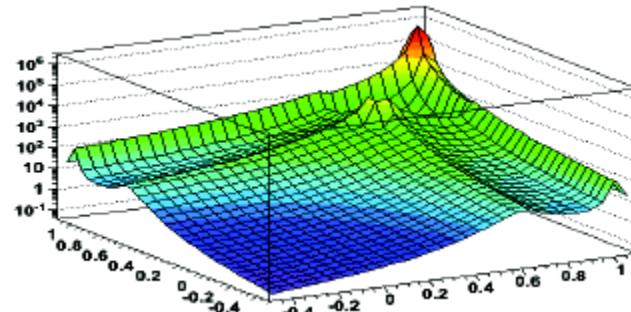


Workshop on Meson Transition Form Factors

May 29-30, 2012 in Cracow, Poland



UPPSALA
UNIVERSITET

A. Kupść

Mainz September 27th, 2012

[Information](#)[References \(115\)](#)[Citations \(1\)](#)[Files](#)[Plots](#)

MesonNet Workshop on Meson Transition Form Factors.

E. Czerwinski, S. Eidelman, C. Hanhart, B. Kubis, A. Kupsc, S. Leupold, P. Moskal, S. Schadmand.

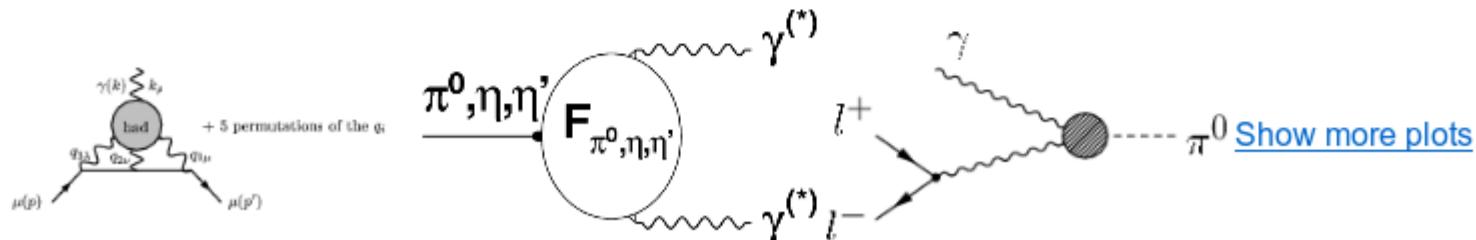
Jul 2012
69 pp.

e-Print: [arXiv:1207.6556 \[hep-ph\]](https://arxiv.org/abs/1207.6556) [PDF](#)

Abstract: The mini-proceedings of the Workshop on Meson Transition Form Factors held in Cracow from May 29th to 30th, 2012 introduce the meson transition form factor project with special emphasis on the interrelations between the various form factors (on-shell, single off-shell, double off-shell). Short summaries of the talks presented at the workshop follow.

Note: * Temporary entry *; 69 pages, 14 figures/ all talks can be found at http://www2.fz-juelich.de/ikp//mesonnet/meetings/2012_ff_workshop.shtml

Keyword(s): INSPIRE: [conference](#) | [form factor: transition](#) | [meson](#)



