```
In[ ]:= ClearAll["Global`*"];

In[ ]:= $Version
Out[ ]= 12.3.0 for Mac OS X x86 (64-bit) (May 10, 2021)

In[ ]:= SetDirectory[NotebookDirectory[]];
```

Crossed-polarization (CP) optical microscopy intensity calculation

A. Input

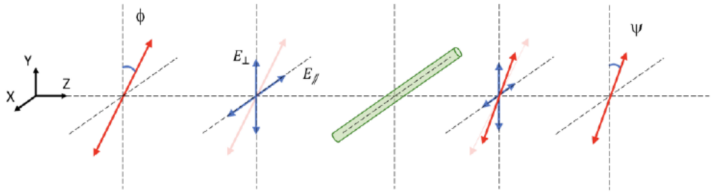
B. Optical properties

C. Light properties after passing through a single CNC (add figure)

- Electric field, intensity and polarization angle as a function of the polarization angle with respect to the CNC angle

(* Supplementary Figure 8a *)

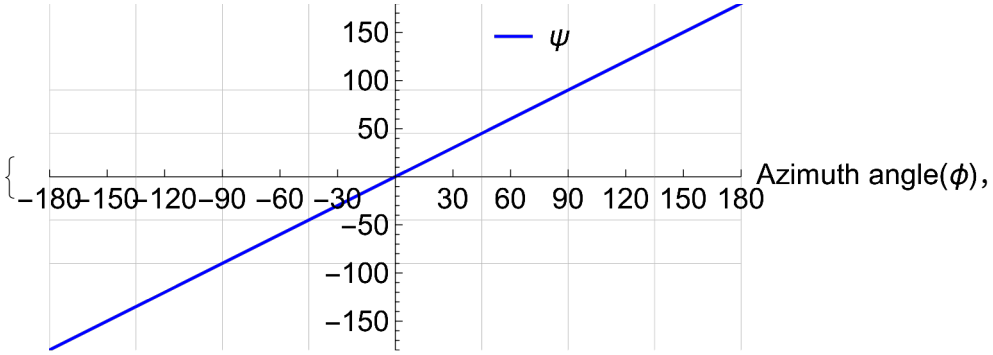
Ep = $E_{\parallel}$, Es = $E_{\perp}$



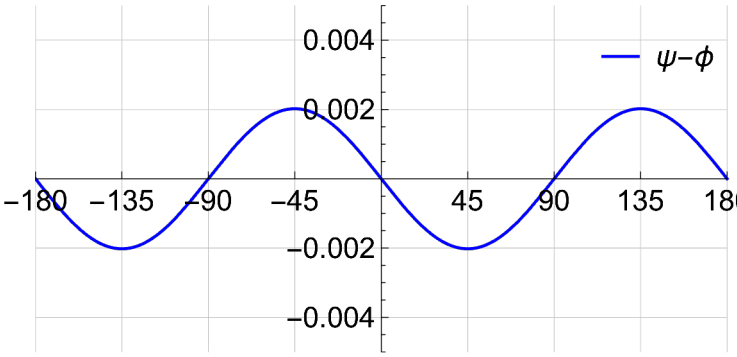
In[•]:=
```
(*ϵ= ~0 *)
ϵ = 10^-9;
Θ = ϵ(*deg*);

(*Incident beam Ep0, Es0, Ip0, Is0*)
Ep0[ϕ_] := 1 Sin[ϕ * (π / 180)];
Es0[ϕ_] := 1 Cos[ϕ * (π / 180)];
Ip0[ϕ_] := Ep0[ϕ]^2;
Is0[ϕ_] := Es0[ϕ]^2;

(* Output beam- Ep1, Es1, Ip1, Is1 after a single CNC *)
Ep[ϕ_] := Ep0[ϕ] * t123p[[8]];(*[[8]]=600nm *)
Es[ϕ_] := Es0[ϕ] * t123s[[8]];(*[[8]]=600nm *)
Ip[ϕ_] := Ep[ϕ] * Conjugate[Ep[ϕ]];
Is[ϕ_] := Es[ϕ] * Conjugate[Es[ϕ]];

(* Output beam- ψ, (ψ-ϕ) (ϕ dependence) *)
ψ[ϕ_] := Piecewise[{
   {ArcTan[Sqrt[Ep[ϕ] * Conjugate[Ep[ϕ]]] / Sqrt[Es[ϕ] * Conjugate[Es[ϕ]]]] * 180/π - 180,
    ϕ < -90},
   {ArcTan[Sqrt[Ep[ϕ] * Conjugate[Ep[ϕ]]] / -Sqrt[Es[ϕ] * Conjugate[Es[ϕ]]]] * 180/π + 180,
    ϕ > 90},
   {ArcTan[Sqrt[Ep[ϕ] * Conjugate[Ep[ϕ]]] / Sqrt[Es[ϕ] * Conjugate[Es[ϕ]]]] * 180/π, ϕ > 0},
   {ArcTan[Sqrt[Ep[ϕ] * Conjugate[Ep[ϕ]]] / -Sqrt[Es[ϕ] * Conjugate[Es[ϕ]]]] * 180/π, ϕ > -90}
  }](* ψ=tan^-1[E∥/E⊥] - Equation 3 *)

(*Output beam |Etot| and Itot*)
Et[ϕ_] := Sqrt[Ep[ϕ] * Conjugate[Ep[ϕ]] + Es[ϕ] * Conjugate[Es[ϕ]]];
(* |E_total| = Sqrt[E∥*E∥* + E⊥*E⊥*] - Equation 4 *)
It[ϕ_] := Et[ϕ] * Conjugate[Et[ϕ]];

(*transmission coefficient*)
tt[ϕ_] := Et[ϕ] / 1;
```

In[ ]:=
```
(*check plots*)
{Plot[ψ[ϕ], {ϕ, -180, 180}, PlotRange → {{-180, 180}, {-180, 180}},
  Ticks → {Table[30 i, {i, -12, 12}], Automatic},
  GridLines → {Table[45 i, {i, -4, 4}], {-90, -45, 45, 90}},
  PlotLegends → Placed[{"ψ"}, {0.7, 0.9}], PlotStyle → {Blue},
  AxesLabel → {"Azimuth angle(ϕ)", None}, ImageSize → 500, AspectRatio → 1 / 2,
  LabelStyle → {FontFamily → "Arial", FontSize → 15, Black}],
 Plot[{ψ[ϕ] - ϕ}, {ϕ, -180, 180}, PlotRange → {{-180, 180}, {-0.005, 0.005}},
  Ticks → {Table[45 i, {i, -12, 12}], Automatic},
  GridLines → {Table[45 i, {i, -12, 12}], Automatic},
  PlotLegends → Placed[{"ψ-ϕ"}, {0.9, 0.85}], PlotStyle → {Blue},
  AxesLabel → {"Azimuth angle(ϕ)", None}, ImageSize → 500, AspectRatio → 1 / 2,
  LabelStyle → {FontFamily → "Arial", FontSize → 15, Black}]
  (* Supplementary Figure 8b *)
}

{Plot[Et[ϕ], {ϕ, -180, 180}, PlotRange → {{-180, 180}, All},
  Ticks → {Table[30 i, {i, -12, 12}], Automatic},
  GridLines → {Table[45 i, {i, -12, 12}], Automatic},
  PlotLegends → Placed[{"|Et|"}, {0.84, 0.87}], PlotStyle → {Blue},
  AxesLabel → {"  Azimuth ang(ϕ)", None}, ImageSize → 500, AspectRatio → 1 / 2,
  LabelStyle → {FontFamily → "Arial", FontSize → 15, Black}]
  (* Supplementary Figure 8c *),
 Plot[It[ϕ], {ϕ, -180, 180}, PlotRange → {{-180, 180}, All},
  Ticks → {Table[30 i, {i, -12, 12}], Automatic},
  GridLines → {Table[45 i, {i, -12, 12}], Automatic},
  PlotLegends → Placed[{"It"}, {0.84, 0.87}], PlotStyle → {Blue},
  AxesLabel → {"  Azimuth ang(ϕ)", None}, ImageSize → 500, AspectRatio → 1 / 2,
  LabelStyle → {FontFamily → "Arial", FontSize → 15, Black}]}

Plot[tt[ϕ], {ϕ, -180, 180}, PlotRange → {{-180, 180}, All},
 Ticks → {Table[30 i, {i, -12, 12}], Automatic},
 GridLines → {Table[45 i, {i, -12, 12}], Automatic},
 PlotLegends → Placed[{"ttot"}, {0.84, 0.87}], PlotStyle → {Blue},
 AxesLabel → {"  Azimuth ang(ϕ)", None}, ImageSize → 500, AspectRatio → 1 / 2,
 LabelStyle → {FontFamily → "Arial", FontSize → 15, Black}]
```

