Joint Institute for Nuclear Research

International Intergovernmental Organization

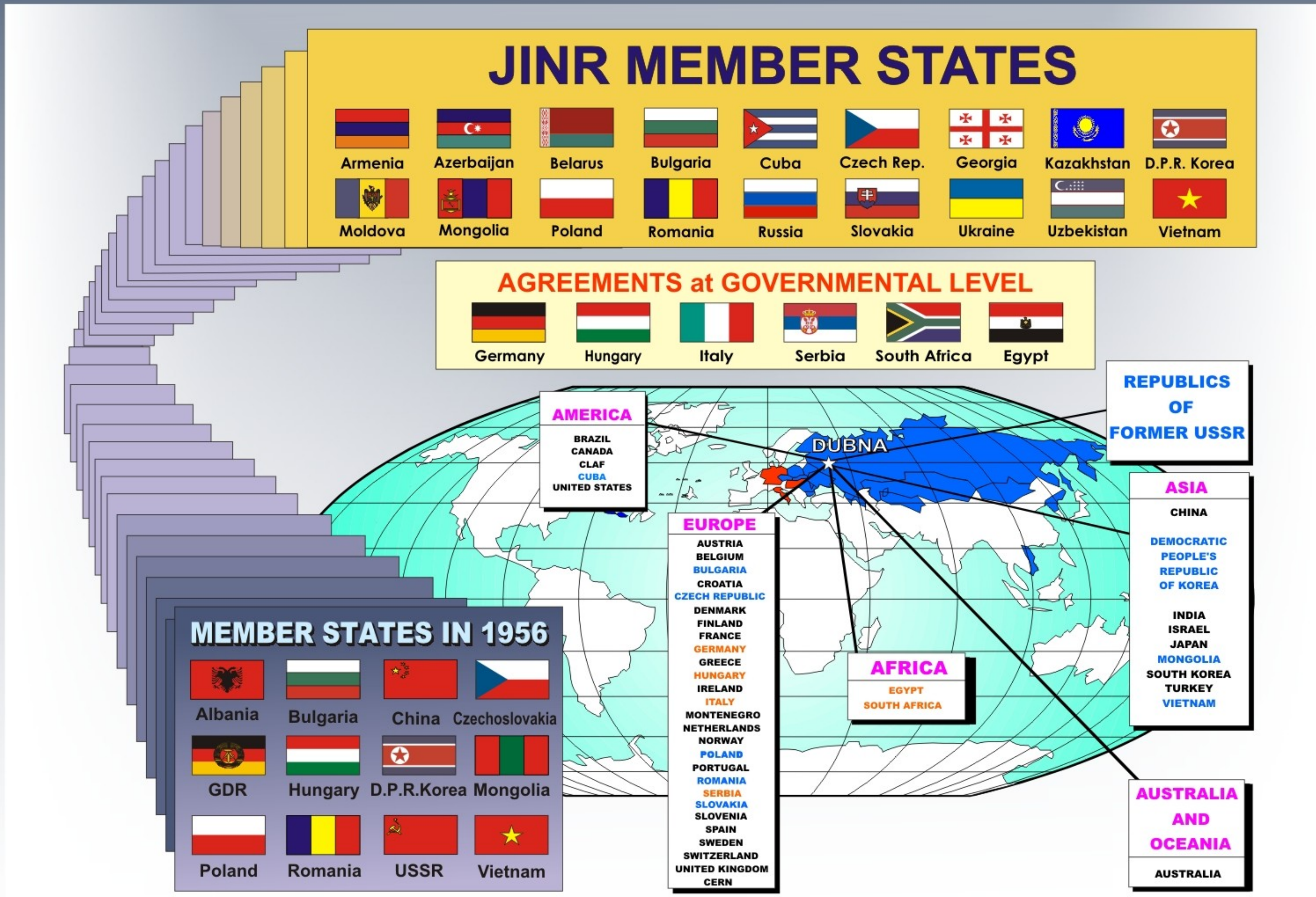
JOINT INSTITUTE FOR NUCLEAR RESEARCH

JINR

ILC SITING in DUBNA REGION and ILC ACTIVITY at JINR

Grigori SHIRKOV

2006 European School on HEP



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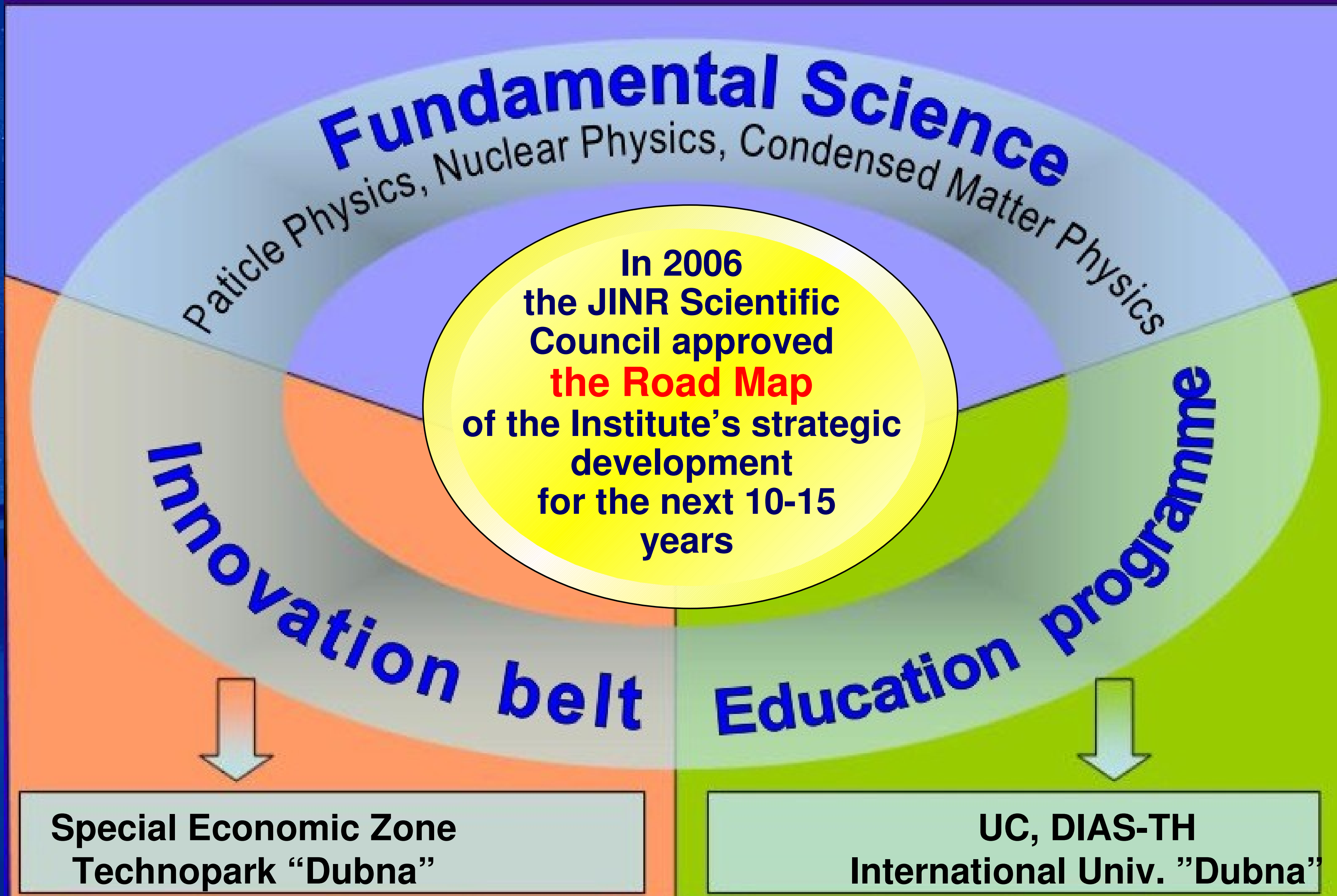
JINR in figures

JINR Dubna

JINR's staff members	~ 5100
researchers	~ 1300
including from the Member States (but Russia)	~ 500
Doctors and PhD	~ 1000
Total operation of basic facilities	~ 15000 hours/year

JINR’s Science Policy Today and Tomorrow



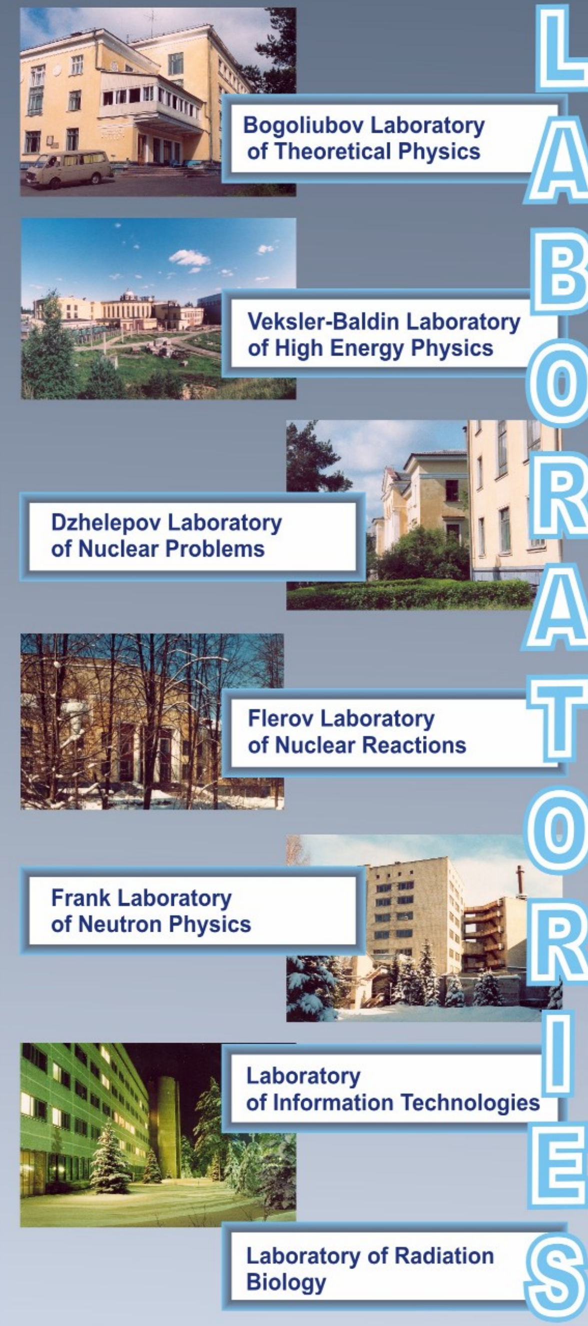
J I N R

D u b n a

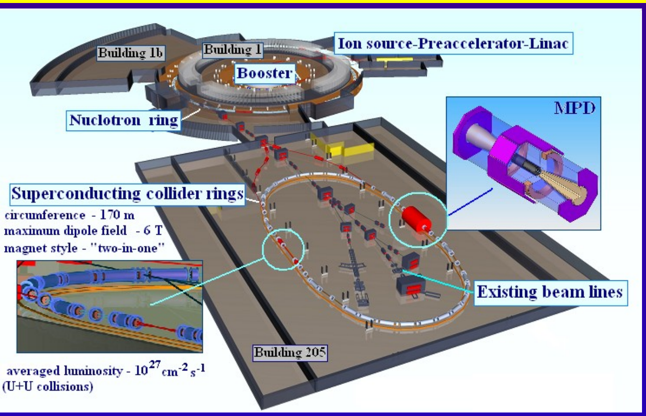
JINR's research niche offered by home facilities

- **Heavy-Ion Physics:**
  - at high energies (up to 5 GeV/n) (in future $\sqrt{s_{NN}}$ = 9 GeV, NICA facility)
  - at low and intermediate energies (5 – 100 MeV/n)

- **Condensed Matter Physics using nuclear physics methods**

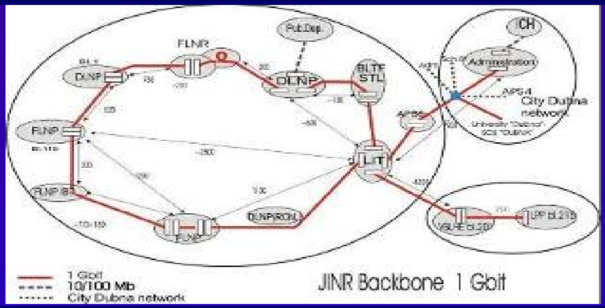


Upgrade and Development of JINR Basic Facilities

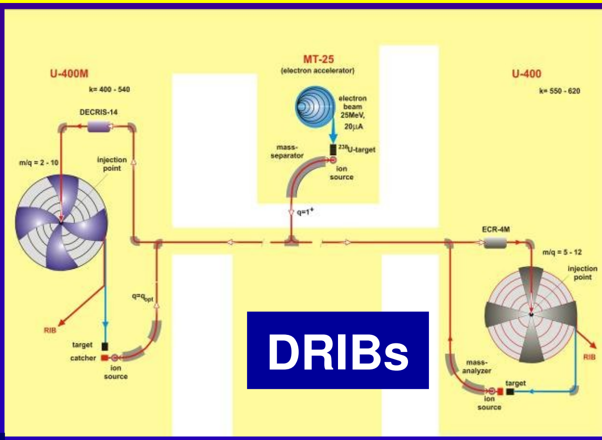


Upgraded
Nuclotron-M (2009)
+
NICA (2013-2014)

Telecommunication channels:
77 Gbps – November 2008,

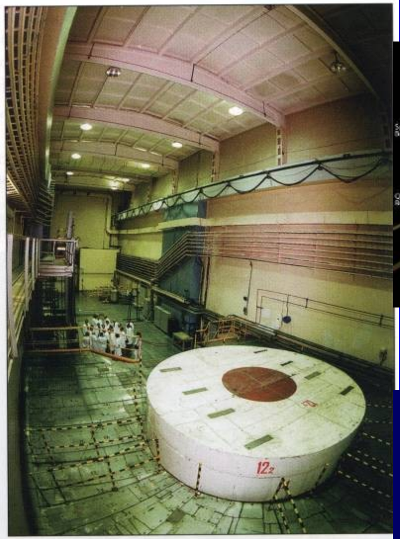


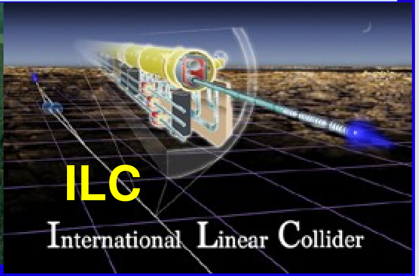
JINR networks,
including GRID technology



