



# *Current status of the SPD project*

*A. Guskov*

22.3.2021



## **Plans for 2020**

- Update the physics program**
- Prepare the Conceptual Design Report**
- Form the international collaboration**

# SPD Physics Program



**SPD - a universal facility for comprehensive study of gluon content in proton and deuteron at large  $x$**

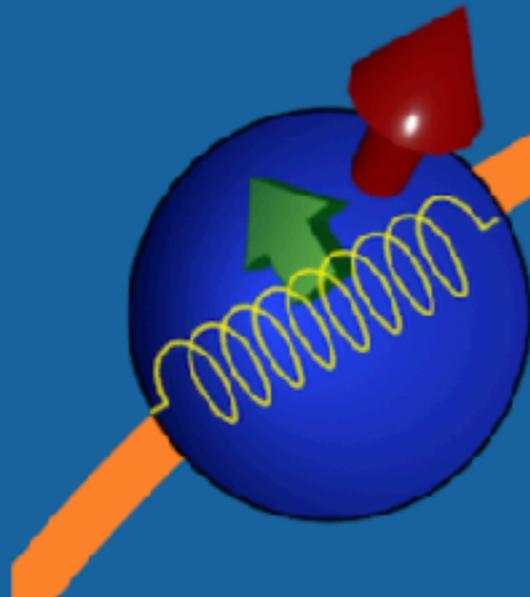
Charmonia

Prompt photons

Open charm

Other spin-related phenomena

Other physics



Gluon content of proton and deuteron with the Spin Physics Detector at the NICA collider

30 September 2020 to 1 October 2020



Physics programme for the first stage of the NICA SPD experiment

5-6 October 2020

# SPD Physics Program

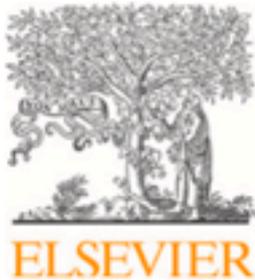
JPPNP: 103858

Model 3G

pp. 1–43 (col. fig: NIL)

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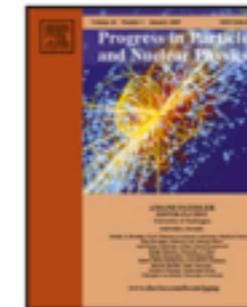
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journal homepage: [www.elsevier.com/locate/ppnp](http://www.elsevier.com/locate/ppnp)



Review

## On the physics potential to study the gluon content of proton and deuteron at NICA SPD

A. Arbutov<sup>a</sup>, A. Bacchetta<sup>b,c</sup>, M. Butenschoen<sup>d</sup>, F.G. Celiberto<sup>b,c,e,f</sup>,  
U. D'Alesio<sup>g,h</sup>, M. Deka<sup>a</sup>, I. Denisenko<sup>a</sup>, M.G. Echevarria<sup>i</sup>, A. Efremov<sup>a</sup>,  
N.Ya. Ivanov<sup>a,j</sup>, A. Guskov<sup>a,k,\*</sup>, A. Karpishkov<sup>l,a</sup>, Ya. Klopot<sup>a,m</sup>, B.A. Kniehl<sup>d</sup>,  
A. Kotzinian<sup>j,o</sup>, S. Kumano<sup>p</sup>, J.P. Lansberg<sup>q</sup>, Keh-Fei Liu<sup>r</sup>, F. Murgia<sup>h</sup>,  
M. Nefedov<sup>l</sup>, B. Parsamyan<sup>a,n,o</sup>, C. Pisano<sup>g,h</sup>, M. Radici<sup>c</sup>, A. Rymbekova<sup>a</sup>,  
V. Saleev<sup>l,a</sup>, A. Shipilova<sup>l,a</sup>, Qin-Tao Song<sup>s</sup>, O. Teryaev<sup>a</sup>

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<sup>c</sup> INFN Sezione di Pavia, via Bassi 6, I-27100 Pavia, Italy

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<sup>e</sup> European Centre for Theoretical Studies in Nuclear Physics and Related Areas (ECT\*), I-38123 Villazzano, Trento, Italy

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Accepted for publication  
to PPNP

arXiv:2011.15005

# SPD Physics Program

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Prepared for Physics of Elementary Particles and Atomic Nuclei. Theory

