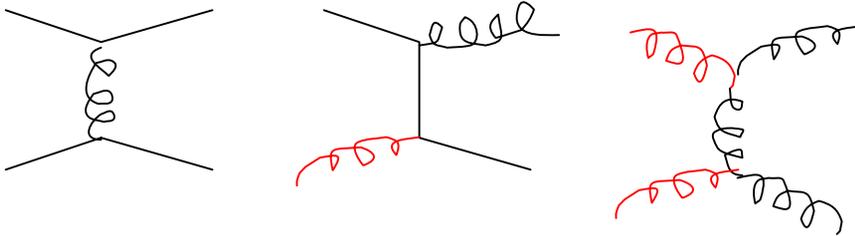


Charged Hadron Trigger

Kensuke Okada (RIKEN)

12/6/2001



Hadron production asymmetry is one of probes for Δg .

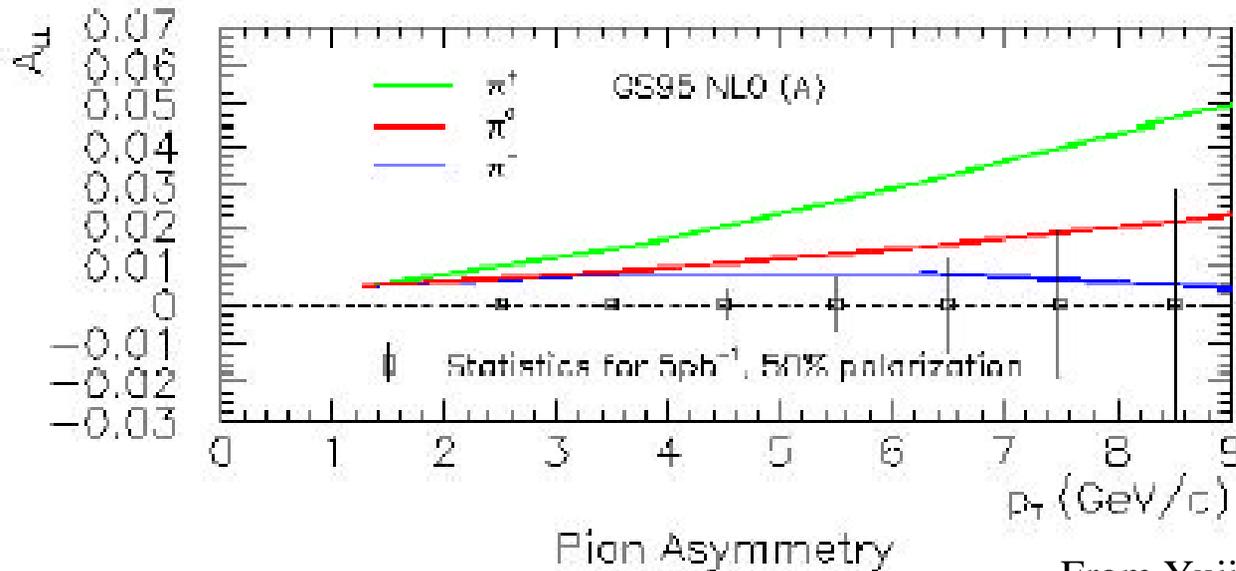
$$A_{LL} \equiv \frac{(\sigma_{++} + \sigma_{--}) - (\sigma_{+-} + \sigma_{-+})}{(\sigma_{++} + \sigma_{--}) + (\sigma_{+-} + \sigma_{-+})}$$

$$\delta A_{LL} = \frac{1}{P^2} \cdot \frac{1}{\sqrt{N}}$$

P : polarization (50%?)

N : statistics

Pion production asymmetry



From Yuji

Error bars are calculated assuming 5pb^{-1} , 50% proton polarization, without considering trigger

A_{LL} is expected to be larger in π^+ than in π^0 , because u-quark has larger polarization than d-quark in proton. π^+ selects preferentially $ug \rightarrow ug$.

