Final Conference CS3

Report of Contributions

https://indico.cern.ch/e/211421

Contribution ID: **0** Type: **not specified**

Welcome to the ICAN Final Conference

Thursday 27 June 2013 09:25 (15 minutes)

Author: SPIRO, Michel (CEA/IRFU,Centre d'etude de Saclay Gif-sur-Yvette (FR))

Presenter: SPIRO, Michel (CEA/IRFU,Centre d'etude de Saclay Gif-sur-Yvette (FR))

Session Classification: Project Overview & Background

Contribution ID: **1** Type: **not specified**

Laser Accelerators in Particle Physics

Thursday 27 June 2013 09:40 (30 minutes)

The science of laser acceleration has matured to the extent that we see routinely GeV electron acceleration over cm distances. On one hand, we at IZEST try to extend the proof-of-principle experiments to the 100GeV level by employing world's large energy lasers. On the other hand ICAN program of IZEST has introduced the fiber laser based concept Coherent Amplification Network (CAN) so that the highly efficient, high rep rated fiber laser may be combined coherently (and digitally) to large energy, large intensity laser pulses. Thus the CAN laser may be able to serve as an ideal driver for high luminosity accelerators such as a future collider, including a gamma-gamma collider. In addition laser accelerators have some advantages such as their compactness, which can serve well in many applications. For example, the CAN laser driver for ADS (accelerator driven systems) makes ADS much simpler system [1].
The laser acceleration is unique in pursuing extremely high energies (up to PeV) (but not necessarily with high luminosity), in which we could investigate extreme high energy phenomena such as the test of the Special Theory of Relativity [2]. Recently the wakefield acceleration mechanism has been also adopted as an acceleration mechanism for the ZeV cosmic ray genesis that is not hampered by the radiation energy loss suffered by the prevailing theory of the Fermi acceleration [3]. Further, the high fluence laser of CAN may be used for exploring to detect weakly interacting 'vacuum fields'such as Dark Matter fields [4].

[1] G. Mourou, W. Brocklesby, T. Tajima, and J. Limpert, Nature Photon. 7, 258 (2013).
[2] T. Tajima, M. Kando, and M. Teshima, Prog. Theor. Phys. 125, 617 (2011).
[3] T. Ebisuzaki and T. Tajima, submitted to Ap. J. Lett. (2013); arXiv: 1306.0970 [astro-ph.HE].
[4] K. Homma, D. Habs, and T. Tajima, Appl. Phys. B 106, 229 (2012).

Author: TAJIMA, Toshiki (IZEST)

Presenter: TAJIMA, Toshiki (IZEST)

Session Classification: Project Overview & Background

Contribution ID: **2** Type: **not specified**

Required laser system toward laboratory search for low-mass Dark Matter and Dark Energy candidates

Thursday 27 June 2013 15:45 (15 minutes)

Probing the nature of the quantum vacuum is indispensable to resolve the crucial problems in contemporary physics; dark matter and dark energy in the universe. Probing the vacuum to date has been limited to either the macroscopic space-time via astronomical observations or microscopic space-time points at high-energy particle collisions. With high-intensity lasers, however, we anticipate to be able to unveil the different aspects of the quantum vacuum at different space-time scales based on analogous observables in quantum optics [1-4]. We present the new approach to realize the laboratory search for low-mass and weakly coupling particles which can be light Dark Matter / Dark Energy candidates by detecting four-wave mixing of two-color laser fields in the vacuum. This can be interpreted as a kind of quasi-parallel photon-photon collider[5]. We emphasize the advantage to utilize high-rep rate and high-intensity laser systems such as ICAN.

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by T. Tajima and K. Homma, International Journal of Modern Physics A, Vol. 27, No. 25 (2012) 1230027,
arXiv:1209.2822[hep-ph].

[5] "Sensitivity to dark energy candidates by searching for four-wave mixing of high-intensity lasers
in the vacuum "by K. Homma, Prog. Theor. Exp. Phys. (2012) 04D004.

