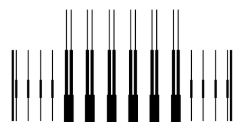


One Lab – Many Project Review of the WSCLAB



Gergely Gábor Barnaföldi
WSCLAB, HUN-REN Wigner Research Centre for Physics



MTA
Centre
of Excellence



ROLE>_

WSCLAB's origin

14 YEARS IN PARALLEL COMPUTING (WIGNER GPU LABORATORY) & HPC @ WDC

The aim of the Wigner GPU Laboratory is to provide support for any fields in science in sense of parallel computing techniques, especially for faster numerical calculations in gravitational and high-energy physics, astronomy, astrophysics, material sciences, and detector simulations. We have started with GPU technologies in 2009, but later our aim was improved to any kind of parallel computing technology. Today, many- and multi-core, GPU, FPGA, Xeon Phi technologies are all available in the laboratory. Beside the academic environment and other institutes, we have connections to industrial partners as well.





WSCLAB's origin

14 YEARS IN PARALLEL COMPUTING (WIGNER GPU LABORATORY) & HPC @ WDC

Since 2010, the GPU Day is a yearly international conference on massively parallel technologies and their applications and quantum computing.

Its dedicated goal is to bring together researchers from academia, developers from industry and interested students to exchange experiences and learn about novel and future technologies.

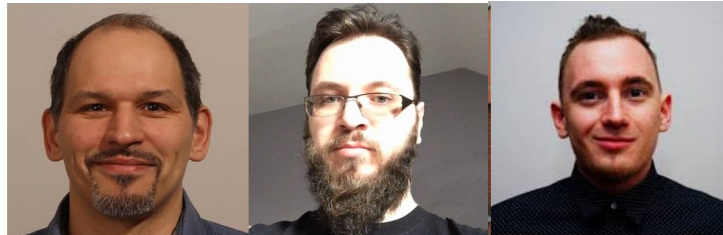
It is a unique event with focus on exchange of knowledge and expertise such topics as GPU, FPGA and quantum computing simulations.

Presentation of talks and demo desks help to draw attention to your cutting-edge solutions.

This conference is an established meeting of experts, where you can discuss methods, exchange ideas, find new collaborators and business partners.

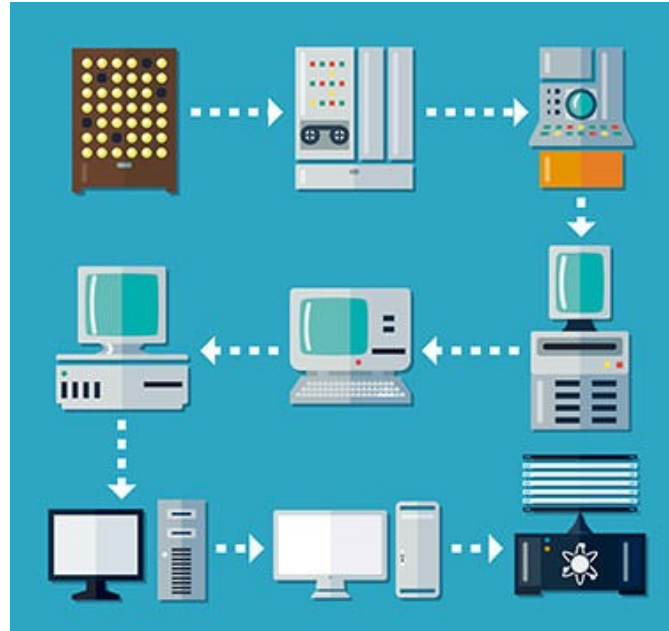
Best place to see the Wigner GPU Lab's activity.

Our sponsors gain additional visibility at the event, on the webpage and related digital appearances including special interviews.



