

# XVII Workshop on High Energy Spin Physics

## *DSPIN-17*

Dubna, Russia, September 10 - 15, 2017

Starts 1981

by L.I. Lapidus

Possibility to participate of physicists from the former USSR was important motivation. Distant trips are complicated by financial (earlier also by political and bureaucratic) reason.

110 participants

50 invited talks (40-30')

40 original talks (20').

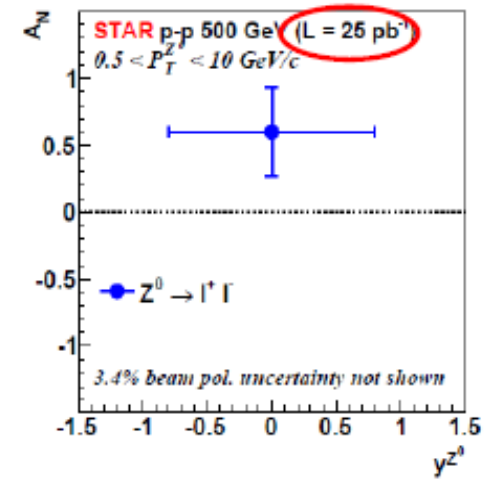
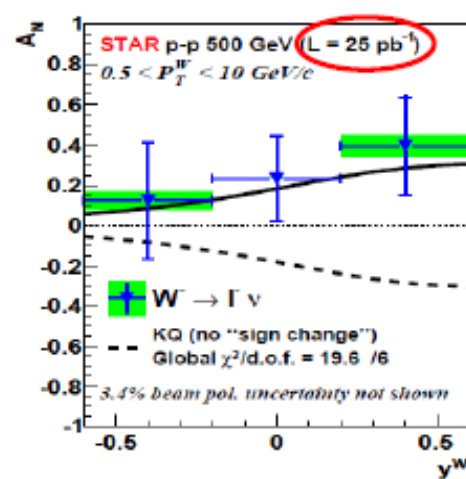
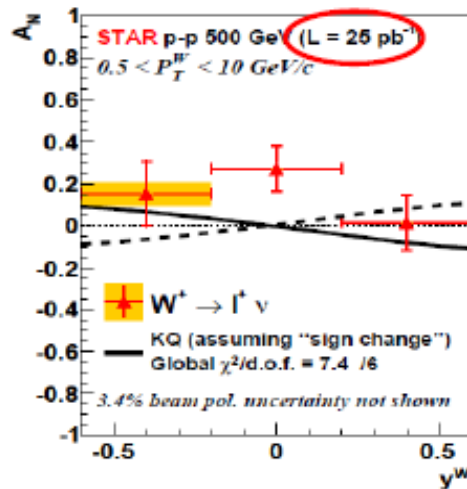
3 parallel sections.



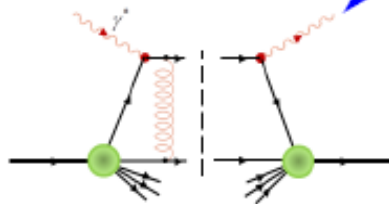
JINR - 64, Russia - 22 ,  
Czech Republic - 4 ,  
Germany – 3, USA - 3 ,  
Belarus - 3, Poland - 2,  
Italy - 4, Slovakia - 4,  
Armenia, Bulgaria,  
Estonia, Netherlands and  
UK - 1

STAR Collaboration  
Phys.Rev.Lett.  
116, 132301 (2016)

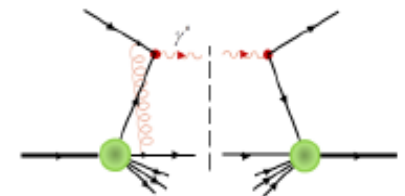
$$p^\uparrow + p \rightarrow W^\pm(Z) + X$$



- $A_N$  is sensitive to the Sivers function
- Expect opposite sign for the Sivers function in SIDIS and pp

