Swissphotonics

Swiss National Laboratory for Solid State Lighting (SNL-SSL)

Dr. Rolando Ferrini

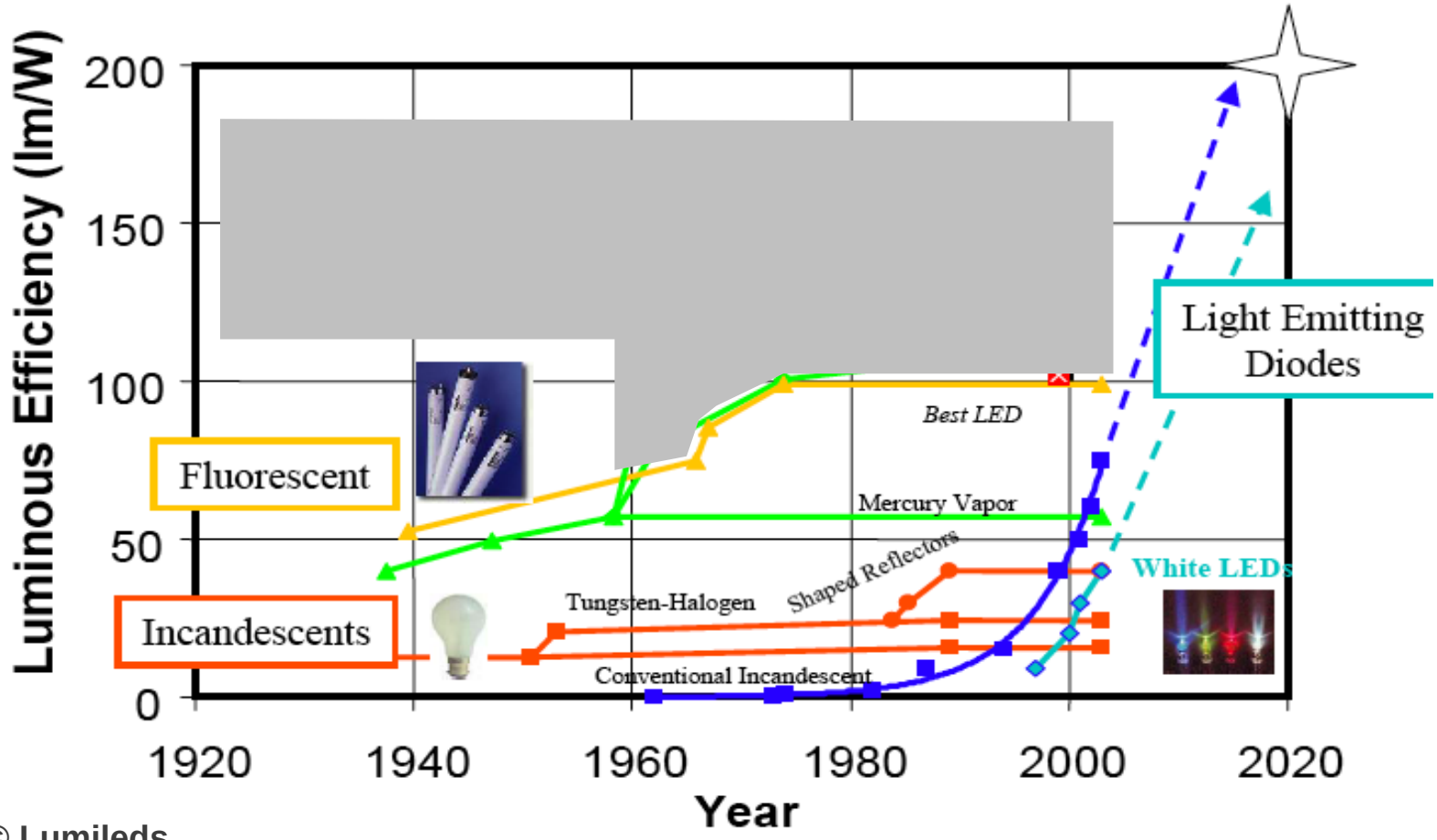
Burgdorf, 28.03.2013

Outline

- Why Solid State Lighting?
- Why a Swiss National Laboratory?
- Why CSEM Muttenz?

