Polymers en lasertechnologie

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April 2013
ECN-L--13-019

ECN
Your energy. Our passion.

Polymers en lasertechnologie

Emmen 2013

www.ecn.nl

Introductie

- TNO metaal instituut — Laser groep Apeldoorn
- Philips CFT — Decoratie & Labelling
- Philips Apptech — Thermal processing

- ECN Energie Centrum Nederland — E&EE

Locaties ECN

ECN Petten
(head office)

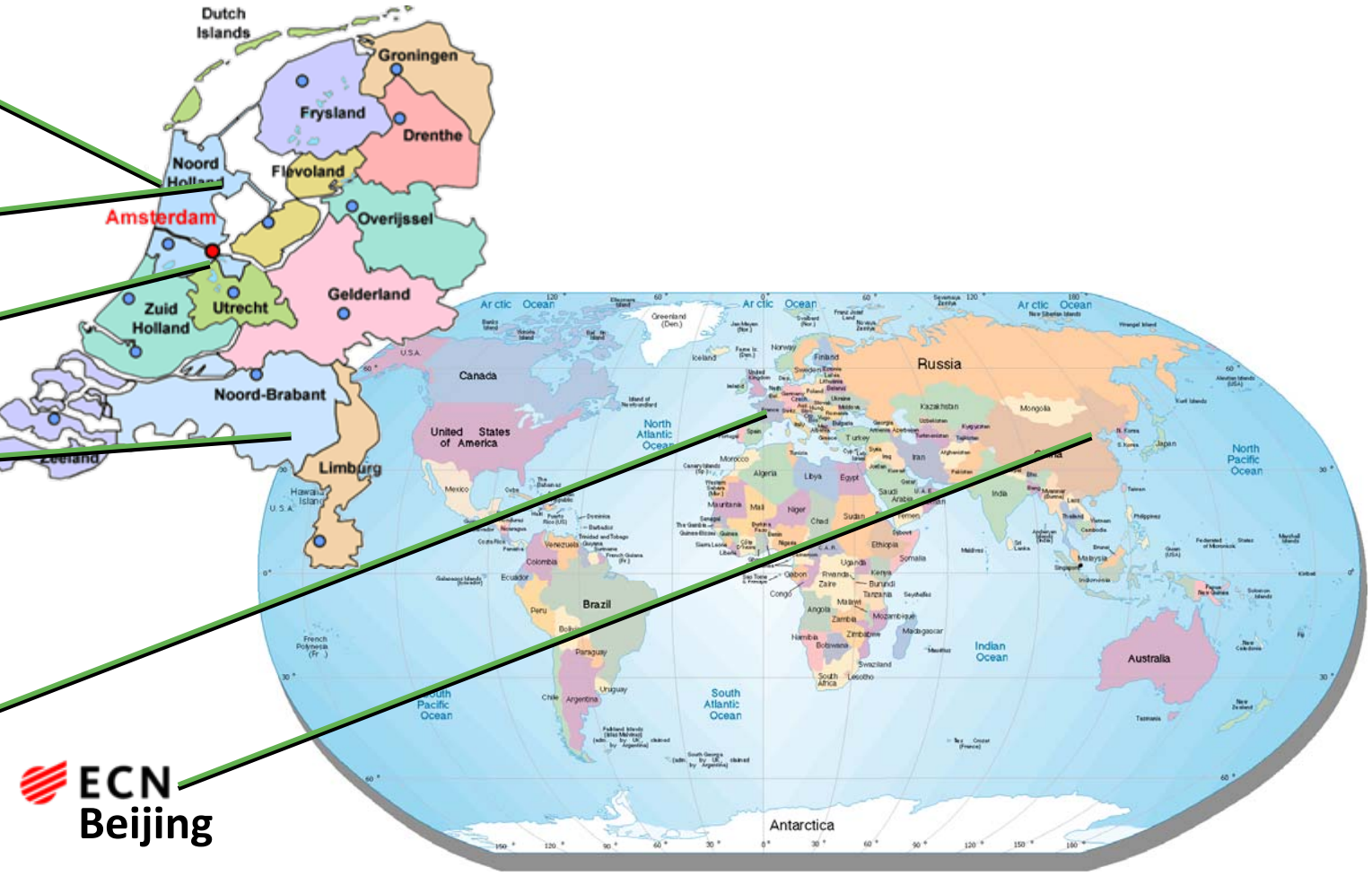
ECN Wieringerwerf

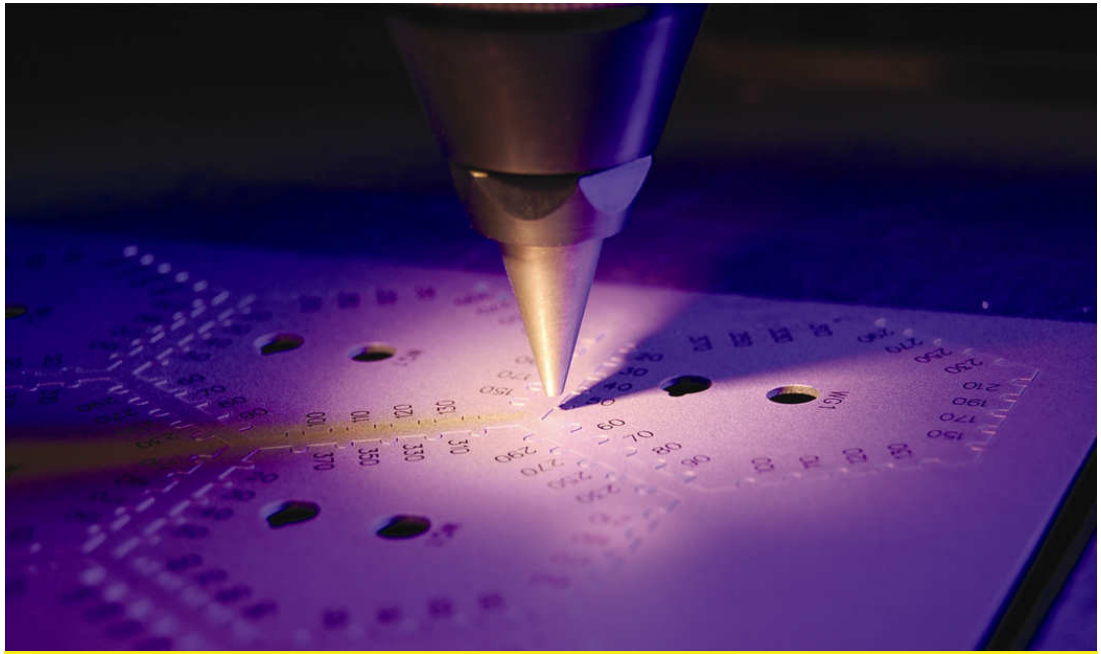
ECN Amsterdam

ECN Eindhoven

ECN Brussels

ECN Beijing



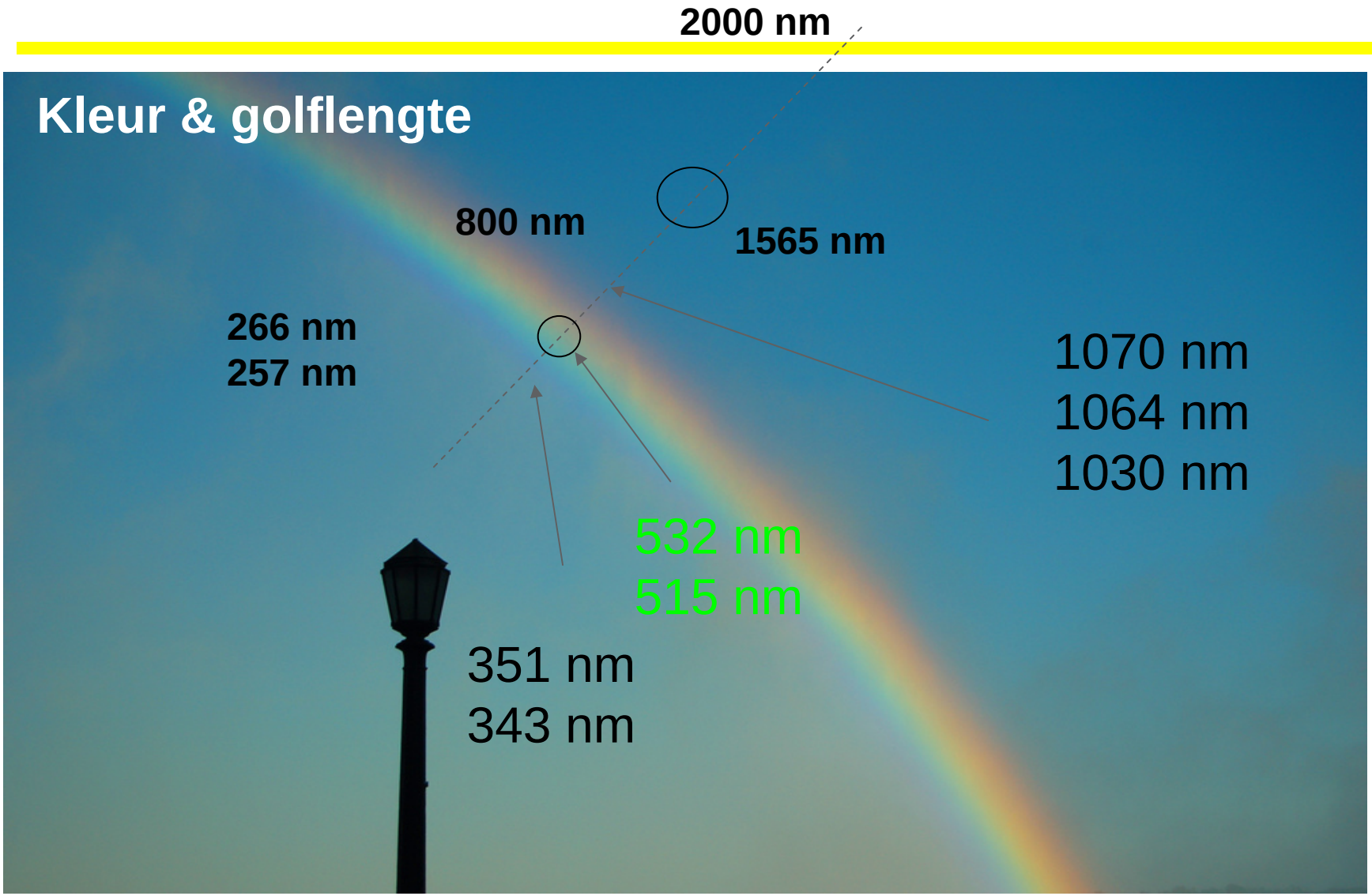


Environment & Energy Engineering

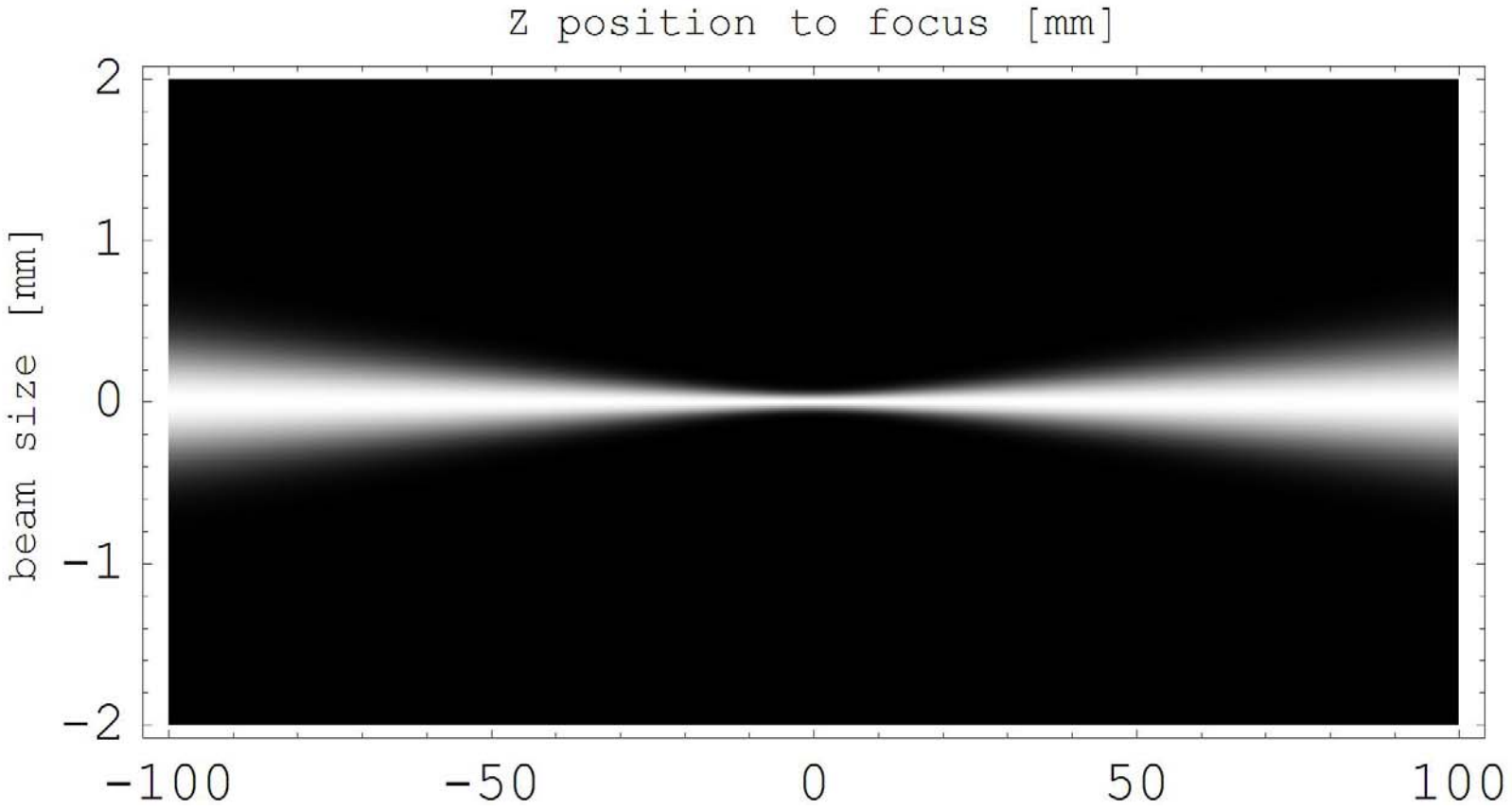
Solutions provider beyond the state-of-art