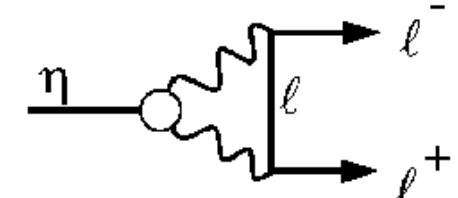
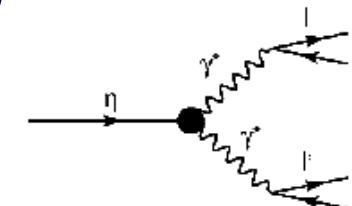
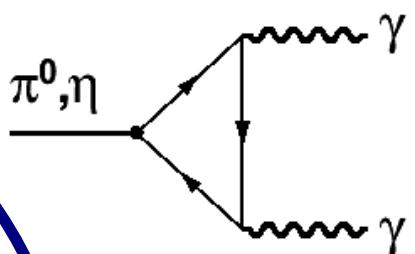
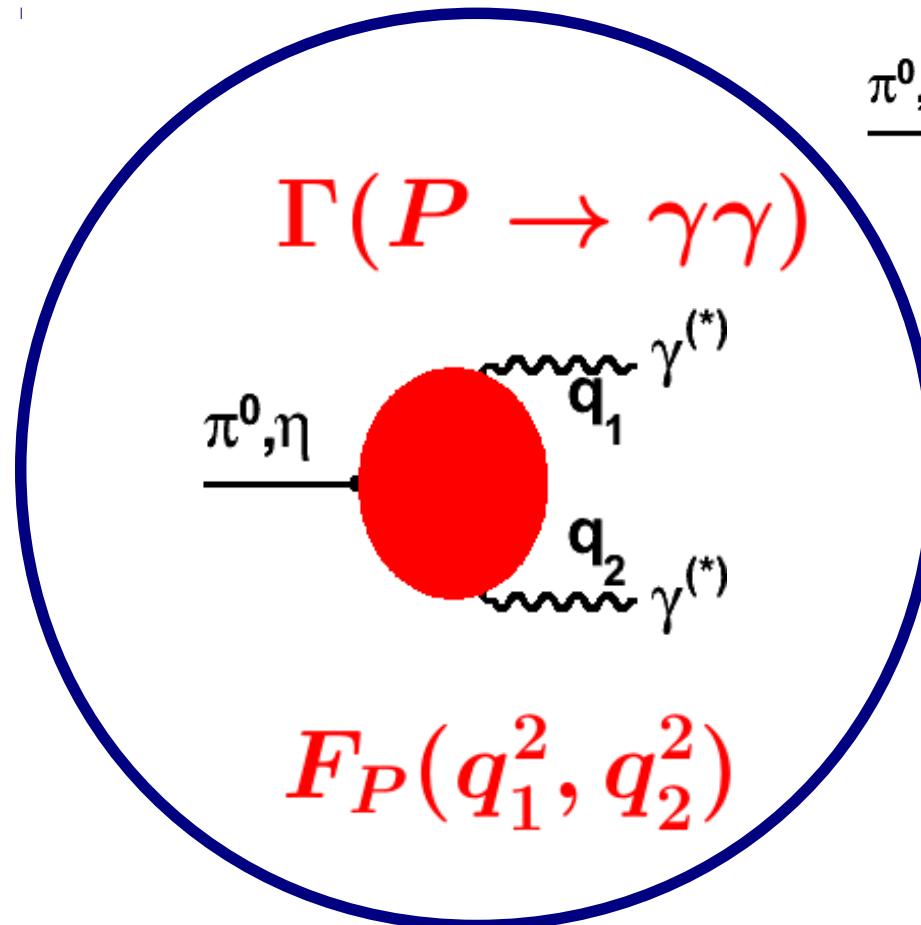
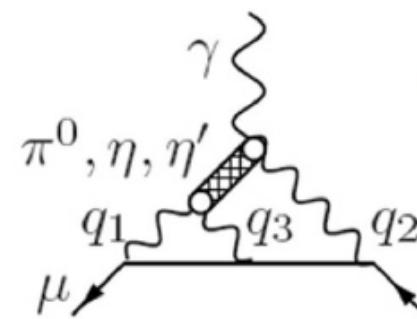
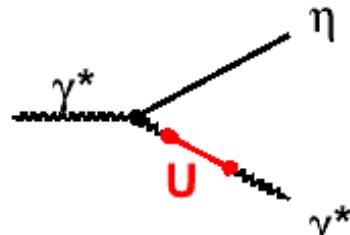
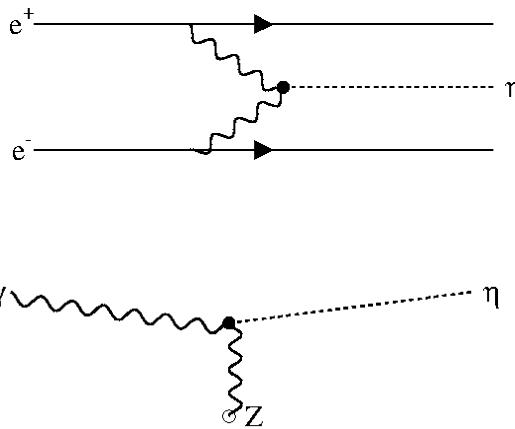
Meson Transition Form Factors (TFF)

