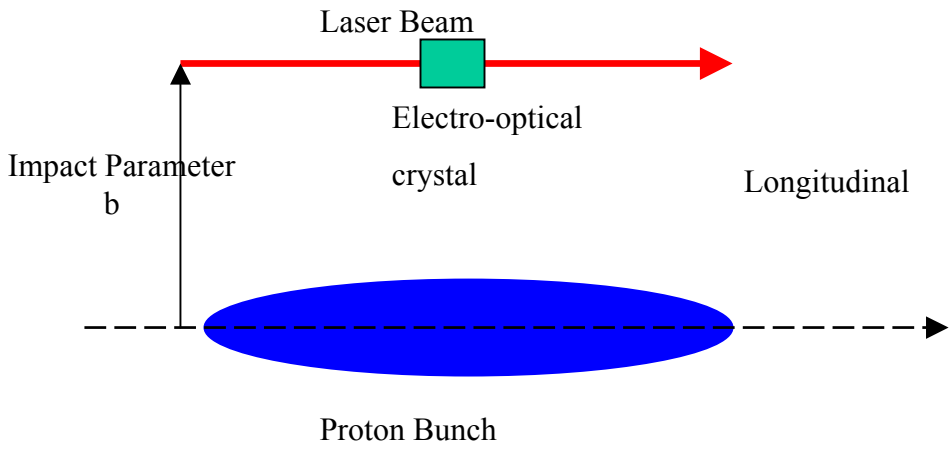
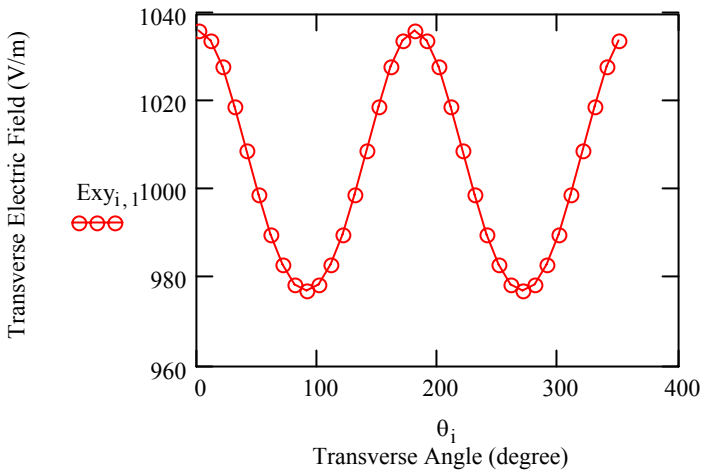
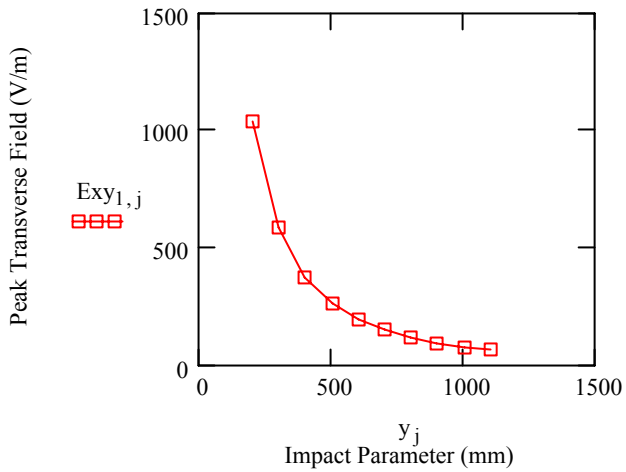
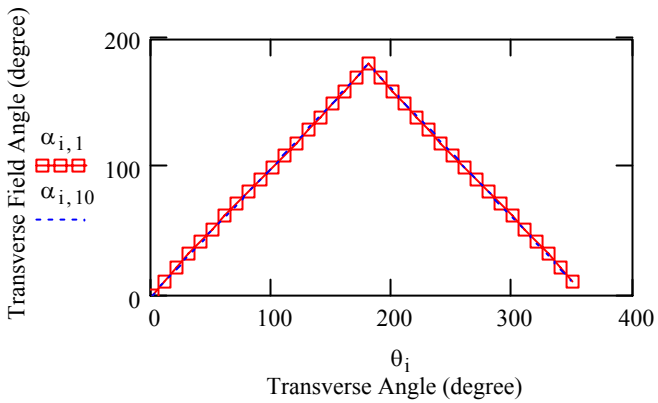
Study of employing laser for a transverse beam profile monitor

