## Communications from Physics Coordinator(s)

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# DIS-2025 : A Very Short Summary

- DIS-2025 started with a celebration of James Bjorken's long life and pioneering work (passed away in 2024)
- Apart from upcoming EIC, major long term projects (FCC) in Europe were discussed
- China has two major proposed experiments EICc and CEPC - JINR is participating in at least CEPC
- A very unique feature in proposed LHCSpin exp : both fixed target (polarized) and beam-beam (unpol) collisions at the same detector - with well separated event vertices
- NNPDF group announced updated polarized PDF set (v.2), they also started working on TMD PDFs (also MAP coll.)

There are some be not such to discover within the term and range except the single Higgs boson, especially if it turns out it have low mass. This is a very minimized view, which softwar from "Risearchys." Wine tuning," and other technical problems of the incorists. But, albeit unlikely, it is at least thickshic that there is nothing brown is angle Higgs boson until the frantastic port.





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# DIS-2025 : Intriguing Spin Results

- Correlation between ΛΛ̄ pair at STAR probes ss̄ coherence, an interesting result that we want to measure at SPD too
- Very forward neutron and  $\pi^0$  asymmetries at RHICf exp that is (possibly) consistent with pion-cloud model
- EM-jet (multi-photon) asymmetry at STAR shows interesting behavior (a brand new result that needs theoretical understanding)





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# Activities : Meetings and Communications

- **Physics and MC monthly meetings** 6 meetings since the last Collaboration Meeting
- Purpose : to present (more polished) results of theoretical and data driven studies (typical attendance : 30-45 persons)
- Next Physics and MC meeting proposed on June 18
- **Physics Bi-weekly meeting** 5 meeting so far since the last Collaboration Meeting (typical attendance : 20-35 persons)
- Purpose : to present intermediate results/status, report problems with software/analysis/data, ask for opinions/ideas/help from a wider pool of colleagues attending the meetings, longer discussions
- Typically on Tuesdays at 15:00 Moscow time - now focussed on stage-II physics and SpdRoot/reconstruction

## Activities : Meetings and Communications

- Stage-I physics is a major focus now for the collaboration as a whole
- A separate working group convened by Evgeny Soldatov was created after the last CM - holds meetings in alternate weeks at the same day/time as Physics bi-weekly - next talk by E. Soldatov
- No seminar in the last 6 months feel free to suggest topics/persons for seminar (contact Amaresh or Igor) or Evgeny, especially if it focussed on stage-I topics
- Contact and communications : SPD\_MC mail list, private emails, a Telegram channel (feel free to contact, especially if you are stuck in an analysis)
- A dedicated forum (spd-forum.jinr.ru). Main purpose : analysis note review, spdroot issue reporting. For advanced simulation studies : PLEASE write and submit a detailed analysis note describing technique, simu details, cuts, lots of plots, final results, inferences EXTREMELY useful in future

SpdRoot :

#### Merged :

- Generator update : custom pp elastic generator (A. Galoyan, V. Uzhinsky) and FTF generator (A. Gridin) now integrated within SpdRoot framework
- FARICH PID likelihood fixed and ready for physics analysis (Thursday talk by A. Ivanov)
- Improved Vertex detector (MAPS/DSSD) description (Thursday talk by A. Vasyukov)

#### Not Merged :

- FE modules for vertex detector (A. Vasyukov)
- Sextant geometry for TS barrel (Thursday talk by R. Akhunzyanov)
- Realistic r-t dependence of tracks in TS (Thursday talk by E. Mosolova)
- Track finding in TS barrel (Thursday talk by V. Andreev)

#### Still Needed Features :

- Elastic (and quasi-elastic) dd scattering (Thursday talk by A. Galoyan)
- Track finding in TS end-caps
- Muon identification (NN-based work ongoing) and neutron cluster finding in RS
- ZDC description and neutron reconstruction (work ongoing)

Fast Reconstruction (ongoing work) : vertex (Maria Dima) and track finding (Mihai Dima)

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# SpdRoot Workshop

- A workshop on SpdRoot code, development and usage was held on Apr 16, 2025 (https://indico. jinr.ru/event/5367/) - 75 participants
- Slides and video of each presentation can be found on the link (special thanks to Aytadzh for video editing)
- Feel free to contact to learn more about using SpdRoot to do simulations of proposed physics studies at the SPD



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- A stable and elaborate system of large scale MC productions is finally ready and operating special thanks to Artem Petrosyan (Elena Zemlyanichkina now handles regular operations)
- Look for the regularly updated table (a google data-sheet) link at **Available Data** on wiki to find what is available
- Avoid sets with 'deprecated' tag. Sets with 5 million events are typically for testing data quality
- Check the simu/reco script to make sure the data set serves your purpose (all detectors you need are included or not)
- The FTF sample is generated with Geant4 10.5.1 and doesn't contain deuterons in the final state. Consider using separate container for Geant4 10.7 (in the /cvmfs/ area)

