МИСиС

О перспективах сотрудничества с новым экспериментом SHiP в CERN

Фундаментальная наука в европейских и российских программах поддержки научных исследований и инноваций.

Реализация существующих инструментов сотрудничества в 2015 г. Информационный семинар

Москва, НИТУ «МИСиС», 12.12.2014 г.

И. Э. Булыженков,

ibphys@gmail.com

По определению Еврокомиссии, под исследовательскими инфраструктурами понимаются установки, ресурсы и соответствующие услуги, востребованные научным сообществом для проведения высшего уровня исследований по целевым направлениям. Предполагается, что есовские исследовательские инфраструктуры должны соответствовать мировому уровню качества во всех аспектах их активности, включая научные, образовательные, технические и управленческие. Такие инфраструктуры должны способствовать привлечению в Европу лучших в мире специалистов и, по замыслу, научной поддержке промышленности есовских стран для их устойчивого развития и конкуренции на рынках наукоемкой продукции.

Интеграция национальных лабораторий в есовские исследовательские инфраструктуры началась при поддержке 6-й Рамочной программы (РП6, 2002-2006 гг.) и продолжилась за счет фондов 7-й Рамочной программы (2007-2013 гг.). Европейский стратегический форум по исследовательским инфраструктурам (ESFRI) наиболее часто упоминает в отчетах Еврокомиссии следующие 48 исследовательских инфраструктур общеевропейского масштаба:

European large scale projects

48 new - or major upgrade of - Research Infrastructures of pan-European interest

Social Sc. & Hum. (5)	Life Sciences (13)		Environmental Sciences (9)		Energy (7)	Material and Analytical Facilities (6)	Physics and Astronomy (10)		e-Infra-structures (1)
SHARE	BBMRI	ELIXIR	ICOS	EURO-ARGO	ECCSEL	EUROFEL	ELI	TIARA*	PRACE
European Social Survey	ECRIN	INFRA FRONTIER	LIFE WATCH	IAGOS	Wind scanner	EMFL	SPIRAL2	CTA	
CESSDA	INSTRUCT	EATRIS	EMSO	EPOS	EU-SOLARIS	European XFEL	E-ELT	SKA	
CLARIN	EU-OPEN SCREEN	EMBRC	SIOS	EISCAT_3D	JHR	ESRF Upgrade	KM3NeT	FAIR	
DARIAH	Euro BioImaging	ERINHA BSL4 Lab		COPAL	IFMIF	NEUTRON ESS	SLHC-PP*	ILC-HIGRADE*	
	ISBE	MIRRI			HiPER	ILL20/20 Upgrade			
	ANAEE				MYRRHA				

(+ 3 additional projects from the CERN Council strategic roadmap for particle physics*

Distributed research infrastructures

Single sited research infrastructures

ESFRI

The Roadmap update 2016

The Roadmap 2016 update process was launched in September 2014 in Trieste. In the framework of this update, ESFRI is expecting proposals for new (or major upgrades of) research infrastructures of pan-European interest corresponding to the long term needs of the European research communities, covering all scientific areas.

Projects identified in the Roadmap will be expected to move to implementation in less than 10 years from their first inclusion on the Roadmap. This will mean a smaller but more "mature" number of new projects will enter the updated Roadmap. ESFRI will assess candidate projects on scientific excellence, pan-European relevance, socio-economic impact, e-needs and maturity level.

Prioritisation of Support to ESFRI Projects for Implementation

1. Three Priority Projects for implementation

- EPOS: European Plate Observing System
- ELIXIR: The European Life-Science Infrastructure for Biological Information
- ESS: The European Spallation Source

2. **Implementation Support**

- ECCSEL: European Carbon dioxide Capture and Storage Laboratory Infrastructure
- EISCAT-3D: The next generation incoherent scatter radar system
- EMSO: European Multidisciplinary Seafloor & Water column Observatory
- BBMRI: Biobanking and Biomolecular Resources Research Infrastructure
- ELI: Extreme Light Infrastructure
- CTA: Cherenkov Telescope Array
- SKA: Square Kilometre Array
- CLARIN: Common Language Resources and Technology Infrastructure
- DARIAH: Digital Research Infrastructure for the Arts and Humanities

3. Support for Sustainability and European Coverage

- CESSDA: Council of European Social Science Data Archives
- SHARE: Survey on Health, Ageing and Retirement in Europe

SCIENCE EUROPE PRESS RELEASE (11 December 2014)

Protect the EU Research Budget

Science Europe calls on the institutions and Member States of the European Union to safeguard Horizon 2020, the EU's programme for research and innovation.

