ϕ meson production in pp collisions at $\sqrt{s} = 13$ TeV in ALICE

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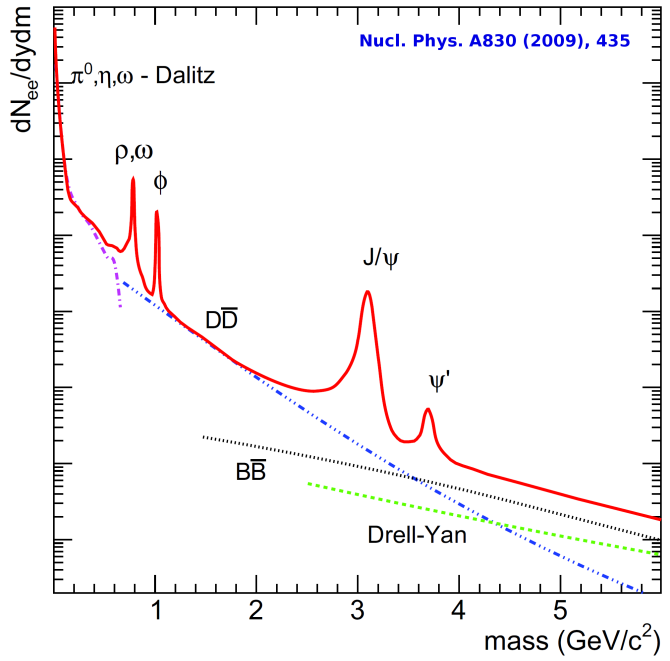
October 11, 2016

Low-Mass dilepton physics

Low mass dilepton production in AA collisions → information on the hot and dense state of strongly-interacting matter produced in high energy nucleus nucleus collisions

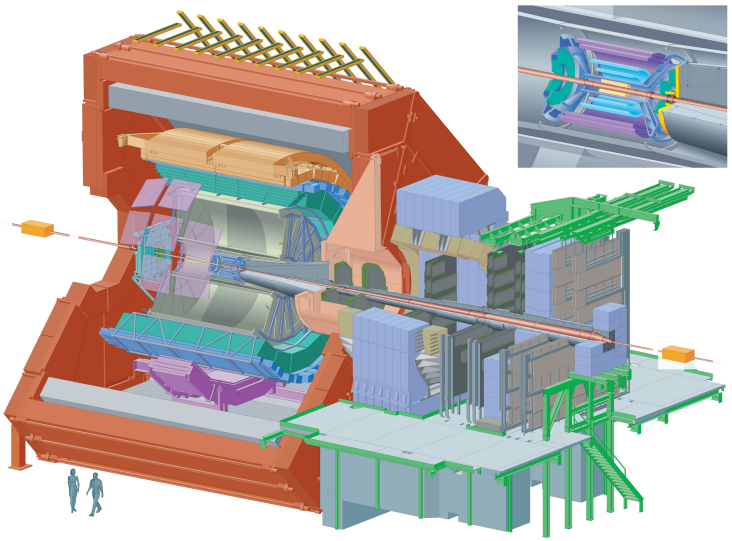


- Strangeness production via the ϕ meson
- Modification of ρ spectral function linked to the chiral symmetry restoration

Dileptons (dielectrons, dimuons)

→ negligible final-state effects

Measurements in pp and p-A collisions : Soft particle production in Cold Nuclear Matter, needed reference for correctly interpreting heavy-ion observations.



Two dilepton channels in ALICE

- e^+e^- in mid rapidity : $|y| < 0.9$ in the central barrel
- $\mu^+\mu^-$ in forward rapidity : $-4.0 < y < -2.5$ in the muon arm. **channel of interest for this talk**

Collision systems:

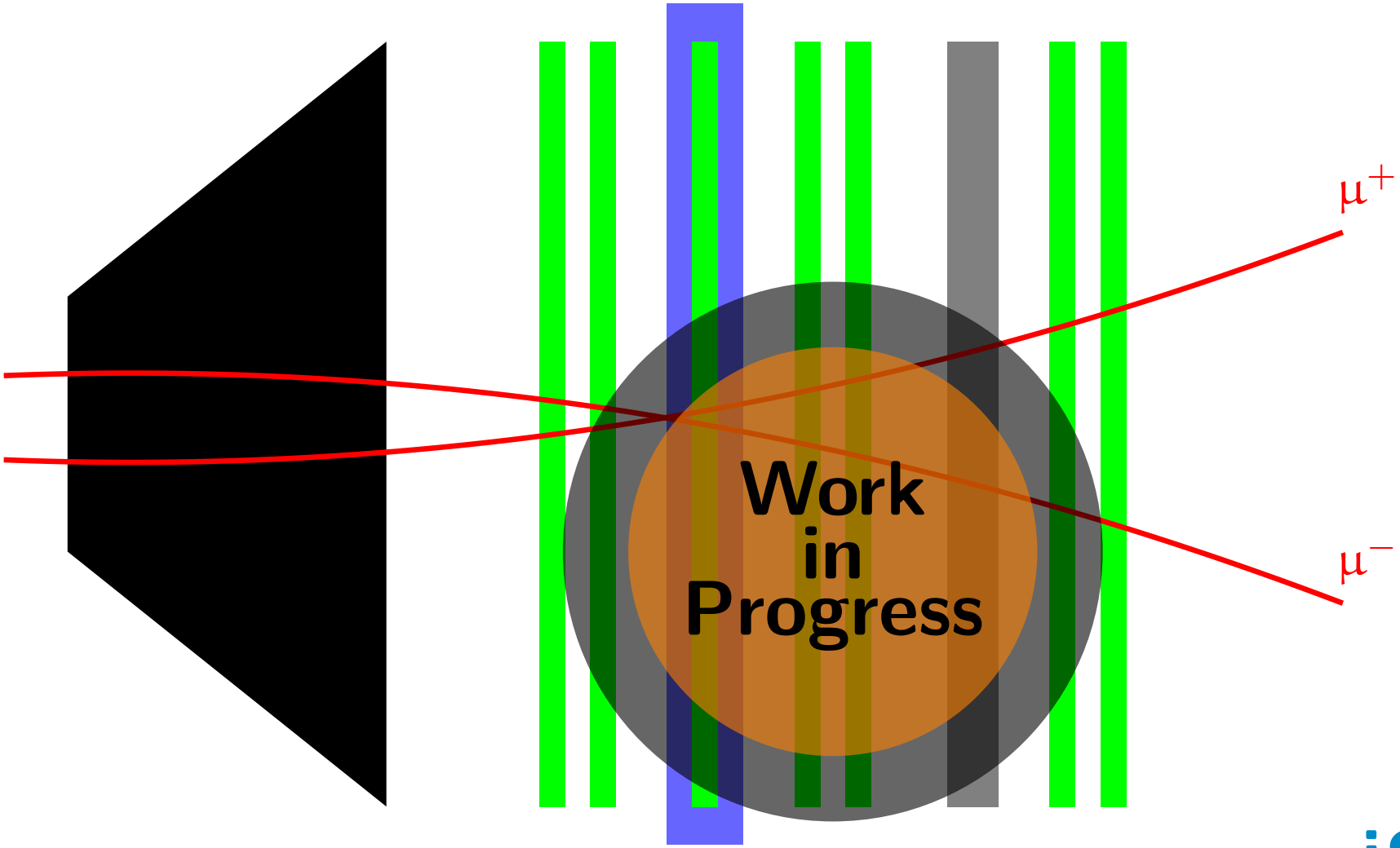
Pb-Pb : $\sqrt{s_{NN}} = 2.76 - 5.02$ TeV

p-Pb : $\sqrt{s_{NN}} = 5.02$ TeV

pp : $\sqrt{s} = 2.76 - 5.02 - 7 - 8 - 13$ TeV

pp at 13 TeV

pp collisions - $\sqrt{s} = 13$ TeV



ALICE

Data set

- Data : LHC15[ijl] periods. Single μ thr. $\approx$ 1 GeV/c
  LHC16[ghijklmn] periods. Single μ thr. ≈ 0.5 GeV/c

- Single Muon selection (in addition to $|Z_{\text{vtx}}| < 10$ cm):
  - Trigger matching Level : 2
  - sharp low p_{T} cut [ijl] period : 0.75 GeV/c
    sharp low p_{T} cut [ghijklmn] period : 0.25 GeV/c
  - Eta cut : $-4 < \eta < -2.5$

- statistical uncertainties only, no systematics yet

$\sqrt{s} = 13$ TeV : Raw mass spectrum


Combinatorial background estimation

Two ways to estimate the opposite sign combinatorial background

1. Background estimation from data themselves

$$N^{\text{dir}}_{bkg}(M) = 2R(M)\sqrt{N^{\text{dir}}_{++}(M)\cdot N^{\text{dir}}_{--}(M)}$$

with R factor estimated with mixing

$$R(M) = \frac{N^{\text{mix}}_{+-}(M)}{2\sqrt{N^{\text{mix}}_{++}(M)\cdot N^{\text{mix}}_{--}(M)}}$$

2. Event Mixing

Combinatorial background estimation

Background estimation from data :

- normalization automatically fixed by the data
- statistics limited by the data

Background estimation with mixing :

- no normalization
- no statistical limits

We combine the strengths of the two methods by taking the shape from the event mixing and imposing the **data-driven normalization**

$\rightarrow$ Residual differences between the bkg shape from the two methods are propagated in the analysis as a source of systematics : independent signal extractions and analyses for the **"reference" and "alternative" bkg**.