- Quality study for the Pythia8 generated sample for 10 GeV was performed by Elena
- A volunteer for coordinating the quality assurance is needed
- Data (pp at 27 GeV) is ready for D-meson and Lambda studies (80 million available now, will reach 200 million soon)
- Register in IAM authentication system and use RUCIO system to get file lists (see workshop talk on RUCIO for details)
- Files are stored on /eos/ mounted area and can be conveniently processes using the lxui cluster batch jobs (recording my interactive talk on workshop)
- Contact us (me and/or lgor) to provide feedback and to request special data sets for productions

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- Reconstruction of  $\Xi^-$  hyperons in pp collisions by D. Gubachev, performed for 27 GeV, work ongoing to extend study for 10 GeV
- Inclusive  $K_s^0$  production in pp with both Pythia8 and FTF generators at 10 GeV by N. Rogacheva
- Inclusive and exclusive Φ meson production (Thursday talks by E. Zemlyanichkina and L. Seryogin)
- Simulation of BBC performance for pp and dd scattering by A. Terekhin

### New Prediction Results



Left  $A_N^{\chi_{c1}}$  Middle  $A_N^{\chi_{c2}}$  - D'Alesio parameters Right  $A_N^{\chi_{c2}}$  - SIDIS1 parameters

Transverse single spin asymmetry  $(A_N)$  predictions as functions of  $x_F$  of  $\chi_{c1}, \chi_{c2}$  charmonia in pp collisions in stage-II from A. Karpishkov

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### Predictions :

- Available : predictions for most of our main probes (prompt photon, charmonia, open-charm mesons) of gluon structure in p + p collisions at or near 27 GeV are now available (thanks to our Samara group colleagues)
- Not Available : asymmetries for gluon tensor polarized distributions for prompt photons and charmonia  $(J/\Psi)$  and  $A_{TT}$  from gluon transversity in d + d collisions at stage-II

#### Impacts :

- Estimated : impact of  $J/\Psi$  and prompt photon  $A_{LL}$  on gluon helicity PDF
- Not Estimated : impact on unpolarized gluon PDF, impact of possible open-charm  $A_{LL}$ , impact of any  $A_N$  measurement on Gluon Sivers Function (can not quantify without any previous extraction impact as new data points to be used in future global analysis)

### Agenda of Physics Talks on Thursday

	J[psi production in the soft gluon resummation approach using the improved color-evaporation model Prof. Vladimir Saleev		
	Pair production of D-mesons at small and large transverse momenta	Alexandra Shipilova	
10:00		09:50 - 10:10	
	Comparison of the mechanisms of proton and pion production in dd collisions in the new cumulative region of central r Vladimir Vechernin		
	Spin observables in dd $\rightarrow$ n+p+d AND in pd-pd processes at NICA SPD energies	Yury Uzikov	
		10:30 - 10:50	
	Coffee break		
11:00		10:50 - 11:10	
	Large-pT production of baryons and tetraquarks at SPD NICA energies	Andrei Zelenov	
		11:10 - 11:30	
	Simulation of elastic and inelastic \$dd\$-interactions	Аида Галоян	
		11:30 - 11:50	
12:00	Report from MEPhI Group	Evgeny Soldatov	
		11:50 - 12:05	
	Track finding status at SPD [R]	Vladimir Andreev	
		12:05 - 12:30	
	Lunch		

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### Agenda of Physics Talks on Thursday

14:00	Garfield++/LTSpice studies of the straw time and charge r Sofia Bulanova	Monte Carlo simulations of the prototype SPD aerogel detectors Vardan Tadevosyan		
	Update on realistic simulation and hit reconstruction for t Ekaterina Mosolova	FARICH simulation and PID Artem Ivanov 14:20 - 14:35		
	Status of vertex detector simulation Artem Vasyukov 14:30 - 14:45 Momentum resolution of straw detector in sextant geometry	Machine Learning for FARICH Reconstruction. Production sample Forma Shipilov		
	Ruslan Akhunzyanov Progress report of SPD Zero Degree Calorimeter in the fir Kamepun Illmexep	Improvement of the energy resolution of ECal SPD Dr Илья Зимин		
		Simulation of heavy ion collisions in BBC detector (phas Ivan Volkov		
	Coffee brea			
	Phi meson production in pp@10 GeV with SPD spectrometer	Elena Zemlyanichkina 15:40 - 15:55		
16:00	Exclusive phi meson production at the NICA SPD [R]	Leonid Seryogin 15:55 - 16:10		
	Study of pd scattring in dd collisions	Amaresh Datta 16:10 - 16:25		
	pp and dd scattering simulation for Beam-Beam Counter of t	he SPD [R] Arkadiy Terekhin 16:25 - 16:45		
	Cluster particle production @SPD experiment. Pythia vs Here	vig Dzmitry Budkouski 16:45 - 17:00		

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- Physics of stage-I is of prime focus for the collaboration, new working group was formed next talk will give details of activities there
- An overview of theoretical predictions, reconstruction software status, physics analysis studies and activities of the (now) stage-II focussed group is presented (on behalf of I. Denisenko and myself)
- Important to keep in focus where we still need more work/man-power (mostly in red ink on these slides)
- In particular, predictions of observables in d + d collisions is practically non-existent - would be much appreciated
- Gaudi-based (SAMPO) framework is being developed (man-power needed)
- Please contact publication committee before publishing and giving presentations on behalf of the collaboration, for topical presentations, go through group conveners

# Thank You

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