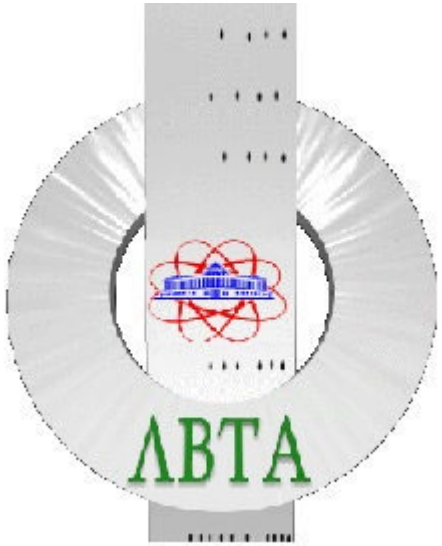
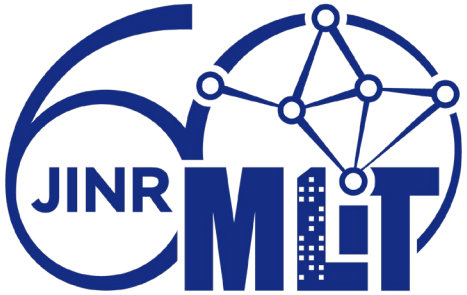


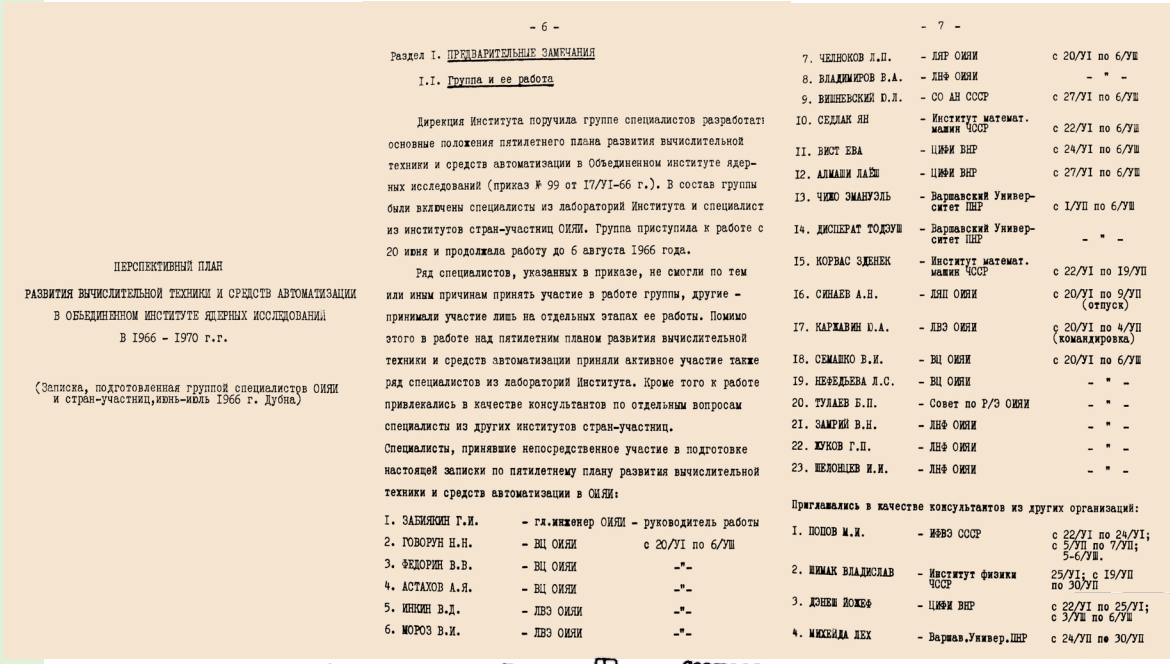


LCTA-MLIT 1966-2026

T.A. STRIZH

MESHCHERYAKOV LABORATORY OF INFORMATION TECHNOLOGIES, JINR

On June 1, 1966, two reports were presented at the evening session of the XX session of the JINR Scientific Council. The first one, "**On the preparation of the Computing Center for receiving the BESM-6 computer**," was made by JINR Chief Engineer for Computing Techniques and Electronics G.I. Zabiyakin, the second one, "**The JINR Directorate's proposal to create a Laboratory of Computing Techniques and Automation (LCTA)**," was presented by the JINR Vice Director Professor I.M. Ulegla.



ПЕРСПЕКТИВНЫЙ ПЛАН

РАЗВИТИЯ ВЫЧИСЛИТЕЛЬНОЙ ТЕХНИКИ И СРЕДСТВ АВТОМАТИЗАЦИИ В ОБЪЕДИНЕННОМ ИНСТИТУТЕ ЯДЕРНЫХ ИССЛЕДОВАНИЙ В 1966 - 1970 г.г.

(Записка, подготовленная группой специалистов ОИЯИ и стран-участниц, июнь-июль 1966 г. Дубна)

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Раздел I. ПРЕДВАРИТЕЛЬНЫЕ ЗАМЕЧАНИЯ

I.I. Группа и ее работа

Дирекция Института поручила группе специалистов разработать основные положения пятилетнего плана развития вычислительной техники и средств автоматизации в Объединенном институте ядерных исследований (приказ № 99 от I7/УI-66 г.). В состав группы были включены специалисты из лабораторий Института и специалист из институтов стран-участниц ОИЯИ. Группа приступила к работе с 20 июня и продолжала работу до 6 августа I966 года.

Ряд специалистов, указанных в приказе, не смогли по тем или иным причинам принять участие в работе группы, другие - принимали участие лишь на отдельных этапах ее работы. Помимо этого в работе над пятилетним планом развития вычислительной техники и средств автоматизации приняли активное участие также ряд специалистов из лабораторий Института. Кроме того к работе привлекались в качестве консультантов по отдельным вопросам специалисты из других институтов стран-участниц.

Специалисты, принявшие непосредственное участие в подготовке настоящей записки по пятилетнему плану развития вычислительной техники и средств автоматизации в ОИЯИ:

I.	ЗАБИЯКИН Г.И.	- гл.инженер ОИЯИ	- руководитель работы
2.	ГОВОРУН Н.Н.	- ВЦ ОИЯИ	с 20/УI по 6/УП
3.	ФЕДОРИН В.В.	- ВЦ ОИЯИ	-"-
4.	АСТАХОВ А.Я.	- ВЦ ОИЯИ	-"-
5.	ИНКИН В.Д.	- ЛВЭ ОИЯИ	-"-
6.	МОРОЗ В.И.	- ЛВЭ ОИЯИ	-"-

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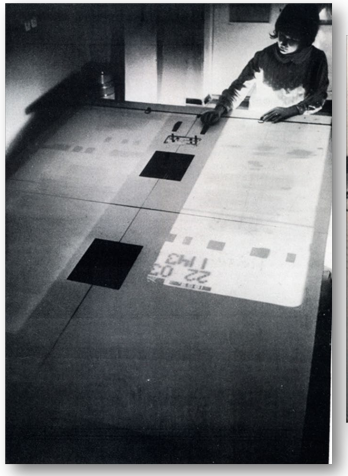
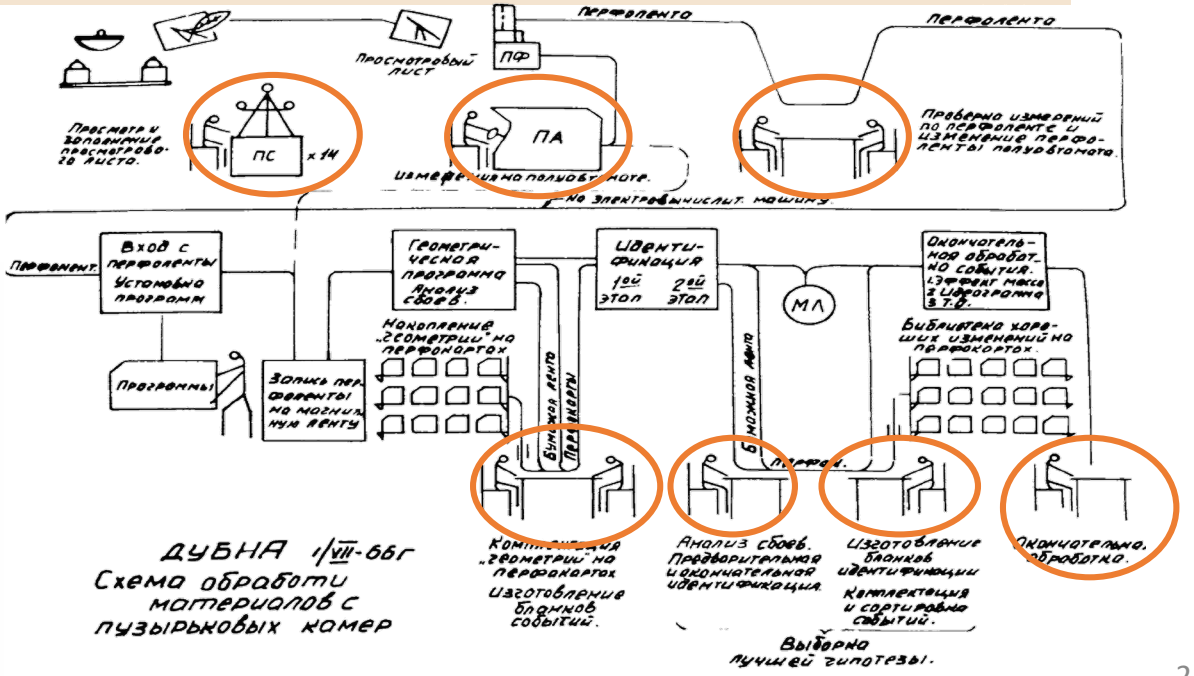
7.	ЧЕЛНОКОВ Л.П.	- ЛЯР ОИЯИ	с 20/УI по 6/УП
8.	ВЛАДИМИРОВ В.А.	- ЛНФ ОИЯИ	- " -
9.	ВИШНЕВСКИЙ Ю.Л.	- СО АН СССР	с 27/УI по 6/УП
I0.	СЕДЛАК ЯН	- Институт математ. машин ЧССР	с 22/УI по 6/УП
II.	ВИСТ ЕВА	- ЦИФИ ВНР	с 24/УI по 6/УП
I2.	АЛМАШИ ЛАЁШ	- ЦИФИ ВНР	с 27/УI по 6/УП
I3.	ЧИЖО ЭМАНУЭЛЬ	- Варшавский Университет ПНР	с I/УП по 6/УП
I4.	ДИСПЕКРАТ ТОДЗУШ	- Варшавский Университет ПНР	- " -
I5.	КОРВАС ЗДЕНЕК	- Институт математ. машин ЧССР	с 22/УI по I9/УП
I6.	СИНАЕВ А.Н.	- ЛЯП ОИЯИ	с 20/УI по 9/УП (отпуск)
I7.	КАРМАВИН Ю.А.	- ЛВЭ ОИЯИ	с 20/УI по 4/УП (командировка)
I8.	СЕМАШКО В.И.	- ВЦ ОИЯИ	с 20/УI по 6/УП
I9.	НЕФЕДЬЕВА Л.С.	- ВЦ ОИЯИ	- " -
20.	ТУЛАЕВ Б.П.	- Совет по Р/Э ОИЯИ	- " -
2I.	ЗАМРИЙ В.Н.	- ЛНФ ОИЯИ	- " -
22.	КУКОВ Г.П.	- ЛНФ ОИЯИ	- " -
23.	ШЕЛОНЦЕВ И.И.	- ЛНФ ОИЯИ	- " -

Приглашались в качестве консультантов из других организаций:

I.	ПОПОВ М.И.	- ИФВЭ СССР	с 22/УI по 24/УI; с 5/УП по 7/УП; 5-6/УШ.
2.	НИМАК ВЛАДИСЛАВ	- Институт физики ЧССР	25/УI; с I9/УП по 30/УП
3.	ЭДНЕИ ЙОЖЕФ	- ЦИФИ ВНР	с 22/УI по 25/УI; с 3/УП по 6/УП
4.	МИХЕЙДА ЛЕХ	- Варшав.Универ.ПНР	с 24/УП по 30/УП

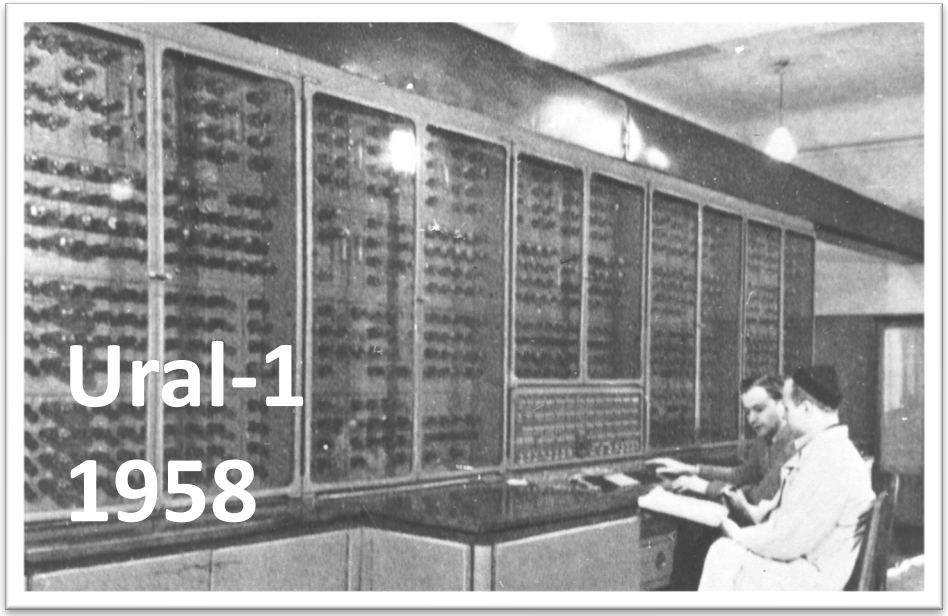
It is the performance of experimental information processing tools that will ultimately determine the “productivity” of physics research

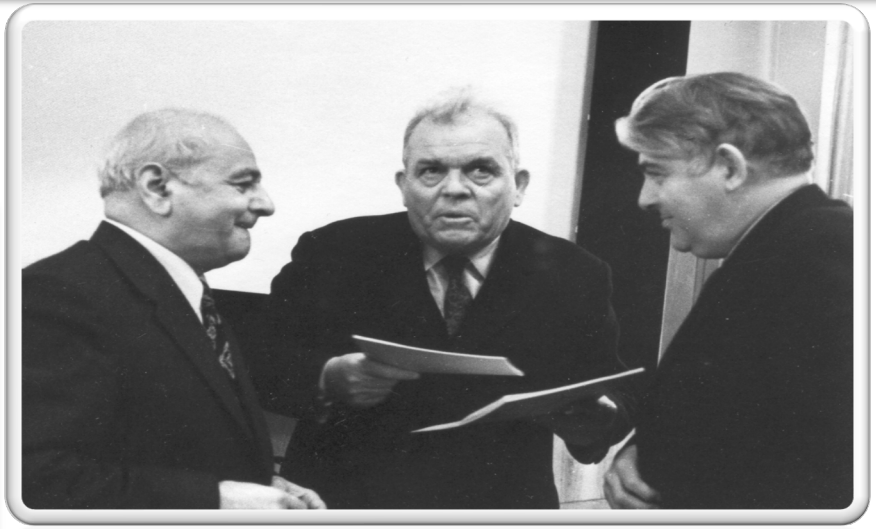


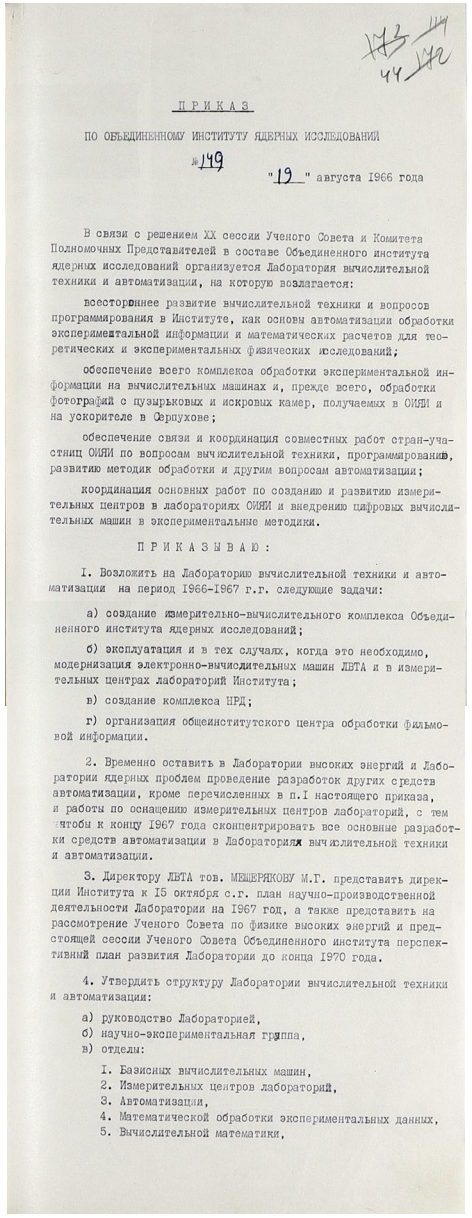


“On April 12, 1966, N.N. Bogolyubov invited me to start organizing a special Laboratory of Computing Techniques and Automation at our Institute, I was internally prepared for this: back in 1946, in New York, I was lucky enough to listen to lectures by Norbert Wiener himself, who proclaimed the creation of a new science - cybernetics, and in the early 50-th, already here, we had to equip the first Ural-1 computers at the Institute of Nuclear Problems. Nevertheless, I did not immediately agree to take up this case, but asked to wait 3-4 days for an answer. During this time, I have got support from the leadership of our State Committee (A.M. Petrosyants), and then from the decision-making body, with support for financing and building a laboratory at a modern level. After all this, I gave a positive response to N.N. Bogolyubov's proposal. I have always followed the saying “Not knowing where is the ford, do not dare crossing.”

M.G. Meshcheryakov







ПРИКАЗ

ПО ОБЪЕДИНЕННОМУ ИНСТИТУТУ ЯДЕРНЫХ ИССЛЕДОВАНИЙ

№149

"19" августа 1966 года

В связи с решением XX сессии Ученого Совета и Комитета Полномочных Представителей в составе Объединенного института ядерных исследований организуется Лаборатория вычислительной техники и автоматизации, на которую возлагается:

всестороннее развитие вычислительной техники и вопросов программирования в Институте, как основы автоматизации обработки экспериментальной информации и математических расчетов для теоретических и экспериментальных физических исследований;

обеспечение всего комплекса обработки экспериментальной информации на вычислительных машинах и, прежде всего, обработки фотографий с пузырьковых и искровых камер, получаемых в ОИЯИ и на ускорителе в Серпухове;

обеспечение связи и координация совместных работ стран-участниц ОИЯИ по вопросам вычислительной техники, программирования, развитию методик обработки и другим вопросам автоматизации;

координация основных работ по созданию и развитию измерительных центров в лабораториях ОИЯИ и внедрению цифровых вычислительных машин в экспериментальные методики.

