Willkommen
Welcome
Bienvenue

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Materials Science & Technology

Devastative contamination on DUV Laser mirrors and dreams for laser processing

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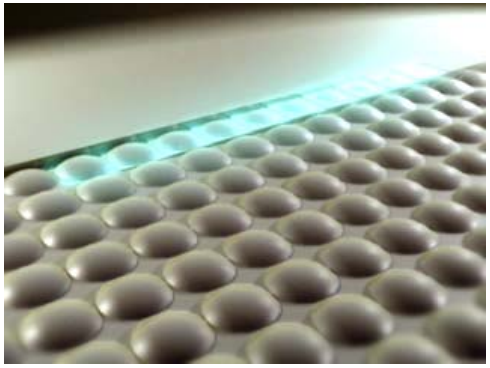
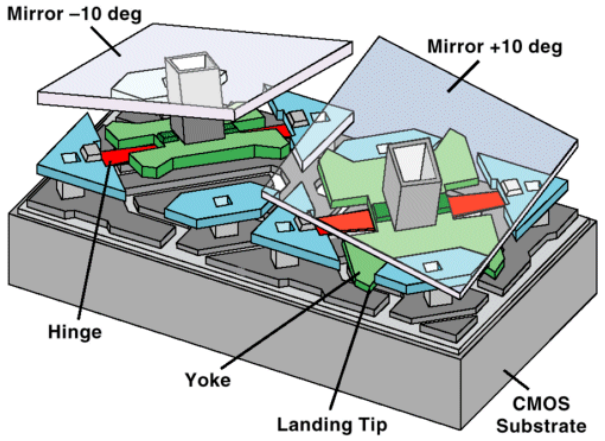
Outline

- Laser Materials processing by mask projection direct ablation
  - Excimer laser ablation on 3 m^2 substrate



- Dream of DUV micro mirror array
  - DLP® Products & MEMS



Full process for large surface microstructures

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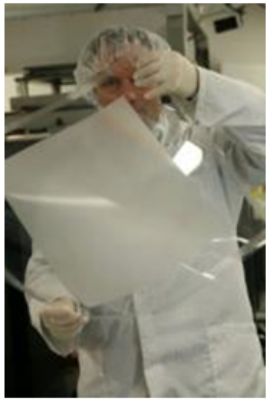
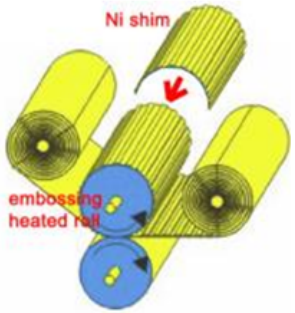
From Idea to CAD → Master substrate → Metal copy Ni shim → Production tools → Roll to roll embossing

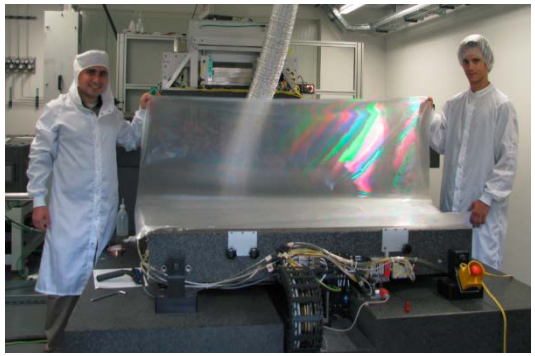




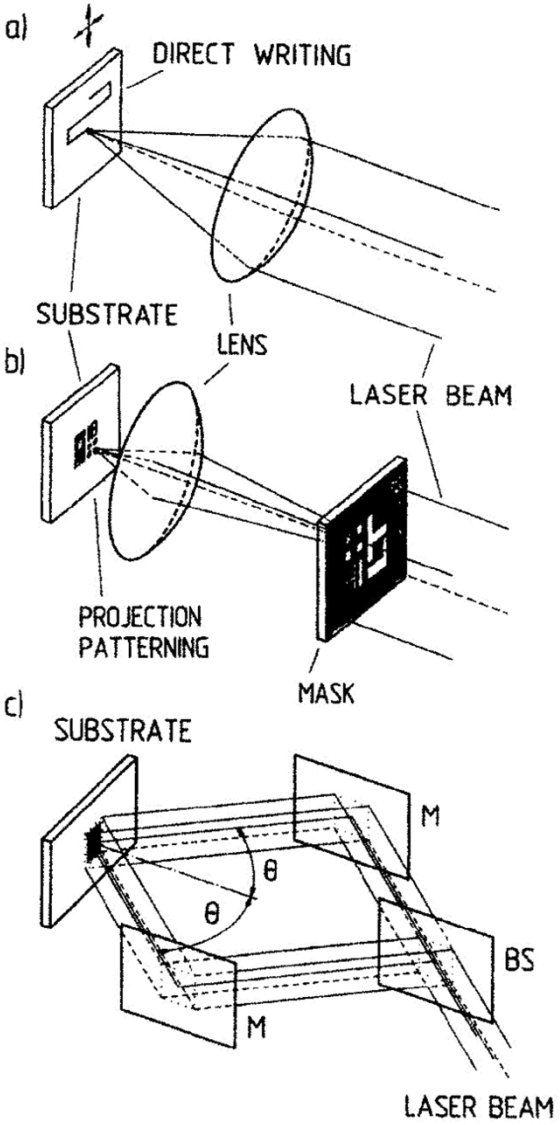
From requirements to origination to mass production