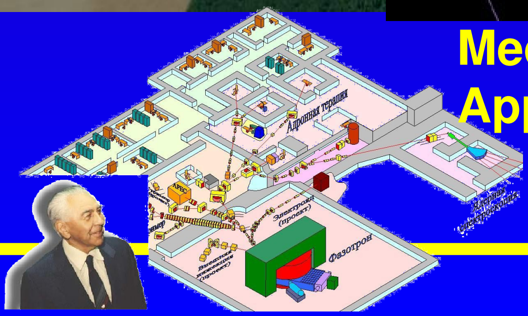
second phase 2009

Participating in LHC, RHIC, TEVATRON…
In future: FAIR, ILC …

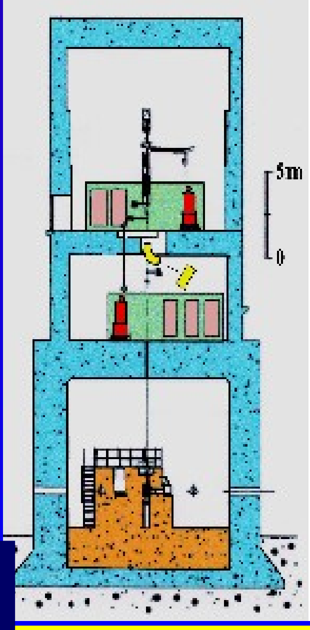




New reactor
IBR-2M
2010

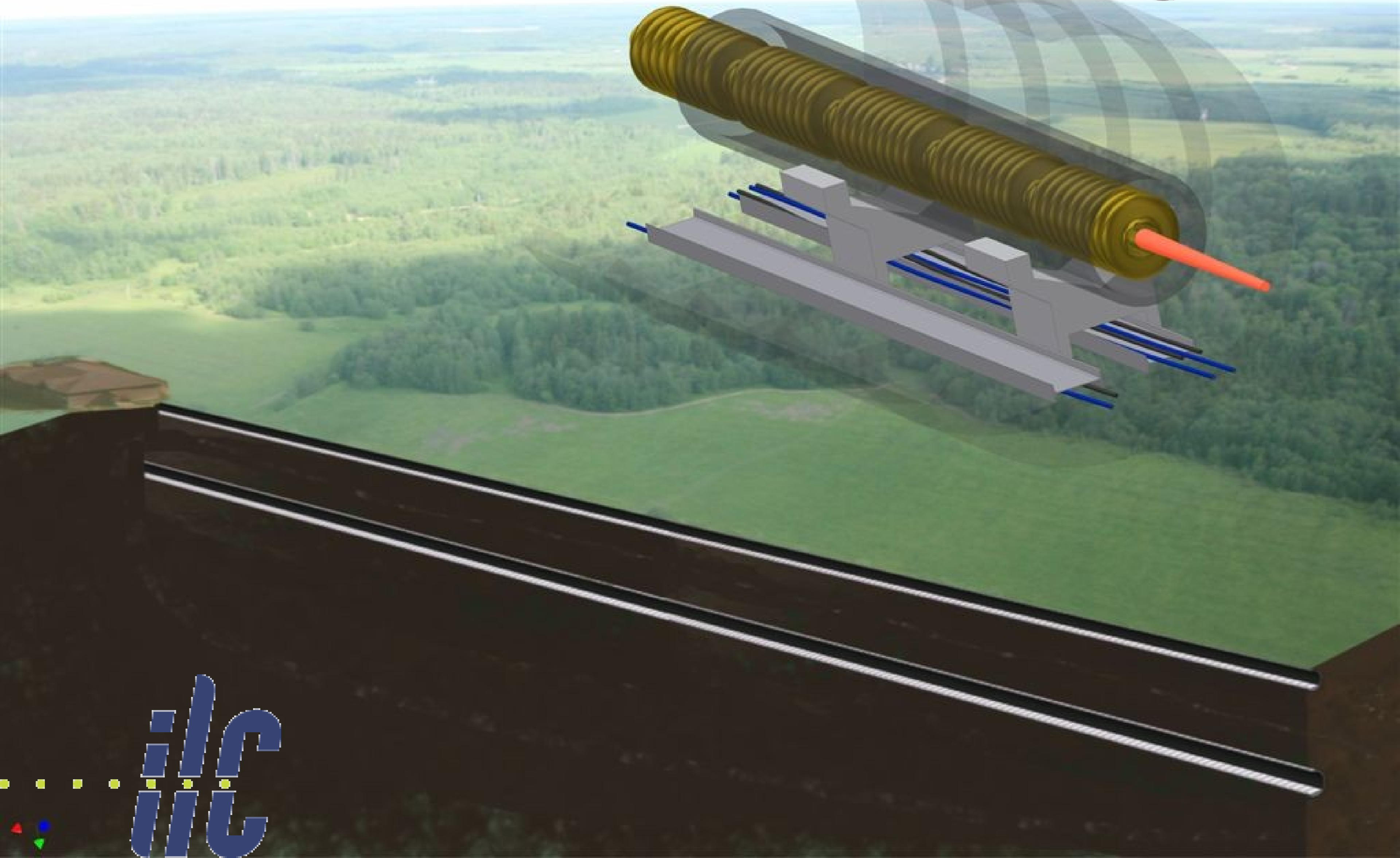


Medical
Applications

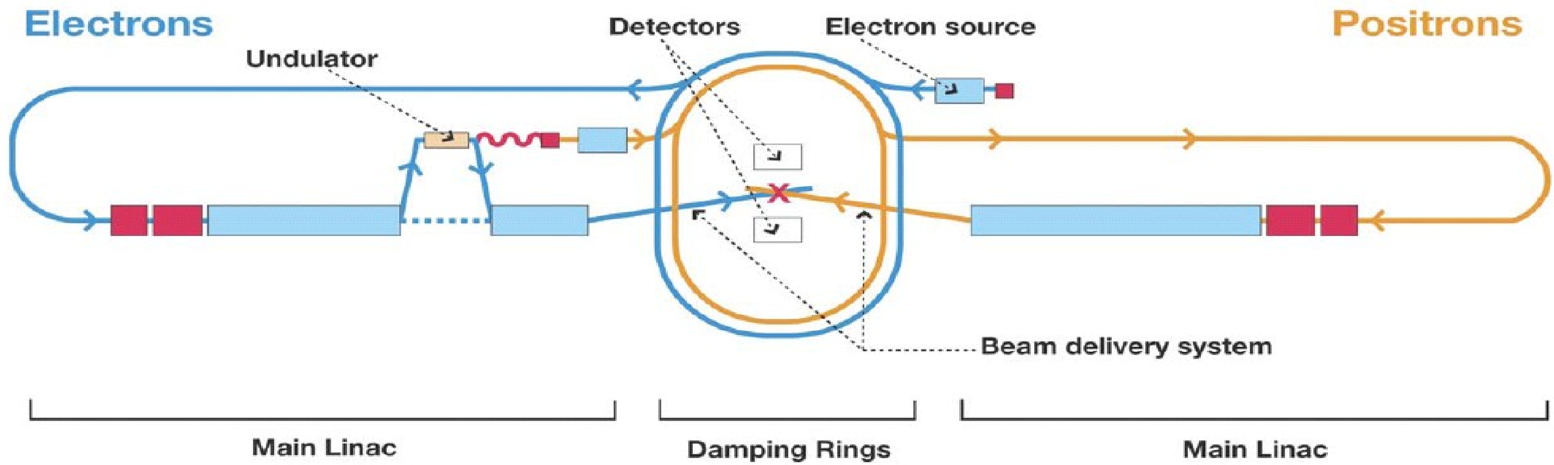


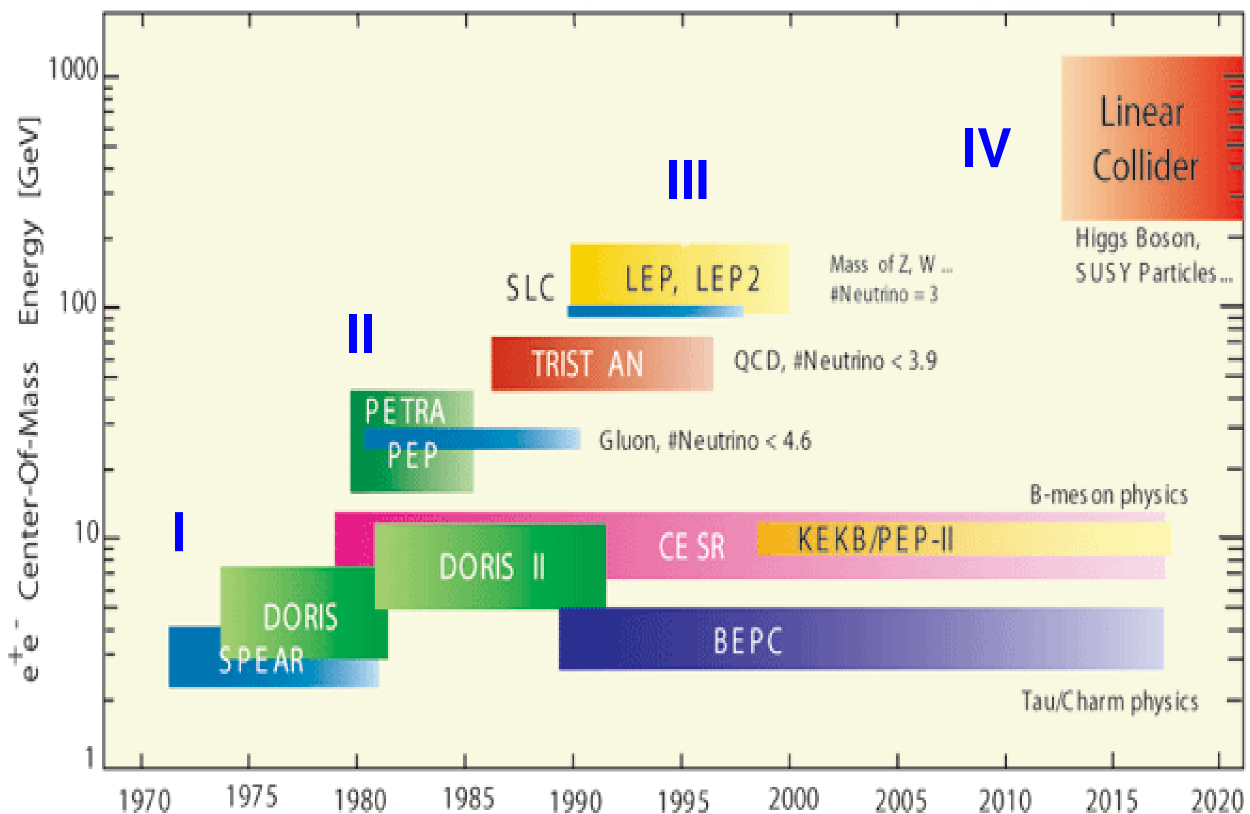
IREN-I
2008

ILC SITING in DUBNA REGION and ILC ACTIVITY at JINR



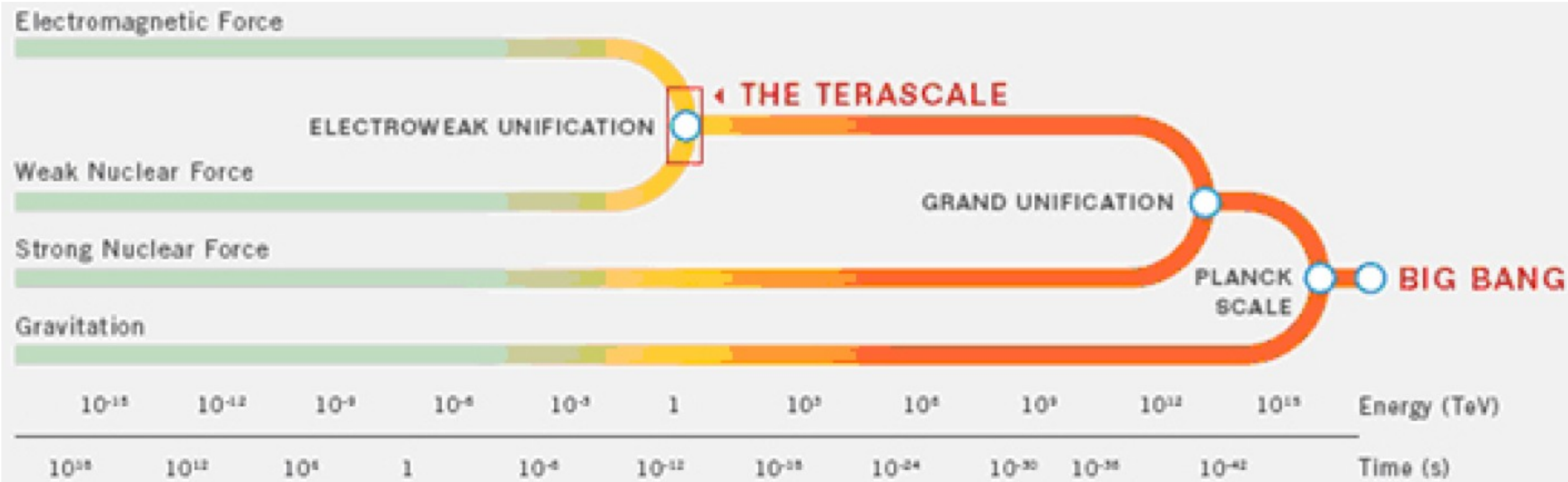
ILC is the main and the only international project in high energy and elementary particle physics at the moment





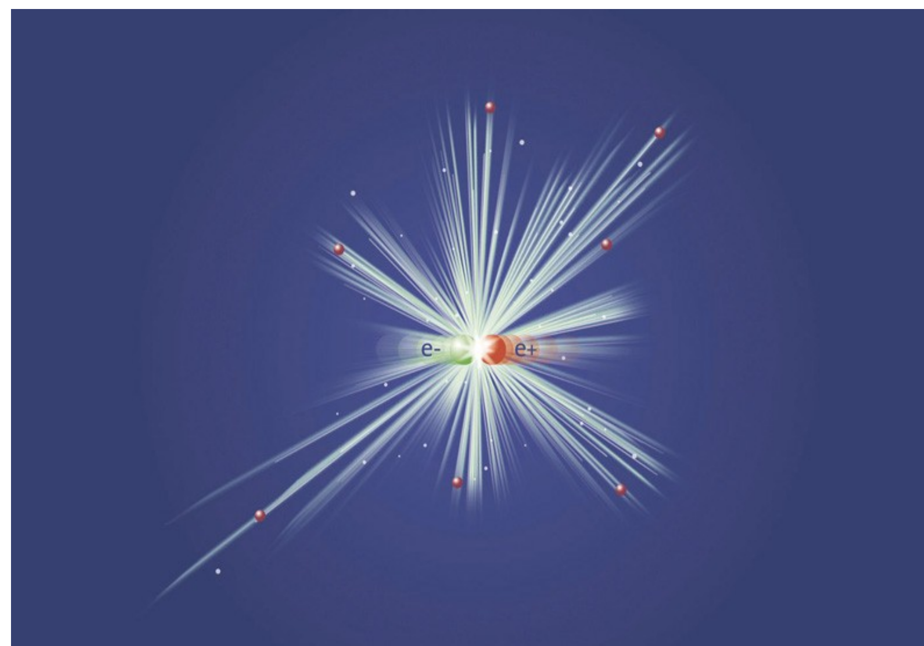
ILC is the Fourth Generations of e+e- Colliders

PRECISION TERASCALE PHYSICS AT ILC



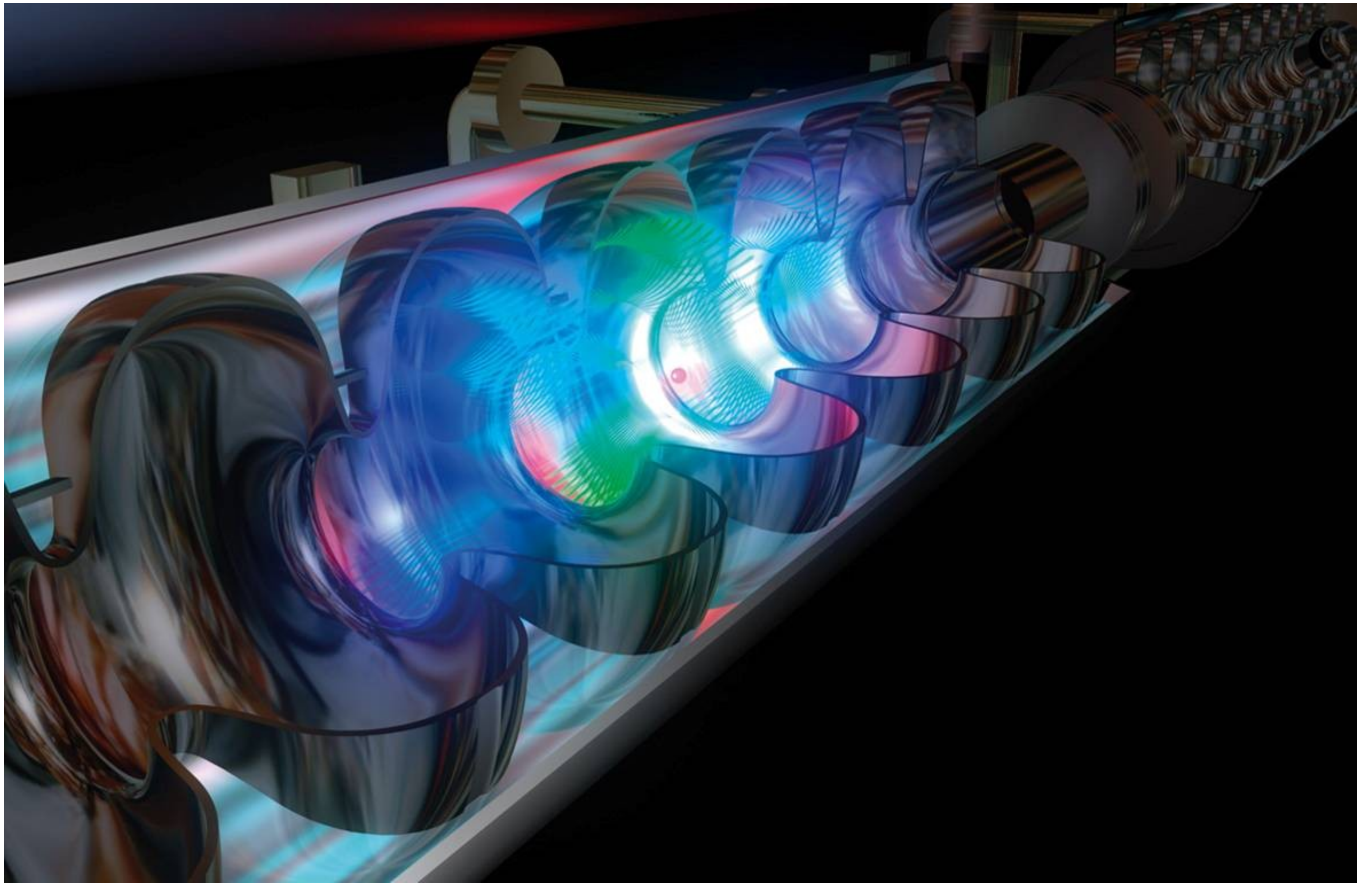
The electromagnetic and nuclear forces unify at the Terascale.

