- Model: Zc3900 + f0500 + f0980
- ToyMC generation: BESEVTGEN+KKMC
- The PHSP MC sample size is about 2000 times of the toyMC size, at least over 4000k for PHSP MC
- The psi(3686) charged channel and psi(3686) neutral channel are combined
- The parameters of resonances are fixed

```
SHARE_sigma_mass =    0.526  -1 999 999
SHARE_sigma_width =   0.535  -2 999 999
SHARE_f0980_mass =    0.965  -1 999 999
SHARE_f0980_g1 =   0.165  -2 999 999
SHARE_f0980_g2 =   4.21   -2 999 999
SHARE_Zc3900_mass =   3.89612 -0.0001  3.85 3.95
SHARE_Zc3900_width =  0.03755 -0.0001  0.025 0.045
```

```
ana_4246_sigma_para1_mag      =      100          -1    0    0
ana_4246_sigma_para1_phase    =      0            -1    0    0
ana_4260_sigma_para1_mag      =      100          -1    0    0
ana_4260_sigma_para1_phase    =      0            -1    0    0
ana_4270_sigma_para1_mag      =      100          -1    0    0
ana_4270_sigma_para1_phase    =      0            -1    0    0
ana_4280_sigma_para1_mag      =      100          -1    0    0
ana_4280_sigma_para1_phase    =      0            -1    0    0
ana_4290_sigma_para1_mag      =      100          -1    0    0
ana_4290_sigma_para1_phase    =      0            -1    0    0
```

$$\frac{d\sigma}{d\Phi_n} \propto -\frac{1}{2}\sum_{\mu=1}^{2}\tilde{g}_{\nu\nu'}(p_{(\psi)})A^{\mu\nu}A^{*\mu\nu'}$$

$$= -\frac{1}{2}\sum_{i,j}\Lambda_i\Lambda_j^*\sum_{\mu=1}^{2}U_i^{\mu\nu}\tilde{g}_{\nu\nu'}(p_{(\psi)})U_j^{*\mu\nu'}$$

$$U^{\mu\nu}_{(Y\to Z_c^{\pm}\pi^{\mp})SS} = \tilde{g}^{\mu\nu}_{(Z_c^+)}f^{(Z_c^+)}_{(01)} + \tilde{g}^{\mu\nu}_{(Z_c^-)}f^{(Z_c^-)}_{(02)}$$

$$U^{\mu\nu}_{(Y\to Z_c^{\pm}\pi^{\mp})SD} = \tilde{t}^{(2)\mu\nu}_{(\psi\pi^+)}f^{(Z_c^+)}_{(01)} + \tilde{t}^{(2)\mu\nu}_{(\psi\pi^-)}f^{(Z_c^-)}_{(02)}$$

$$U^{\mu\nu}_{(Y\to Z_c^{\pm}\pi^{\mp})DS} = \tilde{T}^{(2)\mu\lambda}_{(Z_c^+\pi^-)}\tilde{g}_{(Z_c^+)\lambda\sigma}g^{\sigma\nu}f^{(Z_c^+)}_{(01)} + \tilde{T}^{(2)\mu\lambda}_{(Z_c^-\pi^+)}\tilde{g}_{(Z_c^-)\lambda\sigma}g^{\sigma\nu}f^{(Z_c^-)}_{(02)}$$

$$U^{\mu\nu}_{(Y\to\psi(2S)f_0)SS} = \langle\psi f_0|01\rangle = g^{\mu\nu}f^{(f_0)}_{(12)}$$

$$U^{\mu\nu}_{(Y\to\psi(2S)f_0)DS} = \langle\psi f_0|21\rangle = \tilde{T}^{(2)\mu\nu}_{(\psi f_0)}f^{(f_0)}_{(12)}$$

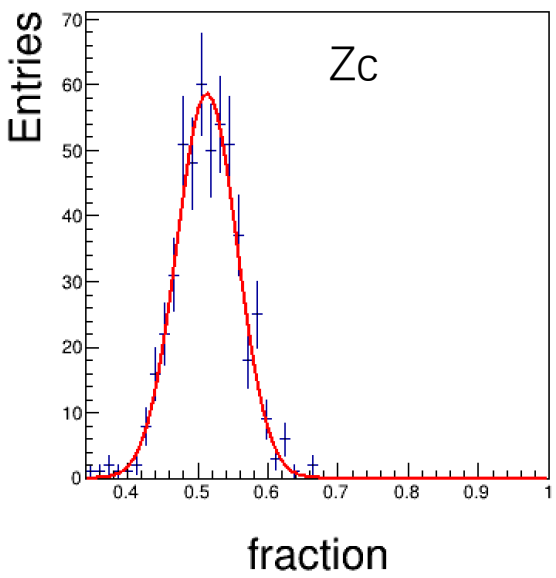
$$U^{\mu\nu}_{(Y\to Z_c^{\pm}\pi^{\mp})DD} = \tilde{T}^{(2)\mu\lambda}_{(Z_c^+\pi^-)}\tilde{t}^{(2)}_{(\psi\pi^+)\lambda\sigma}g^{\sigma\nu}f^{(Z_c^+)}_{(01)} + \tilde{T}^{(2)\mu\lambda}_{(Z_c^-\pi^+)}\tilde{t}^{(2)}_{(\psi\pi^-)\lambda\sigma}g^{\sigma\nu}f^{(Z_c^-)}_{(02)}$$

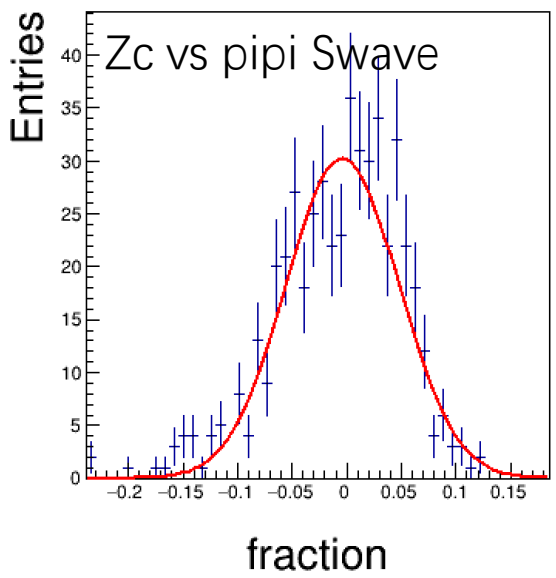
- 300 sets of toyMC and 300 sets of PHSP MC are generated separately with different random number

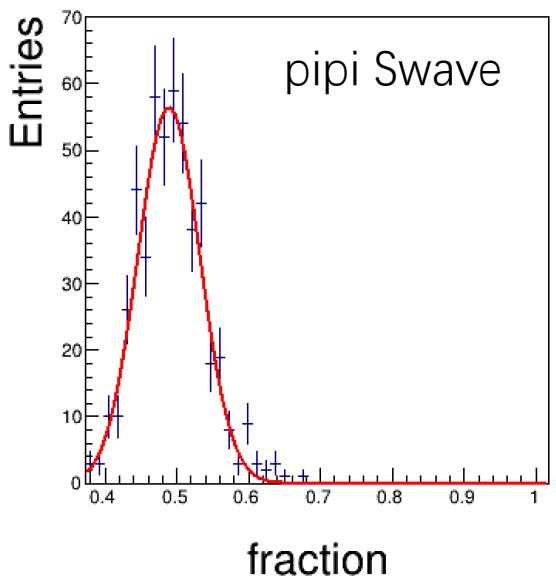
$$Decay: Y \quad \rightarrow Z_c \quad \pi, Z_c \rightarrow \psi \quad \pi$$
$$J^{PC}: 1^{--} \quad \rightarrow J^P \quad 0^-, J^P \rightarrow 1^{--} \quad 0^-$$

- The magnitude and phase of Zc->pi psi(2S) are shared by different energy points

