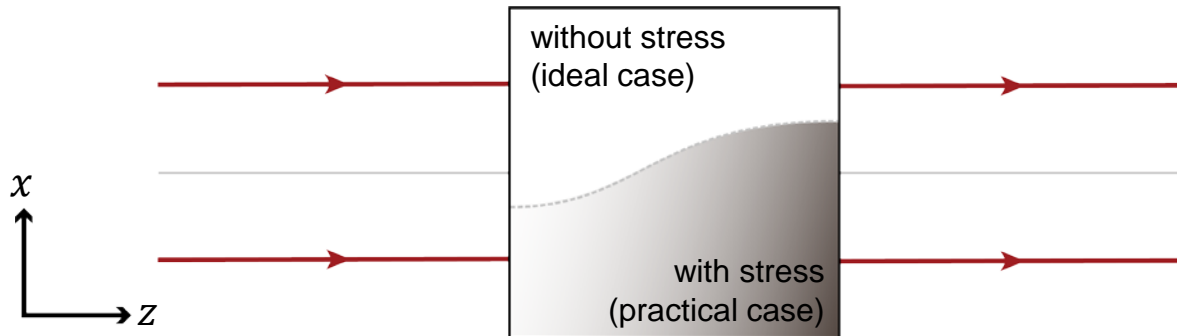


Laser Systems > Crystal Modeling

Stress-induced Birefringence in Laser Crystals

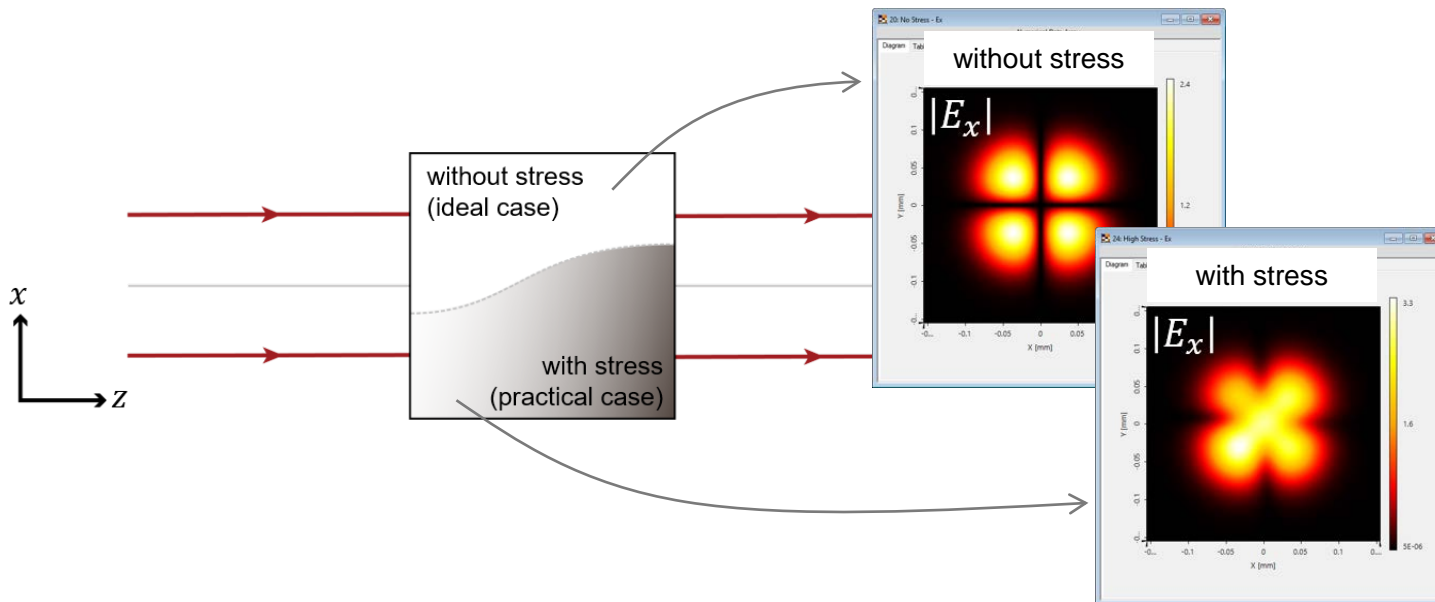
Task/System Illustration



analysis of stress-induced birefringence in laser crystals
and its influence on the beam propagating through it, e.g.
the change in polarization

