

Light vector meson production at the LHC with the ALICE detector

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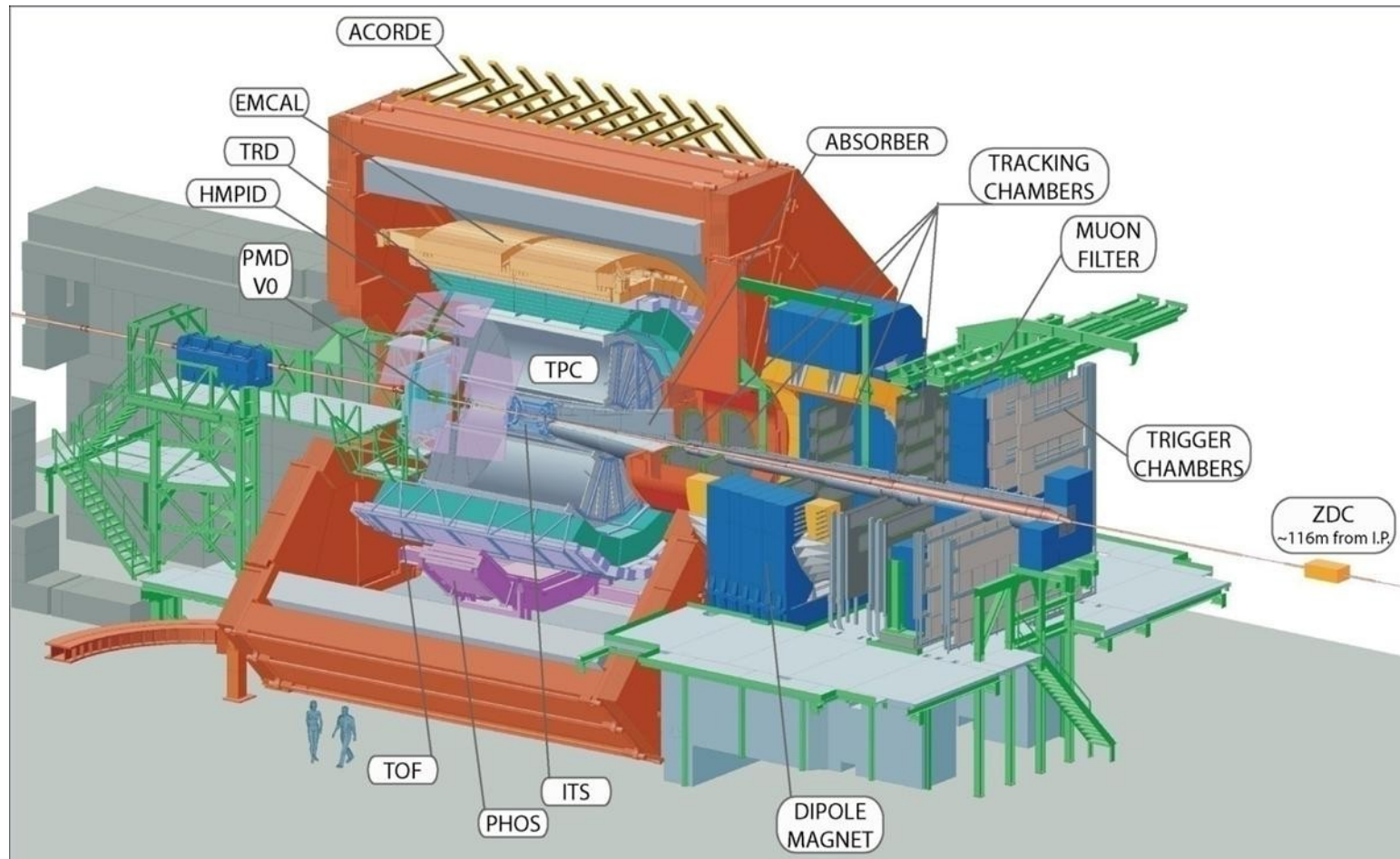


- ★ ρ , ω and ϕ provide key information on the hot and dense state of strongly interacting matter produced in high-energy heavy ion collisions
 - ★ Strangeness enhancement accessed via ϕ meson production
 - ★ In-medium modifications of hadron properties accessed through ρ spectral function
- ★ pp collisions are a useful test of the theory and provide a baseline for the study in AA collisions