- For each set of toyMC, 500 sets parameters are generated randomly according to the fit result
- Fraction distributions can be obtained, after fiting with Gaussian function, the widths are considered as the error of fraction

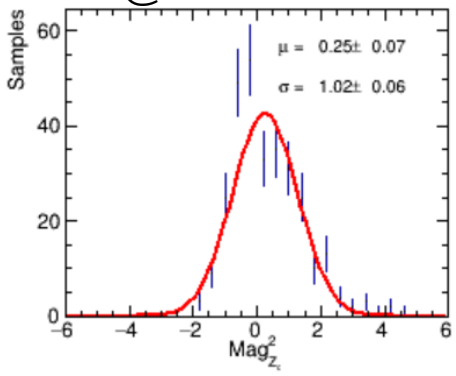


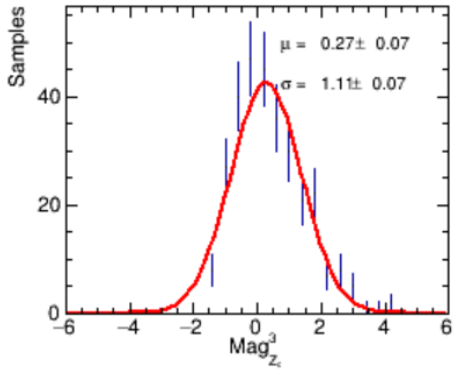


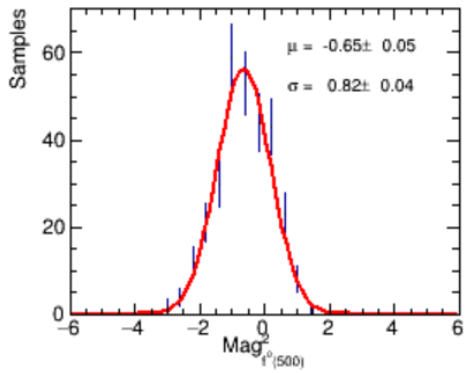


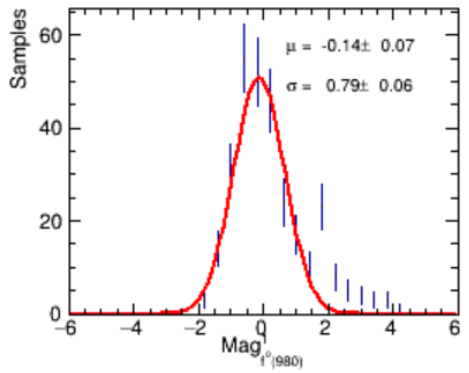
@4246

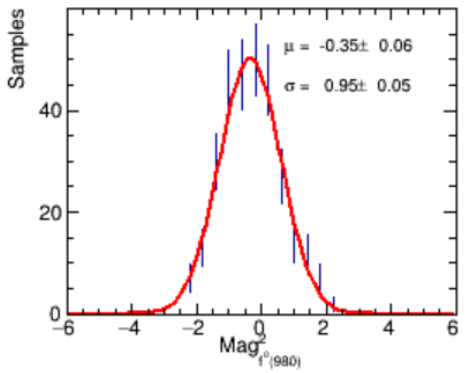
Pull distributions of parameters

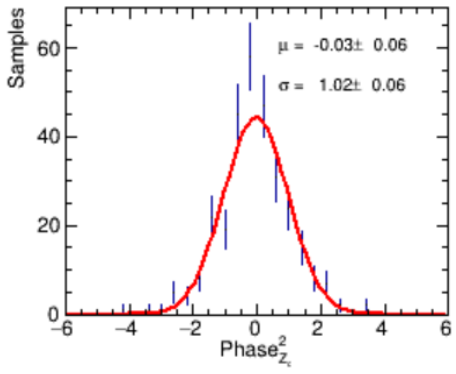


