



Measurement of transverse polarization of Λ within jet in pp collisions at $\sqrt{s} = 200$ GeV

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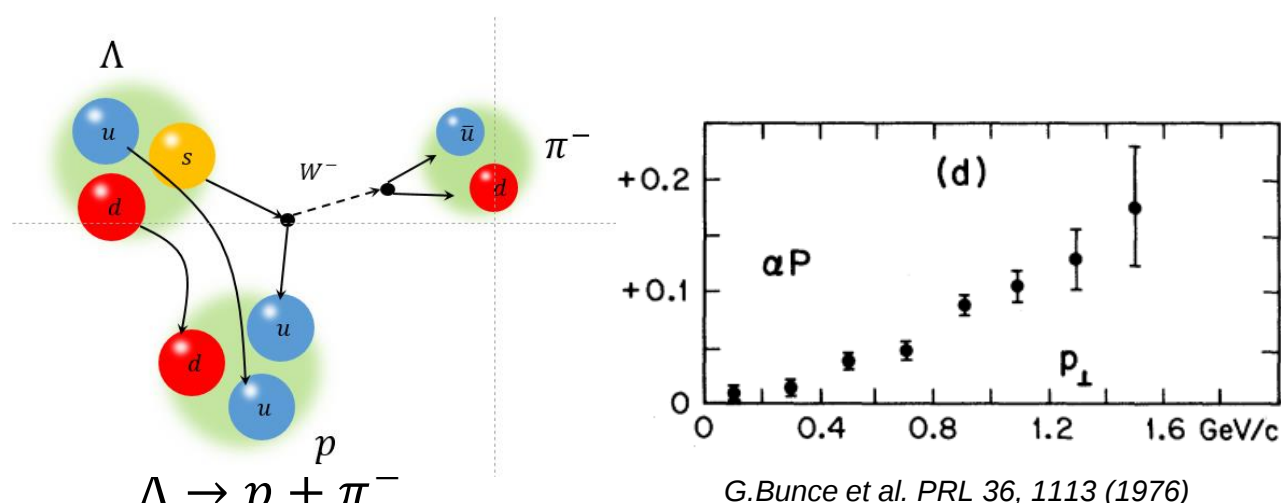
Abstract

Spontaneous polarization of Λ was observed in 1976 and still puzzles us. Polarizing Fragmentation Functions (pFFs), which describe unpolarized parton fragmenting into a polarized hadron, might be a possible origin of the spontaneous polarization. Recently, a significant transverse polarization of Λ was observed by the Belle experiment in unpolarized e^+e^- annihilation.

In pp collisions at RHIC, transverse polarization of Λ in jet can access pFFs at different energy scales and test their universality. In this poster, we present the first measurement of transverse polarization of Λ in jet as functions of z , j_T , in unpolarized pp collision at $\sqrt{s} = 200$ GeV with an integral luminosity of 104 pb^{-1} .

Motivation

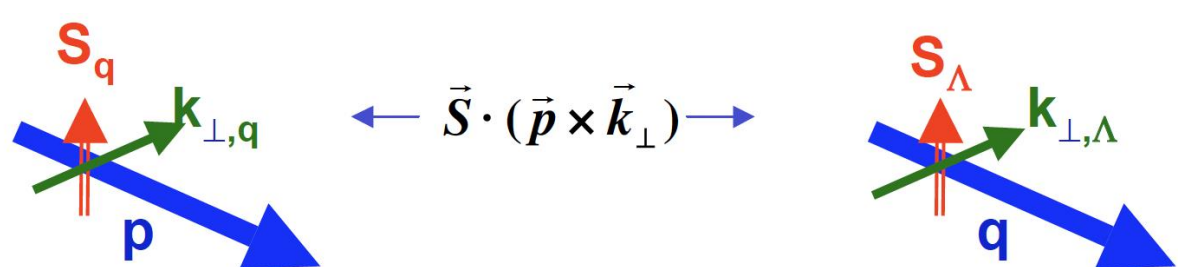
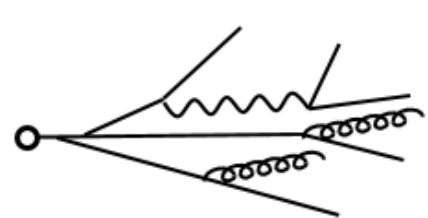
- Self analyzing weak decay makes Λ an ideal final state polarimetry
- Λ spontaneous polarization first observed in 1976 G.Bunce et al. PRL 36, 1113 (1976)



