Longitudinal Spin Program at STAR

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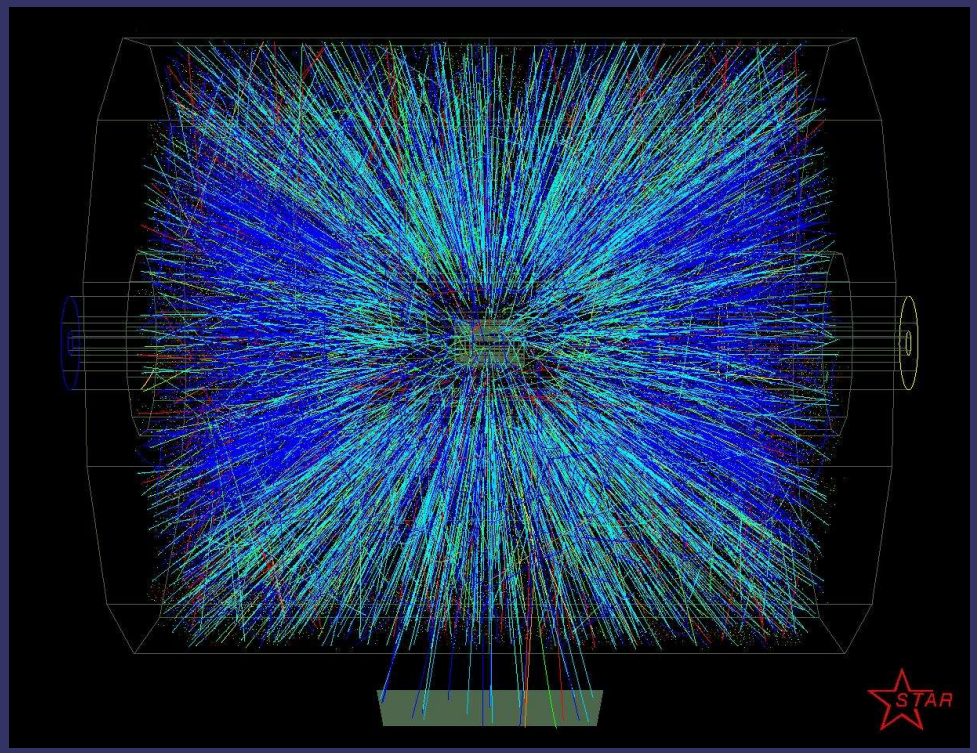
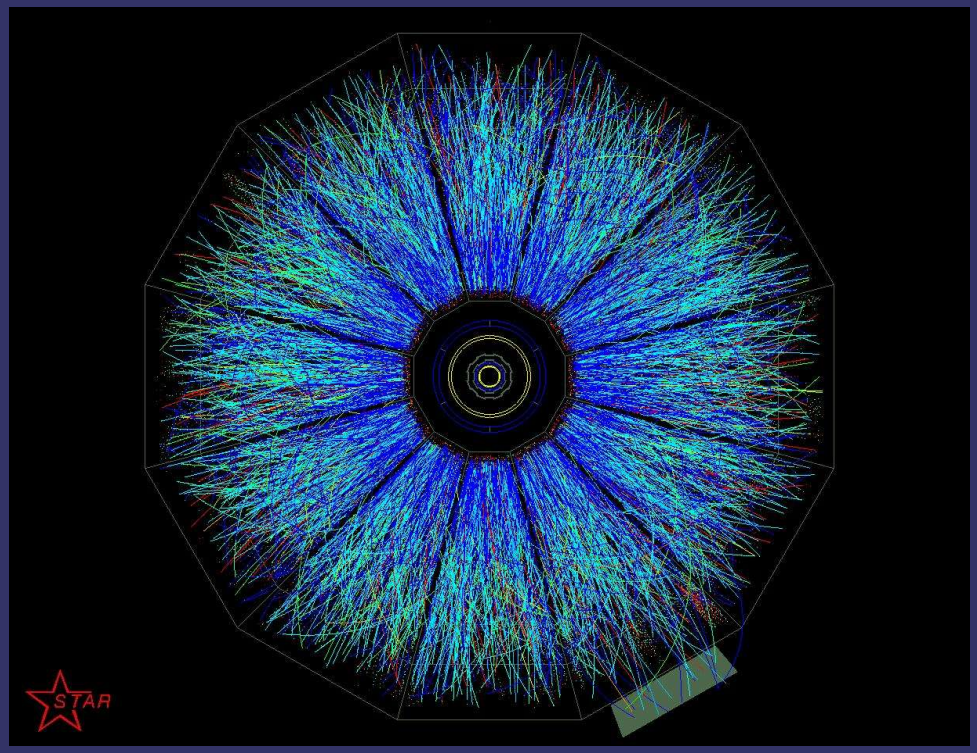
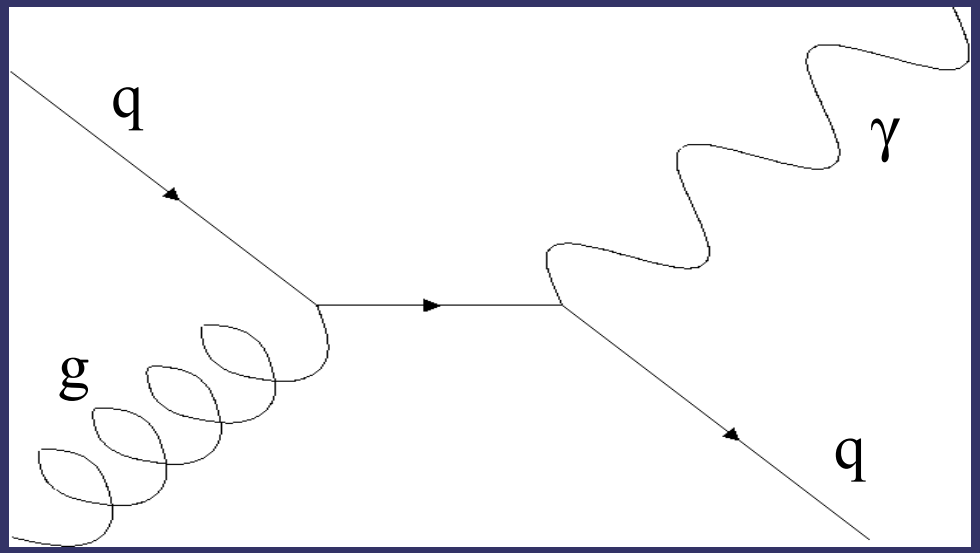
for the STAR Collaboration





