Optical Testing and Repair for Iranian Cinema

By Ali Afshari

Iranian cinema has flourished in past 50 yeas with big names like director Abas Kiarostami, and two recent Oscars won by Asghar Farhadi. While most studios owned their own equipment in the past, camera rental houses have been around for more than 50 years, and they know almost everything there is to know about the cinematography market. The cinema rental houses have made their fortune in support of Iranian cinema while government owned Farabi, who had supplied most of the gear to Iranian film makers for past 34 years was recently forced to close its doors. All the camera, and lens

Bashirzadeh stands next to his certificate from Zeiss. “We had to change our direction to meet market demands.”

Arri Alexa remains to be the most popular camera in Iranian cinema, with currently around 60 Alexas being rented.

Zeiss proudly displays its Compact Prime lenses at NAB show (left) because it covers new full frame sensors. The sensor size of RED cameras (right) kept increasing as the Resolution went up from 4K to 5K (Mysterium), then to 6K (Dragon), and then 8K (Helium), while 36 MP Nikon D800, and Sony F65 (8K) maintained their sensor size as resolution increased.

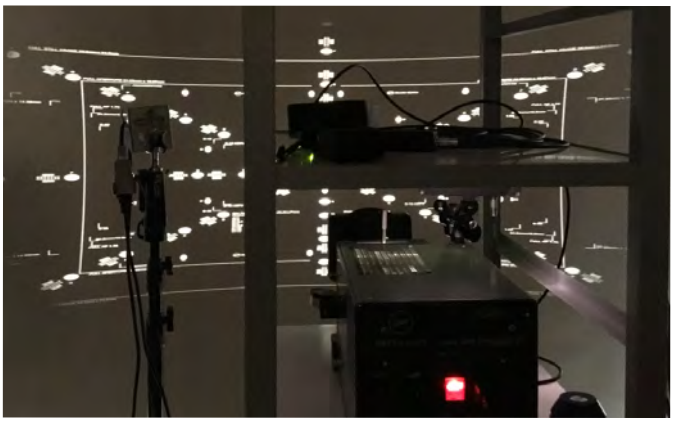
rentals are now in the hands of private owned rental houses. While Arri Alexa, RED Epic, Sony F55 have been typically available from rental houses, Canon 5D Mark III, and C300 have singlehandedly changed the marketplace. This all began with the introduction of RED One camera priced around $18K, and it changed all the rules in the business. Film makers could do a lot more at a lot less.

For the high-end market, the race between RED, and Arri has favored Alexa in Iranian cinema, while RED sales have stagnated behind. In spite of RED camera's high resolution sensor, it hasn't been popular because most film makers weren't happy with camera's user interface. "It wasn't an easy camera to work with," Says Mr. Aladpoush, an experienced camera man, who has worked for many years in Iranian cinema. "Alexa's functions are much easier to set, specially when it comes to setting colors. With a color chart, I could never get it right with RED." After the digital era began, the number of rental houses have dramatically increased in Iran, and today, around 60 Alexas circulate in Iranian movie industry with less than 15 RED cameras that are mostly used at weddings. Along with these cameras, are Zeiss Compact Primes, Ultra Primes, and Master Prime lenses that the movie industry has been using. There are also Cooke optics, and Angenioux depending on a director's personal taste. Iranian cinema has been most up-to-date with its gear, and older Zeiss Super Speeds (pre $25,000 Master Primes) have practically banished from the scene.

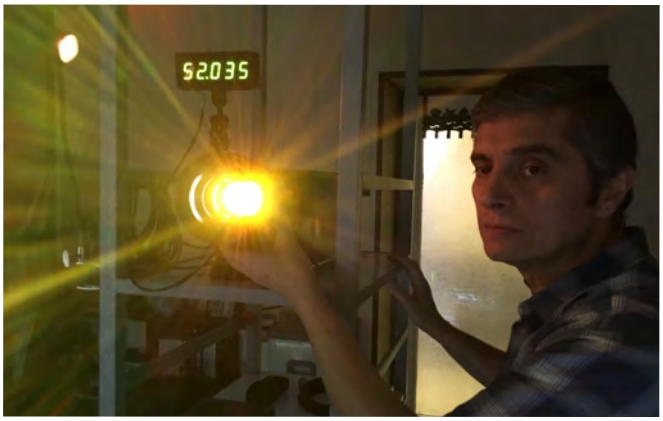
The success of Iranian cinema industry has created the need for highly equipped service centers for their evaluation, testing, and repair. To respond to this need, PD Cine rental house opened its optics shop with the most up-to-date test equipment to check optical performance such as resolution, collimation, and MTF measurements, etc. Evaluating optics for cinematography is really an art. This is because optical characteristics of cine lenses are not just evaluated by their resolution, and MTF tests alone. PD Cine has been in business for 10 years, and has regularly been visited by cinematographers who express their expectations of lenses, and their preference on their optical properties. The right way of using optics, and proper training in use of cameras is essential, and there are also training sessions to cover these areas. Today's digital cinema lenses are designed with higher resolutions in mind. The projection target for the film era had up to 200 lines of resolution lines and today's lens projectors can have the same resolution for testing 5K optics.