Lighting sources: past & present

Evolution of the lighting technology



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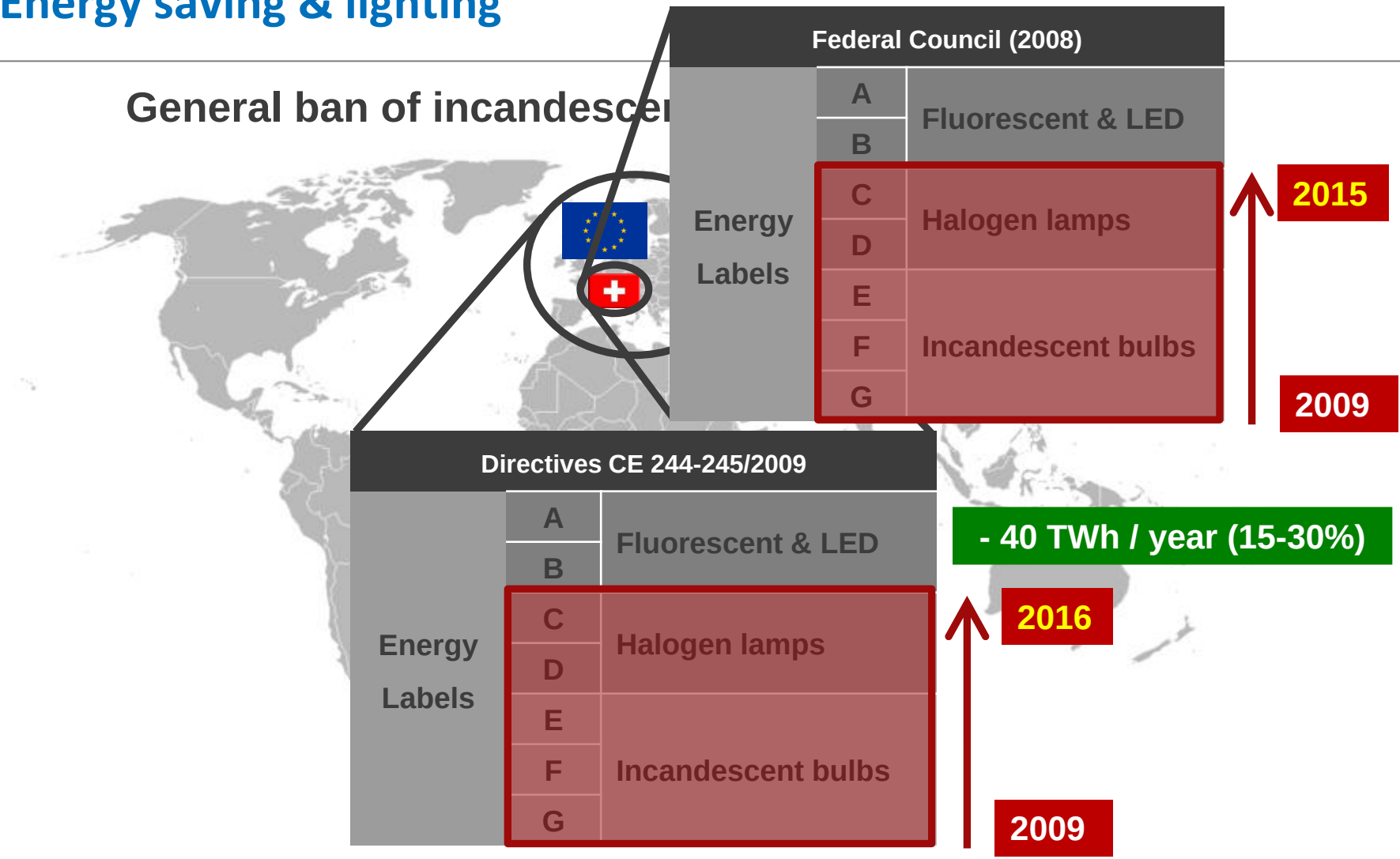
Energy saving & lighting



R. Ferrini, Bulletin d'Electrosuisse SEV/AES, Vol. 6 (4th June 2010)

Lighting sources: a new revolution

L. Zuppiroli and D. Schlaepfer, Lumières du futur (2011)

From incandescent bulbs to solid state lighting

Source	Efficacy (lm/W)	CCT (k)	CRI	Price (CHF)
Incandescent bulbs (40 up to 100 W)	10-15	2700	100	≈ 1
Halogen lamps (50 W / 12 V)	25	3200	100	5
Fluorescent tube (Osram 58W / 827-840)	≥ 80	2700-4000	80-90	≤ 10
LED-based lamps	30-80	2700-4000	≤ 80	20-80