Motivation:

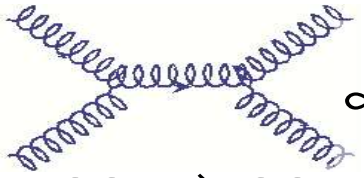
$$\text{spin}\,\frac{1}{2} = \frac{1}{2}\Delta\Sigma + \Delta G + L_z^q + L_z^g$$



Photon + jet coincidence channel allows the most model-independent measure of $\Delta G(x)/G(x)$

Parton Level Asymmetries

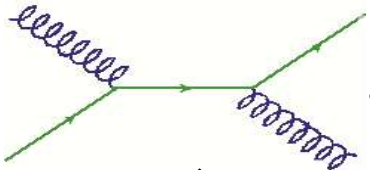
A



$gg \to gg$

$$\propto \frac{\Delta G}{G}\frac{\Delta G}{G}$$

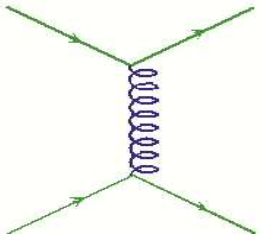
C



$gq \to gq$

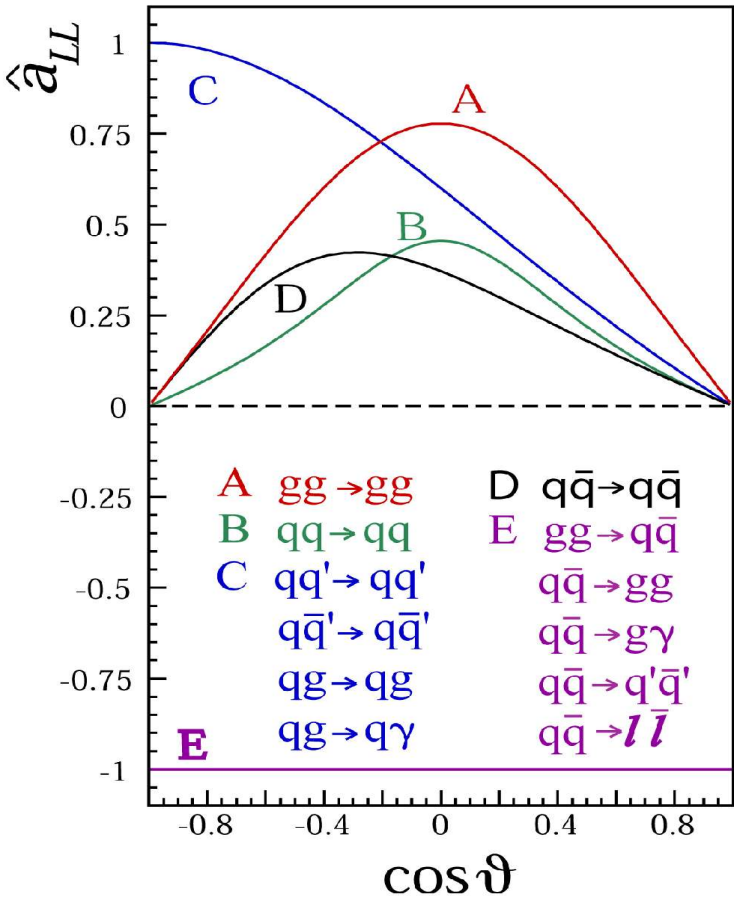
$$\propto \frac{\Delta q}{q}\frac{\Delta G}{G}$$

