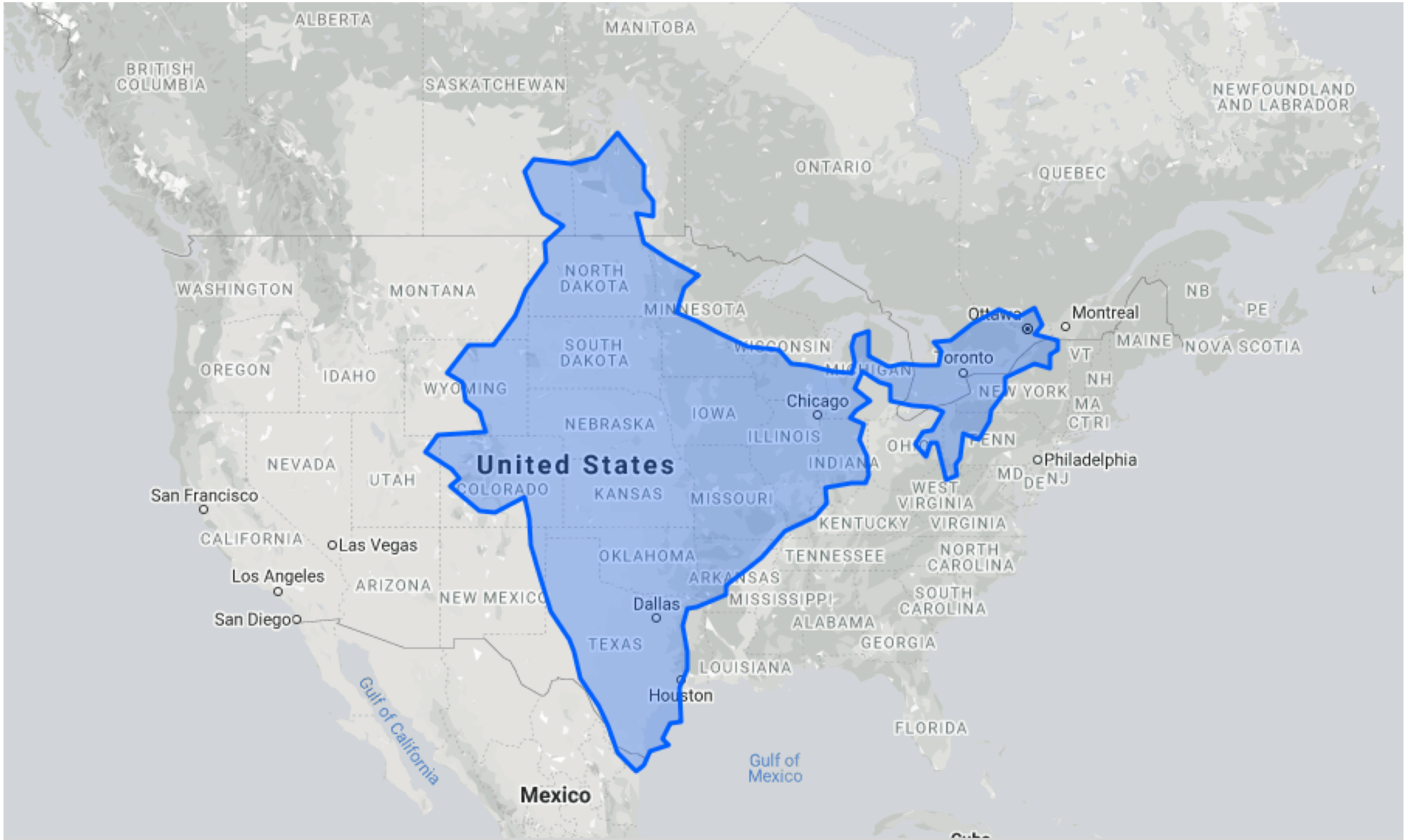
EIC सॉफ्टवेयर Meeting

July 31, 2020



India second-most populous country (1353M) and seventh-largest country by area (3.3M km^2)'

U.S. third-most populous country (328M) and fourth-largest county by area (9.8M km^2)

Honduras

Caribbean Sea

EICUG Software Working Group

84 members

Convener
A. Bressan (Trieste)
M. Diefenthaler (JLAB)
T. Wenaus (BNL)

Mailing list eicug-software@eicug.org
subscribe via Google Group
Repository https://github.com/eic
Website https://eic.github.io/

Core Group


J. Adam (BNL)


M. Asai (SLAC)


N. Brei (JLAB)


A. Bressan (Trieste)


W. Deconinck (Manitoba)


M. Diefenthaler (JLAB)


J. Furletova (JLAB)

Picture
S. Furletov (JLAB)


