Railenergy

ALSTOM

Energy Efficiency Days 2009

Panel 3 – Innovative Energy Efficient Trackside

PILOT PROJECT FOR REVERSIBLE DC SUBSTATION

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ALSTOM Transport

The context

- Transport Authorities and their suppliers today seek Energy Efficiencies as a contribution to both:
  - Their overall business performance
  - Their identity as a modern & responsible public service organisations
- This presentation is about the original design and validation of a reversible DC substation conceived by ALSTOM and shared with NRJ Trackside works:

  -It is one of several ALSTOM solutions developed to address customer demand for superior energy management capability in public transport.

  -It is also the fruit of thinking and initiatives that go back to a time before “Sustainable Development” became fashionable.

Scope & Objectives

- INPUTS:

  EVENT Report 2004 (UIC-IZT) recommendations for energy efficiency technologies with highest priority § 2.3 and 2.6 :

  -”Short term: Study potential for brake energy recovery

  -Medium term: Assess and test options to enhance recuperation rates in DC systems

  -Long term:Integrate recovery and storage options in early development stage”

Scope & Objectives

- OUTPUTS:

  Assessment and tests of Reversible DC substation for:

  -Receptivity of the line: >99%,

  -Possible suppression of on-board braking resistors,

  -Dynamic balancing the power between adjacent substations to compensate dynamically fluctuations of primary voltage, control overloads,and avoid penalties on power contract subscription,

  -Control of harmonic content and reactive power to comply with electricity provider regulations ,

  -Sustainable solution for all DC power/energy and voltage systems.

Scope & Objectives

- LIST OF ACTIVITIES:

  -1) Confirm the potential of braking energy recovery for regional and suburban lines in 1.5 and 3kV

  -2) Build a model of power converter to cope with traction and braking efficiency targets,

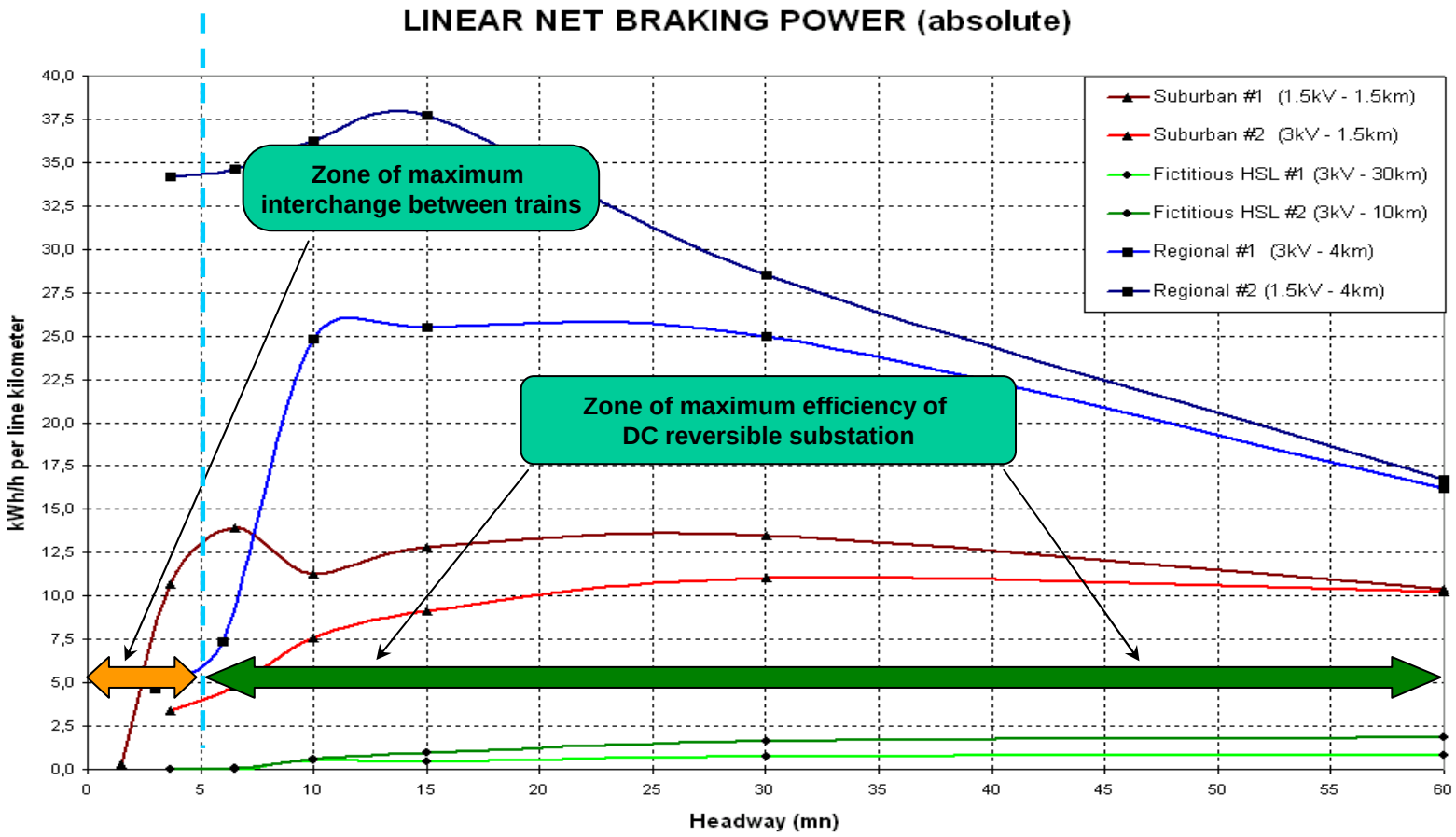
  -3) Build a research program for S/S power converter feasibility and architecture,

