Generation and application of high power Flattened Gaussian Beams

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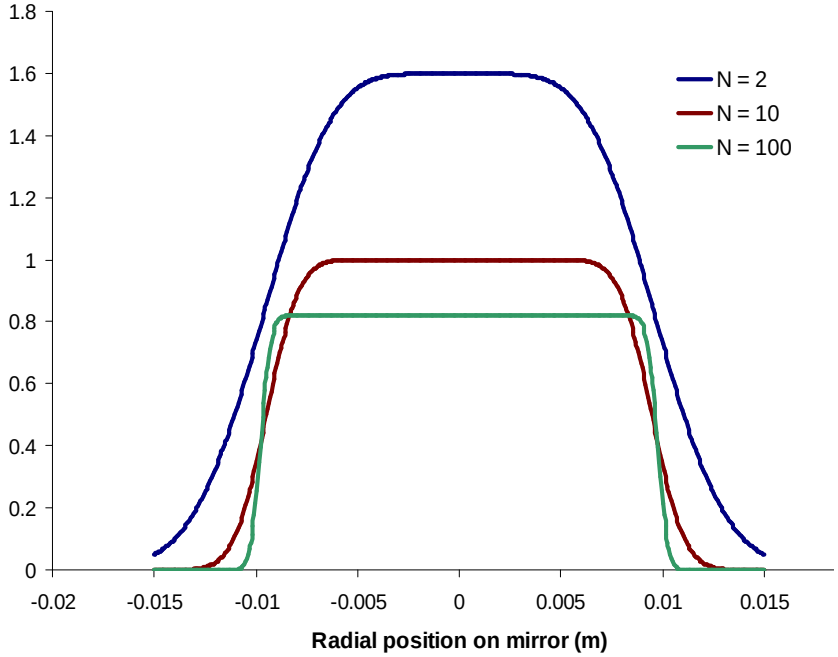
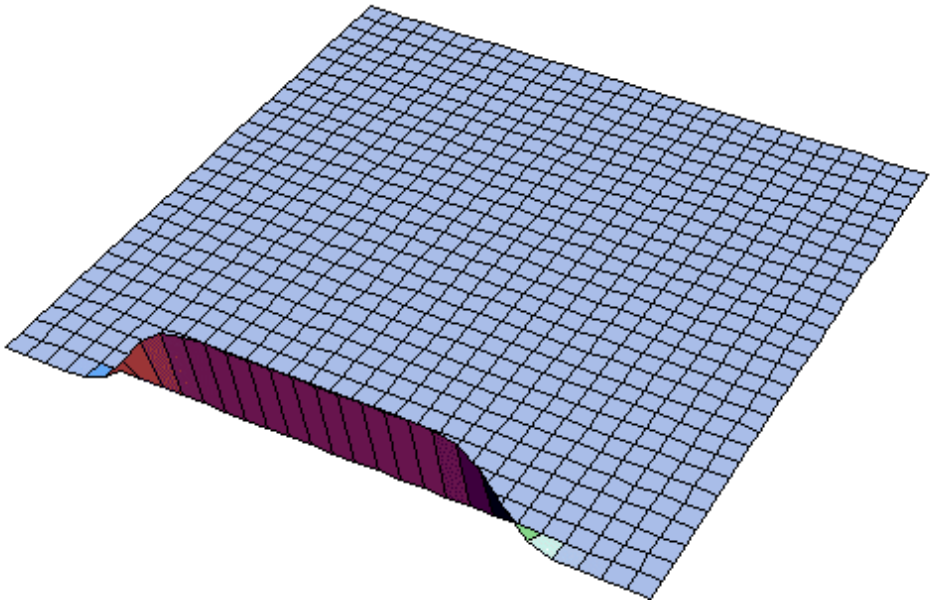
Flattened Gaussian Beams (FGBs) change shape as they propagation

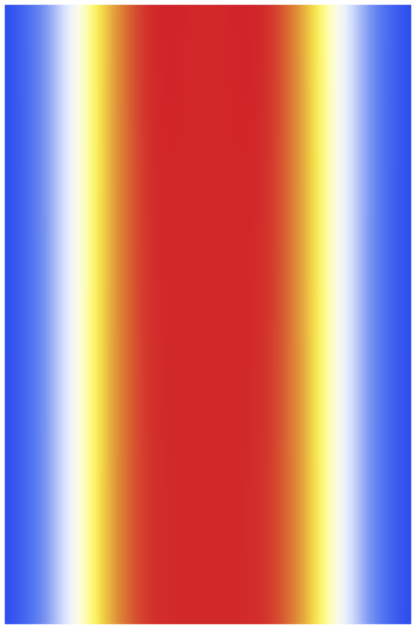
$$U(r,z) = U_0 \exp\left(-i(\Phi(p,z,w_0) - kz - kr^2/2R(p,z,w_0)) - (r/w(p,z,w_0))^2\right) \times \sum_{n=0}^{p} C_n(p) L_n\left(2(r/w)^2\right) \exp\left(-2in\Phi(p,z,w_0)\right)$$