Inhoud

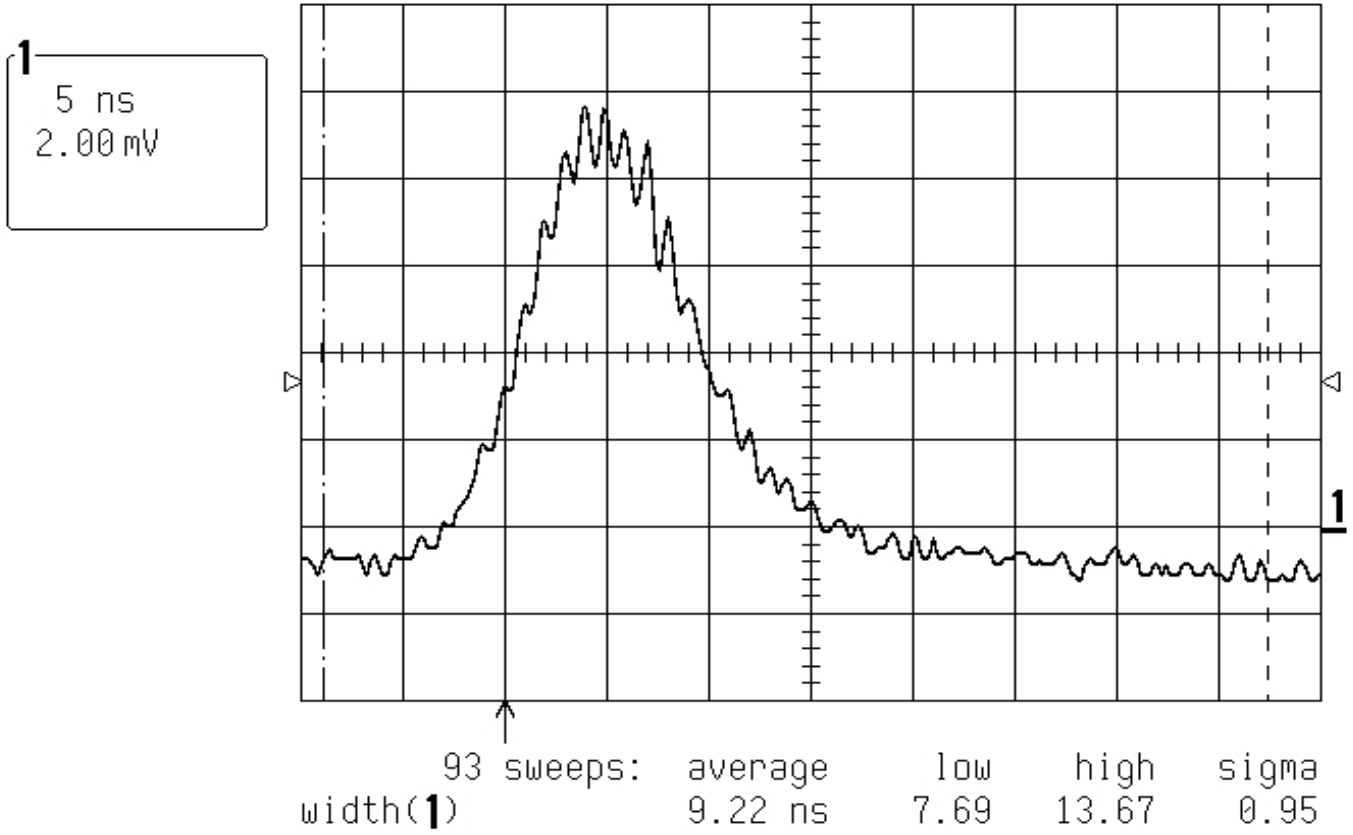
- Transport van energie
- Polymeren en laser
- Toepassingen Laser en polymeren
- ECN lasers en systemen


2000 nm
Kleur & golflengte
800 nm
1565 nm
266 nm
257 nm
1070 nm
1064 nm
1030 nm
532 nm
515 nm
351 nm
343 nm

Concentreren van energie: volume



Concentreren van energie: tijd



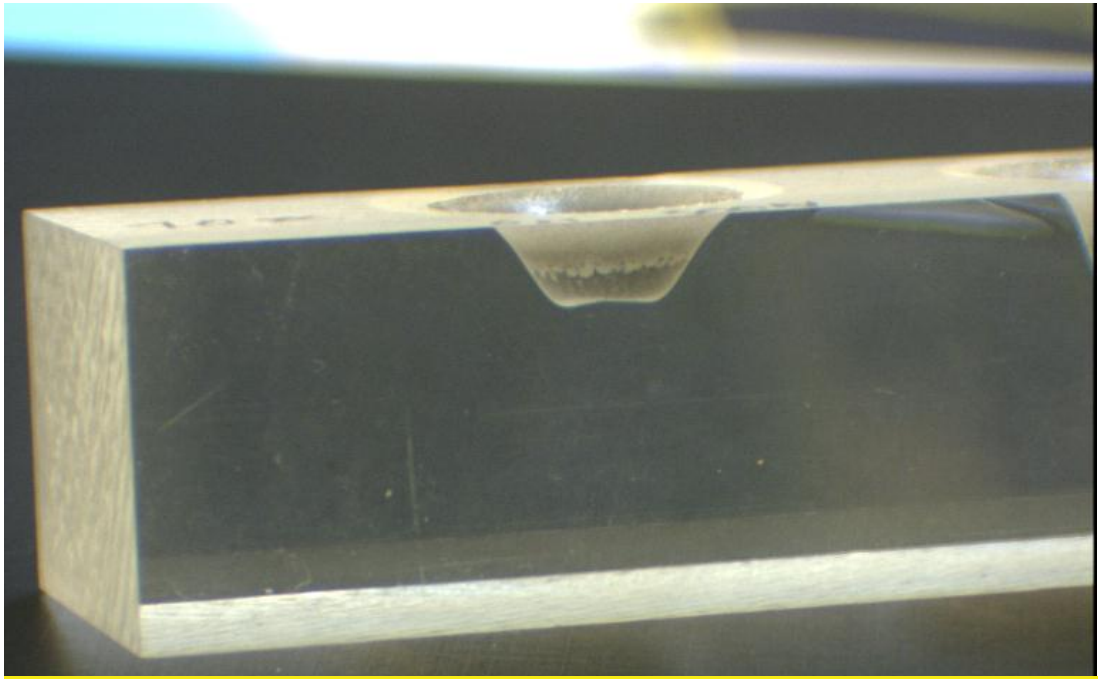
Lengte puls [m]

1 ns ~ 30 cm

1 ps ~ 0.3 mm

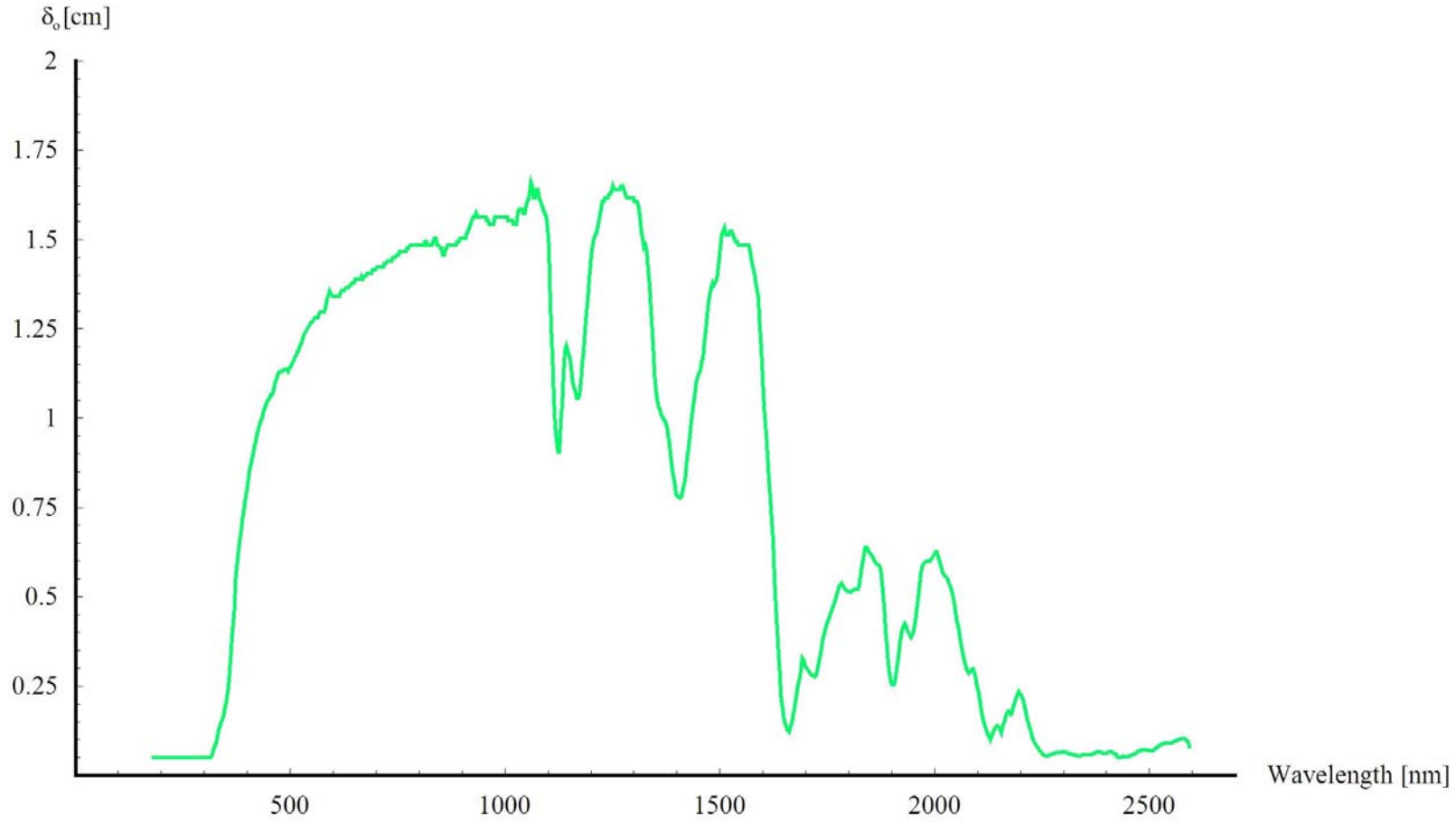
250 fs ~ 75 μm

Laser en polymeren



PMMA & CO_2

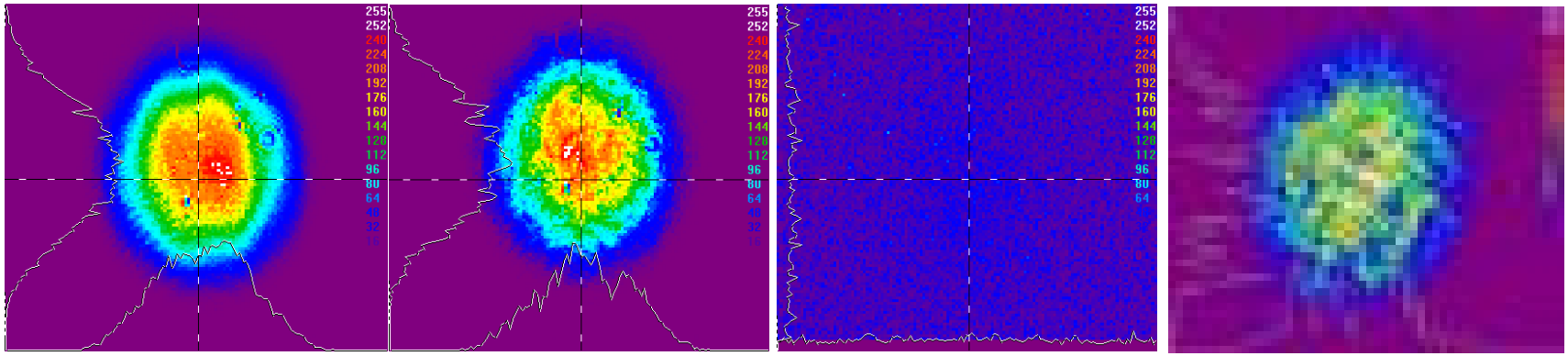
Optische penetratie diepte PET Arnite A04 102



