K->μ + missing mass

Evgueni's analysis: K-> μN, μνX (X inv)

From NA62-20-09

- Roberta's shape analysis procedure is not able yet to account for correlated uncertainties among the mass bins. The dominant uncertainties in the $K_{\mu\nu X}$ case (due to the non-gaussian tail and the simulation of the LAV veto inefficiency) are highly correlated among the mass bins. The analysis procedure for this case is yet to be developed.

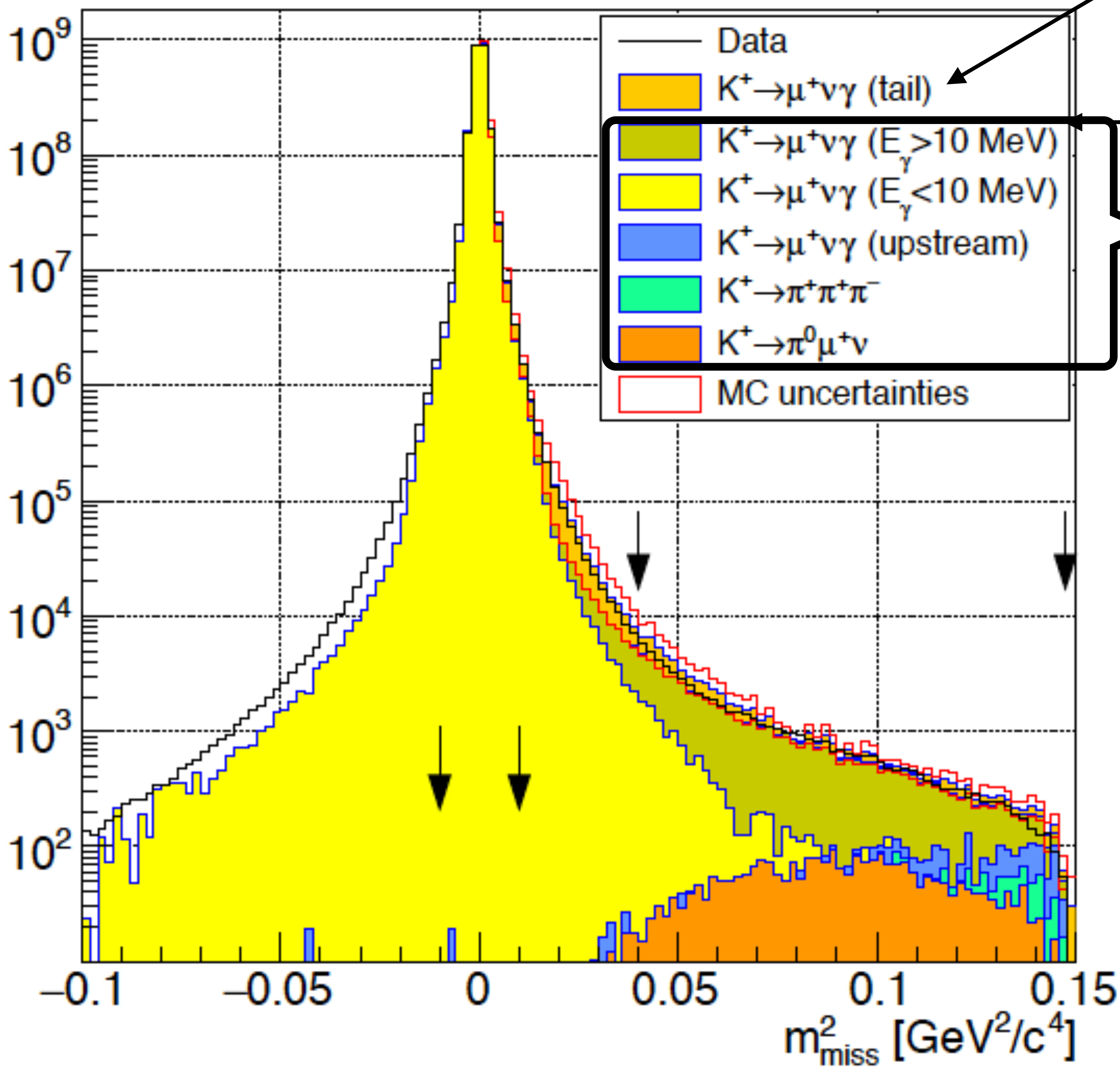
I don't understand this sentence,
if Evgueni agrees we could talk about this in one of the next meetings

Of course some work should be done to find the best model to describe this analysis, but I think it is not impossible.

This was my slide 2 weeks ago, Evgueni contacted me yesterday, I'll ask few questions and we can discuss now

I would discuss also about other aspects of this analysis, but now let's focus on this issue

Bkg model (my questions)



This (the orange histo) is taken from the negative tail

Till here

From MC (with all corrections etc..)