$$C_n(p) = (-1)^n \sum_{m=n}^{p} \binom{m}{n} \frac{1}{2^m}$$

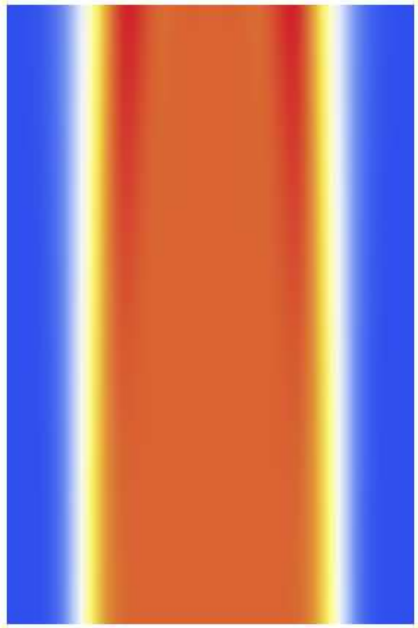




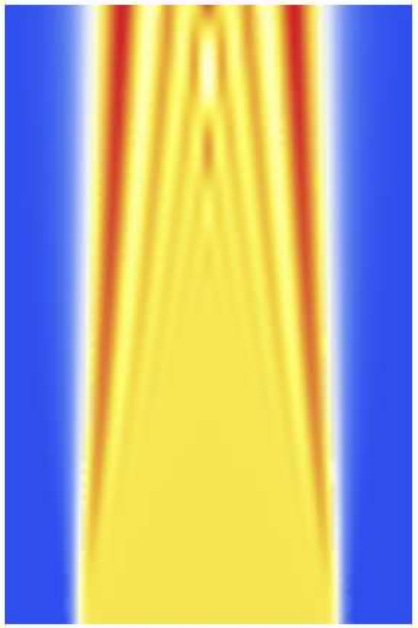
The Rayleigh range is inversely proportional to the order of the beam



N = 2

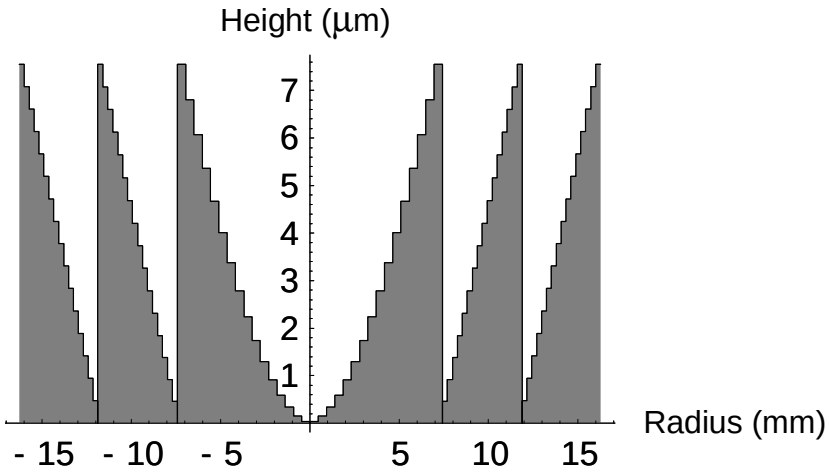


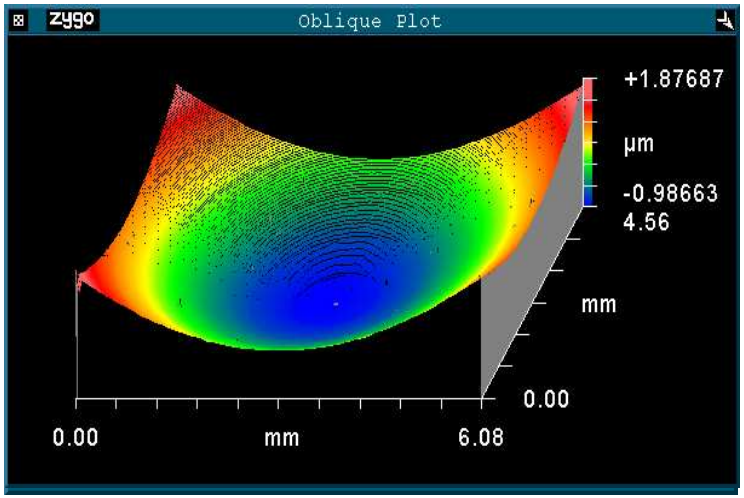
N = 10

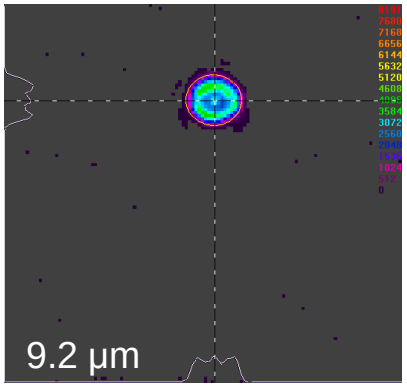


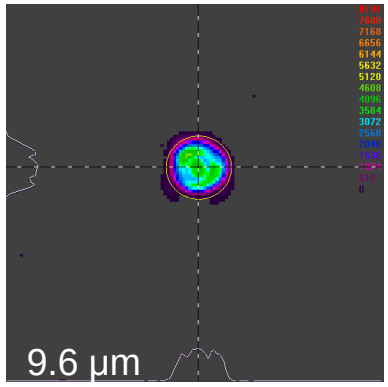
N = 100

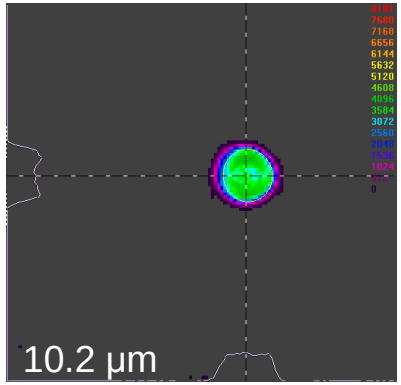
Using a transmission DOE one can convert a Gaussian to flat-top intensity profile