Author: Mr HOMMA, Kensuke (Hiroshima University)

Presenter: Mr HOMMA, Kensuke (Hiroshima University)

Session Classification: ICAN Applications

Contribution ID: **3** Type: **not specified**

Future large scale accelerators

Thursday 27 June 2013 10:10 (20 minutes)

The recent major discoveries in particle physics have motivated further the needs of new large scale accelerators, accompanied with outstanding scientific and technological challenges. After a brief summary on the status of the field, we will present in this talk the various scientific directions, which these discoveries open. We will then discuss the different types of particle accelerators that are required for investigating the issues raised by these new findings, the required performances for these accelerator and the related technological challenges.

Author: Dr ALEKSAN, Roy (CEA/IRFU,Centre d'etude de Saclay Gif-sur-Yvette (FR))

Presenter: Dr ALEKSAN, Roy (CEA/IRFU,Centre d'etude de Saclay Gif-sur-Yvette (FR))

Session Classification: Project Overview & Background

Contribution ID: **4** Type: **not specified**

The European Network for Novel Accelerators (EuroNNAc)

Thursday 27 June 2013 10:30 (15 minutes)

The European Network for Novel Accelerators (EuroNNAc) is part of the European Accelerator R&D (EuCARD2) project and aims at providing a forum for discussion and coordination of advanced accelerator R&D in Europe. Presently it has 52 member institutes with a majority from Europe but also strong links to American and Asian research leaders. The talk will discuss the role that EuroNNAc can play in bringing advanced accelerator technology to users in fundamental and applied science.

Author: OSTERHOFF, Jens (University of Hamburg)

Presenter: OSTERHOFF, Jens (University of Hamburg)

Session Classification: Project Overview & Background

Contribution ID: **5** Type: **not specified**

ICAN: A Fiber Laser-Based High Peak, High Average Power, High Efficiency Light Source - Present and Future

Thursday 27 June 2013 11:30 (35 minutes)

Lasers are notorious for their poor efficiency. This is especially true for high peak power laser systems exhibiting wall-plug efficiency in the range of 0.1% at best. This situation is economically unacceptable and seriously impairs the spread of important scientific and societal laser applications in material science, environment, medicine and energy production. For 18 months the consortium ICAN sponsored by the European Commission has studied the possibility to develop a novel laser architecture, based on fiber lasers, to produce simultaneously:
1) High peak power in the PW regime,
2) Average power in the MW range
3) Efficiency at the 30% level
4) The first digital laser with heuristic capability. Each fiber laser can be independently controlled in phase and amplitude at kHz rate offering the possibility to modify at the same rate the laser wave front, and amplitude distribution across the beam in a digital way. Using genetic algorithm this laser offer unique heuristic capabilities. This feature is of paramount importance in the context of laser plasma interaction where the simulation provides an idealistic outcome that does not fit with the reality. The heuristic capability will look and find an optimized output.
This study provides a good basis for the construction of the demonstrator ICAN-B that would be apposite to relativistic electron and proton science with the generation of gamma ray, neutron, and muon or neutrino sources. Higgs factory is an example of important scientific application.
ICAN-B demonstrator could have paramount societal applications in the domain of nuclear pharmacology, transmutation of nuclear waste, in energy with subcritical reactor or in medicine with proton therapy.
An ICAN conference with the participation of 13 countries is organized at CERN the June 27-28 to go over the final conclusions of the ICAN work-study and to discuss the strategy that could make possible the construction and applications of the novel ICAN-B demonstrator, in the domain of High-energy Physics and Nuclear Physics.

Author: Prof. MOUROU, Gérard (IZEST)

Presenter: Prof. MOUROU, Gérard

Session Classification: Project Overview & Background

Contribution ID: **6** Type: **not specified**

Research Infrastructures: From FP7 TO Horizon 2020

Thursday 27 June 2013 12:20 (10 minutes)

The European policy for Research Infrastructures is developed under Horizon 2020 with the aim to contribute to the reinforcement of the European Research Area (ERA) and with strong partnership with the Member States.
Under Horizon 2020 more focused support will be provided to the implementation and also operation of world-class infrastructures such as ESFRI infrastructures. The effort for a deeper integration of the existing European Research Infrastructures will be continued as well as a broader and open access to European Researchers.
Specific measures will be promoted to foster the innovation potential within the European landscape of Research Infrastructures. Particular attention will be given to develop the international dimension in all our actions.
Finally, more support will be provided to e-infrastructures with the aim to better connect research communities and approaches in order to increase the overall quality of research and innovation in Europe.