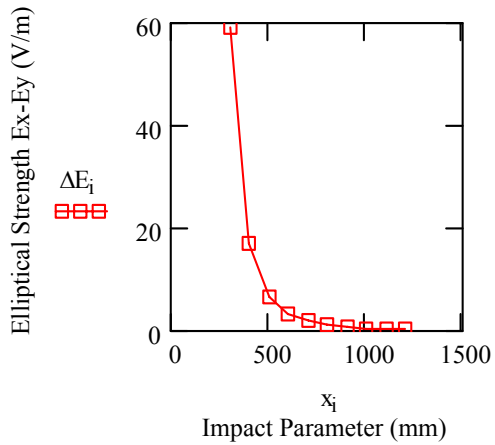


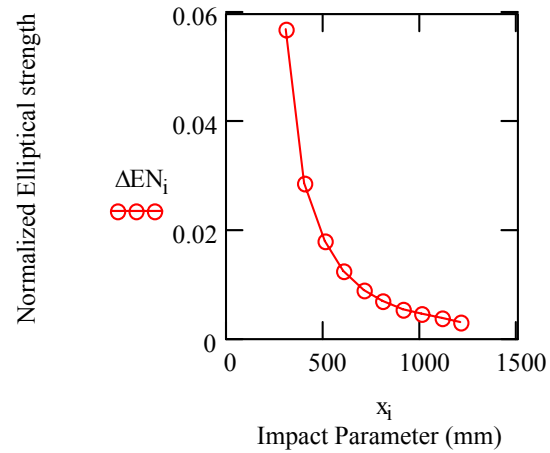
Injection, short: σx = 35.3 mm, σy = 14.0 mm, bunch length 1.2 m, bunch charge 9.6 nC