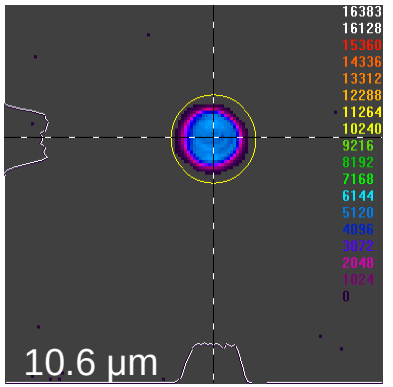




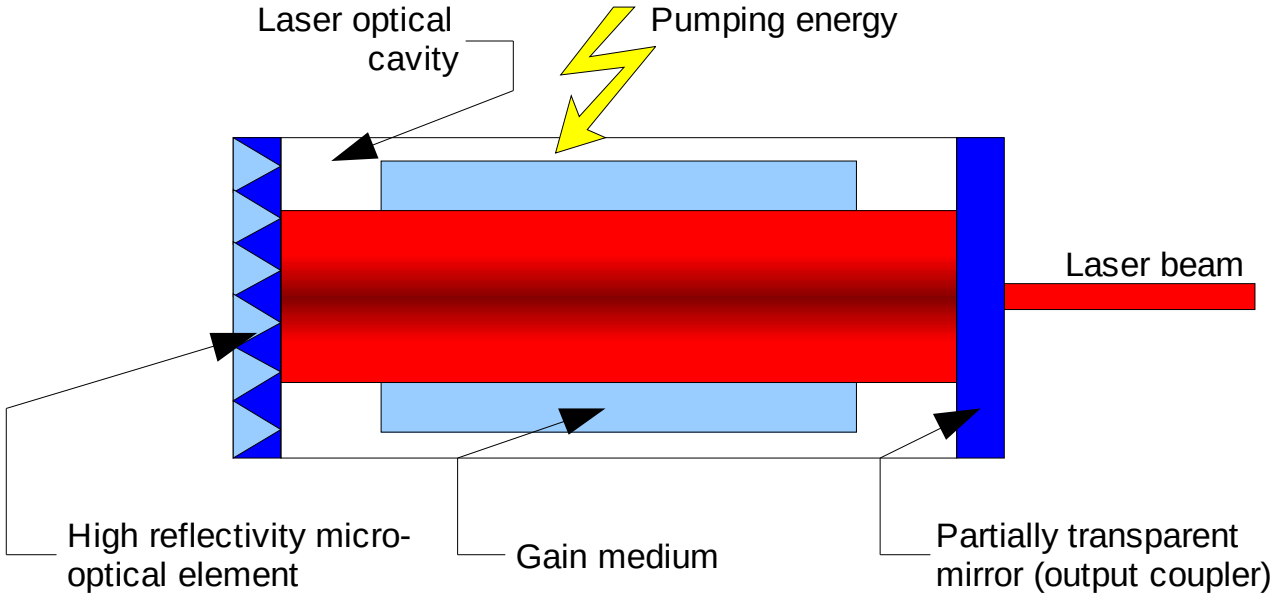




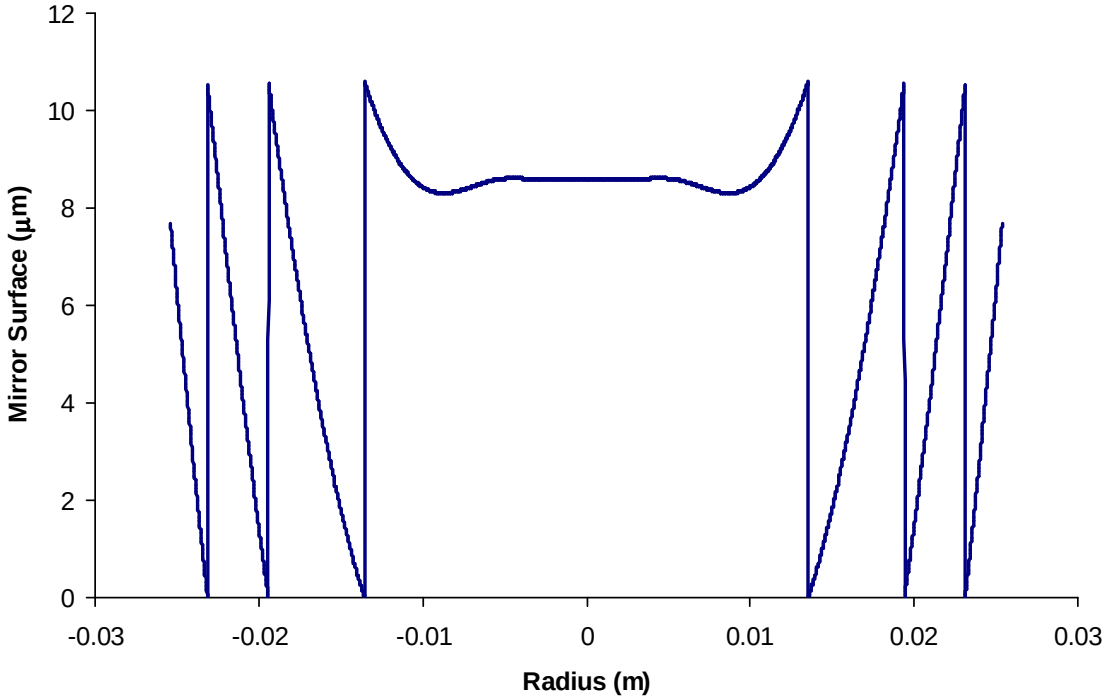


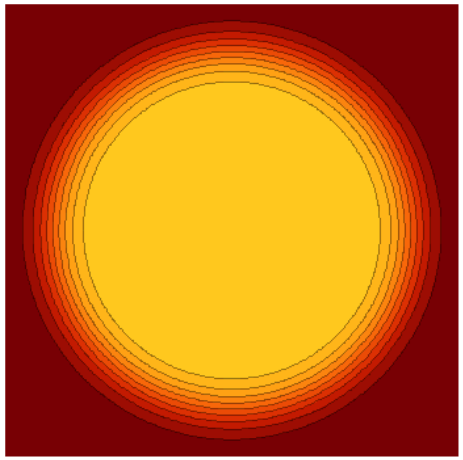