B



$qq \to qq$

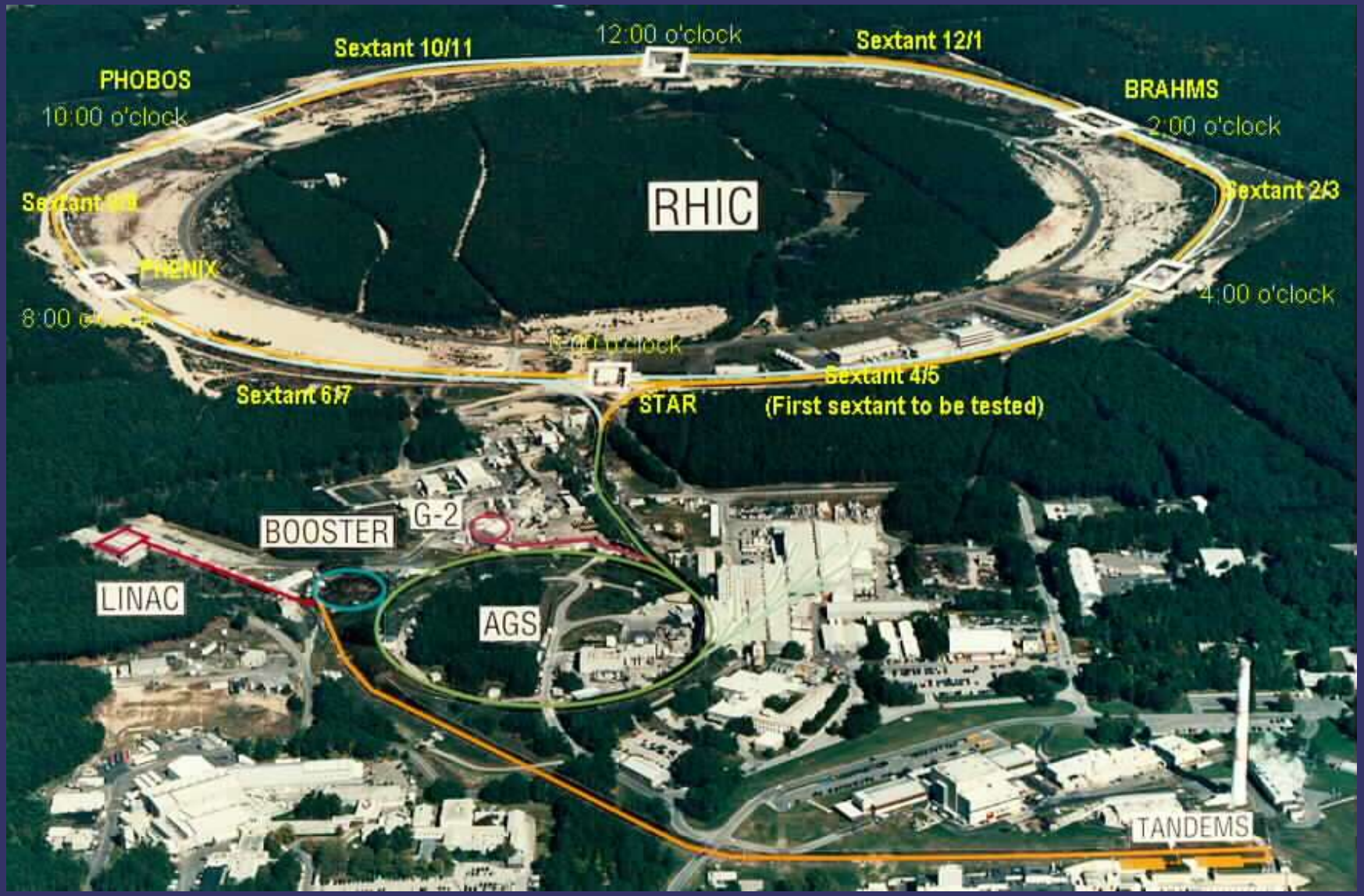
$$\propto \frac{\Delta q}{q}\frac{\Delta q}{q}$$



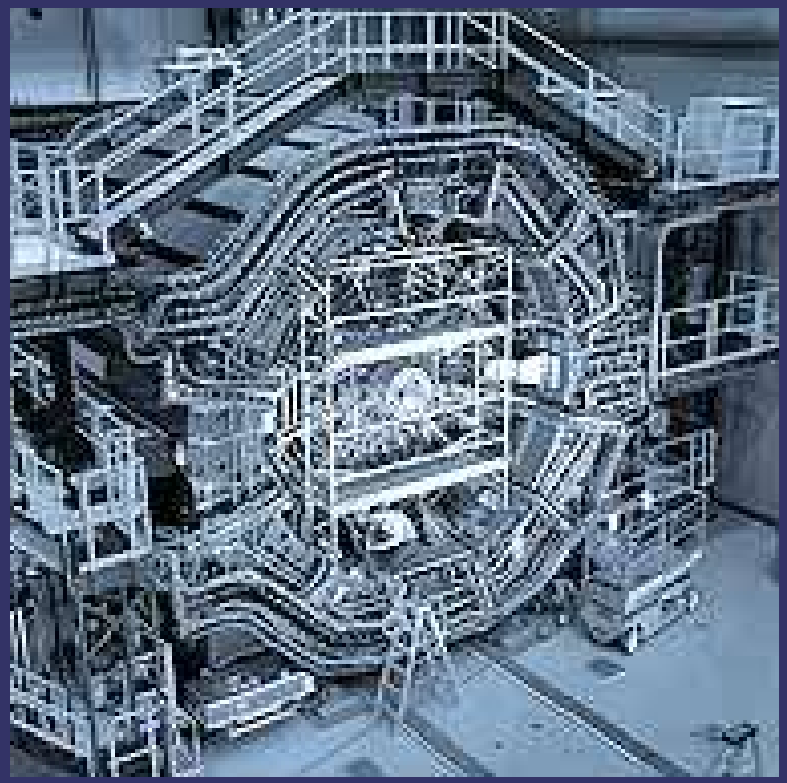
Goals:

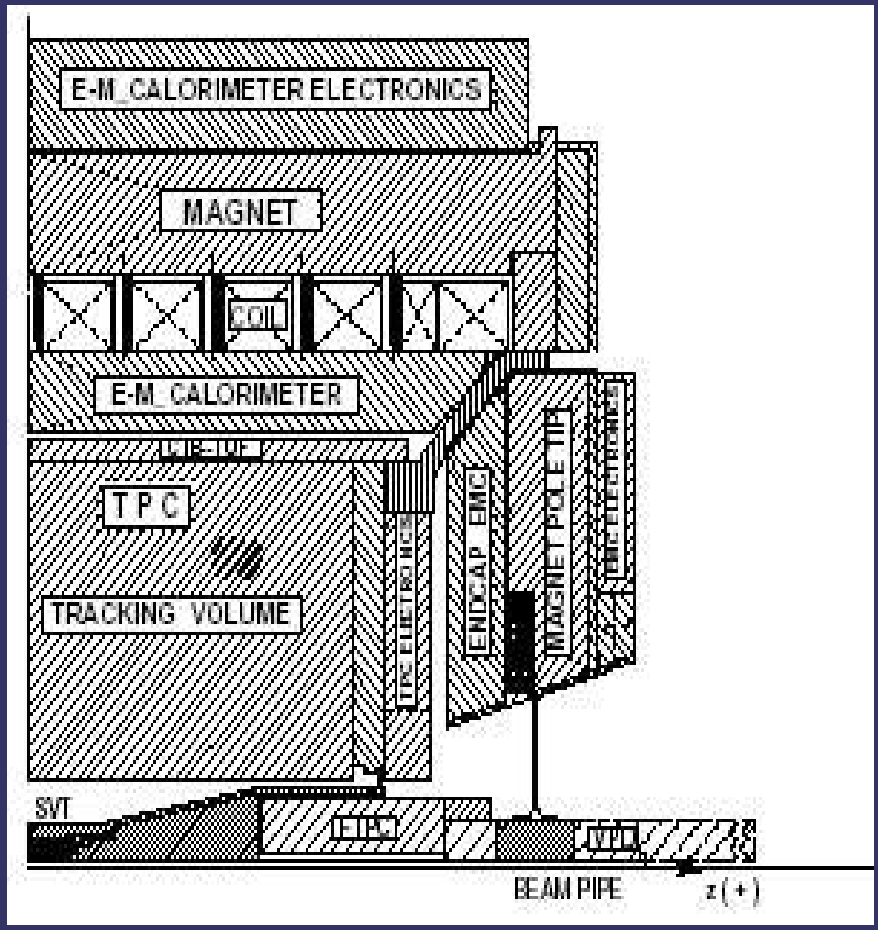
- Long term: photon/jet coincidences
- Intermediate: di-jet coincidences
- Near term: inclusive jets and inclusive π^0
- Calorimeter trigger needed:
  - single tower $E_T > \sim 3.5$ GeV
  - sum over jet patch $\eta \times \phi = 1 \times 1$, $E_T > \sim 7$ GeV