ПРИКАЗЫВАЮ:

I. Возложить на Лабораторию вычислительной техники и автоматизации на период 1966-1967 г.г. следующие задачи:

а) создание измерительно-вычислительного комплекса Объединенного института ядерных исследований;

б) эксплуатация и в тех случаях, когда это необходимо, модернизация электронно-вычислительных машин ЛВТА и в измерительных центрах лабораторий Института;

в) создание комплекса НРД;

г) организация общеинститутского центра обработки фильмовой информации.

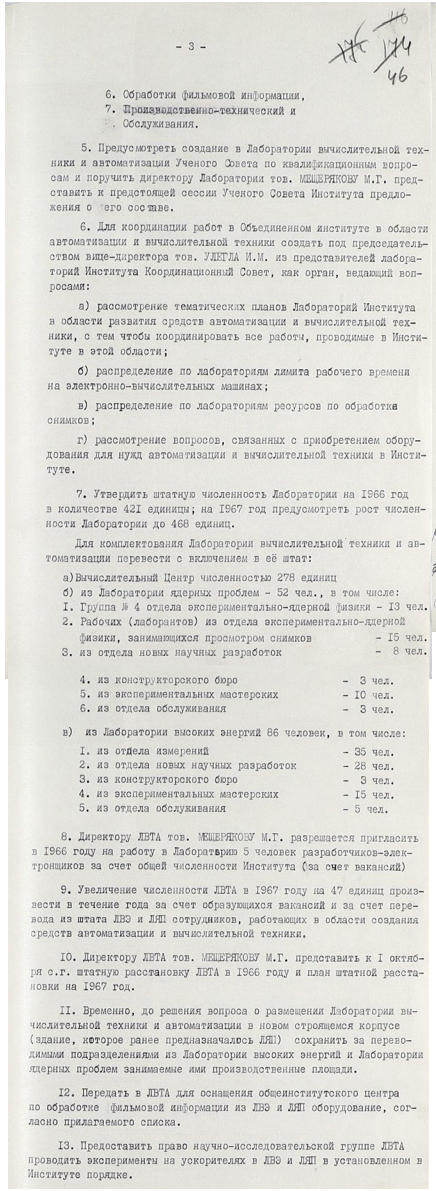
2. Временно оставить в Лаборатории высоких энергий и Лаборатории ядерных проблем проведение разработок других средств автоматизации, кроме перечисленных в п.I настоящего приказа, и работы по оснащению измерительных центров лабораторий, с тем чтобы к концу 1967 года сконцентрировать все основные разработки средств автоматизации в Лаборатории вычислительной техники и автоматизации.

3. Директору ЛВТА тов. МЕЩЕРЯКОВУ М.Г. представить дирекции Института к I5 октября с.г. план научно-производственной деятельности Лаборатории на 1967 год, а также представить на рассмотрение Ученого Совета по физике высоких энергий и предстоящей сессии Ученого Совета Объединенного института перспективный план развития Лаборатории до конца 1970 года.

4. Утвердить структуру Лаборатории вычислительной техники и автоматизации:

а) руководство Лабораторией,
б) научно-экспериментальная группа,
в) отделы:

I. Базисных вычислительных машин,
2. Измерительных центров лабораторий,
3. Автоматизации,
4. Математической обработки экспериментальных данных,
5. Вычислительной математики,



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6. Обработки фильмовой информации,
7. Производственно-технический и обслуживания.

5. Предусмотреть создание в Лаборатории вычислительной техники и автоматизации Ученого Совета по квалификационным вопросам и поручить директору Лаборатории тов. МЕЩЕРЯКОВУ М.Г. представить к предстоящей сессии Ученого Совета Института предложения о его составе.

6. Для координации работ в Объединенном институте в области автоматизации и вычислительной техники создать под председательством вице-директора тов. УЛЕТЛА И.М. из представителей лабораторий Института Координационный Совет, как орган, ведающий вопросами:

а) рассмотрение тематических планов Лабораторий Института в области развития средств автоматизации и вычислительной техники, с тем чтобы координировать все работы, проводимые в Институте в этой области;

б) распределение по лабораториям лимита рабочего времени на электронно-вычислительных машинах;

в) распределение по лабораториям ресурсов по обработке снимков;

г) рассмотрение вопросов, связанных с приобретением оборудования для нужд автоматизации и вычислительной техники в Институте.

7. Утвердить штатную численность Лаборатории на 1966 год в количестве 42I единицы; на 1967 год предусмотреть рост численности Лаборатории до 468 единиц.

Для комплектования Лаборатории вычислительной техники и автоматизации перевести с включением в её штат:

а) Вычислительный Центр численностью 278 единиц
б) из Лаборатории ядерных проблем - 52 чел., в том числе:
I. Группа № 4 отдела экспериментально-ядерной физики - I9 чел.
2. Рабочих (лаборантов) из отдела экспериментально-ядерной физики, занимающихся просмотром снимков - I5 чел.
3. из отдела новых научных разработок - 8 чел.
4. из конструкторского бюро - 3 чел.
5. из экспериментальных мастерских - I0 чел.
6. из отдела обслуживания - 3 чел.

в) из Лаборатории высоких энергий 86 человек, в том числе:
I. из отдела измерений - 35 чел.
2. из отдела новых научных разработок - 28 чел.
3. из конструкторского бюро - 3 чел.
4. из экспериментальных мастерских - I5 чел.
5. из отдела обслуживания - 5 чел.

8. Директору ЛВТА тов. МЕЩЕРЯКОВУ М.Г. разрешается пригласить в 1966 году на работу в Лабораторию 5 человек разработчиков-электронщиков за счет общей численности Института (за счет вакансий)

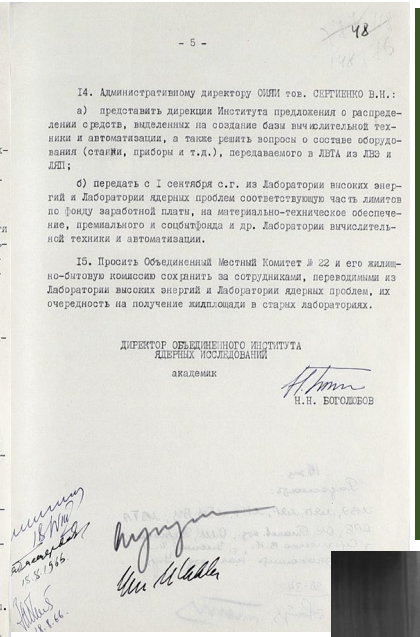
9. Увеличение численности ЛВТА в 1967 году на 47 единиц произвести в течение года за счет образующихся вакансий и за счет перевода из штата ЛВЭ и ЛЯП сотрудников, работающих в области создания средств автоматизации и вычислительной техники.

I0. Директору ЛВТА тов. МЕЩЕРЯКОВУ М.Г. представить к I октября с.г. штатную расстановку ЛВТА в 1966 году и план штатной расстановки на 1967 год.

II. Временно, до решения вопроса о размещении Лаборатории вычислительной техники и автоматизации в новом строящемся корпусе (здание, которое ранее предназначалось ЛЯП) сохранить за переводимыми подразделениями из Лаборатории высоких энергий и Лаборатории ядерных проблем занимаемые ими производственные площади.

I2. Передать в ЛВТА для оснащения общеинститутского центра по обработке фильмовой информации из ЛВЭ и ЛЯП оборудование, согласно прилагаемого списка.

I3. Предоставить право научно-исследовательской группе ЛВТА проводить эксперименты на ускорителях в ЛВЭ и ЛЯП в установленном в Институте порядке.



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I4. Административному директору ОИЯИ тов. СКРИПЧЕНКО В.Н.:

а) представить дирекции Института предложения о распределении средств, выделенных на создание базы вычислительной техники и автоматизации, а также решить вопрос о составе оборудования (станки, приборы и т.д.), передаваемого в ЛВТА из ЛВЭ и ЛЯП;

б) передать с I сентября с.г. из Лаборатории высоких энергий и Лаборатории ядерных проблем соответствующую часть лимитов по фонду заработной платы, на материально-техническое обеспечение, премиального и соцфонда и др. Лаборатории вычислительной техники и автоматизации.

I5. Просить Объединенный Местный Комитет № 22 и его жилищно-бытовую комиссию сохранить за сотрудниками, переводимыми из Лаборатории высоких энергий и Лаборатории ядерных проблем, их очередность на получение жилплощади в старых лабораториях.

ДИРЕКТОР ОБЪЕДИНЕННОГО ИНСТИТУТА
ЯДЕРНЫХ ИССЛЕДОВАНИЙ
академик
Н.Н. БОГОЛЮБОВ

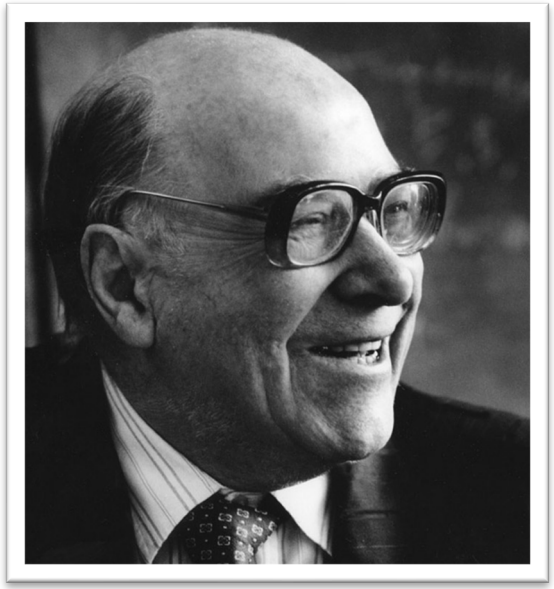
The issue of the management of the new laboratory and personnel is highly important and fundamental. Since the new Laboratory is designed to drastically change the situation with the processing of scientific information coming from experimental facilities, its activities should be closely linked to the scientific activities of our experimental laboratories, it should feel their "breath".

M.G. Meshcheryakov
Corresponding Member of the USSR Academy of Sciences, the first director of the Laboratory (1966–1988)

N.N. Govorun
Corresponding Member of the USSR Academy of Sciences, Deputy Director of the Laboratory (1966–1988), director of the Laboratory (1988–1989)

G.I. Zabiyakin
Deputy Director of the Laboratory (1966-1972)

LCTA's think tank was a group of mathematicians, organized on the initiative of Academician N.N. Bogolyubov in the late 50s at the LTP under the leadership of Professor E.P. Zhidkov



E.P. Zhidkov

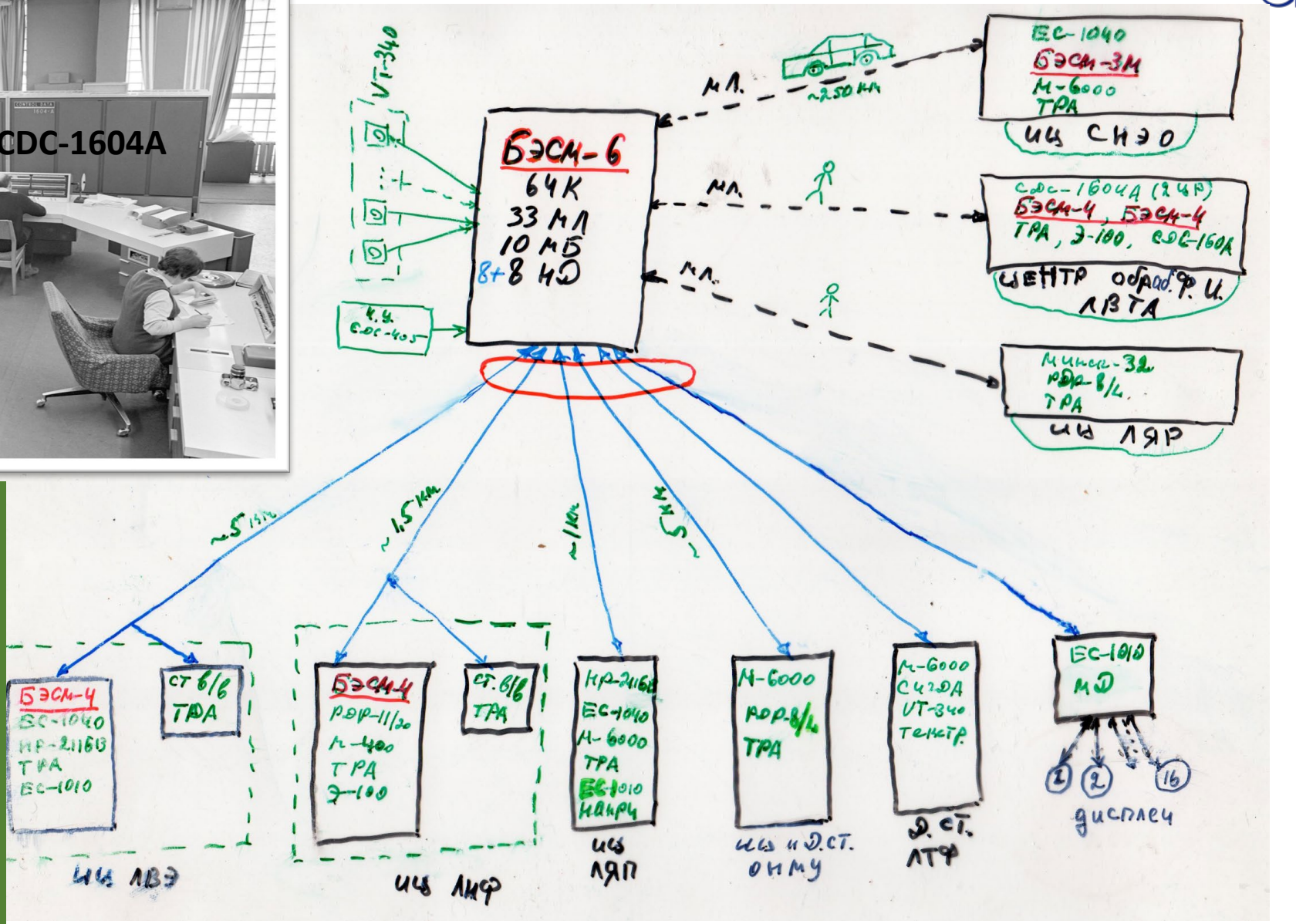
The year 1967 brought significant success in solving the most important task of creating a powerful physics data processing center. The main rooms are ready in the Laboratory, and the main components of the BESM-6 high-performance machine are received and installed. This machine is one of the largest computers produced in the Institute's Member States.

After 22 years of successful operation at LCTA for JINR users, BESM-6 was decommissioned and dismounted.

The creation of a translator from the FORTRAN language, the «Dubna» monitoring system, which was distributed to all BESM-6 machines in the USSR and abroad (in the GDR, India, etc.), and the «Dubna» operating system at BESM-6 were the most prominent example of the fulfillment of the tasks listed in the order on the establishment of LCTA.

In 1969, the JINR Prize was awarded to the work "The BESM-6 Mathematical Support System with a Fortran translator"

To radically solve the task of the fastest implementation of progressive programs in the FORTRAN language and to provide our computing center with peripheral equipment, the directorate decided to purchase a mid-range CDC-1604A machine. The BESM-6 communication project with the BESM-4 and CDC-1604A, as well as with external computers, fundamentally solved the problem of the operation of BESM-6, BESM-4 and CDC-1604A in the single measuring and computing complex.

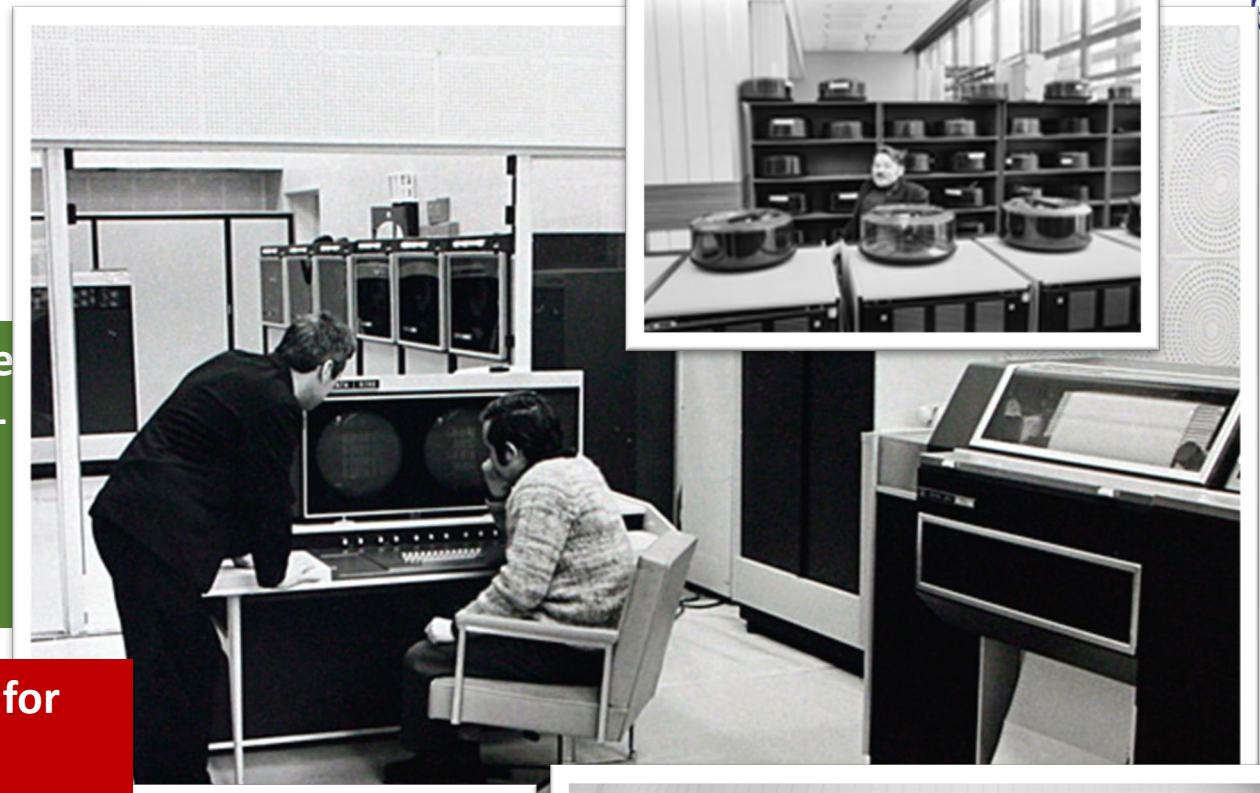


JINR computing center in 1968.
Transparency for the overhead from the report of N.N. Govorun