And the red rectangles are the uncertainties on the full "bkg model", dominated by the uncertainties on the orange histo (100% uncertainty)

Is this correct?

Bkg model

Background source	Branching fraction	Background in the region $m^2_{miss} > 0.1$ GeV$^2/c^4$
$K^+ \to \mu^+\nu\gamma$ (IB, $E^*_\gamma < 10$ MeV)	0.6314	$24 \pm 24_{stat}$
$K^+ \to \mu^+\nu\gamma$ (IB, $E^*_\gamma > 10$ MeV), SD, INT	4.16×10^{-3}	$4690 \pm 59_{stat} \pm 333_{LAV}$
$K^+ \to \mu^+\nu$ (non-gaussian tail)	–	$780 \pm 780_{syst}$
$K^+ \to \mu^+\nu$ (upstream)	0.6356	$730 \pm 83_{stat}$
$K^+ \to \pi^0\mu^+\nu$	3.352%	$981 \pm 40_{stat} \pm 178_{LAV}$
$K^+ \to \pi^0\mu^+\nu$ (upstream)	3.352%	$35 \pm 25_{stat}$
$K^+ \to \pi^+\pi^+\pi^-$	5.583%	$307 \pm 32_{stat}$
$K^+ \to \pi^+\pi^+\pi^-$ (upstream)	5.583%	$2 \pm 1_{stat}$
Total		7549 ± 928

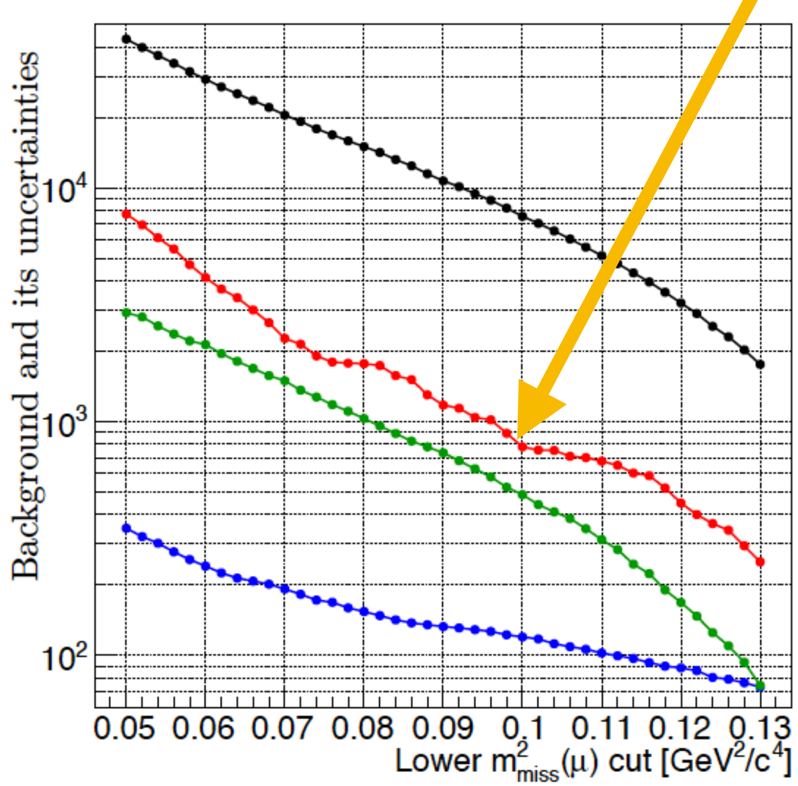


Figure 11: Left: From top to bottom, total estimated background (black), its systematic uncertainties due to the $K_{\mu 2}$ non-gaussian tail (red) and photon veto simulation (green), and the MC statistical error (blue) as functions of the lower m^2_{miss} cut. Right: $K_{\mu\nu\nu}$ acceptance (blue) and

The issue (?)

The kinematic tail contribution (orange histo):
Each bin of the positive mass is taken to be equal to the difference between data and MC of the corresponding negative bin

Is this correct?

The correlation comes from a sort of “normalization” (?)

Is the issue corresponding to the fact that the discrepancy data-MC is of the same sign for all the bins?

Maybe I am too naive, but I don’t see any issue with the shape analysis

- **You can do it binned or unbinned,**
- **you can split the background in several contributions and consider them each one in a different way, depending on the uncertainties**
- **The shape parameters and the yield of each bkg contribution are treated in a separate way**

Discussion

I could say how I would do this analysis but I had no time to prepare the slides (Evgueni agreed yesterday evening to participate to this discussion)
And also, I want to be sure that I understood which is the issue with this "correlations"

Also, considering the HNL, where no MC is used, using shapes is much more easy, smooth, and natural, than making those cuts at 1.5 sigma and with bin size of 0.75 sigma, but I don't want to go off-topic now.