Author: Dr DOUKA, Maria

Presenter: DOUKA, Maria

Session Classification: Project Overview & Background

Contribution ID: **7** Type: **not specified**

OSA's Support of the Photonics Community

Thursday 27 June 2013 12:30 (15 minutes)

As our website says, "The Optical Society (OSA) was organized to increase and diffuse the knowledge of optics, pure and applied; to promote the common interests of investigators of optical problems, of designers and of users of optical apparatus of all kinds; and to encourage cooperation among them." In that spirit, I look forward to discussing ways that OSA can support the ICAN network of scientists and engineers.
A current focus of attention for the OSA is the National Photonics Initiative (NPI). It has resulted from a recommendation of a report titled "Optics and Photonics: Essential Technologies for our Nation," recently released by The United States National Academy of Sciences. The report highlights the integral role optics and photonics plays in enabling technological and economic growth. Although this initiative is USA based, the studies that come from it should highlight the necessity for all governments to invest in photonics research. The far-reaching goals of the ICAN proposals highlight the promising social and economic impact of photonics research.

OSA disseminates scientific knowledge mostly through its large meetings portfolio and highly ranked optics journals. The OSA launched the High Intensity Lasers and High Field Phenomena (HILAS) topical meeting in 2011 to bring together the scientists working in this field. OSA has already had the opportunity to highlight ICAN with a feature article [1] in a recent issue of our news magazine, Optics and Photonics News (OPN). OSA looks forward to working with ICAN to help promote the photonics research into new scientific avenues.

[1] T. Tajima. W. Brocklesby and G. Mourou, "ICAN: The Next Laser Powerhouse," OPN May 2013

Author: STRICKLAND, Donna (University of Waterloo)

Presenter: Prof. STRICKLAND, Donna

Session Classification: Project Overview & Background

Contribution ID: **8** Type: **not specified**

View from EPS

Thursday 27 June 2013 12:45 (15 minutes)

Author: DUDLEY, John (European Physical Society)

Presenter: Prof. DUDLEY, John

Session Classification: Project Overview & Background

Contribution ID: **9** Type: **not specified**

Overview of diode pumped high energy solid state lasers

Friday 28 June 2013 09:00 (30 minutes)

In the past, ultra-short laser pulses with several 100J have been produced by mature flash lamp technologies1, 2. Alternatively, diode-pumped lasers have a great potential for generating peak-powers at higher repetition rates (1-10Hz). Worldwide, several ambitious laser projects e.g. MERCURY3, LUCIA4, GENBU5, HALNA6, DIPOLE7, LIFE8 are developing diode-pumped amplifier systems for output pulses with expected energies of 100J or more.

The Helmholtz-Centre Dresden-Rossendorf (HZDR) is currently building a fully diode-pumped Petawatt laser called PEnELOPE (Petawatt, Energy-Efficient Laser for Optical Plasma Experiments). PEnELOPE is designed for pulse energy of 150J, a repetition rate of 1Hz and pulse duration of 120fs. Additionally, the operational Ti:Sapphire based laser system DRACO (Dresden laser acceleration source9) is currently upgraded (25-30fs, 30J). Both PW-class lasers are designated for laser-plasma and particle acceleration research. While electron acceleration experiments and principles of proton/ion-acceleration are studied with DRACO, PEnELOPE is dedicated to produce laser accelerated proton and ion beams with energies of 100MeV or more which become relevant for future cancer therapy applications10, 11.

