Karlsruhe subnode

J. KÜHN

I radiative return (results from KLOE)

II Plans

- PHOKHARA
- determination of α_s ; m_Q ;

I Radiative return results from KLOE

— Measuring hadronic cross-section — at KLOE

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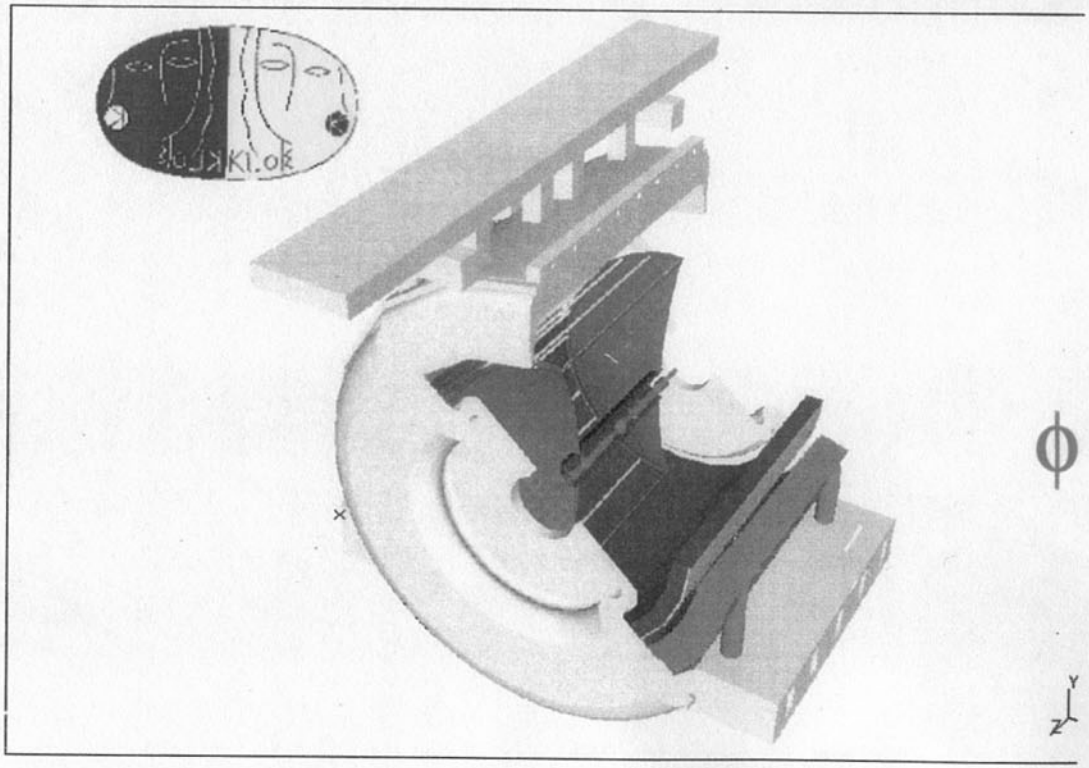
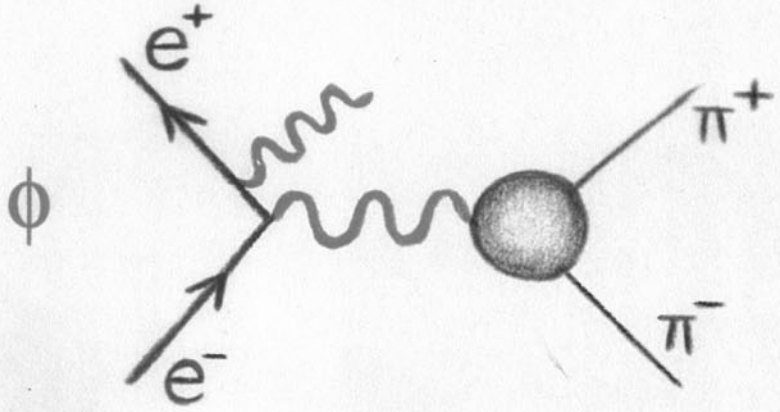
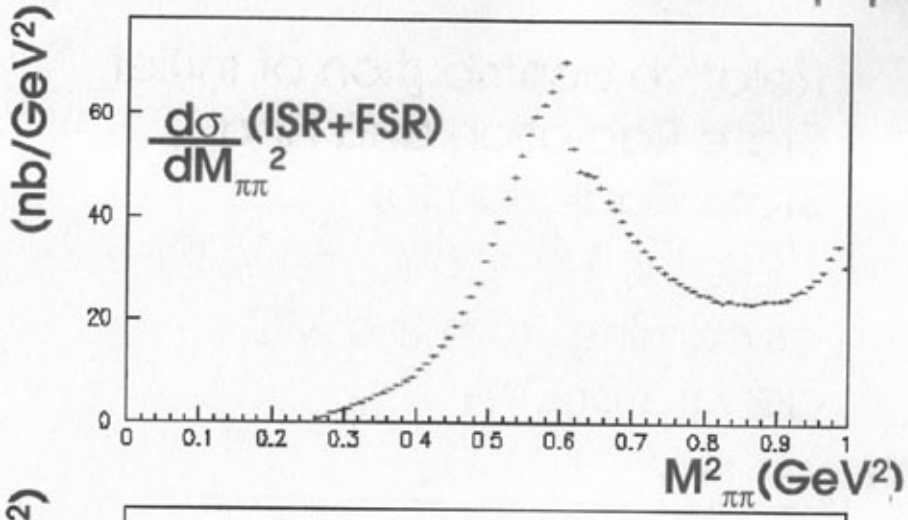




