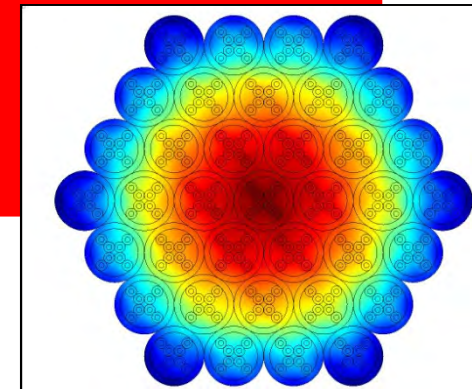




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Cables heating due to PoE/PoE+





Worldwide leader in the cable industry

- Industrial presence in 39 countries and commercial activities worldwide
- 22,700 local experts
- sales in 2009 of 5 billion euros





Infrastructure

Local Area Networks

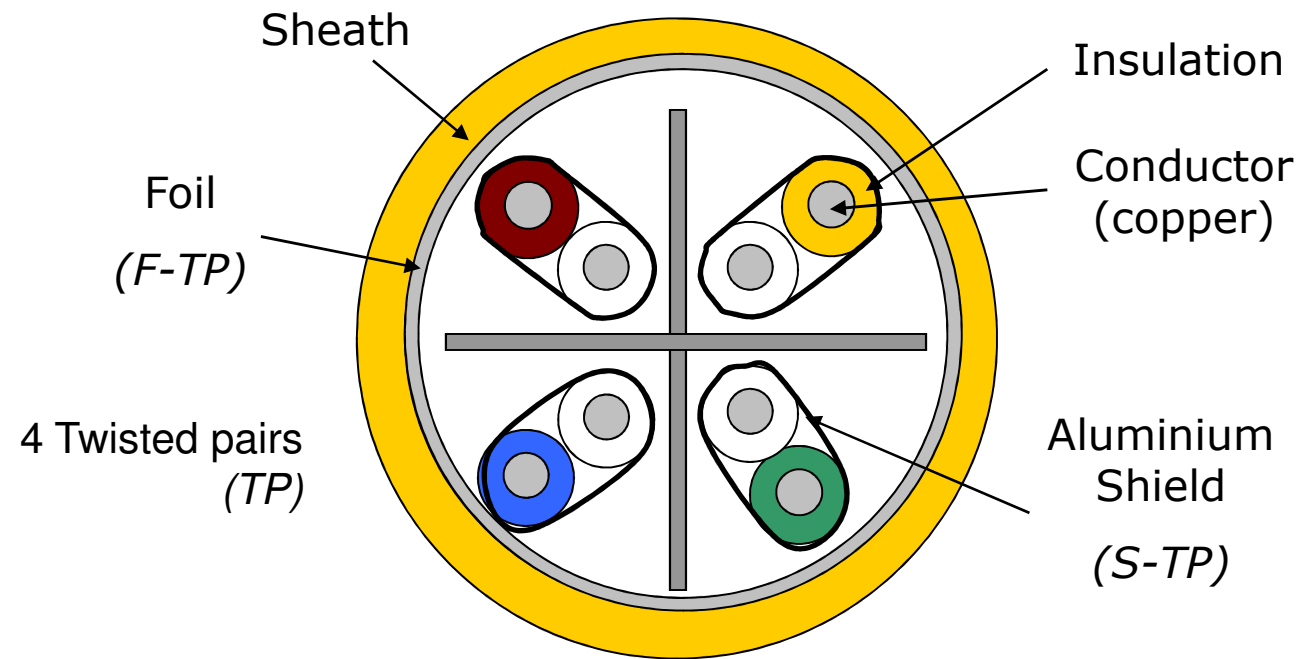
Industry

Building

- Comsol Certified Consultant
- Development of numerical models
- Assistance in modeling



- Expertise
- Efficiency
- Rapid solutions at low-cost



High Data transmission performance



<i>Conductor diameter</i>	← 0.511mm	→ 0.573mm →		
<i>Construction</i>	UTP	U/F/SF-TP	U/F/SF-TP	S/SF-TP

PoE (IEEE 802.3af)

Power over Ethernet allows to provide power via the data cable plant.

2 pairs energized (0.35A), PSE voltage 48V, up to 15W power to the PD.

PoE+ (IEEE 802.3at)

The new standard PoE+ aims at increasing the powered device load up to 30W via cat5e & cat6 cables.

