

# Z(4430)- Analysis Update



PANDA-PWG Meeting - Light Charmonium Exotics

21/04/2021

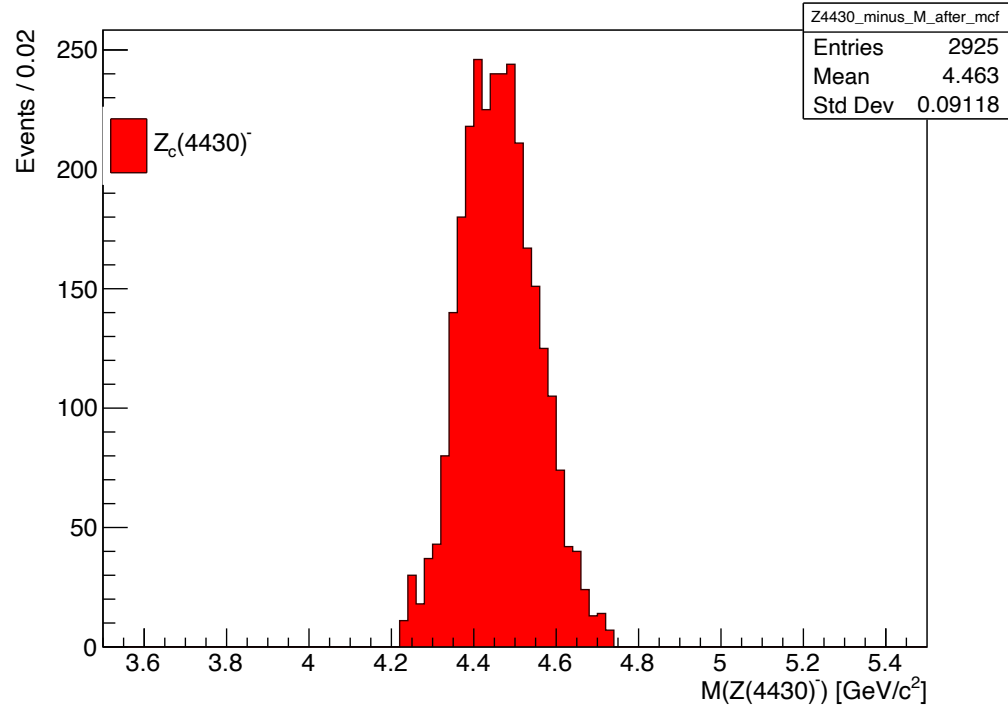
by

Umut Keskin

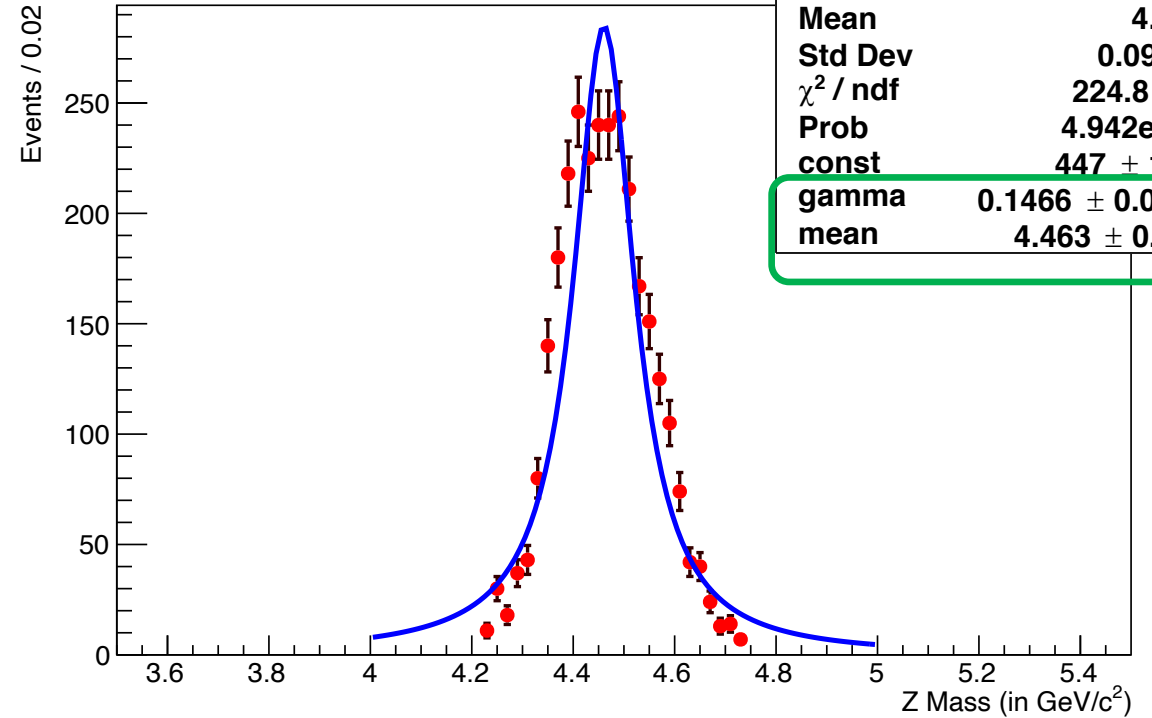


# Analysis : Z(4430)

After Mass Constraint Fit



Breit-Wigner Fit After Cuts

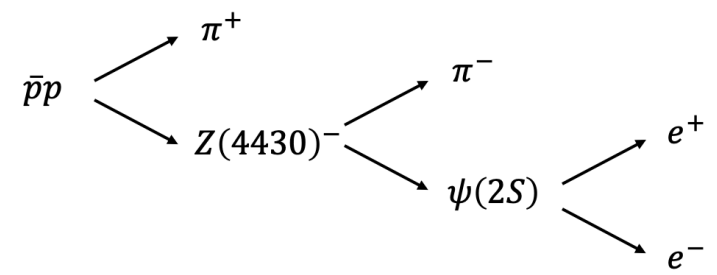


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* 21.04.2020 Updated by K. Goetzen. The format and convention are based on the current evt.pdl and PDG 2019
* - Updated particle data from http://pdg.lbl.gov/2019/mcdata/mass_width_2019.mcd and http://pdglive.lbl.gov
* - Ordering according to http://pdg.lbl.gov/2008/reviews/montecarlopp.pdf
*-----*
*
* [basic]      name          id          mass/GeV    width/GeV    max_Dm/GeV    3*charge  2*spin  lifetime*c/mm  PythiaId
add p Particle Z_c(4430)-    -99210443   4.4780000e+00  1.8100000e-01  1.8100000e+00   -3       2       0.0000000e+00 -99210443
    