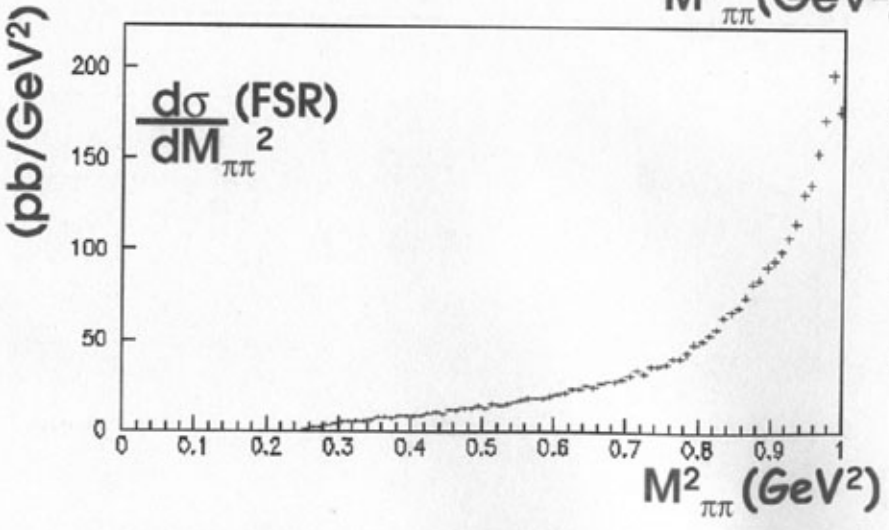
FSR suppression

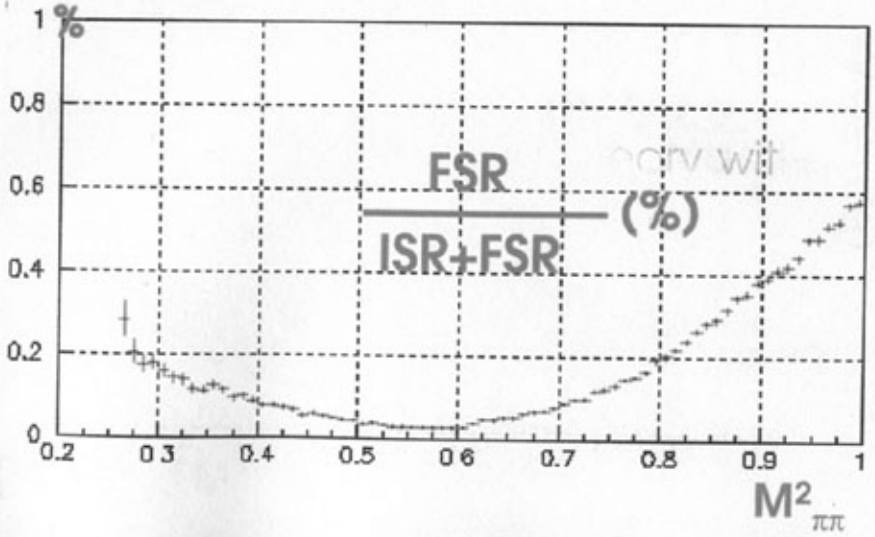


Relative contribution of **I**nitial **S**tate **R**adiation and **F**inal **S**tate **R**adiation for

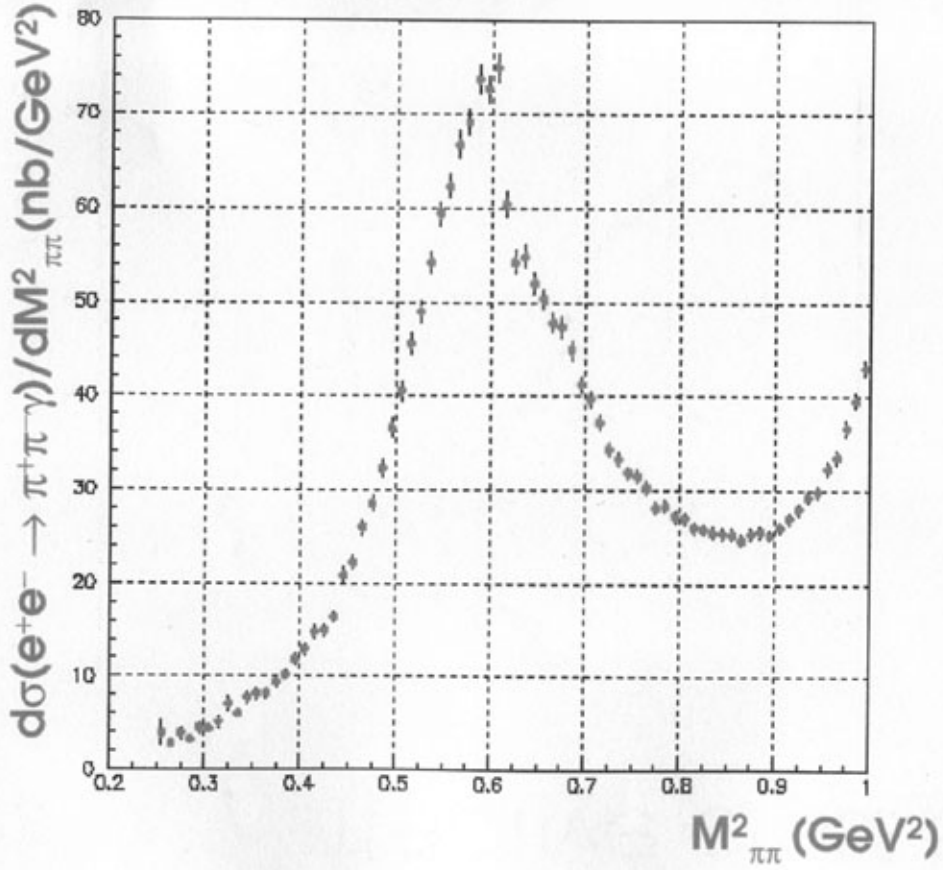
$\theta_{\pi\pi} < 15°$ or $\theta_{\pi\pi} > 165°$

