Siberian Branch of Russian Academy of Sciences

Budker Institute of Nuclear Physics

Accelerator complex with colliding electron-positron beams

Background information to be evaluated

for potential cooperation with the EU

Novosibirsk

2013

General description of the project

The project of the “Accelerator complex with colliding electron-positron beams” is aimed at the construction of a unique facility to solve a number of problems in the fundamental physics: search for *CP*-violating effects in decays of charmed particles, search for the New Physics in rare or forbidden by the Standard Model decays of charmed particles, tests of the Standard Model in the decays of τ-leptons, and search for and study of totally new forms of matter: glueballs, hybrids, etc. The complex will surpass the existing facilities in the productivity (luminosity) by 2-3 orders of magnitude, reaching 10^{35} $cm^{-2}s^{-1}$ at a beam energy of 2 GeV, and will provide a qualitatively new level of experiments. To achieve this extremely high luminosity we are going to apply a novel idea of the Crab Waist collision scheme [-].

The proposed complex is to comprise (Figure 1):

- Two-ring e^+e^--collider – Super-c-τ-factory (SCTF)
- Linear accelerator for full energy
- Positron injector
- Polarized electron injector

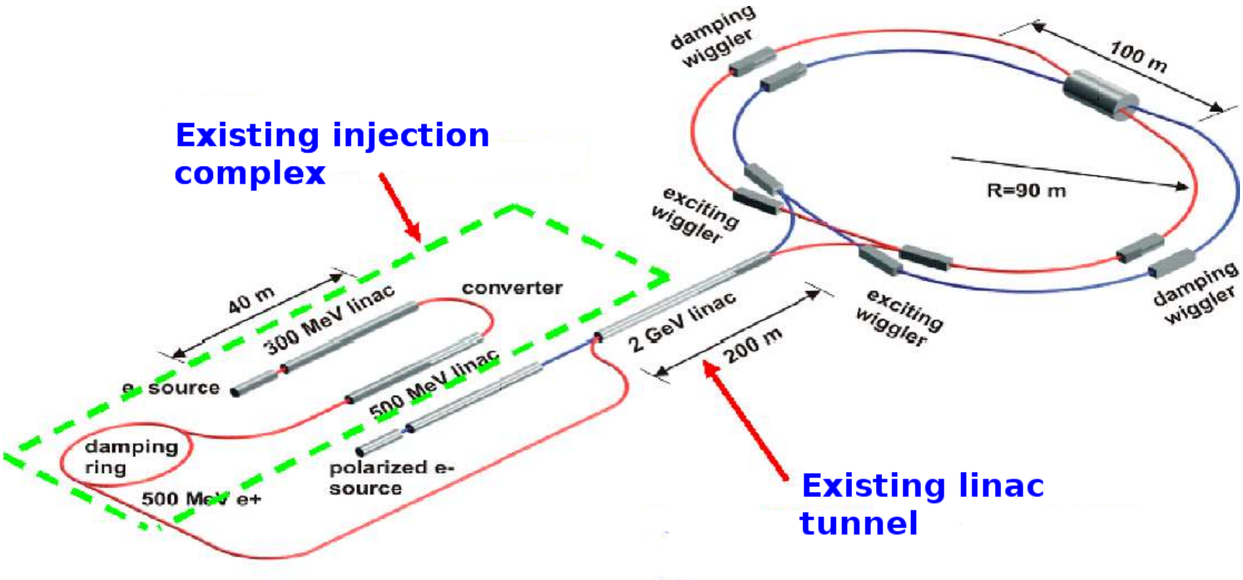

Figure 1: Scheme of the accelerator complex.

The main parameters of the Super-c-τ-factory collider are presented in Table 1.

Table 1: SCTF collider parameters.

Beam energy, E	GeV	1.0÷ 2.5
Perimeter, P	m	813
Beam current, I	A	1.7
Number of particles in beam, N		2.7×10^{13}
Emittance, $\varepsilon_x/\varepsilon_y$	nm·rad	8 / 0.04
Space charge parameter, ξ_x/ξ_y		0.0044 / 0.13
Luminosity, L	$cm^{-2}s^{-1}$	1.0×10^{35}

The design of the detector for the Super-c-τ-factory is based on the most novel methods of particle detection, as well as solutions that have been proven by BINP and the international collaboration experience of BaBar, Belle, ATLAS, etc [].

Evaluation reports and references

The project has received a number of supporting references from the following well-known and acknowledged experts in the field of High Energy Physics and organizations, the full texts of the references presented in APPENDIX A. Experts' references to the project. to this document:

- Prof. Rolf Heuer, Director General of CERN;
- Prof. Martin L. Perl, Nobel Laureate in Physics, Professor at Stanford University;
- Dr. Atsuto Suzuki, Director General of KEK, Japan;
- European Committee for Future Accelerators (ECFA).

Evaluations below have been prepared by the request of the Ministry of Education and Science of the Russian Federation. The following experts have scored the project, the maximum possible score being 90:

- Dr. Beatrix Vierkorn-Rudolph, Deputy-Director General of the Federal Ministry of Education and Research of Germany, ESFRI Chair: no scores, neutral opinion;
- Dr. Atsuto Suzuki, Director General of KEK, Japan: 81 scores;
- Prof. Tatsya Nakada, Full professor at the Swiss Federal Institute of Technology Lausanne, Switzerland, Chair of ECFA till 31.12.2011: 78 scores;
- Prof. Guido Martinelli, Director of the International School for Advanced Studies (SISSA), Italy: 90 scores;
- Prof. Gianpaolo Bellini, Full professor at the University of Milano, Italy: 90 scores.

Present situation and planning

BINP is currently operating a number of large high energy physics facilities:

- e^+e^--collider VEPP-2000 for up to 2 GeV collision energy with the SND and CMD-3 detectors,
- e^+e^--collider VEPP-4M for 2-11 GeV collision energy with the KEDR detector,
- Deuteron facility for nuclear physics experiments at the VEPP-3 accelerator.

The present status of the project is as follows:

- the physics program has been worked out;
- the conceptual design report with cost estimation has been completed [];
- the roadmap of the project with timelines has been prepared [];
- the R&D on FARICH, one of the key SCTF detector subsystems, have advanced well [,]. Philips Digital Photon Counting (Germany) in cooperation with BINP has started an independent development of a novel photon detector for this subsystem;
- with the high luminosity of the SCTF, the data rate from the detector will be close to 10 GBytes/s and the total amount of data to be collected will reach 200 Pbytes, unprecedented for the modern physics experiments. Therefore, the computing infrastructure is one of the key elements in the construction of the SCTF detector. The conceptual model of the computing infrastructure of the SCTF, supported by the Russian Government Program “Research and development in priority directions of development of scientific and technological complex of Russian Federation for 2007-2013”, has been developed;
- the project of construction of the buildings and facilities is close to completion (Q2 2013);
- BINP has already invested 37 MEuro in the capital construction and injection complex.

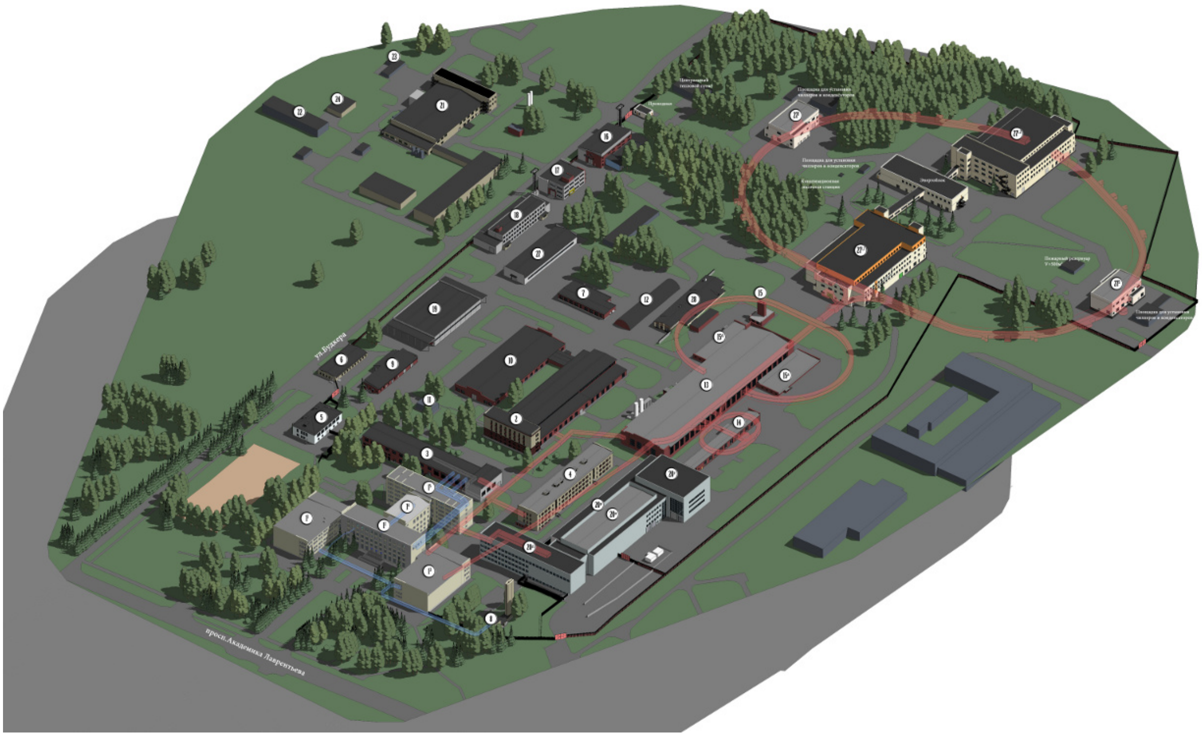

Figure 2: Existing and projected buildings and underground tunnels for the accelerator complex

