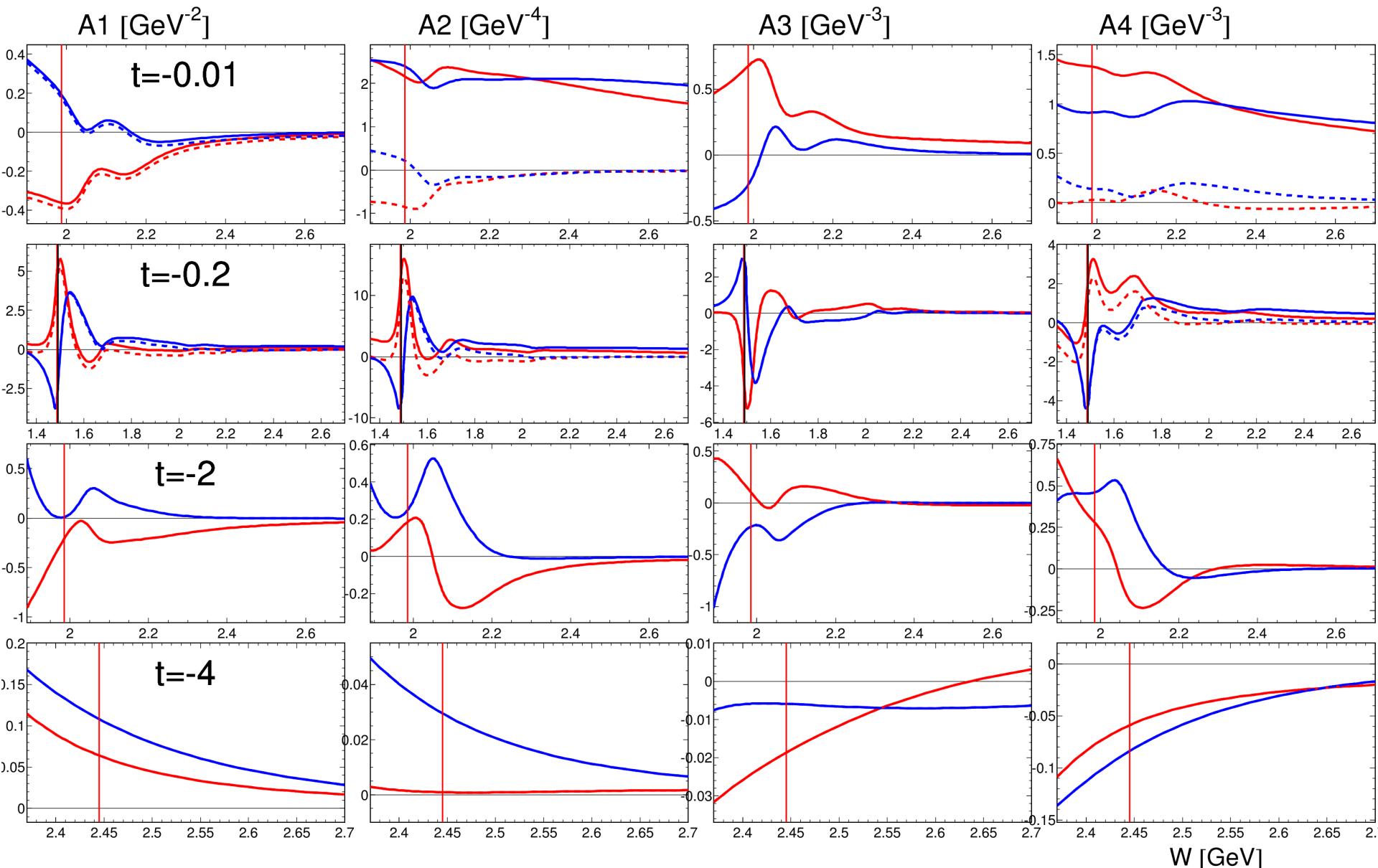


Red line – full solution

Data: A2MAMI-17

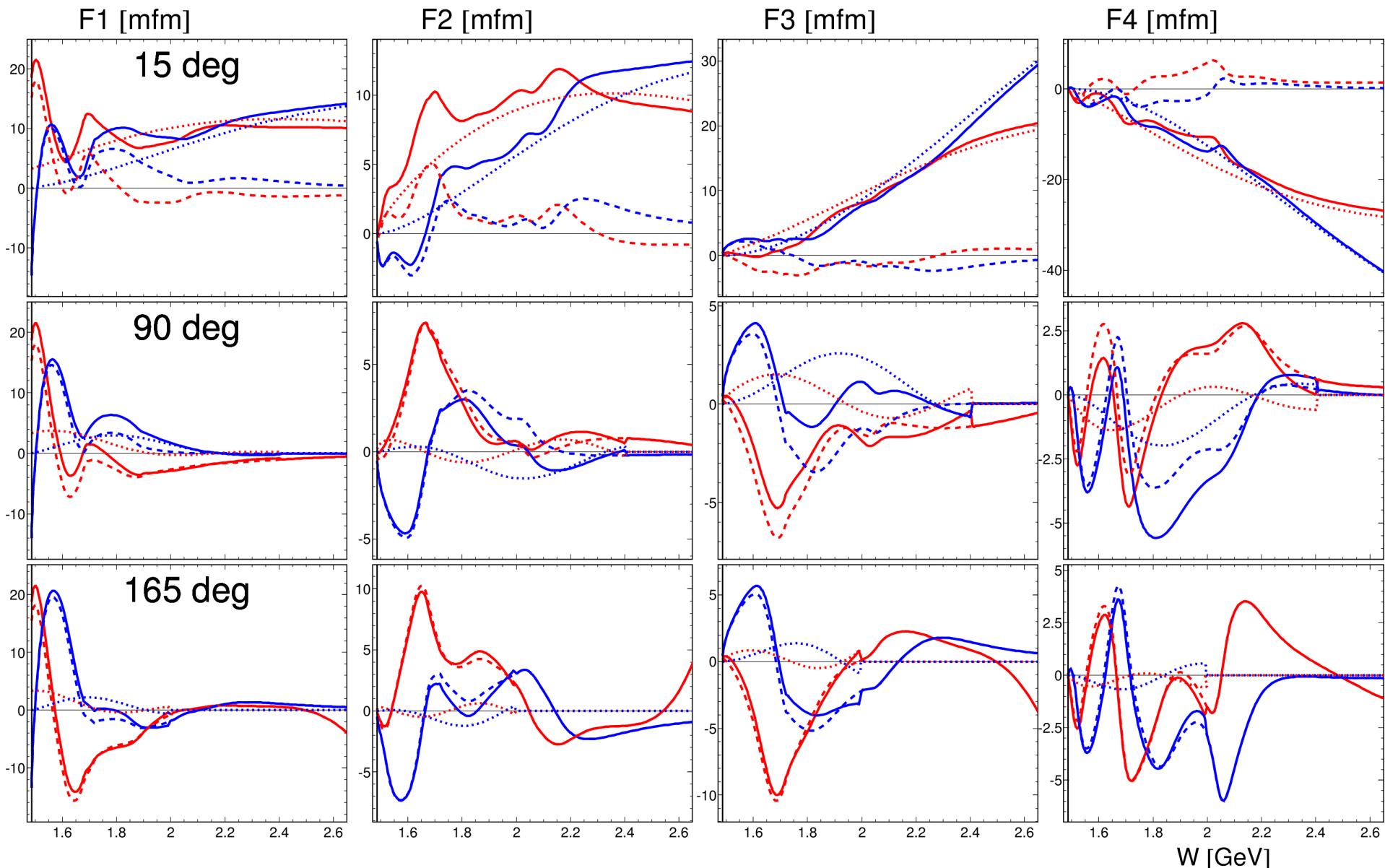
γ p → η p

Invariant amplitudes
red – Real, blue – Imag; solid – full, dashed - resonances



γ p \rightarrow η p

CGLN amplitudes
red – Real, blue – Imag; solid – full, dashed - resonances



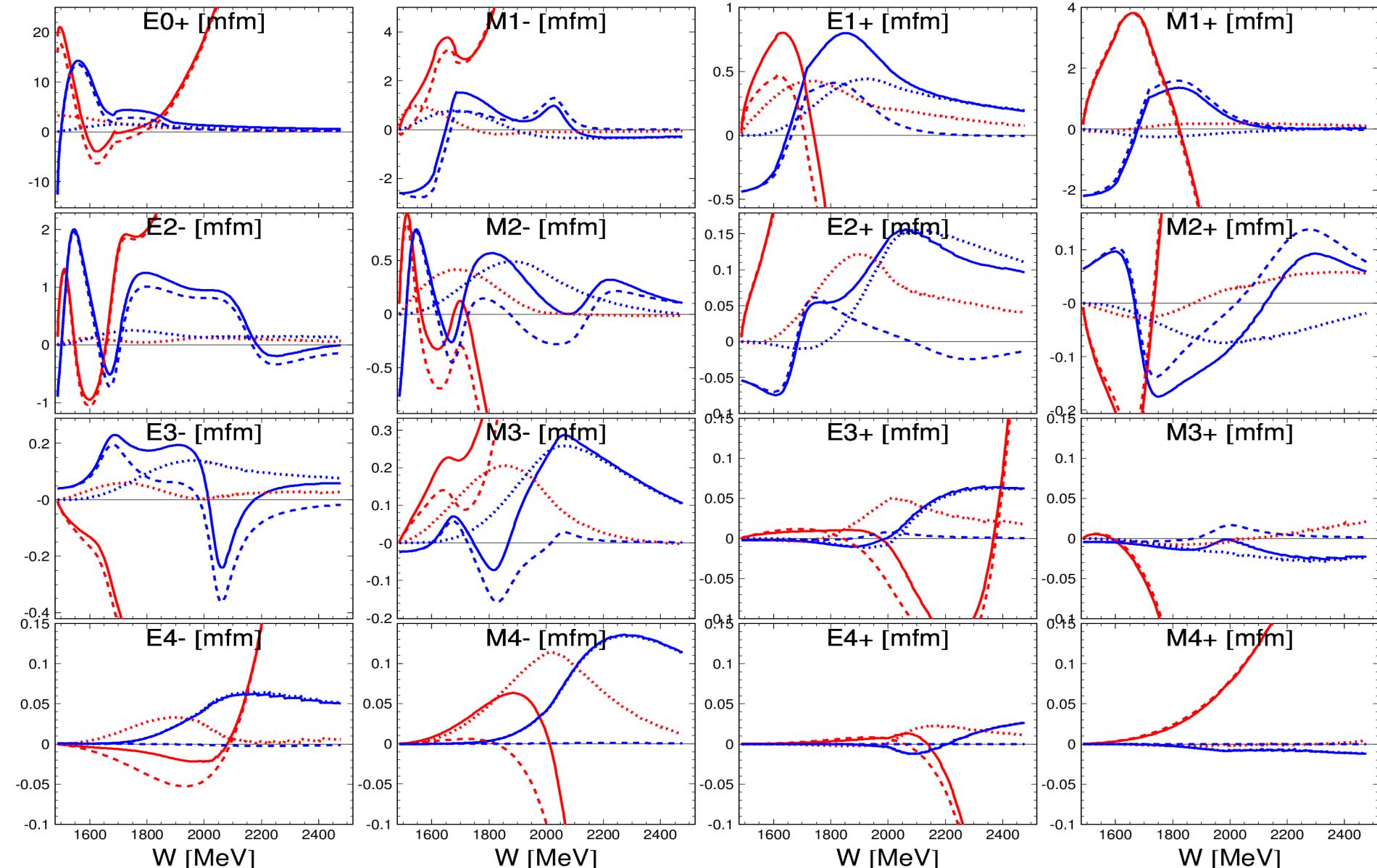
γ p \rightarrow η p

Multipole amplitudes

Real (total) —
Imag (total) —

Real (background) ······
Imag (background) ······

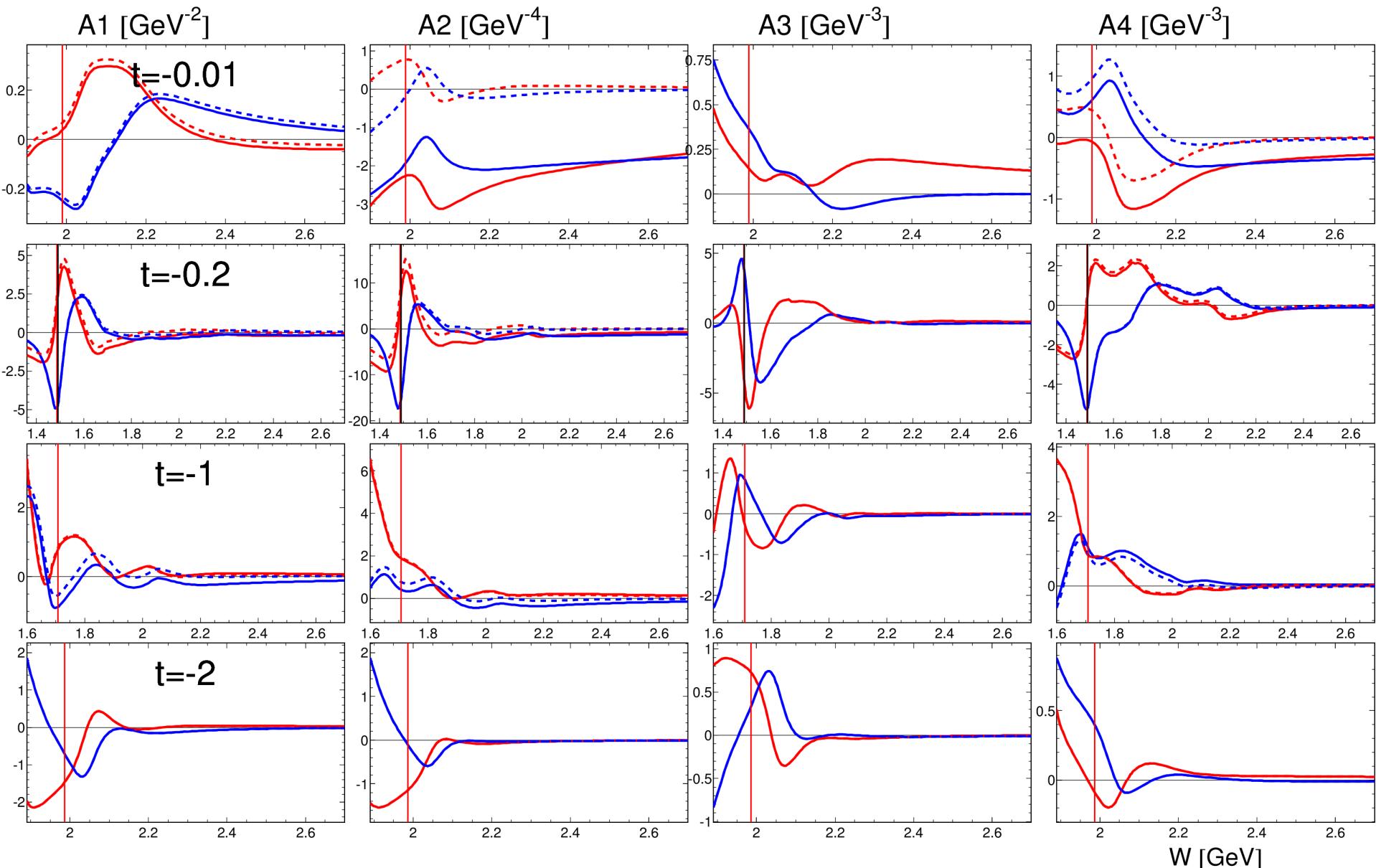
Real (resonances) - - -
Imag (resonances) - - -