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Possible studies at the first stage of the NICA collider operation  
with polarized and unpolarized proton and deuteron beams

*V. V. Abramov<sup>1</sup>, A. Aleshko<sup>2</sup>, V. A. Baskov<sup>3</sup>, E. Boos<sup>2</sup>,  
V. Bunichev<sup>2</sup>, O. D. Dalkarov<sup>3</sup>, R. El-Kholy<sup>4</sup>, A. Galoyan<sup>5</sup>, A. V. Guskov<sup>6</sup>,  
V. T. Kim<sup>7,8</sup>, E. Kokouline<sup>5,9</sup>, I. A. Koop<sup>10,11,12</sup>, B. F. Kostenko<sup>13</sup>,  
A. D. Kovalenko<sup>5</sup>, V. P. Ladygin<sup>5</sup>, A. B. Larionov<sup>14,15</sup>, A. I. L'vov<sup>3</sup>, A. I. Milstein<sup>10,11</sup>,  
V. A. Nikitin<sup>5</sup>, N. N. Nikolaev<sup>16,26</sup>, A. S. Popov<sup>10</sup>, V. V. Polyanskiy<sup>3</sup>,  
J.-M. Richard<sup>17</sup>, S. G. Salnikov<sup>10</sup>, A. A. Shavrin<sup>18</sup>, P. Yu. Shatunov<sup>10,11</sup>,  
Yu. M. Shatunov<sup>10,11</sup>, O. V. Selyugin<sup>14</sup>, M. Strikman<sup>19</sup>, E. Tomasi-Gustafsson<sup>20</sup>,  
V. V. Uzhinsky<sup>13</sup>, Yu. N. Uzikov<sup>6,21,22,\*</sup>, Qian Wang<sup>23</sup>, Qiang Zhao<sup>24,25</sup>, A. V. Zelenov<sup>7</sup>*

<sup>1</sup> NRC "Kurchatov Institute" - IHEP, Protvino 142281, Moscow region, Russia

<sup>2</sup> Skobeltsyn Institute of Nuclear Physics, MSU, Moscow, 119991 Russia

<sup>3</sup> P.N. Lebedev Physical Institute, Leninsky prospect 53, 119991 Moscow, Russia

# SPD Conceptual Design Report

**CDR was presented on the meeting of the JINR Program Advisory Committee  
for particle physics on Jan, 18 by A. Guskov**