Low energy QCD

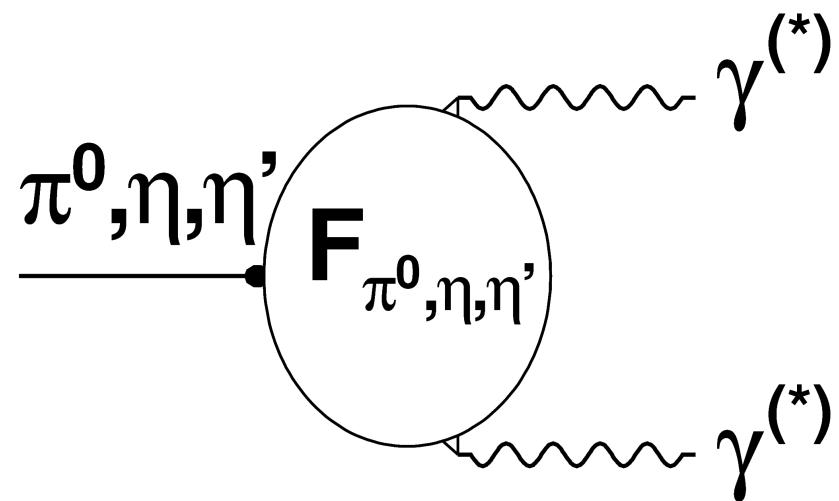
I^+I^- spectra for QGP

SM contribution to $a\mu$

U boson



Qualitative picture VMD



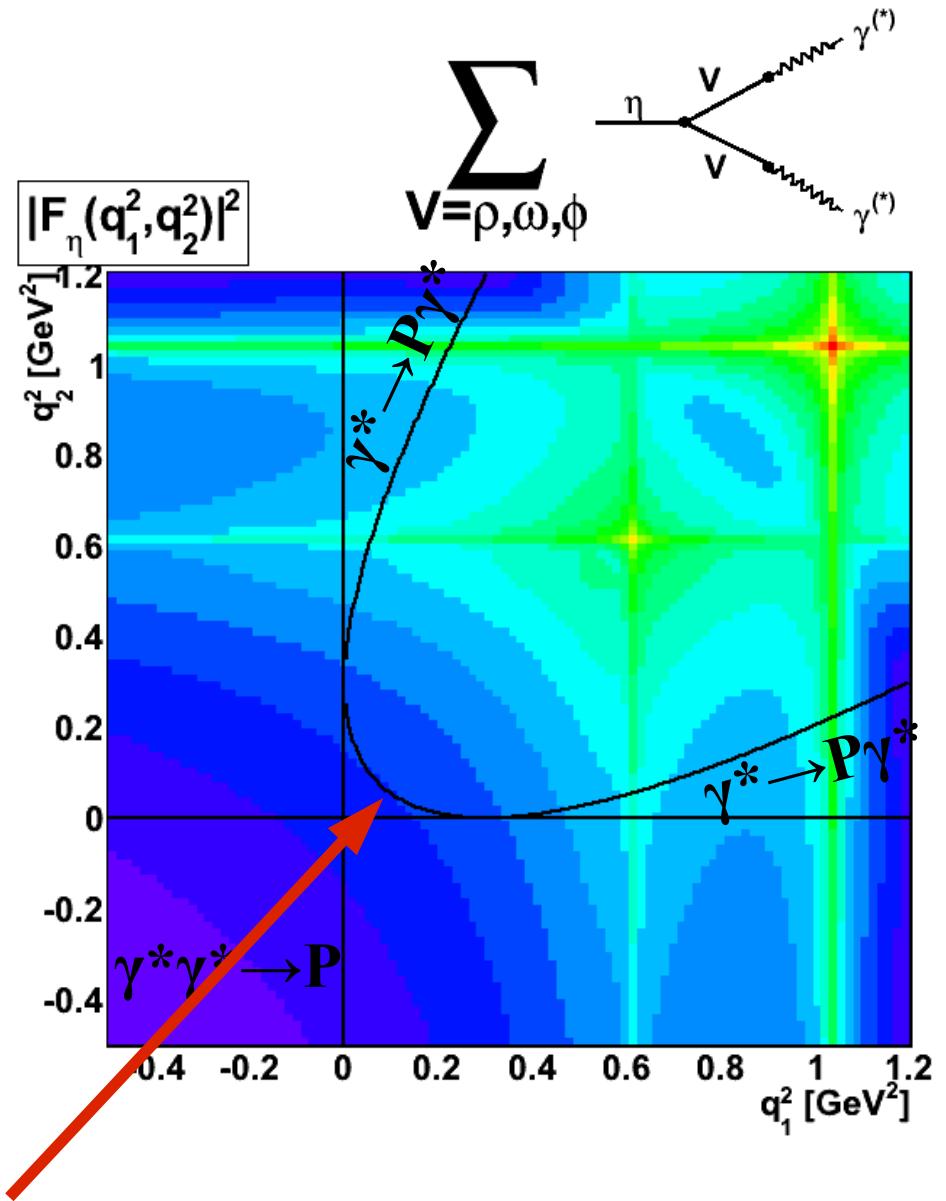
