LEDLUM Leverages Large-Scale LED Lighting

Review/Flashback

About three-and-a-half years ago, on November 1, 2016, the H2020 project LEDLUM launched. Seven partners from four different European countries including two SMEs, three industrial companies, and two universities forged the consortium to work together to achieve the ambitious goals and objectives of the project.

The Project now ended at the end of April and the consortium can look back at a challenging but successful time.

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Consortium
7 partners (4 countries)

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Project number: **731466**
Project website: **www.ledlum-project.eu**

Project start: **1st November, 2016**
Duration: **3,5 years**

Total cost: **EUR 4,118.521,25**
EC contribution: **EUR 4,118.821,25**

PHOTONICS 21
PHOTONICS PUBLIC PRIVATE PARTNERSHIP

The LEDLUM project has received funding from the European Union's Horizon 2020 research and innovation programme under grant agreement No 731466. This project is an initiative of the Photonics Public Private Partnership.

About LEDLUM

The goal of LEDLUM (Tiny Light Engine for Large Scale LED Lighting) is to make major improvements to the volume, weight, lifetime and size of the driver (electrical engine) of light emitting diodes (LEDs), are used in the overwhelming majority of solid state light (SSL) systems. These improvements were to be made while keeping the power rating of the driver. To achieve this, the operating frequency of the driver would have to be increased by a factor of approximately 1,000.

The LEDLUM project objectives:

- 90% size and weight reduction of the power electronics part in the LED driver
- reduction of material cost by a factor of 2
- reduction of energy losses by 45%
- increase lifetime expectancy from 5 to 10 years.

To achieve these objectives, the LEDLUM project introduced the following innovations:

- New soft magnetic thin film inductors to increase magnetic on silicon energy efficiencies
- Increase the capacitance of ultra-high density PICS trench capacitors for HV applications under stable temperature and voltage linearity and state-of-the-art parasitic inductance and resistance
- Use the most competitive power semiconductors in terms of energy efficiency and combine with drive and control circuitry for operation in the VHF range
- Use silicon wafers with embedded capacitors as mechanical and electrical base for other electrical components, especially as magnetic-on-silicon based inductors and power transistors to achieve unprecedented power densities
- Combine the above magnetic, capacitors and power semiconductors in a granular approach with novel ripple port circuit topologies to form a grid-tied AC-DC converter without electrolytic capacitors

LEDLUM summed up

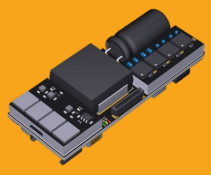
In the past three-and-a-half years quite a bit has happened. Project partners can proudly look back at an active, collaborative and productive time with many ups and a few downs. All project partners were committed; the cooperation within the consortium was stable throughout the project and all partners worked tirelessly to ensure project goals were reached. Within the Project, leaders decided to create two tracks: research and development. Results are listed below.

Research- and Development-track

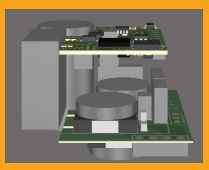
ResearchTrack

Within the research track, three different final demonstrators were developed:

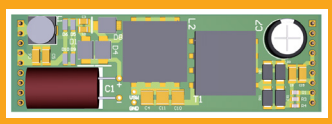
FINAL DEMONSTRATORS



R1



R2A



R3

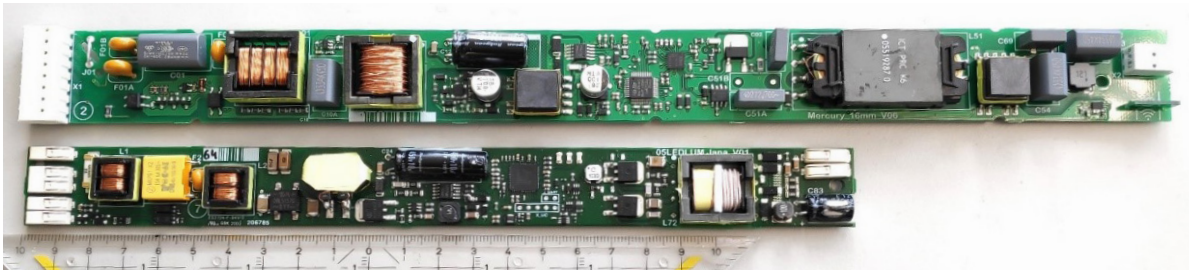
	R1	R2A	R3
Power factor	0.94	0.99	0.99
THD	11%	6%	4%
Efficiency	86%	92.2%	91%
Volume	14.4 cm^3	13.9 cm^3	24 cm^3
Power density	3.47 W/cm^3	3.6 W/cm^3	2 W/cm^3

Research- and Development-track

Development-track:

Within the development track, one final demonstrator was developed. This picture shows the developed demonstrator (below) called JANA compared to a current state of the art LED-Driver.

FINAL
DEMONSTRATOR



The achievements of JANA are:

- **High technology readiness level achieved**
- 40% size reduction
- Attractive cost
- ACDC with standard tech has potential
- Custom IC
- Research track (Passives! and Topologies!)
- DCDC already at sweet spot
- Control IC selection was good for a research project and needs industrialization now
- Form factor is ideal for in-track and slim luminaire designs

LEDLUM summary

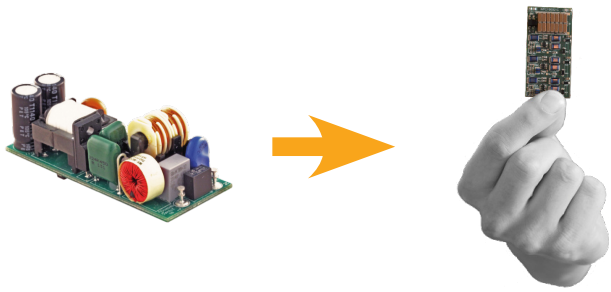
The consortium unquestionably worked well together. Many synergies were developed and unwavering teamwork pushed the consortium to achieve goals and introduce creative problem solving practices. The creation of the separate research and development tracks is a prime example of the team coming together to create efficiencies within the consortium and for the overall success of LEDLUM. The results of this decision were collaboration in smaller groups with stronger focus on specific targets and leveraging high maturity level and high goals, without being over ambitious and overzealous with risks.

Results in summary:

- High maturity level for JANA and attractive performance with 64% size and 59% weight reduction — cost is a bit high, but clear path to reduce
- Prototypes from research track comes very close to the size goal of LEDLUM
- Results from development track can be used for products with strong USPs short term
- Results from research-track can continue with further investment in maturation

The results were presented in a webinar on April 27, 2020. You can find more information about the LEDLUM project on our **website**.

The project demonstrators give a glimpse into the future of LED-Driver.



Project Partners

1 TECHNIKON

2 Nordic Power Converters — Powering a brighter future™

3 TRIDONIC

4 ipdia

5 LEDGROUP

6 DTU

7 Tyndall National Institute