“PRO INVENT” RESEARCH CONFERENCE–24.03.2016

Efficient **LI**ghtweight Electro-**M**agnetic Prop**U**lsion **S**ystem for Electric Vehicles (**ELIMPUS)**

1 October 2015 – 30 September 2017 / 549’930LEI

Research team:

Daniel FODOREAN (manager)
Claudia Violeta POP (PhD student)
Gyorgy Tamas (PhD student)
Aron Attila POPP (PhD student)
Dan Cristian POPA (postdoctoral researcher)
Petre Dorel TEODOSESCU (postdoctoral researcher)

UNIVERSITATEA TEHNICĂ CLUJ-NAPOCA

dmcdi
Departamentul pentru Managementul Cercetării, Dezvoltării şi Inovării

ELIMPUS Project - Summary

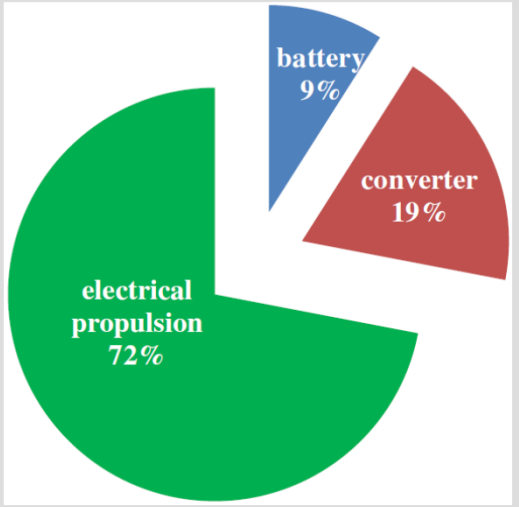
1. **Motivation of the ELIMPUS project**
2. **Objectives and activities**
3. **Milestones and challenges**
4. **Results and next steps**

UNIVERSITATEA TEHNICĂ CLUJ-NAPOCA

dmcdi
Departamentul pentru Managementul Cercetării, Dezvoltării și Inovării

ELIMPUS Project - Motivation

- **The electromagnetic propulsion concerns the main loss source of a propulsion system.**



- The use of pure electromagnetic transmission (magnetic gear) offers the following advantages:

- ✓ **high transmission ratio can be achieved;**
- ✓ **no lubrication needed;**
- ✓ **no local heat (contact on teeth) and mechanical losses (except on bearings);**

<u>Important</u>: - the main loss source in a MG is the iron loss, thus, a special attention should be paid on the used materials;

- our projects exploits the possibility of using variable transmission ratio.

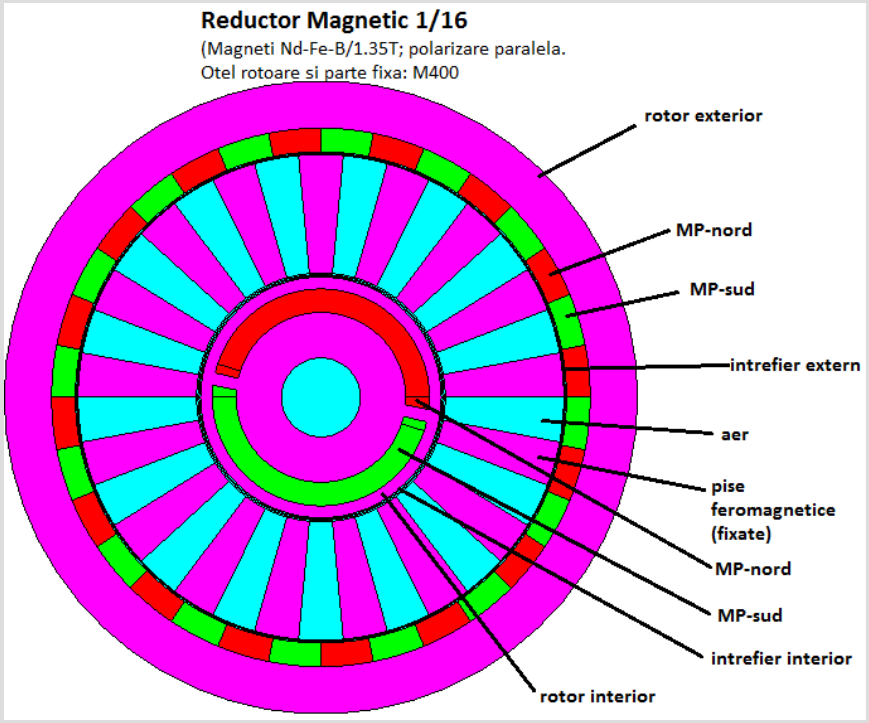
- such solutions can be used in power generation too.