Other activities on the project will start as soon as the project is approved by the Russian government.

The construction of the accelerator complex is planned for a period of 6 years. It is broken into phases, which are presented in Table 2.

The accelerator complex is to start operation in 2020 if the funding starts in 2014.

Table 2: Timeline of the project activities

	Year 1				**Year 2**				**Year 3**				**Year 4**				**Year 5**				**Year 6**			
Formation of management	■	■	■	■	■																			
Accelerator complex																								
Research	■	■	■	■	■																			
R&D		■	■	■	■	■	■	■																
Prototyping & testing								■	■	■	■	■	■	■	■	■								
Manufacturing					■	■	■	■	■	■	■	■	■	■	■	■								
Assembling									■	■	■	■	■	■	■	■	■	■	■					
Commissioning												■	■	■	■	■	■	■	■	■	■	■		
Reaching the design parameters																■	■	■	■	■	■	■	■	■
Detector																								
R&D	■	■	■	■	■	■	■	■	■	■	■	■												
Manufacturing, assembling, and testing					■	■	■	■	■	■	■	■	■	■	■	■	■	■	■	■	■	■		
Mounting and commissioning																	■	■	■	■	■	■	■	■
Software development			■	■	■	■	■	■	■	■	■	■	■	■	■	■	■	■	■	■	■	■	■	■
Building infrastructure																								

Design and research	
Construction	

Legal issues

As a large volume of equipment and components including in-kind contributions from the collaborators will be imported for the construction of the SCTF, it is necessary to develop a simplified legal procedure of import to provide equitable international participation in the project and avoid high taxes. It is a common practice with international particle physics experiments. In addition, it is necessary to establish an appropriate income tax rule for the foreign researches that are working in Russia for the project and paid by their home institutes, to avoid double taxation.

Governance

BINP has

- wide experience (organizational, in particular) of accomplishing large-scale physics projects at the Institute (the VEPP-2000 and VEPP-4M colliders, unique free electron laser with the record parameters in the terahertz range, and thermonuclear facilities GOL and GDL), in Russia (the Sibir-2 synchrotron radiation source) and worldwide (synchrotrons for the free electron laser in the Duke University (USA) and Brookhaven National Laboratory (USA));
- experience of successful collaboration in long-term international projects (LHC, Belle, BaBar, and many others);
- an advanced administrative and economic infrastructure for large-scale purchases (both in Russia and worldwide), accounting and legal activities, etc.

As a result, the Institute has all the background, divisions and structures needed to manage the research and development, construction, and exploitation of the SCTF and carrying out experiments on fundamental physics and to develop innovative technology products.

Since the project has been developed for a few years, it would be appropriate to review the already established structure of the project management (Figure 3).

The existing management of the project is divided according to its basic structural elements: the accelerator complex, detector complex, computing and simulation complex, and civil engineering complex. Each complex is hierarchically subdivided into systems, elements and activities. The working groups are related to the advisory groups, which involve Russian and foreign experts from laboratories of similar profiles, as well as specialists from the International and European committees for Future Accelerators (ICFA and ECFA). The Super-c-τ-factory project is reviewed at specialized seminars and workshops (ICFA Workshop on Beam Dynamics at High Luminosity e^+e^- Factories, Novosibirsk, April 14-16, 2008, 10th International Workshop on Tau Lepton Physics Satellite Meeting: «On the Need for a Super-Tau-Charm Factory», Novosibirsk, September 26-27, 2008, RECFA Meeting, Vienna, Austria, March 12, 2011) as well as in discussion of the project's elements at various Russian and international conferences and workshops.

Since the funding and realization of the proposed project requires significant contributions from government agencies and international collaborators, a considerable modification of the management structure is foreseen after the funding decision is taken. The modification follows the recommendations suggested in Appendix 4 to letter CM-811/16 dated August 16, 2011 from the Russian Ministry of Education and Science. Such modification naturally fits the existing management structure (Figure 4) by including the Management Board, Coordination Committee and Finance and Monitoring Committee. The informal advisory groups are transformed into the Scientific Advisory Board.

The management structure may be reviewed later with participation of all collaborators.

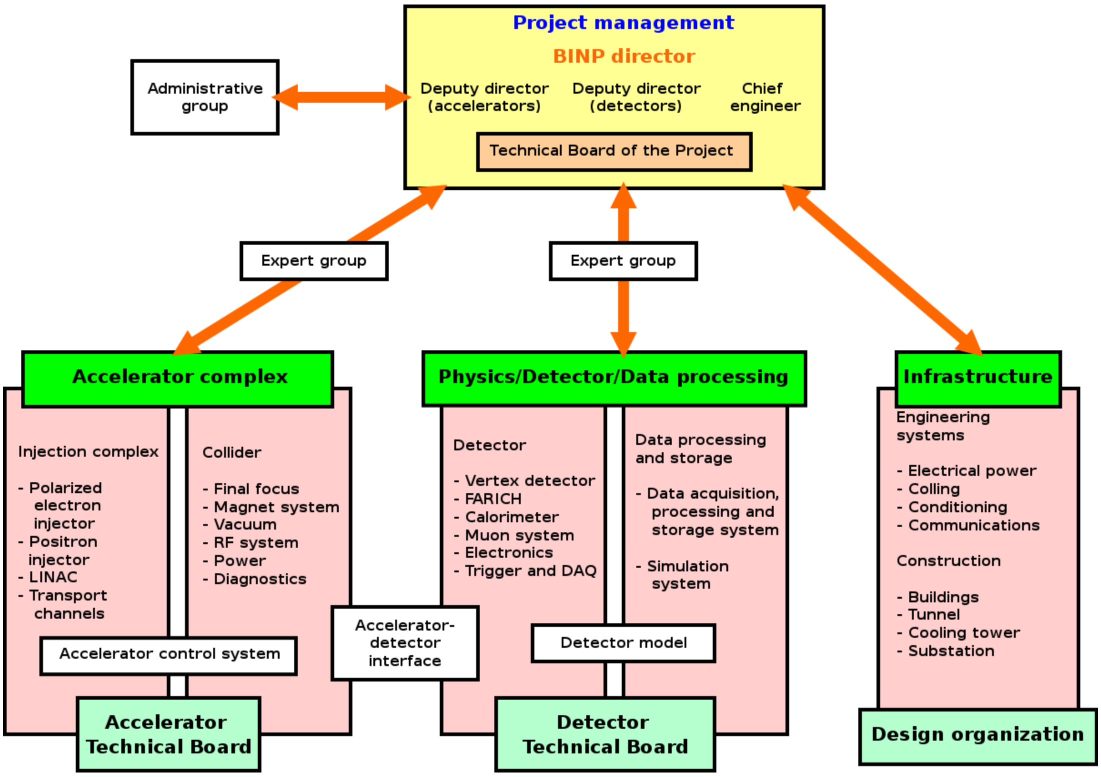

Figure 3: Structure of the Super-c-τ-factory project management at the technical design stage.