JOINT INSTITUTE FOR NUCLEAR RESEARCH



February 3, 2021

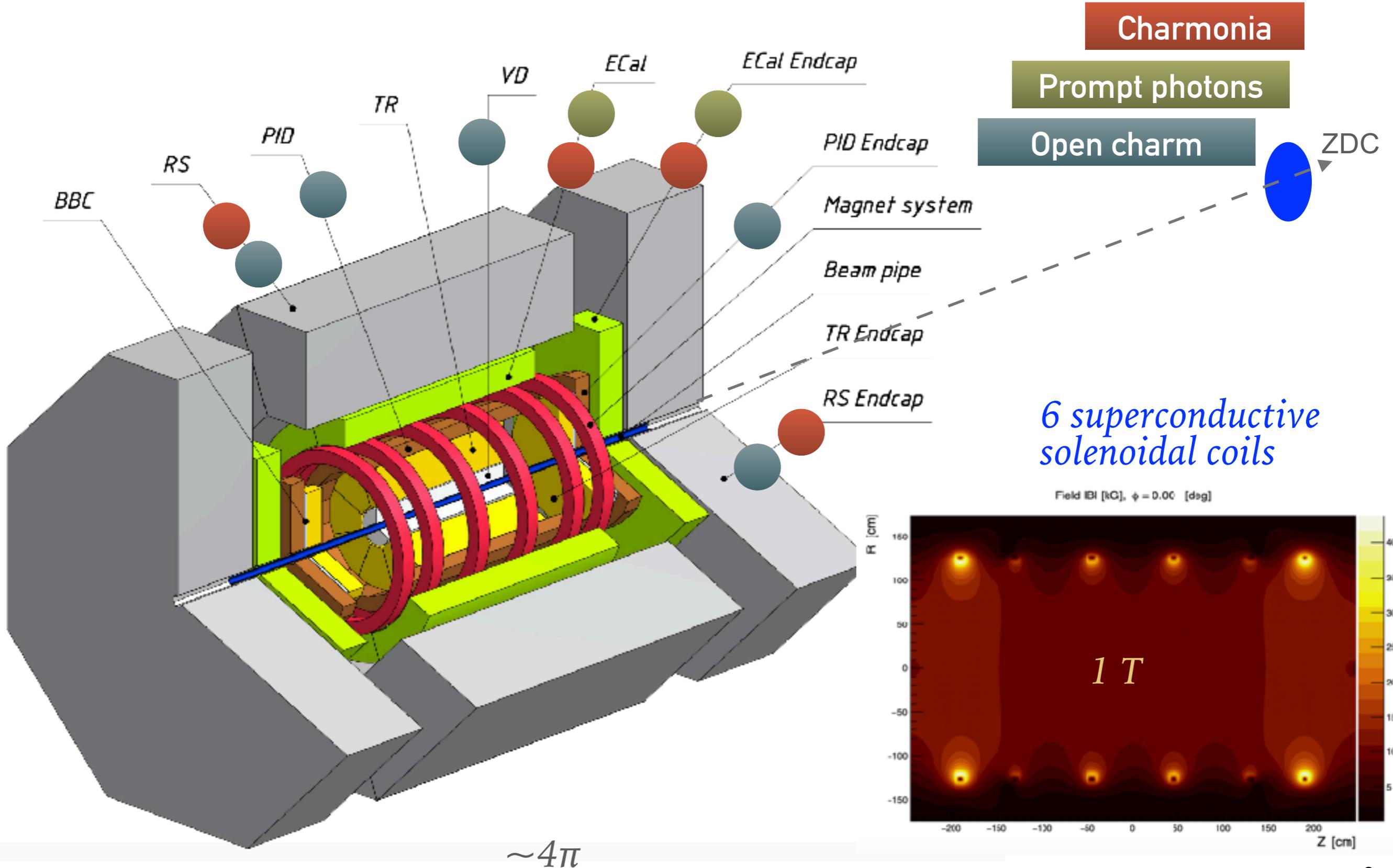
**Conceptual design of the Spin Physics Detector**

Version 1.0

The SPD proto-collaboration<sup>\*</sup>

[arXiv:2102.00442](https://arxiv.org/abs/2102.00442)

# Spin Physics Detector concept



# PAC recommendations

## **V. Conceptual design report for the SPD experiment**

The PAC heard the presentation of the Conceptual Design Report (CDR) for the SPD experiment made by A. Guskov. The main goal of the experiment is to study the polarized gluon structure of proton and deuteron in the production of charmonium, open charm and direct photons. At its initial stage, SPD is supposed to focus on various unpolarized and spin-dependent effects in interactions of protons, deuterons and light nuclei. The SPD facility is meant as a universal  $4\pi$ -detector for registration and identification of secondary particles at high luminosity.

Recommendation. The PAC thanks the SPD (proto-)collaboration for the preparation of the comprehensive CDR and recommends the NICA management to appoint an appropriate detector advisory committee (DAC) for a thorough review of the CDR and its subsequent evolution into an SPD TDR (Technical Design Report). The PAC encourages the team to pursue every effort to form an international collaboration, find adequate resources and attract students and young scientists.

# SPD Detector Advisory Committee

**Subcommittee within the Program Advisory Committee for particle physics**

**Main goal: independent international expertise and long-term support of the SPD project**

## **VIII. Next meeting of the PAC**

The next meeting of the PAC for Particle Physics is scheduled for 21–22 June 2021.

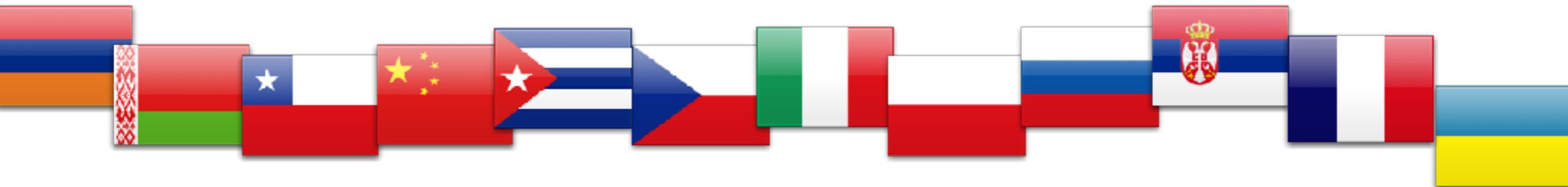
Its preliminary agenda includes:

- status report on the MIPD project including simulation results,
- report on the BM@N project including simulation and physics results;
- report on the SPD CDR by the SPD DAC;
- progress reports on JINR's participation in the LHC experiments;
- consideration of new projects.