Relativistic Heavy-Ion Collider



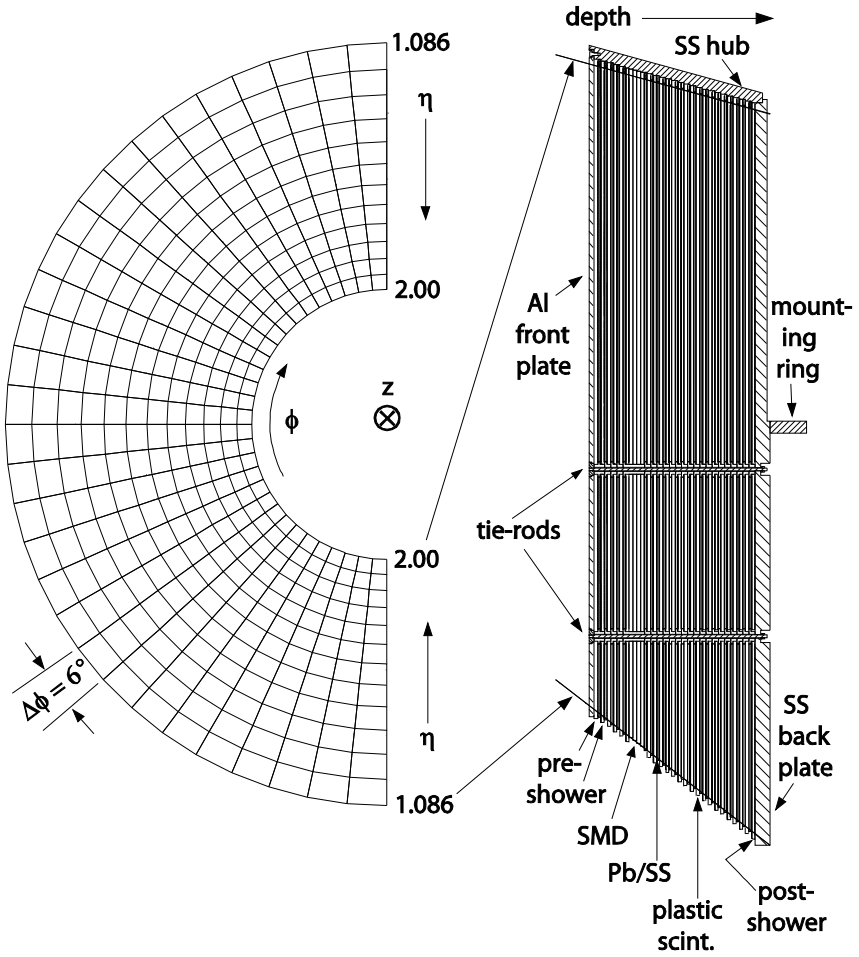
STAR Experiment



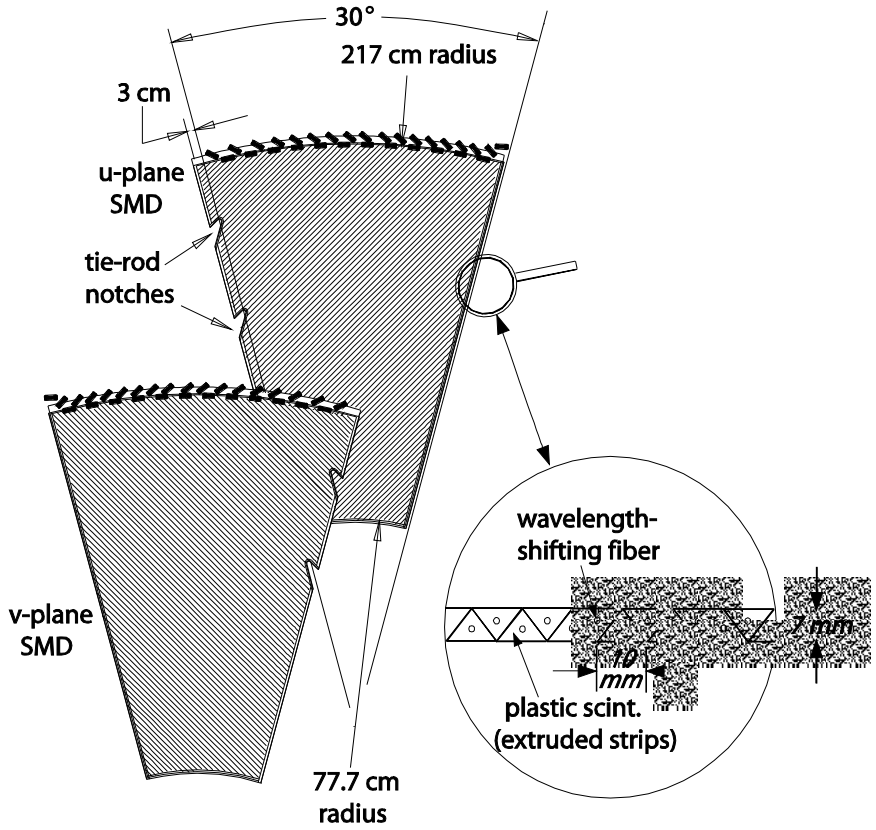


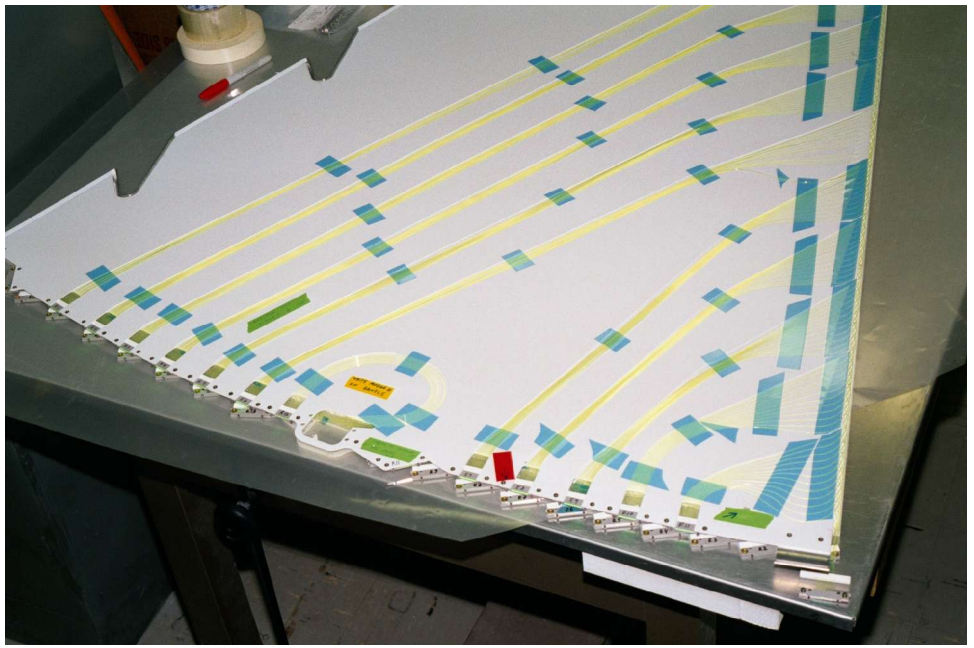
Endcap Electromagnetic Calorimeter

- Pb-Scintillator sampling calorimeter
- Shower Max Layer for shape discrimination
- Status
  - 2003: towers for 4 30-degree sectors
  - 2004: towers for 12 sectors, SMD/pre/post for 4 sectors
  - 2005: fully installed