Out[•]=

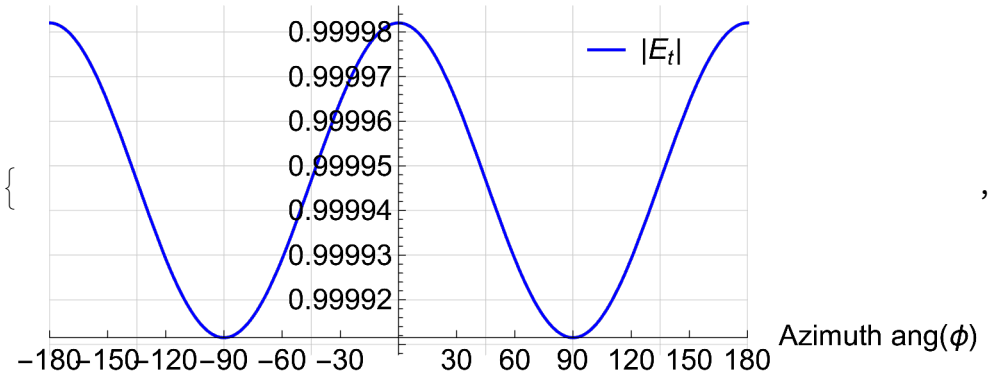


Azimuth angle(ϕ),



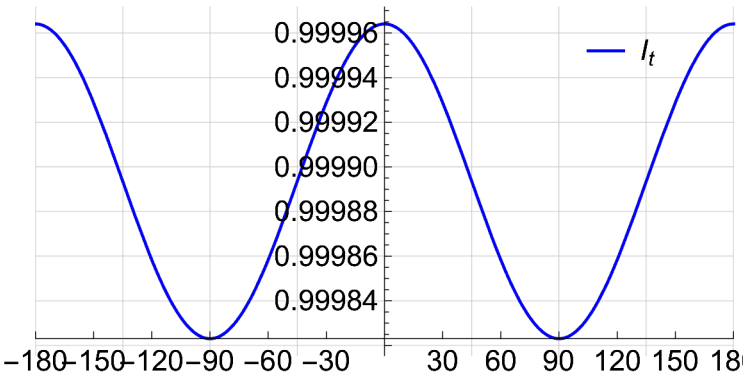
Azimuth angle(ϕ)}

Out[•]=



Azimuth ang(ϕ)

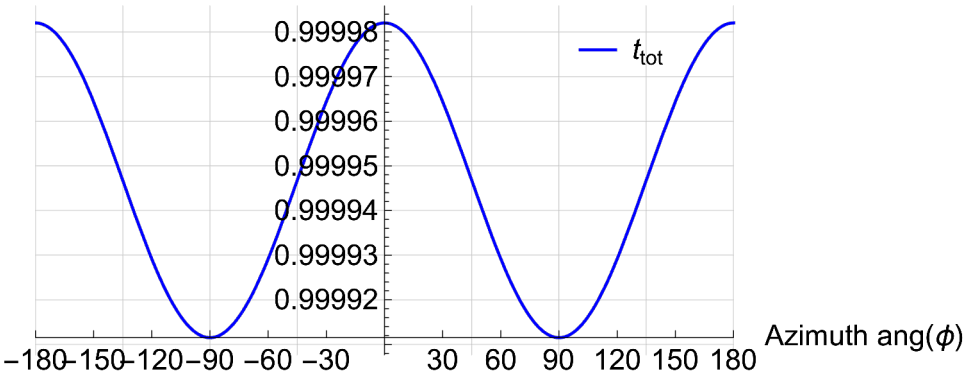
,



Azimuth ang(ϕ)

}

Out[•]=



D. 100 CNC angle generation for the five CMF organizations: crossed-polylamellate, random, helicoidal (10°), uniaxial, and biomodal.

E. Light properties after the 100 CNC organizations - Loop1 for each organization

In[•]:=
```
ϕi = 0;(* the initial polarization direction of the incident beam w.r.t. y-axis *)
(*0 deg was chosen as an example - Supplementary Figure 8 *)
ϕi = ϕi + ϵ;(* ϵ is a small number, 10^-9 *)
```

1) Cross-polylamellate

Storage

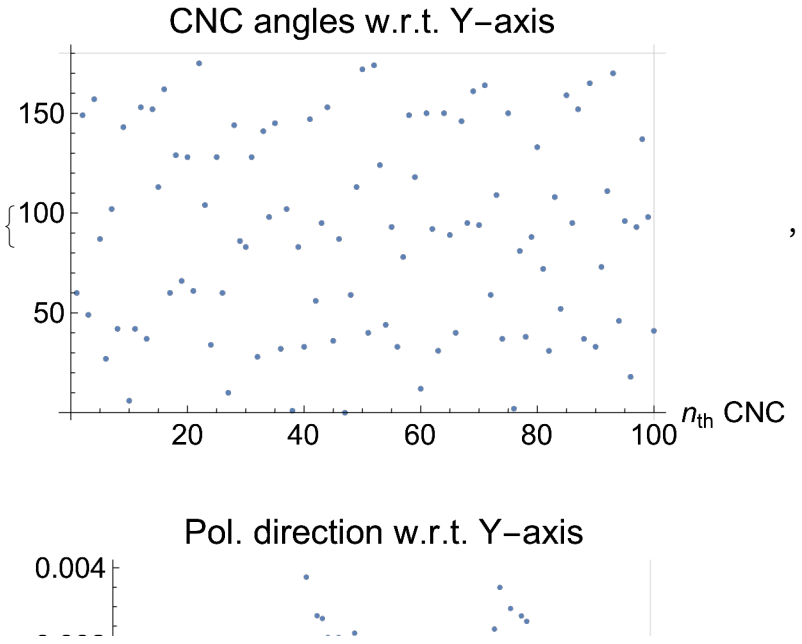
Loop

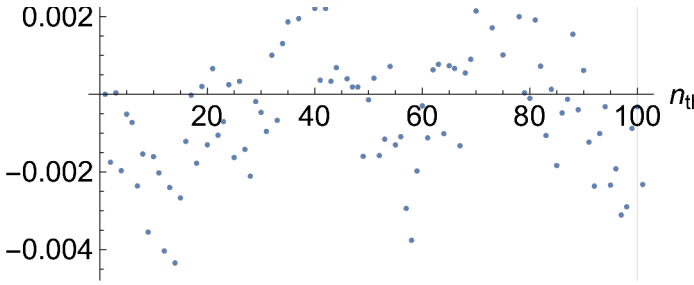
In[•]:=
```
For[p = 1, p < n + 1, p++,

 ϕbtn[[p]] = ψy[[p]] - ϕcl180Norm[[p]]; (* convert axis: From y-axis to CNC normal *)
 ψres[[p]] = ψ[ϕbtn[[p]]]; (* result of rotation in CNC normal axis*)
 ψy[[p + 1]] = ψres[[p]] + ϕcl180Norm[[p]];
 (* back to y-axis system*) (*F180 is for *)

 dψ[[p]] = ψres[[p]] - ϕbtn[[p]]; (* (ψafter - ψbefore) in CNC axis *)

 ttot[[p]] = tt[ϕbtn[[p]]];
 Etot[[p + 1]] = Etot[[p]] * ttot[[p]]; (* energy loss as passing through *)

 dψ2[[p]] = ψy[[p + 1]] - ψy[[p]];
 (* (ψafter - ψbefore) in CNC axis. How much rotation @ each CNC*)
]
PI = (Etot[[n + 1]] * Sin[(ψy[[n + 1]] - ϕ1) * π/180])^2; (* I=(|E_total|*sinψ)^2 - Equation 5 *)
```

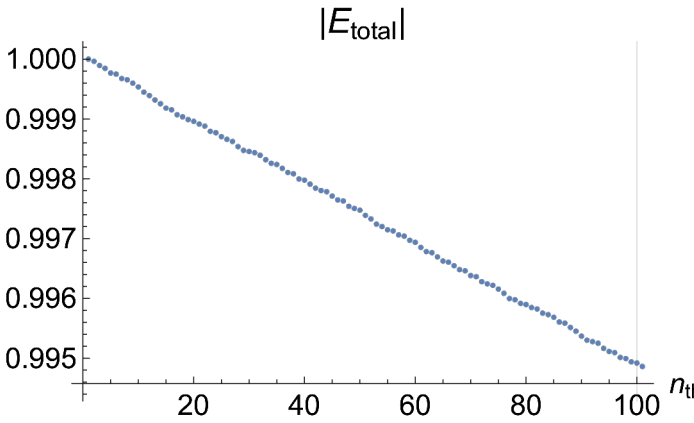
Check plots and final intensity (Supplementary Figure 8e,f here)

