SENSOFAR®

PLμ 2300 Optical Imaging Profiler

Objective List

Objectives for Confocal / Bright Field

CFI L Plan Fluor EPI objectives.

These Objectives are used for standard Confocal profiling applications. Magnifications from 1.5X to 200X. Low magnifications (up to 10X) are mainly used for Bright Field imaging, while magnifications from 20X to 200X are more suitable for 3D profiling.

	NA	W.D. (mm)
1.5X	0.045	3.6
2.5X	0.075	8.8
5X	0.15	23.5
10X	0.3	17.5
20X	0.45	4.5
50X	0.8	1.0
50X	0.95	0.3
100X	0.9	1.0
100X	0.95	0.4
150X	0.95	0.3
200X	0.95	0.2

CFI LU Plan EPI ELWD Objectives

Extra Long Working Distance Jollision between the surface and the objective can exist.

	NA	W.D. (mm)
20X	0.40	13.0
50X	0.55	10.1
100X	0.80	3.5

CFI LU Plan EPI SLWD Objectives

Super Long Working Distance Objectives are used for very difficult to access geometries, were a physical collision between the surface and the objective can exist.

	NA	W.D. (mm)
20X	0.35	24.0
50X	0.45	17.0
100X	0.70	6.5

CFI L Plan Water Immersion Objectives

These objectives are used for the inspection of surfaces under the water.

	NA	W.D. (mm)
10XW	0.30	3.5
20XW	0.50	2.0
150XW	1.25	0.25

CFI L Plan EPI CR Objectives

Collar Adjustment Ring Objectives are used for that applications were the surface under inspection is under a cover glass. The objective has an adjustment compensation of the optical properties of the cover glass. A special family for Flat Pannel Display inspection is available with glass corrections from 0 to 1.2 mm.

	NA	W.D. (mm)	Glass thickness Correction
ELWD 20XC	0.45	7.0	0 - 2 mm
20XCR/LCD	0.45	10.9 -10.0	0 - 1.2 mm
50XCR/LCD	0.70	3.9 -3.0	0 - 1.2 mm
100XCRA/LCD	0.85	1.2 -0.85	0 - 1.2 mm
100XCRB/LCD	0.85	1.3 - 0.95	0 - 0.7 mm

Objectives for Interferometry

CF IC EPI Plan DI/TI Objectives

Inteferential objectives with Michaelson (TI) and Mirau (DI) configurations. For the Mirau objectives it is possible to choose between a 100% and 20% reference reflection at the moment of the purchase. The Michaelson Objectives incorporates a Tip-Tilt stage.

	NA	W.D. (mm)	Reference reflectance
2.5XTI	0.075	9.3	100%
5XTI	0.13	10.3	100%
10XDI	0.30	7.4	100% or 20%
20XDI	0.40	4.7	100% or 20%
50XDI	0.55	3.4	100% or 20%

Inteferential TI/DI objectives

This family of objectives incorporates a Tip-Tilt, a beamsplitter filter wheel selector with reflectance of the reference from 5% to 85% and a adjustment collar ring of the reference position (temperature compensation).

	NA	W.D. (mm)	Reference reflectance
5XTI	0.15	-	5% - 25% -50% - 85%
10XDI	0.30	-	5% - 25% -50% - 85%
20XDI	0.40	-	5% - 25% -50% - 85%
50XDI	0.50	-	5% - 25% -50% - 85%

Objective Specifications

Working Distance:
This is the distance between the bottom part of the objective and the surface when the surface under inspection is placed in the focus.

Numerical Aperture (NA):
NA = n * sin (ϕ) . Where ϕ is the angle existing between the marginal ray of the objective and the optical axis and n the refraction index between the optics and the surface. This is the most important parameter in an objective. It is responsible for the resolving power, brightness of the image and depth of focus.