The final scientific goals of ILC as well as the time schedule of construction will be accomplished in concert with physical achievements at LHC as well as at other accelerator and nonaccelerator experiments including neutrinos, astrophysics and etc.



Linear Collider is based on two main challenges:

- **Energy** – need to reach at least 500 GeV CM as a start
- **Luminosity** – need to reach 10^34 level

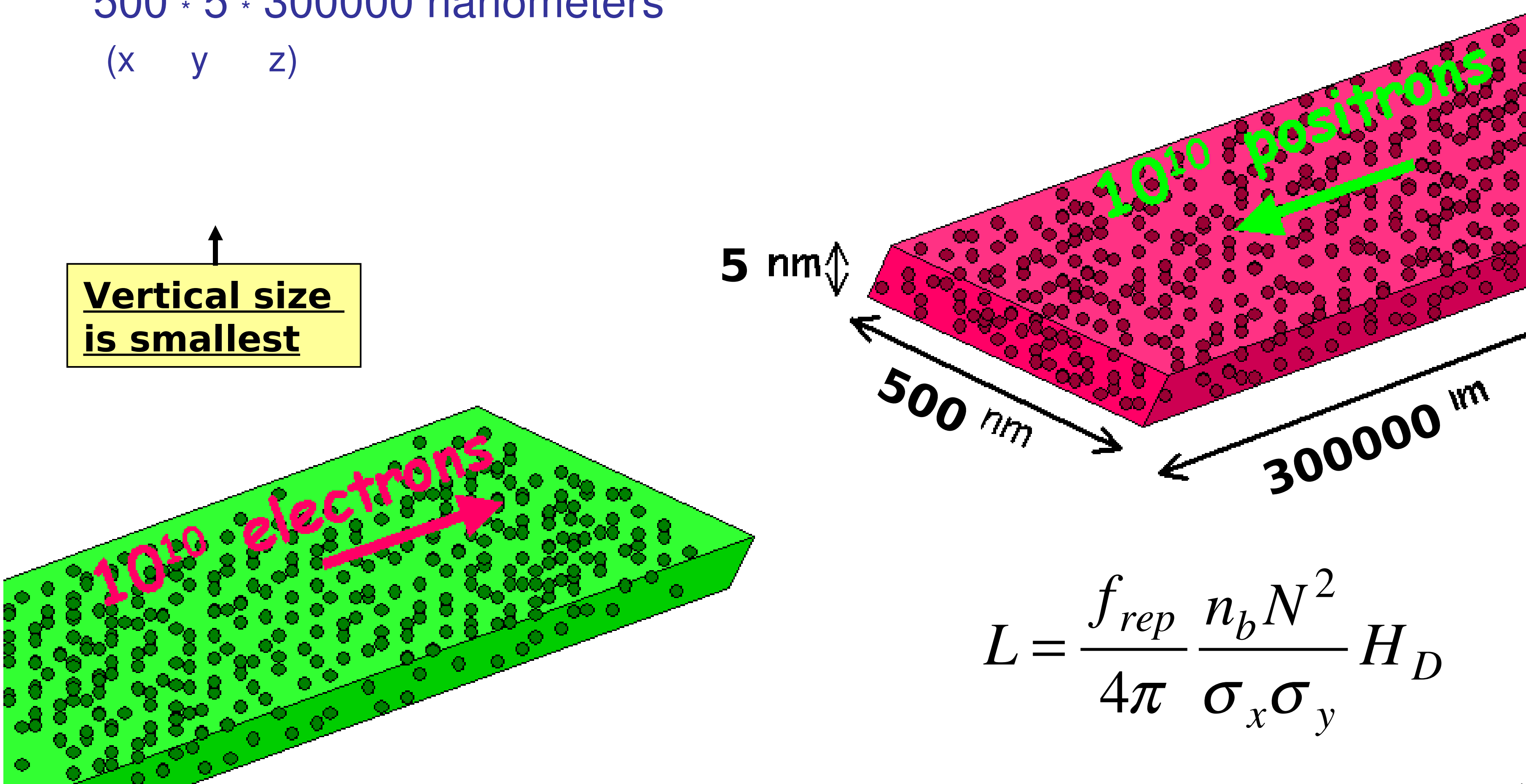


ILC is based on the TESLA superconducting RF cavities with 31.5 MV/m (as well as X-FEL and FLASH at DESY)

How to get Luminosity

- To increase probability of direct e^+e^- collisions (*luminosity*) and birth of new particles, beam sizes at IP must be very small
- E.g., ILC beam sizes just before collision (500GeV CM):
  500 * 5 * 300000 nanometers
  (x y z)

Vertical size is smallest



$$L = \frac{f_{rep}}{4\pi} \frac{n_b N^2}{\sigma_x \sigma_y} H_D$$

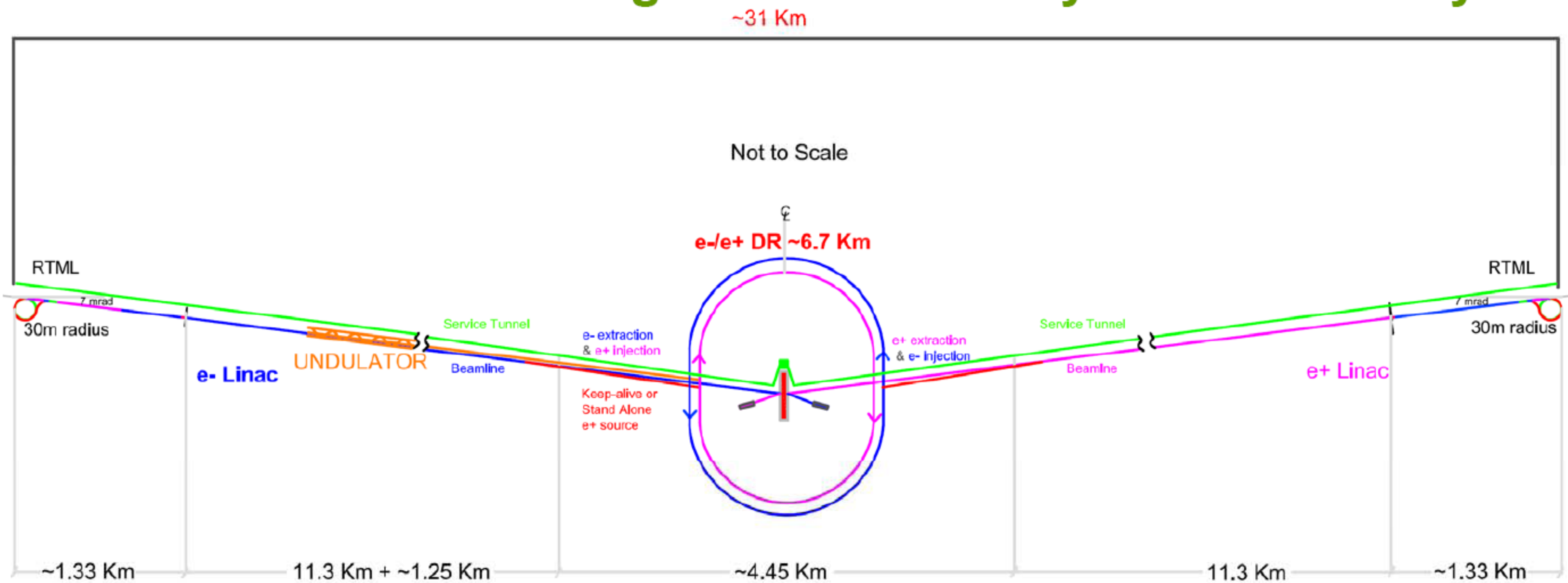
ILC Parameters (*I stage*)

Max. Center-of-mass energy	500	GeV
Peak Luminosity	$\sim 2 \times 10^{34}$	$1/cm^2s$
Beam Current	9.0	mA
Repetition rate	5	Hz
Average accelerating gradient	31.5	MV/m
Beam pulse length	0.95	ms
Total Site Length	31	km
Total AC Power Consumption	~230	MW

Parameter range established to allow for operational optimization

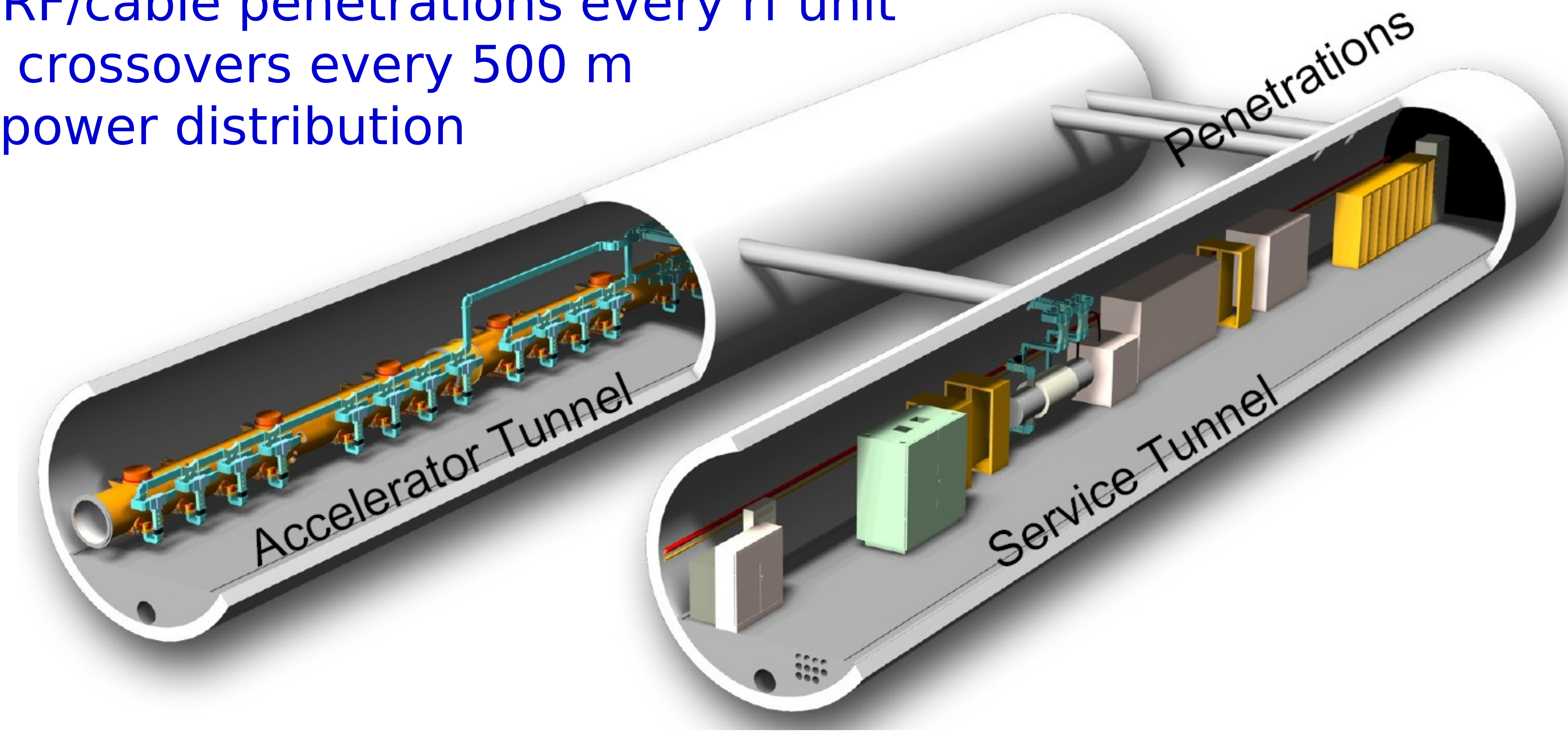
New scheme of the ILC (according to RDR)

- 11km SC linacs operating at 31.5 MV/m for 500 GeV
- Centralized injector
  - Circular damping rings for electrons and positrons
  - Undulator-based positron source
- Single IR with 14 mrad crossing angle
- Dual tunnel configuration for safety and availability



Basic Layout: Main Linac Double Tunnel

- Three RF/cable penetrations every rf unit
- Safety crossovers every 500 m
- 34 kV power distribution

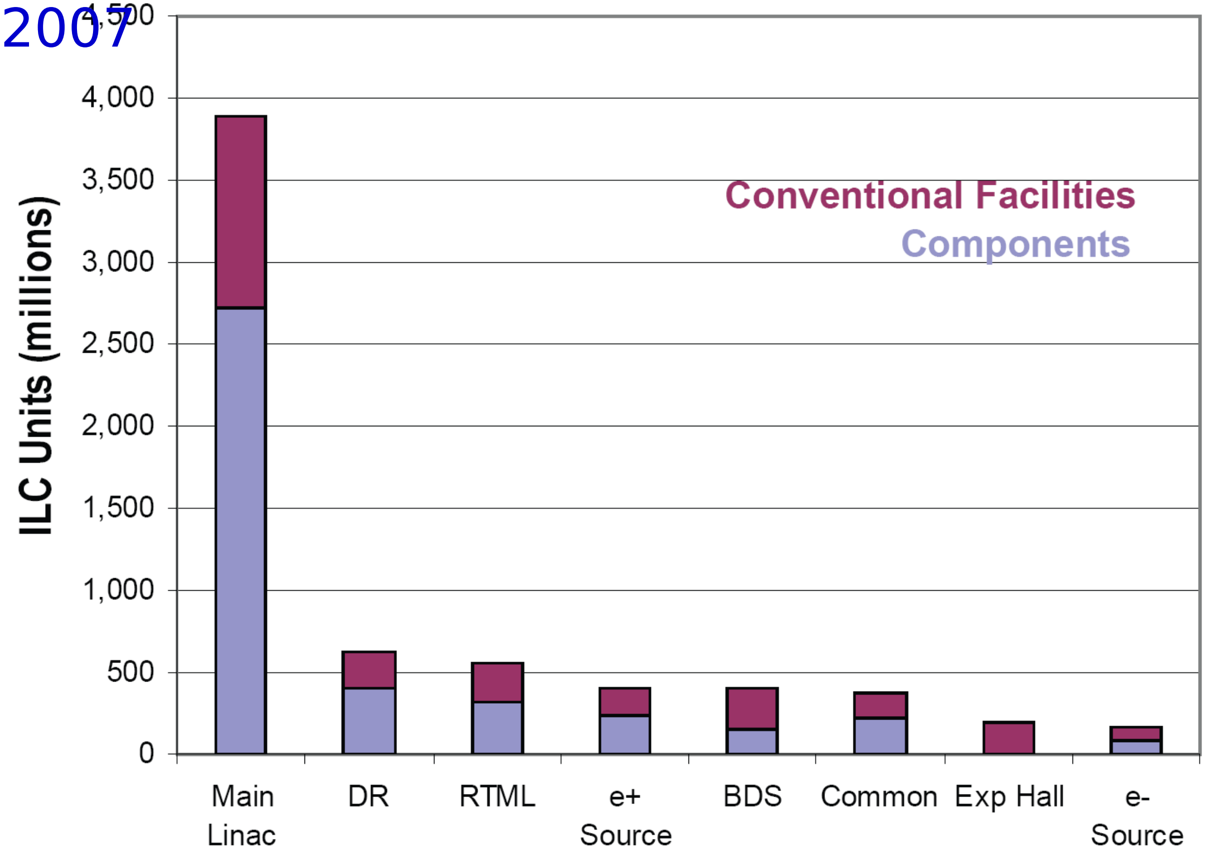


Conventional Facilities

- 72.5 km tunnels ~ 100-150 meters underground (for US, Asia, and CERN cites)
- 13 major shafts $\geq$ 9 meter diameter
- 443 K cu. m. underground excavation: caverns, alcoves, halls