Modes may be selected by phase inside the optical resonator

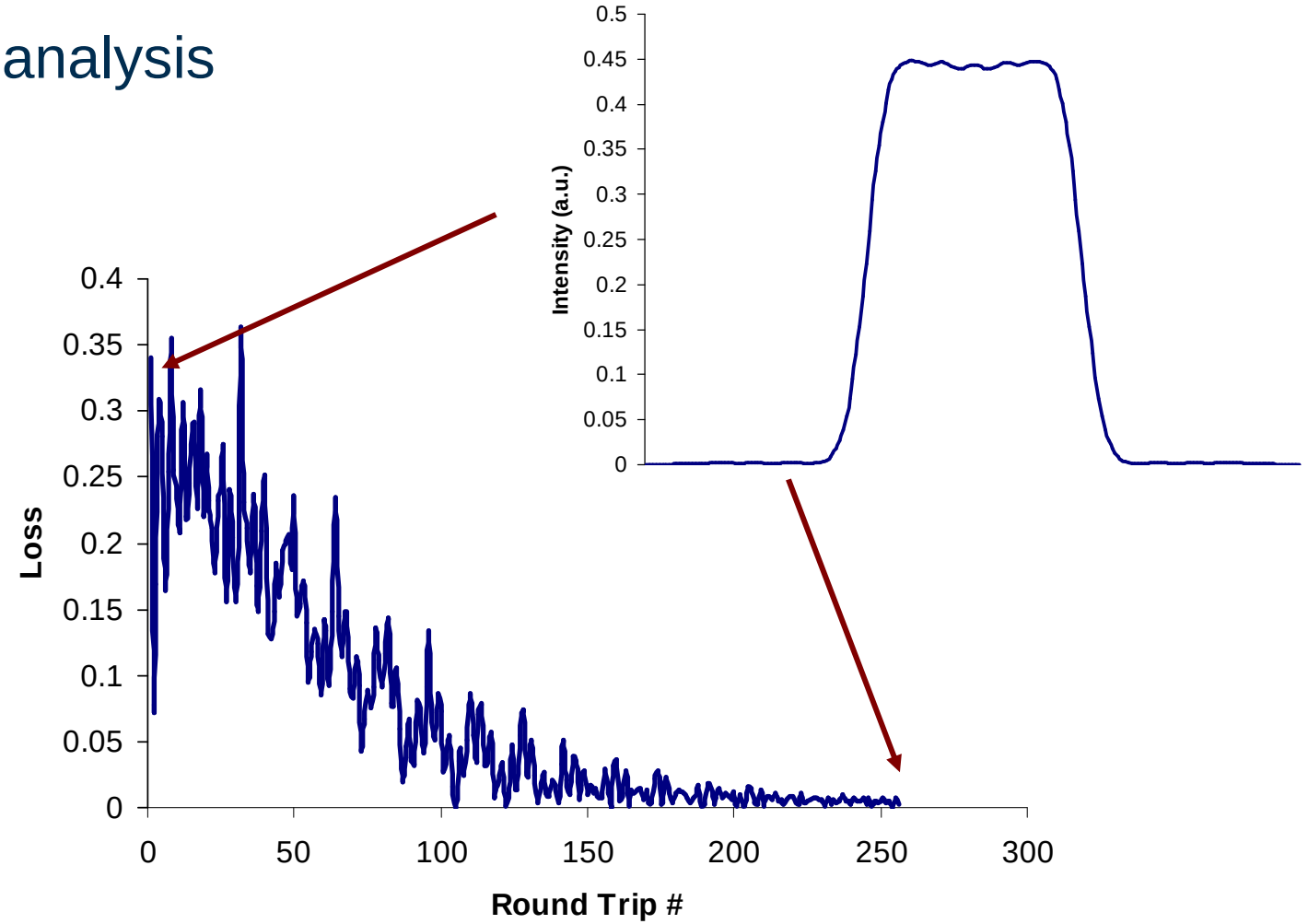


Design of a mirror to produce an N = 10 FGB

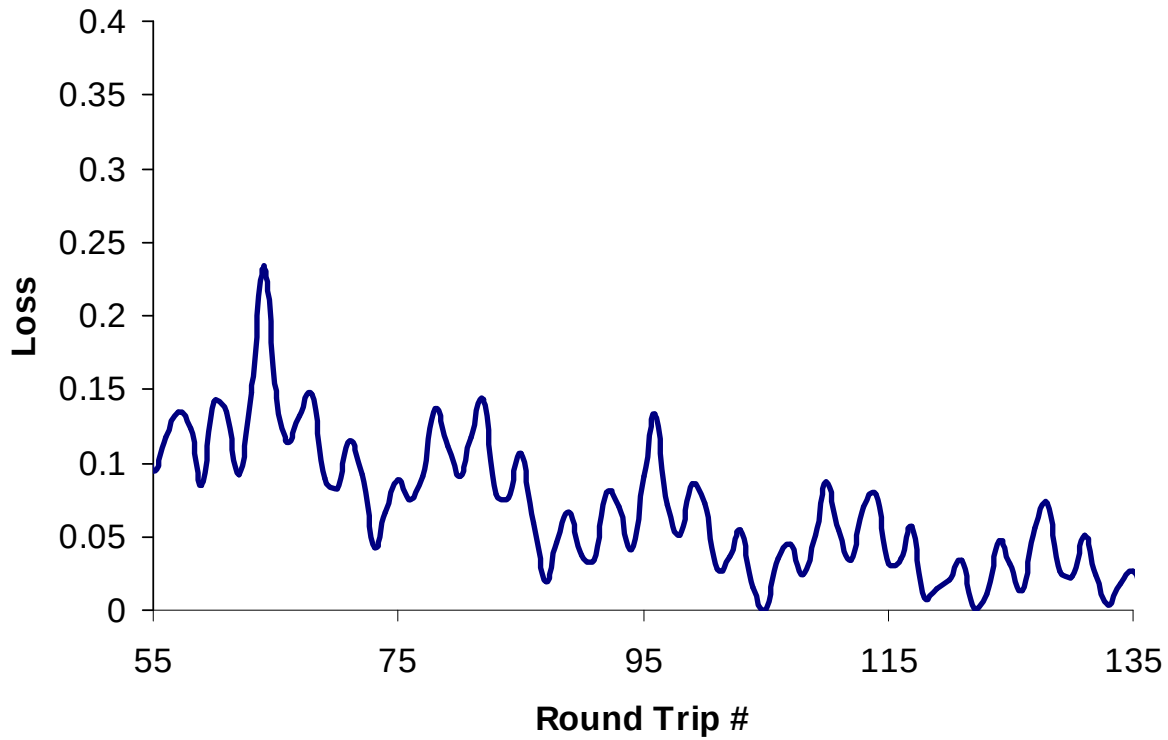