Horizon 2020 has recently been under threat due to the negotiations over the 2014 and 2015 EU budget. It now faces a new threat, in the form of European Commission President Jean-Claude Juncker's **proposal to create a European Fund for Strategic Investment, likely to be financed by moving money from existing programmes, including Horizon 2020.**

Whilst Science Europe recognises the importance of high-risk investment and the need to stimulate innovation and economic growth, any diversion of funding away from Horizon 2020 would be damaging to exactly these objectives. Research funding supports the knowledge base; the capacity to innovate, and therefore to ensure economic growth and societal well-being, is dependent on this knowledge. It does not make sense to leverage investment from the private sector by depriving that same sector of an equally, if not more vital, resource in the long term.

Horizon 2020 is a crucial mechanism for fostering scientific breakthroughs, driving cutting-edge innovation and tackling major societal challenges. Within its 'Excellence' pillar, the European Research Council supports excellent frontier research, leading to invention and discovery that is the foundation for applied science and innovation. The Marie Skłodowska-Curie Actions foster the next generation of European research talent. The Research Infrastructures programme helps Europe to maintain and use cutting-edge scientific facilities. The 'Societal Challenges' pillar of the programme facilitates scientific collaborations that seek to find solutions to major global problems. These efforts cannot and should not be compromised, and these critical pillars should not be reduced.

The damage caused by reducing funding for research, including basic research, will have a severe negative impact on future development, and private investment cannot compensate for this. In contrast, spending on research now will help to make Europe globally competitive and resilient to crises. Investment in fundamental research is a vital and indispensable investment in the future of Europe, and it is counter-productive to reduce funding for this.

Science Europe therefore strongly advocates the protection of the budget for Horizon 2020, for the growth and prosperity of Europe.

About Science Europe:
Science Europe is an association of major European research funding and research performing organisations in 27 countries, established in 2011 to promote the collective interest of its members and to foster collaboration between them. For more information, see www.scienceeurope.org.

For further information please contact:
Belinda Whitehead, Science Europe Communications Manager (Maternity Cover)
communications@scienceeurope.org
Tel: +32 (0)2-226-03-06/+32 (0)471-651737

Press Release

Brussels, 11 December 2014

EARTO, the voice of 350 Research and Technology Organisations, published today an open letter to European Commission President Jean-Claude Juncker expressing its views on his proposed €315 billion Investment Package.

The EARTO open letter raises the following points:

Innovation is the key to changing today's economic trends and the European Commission has launched Horizon 2020 as a major vehicle for such change. Accordingly, Horizon 2020 should be strongly protected and suffer no cuts, being the only real pan-European R&I programme today, in particular the key pillars looking at solving societal challenges and supporting industry with the developments of Key Enabling Technologies as well as the new instrument Fast Track to Innovation.
If European industry is to maintain its leading role on global markets in important areas such as energy, telecom, digitalisation, life science, built environment and transport, investments should be heavily directed to supporting the renewal of European industry by making use of research, technology and innovation activities.
In the face of decreasing research & innovation investments from Member States and industry, the new Investment Package should be a complement to Horizon 2020 and ESIF funds. Projects to be financed under the new Investment Package should include strong research & innovation components aiming to support existing strengths in European value chains and innovation ecosystems. Such requirement should be mirrored in the selection criteria of projects under the Plan's regulations to be developed in the coming weeks.
EARTO, as the European RTOs network, is open for dialogue on these issues and is ready to work with the European Commission, European Parliament and Council in the set-up and implementation of the Investment Package regulations.

END

Notes to Editors
For further information, please contact Muriel Attané, Secretary General, EARTO: +32 (0)2 502 86 98

Research and Technology Organisations (RTOs) have a distinct mission and a key role in the knowledge and innovation economy: they produce, integrate and transfer science and technology to help resolve the grand challenges of society and support Europe's industrial competitiveness. RTOs occupy nodal positions within innovation ecosystems, bringing together key players across the whole innovation chain, from fundamental to technological research, from product and process development to prototyping and demonstration, and on to full-scale implementation in the public and private sectors.

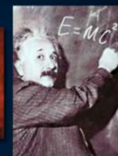
EARTO is the European trade association of the Research and Technology Organisations (RTOs), a non-profit organisation founded in 1999. EARTO groups over 350 RTOs with a combined staff of 150,000, an annual turnover of €23 billion, special equipment and facilities to a value of many € billions and more than 100,000 customers from the public and private sectors annually. EARTO Corporate Video.