# SPD Collaboration formation

- proto-collaboration meeting in June 2019 (Dubna)
- remote proto-Collaboration Board meeting 27.10.2020
- remote proto-Collaboration Board meeting 10.03.2021

*about 30 institutes from 12 states*

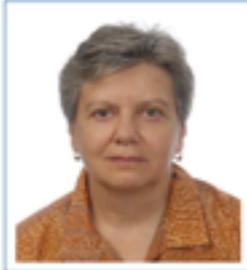


1	Institute of Applied Physics of the National Academy of Sciences of Belarus	Belarus
2	InSTEC, Havana University	Havana, Cuba
3	Charles University	Prague, Czech Republic
4	Czech Technical University	Prague, Czech Republic
5	University of Turin and INFN Section	Turin, Italy
6	Joint Institute for Nuclear Research, JINR	Dubna, Russia
7	St. Petersburg Nuclear Physics Institute	Gatchina, Russia
8	Lebedev Physical Institute of the Russian Academy of Sciences	Moscow, Russia
10	Skobeltsin Institute of Nuclear Physics of the Moscow State University	Moscow, Russia
11	Institute for Theoretical and Experimental Physics	Moscow, Russia
12	Institute for High-Energy Physics	Protvino, Russia
13	Samara National Research University	Samara, Russia
14	St. Petersburg Polytechnic University	St. Petersburg, Russia
15	St. Petersburg State University	St. Petersburg, Russia
16	Tomsk State University	Tomsk, Russia
17	CTEPP, UNAB	Santiago, Chile
19	Cairo University	Egypt
20	China Institute of Atomic Energy	Beijing, China
21	National Science Laboratory	Erevan, Armenia
22	Gomel state technical university	Gomel, Belarus
23	Institute for Nuclear problems of BSU	Minsk, Belarus
24	Tsinghua University	Beijing, China
25	CEA Saclay	Paris, France
26	Warsaw University of Technology	Warsaw, Poland
27	Toms Politechnic University	Tomsk, Russia
28	Institute for Nuclear Research RAS	Troitsk, Russia
29	Belgorod National Research University	Belgorod, Russia
30	Kharkov National University	Kharkov, Ukraine
31	University of Warsaw	Warsaw, Poland
32	ISMA	Kharkov, Ukraine
33	University of Belgrade	Belgrad, Serbia

# **SPD Interim Steering Committee**

- **Guskov Alexey – chair, physics,**
- **Afanasiev Leonid – trigger and DAQ,**
- **Alexeev Gennady – muon system,**
- **Anosov Vladimir – engineering integration,**
- **Baldine Anton – PID system, beam test zone,**
- **Gavrishchuk Oleg – EM calorimeter,**
- **Enik Temur – tracking detectors,**
- **Korzenev Alexander - technical coordinator.**
- **Koulikov Anatoly – trigger and DAQ,**
- **Kovalenko Alexander – magnetic system, interface between the detector and collider,**
- **Ladygin Vladimir – local polarimetry,**
- **Livanov Alexey – SPD hall coordinator,**
- **Teryaev Oleg – theory, physics,**
- **Zamyatin Nikolay – vertex detector,**
- **Zhemchugov Alexey – software coordinator.**

# SPD Collaboration Board chair



Egle Tomasi-Gustafsson

*Curriculum Vitae*

## Skills

Experimentation and Phenomenology in Nuclear and Hadron Physics, Management of experiments and Organization of international teams, Modelization, Simulation of complex systems, Computing (Linux, Windows, Microsoft Office, Root,  $\LaTeX$ ), Teaching, Students' supervision, Event organisation and planning, Mediation, Multi-lingual intercultural communication, Evaluation of scientific articles and projects, Adviser for recruitment and career development.