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Author: Dr RÖSER, Fabian (Helmholtz-Center Dresden)

Co-authors: ALBACH, D. (Helmholtz-Center Dresden); LOESER, M. (Helmholtz-Center Dresden); SIEBOLD, M. (Helmholtz-Center Dresden); SAUERBREY, R. (Helmholtz-Center Dresden); SCHRAMM, U. (Helmholtz-Center Dresden)

Presenter: Dr RÖSER, Fabian

Session Classification: ICAN - Technical Aspects

Contribution ID: **10** Type: **not specified**

Introduction to optical fibre lasers

Thursday 27 June 2013 14:00 (30 minutes)

Author: PAYNE, David (University of Southampton)

Presenter: Prof. PAYNE, David

Session Classification: Laser Overview

Contribution ID: **11** Type: **not specified**

ICAN - Technical Overview

Thursday 27 June 2013 14:30 (45 minutes)

The International Coherent Amplification Network (ICAN) has discussed concepts of a novel laser system based on a massive array of fibre amplifiers for the final goal to achieve particle acceleration at highest efficiencies. The laser parameters of >10 J, <300 fs at repetition rates above 10 kHz require a fundamental new approach in order to overcome known limitations of todays Peta-Watt Solid-State Laser systems that work at one pulse per second with an efficiency of a fraction of a percent. The technical overview will provide an insight into the results of the different concepts discussed during the project. The advantages but also the still-to-solve issues for the suggested spatial and temporal coherent combining techniques as well as different fibre aspects will be highlighted.

Author: SCHREIBER, Thomas (Fraunhofer Society Germany)

Presenter: SCHREIBER, Thomas (Fraunhofer Society Germany)

Session Classification: Laser Overview

Contribution ID: **12** Type: **not specified**

ICAN Applications Roadmap

Thursday 27 June 2013 15:15 (30 minutes)

I will present a discussion of the applications of high peak, high average power fibre lasers, introducing some of the areas of scientific and industrial research where they have advantages over current conventional laser sources.

Author: CORNER, Laura (Oxford University)

Presenter: CORNER, Laura (Oxford University)

Session Classification: ICAN Applications

Contribution ID: **13** Type: **not specified**

iCAN for structured electron and ion acceleration

Thursday 27 June 2013 16:20 (20 minutes)

iCAN project opens new and unmatched possibilities both for electron and ion acceleration. The availability of a huge number of coherent to each other laser pulses allows for efficient use of the laser field itself for electron acceleration. A periodic dielectric structure can be used at intensities of around 1012 W/cm2 and provide accelerating fields on the order of GV/m. Due to the simplicity of the structure, replaceable single shot structures can be driven to plasma condition and the accelerating field will be increased further to the strength of TV/m. Hybrid simulations of these structures will be presented.
Simulations suggest [M Chen, A Pukhov, TP Yu, ZM Sheng, PRL 103, 024801 (2009)] that nanostructured targets may significantly enhance efficiency and quality of ion acceleration in the light sail regime. Yet, the laser pulse must be perfectly aligned with the nanostructured target for the mechanism to work. The iCAN principle has all the capability to meet this requirement.

Author: PUKHOV, Alexander (SINP, MSU)

Presenter: PUKHOV, Alexander (SINP, MSU)

Session Classification: ICAN Applications

Contribution ID: **14** Type: **not specified**

Relativistic Protons and their Applications

Thursday 27 June 2013 16:40 (20 minutes)

The broad applications of relativistic proton beam, ranging from particle physics to nuclear energy generation systems, will be reviewed including a description of the relevant proton beam parameters and operational requirements for the proton sources and proton accelerators. The difficulties and limitations of the state of the art acceleration systems will be put in perspectives with laser acceleration concepts.

Author: NAPOLY, Olivier (CEA/Saclay)

Presenter: NAPOLY, Olivier (CEA/Saclay)

Session Classification: ICAN Applications

Contribution ID: **15** Type: **not specified**

Accelerator-Driven System Reactors

Friday 28 June 2013 13:20 (20 minutes)

After a rough recall of the history of the ADS concept, the motivations for its development at an industrial-scale are briefly presented. Then, the ADS concept is presented with some key numbers and the identification of the technical challenges to be resolved.