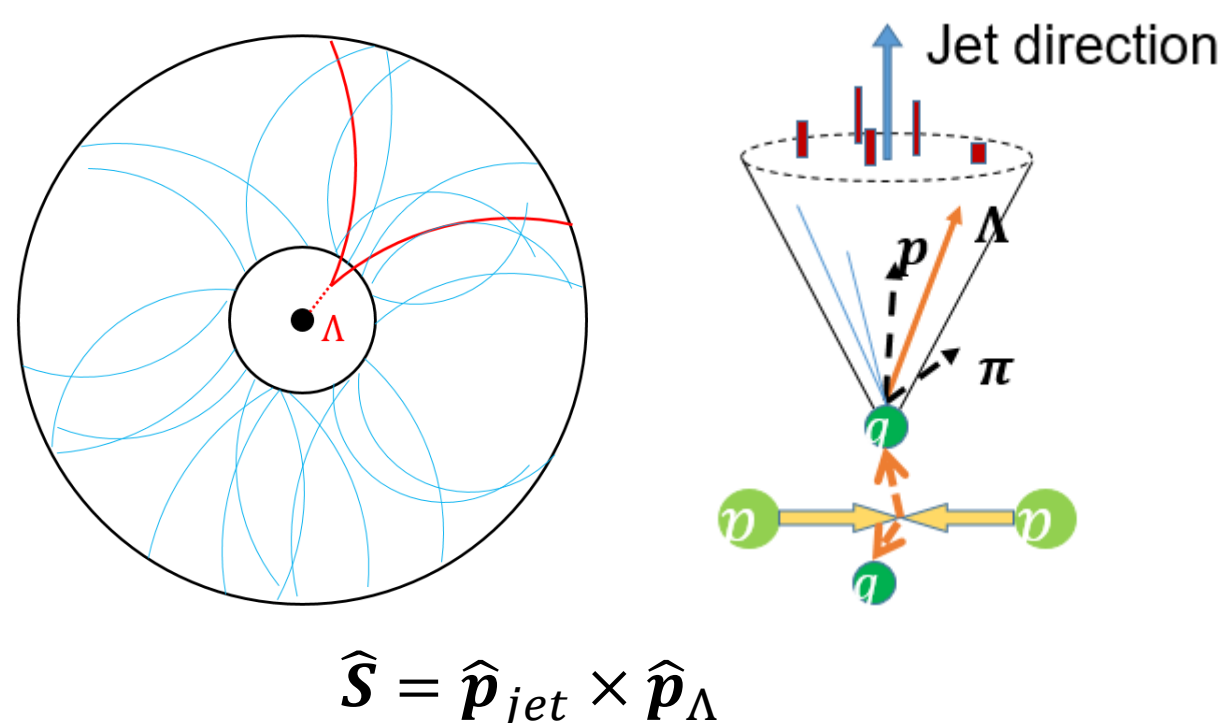
- Contribution from hard-scattering ~ 0 , other possible sources:

Initial state contribution:
Boer-Mulders function

Final state contribution:
Polarizing Fragmentation
Functions(pFFs)
Boer et al, PLB 671, 91-98 (2008)
Kang, Lee, Zhao, PLB 809, 135756 (2020)



Reconstruction of Λ and jet



- pFFs can be accessed by transverse polarization of Λ -in-jet in pp collisions
- Cover a wide range of jet p_T : 5~50 GeV/c for measurement of energy scale dependence
- Test universality of pFFs
- Λ polarization extraction function

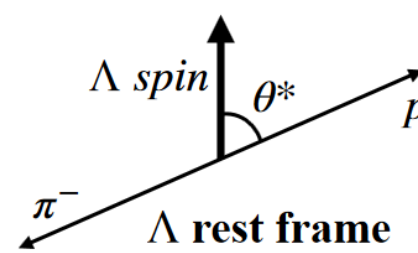
$$\frac{dN}{d \cos \theta^*} \propto A_{\cos \theta^*} (1 + \alpha P \cos \theta^*)$$

A: detector acceptance function

α : decay parameter (0.732 ± 0.014)