## Present position

**Leading researcher in fundamental physics, IRFU/DPhN, Commissariat à l'Energie Atomique (CEA), Saclay, France.**

Original results are reported in more than 200 peer reviewed articles, the scientific activity is presented in more than 200 talks in seminars, workshop and conferences

## Education

1988 **Thèse d'Etat**, *Université Paris-Sud, Orsay, France.*

1975–1979 **Corso di Laurea in Fisica**, *Università degli Studi, Padova, Italy.*  
Tesi di Laurea, 110/110 with honours.

## Languages

*Italian (Mothertongue), French, English (Very good), Swedish, German, Russian (Intermediate)*

# SPD Software Coordinator

## PERSONAL INFORMATION

Alexey ZHEMCHUGOV



**Affiliation** Joint Institute for Nuclear Research  
**Phone** +7 (49621) 62014 **Mobile** +7 (915) 136-0731  
**Email** [zhemchugov@jinr.ru](mailto:zhemchugov@jinr.ru)

**Sex** Male | **Date of birth** 11/12/1978 | **Nationality** Russian

## WORK EXPERIENCE

**2016 - now** **Deputy director (part-time),**  
**University Centre, Joint Institute for Nuclear Research, Dubna, Russia**

- Effective use of capabilities of the JINR's research groups and facilities for education and training
- Arrangement of the student's internship at JINR
- Organization of practical training for engineers and research scientists

**2001 – now** **Junior researcher, researcher, head of subdepartment, head of department**  
**Laboratory of Nuclear Problems, Joint Institute for Nuclear Research, Dubna, Russia**

- 2005 - now: BES-III experiment. Software development, distributed computing, data taking, data analysis
- 2010 - 2017: Detector R&D within collaborations MEDIPIX, FCAL (detector characterisation, detector simulation, data analysis)
- 2006 - 2016: ATLAS experiment. Management of ATLAS Tier-2 at JINR
- 2001 - 2012: HARP experiment. Software development (DAQ, simulation, reconstruction, production system), data taking, data analysis.
- 2000 - 2003: ATLAS experiment. Detector R&D and construction of MDT muon chambers

**2002** **Project associate**

CERN, Geneva, Switzerland

# SPD Publication Committee chair

Candidate for chair:

Oleg Teryaev, JINR

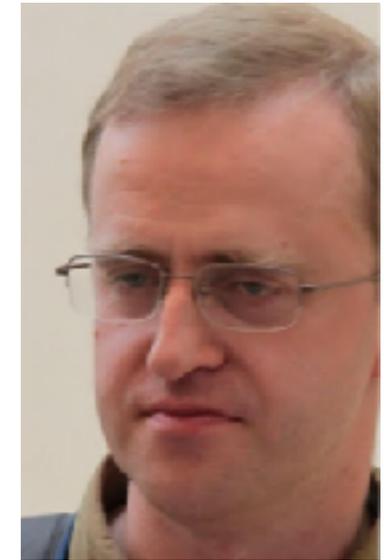


## International Spin Physics Committee

### Members:

- H. Gao (Chair, Duke U.),
- R. Milner (Past Chair, MIT),
- E. Aschenauer (BNL),
- K. Aulenbacher (Mainz),
- N. D'Hose (Saclay),
- H. En'yo (RIKEN),
- P. Lenisa (Chair-Elect, U. Ferrara),
- B.-Q. Ma (Peking U.),
- N. Makins (U. Illinois),
- A. Martin (U. Trieste),
- A. Milstein (Budker),
- P. Mulders (VU),
- M. Poelker (Jefferson Lab),
- N. Saito (J-PARC),
- H. Stroeher (Jülich),
- O. Teryaev (JINR),
- W. Vogelsang (Tuebingen)

# SPD Technical Coordinator



## PERSONAL DATA

Name **Alexander KORZENEV**  
Position Senior Researcher in the hadron spin structure sector, department of the hadron spin structure and rare processes, LHEP, JINR  
Phone +7(496)216-49-56  
E-mail alexander.korzenev@jinr.ru