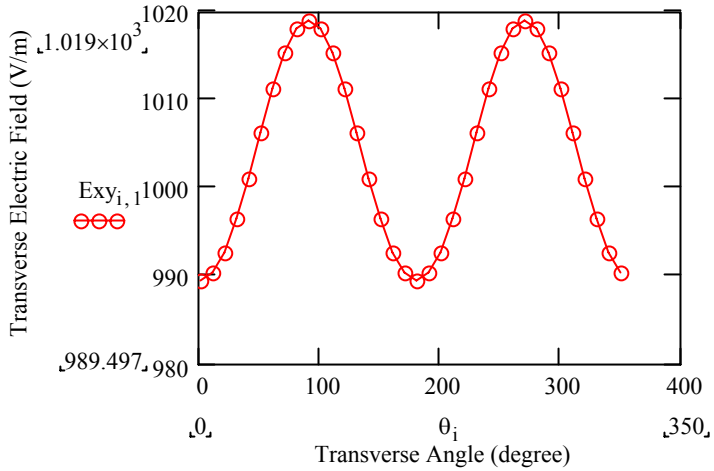


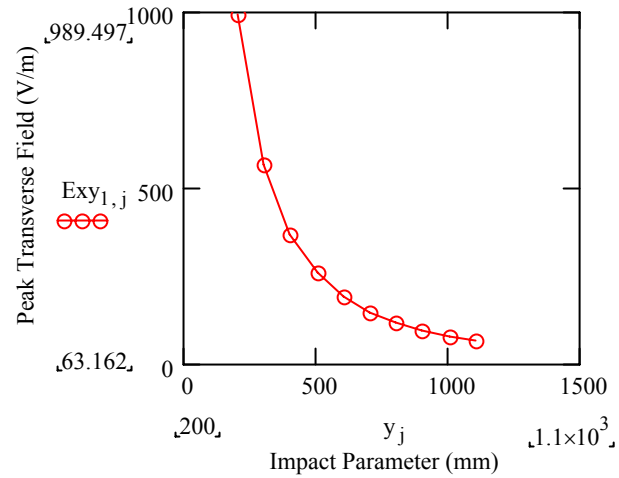


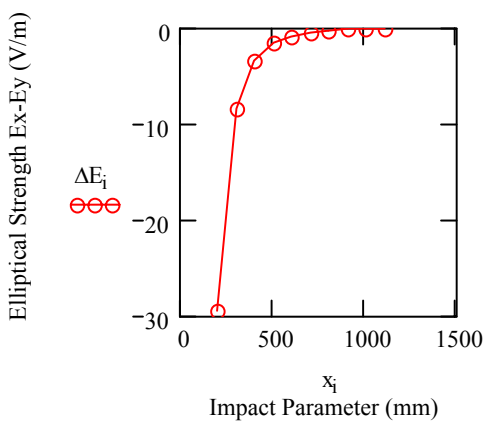


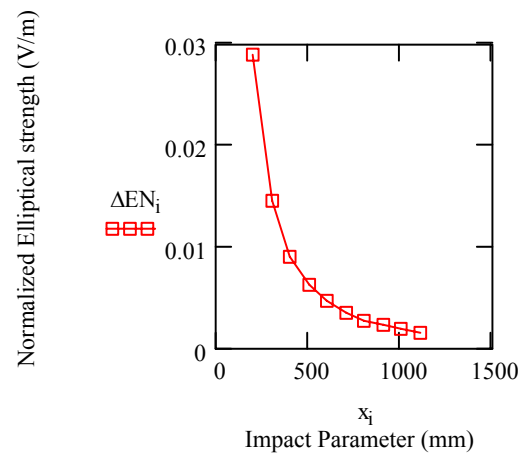
- Example using $BaTiO_3$
- Impact Parameter b = 200 mm
- $\theta x - \theta y \propto (2\pi/\lambda) \times p \times (Ex - Ey) \times L$
- where $\lambda = 1.054\ \mu m$
- $p = 0.5 \times (2.3)^3 \times 1920 \times 10^{-12}$ (m/V)
- Ex-Ey = 60 (V/m)
- L = 5 mm, $\theta x - \theta y$ is about 1.2°
- at Y- signal is about $I \times \sin^2(\theta x - \theta y) \approx 0.04\ \mu J$ when $I = 100\ \mu J$

Injection, long: σx = 15.1 mm, σy = 27.5 mm, bunch length 1.2 m, bunch charge 9.6 nC