γ n → n n

Invariant amplitudes

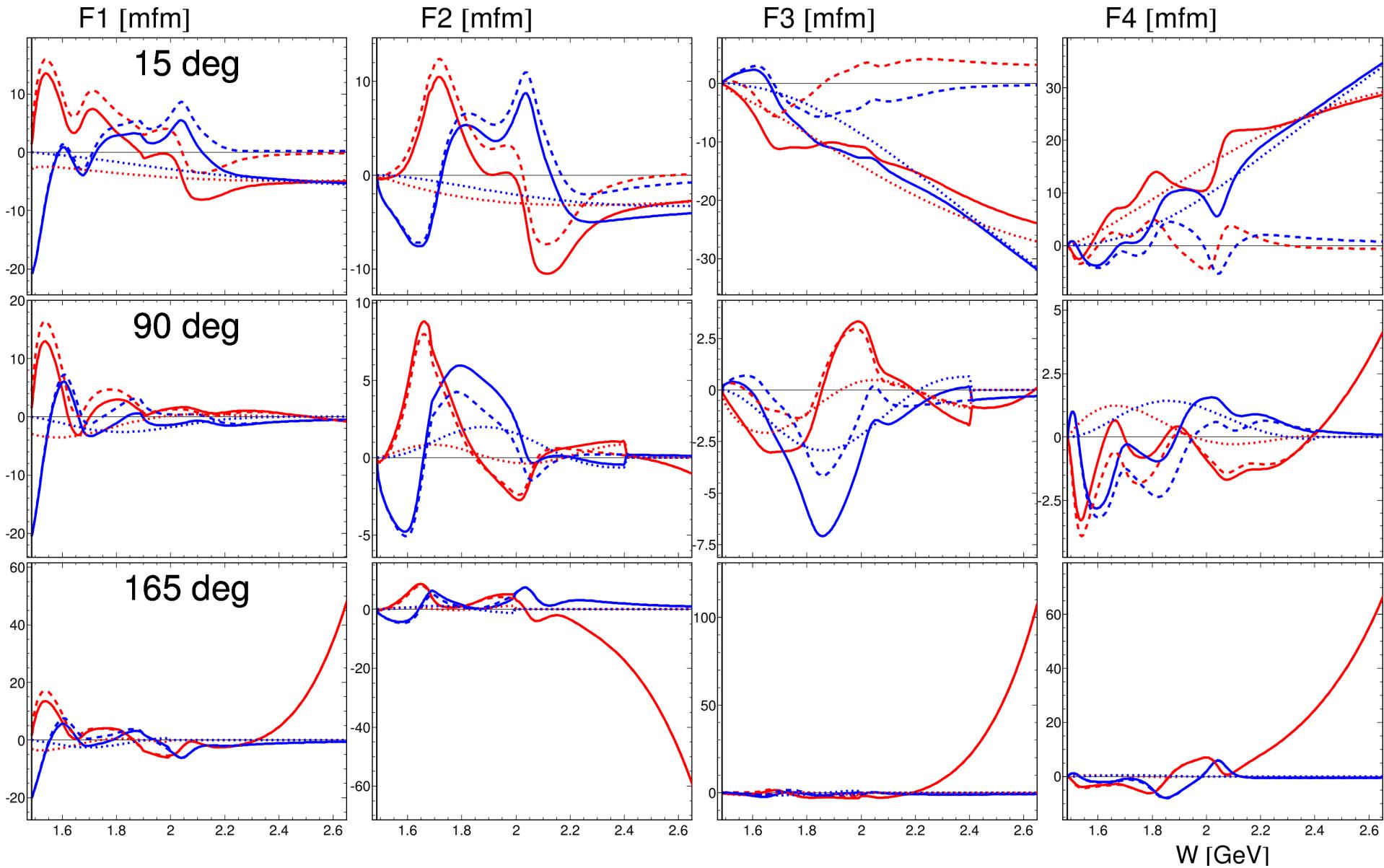
red – Real, blue – Imag; solid – full, dashed - resonances





