

Overview CREMLIN+

- history
- scope
- science communities/projects
- WPs
- consortium / management bodies

WP2 [NICA - FAIR]

(NICA (BM@N-MPD) – FAIR(CBM))

- tasks
- participants
- recruitments of personnel
- milestones and deliverables
- workplan and future meetings



This project has received funding from the European Union's Horizon 2020 research and innovation programme under grant agreement No. 871072

History of EU projects dedicated to European Russian cooperation for Large-scale Research Infrastructures

CREMLIN PLUS
Connecting Russian and European Measures
for Large-scale Research Infrastructures



Cremlin Connecting
Russian and European Measures
for Large-scale Research Infrastructures

2015-2018

CREMLIN
project



2020-2024

CREMLINplus
project

2013

EU Expert
Report

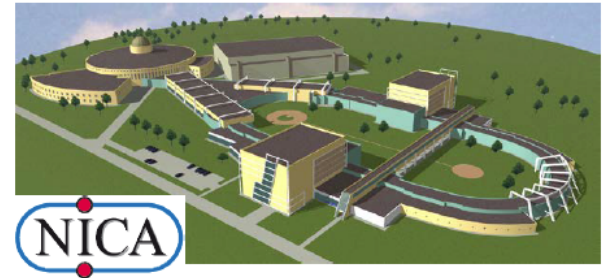


CREMLIN Closing Conference, June 2018, DESY

Scope: Science cooperation between European Research Infrastructures and the following

5 Russian megascience projects

- **NICA**: Superconducting accelerator complex („Nuclotron-based ion collider facility“); Dubna
- **PIK**: High-flux research reactor (International Centre for Neutron Research, ICNR); Gatchina
- **USSR**: Ultima Synchrotron Storage Ring; Protvino
- **SCT**: Lepton Collider „Super Charm-Tau Factory“; Novosibirsk
- **XCELS**: High power laser „Exawatt Center for Extreme Light Studies“; Nizhniy Novgorod



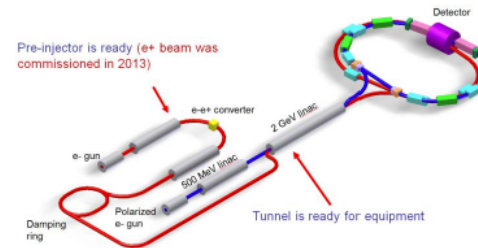
NICA



PIK



USSR sketch, NRC KI



SCT sketch



XCELS

Facts about CREMLINplus

A European-Russian flagship project

- Funded under EU's Research and innovation Programme Horizon 2020
- EU's **Flagship project** in the EU-Russian cooperation in the domain of RI
- CEMLINplus is a Research and Innovation Action (RIA), following INFRASUPP-01-2018-2019
- Project duration: 4 years, 01.02.2020-31.01.2024
- **Budget: 25 million EUR**
- **Consortium: 35 partners**
- Building on "First CREMLIN Recommendations"
- Coordinator: DESY

Participant No *	Participant short name	Participant organisation name	Country
1	DESY	Stiftung Deutsches Elektronen-Synchrotron	DE
2	BINP	Budker Institute of Nuclear Physics of SB RUS	RU
3	IAP	Institute of Applied Physics, Russian Academy of Sciences	RU
4	ICISTE	International Centre for Innovations in Science, Technology and Education	RU
5	INR RAS	Institute for Nuclear Research of the Russian Academy of Sciences	RU
6	JINR	Joint Institute for Nuclear Research	RU
7	MEPhI	National Research Nuclear University "MEPhI"	RU
8	NRC KI	National Research Center "Kurchatov Institute"	RU
9	NUST MISIS	National University of Science and Technology MISIS	RU
10	PTI	IOFFE Physico-Technical Institute of the Russian Academy of Sciences	RU
11	SPSU	Saint Petersburg State University	RU
12	EKUT	Eberhard Karls Universität Tübingen	DE
13	European XFEL	European X-Ray Free-Electron Laserfacility GmbH	DE
14	FAIR	Facility for Antiproton and Ion Research in Europe GmbH	DE
15	FZJ	Forschungszentrum Jülich GmbH	DE
16	GUF	Johann Wolfgang Goethe-Universität Frankfurt am Main	DE
17	HZG	Helmholtz-Zentrum Geesthacht Zentrum für Material- und Küstenforschung GmbH	DE
18	JLU	Justus-Liebig-Universität Giessen	DE
19	TUM	Technische Universität München	DE
20	CEA	Commissariat à l'Énergie Atomique et aux Énergies Alternatives	FR
21	ESRF	European Synchrotron Radiation Facility	FR
22	ILL	Institut Max von Laue - Paul Langevin	FR
23	CNRS	Centre National de la Recherche Scientifique	FR
24	UCA	Université Clermont Auvergne	FR
25	ELI-DC AISBL	Association Internationale Extreme-Light-Infrastructure Delivery Consortium	BE
26	NPI CAS	Nuclear Physics Institute, Czech Academy of Science	CZ
27	MTA EK	Magyar Tudományos Akademia Energiatudományi Kutatóközpont	HU
28	Wigner RCP	Magyar Tudományos Akademia Wigner Fizikai Kutatóközpont	HU
29	INFN	Istituto Nazionale di Fisica Nucleare	IT
30	UNIMIB	Università degli Studi di Milano-Bicocca	IT
	ADSI (LTP*)	Austrian Drug Screening Institute GmbH	AT
31	CERN	European Organization for Nuclear Research	CH
32	WUT	Politechnika Warszawska	PL
33	ESS	European Spallation Source ESS ERIC	SE
34	INR NASU	Institute for Nuclear Research of NAS of Ukraine	UA
35	LLE-AISBL	Laserlab-Europe AISBL	BE

