A$_N$DY-Gold

A proposal for $\sqrt{s_{NN}}$=200 GeV Au+Au at IP2

$$Au + Au \rightarrow \vec{\Lambda} + X$$

Goal:

Establish the feasibility of forward Λ reconstruction via its $n+\pi^0$ decay

If forward Λ reconstruction is feasible, there is a potentially interesting future experiment to search for parity violation in Au+Au collisions by measurement of induced longitudinal polarization for inclusively produced lambdas. The feasibility test we propose is to confirm whether reconstruction of full HIJING/GEANT simulations that shows Λ are robust.

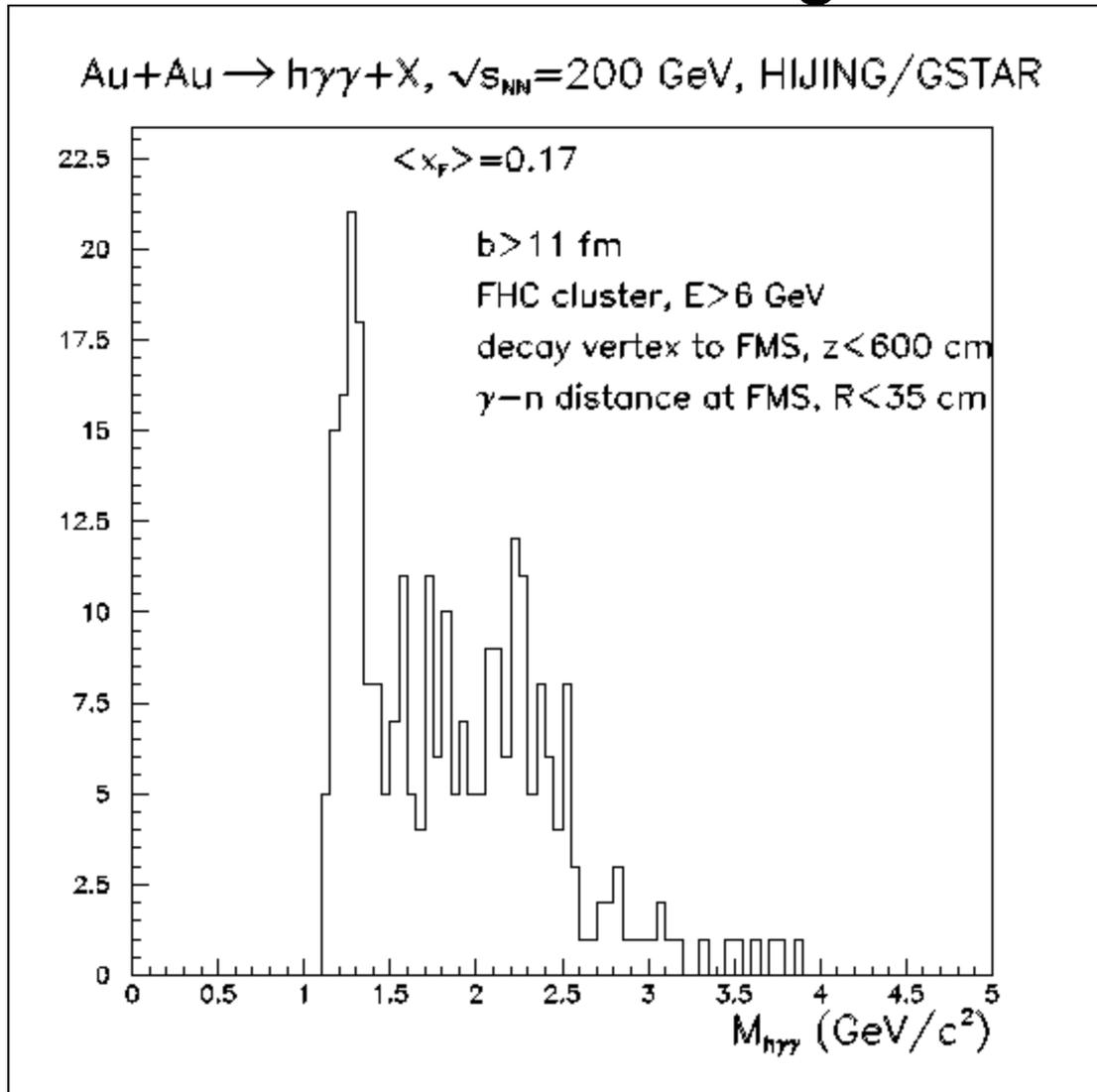L.C. Bland for AnDY, BNL

Planning Meeting

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Forward Λ Reconstruction

- *Relies on large relativistic Lorentz factors, so must be done at high energies*

- *Relies on small deflections at $\Lambda \to n+\pi^0$ decay vertex, so that neutron impact point at calorimeter and primary vertex point provide the line containing the decay vertex point*

- *Uses the $\pi^0 \to \gamma\gamma$ decay to "triangulate" the decay vertex point. Distance of decay vertex from calorimeter (Z) from the meaured di-photon energy ($E_{\gamma\gamma}$), the di-photon energy sharing ($z_{\gamma\gamma}$) and the di-photon separation at the calorimeter ($d_{\gamma\gamma}$). With these measured quantities the distance along the Λ line from the decay vertex to the calorimeter is given by …*

$$Z \approx E_{\gamma\gamma} \sqrt{1 - z_{\gamma\gamma}^2} \, \frac{d}{2M_\pi}$$

Requires hadron calorimeter to measure x,y,E for the neutron and a good electromagnetic calorimeter to measure x,y,E for each decay photon. The run-11 AnDY apparatus meets these requirements, so provides a unique opportunity for establishing feasibility.

Reconstructions applied to peripheral AuAu collisions modeled by HIJING and run through GEANT

Au+Au → hγγ+X, √s_NN=200 GeV, HIJING/GSTAR

$\langle x_F \rangle = 0.17$

b>11 fm
FHC cluster, E>6 GeV
decay vertex to FMS, z<600 cm
γ−n distance at FMS, R<35 cm

$M_{h\gamma\gamma}$ (GeV/c²)

Comments

1) *A critical component of the reconstruction is to require a displaced vertex, to eliminate most of the background.*

2) *There were 4500 centrality-selected (b>11 fm) Au+Au events used for these studies*

3) *Efficiency with the run-11 AnDY apparatus is expected to be smaller since the search radius at the ECal will be ~2x smaller*

4) *Feasibility not so easy to establish in p+p data since Λ production rates are smaller given there is little rescattering*

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Proposal

- *Pending demonstration of minimal impact of IP2 collisions on IP6,IP8, we propose to record ≥10M minimum bias AuAu events with the run-11 AnDY apparatus.*

- *We estimate that 10M events can be recorded in a single store with collisions at IP2 (2kHz interaction rate x 5000 seconds)*

- *We require collisions at IP2 for >1 store to confirm the readiness of the run-11 AnDY apparatus and to intercompare existing HIJING/GEANT simulated events against AnDY data.*

This test will also allow calibration of IP2 ZDC, an in-situ test of a SiPM, and a search for other exciting new possibilities.