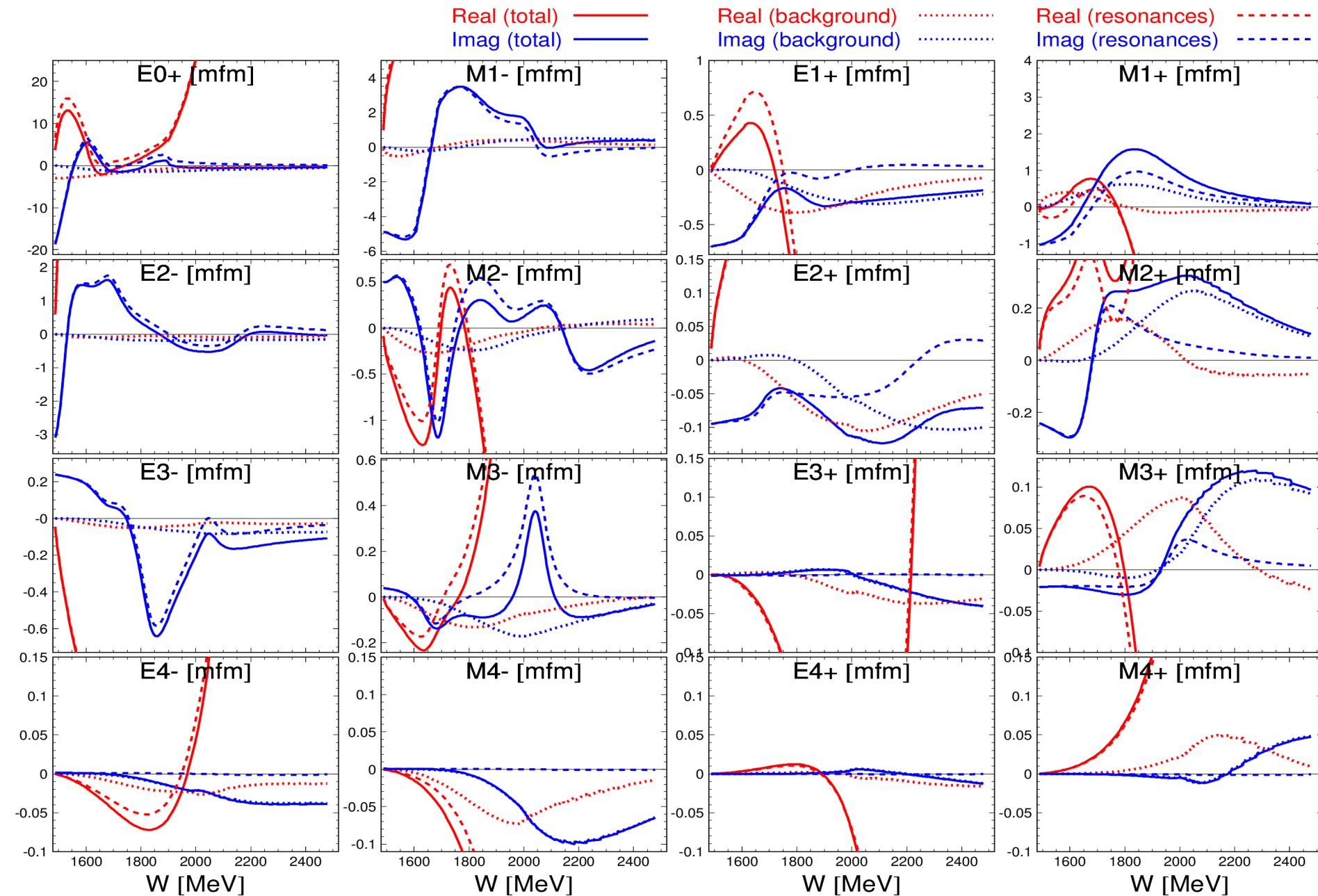
CGLN amplitudes

red – Real, blue – Imag; solid – full, dashed - resonances



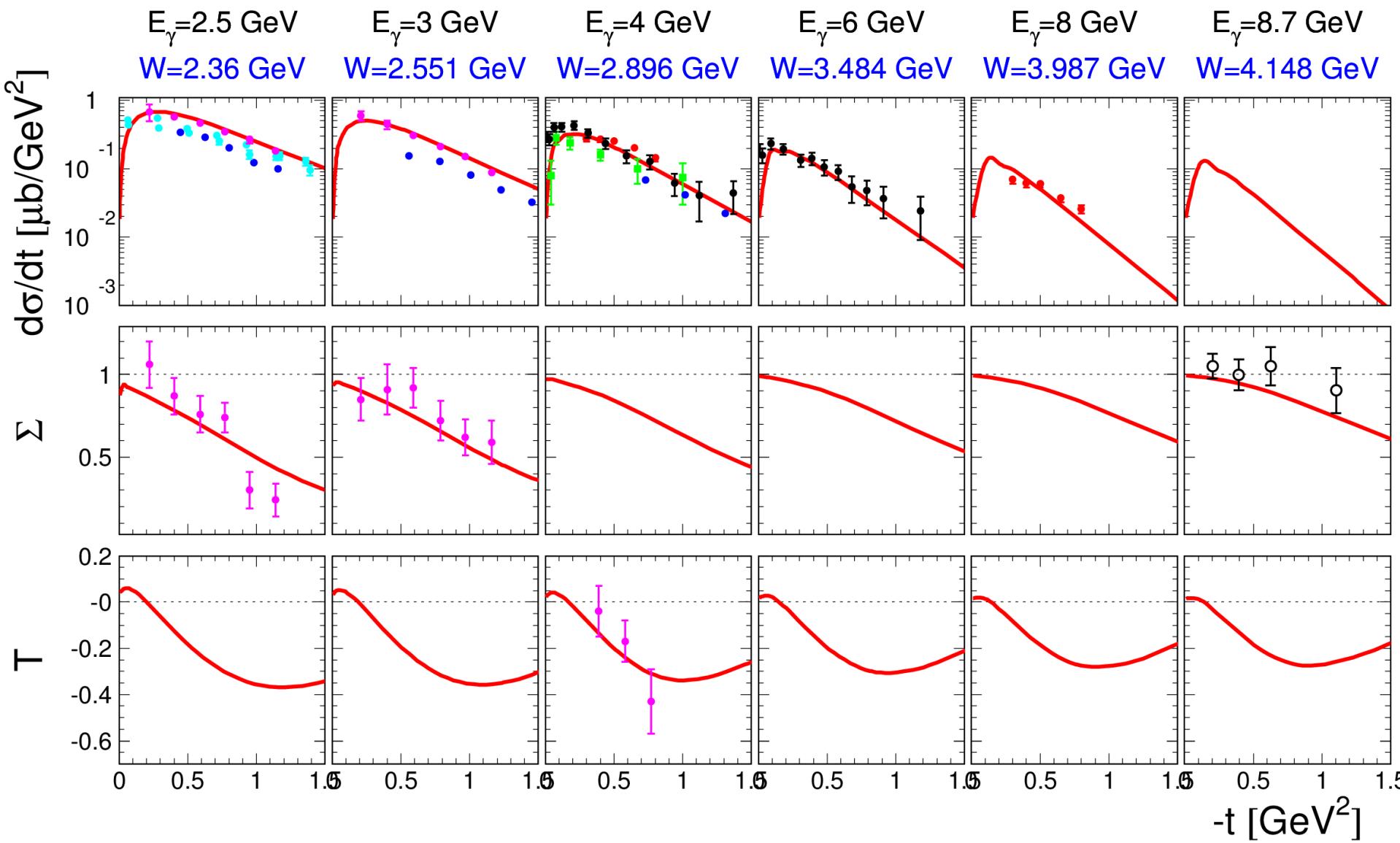


Multipole amplitudes



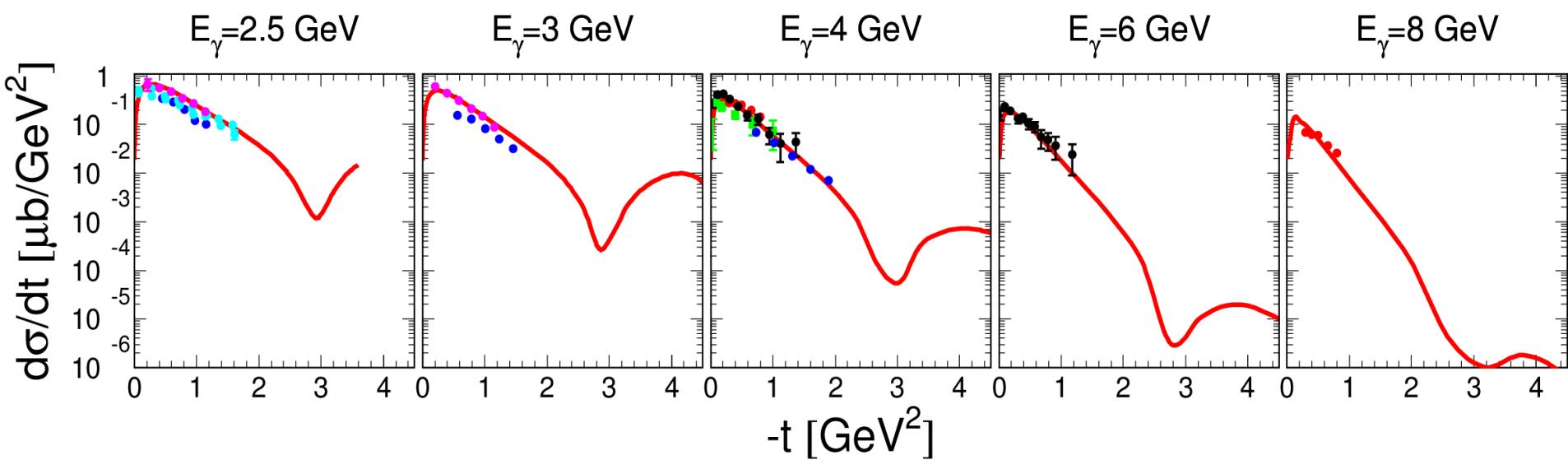
γ p → η p

JPACphi with damping factor



γ p → η p

JPA Cphi with damping factor

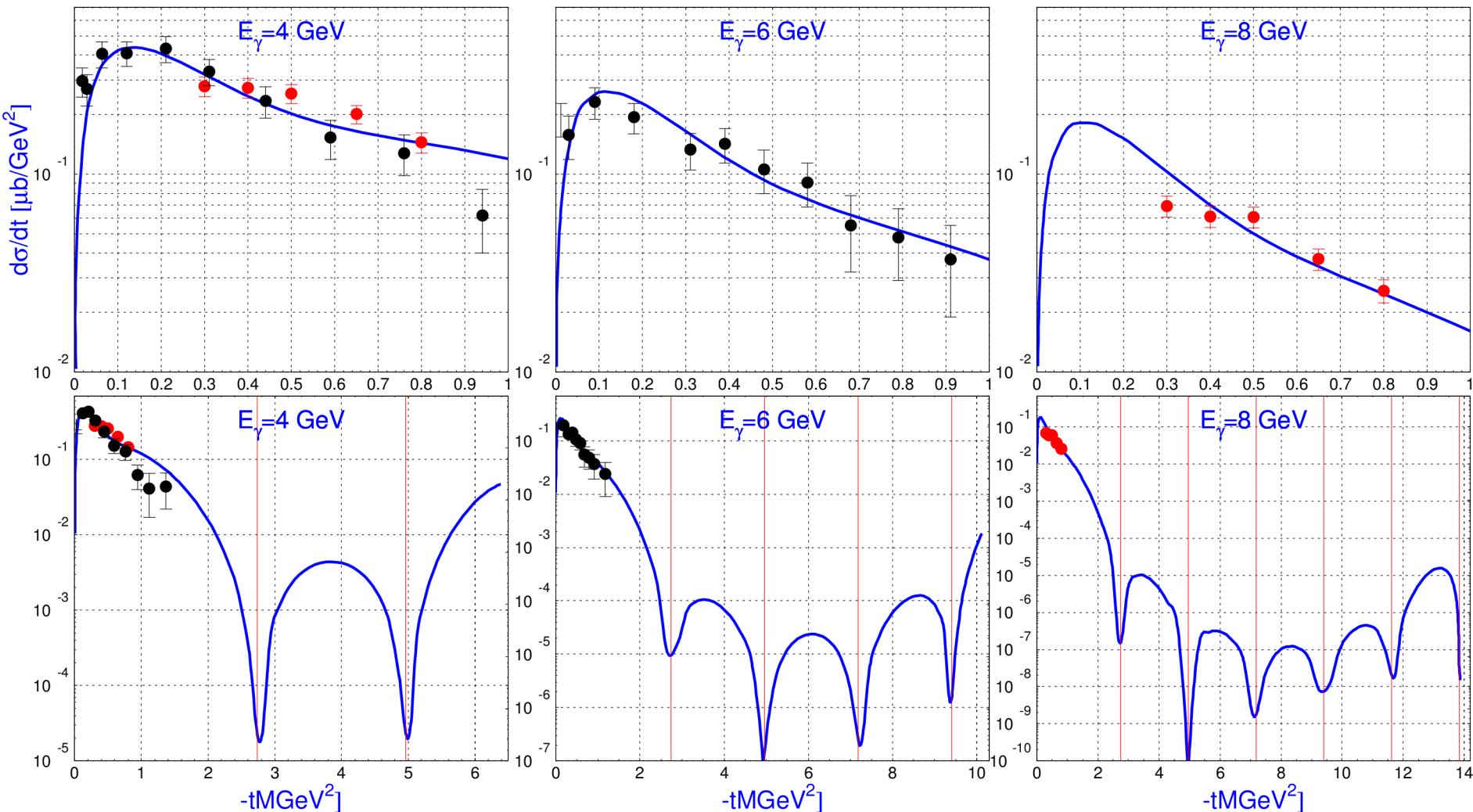


Summary

- 1.
- 2.
- 3.
- 4.

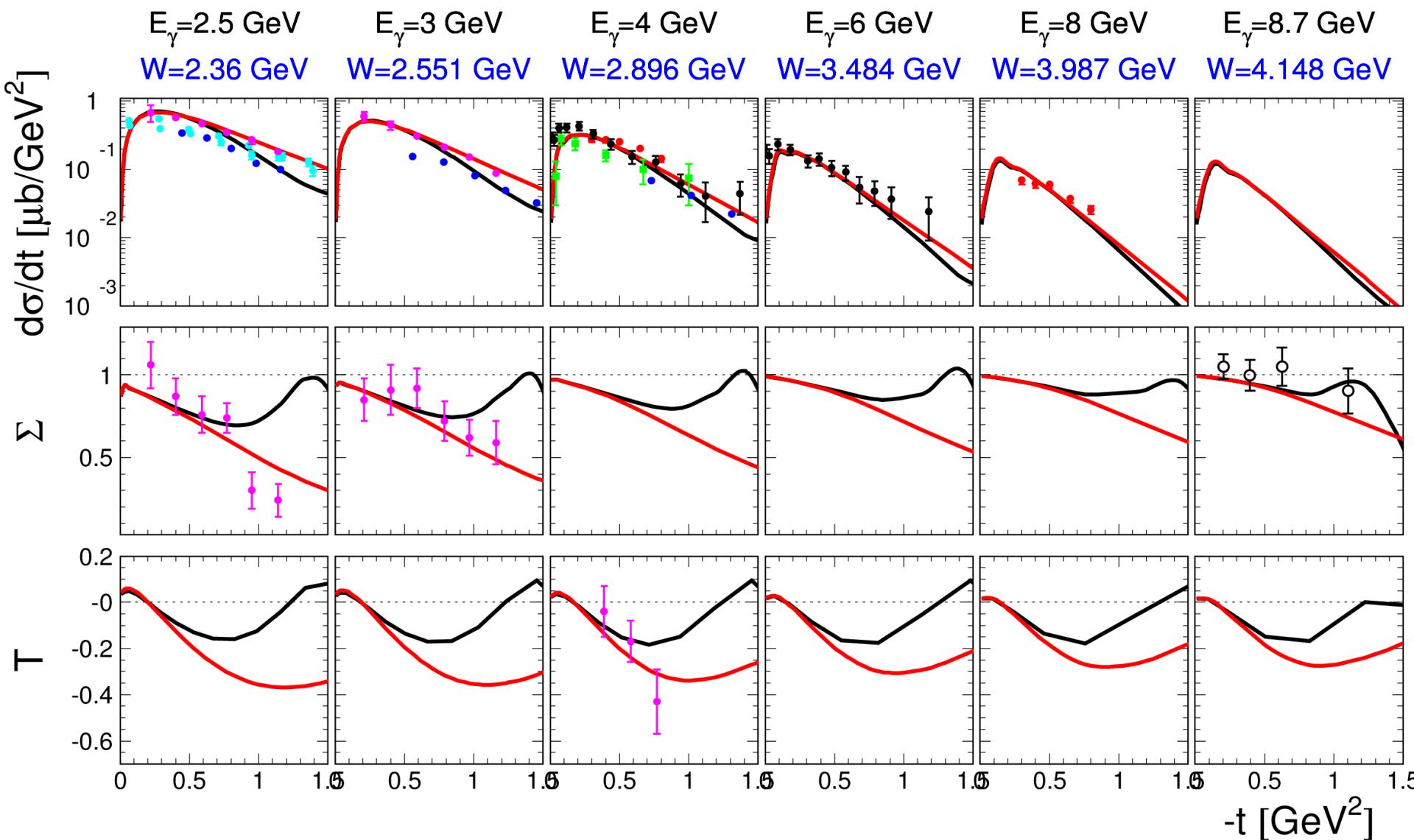


JPAC model (original version without DR)



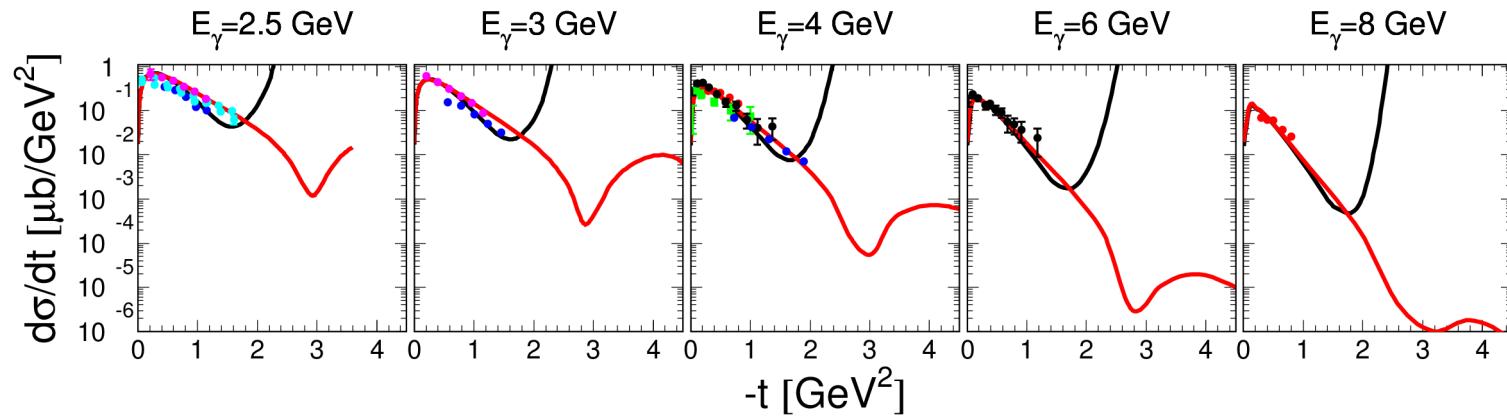
γ p → η p

JPACphi with damping factor: black lines – Fit7_DR, red lines – Fit7_IB





JPACphi with damping factor: black lines – Fit7_DR, red lines – Fit7_IB

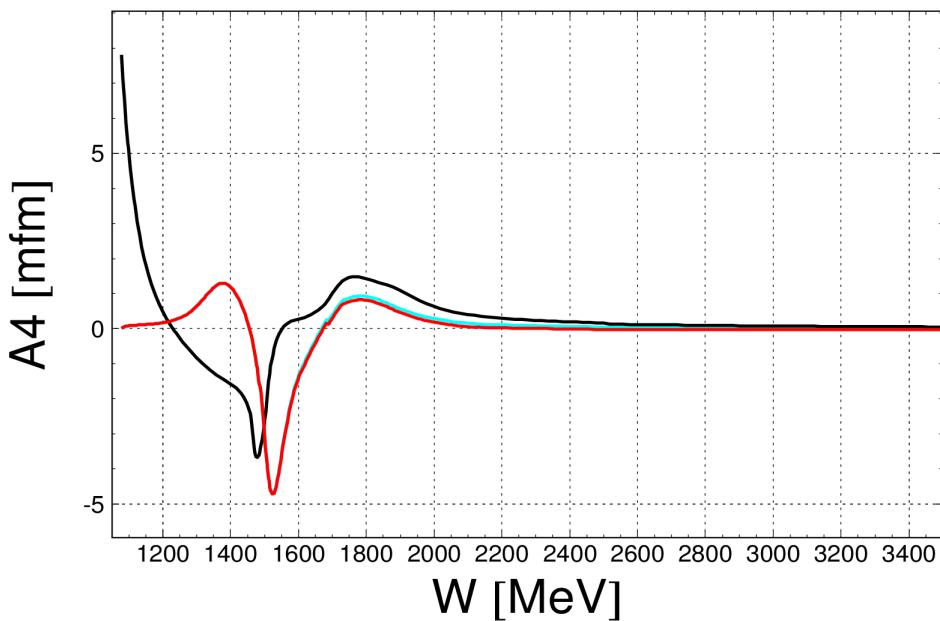
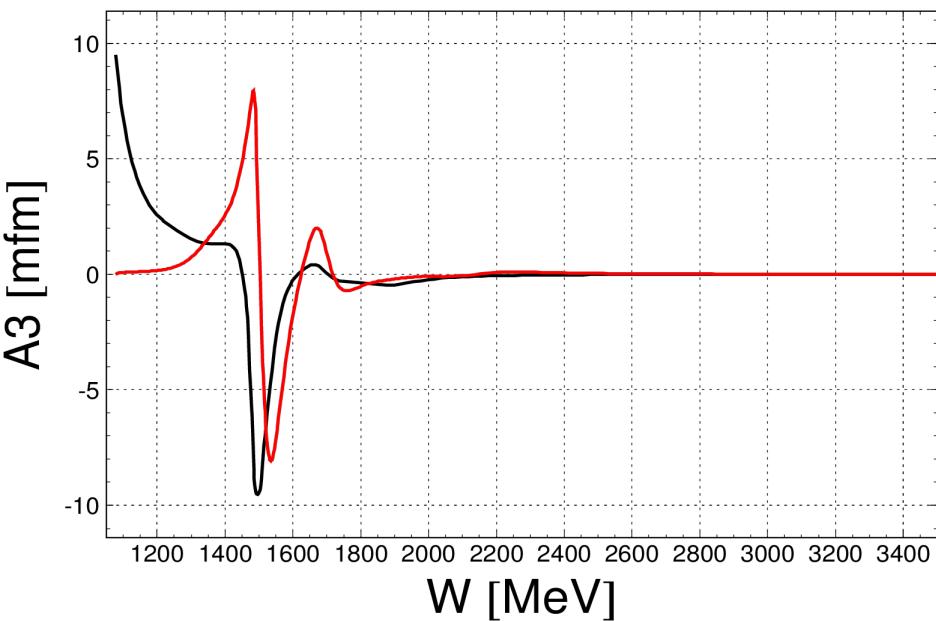
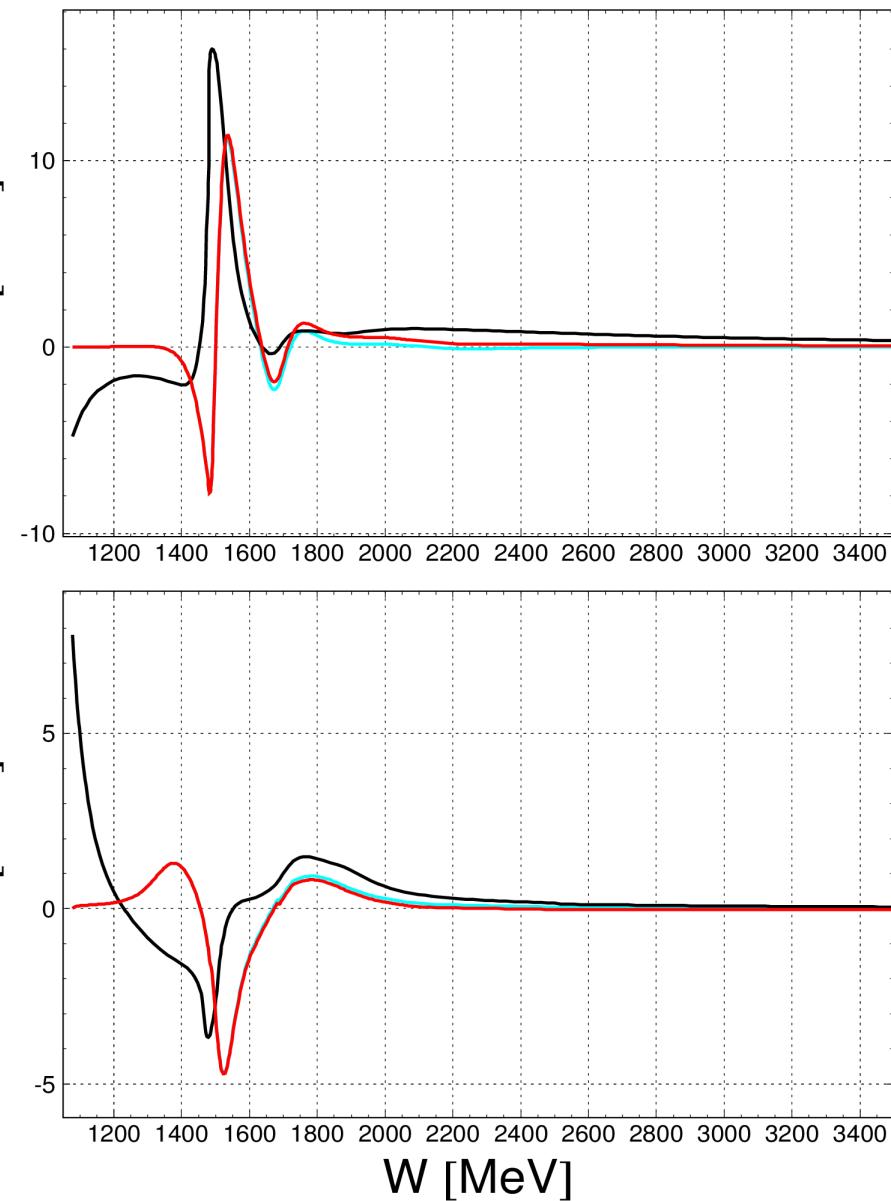
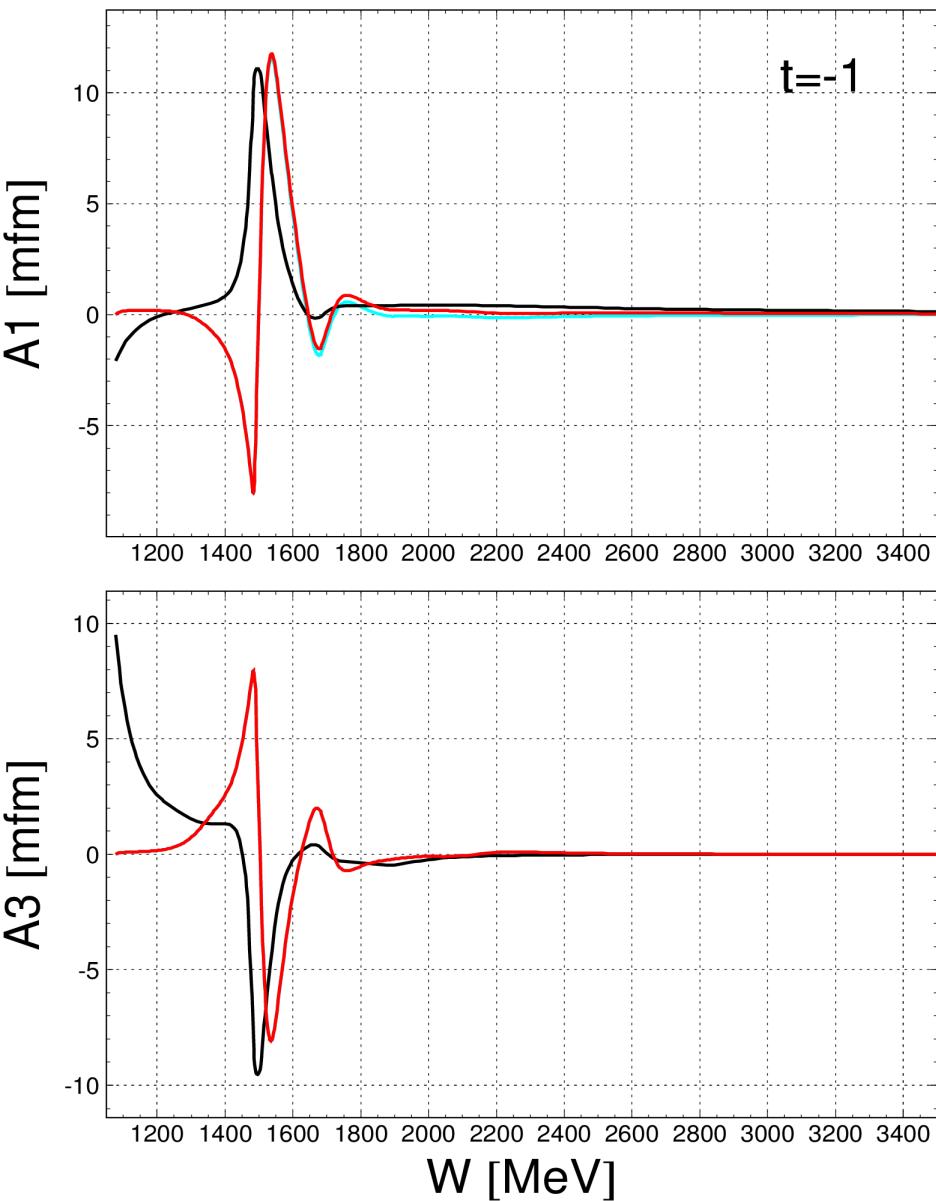


