Chic @ SPS

(Charm in Heavy Ion Collisions)

Detector design

A 3rd generation experiment to study charm with proton and ion beams on fixed target at SPS

Physics motivations – 2 key questions

1. **Measure χ_c in A+A**

   Similar J/Ψ suppression at SPS and RHIC:

   1. Either more suppression at RHIC compensated by recombination
   2. Or J/Ψ suppression due to χ_c only → sequential suppression

   How χ_c is suppressed relative to J/Ψ ?

   Mandatory to draw the whole picture (SPS .vs. RHIC .vs. LHC)

2. **Measure charmonia production in p+A**

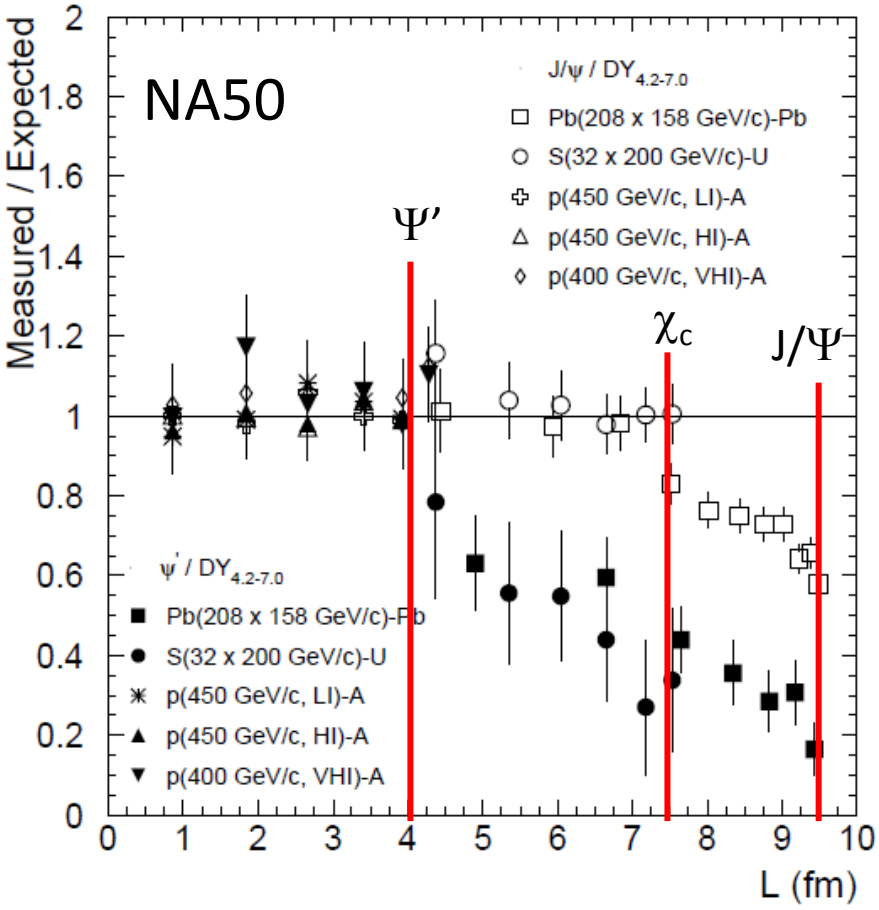
   what is the depence of charmonia suppression with rapidity ?

   Crucial to understand effects due to cold nuclear matter

We need to correctly calibrate our QGP thermometer.

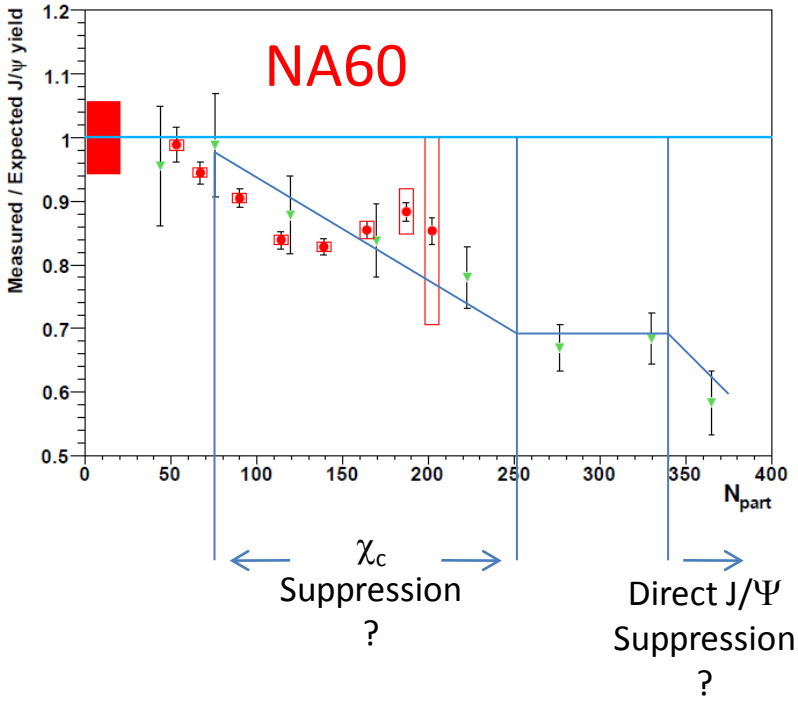
1. Measure χ_c in A+A

Eur. Phys. J. C49 (2007) 559



$N_{J/\Psi}$ ~ 60% direct + ~30% from χ_c + ~10% from Ψ'