In[ ]:=
```
{ListPlot[ϕcl180, ImageSize → 400, PlotRange → All, AxesLabel → {"n_th CNC", None},
  LabelStyle → {FontFamily → "Arial", FontSize → 15, Black},
  GridLines → {{100}, {180}}, AxesOrigin → {0, 0},
  PlotLabel → "CNC angles w.r.t. Y-axis"](* Supplementary Figure 8e *),
 ListPlot[ψy, ImageSize → 400, PlotRange → All,
  LabelStyle → {FontFamily → "Arial", FontSize → 15, Black},
  AxesLabel → {"n_th CNC", None}, PlotLabel → "Pol. direction w.r.t. Y-axis",
  GridLines → {{100}, None}](* Supplementary Figure 8f *),
 ListPlot[Etot, ImageSize → 400, PlotRange → All,
  LabelStyle → {FontFamily → "Arial", FontSize → 15, Black},
  AxesLabel → {"n_th CNC", None}, PlotLabel → "|E_total|", GridLines → {{100}, None}],
 ListPlot[(dψ), ImageSize → 400, PlotRange → All, LabelStyle →
   {FontFamily → "Arial", FontSize → 15, Black}, AxesLabel → {"n_th CNC", None},
  PlotLabel → "Rotation (ψ-ψ0)", GridLines → {{100}, None}]}
{ListPlot[ϕbtn, ImageSize → 400, LabelStyle →
   {FontFamily → "Arial", FontSize → 15, Black}, AxesLabel → {"n_th CNC", None},
  PlotLabel → "Pol. direction w.r.t. CNC normal (before)",
  GridLines → {{100}, None}],
 ListPlot[ψres, ImageSize → 400, LabelStyle →
   {FontFamily → "Arial", FontSize → 15, Black}, AxesLabel → {"n_th CNC", None},
  PlotLabel → "Pol. direction w.r.t. CNC normal (after)",
  GridLines → {{100}, None}]}

Print["E_total after 100th CNC=", Etot[[n + 1]]]
Print["Final intensity after the 2nd polarizer=", PI]
```

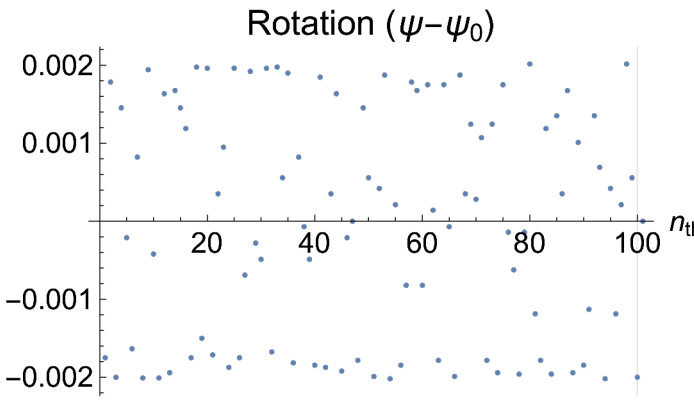
Out[ ]=




0.002
−0.002
−0.004
20
40
60
80
100
n_{th} CNC'

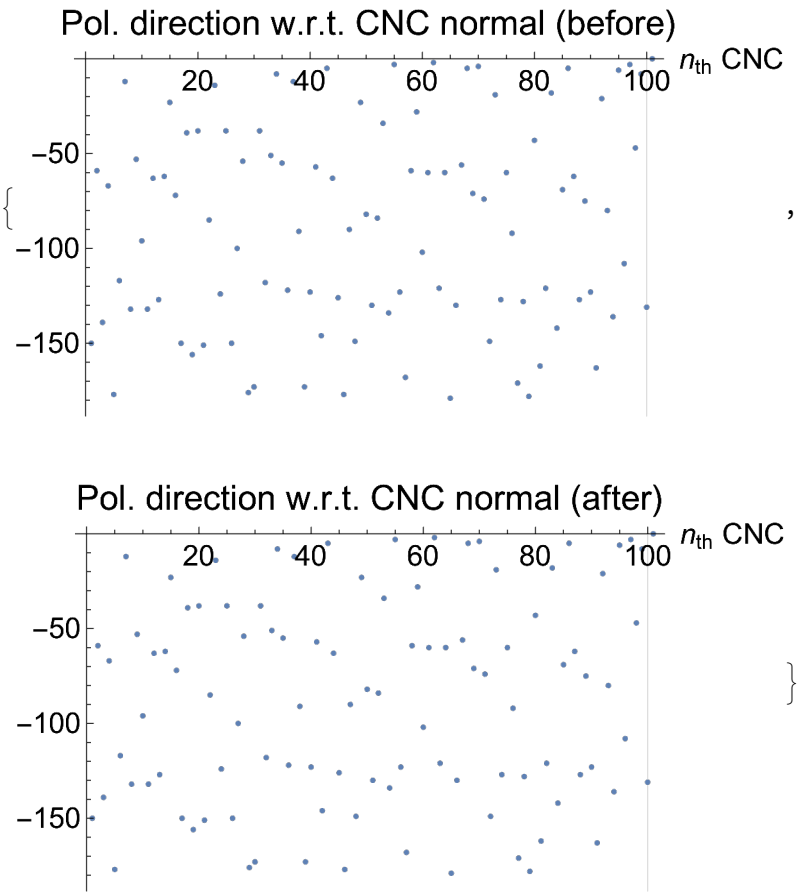

$|E_{total}|$
1.000
0.999
0.998
0.997
0.996
0.995
20
40
60
80
100
n_{th} CNC

,


Rotation $(\psi-\psi_0)$
0.002
0.001
−0.001
−0.002
20
40
60
80
100
n_{th} CNC

}

Out[•]=



E_{total} after 100th CNC=0.994861 + 0. i

Final intensity after the 2nd polarizer=0.742347 + 0. i

Check numbers after each CNC

2) Random

Storage

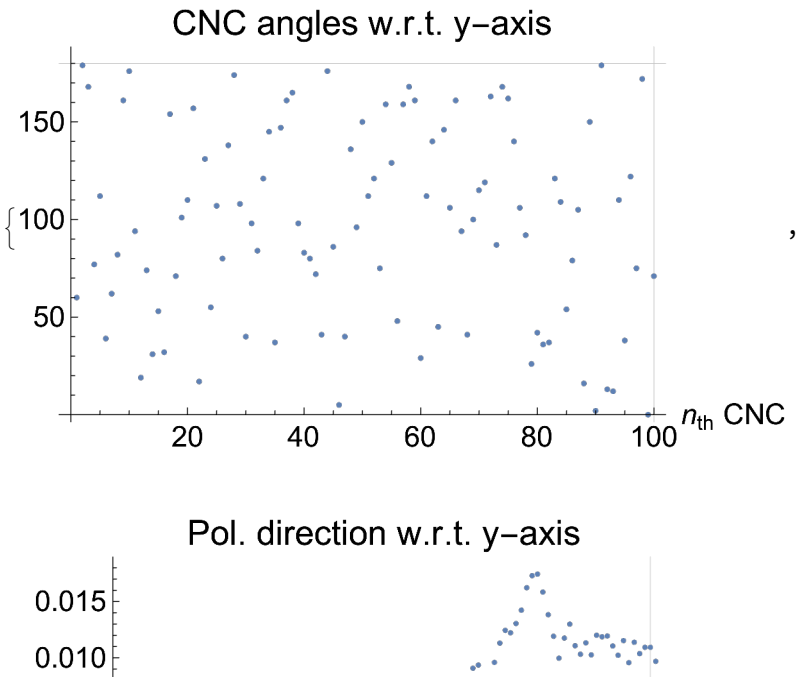
Loop

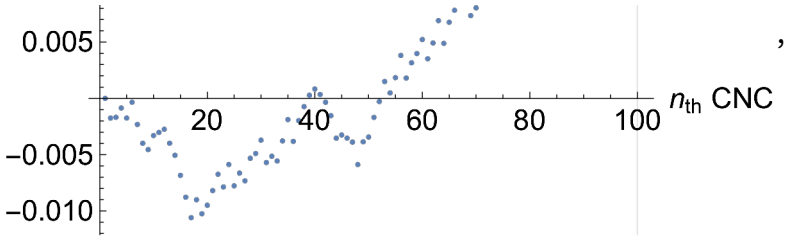
In[•]:=
```
For[p = 1, p < n + 1, p++,

 ϕbtn[[p]] = ψy[[p]] - ϕra180Norm[[p]]; (* convert axis: From y-axis to CNC normal *)
 ψres[[p]] = ψ[ϕbtn[[p]]]; (* result of rotation in CNC normal axis*)
 ψy[[p + 1]] = ψres[[p]] + ϕra180Norm[[p]];
 (* back to y-axis system*) (*F180 is for *)

 dψ[[p]] = ψres[[p]] - ϕbtn[[p]]; (* (ψafter - ψbefore) in CNC axis *)

 ttot[[p]] = tt[ϕbtn[[p]]];
 Etot[[p + 1]] = Etot[[p]] * ttot[[p]]; (* energy loss as passing through *)

 dψ2[[p]] = ψy[[p + 1]] - ψy[[p]];
 (* (ψafter - ψbefore) in CNC axis. How much rotation @ each CNC*)
]
PI = (Etot[[n + 1]] * Sin[(ψy[[n + 1]] - ϕ1) * π/180])^2; (* I=(|E_total|*sinψ)^2 - Equation 5 *)
```

