Empa
Materials Science and Technology

ÉCOLE POLYTECHNIQUE
FÉDÉRALE DE LAUSANNE

Laser Processing of Materials

Introduction

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Applications

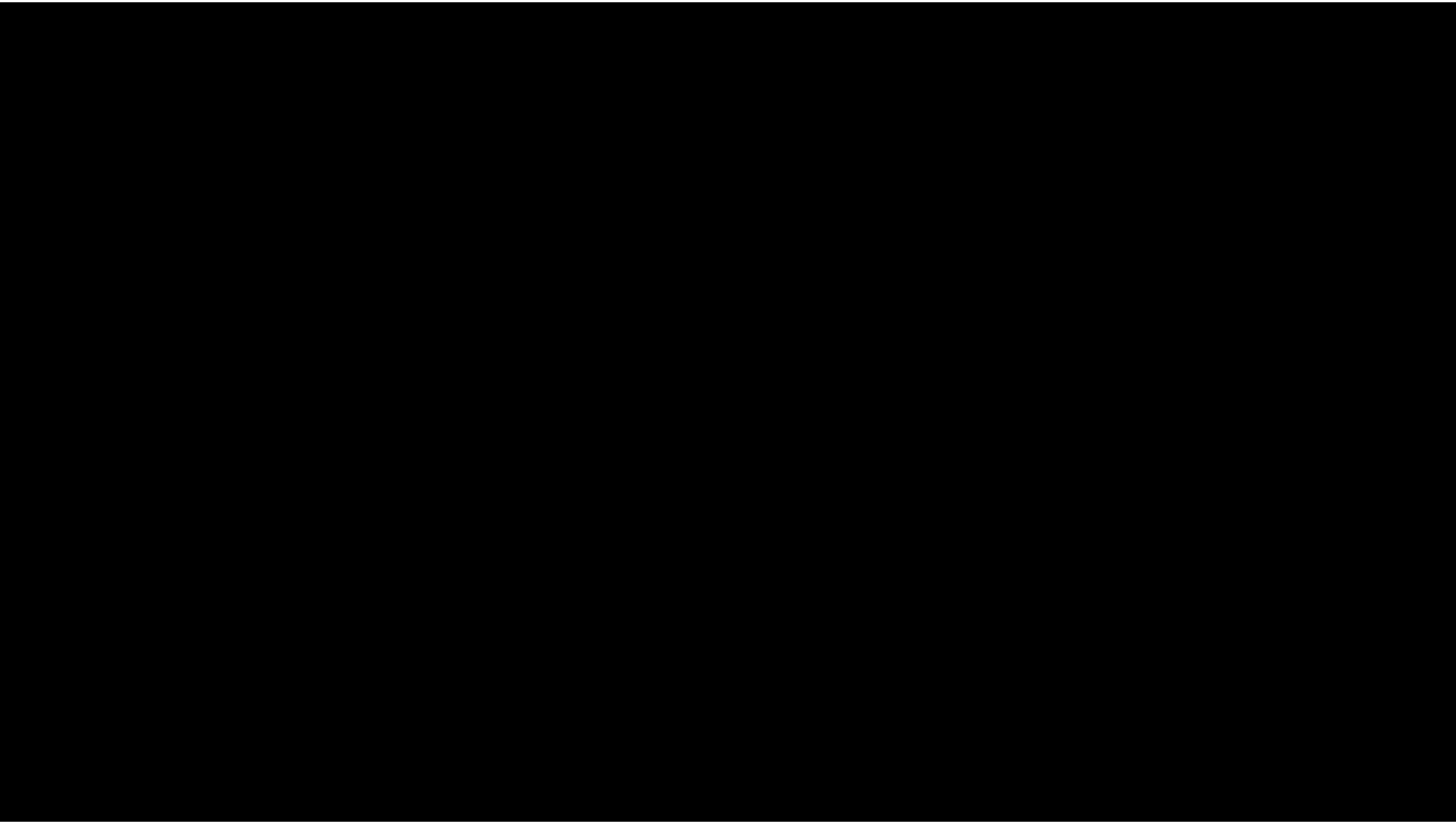
Classical Laser Processing:

- Cutting
- Drilling
- Bending
- Welding
- Marking
- Ablation

Generative Techniques:

- Sintering
- Polymerization

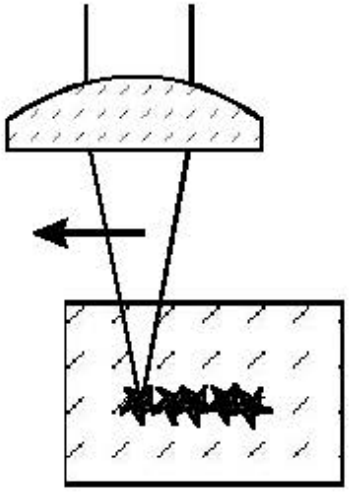
Some Nice Examples

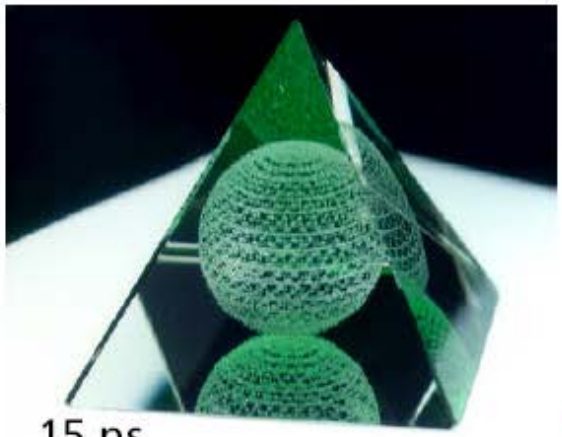


Some Puzzles

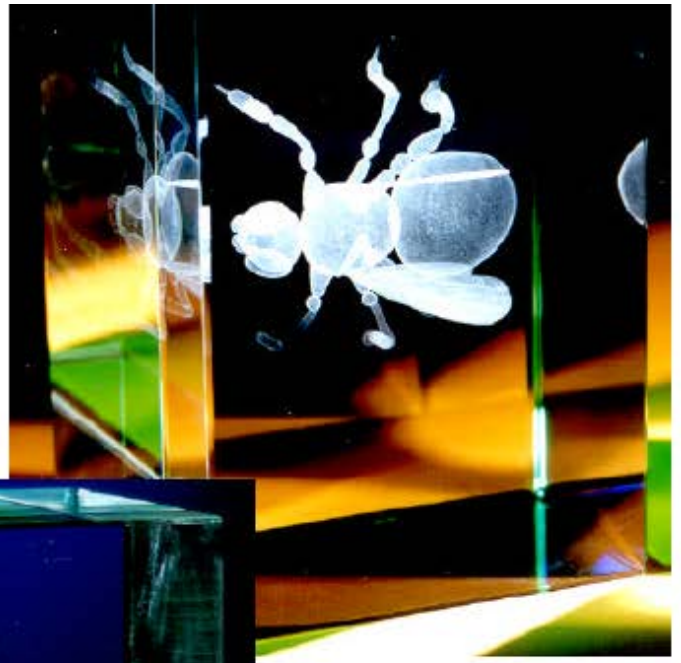
How does it work in transparent glass???

- DPSSL, Stab/Innoslab
- Process Intensity > 10^9 W/cm^2
- Q-switch, f bis 20 kHz
- Pulse duration: 15ns / 6ns / 100ps
- $M^2 = 1$, $r_F = 50$ - 200 µm