Partnership

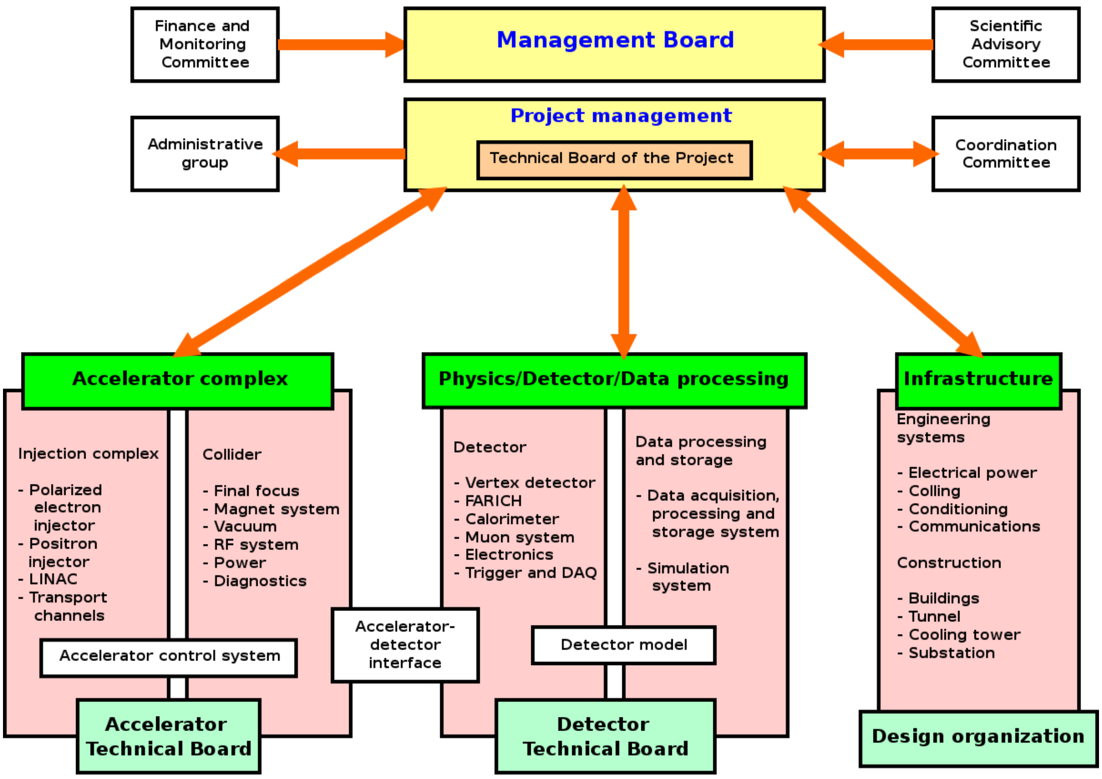

Figure 4: Structure of the Super-c-τ-factory factory project management at the construction stage.

Apart from its mission in performing the fundamental and applied research, BINP serves as a center for development of the university science. BINP most closely collaborates with the Novosibirsk State University (NSU) and the Novosibirsk State Technical University (NSTU). BINP is the home institute for six departments of the Faculty of Physics at NSU and for a department of the Faculty of Physics and Technology at NSTU. The departments are quartered at BINP with fully equipped classrooms and lecture halls as well as training laboratories. Undergraduate internship at the Institute starts from 3rd or 4th year. Lectures are given by the leading researchers of the Institute, and students carry out research work in its laboratories supervised by highly qualified specialists. Such a problem-oriented close-to-practice education system allows BINP to train competent physicists and engineers that are necessary for realization of the project.

BINP is involved in long lasting collaborations with other world-known institutes of Novosibirsk Scientific Center, namely Boreskov Institute of Catalysis, Nikolaev Institute of Inorganic Chemistry, Rzhanov Institute of Semiconductor Physics, etc. Besides scientific collaboration, these institutes supply various materials (high purity gases, scintillating crystals, silica aerogel) and devices to BINP. These relations will be of high importance for the project.

Budget issues

The financing required for the construction was estimated in 2011 (Table 3). It should include contributions from the Russian Federal budget, foreign partners and non-budgetary sources. Construction of a hotel in the local area is foreseen with local business involvement.

BINP has already invested 25 MEuro of its non-appropriated funds, mainly in the injector facility. Another 12.5 MEuro of federal budget funds have been spent on the design and capital construction of the buildings and tunnels for the SCTF. The total budget of the construction including the already spent funds is estimated as 436 MEuro.

The operation of the accelerator complex during 10 years of the lifetime period requires an annual financing of 7.5 MEuro. It is also planned to upgrade the complex in the middle of that period, to meet the updated physics requirements. That will require additional financing.

Table 3: Required budget for the construction of the SCTF, million Euro.

Accelerator	**207.50**
Research&Development	14.75
Purchase and production	148.75
Assembly and commissioning	44.00
Detector	**91.00**
Research&Development	11.50
Purchase and production	77.75
Assembly and commissioning	1.75
Building infrastructure	**100.00**
Design and research	1.38
Construction	98.62
Total	**398.50**

Present and potential user community in Russia and abroad

187 scientists from 20 institutes and universities all over the world are taking part in the project. They are listed in Appendix A to Ref. .

In future the collaboration will expand up to several hundred researchers due to the high scientific significance of the project and strength of the existing and recent international collaborations at the flavor factories over the world (BaBar, Belle, CLEO*c*, BES-III, SuperKEK*B*).

Existing and planned international collaborations

BINP has 40 years' experience of collaboration with numerous institutes and laboratories all over the world. BINP has been participating in all the major accelerator, HEP, SR and plasma projects including LHC, PETRA III, X-FEL, FAIR, Belle, Babar, etc.

It is also planned to attract a wide international collaboration to the construction of the accelerator complex and carrying out experiments with it.

BINP signed memoranda on cooperation with INFN, Italy and KEK, Japan on joint development and construction of the SCTF. These laboratories have large experience in the creation and operation of high luminosity e^+e^--colliders: DAFNE at INFN and KEK-*B* at KEK.

A Letter of Interest has been signed with the John Adams Institute (UK). Execution of similar documents is being discussed with scientific centers in USA, France, Poland, Italy, China and other countries. Regarding Russian scientific organizations, nine institutes (JINR, PINP, ITEP, INR RAS and others) expressed their readiness to participate in the project. An agreement on participation in the project was signed with the Joint Institute of Nuclear Research (Dubna).

The signed collaboration agreements are presented in Ref. (Appendix D).

Access policies to facilities and data

1. All collaboration members will have access to facilities intended for accomplishment of the collaboration experimental tasks.
2. However, each person who wants to participate in the R&D detector works and/or in shifts during the experiment should have a confirmation of his/her ability to work in the related conditions (electricity, radiation etc.) issued by his/her home institute. While working at BINP, each collaborator should follow the BINP safety instructions.
3. All collaborators will have access to the general design drawings of the detector as well as sub-detectors. However, access to the drawings of some details of the sub-detectors may be limited by a decision of the responsible sub-detector group.
4. The full data set collected by the collaboration in the experiments will be available for all collaboration members.
5. Specific software needed for handling and analysis of the experimental data collected by the collaboration will also be available to all collaborators.
6. All experimental results obtained by the collaboration will be published in Russian and International scientific journals for the community of physicists to know these results.

Relations with industry

BINP has workshops and broad experience of producing accelerator and detector components for HEP, medical and industrial applications. Most of the accelerator complex components will be produced by the BINP workshop. Some components will be produced by other Russian and foreign contractors.

The BINP workshop comprises 150 technological divisions, sectors and specialized shops with the total area of 60,000 m^2 and about 1,000 workers, technologists and engineers. It has many precise test benches for mechanical, magnetic, electrical, vacuum, cryogenic, water, etc. tests of manufactured equipment. The workshop has obtained an ISO 9001:2008 certificate for production of electromagnetic, vacuum, cryogenic and other elements of electrophysical facilities for the scientific researches and applications.

The BINP design department employs 70 designers and is equipped with modern graphical workstations.

In addition, BINP has been fruitfully cooperating with a lot of Russian and foreign industrial companies. BINP and its Russian partner companies produced a vast number of components for the LHC.

BINP has close relations with the local photomultiplier tube producers (Ekran-FEP and Katod).

BINP has established close relationship with Philips Digital Photon Counting (PDPC), Germany. A joint development of a novel digital silicon photomultiplier for application at the SCTF has been started without any external funding.

The cryogenic system for the superconducting coil of the SCTF detector is to be produced by Linde Engineering.