Check plots and final intensity

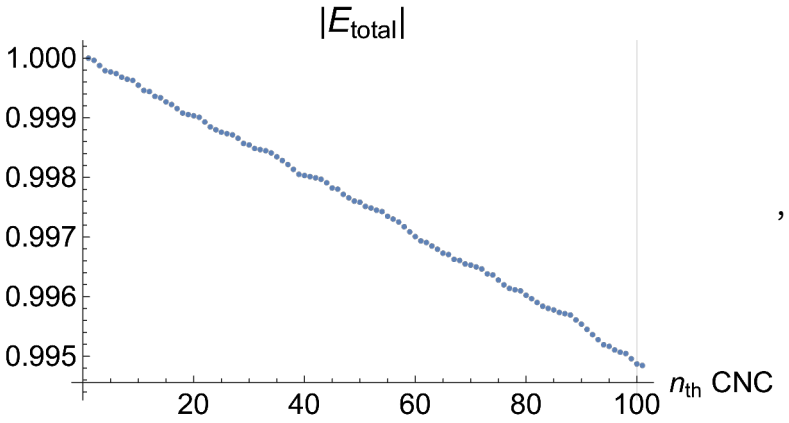
In[ ]:=
```
{ListPlot[ϕra180, ImageSize → 400, PlotRange → All, AxesLabel → {"n_th CNC", None},
  LabelStyle → {FontFamily → "Arial", FontSize → 15, Black},
  GridLines → {{100}, {180}}, AxesOrigin → {0, 0},
  PlotLabel → "CNC angles w.r.t. y-axis"],
 ListPlot[ψy, ImageSize → 400, PlotRange → All, LabelStyle →
   {FontFamily → "Arial", FontSize → 15, Black}, AxesLabel → {"n_th CNC", None},
  PlotLabel → "Pol. direction w.r.t. y-axis", GridLines → {{100}, None}],
 ListPlot[Etot, ImageSize → 400, PlotRange → All,
  LabelStyle → {FontFamily → "Arial", FontSize → 15, Black},
  AxesLabel → {"n_th CNC", None}, PlotLabel → "|E_total|", GridLines → {{100}, None}],
 ListPlot[(dψ), ImageSize → 400, PlotRange → All, LabelStyle →
   {FontFamily → "Arial", FontSize → 15, Black}, AxesLabel → {"n_th CNC", None},
  PlotLabel → "Pol. rotation", GridLines → {{100}, None}]}
{ListPlot[ϕbtn, ImageSize → 400, LabelStyle →
   {FontFamily → "Arial", FontSize → 15, Black}, AxesLabel → {"n_th CNC", None},
  PlotLabel → "Pol. direction w.r.t. CNC normal (before)",
  GridLines → {{100}, None}],
 ListPlot[ψres, ImageSize → 400, LabelStyle →
   {FontFamily → "Arial", FontSize → 15, Black}, AxesLabel → {"n_th CNC", None},
  PlotLabel → "Pol. direction w.r.t. CNC normal (after)",
  GridLines → {{100}, None}]}

Print["E_total after 100th CNC=", Etot[[n + 1]]]
Print["Final intensity after the 2nd polarizer=", PI]
```

Out[ ]=

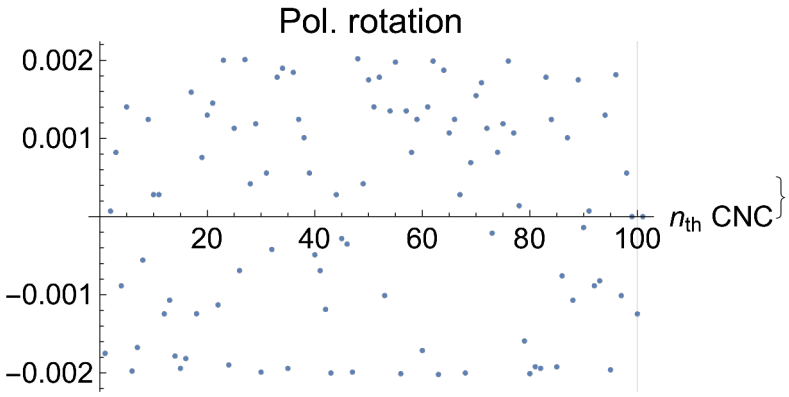



0.005
−0.005
−0.010
20
40
60
80
100
n_{th} CNC

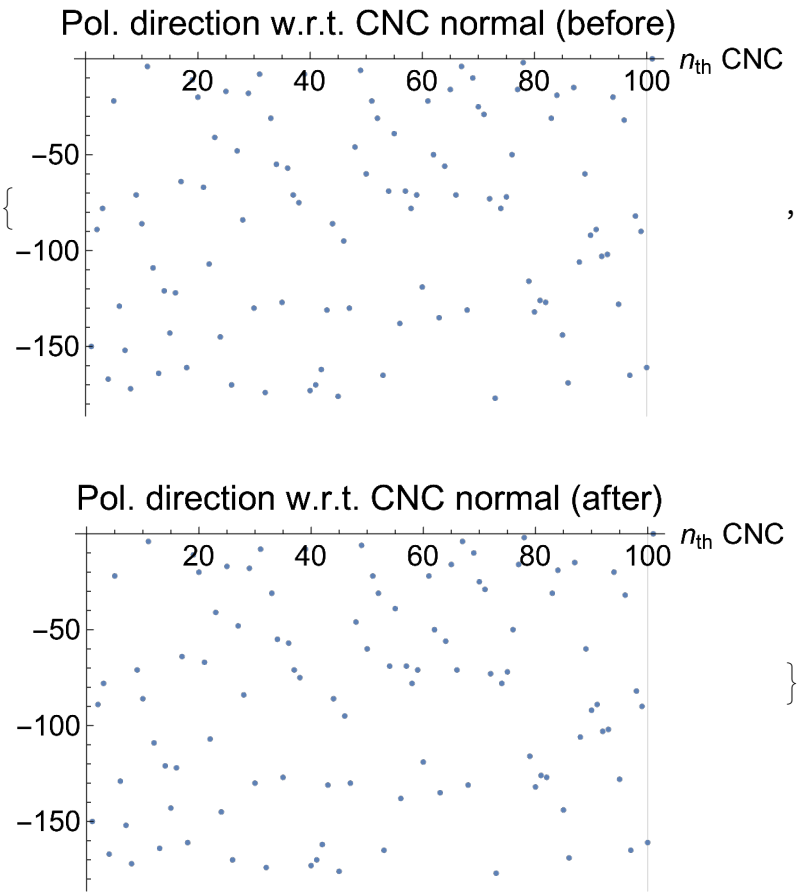
,


$|E_{total}|$
1.000
0.999
0.998
0.997
0.996
0.995
20
40
60
80
100
n_{th} CNC

,


Pol. rotation
0.002
0.001
−0.001
−0.002
20
40
60
80
100
n_{th} CNC

Out[•]=



E_{total} after 100th CNC=0.994844 + 0. i

Final intensity after the 2nd polarizer=0.742141 + 0. i

Check numbers after each CNC

3) Helicoidal

Storage

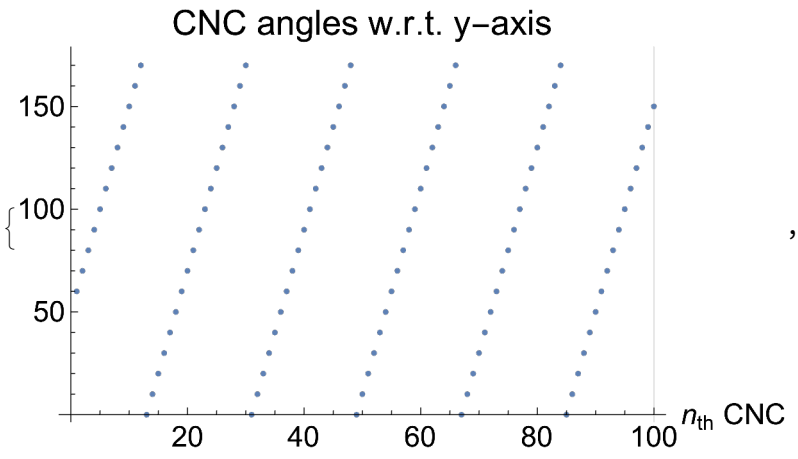
Loop

In[•]:=
```
For[p = 1, p < n + 1, p++,

 ϕbtn[[p]] = ψy[[p]] - ϕhe180Norm[[p]]; (* convert axis: From y-axis to CNC normal *)
 ψres[[p]] = ψ[ϕbtn[[p]]]; (* result of rotation in CNC normal axis*)
 ψy[[p + 1]] = ψres[[p]] + ϕhe180Norm[[p]];
 (* back to y-axis system*) (*F180 is for *)

 dψ[[p]] = ψres[[p]] - ϕbtn[[p]]; (* (ψafter - ψbefore) in CNC axis *)

 ttot[[p]] = tt[ϕbtn[[p]]];
 Etot[[p + 1]] = Etot[[p]] * ttot[[p]]; (* energy loss as passing through *)

 dψ2[[p]] = ψy[[p + 1]] - ψy[[p]];
 (* (ψafter - ψbefore) in CNC axis. How much rotation @ each CNC*)
]
PI = (Etot[[n + 1]] * Sin[(ψy[[n + 1]] - ϕ1) * π/180])^2; (* I=(|E_total|*sinψ)^2 - Equation 5 *)
```