γ P → η P

Invariant amplitudes,

Imaginary part

Black – Fit7_DR; red (cyan) – EtaMAID2019-DR full solution (resonances)

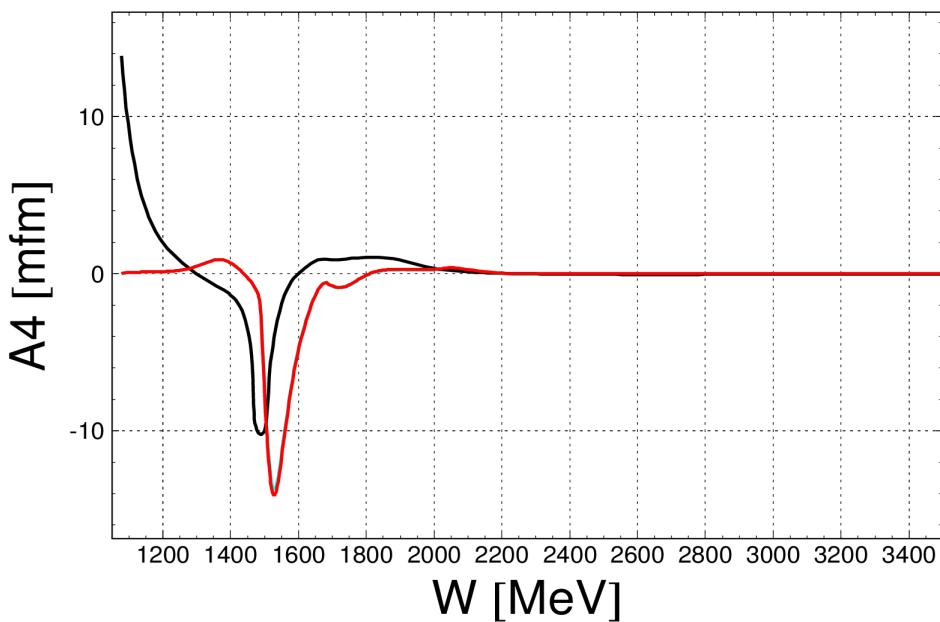
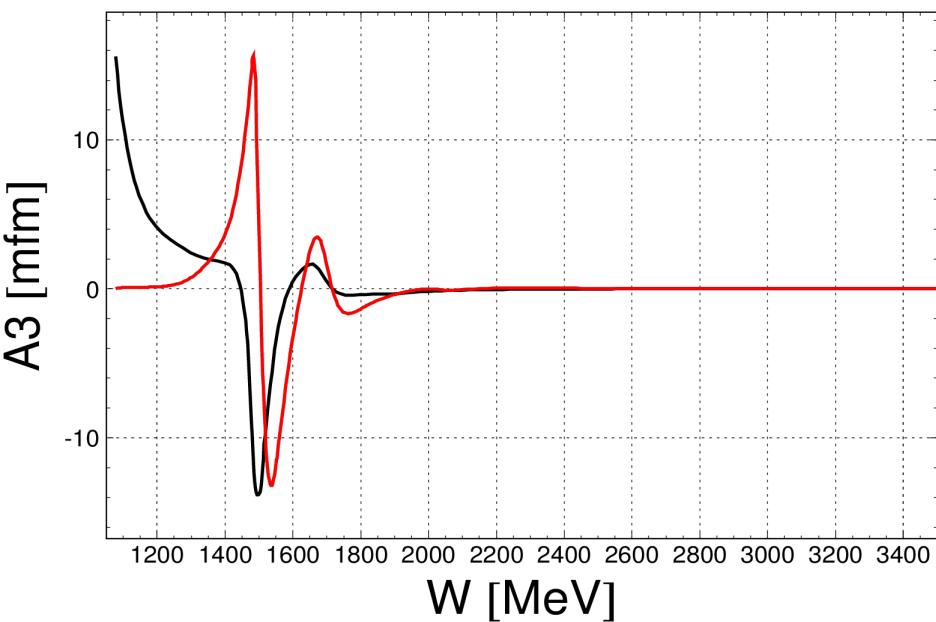
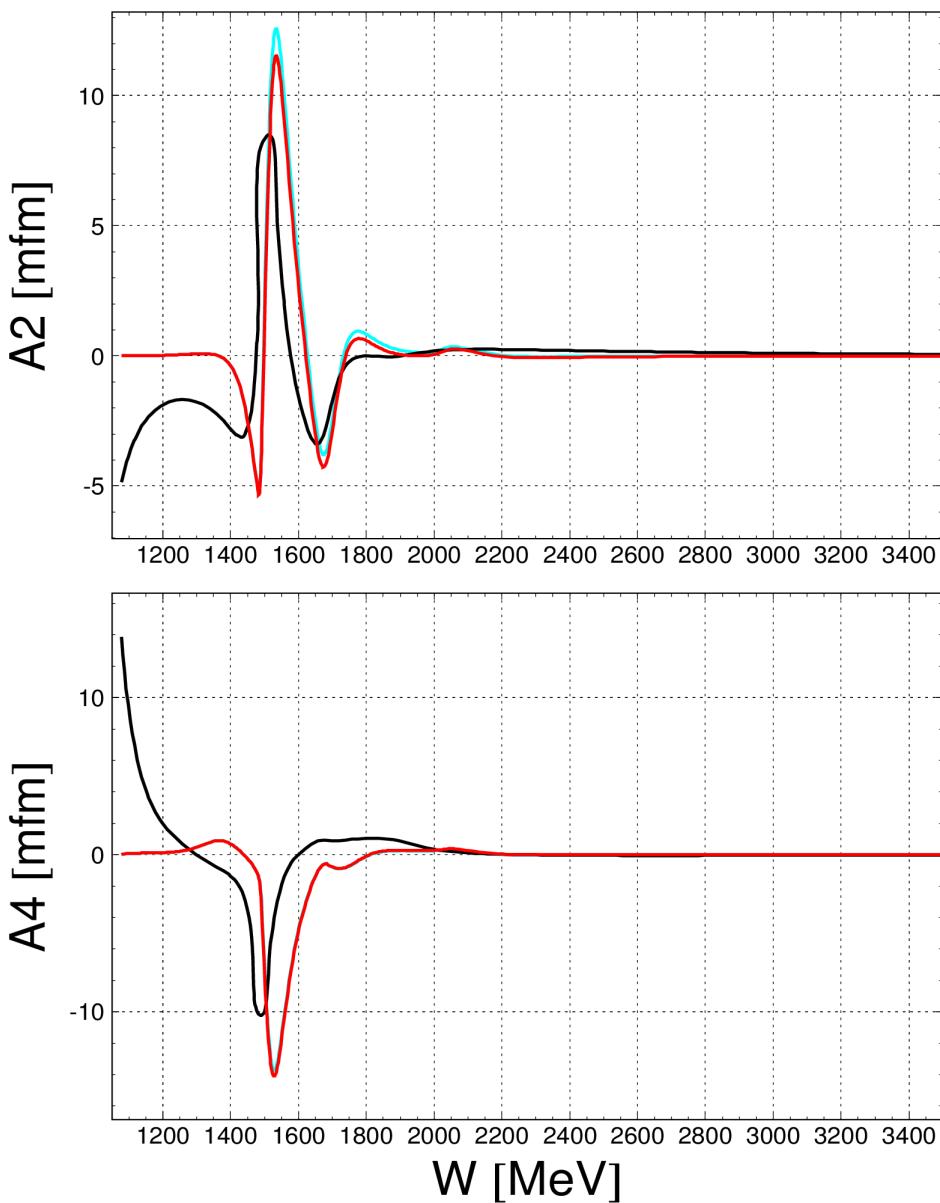
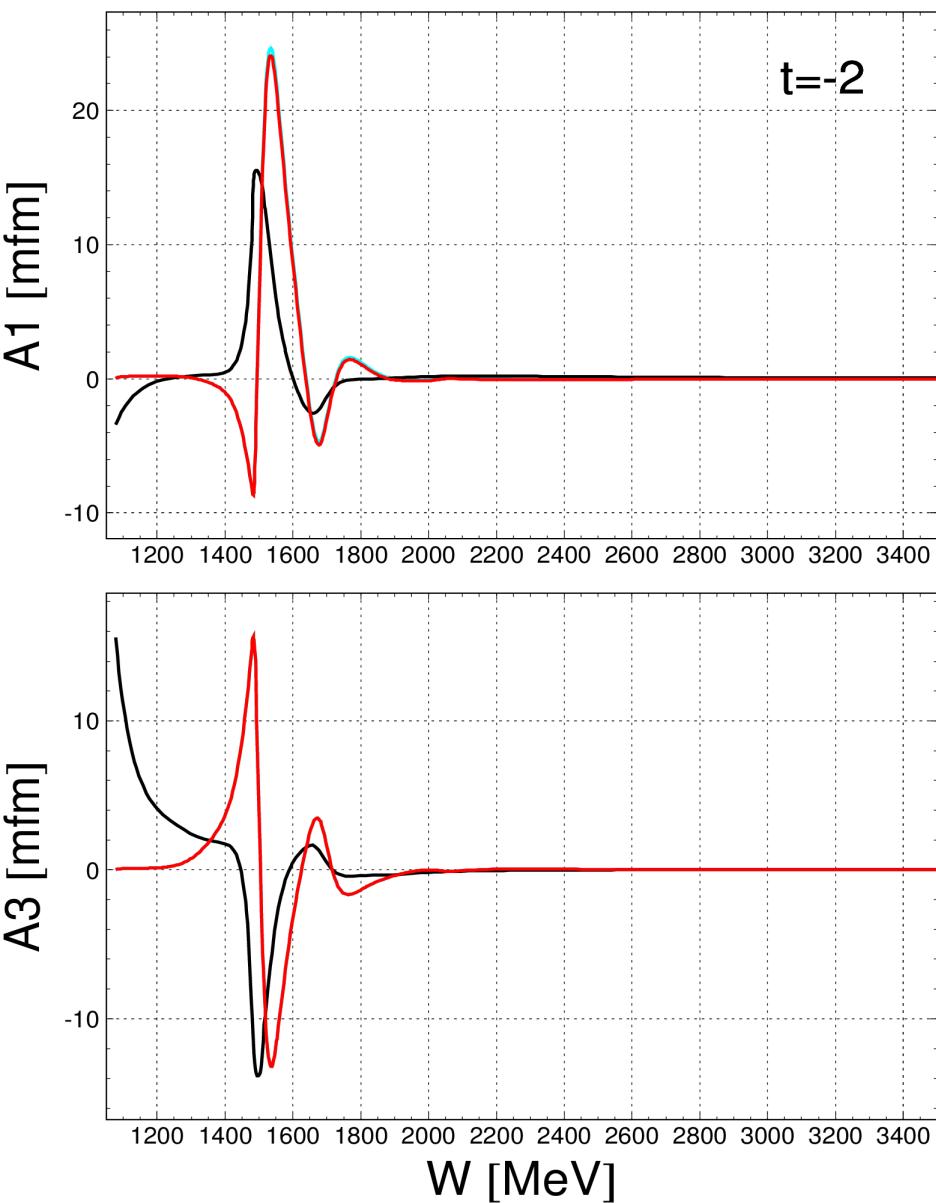