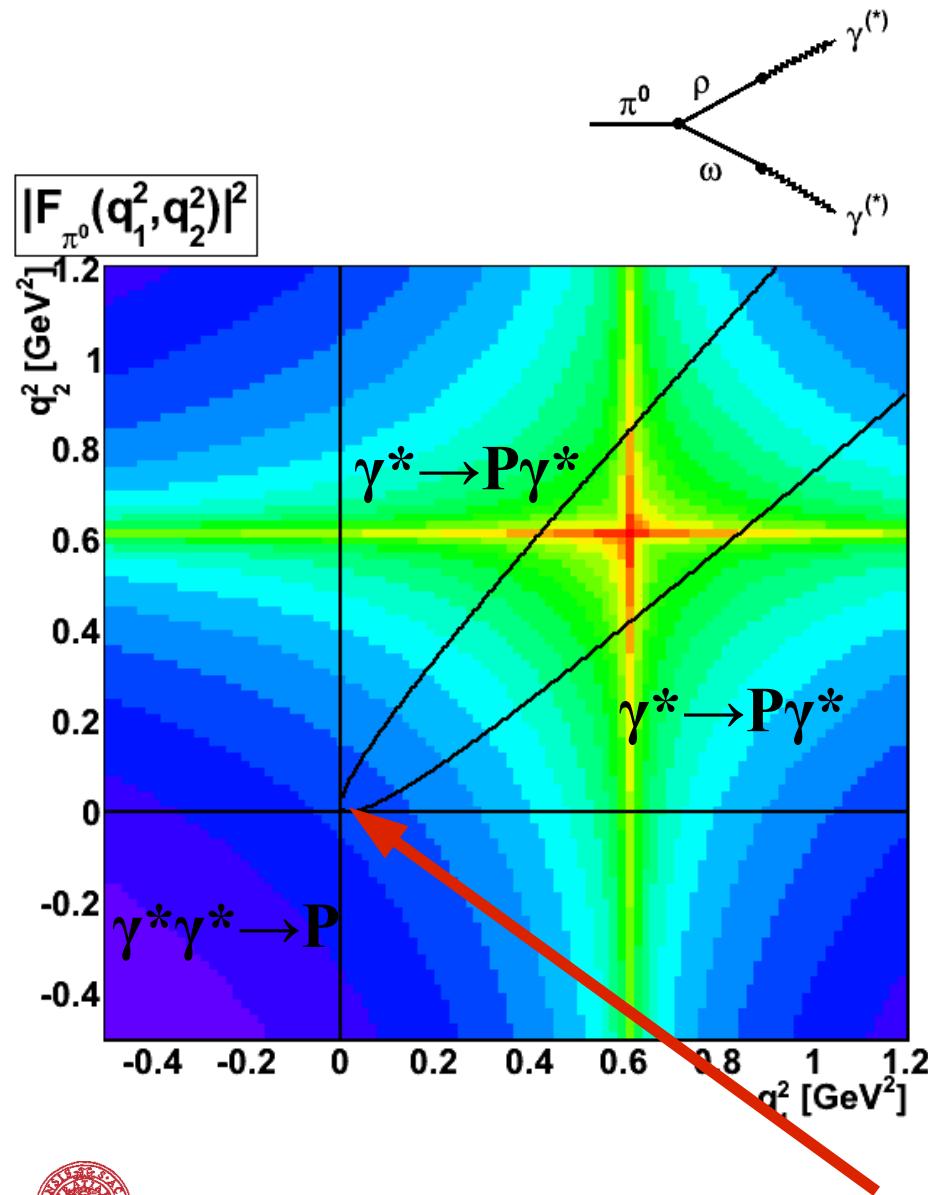
$$F_P(q_1^2, q_2^2) = \sum_V \sum_{V'} P \xrightarrow{g_{PVV}} V \xrightarrow{\frac{1}{g_{VV'}}} V' \xrightarrow{\frac{1}{g_{V'\gamma}}} \gamma^{(*)}$$