The ALICE detector

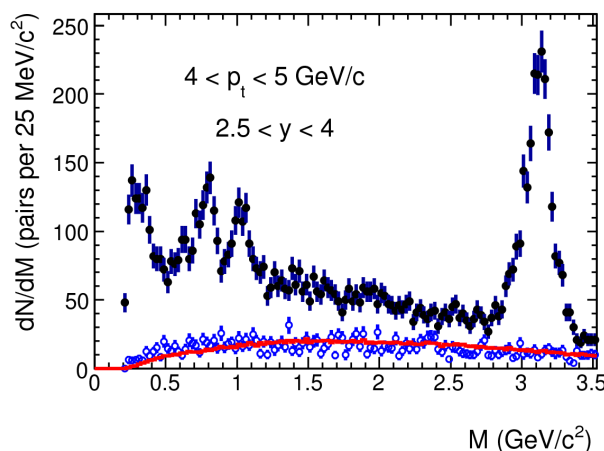
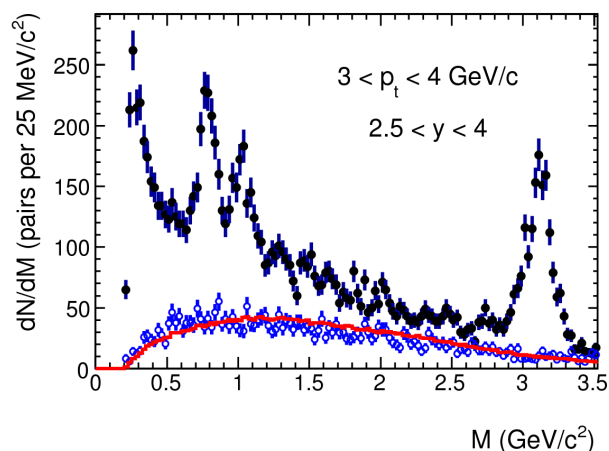
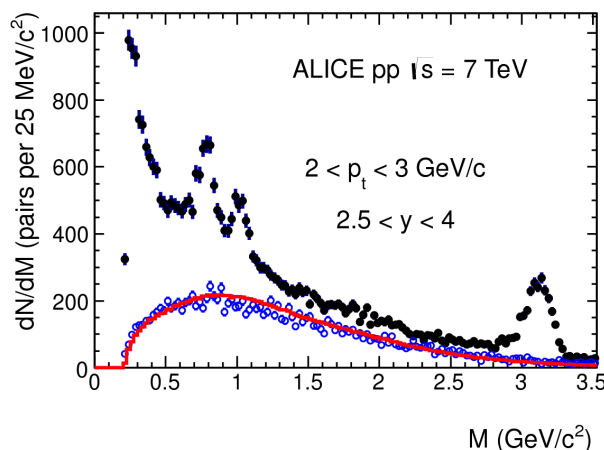
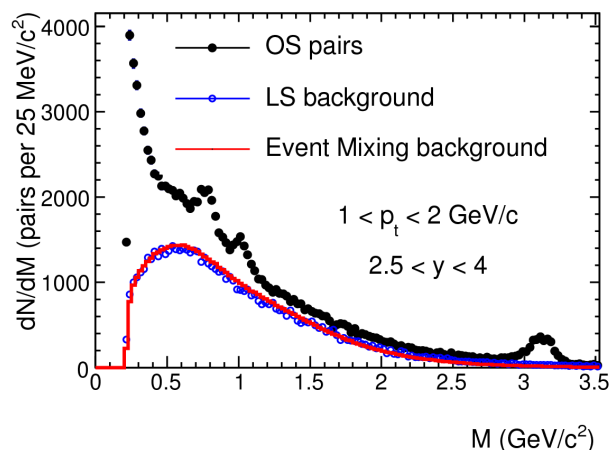
The ALICE experiment is dedicated to the study of QGP in heavy ion collisions.

Vector mesons can be detected through their decays in muon pairs with the **muon spectrometer**, that covers the rapidity range $2.5 < y < 4$



Analyzed data were collected in 2010 in pp collisions at $\sqrt{s} = 7$ TeV,

$$L_{\text{INT}} = 55.7 \text{ nb}^{-1}$$



★ SELECTIONS APPLIED:

★ $2.5 < y_{\mu} < 4$ and $2.5 < y_{\mu\mu} < 4$

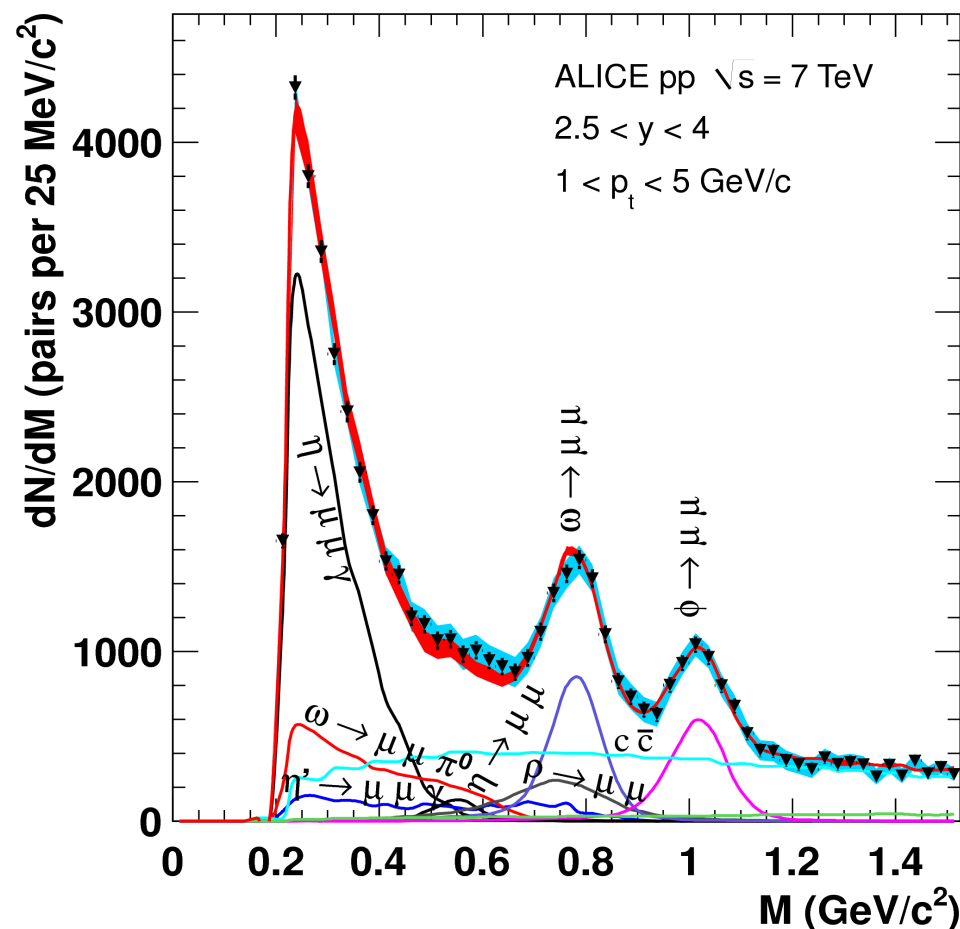
★ Each muon track is required to match the muon trigger

★ Cuts for beam-gas interaction

Combinatorial background evaluated through event mixing

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OS mass spectrum after background subtraction



Free parameters of the fit:

- ★ the normalization of $\eta \rightarrow \mu\mu\gamma$
- ★ the normalization of $\omega \rightarrow \mu\mu$
- ★ the normalization of $\phi \rightarrow \mu\mu$
- ★ Open Charm normalization

- ★ Blue band: systematic error on data, due to the uncertainty in the BKG normalization
- ★ Red band: systematic error on sources

At 7 TeV

$$N_{\phi} = (3.20 \pm 0.15) 10^3$$

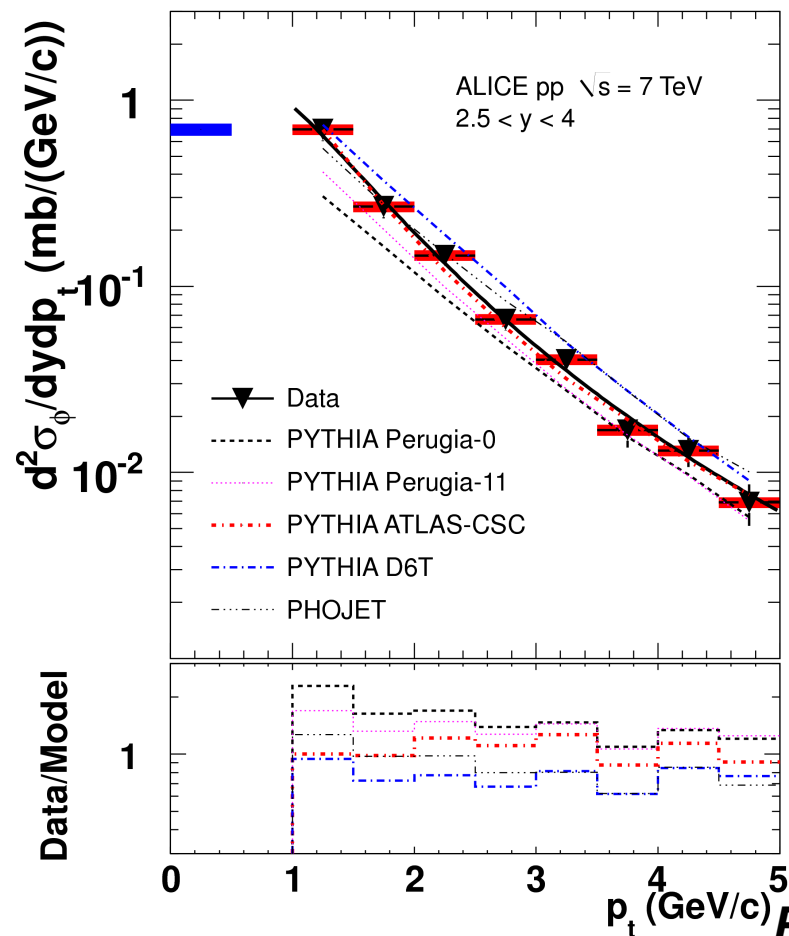
$$N_{\rho+\omega} = (6.83 \pm 0.15) 10^3$$