Value Estimate

The value and explicit labor estimates are current as of 01.02.2007



The estimate contains three elements:

- 1.83 Billion (ILC Units) for site-dependent costs, such as the costs for tunneling in a specific region
- 4.79 Billion (ILC Units) for shared value of the high technology and conventional components
- 14,200 person-years for the required supporting manpower (=24 million person-hours)

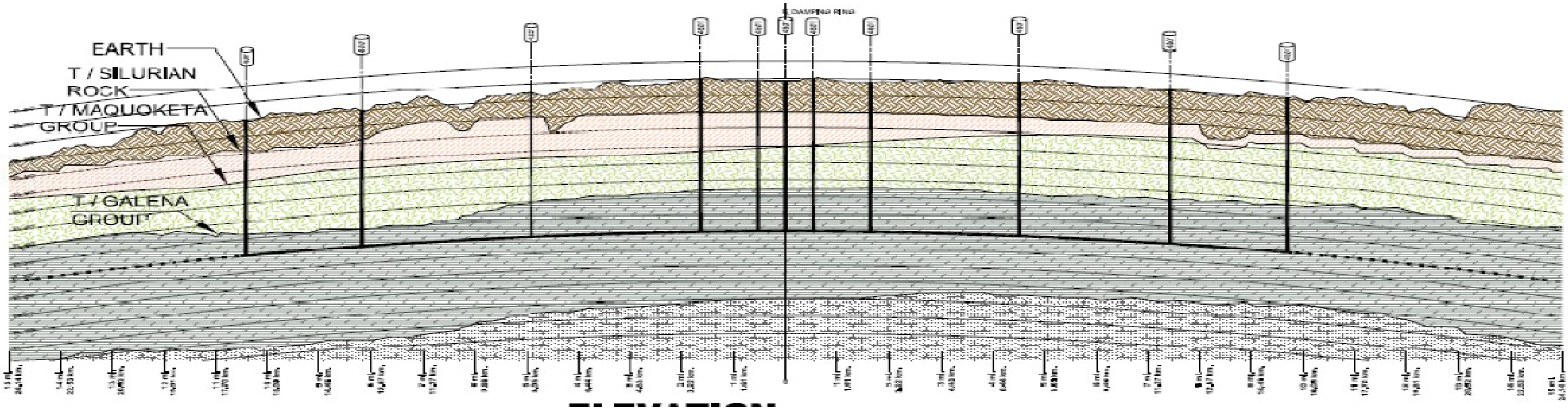
For this value estimate: 1 ILC Unit = 1 US 2007$ (= 0.83 Euro = 117 Yen)

AMERICAS FERMILAB SAMPLE SITE

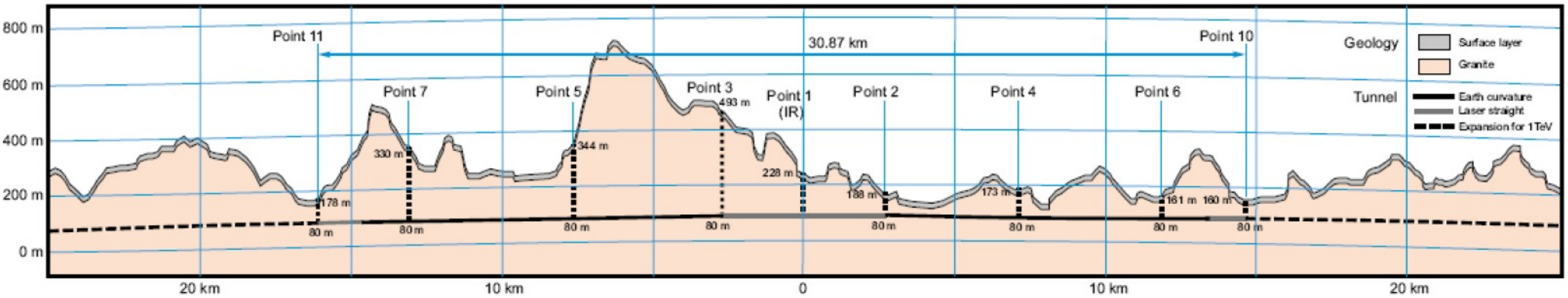
Situation : in solid rock, close to existing institute, close to the city of Chicago and international airport, close to railway and highway networks.

Geology : Glacially derived deposits overlaying Bedrock. The concerned rock layers are from top to bottom the Silurian dolomite, Maquoketa dolomitic shale, and the Galena-Platteville dolomites.

Depth of main tunnels : Average ~ 135 m



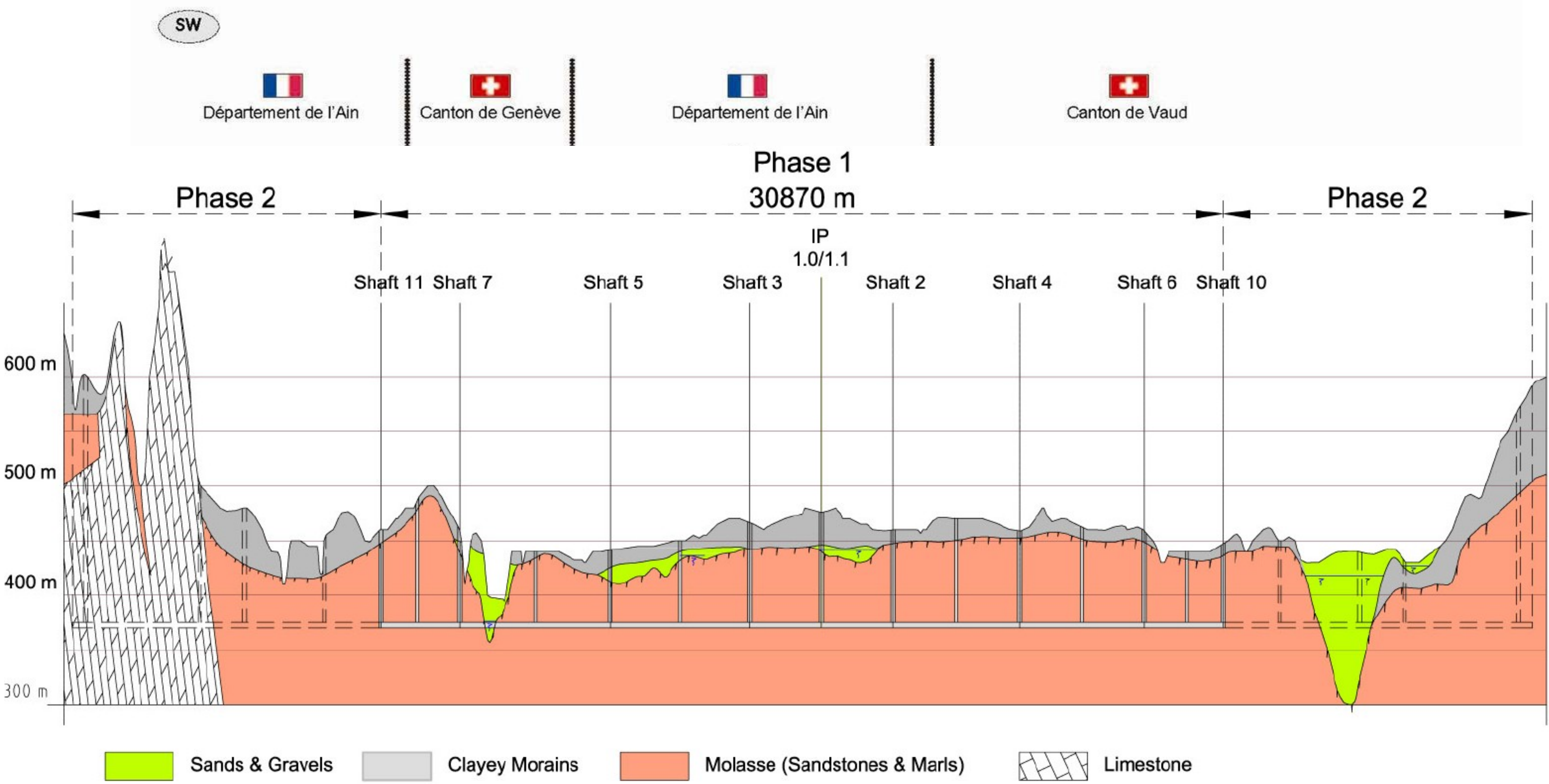
ASIAN SAMPLE SITE



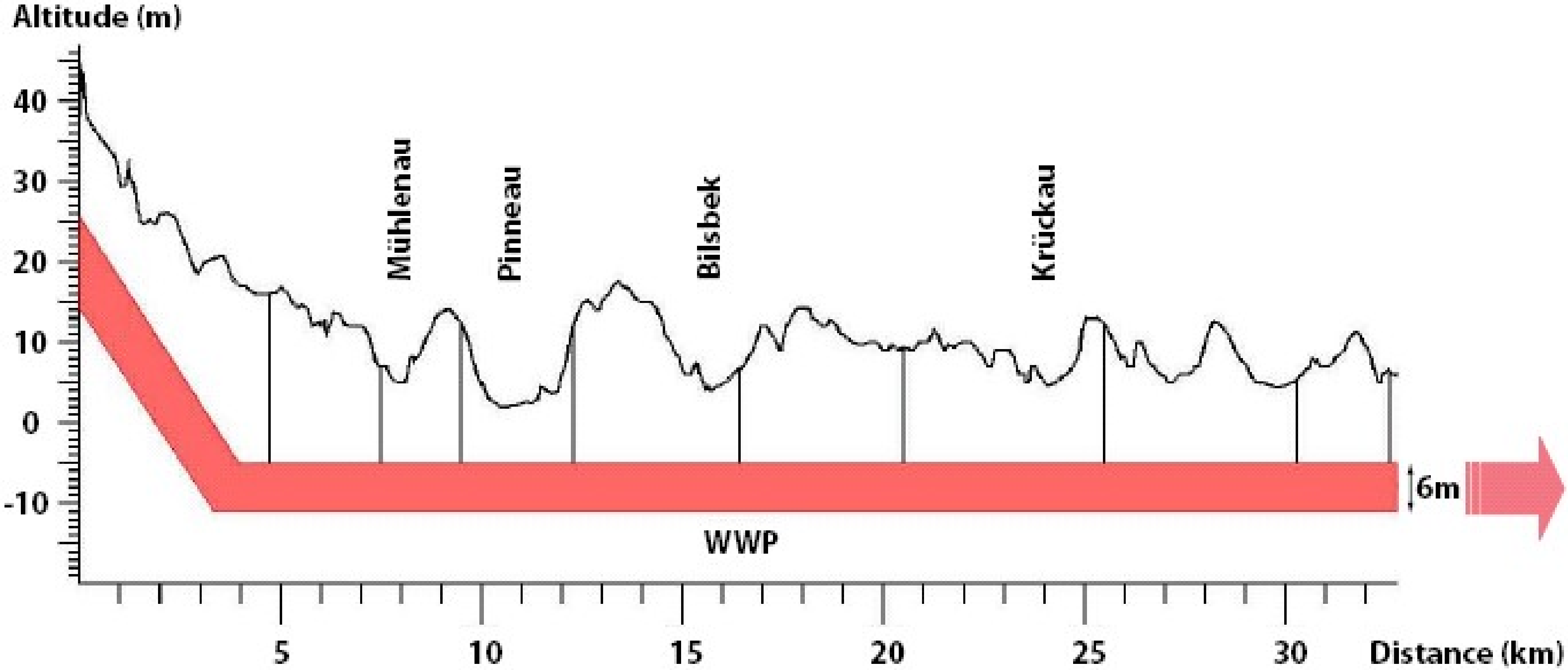
Longitudinal Section

EUROPEAN SAMPLE SITE – CERN REGION

Longitudinal Frofile

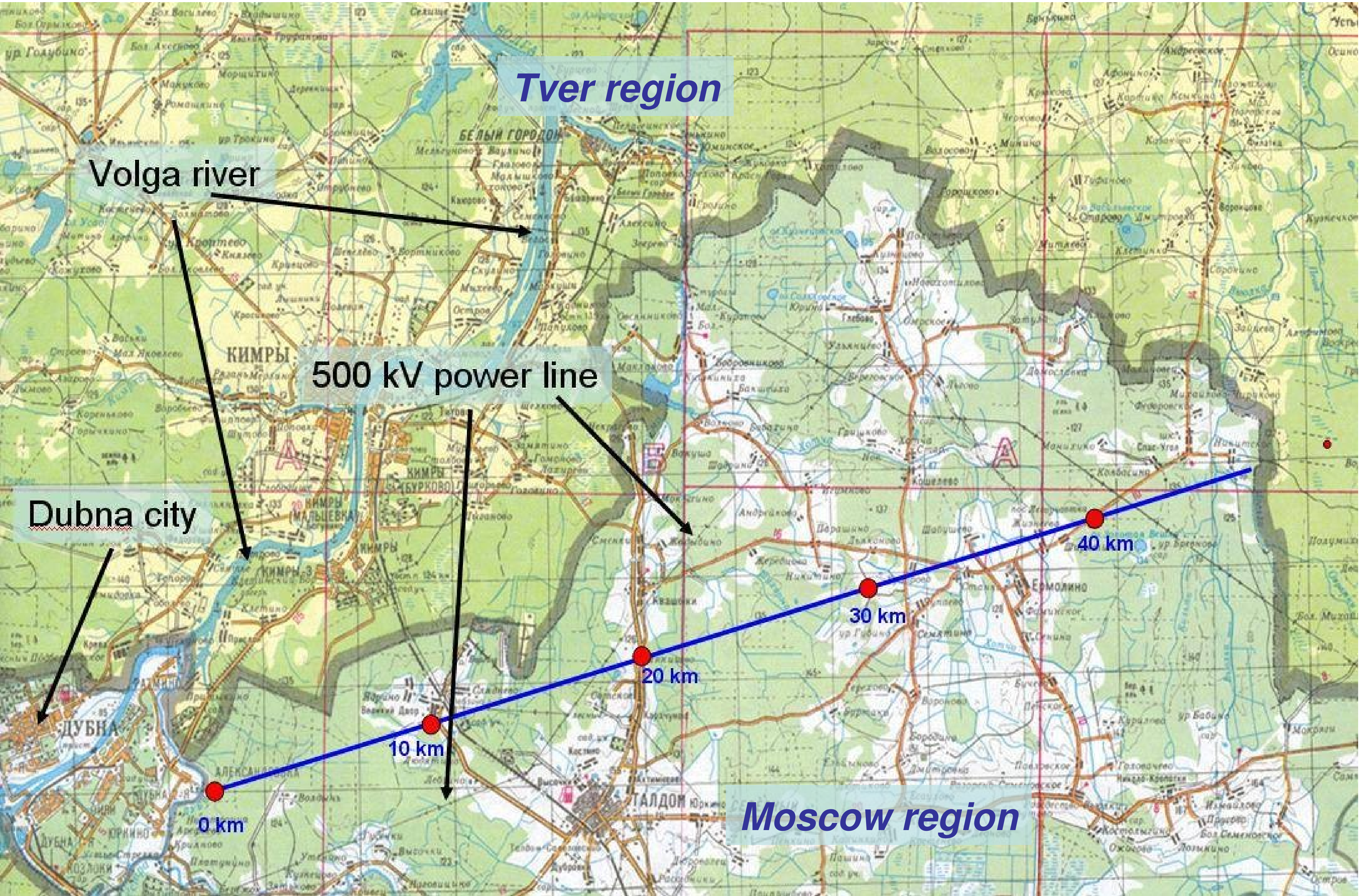


EUROPEAN SAMPLE SITE – DESY REGION



Longitudinal Section

Layout of ILC in the Moscow Region



GDE Meeting

ILC Conventional Facilities and Siting Workshop

June 3 - 7, 2008

JINR, Dubna, RUSSIA

Program Committee

Barry Barish
Mike Harrison
Brian Foster
Mitsuaki Nozaki
Ewan Paterson
Marc Ross
Grigory Shirkov
Alexey Sissakian
Nicolas Walker
Akira Yamamoto
Kaoru Yokoya

Contact person:

Yulia Polyakova - secretary of the meeting
(visa application, transportation and accomodation)
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Nadezhda Tokareva - administrative manager
e-mail tokarevan@jinr.ru

Local Organizing Committee:

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Shirkov G. - co-chairman
Trubnikov G. - scientific secretary
Kakurin S. - coordinator
Kuznetsova E. - secretary
Budagov Ju.
Meshkov I.
Tokareva N.
Shirkova E.
Poliakova Yu.