WSCLAB's role

14 YEARS IN PARALLEL COMPUTING (WIGNER GPU LABORATORY) & HPC @ WDC



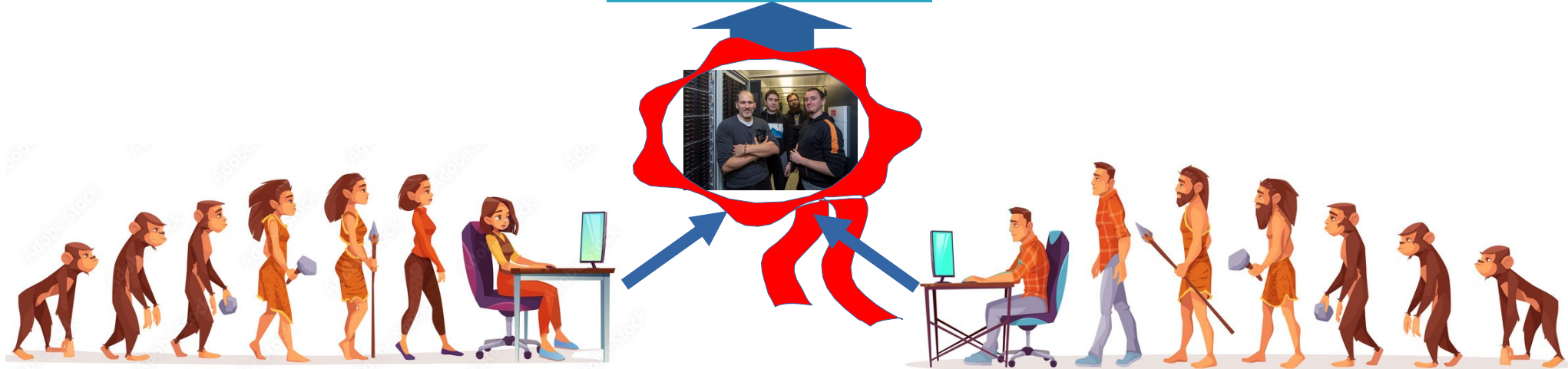
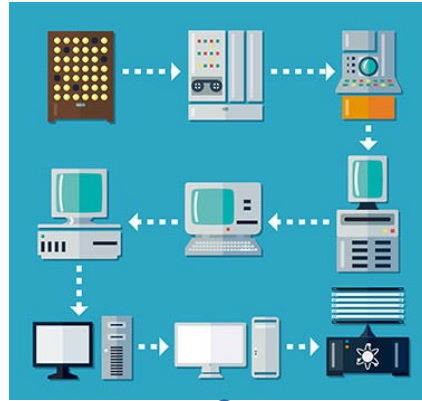
WSCLAB's role

14 YEARS IN PARALLEL COMPUTING (WIGNER GPU LABORATORY) & HPC @ WDC



WSCLAB's role

14 YEARS IN PARALLEL COMPUTING (WIGNER GPU LABORATORY) & HPC @ WDC



The History of WSCLAB's Wigner GPU Laboratory

- **2005-2008 Early years: idea of using GPU in HEP calculations**

Starting of the WLCG Grid (ALICE & CMS) Tier-2 at the Wigner

- 2009 Discussion with GGB & P. Lévai & G. Debreczeni

2 main direction: HEP & Gravity

- **2010- 1st GPU Day & formation of the Wigner GPU Laboratory**

Students: M. F. Nagy-Egri & D. Berényi

- 2010- GPU Day series
- 2016- Lectures on Modern Computing in Science series
- 2016- Wigner GPU Lab Fellowship
- **2021- Wigner Scientific Computing Laboratory (NKFIH TOP50 RI)**



WSCLAB @ NKFIH TOP50 Research Infrastructure

START: 17TH DECEMBER 2021.



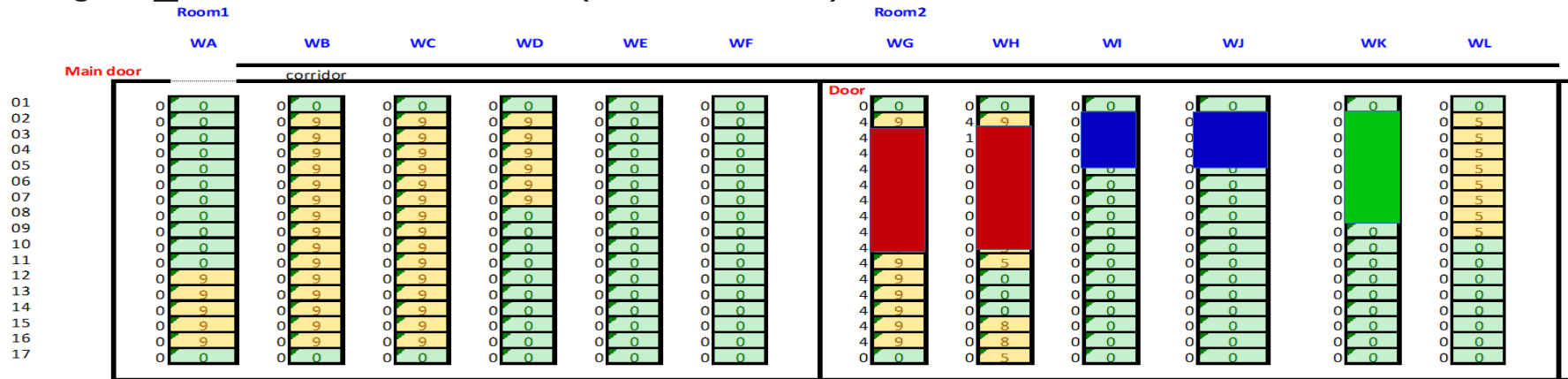


HARDWARES>_

WSCLAB @ WDC

THE PLACE

- ✓ Wigner Analysis Facility (Wigner AF)
- ✓ Wigner GPU Laboratory
- ✓ Wigner_KFKI WLCG T2 Grid (ALICE+CMS)