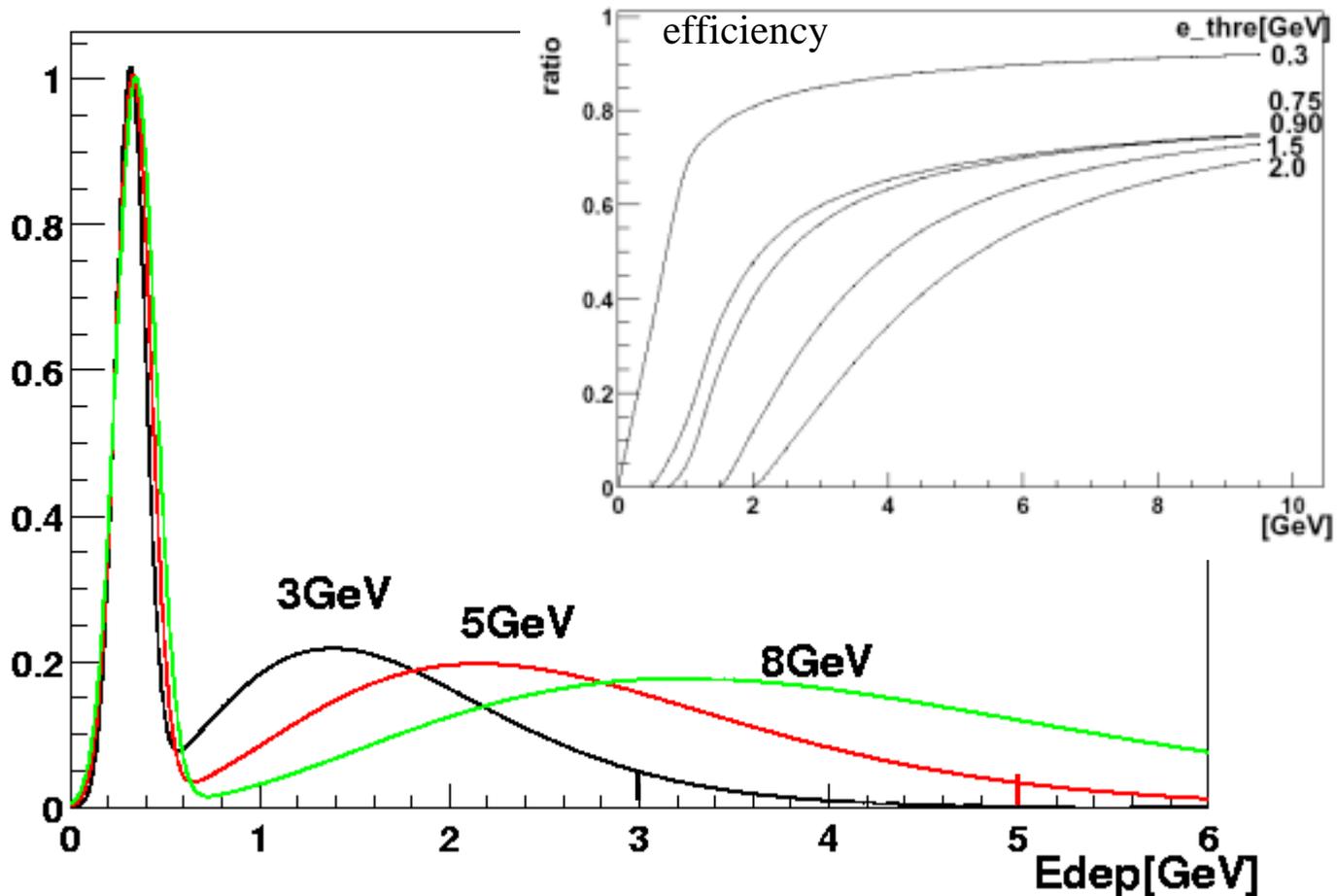
To get h^\pm in 2-6GeV/c range

- **Level1 trigger** (50kHz? to 500Hz)
select particle deposited large energy in EMCal
($\rightarrow \gamma, e, \pi^\pm, \bar{p}, \bar{n}, \dots$)
 - **Level2 trigger** (500Hz to 100Hz)
select charged high p_T hadron
DC charged high p_T trigger.
PC charged high p_T trigger.
 - **Offline** (to remove trigger bias)
select charged hadrons really interacted in EMCal
- Most critical part

