```
μm = 10^-6;
μs = 10^-6;
ms = 10^-3;
ns = 10^-9;
mm = 10^-3;
kHz = 10^3;
fscan = 50 mm;(*Focal length of the scan lens*)
ftube = 200 mm;(*Focal length of the tube lens*)
fObj = 7.2 mm;(*Focal length of the objective*)
n = 16;(*Number of beamlets*)
Δx = 0.5 μm;(*Sampling resolution*)
Npix = n * 35;(*Number of pixels*)
FFOV = Npix * Δx;(*Scanned full field of view. The FFOV of the objective is ~0.5mm*)
M = ftube/fscan;(*Magnification*)
FFOV / μm
```

```
280.
```

1. SINGLE BEAM

```
θmax = ArcTan[FFOV / 2 / fObj];
(*Max optical angle wrt the symmetry axis measured at the objective*)
(*Optical angle FFOV at the OBJECTIVE*)
2 * θmax / Degree
(*Optical angle FFOV at the SCANNING MIRROR*)
2 * θmax * M / Degree
(*Mech angle FFOV at the SCANNING MIRROR. Mech. angle = optical angle/2*)
θmax * M / Degree
```

```
2.22789
```

```
8.91155
```

```
4.45578
```

2. MULTIPLEXING: n beams evenly spaced

```
Δθ = 2 θmax / n;(*"Optical angle FFOV covered by each beamlet measured at the objective*)
θ[ii_, α_] := (-1 + 1/n) * θmax + ii * Δθ +
  α Δθ/2 (*Optical angle of each beamlet measured at the objective. ii = beam index,
   α = beam position [-1,1]*)
```

2.1. Angles at the OBJECTIVE

```
header = {{"Beam No.", ""}, {"Angle(°)", "centered"},
   {"Angle(°)", "neg. swing"}, {"Angle(°)", "pos. swing"}};
Labeled[TableForm[Prepend[Table[{ii + 1, θ[ii, 0] / Degree, θ[ii, -1] / Degree,
     θ[ii, 1] / Degree}, {ii, 0, 15}], header]], "Optical angles at the OBJECTIVE", Top]
```

Optical angles at the OBJECTIVE

Beam No.	Angle(°) centered	Angle(°) neg. swing	Angle(°) pos. swing
1	−1.04432	−1.11394	−0.974701
2	−0.90508	−0.974701	−0.835458
3	−0.765837	−0.835458	−0.696215
4	−0.626594	−0.696215	−0.556972
5	−0.487351	−0.556972	−0.417729
6	−0.348108	−0.417729	−0.278486
7	−0.208865	−0.278486	−0.139243
8	−0.0696215	−0.139243	-2.48481×10^{-17}
9	0.0696215	2.48481×10^{-17}	0.139243
10	0.208865	0.139243	0.278486
11	0.348108	0.278486	0.417729
12	0.487351	0.417729	0.556972
13	0.626594	0.556972	0.696215
14	0.765837	0.696215	0.835458
15	0.90508	0.835458	0.974701
16	1.04432	0.974701	1.11394

```
(*Optical angle FFOV covered by each beam measured AT THE OBJECTIVE*)
(θ[0, 1] - θ[0, -1]) / Degree
(*Mech angle FFOV covered by each beam
  measured AT THE OBJECTIVE*. Mech. angle = optical angle/2*)
(θ[0, 1] - θ[0, -1]) / 2 / Degree
```

```
0.139243
```

```
0.0696215
```

2.1. Angles at the SCANNING MIRROR

```
header = {{"Beam No.", ""}, {"Angle(°)", "centered"},
   {"Angle(°)", "neg. swing"}, {"Angle(°)", "pos. swing"}};
Labeled[TableForm[Prepend[Table[{ii + 1, θ[ii, 0] * M / Degree,
     θ[ii, -1] * M / Degree, θ[ii, 1] * M / Degree}, {ii, 0, 15}], header]],
 "Optical angles at the SCANNING MIRROR", Top]
```