R. Ferrini, Bulletin d'Electrosuisse SEV/AES, Vol. 6 (2010)

L. Zuppiroli, Bulletin d'Electrosuisse SEV/AES, Vol. 1 (2013)

Solid State Lighting: present and future challenges

- **Price**
  - Incandescent bulb 40W < 10 CHF ➔ LED lamp = 20-50 CHF
  - Halogen lamp 35W < 10 CHF ➔ LED lamp = 20-80 CHF

  Impact factors
  - Materials
  - Components (supply, number, reliability)
  - Light management
  - Heat management
  - Performances

L. Zuppiroli, Bulletin d'Electrosuisse SEV/AES, Vol. 1 (2013)

Solid State Lighting: present and future challenges

- **Luminous flux**
  - Incandescent bulb 40W = 400 lm ➔ LED lamp = 50-250 lm
  - Halogen lamp 35W = 700 lm ➔ LED lamp = 350 lm

- **Lighting quality (color rendering)**
  - LED lamp – *Cold white* (6500 K) ➔ CRI = 60-70 (100 lm/W)
  - LED lamp – *Warm white* (2700 K) ➔ CRI = 80 (70 lm/W)

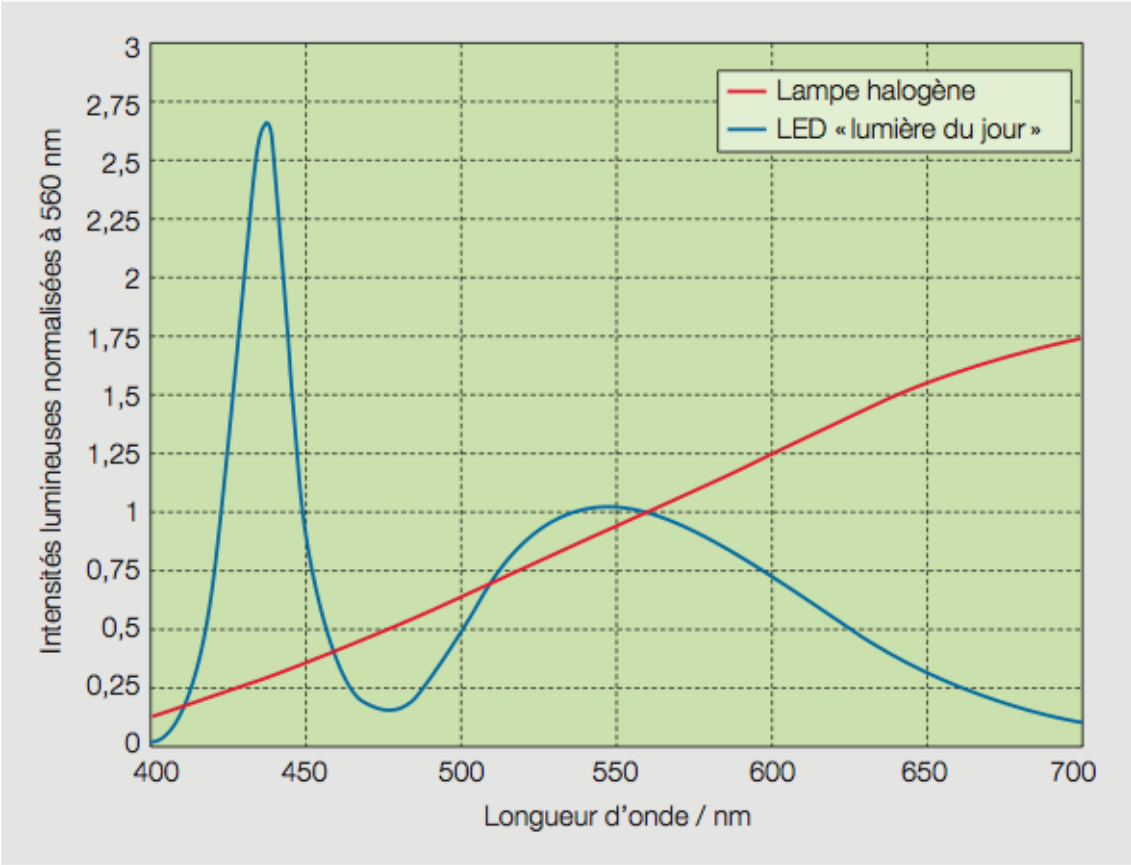