  -4) Validate the energy saving targets by simulations and Design Scenario SP2.5 and if possible on test track with vehicle(s) ,

  -5) Evaluate the LCC and Return On Investment (ROI)

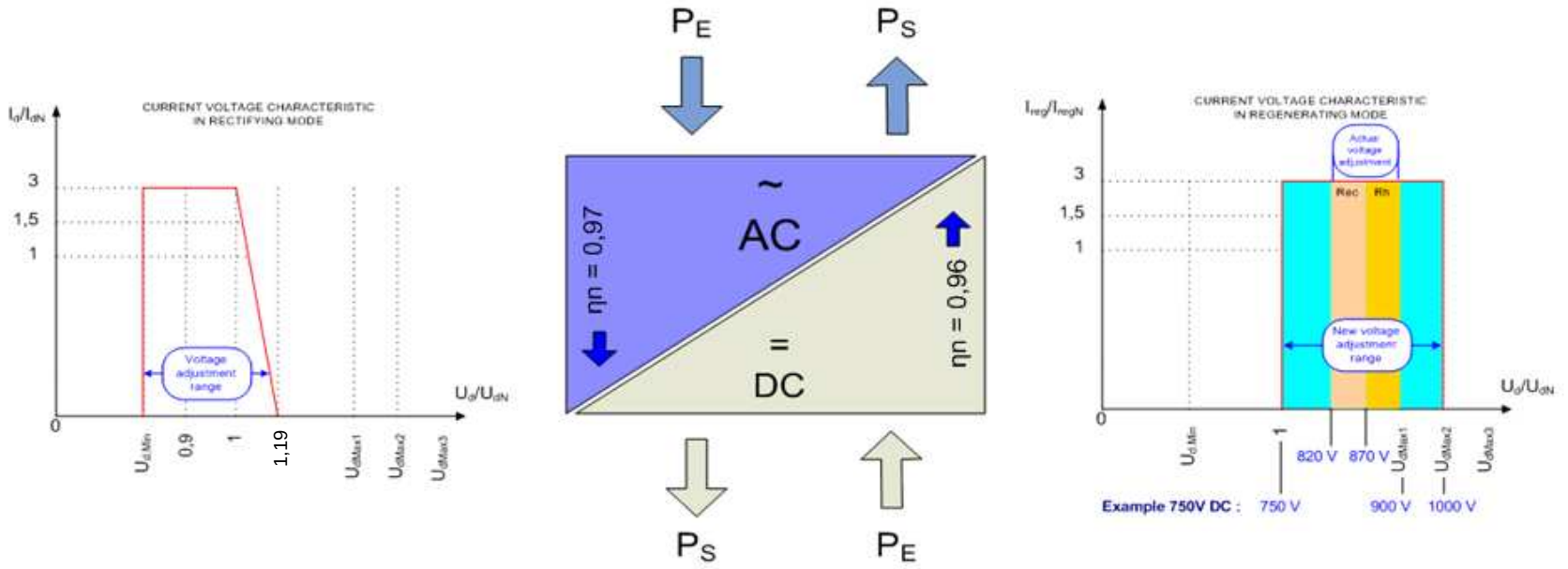
Activities performed & Status

- 1) Confirm the potential of braking energy recovery into the fleet: 100%-M6



Activities performed & Status

2) Build a model for S/S Power Converter-Functional Specification: M6 & M24:100% achieved