Optische transmissie

Golflengte 1064 nm,

1000 Hz puls frequentie, E_p 0.55 mJ /pulse, t_p 120 ns.



Originele bundel

Kapton
0.1 mm

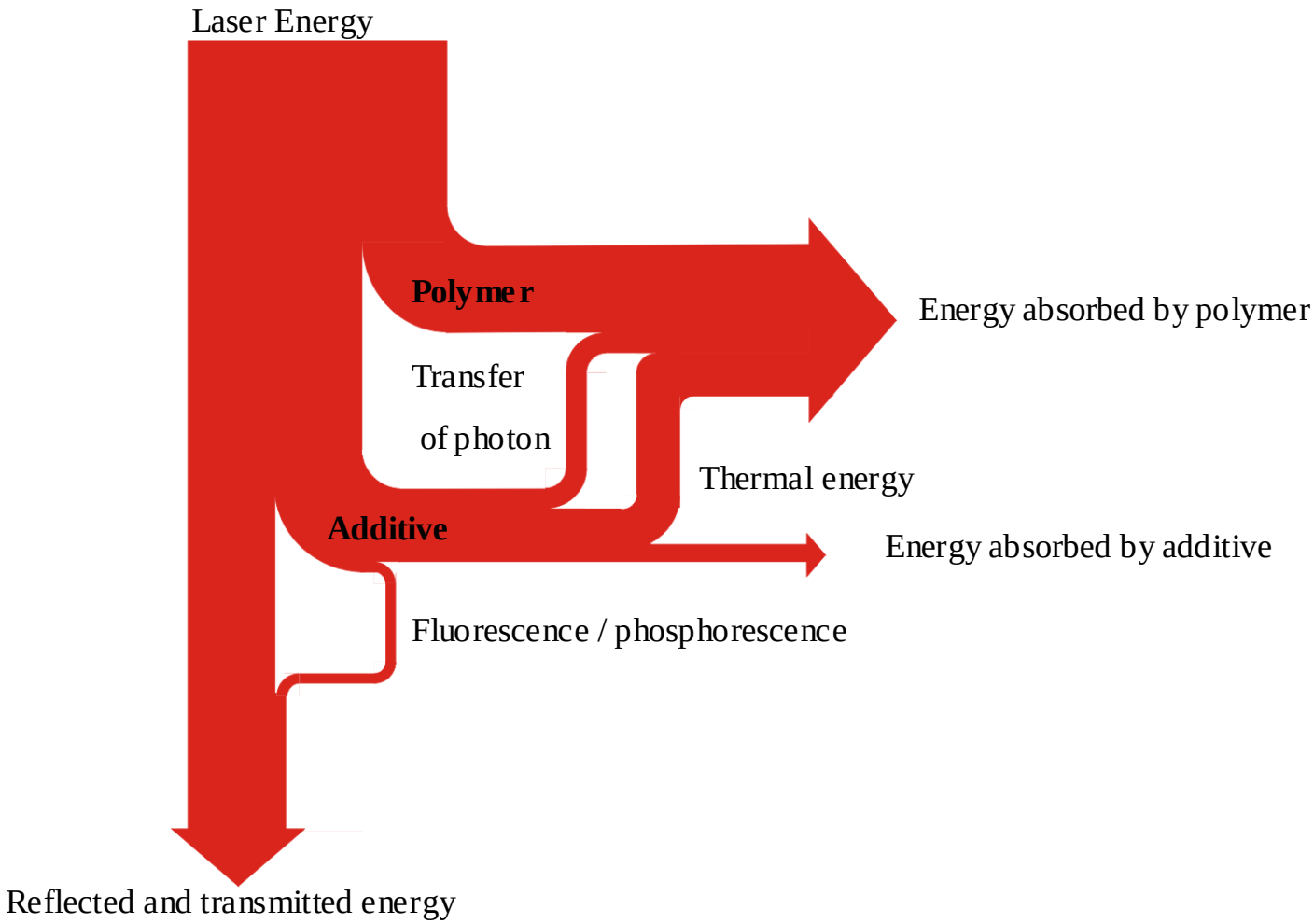
PP
1 mm

ABS
2 mm

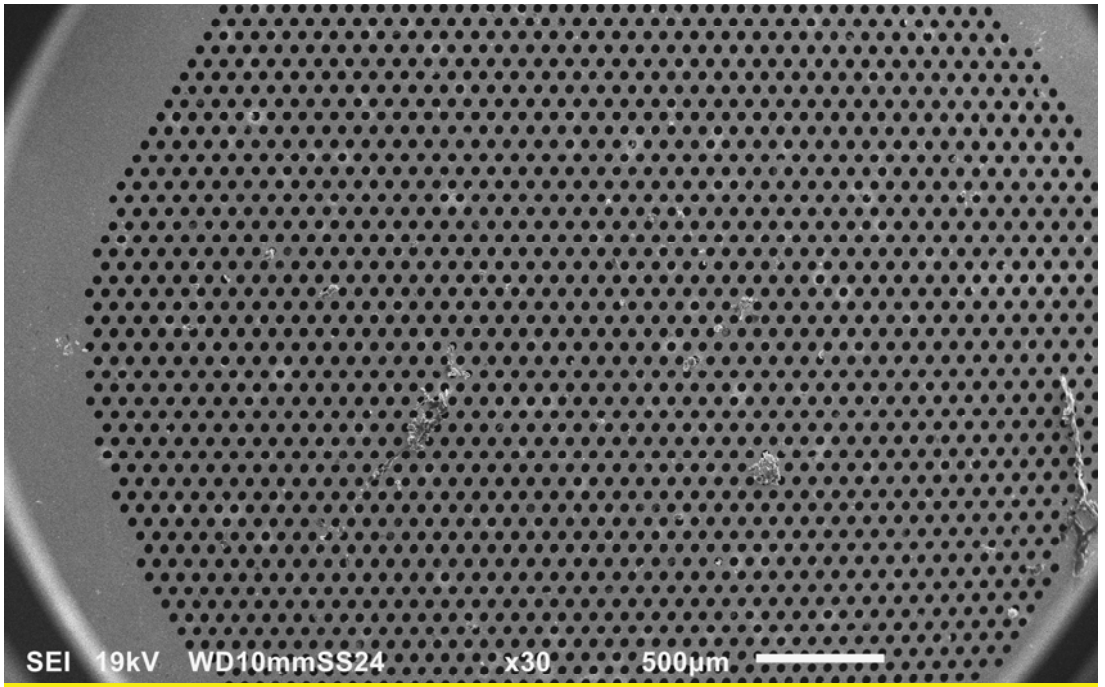
Optische en thermische indringing diepte

Optische penetratie diepte δ_0 [μm]		Thermische penetratie diepte δ_h [μm] ←			
Metalen		1 ms	1 ns	1 ps	250 fs
Ag	0.01	829	0,83	0,026	0,013
Al	0.01	642	0,64	0,020	0,01
Au	0.01	699	0,7	0,022	0,01
Cu	0.01	675	0,68	0,022	0,01
Polymeren					
ABS	7020	26.2	0,03	0,001	0,0005
PET	3200	23.9	0,02	0,0006	0,0003
PC	7500	22.4	0,02	0,0006	0,0003
PMMA	41000	21.9	0,02	0,0006	0,0003