CERN and Russia (from CERN DG presentation)

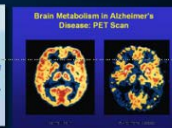
The Mission of CERN

CERN uniting people — Innovation, Education, Research

- **Push forward** the frontiers of knowledge
  E.g. the secrets of the Big Bang …what was the matter like within the first moments of the Universe's existence?

- **Develop** new technologies for accelerators and detectors
  Information technology - the Web and the GRID
  Medicine - diagnosis and therapy

- **Train** scientists and engineers of tomorrow


- **Unite** people from different countries and cultures

Russia and CERN

- Observer State in the CERN Council with special rights to attend restricted sessions
- Scientific contacts since the early 1960s
- First International Co-operation Agreement signed in 1967
- Strong involvement in experimental programme at CERN
- Today one of the largest CERN user communities
- Important contributions to the LHC accelerator complex
- In total ~ 40 industrial plants were involved in the production of the equipment for the LHC project

400 Magnets for the LHC transfer line, BINP

Russia and CERN

Strong involvement in the LHC experimental programme
ATLAS, CMS, LHCb and ALICE

ALICE: 10 Institutes
ATLAS: 8 Institutes
LHCb: 6 Institutes
CMS: 6 Institutes

Innovative technologies developed

+ non-LHC: COMPASS, DIRAC, AD-6, NA-61, NA-62, UA9

GRID Tier-2 centre / proposal to create Tier1 centres in Russia, accelerator projects (LINAC4) and R&D (RD-50, RD-51, CLIC/CTF3)

Russian Institutes and CERN

- National Research Centre "Kurchatov Institute" comprising:
  - Kurchatov Institute for Nuclear Research, Moscow
  - Institute for Theoretical and Experimental Physics (ITEP), Moscow
  - Institute for High Energy Physics (IHEP), Protvino
  - Petersburg Nuclear Physics Institute (PNPI), Gatchina
- Moscow State University (Skobeltsyn Institute for Nuclear Physics)
- Moscow Engineering and Physics Institute (MEPhI)
- St. Petersburg State University
- Russian Academy of Science
  - Lebedev Institute of Physics (LPI), Moscow
  - Institute for Nuclear Research (INR), Moscow
  - Budker Institute for Nuclear Physics (BINP), Novosibirsk
  - Ioffe Physical Technical Institute, St. Petersburg
- Joint Institute for Nuclear Research (JINR), Dubna

SHiP эксперимент - поиск скрытых частиц

arXiv:1310.1762v1 [hep-ex] 7 Oct 2013

CERN-SPSC-2013-024 / SPSC-EOI-010
October 8, 2013

Proposal to Search for Heavy Neutral Leptons at the SPS

W. Bonivento[1,2], A. Boyarsky[3], H. Dijkstra[2], U. Egede[4], M. Ferro-Luzzi[2], B. Goddard[2], A. Golutvin[4], D. Gorbunov[5], R. Jacobsson[2], J. Panman[2], M. Patel[4], O. Ruchayskiy[6], T. Ruf[2], N. Serra[7], M. Shaposhnikov[6], D. Treille[2 (‡)]

[1] *Sezione INFN di Cagliari, Cagliari, Italy*
[2] *European Organization for Nuclear Research (CERN), Geneva, Switzerland*
[3] *Instituut-Lorentz for Theoretical Physics, Universiteit Leiden, Niels Bohrweg 2, Leiden, The Netherlands*
[4] *Imperial College London, London, United Kingdom*
[5] *Institute for Nuclear Research of the Russian Academy of Sciences (INR RAN), Moscow, Russia*
[6] *Ecole Polytechnique Fédérale de Lausanne (EPFL), Lausanne, Switzerland*
[7] *Physik-Institut, Universität Zürich, Zürich, Switzerland*
(‡) *retired*

Executive Summary

A new fixed-target experiment at the CERN SPS accelerator is proposed that will use decays of charm mesons to search for Heavy Neutral Leptons (HNLs), which are right-handed partners of the Standard Model neutrinos. The existence of such particles is strongly motivated by theory, as they can simultaneously explain the baryon asymmetry of the Universe, account for the pattern of neutrino masses and oscillations and provide a Dark Matter candidate.

Cosmological constraints on the properties of HNLs now indicate that the majority of the interesting parameter space for such particles was beyond the reach of the previous searches at the PS191, BEBC, CHARM, CCFR and NuTeV experiments. For HNLs with mass below 2 GeV, the proposed experiment will improve on the sensitivity of previous searches by four orders of magnitude and will cover a major fraction of the parameter space favoured by theoretical models.