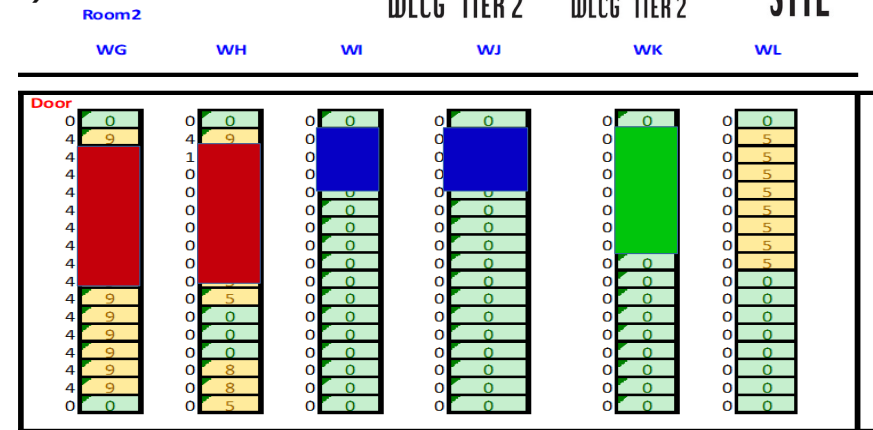
WSCLAB @ WDC

THE PLACE

- ✓ Wigner Analysis Facility (Wigner AF)
- ✓ Wigner GPU Laboratory
- ✓ Wigner_KFKI WLCG T2 Grid (ALICE+CMS)
- ✓ New: LIGO/VIRGO
- ✓ New: EuPRAXIA



SERVING LARGE-SCALE EU &
WORLDWIDE SCIENTIFIC
COMMUNITIES





EVENTS>_

GPU Days so far...

GPU nap 2010

MTA KFKI Részecske- és Magfizikai Kutatóintézet

XII. Budapest, Konkoly-Thege Mikós út 29-33

2010 június 4.

(Előjelentkezés szükséges: <http://gpu.kfki.hu>)



Program kivonat:

- Ismerkedés a GPU programozással, gyakorlat
- Grafikus kártyák, mint asztali szuperszámítógépek
- Molekuladinamika számítások GPU-val
- Rács QCD és részecskefizikai alkalmazások
- GPU a kísérleti és elméleti gravitációkutatásban

gpu@2011
GPU programozás a tudományos kutatásokban

PROGRAM:

- 09:00 Regisztráció
- 09:30 Munka
- 10:00 GPU az IKT-tervezésben
- 10:30 Grafikus kártyák mint asztali szuperszámítógépek
- 11:00 Molekuladinamika számítások GPU-val
- 11:30 Rács QCD és részecskefizikai alkalmazások
- 12:00 GPU a kísérleti és elméleti gravitációkutatásban
- 13:00 GPU programozás

MTA Részecske- és Magfizikai Kutatóintézet

gpu@2012
GPU programozás a tudományos kutatásokban

PROGRAM:

- 09:00 Regisztráció
- 09:30 Munka
- 10:00 GPU az IKT-tervezésben
- 10:30 Grafikus kártyák mint asztali szuperszámítógépek
- 11:00 Molekuladinamika számítások GPU-val
- 11:30 Rács QCD és részecskefizikai alkalmazások
- 12:00 GPU a kísérleti és elméleti gravitációkutatásban
- 13:00 GPU programozás

MTA Részecske- és Magfizikai Kutatóintézet

gpu@2013
GPU programozás a tudományos kutatásokban

PROGRAM:

- 09:00 Regisztráció
- 09:30 Munka
- 10:00 GPU az IKT-tervezésben
- 10:30 Grafikus kártyák mint asztali szuperszámítógépek
- 11:00 Molekuladinamika számítások GPU-val
- 11:30 Rács QCD és részecskefizikai alkalmazások
- 12:00 GPU a kísérleti és elméleti gravitációkutatásban
- 13:00 GPU programozás

MTA Részecske- és Magfizikai Kutatóintézet

FUTURE OF MANY-CORE COMPUTING IN SCIENCE

MAY 20 2014

PROGRAM:

- 09:00 Regisztráció
- 09:30 Munka
- 10:00 GPU az IKT-tervezésben
- 10:30 Grafikus kártyák mint asztali szuperszámítógépek
- 11:00 Molekuladinamika számítások GPU-val
- 11:30 Rács QCD és részecskefizikai alkalmazások
- 12:00 GPU a kísérleti és elméleti gravitációkutatásban
- 13:00 GPU programozás

MTA Részecske- és Magfizikai Kutatóintézet

GPU DAY 2015
The Future of Many-Core Computing in Science

2015 May 20-21 WED-THU

KEYNOTE: INTRODUCTION, SPECIAL TOPICS, CONTRIBUTED

VENUE: Wigner RSP, KFKI Colloquium Hall, Wigner Gyűjtemény

6th GPU DAY
The Future of Many-Core Computing in Science

2nd JUN 3rd JUN

PROGRAM:

- HPC for Research and Education
- AVX-512 Building Blocks
- Graphical Shaders
- Self-Driver Cars
- Light-Cone Modeling
- GPU for Research and Education
- AVX-512 Building Blocks
- Graphical Shaders
- Self-Driver Cars
- Light-Cone Modeling
- GPU for Research and Education