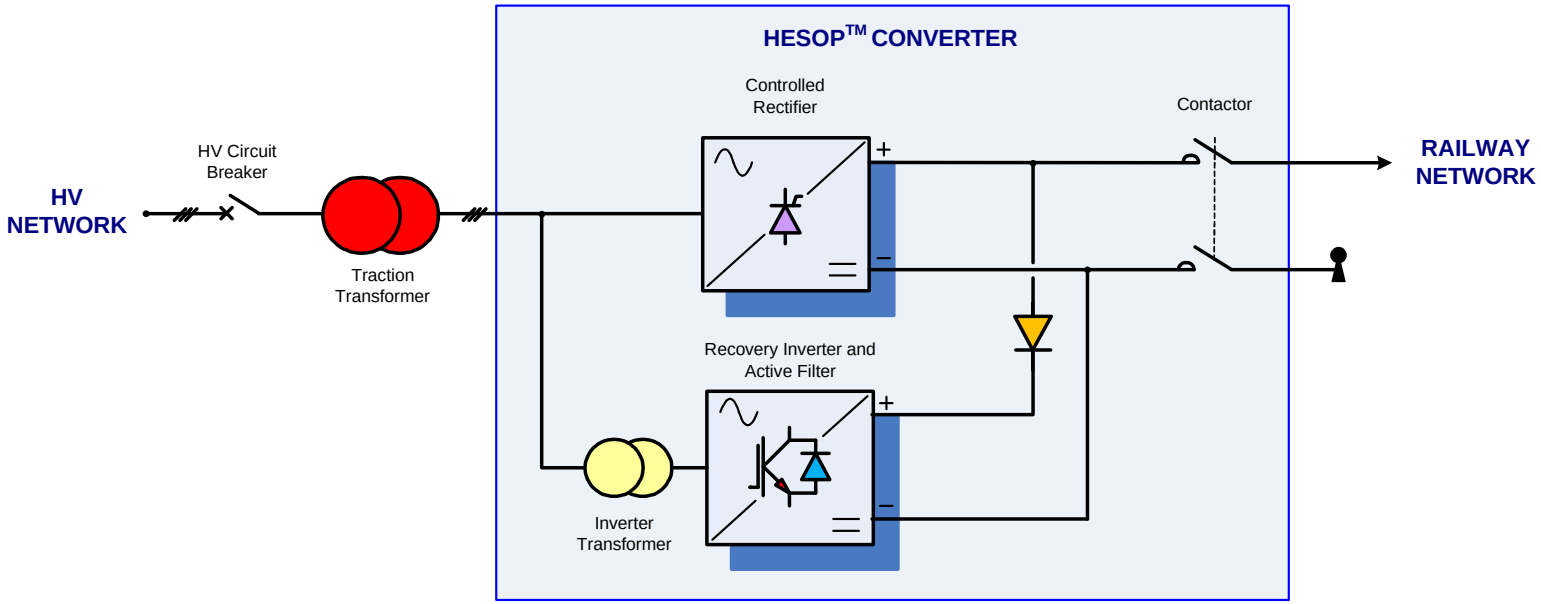


Voltages U_{Max} et U_{Min} : According to EN50163

Activities performed & Status

- 3) Build a research program for S/S Power Converter development:Requirements and Architecture: M12 & M18 for prototype :100%

HESOP™ Prototype Converter structure



Activities performed & Status

- 4.1) Validate the Reversible DC substation technology according to Demonstration Scenarios and Use Cases as defined by SP2.5 with multi-train simulation tool:M30-M39: 50%