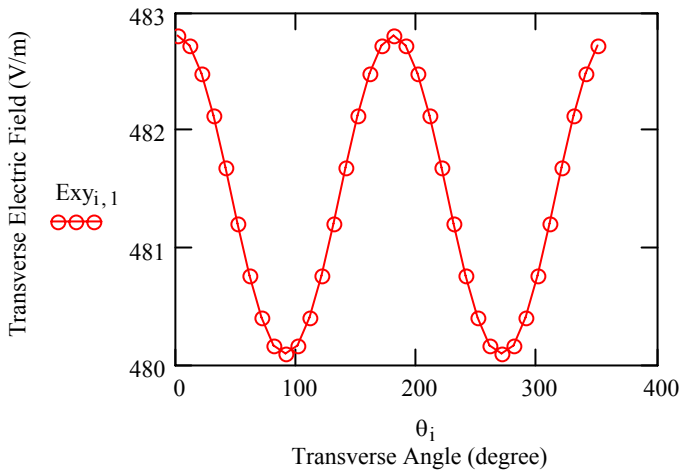


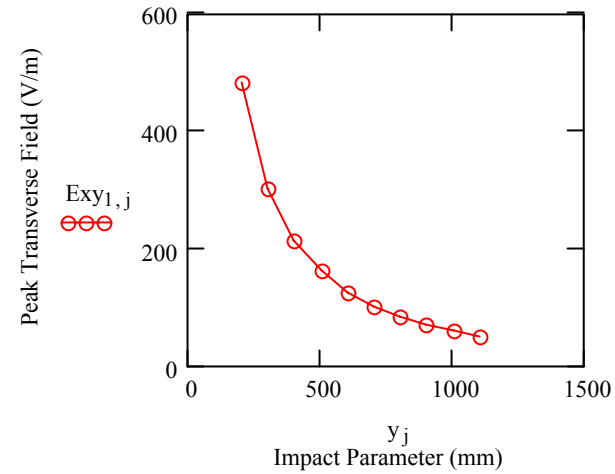


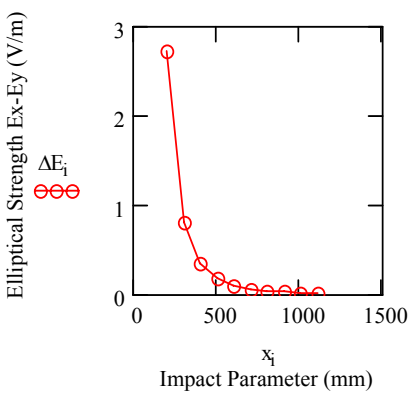


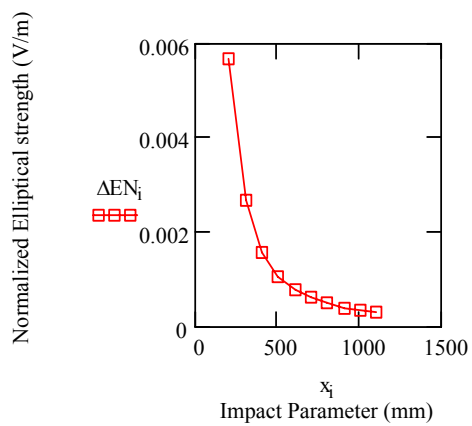
- Example using BaTiO3
- Impact Parameter b = 200 mm
- $\theta x-\theta y \propto (2\pi/\lambda)\times p\times(Ex-Ey)\times L$
- where $\lambda = 1.054\ \mu m$
- $p = 0.5\times(2.3)^3\times1920\times10^{-12}$ (m/V)
- Ex-Ey =-30 (V/m)
- L = 5 mm, θx-θy is about -0.6°
- at Y- signal is about $I\times\sin^2(\theta x-\theta y) \approx 0.01\ \mu J$ when $I = 100\ \mu J$

Extraction, short: σx = 11.6 mm, σy = 4.6 mm, bunch length 3 m, bunch charge 9.6 nC