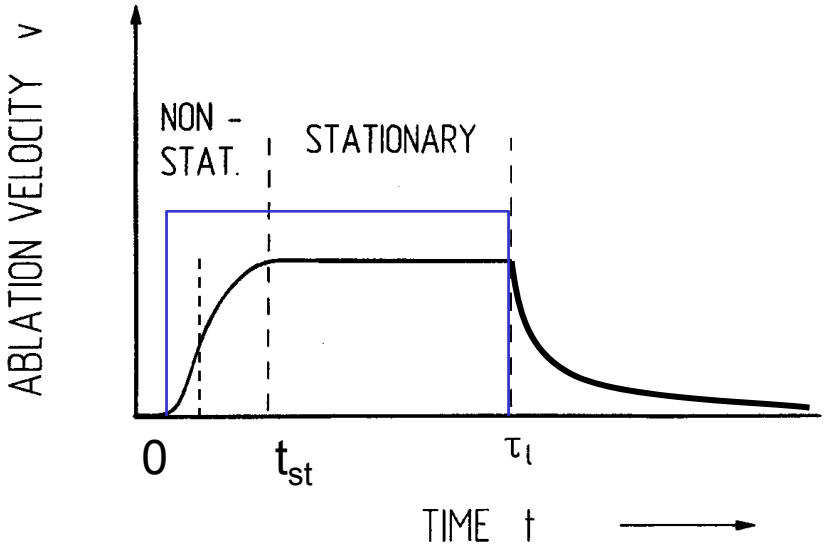
Empa and its partners can offer you all the steps from design up to roll to roll production.

use mold for other materials – ceramics, glasses, ….



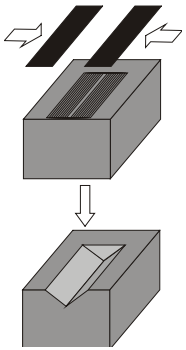
Laser materials processing : patterning



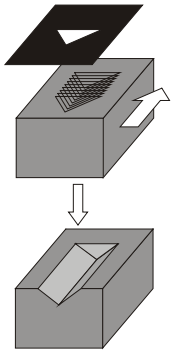


Projection ablation options for complex surface shapes

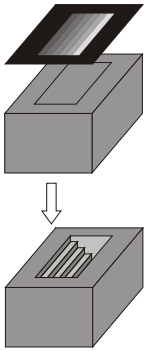
Variable aperture mask



Scanned mask &/or workpiece



Gray scale mask



Ablation through the Graded Mask

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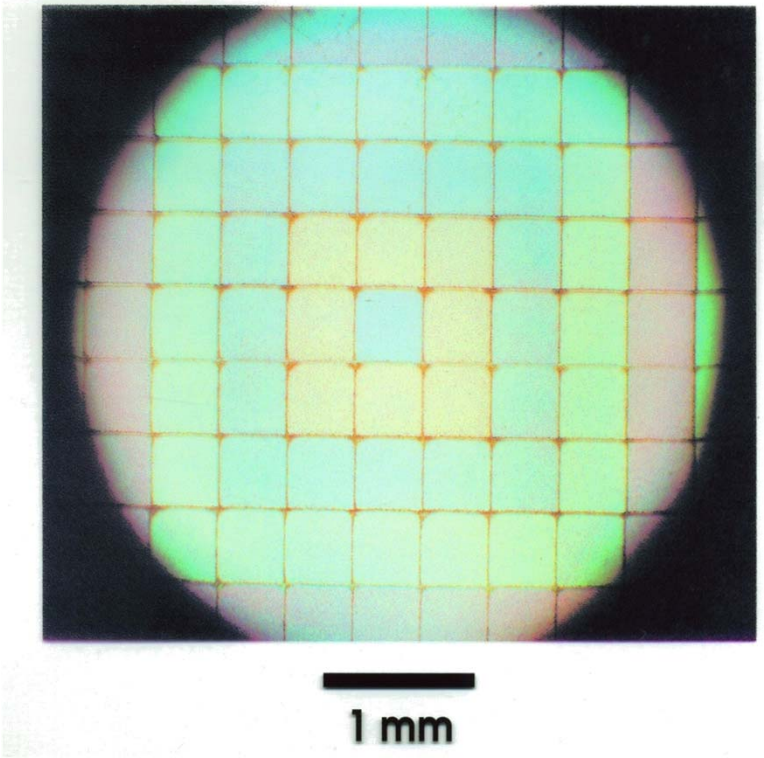
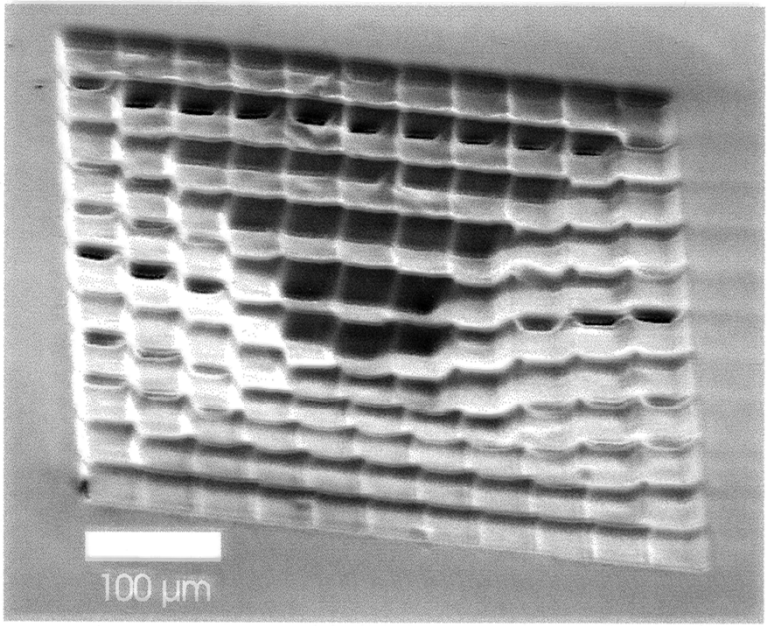
Graded Mask
Material: HfO_2/SiO_2 on fused silica

Material: Polycarbonate
Laser 248 nm, 960 mJ/cm^2 (average),
100 pulse





Laser-
Laboratorium
Göttingen e.V.

