Igor Danilkin: $\omega\to 3\pi$, $\phi\to 3\pi$ [Preliminary]

The double differential decay rate is determined by

$$\frac{d^2\Gamma}{d\,s\,d\,t} = \frac{1}{(2\,\pi)^3}\,\frac{1}{32\,M_V^3}\,\frac{1}{3}\sum_\lambda \|\,M_\lambda(s,\,t,\,u)\,\|^{\,2}$$

$$= \frac{1}{(2\,\pi)^3}\,\frac{1}{32\,M_V^3}\,\frac{1}{3}\,P\;\|\,F(s,\,t,\,u)\,\|^2, \tag{1}$$

$$M_\lambda(s,\,t,\,u) = i\,\epsilon_{\mu\nu\alpha\beta}\,\epsilon^\mu(p,\,\lambda)\,p_+^\nu\,p_-^\alpha\,p_0^\beta\,F(s,\,t,\,u),\;\; P = \frac{1}{4}\left(s\,t\,u - m_\pi^2\left(M_V^2 - m_\pi^2\right)^2\right)$$

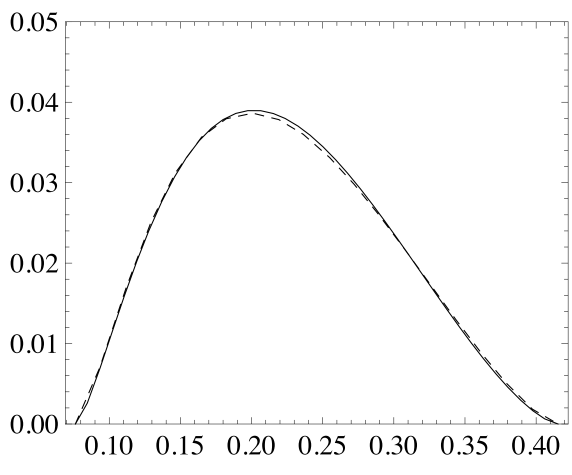
Below are the results for the **one unknown parameter** (in both methods), which is fitted to the experimental partial decay width

$$\Gamma^{\rm exp}_{\omega\to 3\,\pi} = 7.56\,\text{MeV},\quad \Gamma^{\rm exp}_{\phi\to 3\,\pi} = 0.65\,\text{MeV} \tag{2}$$

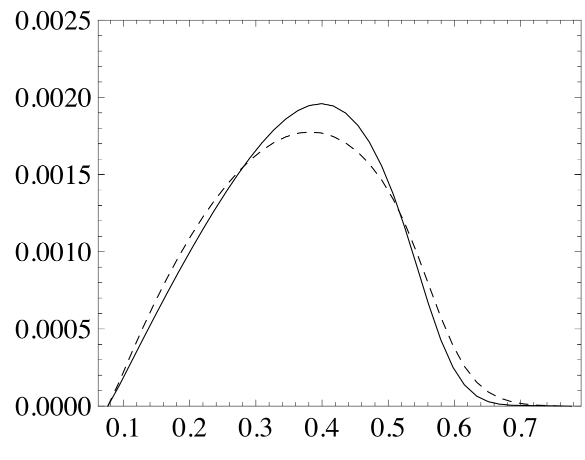
First, we plot

$$\frac{d\,\Gamma}{d\,s},\;\; s\in\left[4\,m_\pi^2,\;(M_V - m_\pi)^2\right] \tag{3}$$

$\omega\to\;3\,\pi$ (Our-solid, Bastian-dashed)