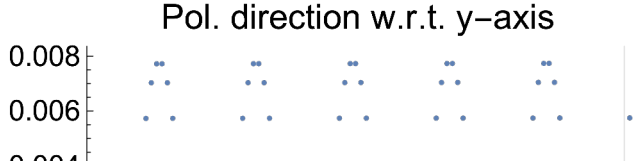
Check plots and final intensity

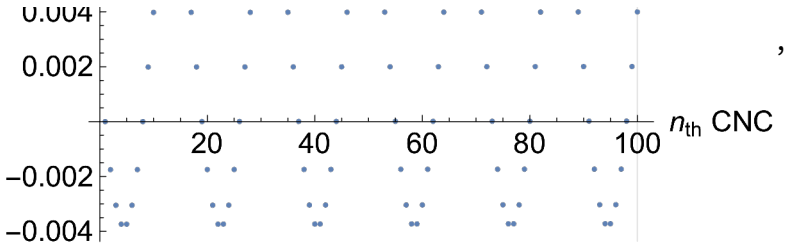
In[ ]:=
```
{ListPlot[ϕhe180, ImageSize → 400, PlotRange → All, AxesLabel → {"n_th CNC", None},
  LabelStyle → {FontFamily → "Arial", FontSize → 15, Black},
  GridLines → {{100}, {180}}, AxesOrigin → {0, 0},
  PlotLabel → "CNC angles w.r.t. y-axis"],
 ListPlot[ψy, ImageSize → 400, PlotRange → All, LabelStyle →
   {FontFamily → "Arial", FontSize → 15, Black}, AxesLabel → {"n_th CNC", None},
  PlotLabel → "Pol. direction w.r.t. y-axis", GridLines → {{100}, None}],
 ListPlot[Etot, ImageSize → 400, PlotRange → All,
  LabelStyle → {FontFamily → "Arial", FontSize → 15, Black},
  AxesLabel → {"n_th CNC", None}, PlotLabel → "|E_total|", GridLines → {{100}, None}],
 ListPlot[(dψ), ImageSize → 400, PlotRange → All, LabelStyle →
   {FontFamily → "Arial", FontSize → 15, Black}, AxesLabel → {"n_th CNC", None},
  PlotLabel → "Pol. rotation", GridLines → {{100}, None}]}
{ListPlot[ϕbtn, ImageSize → 400, LabelStyle →
   {FontFamily → "Arial", FontSize → 15, Black}, AxesLabel → {"n_th CNC", None},
  PlotLabel → "Pol. direction w.r.t. CNC normal (before)",
  GridLines → {{100}, None}],
 ListPlot[ψres, ImageSize → 400, LabelStyle →
   {FontFamily → "Arial", FontSize → 15, Black}, AxesLabel → {"n_th CNC", None},
  PlotLabel → "Pol. direction w.r.t. CNC normal (after)",
  GridLines → {{100}, None}]}

Print["E_total after 100th CNC=", Etot[[n + 1]]]
Print["Final intensity after the 2nd polarizer=", PI]
```