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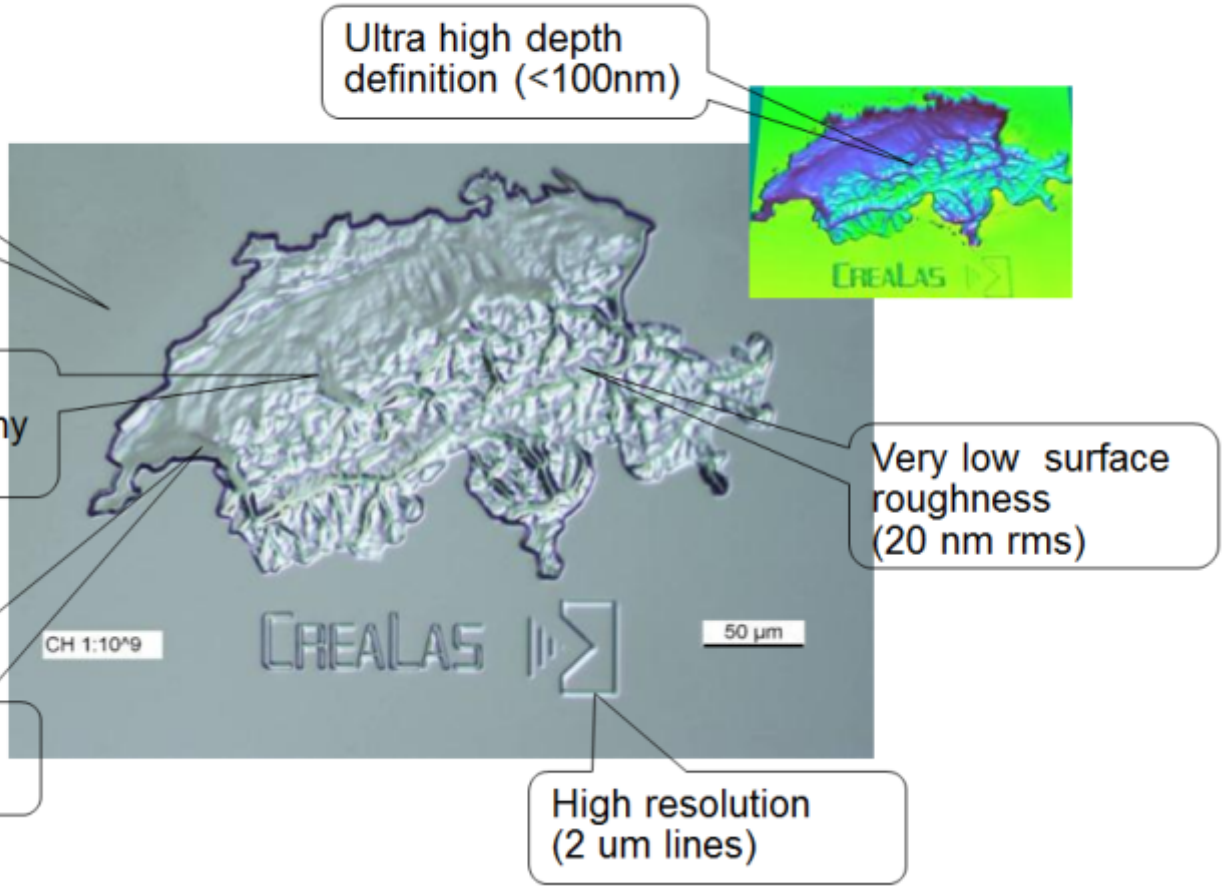
Technology:



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Product

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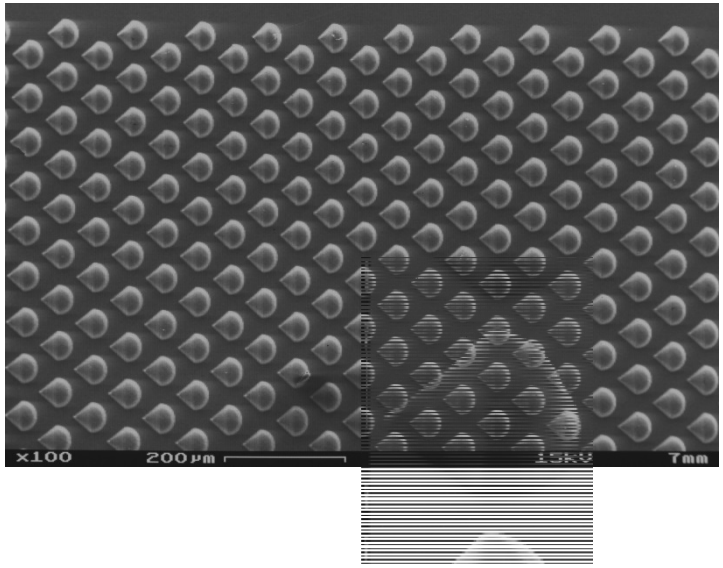
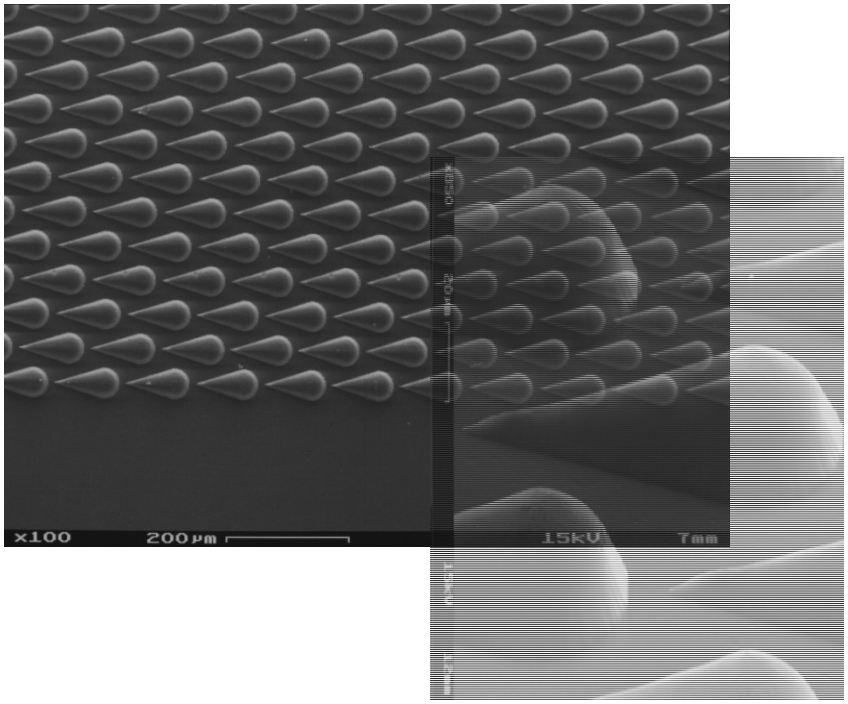
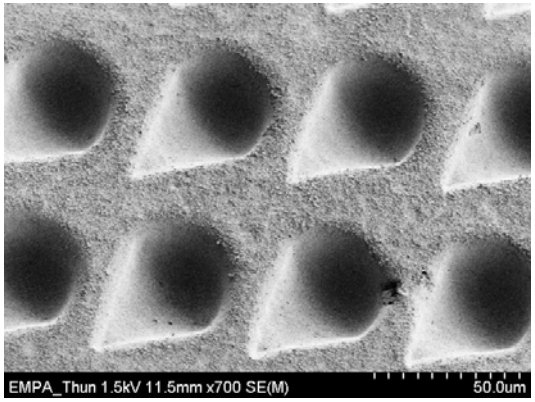
- Tear drop structures with variation of tear drop lenght and obstacle density





Replication in alumina nanoceramics



Few applications

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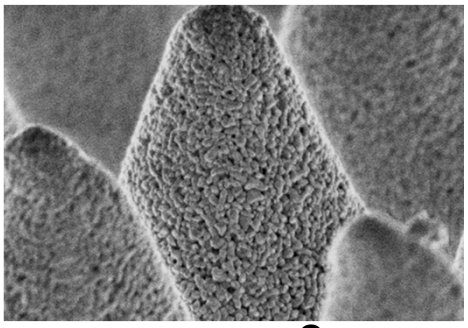
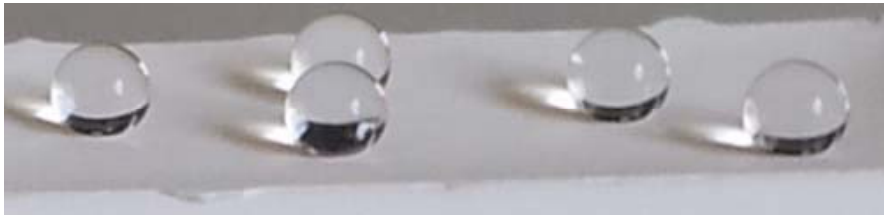
1 Wetting

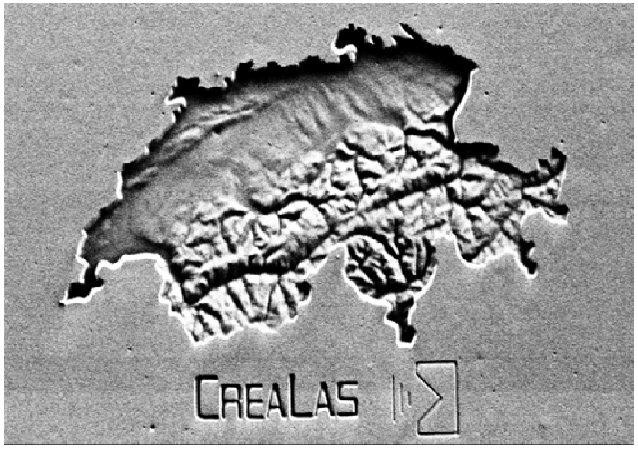




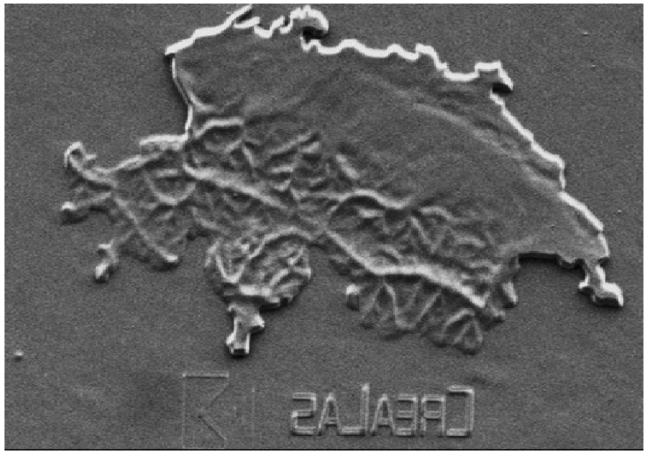
Superhydrophobic!!