Fox–Li analysis

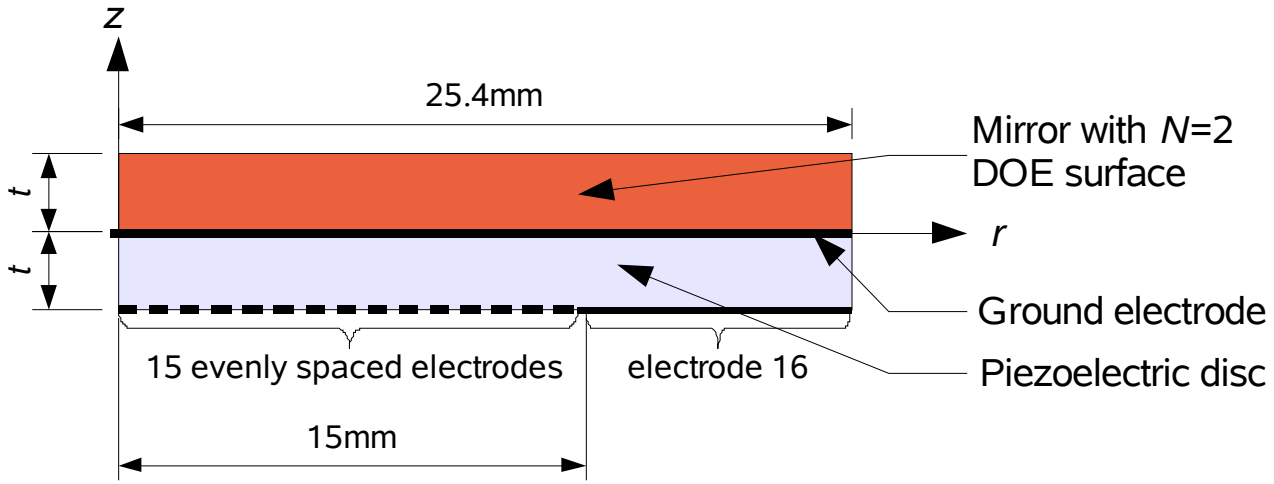


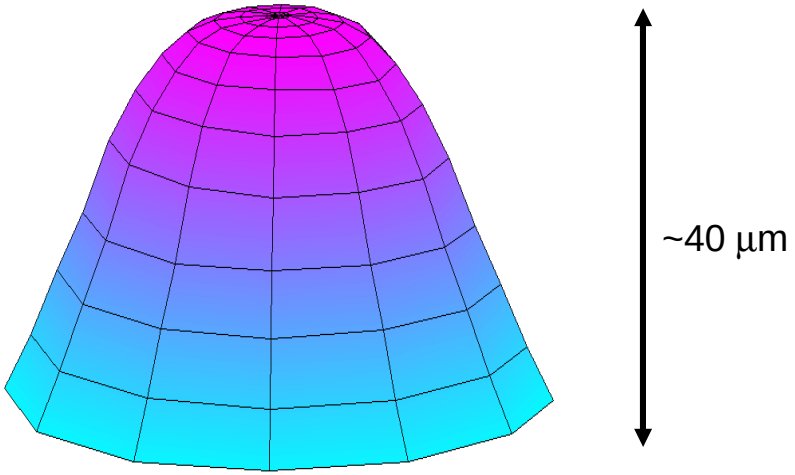
The mode competition is revealed in the loss convergence per round trip