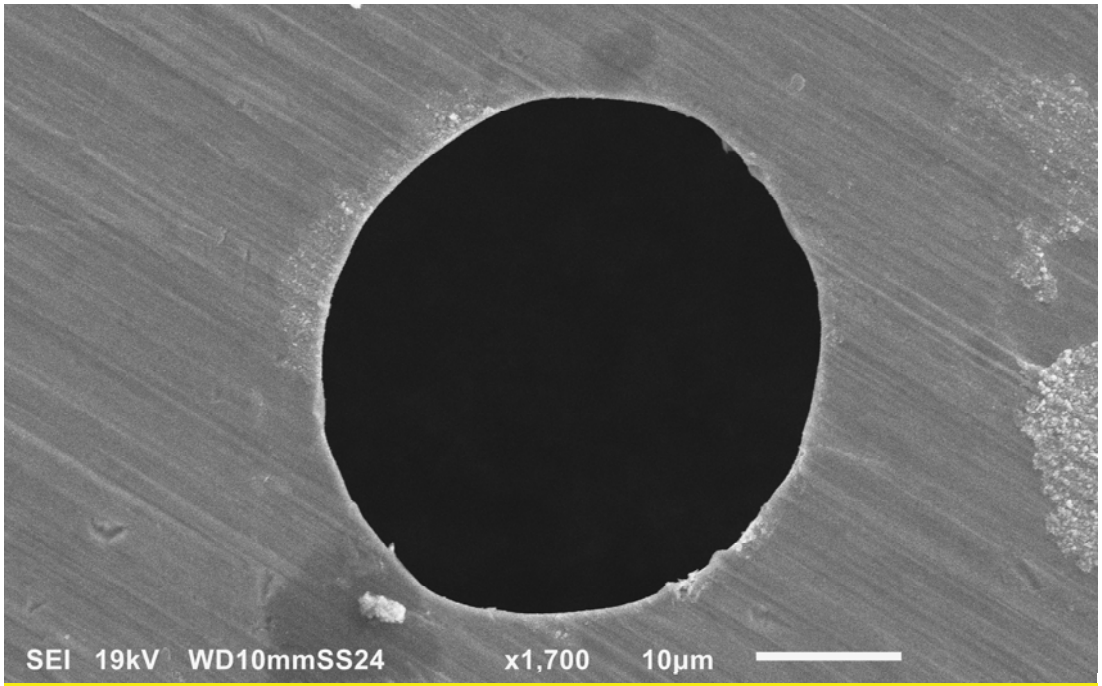
Energie stromen in polymer met additief



Toepassingen



Molybdeen



Molybdeen 343 nm, 250 fs

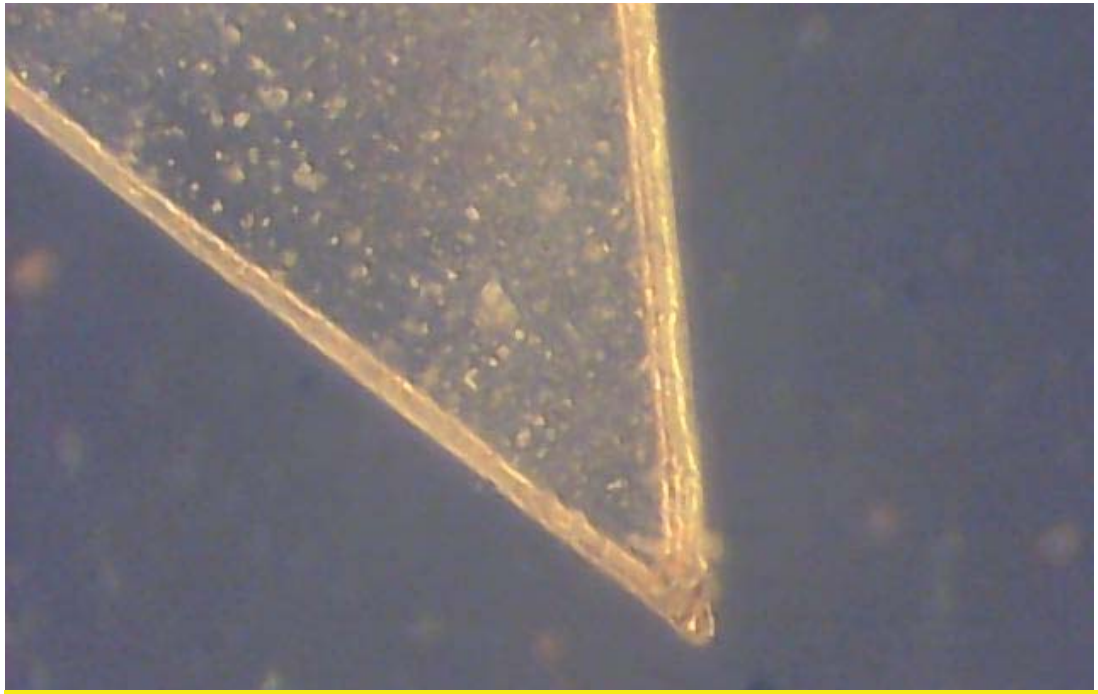
250 fs

343 nm

0.5 W

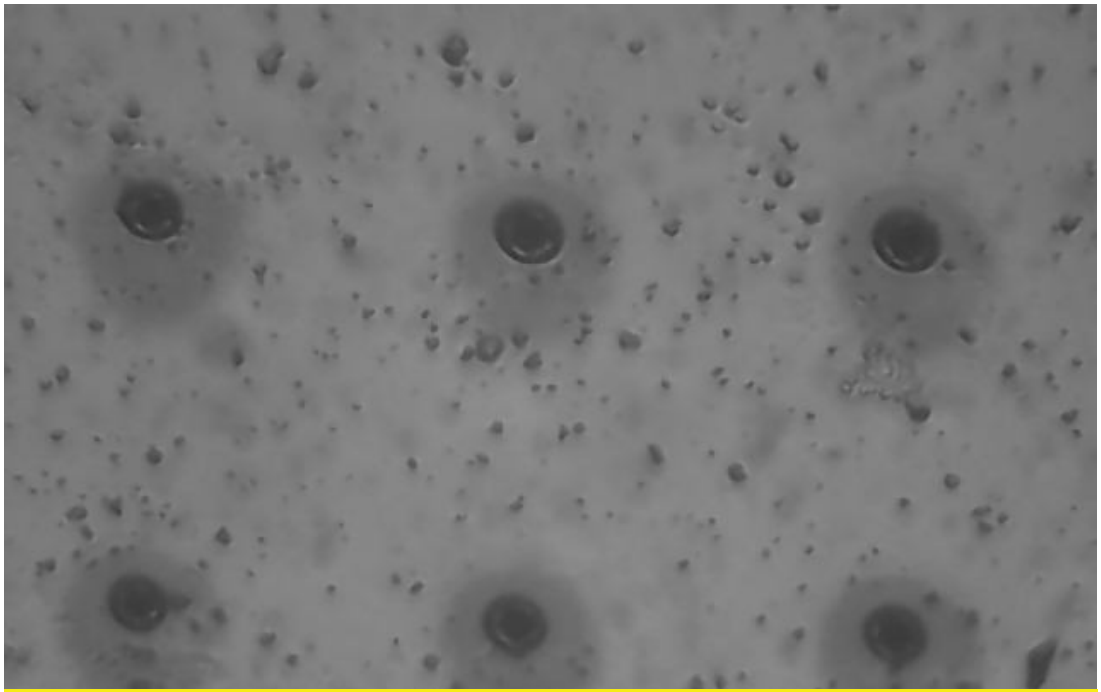
500 mm/s

N= 15x

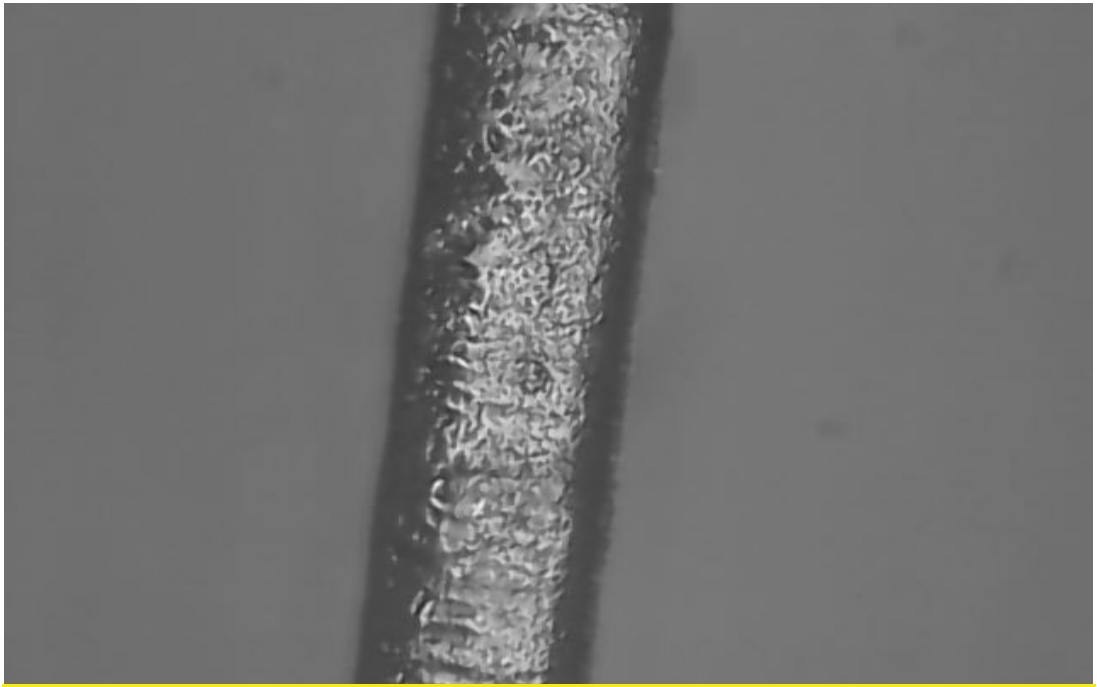


PET folie bovenkant

100 μm

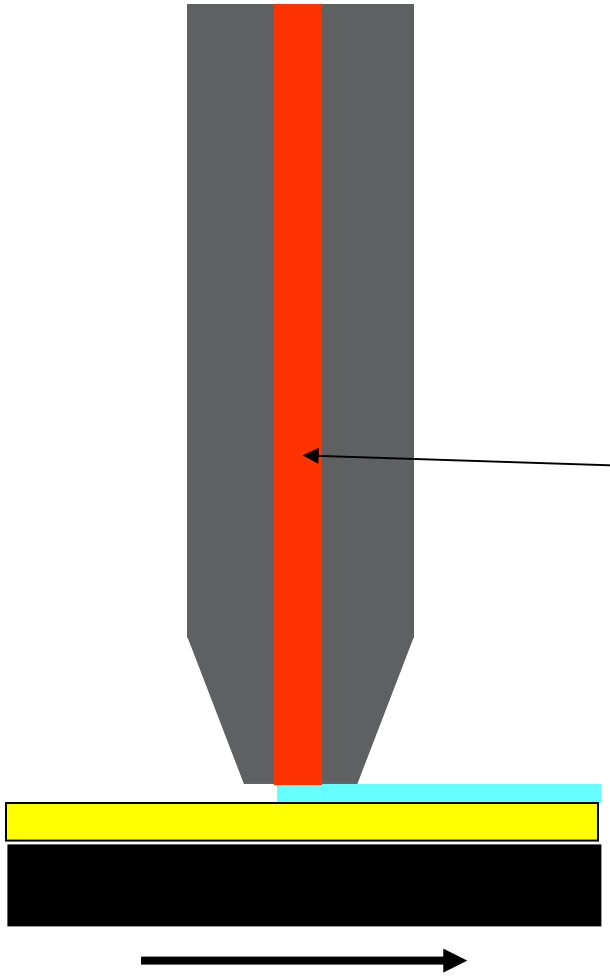


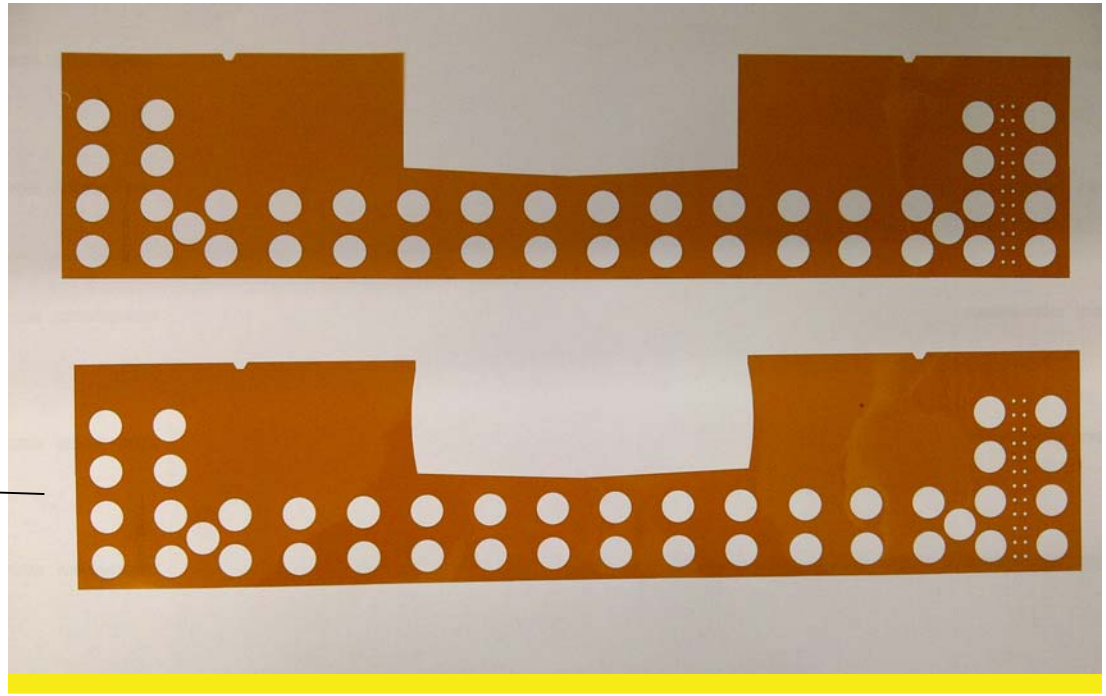
PET folie onderkant gat diameter 10 μm



PET folie zijkant

50 μm





Slot-die coater onderdeel:
Kapton snijden

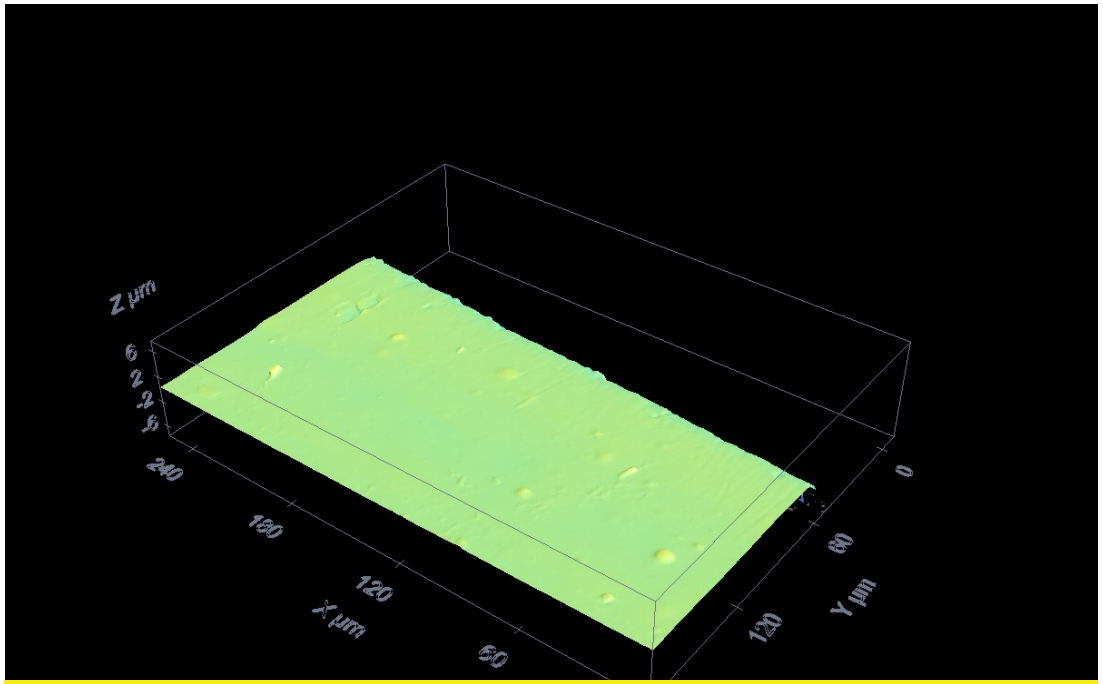