as coming from the MC generator EVA





– $e^+ e^- \to \pi^+ \pi^- \gamma$ effective cross section –

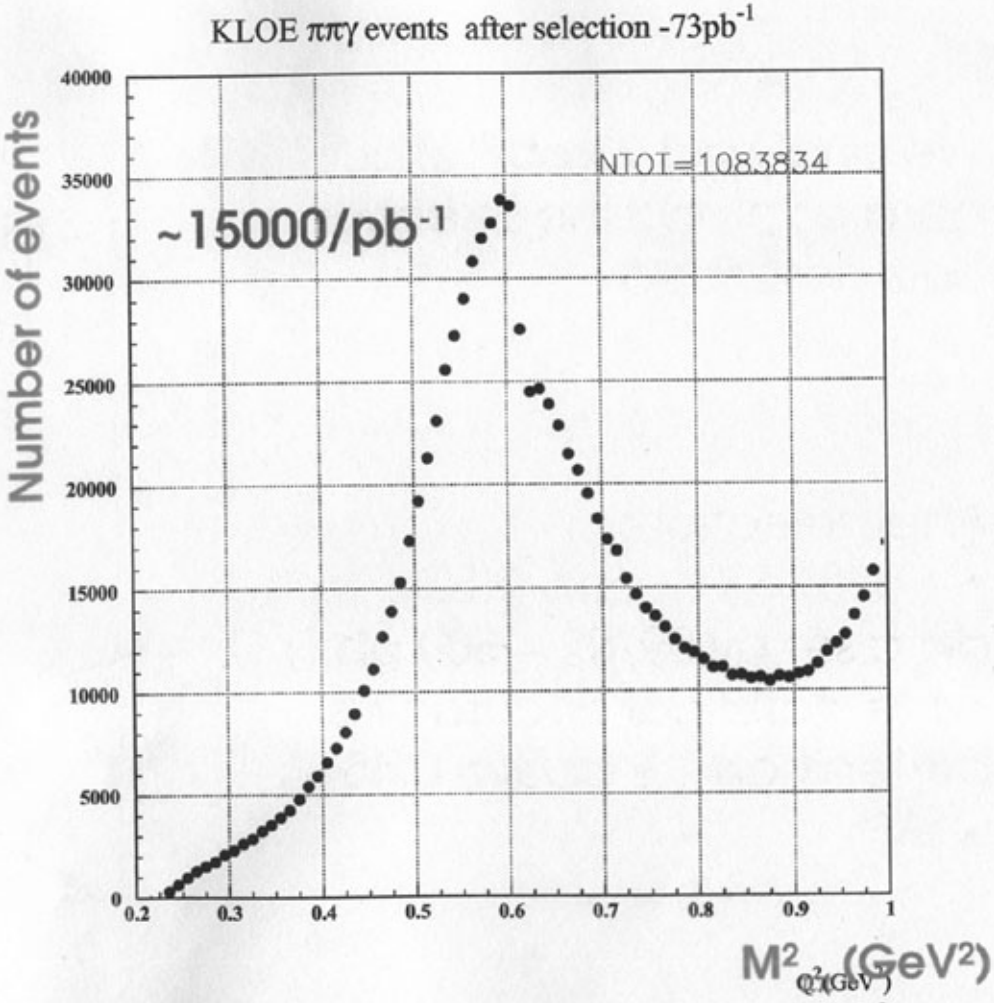


$M^2_{\pi\pi}$ spectrum

We analyzed **73 pb^{-1}** of 2001 data applying the selection cuts described.

After selection:

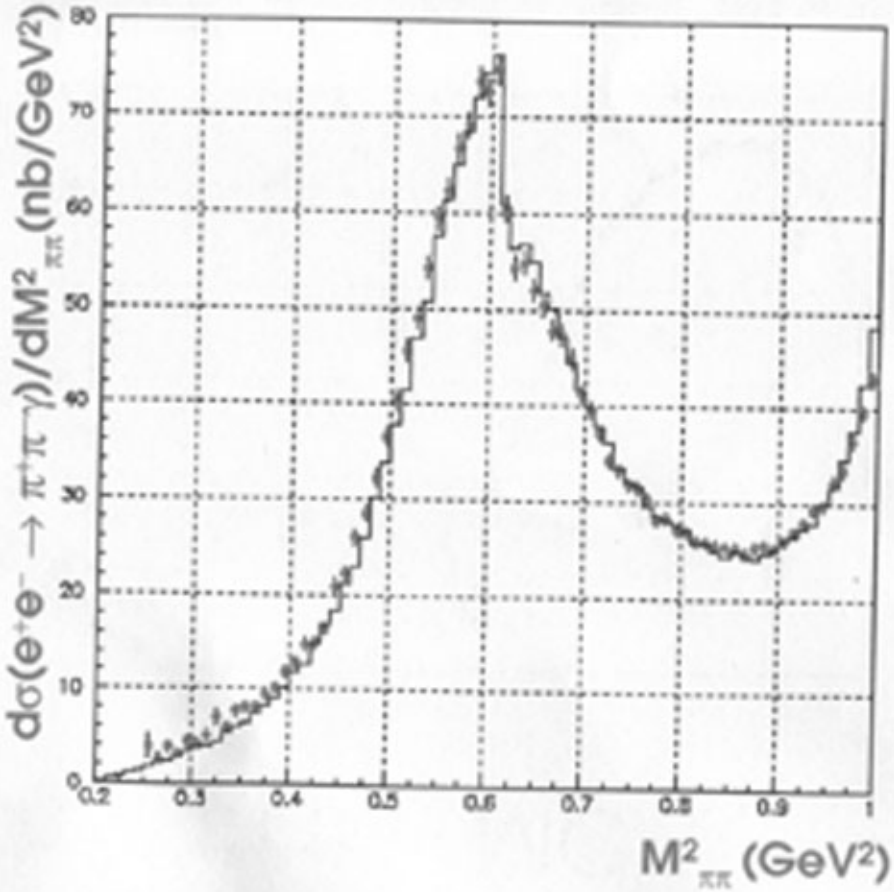
- 1 083 834 events (KLOE data set by 09/02 ~ **500 pb^{-1}**)
- the statistical accuracy is better than 1% above 0.45 GeV^2



Comparison with the MC

DATA have been compared with the MC generator **PHOKHARA (NLO).**

No **unfolding** has been applied to the data spectrum.