Highlights

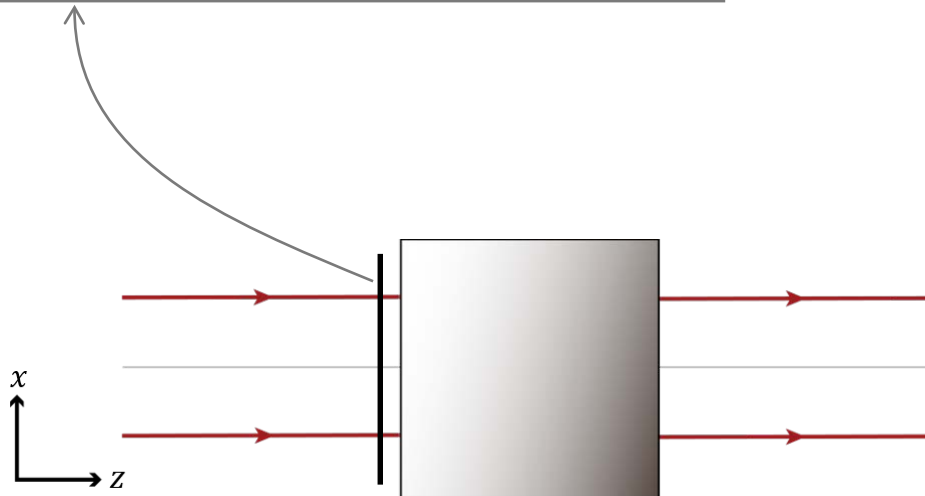
- import ANSYS stress analysis result
- inhomogeneity along beam path
- conversion from stress to optical birefringence
- full access to polarization analysis



Specification: Light Source

Input laser beam

wavelength	532nm
mode	Hermite (0, 0)
waist radius	$50\mu\text{m} \times 50\mu\text{m}$
polarization	linear along y -axis (90°)



Specification: Laser Crystal

Highlights

- import ANSYS stress analysis result
- inhomogeneity along beam path
- conversion from stress to optical birefringence
- full access to polarization analysis

Laser crystal

crystal type YAG (isotropic)

base ref. index (@ 532nm) 1.8415

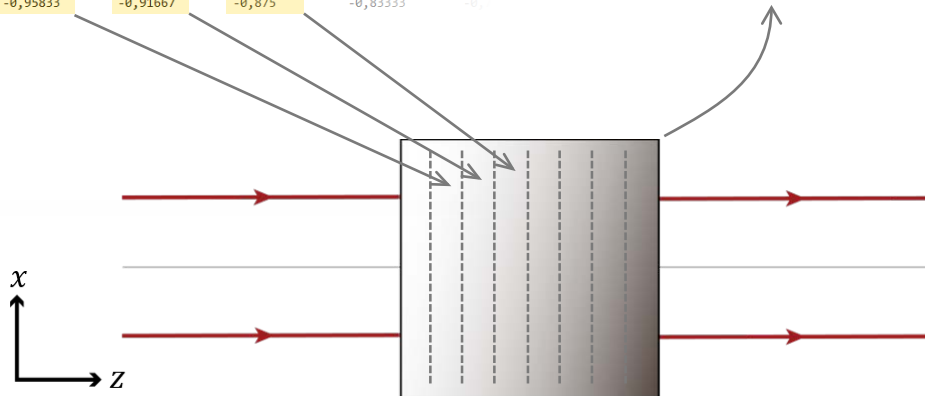
inhomogeneous stress distribution import from ANSYS (txt format)

photoelastic tensor 6×6 -matrix form

```

ANSYS_StressAnalysisData.txt - Notepad
File Edit Format View Help
Output stress by Ansys:
SX (Pa)      -9,00E+01    -8,81E+01    -8,62E+01    -8,43E+01    -8,22E+01    -8,01E+01
SY (Pa)      -1,59E+03    -1,58E+03    -1,58E+03    -1,57E+03    -1,56E+03    -1,55E+03
SZ (Pa)      4,83E-01    -3,18E+00    -6,84E+00    -1,17E+01    -1,75E+01    -2,33E+01
SXY (Pa)     -4,68E+00    -4,51E+00    -4,33E+00    -4,18E+00    -4,05E+00    -3,92E+00
SVZ (Pa)     -5,94E-01    -1,57E+01    -3,08E+01    -4,36E+01    -5,49E+01    -6,62E+01
SXZ (Pa)     -2,10E-03    -6,62E-02    -1,30E-01    -1,91E-01    -2,48E-01    -3,05E-01

X Coord (mm) 0          0          0          0          0          0
Y Coord (mm) 1,25       1,25       1,25       1,25       1,25       1,25
Z Coord (mm) -1         -0,95833  -0,91667  -0,875     -0,83333  -0,79167
    
```