Shower Maximum Detector

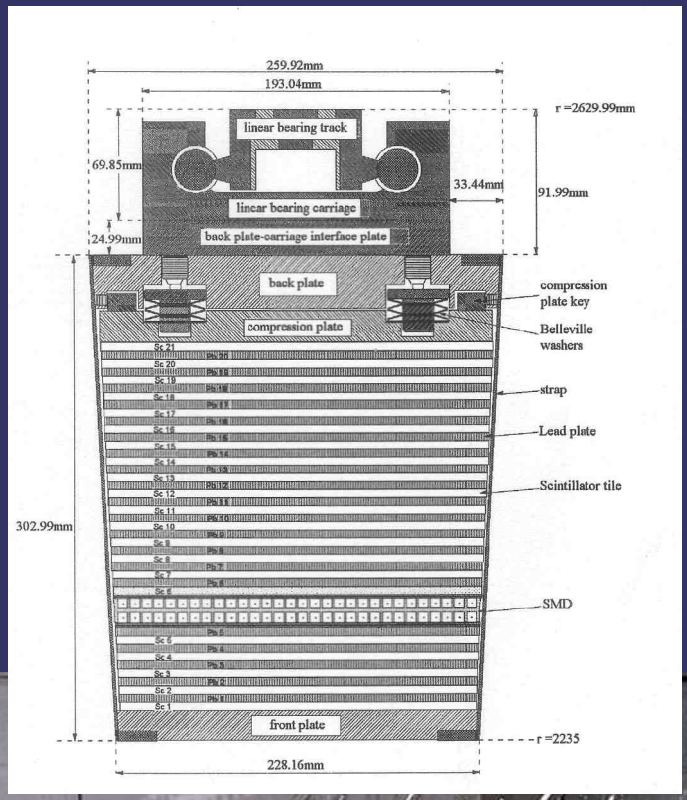


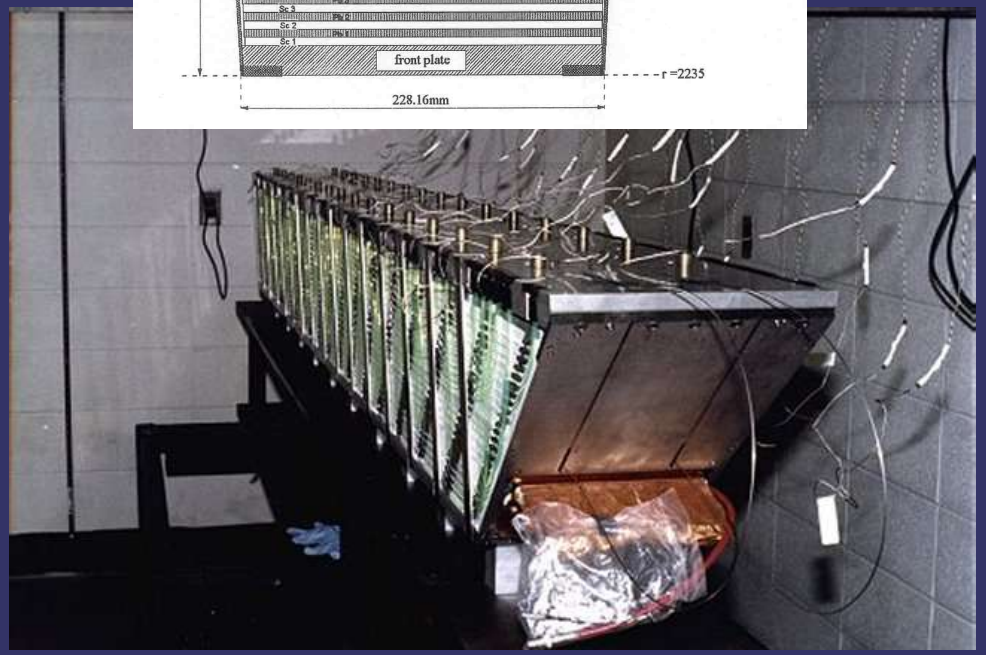


Essential for π^0 identification at high p_T, and for π^0/γ discrimination

Barrel Electromagnetic Calorimeter

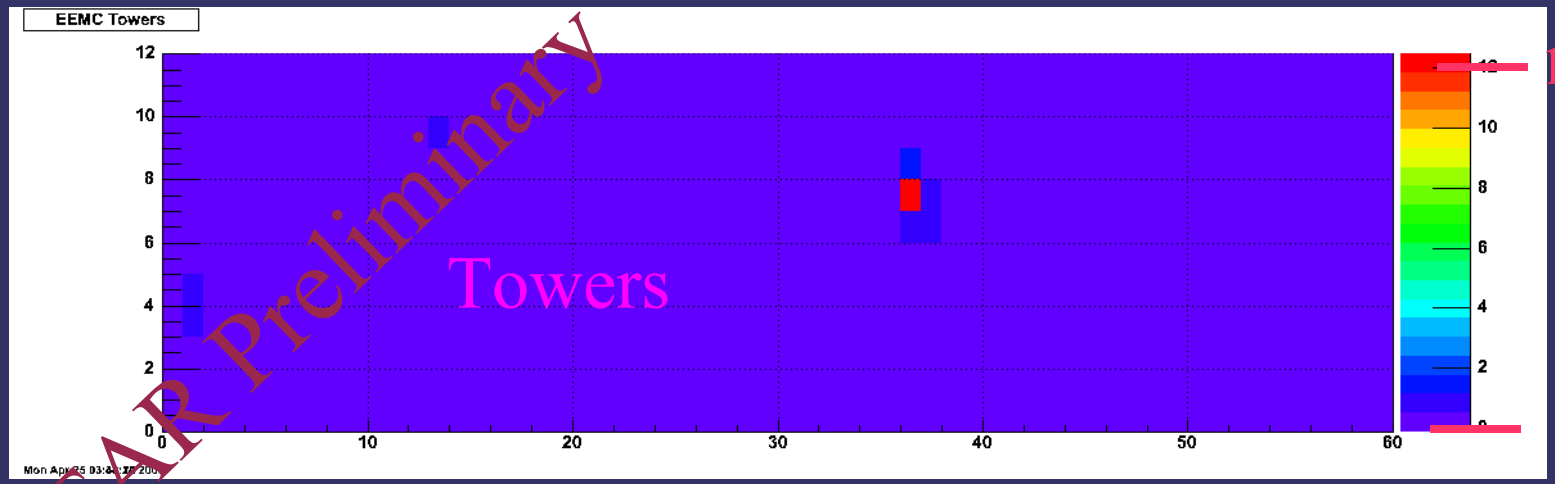
- Similar tower design for both calorimeters
- Gaseous shower max detector
- Status:
  - 2004: West half
  - 2005: 1/2 of east half installed; won't be part of the trigger.
  - 2006 plan: fully operational