Wigner Részecske- és Magfizikai Kutatóintézet

GPU DAY 2019
The Future of Computing, Graphics and Data Analysis

11-12 07 2019

PROGRAM:

- HPC for Research and Education
- AVX-512 Building Blocks
- Graphical Shaders
- Self-Driver Cars
- Light-Cone Modeling
- GPU for Research and Education
- AVX-512 Building Blocks
- Graphical Shaders
- Self-Driver Cars
- Light-Cone Modeling
- GPU for Research and Education

Wigner Részecske- és Magfizikai Kutatóintézet

WIGNER GPU LABORATORY PRESENTS GPU DAY 2021
10-11. NOVEMBER

MORE INFORMATION AND REGISTRATION:
[HTTPS://GPUDAY.COM/](https://gpuday.com/)
[HTTPS://INDICO.KFKI.HU/EVENT/1330/](https://indico.kfki.hu/event/1330/)

KEYNOTE SPEAKERS: ALBERTO DI MEGLIO, OSKAR MENCER
THE FUTURE OF MASSIVE PARALLEL AND QUANTUM COMPUTING

EMERGING ACCELERATOR PLATFORMS
IMAGE PROCESSING, COMPUTER VISION, AND RECONSTRUCTION
INDUSTRIAL APPLICATIONS
GRAPHICS, RENDERING, AND IMAGE SYNTHESIS
COMPUTING AND VISUALIZATION IN EDUCATION
QUANTUM COMPUTING SIMULATION
MACHINE LEARNING, NEURAL NETWORKS, FEATURE RECOGNITION
MANY-CORE COMPUTING IN PHYSICS AND OTHER FIELDS OF SCIENCE

WIGNER SCIENTIFIC COMPUTING LABORATORY GPU DAY 2022
20-21. JUNE

MORE INFORMATION AND REGISTRATION:
[HTTPS://GPUDAY.COM/](https://gpuday.com/)
[HTTPS://INDICO.KFKI.HU/EVENT/1393/](https://indico.kfki.hu/event/1393/)

THE FUTURE OF MASSIVE PARALLEL AND QUANTUM COMPUTING

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WIGNER SCIENTIFIC COMPUTING LABORATORY GPU DAY 2023
15-16. MAY

MORE INFORMATION AND REGISTRATION:
[HTTPS://GPUDAY.COM/](https://gpuday.com/)
[HTTPS://INDICO.KFKI.HU/EVENT/1482/](https://indico.kfki.hu/event/1482/)