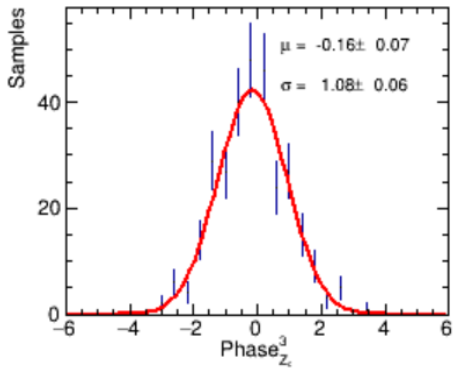


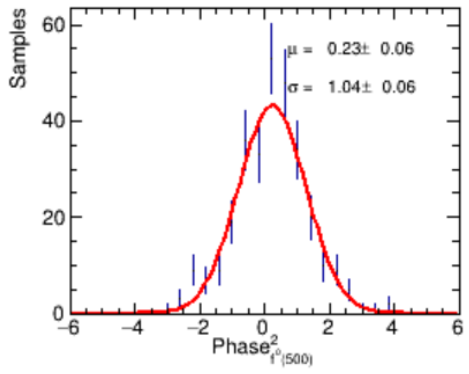


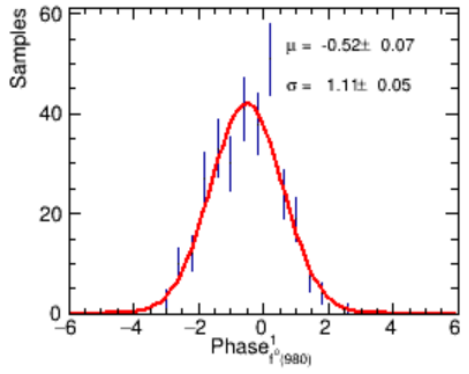


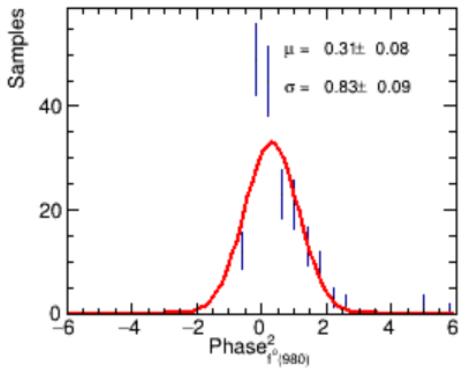




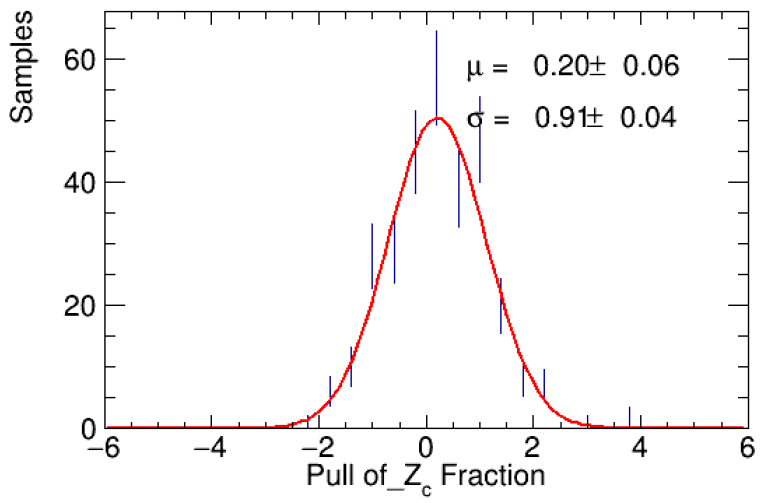


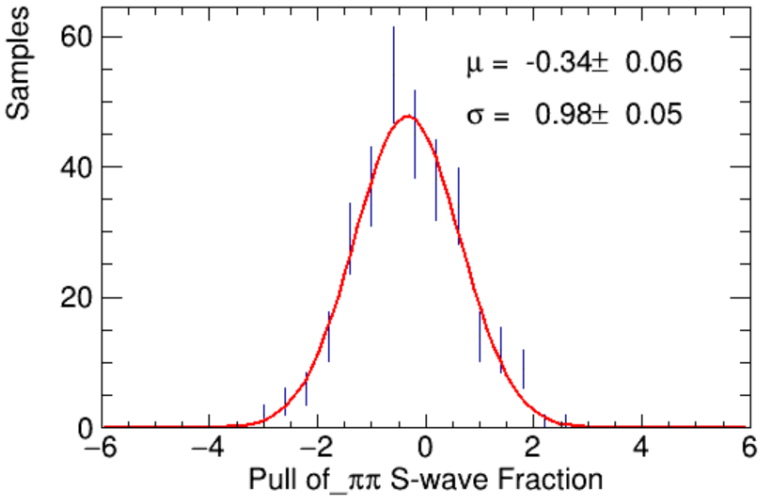






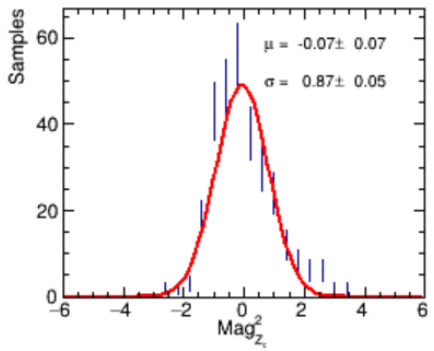
Pull distributions of fraction

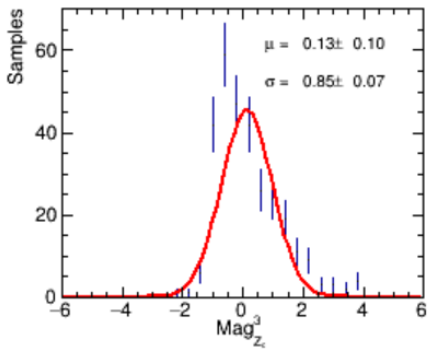


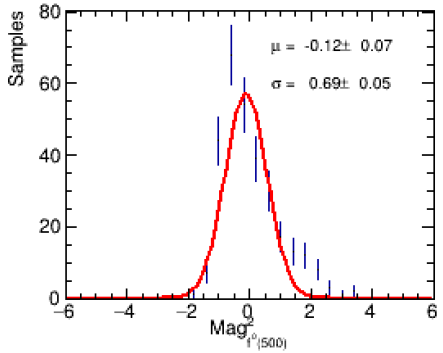


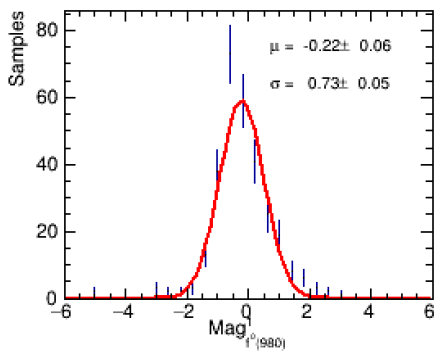
@4260

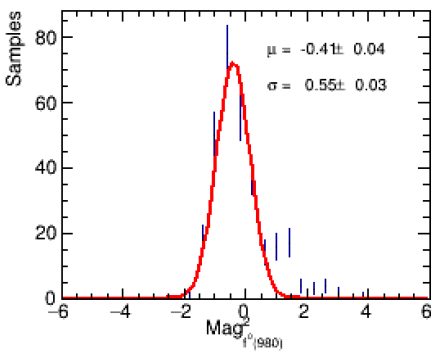