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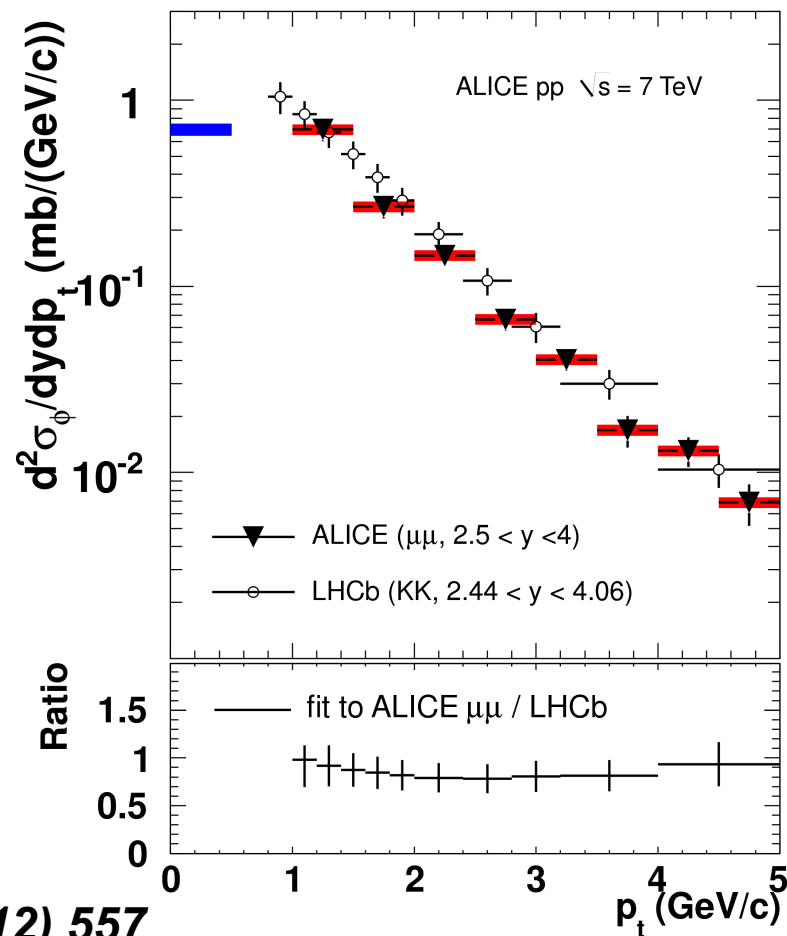
ϕ cross section at 7 TeV