Efficiency estimation from EMCal deposit energy

From Hisa's data analysis

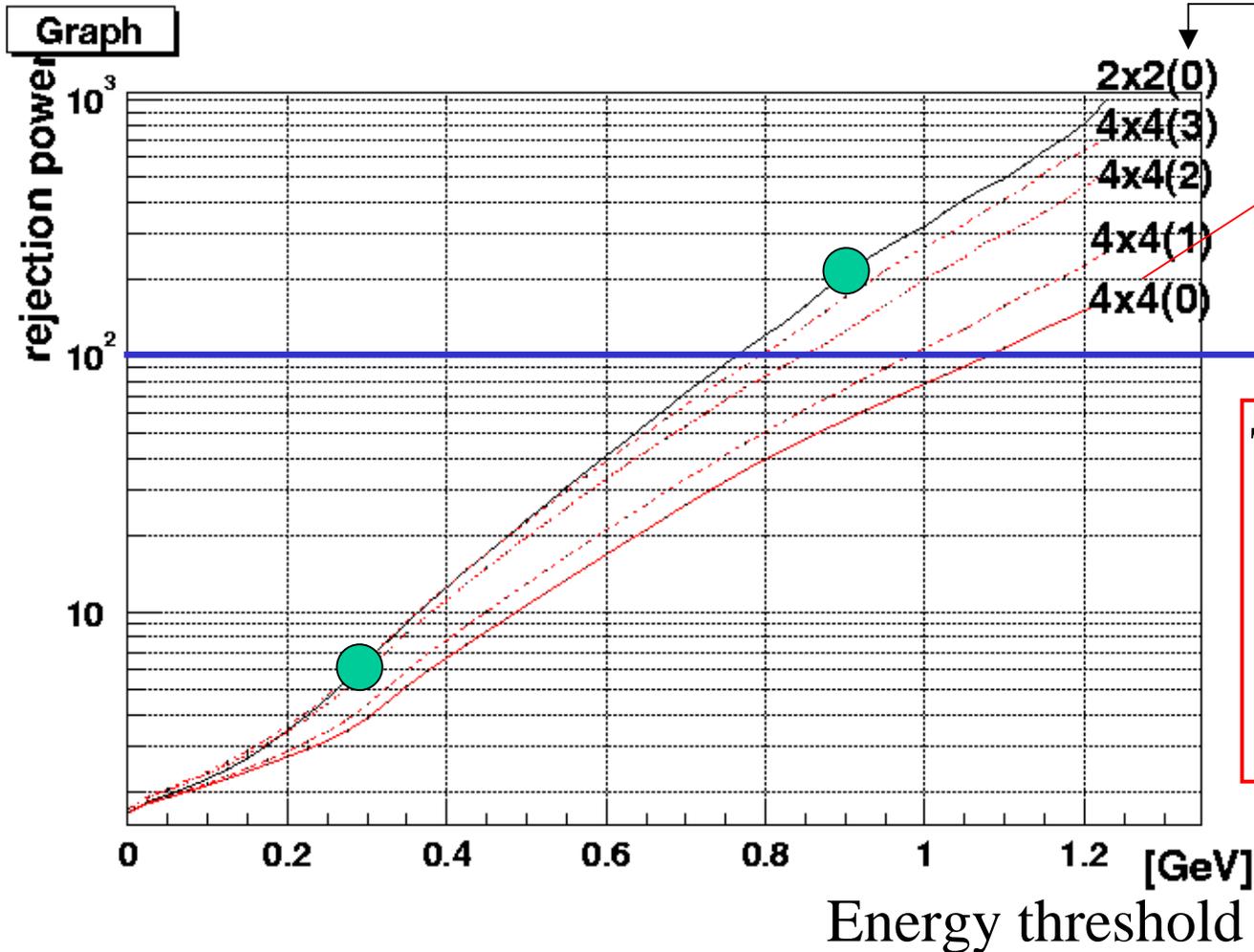
```
exp(-(x-0.316189)/(x-0.316189)/(0.11252E+011252E)))+176.47999E pow((x/3.000000),(4.769291-1))*exp(-E.192125*x/3.000000)
```