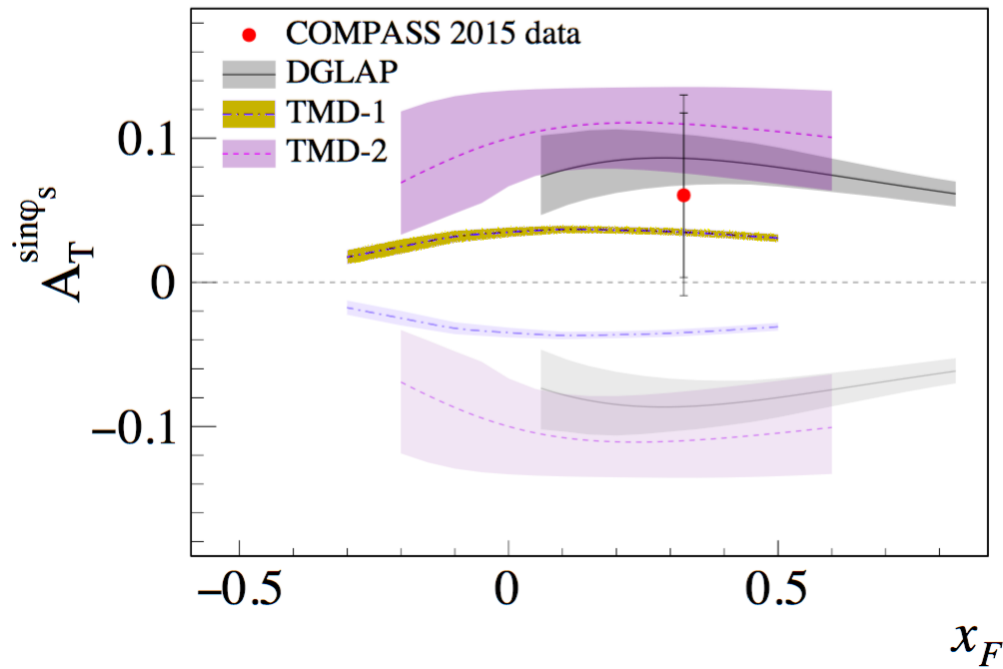


$$f_{q/h^\uparrow}^{\text{SIDIS}}(x, k_T, Q^2) = -f_{q/h^\uparrow}^{p+p \rightarrow DY/W^\pm/Z^0}(x, k_T, Q^2)$$



- Sivers-sign change scenario preferred over no-sign change scenario, if TMD evolution effects are small.

**Michail Pesek**  
**COMPASS Collaboration**



arXiv:1704.00488  
Accepted to PRL

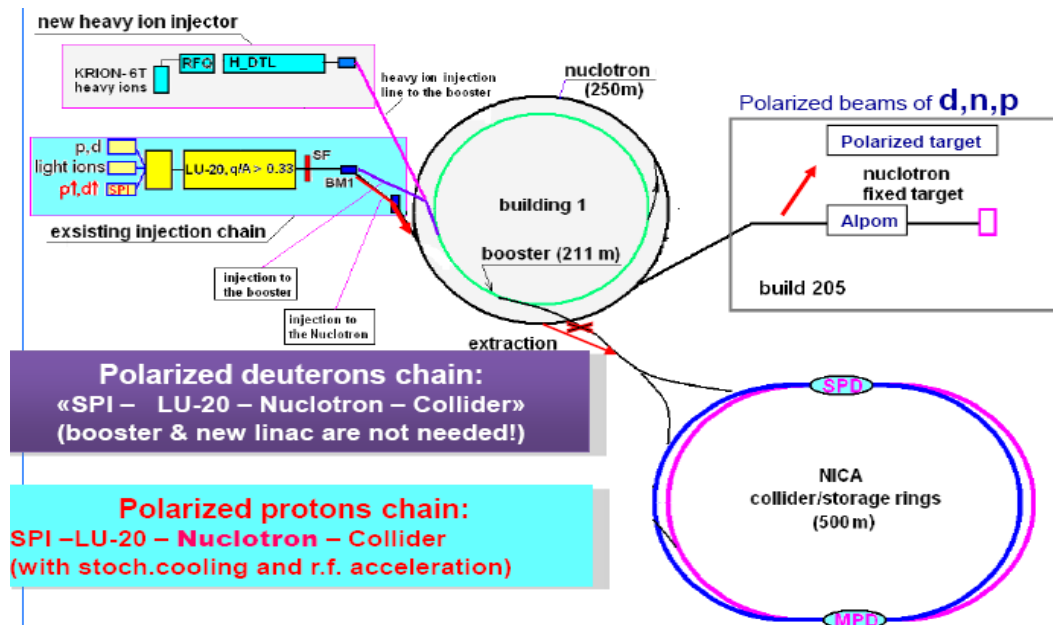
**Consistent with Sivers function sign change!**

