Study the correlation of the J/ψ yield and its φ<ψ> with the density of charged particles produced in the collision. Particle production as a function of multiplicity is a useful tool to study the presence of collective-like effects in small size systems compared to Pb-Pb, such as pp and Pb-Pb collisions.

**J/ψ Yield Measurement**

In ‘standard’ analysis, the J/ψ signal is extracted by fitting the raw opposite-sign dimuon invariant mass spectra [4,5].

- Fitting function for signal: Crystal ball extended or pseudo-Gaussian.
- Tails parameters: Fixed from the pure J/ψ signal simulation.
- Fitting function for background: variable with gaussian or POL2 × EXP.
- Fitting range: 2 - 5 or 2.1 - 2.4 GeV/c².

The number of J/ψ is obtained by integrating the signal function and then correcting for the muon spectrometer AEXE.

In the analysis procedure used to extract the J/ψ <φ<ψ>, we need to correct the dimuons for the AEXE prior to fit the mass spectra. This is done by weighting each dimuon by the two-dimensional (pT, y) AEXE.

**J/ψ <φ<ψ> Measurement**

The ‘standard’ method is to measure the J/ψ yield in p-Pb bins and fit the obtained pT distribution to extract the <φ<ψ>.

This method is expected to measure <φ<ψ> without biasing the dimuon sample in p-Pb bins:

- Each dimuon is weighted by J/ψ AEXE.
- The invariant mass distribution is corrected using AEXE reconstructed dimuon <φ<ψ> fitted with the following formula:

\[
\langle p_T \rangle \langle \phi \rangle \langle \psi \rangle = \frac{a(n_{NN})}{\sigma(n_{NN})} + \frac{1}{\sigma(n_{NN})} \left( \langle p_T \rangle + \langle \phi \rangle + \langle \psi \rangle \right) + \frac{1}{\sigma(n_{NN})} \left( \langle p_T \rangle - \langle \phi \rangle - \langle \psi \rangle \right)
\]

with:

\[
a(n_{NN}) = \frac{N_{ψψ}}{N_{ψψ} + N_{ψ}}
\]

(S(n_{NN}) and B(n_{NN}) are the signal and background contributions extracted from the fit to the AEXE corrected invariant mass spectra.)

**Results**

- Strong increase of J/ψ yield with multiplicity. Similar behaviour at backward rapidity in p-Pb and in pp. Deviation at forward rapidity.
- Observed J/ψ yield behaviour at forward rapidity only due to cold nuclear matter effects? But why <φ<ψ> behave the same at forward and backward rapidities?
- Observed J/ψ <φ<ψ> behaviour similar to that observed in Pb-Pb for charged particles, possible hint of collective effects in p-Pb?