S. Joosten (ANL)


K. Kauder (BNL)


A. Kiselev (BNL)

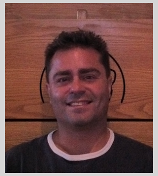

J. Lauret (BNL)


D. Lawrence (JLAB)


C. Pinkenburg (BNL)


M. Potekhin (BNL)


D. Romanov (JLAB)


M. Ungaro (JLAB)


T. Wenaus (BNL)

Working together with the EICUG

Develop

Support

Workflow environment for EIC simulations

- **to use** (tools, documentation, support) **and**
- **to grow with user input** (direction, documentation, tools)

software-support@eicug.org
mailing list anyone can contact

http://eicug.slack.com/
with software-support channel

in-person support

Involvement from EICUG

- **Coordinate simulations** with EICUG Detector and Physics Working Groups.
- **Analysis preservation** Work with EICUG to make software available and integrate it.
- Rely on expertise of EICUG:
  - **Design detectors**
  - **Developing reconstruction algorithms**
  - **Develop physics analysis**

Getting to know each other

Abhay Deshpande

About me

- Country of origin: India
- Current residence & citizenship: USA

Research Interests

- QCD and origin of matter
- Precision EW & BSM Physics

Research History & Path

- Rare Kaon decay at BNL/AGS
  - 1st measurement of $K+ \rightarrow \pi+ \, e+ \, e-$
  - 1st measurement of $\pi 0 \rightarrow e+ \, e-$
- QCD & Nucleon Structure
  - SMC at CERN ➔ Spin Crisis
  - DESY/HERA/ZEUS ➔ unconstrained rise of low-x gluons
  - BNL/RHIC/PHENIX ➔ 1st gluon polarization
- Precision EW : MOLLER @JLab12
- Electron Ion Collider (EIC)

Items of recent pride and satisfaction

- Proposed EIC in 1998/1999 ➔ CD0 for EIC in 2019
- Helped found EICUG & 1st Chair EIC Steering Committee 2016-2017

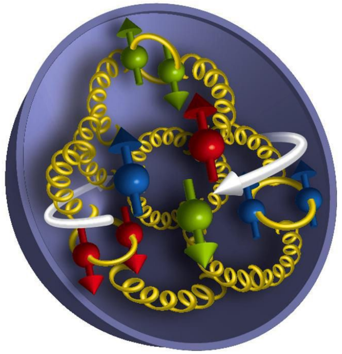
Douglas W. Higinbotham, Ph.D.

- Born in Virginia, USA
- Undergraduate degree from William & Mary
- Doctorial degree from University of Virginia
  - Research done at NIKHEF in the Netherlands
- Postdoctoral scientist at M.I.T.
- Joined Jefferson Lab in 2001
- Currently Head of the EIC Group at Jefferson Lab
- Research Interests:
  - Nucleon Form Factors
  - Short Range Correlations (SRC)
  - EMC Effect
- Research Highlights
  - Corresponding author of JLab's first Science article (SRC)
    https://doi.org/10.1126/science.1156675
  - Possible explanation of the EMC effect in PRL
    https://doi.org/10.1103/PhysRevLett.106.052301
  - Work on the proton radius puzzle
    https://doi.org/10.1103/PhysRevC.93.055207 , https://doi.org/10.1103/PhysRevC.99.044303
    https://doi.org/10.1103/PhysRevC.102.015205

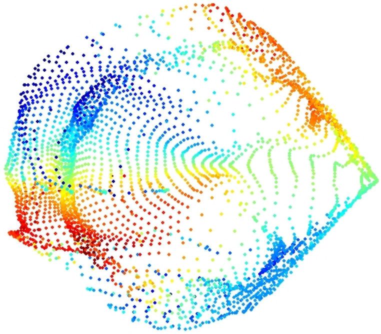
Dmitry Romanov

Jefferson Lab
Exploring the Nature of Matter

- **Professional software architect**
- Artificial Intelligence
- High energy and Nuclear physics



+



Nuclear Physics Artificial Intelligence

Kolja Kauder

Focus Path

→First "job" (12 yo): BASIC

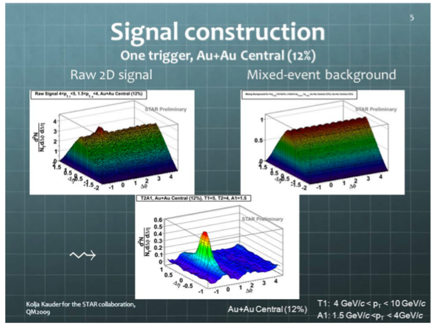
→Pure Maths (Topology, Number Theory)

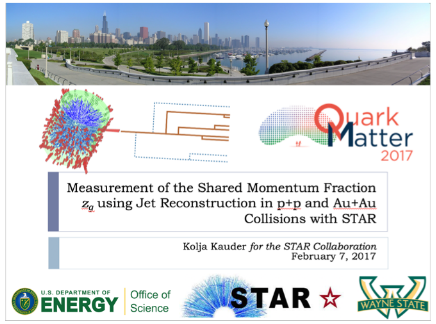
→Applied Maths (Numerical Linear Algebra, PDEs)

→Theoretical Physics (solitons, wave guides, laser wake field)