WIGNER SCIENTIFIC COMPUTING LABORATORY

GPU DAY 2024

EMERGING ACCELERATOR PLATFORMS

IMAGE PROCESSING, COMPUTER VISION, AND RECONSTRUCTION

INDUSTRIAL APPLICATIONS

GRAPHICS, RENDERING, AND IMAGE SYNTHESIS

COMPUTING AND VISUALIZATION IN EDUCATION

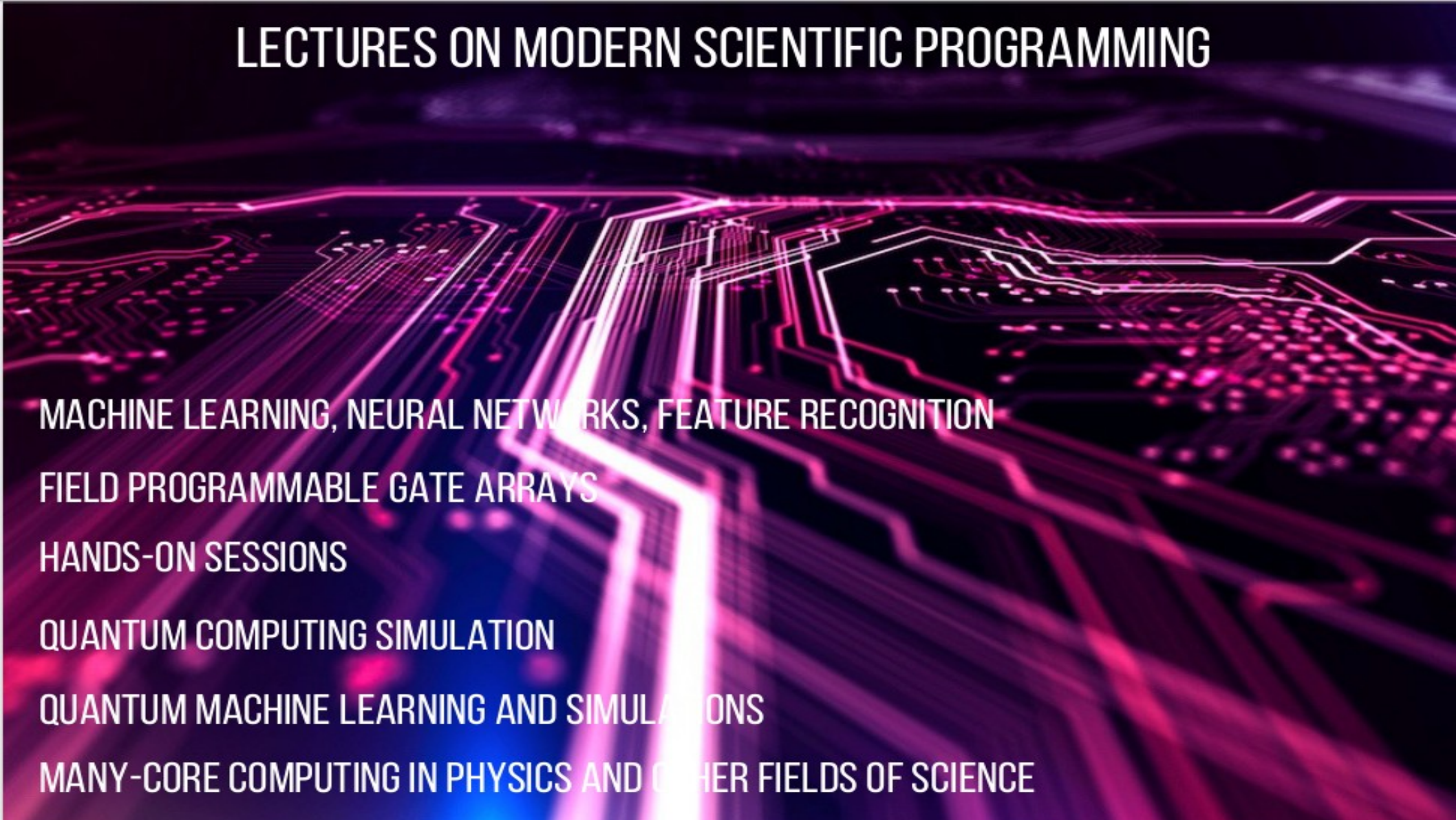
QUANTUM COMPUTING SIMULATION

MACHINE LEARNING, NEURAL NETWORKS, FEATURE RECOGNITION

MANY-CORE COMPUTING IN PHYSICS AND OTHER FIELDS OF SCIENCE



LECTURES ON MODERN SCIENTIFIC PROGRAMMING



MACHINE LEARNING, NEURAL NETWORKS, FEATURE RECOGNITION

FIELD PROGRAMMABLE GATE ARRAYS

HANDS-ON SESSIONS

QUANTUM COMPUTING SIMULATION

QUANTUM MACHINE LEARNING AND SIMULATIONS

MANY-CORE COMPUTING IN PHYSICS AND OTHER FIELDS OF SCIENCE

WSCLAB's EDUCATIONAL MATTERS

Why GitHub? Team Enterprise Explore Marketplace Pricing Search Sign In Sign up

wigner GPU Lab
Research group centered around massively parallel scientific calculations.
Budapest, Hungary <http://gpu.wigner.mta.hu/>

Repositories 6 Packages People Projects

OpenCL-Primer

Documentation on how to get started with OpenCL programming

BSD-3-Clause 0 0 0 0 Updated on Sep 26, 2019

SYCL-PRNG

A pseudo random number generator library written against the SYCL API.

C++ 1 4 1 0 Updated on Jun 11, 2019

Teaching

Material used for teaching.