Out[ ]=

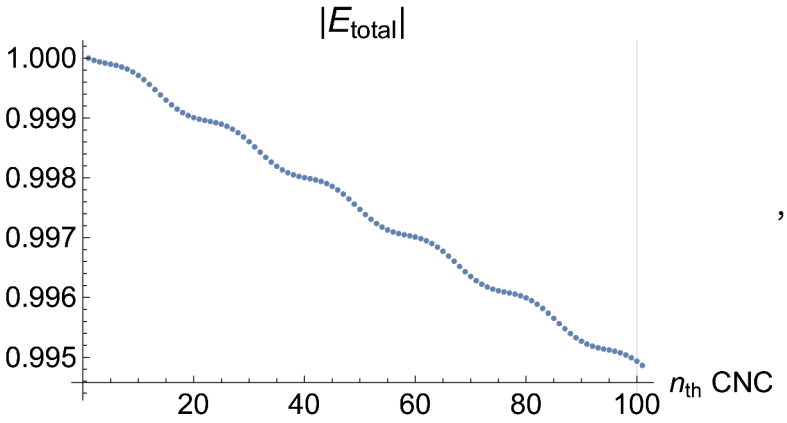


,

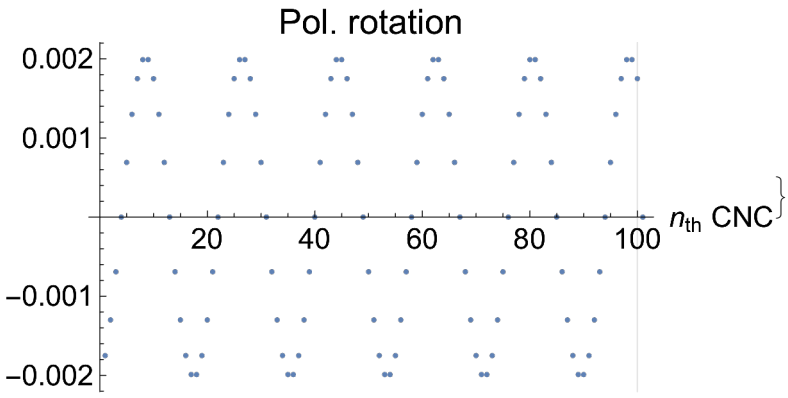



0.004
0.002
−0.002
−0.004
20
40
60
80
100
n_{th} CNC

,

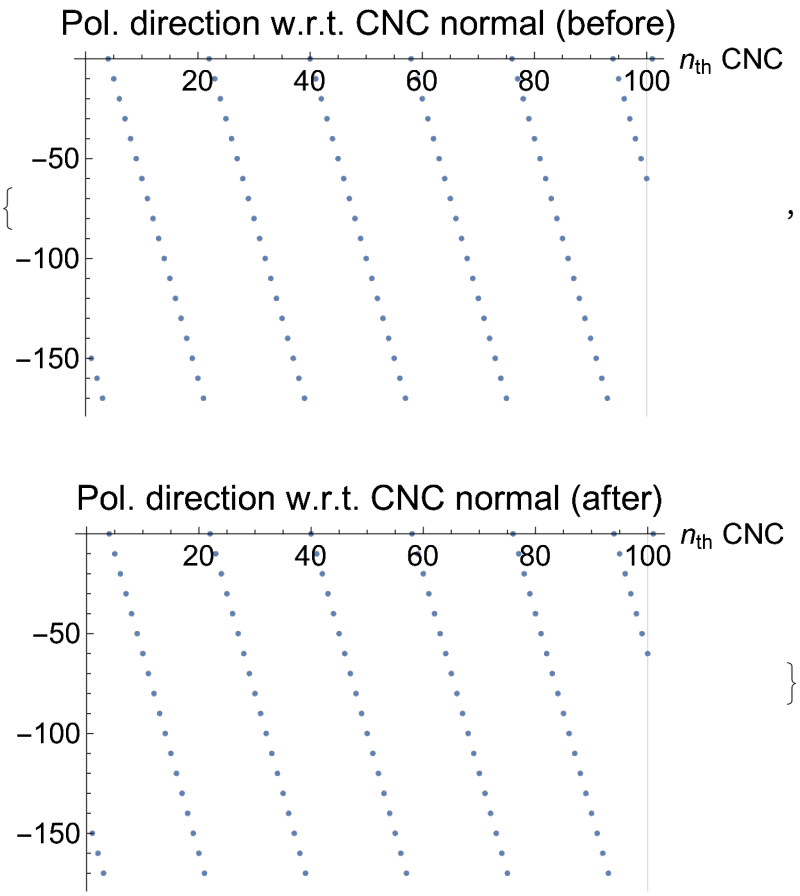

$|E_{total}|$
1.000
0.999
0.998
0.997
0.996
0.995
20
40
60
80
100
n_{th} CNC

,


Pol. rotation
0.002
0.001
−0.001
−0.002
20
40
60
80
100
n_{th} CNC

}

Out[•]=



E_{total} after 100th CNC=0.994863 + 0. i

Final intensity after the 2nd polarizer=0.742228 + 0. i

Check numbers after each CNC

4) Uniaxial

Storage

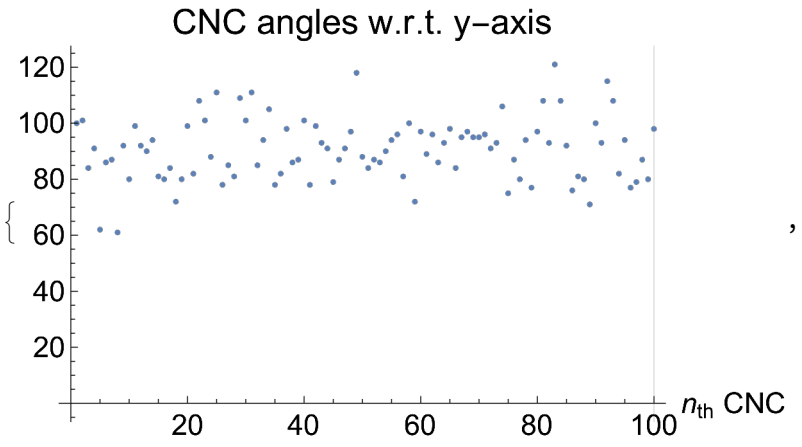
Loop

In[•]:=
```
For[p = 1, p < n + 1, p++,

 ϕbtn[[p]] = ψy[[p]] - ϕun180Norm[[p]]; (* convert axis: From y-axis to CNC normal *)
 ψres[[p]] = ψ[ϕbtn[[p]]]; (* result of rotation in CNC normal axis*)
 ψy[[p + 1]] = ψres[[p]] + ϕun180Norm[[p]];
 (* back to y-axis system*) (*F180 is for *)

 dψ[[p]] = ψres[[p]] - ϕbtn[[p]]; (* (ψafter - ψbefore) in CNC axis *)

 ttot[[p]] = tt[ϕbtn[[p]]];
 Etot[[p + 1]] = Etot[[p]] * ttot[[p]]; (* energy loss as passing through *)

 dψ2[[p]] = ψy[[p + 1]] - ψy[[p]];
 (* (ψafter - ψbefore) in CNC axis. How much rotation @ each CNC*)

]

PI = (Etot[[n + 1]] * Sin[(ψy[[n + 1]] - ϕ1) * π/180])^2; (* I=(|E_total|*sinψ)^2 - Equation 5 *)
```

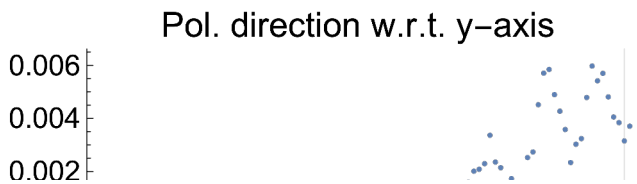
Check plots and final intensity

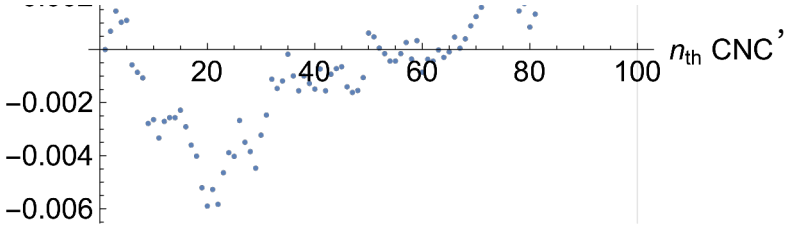
In[ ]:=
```
{ListPlot[ϕun180, ImageSize → 400, PlotRange → All, AxesLabel → {"n_th CNC", None},
  LabelStyle → {FontFamily → "Arial", FontSize → 15, Black},
  GridLines → {{100}, {180}}, AxesOrigin → {0, 0},
  PlotLabel → "CNC angles w.r.t. y-axis"],
 ListPlot[ψy, ImageSize → 400, PlotRange → All, LabelStyle →
   {FontFamily → "Arial", FontSize → 15, Black}, AxesLabel → {"n_th CNC", None},
  PlotLabel → "Pol. direction w.r.t. y-axis", GridLines → {{100}, None}],
 ListPlot[Etot, ImageSize → 400, PlotRange → All,
  LabelStyle → {FontFamily → "Arial", FontSize → 15, Black},
  AxesLabel → {"n_th CNC", None}, PlotLabel → "|E_total|", GridLines → {{100}, None}],
 ListPlot[(dψ), ImageSize → 400, PlotRange → All, LabelStyle →
   {FontFamily → "Arial", FontSize → 15, Black}, AxesLabel → {"n_th CNC", None},
  PlotLabel → "Pol. rotation", GridLines → {{100}, None}]}
{ListPlot[ϕbtn, ImageSize → 400, LabelStyle →
   {FontFamily → "Arial", FontSize → 15, Black}, AxesLabel → {"n_th CNC", None},
  PlotLabel → "Pol. direction w.r.t. CNC normal (before)",
  GridLines → {{100}, None}],
 ListPlot[ψres, ImageSize → 400, LabelStyle →
   {FontFamily → "Arial", FontSize → 15, Black}, AxesLabel → {"n_th CNC", None},
  PlotLabel → "Pol. direction w.r.t. CNC normal (after)",
  GridLines → {{100}, None}]}

Print["E_total after 100th CNC=", Etot[[n + 1]]]
Print["Final intensity after the 2nd polarizer=", PI]
```