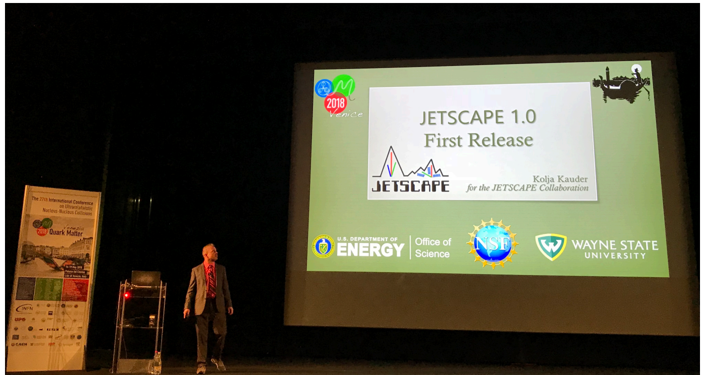
→**Experimental Physics (STAR 2008-present)**

→Correlations, Jets



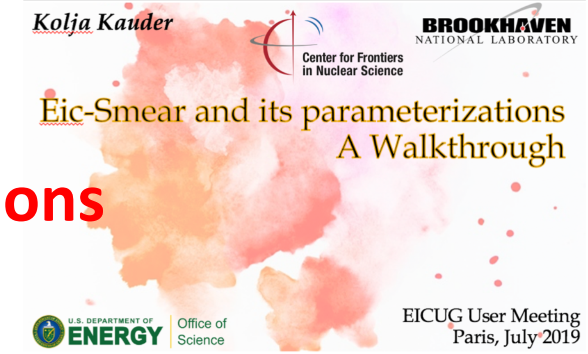


→**Simulating jets**



फ्टवेयर Meeting, July 31, 2020.

→ Simulations



Markus Diefenthaler

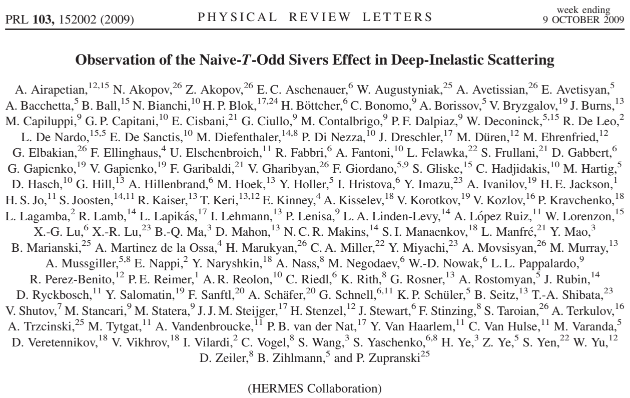
Country of origin

Affiliation Jefferson Lab Exploring the Nature of Matter

Research Interests

- **Nuclear Femtography** Mapping quarks and gluons and their interactions
- **Software & Computing** Seamless data processing from DAQ and analysis using AI
- **Working for the future** Develop the science and technical aspects of the Electron-Ion Collider

Proudest research moment



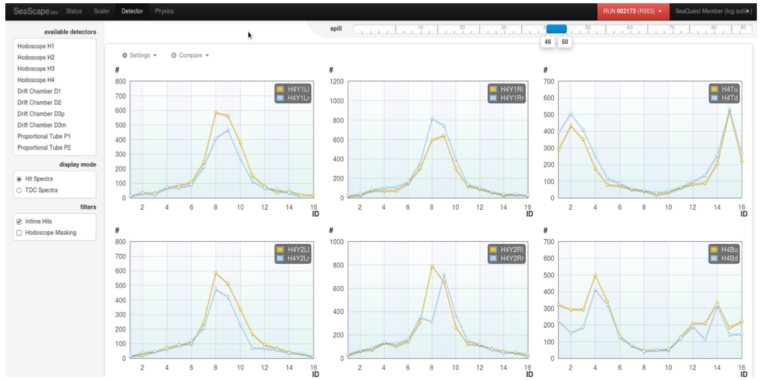
PRL **103,** 152002 (2009) PHYSICAL REVIEW LETTERS week ending 9 OCTOBER 2009

