Light vector meson production in p-Pb and Pb-Pb collisions measured with the ALICE detector

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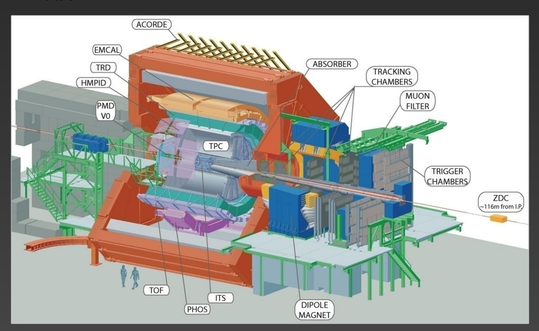
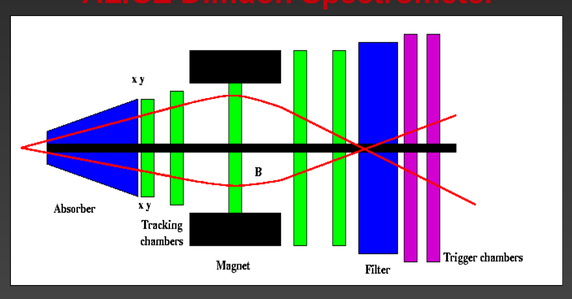
The ALICE detector

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.
Analyzed data were collected in 2010 in pp collisions at $\sqrt{s}$ = 7 TeV, in 2011 in Pb-Pb collisions at $\sqrt{s_{NN}}$ = 2.76 TeV and in 2013 in pp at $\sqrt{s}$ = 2.76 TeV and in p-Pb collisions at $\sqrt{s_{NN}}$ = 5.02 TeV



ALICE Dimuon Spectrometer



Motivations for the study of vector mesons:

- 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 production investigated through ϕ meson
- In-medium modification of hadron properties accessed through ρ spectral function
- Measurement in dileptons: negligible final state effects
- Measurement in pp and pA: reference for heavy ions, soft particle production in cold nuclear matter

Low mass dimuons in p-Pb and Pb-p collisions at 5.02 TeV

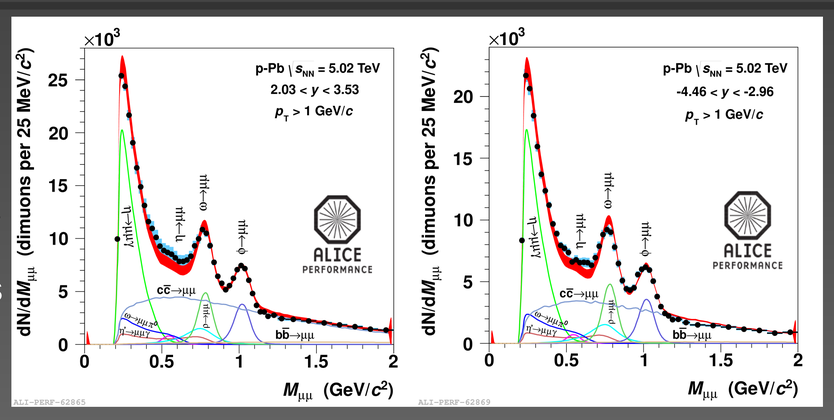
- Combinatorial background evaluated through event mixing

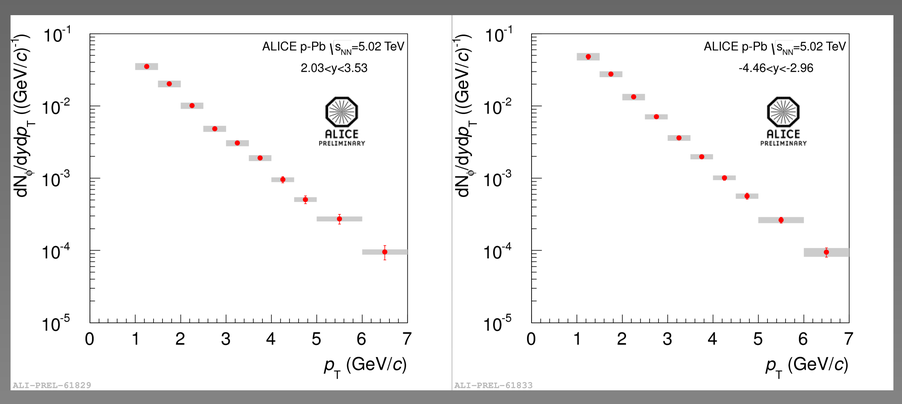
SELECTIONS APPLIED:

- 2.5 <η_μ< 4 and 2.5 <$y_{\mu\mu}$< 4
- muon tracks are required to match the muon trigger
- cuts for beam-gas interactions
- muon trigger introduces a selection $p_{T\mu}$>0.5 GeV/c

Fit to the dimuon mass spectrum after background subtraction:

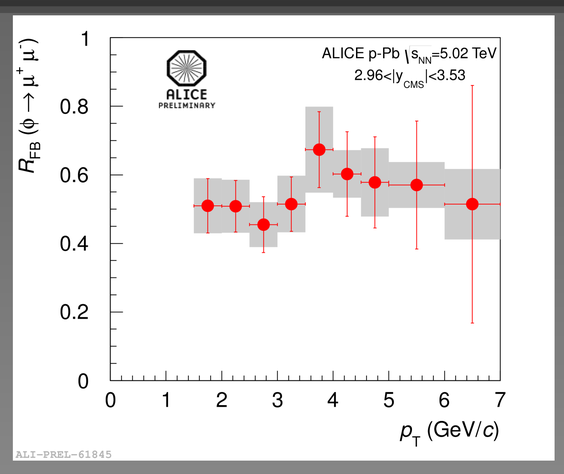
- free parameters of the fit are the normalization of η–> μμγ, ω–>μμ, ϕ–>μμ and open charm
- other processes normalized with ratios between cross sections or branching ratios
- Fair agreement between data and hadronic cocktail+heavy flavors





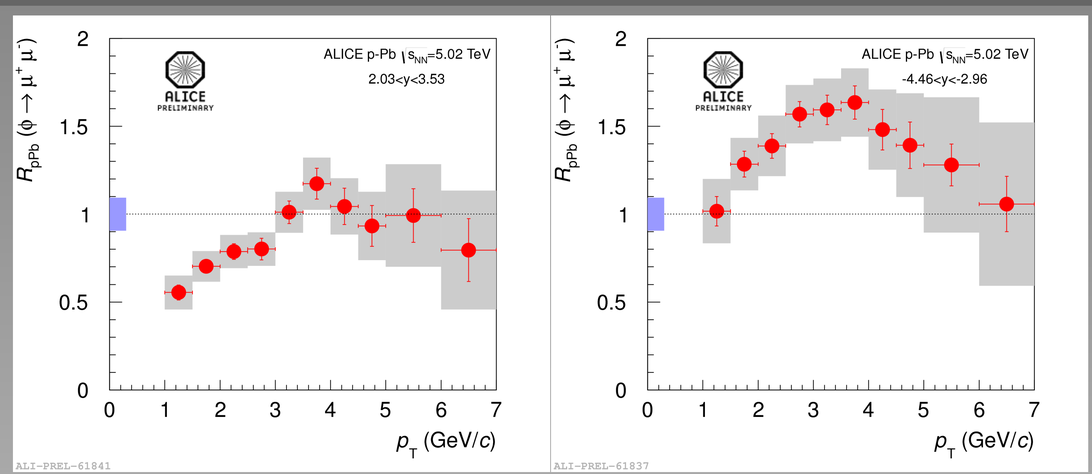
ϕ meson p_T-differential yields in p-Pb

- Yield larger when the Pb beam is directed towards the muon arm (-4.46<y_{CM}<-2.96)
- Similar shapes in the common range 2.96<|y_{CM}|<3.54
- Flat forward/backward ratio in this |y_{CM}| range