15 ns



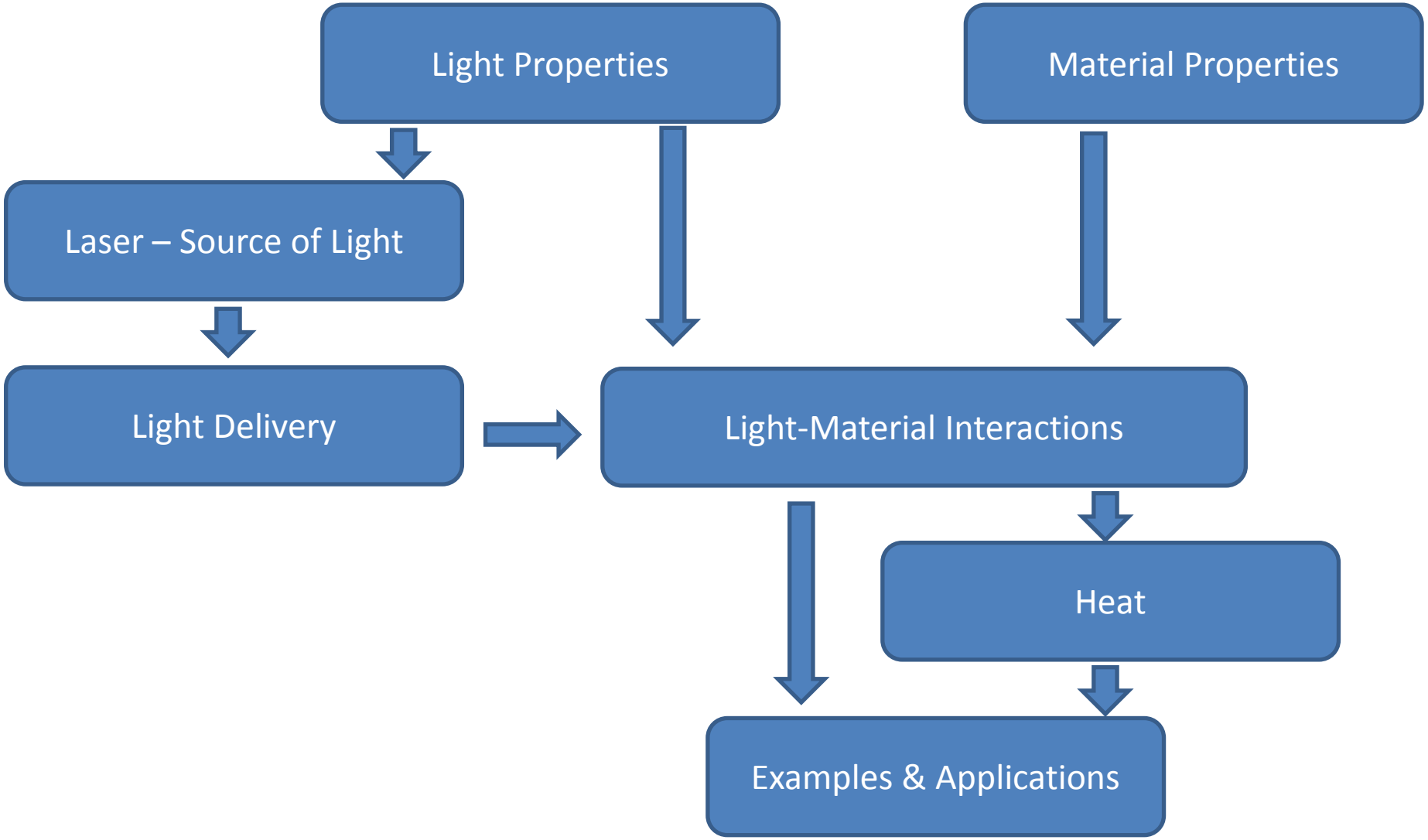
100 ps

What do you think are the important questions of laser processing?

What do you think are the important questions of laser processing?

- Where (and how) the light is absorbed?
- Where the heat goes?
- What happens to the material due to heating?

Content of the Course



Literature

- D. Bäuerle; Laser Processing and Chemistry, 3rd ed. Springer, Berlin, 2000
- The Theory of Laser Materials Processing, ed. John Dowden, Springer, 2009
- Laser Processing of Materials, ed. Peter Schaaf, Springer, 2010

- S.M Sze; Semiconductor Devices Physics and Technology, Wiley&Sons, 1985
- W.M. Steen; Laser Material Processing, Springer, 1991
- Born & Wolf; Principles of Optics, Pergamon, 1999
- B.E.A. Saleh and M.C. Teich, Fundamental of Photonics, John Wiley & Sons, New York., 1991
- Hecht; Optik, Addison- Wesley, 1999
- Siegman; Lasers, University Science Books, 1986
- Carslaw & Jäger; Conduction of Heat in Solids, Claredon, 1997

Some information on the web

- **Scienceworld:**

  http://scienceworld.wolfram.com/physics/Laser.html
  http://scienceworld.wolfram.com/physics/topics/Optics.html

- **Encyclopedia of Laser Physics and Technology**:
  www.rp-photonics.com/encyclopedia.html

- **Laser history:**

  http://www.bell-labs.com/history/laser/

- **TheTech:**

  http://www.thetech.org/exhibits/online/lasers/overview.html