# Special session NICA-SPD preliminary program (Kovalenko, M. Kondratenko, Nagaytsev, Guskov, Anikin, Goloskokov, Sharov, et al.)

- Drell-Yan
- $J/\Psi$  production
- Spin effects in  $pp, pd, dd, pp\uparrow, p\uparrow p\uparrow$ , and  $d\uparrow d\uparrow$  interactions,
- Polarization effects in heavy ions collisions

## Polarized beams of protons and deuterons requirements:

- **longitudinal** and **transverse** polarizations in MPD and SPD detectors
- $p\uparrow p\uparrow \sqrt{s_{pp}} = 12 \div 27 \text{ GeV}$  ( $5 \div 12.6 \text{ GeV}$  kinetic energy )
- $d\uparrow d\uparrow \sqrt{s_{NN}} = 4 \div 13.8 \text{ GeV}$  ( $2 \div 5.9 \text{ GeV/u}$  ion kinetic energy )
- **Lverage  $\approx 1 \cdot 10^{32} \text{ cm}^{-2} \text{s}^{-1}$  (at  $\sqrt{s_{pp}} \geq 27 \text{ GeV}$ )**



Lol is accepted by PAC, Techn. Project in preparation (see R. Tsenov talk).

Invite to NICA-SPDCollaboration!

# **SPASCHARM EXPERIMENT Physics**

## polarized antiproton beam

- Polarized proton beam was realized in different places and has even too high Intensity in our case (from radiation limitations)
- There are many experiments with polarized protons and just a few ones with antiprotons
- The intensity of polarized antiproton beams is much lower than of protons ones
- **We present the result of studying a possibility to obtain a polarized anti-proton beam at the channel 24**

V.A. Okorokov

September 15, 2017

The polarized (anti)proton beam is obtained by selecting (anti)protons from the weak decay of (anti)- $\Lambda$  produced in a primary target by extracted proton beam. This method is for both the E-704 experiment and the SPASCHARM project. Some main features are shown in Table 2 for U-70 and Tevatron beams.

*Table 2. Some characteristics for U-70 and Tevatron beams (for #4,5 first line for  $p$ , second – for anti- $p$ ).*

#	Beam parameter	U-70	Tevatron
1	primary proton beam, $p$ (GeV/ $c$ )	50 – 60	800
2	primary beam intensity <sup>a</sup>	$\sim 2 \times 10^{13}$	$3 \times 10^{12}$
3	polarized beam, $p$ (GeV/ $c$ )	15 – 45 <sup>b</sup>	$185 \pm 17$
4	beam intensities at the target <sup>a</sup>	$(0.9-6.8) \times 10^7$	$3 \times 10^7$
		$\sim (0.8-4.0) \times 10^5$	$3 \times 10^6$
5	beam polarization	$\approx \pm(0.45 \pm 0.05)$	$\pm(0.40 \pm 0.12)$
			$\pm(0.45 \pm 0.03)$