2 Ceramics as permanent molds

Alumina as permanent mold



Replicated in PDMS from Alumina



Further activities

- Metal casting
- Polymer hot embossing

Rapid master fabrication

Excimer Laser Processing on Large Area ($3m^2$)

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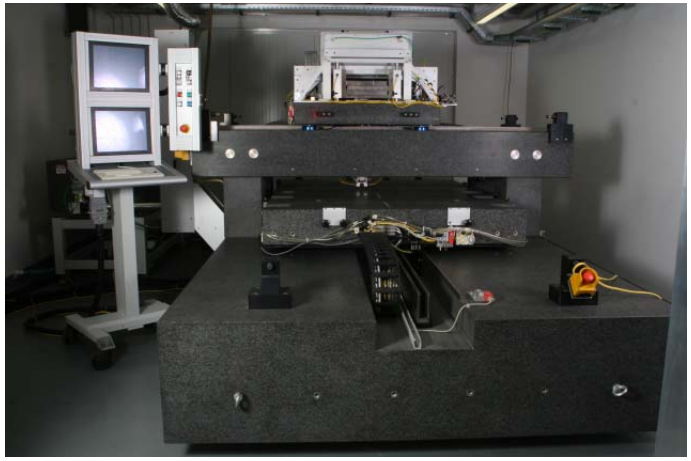
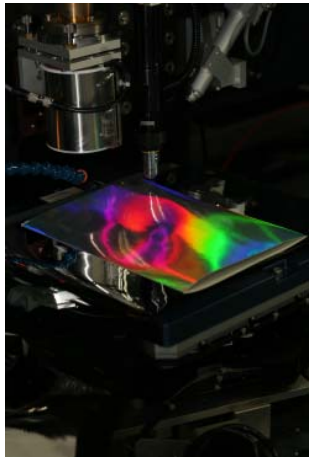
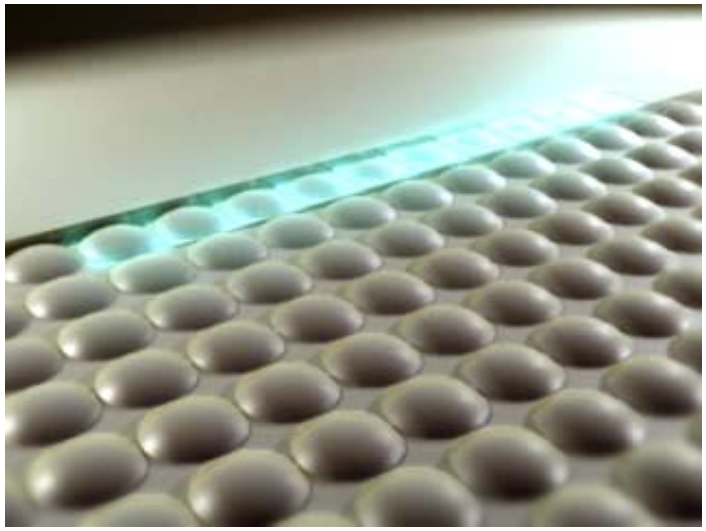
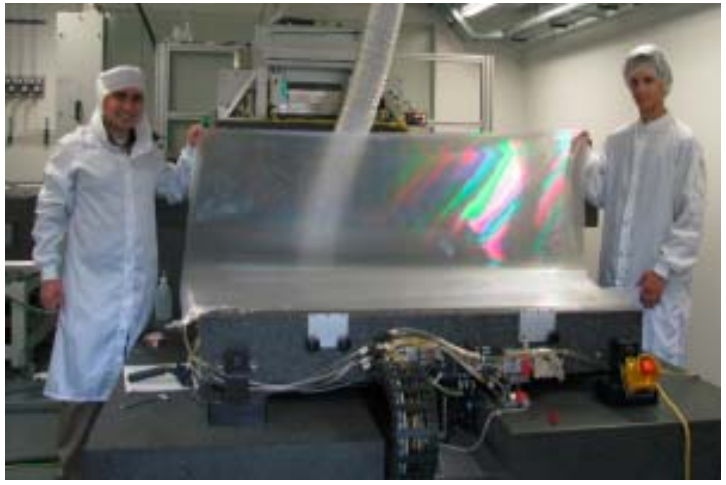
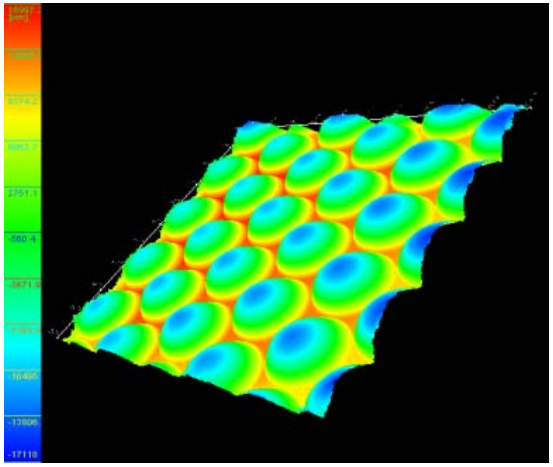






Three Systems worldwide, one running @ Empa in Thun !!