the cross section is extracted for $2.5 < y < 4$ and $1 < p_T < 5$ GeV/c

$$\sigma_\phi = 0.940 \pm 0.084 \text{ (stat.)} \pm 0.076 \text{ (syst.) mb}$$



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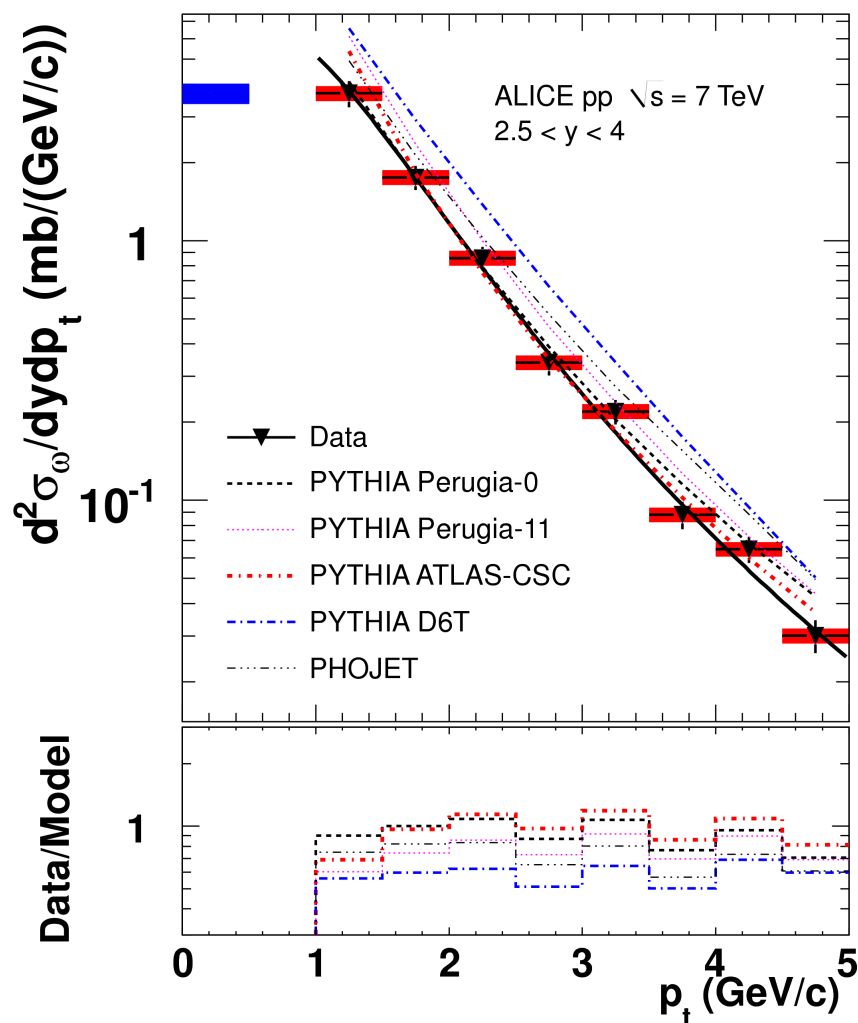
PHOJET and PYTHIA with ATLAS-CSC and D6T tunes reproduce σ_ϕ

The observed shapes of the p_T distributions are similar.

We measure $N_{p+\omega}$

In order to extract σ_ω , we measured the ratio $\sigma_\rho/\sigma_\omega = 1.15 \pm 0.20$ (stat.) ± 0.12 (syst)