GDE and ILCSC meetings at JINR, June 2008

Conclusions

- **We have presented the elements of the GDE plan for the next phase, which we call the Technical Design Phase.**
  - A two stage ILC Technical Design Phase (TDP I 2010 and TDP II 2012 is proposed)
- **Overall Goals: Cost reduction, technical design and implementation plan on the time scale of LHC results**
-
- SCIENCE remains the key to ultimate success.

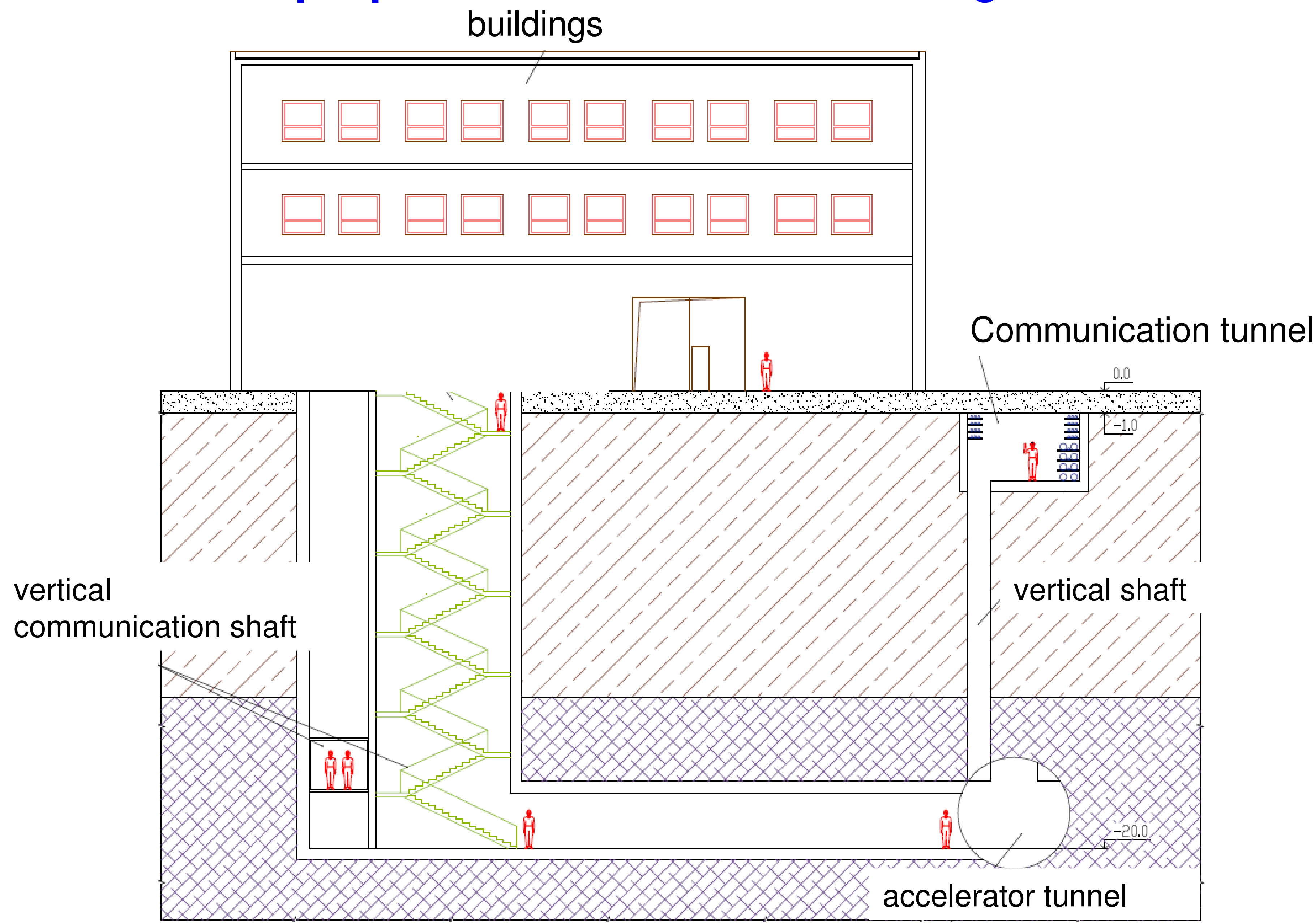
GDE Meeting, Dubna, June 2008: Dubna Site Discussion


Dubna, June 7, 2008
VERTICAL-T

Chair of ILCSC Prof. Enzo Iarocci on the Board of Helicopter

Typical View of ILC Siting in the Dubna Region

Dubna proposal: Shallow site with single tunnel



A new suggested variant of the accelerator tunnel layout is under discussion and estimations now. It assumes the following:

• main (beam) tunnel is located at approximately 15-20 m (at abs. level -100 m) in order to have impermeable layer above and below to be prevented from subsoil waters;

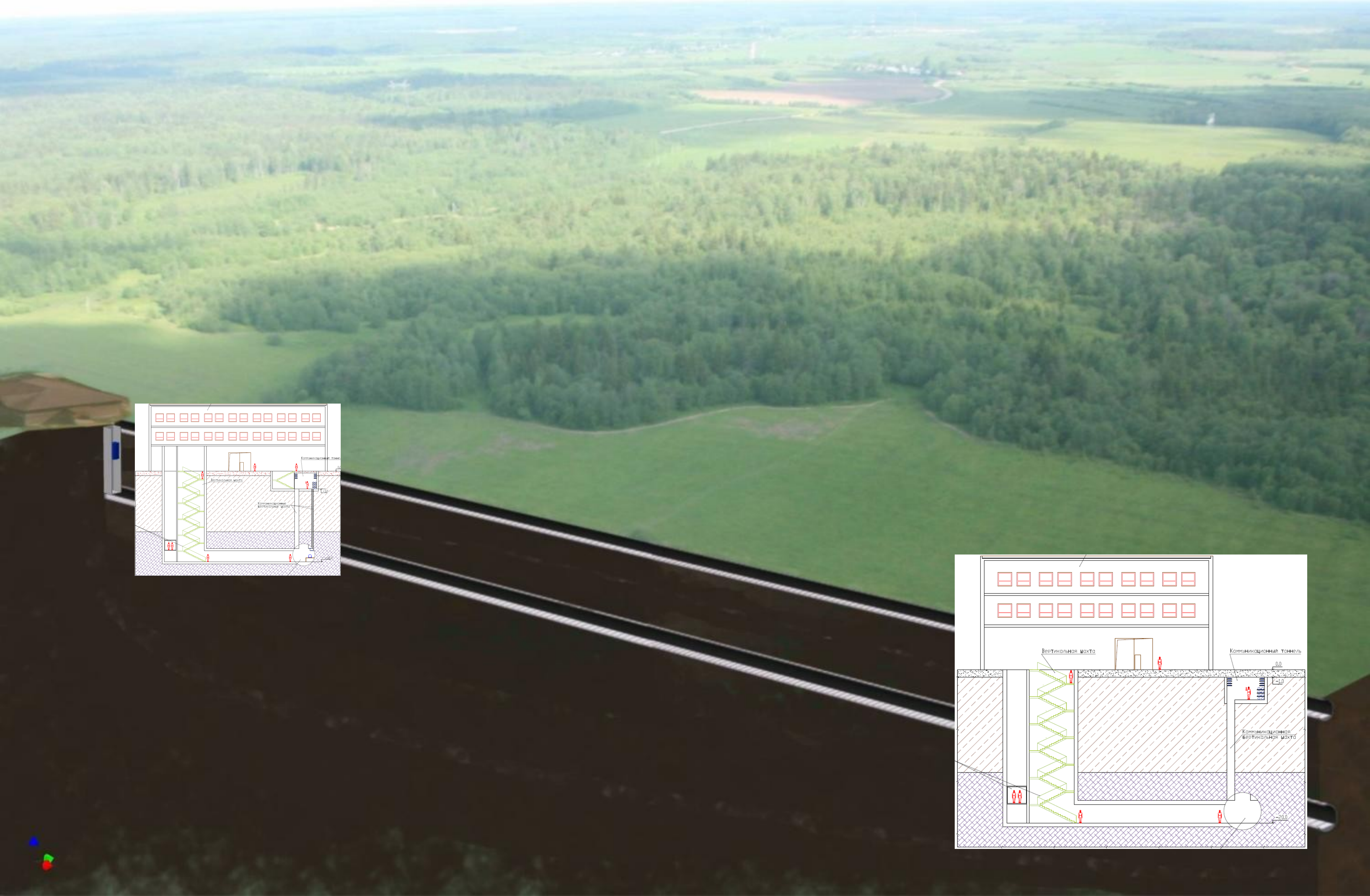
• service (communication) tunnel or gallery is located directly above the main and around the earth surface (<-3-4 m), practically repeating the relief;

• technological connection between two tunnels is provided with vertical shafts of different diameters, which are drilled with usual method;

• connection between surface buildings and underground infrastructure is provided with vertical and horizontal shafts (elevators, stairs, etc)

• cost of communication tunnel itself on the surface (without any equipment) is estimated by GSPI about 10 times cheaper in comparison with underground tunnel.

Shallow site layout with one tunnel in the Dubna region



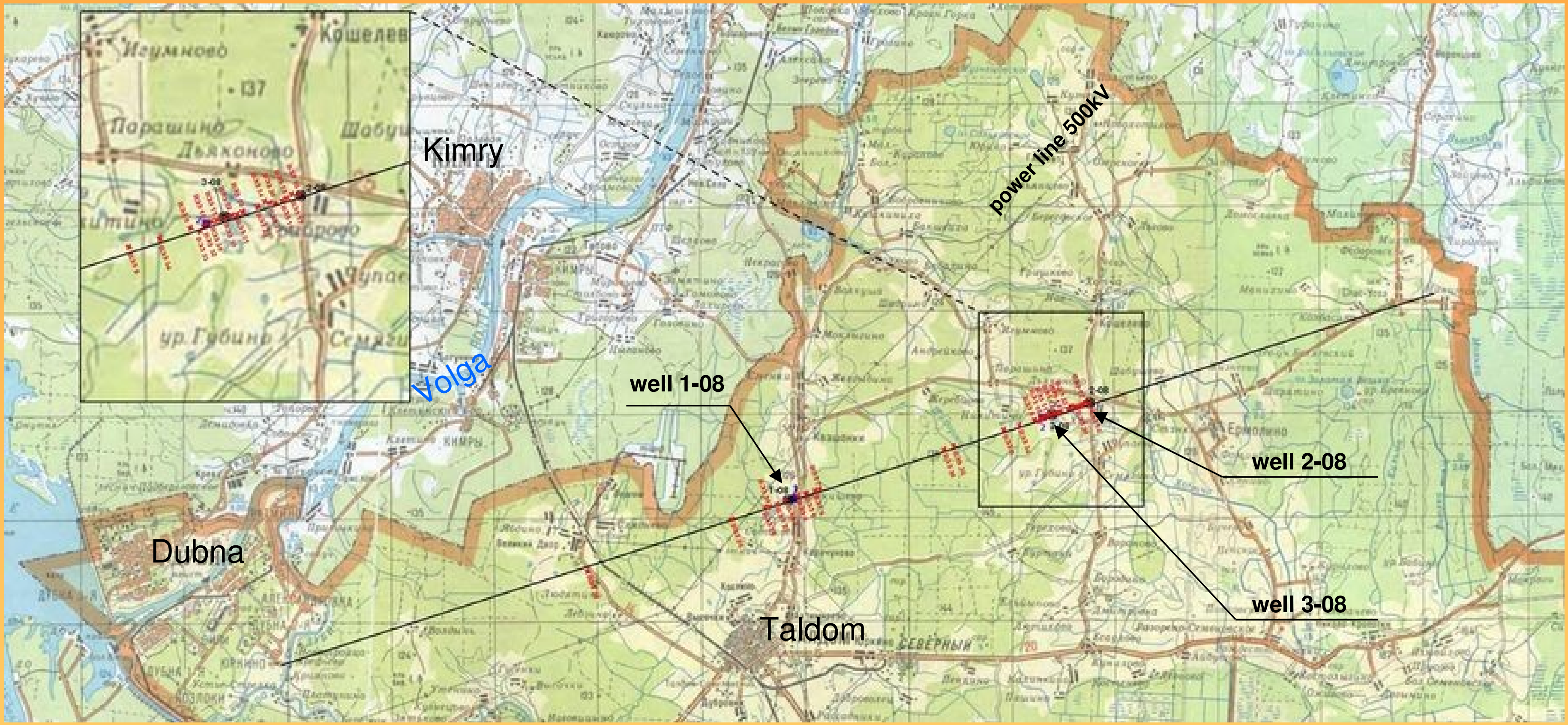
The results of the preliminary geological engineering surveys along the supposed route of the International Linear Collider (ILC) in Taldom area of Moscow region.

- Close to Joint Institute for Nuclear Research (JINR) in Dubna
- The area is sparsely populated
- Route of the accelerator crosses 2 small populated points and railway between the cities Taldom and Kimry
- Moderately-continental climate
- Average temperature in January -10.7°C, in July +17.8 °C
- Annual rainfall is 630 mm

Preliminary geological engineering surveys (October - November 2008)

- drilling of 3 wells of 36.0-47.0 m with full core extraction;
- selection of 40 monoliths of soil, 16 samples of disturbed soil for laboratory investigations of their physical-mechanical properties;
- selection of 10 probes of ground water for chemical analysis;
- gamma-ray logging;
- thermometry;
- vertical seismic profiling;
- 35 points of vertical electric sounding;
- high-resolution surface seismic survey using shear wave reflection method

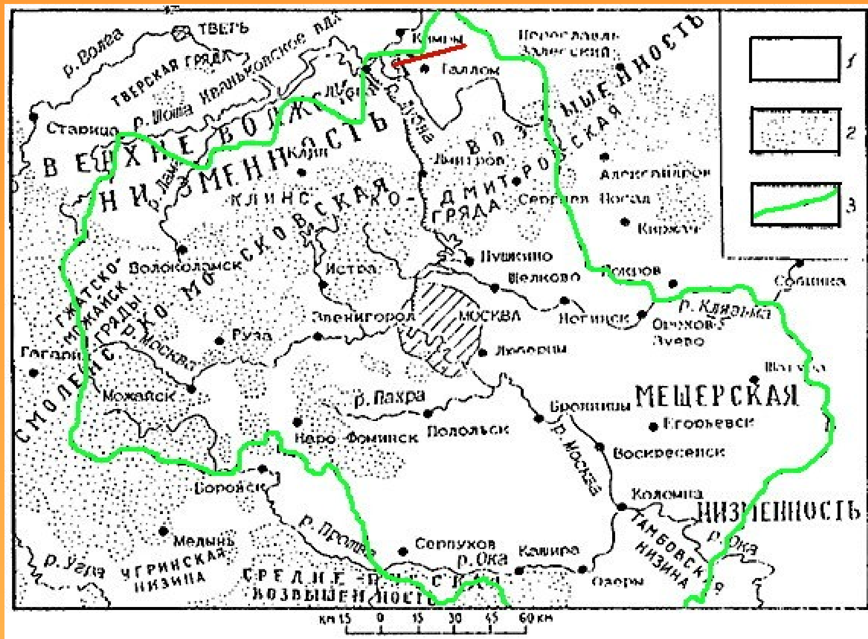
The aim: to confirm the presence of thick solid stratum of moraine loam



Space views of drillings # 1, 2 и 3 (October 2008)