  -Work done by ENOTRAC with FABEL multi-trains simulation tool on a typical regional line (DS3.3: Utrech-Zwolle Netherlands) compared to base line scenario:

  -Inputs: Voltage vs current S/S characteristics

  Losses vs current S/S characteristics

  -Outputs:Net Energy consumptions

  Key performance indicators

Activities performed & Status

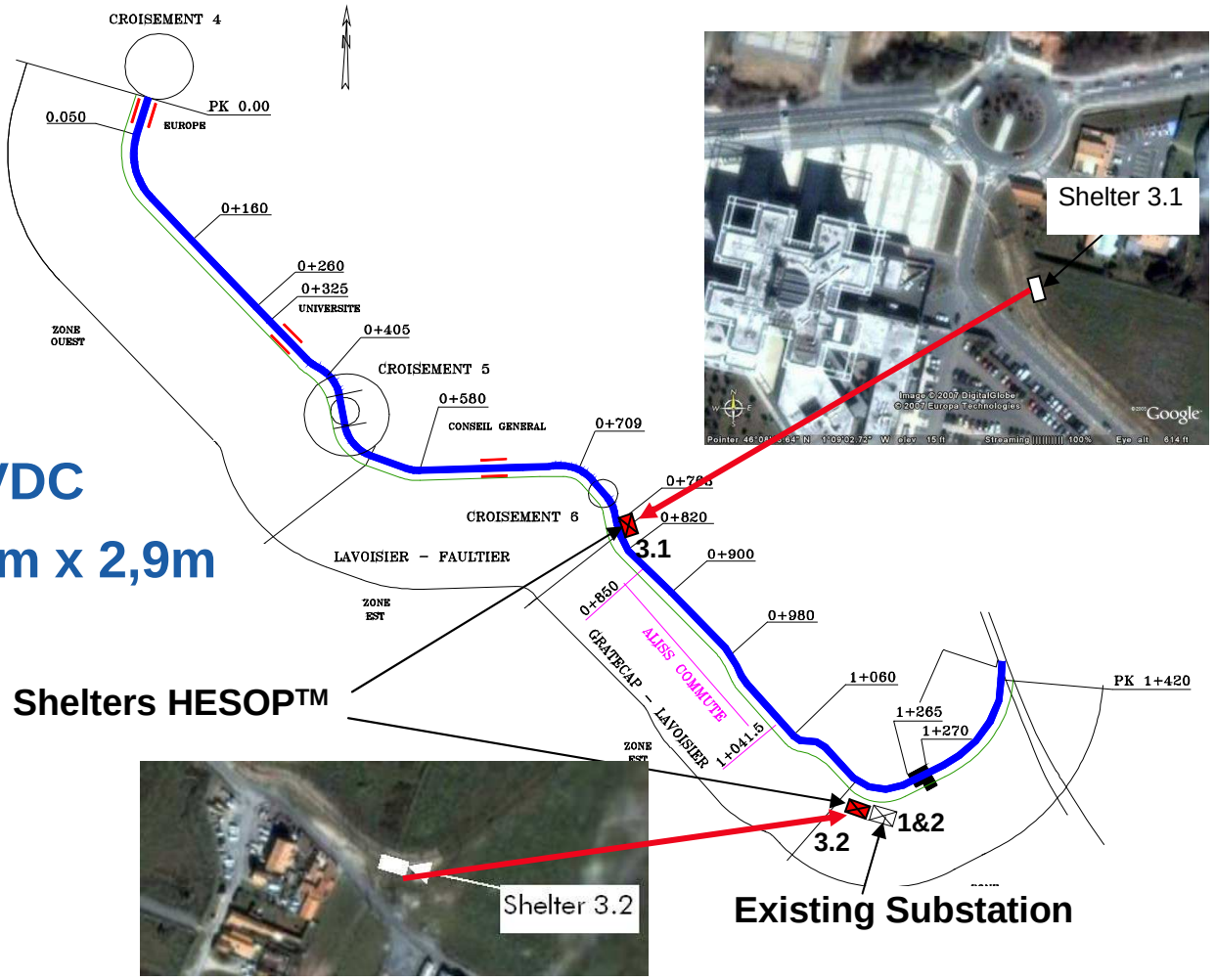
- 4.2) Manufacture a reduced power converter prototype for validation on site with vehicle(s): M21-M32 100%