Author: Dr CARLUEC, Bernard (Areva)

Presenter: Dr CARLUEC, Bernard (Areva)

Session Classification: Industrial View & Future Plans

Contribution ID: **16** Type: **not specified**

Higgs factories based on Photon Colliders

Thursday 27 June 2013 17:00 (20 minutes)

Producing high peak and average power lasers with high efficiency, as proposed by the International Coherent Amplification Network (ICAN) group, will open a new era in particle accelerator physics and will allow us to construct the first high energy photon-photon collider (ggC). Among the various options for Higgs factories, a ggC has the distinct advantage of not requiring a positron source and only needing relatively low energy electron beams, while the main challenge comes from the high power laser requirements needed to produce the high energy photon beam from Compton backscattering.

The physics motivation and the designs for several ggCs, based on recirculating e- linacs and the high power fiber laser technology been developed by ICAN group, will be presented. The two main designs to be discussed, SAPPHIRE (Small Accelerator for Photon-Photon Higgs production using Recirculating Electrons) at CERN and HFiTT (Higgs Factory in Tevatron Tunnel) at Fermilab, have very similar laser requirements and will produce 10,000 Higgs per year.

Author: VELASCO, Mayda (Northwestern University (US))

Presenter: VELASCO, Mayda (Northwestern University (US))

Session Classification: ICAN Applications

Contribution ID: **17** Type: **not specified**

Optical amplifiers for ICAN: Challenges and opportunities

Friday 28 June 2013 09:30 (20 minutes)

The ICAN concept of coherent combination of femtosecond pulses at high energies presents new challenges on the optical amplifiers in terms of fidelity, reliability, efficiency, and cost. The more mature continuous-wave amplifiers for coherent combination, femtosecond amplifiers, high-power amplifier systems, and not least telecom amplifiers lay a very strong foundation for the ICAN amplifiers. However there are important differences, and important points from amplifier physics to amplifier configurations need to be better understood before an ICAN system can be realized. At the same time ICAN's scale and highly parallel architecture open up new design opportunities that can help to overcome some common amplifier problems. Throughout this work it is critical to stay aligned with rapidly developing commercial amplifier markets in order to maximize synergies and minimize cost. We will present and compare different amplifier options, from flexible fiber approaches with or without delivery fiber to stiff "rod fibers". These all hold the promise of being able to meet the requirements of ICAN as well as other applications.

Author: NILSSON, Johan (University of Southampton)

Presenter: NILSSON, Johan (University of Southampton)

Session Classification: ICAN - Technical Aspects

Contribution ID: **18** Type: **not specified**

Femtosecond fibre laser beam combination

Friday 28 June 2013 09:50 (25 minutes)

The presentation will start with a brief review about the history and achievements of advanced rod-type rare earth doped fibers and their use in ultrafast fiber laser systems followed by an introduction to coherent addition of multiple individual emissions as a performance-scaling concept. To further enhance the performance towards multi-Joule pulse energy and towards Megawatt average power in an efficient and cost effective scheme we propose spatially and temporally separated amplification of chirped pulses. One representative of that approach is the DPA-CPA (DPA = divided pulse amplification, CPA = chirped pulse amplification) scheme, which allows for a significant reduction of amplification channels (i.e. number of fibers). We will present the concept, an envisaged architecture, the strengths and the challenges, manufacturing aspects as well as a budget estimation.

Author: LIMPERT, Jens (Friedrich-Schiller University Jena)

Co-authors: Prof. TUNNERMANN, Andreas (Friedrich-Schiller University Jena); KLENKE, Arno (Friedrich-Schiller University Jena); KIENEL, Marco (Friedrich-Schiller University Jena); BREITKOPF, Sven (Friedrich-Schiller University Jena); SCHREIBER, Thomas (Fraunhofer Society Germany); EIDAM, Tino (Friedrich-Schiller University Jena)

Presenter: LIMPERT, Jens (Friedrich-Schiller University Jena)

Session Classification: ICAN - Technical Aspects

Contribution ID: **19** Type: **not specified**

Coherent combining of a large number of fibers with an interferometric technique

Friday 28 June 2013 11:05 (10 minutes)

The challenge of producing the next generation of particle accelerators, both for fundamental research, or for more applied tasks such as proton therapy or nuclear transmutation has been taken up by the high intensity laser community. To reach the ultrahigh peak power and high average power requirements of these applications, coherent beam combination of thousands of fiber amplifiers has to be envisaged. Active phase locking solutions can be implemented using frequency tagging technique, heterodyne techniques or by analyzing the interference pattern of the output fibers recorded on a camera. The last method, we called interferometric technique, performs a collective measurement of the phase distribution with a single image measured on the sensor, and is therefore naturally more suited to very large number of fibers. We report CBC of the largest number of combined fibers (64) with this technique. We use a test-system to determine the scaling parameters of the architecture, and to finally estimate the maximal number of combined fibers with conventional hardware. Different strategies for the recombination of the multiple beams, including far field interferences or diffractive optical elements will be reviewed.