*No. Official participant number; *LTP: Linked Third Party

Workpackages

WP Number ⁹	WP Title	Lead beneficiary ¹⁰	Person-months ¹¹	Start month ¹²	End month ¹³
WP1	MGT - Management and dissemination	1 - DESY	73.00	1	48
WP2	NICA - Collaboration with NICA	14 - FAIR GMBH	1,368.00	1	48
WP3	PIK - Collaboration with PIK	15 - FZJ	886.00	1	48
WP4	USSR - Collaboration with USSR	8 - NRC KI	1,098.00	1	48
WP5	SCT - Joint technology development around SCT and future lepton colliders	2 - BINP	192.00	1	48
WP6	XCELS – Joint technology development around XCELS	3 - IAP RAS	278.00	1	48
WP7	DETEC - Joint development of detector technologies	14 - FAIR GMBH	291.00	1	48
WP8	TNA - Access to Russian RI	4 - ICISTE	238.00	1	48
WP9	TRAIN - Staff exchange and training for RI management	30 - UNIMIB	144.00	1	48
WP10	LTS – Joint long-term sustainability of RIs	8 - NRC KI	72.00	1	48
WP11	Ethics requirements	1 - DESY	N/A	1	48
Total			4,640.00		

Coordinator:
Martin Sandhop, DESY



Governance

✓ **General Assembly (GA)**: decision-making; annual meetings (chair: Jürgen Eschke)

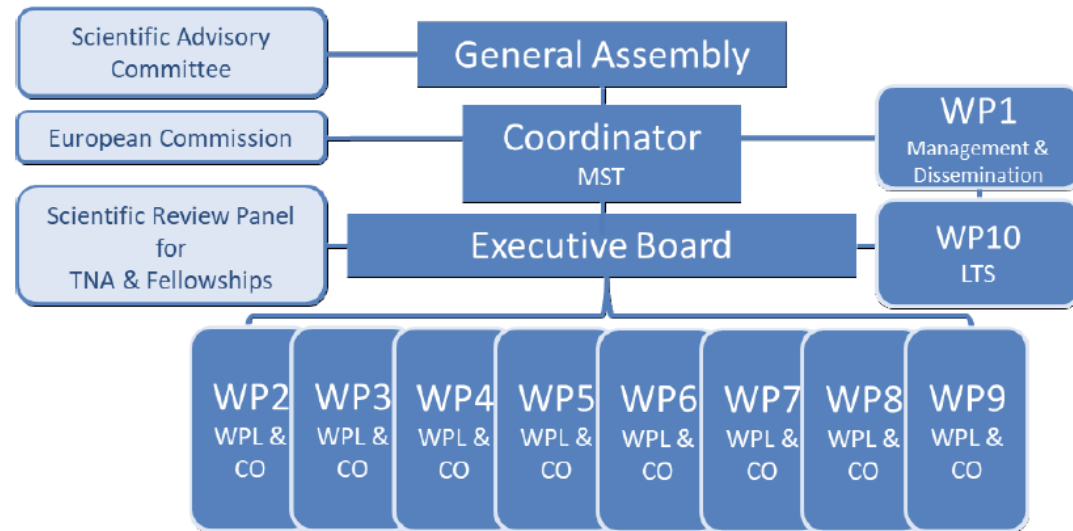
✓ **Executive Board (EB)**: engine of the project; quarterly; = WP lead tandems, following policy of **shared responsibility**

3.7. ✓ **Scientific Advisory Committee (SAC)**: recommendations to GA

⚠ **Scientific Review Panel**: evaluates proposals within several calls in WP8 TNA and WP9 TRAIN

⚠ **Management Support Team (MST)**: to be set up with members not only from DESY