Optics Express **16** (17), 12707–12714, 2008

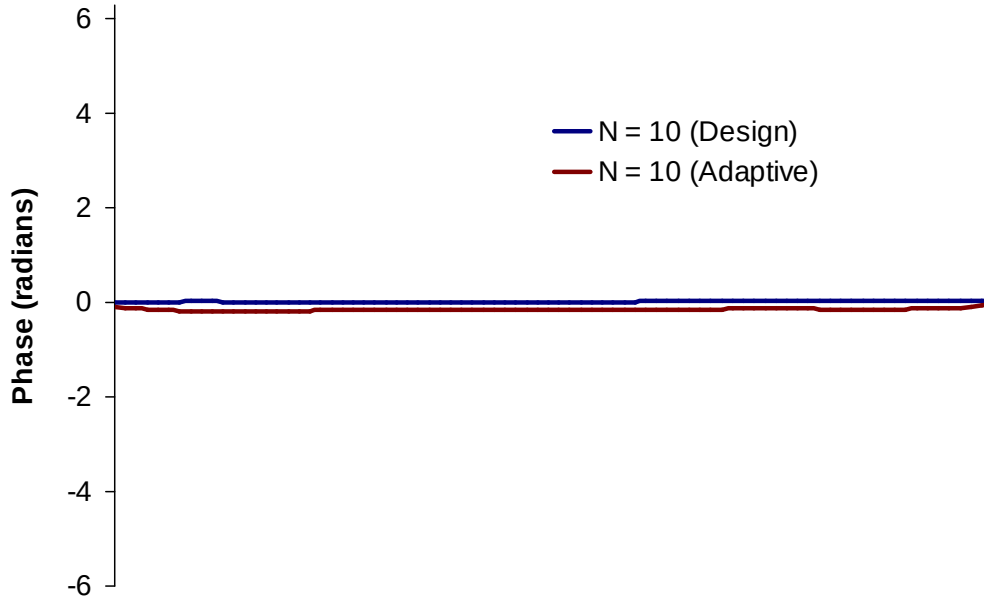
Piezoelectric unimorph mirror





Proc. SPIE **6930**, 6930Y1, 2008

Combination of a DOE and adaptive mirror allows in-situ mode selection



Proc. SPIE **7062**, 706210-1, 2008

Industrial application

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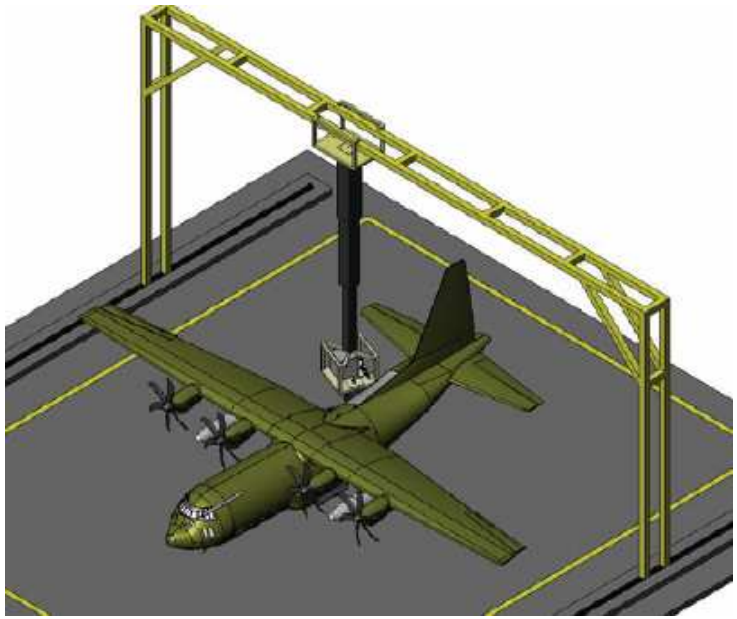
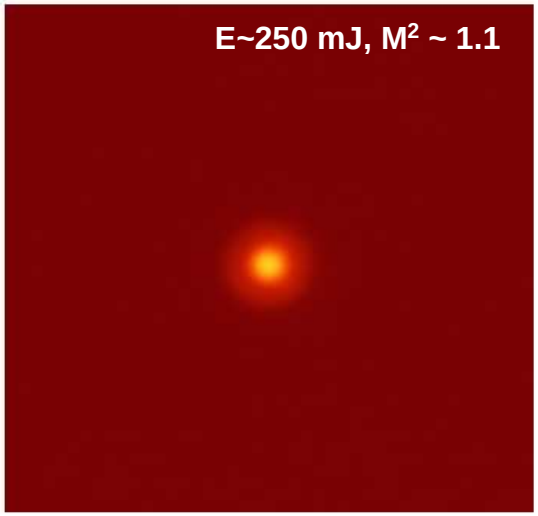
Laser based paint stripping

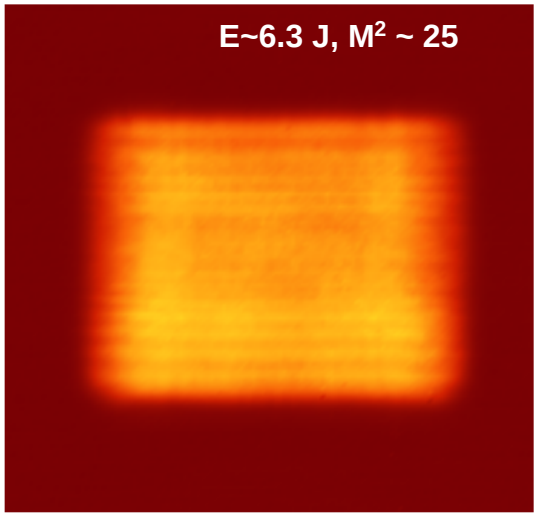
movie

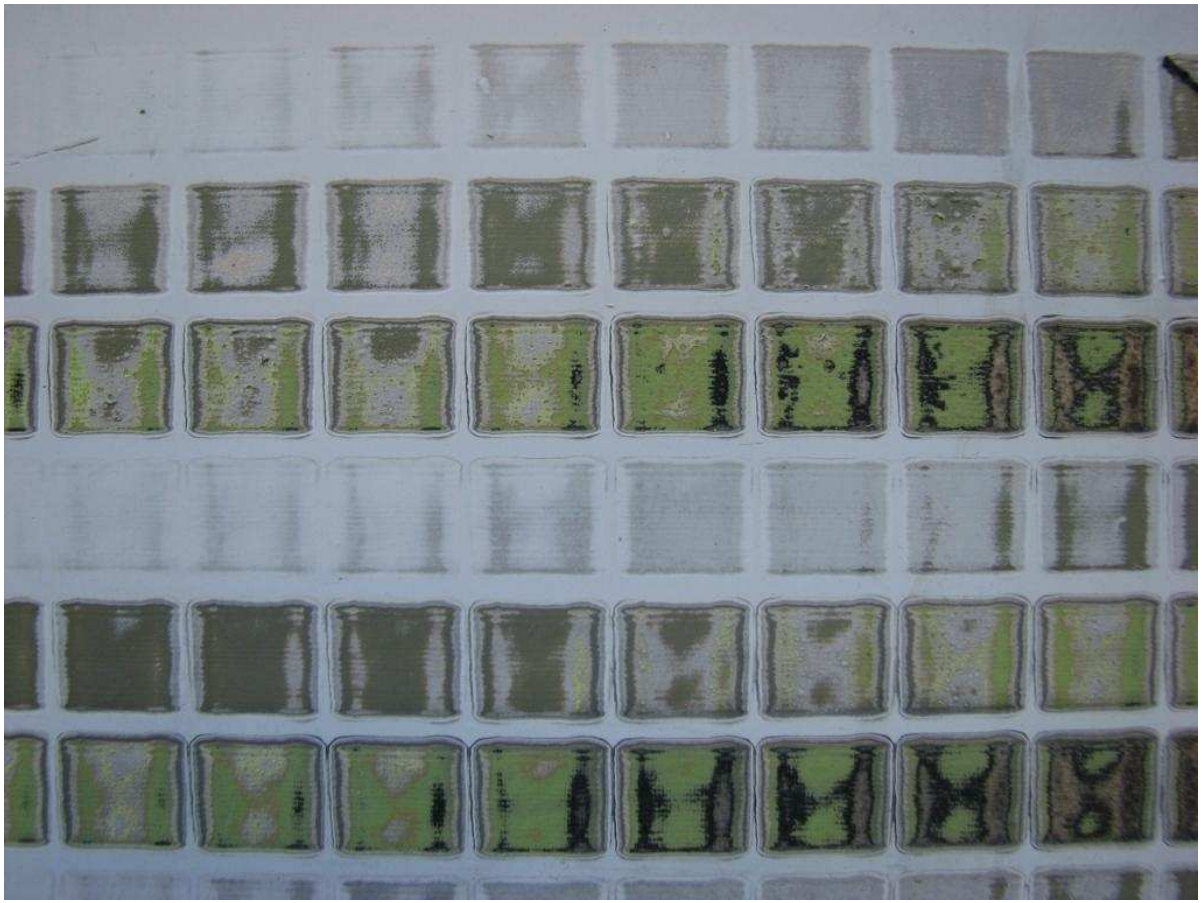
TEA CO_2 laser	
Pulse energy	**5 J**
Repetition rate	**300 Hz**
Average power	**1.5 kW**