Signal for LHC15ijl p_T and rapidity integrated


Preliminary estimation of $\mathrm{d}N/\mathrm{d}p_{\mathrm{T}}$ and $\mathrm{d}N/\mathrm{d}y$ for ϕ meson

- Estimate the shape of p_{T} and rapidity dependence of phi production

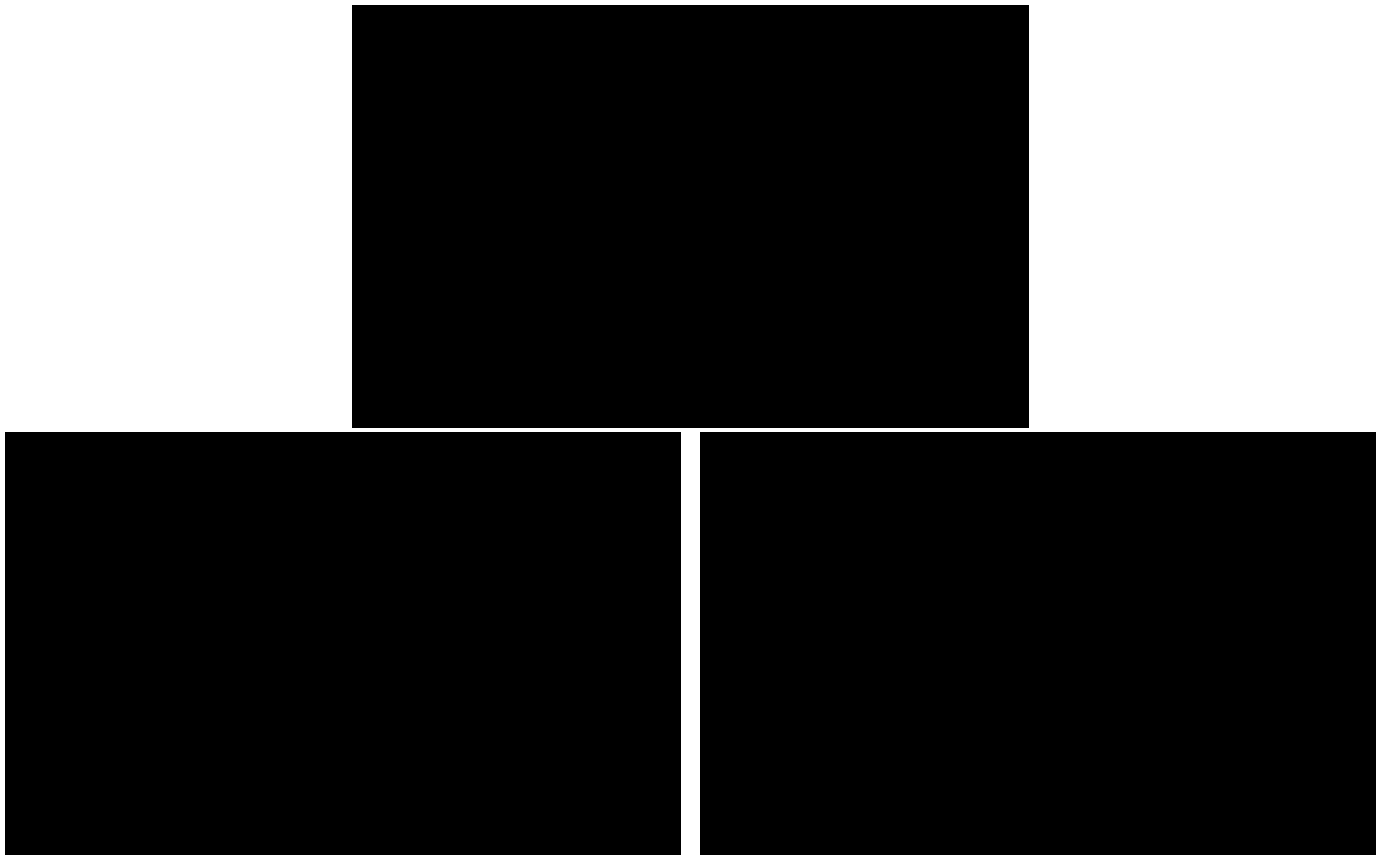
Very preliminary results

Fit for LHC15ijl p_T and rapidity integrated

Very preliminary results

Threshold impact on low masses

Few fit signal for all and low p_T periods



dN_ϕ/dp_T

$$N \cdot \frac{p_T}{\left(1+\left(\frac{p_T}{p_0}\right)^2\right)^n}$$

- filled green square for LHC16ghijklmn period
- filled blue circle for LHC15ijl period

- Extraction of ϕ meson signal

- ALICE collected a large sample of dimuon-triggered events in 2015 and 2016
  - Two single-muon thresholds available: 0.5 and $1\ \mathrm{GeV/c}$
  - p_{T} measurements available for the first time down to almost zero pt for the phi meson thanks to the very large statistics and the low backround conditions of pp collisions

Backup