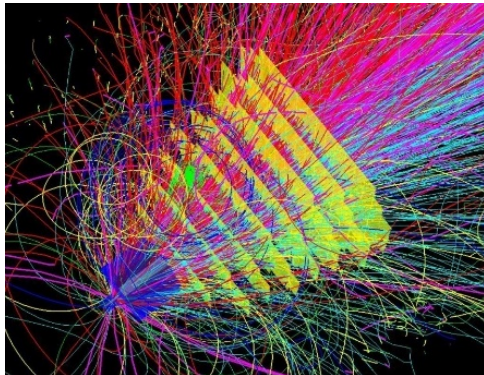
CREMLINplus Governance



Science Cooperation between European Research Infrastructures and the Russian megascience projects (NICA, PIK, USSR, SCT and EXCELS)

Proposal approved: 4-year-project – starting 1.2.2020, **Total Budget: 25 M€**

Consortium: 35 participants from 12 countries - 25 European laboratories 10 Russian laboratories
10 working packages (WPs), GSI/FAIR and JINR involvement in WP2 and WP7



WP2: Collaboration with NICA - Development of instrumentation for NICA and FAIR/CBM (**WP leader: J. Eschke**)

Engineering and construction of fast detectors,
Development of high rate data acquisition chain and software packages for simulation and data analysis, PSD, beam pipe design

Budget 4.61 M€

Participants: JINR (9 FTE), FAIR (8.3 FTE), U Tübingen (1 FTE), WUT Warsaw (2 FTE), Wigner Budapest (2 FTE), MEPHI (4 FTE), INR Moscow (1 FTE), NPI Prague (2 FTE)

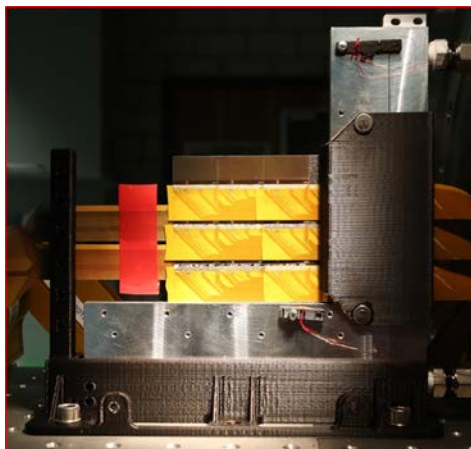
WP7: Joint development of detector technologies

Develop a beyond state of the art CMOS pixel sensors (MAPS) for high-rate Silicon trackers for several particle physics and heavy-ion research communities in Europe and Russia for the potential upgrade of many experimental setups (**WP leader: C. Schmidt**)

Development of neutron detectors, detector school at BINP

Budget 1.8 M€ (~1.0 M€ for MAPS (CBM Institutes only))

Participants: JINR (0,75 FTE), FAIR (0,8 FTE), DESY (0,52 FTE), U Frankfurt (0,75 FTE), IPHC Strasbourg (1 FTE), KINR Kiev (0,75 FTE), ESS (0,75 FTE), PNPI (0,38 FTE), JINR (0,38 FTE), BINP



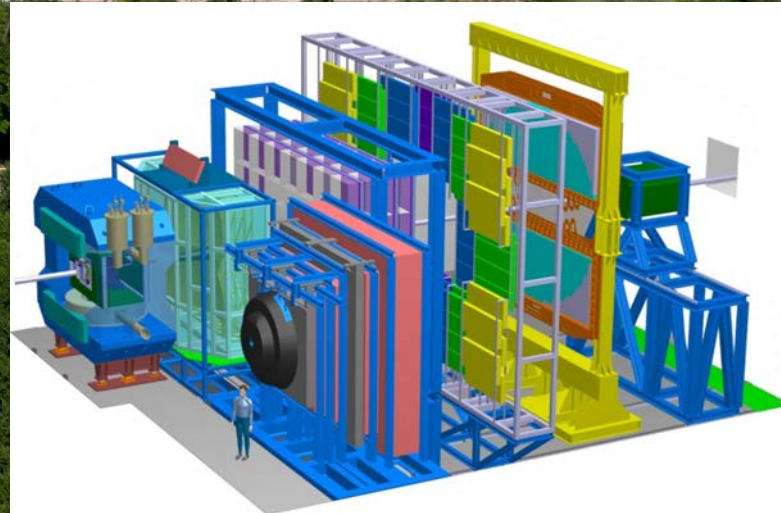
CREMLINplus EU project WP2 – NICA Ion collider facility and joint developments for NICA and FAIR



CBM Cave



Compressed Baryonic Matter
experiment (CBM)



NICA construction site 2019



Booster dipole magnet inside the cryostat

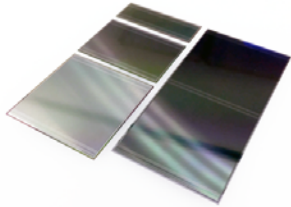


RF3 resonator

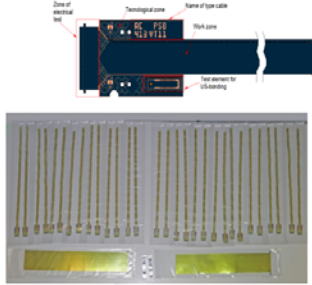


From left to right: dipole magnet, quadrupole lenses, cryostats and vacuum beam pipe of the Collider.