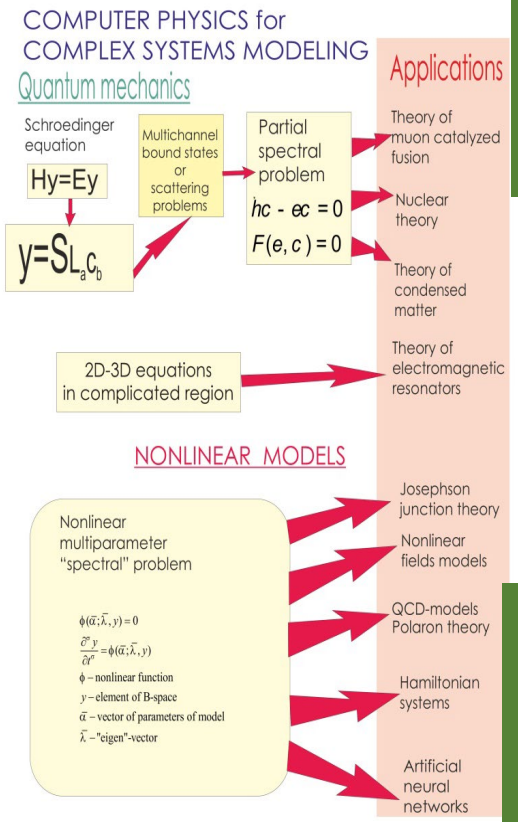
Hundreds of users... BESM-6 is not enough, one needs to buy new ones...
JINR cooperates with CERN and computers of the same type as those at CERN are more preferable

In 1972, the Central Computer Complex was supplemented with the CDC-6200 computer (later upgraded to the dual-processor CDC-6500, equipped with remote terminals in 1976). The complex's productivity increased to 3 million operations/sec

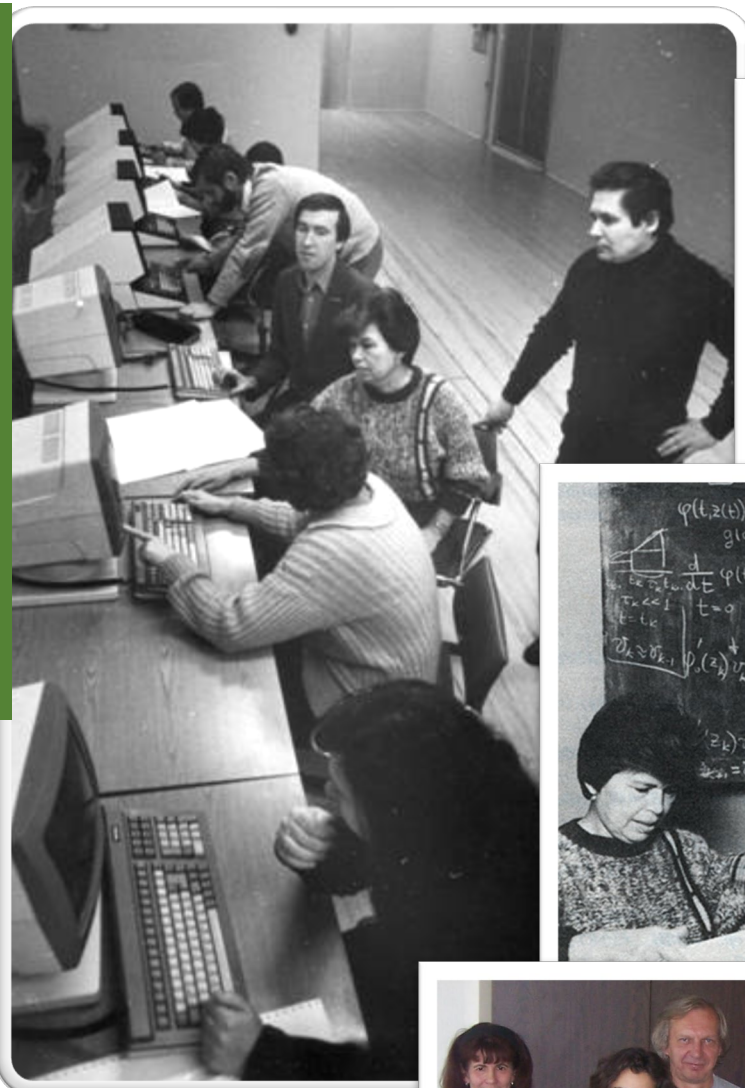
CDC-6500 successfully operated at LCTA for JINR users for 22 years. CDC-6500 was decommissioned in 1995

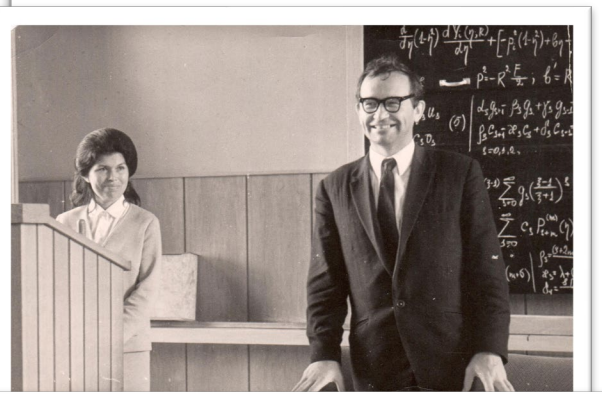


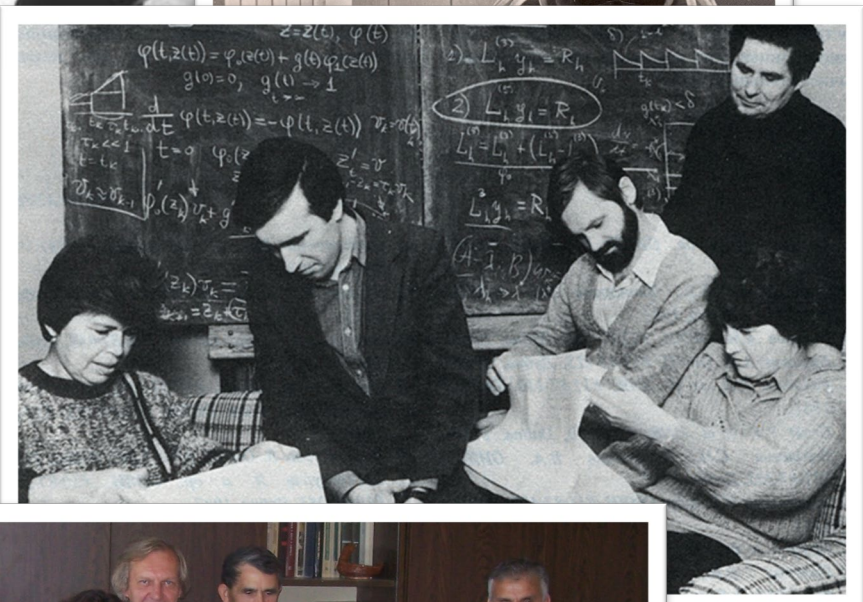
I.V. Puzynin



At the Laboratory, under the supervision of Professor I.V. Puzynin, a scientific direction on the creation, theoretical justification and practical implementation of computational physics methods for the numerical study of nonlinear multiparametric models of complex physical systems was developed.

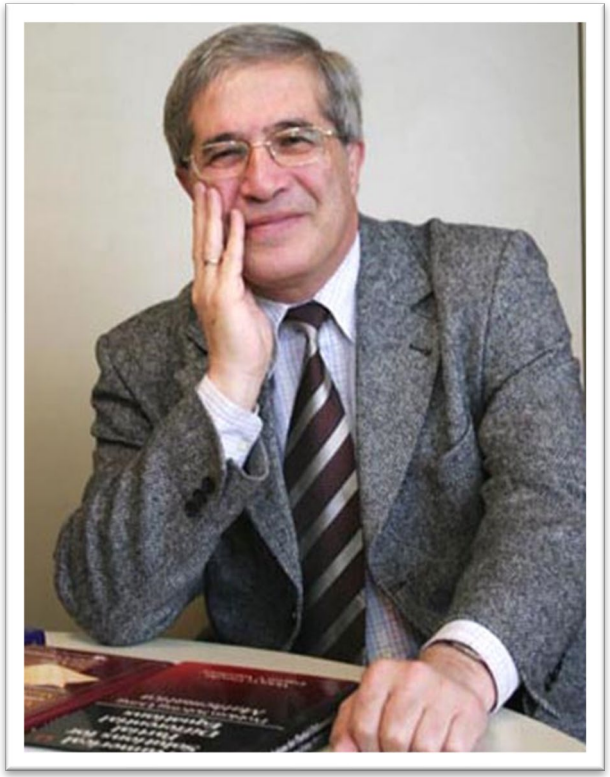






The most important contribution to this field is the development of a unified approach for the numerical analysis of nonlinear spectral problems based on a generalized continuous analogue of Newton's method.

Due to the development of this approach, a number of important physics results have been obtained in the theory of muon catalysis, nuclear theory, and nonlinear problems of quantum chromodynamics and condensed matter physics.



V.P. Gerdt

Research in the field of computer algebra and analytical computing was one of the brightest examples of LCTA's activities. Vladimir Gerdt was one of the first to start using computer algebra in the USSR in the 70th. This activity was supported by Academician Dmitry Shirkov and Professor Nikolay Govorun.

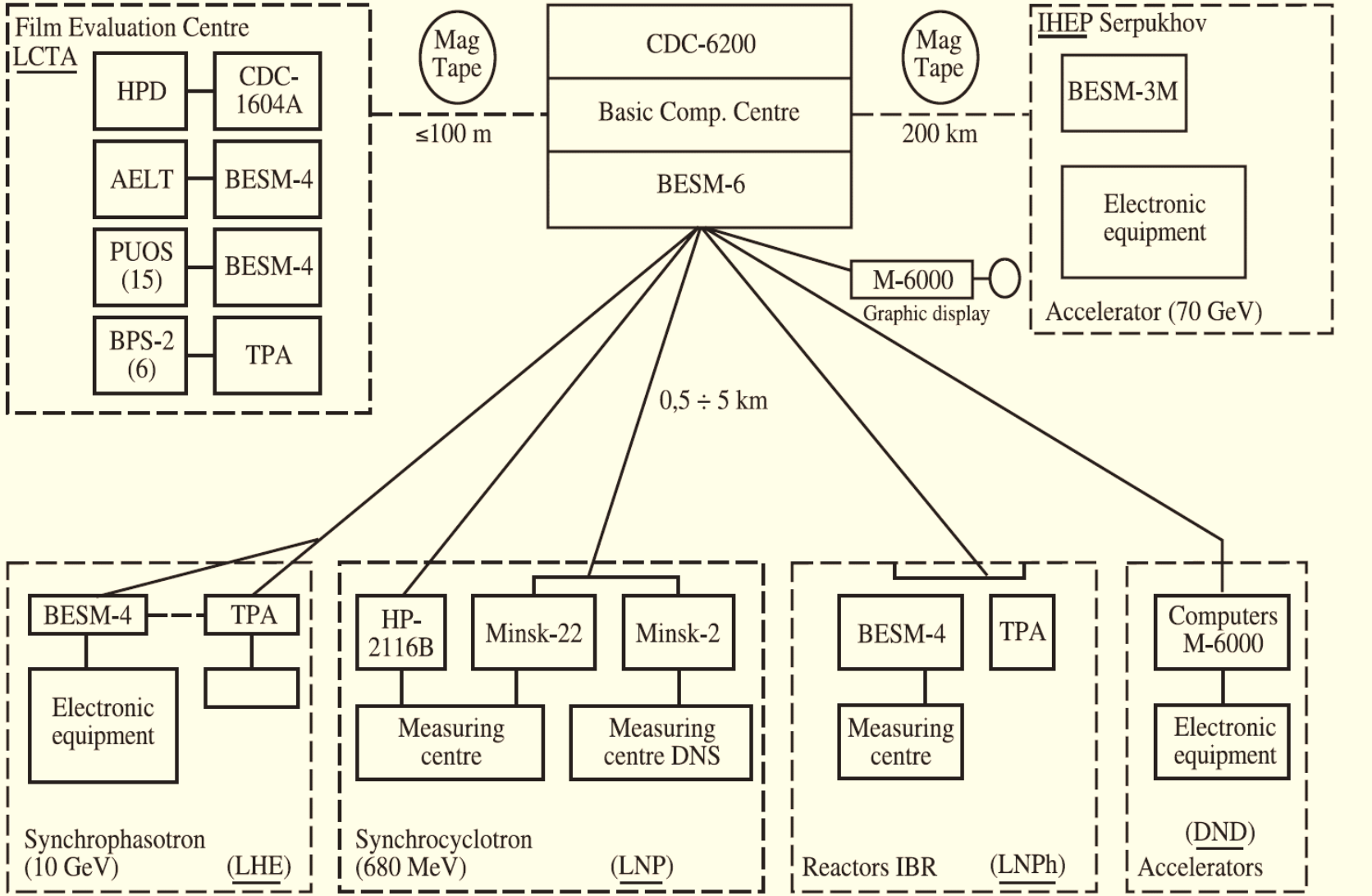
Under the leadership of V.P. Gerdt, the era of development and improvement of analytical computing on computers began. The introduction of analytical computing and the provision of maintenance and development of such computer algebra packages as Maple, Mathematica, Reduce, Form were becoming one of the most important areas in the activities of the Computational Mathematics Department.

CDC-6500 was powerful enough for the implementation of the universal computer algebra systems such as REDUCE and SCHOONSHIP (1975).

These works are still ongoing at the MLIT Algebraic and Quantum Computing Department

It was necessary to ensure inter-machine operation both in remote batch processing mode and in interactive mode

Cable lines for 500 Kbytes/s and at a distance of up to 7 km were laid from the LCTA to all the main physics divisions of the Institute, which had their own measuring centers and computers connected with the installations.

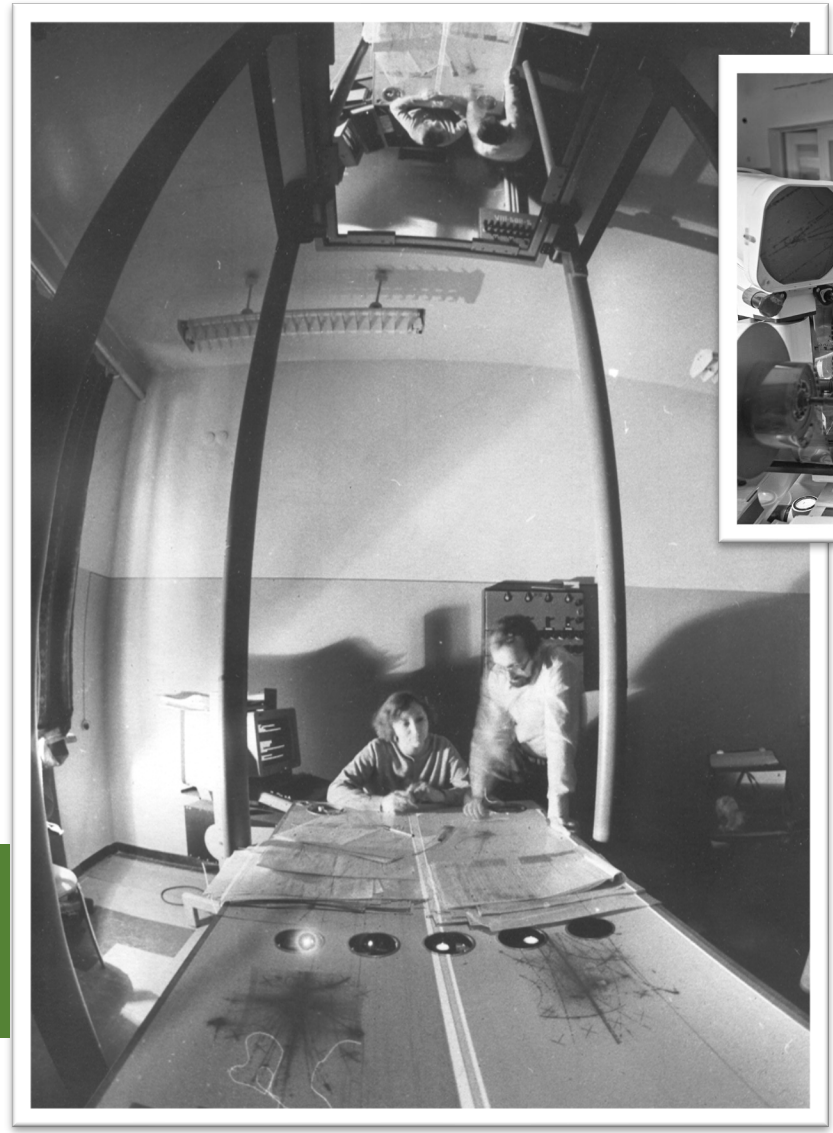


What happened back in the early 70s, just 3-4 years after BESM-6 was commissioned at the Institute, is shown in the picture

In high-energy physics research in the 60s and 70s, studying the interactions of accelerated particles with matter using bubble and other optical tracking chambers played an important role.

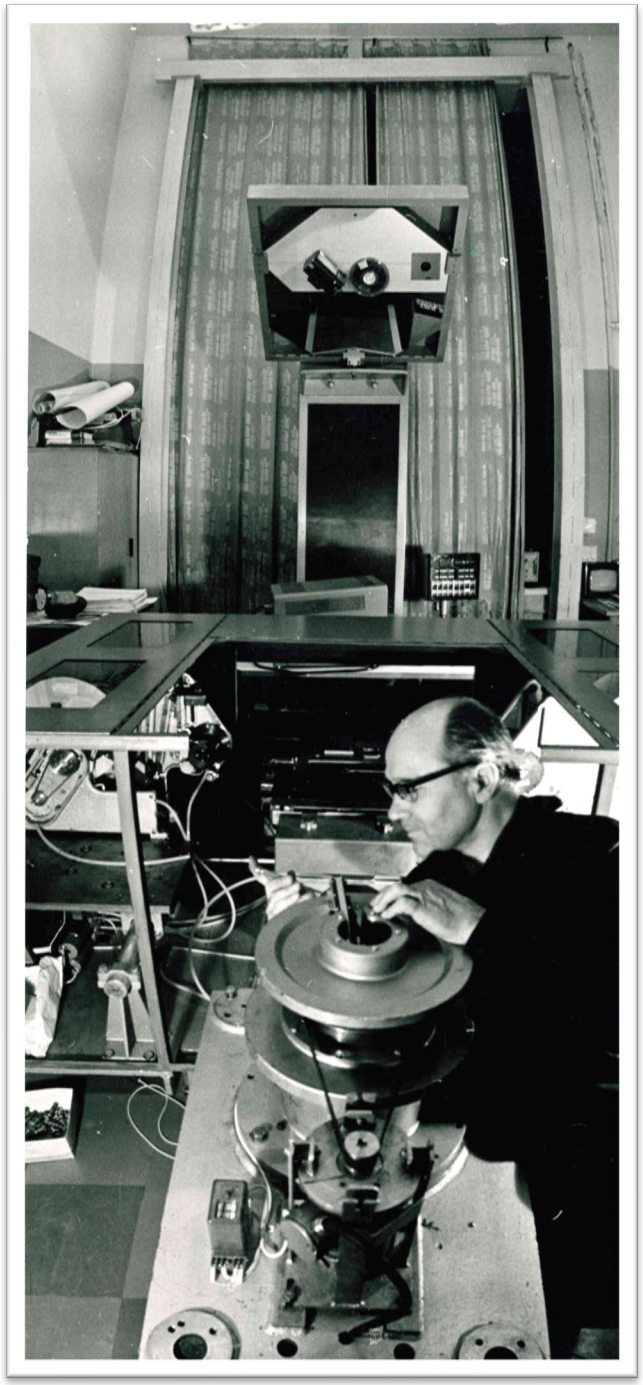
To study the patterns of physical processes occurring during such particle collisions, it is required to measure manually tens and hundreds of thousands of photographs.