References

1. D. Shatilov, E. Levichev, E. Simonov, M. Zobov, "Application of frequency map analysis to beam-beam effects study in crab waist collision scheme", Phys.Rev.ST Accel.Beams 14 (2011) 014001.
2. A. Blinov et al. "The Project of Tau-charm Factory with Crab Waist in Novosibirsk", ICFA Beam Dynamics Newsletter, No.48, April 2009, 268-279.
3. I. Okunev, E. Levichev, P. Vobly, A. Bogomyagkov, S. Sinyatkin, P. Piminov. "Final Focus Quadrupole for the Crab-Waist Tau-Charm Factory", Proceeding of 11th European Particle Accelerator Conference (EPAC08), Genoa, Italy, 23-27 June 2008, WEPP046, 2623-2625.
4. E. Levichev, "The project of a Tau-Charm Factory with Crab Waist in Novosibirsk", Physics of Particles and Nuclei Letters, Vol. 5, No. 7. (2008), pp. 554-559.
5. Project of Super-*c*-*τ*-factory in Novosibirsk. Conceptual Design Report. https://ctd.inp.nsk.su/docs/ScTau_CDR_en/CDR_en_ScTau.pdf
6. Super-*c*-*τ*-factory Roadmap. https://ctd.inp.nsk.su/docs/ScTau_roadMap_ShortVersion/roadMap_ScTau_shortVersion_en.doc
7. A.Y. Barnyakov, et al., "Focusing aerogel RICH (FARICH)," Nucl. Instrum. Meth. A 553 (2005) 70.
8. A.Y. Barnyakov et al., "Focusing aerogel RICH for particle identification and momentum measurement," Nucl. Instrum. Meth. A 639 (2011) 290.
9. Super-*c*-*τ*-factory Roadmap Appendices. https://ctd.inp.nsk.su/docs/ScTau_roadMap_en/ScTau_roadMap_attachment_en.pdf

APPENDIX A. Experts' references to the project.

Prof. Rolf Heuer, Director General of CERN

Prof. Martin Perl, Nobel Laureate in Physics

ORGANISATION EUROPÉENNE POUR LA RECHERCHE NUCLÉAIRE
EUROPEAN ORGANIZATION FOR NUCLEAR RESEARCH

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Our reference: DG/2011-292

Geneva, 14th September 2011

Subject : Tau-Charm Factory

Dear Minister Fursenko,

I have been notified that a decision on future large-projects in Russia is in progress and that one of the projects on the table is the Super Charm Tau Factory.

With this letter, I am very happy to contribute and strongly support this Project.

High precision tau and charm physics is important in itself due to several aspects. One example is the unique advantage of working at the tau/charm threshold providing much more precision compared to today's results. This opens the exiting possibility to find new physics through rare decays of Taus. In addition such an installation will provide crucial information for the interpretation of measurements by the flavour physics experiments at the LHC and the Super B Factories.

The long and well-established tradition and expertise in accelerator science and the available accelerator infrastructure in Russia makes this proposal realistic and valuable. Let me also mention the innovative optics used in the design of this machine stemming from the world renowned Accelerator Group in Novosibirsk. Such a machine would further enhance the international role of Russia in science and attract a worldwide interest.

Many accelerator research and development programmes could be shared and done in collaboration with groups working on, e.g. the Super B Factories, generating synergy among accelerator groups in different regions.

Yours faithfully,

Rolf Heuer

SLAC NATIONAL ACCELERATOR LABORATORY

Martin L. Perl, Nobel Laureate in Physics
Kavli Institute for Particle Astrophysics and Cosmology
SLAC National Accelerator Laboratory
Stanford University
Tel: 650-926-2652
Email: martin@slac.stanford.edu

Re: Super Tau/Charm Project at Novosibirsk

July 10, 2011

Professor Andrey A.Fursenko,
Minister of Education and Science of Russian Federation.
11 Tverskaya ul.
125903
Moscow,
Russian Federation

Dear Professor Fursenko:

It is an honor for me to write to you about the great importance and physics promise of the proposed Super Tau/Charm Project at Novosibirsk. I write about the importance of the project to tau physics, the importance of the project to charm physics, and the importance of continuing and expanding the many magnificent contributions of the Budker Institute of Nuclear Physics to experimental and theoretical particle accelerator physics.

The Super Tau/Charm Facility will produce 10^{10} tau lepton pairs, much larger than existing tau lepton data sets. This 10^{10} data set is also much larger than future data sets that might be produced in existing electron-positron colliders or in other proposed colliders such as Super-B factories. With this immense data set, physicists at the Super Tau/Charm Facility will explore the following areas in tau physics:

- lepton flavor violation decays,
- possible CP violation in tau decays,
- increased precision in the tau decay matrix elements,
- unforeseen new direction in tau physics.

The Super Tau/Charm Facility will offer unique advantages in studying charm physics because the charm particle pairs can be produced near the production threshold. Some of these unique advantages are:

- reduced particle multiplicity,
- much improved detection of charm particle pair production,
- precise , basic quantum-mechanical studies of quantum correlations,
- unforeseen new direction in charm physics.

In the fifty year history of the development, building and operation of electron-positron colliders, many laboratories have made contributions of inventions, basic theoretical understanding, and practical accelerator technology. However the two leading laboratories are the Budker Institute of Nuclear Physics and my institution, the SLAC National Accelerator Laboratory. The construction and operation of the Super Tau/Charm Facility will continue this Budker Institute of Nuclear Physics leadership.

I strongly support the initiation, construction and operation of the Super Tau/Charm Facility at the Budker Institute of Nuclear Physics.

Sincerely,

Martin L. Perl

Martin L. Perl

Nobel Laureate in Physics
Professor in Stanford University

Dr. Atsuto Suzuki, Director General of KEK, Japan

INTER-UNIVERSITY RESEARCH INSTITUTE CORPORATION
HIGH ENERGY ACCELERATOR RESEARCH ORGANIZATION

KEK

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http://www.kek.jp/

July 20, 2011

Dr. Скринский ,
Budker Institute of Nuclear Physics
Lavrentiev Ave. 11, 630090
Novosibirsk, Russian Federation

Dear Dr. Скринский ,
I am writing this to express our support to the Tau-Charm Factory program at BINP. This facility will provide unique opportunity to study tau lepton and charmed particles with great precision, and to enable one to carry out very important physics program including searches for violation of CP symmetry in tau and charm sectors, lepton number violation, exotic resonance states and so on. This physics program will be complementary to the program at SuperKEKB, the next generation B meson factory being constructed at KEK, and will play an essential role to elucidate effects of new physics in the flavor decays. Also, I would like to point out that the technology for this facility has many common items with the one for SuperKEKB, and therefore, joint R&D program between BINP and KEK will be very helpful for both of us.

Sincerely yours,

A. Suzuki

Atsuto Suzuki
Director-General
KEK

ECFA EUROPEAN COMMITTEE FOR FUTURE ACCELERATORS

Prof. A. Skrinsky
Director of the Budker Institute of Nuclear Physics, Novosibirsk
and
Prof. A. Bondar
Dean of the Physics Department of the Novosibirsk State University

ECFA/Secr./11/1571

Geneva, 7 April 2011

Subject: Tau-Charm Factory

Dear Colleagues,

Thank you very much for your presentation on the physics potential and machine design for a Tau-Charm Factory to the Restricted session of European Committee for Future Accelerator in Vienna that took place on 12th of March 2011.

Your presentation clearly demonstrated that high precision tau and charm physics is important not only in itself, but also will provide crucial information for the interpretation of measurements by the flavour physics experiments at the LHC and the Super B Factories. Furthermore, the unique advantage of working at the tau/charm threshold was compellingly shown. For these reasons, the Committee members are all convinced by the physics case of a Tau-Charm Factory.

The Committee is very impressed by the well-advanced machine design study performed by the Novosibirsk group. We also note that the strategy to achieve high luminosities by storing small emittance beams is common to the Super B Factories. Therefore, many accelerator research and development programmes could be shared and done in collaboration with those groups working on the Super B Factories, generating synergy among accelerator groups in different regions.

We consider that the long and well-established tradition and expertise in accelerator science and the available accelerator infrastructure in Russia makes this proposal realistic and valuable. Construction of such a machine would further enhance the international role of Russia and attract a worldwide interest.

Thanks again for your effort in informing us about the project and the Committee is looking forward to hearing about the progress of the project in the future.

Yours Sincerely

T. Nakada

Professor T. Nakada

Chairman of the European Committee for Future Accelerators
Professor of Elementary Particle Physics,
Swiss Federal Institute of Technology Lausanne (EPFL)

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Dr. Beatrix Vierkorn-Rudolph,

Deputy-Director General of the Federal Ministry of Education and Research,

Germany

Super Charm-Tau Factory (Budker Institute of Nuclear Physics)

The project would like to study one of the fundamental forces of nature, the strong force, in great detail. The region under study here is, compared to the energy frontier machines such as the Large Hadron Collider, the "low-energy range", namely a few GeV. Dominantly, particles containing light quarks such as up, down, and strange, but also charm quarks are relevant, as well as the tau lepton. New, unexpected discoveries of particles in this energy range have also been made recently, the nature of which at present is still under investigation.