Impact factors

- Materials
- Heat & Light management
- Component performances

L. Zuppiroli and D. Schlaepfer, Lumières du futur (2011)

L. Zuppiroli, Bulletin d'Electrosuisse SEV/AES, Vol. 1 (2013)

Solid State Lighting: lighting quality



L. Zuppiroli and D. Schlaepfer, Lumières du futur (2011)

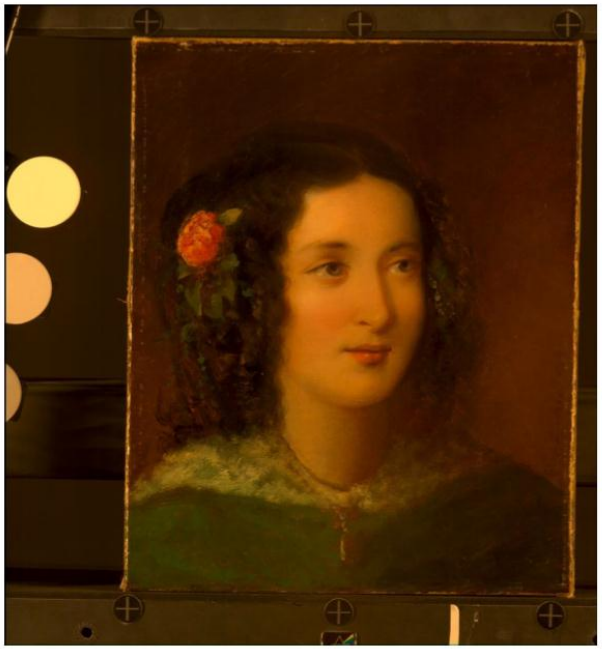
L. Zuppiroli, Bulletin d'Electrosuisse SEV/AES, Vol. 1 (2013)

Solid State Lighting: lighting quality

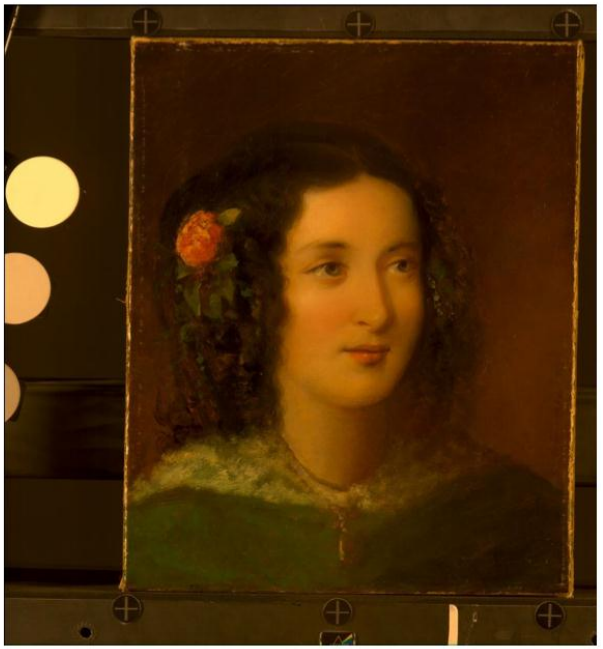
Warm White

Color temperature 2700 K

Black body



LED



L. Zuppiroli and D. Schlaepfer, Lumières du futur (2011)

Solid State Lighting: present and future challenges

- **Lifetime**
  - LED lamp – *Cold white* (6500 K) ➔ 60’000-100’000 hours
  - LED lamp – *Warm white* (2700 K) ➔ 25’000-35’000 hours

  Impact factors

  - Materials
  - Heat management
  - Real measurements: 1’000 hours [T70]