The experiment requires a 400 GeV proton beam from the SPS with a total of 2×10^{20} protons on target, achievable within five years of data taking. The proposed detector will reconstruct exclusive HNL decays and measure the HNL mass. The apparatus is based on existing technologies and consists of a target, a hadron absorber, a muon shield, a decay volume and two magnetic spectrometers, each of which has a 0.5 Tm magnet, a calorimeter and a muon detector. The detector has a total length of about 100 m with a 5 m diameter. The complete experimental set-up could be accommodated in CERN's North Area.

The discovery of a HNL would have a great impact on our understanding of nature and open a new area for future research.

1 Introduction

The new scalar particle with mass $M_H = 125.5 \pm 0.2_{stat}\ ^{+0.5}_{-0.6}{}_{syst}$ GeV (ATLAS) [1], $M_H = 125.7 \pm 0.3_{stat} \pm 0.3_{syst}$ GeV (CMS) [2], recently found at the LHC, has properties consistent with those of the

1

Imperial College London

INFN

CERN
CH1211 Geneva 23
Switzerland

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EN Engineering Department

Date : 2014-05-28

Report

A new Experiment to Search for Hidden Particles (SHIP) at the SPS North Area

Preliminary Project and Cost Estimate

The scope of the recently proposed experiment Search for Heavy Neutral Leptons, EOI-010, includes a general Search for HIdden Particles (SHIP) as well as some aspects of neutrino physics. This report describes the implications of such an experiment for CERN.

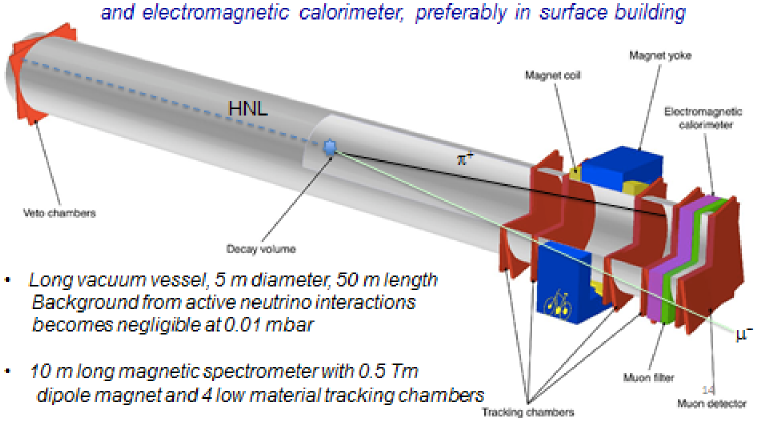
DOCUMENT PREPARED BY:	DOCUMENT CHECKED BY:	DOCUMENT APPROVED BY:
G.Arduini, M.Calviani, K.Cornelis, L.Gatignon, B.Goddard, A.Golutvin, R.Jacobsson, J. Osborne, S.Roesler, T.Ruf, H.Vincke, H.Vincke	S.Baird, O.Brüning,J-P.Burnet, E.Cennini,P.Chiggiato, F.Duval, D.Forkel-Wirth, R.Jones, M.Lamont, R.Losito, D.Missiaen, M.Nonis, L.Scibile, D.Tommasini,	F.Bordry, P.Collier, M.J.Jimenez, L.Miralles, R.Saban, R.Trant

Andrey Golutvin
Imperial College London

Initial detector concept for EOI

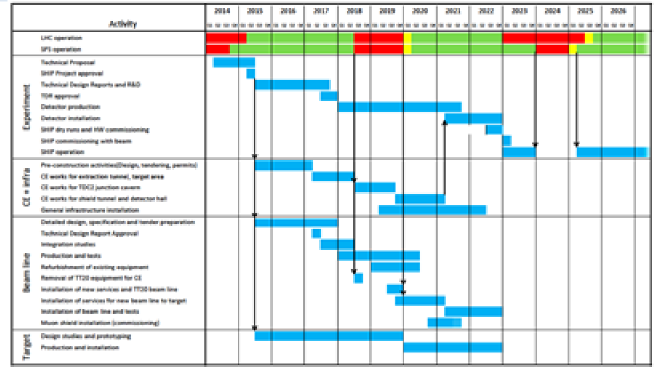
- Reconstruction of the HNL decays in the final states: $\mu^-\pi^+$, $\mu^-\rho^+$ & $e^-\pi^+$