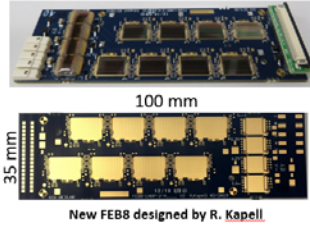
Module components readiness



- ✓ Design of sensors was finalized (except central sensors)
- ✓ Sensors have already been acquired in 2016 at the two vendors
- ✓ Design for the 16 central sensors is now under development at SINP MSU



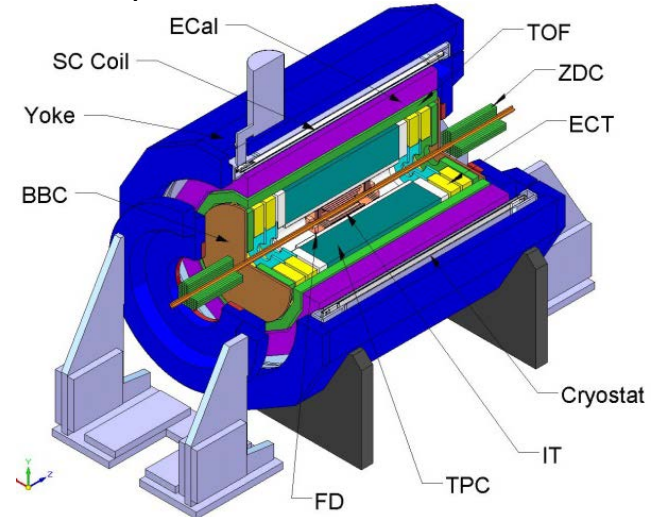
- ✓ Design of micro-cables for first two BM@N stations was finalized in 2019
- ✓ First batch of 40 micro-cable sets will be delivered in the begging of 2020



- ✓ Front-end Boards prototypes of CBM geometry were designed, produced and tested
- ✓ FEB test circuit for QA is under development at GSI
- ✓ BM@N FEB design is under development at SINP MSU



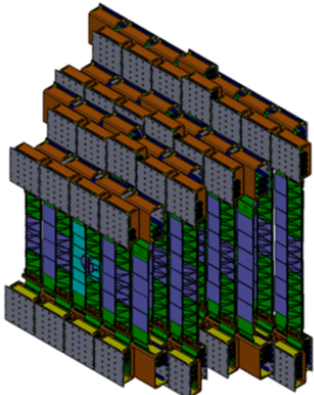
The complete assembly of the MPD solenoid has been finished in September 2019



Technical Design Report

The Silicon Tracking System

as part of the hybrid tracker of the BM@N experiment



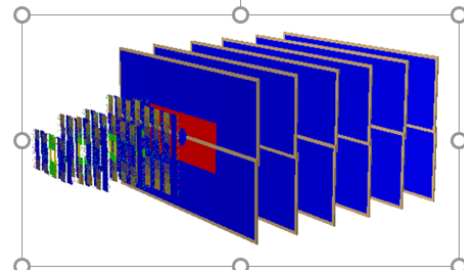
Dec. 2019

The BM@N STS group:

A. V. Baranov¹, D. Dementev¹, V. Elsha¹, J. Heuser², P. I. Kharlamov^{1,4}, I. M. Kovalev⁴, A. Kolzhvari¹, I. A. Kudryashov⁴, A. A. Kurganov⁴, E. Lavrik³, V.V. Leontyev⁴, T. Lygdenova⁴, M. M. Merkin^{4,1}, Y. Murin¹, J. Panasenko⁵, M. Protsenko¹, C. J. Schmidt², H. R. Schmidt^{2,5}, A. Sheremetev¹, A. Sheremeteva¹, A. Senger³, P. Senger^{3,6}, N. Sukhov⁴, M. Shitenkov⁴, A. Voronin⁴, A. G. Voronin⁴, W. Zabolotny⁷, A. Zinchenko¹

- ¹ JINR LHEP Dubna, Russia
- ² GSI Helmholtzzentrum, Darmstadt, Germany
- ³ FAIR Darmstadt, Germany
- ⁴ SINP MSU, Moscow, Russia
- ⁵ University Tübingen, Germany
- ⁶ NRCN MEPhI, Moscow, Russia
- ⁷ Warsaw University of Technology, Warsaw, Poland

Editors: Dmitrii Dementev, Peter Senger



Synergies between NICA experiments (BM@N, MPD) and CBM experiment at FAIR

4th Collaboration Meeting (Dubna, October 2019) of the BM@N Experiment at the NICA Facility



Synergies in:

- Detector development
- Front End Electronics, DAQ and Computing
- Physics Performance Studies and Data Analysis