Pull distributions of parameters

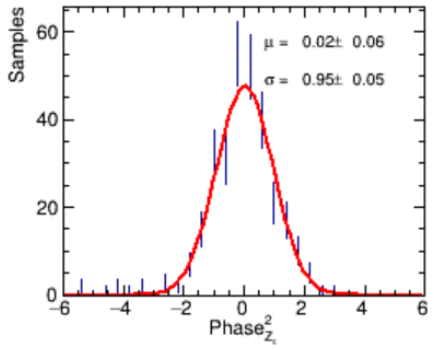


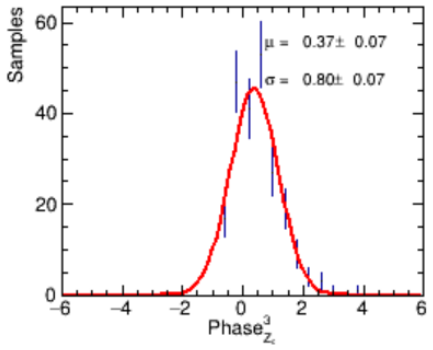


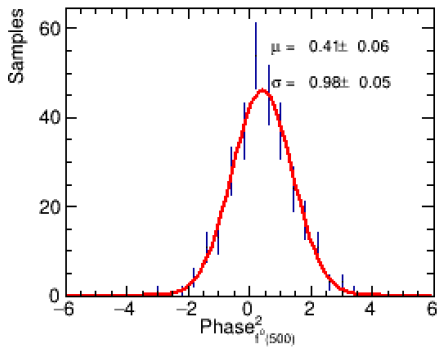


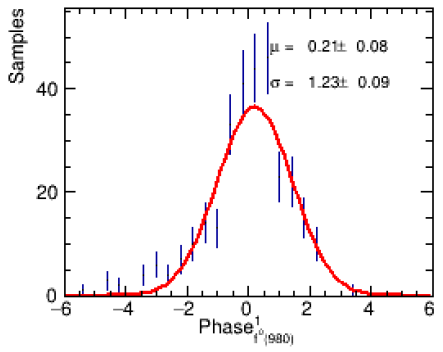


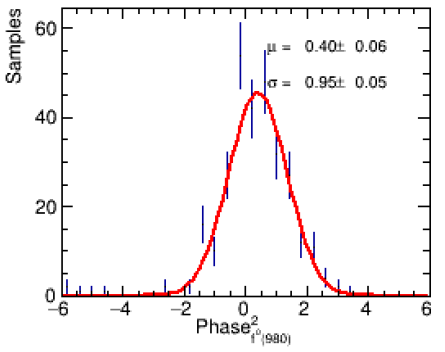




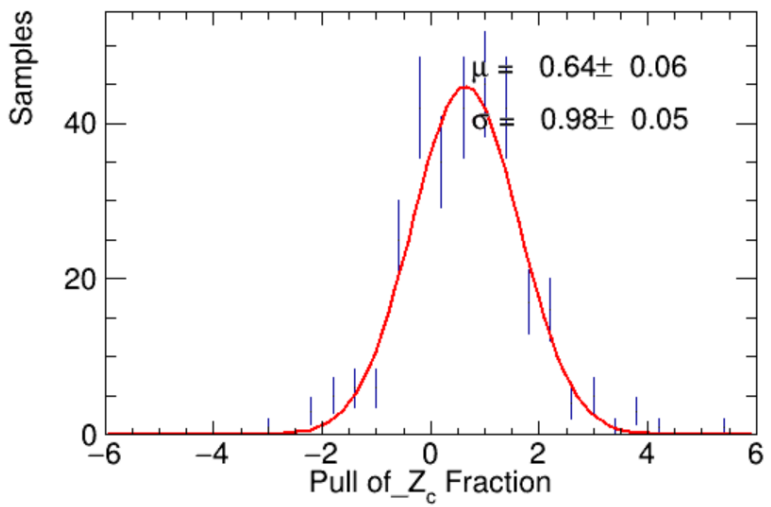


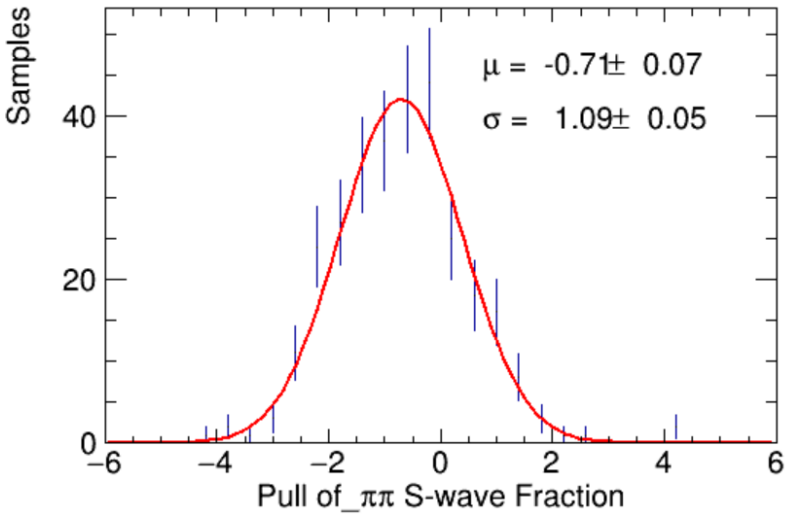






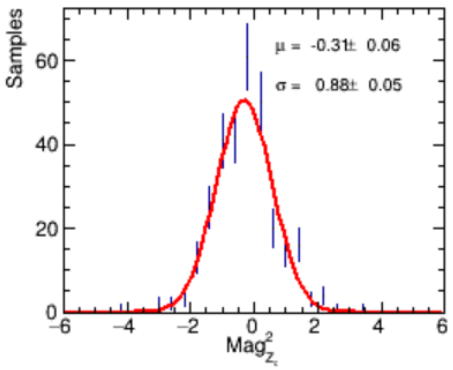
Pull distributions of fraction

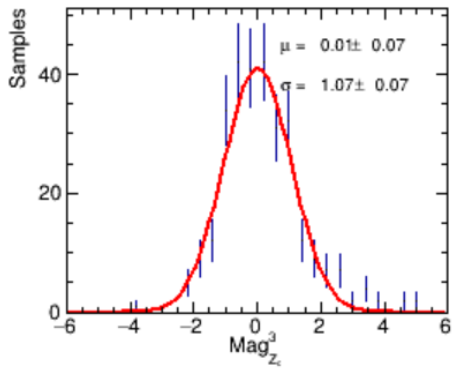


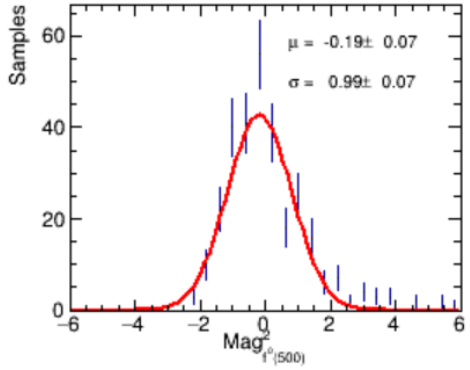


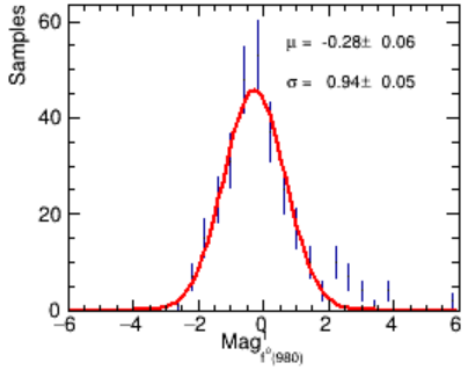