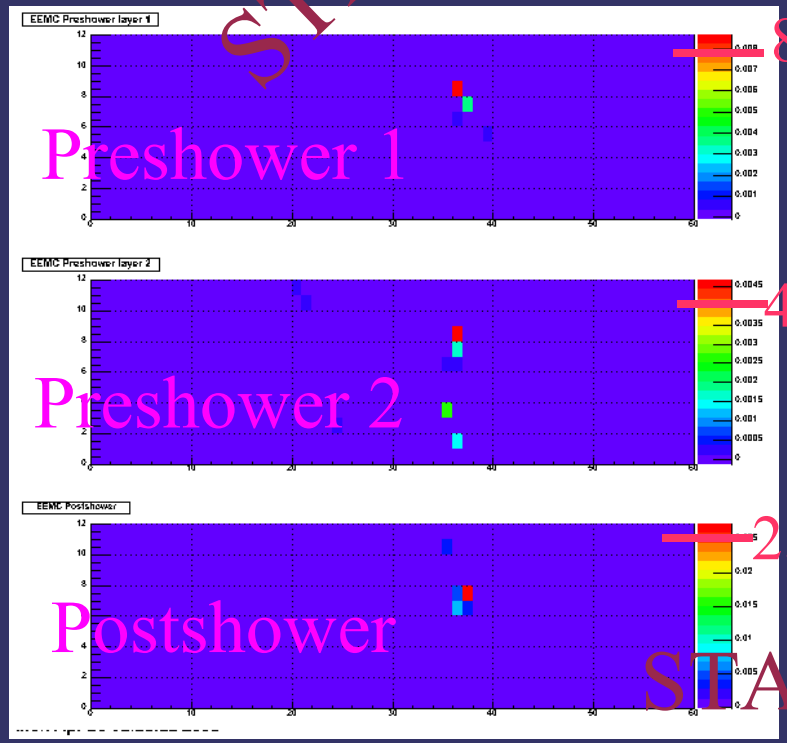


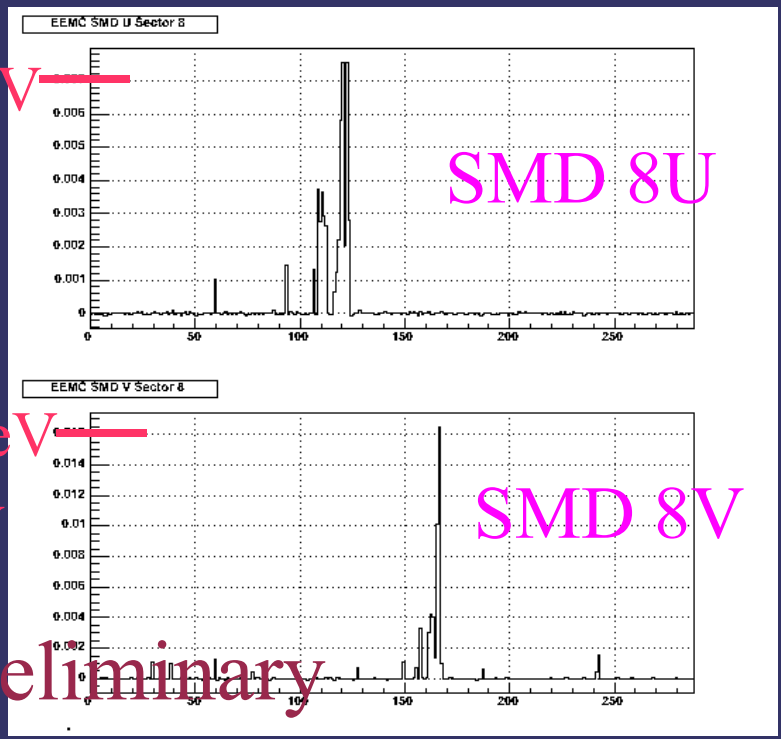


EEMC Data from 2004

14 GeV π^0 candidate:



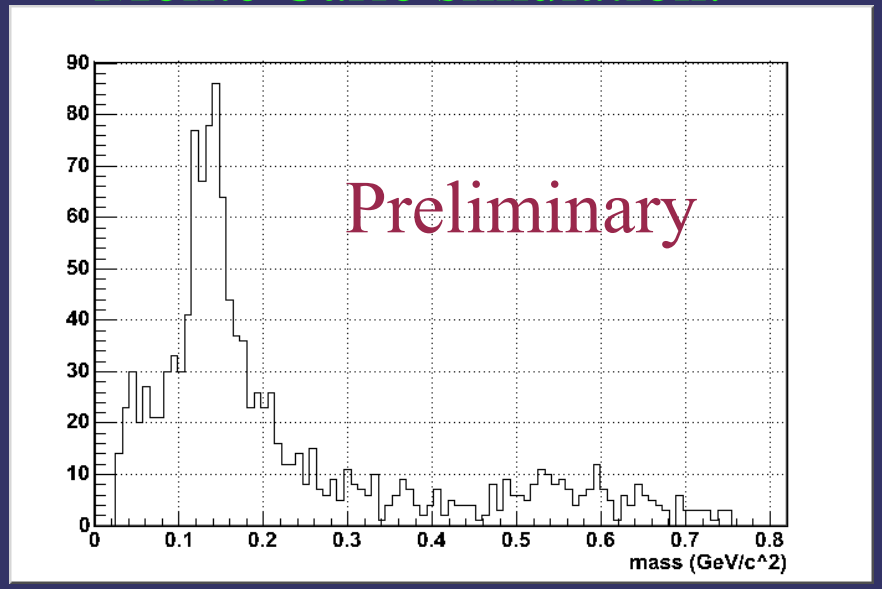


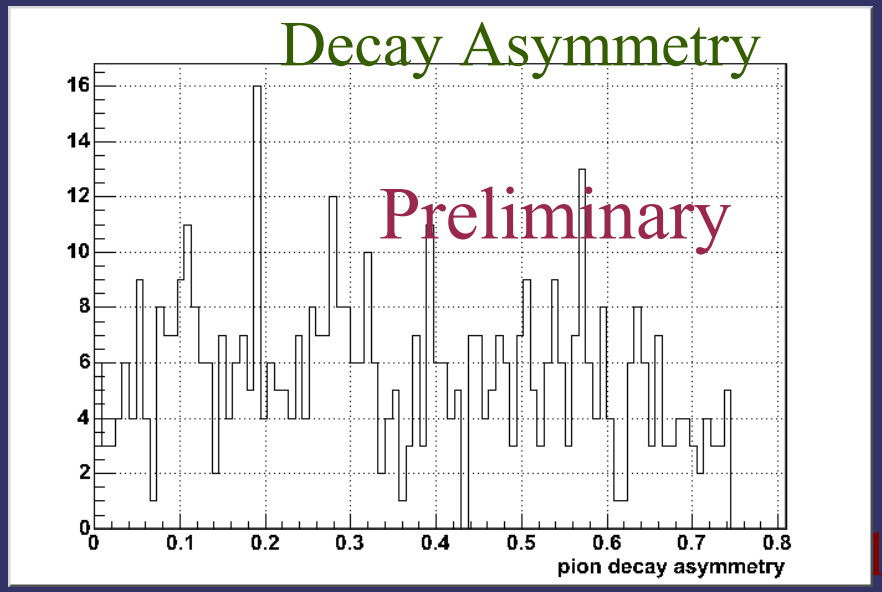


Pion Reconstruction

- STAR collaborators are using 2004 data to prepare algorithms for analysis of 2005 data
- π^0 reconstruction:
  - find clusters in SMD U/V
  - look for tower energy where the U/V strips cross
  - Compute decay asymmetry from towers if possible, or from strips