```

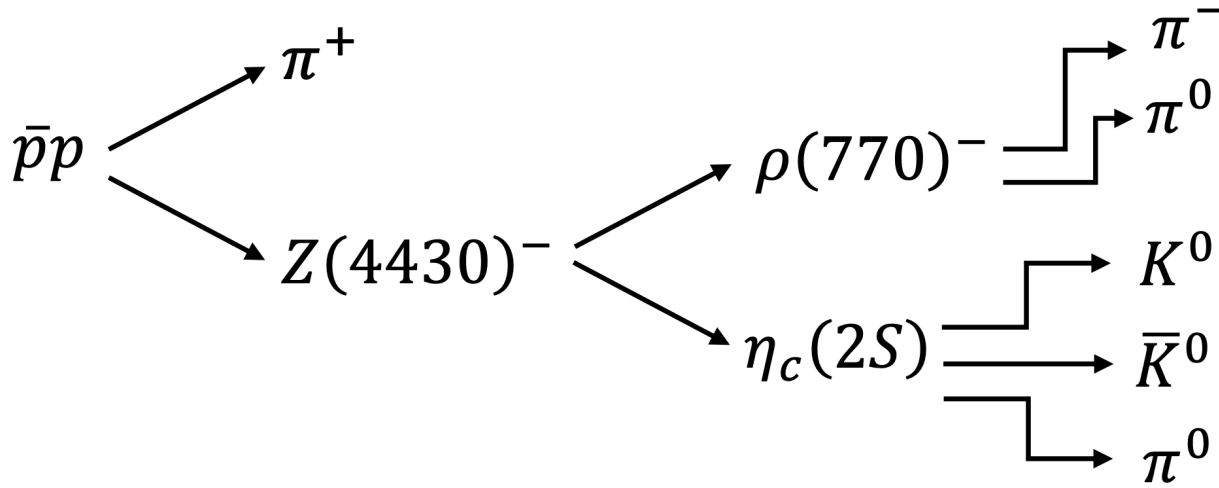
**Z(4430) Mass : 4478<sup>+15</sup><sub>-18</sub> MeV**  
**Z(4430) Width : 181 ± 31 MeV**

**Z(4430) Mass : 4463 ± 2 MeV**  
**Z(4430) Width : 146.6 ± 3.8 MeV**



# New Decay Channel & Decay File

$$\bar{p}p \rightarrow Z(4430)^- \pi^+ \rightarrow \rho(770)^- \eta_c(2S) \rightarrow \pi^- \pi^0 K^0 \bar{K}^0 \pi^0$$



## $c\bar{c}$ MESONS

(including possibly non- $q\bar{q}$  states)

$$\eta_c(2S) \quad I^G(J^{PC}) = 0^+(0^{-+})$$