@4270

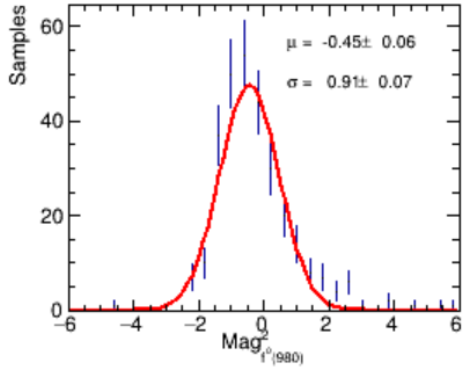
Pull distributions of parameters

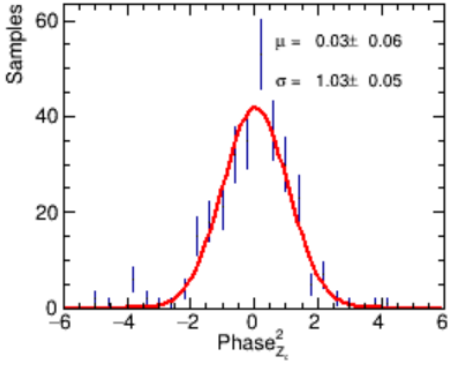


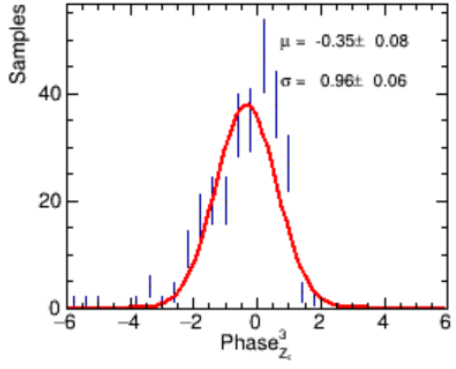


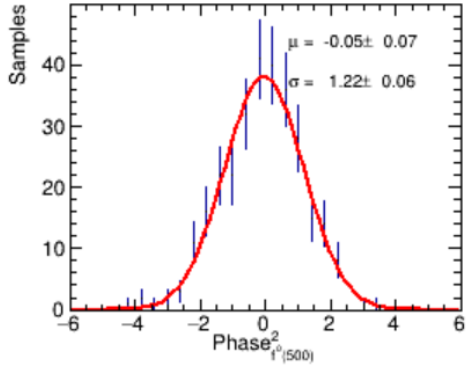


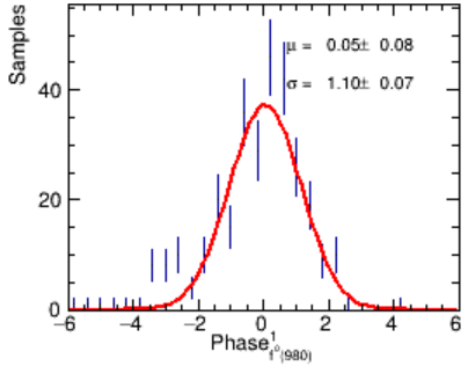


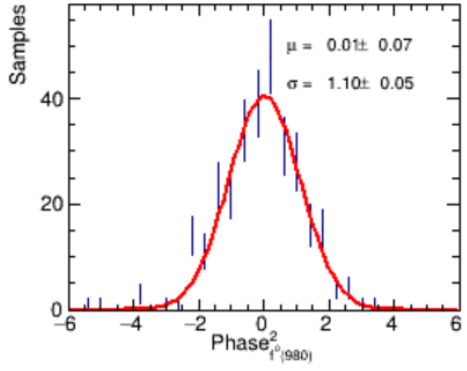




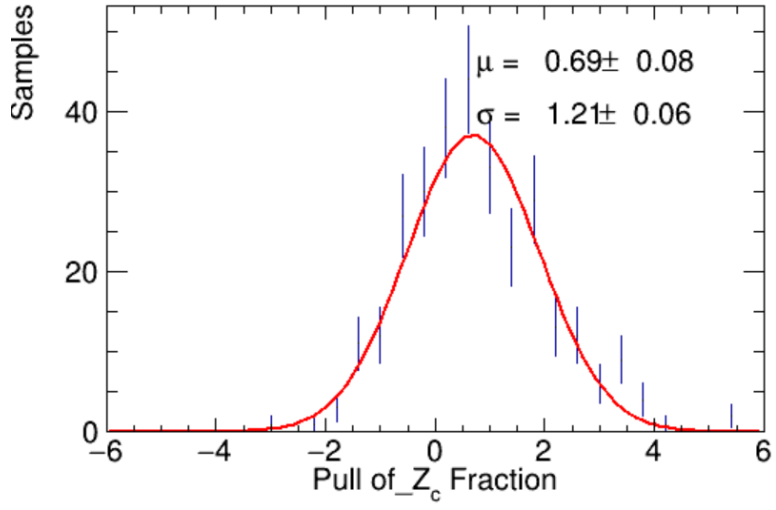


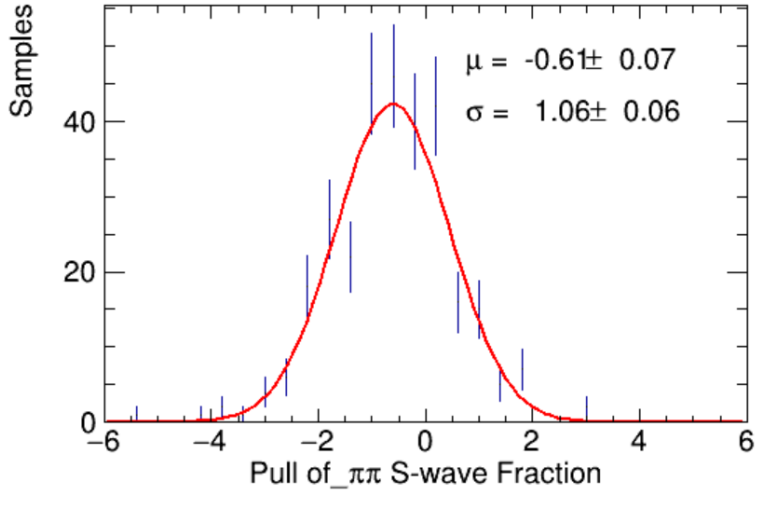






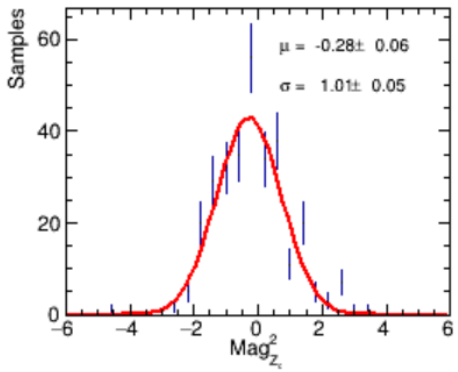
Pull distributions of fraction

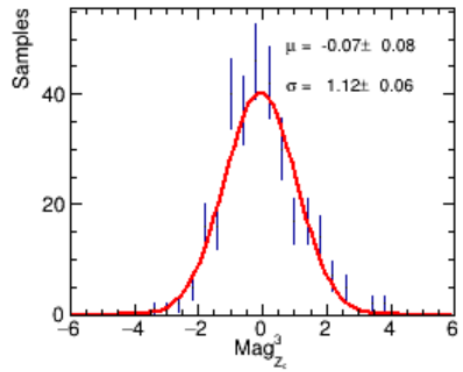