33

Relief of the investigated area

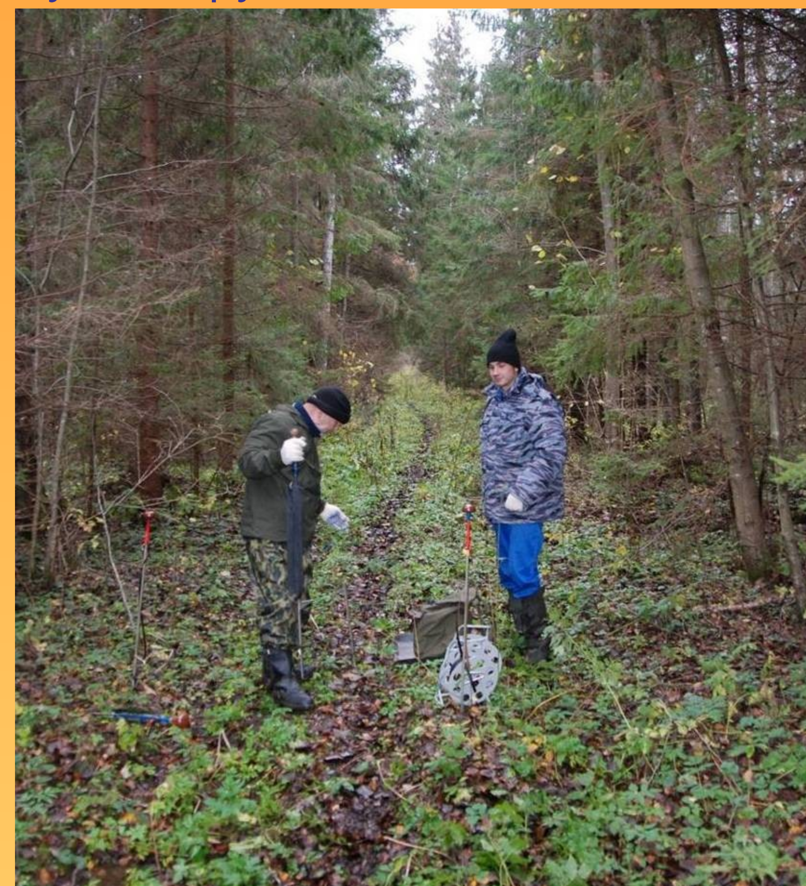


Orohydrographic scheme of Moscow region

Track of assumed ILC placement within upper Volga lowland.
1 - lowlands and hollows,
2 - heights (higher than 200m),
3 - frontier of Moscow region.

Main features:

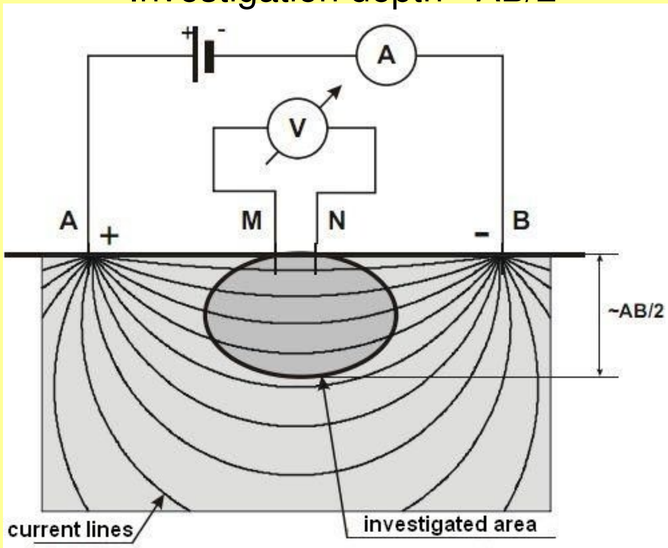
- practically flat surface
- existing hills are smooth
- the altitude is varying from 120 to 150 m (in Baltic system of the heights)
- mainly woodland, grassland and cropland partly swampy



Methods and techniques

Vertical Electric Sounding (VES)

A and B – current source probes (I_{AB}),
M and N – measuring probes (ΔU_{MN})
Investigation depth ~AB/2



$$\rho_a = K \cdot \frac{\Delta U_{MN}}{I_{AB}}$$

where K – coefficient, depending on the distance between electrodes A, B, M, N.
ρ_a- apparent resistance of medium.
It depends on the structure of strata with different resistance.
Using set of measurements it is possible to define the structure of soil layers.

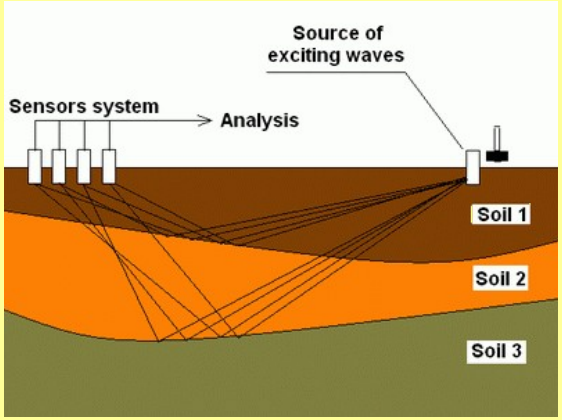
Gamma-ray logging, thermometry and vertical seismic profiling

All these logging methods are done by lowering of corresponding instrument down the hole and measuring necessary physical quantity at each depth.

Laboratory investigations of soil and water probes

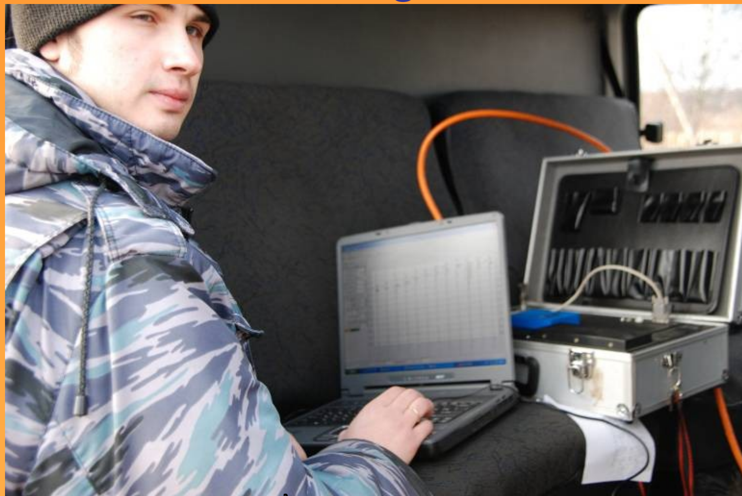
- **grain-size composition;**
- **natural humidity;**
- **density;**
- **liquid limit and limit of plasticity;**
- **flow limit;**
- **porosity factor;**
- **modulus of deformation;**
- **chemical analysis of water probes etc.**

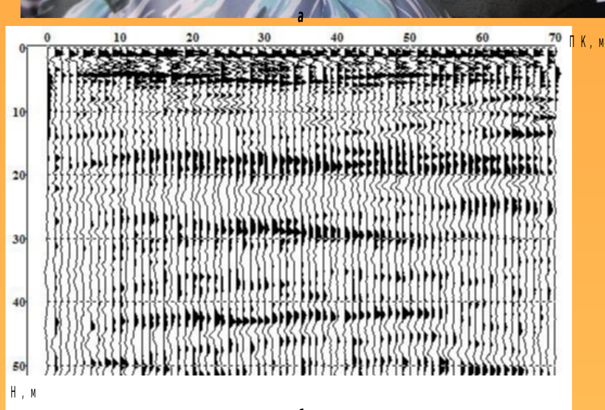
High-resolution prospecting seismology based on reflected SH-waves

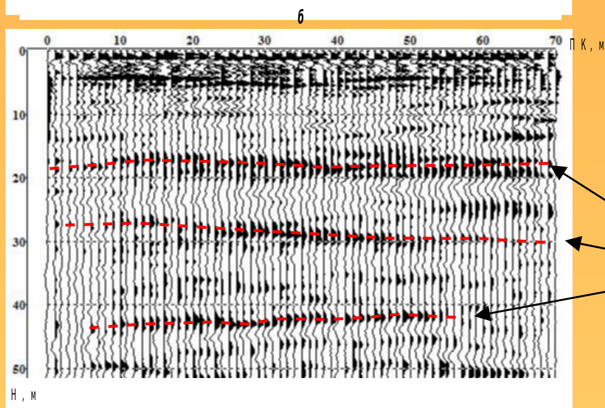


A reflection experiment is carried out by initiating a seismic source (dynamite or hummer in our case), recording the reflected waves using set of seismometers, collecting and analyzing data

Seismic investigations on the profile 1 near the village Miakishevo



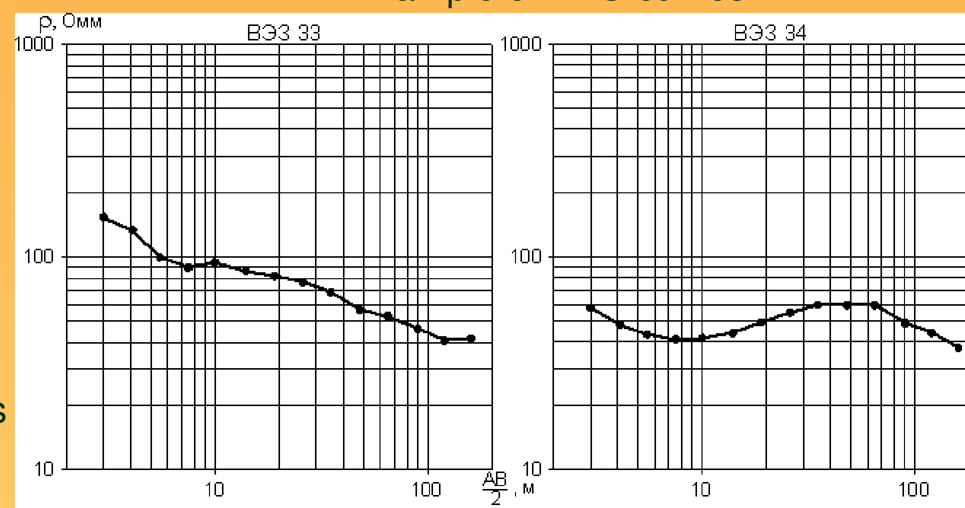


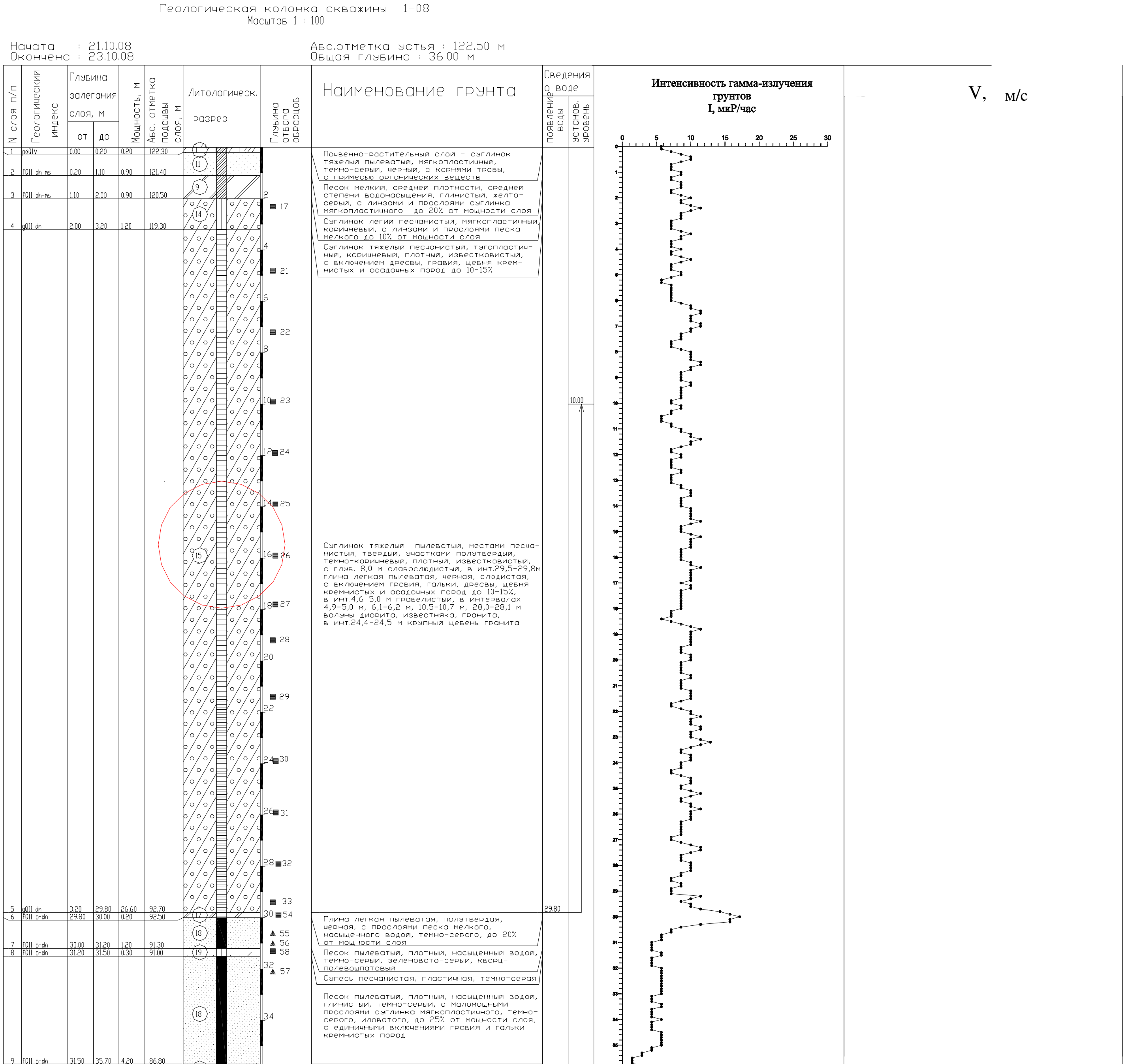


reflecting boundaries

Drilling of well 3-08 in the region of Khrabrovo village.

Example of VES-curves





1. Recommended soils for accelerator placement: firm loamy soils, dense including gruss and road metal up to 15 %

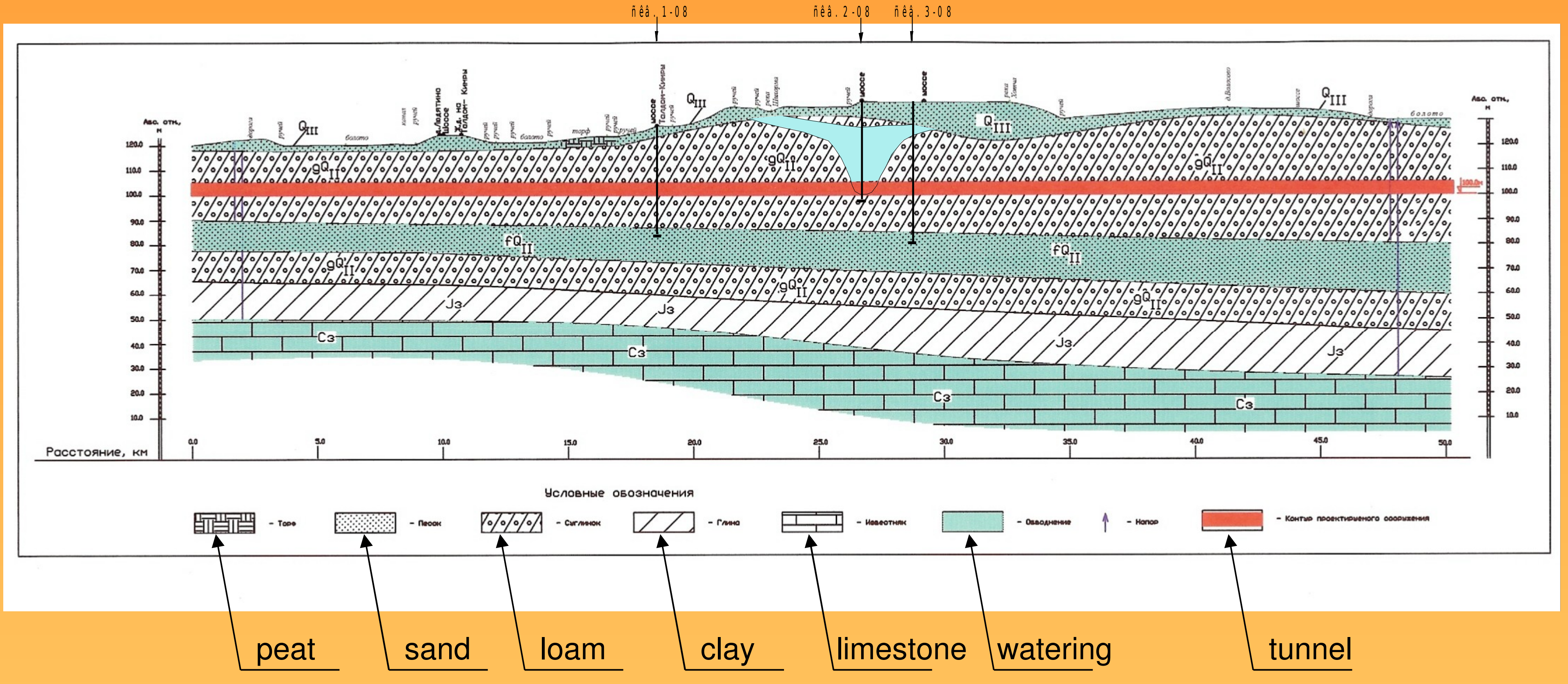
2. Recommended depth of tunnel placement is 13,0m (absolute mark is 110,0m).