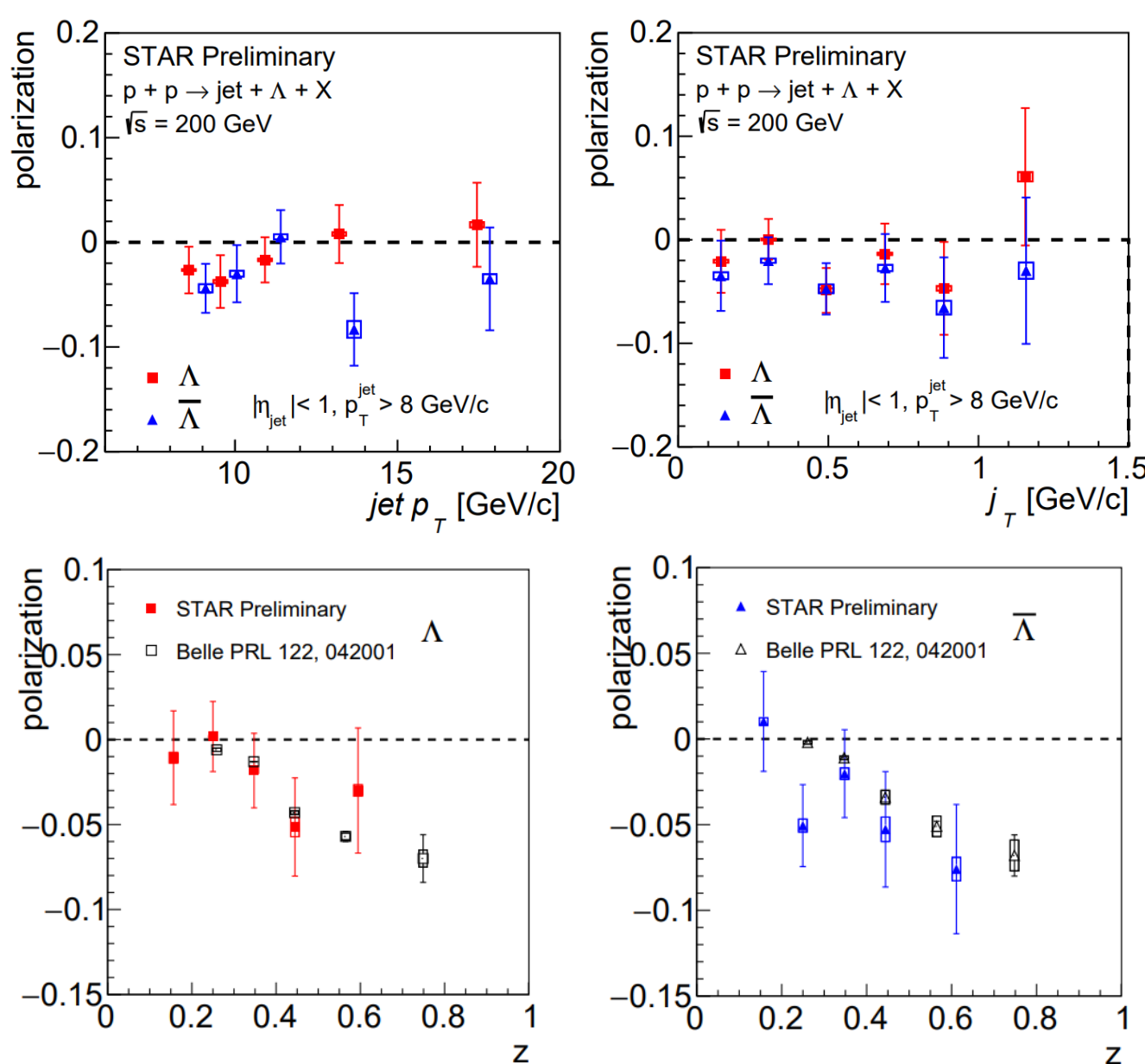
P: Λ polarization

θ^* : angle between p and polarized direction in Λ rest frame



Preliminary results

Transverse polarization of Λ within jet

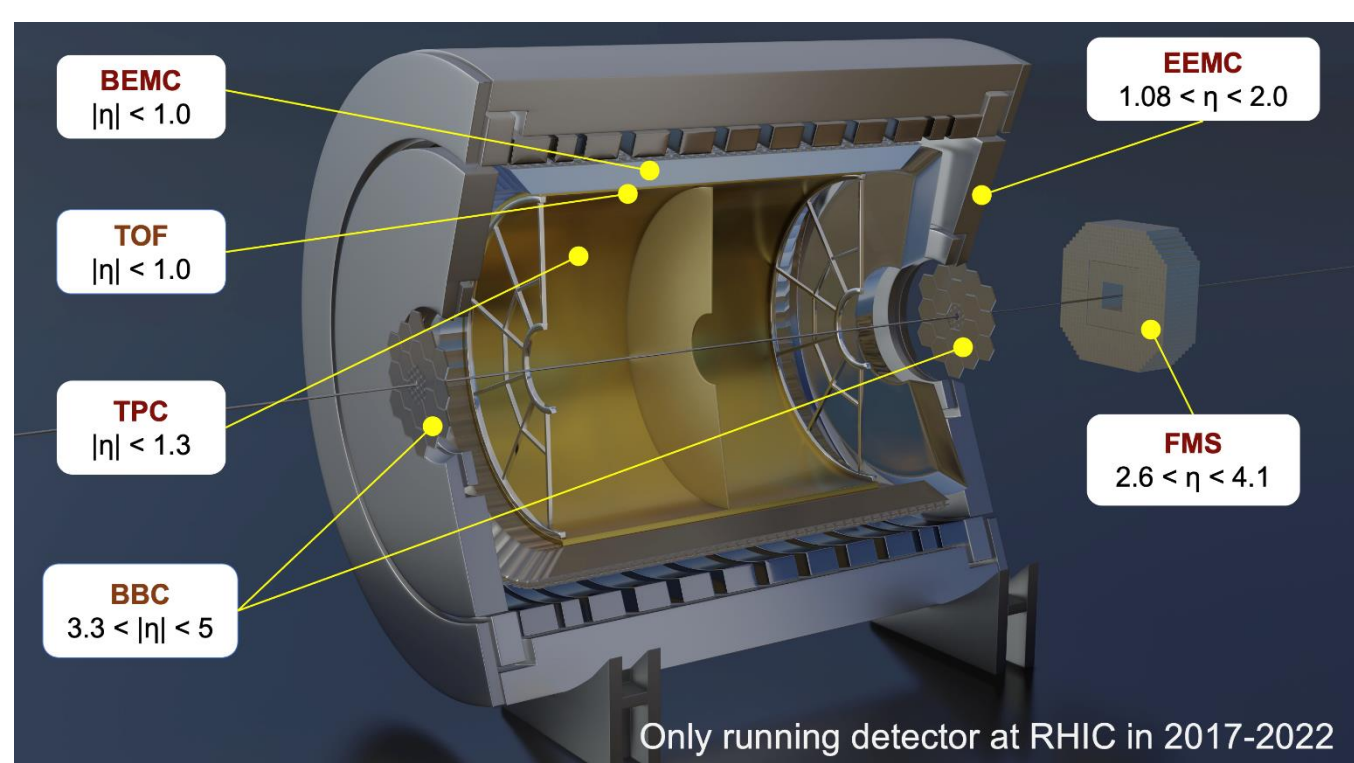


- Dataset: pp collision; $\sqrt{s} = 200$ GeV; 104 pb^{-1}
- First hint of non-zero ($> 2\sigma$) $\bar{\Lambda}$ polarization in pp
- Weak energy scale dependence within current precision
- Comparison with Belle's results:
jet $\bar{p}_T \sim 11$ GeV vs ~ 5.3 GeV and similar z dependence

$$z = \frac{p_{\Lambda} \cdot p_{jet}}{|p_{jet}| |p_{jet}|}$$

$$j_T = \frac{p_{\Lambda} \times p_{jet}}{|p_{jet}|}$$

STAR detector



The STAR experiments is located at the RHIC collider in BNL. Subdetectors used in this analysis are:

- TPC (Time Projection Chamber):
 - Tracking and particle identification
 - $-1.3 < \eta < 1.3, \phi \in [0, 2\pi]$
- Calorimeter system:
 - BEMC (Barrel Electromagnetic Calorimeter) $-1 < \eta < 1, \phi \in [0, 2\pi]$
 - EEMC (Endcap Electromagnetic Calorimeter) $1.086 < \eta < 2, \phi \in [0, 2\pi]$

Conclusions

- The first measurement of transverse polarization of Λ within jet in pp collisions at RHIC
- Providing new constraint for pFFs: energy scale dependence; universality test

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