Quantum numbers are quark model predictions.

[INSPIRE search](#)

$\eta_c(2S)$  MASS  $3637.5 \pm 1.1$  MeV (S = 1.2)

$\eta_c(2S)$  WIDTH  $11.3_{-2.9}^{+3.2}$  MeV

## Decay Modes

Mode	Fraction ( $\Gamma_i / \Gamma$ )	Scale Factor/ Conf. Level	P (MeV/c)
$\Gamma_1$ hadrons	not seen		
$\Gamma_2$ $K\bar{K}\pi$	$(1.9 \pm 1.2)\%$		1729

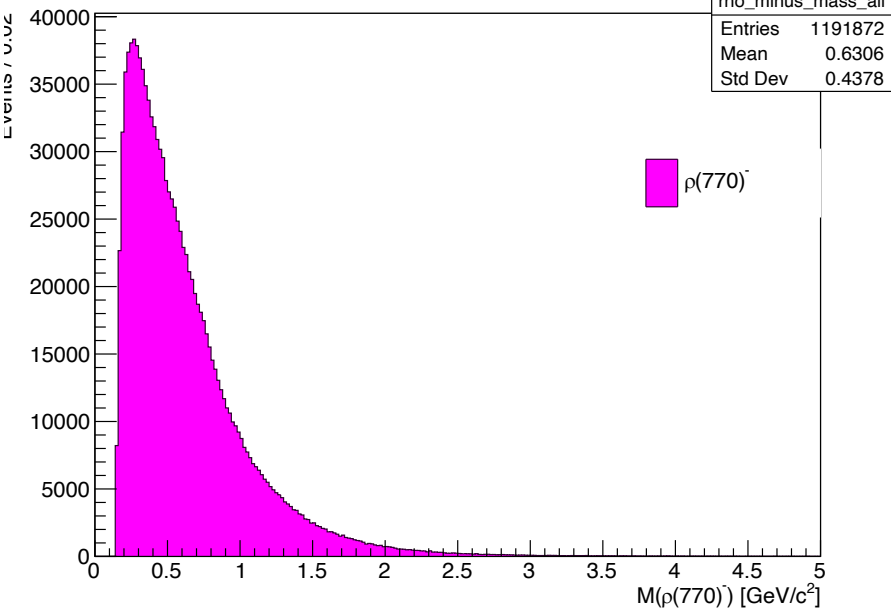
## $\rho(770)^\pm$ decays

$\Gamma_2$   $\pi^\pm \pi^0$  (100%)

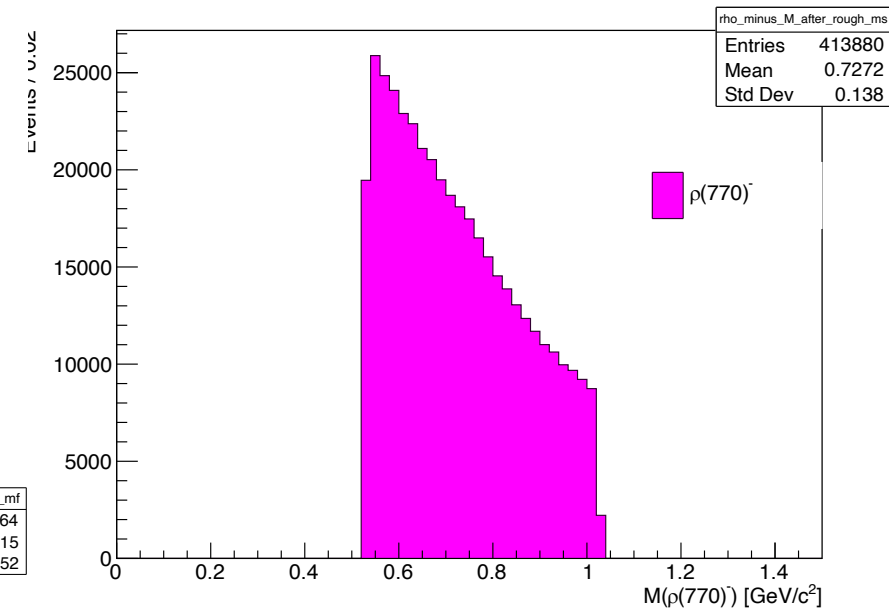
```