Core samples from well 1-08

Description of the Dnieper moraine loam

Heavy pulverescent loam , sometimes sandy, sometimes light pulverescent clay, solid, sometimes semisolid, dense, dark grey, olive-brown, with inclusions up to 10-15% of gravel, grit and rubble of sedimentary and igneous rocks, rarely with lenses of semigravel.
It is found in middle and bottom part of stratum of the Dnieper moraine sediments.
Power of a layer is 2.8-27.2 m.

Schematic geological engineering section of the ILC route



The main characteristics of soils

20 engineering-geological elements (EGE) were selected during area investigation

Номер	Номер слоя геологического элемента	Геологический индекс	Наименование грунта	Коэффициент пористости e	Показатель текучести J_L	Нормативное значение: Плотность ρ, т/м³	Нормативное значение: Угол трения φ, градус	Нормативное значение: Удельное сцепление C	Модуль деформации E	Коэффициент фильтрации K	Нормативная промерзания грунта d fn, по СП 12.1 формуле 2004
1	1	pdQ_{IV}	Суглинок тяжёлый пылеватый, мягкопластичный	0,76	0,55	1,97	-	-	-	0,5	1,34
2	2	aQ_{III}	Суглинок тяжёлый песчанистый, мягкопластичный.	0,95	0,62	1,84	17	33	8	0,5	1,34
3	3	aQ_{III}	Песок мелкий, средней плотности, малой, средней степени водонасыщения.	0,70	-	1,73 /1,83	30	1	23	3,0	1,63
4	4	aQ_{III}	Песок гравелистый, средней плотности, средней степени водонасыщения и насыщенный водой.	0,65	-	1,87 / 2,01	38	0	30	10,0	1,75
5	5	aQ_{III}	Гравийный грунт из обломков изверженных и осадочных пород, с заполнителем из песка крупного, насыщенный водой.	-	-	2,44	-	-	50	25,0	1,98
6	6	gQ_{II}^{ms}	Суглинок лёгкий песчанистый, тугопластичный.	0,40	0,34	2,19	26	29	29	10^{-5}	1.34
7	7	gQ_{II}^{ms}	Суглинок легкий песчанистый, полутвердый.	0,31	0,01	2,27	30	40	62	10^{-5}	1,34
8	8	gQ_{II}^{ms}	Песок средней крупности, средней плотности, насыщен. водой.	0,64	-	2,02	34	7	24	7,6	1,75
9	9	fQ_{II}^{dn-ms}	Суглинок лёгкий песчанистый, мягкопластичный.	0,72	0,65	1,99	18	20	13		1,34
10	10	fQ_{II}^{dn-ms}	Песок пылеватый, средней плотности, насыщенный водой.	0,70	-	1,98	28	3	14	0,9	-
11	11	fQ_{II}^{dn-ms}	Песок мелкий, средней плотности, малой, средней степени водонасыщения и насыщенный водой	0,65	-	2,01	32	2	28	3,0	-
12	12	fQ_{II}^{dn-ms}	Песок средней крупности, прослоями крупный, средней плотности, насыщенный водой.	0,65	-	2,01	35	1	30	5,0	-
13	13	fQ_{II}^{dn-ms}	Гравийный грунт из обломков изверженных и осадочных пород, заполнитель – песок пылеватый, насыщенный водой.	-		2,44	-	-	50	25,0	-
14	14	gQ_{II}^{dn}	Суглинок лёгкий, участ. тяжёлый, песчанистый, полутвёрдый.	0,41	0,24	2,21	26	41	33	10^{-5}	-
15	15	gQ_{II}^{dn}	Суглинок тяжёлый пылеватый, участ. песчанистый, твёрдый.	0,43	<0	2,20	22	59	54	10^{-5}	-
16	16	gQ_{II}^{dn}	Песок пылеватый, средней плотности, насыщенный водой.	0,60	-	2,04	32	5	23	1,0	-
17	17	fQ_{II}^{o-dn}	Глина лёгкая пылеватая, полутвёрдая.	0,66	0,18	2,01	24	34	26	10^{-5}	-
18	18	fQ_{II}^{o-dn}	Песок пылеватый, плотный, насыщенный водой.	0,59	-	2,04	32	5	23	1,0	-
19	19	fQ_{II}^{o-dn}	Супесь песчанистая, пластичная, участками твёрдая.	0,34	0,32	2,02	22	24	38	0,5	-
20	20	fQ_{II}^{o-dn}	Песок мелкий, участками средней крупности, плотный, насыщенный водой.	0,59	-	2,05	34	3	33	2,0	-

Properties of soils, which are important from point of view of Building Code:

- Porosity factor
- Flow index
- Density
- Angle of internal friction
- Specific cohesion
- Modulus of deformation
- Filtration coefficient

Physical-mechanical properties of soil

Properties of EGE 15:
(for example)

- Soil grain-size composition
- Densities
- Deformation behavior
- Deformation moduli
- Shear resistance
- Angle of internal friction

Объект: Трасса размещения международного коллайдера
Номер выработки: ۱-۰۸
Интервал отбора, м: ۱۹,۰۰ – ۱۹,۳۰
ИГЭ №: 15
Наименование грунта: Суглинок тяжелый пылеватый, твердый, незасоленный (g Q_{II}^{dn})

Лабораторный номер: 2667
Структура грунта: ненарушена
Состояние образца: водонасыщенный

Испытание произведено на приборах "ГИДРОПРОЕКТ"
Диметр кольца – 87,5 мм. (сжатие) и 72 мм. (срез)
Высота кольца – 25 мм. (сжатие) и 35 мм. (срез)

ГОСТ 12536-79. ГОСТ 5180-84
ГОСТ 12248-96
ГОСТ 24143-80

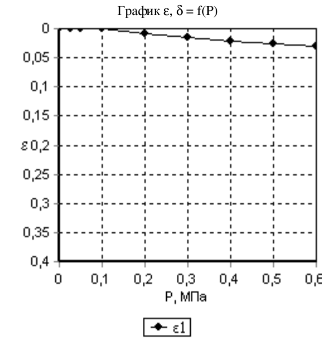
Гранулометрический состав фракций, %

> 10	10 – 5	5 – 2	2 – 1	1 – 0,5	0,5 – 0,25	0,25 – 0,1	0,1 – 0,05	0,05 – 0,01	0,01 – 0,005	< 0,005
7,7	0,4	0,6	0,9	1,3	5,4	9,9	15,3	28,6	10,5	19,4

Физические свойства грунта

Плотность грунта, г/см³	Плотность сухого грунта, г/см³	Плотность частиц, г/см³	Коэф. пористости	Степень влажности, д.е.	Влажность, %: природная	Влажность, %: на границе текучести	Влажность, %: на границе раскат.	Число пластичности, %	Показатель текучести
2,13	1,84	2,72	0,480	0,90	15,9	32,2	18,1	14,1	-0,16

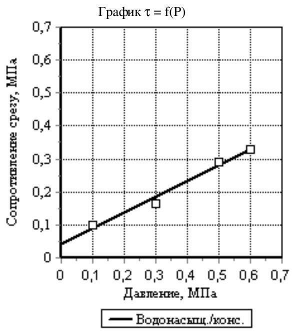
Вертик давл-е P	Отн. деф. ε	Коэф. порист. e	Коэф. уплотн. a	Мод. деф., МПа E	Отн. деф. (зам.) $ε_1$	Коэф. порист. (зам.) e_z	Коэф. уплотн. (зам.) a_z	Мод. деф. (зам.) E_z
0,0					0,0000	0,480		
0,025					0,0000	0,480	0,00	
0,05					0,0000	0,480	0,00	
0,1					0,0004	0,480	0,01	84,70
0,2					0,0087	0,467	0,12	7,16
0,3					0,0159	0,457	0,11	8,20
0,4					0,0206	0,450	0,07	12,63
0,5					0,0259	0,442	0,08	11,25
0,6					0,0302	0,435	0,06	13,78



Модуль общей деформации $E_{0,1-0,2}$, МПа:
Модуль деформации с учетом M_k $E_{0,1-0,2}$, МПа:
Модуль общей деформации(водонасыщ) $E_{0,1-0,2}$, МПа: 7,16
Модуль деформации(водонасыщ) с учетом M_k $E_{0,1-0,2}$, МПа: 35,8
Относительная просадочность при P=0,3 МПа:
Начальное просадочное давление $P_{пр}$, МПа:
Относительное набухание (ПНГ), д.е.:
Влажность набухания (ПНГ), %:
Давление набухания (ПНГ), МПа:

	Состояние грунта			
	Водонасыщенное			
Вид среза	медленный консолидированный срез			
нормальное давление P, МПа	срезающая нагрузка, Кг	сопротивл. срезу τ, МПа	срезающая нагрузка, Кг	сопротивл. срезу τ, МПа
0,1	4,0	0,1		
0,3	6,6	0,165		
0,5	11,6	0,29		
0,6	13,2	0,33		

Тангенс угла внутр. трения	0,479	
Угол внутр. трения, град.	26	
Удельн. сцепление, МПа	0,042	



Statistical investigation of soils

EGE 15 (for example)

Using 31 sample of soil

Grain size distribution:

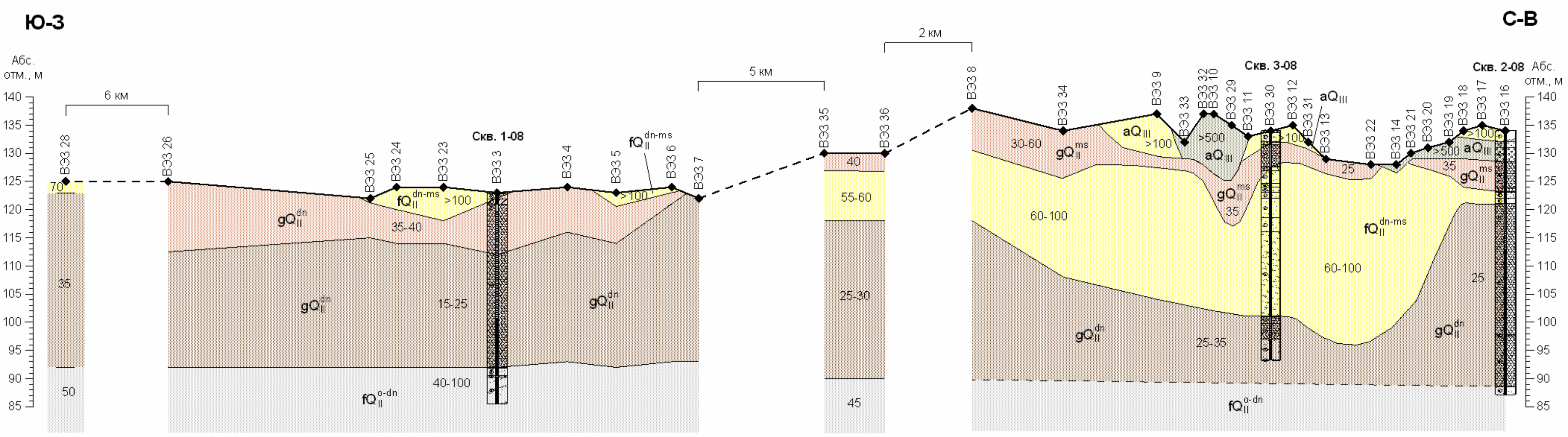
From > 10 mm
To < 1µm

Other physical-mechanical properties

(ГОСТ 20522- 96)

Наименование характеристики	Кол-во значений характеристики		Значения характеристики			Коэф. вариации	Коэф. надежности по грунту при доверительной вероятности		Расчетные значения характеристики при доверительной вероятности	
	общее	взятое в расчет	мин.	макс.	средн.		0,85	0,95	0,85	0,95
ИГЭ 15. Суглинок тяжелый пылеватый, твердый (g Q_{II}^{dn})										
Лаб. №№ 2629, 2630, 2631, 2632, 2633, 2634, 2635, 2636, 2637, 2638, 2639, 2640, 2641, 2642, 2644, 2658, 2660, 2662, 2663, 2664, 2665, 2666, 2667, 2668, 2669, 2670, 2671, 2672, 2692, 2710, 2711										
1. Частиц >10 мм	31	31	0,3	17,7	4,9					
2. Частиц 10-5 мм	31	31	0,1	10,1	1,0					
3. Частиц 5-2 мм	31	31	0,2	3,1	1,1					
4. Частиц 2-1мм	31	31	0,5	8,3	1,4					
5. Частиц 1-0.5 мм	31	31	0,8	9,0	1,9					
6. Частиц 0.5-0.25 мм	31	31	4,1	18,1	6,9					
7. Частиц 0.25-0.1 мм	31	31	7,5	17,5	12,6					
8. Частиц 0.1-0.05 мм	31	31	1,6	48,4	14,3					
9. Частиц 0.05-0.01 мм	31	31	0,0	43,7	27,0					
10. Частиц 0.01-0.005мм	31	31	3,6	17,9	9,9					
11. Частиц 0.005-0.001мм	31	31	2,9	32,5	19,0					
12. Частиц < 0.001мм	31	31	0,0	0,0	0,0					
13. Плотность частиц грунта, г/см3	30	30	2,68	2,76	2,72	0,007	1,001	1,002	2,72	2,71
14. Влажность природная, %	30	30	10,0	17,4	14,2	0,15				
15. Плотность грунта прир. сложения, г/см3	30	30	2,10	2,30	2,17	0,024	1,005	1,007	2,16	2,16
16. Плотность сухого грунта, г/см3	30	30	1,81	2,09	1,90	0,041				
17. Плотность водонас. грунта, г/см3	30	30	2,14	2,32	2,20	0,021				
18. Коэффициент пористости прир.	30	30	0,301	0,517	0,432	0,142				
19. Влажность на границе текучести, %	30	30	18,2	38,0	29,7					
20. Влажность на границе раскатывания, %	30	30	10,5	19,8	15,5					
21. Число пластичности	30	30	7,2	18,3	14,2					
22. Показатель текучести	30	30	-0,39	0,23	-0,09					
23. Степень влажности	30	30	0,75	0,97	0,89	0,056				
24. Степень неоднородности грансостава	1	1	18,62	18,62	18,62					
25. Модуль деформации Emk водонас., МПа	27	24	19,8	134,8	53,5	0,597				
26. Удельное сцепление, МПа (водонас., конс.)	29	29	0,005	0,125	0,059	0,408	1,087	1,149	0,054	0,051
27. Тангенс угла (угол) внут. трения (водонас., конс.)	29	29	0,23 (13°)	0,60 (31°)	0,41 (22°)	0,234	1,048	1,08	0,39 (21°)	0,38 (21°)

Profiles of Soil Layers in the Investigated Regions of ILC Layout



Условные обозначения

I геоэлектрический горизонт - моренные суглинки московской и днепровской стадии оледенения

II геоэлектрический горизонт - моренные суглинки днепровской стадии оледенения

III геоэлектрический горизонт - песчаные отложения окско-днепровского межледниковья