Laser cut Microlens array
DHM measured ⌀ = 70 µm,
h = 25 µm

Synchronized Image Scanning (SIS)

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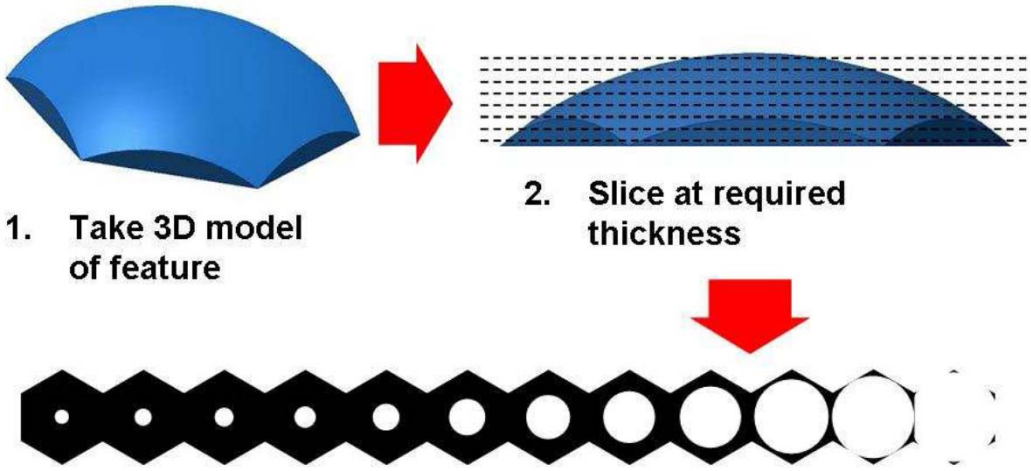

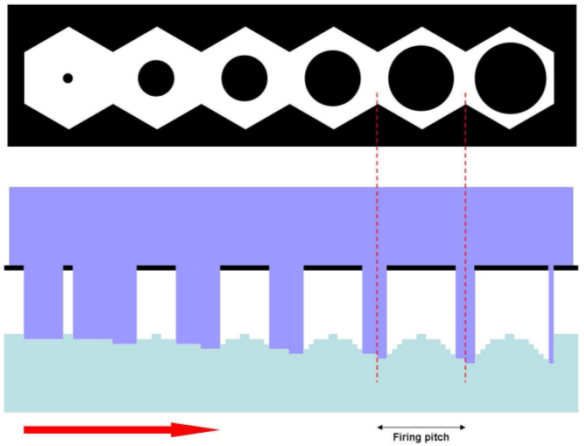

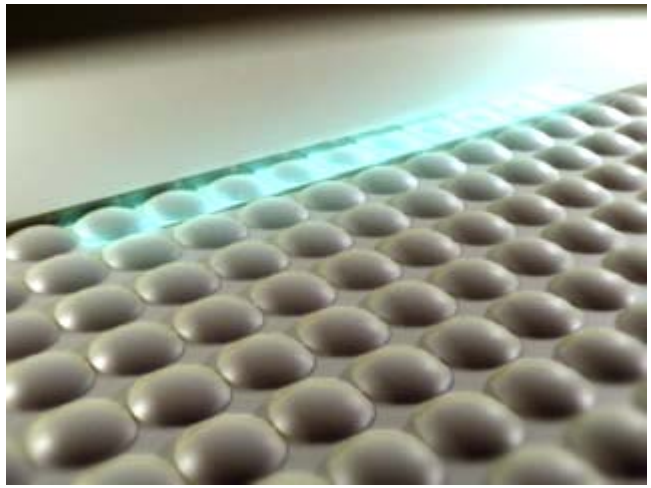

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Feature quality: fit of target shape

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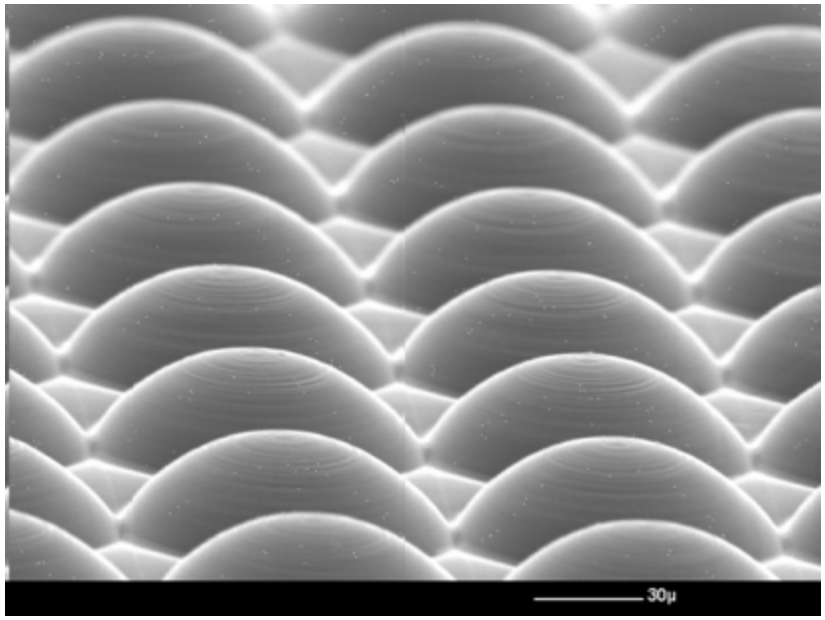