## EDUCATION

1998 **B.S.** in general and applied Physics and Mathematics from Moscow Institute of Physics and Technology, Moscow, Russia  
2000 **M.S.** in general and applied Physics and Mathematics from Moscow Institute of Physics and Technology. Title of thesis: *Magnetic field measurement of the dipole magnet SM1 and the study of  $\Lambda$ -hyperon filtering in COMPASS*  
2007 **Ph.D.** in particle physics from Joint Institute for Nuclear Research, Dubna. Title of thesis: *Measurement of the spin structure function  $g_1^d$  in the COMPASS experiment*, CERN-THESIS-2007-123

## AFFILIATIONS

2000 - 2013	<b>Joint Institute for Nuclear Research / LPP</b> , Joliot-Curie 6, 141980 Dubna, Moscow region, Russia	Fixed term employment contract as a scientist
2007 - 2009	<b>Institute of Nuclear Physics in Mainz University</b> , Johannes Gutenberg-Universität, Mainz, Johann-Joachim-Becher-Weg 45, 55099 Mainz, Germany	PostDoc contract
2009	<b>CEA Saclay</b> , IRFU/Service de Physique Nucleaire, 91191 Gif-sur-Yvette, France	PostDoc contract
2010 - 2020	<b>Université de Genève</b> , Section de physique, DPNC, 24 Quai Ernest-Ansermet, 1211 Genève 4, Suisse	Research associate contract (teacher-assistant)
2020 - now	<b>Joint Institute for Nuclear Research / LIIEP</b> , Joliot-Curie 6, 141980 Dubna, Moscow region, Russia	Fixed term employment contract as a scientist

## Participation in international projects

Year	Collaboration	Main responsibilities
2000 - 2010	COMPASS (CERN SPS)	Development of reconstruction software, analysis of spin structure functions
2010 - 2018	NA61 (CERN SPS)	Detector calibration (TOF, TPC), analysis of hadron production differential cross-sections
2010 - 2020	ND280/T2K upgrade (J-PARC Japan)	R&D and construction of the time-of-flight detector
2015 - 2020	SHiP (CERN SPS)	R&D for the time-of-flight detector
2020 - now	SPD (NICA JINR)	Acting technical coordinator

## AWARDS

2007 First prize of the JINR particle physics laboratory for "Study of spin-dependent structure of nucleons in experiments COMPASS and HERMES" (as a member of the COMPASS group)  
2008 Second prize of JINR for "Study of spin-dependent structure of nucleons in experiments COMPASS and HERMES" (as a member of the COMPASS group)  
2016 Breakthrough Prize in Fundamental Physics for the study of neutrino oscillation (as a member of T2K)

## PUBLICATIONS

Author of articles as a member of COMPASS, NA61/SHINE, T2K, nuSTORM, HyrepK, LBNO, SHiP and MoEDAL collaborations as well as instrumentation articles on R&D and proceedings of conferences. All together about 150 articles which can be found in <http://inspirehep.net/author/profile/A.Korzenev.1>

# SPD Technical Board

<b>L. Afanasiev</b>	JINR	DAQ
<b>G. Alexeev</b>	JINR	Range System
<b>I. Alexeev</b>	ITEP, Russia	ZDC
<b>M. Alexeev</b>	Turino Univ./ INFN, Italy	
<b>V. Anosov</b>	JINR	integration
<b>A. Baldin</b>	JINR	test zone
<b>Y. Bedfer</b>	Saclay, France	
<b>T. Enik</b>	JINR	Straw tracker
<b>O. Gavrishchuk</b>	JINR	ECal
<b>A. Guskov</b>	JINR	ex officio
<b>A. Korzenev</b>	JINR	technical coordinator
<b>A. Kovalenko</b>	JINR	Magnet & accelerator
<b>V. Ladygin</b>	JINR	BBC and polarimetry
<b>A. Livanov</b>	JINR	Experimental hall coordinator
<b>X. Li</b>	CIAE, China	
<b>Y. Wang</b>	Tsinghua Univ., China	
<b>N. Zamyatin</b>	JINR	Vertex Detector