$$|\mathcal{F}_P(0,0)|^2 = \frac{64\pi}{m_P^3} \Gamma(P \rightarrow \gamma\gamma)$$

$$F_P(q_1^2, q_2^2) = \frac{\mathcal{F}_P(q_1^2, q_2^2)}{\mathcal{F}_P(0,0)}$$



TFF “naive” VMD



Radiative widths η, π^0

η, π^0 : narrow and short lived

$$\Rightarrow \Gamma_{\text{tot}} = \Gamma_{\gamma\gamma} / \text{BR}_{\gamma\gamma}$$

η : 5×10^{-19} s; $\Gamma = 1.3$ keV	$\eta \rightarrow \gamma\gamma$
π^0 : 8×10^{-17} s; $c\tau = 25$ nm	$\pi^0 \rightarrow \gamma\gamma$

Two kinds of measurements

$\gamma Z \rightarrow \eta, \pi^0$ Primakoff

$$\delta\Gamma(\pi^0 \rightarrow \gamma\gamma) \sim 2.8\%$$

PrimEx PRL 106, 162303(2011)

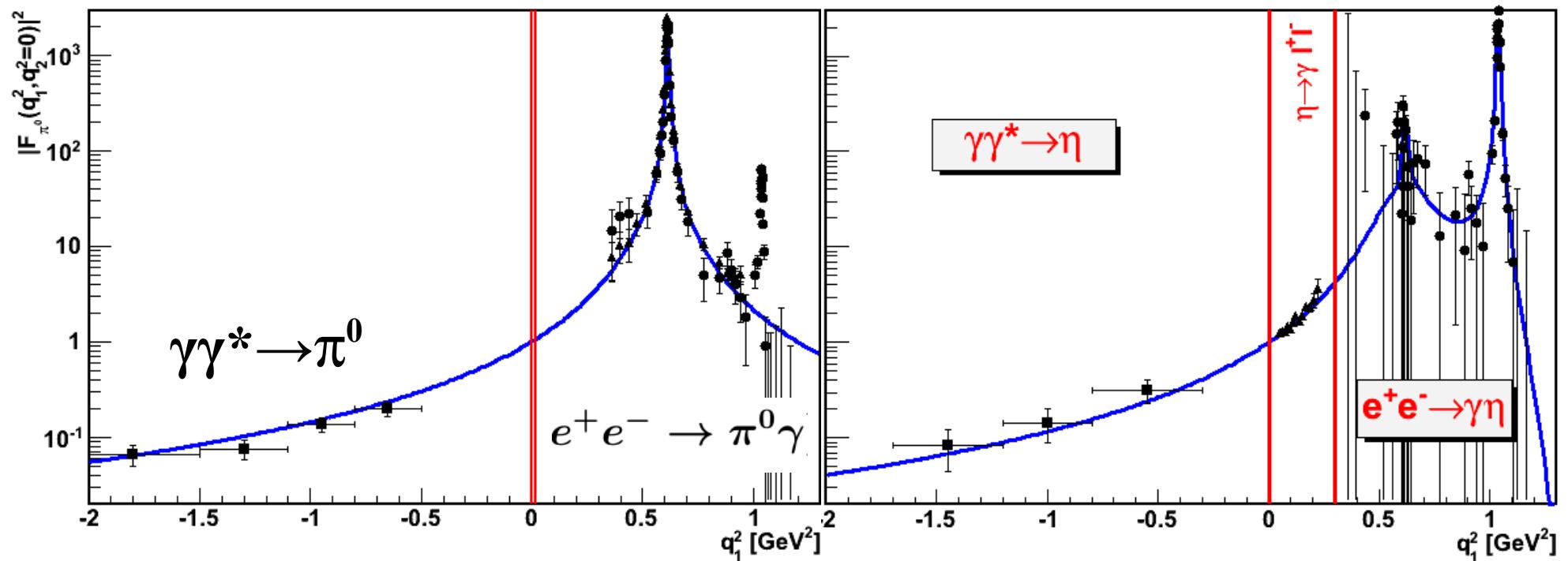
e^+e^- : $\gamma\gamma \rightarrow \eta, \pi^0$

VALUE (keV)	EVTS	DOCUMENT ID	TECN	COMMENT
0.510 ± 0.026	OUR FIT			
0.510 ± 0.026	OUR AVERAGE			
$0.51 \pm 0.12 \pm 0.05$	36	BARU	90	$e^+ e^- \rightarrow e^+ e^- \eta$
$0.490 \pm 0.010 \pm 0.048$	2287	ROE	90	$e^+ e^- \rightarrow e^+ e^- \eta$
$0.514 \pm 0.017 \pm 0.035$	1295	WILLIAMS	88	$e^+ e^- \rightarrow e^+ e^- \eta$
$0.53 \pm 0.04 \pm 0.04$		BARTEL	85E	$e^+ e^- \rightarrow e^+ e^- \eta$
*** We do not use the following data for averages, fits, limits, etc. ***				
0.476 ± 0.062	¹	RODRIGUES	08	CNTR Reanalysis
$0.64 \pm 0.14 \pm 0.13$		AIHARA	86	$e^+ e^- \rightarrow e^+ e^- \eta$
0.56 ± 0.16	56	WEINSTEIN	83	$e^+ e^- \rightarrow e^+ e^- \eta$
0.324 ± 0.046		BROWMAN	74B	CNTR Primakoff effect
1.00 ± 0.22	²	BEMPORAD	67	CNTR Primakoff effect

$$\sigma(\gamma^*\gamma^* \rightarrow P) = \frac{16\pi^2}{m_P^3} \Gamma_{\gamma\gamma} |F(q_1^2, q_2^2)|^2 \sqrt{(q_1 \cdot q_2)^2 - q_1^2 q_2^2} \delta((q_1 + q_2)^2 - m_P^2)$$

$\Gamma_{\gamma\gamma}$ fundamental parameter

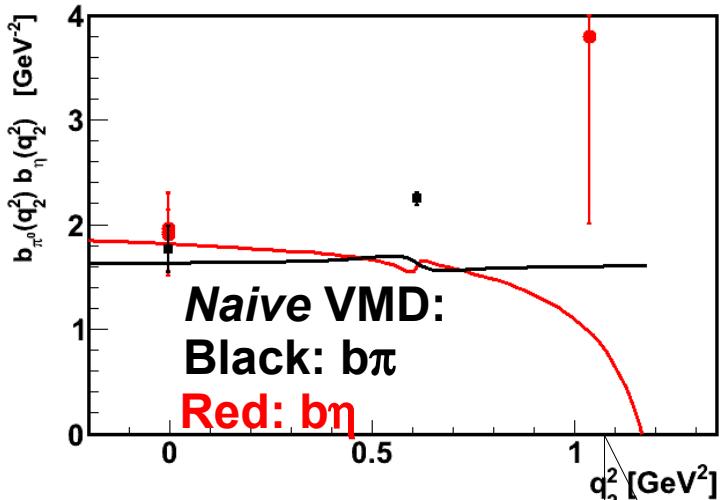
=> should be known precisely (eg m_u/m_d)



Double off shell TFF

slopes $b\pi$, $b\eta$

$$b_P(q_2^2) = \left. \frac{\partial \ln |F(q_1^2, q_2^2)|}{\partial q_1^2} \right|_{q_1^2=0}$$