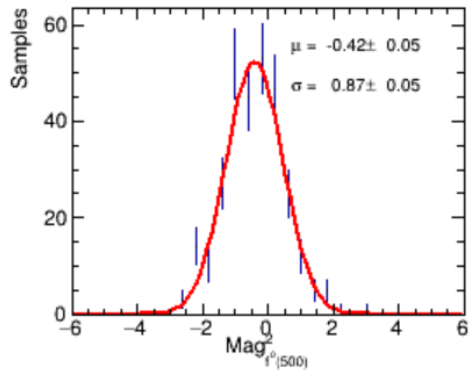


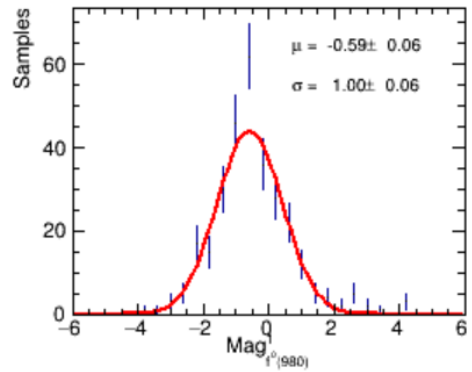
@4280

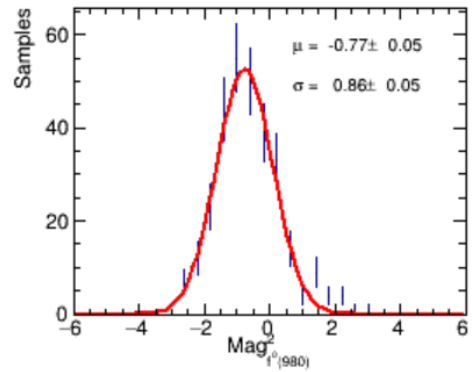
Pull distributions of parameters

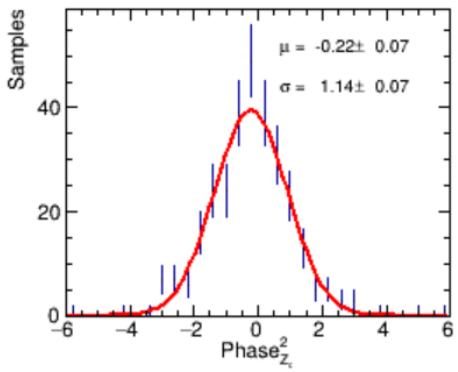


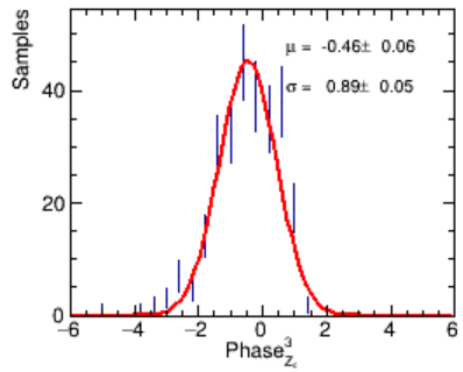


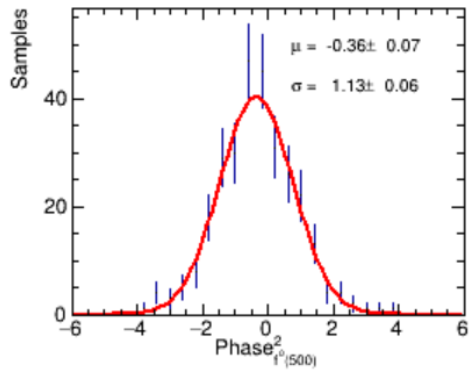


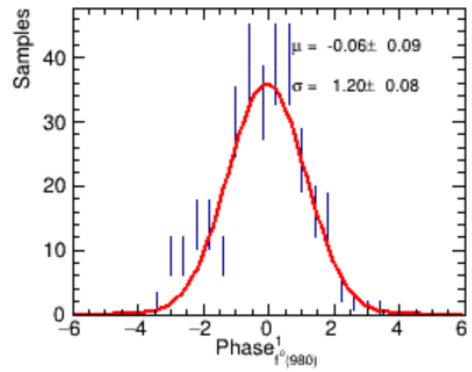


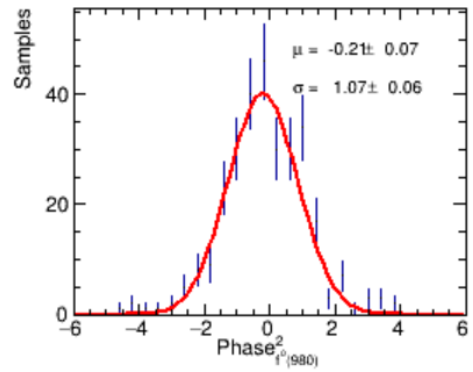




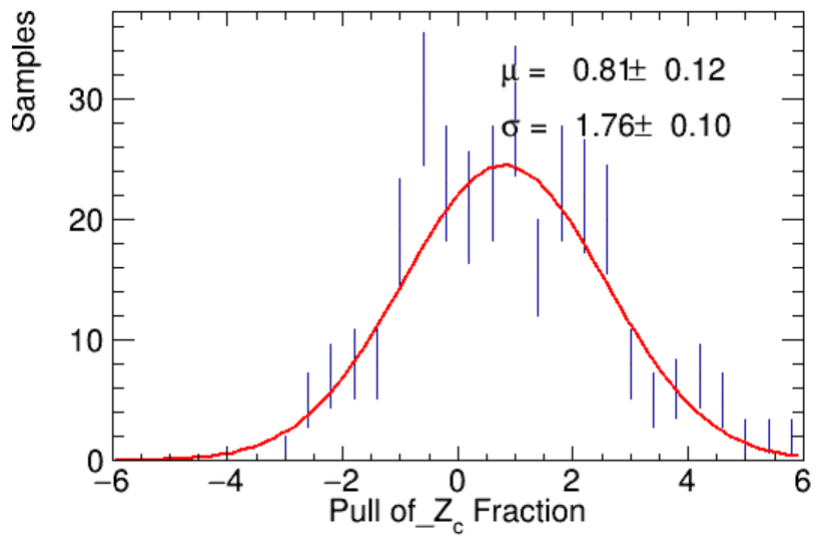


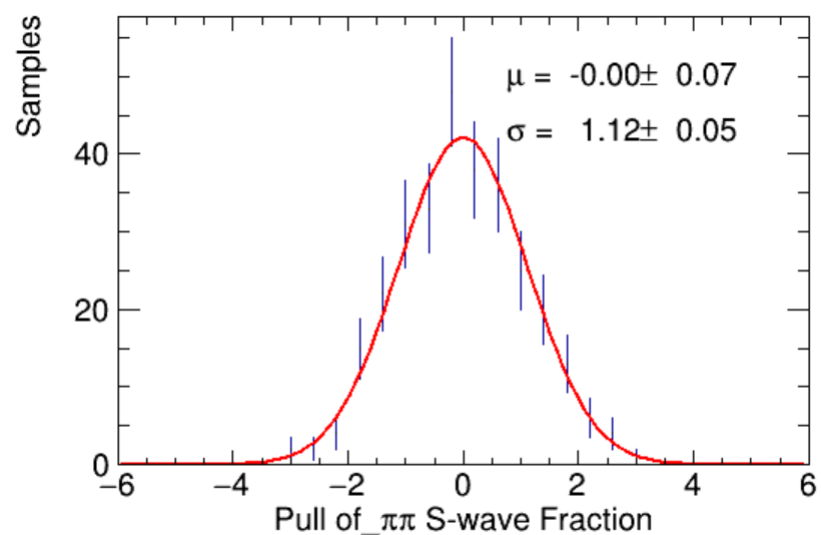






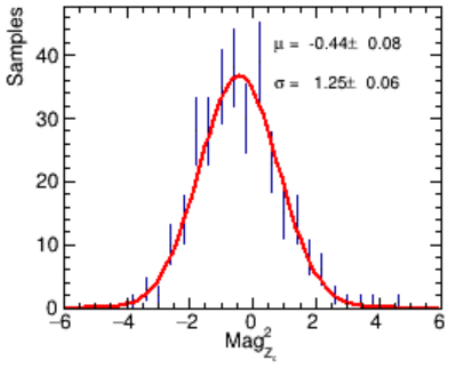
