Direct Photon as the light at the end of the tunnel

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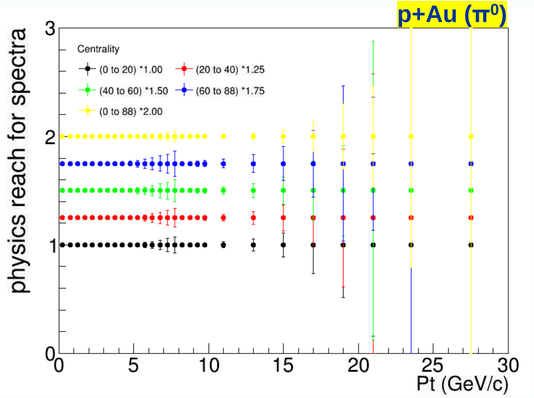
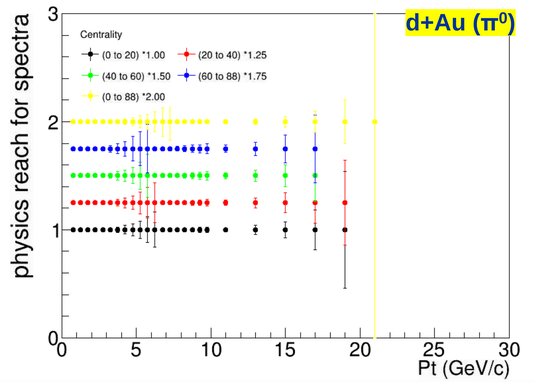
Introduction

The last few years have seen some surprising, unexpected results in R_{AA} of π^0s, jets, flow etc in asymmetric heavy ion collisions. These results are even more counter-intuitive when it's plotted in centrality classified events. This raises the question if this observation is due to droplets of Quark Gluon Plasma created in these collisions, or some other reason, like a possible problem in how centrality is determined.

High p_t direct photons which travel virtually unaffected through the QGP medium (if formed) can shed some light on the validity of other measurements, especially the applicability of Glauber Model in asymmetric collision systems.

Statistical significance of anticipated results





In this poster I discuss the feasibility and progress of High p_t direct photons analysis in p/d+Au system from data taken in 2015 and 2016 at RHIC, BNL

Plot here shows the expected significance of π^0 measurements in these two systems based only on statistical uncertainty. The yield at different p_t is equaled to one. Different centralities are separated in the y-axis by a multiplication factor only for visualization purpose.

As it can be seen we have good statistics for **this measurement to be done up to 17GeV**

It is yet to be seen how big an effect systematics uncertainties would play a role.

Interesting results from simulation of asymmetric collisions

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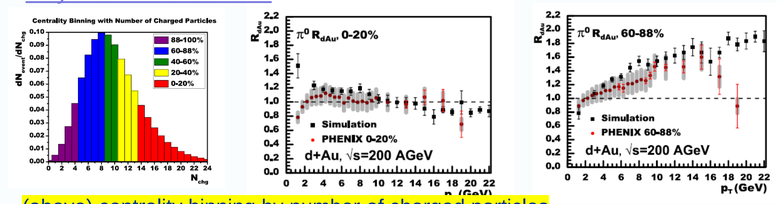
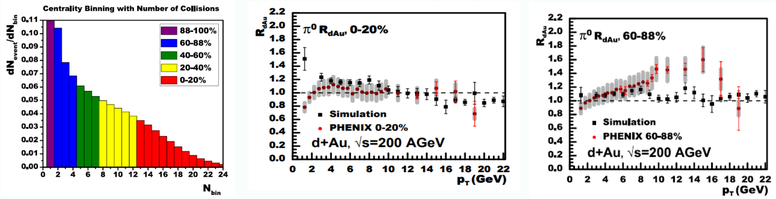


(above) centrality binning by number of charged particles

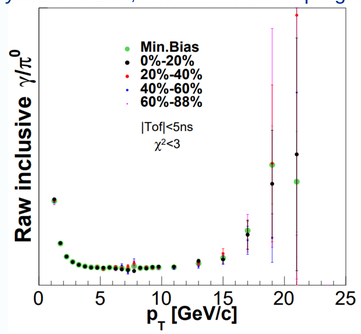


(above) centrality binning by Number of binary collisions

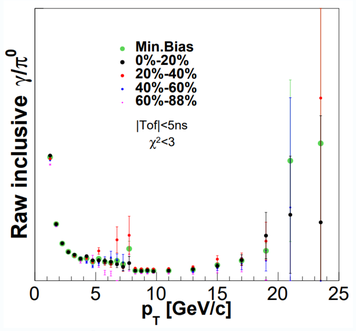
Experimentally, the events are binned in different centrality using charged particles in the forward region as the observable. The first type of binning agrees well with the published result whereas **the "true" type of binning gives very different results**.

Raw inclusive photons over π^0 spectrum

So far, in the analysis, the data has been processed up by applying various calibrations like removing dead and hot towers in EMCal, timing corrections which includes slewing correction etc. The raw yield π^0 and inclusive photons have been obtained. The ratio of these (scale omitted) are shown here. The flat region between 5GeV and 13GeV in pAu is a good measure of validity of these yields. In dAu, it is still a work in progress.



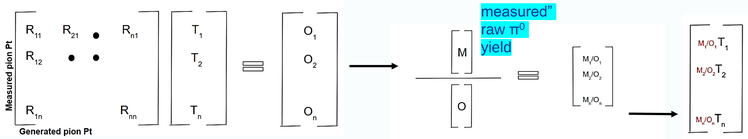
p+Au



d+Au (Work in progress)

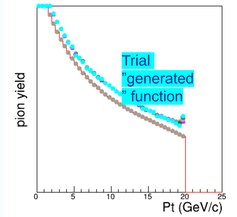
2D response matrix

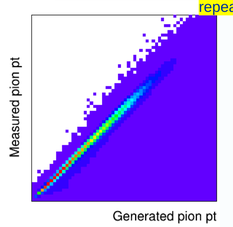
Using the π^0 p_t response matrix from simulation, we get the generated π^0 spectrum from the measured π^0 spectrum. This is an iterative process which is done instead of calculating the acceptance*efficiency



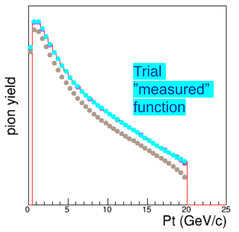
Response matrix | Trial "generated" function | Trial "measured" function | Compare the trial function convolved with response matrix with the measured raw yield | New Trial function

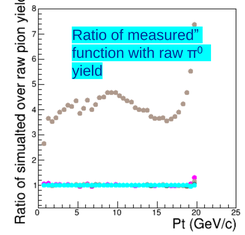
repeated iteratively



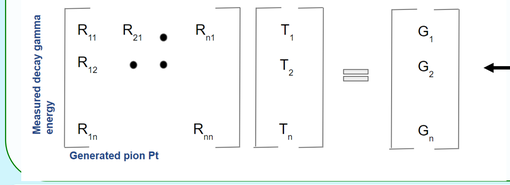


The above method gives us a generated spectrum of π^0 which will produce the π^0 spectrum that we observe.





The trial function changes through every iteration. After 14 iterations, it converges to the cyan points.



expected decay photons yield

Conclusion and work ahead

After obtaining the decay photon's yield, it will be subtracted from the raw inclusive photon yield to give us the yield of direct photons. This will be used to construct the $R_{p/d+Au}$ of direct photons.