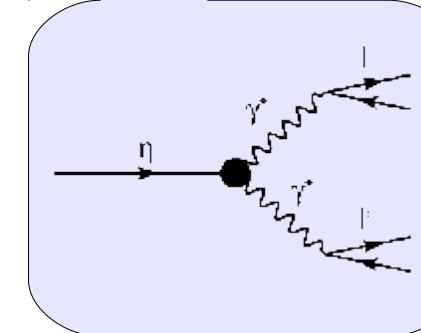
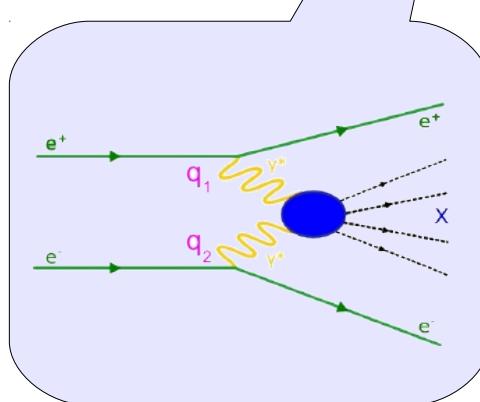
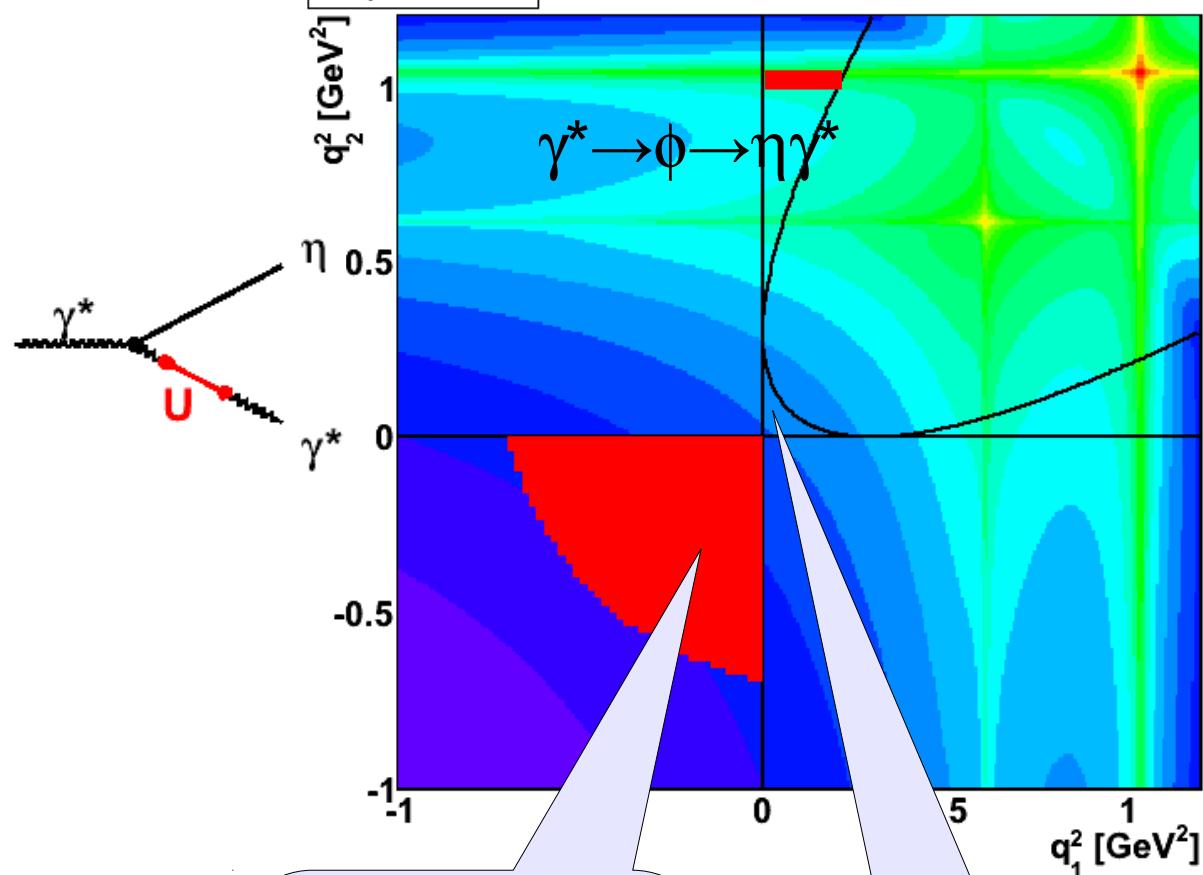