L. Zuppiroli, Bulletin d'Electrosuisse SEV/AES, Vol. 1 (2013)

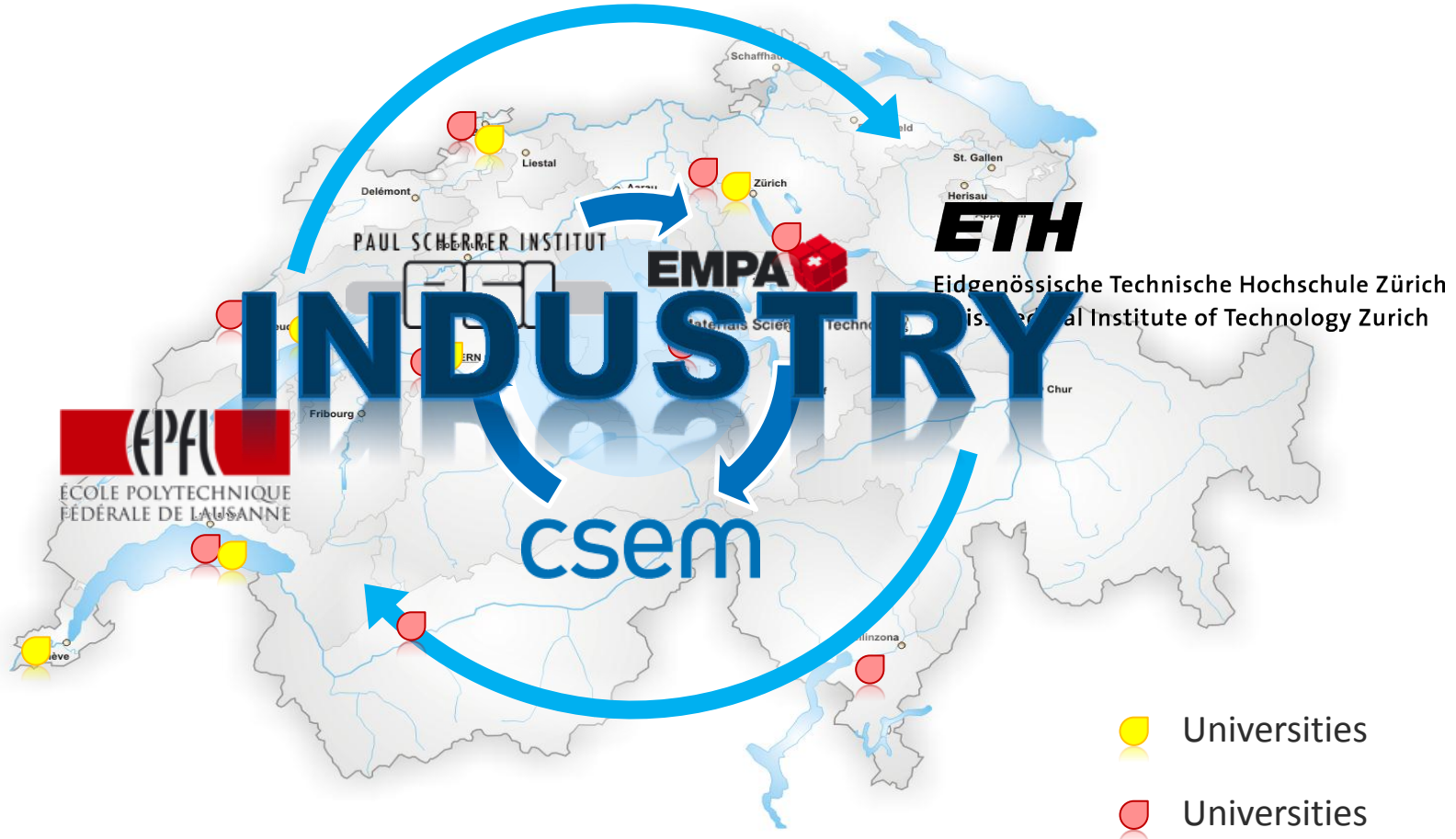
Solid State Lighting: present and future challenges

- **Components**
  - Supply
  - Reliability

- **Health & Environmental impact**
  - Components & Materials
  - Blue/UV light
  - Glaring

L. Zuppiroli, Bulletin d'Electrosuisse SEV/AES, Vol. 1 (2013)

Solid State Lighting in Switzerland



Solid State Lighting in Switzerland: Opportunities

- New materials
- Innovative components
- New light and heat management solutions
- Novel integration schemes
- Novel designs
- Innovative lighting solutions
- New standards
- New lighting models for customers
- Eco-sustainability

CSEM Muttenz

CSEM Muttenz can offer

- a long-lasting experience in the development and fabrication of
  - Large-area low-cost micro- and nano-optical structures
  - Large-area low-cost printed optoelectronic devices

- a well equipped infrastructure in a clean-room environment

- a proved experience in industrially oriented projects in the light management domain with Swiss companies such as BASF, SEFAR AG, REGENT Lighting AG, etc.