34th CBM Collaboration Meeting, Kolkata, October 2019



NICA Days and 4th MPD collaboration meeting, Warsaw, October 2019

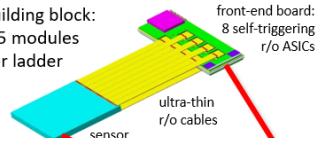


CREMLINplus WP2:NICA-FAIR/CBM WP Leader: Jürgen Eschke (FAIR), Deputy WP Leader: Yuri Murin(JINR)	FAIR 7,5 FTE over 48 months (360 PM)	JINR 9 FTE over 48months (432 PM)	EKUT Tübingen 1 FTE (48 PM)	WUT Warsaw 2 FTE (96 PM)	Mephi Moscow 4 FTE (192 PM)	Wigner Budapest 2 FTE (96 PM)	NPI Rez 2 FTE (96 PM)	INR Moscow 1 FTE (48 PM)
Task 2.1: Integration, installation, and test of Silicon trackers for NICA and CBM (FAIR, JINR, EKUT) (Taskleader: Johann Heuser, GSI)	2	4	1					
Task 2.2: Developments for the data acquisition chain, for data preprocessing and computing (WUT, FAIR, JINR) (Taskleader: Wojtek Zabolotny, WUT)	2	2		2				
Task 2.3: Development of common software packages for simulation and data analysis, participation in physics performance studies(MEPHI, FAIR, JINR, Wigner RCP) (Taskleader: Arkadiy Taranenko,MEPHI, deputy taskleader Ilya Selyuzhenkov, GSI)	2	2			4	2		
Task 2.4: Development and construction of beam monitors, target chamber and beam pipe for NICA and CBM (FAIR, JINR) (Taskleader: Peter Senger, FAIR)	1	1						
Task 2.5: Development and construction of Zero Degree Calorimeters for NICA and CBM (INR RAS, NPI CAS) (Taskleader: Fedor Guber, INR)							2	1
Coordination of joint activities	0.5							

Task 2.1: Integration, installation, and test of Silicon trackers for NICA and CBM (FAIR, JINR, EKUT)

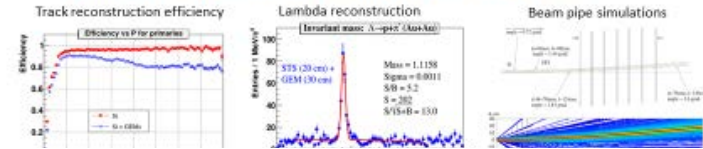
STS integration concept

building block:
4-5 modules
per ladder



- 8 stations, volume 2 m³, area 4 m²
- 896 detector modules
 - 1220 double-sided microstrip sensors
 - ~ 1.8 million read-out channels
 - ~ 16 000 r/o STS-XYTER ASICs
 - ~ 58 000 ultra-thin r/o cables
- 106 detector ladders with 4-5 modules

Joint development of the BM@N silicon tracker



1:45 PM

→ 2:30 PM

Task 2.1: Integration, installation, and test of Silicon trackers for NICA and CBM (FAIR, JINR, EKUT) (Task leader: Johann Heuser, GSI)

Convener: Johann Heuser (GSI Helmholtzzentrum für Schwerionenforschung GmbH(GSI))

1:45 PM

Task overview: Aim, participants, milestones and deliverables

Speaker: Johann Heuser (GSI Helmholtzzentrum für Schwerionenforschung GmbH(GSI))

5m

1:50 PM

Towards Milestone 6 (Month 12): First detector ladder for BM@N-STS [assembled and tested]

Speaker: Dmitri Dementiev (Veksler and Baldin Laboratory of High Energy Physics(JINR-VBLHEP))

20m

2:10 PM

Towards Milestone 7 (Month 24): Series production of detector ladders for CBM-STS started

Speaker: Andrea Wilms (GSI Helmholtzzentrum für Schwerionenforschung GmbH(GSI))

20m



Task 2.2: Developments for the data acquisition chain, for data preprocessing and computing (WUT, FAIR, JINR)

DAQ and online event selection

1 TByte/s Total

2:30 PM → 3:35 PM **Task 2.2: Developments for the data acquisition chain, for data preprocessing and computing (WUT, FAIR, JINR) (Task leader: Wojtek Zabolotny, WUT)**

Convener: Wojciech Zabolotny (Warsaw University of Technology(WUT))

2:30 PM

Task overview

🕒 5m

Speaker: Wojciech Zabolotny (Warsaw University of Technology(WUT))

2:35 PM

Requirements for DAQ and processing chain, Contribution of JINR to T2.2

🕒 10m

Speaker: Dmitri Dementiev (Veksler and Baldin Laboratory of High Energy Physics(JINR-VBLHEP))

2:45 PM

Contribution of WUT for T2.2

🕒 10m

Speaker: Wojciech Zabolotny (Warsaw University of Technology(WUT))