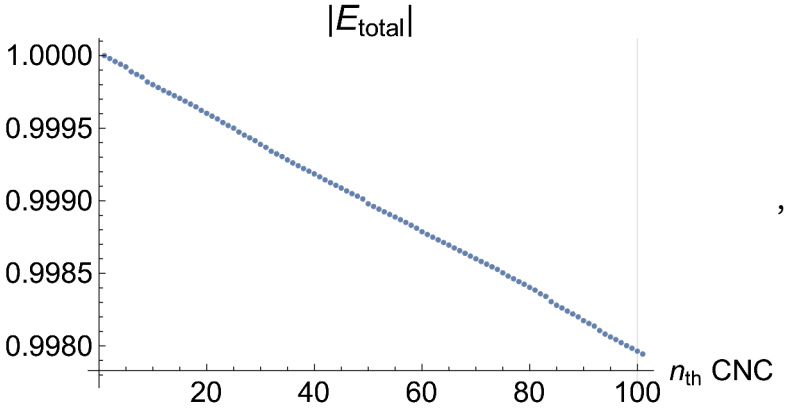
Out[ ]=



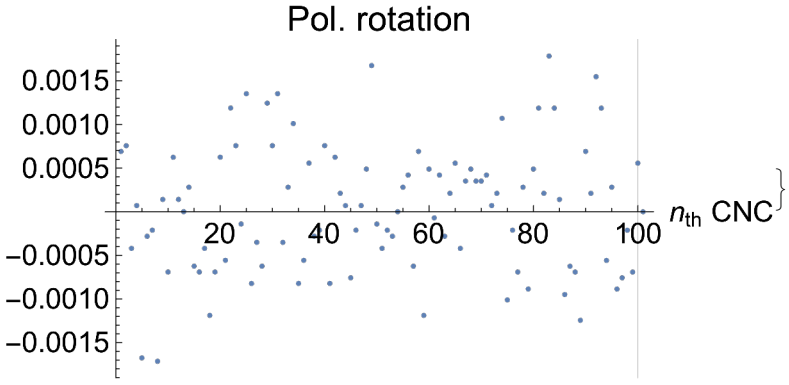
,




20
40
60
80
100
n_{th} CNC'
−0.002
−0.004
−0.006

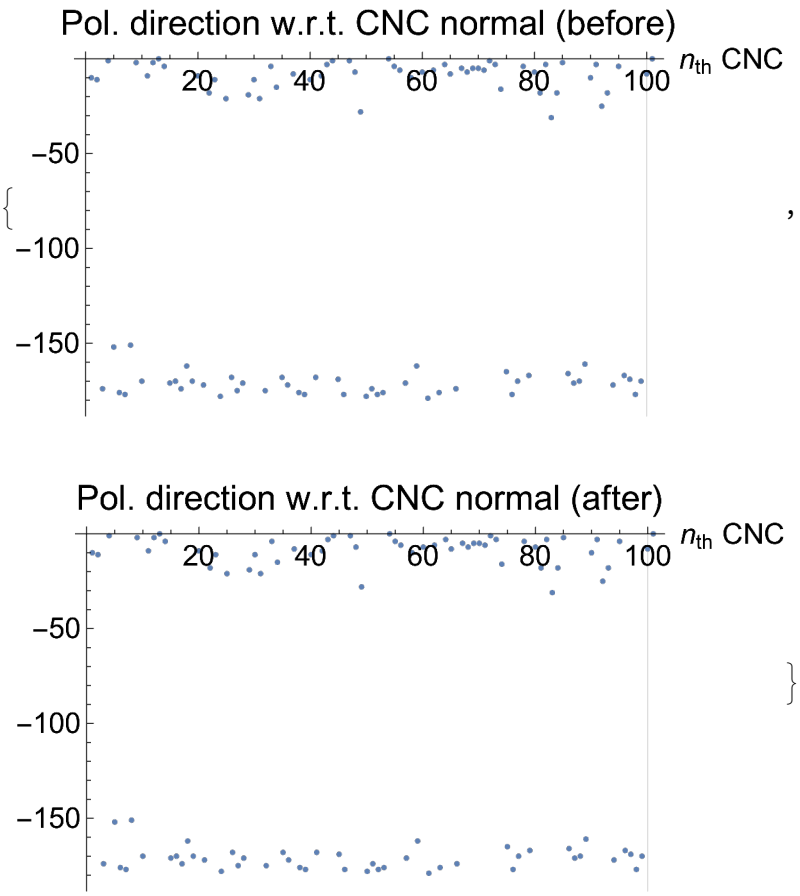

$|E_{total}|$
1.0000
0.9995
0.9990
0.9985
0.9980
20
40
60
80
100
n_{th} CNC

,


Pol. rotation
0.0015
0.0010
0.0005
−0.0005
−0.0010
−0.0015
20
40
60
80
100
n_{th} CNC

}

Out[•]=



E_{total} after 100th CNC=0.997945 + 0. i

Final intensity after the 2nd polarizer=0.746864 + 0. i

Check numbers after each CNC

5) Bimodal

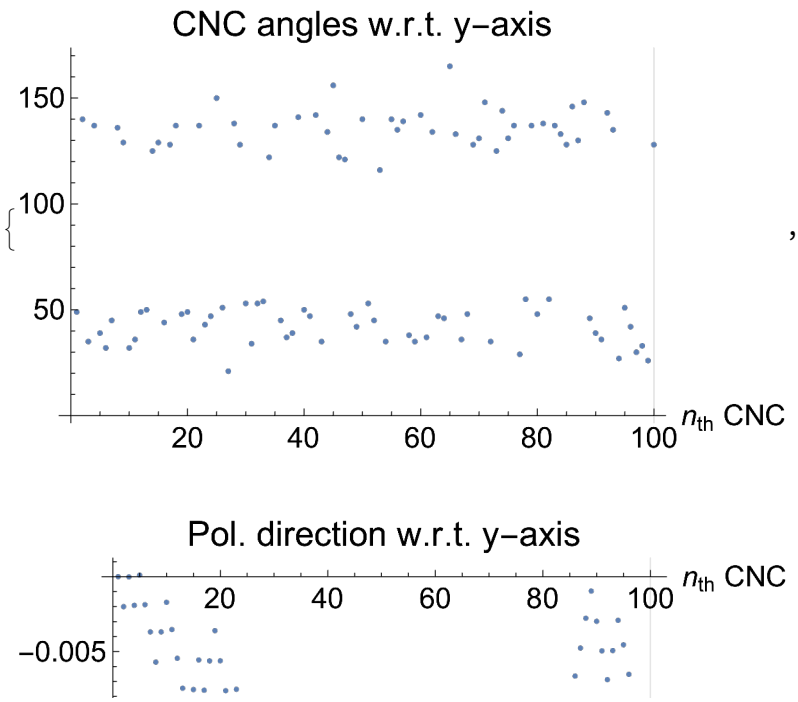
Storage

Loop

Check plots and final intensity

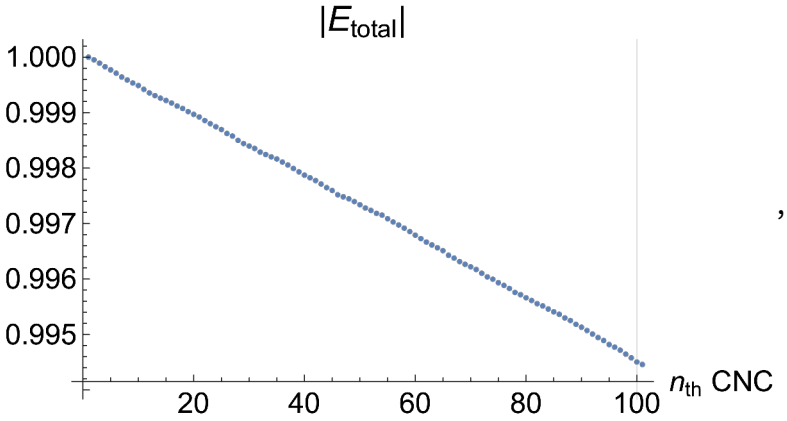
In[ ]:=
```
{ListPlot[ϕbi180, ImageSize → 400, PlotRange → All, AxesLabel → {"nth CNC", None},
  LabelStyle → {FontFamily → "Arial", FontSize → 15, Black},
  GridLines → {{100}, {180}}, AxesOrigin → {0, 0},
  PlotLabel → "CNC angles w.r.t. y-axis"],
 ListPlot[ψy, ImageSize → 400, PlotRange → All, LabelStyle →
   {FontFamily → "Arial", FontSize → 15, Black}, AxesLabel → {"nth CNC", None},
  PlotLabel → "Pol. direction w.r.t. y-axis", GridLines → {{100}, None}],
 ListPlot[Etot, ImageSize → 400, PlotRange → All,
  LabelStyle → {FontFamily → "Arial", FontSize → 15, Black},
  AxesLabel → {"nth CNC", None}, PlotLabel → "|Etotal|", GridLines → {{100}, None}],
 ListPlot[(dψ), ImageSize → 400, PlotRange → All, LabelStyle →
   {FontFamily → "Arial", FontSize → 15, Black}, AxesLabel → {"nth CNC", None},
  PlotLabel → "Pol. rotation", GridLines → {{100}, None}]}
{ListPlot[ϕbtn, ImageSize → 400, LabelStyle →
   {FontFamily → "Arial", FontSize → 15, Black}, AxesLabel → {"nth CNC", None},
  PlotLabel → "Pol. direction w.r.t. CNC normal (before)",
  GridLines → {{100}, None}],
 ListPlot[ψres, ImageSize → 400, LabelStyle →
   {FontFamily → "Arial", FontSize → 15, Black}, AxesLabel → {"nth CNC", None},
  PlotLabel → "Pol. direction w.r.t. CNC normal (after)",
  GridLines → {{100}, None}]}

Print["Etotal after 100th CNC=", Etot[[n + 1]]]
Print["Final intensity after the 2nd polarizer=", PI]
```