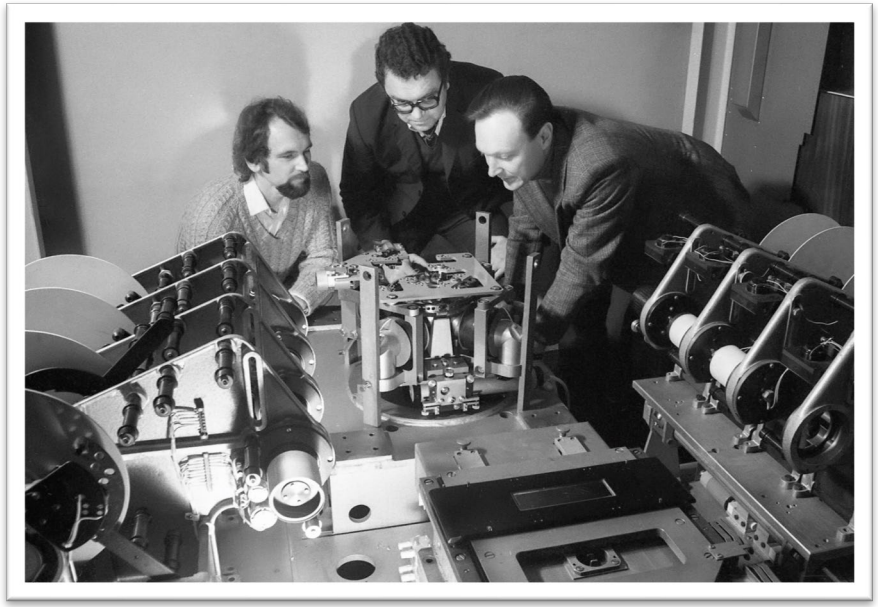
It was natural to think about automating such complex and repetitive processing processes



The automation of chamber image processing at LCTA was carried out simultaneously in several areas, mainly in the Automation Department under the leadership of Y.A. Karzhavin. To process the photographs obtained with JINR track chambers, and subsequently the chambers of some other institutes, a Film Information Processing Department was established at LCTA under the leadership of V.I. Moroz.

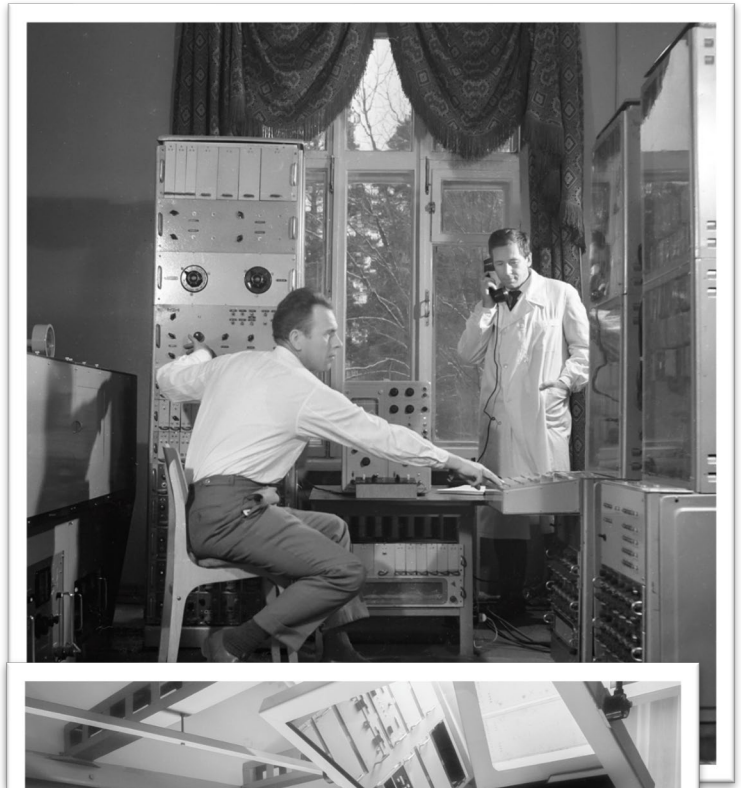
Since the first years of its creation, the Laboratory has been developing and creating automatic and semi-automatic devices for processing film images: automatic mechanical scanning HPD (Hough P.V.C. and Powell B.W. Device), a high-speed precision instrument for measuring photographs from bubble chambers on the CDC1604A line (electronic components developed at LCTA under the leadership of Yu.A. Karzhavin) and with a capacity of 180-300 thousand events per year

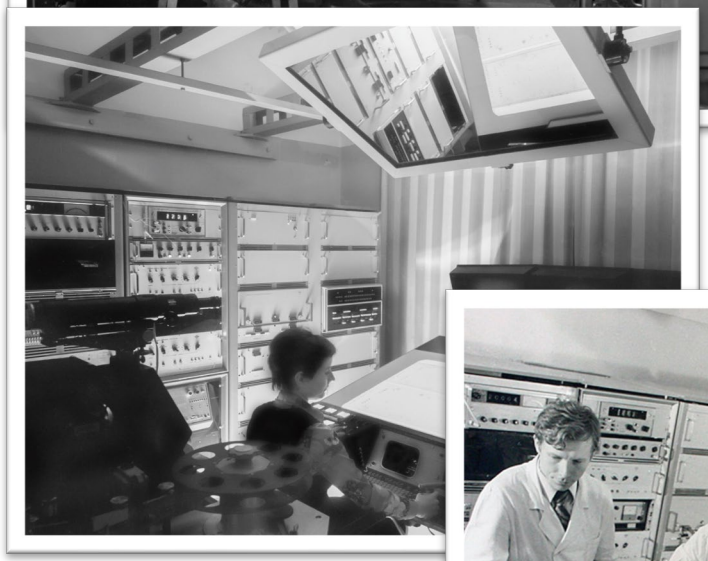


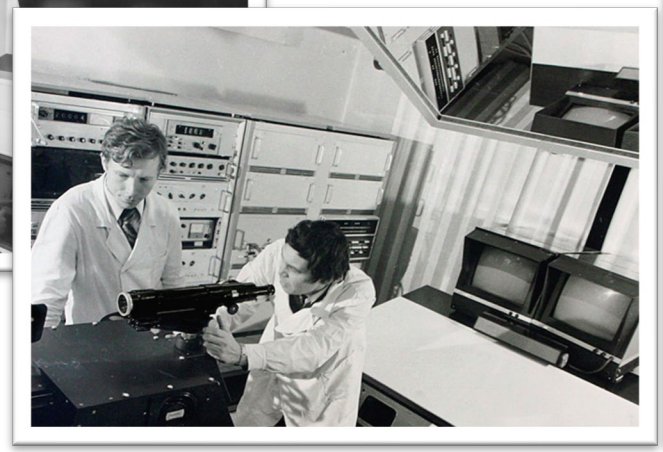


On the initiative of M.G. Meshcheryakov, the Laboratory began developing a series of automatic machines for processing photographs from bubble chambers. While visiting a number of institutes in the USA, M.G. got acquainted with the Laboratory of L. Alvarez. He was particularly interested in the development of a special scanning device called the "Spiral Reader". Alvarez presented him with a general view drawing of the main assembly of this scanning device, the so-called periscope, and a group to develop such a setup at LCTA was organized under the leadership of Professor R. Pose and V. Kotov

The first mass measurements of images began in 1974, after which there followed the continuous modernization of the device, improvement of its mathematical support, work on connecting it to BESM-6, CDC-6500 and mass measurement of images from the RISK spectrometer and other devices until the end of the 80s.

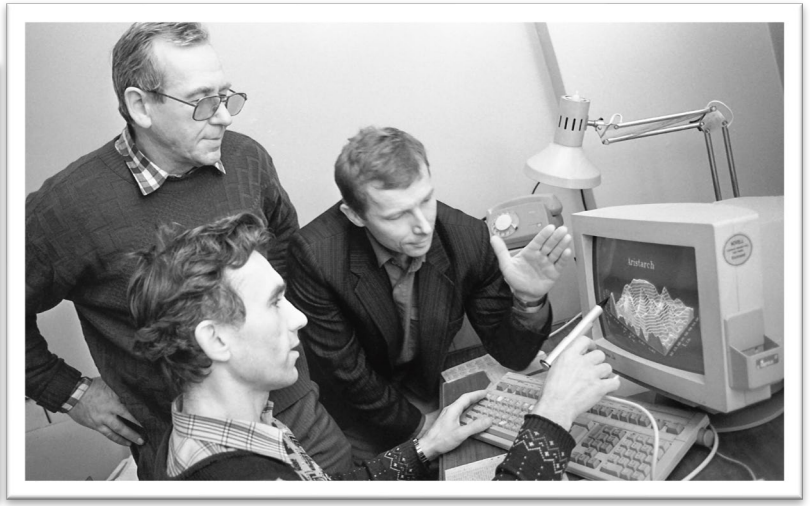




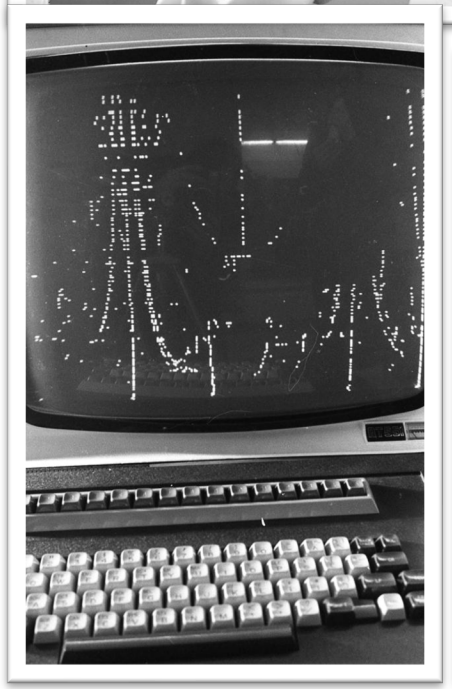


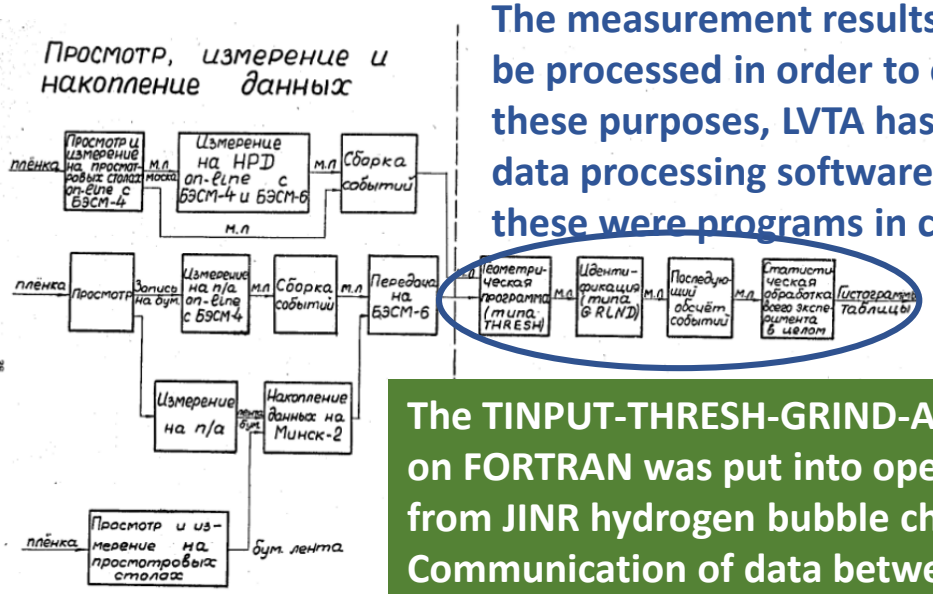
The next device was a cathode-ray tube scanning machine (AELT), characterized by an electronic method of reading information from images, designed to view and measure tracks in images from spark chambers connected to BESM-4 computer (head of work V.N. Shkundenkov) and with a three-shift work capacity of about 3 million images per year.

The next version of the AELT-2/160 was used not only for measuring film images, but also in applied research, for example, a number of software packages were created and photo processing was organized on the AELT-2/160 scanning system for measuring fundus vessels and tumor formations in eye cells. The AELT-2/160 scanning machine created at LCTA JINR was used for processing black-and-white films, as well as color films



Much attention was paid to the creation of effective tools for human-computer communication, in particular, for human-computer dialogue using on-screen consoles developed on the basis of cathode ray tubes (displays). Several types of graphic displays developed in the Laboratory for both mid-range and small computers have been put into production. The displays had high technical parameters and modern design. They have found application not only in the Joint Institute, but also in a number of institutes of the Member States.





The measurement results of the film information must be processed in order to obtain real physics results. For these purposes, LVTA has been developing experimental data processing software systems. In the beginning, these were programs in computer codes.

Next step - programs such as GRIND, SLICE and SUMX in ALGOL for BESM-4

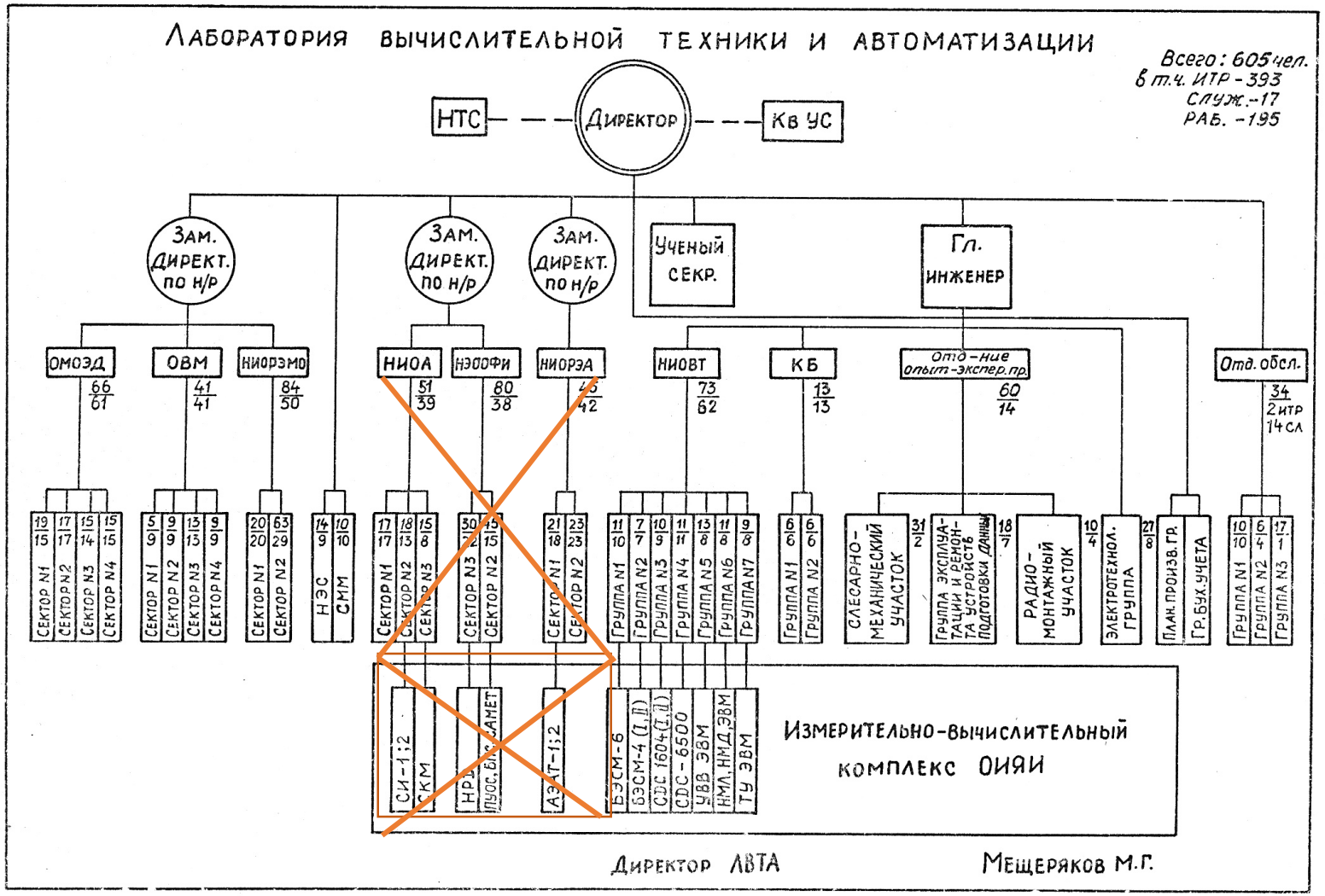
The TINPUT-THRESH-GRIND-AUTOGR-SLICE-SUMX software chain on FORTRAN was put into operation to process film information from JINR hydrogen bubble chambers on the BESM-6 computer. Communication of data between the programs goes via magnetic tape.

In 1972 a system called HYDRA was put in operation as a framework for new bubble chamber program. Its purpose was to provide data modularity and program modularity

In 1997, after 20 years of using old programs and with the development of computing technology, it was time to rethink approaches to processing large amounts of data, and the old one was replaced by an object-oriented approach and ROOT (Rapid Object-Oriented Technology) was born.

The "Collection of Libraries of ProgrRams and software complexes" was awarded with gold, silver and bronze medals of the VDNKH of the USSR. The team that prepared a number of library programs under the leadership of N.N. Govorun included V.P. Shirikov, R.N. Fedorova, L.S. Nefedieva received the USSR Council of Ministers Award in 1986.

Film-based information was replaced by a filmless one, and the main work on automating the processing of photographs was completed in 1993 and the created installations were transferred for operation to the Film Information Processing Department, which was closed at the end of 1996. The closure of these departments led to a reduction in full-time staff, which decreased to 365 people in 1997.