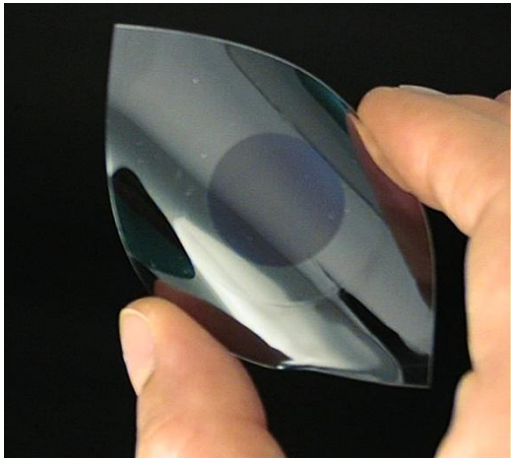
Lab facilities & Manufacturing technologies

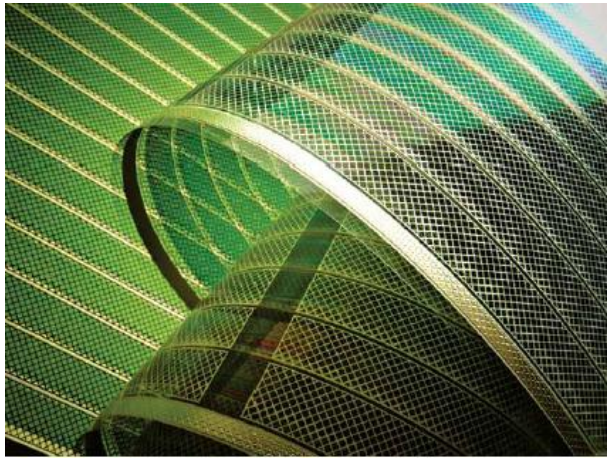
- ***Facilities***

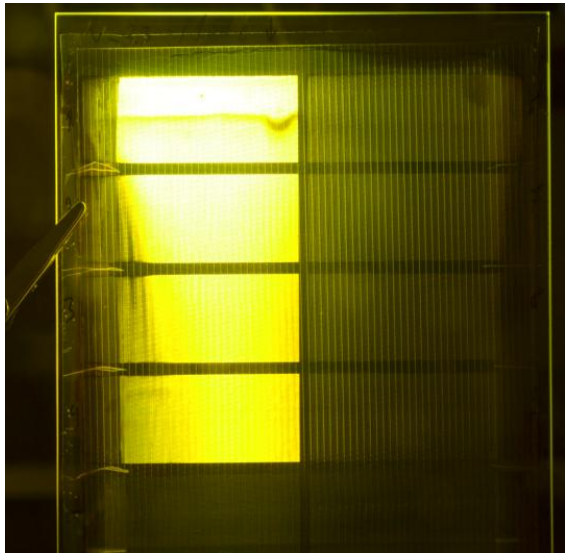
- Class <10k clean room
- 500 m2 lab room, machine shop, CAD
- Dedicated equipment for manufacturing, prototyping and characterization