C++ 8 43 6 (1 issue needs help) 0 Updated on Jun 7, 2019

HaladoAlkProg

Code samples for the "Haladó Alkalmazott Programozás" course

C++ MIT 0 0 0 Updated on May 15, 2019

LOMSP

Sample codes from the Lectures On Modern Scientific Programming series

C++ 1 1 0 0 Updated on Feb 14, 2018

SchwarzschildRaytracer

Raytracer in the Schwarzschild metric for visualization

C++ 1 0 0 0 Updated on Jun 2, 2017



GitHub

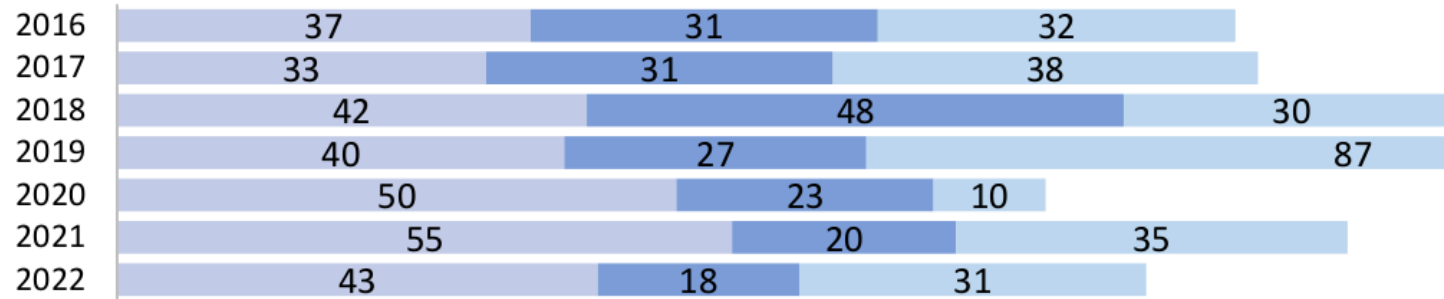


PROJECTS>_

WSCLAB in numbers

KNOWLEDGE HUB: GPU DAY.COM

✓ 14 GPU Days

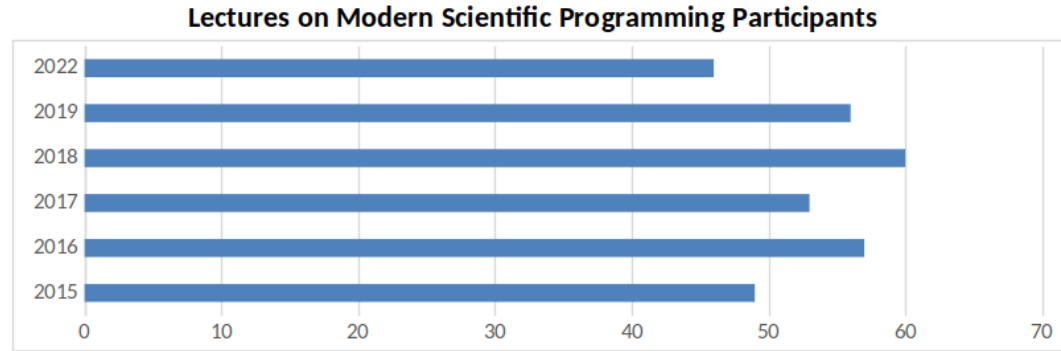


- ✓ 9 Lectures in Modern Computing in Science
- ✓ 55+ WSCLAB (Wigner GPU Lab) Fellowship
- ✓ 35+ industrial & academic partners (Lombiq LTD, Ericsson, Khronos, CERN...)
- ✓ 70+ scientific publications and program codes

WSCLAB in numbers

KNOWLEDGE HUB: GPU DAY.COM

- ✓ 14 GPU Days
- ✓ 9 Lectures in Modern Computing in Science



- ✓ 55+ WSCLAB (Wigner GPU Lab) Fellowship
- ✓ 35+ industrial & academic partners (Lombiq LTD, Ericsson, Khronos, CERN...)
- ✓ 70+ scientific publications and program codes

WSCLAB's SCIENTIFIC RESULTS

BASED ON THE PROJECTS

✓ Finished Projects from various fields

- Astronomy & Astrophysics (16)
- Physics (30)
- Biochemistry (6)
- Life & Medical Sciences, Etology/Ornitology (7)
- Computational Sciences, Imaging, Simulations (13)
- Quantum Computing (9)

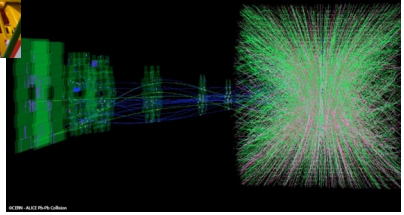
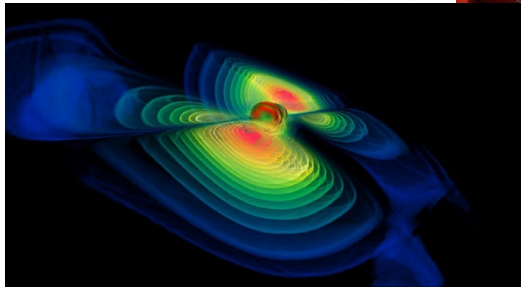
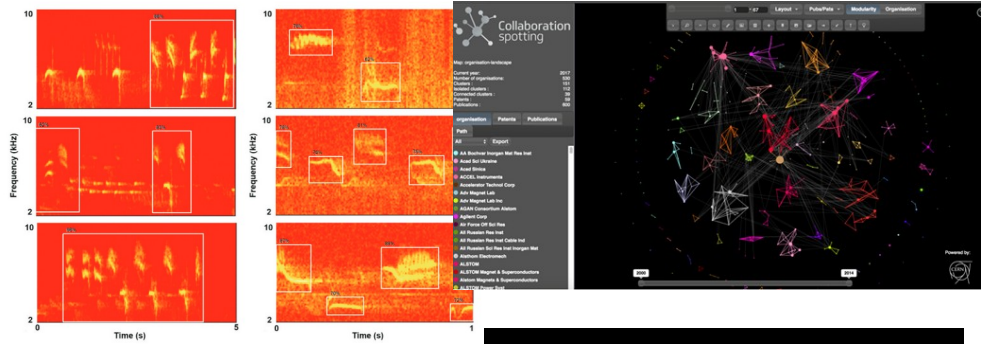
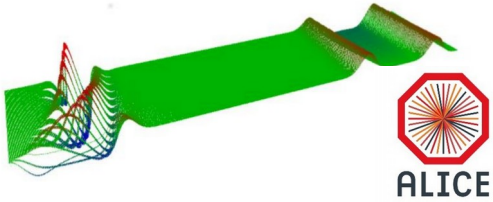
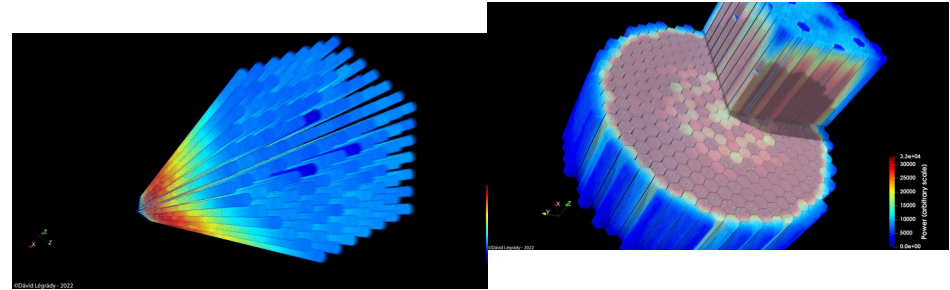
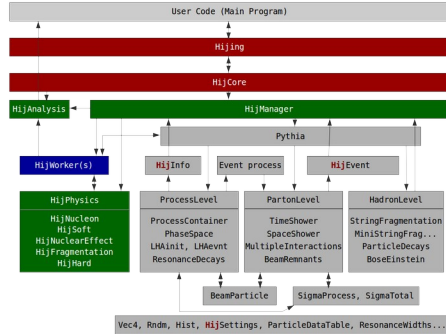