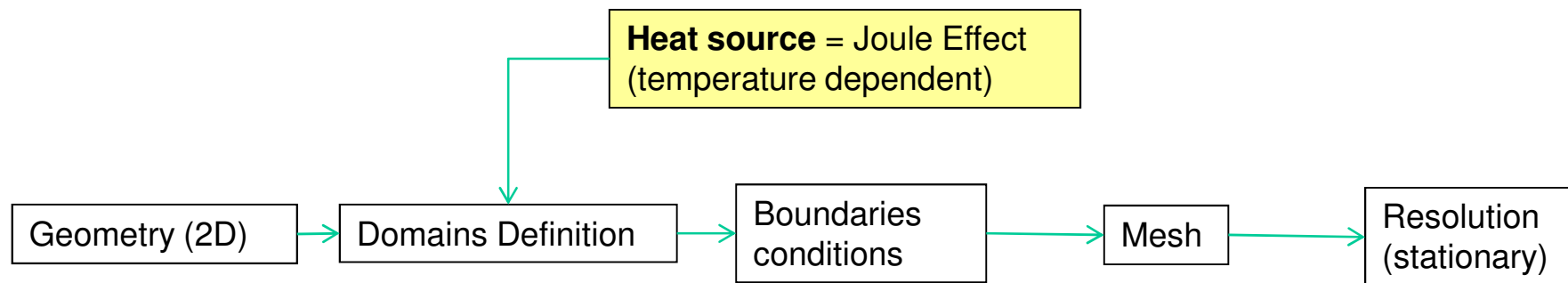
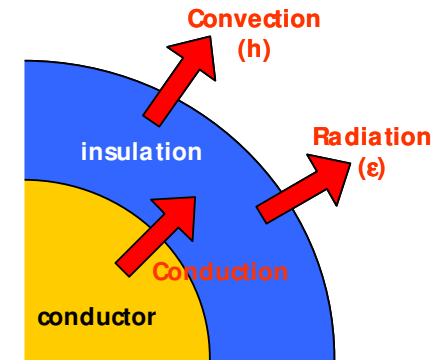
2 or 4 pairs energized, PSE voltage 50V.

This increased power leads to added heat, specially in high cable density areas such as data centers. This higher temperature will affect electrical properties of the cable (specially attenuation).

Objective: To quantify added heat and transmission degradation for PoE/PoE+

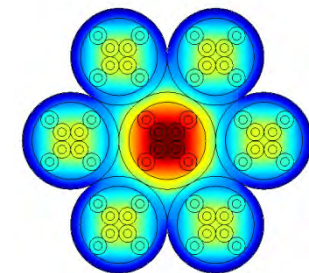
FE thermal model based on COMSOL Multiphysics

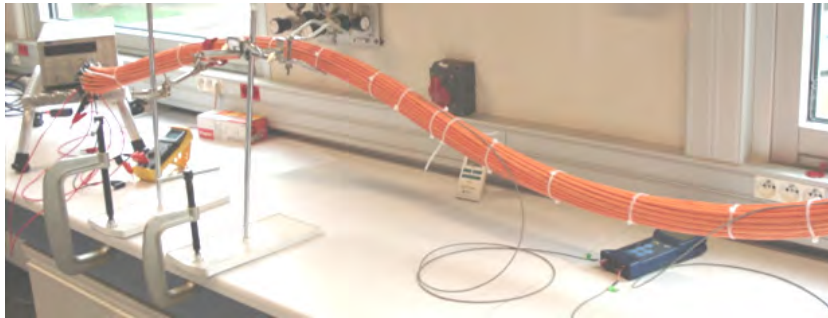
- Physical mechanisms taken into account :
 - conduction for internal heat transfer
 - convection and radiation for external heat transfer
- 2D stationary calculation (cross section), for all types of cables



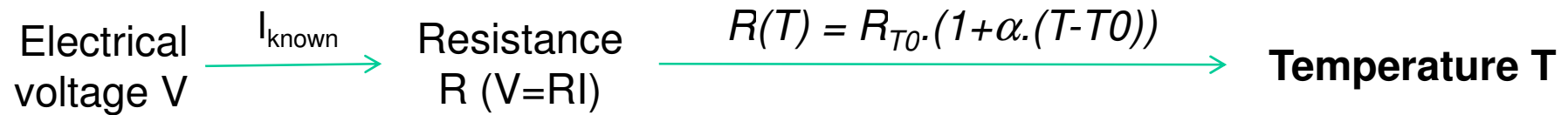
↑
**Thermal
conductivities**

↑
**Ambient temperature
Radiation
Convection**





Temperature obtained from voltage measurement performed on bundles of LANmark cables (7 to 37 cables, all categories)