This energy regime is one where many theoretical simplifications that hold at higher energies are not valid, and hence new approaches to theoretical descriptions especially of the strong force at low energies must be tested. Recent experimental data in the charm region come from the CLEOc experiment (hosted by Cornell University) and the B-factories (Belle at KEK, BaBar at SLAC).

With the proposed project, Budker aim for an increase over existing data yields of a factor of a thousand to ten thousand. This would allow for substantial improvements over current measurements.

German groups have been involved in Belle and BaBar; many of them have moved on to Belle II. The German groups are also actively engaged in preparations for PANDA (450 scientists from 17 countries, about ten German institutes). But the study of tau mesons is at present not a great emphasis for the German particle physics community.

Vierkorn Rudolph

B. Vierkorn-Rudolph

Dr. Atsuto Suzuki,
Director General of KEK,
Japan

Expert opinion form to be completed when assessing a megaproject on account of the expediency of its implementation in the Russian Federation

Title of megaproject Super C-τ Factory

Project proposal scoring scale to be used when assessing each section:

0 – The project proposal in its entirety fails to meet the eligibility criteria;

1 – Most of the important parameters of the project proposal fail to meet the eligibility criteria;

2 – The project proposal rather fails to meet the eligibility criteria but a final analysis is difficult due to the incompleteness or absence of requisite information or there are serious comments on many parameters;

3 – The project proposal rather meets the eligibility criteria but a final analysis is difficult due to the incompleteness or absence of requisite information or there are serious comments on many parameters;

4 – Most of the important parameters of the project proposal meet the eligibility criteria, although there are some questions and inconsistencies;

5 – The project proposal fully meets the eligibility criteria.

Section 1. Assessment of the scientific research component

Please score every paragraph of this section using the 0 - 5 project proposal scoring scale provided above and justify your score.

Detailed justification (maximum - one page per paragraph)	Score
1.1. Level of expected research achievements *How relevant is the research project for the current state of the global science? Is the project capable of delivering new and groundbreaking scientific results or is it only capable of particularizing already existing data? Are the megaproject's expected results likely to make a fundamental contribution to the development of science?*	5
Researches on particle physics have been experimentally explored in "energy frontier" and "intensity frontier". For the former, the LHC, proton-proton collider at 7 TeV at CERN, is in operation and searches for Higgs particle and new particles/phenomena in TeV scale due to new physics beyond the Standard Model (SM) are in progress. For the latter, so-called flavor physics on B, Charm, tau, muon, and neutrino are explored in various facilities. These are key elements in understanding fundamental law of particle physics and universe, and each has unique and complementary role. For example, since the CP violation in charm is expected to be very small, the observation of CP violation gives clear signature of the new physics and provides very important information on flavor structure of new	

physics related to the 2nd generation quark-sector, while CP violation in B beyond the SM provides the information related to the 3rd generation quark-sector. Similarly, the observation of lepton flavor violation decays and CP violation of tau decays provide clear information on new physics in the lepton-sector. If observed, these are new and groundbreaking results in particle physics. This could be possible by the proposed Super C-τ Factory with the luminosity of 10^{35} $cm^{-2}s^{-1}$, using 3-4 orders of magnitude larger data sample than existing data today, or still 100 times larger than data obtained by currently operating C-τ Factory, BEPC II at IHEP-Beijing, aiming the design luminosity of 10^{33} $cm^{-2}s^{-1}$ (so far 0.5x 10^{33} $cm^{-2}s^{-1}$ is achieved).

The proposed Super C-τ Factory can also provide quite fruitful information on the hadron physics studying various hadrons including exotic states. The exact mechanism of formation of hadrons from quarks and gluons is still unknown and fundamental question. The detailed study of exotic hadrons can provide new picture of hadron formation mechanism.

Charm, tau and hadron physics mentioned above can be also studied by Super B-factories operated at Upsilon resonance energy (~10 GeV) which are under construction with design luminosity of 10^{36} $cm^{-2}s^{-1}$ in Japan and Italy. Similar number of charm, tau, and hadrons would be produced at Super B-Factories, however Super C-τ Factory has several unique features. Charmed meson pairs produced just above threshold can provide very clean environment to study charmed meson decay which is quite powerful to study decays including neutrino. Also, they are in coherent state (either $C=-1$ or $+1$) and give unique way to obtain CP violation and hadronic phase. The tau pair produced around threshold provides clean environment to study the detail of tau decays. Huge sample of charmonium decays with high purity provides unique opportunity to search new phenomena both in hadron physics and new physics. The Super C-τ Factory is complementary to Super B-Factories.

1.2. Project parameters 5

Are the megaproject's parameters fundamentally new and necessary for the development of science? Are there any similar or analogous research equipments (including those under construction)? How large is the scale of the project goals? How long are the project and its results likely to remain unique?

In order to achieve the proposed physics goals, the data sample of order of 1 ab^{-1} is essential, based on theoretical predictions. The highest luminosity ever achieved by the colliders at this energy is around 0.5x 10^{33} $cm^{-2}s^{-1}$. The goal of the Super C-τ Factory is more than 100 times higher than them, so it is quite ambitious. It is very hard to imagine a machine which exceeds the Super C-τ Factory with accelerator technologies in the near future.

The basic machine parameters of this accelerator, however, are basically set within the level experienced by other accelerators in the world. The beam and bunch currents are equal to what has been operated at B-factories. The beam emittance is also modest compared to what has been achieved by a number of light source rings. One thing which has not been verified experimentally is the beam-beam space charge parameter. The luminosity is proportional to this parameter. The world's highest level of this parameter is below 0.1, while the Super C-τ Factory assumes 0.13, which can be achieved using a new scheme, for instance "crab waist". The crab waist scheme has been tested at the DAFNE collider, but the achieved beam-beam parameter was around 0.05. This scheme will be

tested once it is built.	
1.3. Availability of technologies required for project implementation *Do the technologies required for project implementation already exist? How likely are the research and technology development activities required for the creation of the research equipment to be completed within the specified timeframe? Are the timeframe and methods adequate enough to ensure the project is implemented in full?*	**5**
The most of accelerator technology for the Super C-τ Factory already exist. They are basically common to the Super B-Factories, at least one of which has started construction in Japan. As Russian scientists both in the accelerator and the detector have been involved in these projects for years, the basic technology of B-Factories is already accessible to them. Actually a number of components such as beam pipes and magnets have been produced in Russia. Therefore once enough amounts of resources are allocated, the construction of the machine will be smoothly performed. Technologies for sub-detectors are also either established or very promising. There will be technical development until the last day before mass production or even during mass production, especially in the vertex and the particle identification detectors. There are still some technology choices to be made, where special care should be taken to obtain highest possible physics sensitivity; for which, detector simulation studies with reasonable beam background and dark noise must be performed. The radiation tolerance of sensors, especially silicon devices such as MPPC must also be evaluated and secured throughout the operation period. However, these are rather an issue of man-hour, and can be quickly developed in coming years.	
1.4. Possible economic effects *Is further commercialization of the research project results possible? Are there any advanced or promising technologies that can be used to create the same commercial product at a lower cost?*	**4**
The accelerator technology of the Super C-τ Factory is fully applicable to any kind of accelerators such as synchrotron light sources and medical accelerators. Although a direct use of the Super C-τ Factory itself for industry may be limited, the indirect benefit on the industry will be tremendous.	
1.5. Level of current research activities *Is the current level of research activities implemented by Russian and foreign scientists sufficient to accomplish the project tasks to the fullest possible extent? Is the workforce required to implement the project sufficient and fully available?*	**5**
Russian accelerator science and technology has been leading the world from the beginning. A number of ideas and theories have arisen at BINP. Also BINP can be the world's largest factory which is dedicated to particle accelerators. A large number of components of major accelerators in the world have been produced at BINP, including LHC at CERN, SNS at Oak Ridge, and KEKB at Tsukuba. As mentioned above, technologies experienced at B-Factories will be easily transferred to BINP via Russian collaborators. Russian experimental researchers are active in developing their detector technologies and physics analysis methods in their own laboratory, such as CMD and KEDR experiments in BINP, and also in participating to various experiments in foreign countries, such as Belle, BaBar, LHC experiments. They made substantial contributions in these	

experiments.	

Conclusion on the section (maximum - two pages)

Assess the scientific research component of the project, the expediency and relevance of its implementation for the development of science upon the whole, the project's feasibility, practicability, and scientific novelty, and opportunities for commercialization of the project results.