The cross section is extracted for $2.5 < y < 4$ and $1 < p_T < 5$ GeV/c



$$\sigma_\omega = 5.28 \pm 0.54 \text{ (stat.)} \pm 0.49 \text{ (syst.) mb}$$

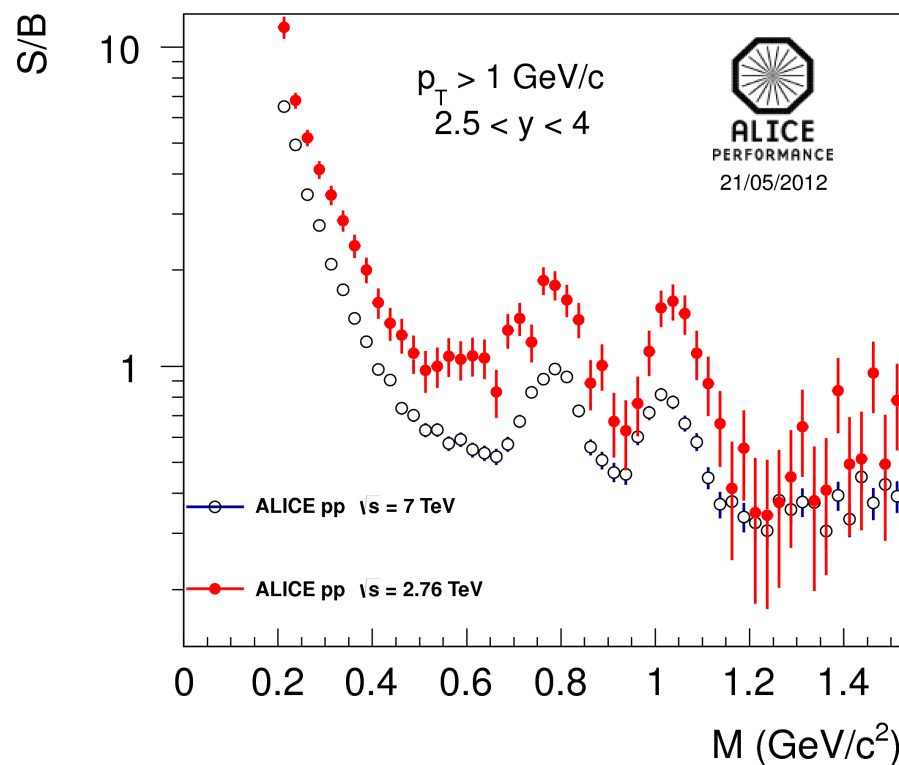
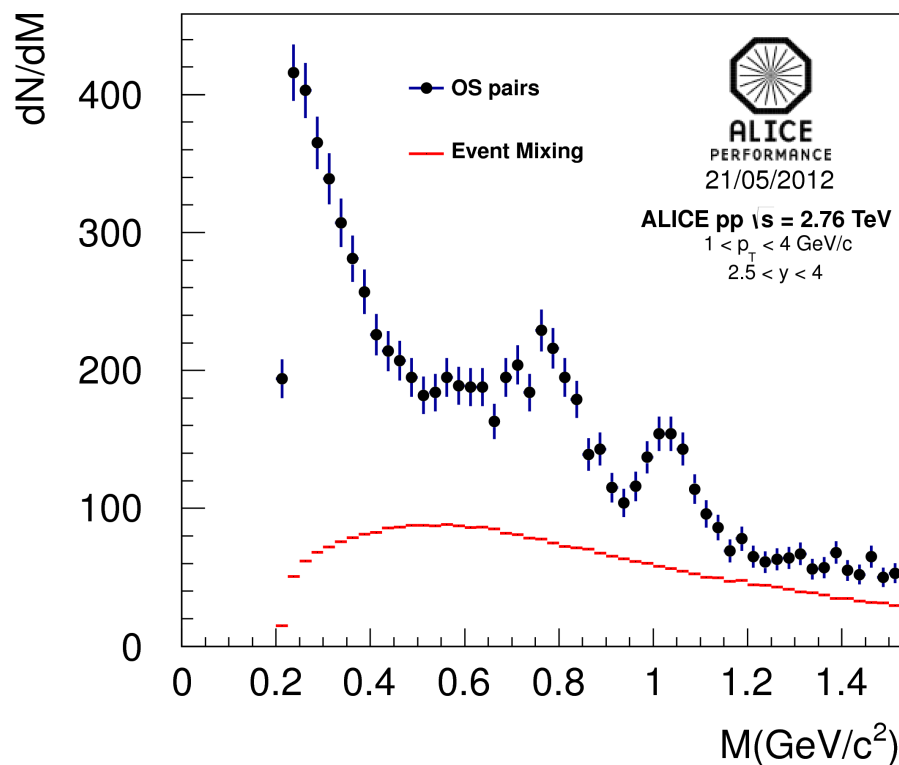
σ_ω overestimated by all models
except PYTHIA-Perugia0

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ϕ Dimuon mass spectrum in pp collisions at 2.76 TeV

Analyzed data were collected in 2011 in pp collisions at $\sqrt{s} = 2.76$ TeV,
 $L_{\text{INT}} = 17.6 \text{ nb}^{-1}$