+ A. Zhemchugov, A. Kulikov and B. Topko as permanent guests

# SPD Executive Board

<b>A. Guskov</b>	JINR	ex-officio, JINR project leader
<b>A. Korzenev</b>	JINR	ex-officio, Technical coordinator
<b>V. Ladygin</b>	JINR	ex-officio, representative of the host lab.
<b>E. Tomasi</b>	Saclay, France	ex-officio, CB-chair
<b>A. Zhemchugov</b>	JINR	ex-officio, software coordinator
<b>V. Anosov</b>	JINR	
<b>A. Baldin</b>	JINR	
<b>O. Dalkarov</b>	Lebedev Physical Institute of RAS	
<b>A. Kovalenko</b>	JINR	
<b>A. Kulikov</b>	JINR	
<b>D. Panzieri</b>	Turino Univ./ INFN, Italy	
<b>Y. Wang</b>	Tsinghua Univ., China	



## **Plans for 2020**

- **Update the physics program ✓**
- **Prepare the Conceptual Design Report ✓**
- **Form the international collaboration**



## **Plans for 2021**

- Work on the Technical Design Report of the SPD
- Interaction with DAC
- SPD test zone: first beams in November-December
- Formation of the SPD collaboration

# SPD Collaboration formation

- **proto-Collaboration meeting in June 2019 (Dubna)**  
start work on the SPD constitution
  - **remote proto-Collaboration Board meeting, 27.10.2020**  
agreement on the principles of the SPD collaboration formation
  - **remote proto-Collaboration Board meeting, 10.03.2021**  
election of the CB chair, election and improvement of the main bodies
- 
- **remote proto-Collaboration Board meeting, June 2021**  
**(together with Collaboration meeting?)**  
adoption of the SPD constitution (4-th edition is under discussion now)
  - **remote proto-Collaboration Board meeting, autumn 2021**  
spokespersons election, preparation and discussion of the MoU

**We hope to start operation as normal international collaboration till the end of the year**

# If you want to contribute:

to physics case & physics MC  $\implies$  **contact A. Guskov**

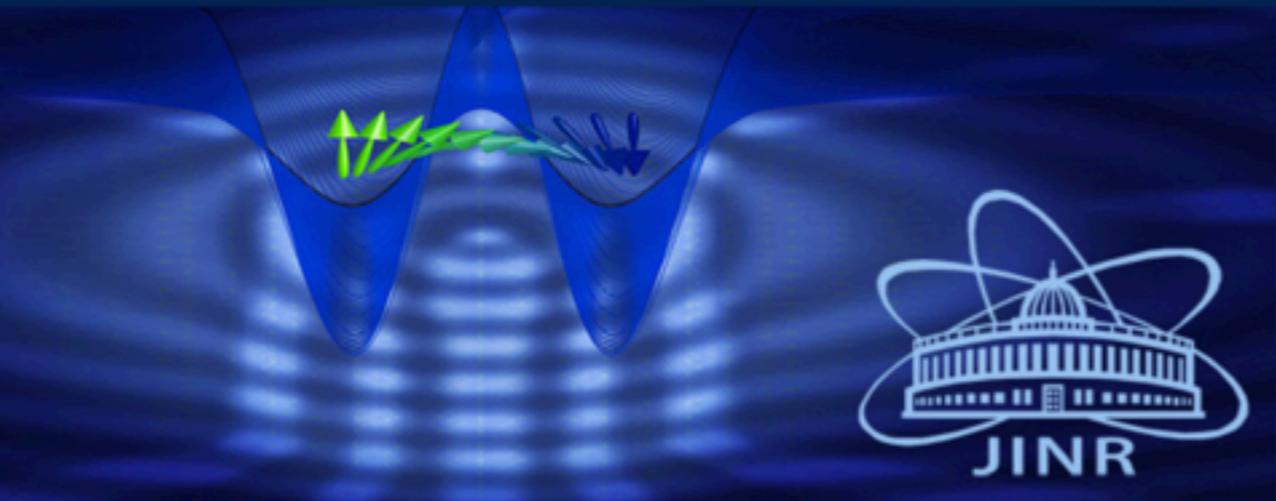
to simulation/reconstruction software and data processing  $\implies$  **contact A. Zhemchugov**

to development of detector hardware, electronics, DAQ  $\implies$  **contact A. Korzenev** and **corresponding detector expert**