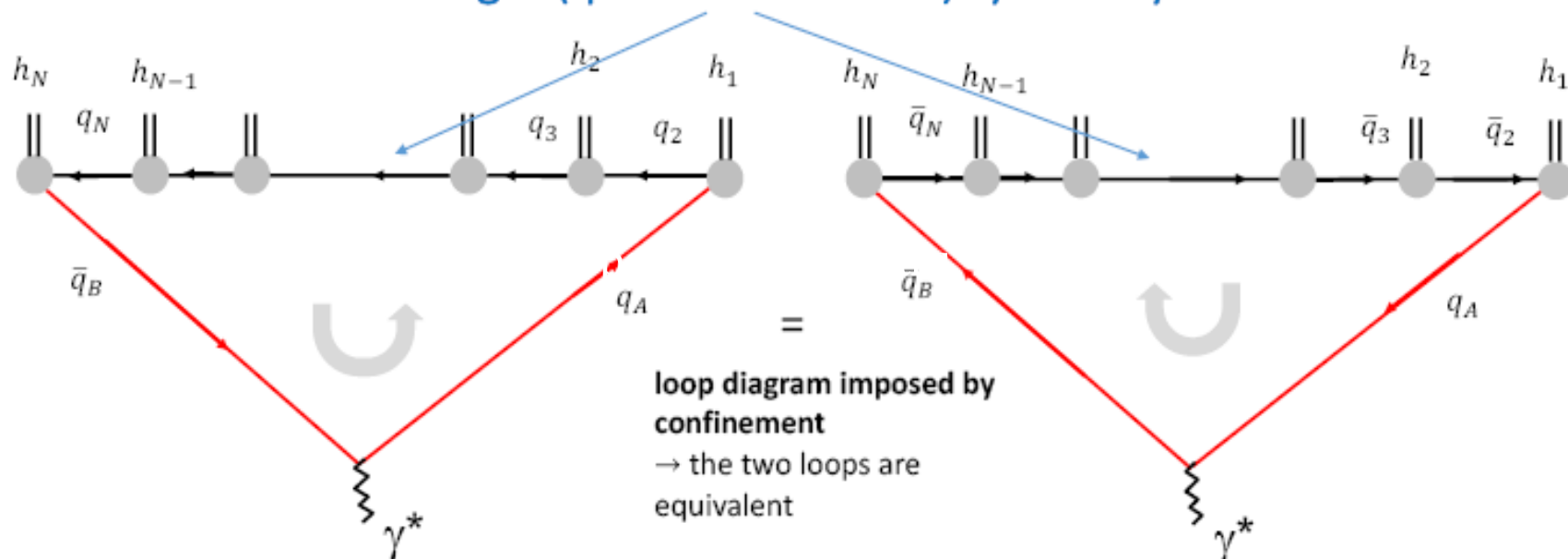
**Stage 1:** Study of single-spin asymmetries at the existing beam line 14, using unpolarized meson and proton beams, interacting with transversely polarized protons or deuterons of the “frozen” target. The first physics data taking run - Spring-2018.

**Stage 2 (Beginning in 2022):** Polarized proton and antiproton beams will be available at the new 24A beam line.

The polarised quark fragmentation process has been implemented in a stand alone MC code

The starting point is the Symmetric Lund Model and the  $^3P_0$  mechanism proposed by X. Artru (discussed previously at DSPIN)