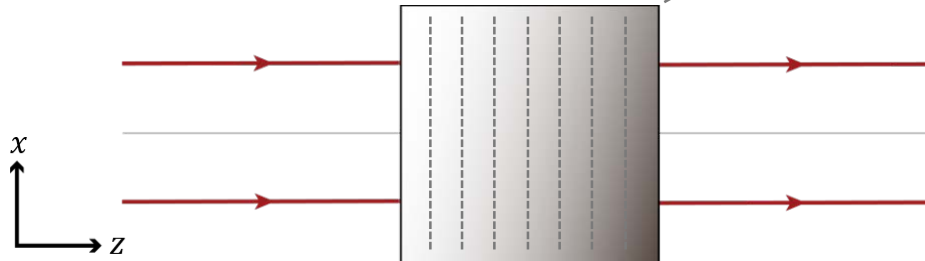
Specification: Laser Crystal

Highlights

- import ANSYS stress analysis result
- inhomogeneity along beam path
- conversion from stress to optical birefringence
- full access to polarization analysis

$$[\pi'_{mn}]^{m3m} = \begin{bmatrix} \pi'_{11} & \pi'_{12} & \pi'_{12} & 0 & 0 & 0 \\ \pi'_{12} & \pi'_{11} & \pi'_{12} & 0 & 0 & 0 \\ \pi'_{12} & \pi'_{12} & \pi'_{11} & 0 & 0 & 0 \\ 0 & 0 & 0 & \pi'_{44} & 0 & 0 \\ 0 & 0 & 0 & 0 & \pi'_{44} & 0 \\ 0 & 0 & 0 & 0 & 0 & \pi'_{44} \end{bmatrix}$$

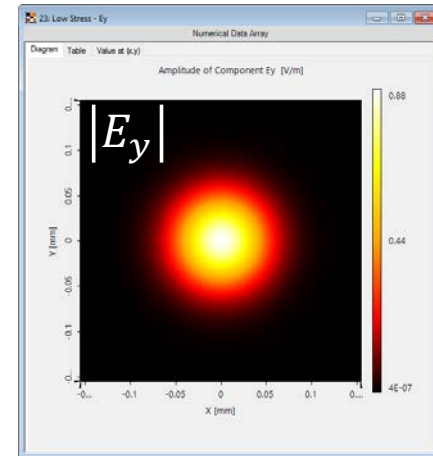
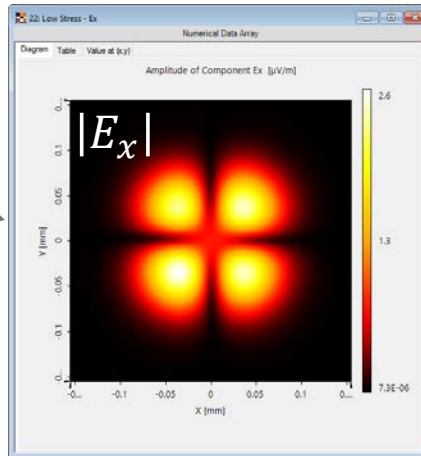
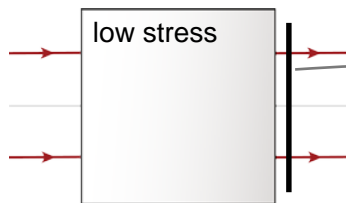
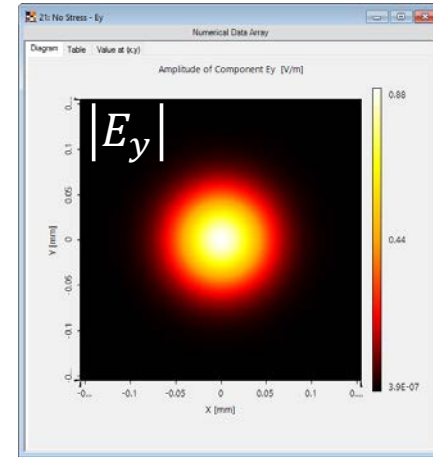
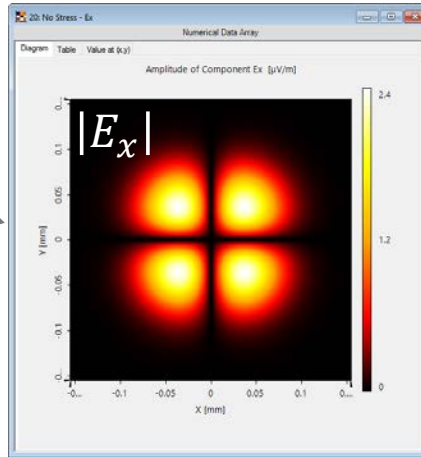
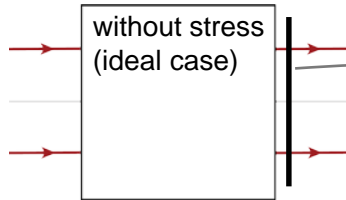
Equation from P. Ribes-Pleguezuelo *et al.*,
Opt. Express **25**, 5927-5940 (2017)