to involve new people, groups or students  $\implies$  **contact A. Guskov**



# SPD



## SPIN PHYSICS DETECTOR

International spin physics collaboration at the collider NICA

### Main Information

NEWS AND ANNOUNCEMENTS

CONTACTS

### Public Access

SPD MANAGEMENT

SPD ACTIVITIES

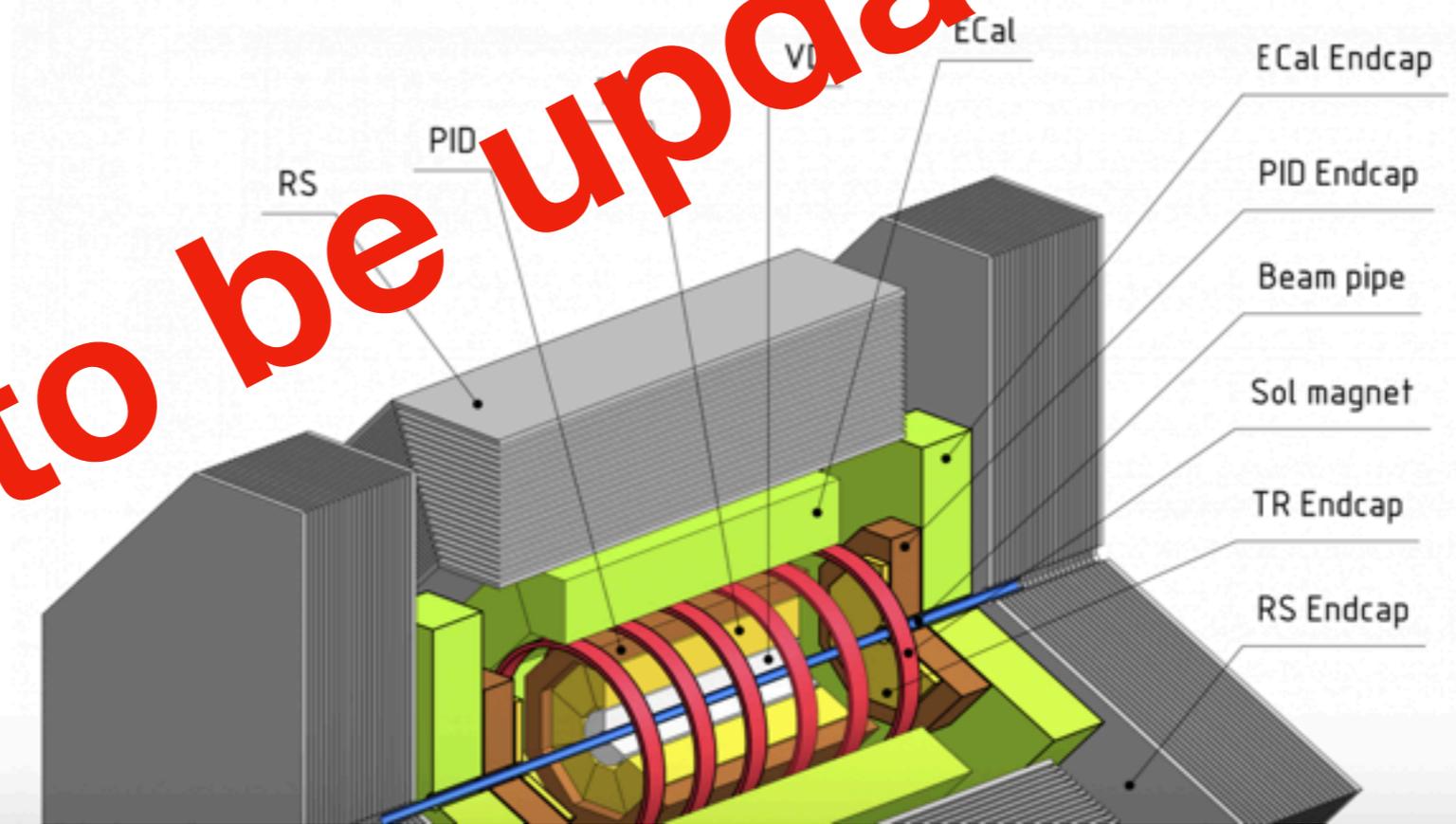
SPD DOCUMENTS

INTERESTED INSTITUTIONS

SPD SOFTWARE

USEFUL LINKS

## SPD Introduction



**Has to be updated!**

# Reminder:

the next Physics & MC meeting is scheduled  
to next Wednesday 31.3.2021

Welcome to contribute!