$\phi\to 3\,\pi$

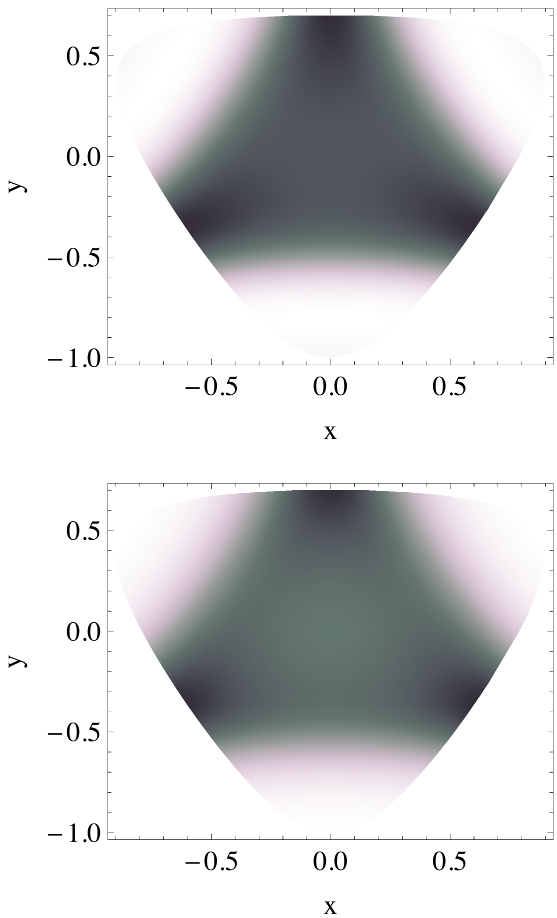


Transition to X and Y variables

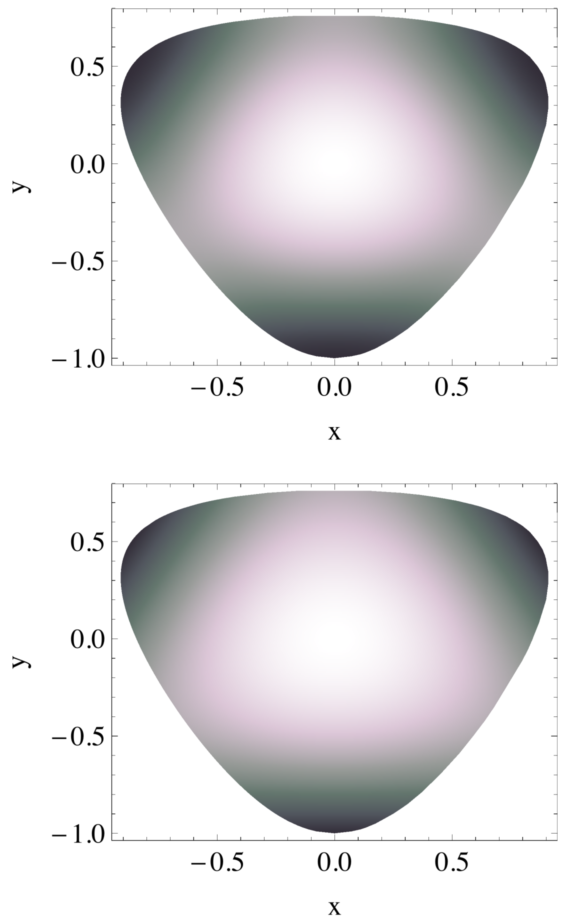
$$X = \frac{t-u}{\sqrt{3}\;R_V},\;\; Y = \frac{s_0 - s}{R_V},\;\; R_V = \frac{2}{3}\,M_V(M_V - 3\,M_\pi),\;\; s_0 = \frac{1}{3}\left(3\,m_\pi^2 + M_V^2\right). \tag{4}$$

Below are Dalitz plots $\frac{d^2\Gamma}{d\,s\,d\,t}$ divided by the p-wave phase space factor P.

$\omega \to 3\,\pi$ (Our-top, Bastian-bottom)



$\phi \to 3\,\pi$ (Our-top, Bastian-bottom)