Super C-τ Factory is the project to make pioneering roles in advancing elementary particle physics and cosmology. This project together with Super B Factory, takes a lead of "Intensity Frontier" approach which is complementary to the "Energy Frontier" approach like the LHC, proton-proton collider at 7 TeV at CERN. This project can provide, in particular, quite fruitful information on the charm, tau and hadron physics.

The BINP group has been developed the accelerator science and technologies, leading the world from the beginning. And also this group has many experiences on producing cutting-edge accelerator major components for many large-scale international collaboration projects. Nobody doubts the project's feasibility and practicability. BINP is the most suitable facility for this project in the world. New technologies which are developed in constructing the Super C-τ Factory, open a variety of applications to other accelerator research fields, in particular, photon factories and neutron spallation -source facilities. However it is a quite few to generate direct opportunities for commercialization from accelerator projects.

Section 2. Assessment of the infrastructure

Detailed justification (maximum - one page per paragraph)	Score
2.1. Attainability of the project results within the proposed timeframe and using the proposed methods *How well is the project infrastructure development plan designed? Are the timeframe and methods proposed by the applicant sufficient to implement the project in full from the infrastructural point of view? If the timeframe is insufficient to complete the project, is it nevertheless possible to achieve a number of significant research results of the global scale (please justify)?*	5
The proposed timeframe looks challenging. Both human and financial resources must be assured as soon as possible. In the case of resource shortage, the completion of construction will certainly delay. In such a case, one should consider starting with moderate target luminosity with part of detectors filled in, which will still yield several significant research results. Obviously, the missing resources at the initial stage must be added as soon as possible after the start up of experiment to reach the full scope of the project.	
2.2. Adequacy of the project's funding *Is the overall funding of the project, including its infrastructural support, adequate to its goals and scale? Is it excessive or insufficient to implement the project?*	5
Apart from the civil engineering cost which we are not familiar how it is in Russia, the rates for both machine and detector are close to the estimate for Super KEK B-factory and	

other high energy projects, and look somewhat reasonable. However, the total cost estimate looks barely sufficient to implement the project. There should be some margin included for any incident that may happen.	
2.3. Existing infrastructure *Can the project be implemented on the basis of the already existing infrastructure? Does the research infrastructure require a significant modernization in order to accomplish the project objectives?*	5
The proposed scheme to build new facilities in addition to already existing facilities is perfectly reasonable. As proposed, the tunnel and several buildings must be newly built.	
2.4. Attainability and adequacy of the project's efficiency indicators *Are the project efficiency indicators identified in their proposal? Are these project efficiency indicators attainable? How do their dynamics characterize the project?*	
2.5. Security assurance *Can the project be implemented without jeopardizing the safety and security of the population? Do the infrastructural solutions proposed by the applicant ensure safe operation of the research equipment? What kind of efforts and/or solutions could significantly contribute to safe operation of the research equipment?*	5
The machine will be built in the tunnel where a strict control of access will be made. The radiation control is very usual in any international high energy accelerator experiments, and there is no doubt that the applicant can ensure the safety. For the population, the difference of nuclear reactor and the particle accelerator should be explained. Regular Open Campus would certainly help the laboratory being understood.	
2.6. Project vs. Environment *How likely is the project to harm the environment? How well do the infrastructural solutions proposed by the applicant ensure the project's ecological safety? What kind of efforts and/or solutions could significantly contribute to the environmental safety of the research equipment?*	4
There is no direct impact on the environment by operating the facility. Consumption of electricity at the facility means the generation at power plants, which does harm the environment, and should be carefully controlled in general.	
2.7. Ancillary infrastructure *Does the project ensure comfortable living and working conditions of the project specialists? What kind of efforts and/or solutions could significantly improve the project's social aspect?*	5
As the project attracts researchers from overseas, living facilities must be well prepared. A good capacity of pleasant guesthouse, good variety of foods in on-campus or neighboring restaurants, a store with good selection of daily commodities, a good access to international ATM are often requested to the host institutes. Language support on the way to the campus must be improved so that at least an English speaker can be instructed which way to go.	

2.8. Economic effects *What are the possible economic effects that can be achieved by creating a new infrastructure? How many jobs can be created in the region as a result of the project implementation and new infrastructure development? Are the effects achieved by creating a new social infrastructure visible?*	4
This is not very well presented in the proposal document. In general, there must be a certain economic effect in the region around the facility.	

Conclusion on the section (maximum - two pages) *Assess the project's ability to achieve the specified results within the timeframe and using the methods proposed by the applicant, assess the project implementation safety, its efficiency, and its potential impact upon the economy and the social sphere.* Although the project timeframe is aggressive, BINP is highly competent in achieving this project. On the other hand, it should be supported to procure enough human and financial resources. Enlarging the international collaboration much more is one option to solve this issue. It is too rare to invoke safety and environment problems by large-scale accelerator projects, being different from nuclear reactor constructions. BINP is very mature for taking care of the project safety and achieving the efficiency through various international accelerator constructions. Direct impact on the economy is not envisioned, but inspiring an emotion of learning science in younger persons is enormous.

Section 3. Assessment of project management

Detailed justification (maximum - one page per paragraph)	Score
3.1. Efficiency of the project management scheme proposed by the applicant *How well is the project management scheme developed? Are the management solutions proposed by the applicant likely to ensure effective project implementation within the specified timeframe? Does the project management scheme proposed by the applicant ensure requisite transparency and efficiency of expenditure of the grant funds?*	4
The project management scheme is not described in the proposal, but considering the current management on various accelerators (VEPP-2000, VEPP-4M etc.) and experiments (SND, CMD-x, KEDR etc.) at BINP, the applicant likely make an efficient management on the proposed project.	

3.2. Host university's human potential *Does the host university have sufficient human potential required to implement the project?*	5
The BINP has been built and operated various e^+e^- colliders and experiments and has human resources for them. The proposed accelerator is in the same energy range as existing accelerator, but has much more demands on the luminosity. Therefore, enough manpower needs to be transferred to the proposed project. For the experimental detector, provided that the experiment will be made by the collation with other Russian institutes and foreign institutes, the BINP has enough human resources as host institute.	
3.3. Adequacy of commitment *Is the host university's commitment to the establishment of a new research laboratory (including the host university's obligations to outfit the laboratory with the requisite equipment, recruit young and promising researchers, create conditions required to boost the publication activities, etc.) commensurate with the scale and magnitude of the project objectives?*	5
As the proposal includes the most of top management people of BINP, the enough commitment is expected to the proposed project by BINP.	
3.4. Need in institutional and legal changes *Does the project require institutional and legal changes? Are such changes feasible and practicable?*	5
The proposed project is basically an expansion of the current projects and facilities at BINP, no institutional or legal changes are expected to need.	
3.5. International cooperation *Assess the degree of efficiency of the international cooperation efforts proposed by the applicant. Do the management solutions proposed by the applicant ensure effective participation of foreign partners in the project activities? What kind of efforts and/or solutions could significantly enhance the scale of international involvement in the project? What countries and organizations could be most interested in the project implementation?*	5
The construction of the accelerator and infrastructure will be a responsibility of BINP. As mentioned in the proposal, the accelerator design incorporates various developments made in other accelerators in foreign laboratories. In many of these, BINP accelerator people are involved as international collaboration works. These international collaboration efforts should be continued for further refinement of the accelerator design. For the experiments, the proposal includes physicists from Ljubljana, Italy, Poland, and Germany. As other high energy experiments, the wider international collaboration is recommended. The collaborators in past and current C-τ Factories would be potential collaborators.	

Conclusion on the section (maximum - five pages)

Assess the adequacy of the project management scheme, as well as the efficiency of i n t e r n a t i o n a l Cooperation proposed by the applicant.

Although the project management scheme is not appeared in the proposal, the project would be managed successfully, because the project size is within a little bit extension of current BINP collaborations. The fact that BINP takes the responsibility to construct the accelerator and infrastructure makes the management robust.

As mentioned before, it is recommended to reinforce the international collaboration in order to secure the human and financial resources.

Section 4. General parameters of the project proposal

General parameters of the project proposal (maximum – five pages)

Please describe the general parameters of the project and its contribution to the accomplishment of scientific research objectives. Describe the applied significance of the project, as well as its ability to deliver specific products and/or technologies.