250 fs

343 nm

0.5 W

500 mm/s

N= 15x



Kapton snijden, lange tijd tussen bewerkingen

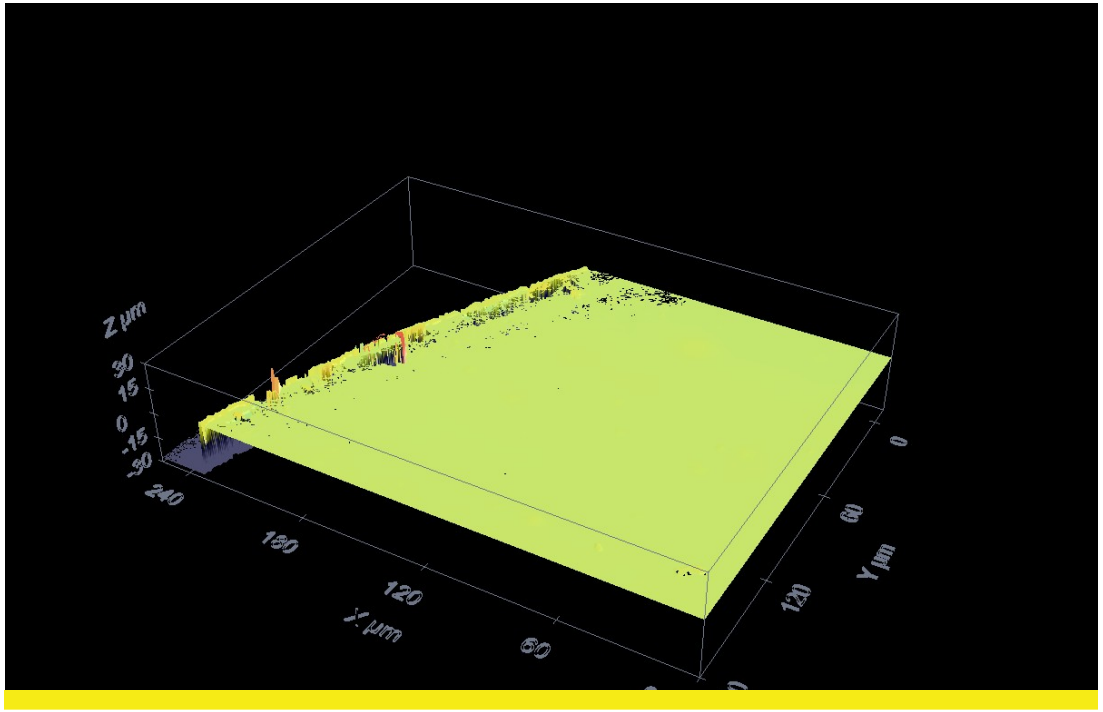
250 fs

343 nm

0.5 W

500 mm/s

N= 15x



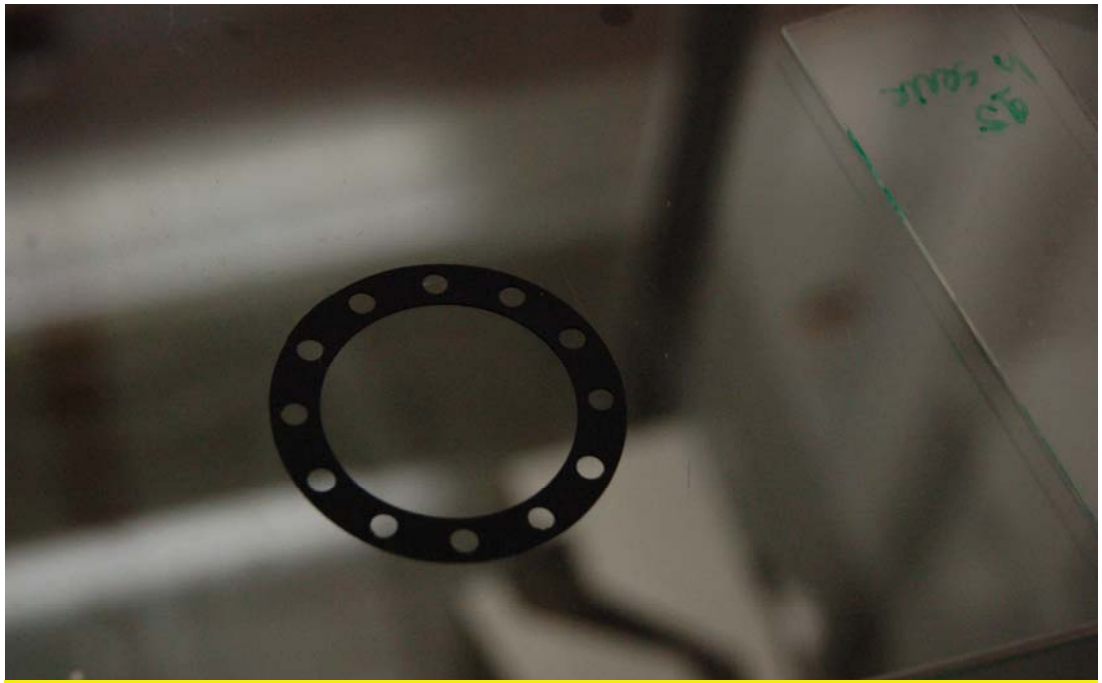
Kapton snijden, 40x sneller
(kleine diameter).

Fiber laser

1064 nm

1 ns

15 W



Rubber (EPDM) seal **Rond 30 mm**

Nd:YAG

1064 nm

10 ns

~ 1W

PBT, opschuimen door brandvertrager

CO_2 laser

Cw

10 W

100 mm/s

ABS, Laser foil transfer

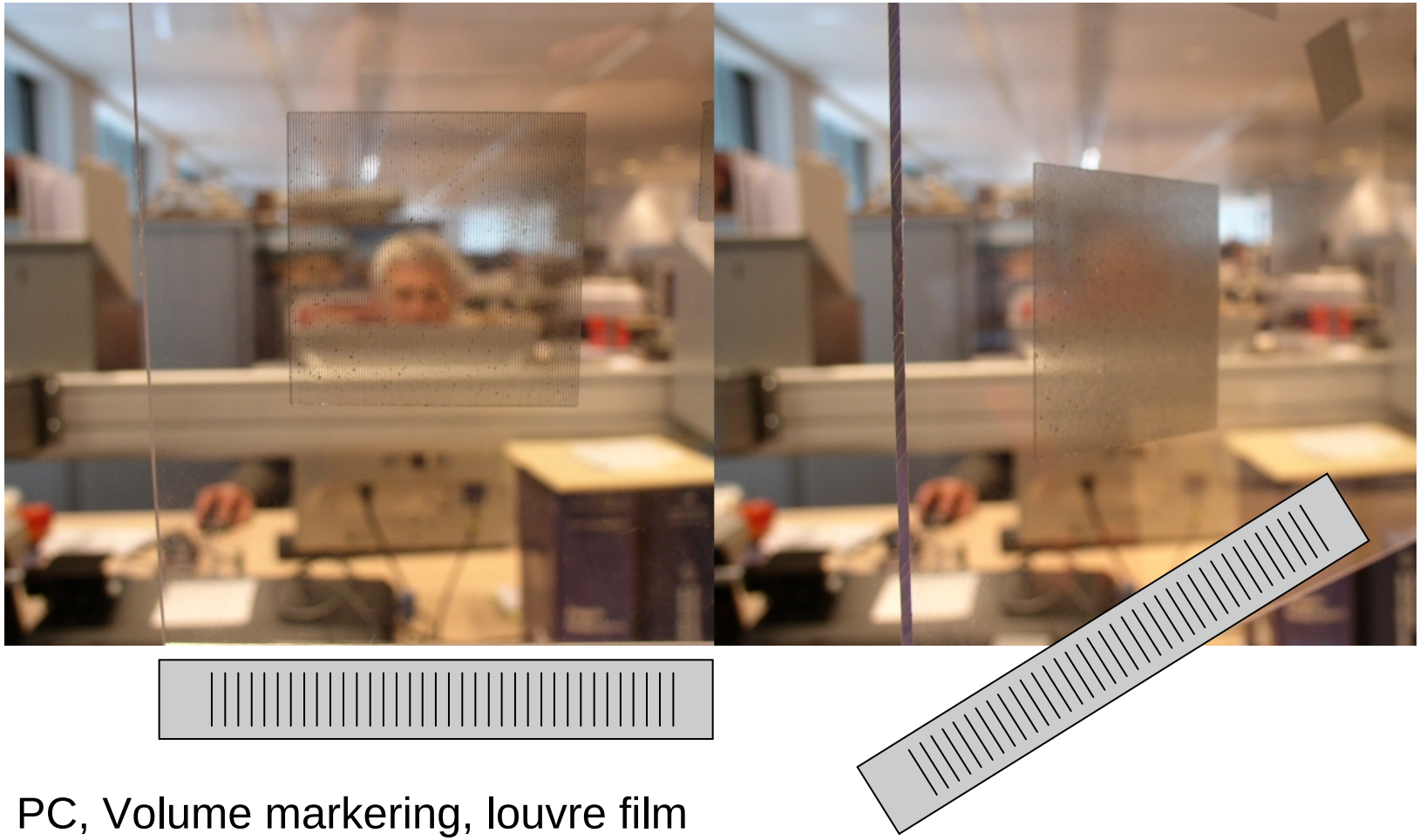
Kunststof

Carbonisatie

Pulstijd 1 ns

1064 nm.