Rejection power

PYTHIA & PISA
simulation

EMCal has 2 type of triggers
(2x2 non-overlap tile and 4x4 overlap tile)



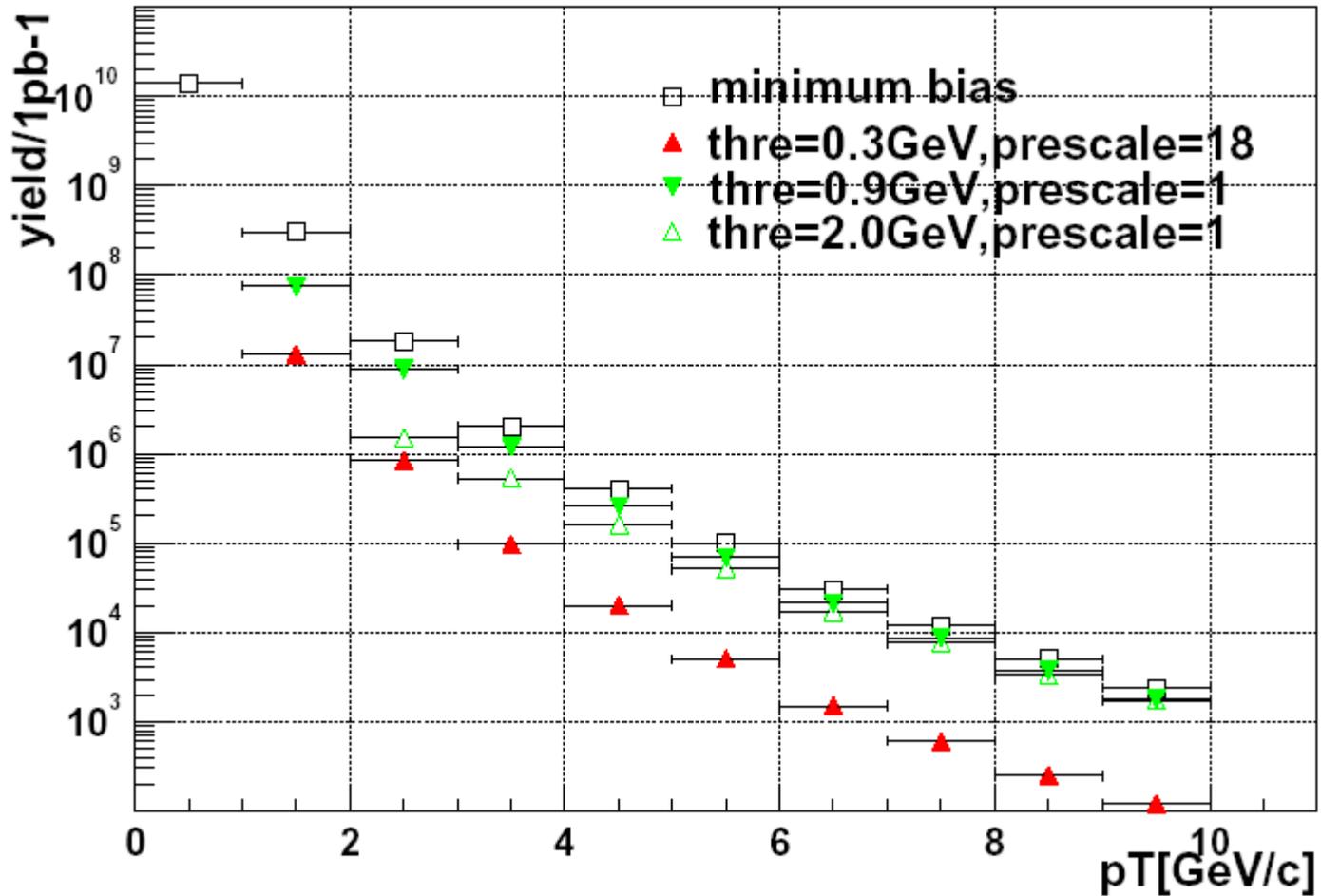
Multiplicity cut
(#hits > 0,1,2,3)