Author: BRIGNON, Arnaud (Thales)

Presenter: Dr BRIGNON, Arnaud (THALES)

Session Classification: ICAN - Technical Aspects

Contribution ID: **20** Type: **not specified**

Cavities for high-energy pulse applications

Friday 28 June 2013 10:15 (20 minutes)

The demand for a huge number (i.e. up to millions) of channels for a fiber laser based particle accelerator originates from the energy limitation of a single fiber emission rather than average-power capabilities of rare-earth-doped fibers. Therefore, it is possible to reduce the required number of channels by 2-3 orders of magnitude by operating the fiber amplifiers at a higher repetition rate and average power (fiber's favorite operation regime) followed by a pulse stacking element in order to enhance the pulse energy. Passive enhancement cavities appear as an excellent choice in such a high-performance system, as the pulses of a high-repetition-rate laser (e.g. 10 MHz) can be coherently overlapped and the resulting high-energy pulse can be dumped out of the cavity at a repetition rate much lower (e.g. 15 kHz) via a fast switching element. Thus, in case of an ideal switching element the pulse energy is increased by simultaneous reduction of the repetition frequency at a constant average power.
We will discuss the important components of this concept such as the cavity (stack) and the switching element (dump) and, finally, present a system design that employs (only) 516 fibers to reach the final ICAN parameters. In addition a risk analysis and a budget estimation is provided.

Author: EIDAM, Tino (Friedrich-Schiller University Jena)

Co-authors: Prof. TUNNERMANN, Andreas (Friedrich-Schiller University Jena); KLENKE, Arno (Friedrich-Schiller University Jena); FILL, Ernst (Max-Planck-Institut für Quantenoptik); Prof. KRAUSZ, Ferenc (Max-Planck-Institut für Quantenoptik); CARSTENS, Henning (Max-Planck-Institut für Quantenoptik); Dr PUPEZA, Ioachim (Max-Planck-Institut für Quantenoptik); LIMPERT, Jens (Friedrich-Schiller University Jena); VON GRAFENSTEIN, Lorenz (Friedrich-Schiller University Jena); KIENEL, Marco (Friedrich-Schiller University Jena); HOLZBERGER, Simon (Max-Planck-Institut für Quantenoptik); BREITKOPF, Sven (Friedrich-Schiller University Jena); SCHREIBER, Thomas (Fraunhofer Society Germany)

Presenter: EIDAM, Tino (Friedrich-Schiller University Jena)

Session Classification: ICAN - Technical Aspects

Contribution ID: **21** Type: **not specified**

Components for high peak & average power

Friday 28 June 2013 11:15 (20 minutes)

The ICAN laser proposal aims for multi-100 kW of average power. Optical Components handling such power have to be identified in the future. In this contribution, the relevant components and their power handling is reviewed. Additionally, the physical background for thermal- and nonlinear limitations are given and strategies and perspectives of reducing these effects are discussed.

Author: SCHREIBER, Thomas (Fraunhofer Society Germany)

Presenter: SCHREIBER, Thomas (Fraunhofer Society Germany)

Session Classification: ICAN - Technical Aspects

Contribution ID: **22** Type: **not specified**

Design & manufacture of a multijoule, kW laser system

Friday 28 June 2013 11:35 (30 minutes)

We provide conceptual views of how a multi-joule, kW laser system could be built with many thousand channels from piece parts, and extended to suit the application in mind. The choices and main challenges of the optical and mechanical architectures are discussed with reference to power budgets and costs.