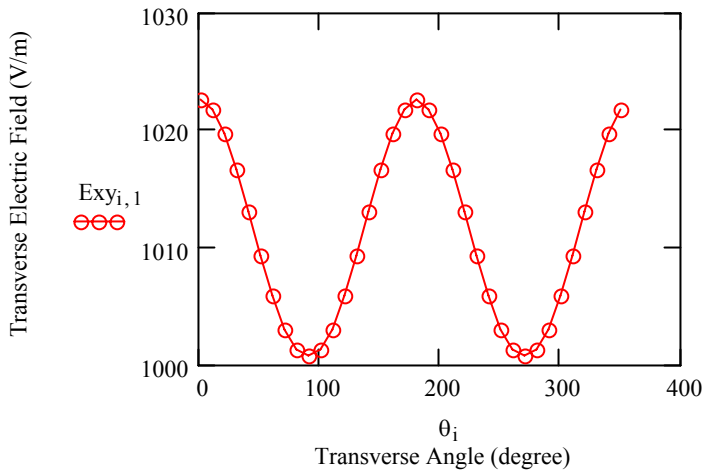


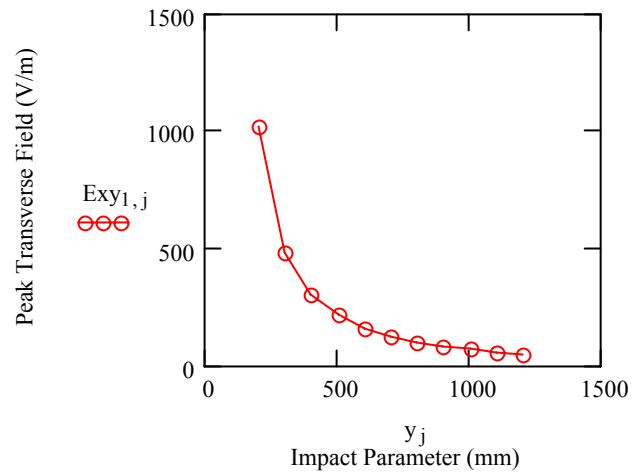


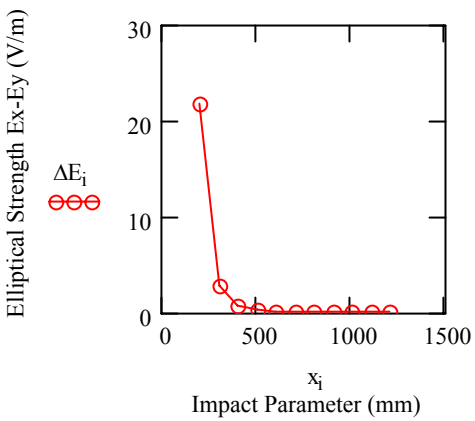


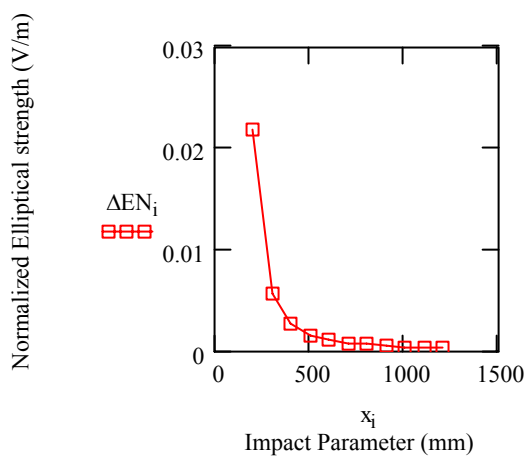
- Example using BaTiO3
- Impact Parameter b = 200 mm
- $\theta x\text{-}\theta y \propto (2\pi/\lambda)\times p\times(Ex\text{-}Ey)\times L$
- where $\lambda = 1.054\ \mu m$
- $p = 0.5\times(2.3)^3\times1920\times10^{-12}$ (m/V)
- Ex-Ey = 3 (V/m)
- L = 5 mm, θx-θy is about 0.06°
- at Y- signal is about $I\times\sin^2(\theta x\text{-}\theta y) \approx 0.1$ nJ when I = 100 μJ
- If we put crystal 100 mm away from the center of the particle beam, Ex-Ey = 12 (V/m), θx-θy is about 0.24°, at Y- signal is about $I\times\sin^2(\theta x\text{-}\theta y) \approx 1.8$ nJ when I = 100 μJ

Extraction, long: σx = 4.94 mm, σy = 9.03 mm, bunch length 3 m, bunch charge 9.6 nC