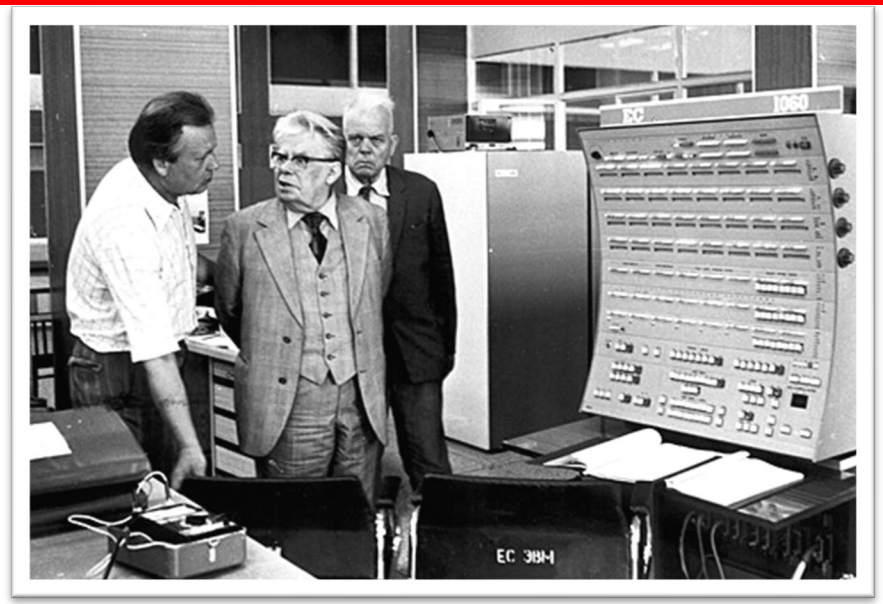


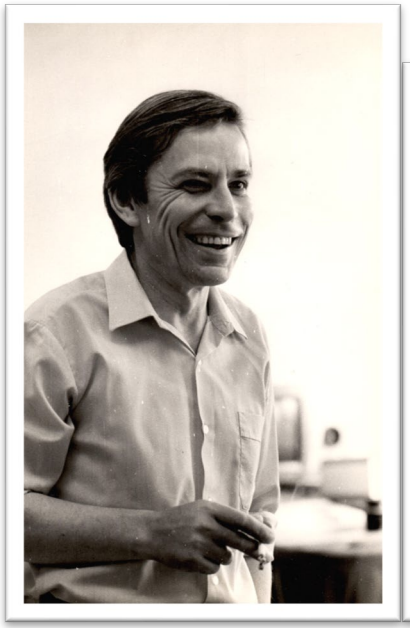
ES Computers Family

1981: Commissioning of a single series of computers – ES-1060, ES-1061. Connection of end-terminal devices to all JINR base computers (Intercom and TERM subsystem).

1989: Commissioning of the ES-1037, ES-1066 computers, organization of a multi-machine complex of ES computers based on shared disk memory.

In the second half of 1996, all ES machines were decommissioned.





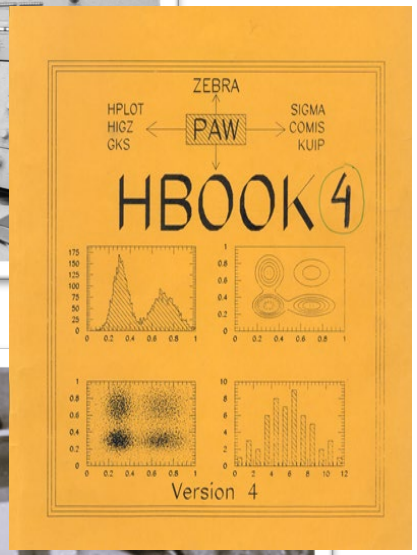
1985: The first institute-wide terminal network JINET (Joint Institute Network) has been commissioned. The software for the network equipment for the JINR local area network was fully developed at LCTA under the supervision of Professor V.P. Shirikov.

The reason for the network's own software development was the most prosaic: : it was possible to order its manufacture by one of the Western companies for several hundred thousand dollars, and that's when N.N. Govorun appealed to the professional pride of his team: "Money is tight, time is running out, can't we do it ourselves?!"

V.P. Shirikov

1986: Mass acquisition of personal computers “Pravetz-2”, compatible with IBM PC/XT; PC inclusion in JINET

1987: The organization of a parallel to JINET and its associated high-speed ETHERNET network (up to 10 MB/s) begun. The JINET become a member of the international computer network.



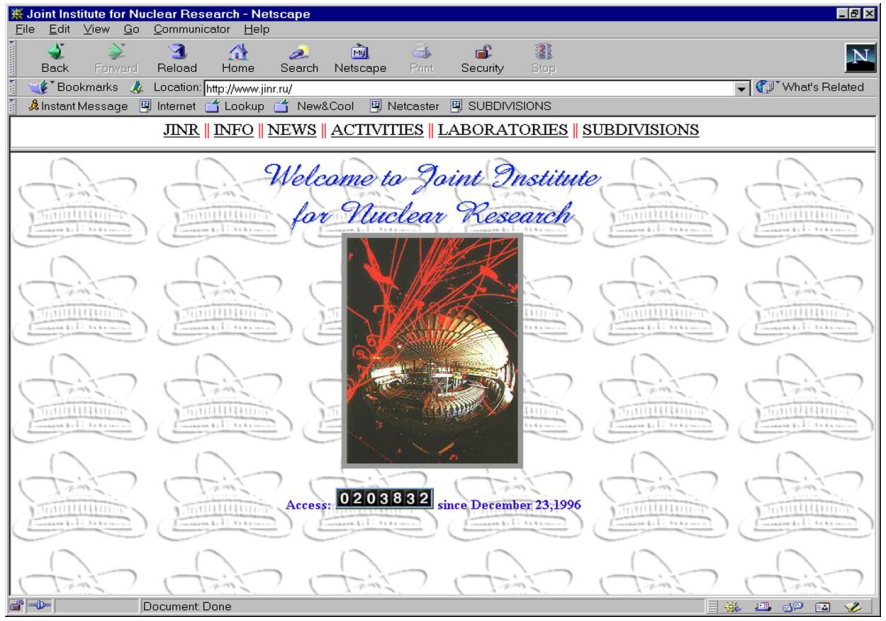
Film-based information was replaced by a filmless method of information registration.
This required the development of computer technology and appropriate mathematical support for using computers connected to experimental physics installations.

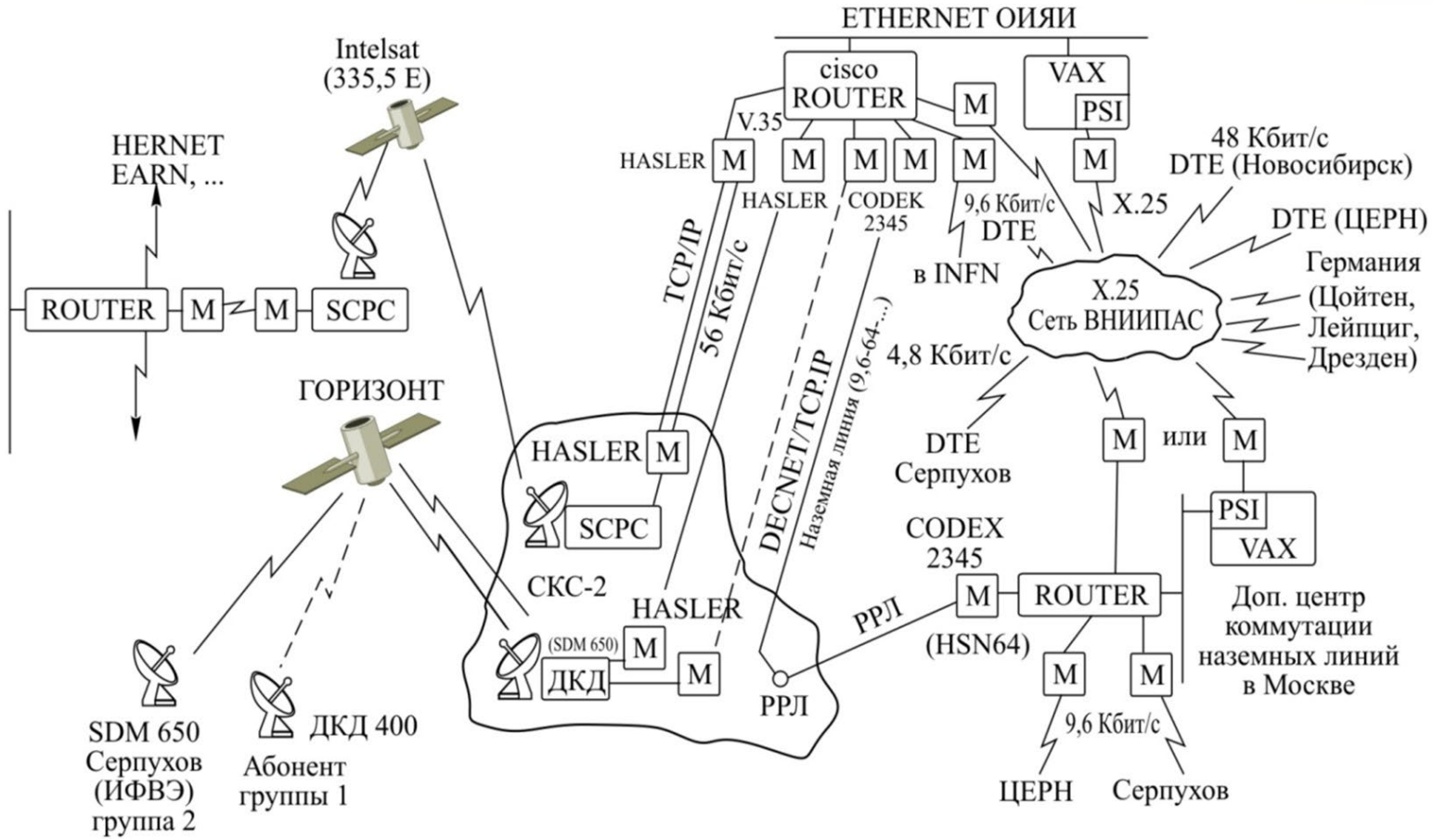
I.M. Ivanchenko's group at LCTA has developed a large set of programs to ensure the operation of various experimental installations connected to a computer. This complex includes programs for monitoring the equipment and accumulating information in real time, programs for finding parameters of an experimental installation, etc. and is applicable to a whole class of experiments conducted using equipment on-line.

An important stage of the work was associated with the experiments on joint JINR-CERN NA-4 experiment, I.M. Ivanchenko's group installed a software system on CDC-6500, developed jointly with staff at the CERN Data Processing Department. The system includes all the mathematical software of the NA-4 experiment necessary for data processing at JINR (HBOOK, ZBOOK, FFREAD, LINTRA programs).

1992 – 1996 Implementation of the scheme for connecting JINR's local network and cooperating organizations to the Western HEPNET (High Energy Physics NETwork) using satellite communications

1987 – the JINET network is connected to an international computer network using the X.25 protocol (2 hours/day)

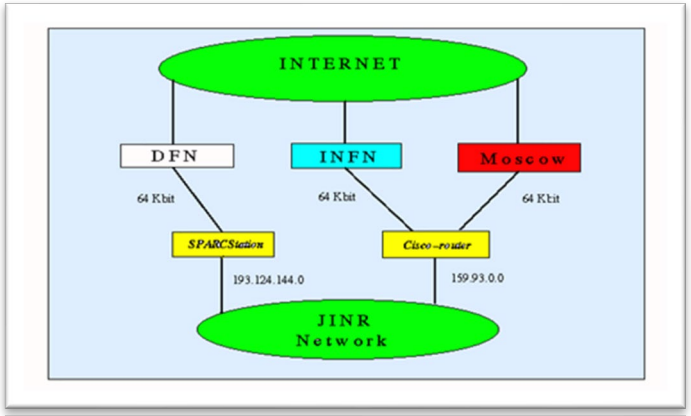


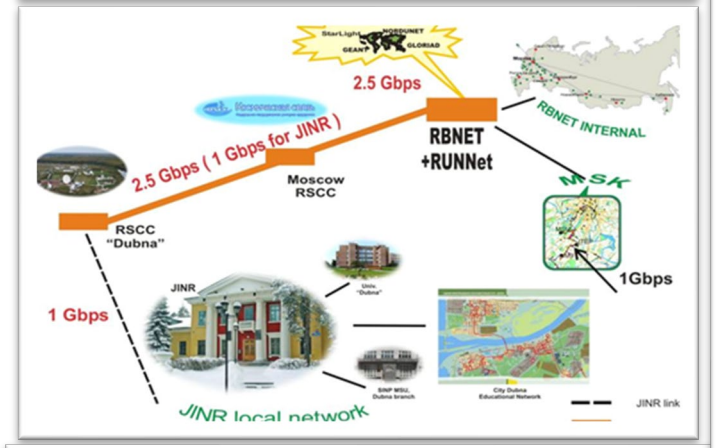


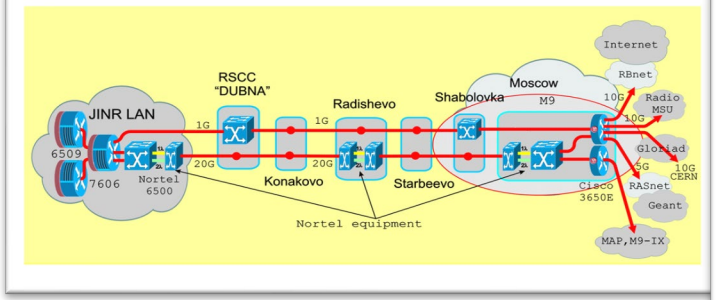
Work on the organization of terrestrial and two satellite communication channels via the TCP/IP protocol of the JINR local network with global networks and on the introduction of the first WWW servers begun. 1200 computers were connected to the network.

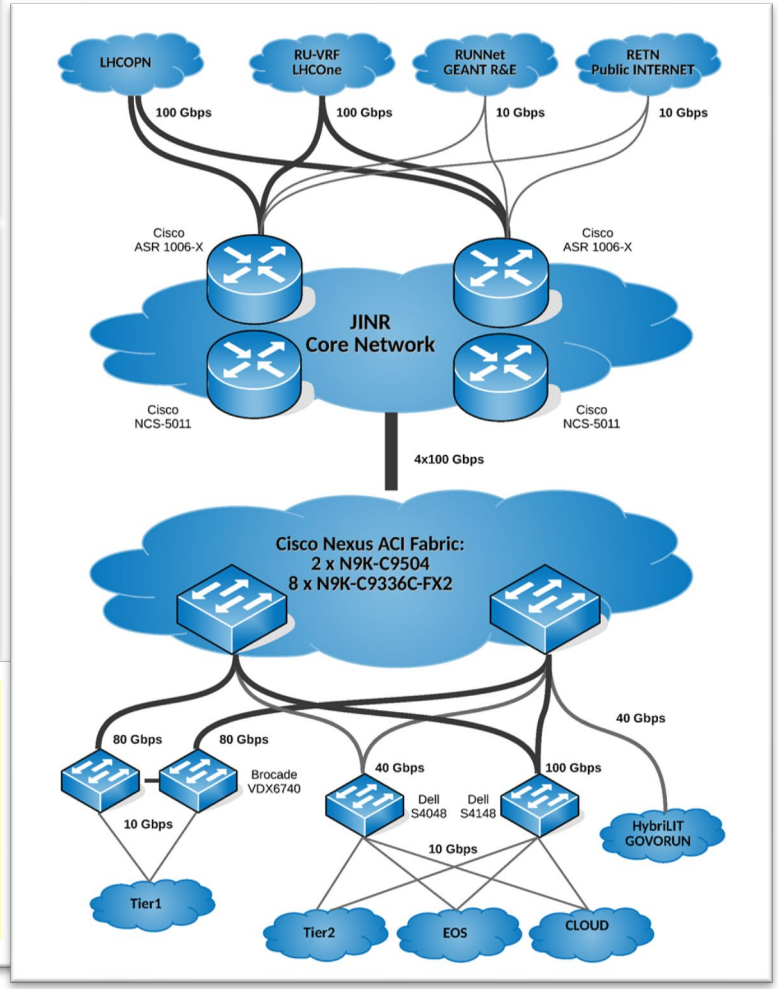
JINR's telecommunication channels step by step

1992 – 64 Kbit/s satellite communication channel with the HEPNET network node in Italy
1994 – 64 Kbit/s satellite communication channel with the DFN network node in Germany
1995 – 128 Kbit/s terrestrial communication channel with the INTERNET node in Moscow
1997 – 2 Mbit/s optical communication channel JINR-CCS Dubna-Shabolovka-M9
2001 – implementation of the Dubna-Moscow ATM communication channel project with a capacity of 622 Mbit/s (155 Mbit/s for JINR)









2002 – JINR satellite channel Dubna - Alushta (the first channel in Crimea)
2005 – implementation of the Dubna-Moscow communication channel with a capacity of 2.48 Gbit/s (1 Gbit/s for JINR)
2008 – JINR's telecommunication channels 10 Gbit/s
2009 – implementation of the Moscow-Dubna communication channel project based on DWDM technology (20 Gbit/s)
2014 – redundant dedicated channel at CERN for Tier1 in Russia (together with RSC KI) 10 Gbit/s
2016 – JINR's telecommunication channels 100 Gbit/s
2019 – JINR's telecommunication channels 3*100 Gbit/s
Direct channel JINR-CERN 100 Gbit/s (LHCOPN)
2022 – JINR's telecommunication channels 4*100 Gbit/s
Direct channel JINR-CERN 2*100 Gbit/s(LHCOPN)

1989: Commissioning of a cluster of VAX-8350 machines

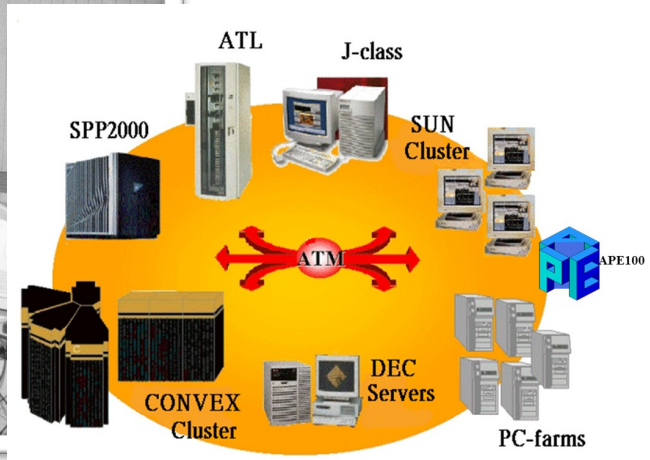
1995: CONVEX family superminicomputers (C-120, C-220). Decommissioned - 2003

1996: Commissioning of the DEC ALPHA 2100 base server for the JINR Interinstitutional Information Center under the BAFIZ project with open network access via WWW.