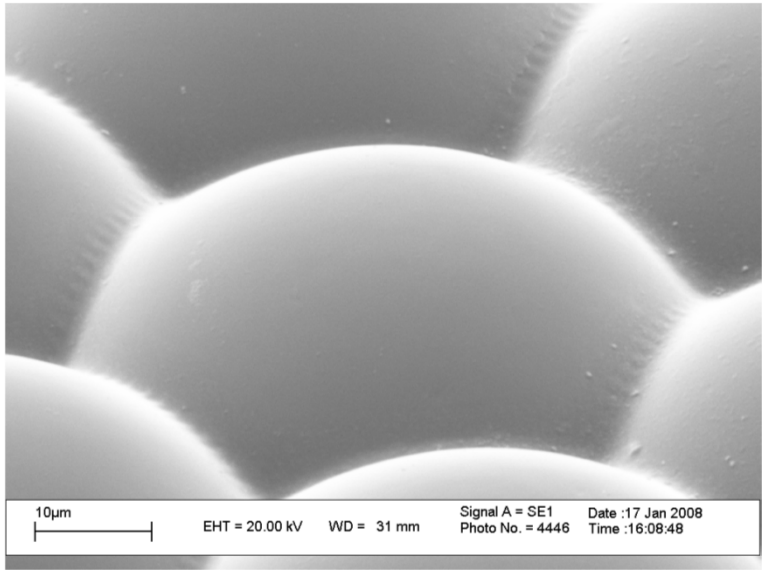

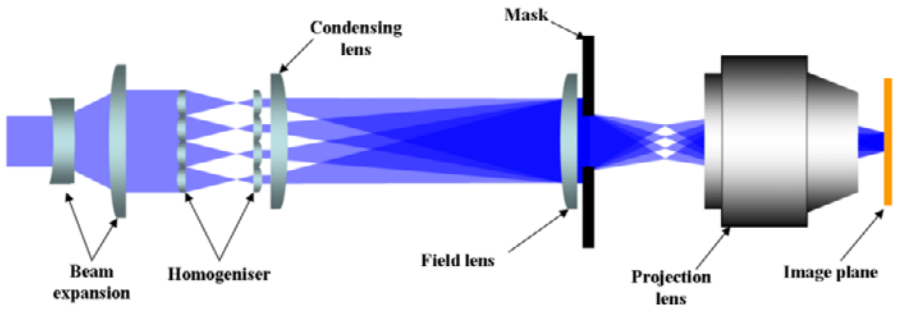

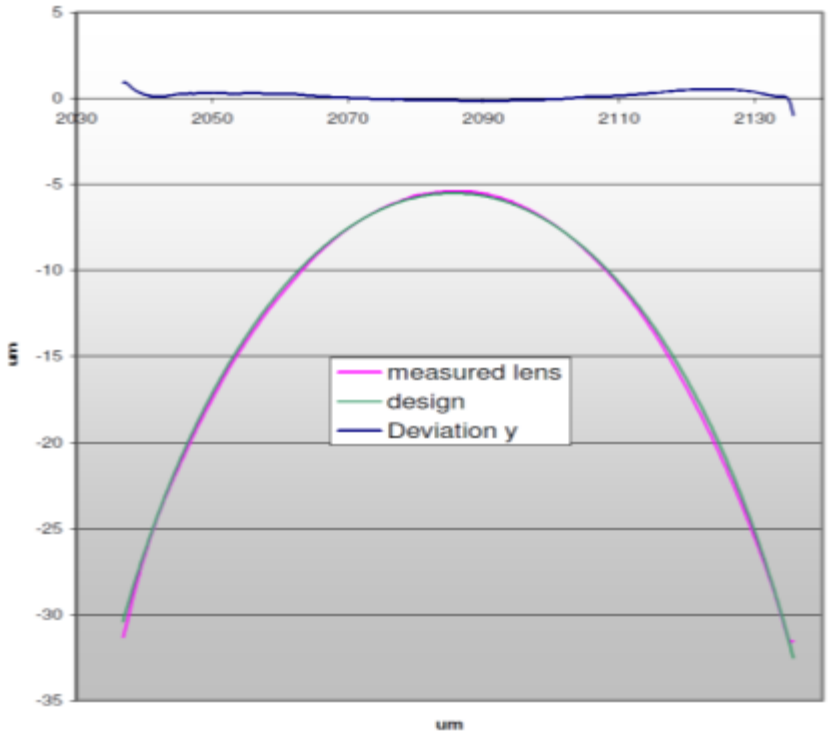

The average deviation from the best fit ROC is 147 nm with a ROC of 59.2 µm while the target is 60 µm.

The problem: large surface machining – small but irreversible, irregular loss of light intensity

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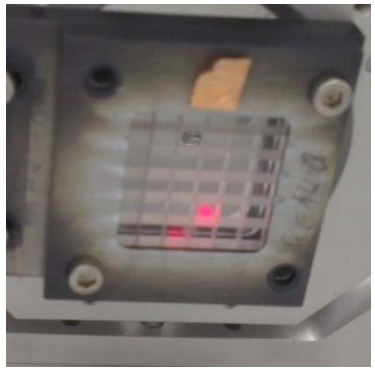