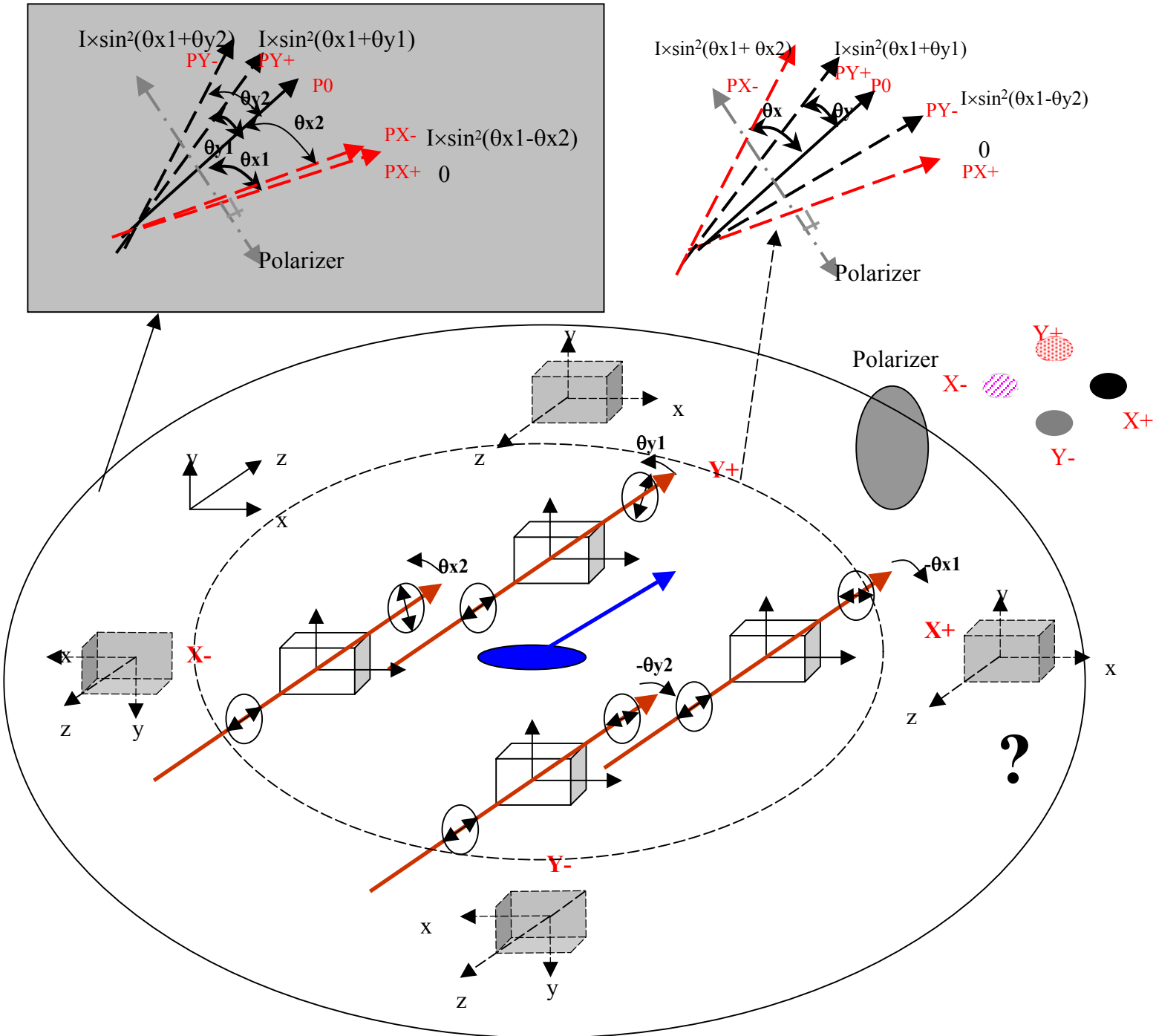








- Example using BaTiO3
- Impact Parameter b = 100 mm
- $\theta x - \theta y \propto (2\pi/\lambda) \times p \times (Ex-Ey) \times L$
- where $\lambda = 1.054\ \mu m$
- $p = 0.5 \times (2.3)^3 \times 1920 \times 10^{-12}$ (m/V)
- Ex-Ey = 22 (V/m)
- L = 5 mm, θx-θy is about 0.44°
- at Y- signal is about $I \times \sin^2(\theta x - \theta y) \approx 5.9$ nJ when I = 100 μJ