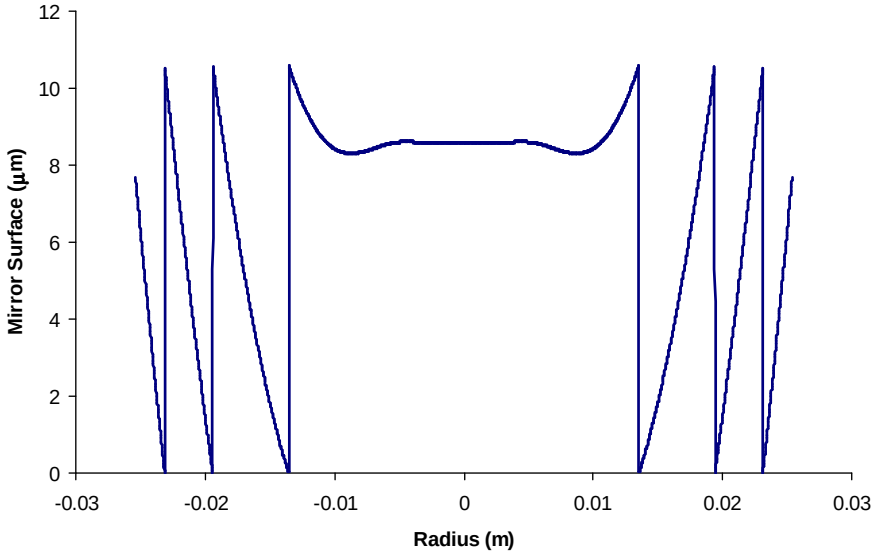
Single mode or multimode?