  → Requires long decay volume, magnetic spectrometer, muon detector and electromagnetic calorimeter, preferably in surface building



- Long vacuum vessel, 5 m diameter, 50 m length
  Background from active neutrino interactions becomes negligible at 0.01 mbar
- 10 m long magnetic spectrometer with 0.5 Tm dipole magnet and 4 low material tracking chambers

Planning schedule of the SHIP facility

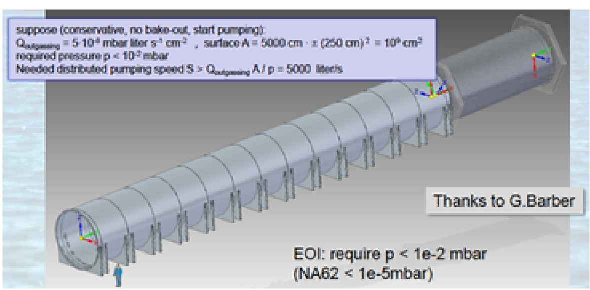


A few milestones:

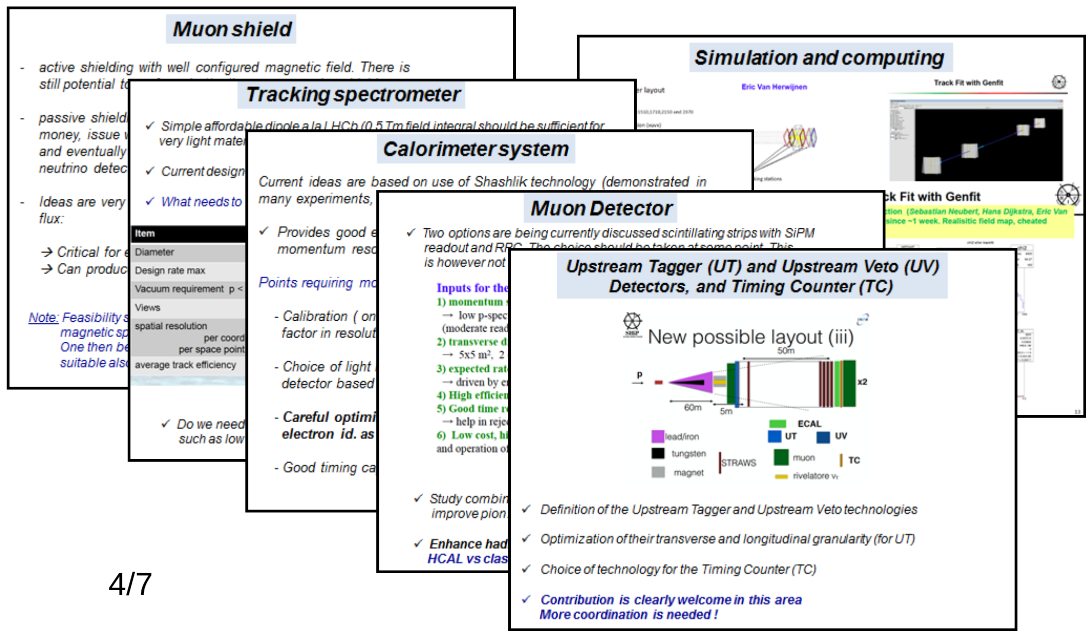
- ✓ Form SHIP collaboration → June-September 2014
- ✓ Technical proposal → 2015
- ✓ Technical Design Report → 2018
- ✓ Construction and installation → 2018 – 2022
- ✓ Commissioning → 2022
- ✓ Data taking and analysis of 2×10^{20} pot → 2023 - 2027

Vacuum vessel and Magnet

- ✓ Conceptual design, with properly addressed engineering issues (Modern submarine but not Noah's arc)
- ✓ Investigate an option with larger angular coverage, larger magnet aperture



- ✓ Design of the vessel flanges
  Thinnest possible entrance window → can be useful for optimization of the VETO detectors outside of the vacuum vessel
- ✓ Vacuum system, possibility to pump down to 10^{-3} mbar