I×sin²(θx1+θy2)
I×sin²(θx1+θy1)
PY-
PY+
P0
θy2
θx2
θy1
θx1
PX-
I×sin²(θx1-θx2)
PX+
0
Polarizer
I×sin²(θx1+ θx2)
I×sin²(θx1+θy1)
PX-
PY+
P0
θx
θy
PY-
I×sin²(θx1-θy2)
0
PX+
Polarizer
Polarizer
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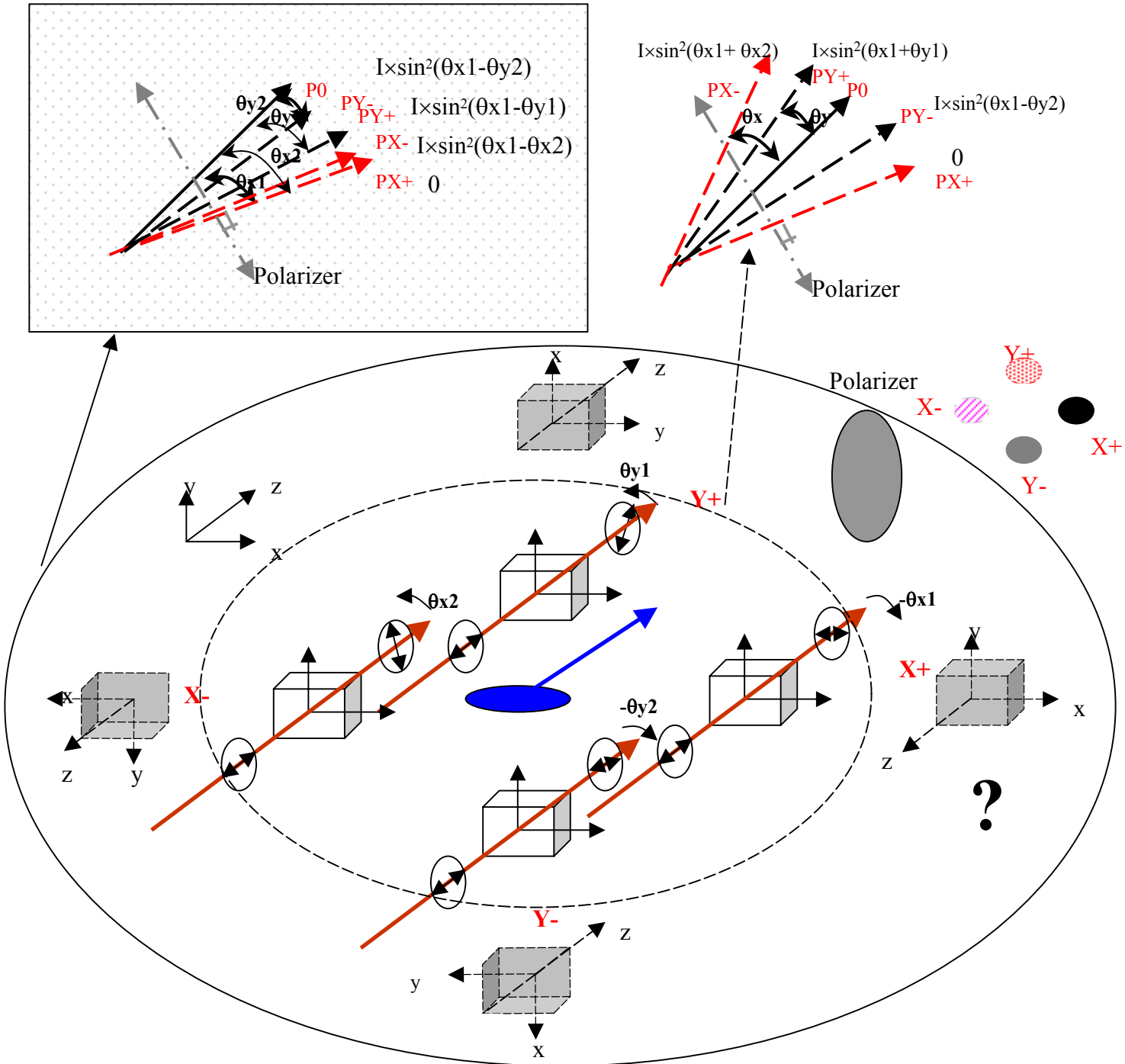
θy1
Y+
θx2
θx1
X-
X+
-θy2
Y-
?


I×sin²(θx1-θy2)
P0
θy2
θy1
PY-
PY+
I×sin²(θx1-θy1)
PX-
I×sin²(θx1-θx2)
θx2
θx1
PX+
0
Polarizer
I×sin²(θx1+ θx2)
I×sin²(θx1+θy1)
PX-
PY+
P0
θx
θy
PY-
I×sin²(θx1-θy2)
0
PX+
Polarizer
Polarizer
Y+
X-
X+
Y-
θy1
Y+
θx2
-θx1
X-
X+
-θy2
Y-
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