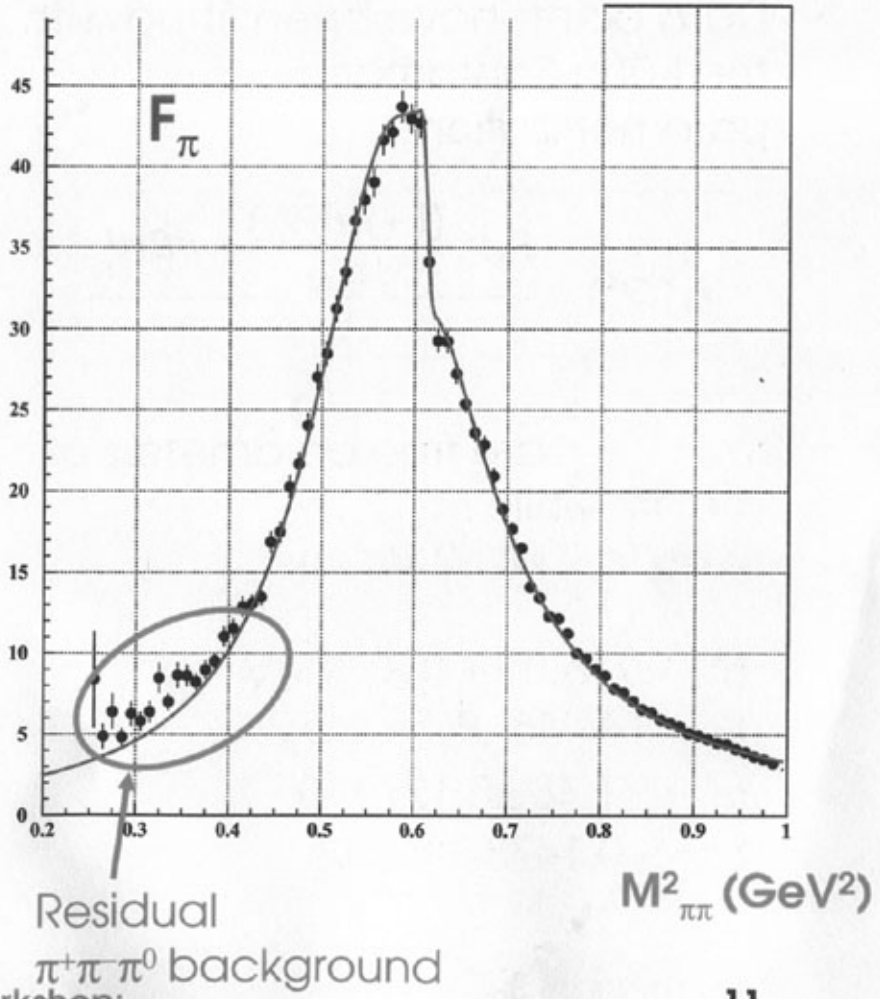
The pion form factor

- Data points have been fitted with the Kühn-Santamaria parametrization

$$F_\pi(Q^2) = \frac{BW_\rho \dfrac{(1+\alpha BW_\omega)}{1+\alpha} + \beta BW_{\rho'}}{1+\beta}$$

- $m_\rho, \Gamma_\rho, \alpha, \beta$ are free parameters of the fit, while $m_\omega, \Gamma_\omega, m_{\rho'}, \Gamma_{\rho'}$ **are fixed to CMD-2 values**

$M_\rho = 776.09 \pm 0.81$ MeV
$\Gamma_\rho = 144.46 \pm 1.55$ MeV
$\alpha = (1.48 \pm 0.12) \cdot 10^{-3}$
$\beta = -0.1473 \pm 0.002$