Author: WALKER, Louise (ICAN)

Presenter: Dr WALKER, Louise (Lightwrks Ltd)

Session Classification: ICAN - Technical Aspects

Contribution ID: **23** Type: **not specified**

Industrial panel

Friday 28 June 2013 13:40 (1 hour)

Session Classification: Industrial View & Future Plans

Contribution ID: **24** Type: **not specified**

Future directions for ICAN

Friday 28 June 2013 14:40 (30 minutes)

Author: Prof. MOUROU, Gérard (IZEST)

Presenter: Prof. MOUROU, Gérard (IZEST)

Session Classification: Industrial View & Future Plans

Contribution ID: **26** Type: **not specified**

Extreme Light Infrastructure - Nuclear Physics (ELI-NP): Present status and perspectives

Thursday 27 June 2013 10:45 (15 minutes)

ELI Nuclear Physics, one of the 4 pillars of ELI, will be built in Bucharest-Magurele, Romania. It is meant as an unique research facility to investigate the impact of very intense electromagnetic radiation (Extreme Light) on matter with specific focus on nuclear phenomena and their applications. The extreme light is realized at ELI-NP in two ways: by very high optical laser intensities and by the very short wavelength beams on γ-ray domain. The Gamma Beam System, based on Compton backscattering of a laser beam on electron beam accelerated by a warm LINAC, will produce variable energy gamma beam (Eγ = 0.2 –19.5 MeV) with a very good bandwidth (in the 10ˆ-3 domain) and with very high brilliance. This combination allows for stand-alone experiments with a state-of-art high-intensity laser, standalone high resolution γ-beam experiments or combined experiments of both photon sources. The description of the future ELI-NP facility, the planned experiments and the status of the project implementation will be presented.

Author: Prof. ZAMFIR, Nicolae (ELI-NP)

Presenter: Prof. ZAMFIR, Nicolae (ELI-NP)

Session Classification: Project Overview & Background

Contribution ID: **27** Type: **not specified**

The E-ELT - parallels with ICAN

Thursday 27 June 2013 12:05 (15 minutes)

The large existing astronomical telescopes - Very Large Telescope, Gemini, Subaru, Large Binary Telescope or Keck telescope - include primary mirrors of about 10 meters in diameter. More, they deliver images close to the diffraction limit thanks to new technologies such active and adaptive optics.

A new generation of telescopes, called Extremely Large Telescope or ELT, was proposed a few years ago. They will vastly advance astrophysical knowledge by allowing detailed studies of subjects including exoplanets, the first objects in the Universe, super-massive black holes, and the nature and distribution of the dark matter and dark energy which dominate the Universe. The telescope light collecting capability and its spatial resolution have to increase dramatically to reach these objectives. These telescopes will have primary mirrors with surfaces 10 times greater than those of previous telescopes. Consequently, new technologies developed for the present telescopes have to be scaled. In the same time, their maturity has to be improved to get a full operational system.

Different projects are presently under development around the world, such as the Thirty Meter Telescope, the Giant Magellan Telescope or the European Extremely Large Telescope (E-ELT). Among them, the E-ELT is certainly the most ambitious one. After a brief description of the telescope, the technological challenges of active and adaptive optics for the E-ELT will be presented. The commonalities with the issues encountered in the ICAN project will then be emphasized.

Author: MICHAU, Vincent (ONERA)

Presenter: Prof. MICHAU, Vincent (ONERA)

Session Classification: Project Overview & Background

Contribution ID: **28** Type: **not specified**

Laser-acceleration of energetic ions

Thursday 27 June 2013 17:20 (20 minutes)

Beam optimization of laser-accelerated protons is a crucial point for the development of applications in various areas. Several directions need to be pursued, namely (i) optimization of the high-energy end of the spectrum e.g. for dense plasma radiography, (ii) optimization of the low-energy end of the spectrum e.g. for isochoric heating of matter, (iii) enhancement of laser-to-protons conversion efficiency and reduction of divergence e.g. for medical applications or ion irradiation. We will present recent experimental results and simulations on these topics. New diagnostic capabilities open the way to precise time and space-resolved measurement of laser-acceleration of protons. We will show that high-energy protons in the can be enhanced using low-density plasmas or special targets, and discuss applications taking advantage of the unique characteristics of those beams.