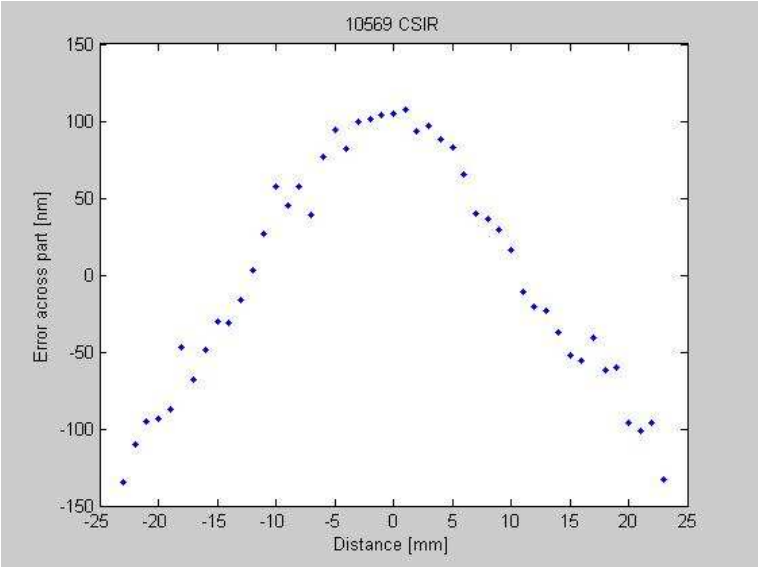


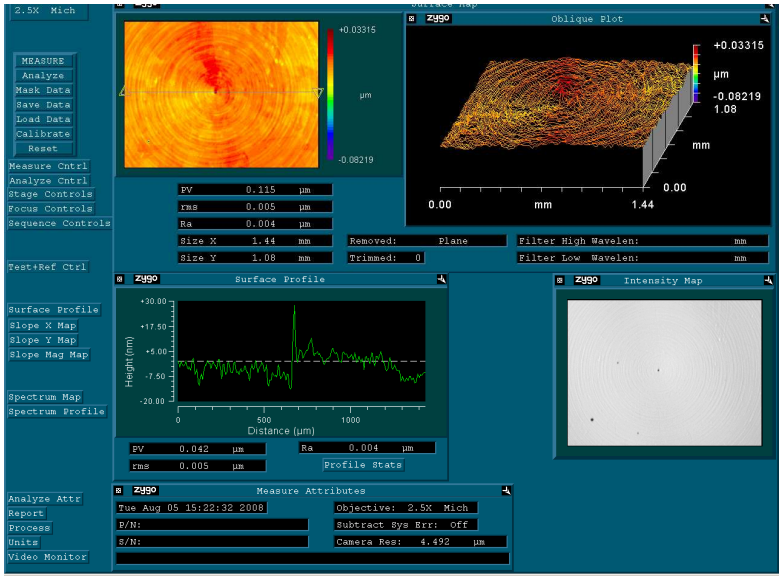


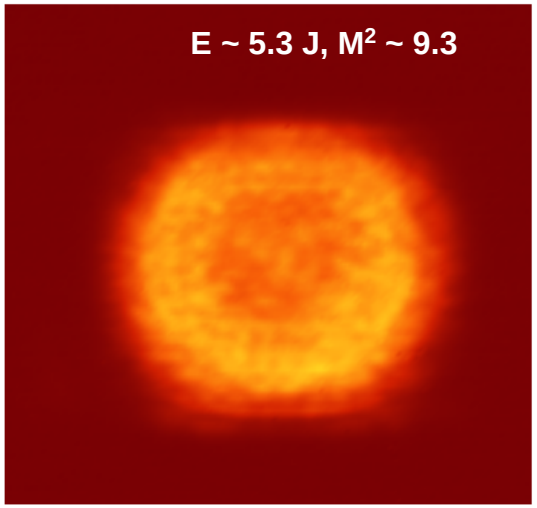


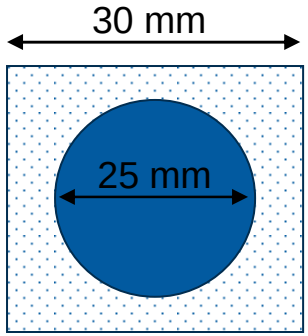
Design and fabrication of an intra-cavity DOE





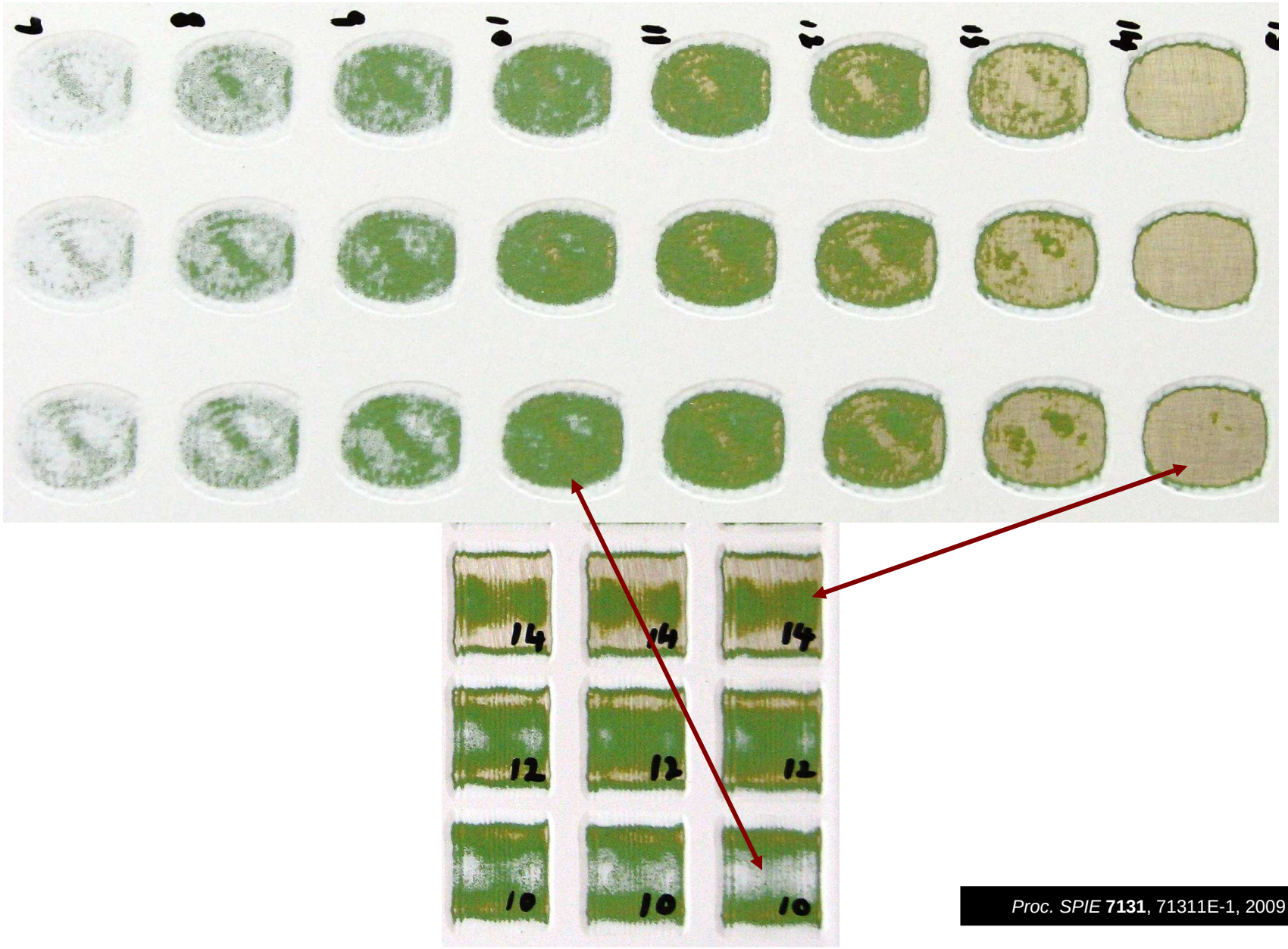






Proc. SPIE **7062**, 706210-1, 2008

Paint stripping improvement



Proc. SPIE **7131**, 71311E-1, 2009

Thank You

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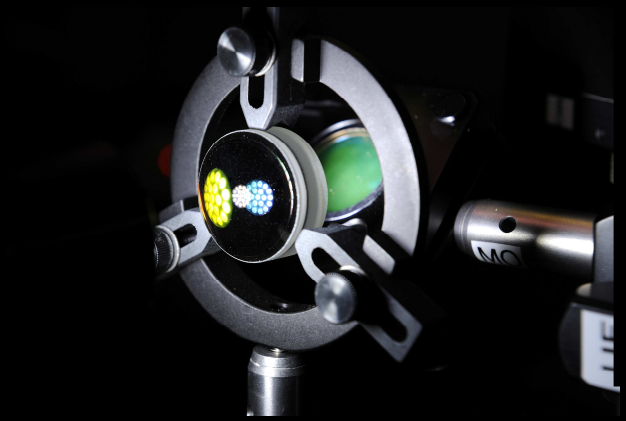

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