The ultimate goal of particle physics is to reduce one fundamental particle and force at the birth of the universe which is described by Super-Ground Unified Theory. The unification of fundamental particle and force provides the key to solve two big enigmas of Origin of Matters and Birth of the Universe. At present it is indispensable to go beyond the standard particle theory in order to establish Grand Unified Theory which is the next step along unifying particles and forces. Energy and intensity frontier accelerators are powerful tools to probe the new world beyond the standard particle theory. The Super C-τ Factory is one of the pioneering projects in this sense, and envisions rich harvests on detecting new phenomena beyond the standard particle theory. Since Ground Unified Theory opens the way to advance to the final goal of the Super-Ground Unified theory, the Super C-τ Factory has a potential to make prominent roles for developing the particle physics.

Newly developed accelerator technologies in this project cause quantum leaves in research fields using photon factory, spallation neutron facility and muon facility. However it is too few to deliver specific products and /or technologies to the society and public.

Expert's details: full name, country of residence, job title, organization, academic degree and title:

Atsuto Suzuki : PhD by "Isobaric Analogue Resonances of"

Director General of KEK, High Energy Accelerator Research Organization

Oho 1-1, Tsukuba, Ibaragi, 305-0801, JAPAN

Prof. Tatsya Nakada,
Full professor at the Swiss Federal Institute of Technology Lausanne,
Switzerland

Expert opinion form to be completed when assessing a megaproject on account of the expediency of its implementation in the Russian Federation

Title of megaproject _A project of Super c-tau Factory in Novosibirsk_

Project proposal scoring scale to be used when assessing each section:

0 – The project proposal in its entirety fails to meet the eligibility criteria;
1 – Most of the important parameters of the project proposal fail to meet the eligibility criteria;
2 – The project proposal rather fails to meet the eligibility criteria but a final analysis is difficult due to the incompleteness or absence of requisite information or there are serious comments on many parameters;
3 – The project proposal rather meets the eligibility criteria but a final analysis is difficult due to the incompleteness or absence of requisite information or there are serious comments on many parameters;
4 – Most of the important parameters of the project proposal meet the eligibility criteria, although there are some questions and inconsistencies;
5 – The project proposal fully meets the eligibility criteria.

Section 1. Assessment of the scientific research component

Please score every paragraph of this section using the 0 - 5 project proposal scoring scale provided above and justify your score.

Detailed justification (maximum - one page per paragraph)	Score
1.1. Level of expected research achievements *How relevant is the research project for the current state of the global science? Is the project capable of delivering new and groundbreaking scientific results or is it only capable of particularizing already existing data? Are the megaproject's expected results likely to make a fundamental contribution to the development of science?*	5
With the unprecedented designed luminosity of the Super charm-tau factory, the project will break into a new territory of search for physics beyond the Standard Model of particle physics in rare and forbidden decays in the D meson systems and tau leptons. Their results are not only unique and explore the new landscape of particle physics by their own, but also they will provide many essential information for exploiting results on B mesons decays by the LHCb experiment and experiments at the future Super B factories in order to search for an evidence for new physics.	

1.2. Project parameters *Are the megaproject's parameters fundamentally new and necessary for the development of science? Are there any similar or analogous research equipments (including those under construction)? How large is the scale of the project goals? How long are the project and its results likely to remain unique?*	5
The proposed scheme to achieve high luminosity is new and little know about its full potential. The principle of the method was successfully demonstrated in Italy and future Super B factory projects in Italy and Japan will adapt the same principle. The Super charm-tau factory operating at different energies, will have its own challenges. However if it works successfully, there will be a large implication for the design of the future colliders.	
1.3. Availability of technologies required for project implementation *Do the technologies required for project implementation already exist? How likely are the research and technology development activities required for the creation of the research equipment to be completed within the specified timeframe? Are the timeframe and methods adequate enough to ensure the project is implemented in full?*	5
Although the specific way to achieve high luminosity is new, it relies on the well established electron-positron storage ring collider. And the Budker Institute for Nuclear Physics is one of the pioneering institutes for a storage ring. Therefore, a risk of not achieving the designed machine parameters is low.	
1.4. Possible economic effects *Is further commercialization of the research project results possible? Are there any advanced or promising technologies that can be used to create the same commercial product at a lower cost?*	4
The goal of the being fundamental science, there is no immediate application from the project. On the other hand, the Budker Institute for Nuclear Physics has been a well known supplier for the various components and systems to the world wide accelerator projects. The Super charm-tau project can only boost their activities. In addition, computing requirement by the Super charm-tau factory experiment will encourage the IT infrastructure of the region.	
1.5. Level of current research activities *Is the current level of research activities implemented by Russian and foreign scientists sufficient to accomplish the project tasks to the fullest possible extent? Is the workforce required to implement the project sufficient and fully available?*	5
The Budker Institute for Nuclear Physics has clearly sufficient expertise to execute the Super charm-tau project. It has also well established close connection with the other accelerator laboratories in the world who can provide many intellectual inputs.	
Conclusion on the section (maximum - two pages) *Assess the scientific research component of the project, the expediency and relevance of its implementation for the development of science upon the whole, the project's feasibility, practicability, and scientific novelty, and opportunities for commercialization of the project results.*	

Although there are several observations supporting the existence of new physics beyond the current Standard Model of elementary particle physics, no real sign has been seen by the accelerator experiments. While the production of new particles associated with the new physics is being search by the two LHC experiments, ATLAS and CMS, an alternative way is to look for the appearance of those particles as virtual states in addition to the Standard Model particle which should produce a deviation from the Standard Model expectations. Although this, so called flavour physics, is an indirect way, it can probe the existence of new particles at a much higher energy scale than accessible by any high energy accelerators. On the other hand, possible deviations are expected be small and very precise measurements are needed. The proposed Super charm-tau factory pushes this precision frontier of flavour physics by constructing electron positron storage rings to collide the two beams with unprecedented luminosity. This should allow to make very precise measurements for the decays of hadrons containing charm quark and tau leptons. There is an increasing indication that the mass scale of new particles could be higher than that is accessed by LHC. Therefore, search for physics beyond the Standard Model must be performed at may different fonts. For this reason, the proposed Super charm-tau project is very relevant for the advancement of particle physics.

Section 2. Assessment of the infrastructure

Detailed justification (maximum - one page per paragraph)	Score
2.1. Attainability of the project results within the proposed timeframe and using the proposed methods *How well is the project infrastructure development plan designed? Are the timeframe and methods proposed by the applicant sufficient to implement the project in full from the infrastructural point of view? If the timeframe is insufficient to complete the project, is it nevertheless possible to achieve a number of significant research results of the global scale (please justify)?*	5
The submitted document describes the necessary infrastructure in detail. Together with the existing facilities at the Budker Institute, there is little risk for not achieving sufficient infrastructure.	
2.2. Adequacy of the project's funding *Is the overall funding of the project, including its infrastructural support, adequate to its goals and scale? Is it excessive or insufficient to implement the project?*	5
Judging from the description of the project, which is rather detailed, the requested funding appears to be adequate to complete the project. However, a dedicated commitee would be needed for examining more carefully in order to veryfy this.	
2.3. Existing infrastructure *Can the project be implemented on the basis of the already existing infrastructure? Does the research infrastructure require a significant modernization in order to accomplish the project objectives?*	5
The proposed project does assume to use the exisiting infrastructure of the Budker institute which is considereable, as well as the knowhow developped there. The equippment itself does need a major upgrade.	
2.4. Attainability and adequacy of the project's efficiency indicators *Are the project efficiency indicators identified in their proposal? Are these project efficiency indicators attainable? How do their dynamics characterize the project?*	–
I do not quite understand the question.	

2.5. Security assurance *Can the project be implemented without jeopardizing the safety and security of the population? Do the infrastructural solutions proposed by the applicant ensure safe operation of the research equipment? What kind of efforts and/or solutions could significantly contribute to safe operation of the research equipment?*	4
Since it is more like replacing the existing facility and the institute has a considerable experience in running such facilities, safety risk should be small.	
2.5. Project vs. Environment *How likely is the project to harm the environment? How well do the infrastructural solutions proposed by the applicant ensure the project's ecological safety? What kind of efforts and/or solutions could significantly contribute to the environmental safety of the research equipment?*	4
For the same reasons given in 2.5. the environmental impact should be small.	
2.6. Ancillary infrastructure *Does the project ensure comfortable living and working conditions of the project specialists? What kind of efforts and/or solutions could significantly improve the project's social aspect?*	4
Given the existing infrastructure in the Academic town of Novosibirsk, there is no problem in providing comfortable living and working condition for the project specialists.	
2.7. Economic effects *What are the possible economic effects that can be achieved by creating a new infrastructure? How many jobs can be created in the region as a result of the project implementation and new infrastructure development? Are the effects achieved by creating a new social infrastructure visible?*	4
The Academic town of Novosibirsk has established the high scientific level in fundamental and applied research. It is vital to maintain this level for the local scientific activities around Novosibirsk and in whole of Russia. The planed facility can be an important element for this and attract the international community of particle physicists to come to Novosibirsk.	

