

Message from the Coordinator

LEDLUM will make major improvements to the volume, the weight, the lifetime and the size of the driver (electrical engine) of light emitting diodes (LED), that are used in the majority of solid state light (SSL) systems. The project aims for the world's **smallest SSL engine** with **lowest weight** and **longest expected lifetime** and **cheapest material cost** based on novel technology and IP protected solutions. Major technological advances **in the field of Very High Frequency (VHF) power electronics** based on European research are expected. Furthermore, LEDLUM will **strengthen Europe's lighting business** with **advanced technology** and will lead to **higher skilled jobs** in development and production.

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Technical Meetings in Dublin and in Dornbirn

After the kick-off meeting in November 2016, the next big **technical meeting**, which brought together all LEDLUM partners took place from **5th to 6th April in Dublin**, Ireland at LGR premises. The first day was dedicated to provide the status and future outlook of the technical work packages (WPs). Each technical WP leader presented the work done and some in-depth and ground-laying technical discussions took place. On the second day, the main tasks of the dissemination and the project management WPs were discussed and responsibilities for certain activities were assigned. Afterwards, a rough plan for the upcoming months was established and further technical discussions took place. Summing up, it was a very successful and engaging meeting, providing many inputs that can be used for further research and developments within the LEDLUM project.

After this face-to-face meeting the directions and the work to be done for the next few months were clear. The progress was monitored, reported and discussed during monthly Executive Board telcos. After the summer, when all partners had returned from their vacation, another **technical meeting** was organized from **28th to 29th September in Dornbirn**, Austria, hosted by partner Tridonic. The meeting was organized around the **7th International LED Professional Symposium + Expo (LPS)** in Bregenz, which was attended by most of the LEDLUM partners. On the first day the focus was put on the power electronics—both the AC/DC and the DC/DC stage as well on the progress of integrated inductors and capacitors. The second day was dedicated to discussions on the driver system, particularly the housekeeping circuitry. Also an outlook regarding Electromagnetic Interference (EMI) and thermal issues was given. Furthermore, the day was used to kick-off WP6 “Luminaire System”, which goal it is to make the complete LED Light Fitting system. First discussions regarding control and outputs were initiated and inputs were gathered. Furthermore, the overall project plan was discussed in detail, dependencies were highlighted and minor adjustments were made. Last but not least some general administrative issues were discussed and first preparatory steps towards the interim review meeting were taken.



The picture below shows the components of a classic LED driver. The white pieces are a real size replication of the single components, whereas the yellow pieces illustrate the 90% size and weight reduction that is pursued by the LEDLUM project partners.



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Consortium:
Project Coordinator:

Technical Leader:

Project Website:

7 partners (4 countries)
 Dr. Klaus-Michael Koch
 coordination@ledlum-project.eu
 Dr. Mickey Madsen
 mickey@nopoc.com
www.ledlum-project.eu



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Technical progress since March 2017

WP1 “System Architecture” is responsible for establishing a detailed system architecture and requirements (SAnR), which is crucial for the overall success of the project, as it defines the overall architecture of the LED driver systems, the system components and interfaces, and the system requirements. In the last couple of months several SAnR were released and reviewed. **SAnR v1.0 was released** and formally documented in D1.2, which was submitted in April 2016 and constituted at the same time the **accomplishment of Milestone 2 “Defined system architecture”**. In comparison to previous versions, v1.0 includes a system requirements list, a system architecture block diagram and target volumes for each module, as well as a description of all interface signals between modules. An updated SAnR (v1.1) was released at the end of June 2017.

During the last few months a state-of-the-art review for sputtered soft magnetic materials was performed within **WP2 “Passives”**. This analysis has identified **CZTB as a promising first candidate material**, which shows a significant improvement over the present plated material. Consequently, CZTB is the choice of material for fabricating the generation 1 magnetic devices. Laminated films of CZTB and dielectric material have been fabricated and characterised in relation to their magnetic properties. The development of a patterning process for laminated CZTB stacks has started and a dummy-run to CZTB fabricate strip-line device using CZTB process flow and lift off patterning was completed. Furthermore, **performance data** in relation to inductance density and current handling of previously fabricated integrated inductors have been supplied in order to allow partners working on the Power Electronics design in WP4 to **use realistic performance values**. Finally, design study for AC/DC inductors commenced.

WP3 “Semiconductors” shall physically realize the **optimum solution for power devices**, which is then developed in different processes. To achieve this, a dedicated and very focused face-to-face meeting was organized in Denmark. During the last few months the **process selection** for full integration was carefully undertaken and possible solutions were identified. A first dummy-run towards the **first prototype was realized in a tape-out**. Despite the pad-ring design, a start-up circuit for the Class-E inverters was designed, simulated, laid out and sent for production as a tape-out in the AMS 180nm, 50 V process.

In order to start the interface discussions for the **AC/DC—DC/DC specifications** in **WP4 “Power Electronics”**, a face-to-face meeting where a few partners participated, was organized. Since then the **design and implementation** of mock-up as preparation work for the **first prototype** of the AC/DC is ongoing in strong collaboration with WP2. Also on the DC/DC side a low voltage mock-up was designed and debugged. Currently, another preparation DC/DC converter for a high bus voltage is on the way. Furthermore, the interface between the AC/DC and DC/DC is currently examined and partners are working on the tradeoffs between various absolute voltages.

WP5 “Driver System” is still in its early stages. The work in this WP has primarily been focused on the specification of **interfaces** and the **evaluation of architectures and processes**. The provision of an open loop DC/DC module by one of the partners enabled the investigation of various PWM modulation techniques of the converter topology. Furthermore, a first prototype of the low-voltage power supply was built and tested.

EPIC Workshop on Miniaturization of Solid State Lighting Systems at 7th International LED professional Symposium +Expo (LpS)

LpS is the leading international lighting technologies event for design, testing and production of lighting systems, controls and equipment. On 28th September, LEDLUM’s technical leader Dr. Mickey Madsen from NPC gave a presentation with the title **“Miniaturized LED drivers enabling new design solutions”** during a workshop on “Miniaturization of Solid State Lighting systems” arranged by the European Photonics Industry Consortium (EPIC). The main aim with the presentation was to increase the awareness of very high frequency power conversion and the new possibilities it brings to lighting designers. The workshop was collocated with LpS and Trends of Lighting in Bregenz, Austria.

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