Pull distributions of fraction

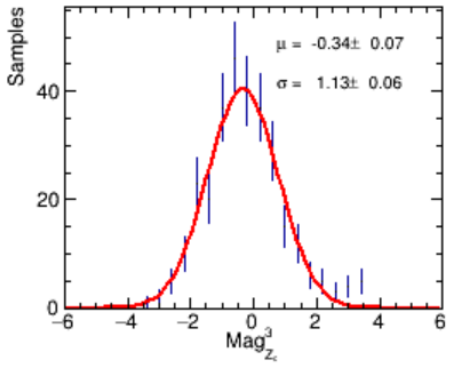


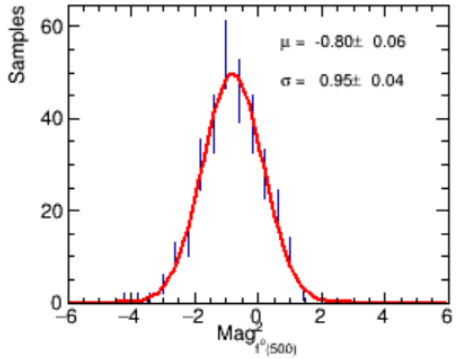


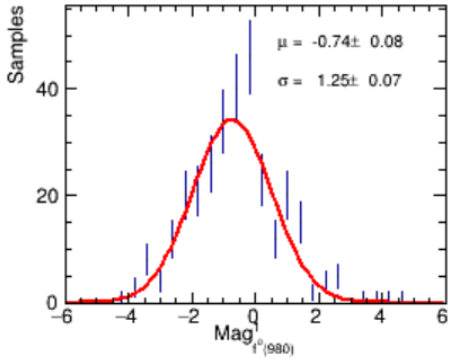
@4290

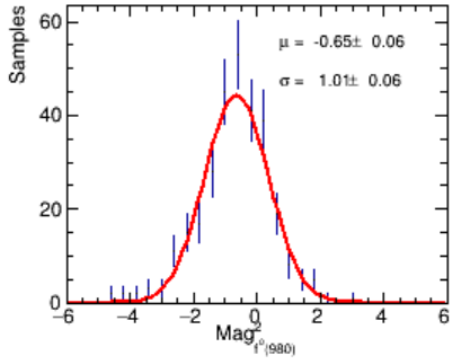
Pull distributions of parameters

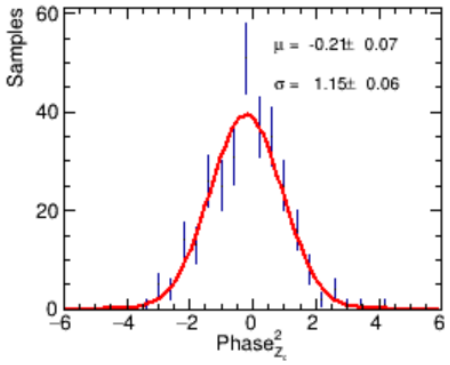


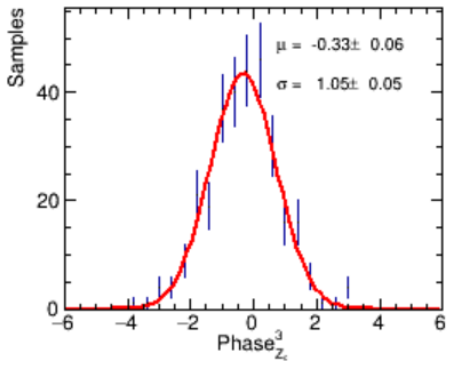


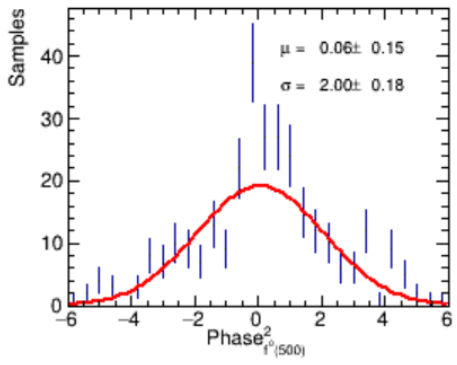


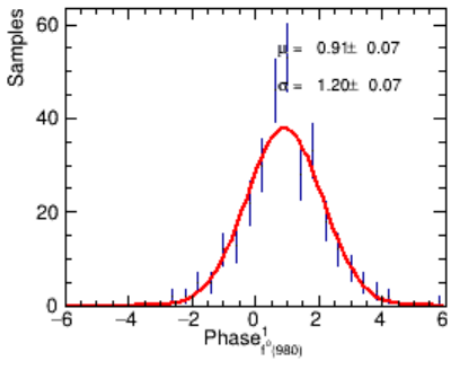


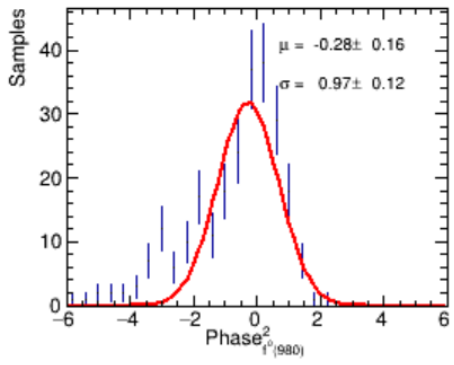




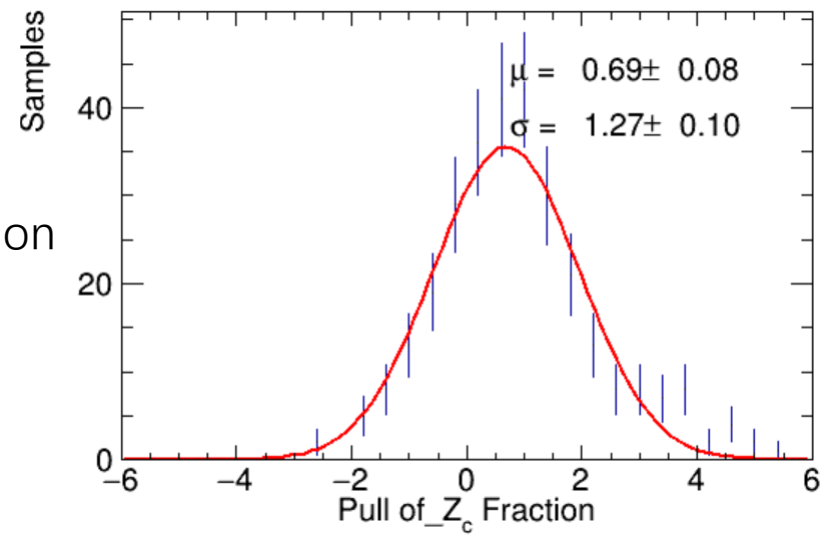