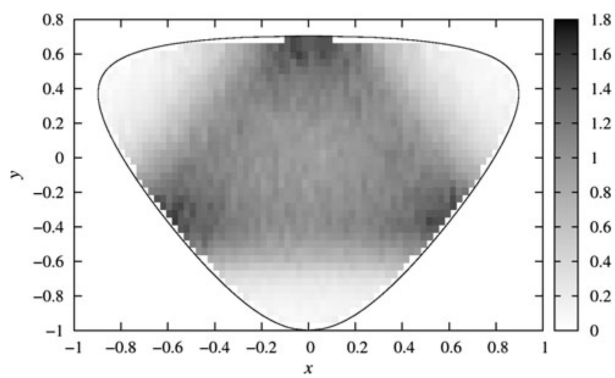


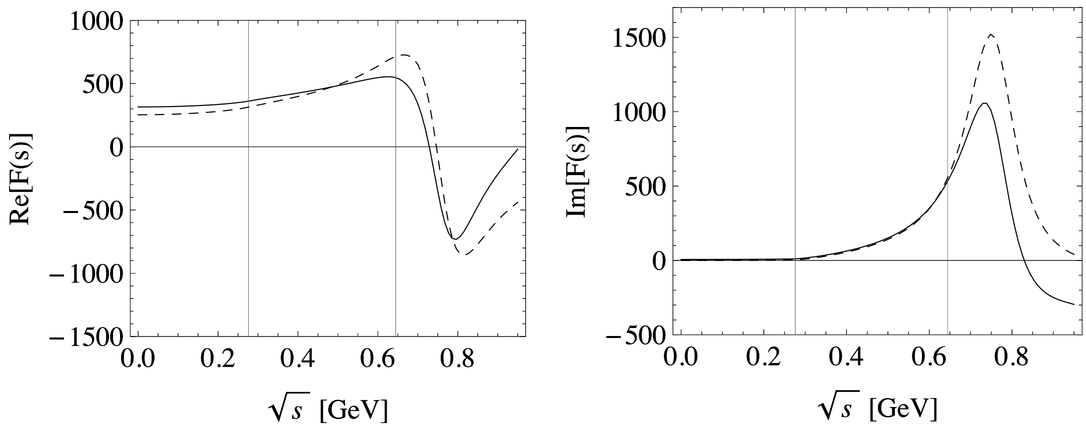
Fig. 9 Selected data from the KLOE measurement [23]. Shown is the efficiency-corrected number of counts in the respective bin, divided by the phase-space factor in Eq. (36) and normalized to 1 in the Dalitz plot center

Let us compare scattering amplitudes:

$$F(s,\,t,\,u) = F(s) + F(t) + F(u) \tag{5}$$

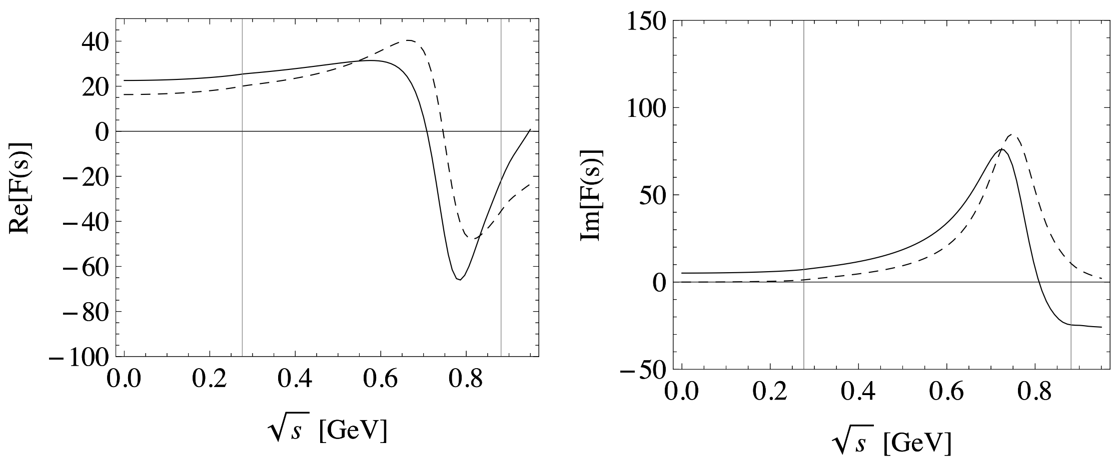
$\omega \to 3\,\pi$: (Our-solid, Bastian-dashed)

Out[84]=



$\phi \to 3\,\pi$

Out[85]=



Graphics