1998: Commissioning of the C3840 multiprocessor vector system. Decommissioned - 2003

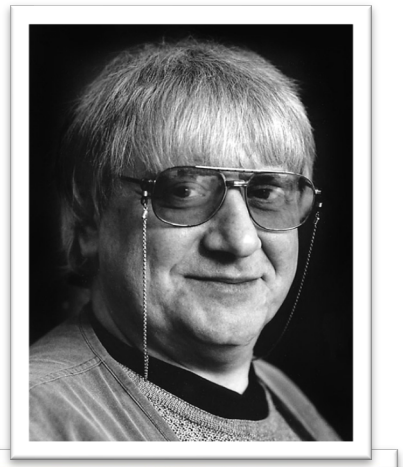
1997: Creation of a specialized distributed SUN cluster for the LHC CMS experiment at JINR

1998: Creation of the JINR high-performance computing center based on the HP Exemplar SPP-2000 massively parallel system and the ATL2640 mass memory system on DLT tapes with a capacity of 10.56 TB and a 10 TB mass memory system



2000 - Reorganization of LCTA into LIT

Development of computer technology and programming issues		Organization and development of high-speed telecommunication channels, reliable, secure and high-speed local area network, distributed, high-performance computing infrastructure of JINR and its Member States
Providing the processing of experimental information on a computer and, above all, the processing of photographs from bubble and spark chambers obtained at JINR and at the accelerator in Serpukhov	❑ Transition of developed countries to a single information society. ❑ Transition to distributed computing, ensuring participation in large international scientific projects (LHC). ❑ Need for connection to computer networks for science and higher education. ❑ Application of international standards. ❑ Transition to electronic methods of particle detection.	Provision and development of information and software support for JINR's scientific and production activities
Providing communication and coordination of joint work of the JINR Member States on issues of computer technology, programming, and development of data processing methods		Development of new methods of mathematical modeling and analysis of the results of theoretical and experimental research in the fields of elementary particle and nuclear physics, condensed matter physics and radiation biology, as well as computations of large physical installations developed at the Institute
Coordination of the main work on the creation and development of measuring centers in JINR Laboratories and introduction of digital computers into experimental methods		Providing assistance to organizations and research centers of the Institute's Member States on the implementation of advanced information technologies

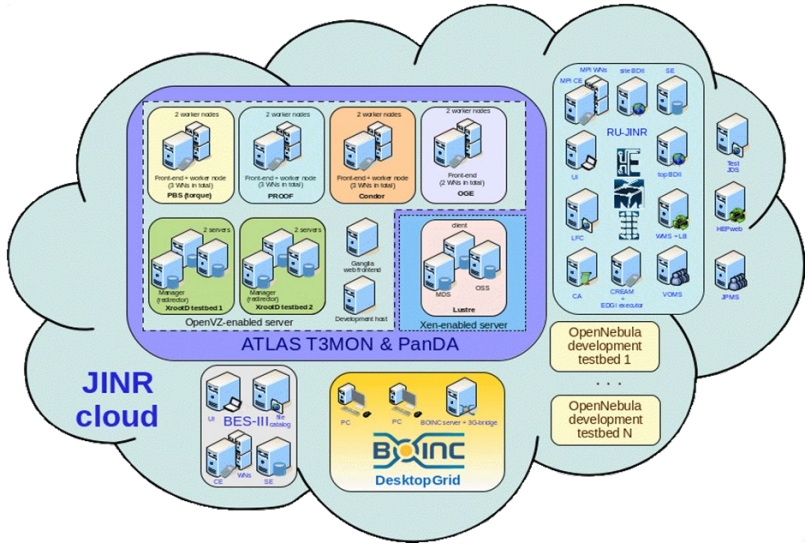


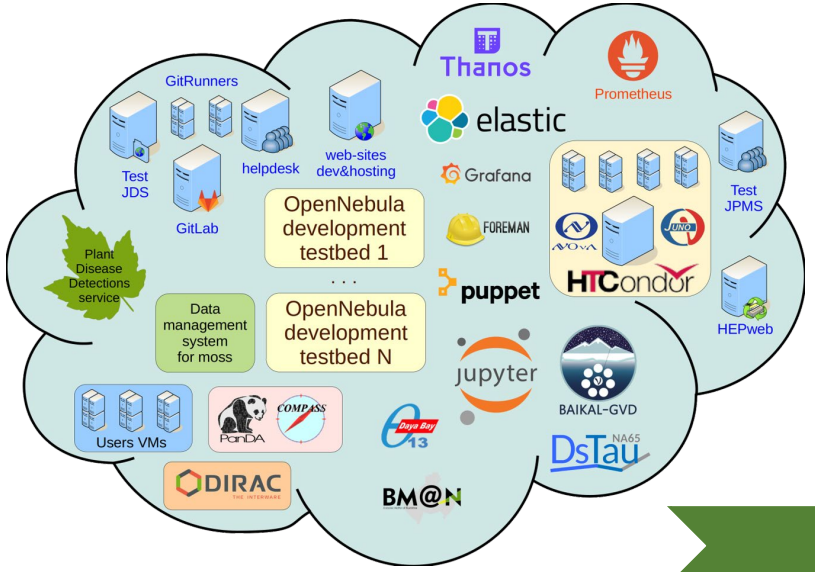
2000 Creation of a shared access PC farm as part of the JINR Computing Center for CMS and ALICE experiments.

In January 2001, the 89th session of the JINR Scientific Council, taking into account the need for scientific and technical cooperation, recommended considering important: … **participation in collaborations on the Data Grid and Grid projects in Europe and America;** creation of high-quality communication between the JINR computer network and scientific networks of the Member States.

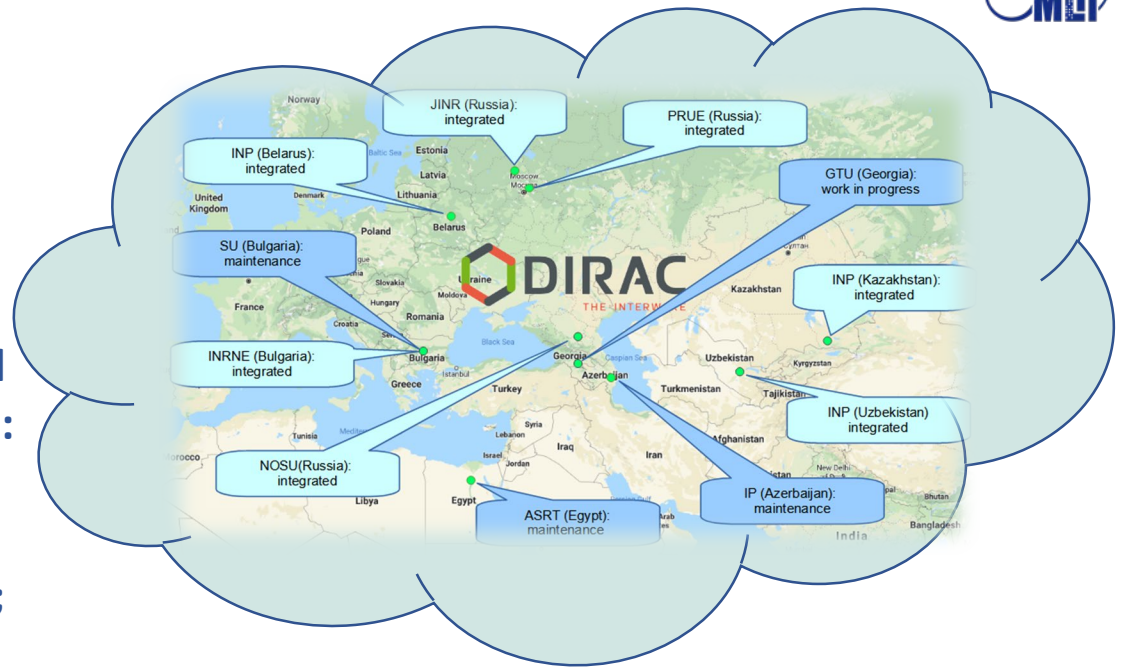
The signing of the protocol between CERN, Russia and JINR in 2003 is an important stage for participation in Grid projects. To fully participate in the projects, the RDIG consortium (Russian Data Intensive Grid) has been created as a national federation to participate in the largest project, the EGEE Project (Enabling Grids for E-science in Europe) and the JINR Tier2 starts

JINR's cloud infrastructure was put into operation in early 2014. The migration of educational, research and test grid infrastructure services to virtual machines in the JINR cloud service has been completed.





JINR cloud resources are used to solve a wide range of tasks: various services for the NOvA/DUNE, Baikal-GVD, JUNO, Daya Bay experiments; COMPASS production system components; resources for BM@N and SPD users, DIRAC services of the JINR DICE, UNECE ICP Vegetation data management system; service for the disease detection of agricultural crops using advanced machine learning approaches; etc.



JINR cloud is one of the resources providers for the users of the Distributed Information and Computing Environment (DICE). The JINR DICE consists of clouds deployed in some research and/or educational organizations of the JINR Member States

On March 26, 2015, during a meeting of the JINR Committee of Plenipotentiaries in LIT, a presentation of the Tier-1 center for CMS experiment data processing at the Large Hadron Collider took place

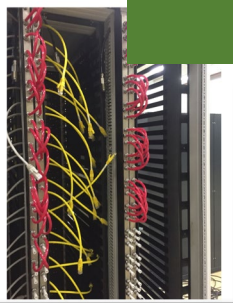
Tier-1 center - 100% reliability and availability of the cluster, a long-term data storage system - 10-Pbyte robotic tape library, isolated module, providing climatic conditions, together with powerful uninterruptible power supplies and diesel generator units outside the LIT building

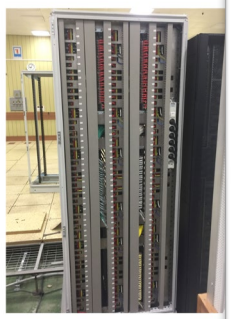
2014 marks the commissioning of the HybriLIT computing cluster. JINR and Member States' staff have the opportunity to perform calculations using graphics processing units (GPUs)

In 2018, the Multifunctional Information and Computing Complex was replenished with a new rising star: the **"Govorun" supercomputer** was successfully commissioned. It was a heterogeneous computing platform containing computing components with nodes based on Intel® Xeon Phi™ 7290 and Intel® Xeon® processors Scalable, as well as a component with NVIDIA V100 GPU (DGX). **"Govorun" is the world's first hyperconverged and 100% hot-water cooled supercomputer based on advanced liquid cooling and a number of RSC own innovative solutions.**

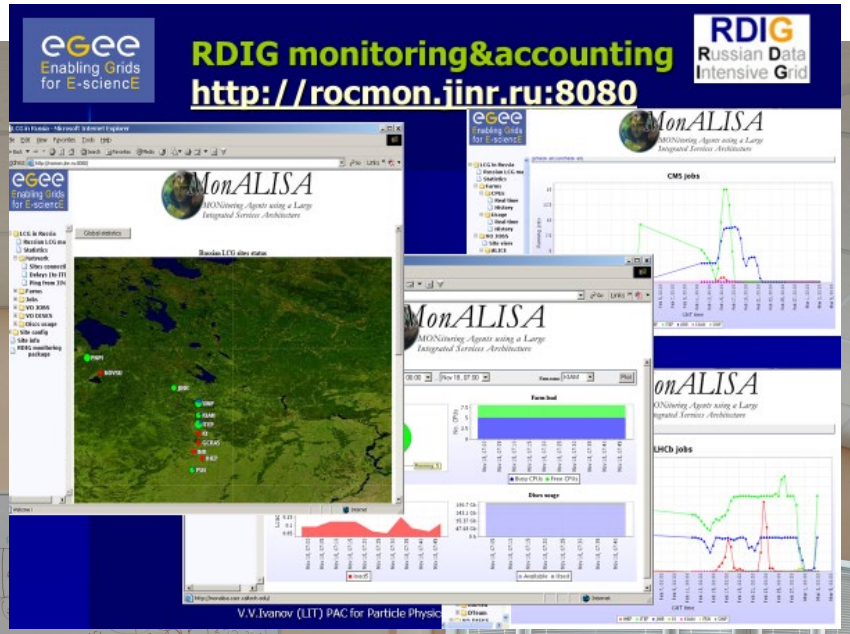
DC Awards 2020 for "The Best IT solution for a Data Center"

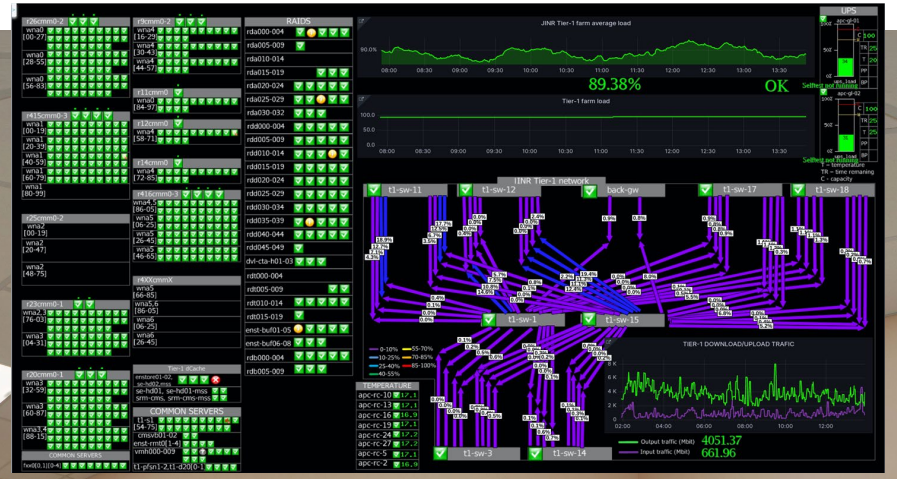
"Govorun" today: 1.7 PFLOPS total peak performance with double precision
26 PFLOPS peak performance for AI
10.6 PB data storage systems



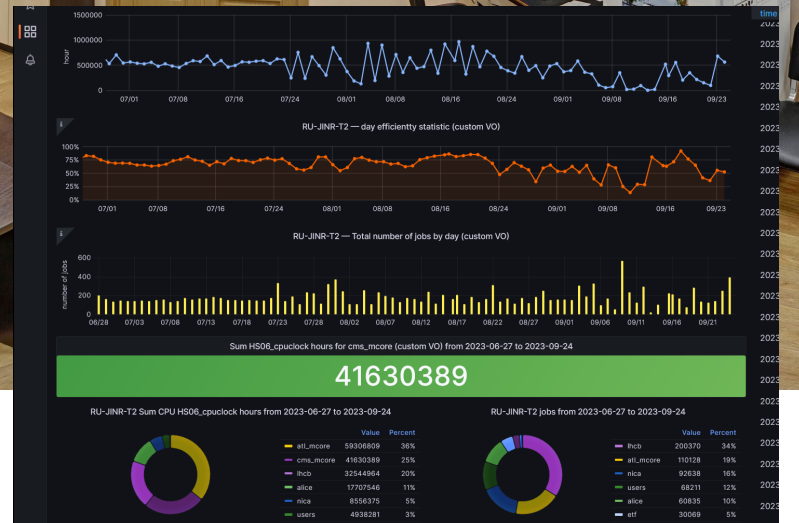


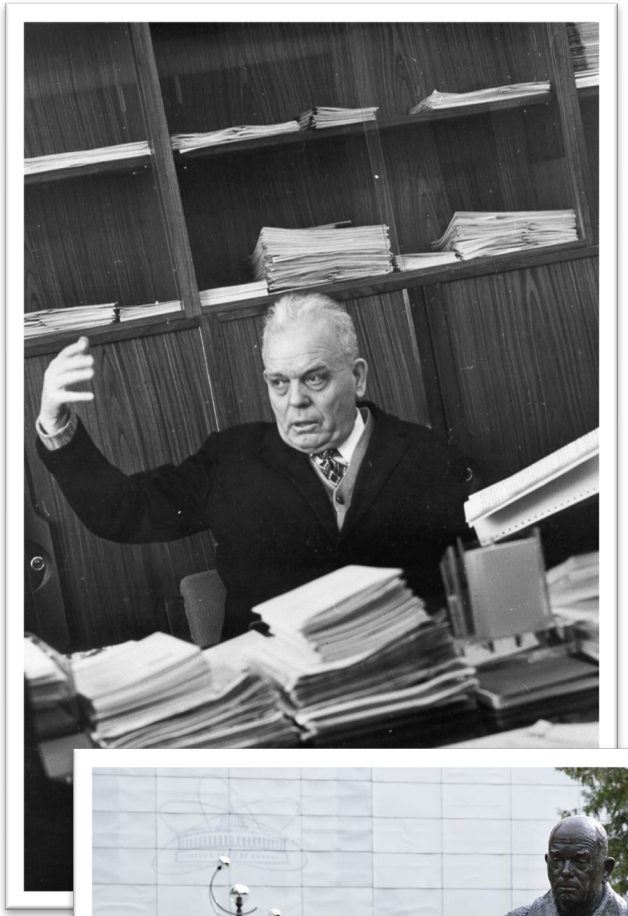
Monitoring


RDIG monitoring&accounting
http://rocmon.jinr.ru:8080
RDIG
Russian Data Intensive Grid
MonALISA
CMS jobs
LHCb jobs
V.V.Ivanov (LIT) PAC for Particle Physic


JINR Tier-1 farm average load
89.38%
OK
Tier-1 farm load
JINR Tier-1 network
TIER-1 DOWNLOAD/UPLOAD TRAFIC
4051.37
661.96


General / start_Dashboard
50.6 PB
2.65 PB
11.7 PB
20000
1.99 PB
1.69 PB
1.94 PB
10364
7.51 PB
15680
22.4 PB
4320
5152
60.6 TB
3.84 PB
1.44 PB
Tier-1 jobs
Tier-2 jobs


RU-JINR-T2 — day efficientty statistic (custom VO)
RU-JINR-T2 — Total number of jobs by day (custom VO)
Sum HS06_cpuclock hours for cms_mcore (custom VO) from 2023-06-27 to 2023-09-24
41630389
RU-JINR-T2 Sum CPU HS06_cpuclock hours from 2023-06-27 to 2023-09-24
RU-JINR-T2 jobs from 2023-06-27 to 2023-09-24