For the reduction
50kHz to 500Hz

Tile	thre [GeV]	prescale
2x2	0.3	1/18
2x2	0.9	1/1
4x4(0)	2.0	1/1

#4x4 Tile has noise problem.
It can't be set less than ~2GeV
(need to investigate)

Yield estimation for 1pb^{-1}



$$\delta A_{LL} \sim \frac{1}{P^2 \sqrt{N}}$$

@P=0.5

← 0.0013

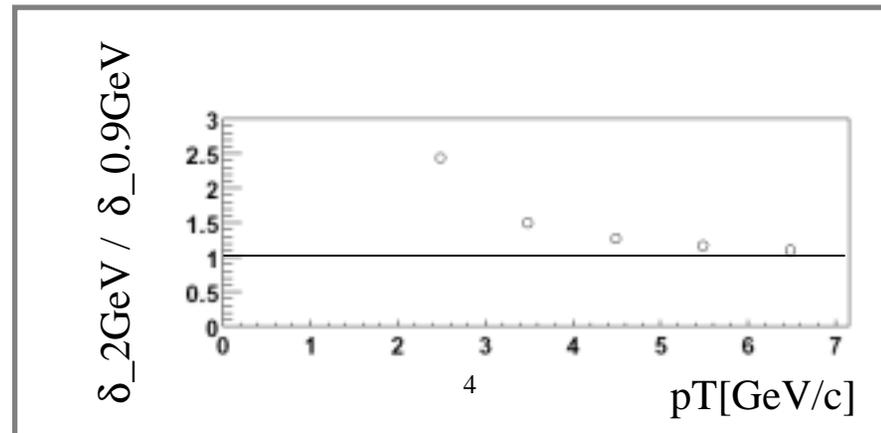
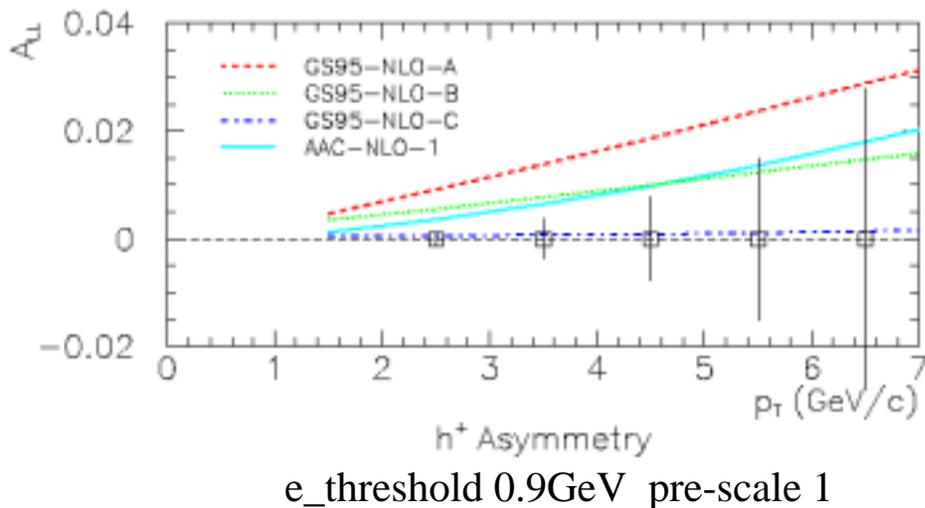
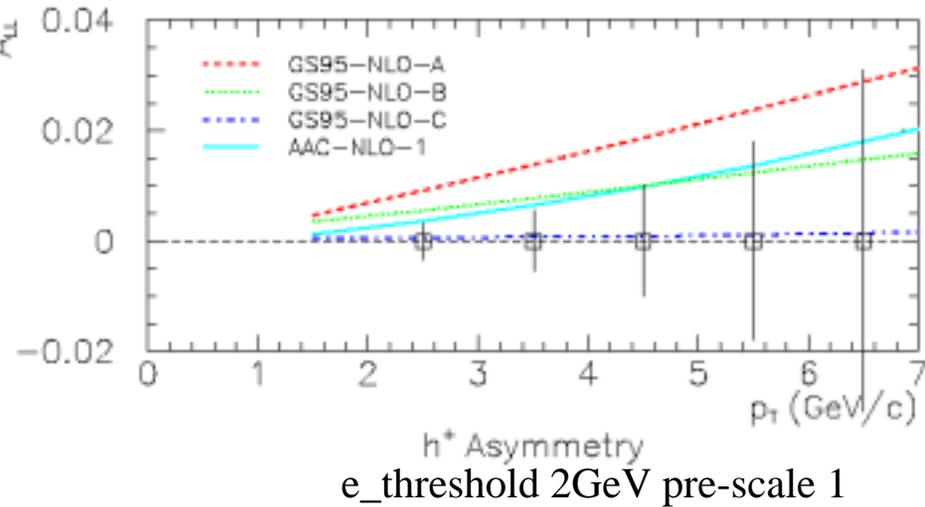
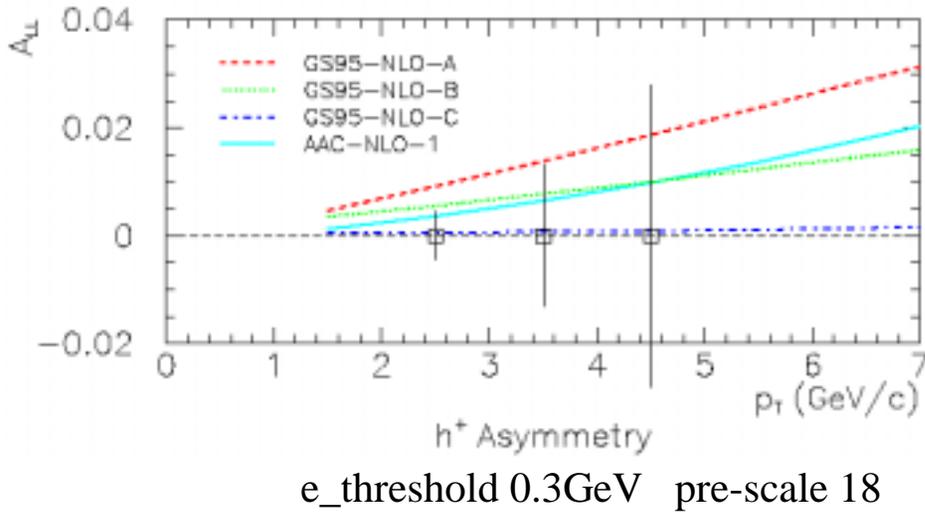
← 0.004