2:55 PM

Overview of the system. Contribution of FAIR to T2.2

🕒 10m

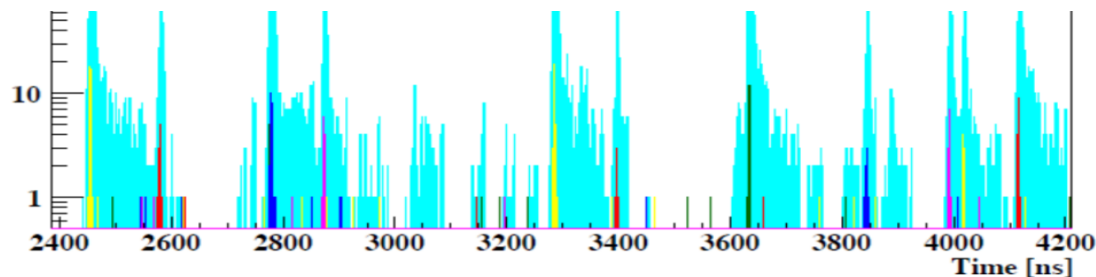
Speaker: Christian Joachim Schmidt (GSI Helmholtzzentrum für Schwerionenforschung GmbH(GSI))

3:05 PM

Summary and discussion

🕒 10m

Speaker: Wojciech Zabolotny (Warsaw University of Technology(WUT))

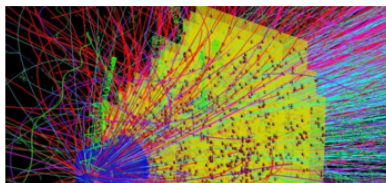


High rack storage, 100,000 cores,
only 5% of total energy
consumption needed for cooling

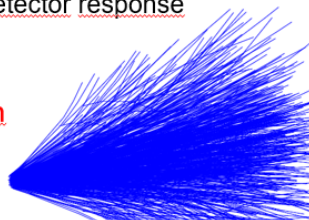
Task 2.3: Development of common software packages for simulation and data analysis, participation in physics performance studies (MEPhi, FAIR, JINR, Wigner RCP,)

Simulation and reconstruction

Event generators UrQMD 3.3
 Transport code GEANT3, FLUKA
Realistic detector geometries, material budget and detector response



reconstruction



3:15 PM → 4:40 PM

Task 2.3: Development of common software packages for simulation and data analysis, participation in physics performance studies (MEPhi, FAIR, JINR, Wigner RCP) (Task leader: Arkadiy Taranenko, MEFHI)

Convener: Arkadiy Taranenko (National Research Nuclear University MEFHI)

3:15 PM

Contribution MEFHI / GSI

🕒 10m

Speakers: Arkadiy Taranenko (National Research Nuclear University MEFHI), Ilya Selyuzhenkov (GSI Helmholtzzentrum für Schwerionenforschung GmbH(GSI))

3:25 PM

Contribution JINR

🕒 10m

Speaker: Yuri Murin (Joint Institute for Nuclear Research (JINR)(JINR))

3:35 PM

Contribution Wigner RCP

🕒 10m

Speaker: Gyorgy Wolf (Wigner RCP)

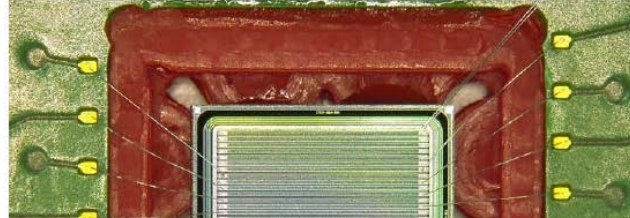
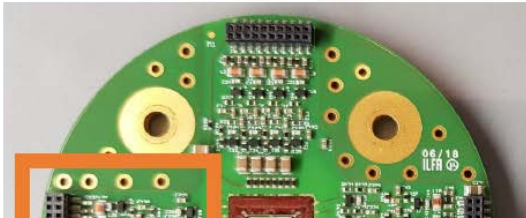
3:45 PM

Coordination and planning

🕒 15m

Speakers: Arkadiy Taranenko (National Research Nuclear University MEFHI), Ilya Selyuzhenkov (GSI Helmholtzzentrum für Schwerionenforschung GmbH(GSI))

Task 2.4: Development and construction of beam monitors, target chamber and beam pipe for NICA and CBM (FAIR, JINR)



4:00 PM → 4:45 PM **Task 2.4: Development and construction of beam monitors, target chamber and beam pipe for NICA and CBM (FAIR, JINR)**
 (Task leader: Peter Senger, FAIR)