Observation of the Naive-*T*-Odd Sivers Effect in Deep-Inelastic Scattering

A. Airapetian,[12,15] N. Akopov,[26] Z. Akopov,[26] E. C. Aschenauer,[6] W. Augustyniak,[25] A. Avetissian,[26] E. Avetisyan,[5] A. Bacchetta,[5] B. Ball,[15] N. Bianchi,[10] H. P. Blok,[17,24] H. Böttcher,[6] C. Bonomo,[9] A. Borissov,[5] V. Bryzgalov,[19] J. Burns,[13] M. Capiluppi,[9] G. P. Capitani,[10] E. Cisbani,[21] G. Ciullo,[9] M. Contalbrigo,[9] P. F. Dalpiaz,[9] W. Deconinck,[5,15] R. De Leo,[2] L. De Nardo,[15,5] E. De Sanctis,[10] M. Diefenthaler,[14,8] P. Di Nezza,[10] J. Dreschler,[17] M. Düren,[12] M. Ehrenfried,[12] G. Elbakian,[26] F. Ellinghaus,[4] U. Elschenbroich,[11] R. Fabbri,[6] A. Fantoni,[10] L. Felawka,[22] S. Frullani,[21] D. Gabbert,[6] G. Gapienko,[19] V. Gapienko,[19] F. Garibaldi,[21] V. Gharibyan,[26] F. Giordano,[5,9] S. Gliske,[15] C. Hadjidakis,[10] M. Hartig,[5] D. Hasch,[10] G. Hill,[13] A. Hillenbrand,[6] M. Hoek,[13] Y. Holler,[5] I. Hristova,[6] Y. Imazu,[23] A. Ivanilov,[19] H. E. Jackson,[1] H. S. Jo,[11] S. Joosten,[14,11] R. Kaiser,[13] T. Keri,[13,12] E. Kinney,[4] A. Kisselev,[18] V. Korotkov,[19] V. Kozlov,[16] P. Kravchenko,[18] L. Lagamba,[2] R. Lamb,[14] L. Lapikás,[17] I. Lehmann,[13] P. Lenisa,[9] L. A. Linden-Levy,[14] A. López Ruiz,[11] W. Lorenzon,[15] X.-G. Lu,[6] X.-R. Lu,[23] B.-Q. Ma,[3] D. Mahon,[13] N. C. R. Makins,[14] S. I. Manaenkov,[18] L. Manfré,[21] Y. Mao,[3] B. Marianski,[25] A. Martinez de la Ossa,[4] H. Marukyan,[26] C. A. Miller,[22] Y. Miyachi,[23] A. Movsisyan,[26] M. Murray,[13] A. Mussgiller,[5,8] E. Nappi,[2] Y. Naryshkin,[18] A. Nass,[8] M. Negodaev,[6] W.-D. Nowak,[6] L. L. Pappalardo,[9] R. Perez-Benito,[12] P. E. Reimer,[1] A. R. Reolon,[10] C. Riedl,[6] K. Rith,[8] G. Rosner,[13] A. Rostomyan,[5] J. Rubin,[14] D. Ryckbosch,[11] Y. Salomatin,[19] F. Sanftl,[20] A. Schäfer,[20] G. Schnell,[6,11] K. P. Schüler,[5] B. Seitz,[13] T.-A. Shibata,[23] V. Shutov,[7] M. Stancari,[9] M. Statera,[9] J. J. M. Steijger,[17] H. Stenzel,[12] J. Stewart,[6] F. Stinzing,[8] S. Taroian,[26] A. Terkulov,[16] A. Trzcinski,[25] M. Tytgat,[11] A. Vandenbroucke,[11] P. B. van der Nat,[17] Y. Van Haarlem,[11] C. Van Hulse,[11] M. Varanda,[5] D. Veretennikov,[18] V. Vikhrov,[18] I. Vilardi,[2] C. Vogel,[8] S. Wang,[3] S. Yaschenko,[6,8] H. Ye,[3] Z. Ye,[5] S. Yen,[22] W. Yu,[12] D. Zeiler,[8] B. Zihlmann,[5] and P. Zupranski[25]

(HERMES Collaboration)

Proudest computing moment



Sylvester Joosten

Argonne NATIONAL LABORATORY

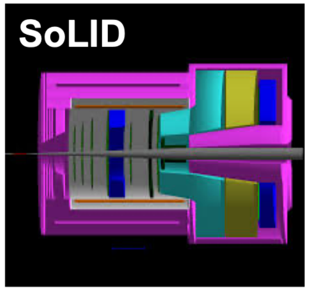
Experiments

hermes

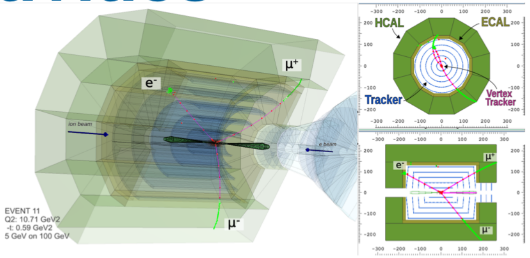
clas
CEBAF Large Acceptance Spectrometer

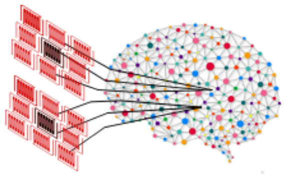
Hall C

007 $^{J/\psi}$



EIC related activities





Latest publication

PHYSICAL REVIEW D **102,** 014016 (2020)

Υ photoproduction on the proton at the Electron-Ion Collider

Oleksii Gryniuk,[1] Sylvester Joosten,[2] Zein-Eddine Meziani,[2] and Marc Vanderhaeghen[1]
[1]*Institut für Kernphysik and PRISMA+ Cluster of Excellence, Johannes Gutenberg Universität, D-55099 Mainz, Germany*
[2]*Argonne National Laboratory, Lemont, Illinois 60439, USA*

Wouter Deconinck

wouter.deconinck@umanitoba.ca

Experience:

- HERA: Hermes
- JLab: Qweak, MOLLER
- William & Mary:
  asst. prof. 2010-2019
- U Manitoba:
  assoc. prof. 2019-now

Current EIC positions:

- EIC Canada
  spokesperson
- EIC UG steering comm.
  International
  Representative

EIC research interests:

- Electroweak physics
- Beyond the Standard
  Model searches
- Parity-violation

EIC detector interests:

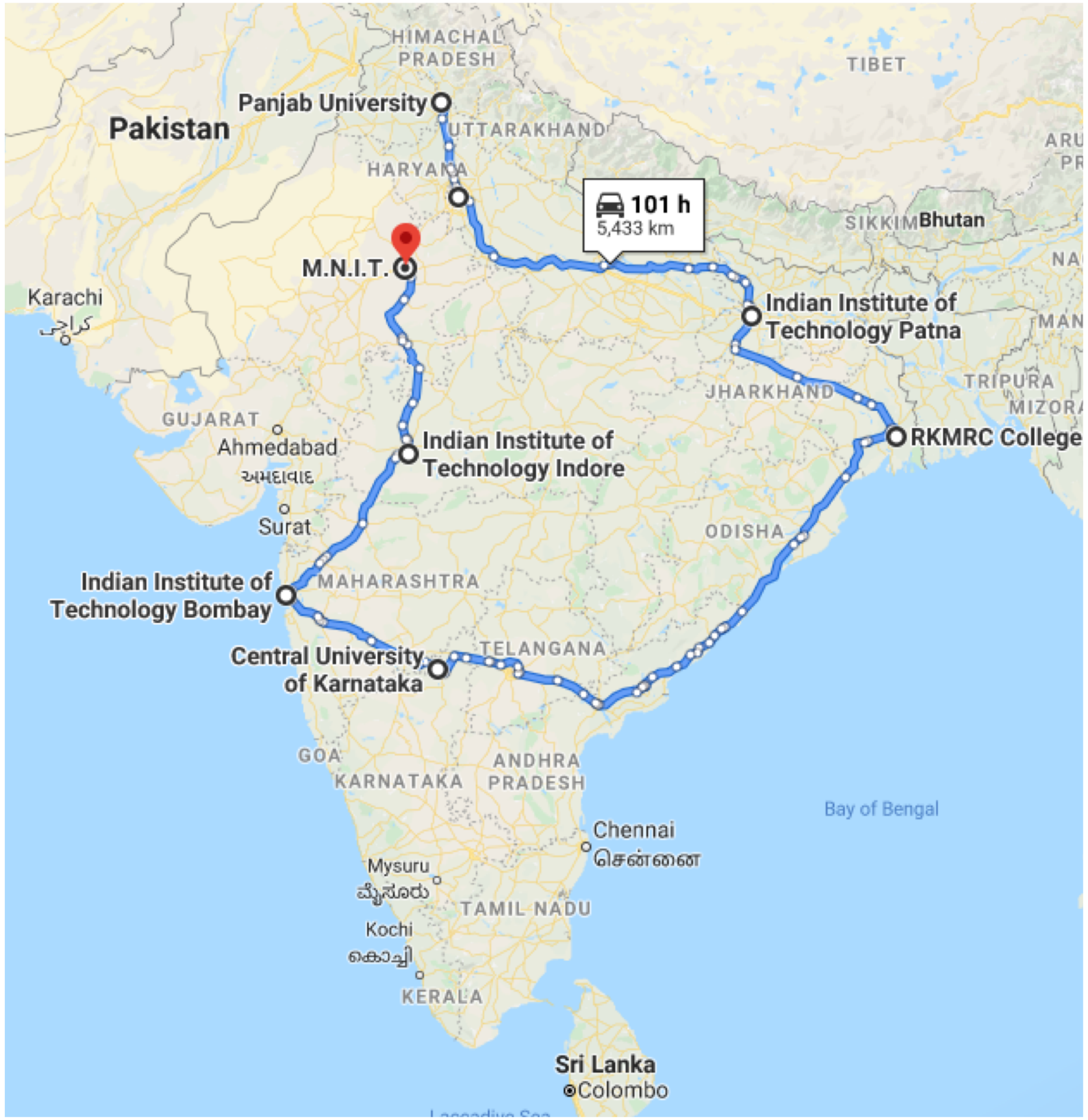
- Polarimetry
- Calorimetry
- Tracking

EIC software interests:

- User-centered design
- Machine learning

University of Manitoba

Software involvement from EIC-India



1. Panjab University: Lokesh Kumar
2. Indian Institute of Technology Bombay: Sadhana Dash and Basanta Nandi
3. Indian Institute of Technology Delhi: Tobias Toll
4. Indian Institute of Technology Patna: Neha Shah
5. Indian Institute of Technology Indore: Ankhi Roy
6. Central University of Karnataka: Deepak Samuel
7. MNIT Jaipur: Kavita Lalwani
8. RKMRC, Kolkata: Amal Sarkar

Panjab University Chandigarh

People for help in the call for cross validation by software group of EIC:

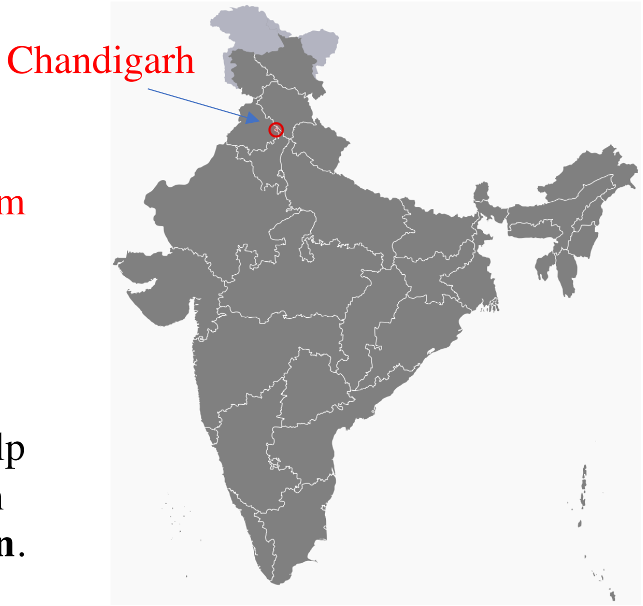
Dr. Lokesh Kumar
Faculty, Group leader
(STAR, ALICE, EIC)
Expertise:
- particle identification
- spectra - pi, k, p
- C++, ROOT

Mr. Sandeep Dudi,
Ph.D. student, advanced stage (ALICE)
Expertise:
- particle identification
- spectra – phi meson
- C++, ROOT

Ms. Simran, Master student
Expertise:
- worked on momentum resolution of EIC GEANT4 simulation based on sPHENIX
- C++, ROOT

Chandigarh is in north of India, 250 km north from Delhi.

- Main student to help for cross validation will be **Ms. Simran**.
- She will be **helped** by Mr. Sandeep Dudi.
- Dr. Lokesh Kumar will **supervise** them.

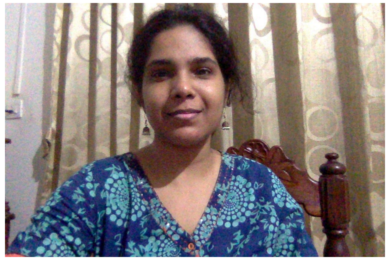


India map

Indian Institute of Technology Bombay: Sadhana Dash and Basanta Nandi

IIT Bombay : Participating Members

1. **Basanta Nandi : Worked in WA98, STAR and ALICE experiment : ROOT, C++**

2.  **Prof. Sadhana Dash : Worked in STAR ands currently working in ALICE experiment. : ROOT , C++**

3.  **Akhil Mithran : Masters Project student : Can contribute in EIC for 10 months: ROOT6, C++ and Python**

Indian Institute of Technology Delhi: Tobias Toll

- **Tobias Tool** I am working on the further development of the event generator sartre, and know C++, Python, and ROOT.

- **Four MSc students that will be working on this benchmarking project**
  - Rishabh had done one introductory course in C++ and has learned Python on his own.
  - Rinku is a beginner in C++ and Python.
  - Suraj knows C++ fairly well, and a bit of Python.
  - Varun
  - They are all new to ROOT.

Indian Institute of Technology Patna: Neha Shah

Dr. Neha Shah
Assistant Professor
Indian Institute of Technology Patna

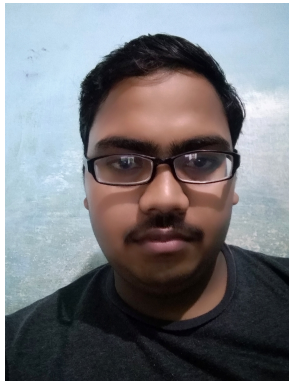
Skills:

FORTRAN, C++
ROOT: Development of Physics analysis for the STAR and the WASA-at-COSY experiments
GEANT4: Worked briefly on ECAL simulation @ UCLA
Simulations for neutron spectrum in 7Li(p,n) reactions at low energy

Students, who will be involved in the project:

Abhishek Kumar Singh
3rd year, B. Tech.
Mechanical Engineering

Skills:
- Python
- MATLAB
- C++ (Basics)



Ashutosh Maurya
3rd year, B. Tech.
Mechanical Engineering

Skills:
- Python
- MATLAB
- C++ (Basics)

Rajat Aggarwal
2nd year, M. Sc.

Skills:
- C++
- ROOT
- Python

Indian Institute of Technology Indore: Ankhi Roy

Indian Institute of Technology Indore

Dr. Ankhi Roy
Associate Professor
Discipline of Physics

Skills: C++, ROOT, GEANT4
Currently Working in ALICE and CBM experiment

Following Students will be involved:

Tarun Sharma (M. Sc):
Skills: C++, ROOT, Python

Sagar Joshi (EE,2ndYear)
Skills: C++,Python

Siddhant Rathi (ME,2nd Year)
Skills: C++,Python

Hasan Mustafa (ME,2ndYear)
Skills: Python, C++, Deep Learning

Vineet Tripathi (ME,2ndyear)
Skills:C++,Python,Machine Learning

Central University of Karnataka: Deepak Samuel

Deepak Samuel
Associate Professor
Central University of Karnataka

Experimental Particle Physics
Ph.D: University of Bonn, Germany
Postdoc: TIFR (4 y) & Harvard Medical School (2 y)

https://github.com/deepaksamuel

Skill	Expert	Hands-on experience
C++	✓(Experienced in Qt libraries)	
Python		✓On VS Code
ROOT	✓https://github.com/deepaksamuel/iRoot	
Geant4	✓https://github.com/deepaksamuel/simple	
GPU Programming		✓ (CUDA/openACC)
ML Toolkits		✓ (Scikit/TMVA)
Git		✓
DAQ	✓(VME/CAMAC based)	
Detectors		RPC development and characterization

