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

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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.

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