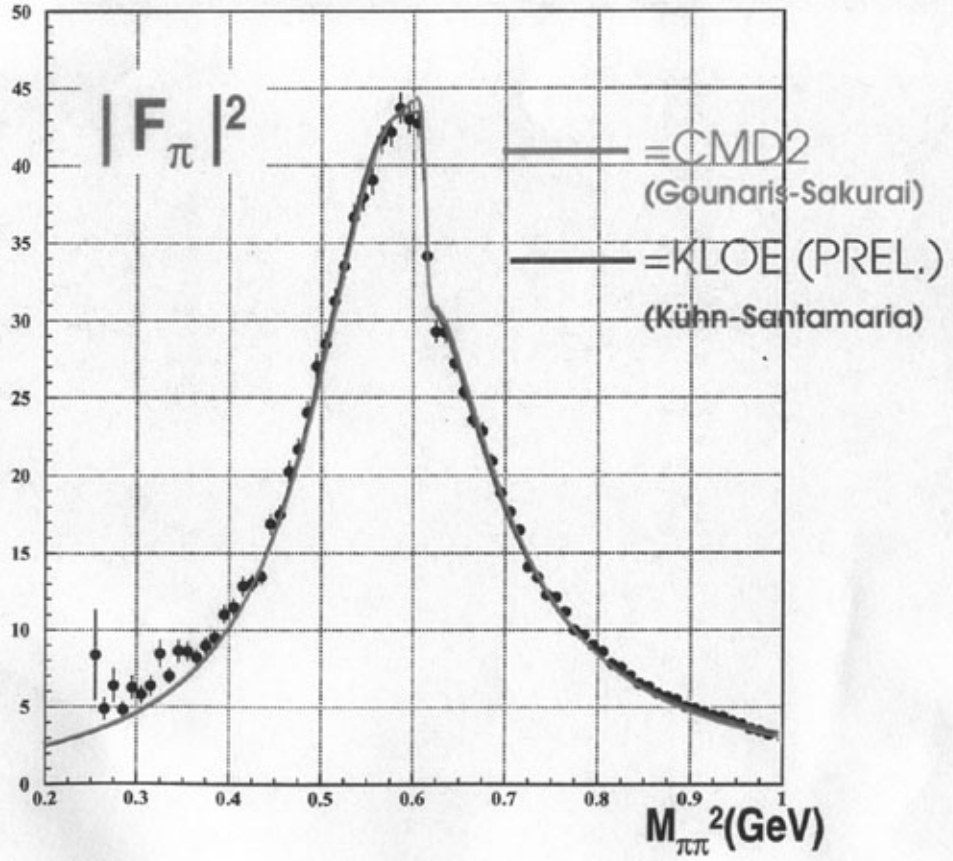
Comparison with CMD-2

Refinements:
- Unfolding of spectrum
- Residual Background Subtraction
- Systematics due to Acceptance Cuts
- Fit to Gounaris-Sakurai

Qualitatively:
excellent agreement with CMD-2 !
Quantitatively: CMD2 uses Gounaris-Sakurai, thus different fit results:

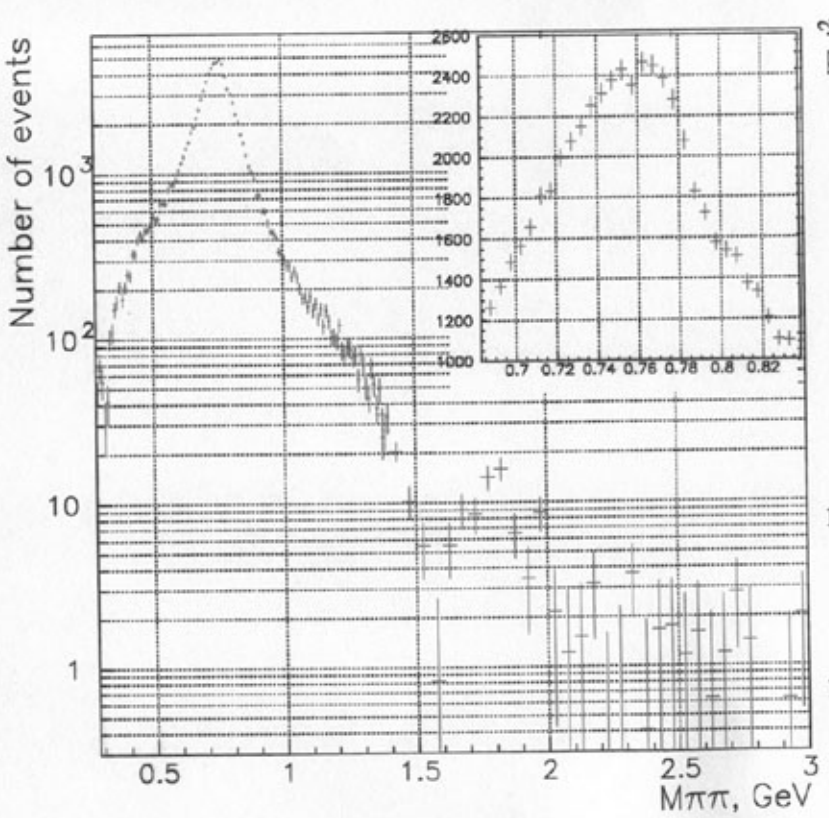
KLOE
$M_\rho = 776.09 \pm 0.81$ MeV
$\Gamma_\rho = 144.46 \pm 1.55$ MeV

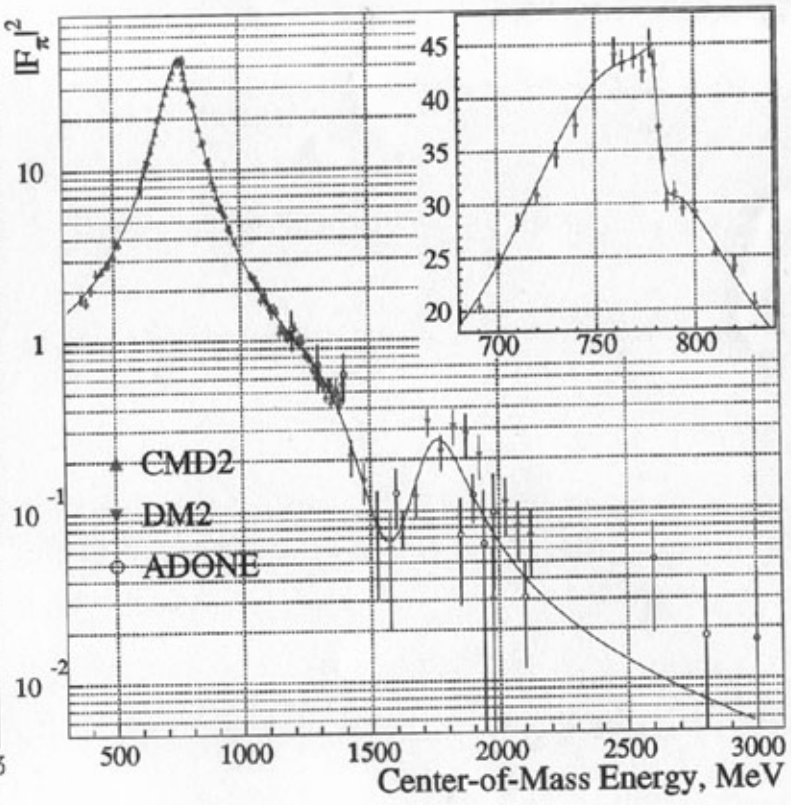
CMD2
$M_\rho = 0.7726 \pm 0.0005$ GeV
$\Gamma_\rho = 0.1437 \pm 0.0007$ GeV