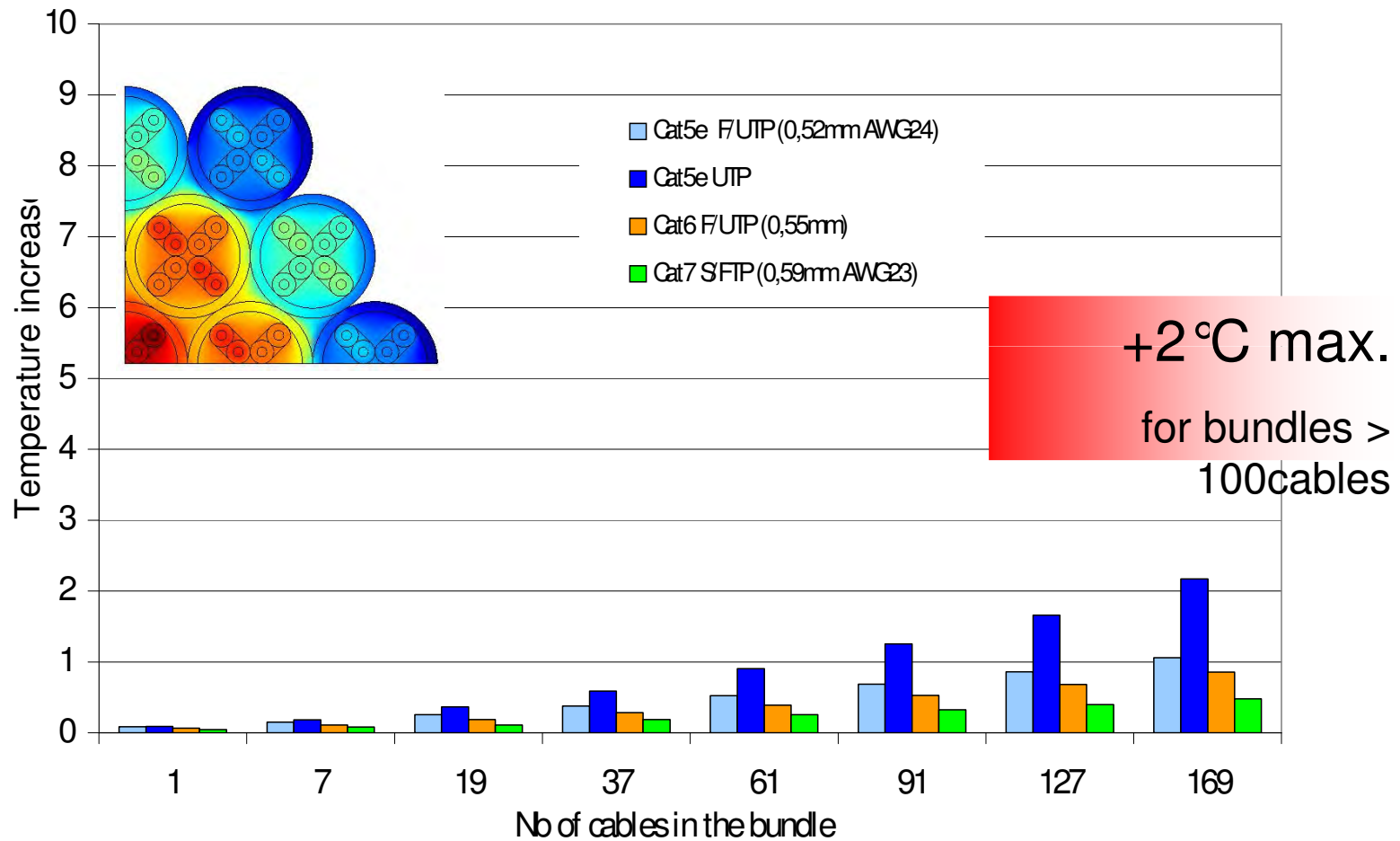


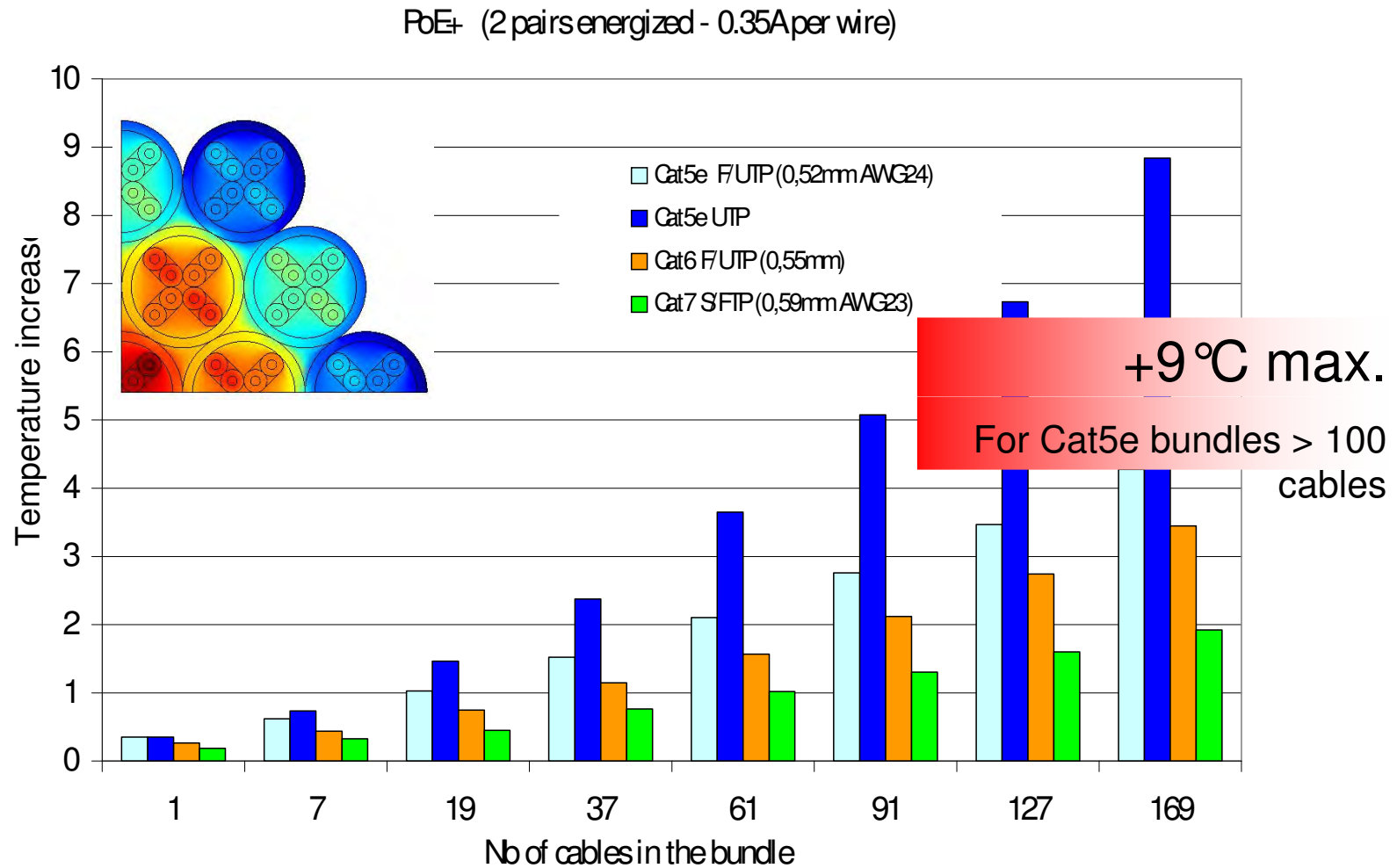
- Measurement performed on each successive layer within a bundle
- Sheath temperature measured using a contact probe



FEA results in accordance with temperature measurements : $\pm 3^\circ\text{C}$
(measurement precision)

PoE(2 pairs energized - 0.175A per wire)





- Temperature rise data provided to IEEE for large bundles composed of more than 100 Cat5e UTP, all pairs energized.

Temp Rise (in °C)	Allowed current (mA) per pair
5°	420
7.5°	550
10°	600
12.5°	680
15°	720

- Max Temp. for equipment/ambient temperature = 45 °C
- Max Temp. for cable = 60 °C → 15 °C Max. Temp. rise, equals 720 mA

- COMSOL model for PoE/ PoE+ was very helpful
 - to overcome one of the major concern of the new standard POE+ (Nexans contribution to 802.3at awarded by IEEE)
 - to show the benefits of a better cabling
- Today, many other FEA performed using COMSOL in Nexans (thermal, electro-thermal, electro-magnetic, CFD)