Out[ ]=

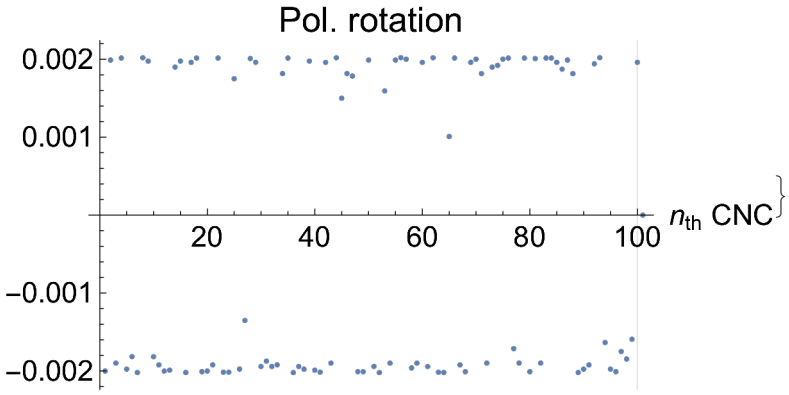



−0.010
−0.015
−0.020

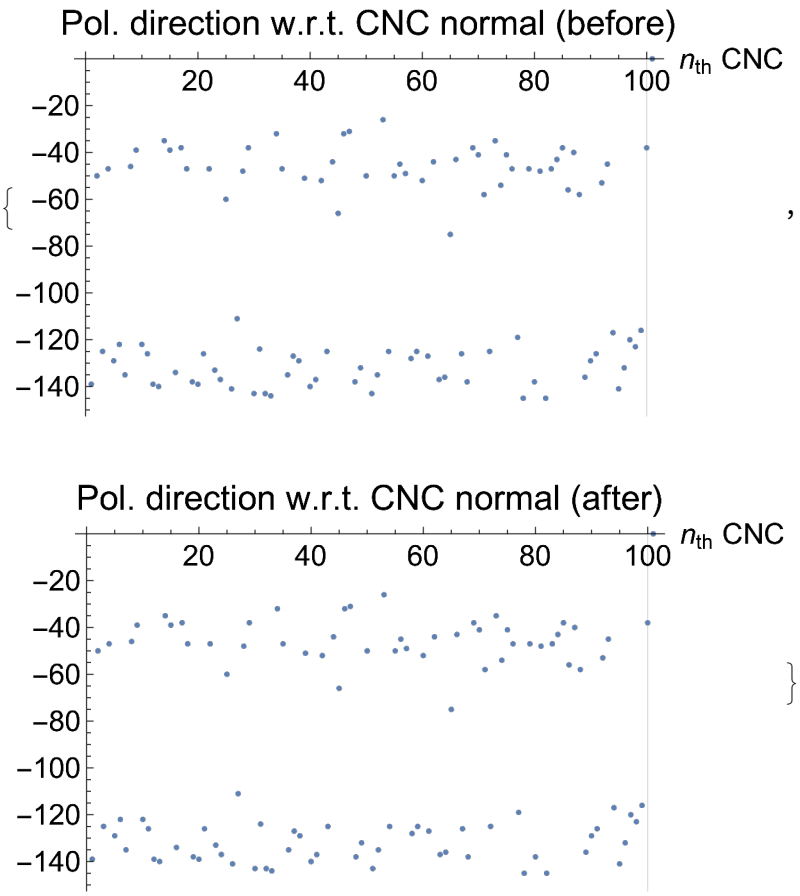
,


|E_total|
1.000
0.999
0.998
0.997
0.996
0.995
20
40
60
80
100
n_th CNC

,


Pol. rotation
0.002
0.001
−0.001
−0.002
20
40
60
80
100
n_th CNC

Out[•]=



E_{total} after 100th CNC=0.994458 + 0. i

Final intensity after the 2nd polarizer=0.741886 + 0. i

Check numbers after each CNC

G. Final intensity as a function of the incident polarization angle

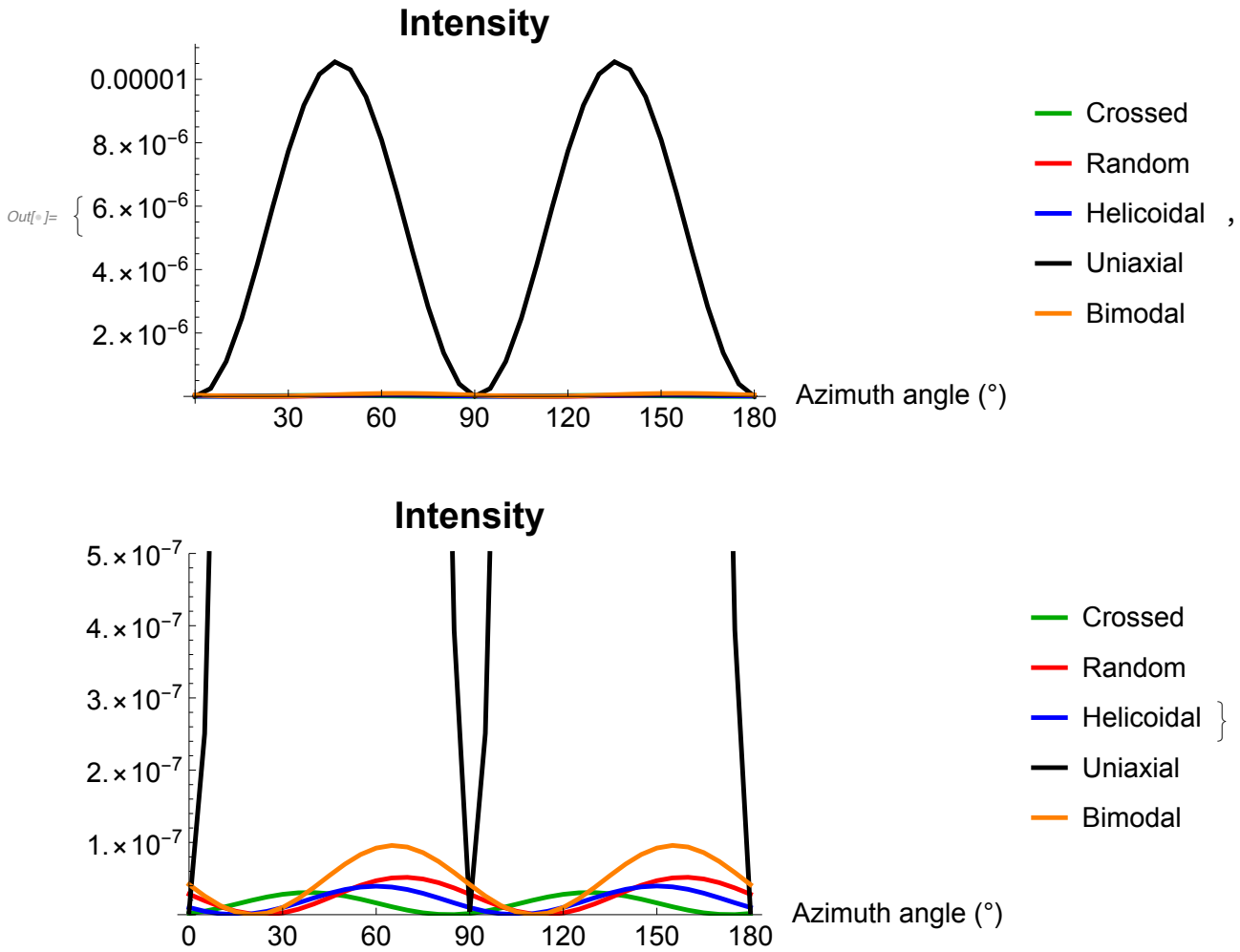
Note: the same calculation with various incident polarization angle (no explanation included). Data exportation included.

Loop

Plot check

In[•]:=
```
(* Check plots *)
{ListPlot[{clAng, raAng, heAng, unAng, biAng},
  PlotStyle → {{Darker[Green], Thickness[0.008]}, {Red, Thickness[0.008]}, {Blue,
     Thickness[0.008]}, {Black, Thickness[0.008]}, {Orange, Thickness[0.008]}},
  Ticks → {Table[30 i, {i, 0, 6}], Automatic}, PlotRange → All,
  ImageSize → 500, AxesLabel → {"  Azimuth angle (°)", None},
  LabelStyle → {FontFamily → "Arial",  FontSize → 15, Black},
  PlotLabel → Style["Intensity", 20, Black, Bold], Joined → True,
  PlotLegends → {"Crossed", "Random", "Helicoidal", "Uniaxial", "Bimodal"}],
 ListPlot[{clAng, raAng, heAng, unAng, biAng},
  PlotStyle → {{Darker[Green], Thickness[0.008]}, {Red, Thickness[0.008]}, {Blue,
     Thickness[0.008]}, {Black, Thickness[0.008]}, {Orange, Thickness[0.008]}},
  Ticks → {Table[30 i, {i, 0, 6}], Automatic}, PlotRange → {All, {0, 5 * 10^-7}},
  ImageSize → 500, AxesLabel → {"  Azimuth angle (°)", None},
  LabelStyle → {FontFamily → "Arial",  FontSize → 15, Black},
  PlotLabel → Style["Intensity", 20, Black, Bold], Joined → True,
  PlotLegends → {"Crossed", "Random", "Helicoidal", "Uniaxial", "Bimodal"}]}
```

Out[•]=


Intensity
0.00001
8.×10^-6
6.×10^-6
4.×10^-6
2.×10^-6
30
60
90
120
150
180
Azimuth angle (°)
Crossed
Random
Helicoidal
Uniaxial
Bimodal
Intensity
5.×10^-7
4.×10^-7
3.×10^-7
2.×10^-7
1.×10^-7
0
30
60
90
120
150
180
Azimuth angle (°)
Crossed
Random
Helicoidal
Uniaxial
Bimodal

H. Data export

In[•]:=
```
(* Combine generated data *)
clAng2 = Transpose[clAng];
raAng2 = Transpose[raAng];
heAng2 = Transpose[heAng];
unAng2 = Transpose[unAng];
biAng2 = Transpose[biAng];
b1 = {clAng2[[1]], clAng2[[2]], raAng2[[2]], heAng2[[2]], unAng2[[2]], biAng2[[2]]};
b1 = Abs[b1];
b1 = b1 // Transpose;
b1 // MatrixForm;
b1 = PrependTo[b1, {"wavenumber", "crossed-polylamellate",
    "random", "helicoidal10", "uniaxial", "bimodal"}];

(* Data exportation *)
name = CurrentValue[EvaluationNotebook[], {"NotebookFileName"}];
name = StringDrop[name, -3];
time = TextString[TimeObject[]];
time2 = ToExpression["StringTake[time,2]"] <>
  ToString["."] <> ToExpression["StringTake[time,{4,5}]"] <>
  ToString["."] <> ToExpression["StringTake[time,-2]"]
Export[NotebookDirectory[] <> ToExpression["name"] <>
   ToExpression["time2"] <> ToString["_"] <> "CRHUB.xlsx", b1];
```

Out[•]= 15.18.50