[Phys. Rev. Lett. 99, 132302 (2007)]

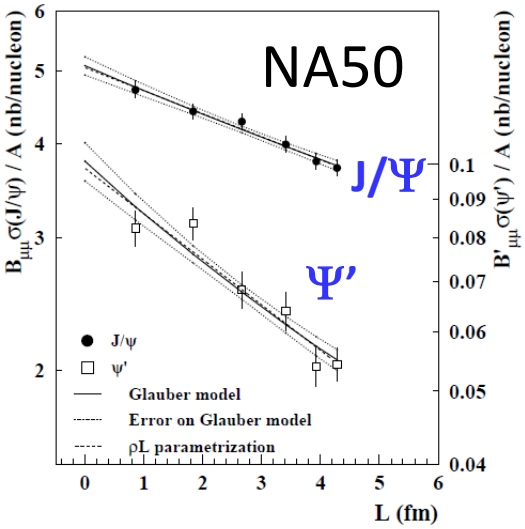


Benchmark: measure χ_c in PbPb

- at mid-rapidity
- for $N_{part} \in [50;300]$
- $N_{part}=300$ ➔ ~10% most central

2. Measure charmonia in p+A

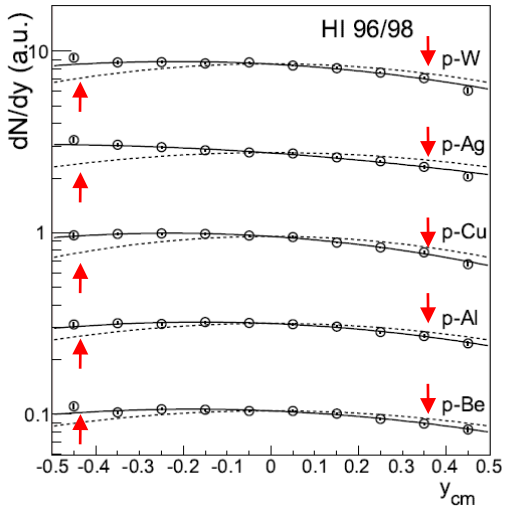
J/Ψ and Ψ' **suppression** in p+A collisions as a function of L



Euro. Phys. J. C48 (2006) 329.

➔ **Measuring different charmonium states gives key information on nuclear « absorption » and production mechanism.**

J/Ψ **rapidity distribution** in p+A collisions



➔ **Measuring charmonium in a wide rapidity range is mandatory to identify possible (anti)shadowing effects**

Experimental landscape

- **Current landscape**
  - **Fixed target : SPS/CERN NA38/50/60 experiments – $\sqrt{s_{NN}}$ = 17 – 30 GeV**
    - **Statistic :100 000's J/ψ**
    - **Data sets : p+A w/ A=p, d, Be, Al, Cu, Ag, W, Pb; S+U, In+In, Pb+Pb**
    - **Small rapidity coverage (typically y ∈ [0,1])**
  - **Collider : RHIC/BNL Phenix, Star experiments – $\sqrt{s_{NN}}$ = 200 GeV**
    - **Statistic : 1000's J/ψ (10000's since 2007)**
    - **Data sets : p+p, d+Au, Cu+Cu, Au+Au**
    - **Large rapidity coverage (y ∈ [-0.5,0.5], y ∈ [-2.2,-1.2] and y ∈ [1.2,2.2])**
  - **Collider : LHC/CERN Alice, CMS, Atlas experiments ($\sqrt{s_{NN}}$ = 5,5 TeV)**
    - **Statistic : 100000's J/ψ**
    - **Data sets : p+p, Pb+Pb, p+Pb**
    - **Large rapidity coverage (|y|<2.5 ATLAS/CMS, |y|<0.9 and -4.0 < y < -2.5 ALICE)**

- **Feedback**
  - **High statistic** → draw clear suppression pattern in **Hot Nuclear Matter** and **Cold Nuclear Matter**
  - **Large data set** → draw clear suppression pattern in **Cold Nuclear Matter**
  - **Large rapidity coverage** → understand suppression mechanism in **Cold Nuclear Matter**
  - **The most quarkonium states** → understand suppression mechanism in **Hot Nuclear Matter** and **Cold Nuclear Matter**