IV геоэлектрический горизонт - аллювиальные песчаные отложения и флювиогляциальные песчаные отложения днепрово-московского межледниковья

V геоэлектрический горизонт - аллювиальные гравийно-галечниковые отложения

Нач. БКИИ	Соколов В.С.	Приложение 8 31805016			
Глав.спец.	Крестинин А. А.				
Глав.спец.	Чернятин А.Г.				
Инж. 2-й кат.	Гусаков И.О.	Трасса размещения международного коллайдера			
		Геолого-геофизический разрез по оси трассы	Стадия	Лист	Листов
				1	1
		Масштаб: горизонтальный 1:20000 вертикальный 1:500	ФГУП "ГСПИ"		

Conclusions

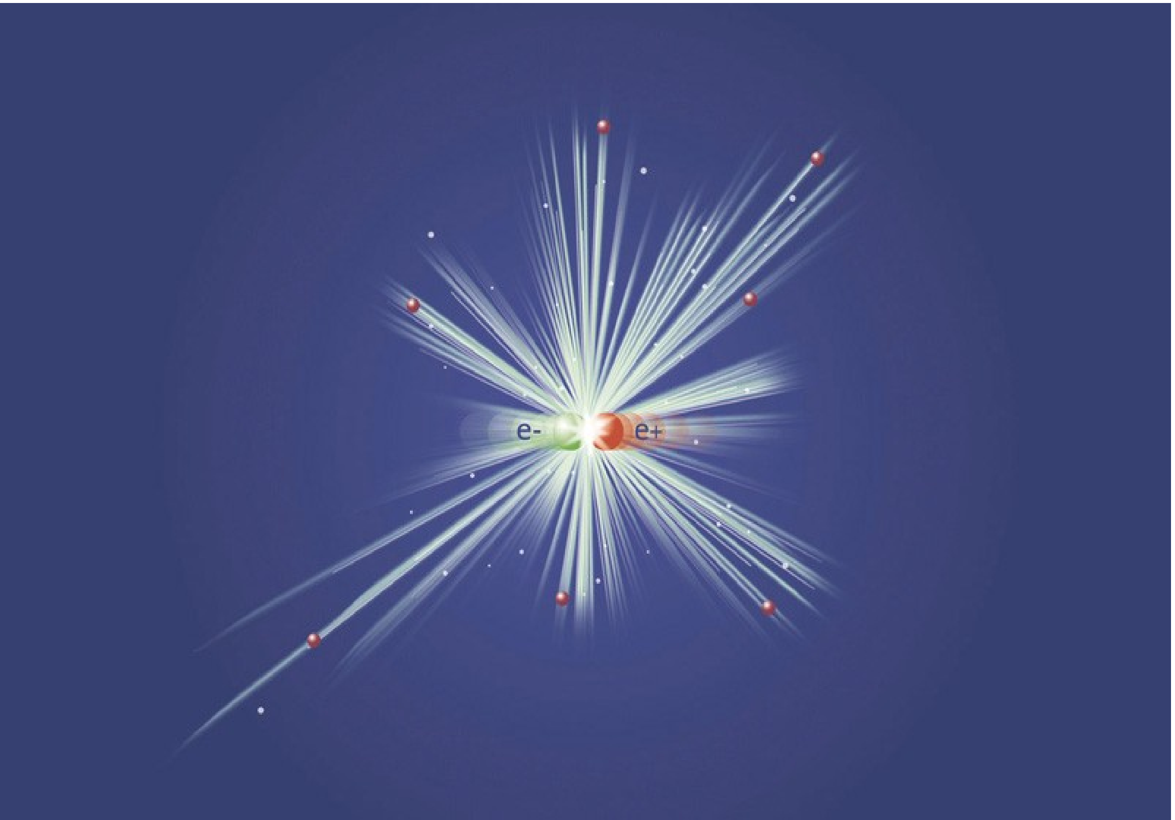
The results of preliminary geological engineering survey

1. Route of the International Linear Collider passes in sparsely populated area near existent International scientific center JINR.
2. Climatic conditions are comfortable.
3. Relief of the area is flat with soft outlines and small excess. The most part of the track is forest, the smaller part is meadows and tillage, partly is swamp land.

- The route passes through the stable, steady structural element of the earth's crust – Russian plate. This territory is related to the 5-point zone under the MSK-64 scale.
- Geological structure, hydrogeological conditions, geotechnical properties of soil are suitable for the ILC construction.
- The ILC is placed at a shallow depth (13-24m) in layer of firm dense drift clay, partly in layer of water-field sand. Under the further researches of the region it is possible to place the route in drift clay entirely.
- In general, the assumed route is favorable for the ILC construction. There is a positive experience of automated tunneling in similar soils in the Russian Federation.

02-0-1067-2007/2009
International Linear Collider: Accelerator Physics and Engineering

Theme leaders: *A.N. Sissakian*
G.D. Shirkov



Period: **2007- 2009**

-**Preparation of works of JINR;**

-**Participation in estimations and design of ILC elements**

Laser metrology

JINR developed test bench at CERN for precise laser metrology. Results are the following: 0,5 micron precision of laser beam position measurement on the base of 40m is achieved. At JINR it is planned to set this complex at b.118 (base is 2x250m).

DR magnetic system simulations and magnet prototype construction

JINR in collaboration with SLAC works on design and possibility to construct at JINR workshop series of magnetic system elements of DR (few dipole magnets). It is also planned to provide test of those elements.
This activity is performed in frames of MoU JINR-KEK on ATF collaboration. Similar MoU between JINR and SLAC is under assignment

CLIC : Continuation of works with CERN:

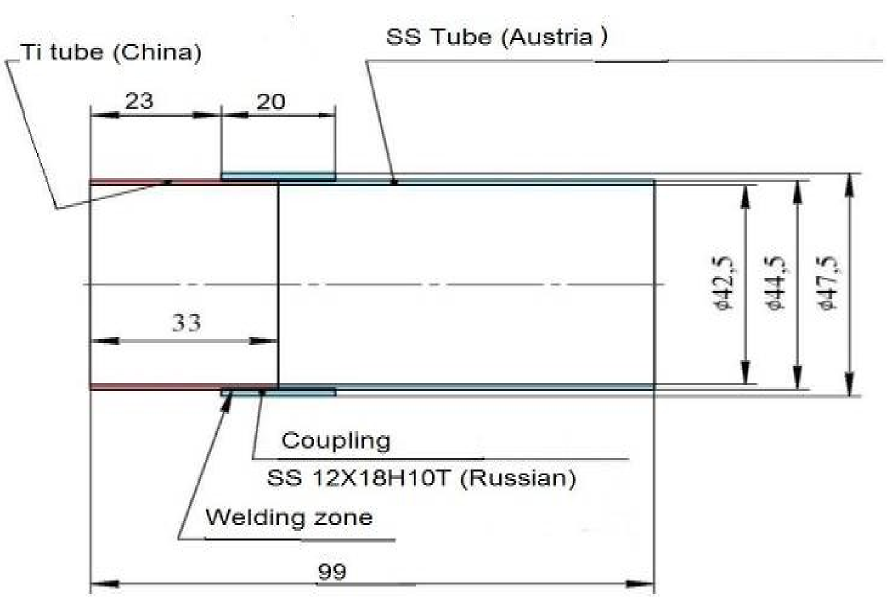
new prototype of the resonator was manufactured, proposed ways for increasing of the pulsed heating, results of the works on 2nd stage of the Contract approved by CERN.

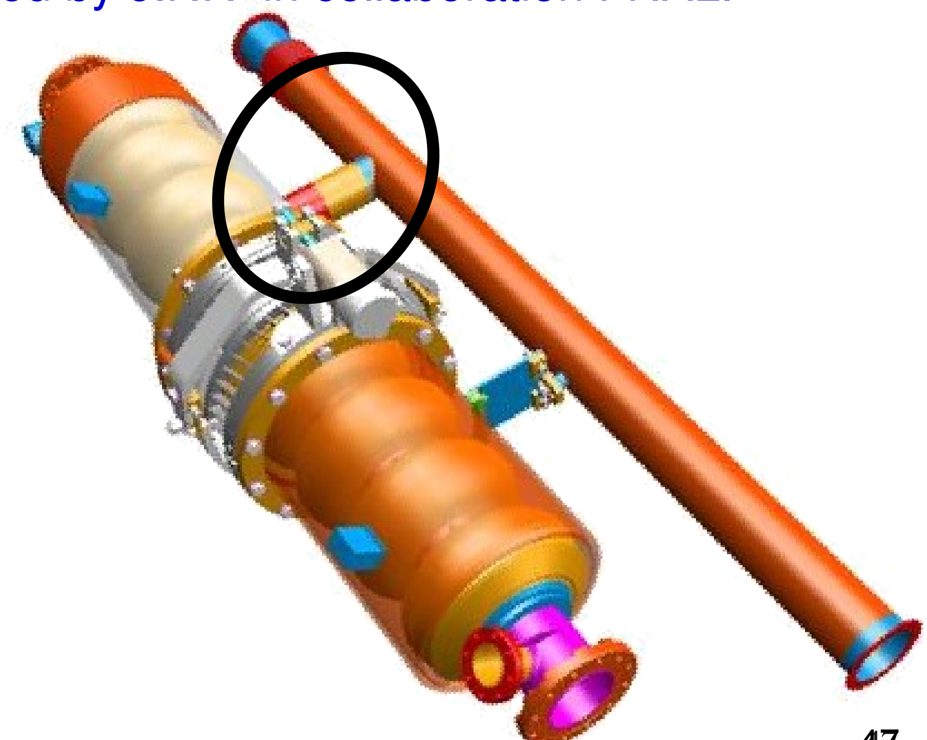
LINAC-800:

Commissioning of the accelerating section (20-40 MeV) - 2009
Construction works at b.118, engineer infrustructure, modulator test bench,
klystron test bench)

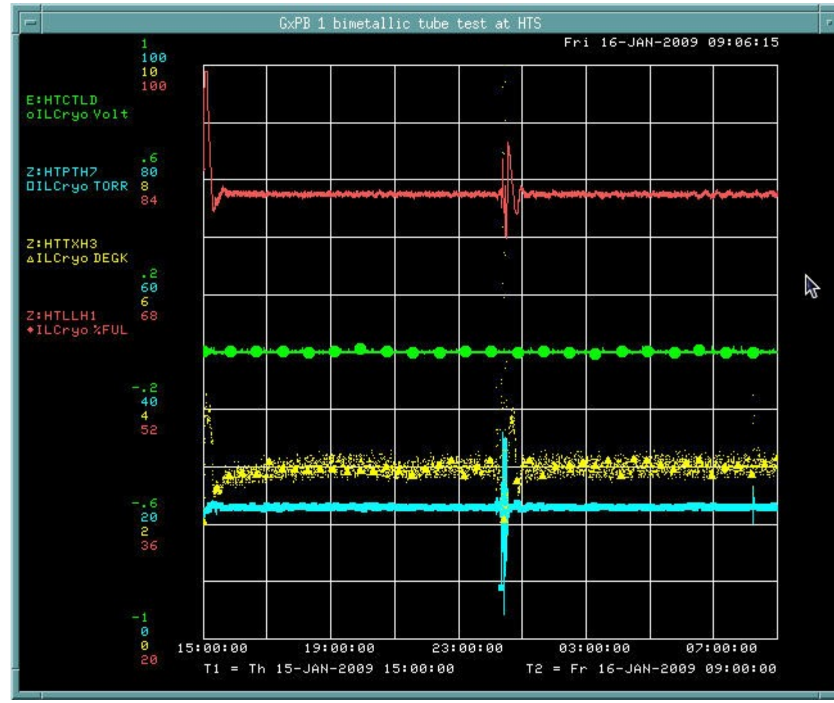
JINR Participation in the ILC Cryomodule design.

This international effort includes contributions from many institutions, including JINR together with FSUE “RFNC-VNIIEF” (Sarov, Russia). The key participants at the JINR are J.Budagov, B.Sabirov and A.Sukhanova.
JINR and Sarov are performing an effective collaboration with INFN-Pisa on a bi-metallic Ti-SS transition tube to connect the Titanium helium vessel with a 76-mm diameter two-phase helium line in an ILC cryomodule (CM). Such a transition would allow for a very substantial cost savings in the ILC cryomodule production.
Successful preliminary tests with prototype transition tubes of a smaller diameter, supplied by JINR and Sarov, were conducted by JINR in collaboration FNAL.





Collaborative R&D of bi-metallic tubes for the ILC cryomodule and testing them successfully performed in conformance with the Technical Specifications. Total of twenty tubes were delivered to Fermilab for tests on ILC purpose.



Those tubes had passed mechanical and metallografic tests at Sarov and Pisa (INFN, Italy), they were also successfully tested on vacuum and pressure at Sarov, Dubna, Pisa and FNAL at different extremal conditions: thermocycling at liquid Nitrogen temperature and leak measurements at room and nitrogen temperatures.

Main tests were performed at the special test bench HTS (real cryomodule conditions). After cooling down to the 2K were provided leakage measurements. Experimental group (with active participation of JINR scientists) had obtained excellent results: no any leak was detected up to 10^{-10}Torr-litre/sec! This value is much better than the specification one.

Photo injector prototype activity

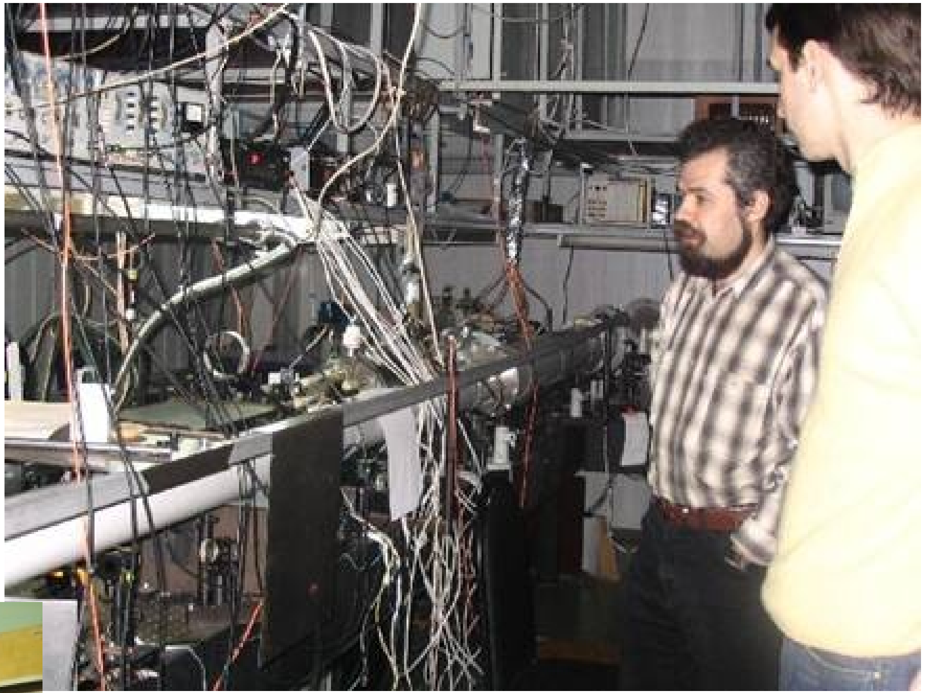
-JINR scientists worked in operation runs at PITZ and FLASH.

- *JINR performed design and started construction* of the test bench for CsTe photocathode preparation.

-Contract with AIP and KEK on the development of the laser system is ongoing;

- It is approved 5-8 weeks visits in 2009 in total JINR to DESY, DESY to JINR, and JINR to KEK.

Laser experimental setup at IAP (N.Novgorod)



Photocathode test-bench at JINR (b.215)

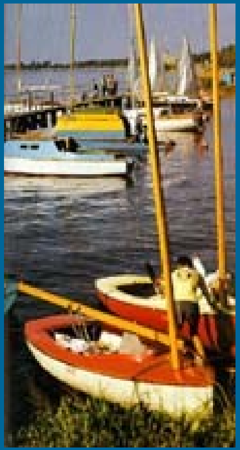
January 2009

V.V. Kobets
N.I. Balalykin
V.F. Minashkin
M.A. Nozdrin
V.G. Shabratov

Welcome to JINR (Dubna)

JINR

Dubna



Thank you for your attention