Facilities available: GPU Server with NVIDIA Tesla V100 & Intel Xeon 6130

MNIT Jaipur: Kavita Lalwani

Dr. Kavita Lalwani (Assistant Professor)
Department of Physics
Malaviya National Institute of Technology
Jaipur, Rajasthan, INDIA

Software Skills https://github.com/kavita-lalwani/software_skills_mnit

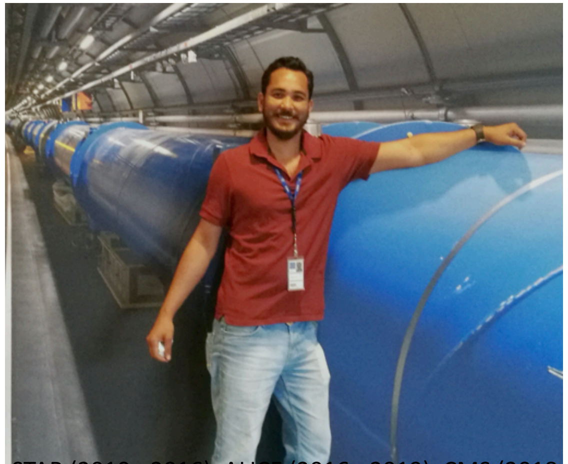
Softwares	**Hands-on Experience**
ROOT	Handling of Ntuples, Histograms, TGraph , Fitting (binned & unbinned (RooFit))
Python	Understanding of preparing the Simulation and Reconstruction scripts on decays of D^0 meson for CP violation analyses, Tree Fitter in Belle II Framework
Geant4 Simulations	• Delivered hands-on trainings on Geant4 simulations in the Indian institutions (TIFR, Mumbai, IISER Mohali) • Floated elective course for Master students on Monte Carlo Simulations at MNIT Jaipur http://mnit.ac.in/dept_phy/downloads/2018/MSc_Physics_Program_Electives_Final.pdf (page 6)
TCAD-Silvaco Device simulations	Used to study the radiation damage in Si sensors for HEP experiments.

✓ One Master student will work with me for EIC software validation task.

RKMRC, Kolkata: Amal Sarkar

Dr. Amal Sarkar (Assistant Professor)
Department of Physics, RKMRC Narendrapur, Kolkata, India
+91 339 4949-131/133 (Office), +41 227665058 (CERN)
amal.sarkar@cern.ch, amal.iitb@gmail.com

Computing
FORTRAN 77 & 90, Python, C++ Advanced, ROOT (rhic, aliroot, cms)
Gird and cluster computing at RHIC (BNL), CERN and on LPC (FNL).
MC Event Generators etc.
AMPT, FONLL, Glauber, Hijing, Pythia, UrQMD (GNT4), POWHEG, Garfield.
Hardware:
TPC at STAR, Muon Chamber and Trigger at ALICE and RPC at CMS



STAR (2010 - 2016), ALICE (2016 - 2019), CMS (2018 -)
https://inspirehep.net/authors/1403364

Sayanta Neogi
sparrow8400@gmail.com
M.Sc (Computer Science), RKMRC (present)
B.Sc (Computer Science)

Technical Skills	Programming
• AI/ML/DL	• C/C++, C#, .net
• Oracle	• Python
• Git	• Java, JSP
• Jenkins	• SQL / PLSQL
• Docker	• PHP

Suman Mondal
s.mon7728@gmail.com
M.Sc (Computer Science), RKMRC (present)
B.Sc (Computer Science)

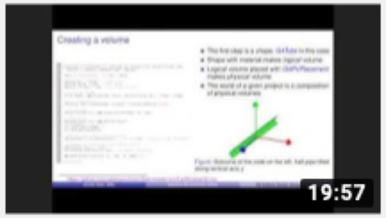
Technical Skills	Programming
• Oracle	• C/C++
• Git	• Python
	• Java, JSP
	• SQL / PLSQL
	• HTML

Recent focus: Get EICUG started on simulation tools

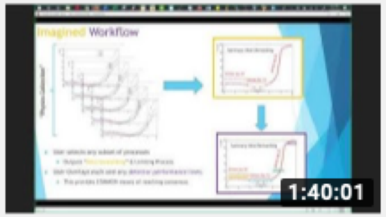
Full simulations	EicRoot	ESCalate	Fun4All
Fast simulations	eic-smear		

Online tutorials on YouTube channel of EICUG

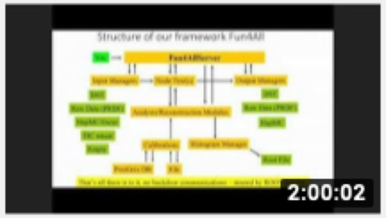
EIC Software Group: An Introduction (01/09/2020)



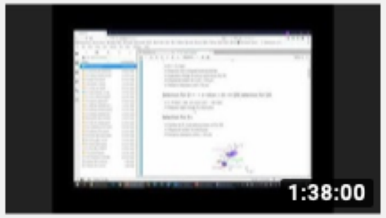
EIC Software Tutorial: Example Detector...