✓ List of Publications

- More than 70 publications & public codes

WSCLAB's SCIENTIFIC PROJECTS

FEW SELECTED ONES



WSCLAB's SCIENTIFIC PROJECTS FOR THE SOCIETY





FUTURE>_

WSCLAB's NEAR FUTURE TODAY & TOMORROW

✓ 8th Lectures on Modern Computing in Science 2024

- Focus: Large Language Models supporting Science

✓ Academy-Industry Matching Event AIME24

- Hotel Mercure Buda (21-22 November 2024)

The screenshot shows the top part of a website for 'Lectures on Modern Scientific Programming 2024'. The header includes the event title and date: 'November 20, 2024 HUN-REN Wigner RCP Europe/Budapest timezone'. Below the header is a search bar with the text 'Enter your search terms'. A navigation menu on the left lists: Overview, Timetable, Contribution List, My Conference, My Contributions, Registration, Participant List, and Useful Information. The main content area starts with the title 'Lectures on Modern Scientific Programming 2024' and a paragraph: 'The Lectures on Modern Scientific Programming series will be organised by the Wigner Scientific Computing Laboratory (former GPU Laboratory) from November 20, 2008 for the 8th time at the HUN-REN Wigner Research Centre for Physics. An annually organized seminar series for university students and researchers. These lectures review topics relevant to everyone working on scientific simulations or high performance computing. The lectures will be a mixture of theoretical talks and hands-on sessions, which grants a perfect opportunity to adopt the collected theoretical knowledge. In 2024 the lectures will focus on Large Language Models and their application on physics and other relevant fields. The lectures are highly recommended to those who haven't got the chance to get to know the basics of these topics and their fields of usage. Invited performers will present these. For the earlier events see: 2023, 2022, 2019, 2018, 2017, 2016, 2015. Confirmed speakers: Natabara Máté Gyöngyösi (ELTE IK), Marcell Stippinger (HUN-REN Wigner RCP). The conference will be held offline form, therefore there are limited places to participate personally on-site. We encourage our former, current, and future partners to participate in the conference. More information is available on the website! Useful pieces of information for sponsors. Patrons of the Workshop: Péter Lévai (Wigner RCP, Member of HAS) and István Csabai (ELTE, Member of HAS). Organizers: Gergely Gábor Barnaföldi, Gábor Biro, Balázs Kevlaiovics.

The screenshot shows the top part of a website for 'Academia-Industry Matching Event (AIME24)'. The header includes the event title and date: 'Nov 21 – 22, 2024 Mercure Budapest Castle Hill Hotel Europe/Budapest timezone'. Below the header is a search bar with the text 'Enter your search terms'. A navigation menu on the left lists: Overview, Call for Abstracts, Timetable, Contribution List, Registration, Participant List, Venue, Organizers, and GDPR. The main content area starts with the title 'Academia-Industry Matching Event (AIME24)' and a paragraph: 'HUN-REN Wigner RCP, together with the HEPTECH Network, is organizing the next Academia-Industry Matching Event (AIME24) in the topics Artificial Intelligence, HPC and Quantum Computing. The aim of this event is to bring together Academic researchers and Industry experts to share ideas, potential applications, and foster collaborations in the field of theoretical and practical aspects of Artificial Intelligence, High Performance Computing (HPC) and Quantum Computing. Patron: Roland Jakab (HUN-REN, CEO), Charaf Hassan (BME, Rector). Confirmed keynote speakers: Matthew Schwartz (Harvard Univ.), Tibor Hóler (FusionNova Electric), Robert Izak (Riverlane LTD), Enrique Rico Ortega (CERN), Ernesto Bonomi (Grey Inc.), Arturo García (Barcelona Supercomputing Center). Contributions to the conference are welcome. Abstracts must contain a title shorter than 100 characters, the name and affiliation of the presenter and coauthors, and a maximum of 4000 characters of body text. Images should be sent separately from the text as the abstract will be reprocessed for display on the website. Talk submission deadline: November 15, 2024. The call for abstracts is open. Starts Nov 21, 2024, 8:00 AM. Ends Nov 22, 2024, 2:00 PM. Europe/Budapest. Mercure Budapest Castle Hill Hotel. H-1013 Budapest, Krisztina Kört 41-43. Tel: +36 1 488-810. Go to map.