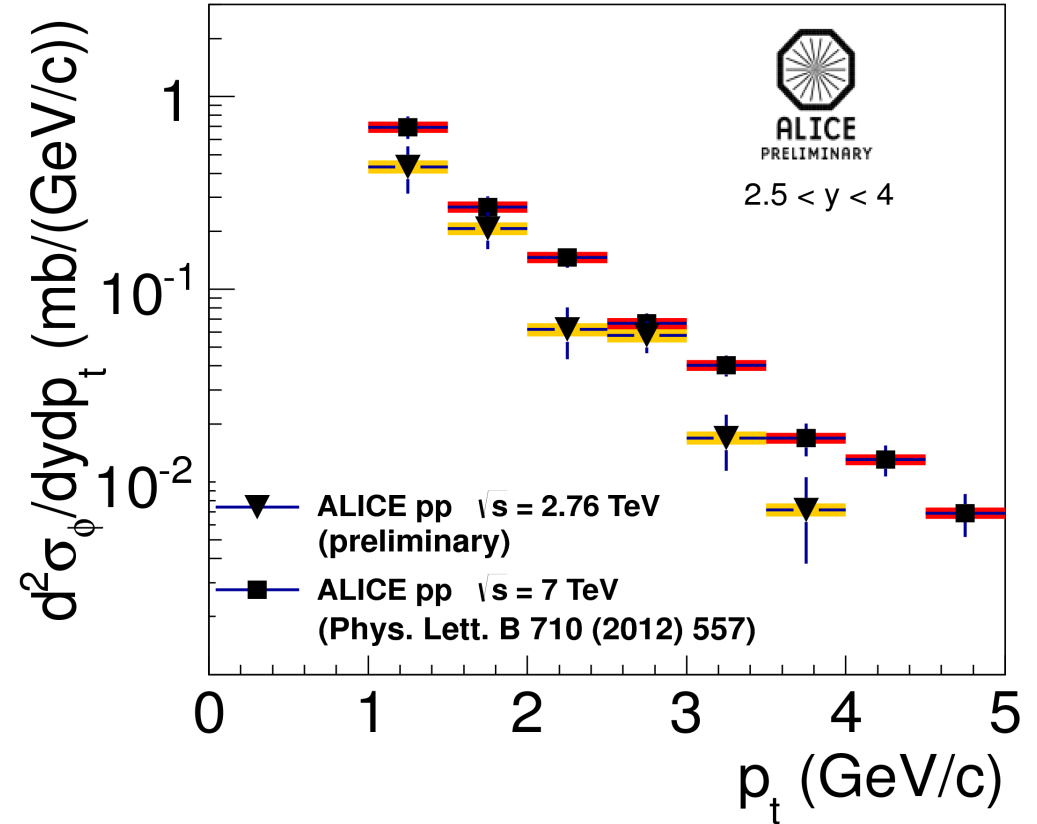
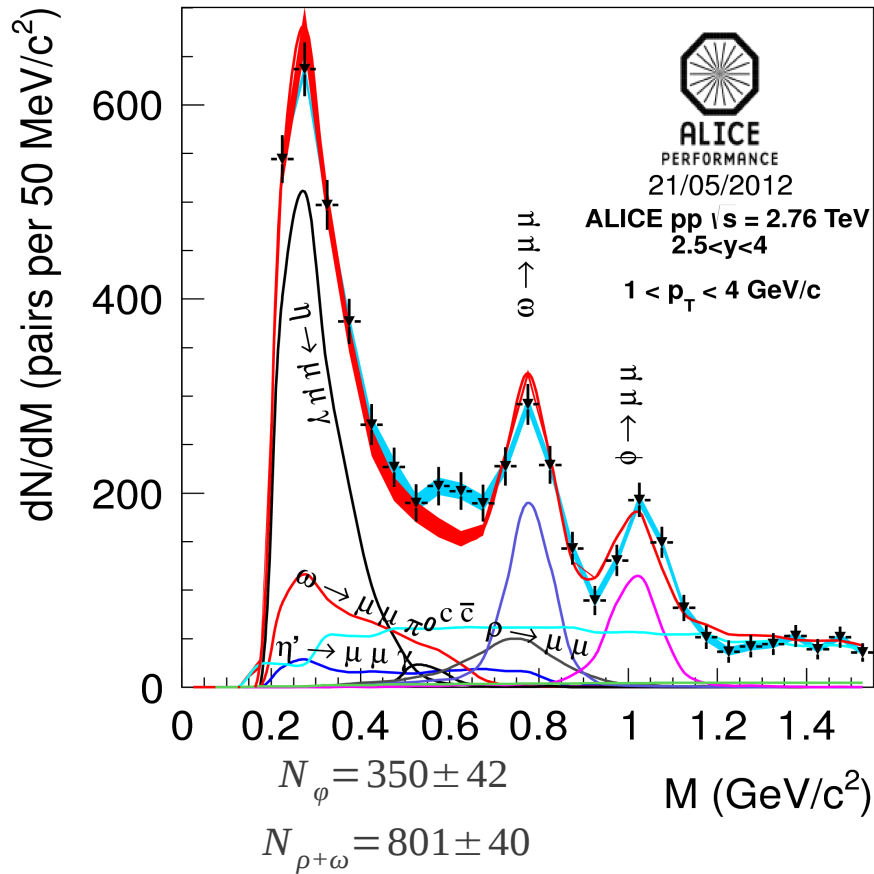
- ★ Same analysis as at 7 TeV
- ★ SIG/BKG at 2.76 TeV at the ϕ and ω peaks ~ 2
- ★ 2 times higher than at 7 TeV