KLOE goal: measure $b\eta(m_\phi^2)$

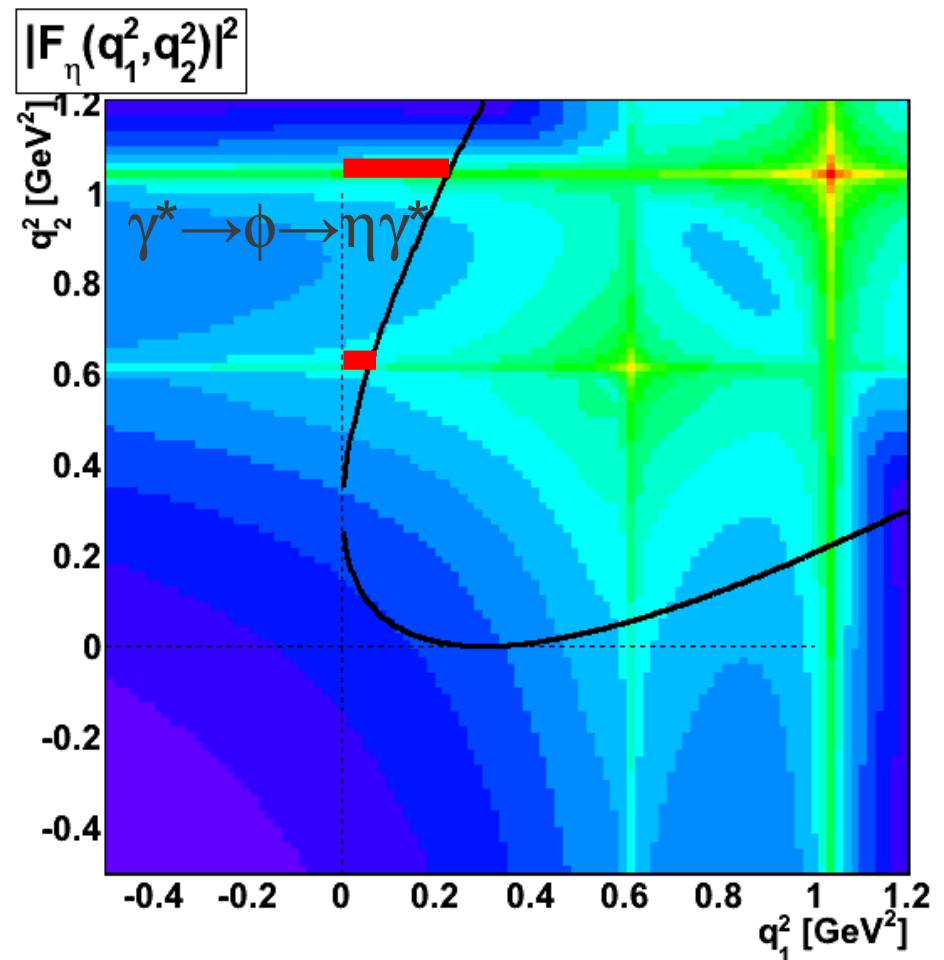
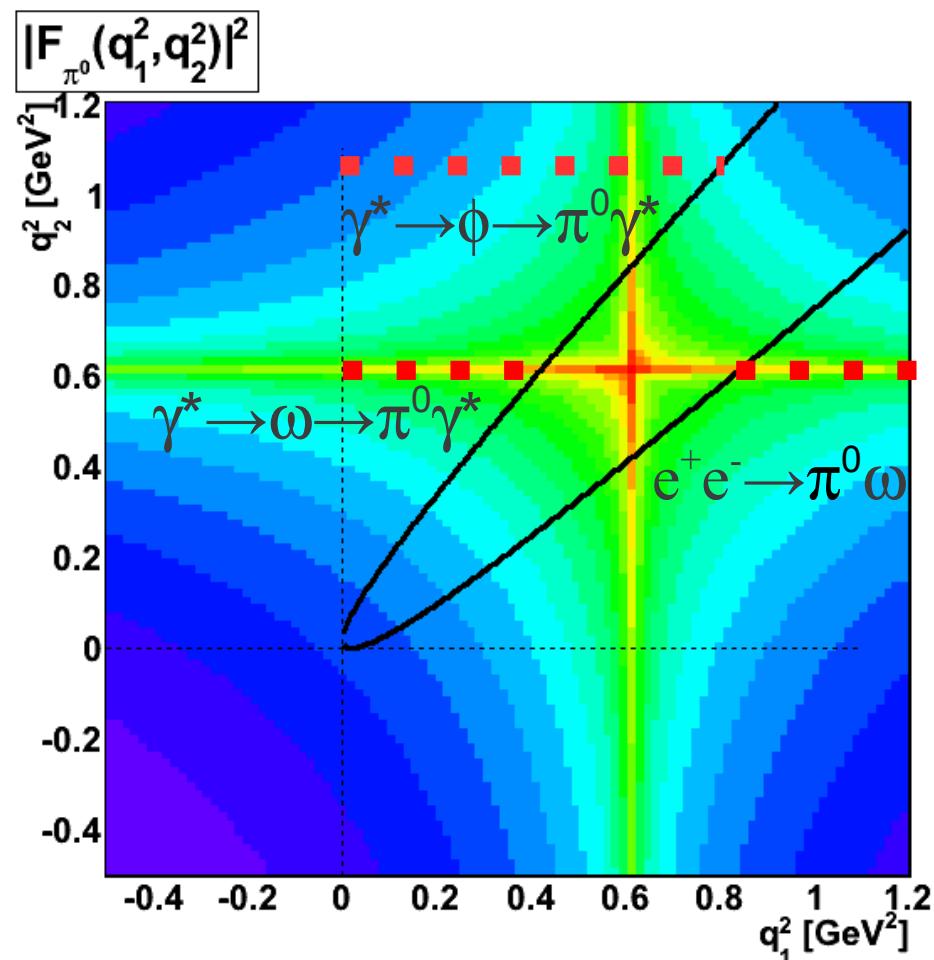
$\phi \rightarrow \eta\gamma^*$ BR 10^{-4}