pp_Zc4430Minus_eta_c_nophot.dec
pp_Zc4430Minus_eta_c_nophot.dec > No Selection
1 noPhotos
2
3 Decay pbarpSystem1
4 1.0 Z_c(4430)- pi+ PHSP;
5 Enddecay
6
7 Decay Z_c(4430)-
8 1.0 eta_c(2S) rho- PHSP;
9 Enddecay
10
11 Decay eta_c(2S)
12 1.0 K0 anti-K0 pi0 PHSP;
13 Enddecay
14
15 Decay rho-
16 1.0 pi- pi0 PHSP;
17 Enddecay
18
19 End
    
```

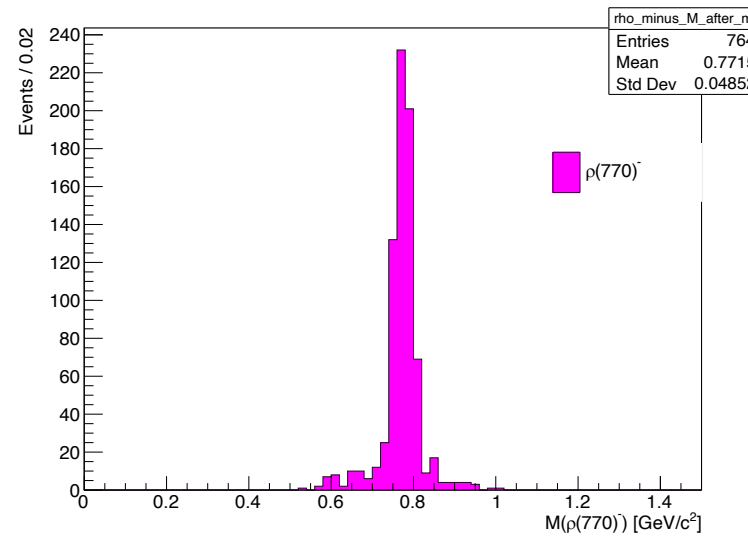
All Mass

Analysis :  $\rho(770)^-$  Mass Reco.

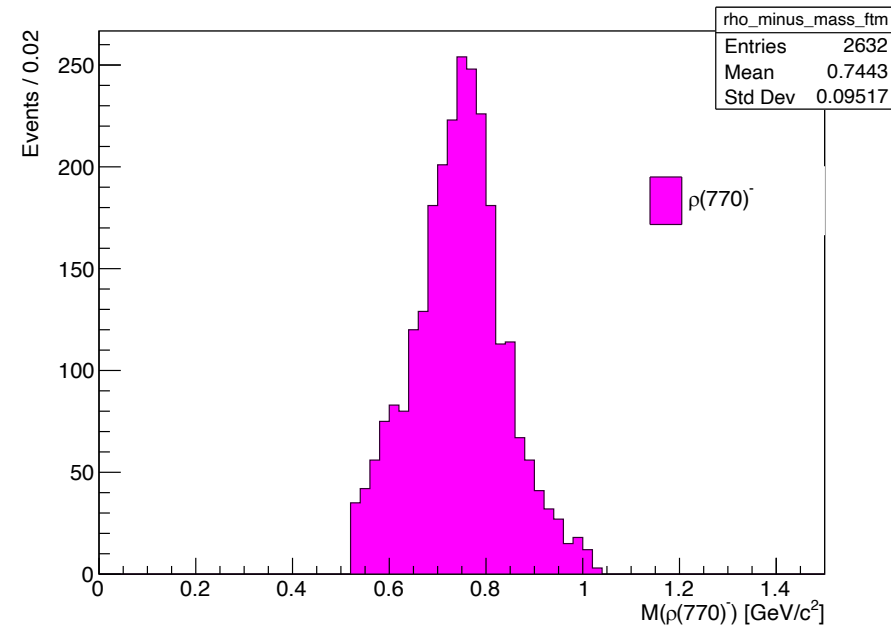
After Mass Selection



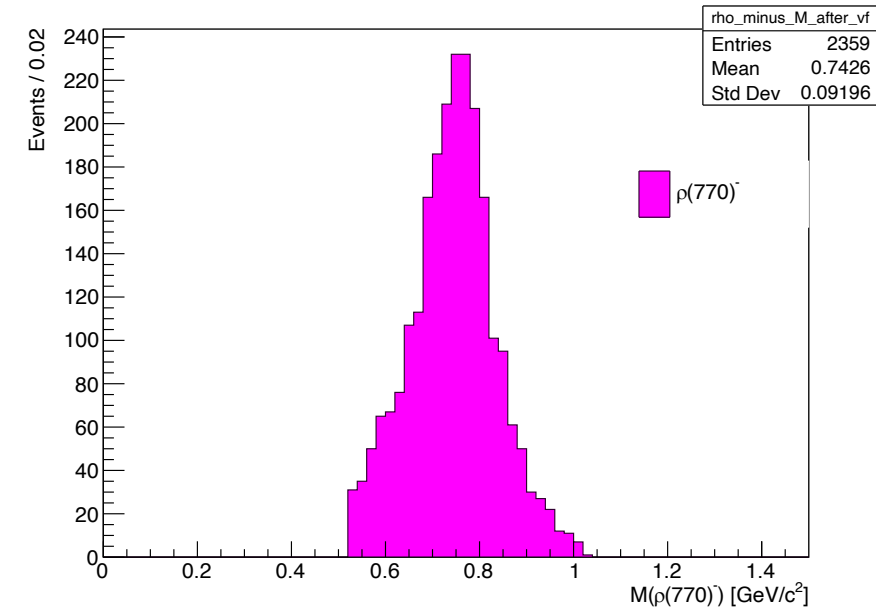
After Mass Constraint Fit



After Full Truth Match



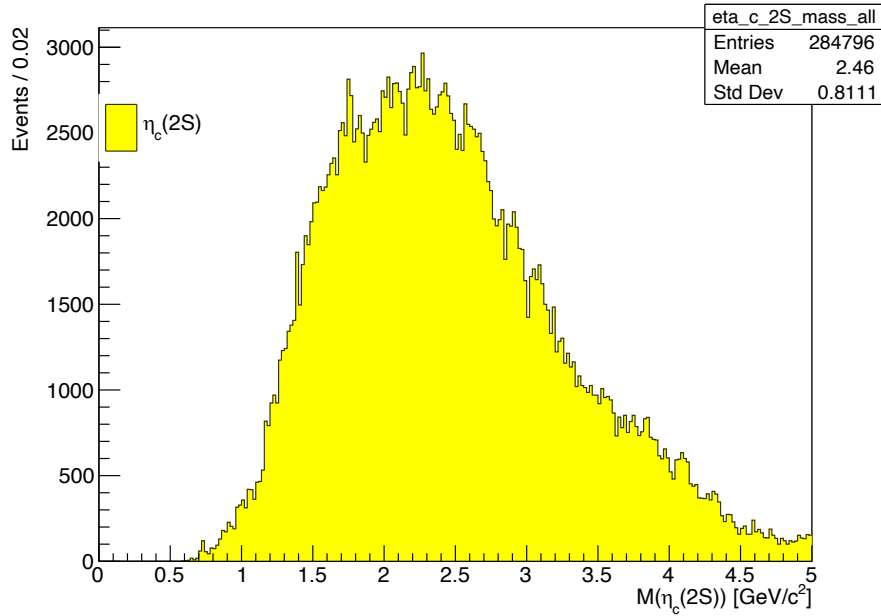