ϕ cross section at 2.76 TeV

The cross section is extracted for $2.5 < y < 4$ and $1 < p_T < 4$ GeV/c

$$\sigma_\phi = 0.587 \pm 0.070 \text{ (stat.)} \pm 0.045 \text{ (syst.) mb}$$



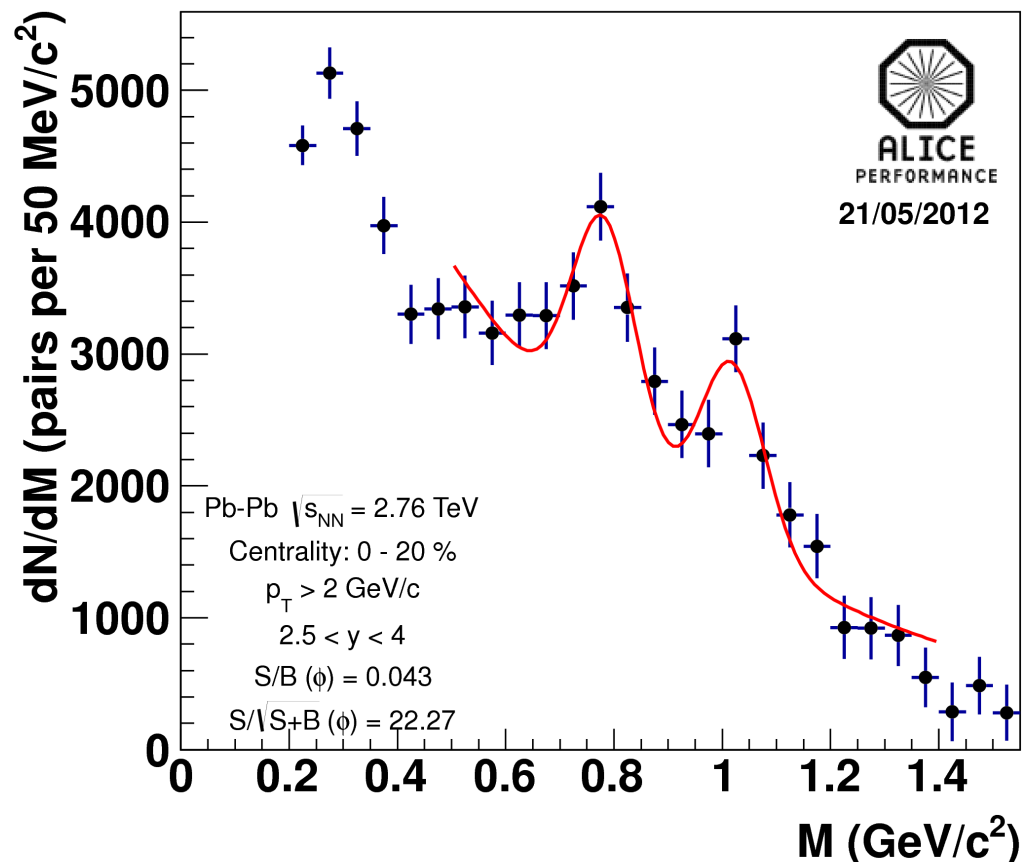
PYTHIA-Perugia-0 $\sigma_\phi = 0.275$ mb, PYTHIA-Perugia-11 $\sigma_\phi = 0.293$ mb, PYTHIA-ATLAS-CSC $\sigma_\phi = 0.464$ mb, PYTHIA-D6T $\sigma_\phi = 0.625$ mb, PHOJET $\sigma_\phi = 0.487$ mb

PHOJET and PYTHIA with ATLAS-CSC and D6T tunes reproduce σ_ϕ .

- ◆ $N_{OS} \sim 9 \cdot 10^6$
- ◆ Combinatorial background evaluated through event mixing
- ◆ Centrality selection performed using VZERO detector

SELECTIONS APPLIED:

- ◆ $-4 < \eta_{\mu} < -2.5$ and $-4 < y_{\mu\mu} < -2.5$
- ◆ $p_{T\mu} > 0.7 \text{ GeV}/c$
- ◆ $17.6 \text{ cm} < R_{abs} < 89.5 \text{ cm}$
- ◆ p VS DCA cut
- ◆ Track $\chi^2 < 3.5$



Light Vector Mesons in the dimuon channel are visible also in central Pb-Pb collisions.
 On-going analysis for the extraction of ϕ R_{AA}

- ★ The ϕ and ω cross sections at 7 TeV in pp collisions was measured for $2.5 < y < 4$ and $1 < p_T < 5$ GeV/c

$$\sigma_{\phi} = 0.940 \pm 0.084 \text{ (stat.)} \pm 0.076 \text{ (syst.) mb}$$

$$\sigma_{\omega} = 5.28 \pm 0.54 \text{ (stat.)} \pm 0.49 \text{ (syst.) mb}$$

- ★ The ϕ cross section at 2.76 TeV was measured for $2.5 < y < 4$ and $1 < p_T < 4$ GeV/c

$$\sigma_{\phi}(2.5 < y < 4, 1 < p_T < 4 \text{ GeV/c}) = 0.587 \pm 0.070 \text{ (stat)} \pm 0.047 \text{ (syst) mb}$$

- ★ In Pb-Pb collisions the ϕ peak is visible also for central collisions