γ P → η P

Invariant amplitudes,

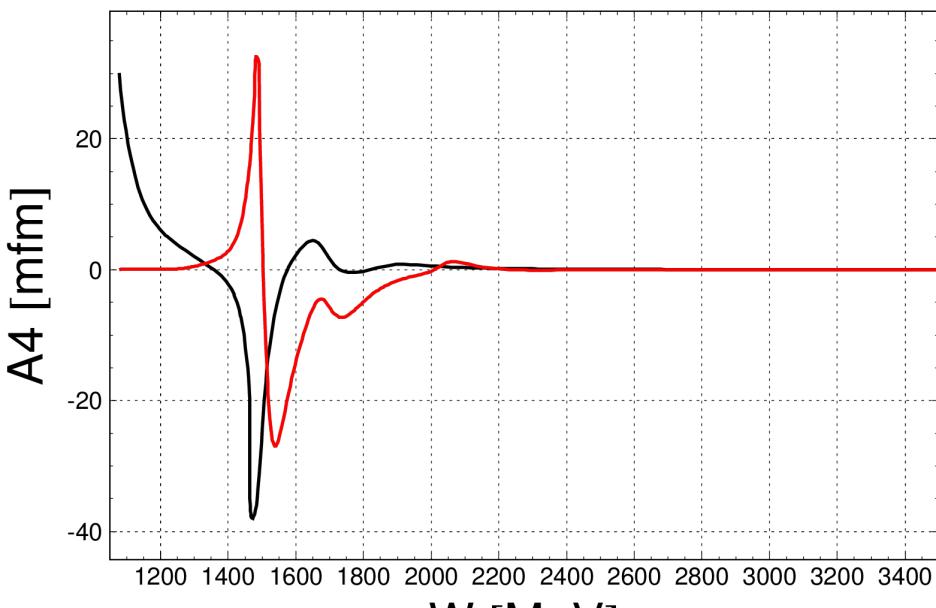
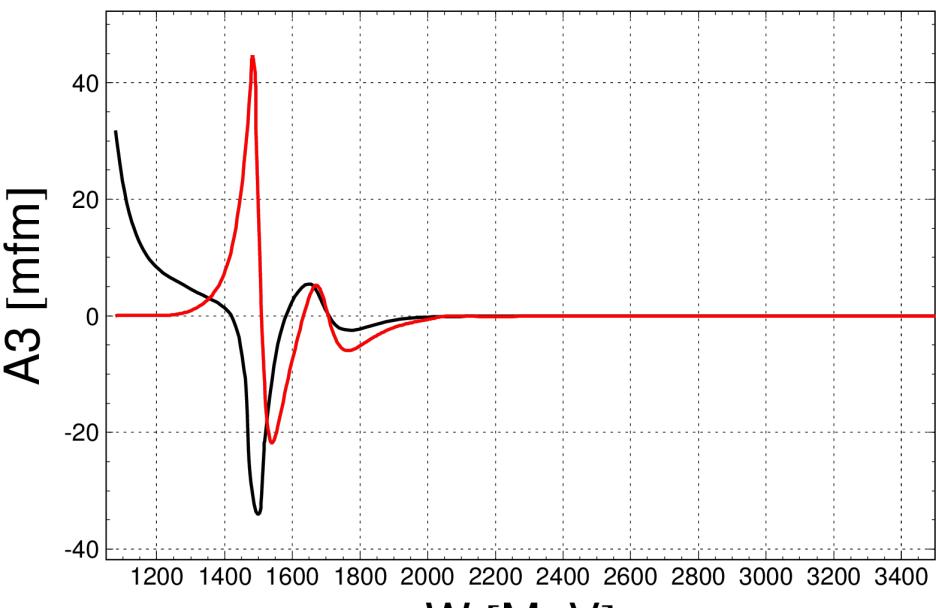
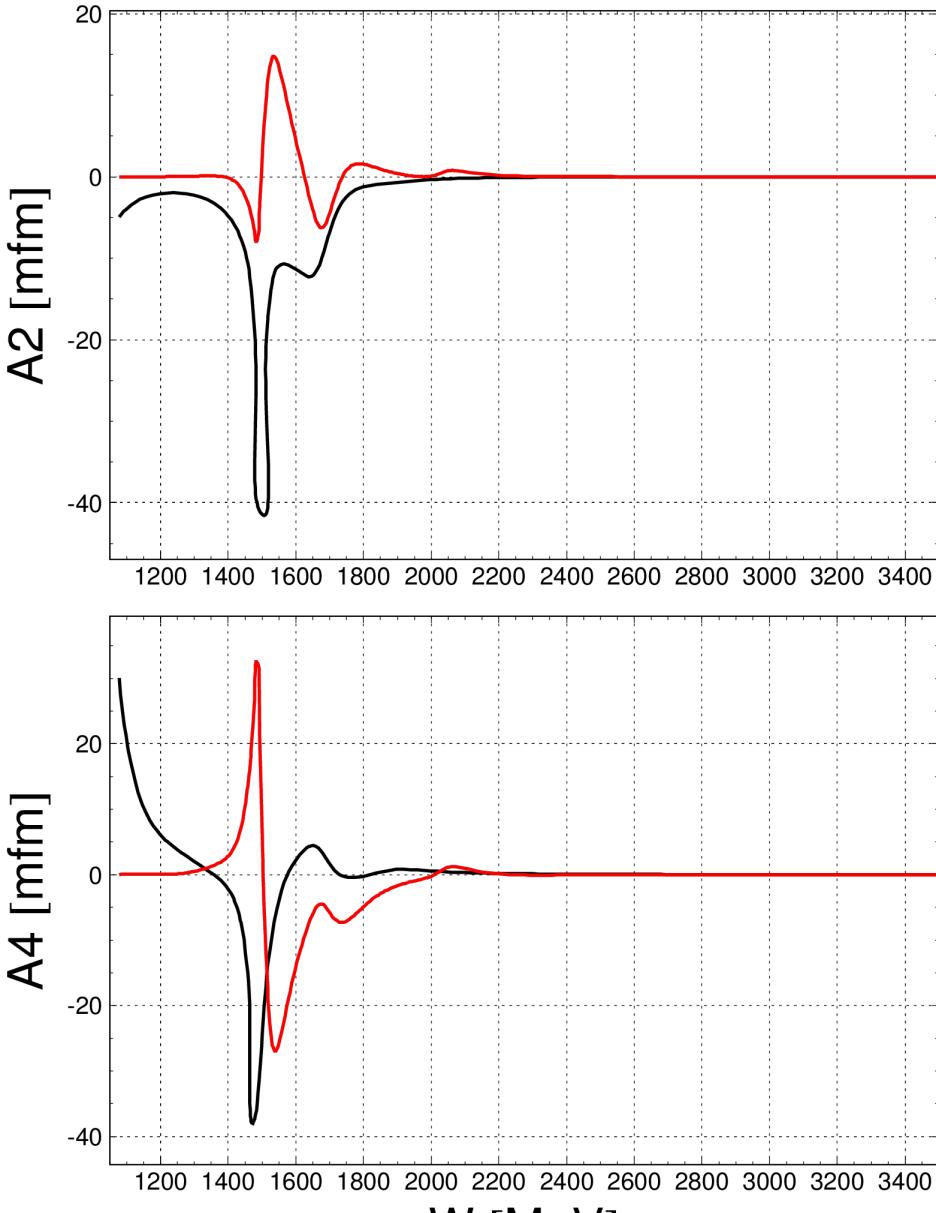
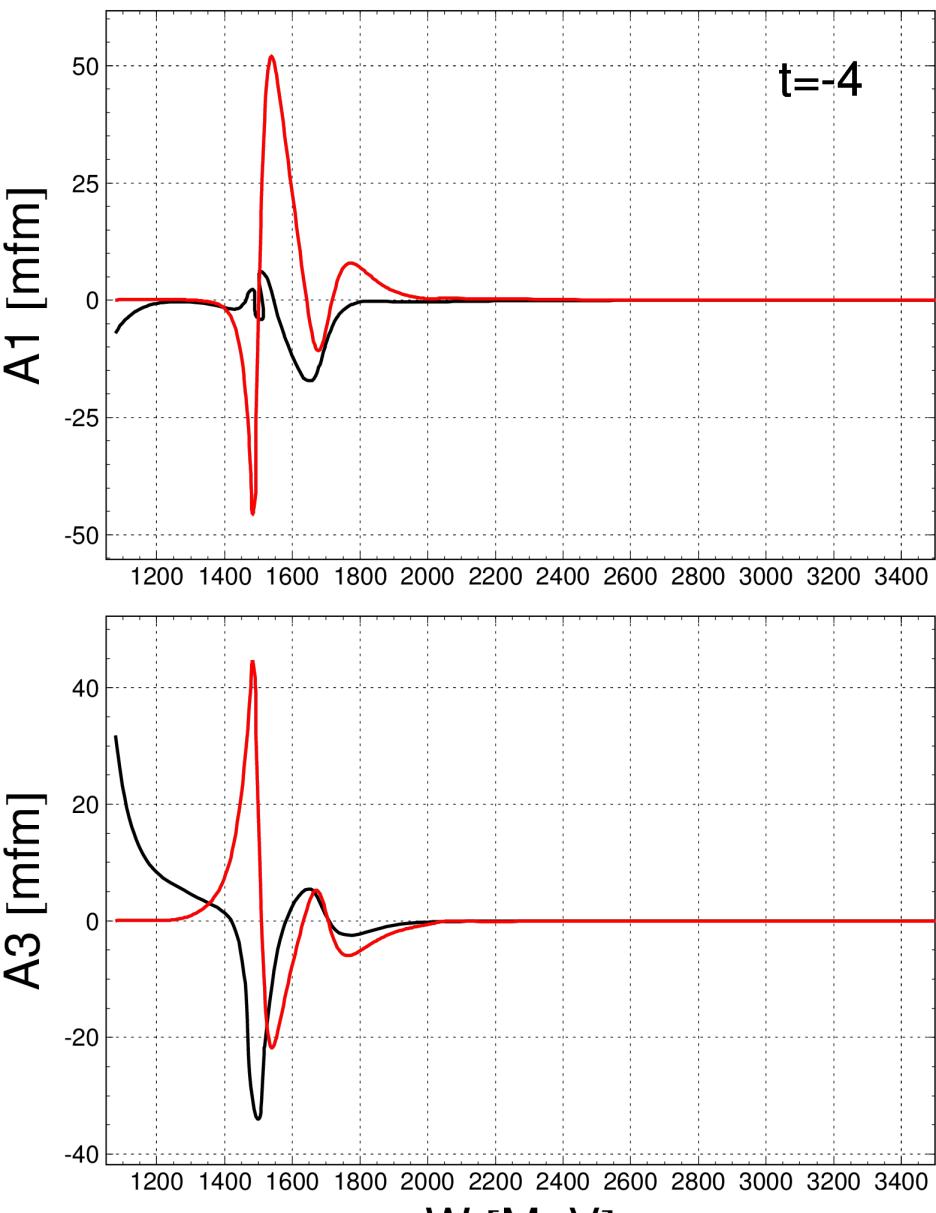
Imaginary part

Black – Fit7_DR; red (cyan) – EtaMAID2019-DR full solution (resonances)