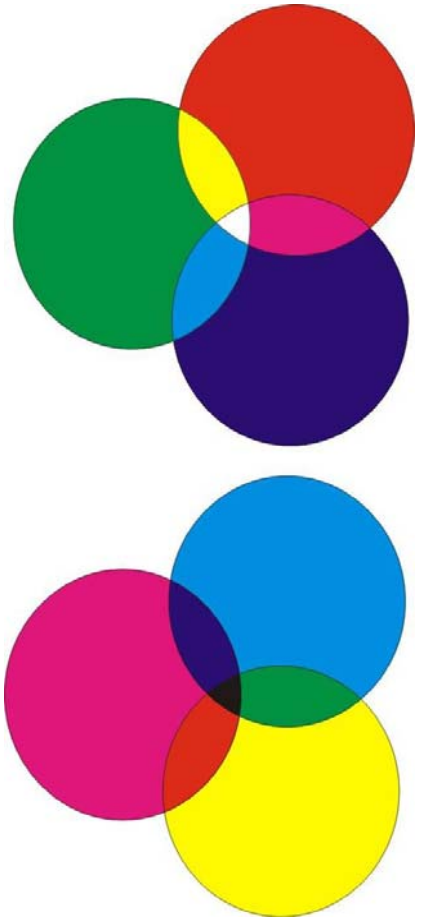
Tedlar, PET + teflon



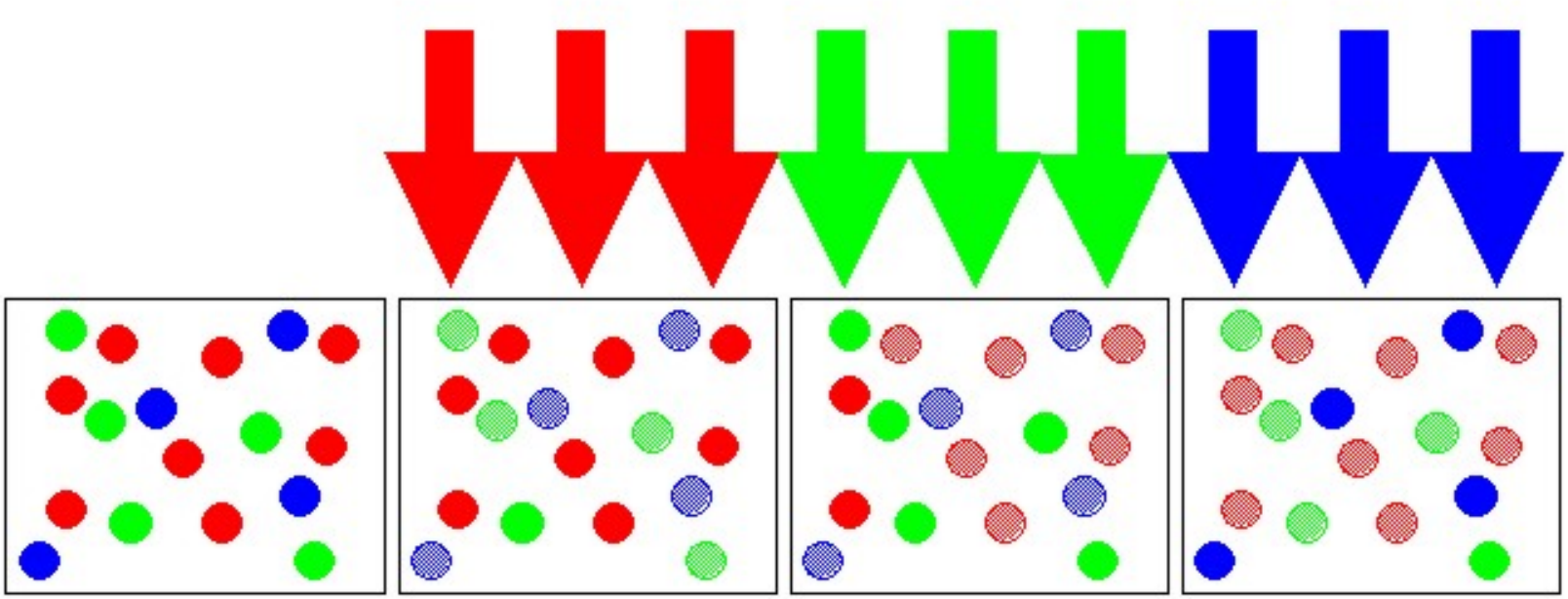
PC, Volume markering, louvre film

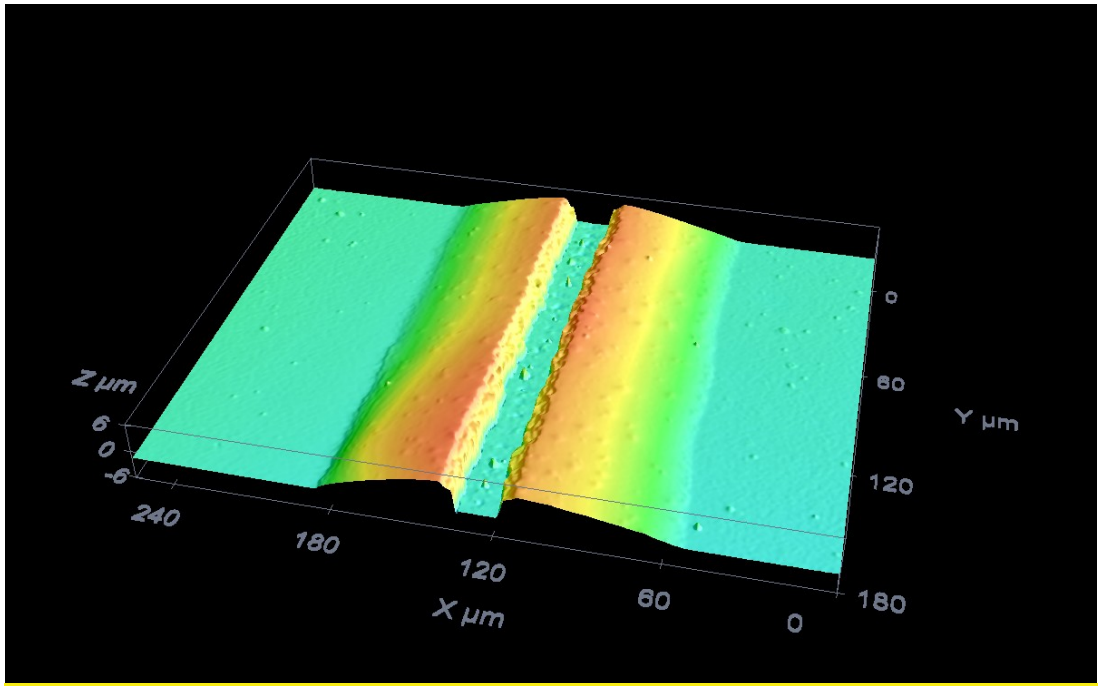
Kleuren markeren I/II

Bleken van pigmenten



Kleuren markeren II/II





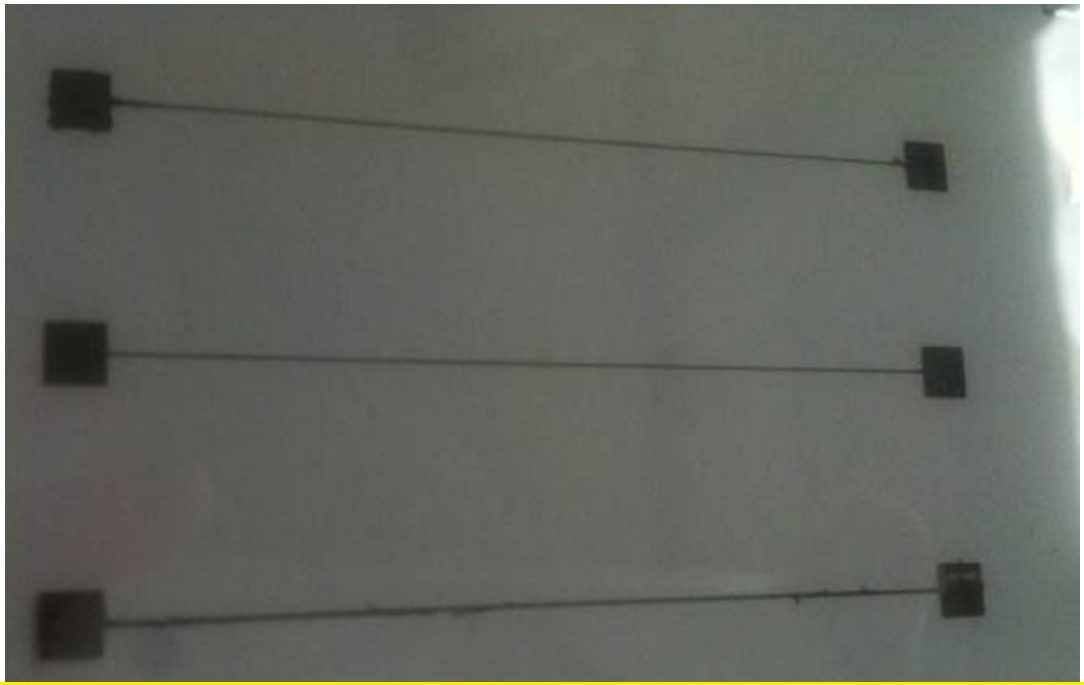
Laser in acrylaat inkjet lijn

Ag inkjet

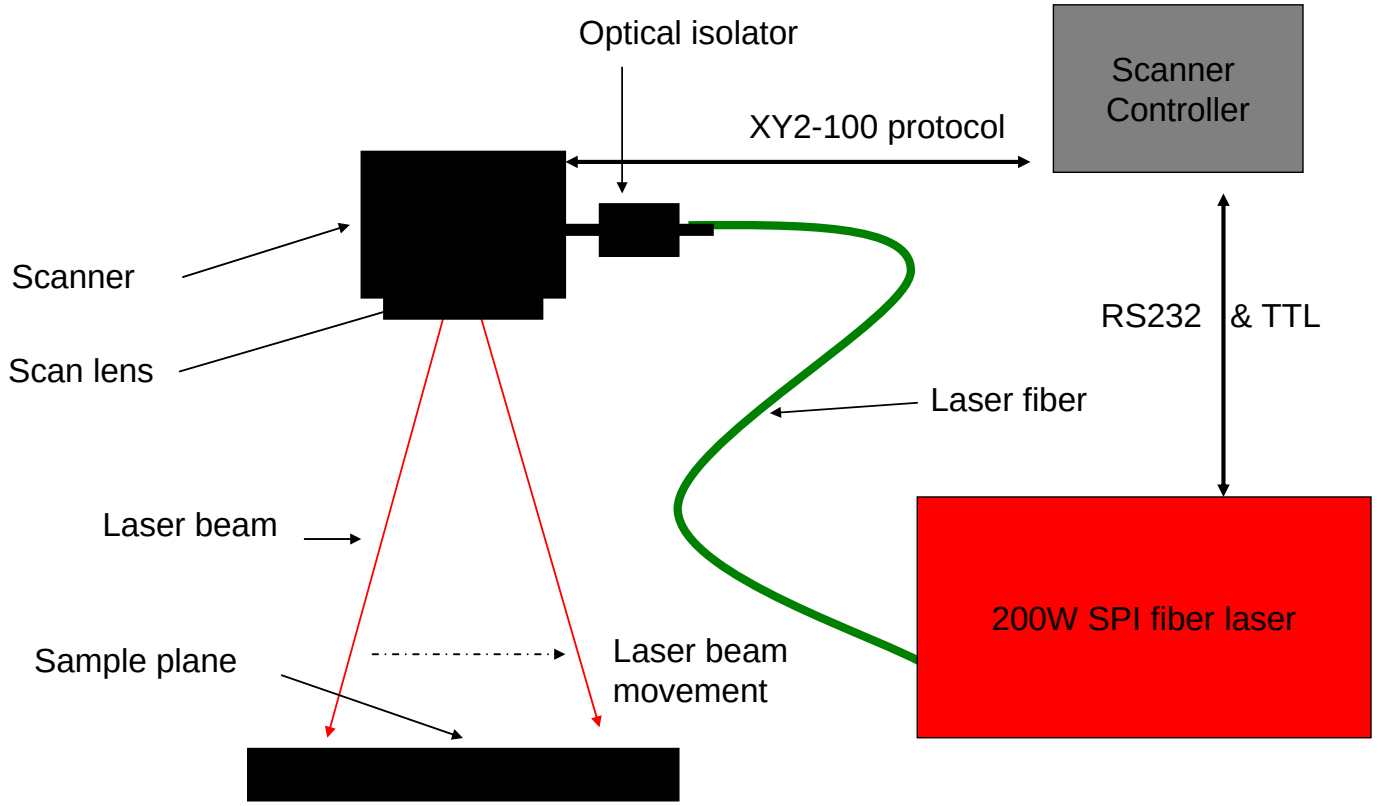
Fiber laser

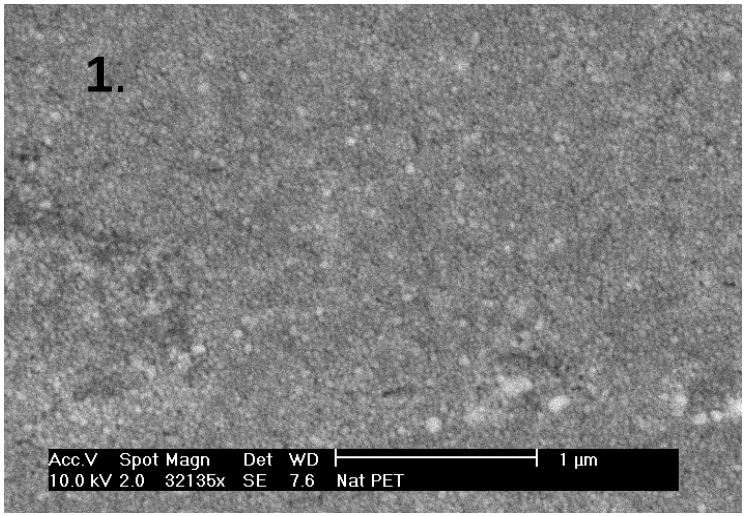
50 W

500 mm/s

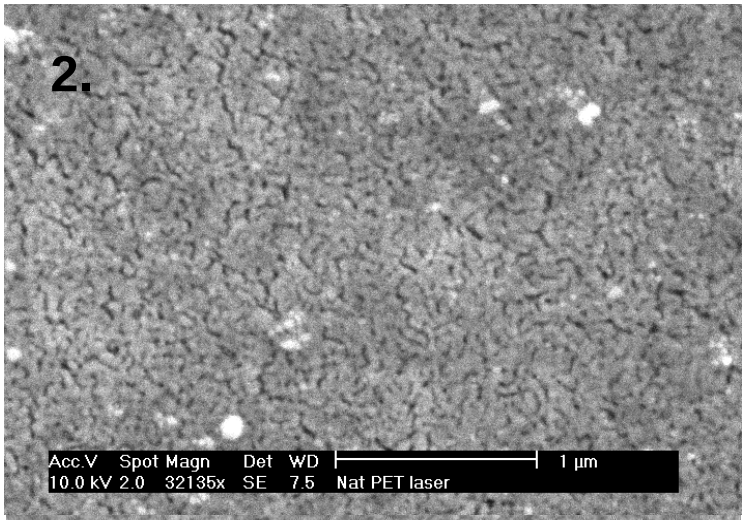


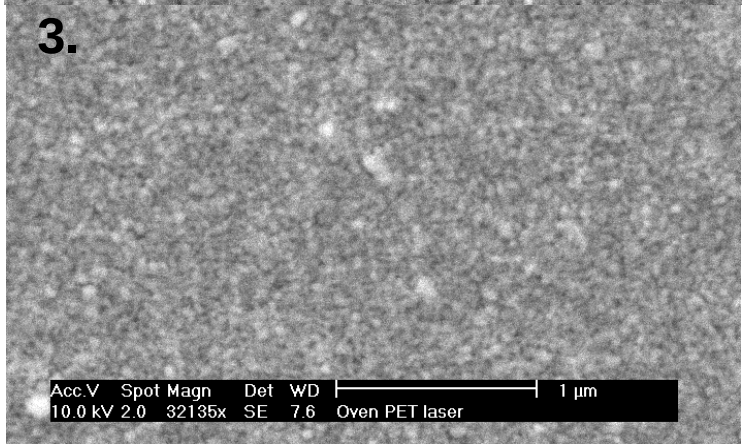
Zilver op PET, laser sinteren

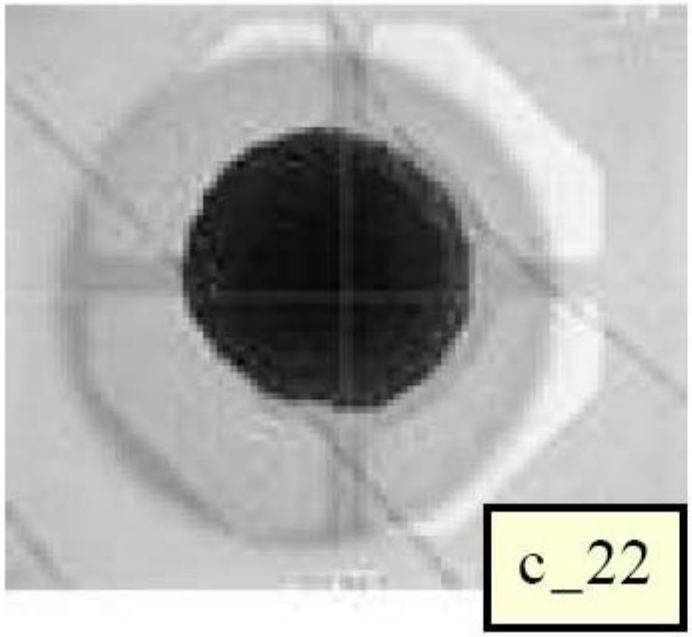

Optical isolator
Scanner Controller
XY2-100 protocol
Scanner
Scan lens
RS232
& TTL
Laser fiber
Laser beam
Sample plane
Laser beam movement
200W SPI fiber laser