Author: FUCHS, julien (cnrs)

Presenter: Prof. FUCHS, Julien (LULI/CNRS & Ecole Polytechnique)

Session Classification: ICAN Applications

Contribution ID: **29** Type: **not specified**

Radio-isotopes production with high average power intense lasers

Thursday 27 June 2013 17:40 (20 minutes)

I will discussed the various techniques used to produce radioisotope for medical applications. The use of intense lasers require high average power that will become available with the ICAN concept. I will present the necessary laser parameters for an efficient generation of radio-isotopes with lasers.

Author: Prof. KIEFFER, Jean Claude (INRS)

Presenter: Prof. KIEFFER, Jean Claude (INRS)

Session Classification: ICAN Applications

Track Classification: Applications

Contribution ID: **30** Type: **not specified**

Welcome to CERN

Thursday 27 June 2013 09:10 (15 minutes)

Author: BERTOLUCCI, Sergio (CERN)

Presenter: BERTOLUCCI, Sergio (CERN)

Session Classification: Project Overview & Background

Contribution ID: **31** Type: **not specified**

Nuclear Pharmacology

Presenter: Prof. KIEFER, Jean-Claude (INRS-EMT, Quebec)

Contribution ID: **32** Type: **not specified**

Review of coherent combining techniques

Friday 28 June 2013 10:55 (10 minutes)

Coherent Beam Combining allows overcoming the nonlinear and damage thresholds that limit the output power/energy of fiber amplifiers, thus enabling new applications as in the ICAN project. We will briefly review the main coherent beam combining techniques useful for ICAN with an insight into optical efficiency, requirements and cost.

Author: Dr LOMBARD, Laurent (ONERA)

Presenter: Dr LOMBARD, Laurent (ONERA)

Session Classification: ICAN - Technical Aspects

Contribution ID: **33** Type: **not specified**

Introduction

Thursday 27 June 2013 09:00 (10 minutes)

Presenter: Prof. MOUROU, Gérard (IZEST)

Session Classification: Project Overview & Background

Contribution ID: **34** Type: **not specified**

High Power Laser Science at the Extreme Light Infrastructure ELI

Thursday 27 June 2013 11:00 (10 minutes)

The Extreme Light Infrastructure ELI will be the world's first international user facility for the scientific laser community. It is part of the ESFRI Roadmap for Pan-European Research Infrastructures of high priority, and it is presently being constructed as a de-centralized facility in the Czech Republic, Hungary and Romania. ELI will be instrumental for establishing and exploiting new scientific communities in the host countries and their neighbouring regions, apart from being open to access by an international user community. ELI's innovative funding model utilizes European Regional Development Funds (ERDF) for construction, and –most likely –an European Research Infrastructure Consortium (ERIC) of participating countries for operation. Investment costs are presently estimated at about 850 M€, not including ELI's yet to be decided fourth pillar.

The recently founded ELI-DC International Association will promote the sustainable development of ELI as a unified pan-European research infrastructure, support the coordinated implementation of the ELI research facilities, and preserve the consistency and complementarity of their scientific missions. It will also organise the establishment of the international ERIC consortium in charge of the future operation of ELI. The Association is open to membership from interested countries.

ELI will be dedicated to the fundamental study of laser-matter interaction in the intensity regime I > 1023 W/cm2 , and even higher in ELI's forthcoming fourth pillar. Technology is based on chirped pulse amplification of fs optical pulses in broadband solid-state laser materials and (or) nonlinear crystals. Single laser beam peak-power will exceed 10 PW, diode pumping will allow for up to 10Hz operation at the multi-PW level. Most of these specifications are at least one order of magnitude above today's top values.

Besides studying fundamental effects of ultra-strong electro-magnetic forces associated with such intensities ELI will serve to investigate a new generation of compact secondary sources delivering particle and radiation beams of femtosecond to attosecond duration at high energies. In this respect, ELI welcomes the ICAN initiative to develop new technologies for even higher average powers of high-power laser systems, which may become the next generation of drivers for novel secondary sources.

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