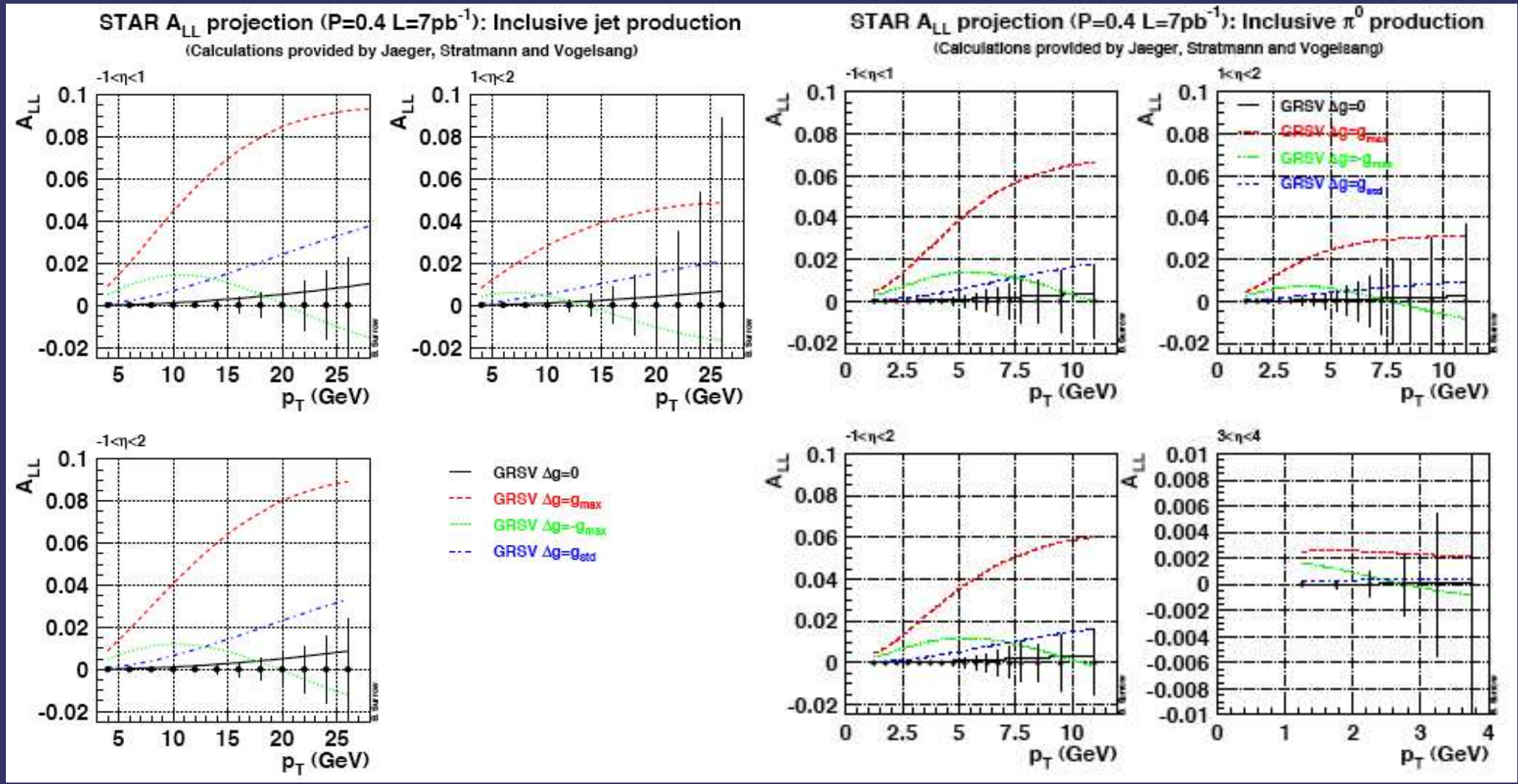
Mass Spectrum from Pythia Monte Carlo simulation:





A_{LL} for 2005: jets, π^0

Projected statistical errors based on cross sections only; experimental efficiencies not included



Summary

- STAR will measure A_{LL} for neutral pions, jets, etc.
- Calorimeters are vital for the spin program; their installation is nearing completion.
- Plan to record 7 pb^{-1} in the current run, results are expected to distinguish between models of ΔG