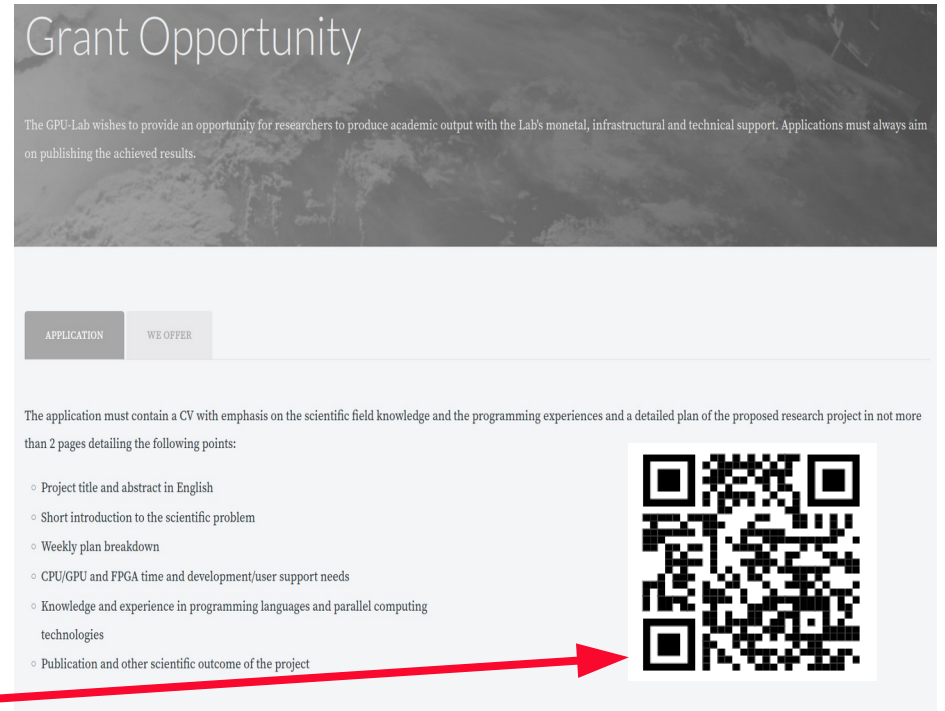
WSCLAB's FUTURE IS IN YOUR HAND

✓ What are the WSCLAB services

- Knowledge hub for scientific computing solutions
- Dedicated GPU & FPGA server hosting & services
- Quantum Computing simulations
- Tutorial series & teaching
- Advising highly-parallel computing
- PhD/PostDoc projects

✓ How to apply

- Visit wsclab.wigner.hu




Grant Opportunity

The GPU-Lab wishes to provide an opportunity for researchers to produce academic output with the Lab's monetal, infrastructural and technical support. Applications must always aim on publishing the achieved results.

APPLICATION WE OFFER

The application must contain a CV with emphasis on the scientific field knowledge and the programming experiences and a detailed plan of the proposed research project in not more than 2 pages detailing the following points:

- Project title and abstract in English
- Short introduction to the scientific problem
- Weekly plan breakdown
- CPU/GPU and FPGA time and development/user support needs
- Knowledge and experience in programming languages and parallel computing technologies
- Publication and other scientific outcome of the project



A red arrow points from the text 'How to apply' to the QR code.

WSCLAB's FUTURE

PLANS FOR THE FUTURE

✓ Short timescale

- New WSCLAB Grants for young scientists for 2024
- GPU Day 2024 series (30-31 May 2024)
- Lectures on Modern Computing in Science series (in fall 2024) on LLM in Science

✓ Intermediate timescale

- Further local HW developments & cloud solutions

✓ Long range plan

- Closely related to the EuroHPC LEVENTE project including Quantum Computing & Quantum simulations



HUN
REN



HUN-REN
Hungarian Research Network



HPC @hu
Kompetencia Központ



SILICON
computers

STREAM
High Performance Computing



Cerntech



IN2P3
INSTITUT NATIONAL DE PHYSIQUE NUCLÉAIRE
ET DE PHYSIQUE DES PARTICULES



<epam>



ELKH | Eötvös Loránd
Research Network

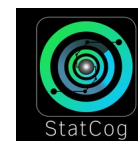


KHRONOS
GROUP
CONNECTING SOFTWARE TO SILICON

SZÉCHENYI 2020



UNIVERSITY OF
OXFORD





WSCLAB>_



WIGNER SCIENTIFIC COMPUTING LABORATORY





THX>_