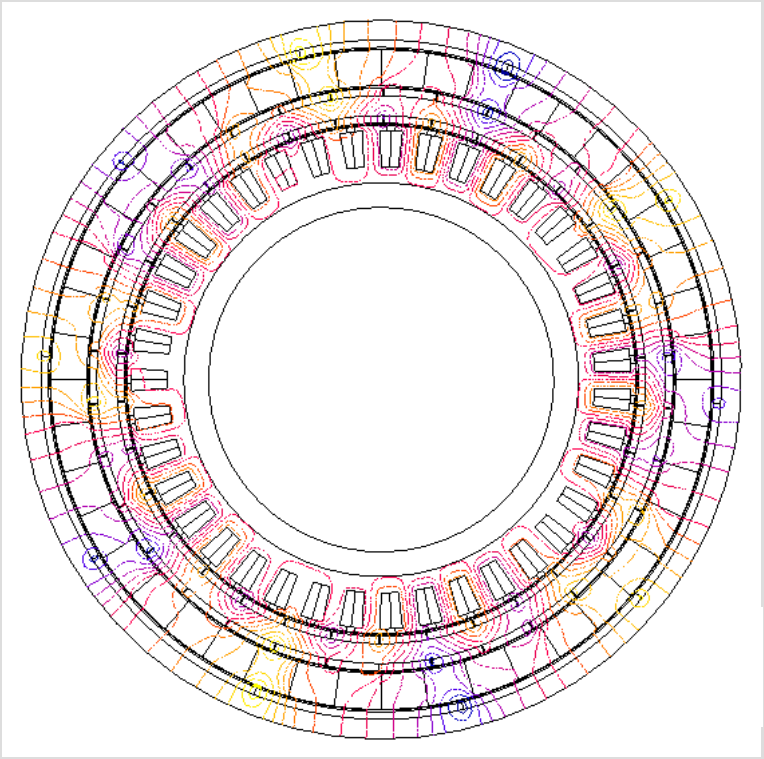
UNIVERSITATEA TEHNICĂ CLUJ-NAPOCA

dmcdi
Departamentul pentru Managementul Cercetării, Dezvoltării și Inovării

ELIMPUS Project - Motivation

- **The elements of an electromagnetic propulsion system: the electric motor and magnetic gear (MG), with/without variable transmission ratio:**
- **The MG can be integrated within the motor (having intrinsic variable Transmission ratio):**
- **A second MG under study can have electromagnet configuration => produces variable transmission ratio – patent proposal under preparation.**