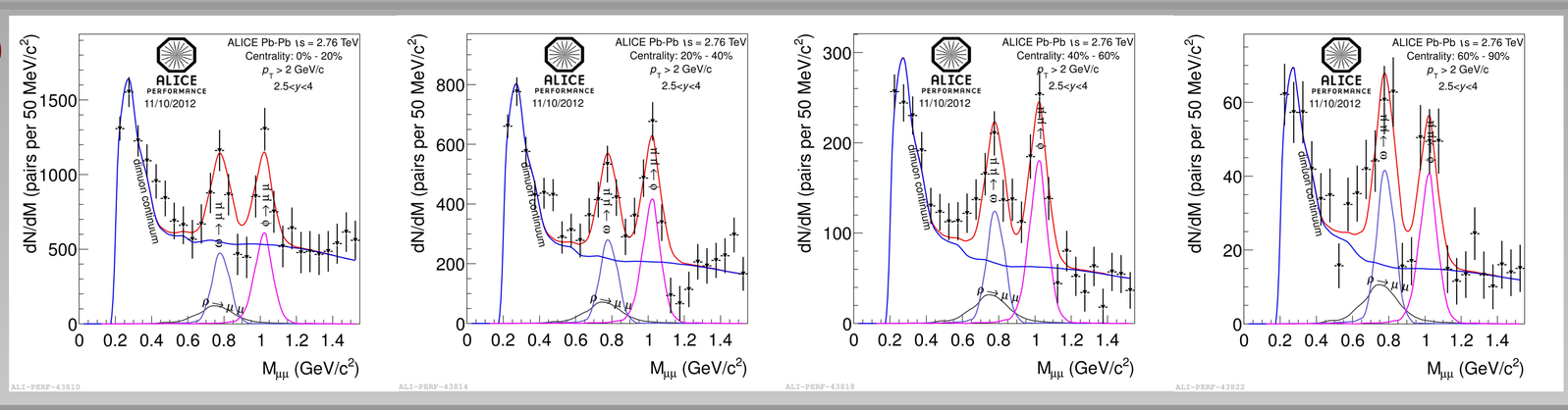
R_{pPb} vs p_T for the ϕ meson

- pp cross section at $\sqrt{s_{NN}}$ = 5.02 TeV obtained through interpolation of the measurements in pp at $\sqrt{s_{NN}}$ = 2.76 TeV and $\sqrt{s_{NN}}$ = 7 TeV
- At forward rapidities, R_{pPb} increases monotonically from ~0.5 at p_T ~1 GeV/c to ~1 at 3-4 GeV/c
- Maximum R_{pPb} at p_T=3-4 GeV/c
- R_{pPb} larger at backward rapidities
- The value approaches 1 at high p_T



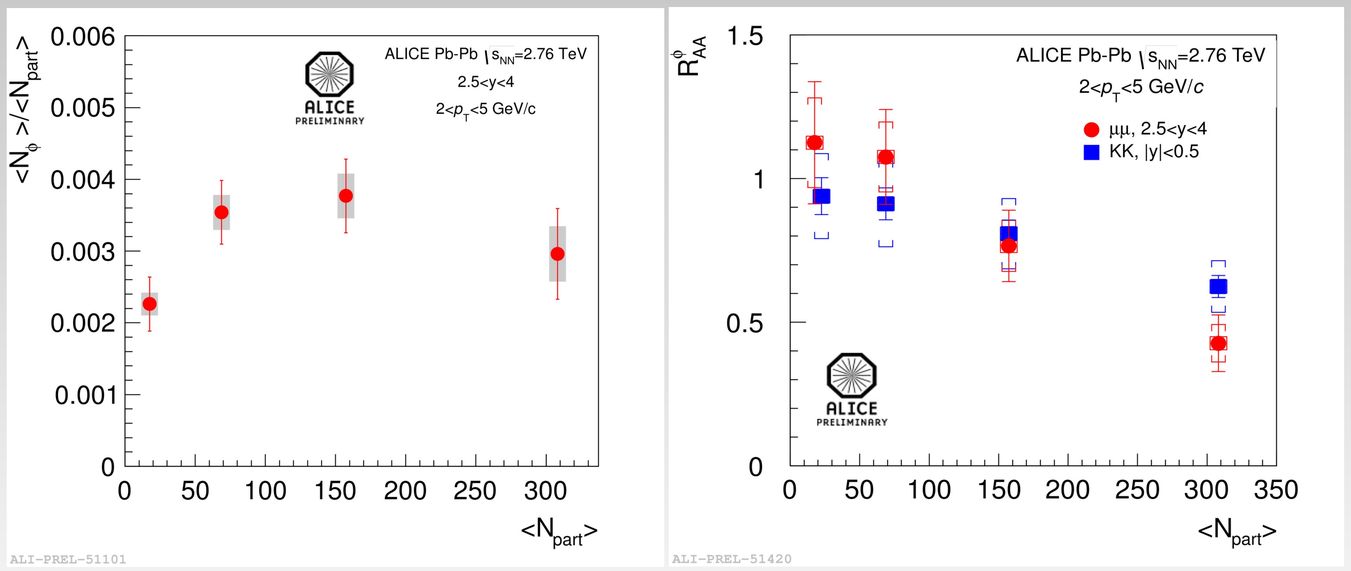
Dimuon mass spectrum in Pb-Pb collisions at $\sqrt{s_{NN}}$=2.76 TeV

- Trigger threshold at $p_{T\mu}$~1 GeV/c
- Mass spectra in different centrality bins for dimuon p_T > 2 GeV/c
- Background (blue line) described as an empirical continuum



ϕ yield and R_{AA}

- Yield vs centrality increases from peripheral to semiperipheral collisions and tends to saturate for central events
- For each point, the measurements in KK at midrapidity and in μμ at forward rapidity are compatible within the errors
- On the other side, different slopes for R_{AA} vs centrality in the two data set for 2<p_T<5 GeV/c are observed
- Hint for a different hydrodinamic push in the two rapidity regions?



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