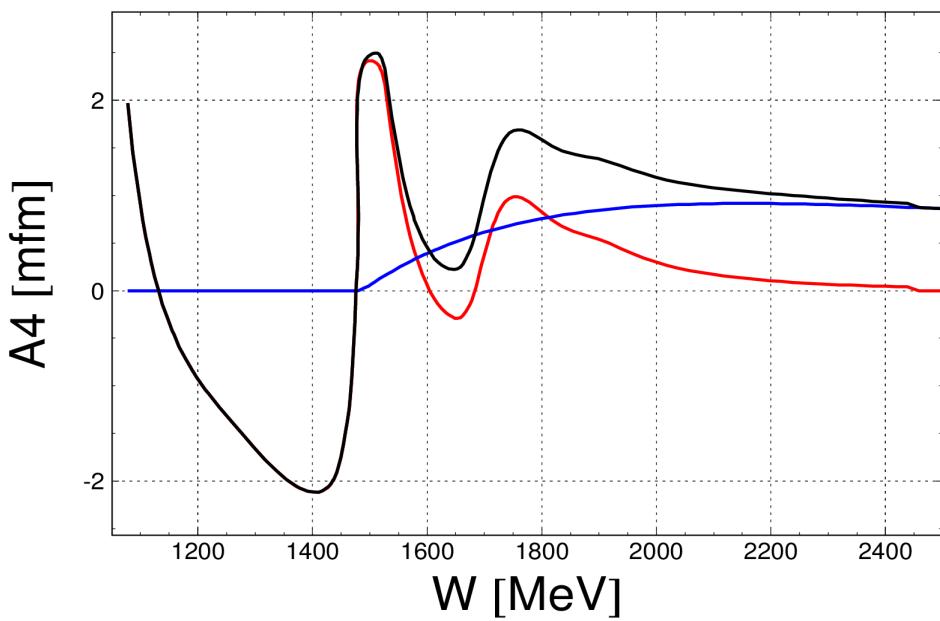
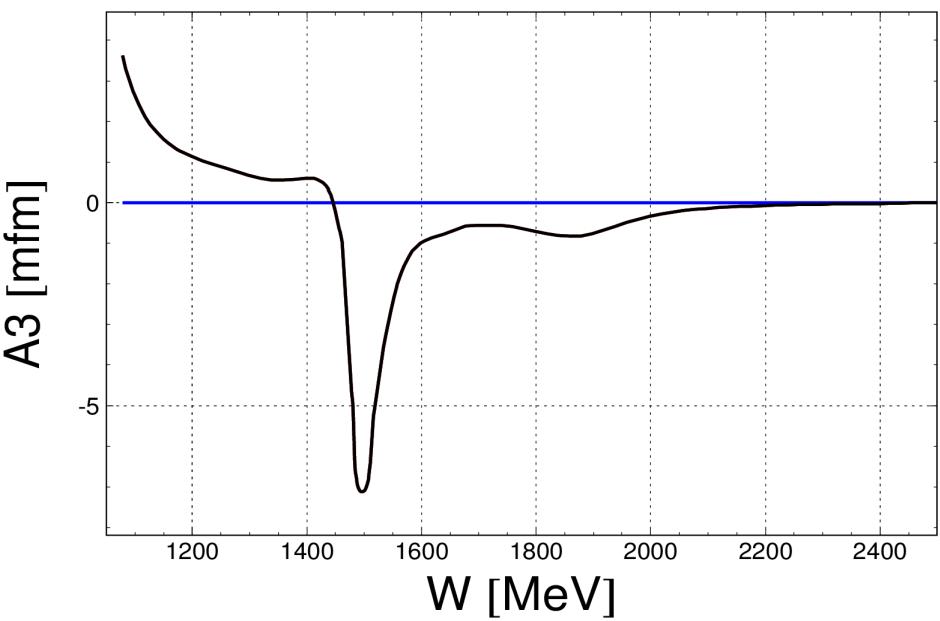
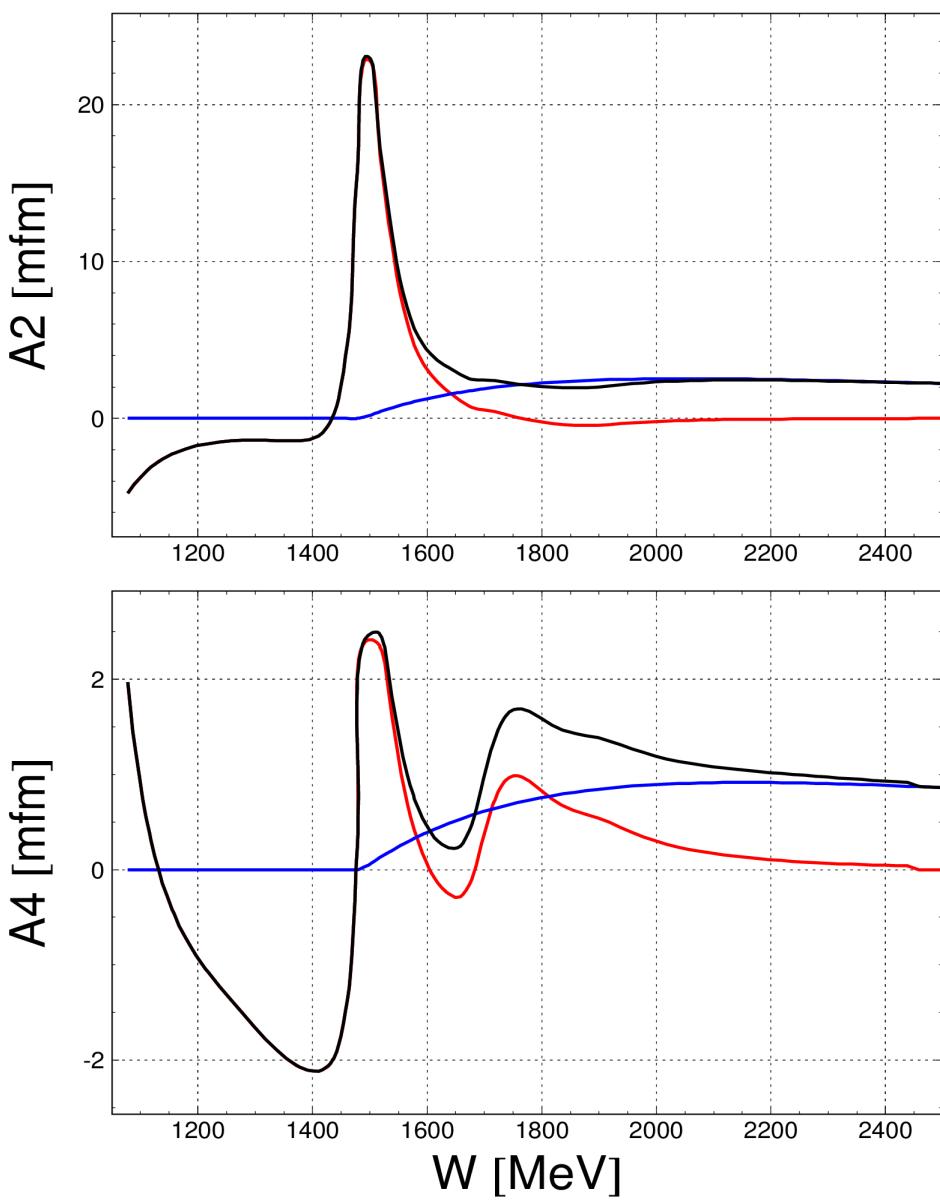
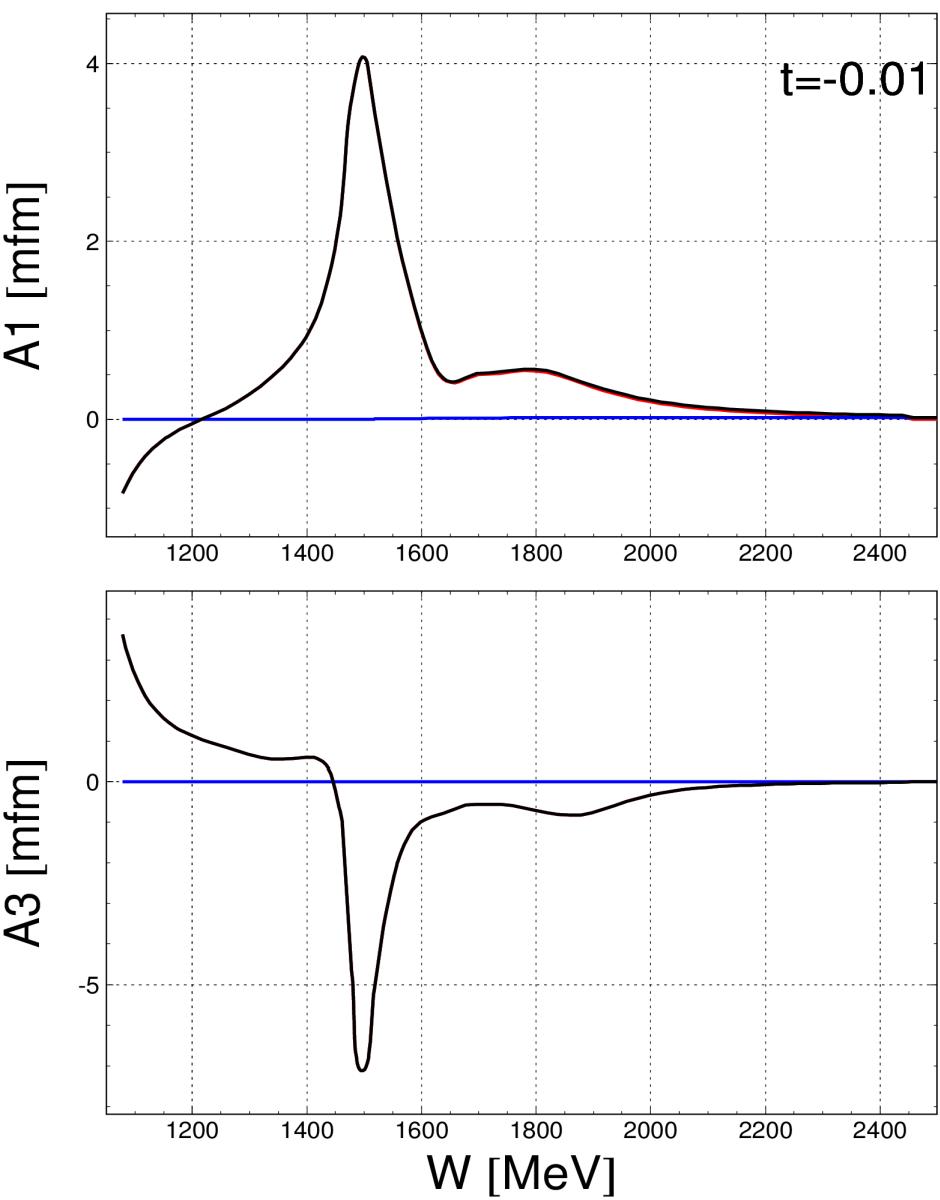


EtaMAID2019-DR: Invariant amplitudes



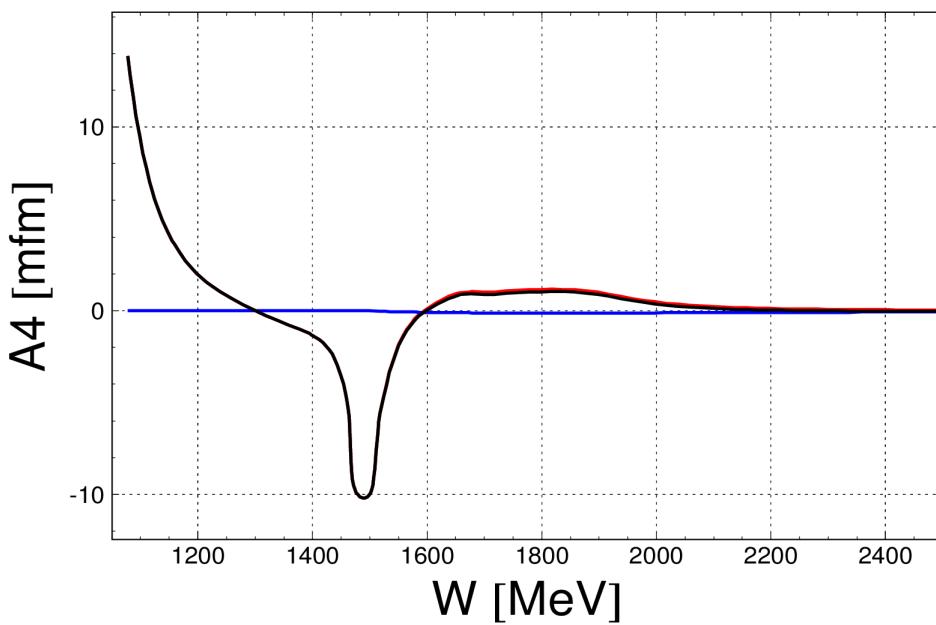
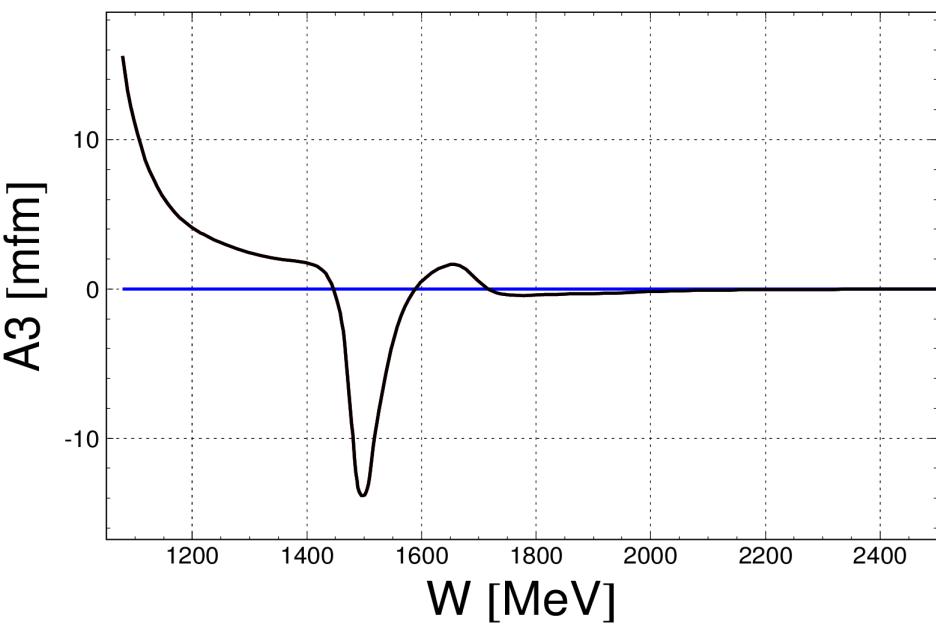
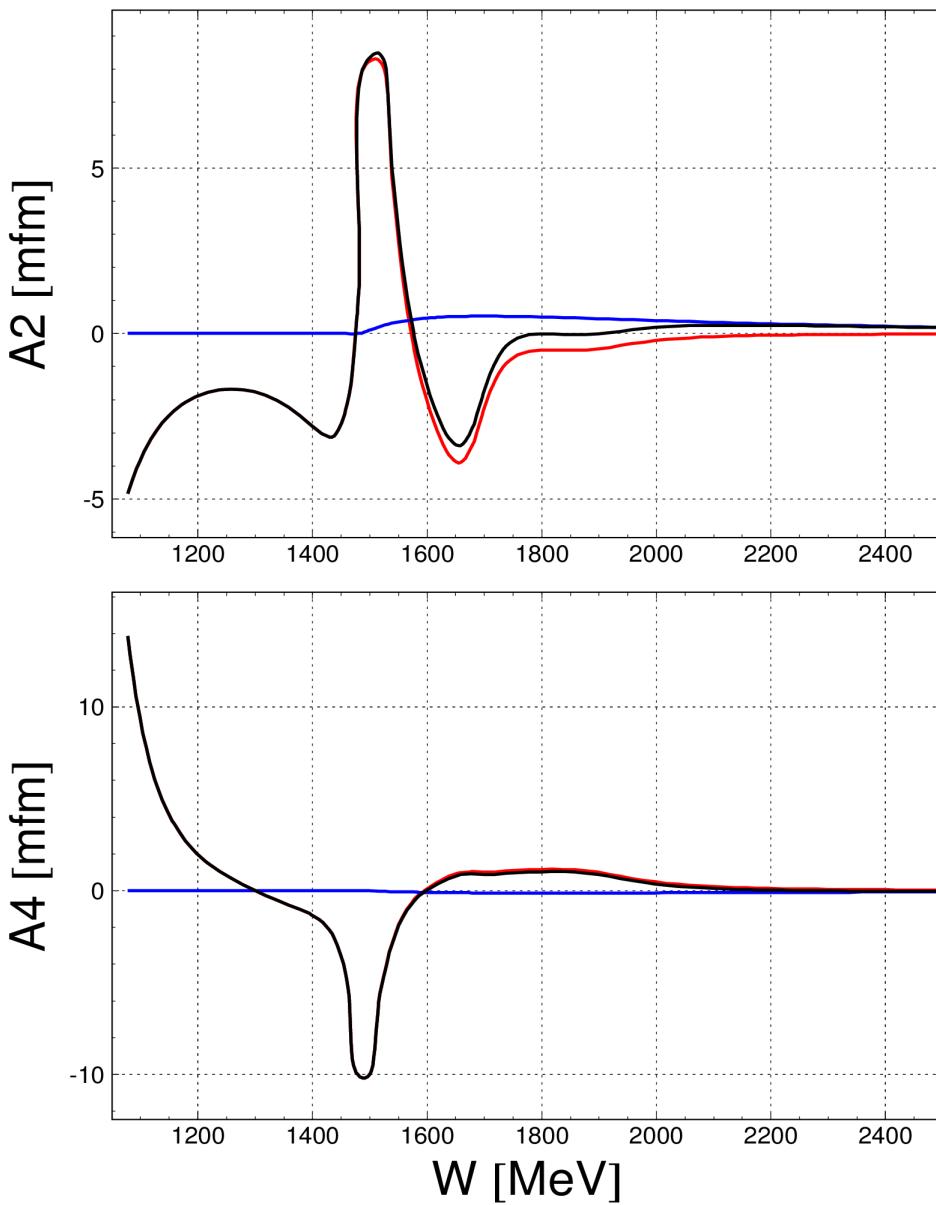
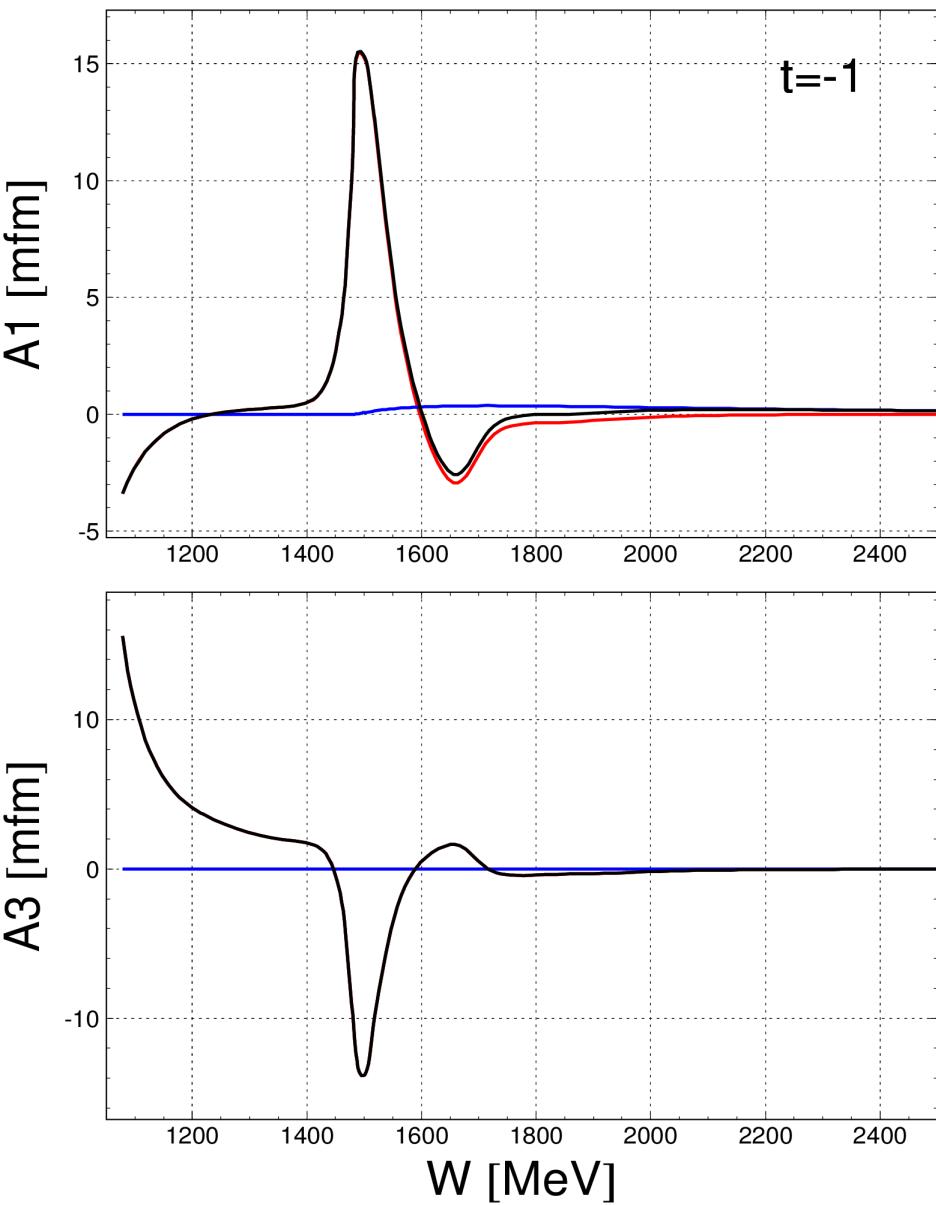