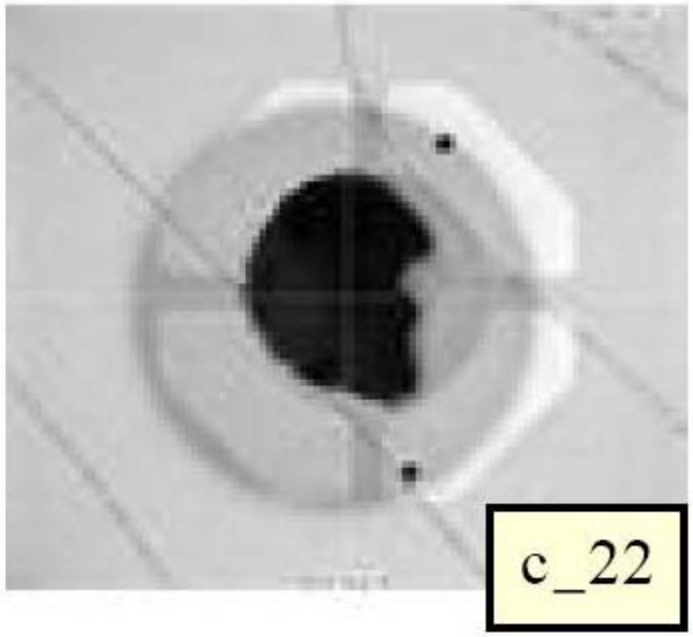


1. Zilver op PET, gedroogd
2. Aleen laser sinteren
3. 130 C + laser



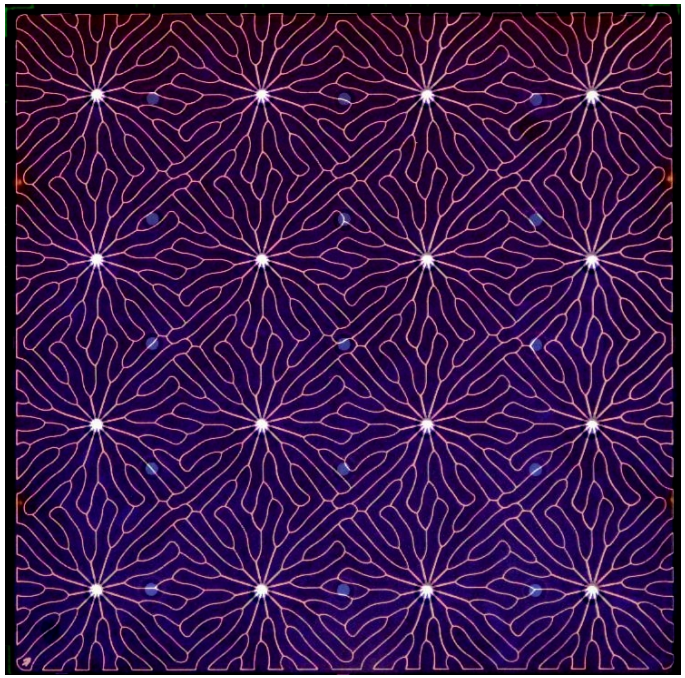


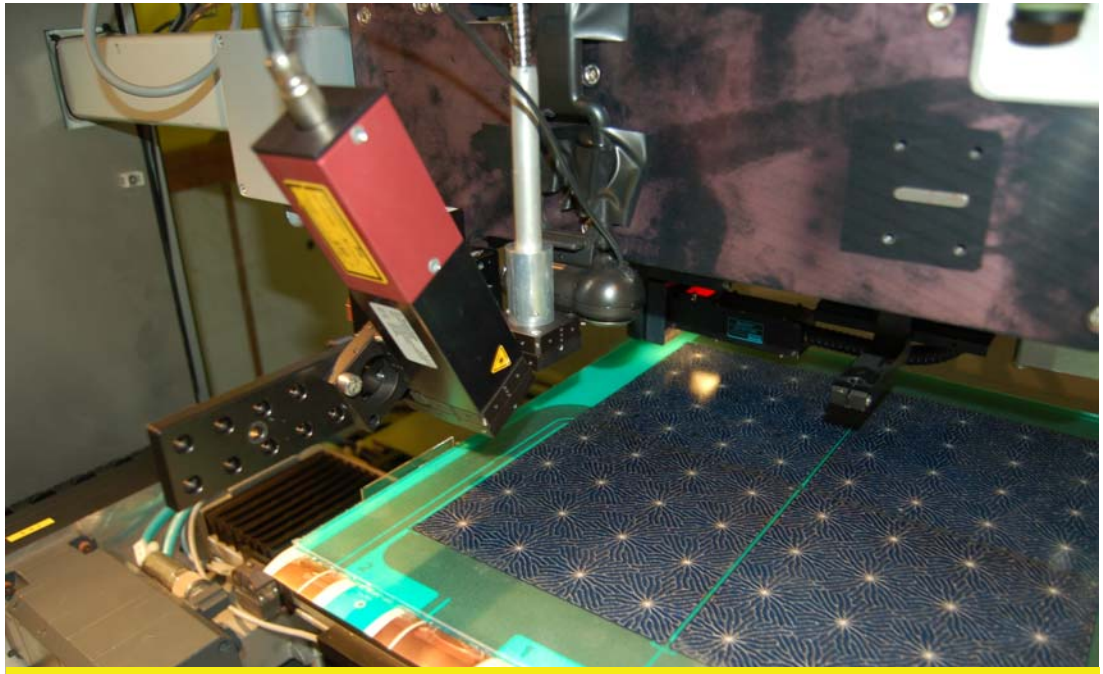




In laminate laser soldering

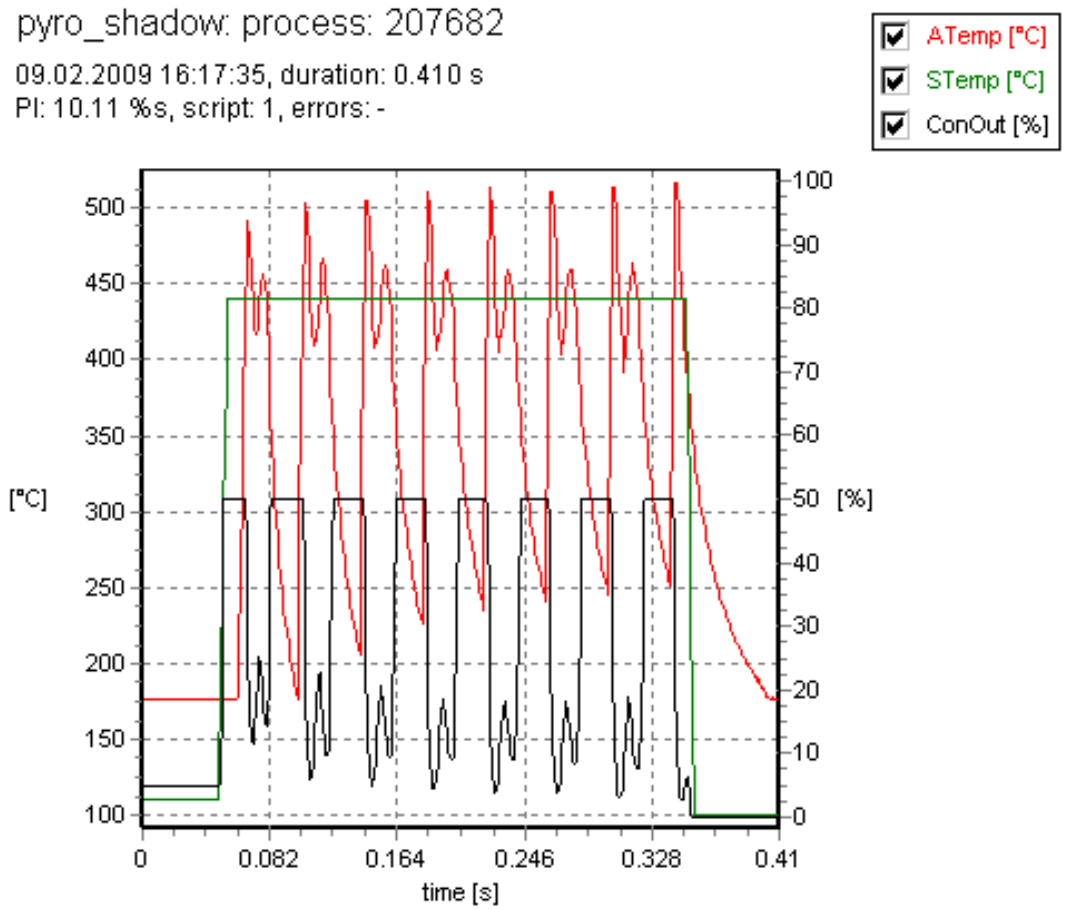
- 200 W
- Fiber laser
- Pyrometer



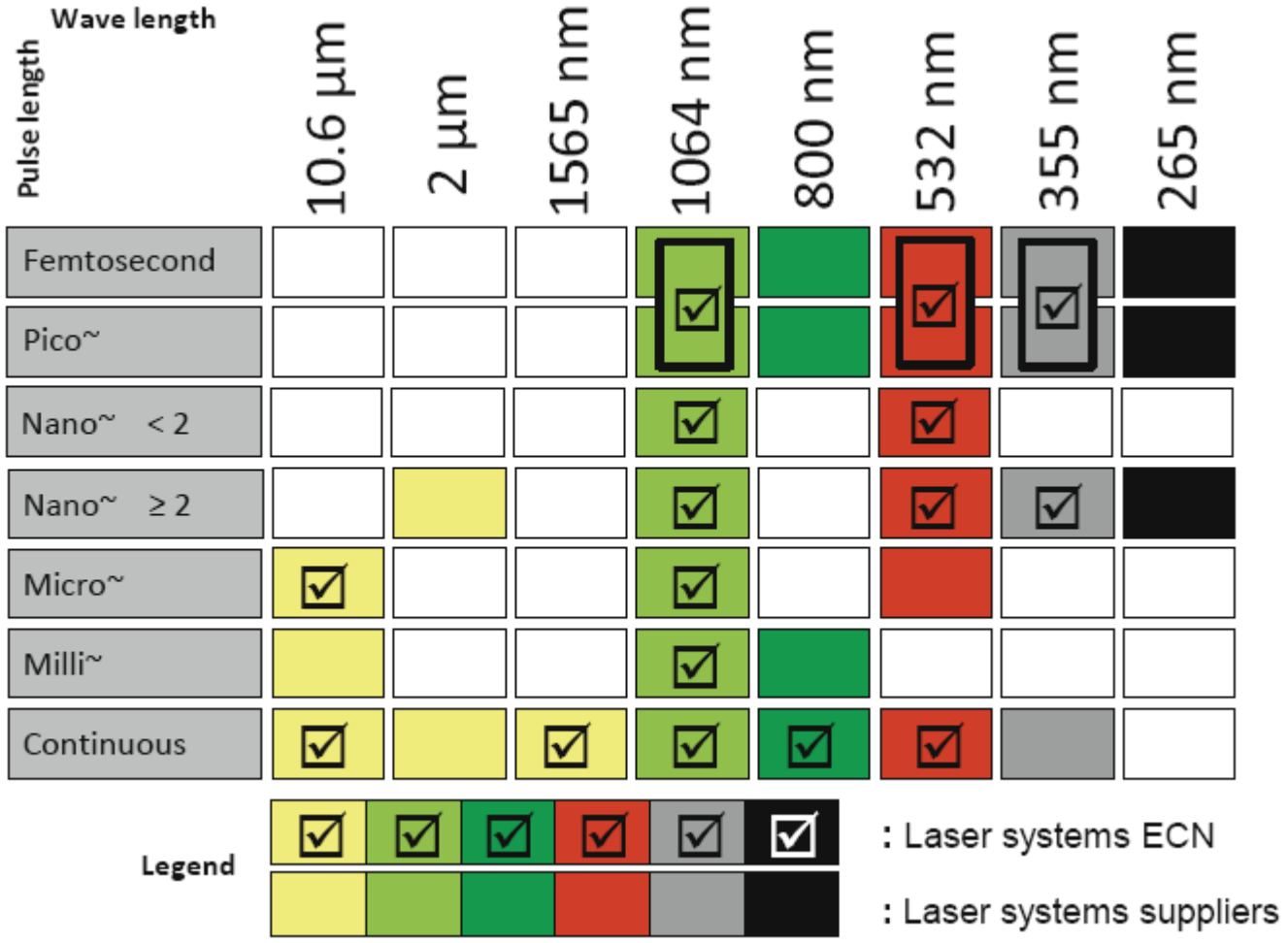


In laminate laser soldering

- Nd:YAG
- Gepulsde las laser
- Pyrometer



ECN lasers en systemen



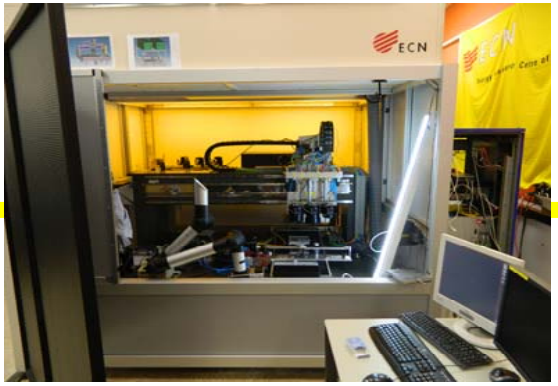
http://www.ecn.nl/uploads/media/20121126_ECN_leaflet_Laser_systems_01.pdf

Laser ECN (totaal 15)