Resolving Power:
This is the smallest feature of the surface that can be detected.
RP = λ / (2 * NA)

Depth of focus:
This is the amount of travel before and after the focus point were the surface under inspection remains sharply focused.
DF = n * λ /(2 * NA²)

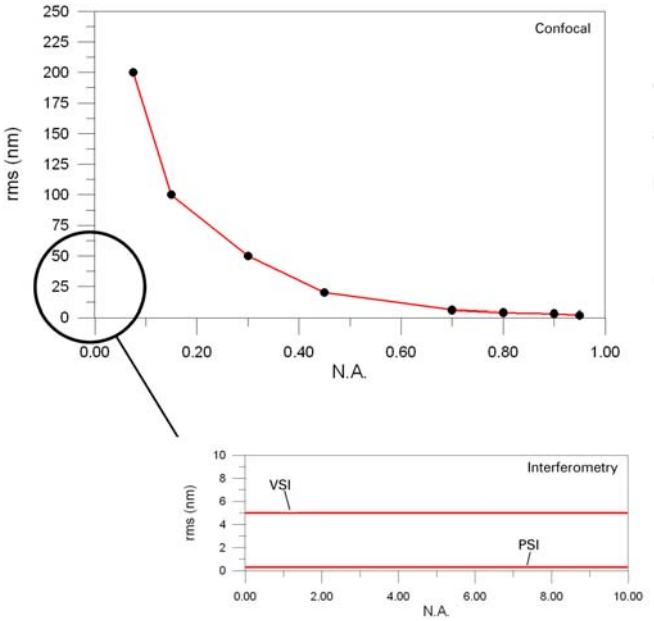

Fig 1: Repeatability for Confocal and Interferential optics. Confocal repeatability is dependant on the NA, while VSI and PSI are dependant on the coherence length and the wavelength of the light source. Values of repeatability with CFI LU Plan Fluor objectives.

Repeatability:
Repeatability in a confocal profiler is dependant on the Depth of Focus, and thus to the numerical aperture of the objective. Generally, the depth discrimination of an step is about 1/100 the depth from focus. This means that High NA objectives are able to resolve steps on the order of few nanometers.

In contrast, repeatability in an Interferential profiler is dependant on the properties of the light source, and not on the NA. Repeatability for VSI is dependant on the coherence length while for PSI is dependant on the wavelength. Few microns coherence length gives few nanometers of repeatability for VSI, and PSI is able to achieve repeatability values on the order of 1/5000 of the wavelength.

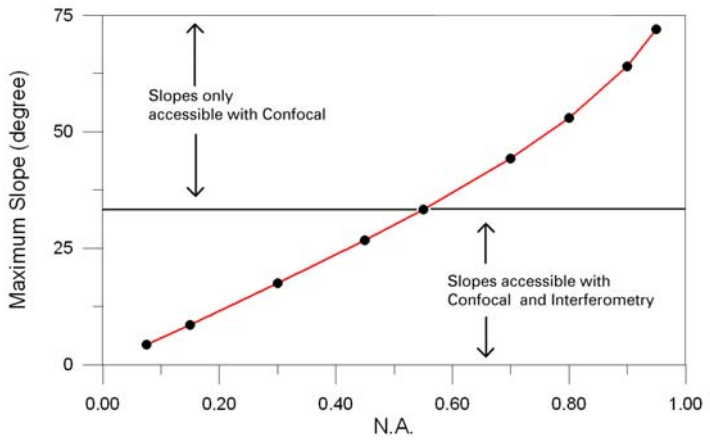

Fig 2: Maximum measurable slope for different NA. A maximum NA of 0.55 is possible with an interferential profiler, limiting the maximum measurable slopes. Confocal is able to use up to 0.95 NA, being possible to measure up to 70 degree.

Maximum Slope:

The maximum slope visible on smooth surfaces is dependant on the NA. The higher the local or gloval slope on a surface, the less the signal that is collected from the objective, and higher the noise on such region. Increasing the NA decreases the working distance, and at the same time collects more signal, being possible to measure higher slopes.