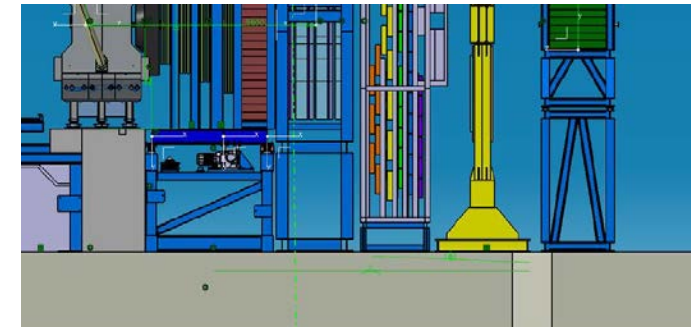
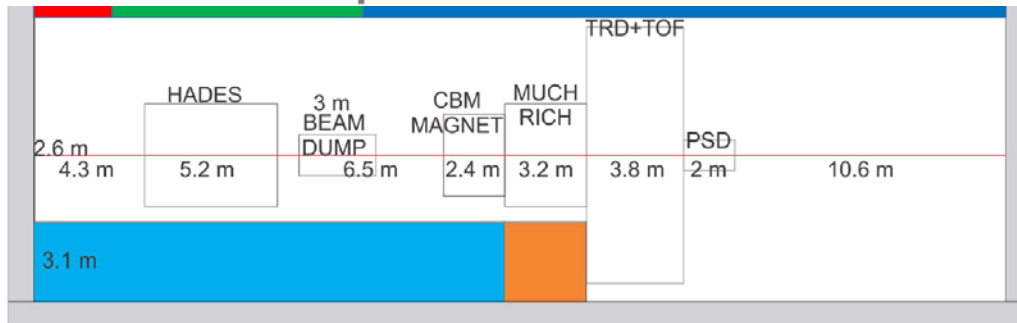
Convener: Peter Senger (Facility for Antiproton and Ion Research In Europe GmbH(FAIR))

- 4:00 PM** **Topics and plans WP2.4** 🕒 15m

Speaker: Peter Senger (Facility for Antiproton and Ion Research In Europe GmbH(FAIR))
- 4:15 PM** **Beam monitor/TO counter** 🕒 15m

Speaker: Adrian Rost (Facility for Antiproton and Ion Research In Europe GmbH(FAIR))
- 4:30 PM** **Beam pipe simulations** 🕒 15m

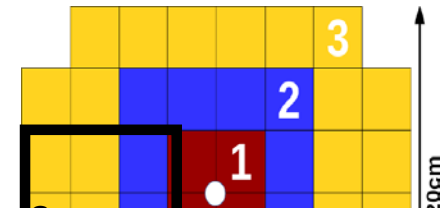
Speaker: Anna Senger (Facility for Antiproton and Ion Research In Europe GmbH(FAIR))



Task 2.5: Development and construction of Zero Degree Calorimeters for NICA and CBM (INR RAS, NPI CAS)

PSD – Projectile Spectator Detector.

This forward hadron calorimeter will be used at the CBM



4:45 PM → 5:30 PM

Task 2.5: Development and construction of Zero Degree Calorimeters for NICA and CBM (INR RAS, NPI CAS) (Task leader: Fedor Guber, INR)

Convener: Fedor Guber

4:45 PM

Task 2.5 - objective, participants, topics, organization of work

🕒 10m

Speaker: Fedor Guber

4:55 PM

Calibration of forward hadron calorimeters with cosmic muons and determination of centrality by ML methods

🕒 7m

Speaker: Nikolay Karpushkin (Institute for Nuclear Research)

5:02 PM

Development of procedure for MPD FHCAL centrality determination

🕒 7m

Speaker: Mr Vadim Volkov (INR RAS)

5:09 PM

Development of DCS for the BM@N and MPD forward hadron calorimeters

🕒 7m

Speaker: Oleg Petukhov (Institute for Nuclear Research (INR)(INR))

5:16 PM

Tests of radiation hardness of SIPM and scintillators

🕒 7m

Speaker: Vasily Mikhaylov (Nuclear Physics Institute CAS)

5:23 PM

Carbon beam pipe for FHCAL and PSD

🕒 7m

Speaker: Petr Chudoba (Nuclear Physics Institute(ASCR))

Milestones

				month
MS6	First detector ladder for BM@N	14 - FAIR GMBH	12	Test results presented
MS7	Series production of detector ladders for CBM-STS started and first batch of ladders produced	14 - FAIR GMBH	24	Test results presented
MS8	Readout concept developed	14 - FAIR GMBH	24	Evaluation by experts
MS9	Common software packages developed	14 - FAIR GMBH	24	Simulation results presented
MS10	Technical design of beam monitor etc. for NICA	14 - FAIR GMBH	36	Report
MS11	First detector modules constructed & tested	14 - FAIR GMBH	24	Presentation of test result