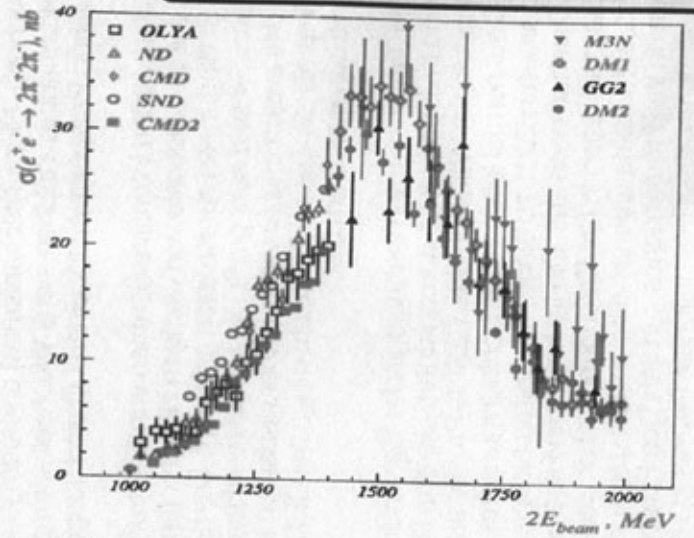
Pion Form Factor: Can ISR compete with direct e^+e^- ?