View of Reversible DC Substation Prototype :750V-300kW in factory;

Results achieved and implementation

Site Implementation characteristics :

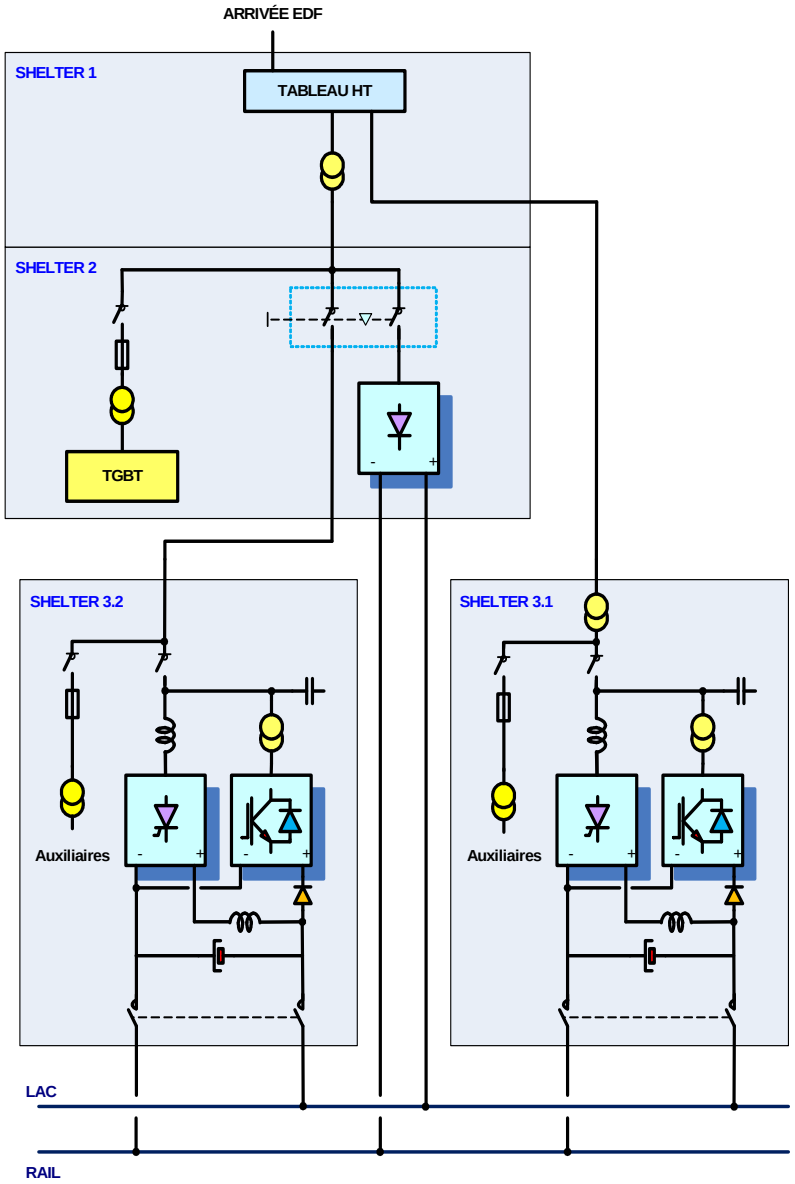
- Track:1.5 km,750VDC
- S/S Size: 5m x 2,8m x 2,9m
- S/S Weight: 7T