$b\pi^0(m_\phi^2)$ $\phi \rightarrow \pi^0\gamma^*$ BR 10^{-5}

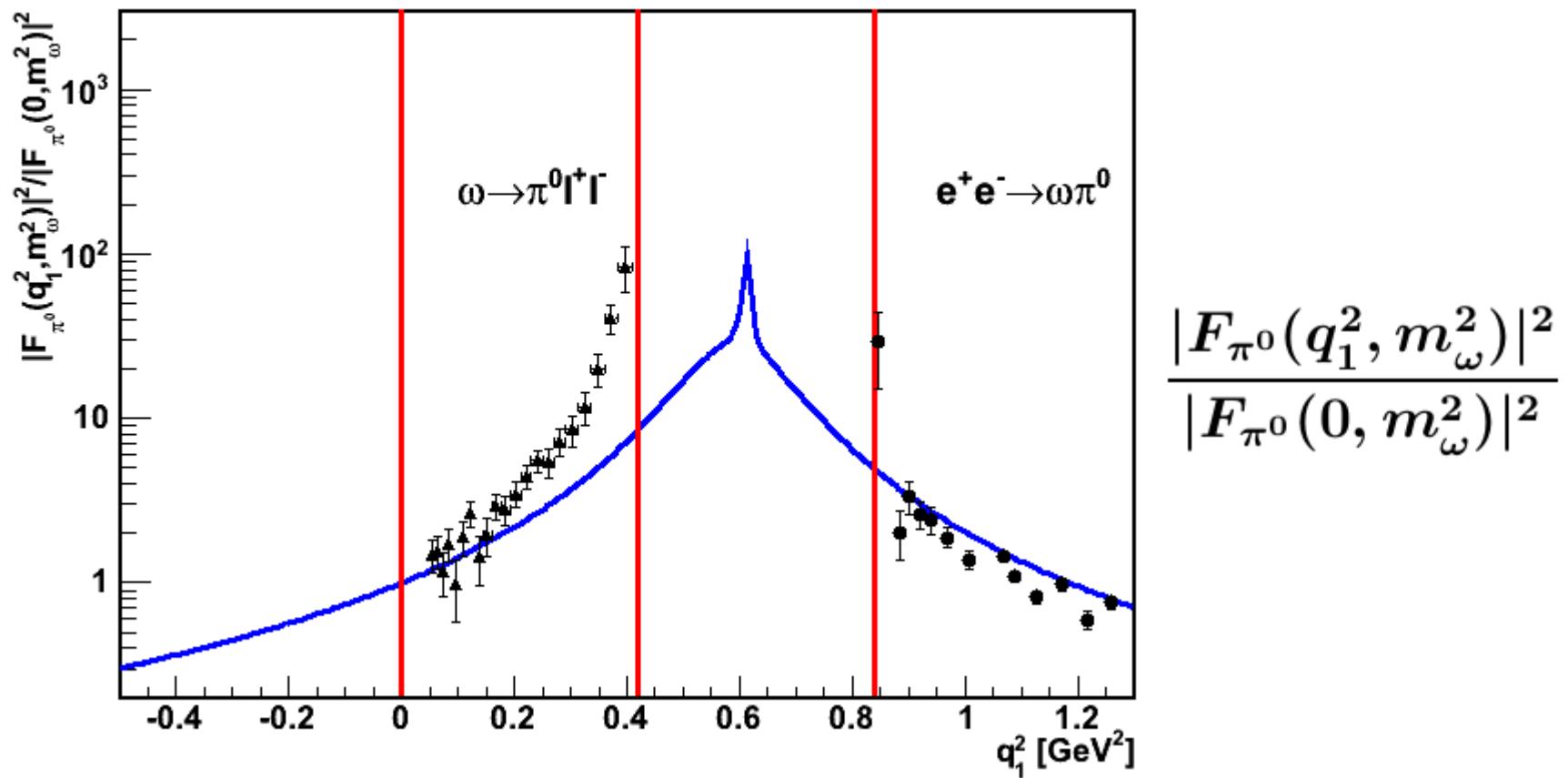
$$|F_\eta(q_1^2, q_2^2)|^2$$



$V \rightarrow P\gamma^*$ and $e^+e^- \rightarrow PV$ processes



$\omega\pi^0$ transition form factor



The Workshop

- Motivations
- Related processes
- Experimental studies
- $\Gamma\gamma\gamma$, TFF
- Processes for $q_1^2, q_2^2 \neq 0$ TFF
- Mini proceedings - intro+abstracts arXiv:1207.6556
- How to proceed?