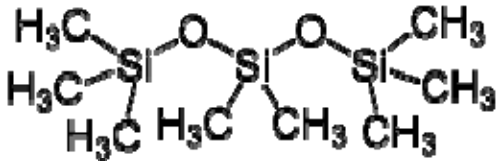

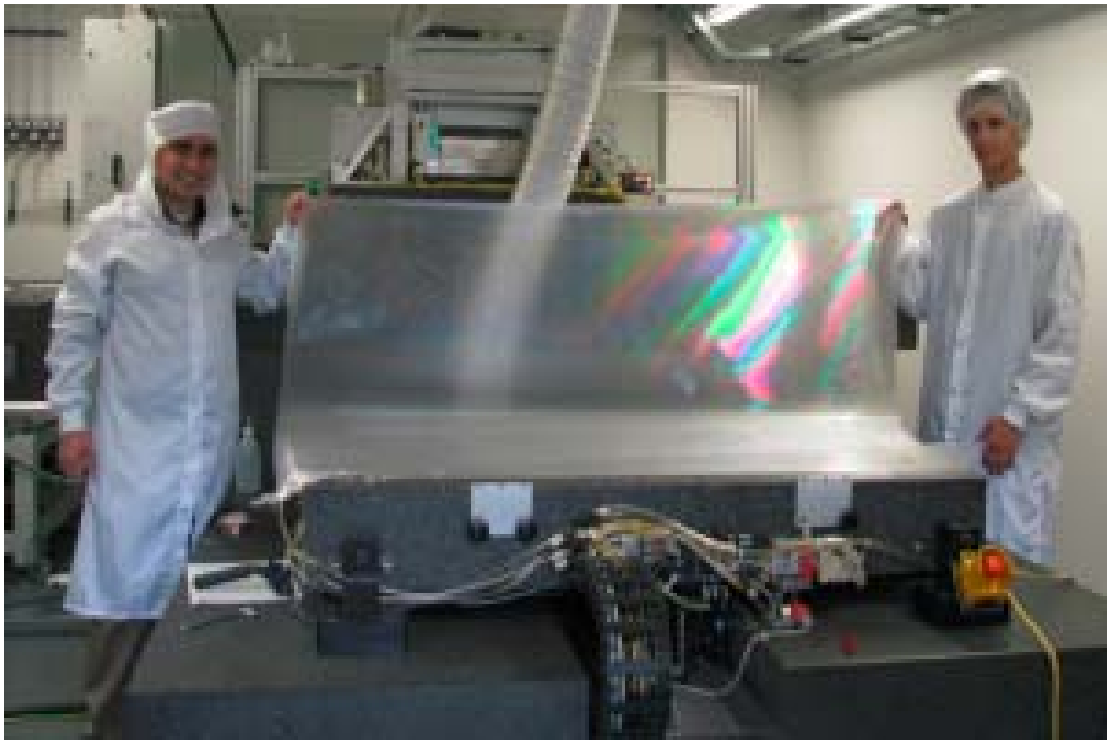

248 nm

photons

SiO_2:C

Dream for laser processing:

DUV Digital Light Processing @ 248nm

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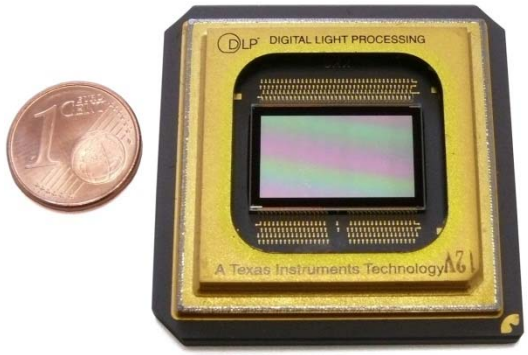

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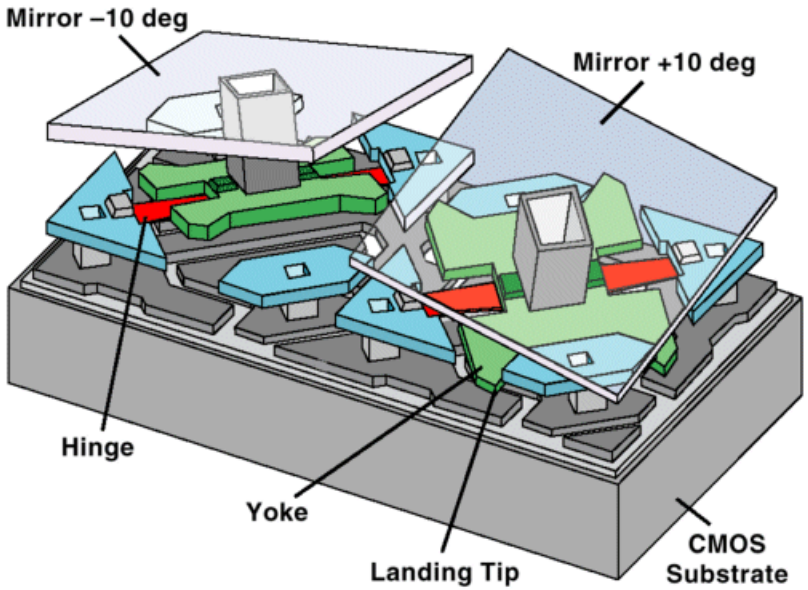

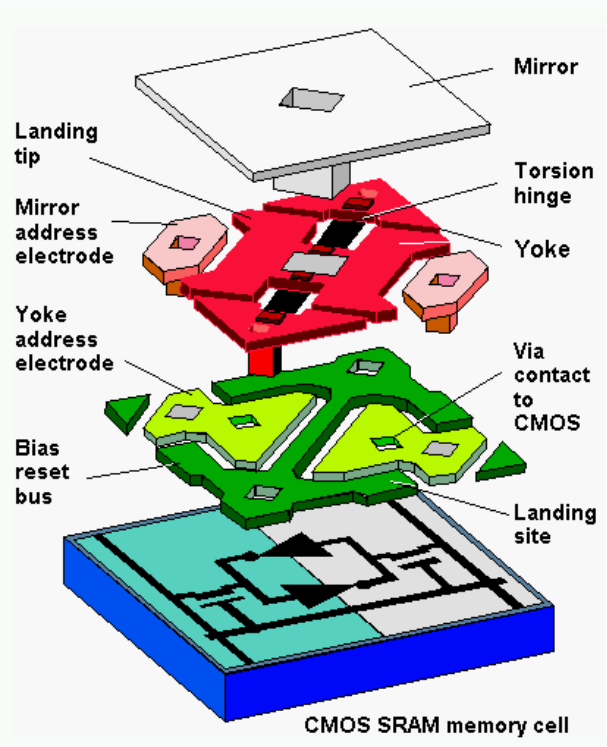

How to do ?

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- Condense vapor on cover glass (liq. N_2)
- Remove cover glass
- Recover volatile liquid from glass
- Carry out two angles 248 nm HR coating on mirrors
- Condense vapor on chip (liq. N_2)
- Cover with 248nm AR coated fused silica or sapphire and hermetically seal cover

Who shares the risk with us ?