Начальная коллаборация SHiP

- Collaboration of six institutes:
  - University of Cagliari, Italy
  - CERN, Geneva, Switzerland
  - EPFL, Lausanne, Switzerland
  - Imperial College, London, UK
  - University of Naples, Italy
  - University of Zurich, Switzerland
- Interim Constitution:
  - Technical proposal preparation
  - Interim Steering Group
  - Interim Spokesperson
  - Interim Membership Panel
  - Working Groups and Convenors
- Interim Membership Panel:
  - Walter Bonivento
  - Hans Dijkstra
  - Andrei Golutvin (interim Spokesperson)
  - Richard Jacobsson
  - Jaap Panman (chair)
  - Mikhail Shaposhnikov
- Working groups :
  - Physics
  - Experimental facility
  - Detectors and electronics
  - Data acquisition and trigger
  - Computing and software
  - Miscellaneous

The SHiP Experiment is a new general-purpose fixed target facility at the SPS to search for hidden particles as predicted by a very large number of recently elaborated models of Hidden Sectors which are capable of accommodating dark matter, neutrino oscillations, and the origin of the full baryon asymmetry in the Universe. Specifically, the experiment is aimed at searching for very weakly interacting long lived particles including Heavy Neutral Leptons - right-handed partners of the active neutrinos; light supersymmetric particles - sgoldstinos, etc; scalar, axion and vector portals to the hidden sector.The high intensity of the SPS and in particular the large production of charm mesons with the 400 GeV beam allow accessing a wide variety of light long-lived exotic particles of such models and of SUSY. Moreover, the facility is ideally suited to study the interactions of tau neutrinos.

SHiP is currently a collaboration of 41 institutes from 14 countries. Groups interested in joining should contact Andrey Golutvin and Jaap Panman.

The 1st SHiP Workshop meeting took place in Zurich on 10-12 June 2014. The aim of the workshop was to explore further the physics with the SHiP detector and to discuss the detector requirements and technologies. The workshop was concluded with a special collaboration meeting to discuss the organization and formation of working groups for the preparation of the Technical Proposal. See also article in July PH Newsletter. For a summary of the meeting see here, Annex 1 (Exploring Hidden Sector portals with SHiP) and Annex 2 (Working groups and contact persons).

The 2nd SHiP Workshop/Collaboration meeting took place at CERN on September 24-26, 2014. The aim was to review the progress in the working groups on the physics, simulation, detector and computing.

The 3rd SHiP Collaboration meeting will take place at CERN on December 15, 2014. It will be a half-day meeting to review the progress with the preparation of the Technical and the Physics Proposals, and a Collaboration Board meeting to formalize the formation of the SHiP Collaboration.

Членство в Коллаборации SHiP

- New institute can be accepted as Member Institute:
  - The candidature of new Member Institutes is first considered by the Interim Membership Panel.
  - Once the Interim Membership Panel decides that sufficient information is available on the intended participation, it presents the candidature to the Interim Steering Group for a vote.
- Contribution to the Technical Proposal, TP (March 2015):
  - Groups are encouraged to evaluate and to express their interest and possible contribution in a certain area of the TP and to give an estimate of the strength of their group during the work.
- Contribution to the Technical Design Report, TDR (2015-2018):
  - Groups are encouraged to attempt estimating their contribution to the TDR - formulate an interest in a hardware and software contribution for the preparation of the TDR.
- Contribution to the construction (2018-2022)
  - Preview of the possible funding, and the different steps to obtain it.

Possible areas of involvement and contribution

- SHiP experiment website:
  http://ship.web.cern.ch/ship/
  - General information about experiment
- First SHiP Workshop meeting presentations:
  http://ship.web.cern.ch/ship/Workshop_June2014/SHIP_workshop.html
  - Proposals in different areas
- Collaboration organization structure:
  http://ship.web.cern.ch/ship/Constitution/Structure.html
  - Working groups and contact persons
- Definition of own interests, abilities and possibilities
  - Establishing a team
- Interactions and discussions with contact persons and other groups
  - Not a customer – contractor relations
  - Not a short-term collaboration

- You will not be left alone!

Our Consortia Proposed Timeline

Consolidated Russian participation in SHiP experiment at CERN

- 19 September – Constituent meeting in Moscow
  - Consortia forming – questions and answers
  - Next steps discussion - organization and preparation work
- 24-25 September - 2nd SHiP Collaboration meeting at CERN
  - Informing SHiP on Consortia intention
  - Start discussion between Consortia and SHiP working group contacts
- 12 November – Consortia meeting in Moscow
  - Presentation to SHiP collaboration
  - Decision on Consortia membership after the meeting
- December 15 - 3nd SHiP Collaboration meeting at CERN
  - Finalize Consortia organization and funding
  - Express interest and possible contribution in certain areas of SHiP
- March 2015
  - Define Consortia commitments towards TDR (2015-2018)