Conclusion on the section (maximum - two pages)

Assess the project's ability to achieve the specified results within the timeframe and using the methods proposed by the applicant, assess the project implementation safety, its efficiency, and its potential impact upon the economy and the social sphere.

Since the primary goal of the project is very fundamental science, it is very difficult to asses any direct benefit to the society. On the other hand, there are many examples in the past where the basic science generated totally new solutions to the problem of the society and generated a new economical activities. For the particular case of the Super charm-tau factory, the project is based on the existing facilities at the Budker Institue of Nuçlear Physics, which will allow efficient and effective usage of funds with a minimum impact on the environment.

Section 3. Assessment of project management

Detailed justification (maximum – one page per paragraph)	Score
3.1. Efficiency of the project management scheme proposed by the applicant *How well is the project management scheme developed? Are the management solutions proposed by the applicant likely to ensure effective project implementation within the specified timeframe? Does the project management scheme proposed by the applicant ensure requisite transparency and efficiency of expenditure of the grant funds?*	5
The Budker Institute is one of the international leading institutions who was the originator of the idea and have developed, designed, constructed and operated several electron-positron storage rings, in the past including the time when resources were limited. There is no doubt that they will successfully mange the project.	
3.2. Host university's human potential *Does the host university have sufficient human potential required to implement the project?*	5
Budker Institute for Nuclear Physics has a very close relation with Novosibirsk University where they participate in the education at all levels. The Super charm-tau factory will provide an excellent opportunity for the students to work with the world class facility.	
3.3. Adequacy of commitment *Is the host university's commitment to the establishment of a new research laboratory (including the host university's obligations to outfit the laboratory with the requisite equipment, recruit young and promising researchers, create conditions required to boost the publication activities, etc.) commensurate with the scale and magnitude of the project objectives?*	5
There exists already well established relation between the Novosibirsk University and Budker Institute for Nuclear Research.	
3.4. Need in institutional and legal changes *Does the project require institutional and legal changes? Are such changes feasible and practicable?*	3
In the area of experimental particle physics, there exists a well established procedure where many institutes from different countries contribute in kind to an experiment. What is needed, however, is a Russian national level arrangement for the custom regulation where the in-kind contribution can be brought in and out without tax nor complicated import-export formalities. Also an appropriate income tax rule for the foreign researchers working in Russia for the project but still being paid by institutes in their home has to be established countries to avoid double taxation.	
3.5. International cooperation *Assess the degree of efficiency of the international cooperation efforts proposed by the applicant. Do the management solutions proposed by the applicant ensure effective participation of foreign partners in the project activities? What kind of efforts and/or solutions could significantly enhance the scale of international involvement in the project? What countries and organizations could be most interested in the project implementation?*	5

The proponent has a proven track record in collaborating with various institutes in Japan, US, Europe, and CERN. For the Super charm-tau factory project, a close collaboration in both the accelerator and experiment can be easily envisaged with France, Germany, Japan and US. Participation from China, India, and Korea would be also possible. For the accelerator, collaboration with CERN would be a clear option. For the experiment, more countries would certainly come if the project were realised.

Conclusion on the section (maximum - five pages)

Assess the adequacy of the project management scheme, as well as the efficiency of international cooperation proposed by the applicant.

The Budker Institute successful constructed large accelerators and performed world class experiments. They are collaborating with the world leading particle physics laboratories. Therefore, there is little doubt on their managing capability for an international project. What is needed to facilitate a truly international project is to establish rules at the national government level on the custom regulation for material import and export, and an arrangement for the easy and flexible access of the foreign visitors.

Section 4. General parameters of the project proposal

General parameters of the project proposal (maximum – five pages)

Please describe the general parameters of the project and its contribution to the accomplishment of scientific research objectives. Describe the applied significance of the project, as well as its ability to deliver specific products and/or technologies.

All the aspects have been already summarised. This proposal is submitted by the institute with an internationally well recognised track record on the subject proposed facility. Their scientists are know as world expert for flavour physics, the scientific goal of the proposed facility. With the emerging results from LHC, the scientific goal of the Super charm-tau factory is gaining further importance.

Expert's details: full name, country of residence, job title, organization, academic degree and title:

Tatsuya NAKDA, Switzerland

Full Professor of Physics at Swiss Federal Institute of Technology Lausanne (EPFL)

Chair of European Committee for Future Accelerator (till 31.12.2011)

Scientific Secretary of the European Strategy Session of CERN Council

Doctor of Natural Science (The University of Heidelberg), MSc and BSc

Expert's signature

____

Date 22 December 2011

Prof. Guido Martinelli,
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Trieste, December 25th 2011

To whom it may concern

Please find below my report about the Super c-τ Factory (SctF) in Novosibirsk

1.1-1.5 The SctF project is intended to study the charm quark and tau lepton production and decays with unprecedented luminosity, and study the e^+e^- cross section in the energy range between 2 and 5 GeV. With a luminosity which is 3-4 order of magnitudes larger than any other collider in this energy range, it will be possible to measure with incomparable accuracy the relevant parameters of semileptonic and non leptonic decays, the mixing of neutral mesons, and also to study with great precision the physics of charmed hadrons and multiquark states and eventually the physics beyond the Standard Model. The accelerator itself will be a technological achievement, with the implementation of the Crab Waist scheme proposed by Pantaleo Raimondi.

The timing of the machine is appropriate and its characteristics, with a maximum luminosity of 10^{35} cm^{-2} s^{-1} in the high energy region and the possibility of longitudinally polarized beams, will allow to pursue an impressive physics program, with essentially non competitors at this level of precision. The project of the machine is particularly innovative in itself, with the mentioned Crab Waist scheme, and low emittance beams.

The investigations foreseen at the SctF are extremely important and will certainly allow a dramatic improvement in tau physics, charm spectroscopy, measurements of decay widths, weak interactions and properties of charmed mesons and baryons, rare decays. Overall one of the most fruitful and fascinating domain of research. The scientific activity will also allow the development of strong technical and scientific competences that can potentially be useful in a different context (commercial or industrial). There is a vast international interest in the planned experimental program, which will be an important part of the world activity in ``modern'' flavor physics.

The proponents are first class scientists in this field of investigation, with exceptional previous achievements, and therefore there is no doubt that the machine and the physics program will be very successful.
Score 5/5.

2.1-2.7 The project is absolutely well presented. The time schedule is realistic, the overall funding looks adequate, including the expected infrastructure support, and the expertise of the laboratory to realize the new facility is ensured. The time schedule of the different goals has been provided and should be supplemented by a table of the benchmarks achieved in the course of the realization of the project. The project is probable to be absolutely safe for the population, and certainly it will have a negligible environmental impact. It is likely to produce instead new job opportunities for technicians and researchers, stimulate high tech Russian industries and contribute to high education and training.
Score 5/5.

3.1-3.5 The project management and timetable are adequate, the human potential sufficient and competent, the quality and experience of the proponents absolutely exceptional.
Score 5/5.

In conclusion, SctF is an excellent project that deserves to be fully supported. It will allow a scientific activity at the highest level, it will attract researchers from abroad, and will be an important center of scientific and technological training, thus contributing to maintain the traditional Russian excellence of particle physics.

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Report of Gianpaolo Bellini on the Russian project: Super c-τ factory in Novosibirsk

The project Super c-τ factory is surely a very interesting project. The score on the total project is 5/5. The reason of this favorable judgment is based on the following considerations:

1- The project concerns fundamental problems on the elementary particle physics, which until now have not been investigated enough due to statistical limits. Aspects, not yet deeply tested, of our understanding of the elementary structure of the matter could reveal that the paradigmatic Standard Model of the Elementary Particles does not fully fit the experimental data. In the recent years many times the experimental investigations trusted too much on the theoretical previsions with the risk to introduce biases on what the experimentalists are searching on. Now the possibility to investigate τ physics, rare decays and widths, mixings and important characteristics of the weak interactions will be allowed by the unprecedented luminosity which is the goal of the project machine.

2- The implementation of the so called Crab Waist scheme at these limits will be a challenging achievement, and of course the performances foreseen with the calculations are not guaranteed in the experimental applications. Nevertheless the scientists involved in the project and especially the well skilled Novosibirsk teams are surely a guarantee of proper and high level efforts in achieving the high technology goals.

3-The collaboration size seems fully adequate as far as the funding request. But this last aspect has to be reviewed by persons expert of the Russian costs.

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