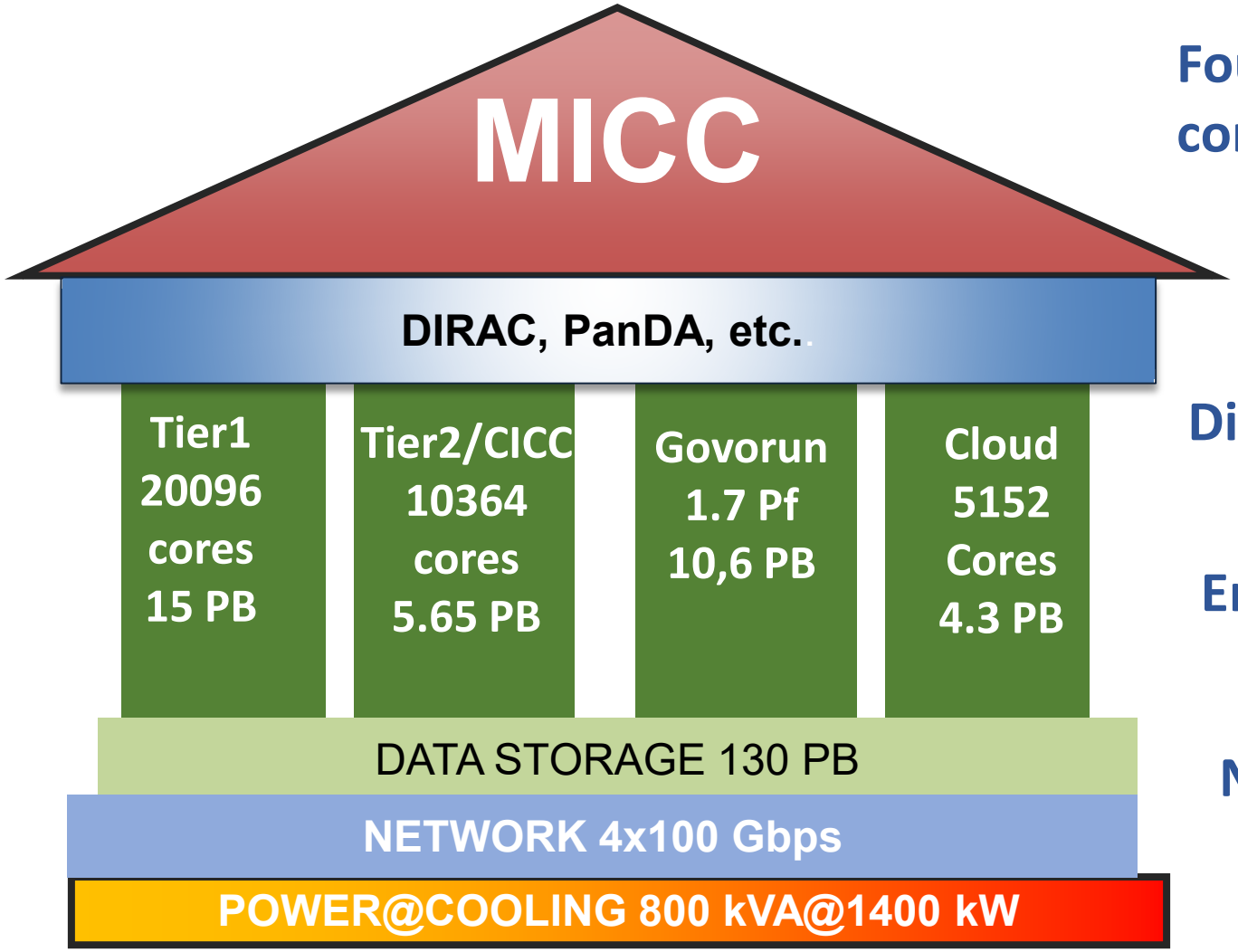


In March 2021, the Committee of Plenipotentiaries decided to assign the Laboratory of Information Laboratory of Information Technologies the name of

Mikhail Grigoryevich Meshcheryakov

for his outstanding contribution to the creation, establishment and development of the network infrastructure and information computing complex of the Laboratory, the Institute and the participating countries.

Multifunctional Information and Computing Complex



Four advanced software and hardware components

- Tier1 grid site (distributed data processing)
- Tier2 grid site (distributed data processing)
- hyperconverged “Govorun” supercomputer
- cloud infrastructure

Distributed multi-layer data storage system

- Disks
- Robotized tape library

Engineering infrastructure

- Power
- Cooling

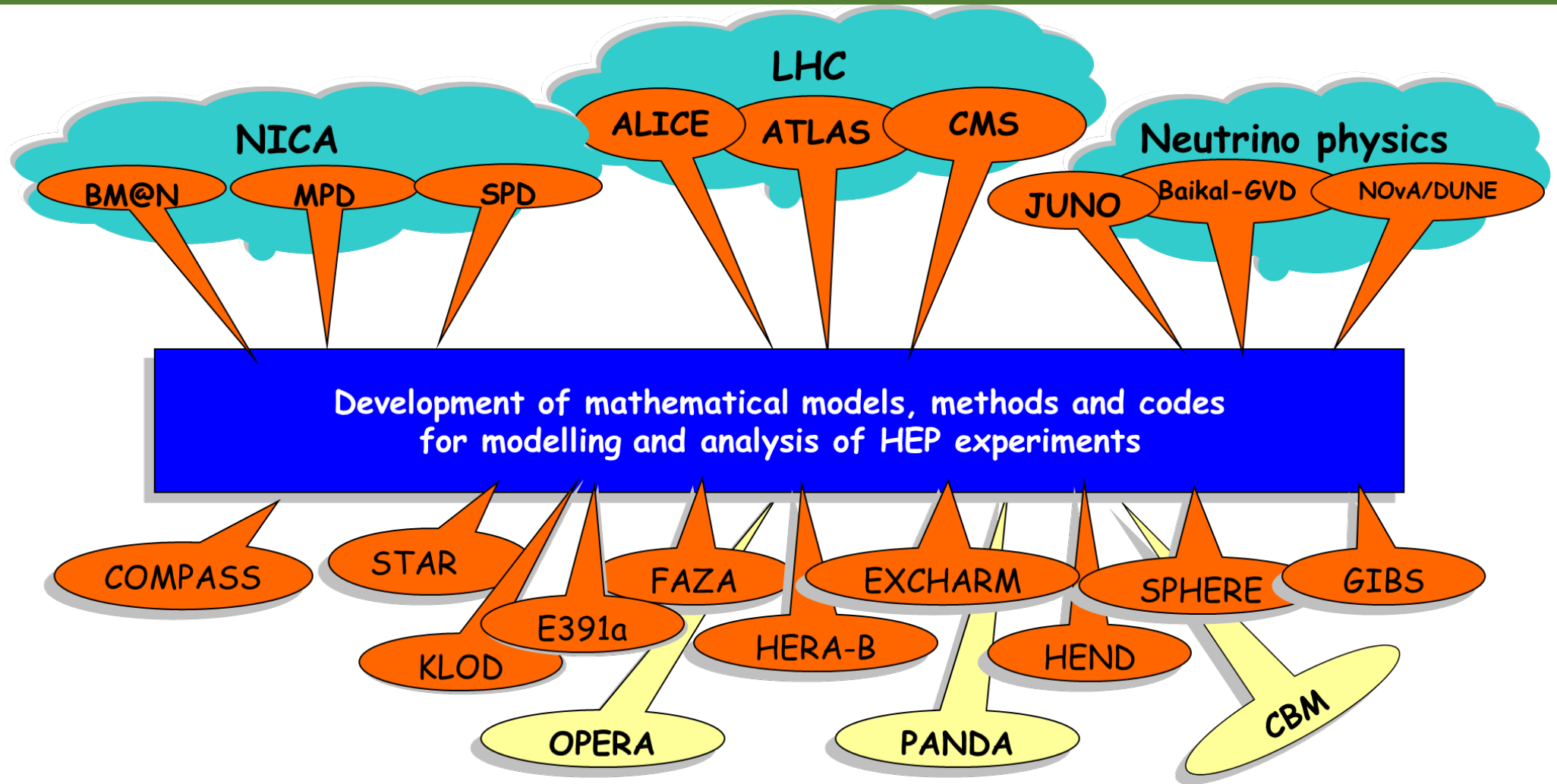
Network

- Wide Area Network
- Local Area Network

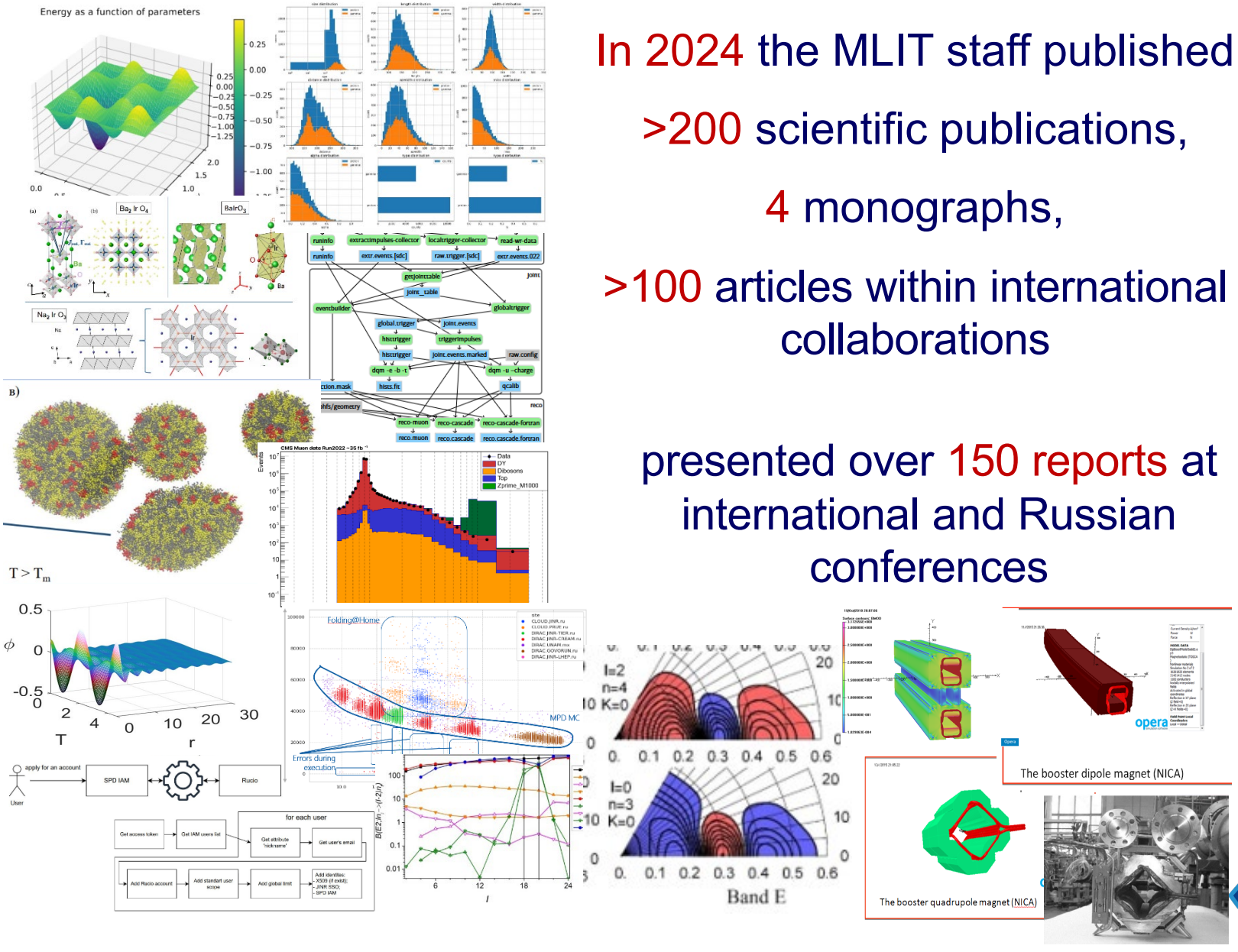
micc.jinr.ru

The main objective of the project is to ensure multifunctionality, scalability, high performance, reliability and availability in 24x7x365 mode for different user groups that carry out scientific studies within the JINR Topical Plan

Modern research in the fields of high energy physics and nuclear physics requires the use of sophisticated modeling methods, data processing algorithms and specialized software. From year to year MLIT has developed and successfully implemented a number of tools and approaches to solve the problems of modeling physical systems, processing and analyzing experimental data. These methods and algorithms play a key role in such large-scale experiments as BM@N, MPD and SPD (NICA), CMS (LHC), ATLAS (LHC), JUNO, Baikal-GVD, etc.



Methods, Algorithms and Software



In 2024 the MLIT staff published

>200 scientific publications,

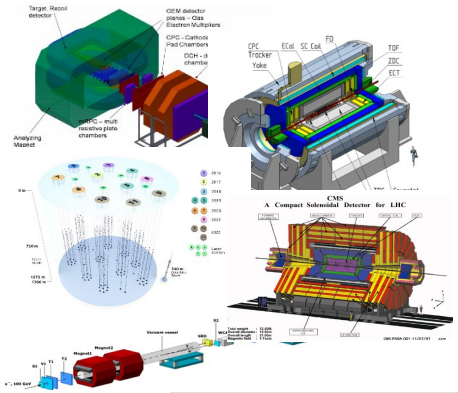
4 monographs,

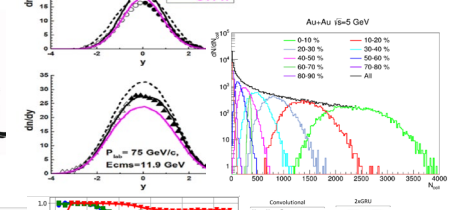
>100 articles within international collaborations

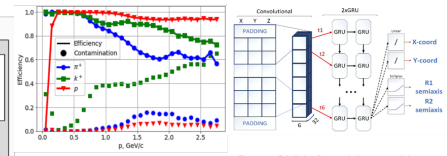
presented over 150 reports at international and Russian conferences

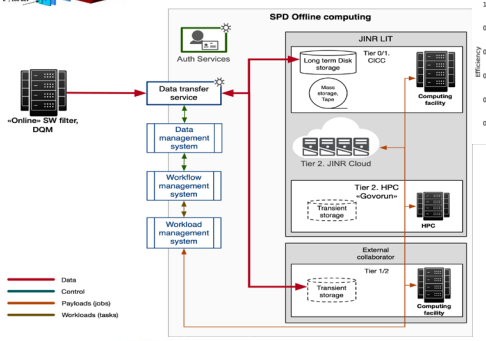
- Numerical modeling of complex physical systems
- Experimental data processing and analysis
- Big Data
- Machine and Deep learning
- Computer algebra
- Quantum computing

Mathematical Methods and Software for Experimental Data Processing and Analysis

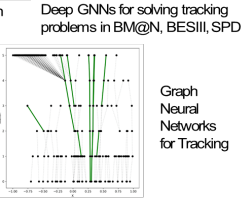






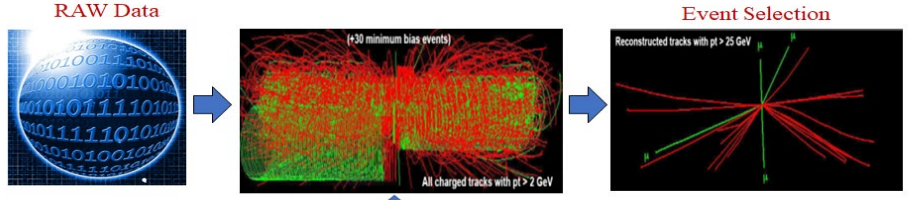


Gradient-boosted decision trees for PID in MPD

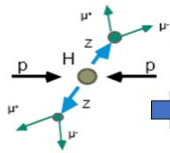


Deep GNNs for solving tracking problems in BM@N, BESIII, SPD

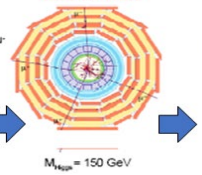
Graph Neural Networks for Tracking



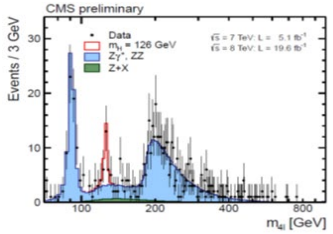
Calibration/Condition/etc Data Bases



Theory/ Monte Carlo Simulation



Detector Response Simulation



- mathematical methods and software, including based on ML/DL algorithms for modelling physical processes and experimental facilities, processing and analyzing experimental data in the fields of elementary particle physics, nuclear physics, neutrino physics, radiobiology, etc.

- the creation of systems for the distributed processing and analysis of experimental data, as well as information and computing platforms to support research conducted at JINR and other research centers.

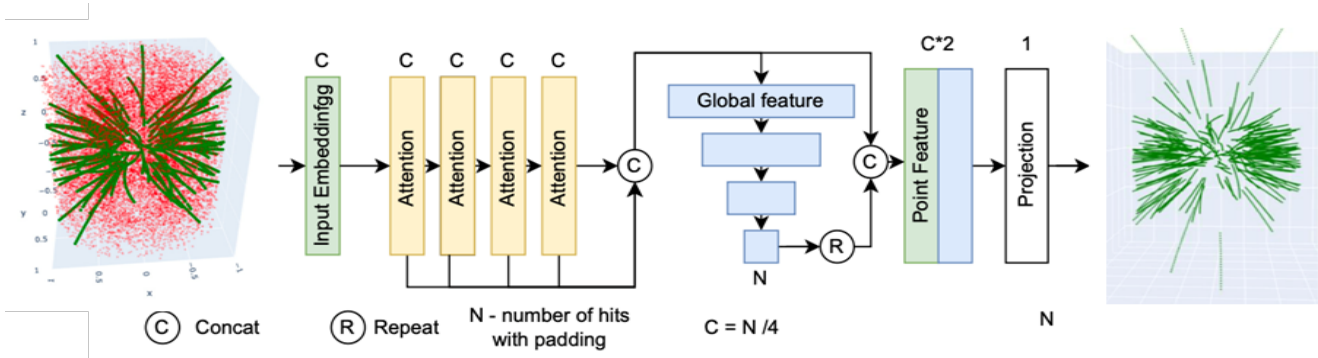
Simulation of Physics Processes and Facilities	Reconstruction and Data Analysis	Software Environment for Experiments
Physics event simulation	Particle trajectory reconstruction	Data processing and analysis models
GEANT-simulation of experimental setups	Particle identification	Data models
	Reconstruction of physics processes	Software platforms and systems
	Experimental data analysis	Development and maintenance of DBs
		Event visualization

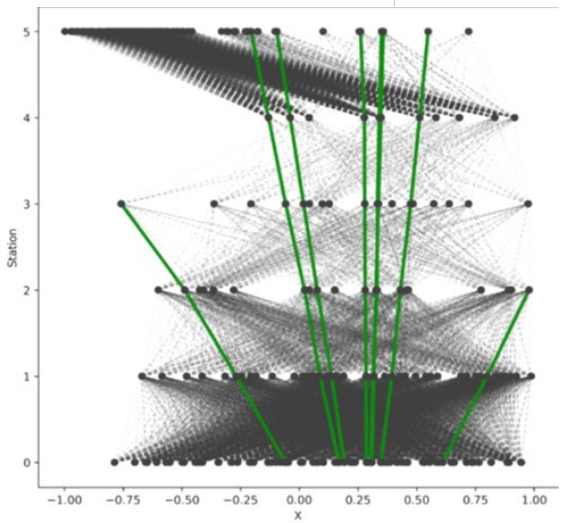
G.A.Ososkov

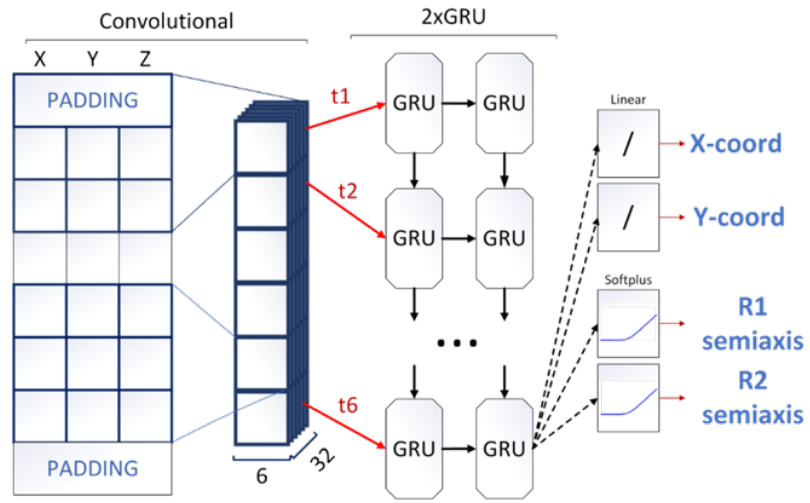
In the early 90s, LCTA began work on the development of new algorithms and the creation of programs based on them for the use of neural networks and cellular automata in the search and analysis of events in electronic experiments. The Laboratory implements these methods in software packages for modeling physical processes and experimental installations and in systems for analyzing experimental data. A decisive contribution to these studies and the application of neural network methods in JINR tasks was made by Prof. G.A.Ososkov.