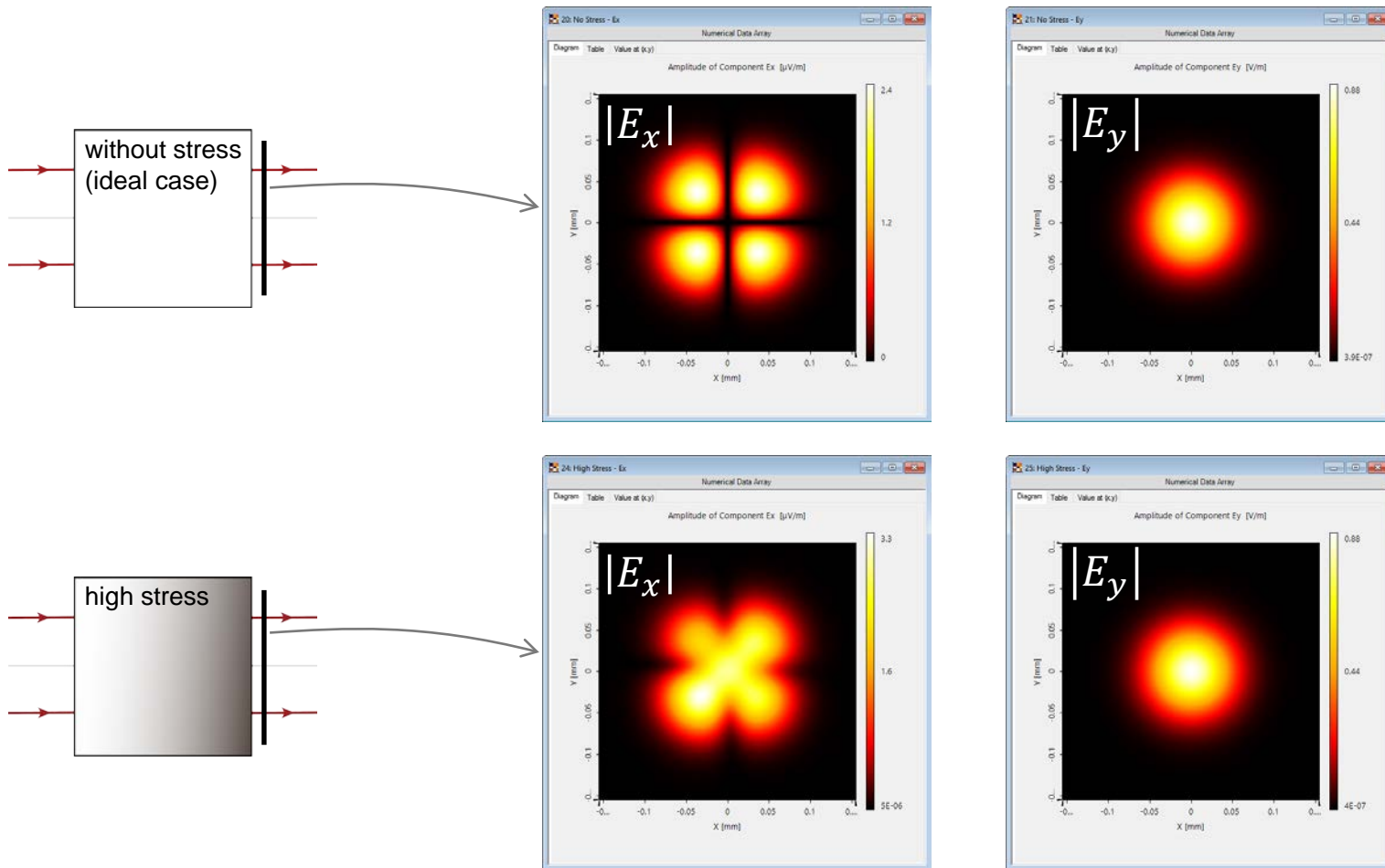
Laser crystal

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base ref. index (@ 532nm)	1.8415
inhomogeneous stress distribution	import from ANSYS (txt format)
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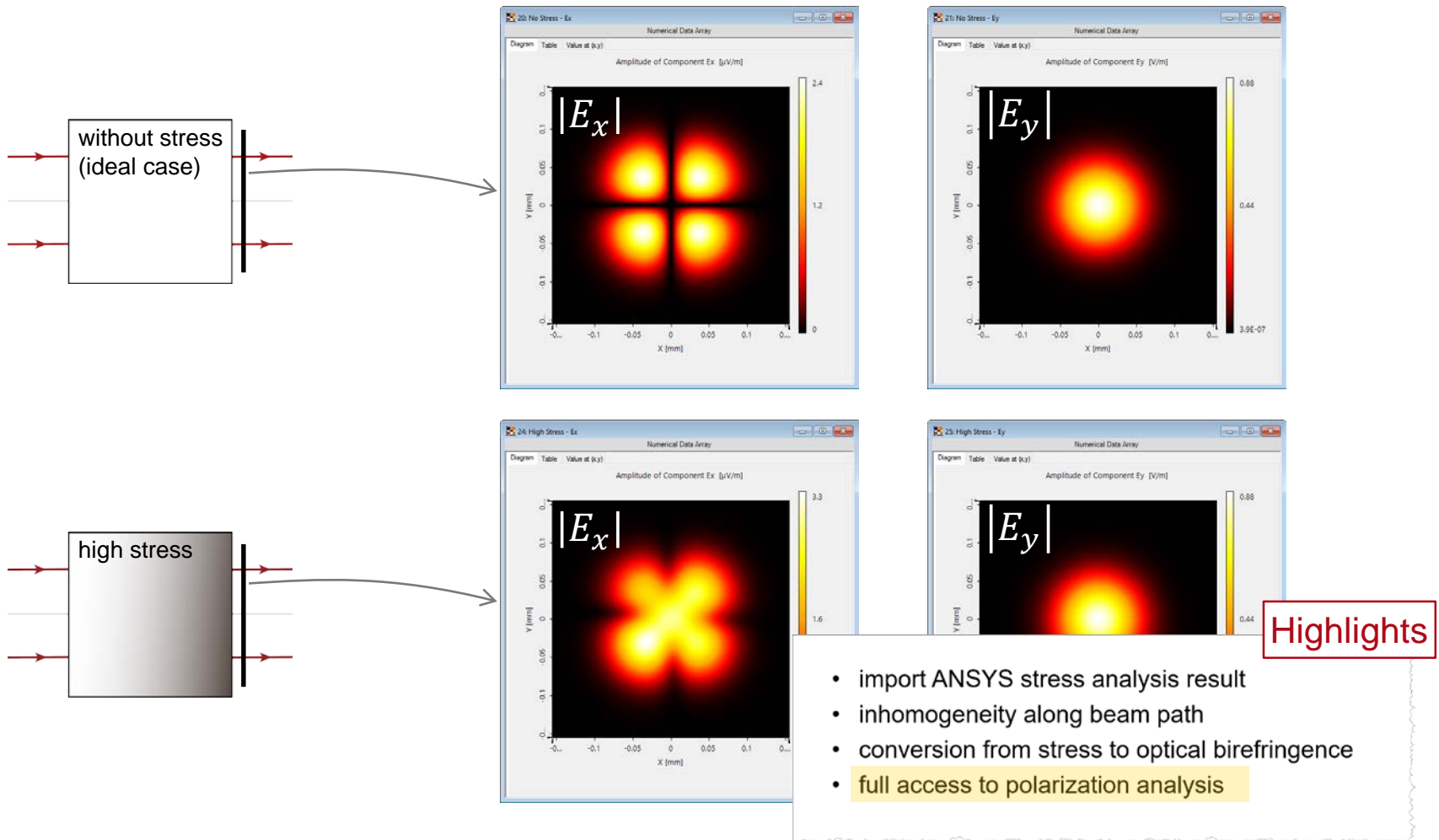
Results: Comparison with Low Stress



Results: Comparison with High Stress



Results



Document & Technical Info

code	CM.0003
version of document	1.1
title	Stress-induced Birefringence in Laser Crystals
category	Laser Systems > Crystal Modeling (CM)
created by	Site Zhang (LightTrans)
used VL version	7.0.3.4

Specifications of PC Used for Simulation

Processor	i7-4910MQ (4 CPU cores)
RAM	32 GB
Operating System	Windows 10