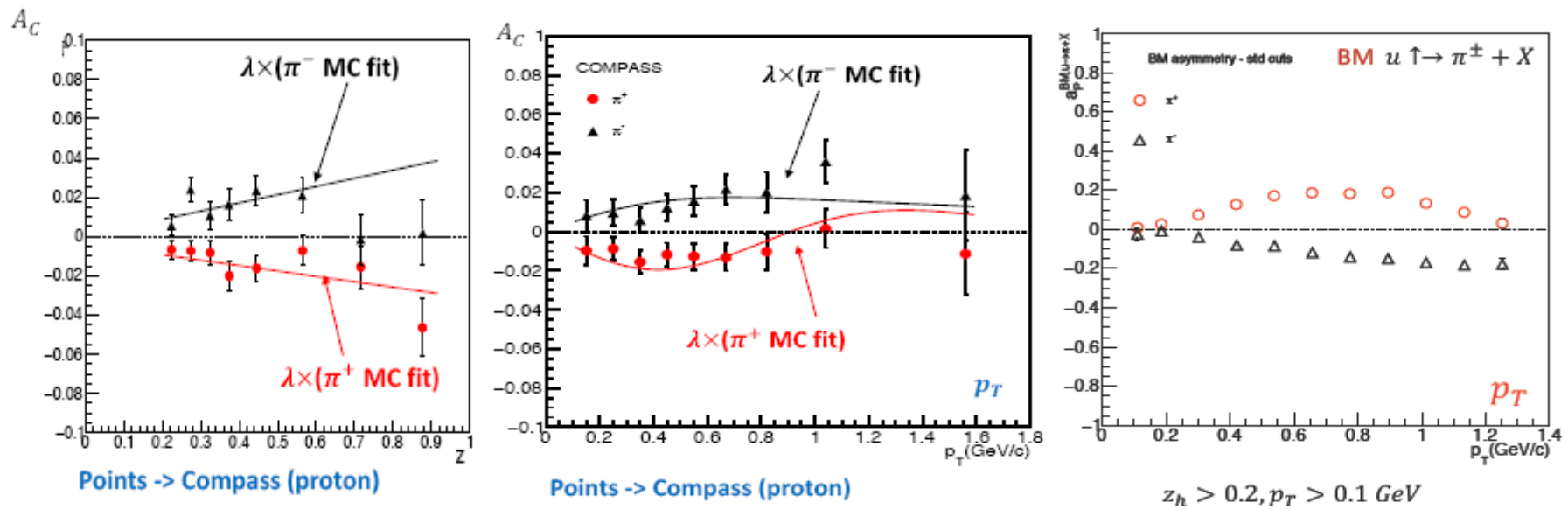
### Left-Right (quark line reversal) symmetry



**Left-Right symmetry** in the string fragmentation framework → important constraint on the **spinless** splitting function  
→ **Symmetric Lund Fragmentation Model (SLFM)** implemented in currently used event generators like Pythia

$$F_{q'hq}(k'_T, k_T, Z) d^2 k'_T \frac{dZ}{Z} \propto d^2 k'_T \frac{\pi}{b_T} e^{-b_T k_T'^2} \cdot \frac{dZ}{Z} N^{-1}(m_T^2) (1 - Z)^a \exp[-b_L m_T^2 / Z]$$

large Z suppression  
Linked to the probability of having a cutting point



- The kinematical dependence of the resulting Collins analysing power has been studied and the agreement with the experimental SIDIS and e+e- data is satisfactory
- The intrinsic  $k_T$  has also been introduced
- First results on the Boer-Mulders effect are obtained

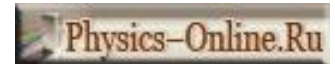


## Sponsored by:

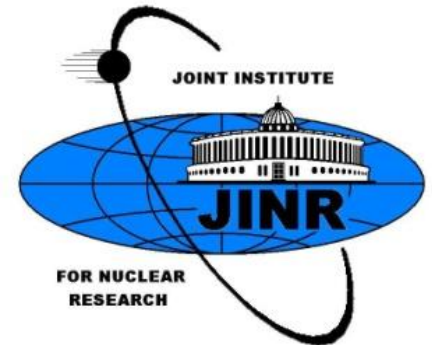
Russian Foundation for Basic Research,  
Physics-Online.ru

International Committee of Spin Physics,  
European Physical Society,

Programs on international JINR cooperations:  
Heisenberg-Landau, Bogolyubov-Infeld and  
Blokhintsev-Votrubá.



European Physical Society  
more than ideas



The Proceedings of DSPIN-17 are published by Journal of Physics:  
Conference Series (<http://iopscience.iop.org/issue/1742-6596/938/1>)  
All talks are available <http://theor.jinr.ru/~spin/2017/>

# Welcome to DSPIN-19!!!

Backup slides

# Organizing Committee:

A. Efremov (*chair*) Dubna  
M. Finger (*co-chair*) Prague  
A. Sandacz (*co-chair*) Warsaw  
S. Goloskokov (*sc. secretary*) Dubna  
O.Teryaev (*program com.*) Dubna  
O. Korotchik (*secretary*) Dubna  
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N. Piskunov Dubna  
I. Savin Dubna  
O. Selyugin Dubna  
M. Strikhanov Moscow  
T. Stucalova Moscow