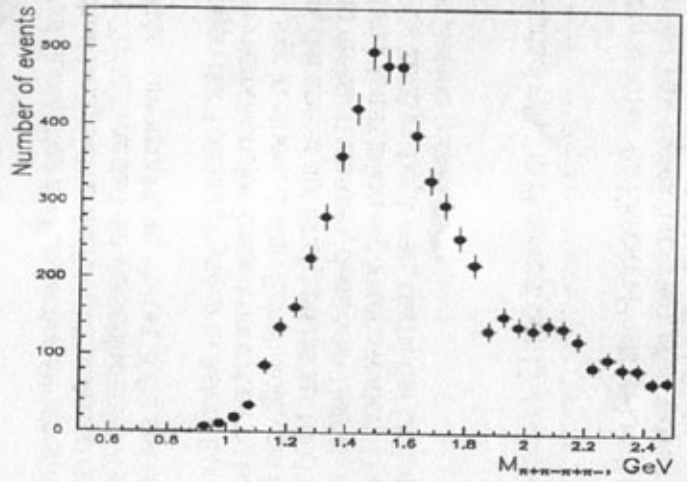
Uncorrected raw BaBar data

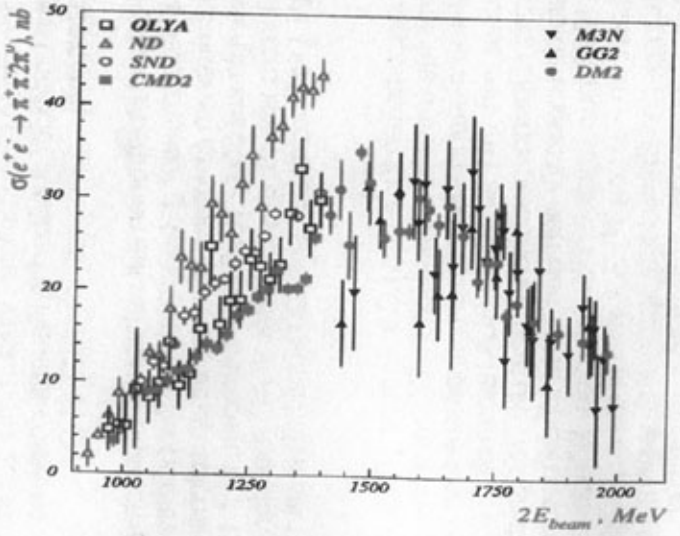


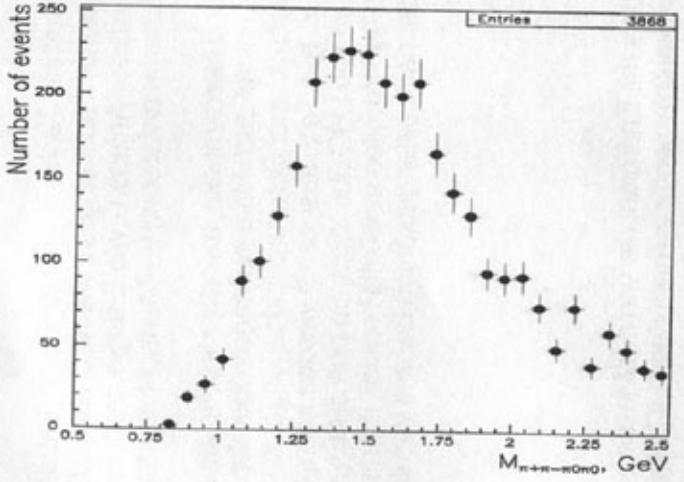


Comparison of BaBar data with $e^+e^- \to 4\pi$

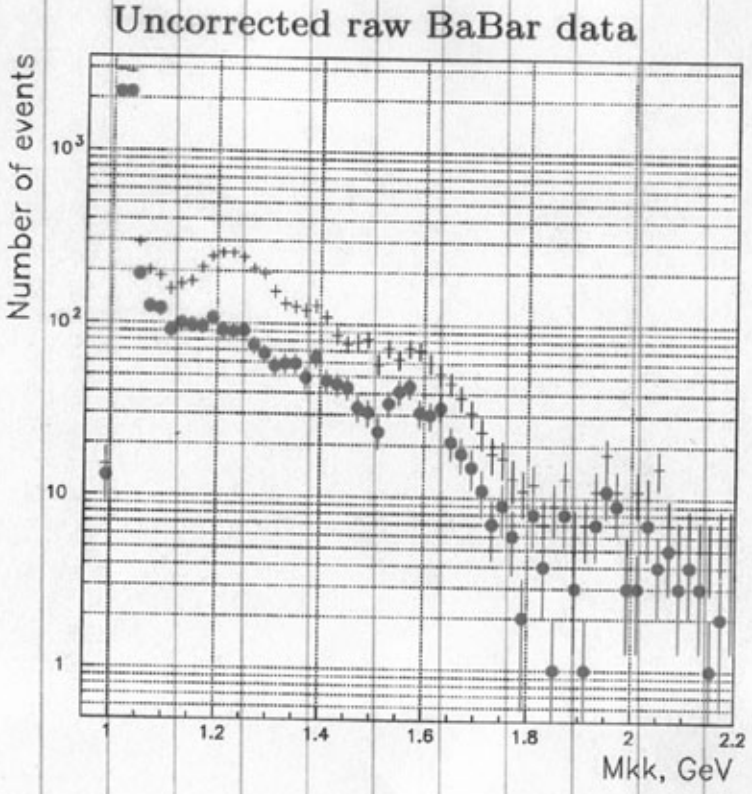


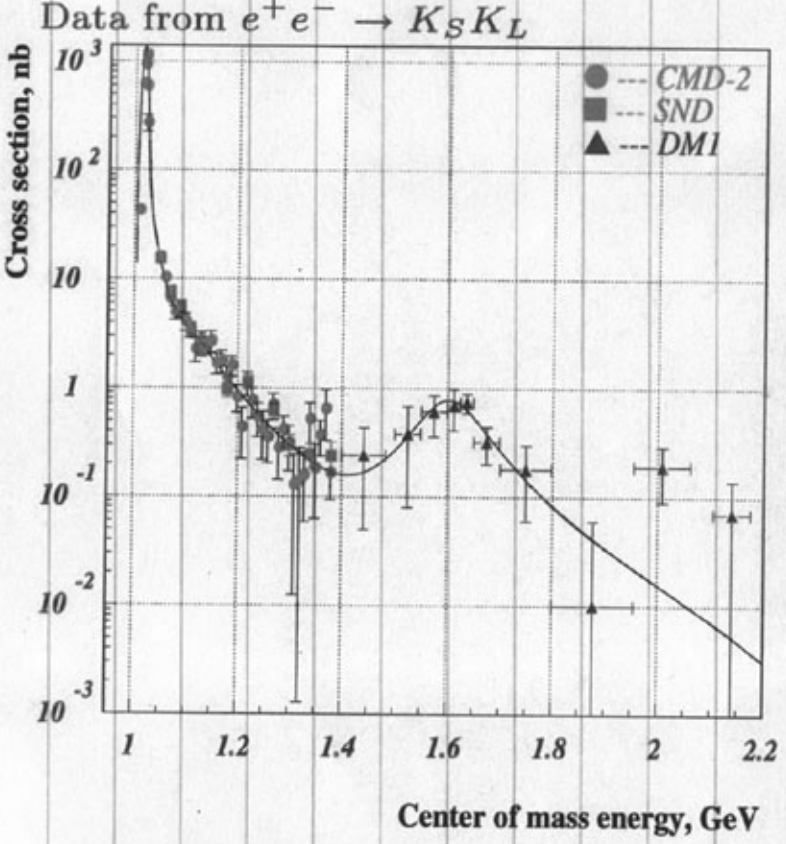






Kaon Form Factor: Can ISR compete with direct e^+e^- ?





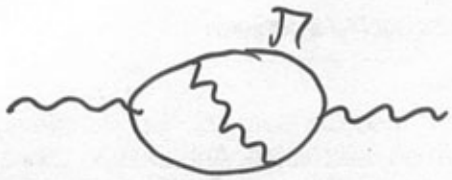
II Plans

upgrades of PHOKHARA

(Czyż, Rodrigo)

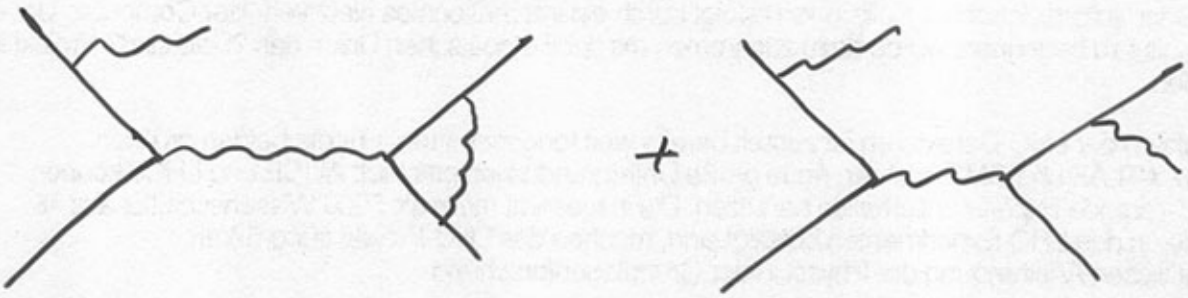
- improved treatment of FSR
  analyse interference