– Pharos (Lightconv.)	λ 1030,515,343 nm	t_p 10 ps – 250 fs
– YLP-18 (IPG)	λ 1060 nm	t_p 1,5,10 ns
– GLP-5 (IPG)	λ 532 nm	t_p 1 ns
– Boreas (Eolite)	λ 532, 353 nm	t_p 20 ns
– SPI-200W (Spi)	λ 1070 nm	cw (200W)
– SPI-20W (Spi)	λ 1565 nm	cw (20W)
– SPI-G3 (Spi)	λ 1062 nm	t_p 60 ns
– HL 204P (Trumpf)	λ 1064 nm	0.3 -10 ms
– Eline 20^E (Rofin)	λ 355, 1064 nm	t_p 10 ns
– LBI 6000 (Baasel) 2x	λ 1064 nm	t_p 120 ns
– SLS C16 (Lasag)	λ 1064 nm	tp 0.2 – 10 ms
– SLS C60 (Lasag) 2x	λ 1064 nm	tp 0.2 – 20 ms
– 48-2 (Synrad)	λ 10.6 □m	cw (100W)

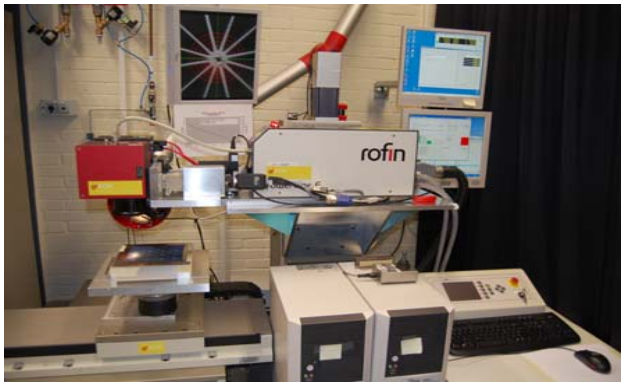
Systemen I/II

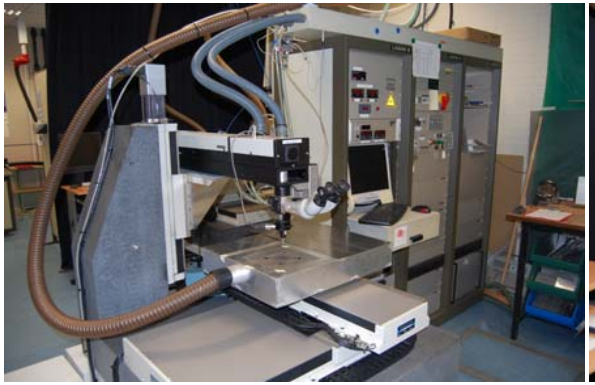
- Eindhoven
  - Adem system
  - Scribe 0
  - Scribe “Utrecht”
- Petten
  - Aerotech UV
  - Aerotech IR
  - Aerotech cutter 2x
  - Schott
  - Scribe Baasel (assm.)

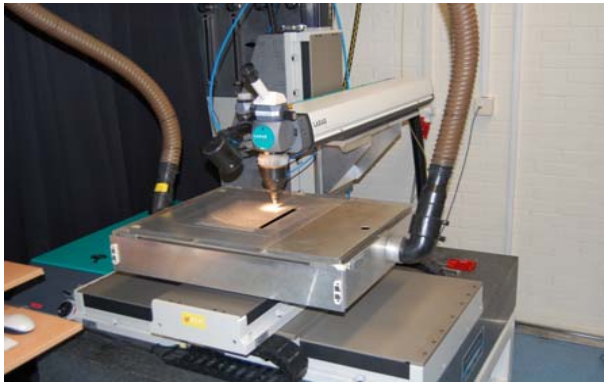


Systemen II/II

- Eindhoven
  - Adem system
  - Scribe 0
  - Scribe Utrecht (assm.)
- Petten
  - Aerotech UV
  - Aerotech IR
  - Aerotech cutter 2x
  - Schott
  - Scribe Baasel (assm.)







Specs. adem systeem

Golflengte 1030 nm & 515 nm & 343 nm,

Puls breedte 250 fs – 10 ps

10 W @ 1030 nm, 5 W @ 515 nm, 2 W @ 343 nm (Light conversion)

XYZ (1300 mm x 600 mm x 200 mm)
nauwkeurigheid X 5µm , Y 5µm, Z 3µm
Hoge snelheids as Y, 2.5 m/s
R2R systeem (300 mm, ~ 0.5 m/s)

Platform voor laser experimenten

Downflow (prevent optical damage) (NXP)

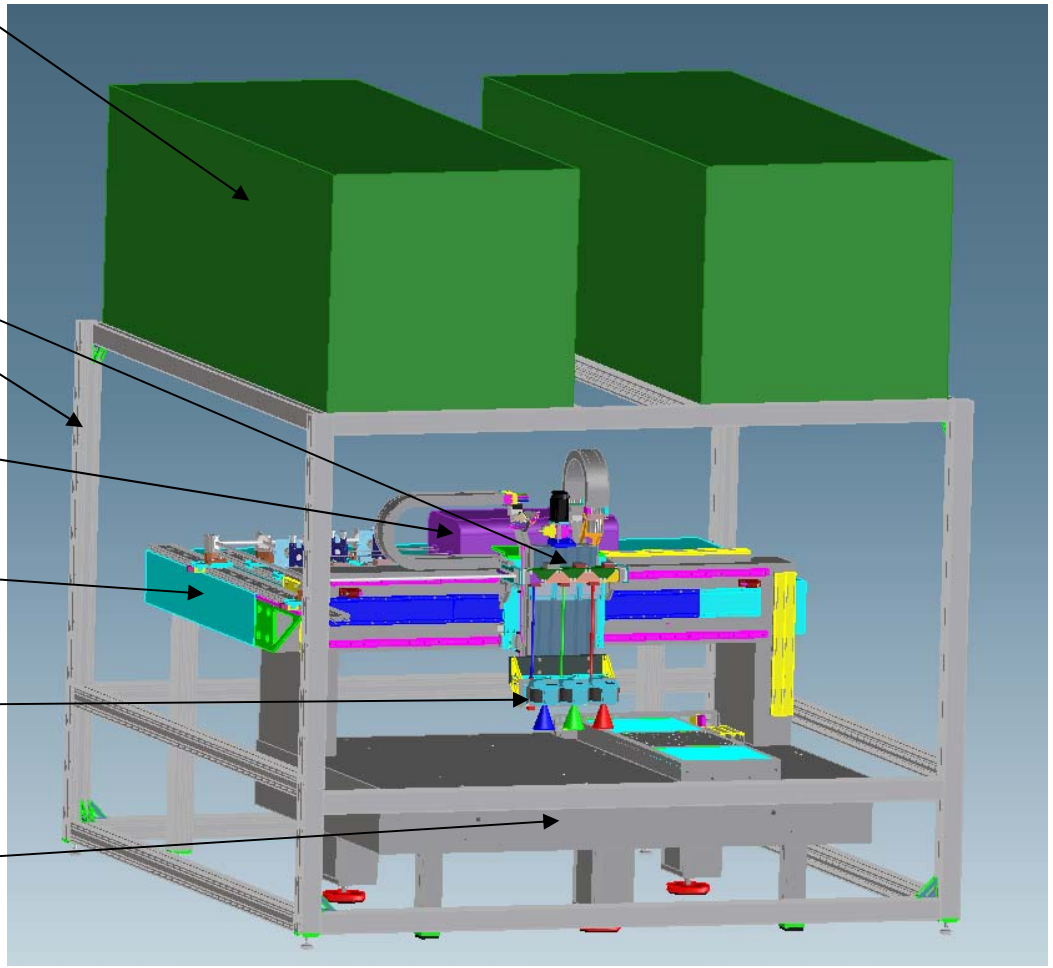
Laser safety cabinet, optics interfaces (ECN)

Laser (Lightconversion)

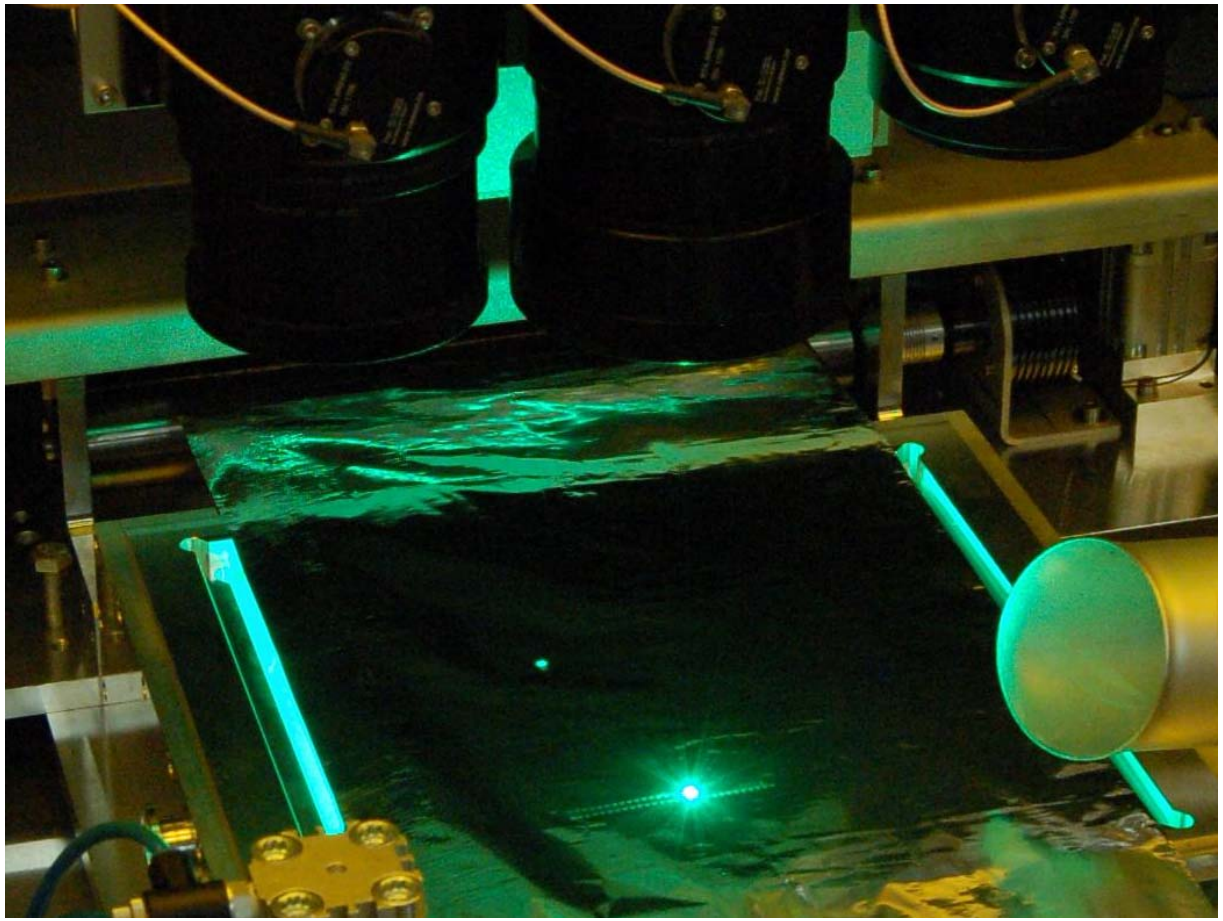
Optical table (Philips)

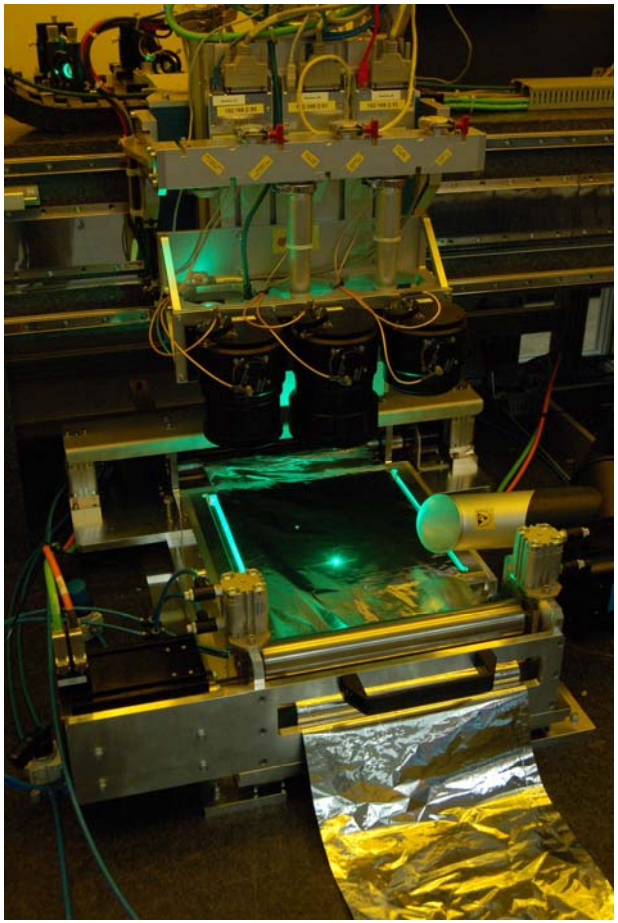
Optics (Sill/molenaar)

Translation system (Q'sys)



R2R, non indexed



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