ELIMPUS Project – Objectives/activities

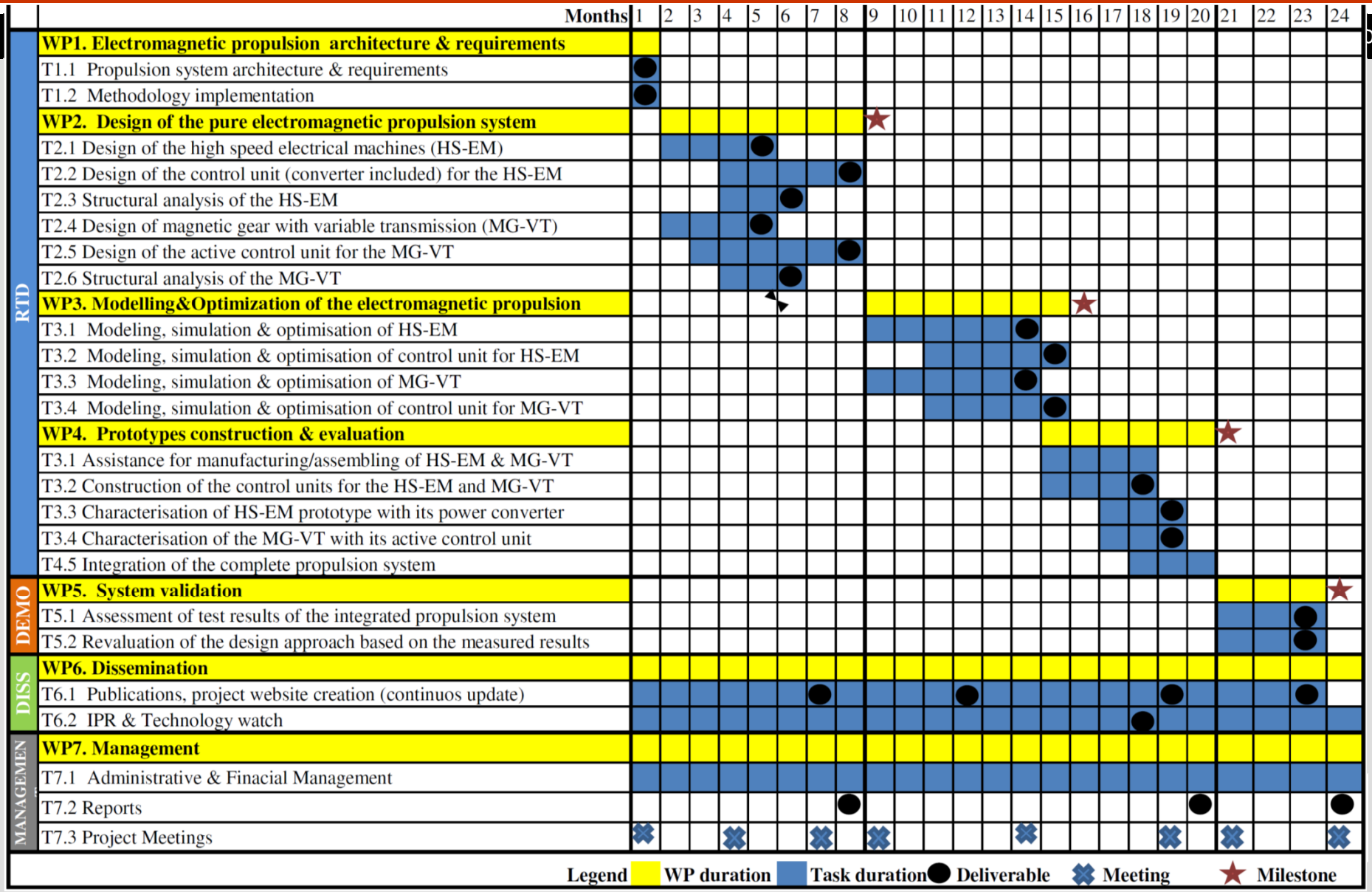
1. Design and structural analysis of purely electromagnetic propulsion.
Activities: design, simulations and optimization of the electromagnetic propulsion kit, by using analytical methods based on electric-thermal-magnetic equivalent circuit.

2. Testing and validation of purely electromagnetic propulsion.
Activities: construction of the motor-gear propulsion system, with variable transmission, and their associated converters. Optimal control strategy for the energy management will be elaborated for the entire electromagnetic integrated system.

UNIVERSITATEA TEHNICĂ CLUJ-NAPOCA

dmcdi
Departamentul pentru Managementul Cercetării, Dezvoltării și Inovării

ELIMPUS Project – Milestones/challenges



ELIMPUS Project – Results/next steps

RESULTS:

- ✓ **Design of numerical analysis of a PMSM with integrated MG.**
- ✓ **Preliminary work on analytical desgin approach of MG, based on equivalent reluctance network and vector potential.**
- ✓ **Evaluation of losses and efficiency on MG and electric motor with integrated MG.**
- ✓ **1 article to be presented at SPEEDAM2016 (ISI Proc), Capri, Italy – June 2016**

FUTURE WORK (2016)

- ✓ **Structural analysis, thermal behavior evaluation and optimization of studied MGs**
- ✓ **Participation at a training for thermal analysis of electrical machinez (Cedrat training in Padova, Italy – May 2016)**
- ✓ **Second paper proposal at UPEC2016 (Coimbra, Portugal – September 2016)**
- ✓ **Preparation of a ISI journal proposal by the end of 2016.**

UNIVERSITATEA TEHNICĂ CLUJ-NAPOCA

dmcdi
Departamentul pentru Managementul Cercetării, Dezvoltării și Inovării

ELIMPUS Project

Thank you for your attention!

www.elimpus.utcluj.ro

Contacts: claudia.pop@mae.utcluj.ro
daniel.fodorean@emd.utcluj.ro

UNIVERSITATEA TEHNICĂ CLUJ-NAPOCA

dmcdi
Departamentul pentru Managementul Cercetării, Dezvoltării și Inovării