for improved understanding o

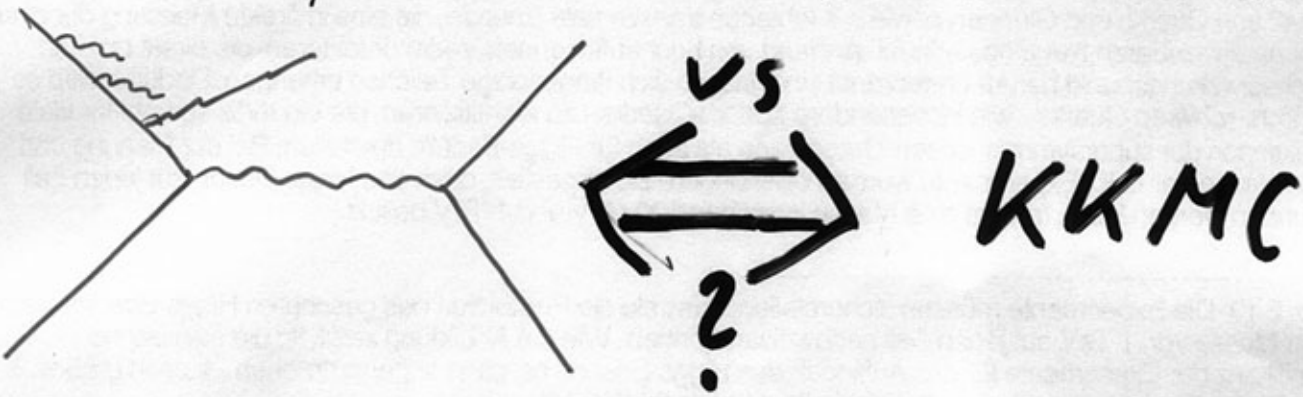


in (g-2)

- include



- multiple initial state radiation



- additional final states

$\pi^+\pi^-$ ✓

(4π) ✓

$\pi^+\pi^-\pi^0$ } next

$K\bar{K}$ }

$K\bar{K}\pi$ }

$p\bar{p}$ } BABAR

⋮ }

high Q^2

determination of couplings ....

α_s towards $R \equiv \frac{\sigma(e^+e^- \to had)}{\sigma_{Pt}}$

in $\mathcal{O}(\alpha_s^4)$

$$\alpha_s^4 \left(n_f^3 + n_f^2 + n_f + cons \right)$$

done done ? ?

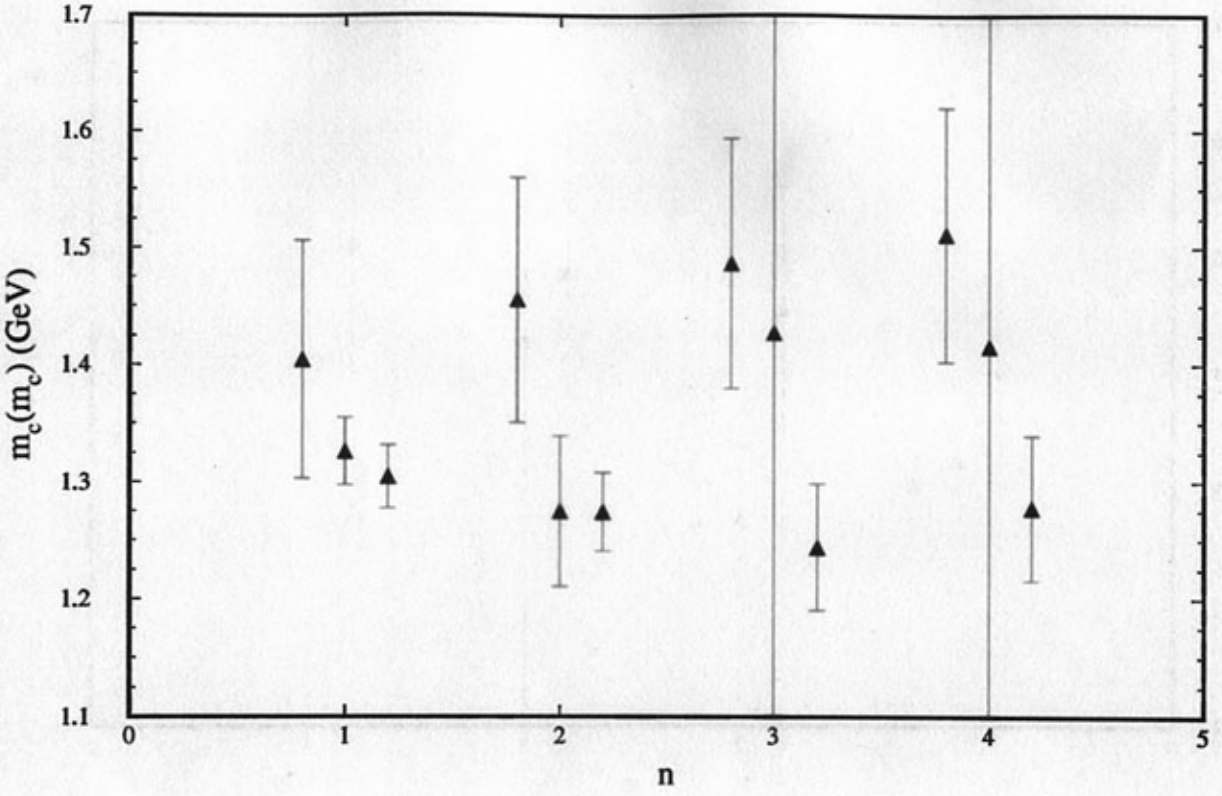
(Baikov, Chetyrkin)

m_b, m_c $\Rightarrow$ fig

improvements

(Steinhauser)

stability: compare LO, NLO, NNLO ➪ clear improvement



$m_c(m_c)$ for $n = 1, 2, 3, 4$ in LO, NLO, NNLO.

FINAL RESULT: $m_c(m_c) = 1.304(27)$ GeV