Optical angles at the SCANNING MIRROR

Beam No.	Angle(°) centered	Angle(°) neg. swing	Angle(°) pos. swing
1	−4.17729	−4.45578	−3.8988
2	−3.62032	−3.8988	−3.34183
3	−3.06335	−3.34183	−2.78486
4	−2.50637	−2.78486	−2.22789
5	−1.9494	−2.22789	−1.67092
6	−1.39243	−1.67092	−1.11394
7	−0.835458	−1.11394	−0.556972
8	−0.278486	−0.556972	-9.93923×10^{-17}
9	0.278486	9.93923×10^{-17}	0.556972
10	0.835458	0.556972	1.11394
11	1.39243	1.11394	1.67092
12	1.9494	1.67092	2.22789
13	2.50637	2.22789	2.78486
14	3.06335	2.78486	3.34183
15	3.62032	3.34183	3.8988
16	4.17729	3.8988	4.45578

```
(*Optical angle FFOV covered by the SCANNING MIRROR*)
(θ[0, 1] - θ[0, -1]) * M / Degree
(*Mech angle FFOV covered by the SCANNING MIRROR. Mech. angle = optical angle/2*)
(θ[0, 1] - θ[0, -1]) * M / 2 / Degree
```

```
0.556972
```

```
0.278486
```

3.1. Beam position at the SAMPLE PLANE

```
x[θ_] := fObj * Tan[θ](*Beam position*)
```

```
header = {{"Beam No.", ""}, {"Position [μm]", "centered"},
   {"Position [μm]", "neg. swing"}, {"Position [μm]", "pos. swing"}};
Labeled[TableForm[Prepend[Table[{ii + 1, x[θ[ii, 0]] / μm, x[θ[ii, -1]] / μm,
     x[θ[ii, 1]] / μm}, {ii, 0, 15}], header]], "Beam position at the focal plane", Top]
```

Beam position at the focal plane

Beam No.	Position [μm] centered	Position [μm] neg. swing	Position [μm] pos. swing
1	−131.248	−140.	−122.496
2	−113.745	−122.496	−104.994
3	−96.2436	−104.994	−87.4933
4	−78.7432	−87.4933	−69.9934
5	−61.2438	−69.9934	−52.4943
6	−43.745	−52.4943	−34.9959
7	−26.2468	−34.9959	−17.4978
8	−8.7489	−17.4978	-3.1225×10^{-15}
9	8.7489	3.1225×10^{-15}	17.4978
10	26.2468	17.4978	34.9959
11	43.745	34.9959	52.4943
12	61.2438	52.4943	69.9934
13	78.7432	69.9934	87.4933
14	96.2436	87.4933	104.994
15	113.745	104.994	122.496
16	131.248	122.496	140.

```
(*ANGLES FOR THE DOE BEAM SPLITTER************************************)

header = {{"Beam No."}, {"Angle(deg)"}, {"Angle(rad)"}};
TableForm[
 Prepend[Table[{ii + 1, NumberForm[θ[ii, 0] * M / Degree, 15], NumberForm[θ[ii, 0] * M, 15]},
   {ii, 0, 15}], header]]
```

Beam No.	Angle(deg)	Angle(rad)
1	−4.17729085025033	−0.0729074791503016
2	−3.62031873688362	−0.0631864819302614
3	−3.06334662351691	−0.0534654847102212
4	−2.5063745101502	−0.043744487490181
5	−1.94940239678349	−0.0340234902701408
6	−1.39243028341678	−0.0243024930501005
7	−0.835458170050065	−0.0145814958300603
8	−0.278486056683355	−0.00486049861002011
9	0.278486056683355	0.00486049861002011
10	0.835458170050066	0.0145814958300603
11	1.39243028341678	0.0243024930501005
12	1.94940239678349	0.0340234902701408
13	2.5063745101502	0.043744487490181
14	3.06334662351691	0.0534654847102212
15	3.62031873688362	0.0631864819302614
16	4.17729085025033	0.0729074791503016

```
Grid[{{"", "Angle (deg)", "Angle (rad)"},
  {"Full angle", NumberForm[(θ[15, 0] - θ[0, 0]) * M / Degree, 10],
   NumberForm[(θ[15, 0] - θ[0, 0]) * M, 10]},
  {"Separation angle", NumberForm[(θ[0, 1] - θ[0, -1]) * M / Degree, 10],
   NumberForm[(θ[0, 1] - θ[0, -1]) * M, 10]}}, Frame → All]
```

	Angle (deg)	Angle (rad)
Full angle	8.354581701	0.1458149583
Separation angle	0.5569721134	0.00972099722