Fit7 DR: Invariant amplitudes, black-full, red-resonances, blue-background



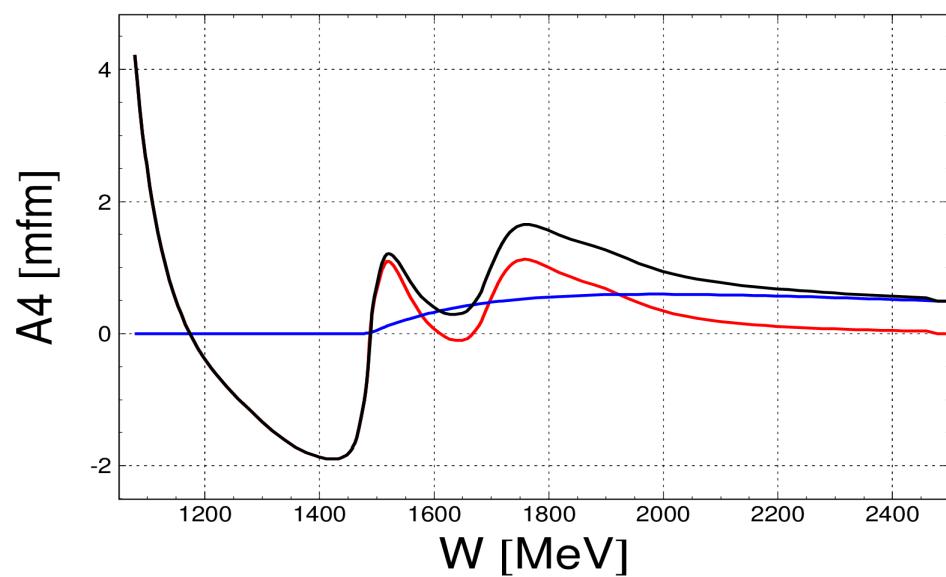
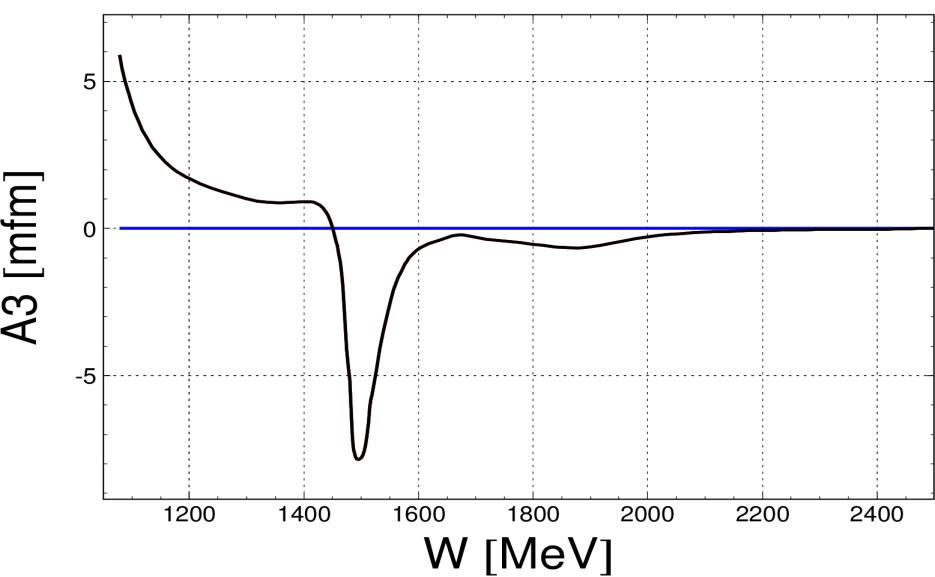
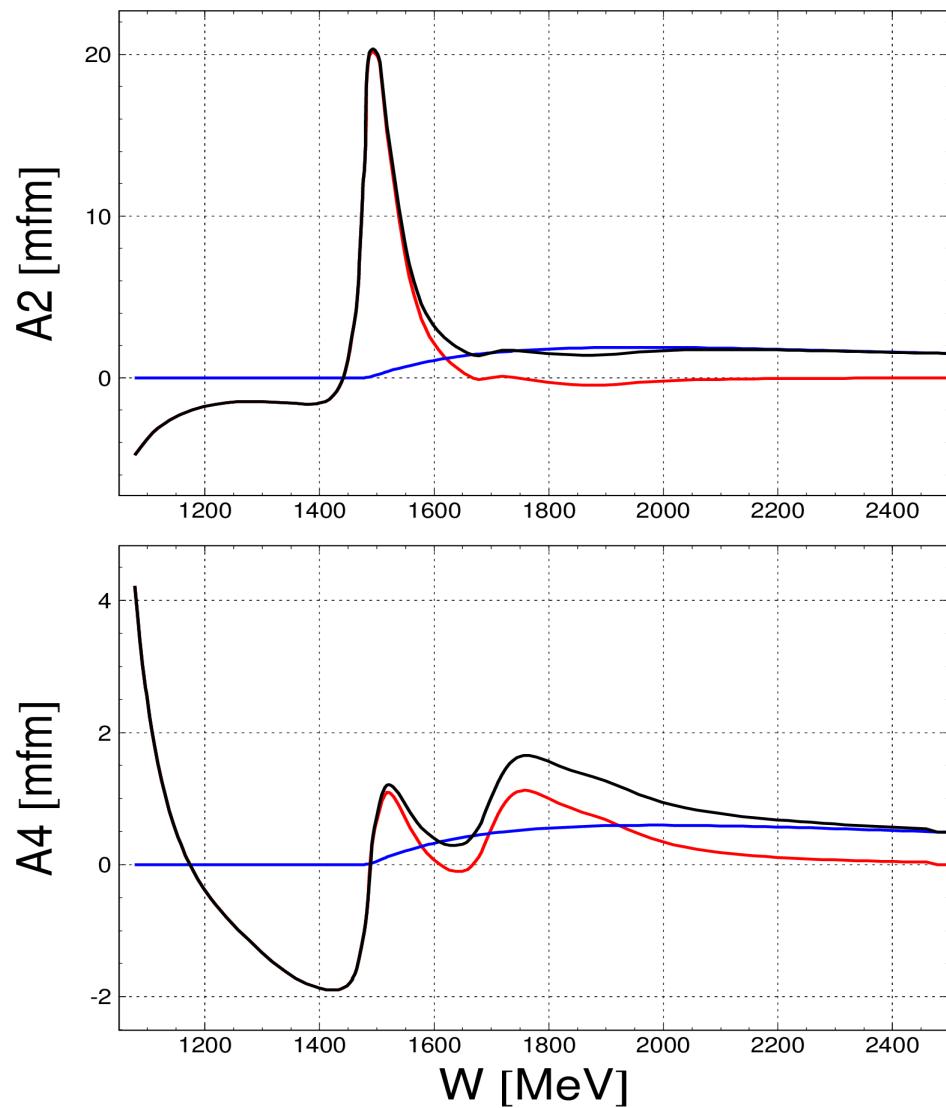
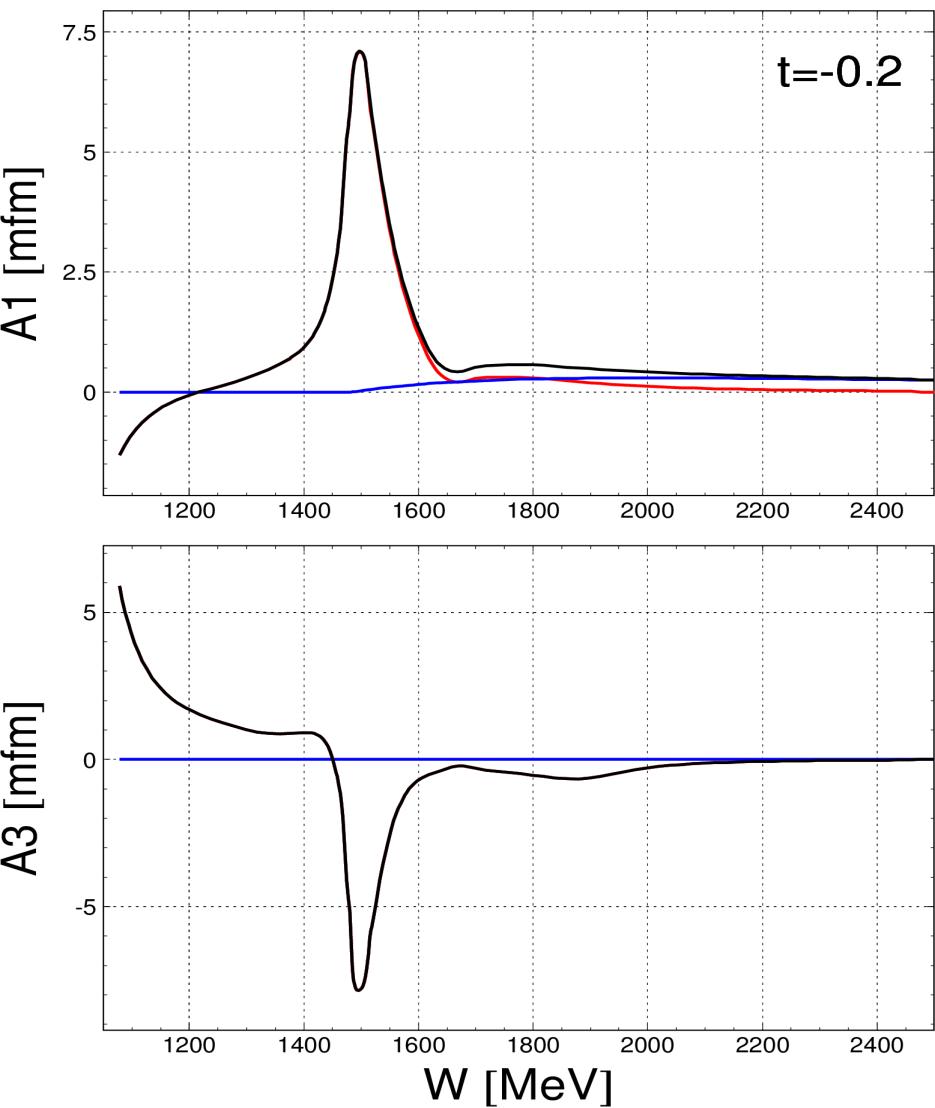