- ***Small scale production***

Integrated light management







Aims

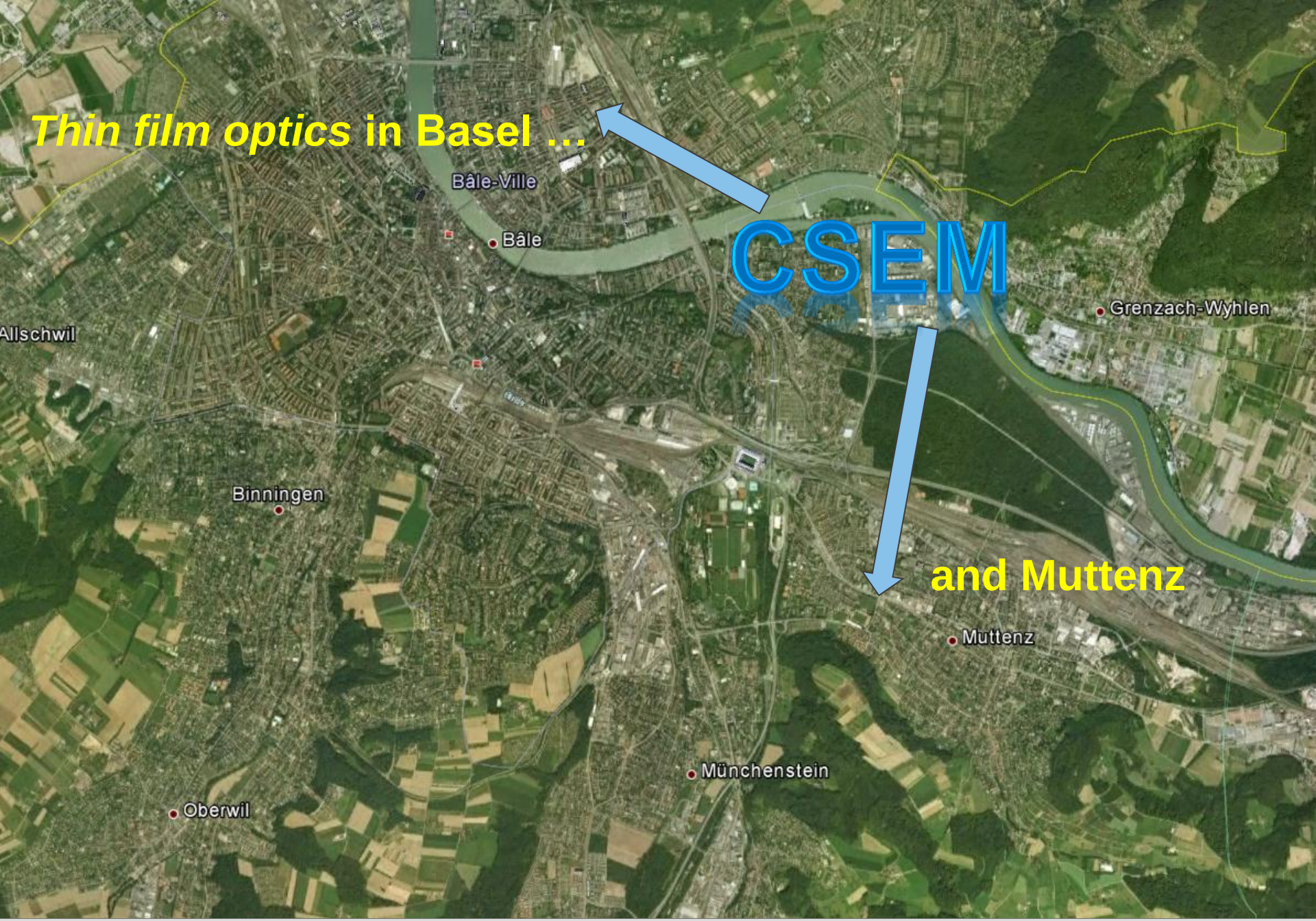
- To be a Swiss-wide reference for all players (LMEs, SMEs, RTOs, etc.) involved in the "solid-state light revolution"

- To build a network connecting Swiss companies and research centers along the entire value chain, from material suppliers to system developers and integrators, till end-users

- CSEM Muttenz will act as contact point to address specific industrial requests within the SNL-SSL and thus ensure the best solution for the customer

Proposal

- Establish a core network including CSEM Muttenz (lead) and additional 2-3 partners
- Define a common roadmap with focus on a few topics that are specifically relevant the Swiss lighting industry
- Regular meetings and visits at partner's sites will foster consolidation and initial momentum for a further development
- New partners will be progressively integrated (top-down or bottom-up)
- Standardization and integration of lab/measurement facilities will be implemented
- Purchasing of small dedicated equipment may be possible to better address specific needs of the Swiss companies addressing to the SNL-SSL
- Work-shops and round-tables will be discussed and organized to gather inputs on the evolution of the global lighting market


Thin film optics in Basel …
Bâle-Ville
Bâle
CSEM
Grenzach-Wyhlen
Allschwil
Binningen
and Muttenz
Muttenz
Münchenstein
Oberwil