← 0.013

δA_{LL} for each trigger configuration

For 1pb^{-1} total luminosity

$$\delta A_{LL} \sim \frac{1}{P^2 \sqrt{N}} \quad @P=0.5$$



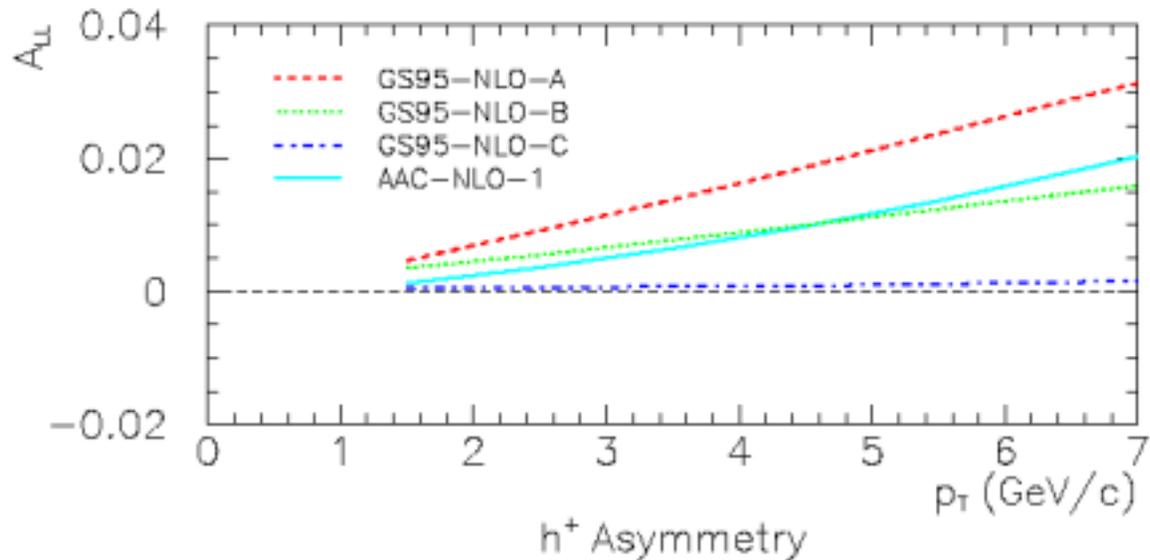
Summary

- Charged hadron (especially p^+) asymmetry measurement is main topic in this year's spin run.
- EMCAL interaction trigger
 - efficiency is estimated by deposit energy distribution
 - rejection power is estimated by PYTHIA&PISA simulation
 - 0.3GeV energy threshold needs high pre-scale value.
 - 2GeV threshold is not so bad solution compared to 0.9GeV threshold.

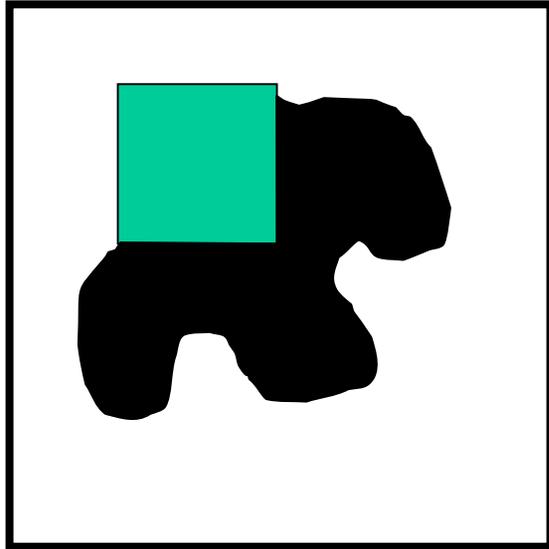
Can we really set 2GeV threshold for 4x4 tile?

Summary table

Lvl1 trigger	Rejection	Prescale	Rate after lvl1 (50kHz→)	δA_{LL} [%] at 1pb^{-1} luminosity 2-3-4-5-6 GeV/c
2x2>0.3GeV	6.5	18	430Hz	0.4, 1.3, 2.8, 5.7
2x2>0.75GeV	94	1	530Hz	0.1, 0.4, 0.8, 1.5
2x2>0.9GeV	208	1	240Hz	0.1, 0.4, 0.8, 1.5
4x4>2.0GeV	1250	1	40Hz	0.3, 0.6, 1.0, 1.8



Trigger Bias



- All charged hadrons
- Charged hadrons in triggered events
- Charged hadrons interacted and deposited energy in EMCal

The ratio of (■) only related to the probability of interaction.
Does not related to the production process.

By selecting charged tracks those exceed the threshold in EMCal,
we can remove trigger bias.