Fit7_DR: Invariant amplitudes, black-full, red-resonances, blue-background



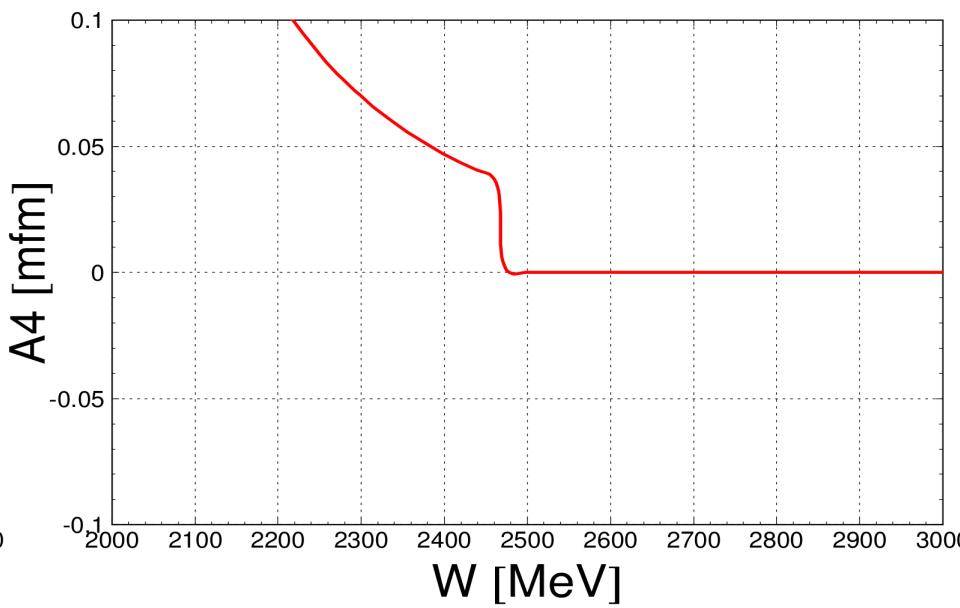
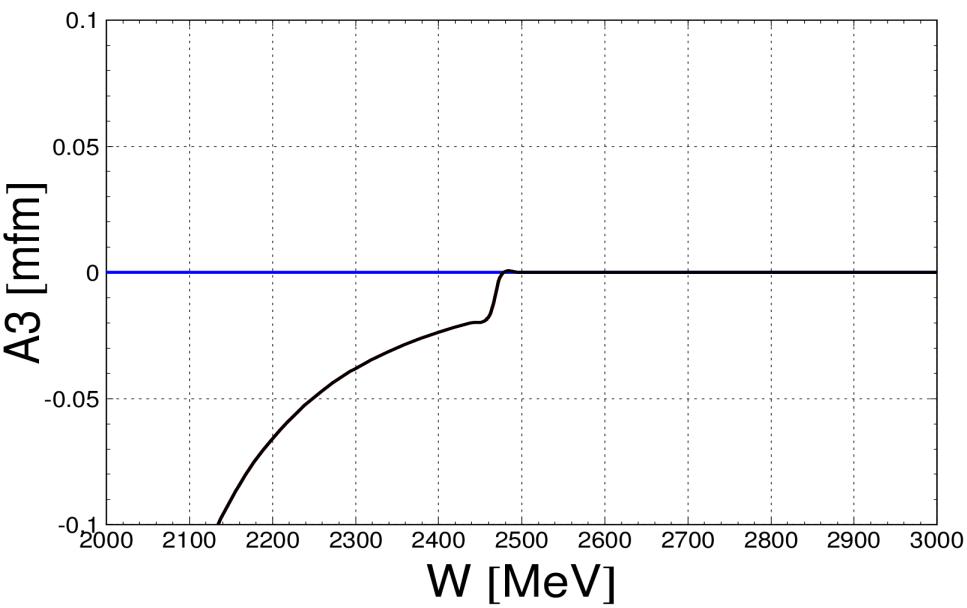
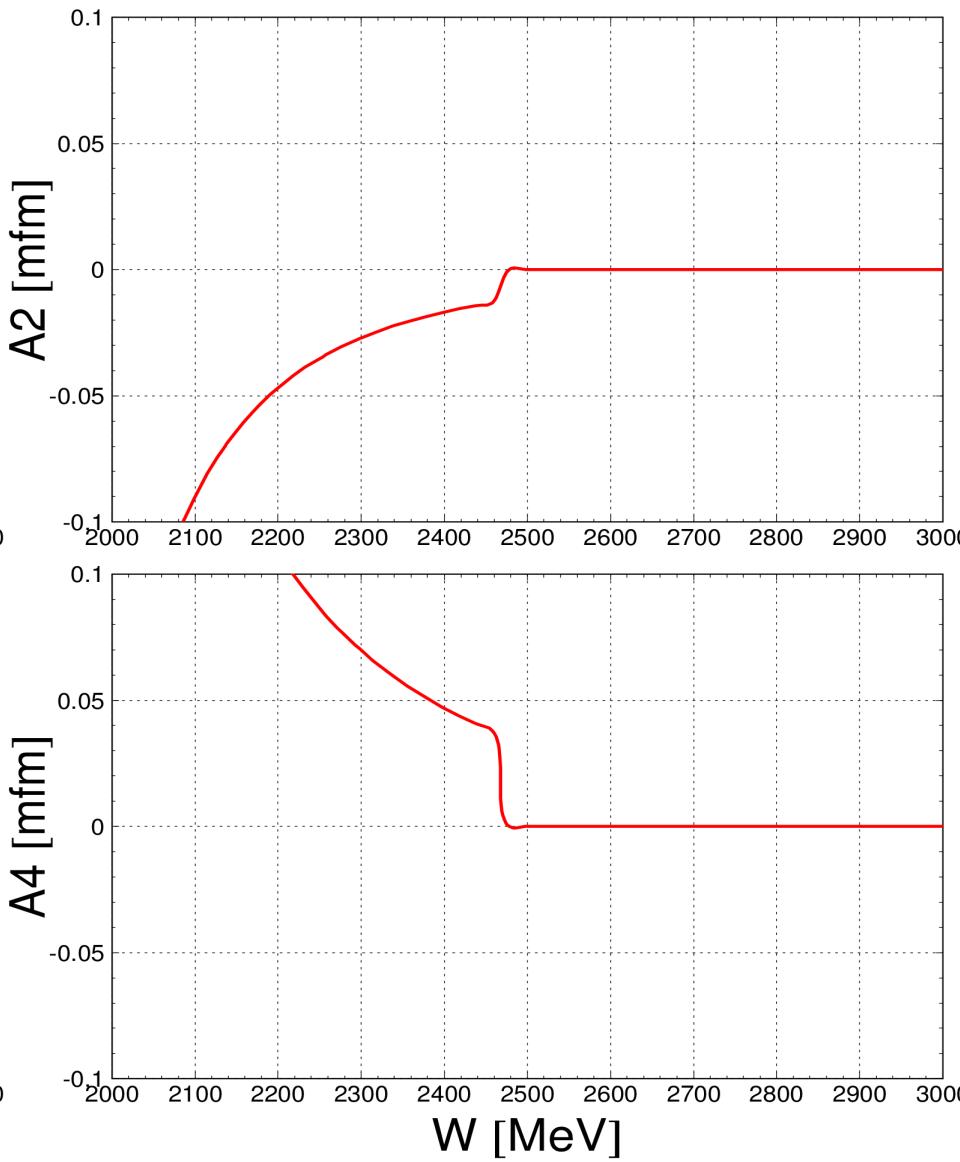
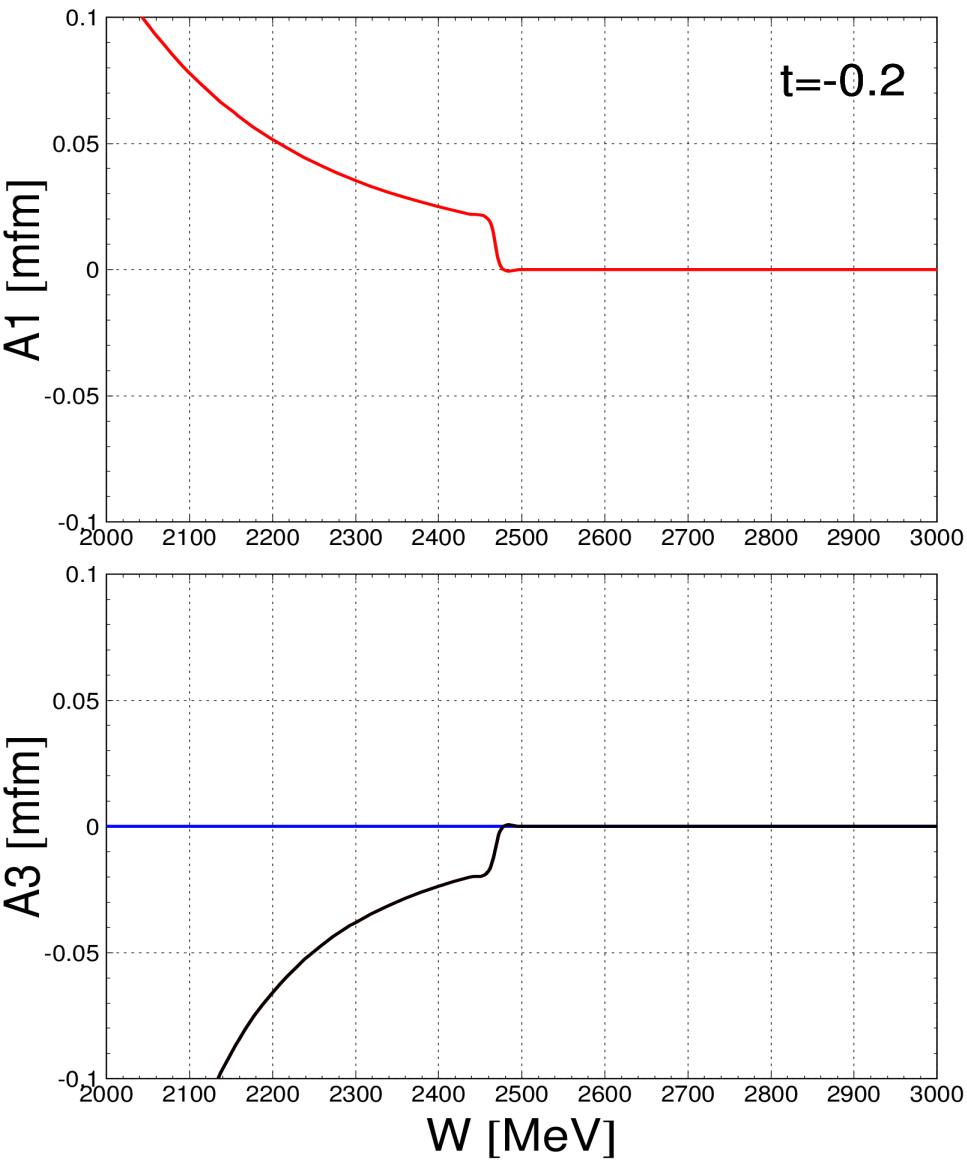


Fit7_DR: Invariant amplitudes, black-full, red-resonances, blue-background



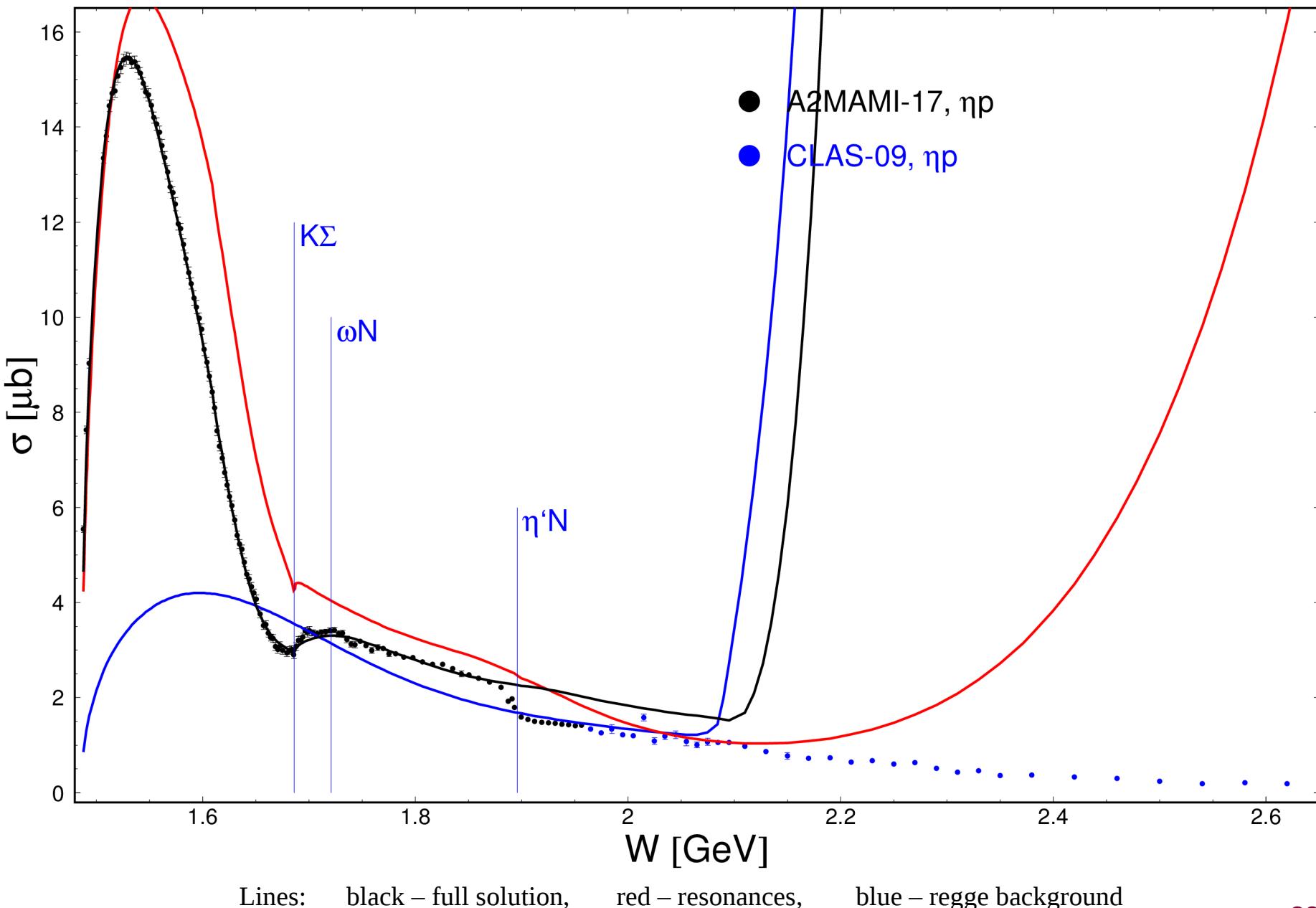


Fit7_DR: Invariant amplitudes, black-full, red-resonances, blue-background



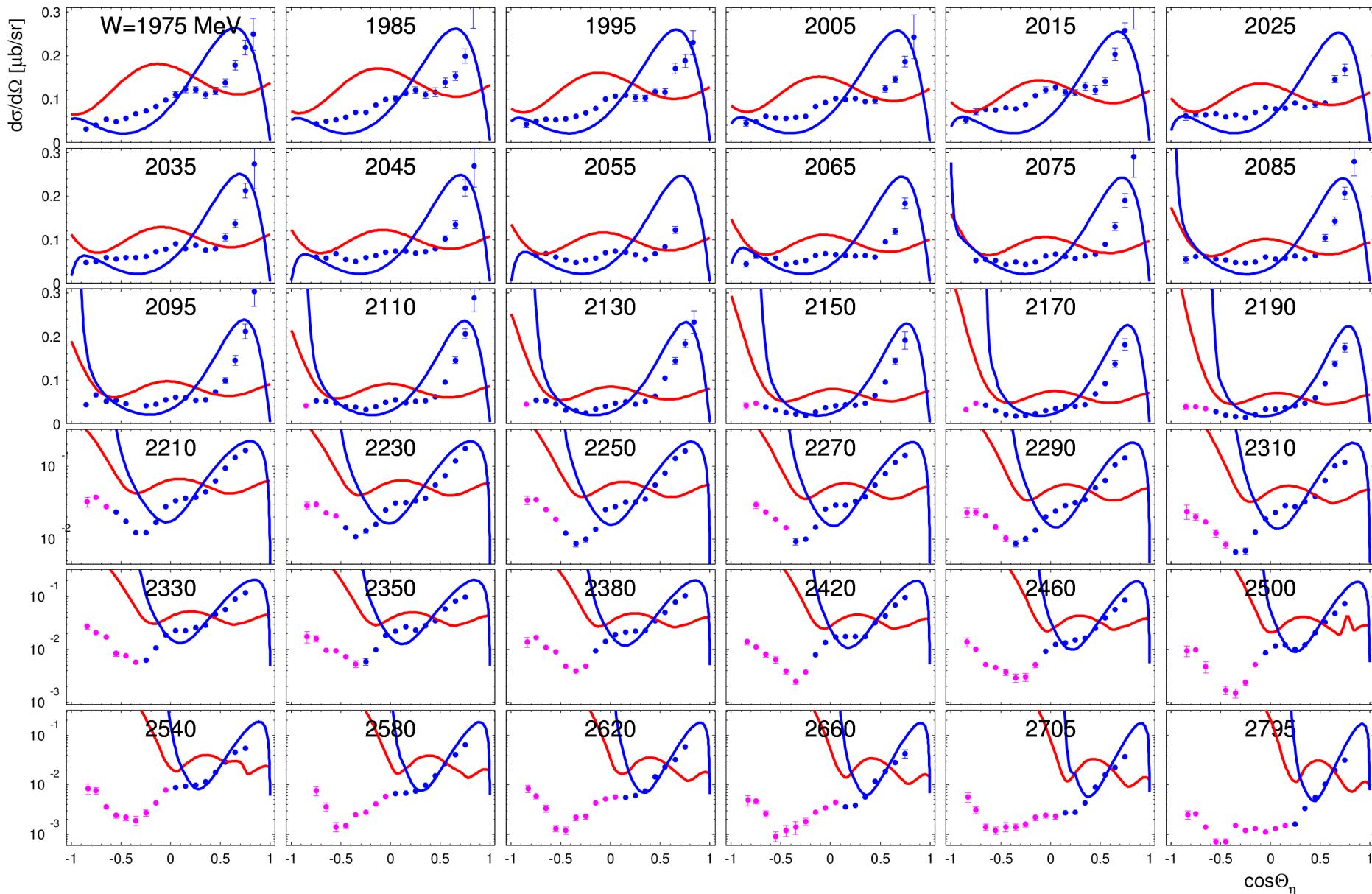
γ p → η p

Fit7_DR: Total cross sections



γ p → η p

Fit7_DR: Differential cross sections



Data: CLAS-09, blue points: $t > -2.3$, magenta points: $t < -2.3$
 Lines: red – resonances, blue – regge background