# Program of DSPIN-17

	11.09 Mo	12.09 Tu	13.09 We	14. 09 Th	15. 09 Fr
<b>Chair</b>	<b>Lednicky</b>	<b>Sandacz</b>	<b>Teryaev</b>	<b>Perdrisat</b>	<b>Mochalov</b>
9.30		Barish 40	Pankov 30	Punjabi 30	Okorokov 30
10.00	Opening 10				
10.10	Tokarev 40	Bradamante 40	Tsytrinov 30	Selyugin 30	Rykov 30
10.30			Klopot 30	Rzayeva 20	Janek 30
10.50	Sandacz 40	Pesek 20		Zykunov 20	
11.10		Matousek 20	Saleev 30	Koshkarev 20	Filip 30
<b>11.30</b>	<b>Coffee break</b>	<b>Coffee break</b>	Coffee break	<b>Coffee break</b>	<b>Coffee break</b>
<b>11.50</b>					
<b>Chair</b>	<b>Bedfer</b>	<b>Barish</b>	<b>Pankov</b>	<b>Ginzburg</b>	<b>Kovalenko</b>
11.50	Biselli 40	Bedfer 30	Silenko 30	Gerasimov 30	Zachariou 30
12.10		Ivanov 20			
12.30	Ginzburg 30	Marianski 30	Teryaev 30	Dorokhov 30	Kondratenko A. 30
12.50			Obukhov 40	Ganbold 20	Belov 20
13.10	Miklukho 30	Mitrofanov 20		Shindin 20	Zorin 20
<b>13.30</b>	<b>Lunch</b>	<b>Lunch</b>	<b>Lunch</b>	<b>Lunch</b>	<b>Lunch</b>
<b>15.00</b>					
<b>Chair</b>	<b>Biselli</b>	<b>Bradamante</b>	<b>Neznamov</b>	<b>Piskunov</b>	<b>Gerasimov</b>
15.00	Murdoch 20	Delcarro 30	Dvornikov 30	Ladygin	Koerner 30
15.20	Marukyan 30			Isupov 20	
15.40		Kotikov 30	Mantovani 30	Skhomenko 20	Artamonov 30
16.00	Christova 30	Gabdrakhmanov 20	Burinskii 20	Kiselev 20	
<b>16.20</b>	<b>Coffee break</b>	<b>Coffee break</b>	<b>Coffee break</b>	<b>Coffee break</b>	<b>Gorbunov 30</b>
<b>16.40</b>					
<b>Chair</b>	<b>Christova</b>	<b>Efremov</b>	<b>Obukhov</b>	<b>Punjaby</b>	
16.40	Kataev 30	Kovalenko30 Kondratenko M. 20 Guskov 30 Nagaytsev 20 Anikin 30 Goloskokov 30 Filatov 20 Sharov 20	Zavada 20	Ladygin 30	Closing Efremov 10
17.00			Abramov 30		<b>Farewell party</b>
17.20	Strozik-Kotlorz 30			Piskunov 30	
17.40	Bertone 20		Neznamov 30	Nurusheva 20	
18.00	Ermolaev 30		Parvan 20	Kerbizi 20	
18.20					
18.40	Manaenkov 30				
<b>19.00</b>	<b>Welcome Party</b>		<b>Concert</b>	<b>Conference dinner</b>	

	12.09 Tu			15.09 Fr
<b>Chair</b>	<b>Anikin</b>			<b>Sukhoruchkin</b>
11.50	Lyuboshitz 20		11.50	Volchanskiy 30
12.10	Chernitskii 20		12.10	
12.30	Haurysh 20		12.30	Makhaldiani 30
12.50	Machavariani 20		12.50	Musulmanbekov 20
13.10	Pestov 20		13.10	Chavleishvili 20
<b>Chair</b>	<b>Chernitskii</b>			
15.00	Duginov 20			
15.20	Shestakov 20			
15.40	Karlovetz 20			
16.00	Sukhoruchkin 20			