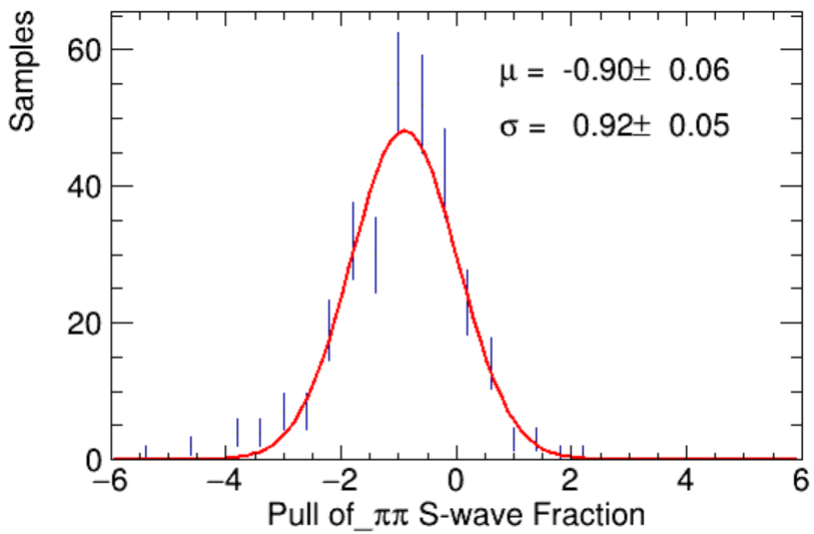




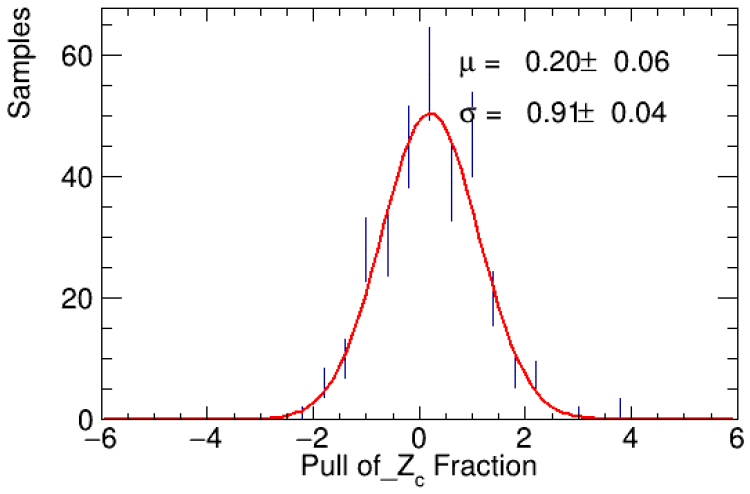


Pull distributions of fraction

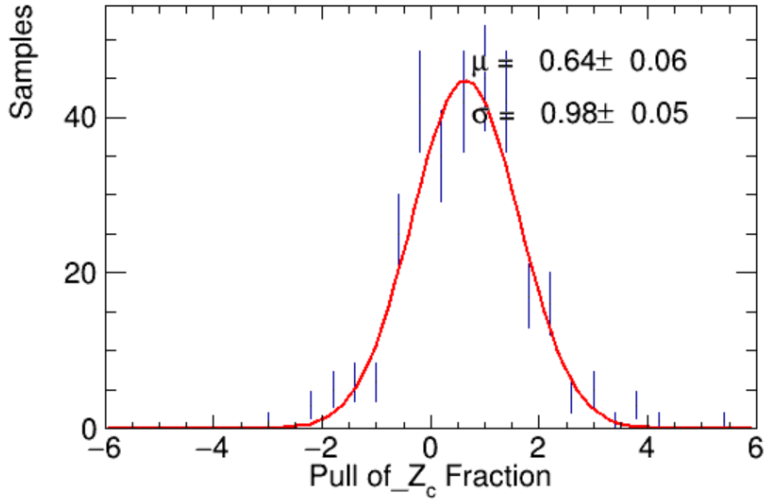




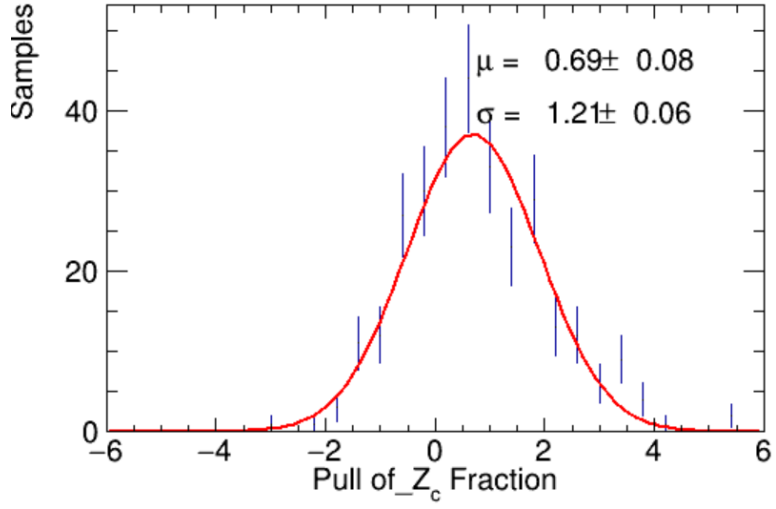
@4246



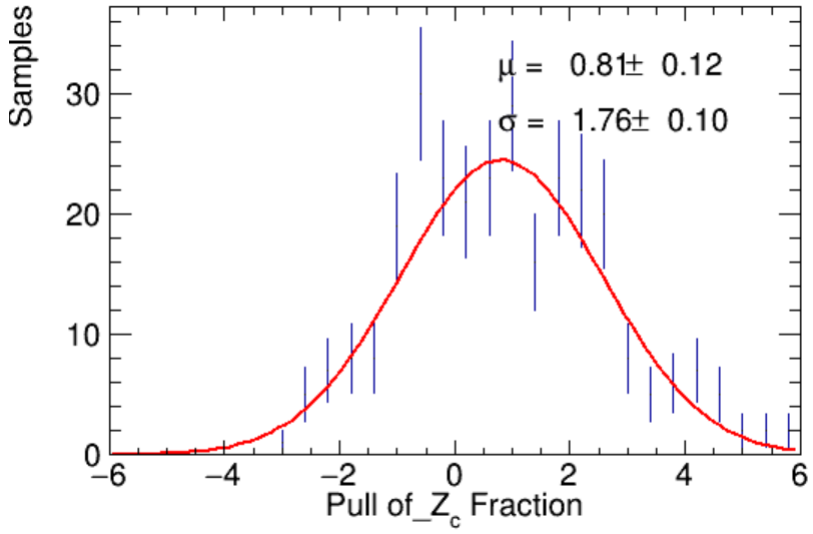
@4260



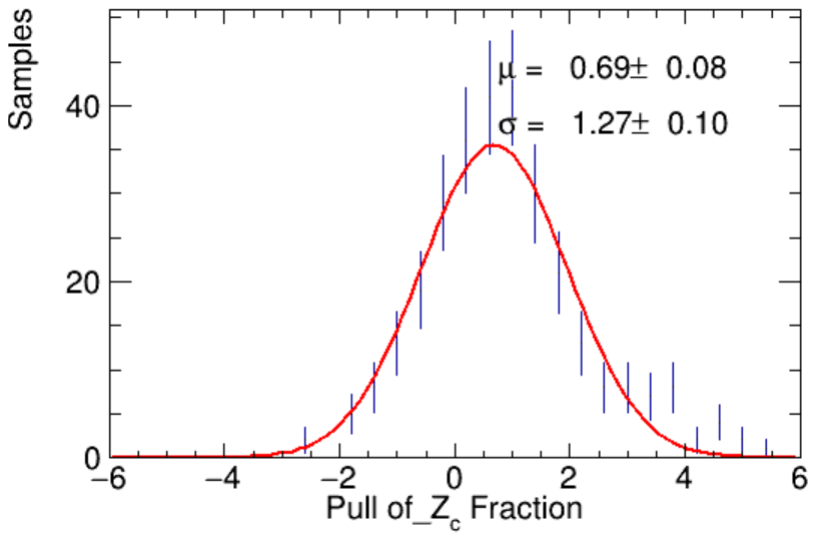
@4270



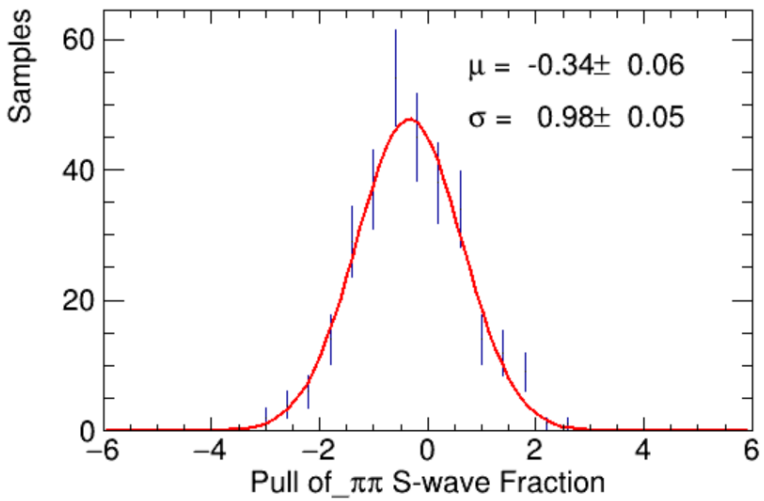
@4280



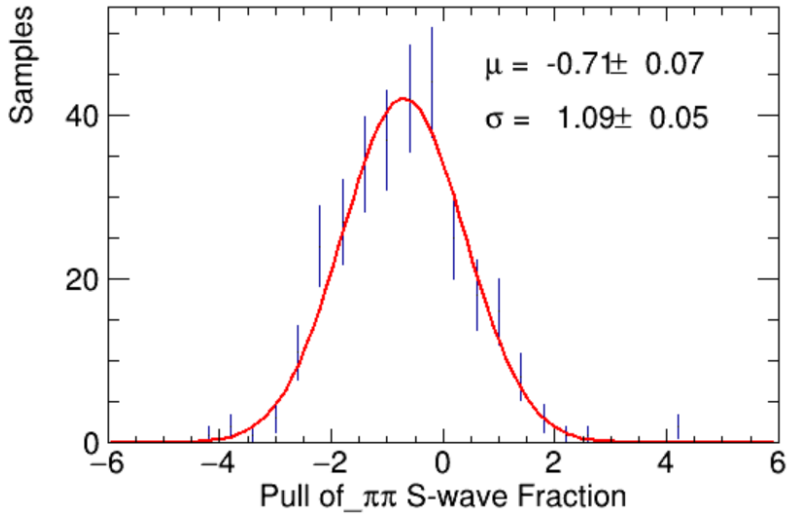
@4290



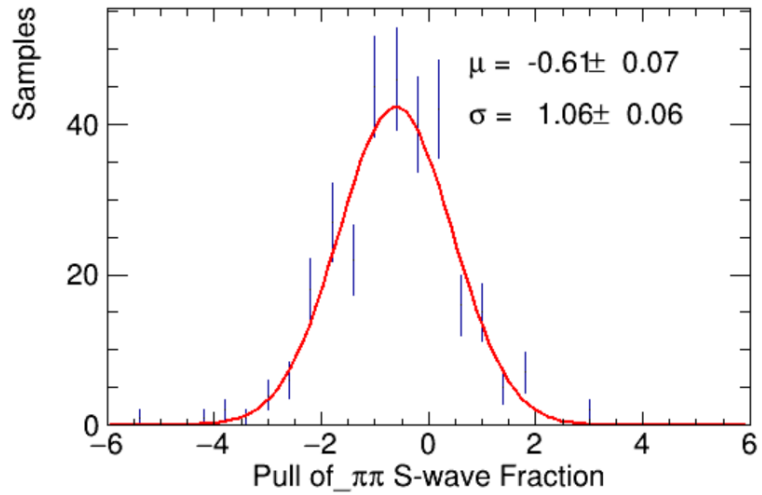
@4246



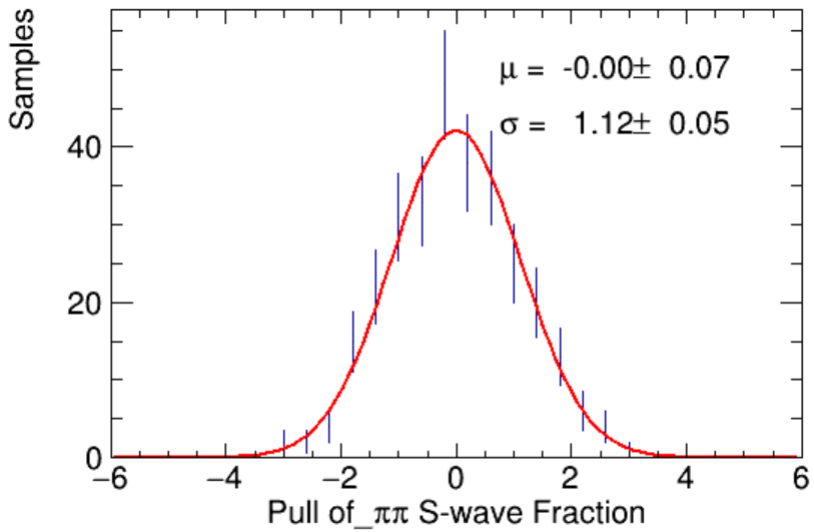
@4260



@4270



@4280



@4290