After Vertex Fit



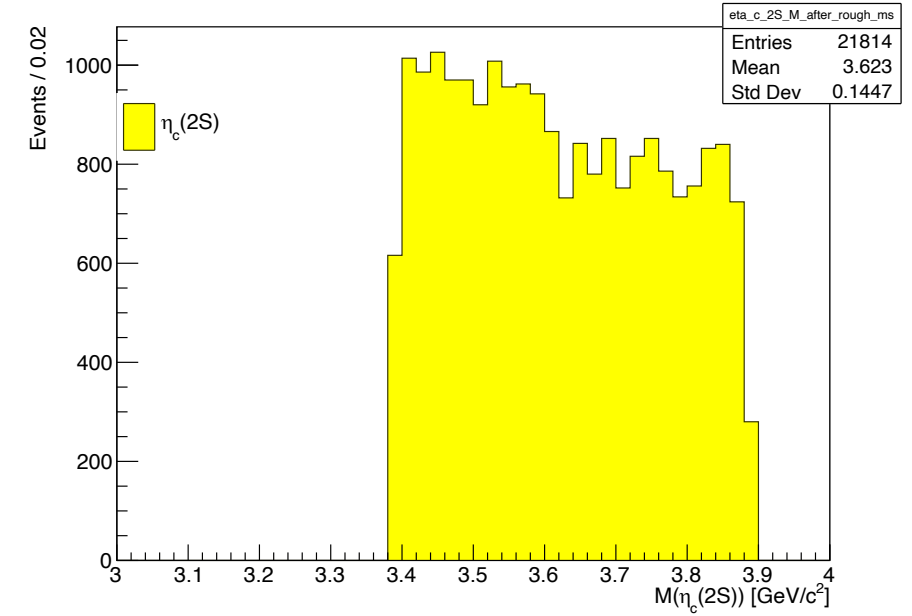
$\rho(770)^-$  Mass:  $775.26 \pm 0.25$  MeV

# Analysis : $\eta_c(2S)$ Mass Reco.

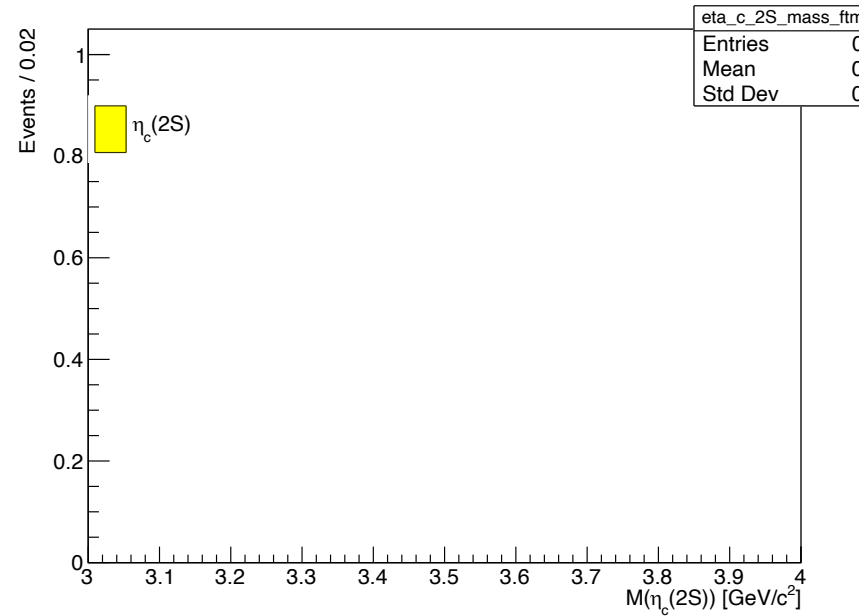
## All Mass



## After Mass Selection



## After Full Truth Match



$\eta_c(2S)$  Mass:  $3637.5 \pm 1.1$  MeV