Deliverables

month

D2.1	STS components assembled	WP2	14 - FAIR GMBH	Report	Public	24
D2.2	STS detectors tested	WP2	14 - FAIR GMBH	Report	Public	48
D2.3	Components of the STS data acquisition chain tested	WP2	32 - WUT	Report	Public	24
D2.4	Full functionality tests of the STS data acquisition chain	WP2	32 - WUT	Report	Public	48
D2.5	Simulation results for selected observables	WP2	7 - MEPHI	Report	Public	24
D2.6	Physics performance for major observables	WP2	7 - MEPHI	Report	Public	48
D2.7	Design of beam monitors, target chambers, beam pipes	WP2	14 - FAIR GMBH	Report	Public	12
D2.8	Beam monitors, target chambers, beam pipes constructed and installed	WP2	14 - FAIR GMBH	Report	Public	48
D2.9	Design of ZDC detector modules	WP2	5 - INR RAS	Report	Public	12
D2.10	ZDC detector modules constructed and tested	WP2	5 - INR RAS	Report	Public	48

Aim of the WP2 kick off meeting

- status organization of work within each task between the participating institutes and persons
- status recruitment of additional personnel in each institution
 - > involving additional person in the work in each task
- strategy for reaching the milestones and deliverable
- mitigating actions taken to deal with potential delay caused by the corona pandemic
- organization of task meetings (example first WP2.1 meeting)



STS Module & Ladder Assembly Retreat

chaired by Hans Rudolf Schmidt (GSI, Darmstadt), Johann Heuser (GSI, Darmstadt)

from Monday, 17 February 2020 at **08:30** to Tuesday, 18 February 2020 at **16:30** (Europe/Berlin)
at **Ringhotel Siegfriedbrunnen**

Description The workshop aims to coordinate the module and ladder assembly at the CBM assembly centers (GSI, KIT & JINR) in terms of:

- technologies & tools
- through-put & logistics
- quality assurance & testing
- data base
- person-power
- milestones
- ...

about 50 participants from FAIR, GSI, JINR, KIT, JU, Tübingen, Frankfurt

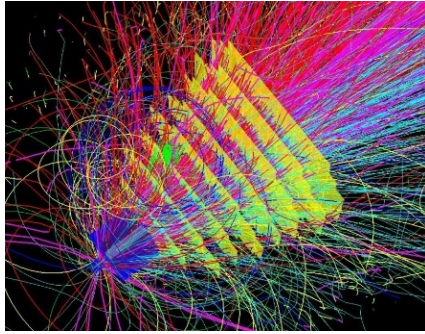
This relates also to EU-H2020 project CREMLINplus, work package 2 "Development of instrumentation for NICA and FAIR/CBM".

first WP2.1 meeting

CREMLINplus WP2- NICA - FAIR

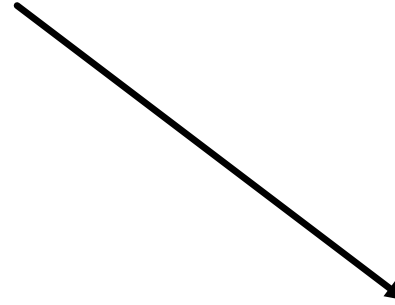
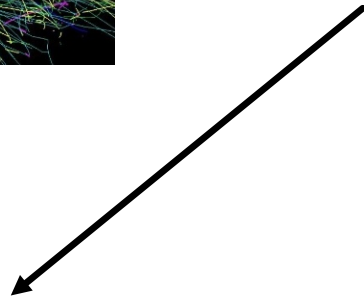
status recruitment at FAIR GmbH

Name	EU Auftrag FAIR GmbH in PROZ
Müller, Walter F. J., Dr. (30%)	471009 EU-H2020:871072-CREMLINplus-WP2.1
Senger, Anna, Dr.	471009 EU-H2020:871072-CREMLINplus-WP2.1
Senger, Peter, Prof. Dr.	471010 EU-H2020:871072-CREMLINplus-WP2.2
Loizeau, Alain-Pierre	471010 EU-H2020:871072-CREMLINplus-WP2.2
Dominik Smith	471011 EU-H2020:871072-CREMLINplus-WP2.3
Eoin Clerkin	471011 EU-H2020:871072-CREMLINplus-WP2.3
Schünemann, Kerstin	471009 EU-H2020:871072-CREMLINplus-WP2.1
Kuhl, Peter	471009 EU-H2020:871072-CREMLINplus-WP2.1
Rost, Adrian	471012 EU-H2020:871072-CREMLINplus-WP2.4
Klochkov, Viktor	471009 EU-H2020:871072-CREMLINplus-WP2.1



WP2: Collaboration with NICA - Development of instrumentation for NICA and FAIR/CBM

Engineering and construction of fast detectors,
Development of high rate data acquisition chain and software packages for simulation and data analysis, PSD, beam pipe design



WP7: Joint development of detector technologies

Develop a beyond state of the art CMOS pixel sensors (MAPS) for high-rate Silicon trackers for several particle physics and heavy-ion research communities in Europe and Russia for the potential upgrade of many experimental setups

Development of
neutron detectors,
detector school at BINP



WP9 TRAIN - Staff exchange and training for RI management

Organisation annual summer schools attracting young scientists
...
additional fellowships for students from all of Europe and Russia.

CBM cave November 2019



Thank you for your attention