Results achieved and implementation:M33

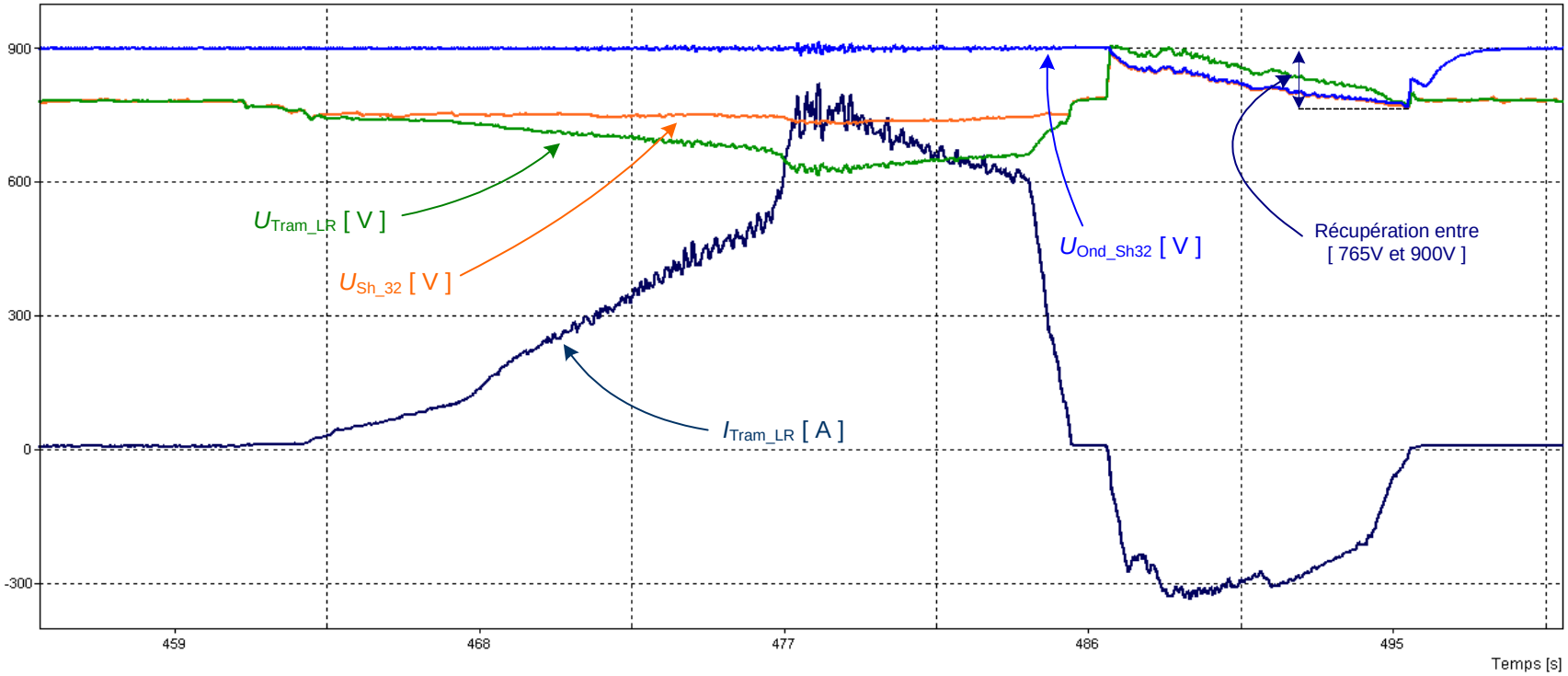
- Site installation

- Electrical architecture



Results achieved and implementation

100% of dynamic braking energy effectively regenerated and restituted to national grid (1 Vehicle-1S/S)



Next Steps & Outlook

- Pursue tests and validations on site:M35-M39
  - -Energy balance:traction,braking, regeneration, efficiencies,
  - -Power quality: Harmonics and reactive power compensation,
  - -Environment: Noise, thermal balance, electromagnetic compatibility,
  - -Priority of energy exchange between vehicles (2 veh)
  - -Compatibility with adjacent diode rectifier substation,
- Provide a test report for energy saving results:M39

Next Steps & Outlook

- Pursue validation of the technology with the results issued from SP2.5 and Demo scenes during M42-M48 for Technology Assessment Report (TAR):
  - -Energy saving benefits,
  - -Life Cycle Cost evaluation,
  - -Return On Investment evaluation,

- ALSTOM is finalizing an industrial plan to develop and produce 750,1500,3000 VDC reversible substations ranging from 600 kW to 8 MW for Mass Transit and Railway applications completing its range of solutions, like SupraC on-board energy storage, to promote sustainable railways development .

End of presentation


SP 3 members in
La Rochelle site test track
Sept 2009

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