EICUG Software Working Group: Greenfield



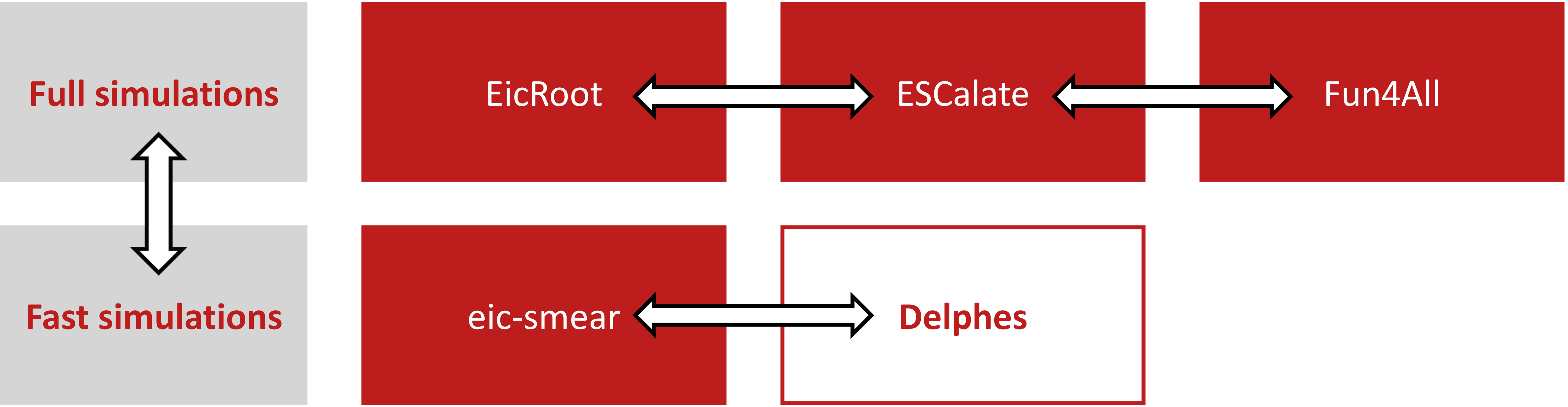
EIC Software Tutorial: Detector Full Simulations in...



EIC Software Tutorial: Detector Full Simulations in...

EIC Software Tutorial: Fast Simulations (01/09/2020)

Current focus: Benchmarks & validation



Current focus: Benchmarks and validation

Cross-tool validation

- **Unified format for the output ROOT tree of all tools (work in progress)**
- **Collect simulation configuration and physics analyses (work in progress)**
  - Any study that is shared with the SWG can be used to **benchmark & validate** the EIC Software tools.
  - Based on analysis scripts and macros for the given study, the SWG can reproduce studies and build up a **validation scheme and tools** on top of it.
- **Call for additional efforts: Thank you so much for your help.**

MCEG validation

- MC-data comparisons and eventually tuning will help to support Yellow Report studies and beyond with the *right* simulations

Next steps

Verify that you are include in the EIC phone book

- http://www.eicug.org/pnb/client/
- If not, send an email to the representative of your institution or register your institution via register@eicug.org.

Google groups / mailings

- eicug-software@eicug.org
- Please send mdiefent@jlab.org your email address (maybe the one associated with your Google account).
- Maybe setup dedicated mailing list for validation.

GitHub

- https://github.com/eic and the related EIC Software portal on https://eic.github.io
- Please send your email address associated with your Github account to eicug-computing-infrastructure-support@eicug.org.

Regular meetings

- Keep time of 8:00 a.m. (EDT) / 5:30 p.m. (IST) on Friday? Move to another day?
- Start weekly to get started and then biweekly?

Next steps: Task forces

Full simulations

EicRoot
Alexander

ESCalate
Dmitry

Fun4All
Chris

Fast simulations

eic-smear
Kolja

Delphes

Fast simulations

MC-data
comparisons
Markus

Please let us know what cross-validation aspect you would like to cover and let's try to cover all topics.

Goals for next meeting: Friday, August 7, at 8:00 a.m. (EDT)

Goals of next meeting

- **Formation task forces and discuss first validation steps**
- **Answer questions**

Preparations for next meeting

- **Follow online tutorial for tool of interests:**
  - https://www.youtube.com/channel/UCXc9WfDKdlLXoZMGrotkf7w
  - available only for eic-smear, ESCalate, Fun4All
- **If you need more information to choose your task force: get in contact with developers**
  - **EicRoot** Alexander Kiselev (ayk@bnl.gov)
  - **eic-smear** Kolja Kauder (kkauder@bnl.gov)
  - **ESCalate** Dmitry Romanov (romanov@jlab.org)
  - **Fun4All** Chris Pinkenburg (pinkenburg@bnl.gov)
  - **MC-data comparison** Markus Diefenthaler (mdiefent@jlab.org)
- By August 6, send your preferred task force to Markus Diefenthaler (mdiefent@jlab.org). Markus will update the slides with your information for the next meeting.
- **Collect ideas for validation plots**
- **Questions for us to get started**