In addition to classical approaches, a number of algorithms using machine and deep learning were developed under his leadership too.

One of the latest examples: "Graph Neural Network with Attention and Two-Stage Aggregation for Particle Track Reconstruction in the TPC MPD of the NICA complex" (2025)

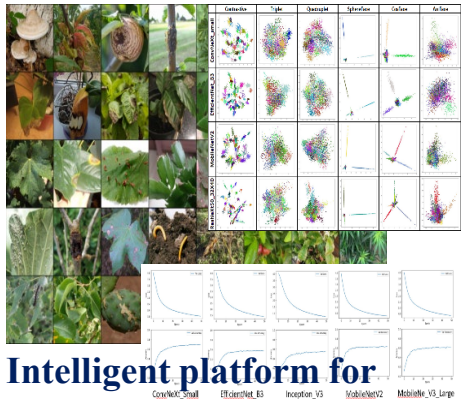






Radiobiology and Life Science

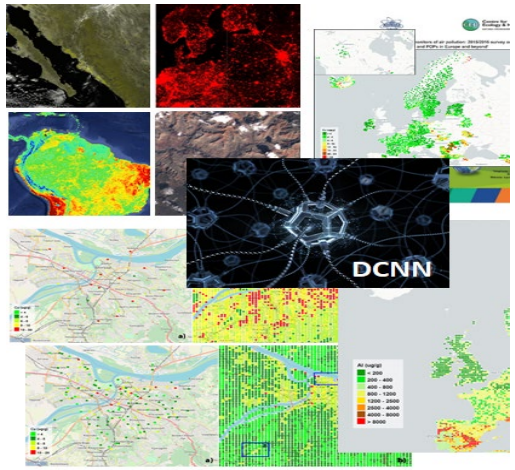
Application of AI technologies to solve various problems in the field of agriculture



- image classification in conditions of a small training sample.
- software and hardware solutions for organizing automated control and accounting in greenhouse complexes.
- methods and means for organizing mobile object tracking complexes.

Intelligent platform for determining the state of agricultural and decorative plants doctorp.ru

Applications of AI technologies and Earth remote sensing data to predict the state of the environment



The prediction of air pollution by heavy metals using biomonitoring data, satellite imagery and different technologies of machine and deep learning

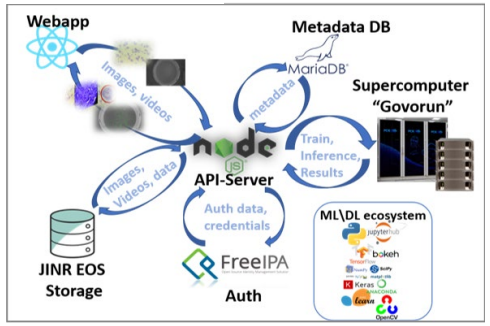
Intelligent Environmental Monitoring Platform
moss.jinr.ru

BIOHLIT project web services on the ML/DL/HPC ecosystem of the HybriLIT platform

(joint projects of MLIT and LRB)

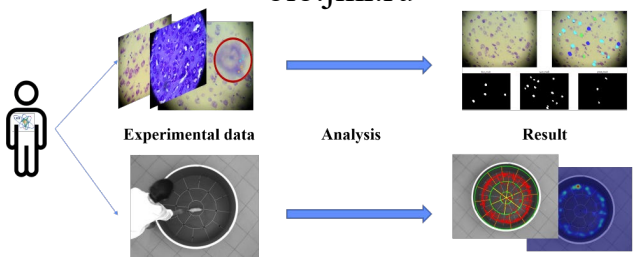
The ML/DL/HPC ecosystem

- top of ML/DL technologies
- modern IT solutions for data storage, processing and visualization
- statistical analysis



Information System for Radiation Biology Tasks

bio.jinr.ru

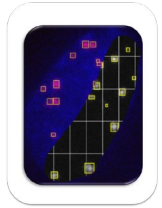


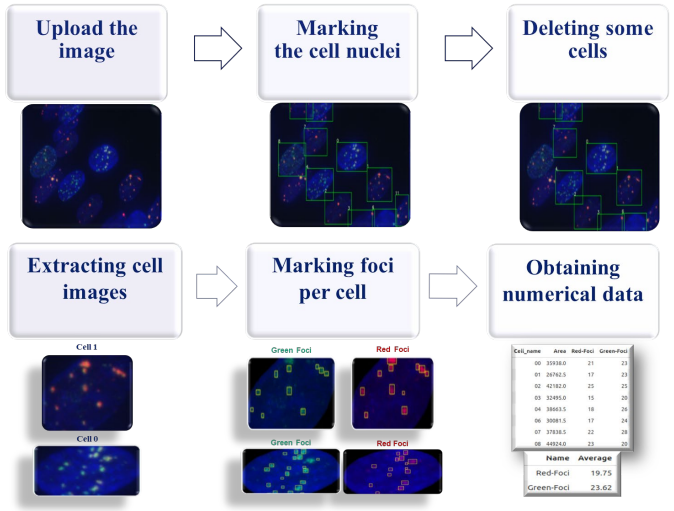
The IS allows one to store, quickly access and process data from experiments at LRB using a stack of neural network and classical algorithms of computer vision, providing a wide range of possibilities for automating routine tasks. It gives an increase in productivity, quality and speed of obtaining results.

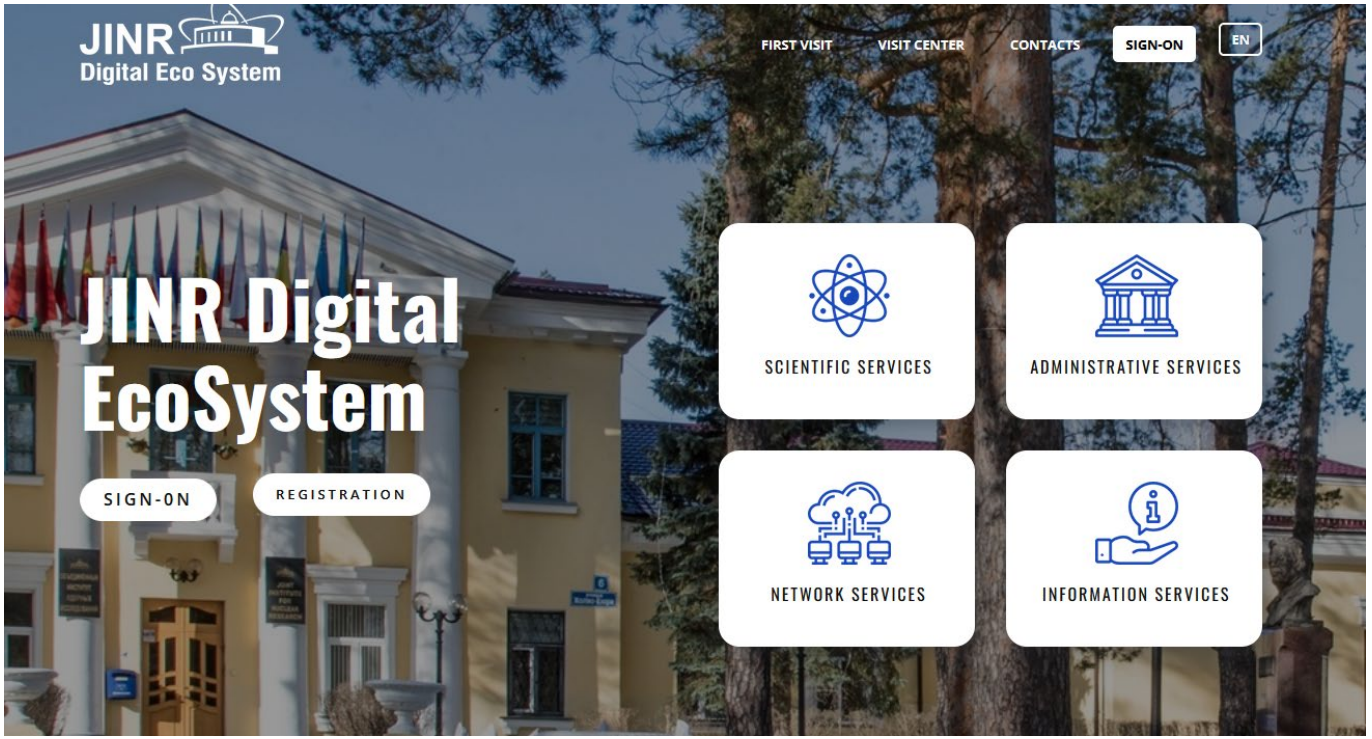
Web service for detection and analysis of radiation-induced foci (RIF)

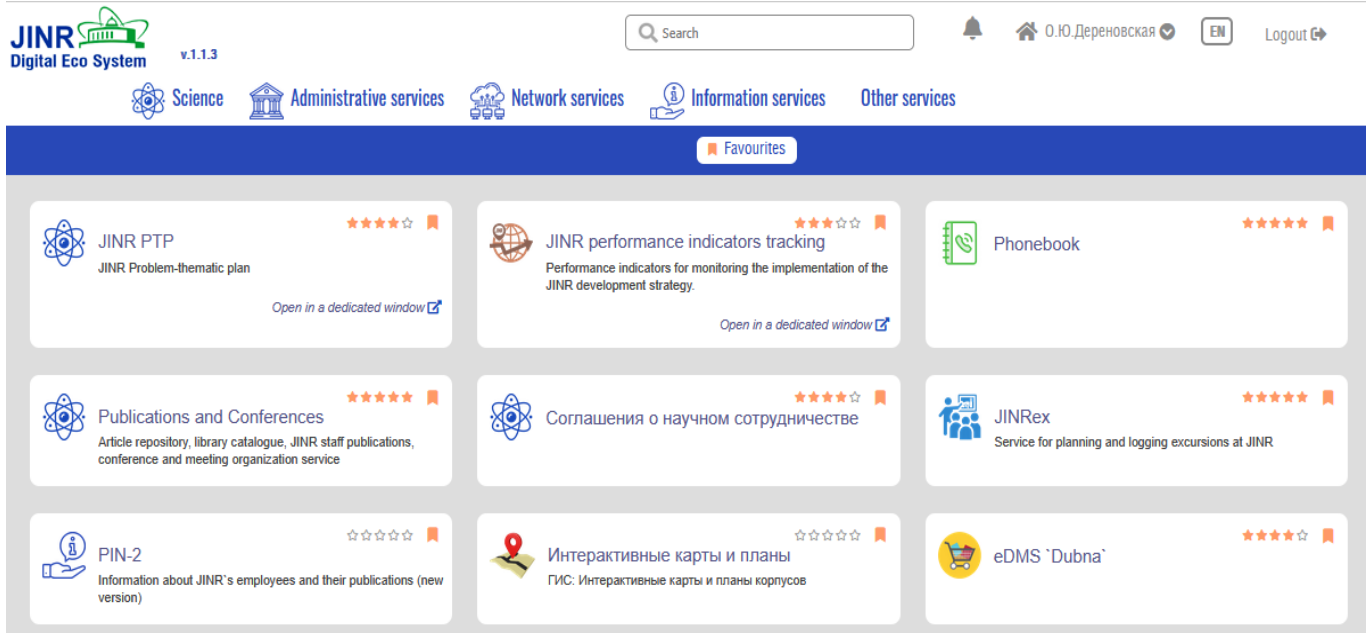
https://mostlit.jinr.ru

The web service functionality allows processing fluorescent images and providing analytical information:
cell area,
average number of RIFs per cell and per set of images.









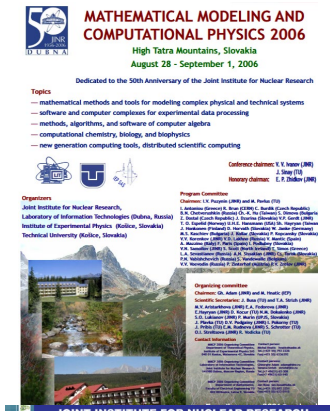
JINR Digital Ecosystem

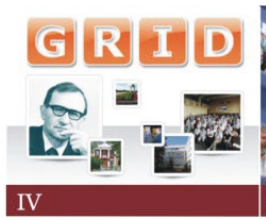
a single window into the JINR digital environment

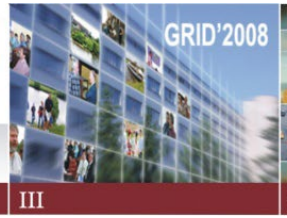
Along with scientific tasks, Laboratory also solves the tasks of creating and maintaining scientific, information and administrative systems. From year to year, work was systematically carried out to maintain previously developed databases and information systems, and to create new ones based on user requests. This experience has allowed us to create a JINR digital ecosystem platform that

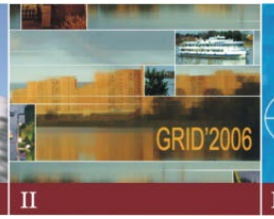
- integrates the existing and prospective services for **supporting scientific, administrative and social activities**, as well as maintenance of the Institute's engineering and IT infrastructure
- has access to the system based on the JINR Single SignOn (SSO) authentication service – a single login and access to all services through a single account
- information is updated promptly and regularly by service owners
- has convenient interface for service administrators
- supports bilingualism: Russian and English
- has mobile version of the system

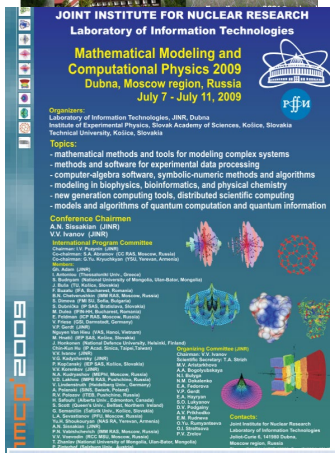
Traditional conferences and schools

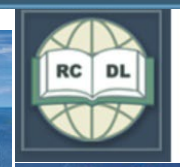






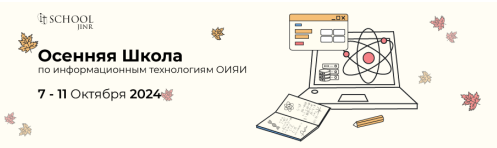






Весенняя школа по информационным технологиям ОИЯИ

SCHOOL JINR



МЕЩЕРЯКОВ
Михаил Григорьевич

Директор ЛВТА
1966-1988;
почетный
директор ЛВТА
1988-1994

ГОВОРУН
Николай Николаевич

Директор ЛВТА
1988-1989;
заместитель
директора ЛВТА
1966-1988

ПОЗЕ
Рудольф (ГДР, ФРГ)

Директор ЛВТА
1990-2000;
заместитель
директора ЛВТА
1969-1971

ПУЗЫНИН
Игорь Викторович

Директор ЛИТ
2000-2003;
заместитель
директора ЛВТА
1988-2000

ИВАНОВ
Виктор Владимирович

Директор ЛИТ
2003-2013;
заместитель
директора ЛИТ
2000-2003

КОРЕНЬКОВ
Владимир Васильевич

Научный руководитель ЛИТ
с 2023;
директор ЛИТ
2013-2023;
заместитель
директора ЛВТА/ЛИТ
1993-2013

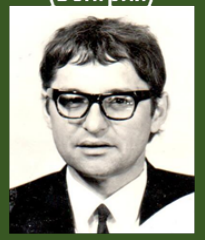
ШМАТОВ
Сергей Владимирович

Директор ЛИТ
с 2023

ЗАБИЯКИН
Георгий Иванович

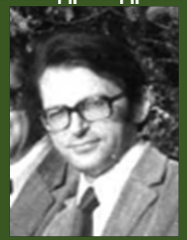
Заместитель
директора ЛВТА
1966-1972

ЗАМОРИ
Золтан
(Венгрия)



Заместитель
директора ЛВТА
1972-1975

КАРЛОВ
Александр Андреевич



Заместитель
директора ЛВТА
1973-1983

ПЕНЕВ
Владимир Николов
(Болгария)

Заместитель
директора ЛВТА
1975-1979

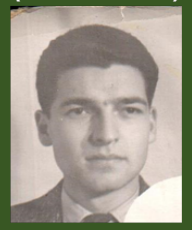
ХОФФМАН
Збигнев
(Польша)

Заместитель
директора ЛВТА
1979-1985

ЩЕЛЕВ
Сергей Александрович

Заместитель
директора ЛВТА
1983-1991

СУК
Михал
(Чехословакия)



Заместитель
директора ЛВТА
1985-1988

АНГЕЛОВ
Николай Стоянов
(НРБ, Болгария)

Заместитель
директора ЛВТА
1983-1993

ПОЛЯНСКИЙ
Александр Янович
(Польша)

Заместитель
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АДАМ
Георгий
(Румыния)

Заместитель
директора ЛИТ
2003-2009,

ЗРЕЛОВ
Петр
Валентинович

Заместитель
директора ЛИТ
2003-2013

АДАМ
Санда Анка
(Румыния)

Заместитель
директора ЛИТ
2009-2013

СТРИЖ
Татьяна
Александровна

Заместитель
директора ЛИТ
2013-2023

БУША
Ян
(Словакия)

Заместитель
директора ЛИТ
2018-2023

ЧУЛУУНБААТАР
Очбадрах
(Монголия)

Заместитель
директора ЛИТ
с 2019

ВОЙТИШИН
Николай
Николаевич

Заместитель
директора ЛИТ
с 2023

ПОДГАЙНЫЙ
Дмитрий
Владимирович

Заместитель
директора ЛИТ
с 2023

Thank you for your attention!

We look forward to our friends and colleagues in 2026

for the Anniversary of the Laboratory