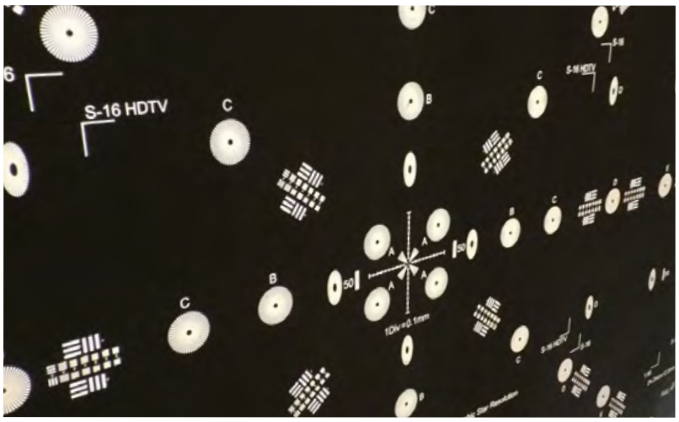
Optical testing is also needed after the lenses are serviced. Iranian cinema industry intends to do everything in house, from lens element replacement, to assembling, and alignment of all elements. For any lenses survived from the film era,

A zeiss Master-prime is installed on Cooke cine projector for direct reading of its lines of resolutuion, and contrast.



An Anamorphic lens test shows pincusion distortion, and visible chromatic abberation, and defocus on the corners.



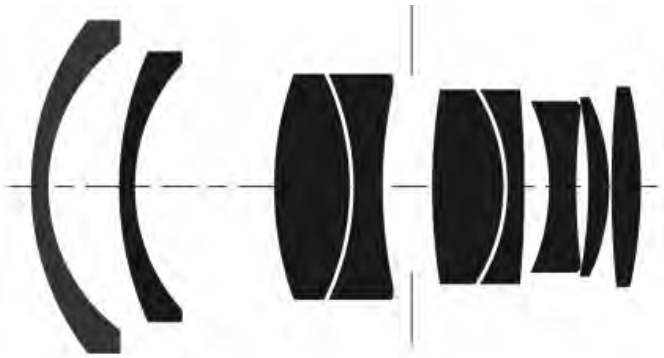


The current lenses designed for 6K, and 8k cinema, require higher than 200 lines/mm test targets that were good enough for 2K/4K/5K optics. The 8K cinema has not been accepted by Iranian film makers yet as a useful or practical format.

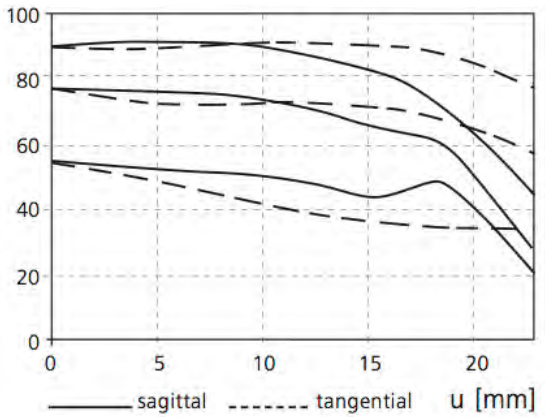
scratched elements are re-polished, and re-coated to keep them going. Cinema lenses for digital age are pricy, and at this center, there is a good collection of cinema optics for buyers to test, and make educated decisions before purchasing new lenses. There is also the more expensive line of Amorphous lenses that can be tried before purchasing.

The initial steps at a lens testing lab are lens cleaning, checking its mechanical alignment, and smoothness of controls. Careful lens cleaning with disposable tissues, and proper cleaning with adequate solvents would come first in lens maintenance. If the lens has been in desert, the first step would be to dust off the sand particles without allowing them to get into the optics. The next step is to view its projection in the darkroom with a resolution projector. Pearl Lens Tester was the standard instrument of the trade, and back in the years that I worked for Vivitar, that was the tester we used. Pearl Lens Projector was also one of the essential tools at Popular Photography's test lab where they are still testing lenses, and publishing their lens test reports. For today's lens testing, I expected a higher line resolution test target but to my

Hossein Jalili testing a Zeiss Master Prime lens with Carl Zeiss tester to verify its MTF performance at PD Cine.



Optical design of Zeiss Compact Prime 35 mm f/2 with 9 elements. Focus range is from infinity to 30 cm.



MTF of Zeiss Compact Prime 35 mm at f/2. MTF is as high as 92% at center, and decreases towards the edges.

Zeiss Compact primes use the same optical elements as their ZE lenses for Cinema use, now being re-designed.

$25K
T1.3

$16K
T1.4

$5K
T2

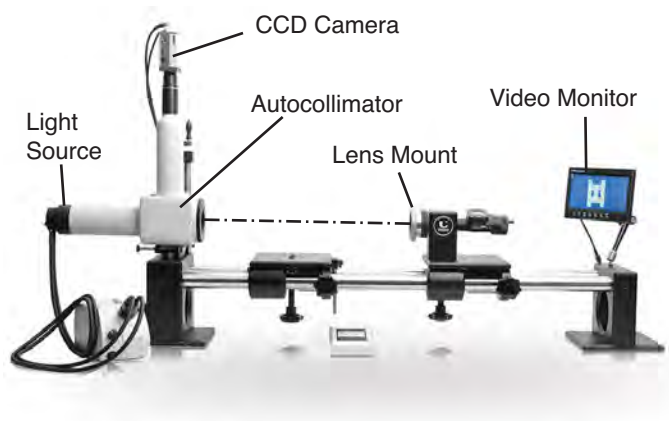
Zeiss Ultra Primes above, are the work horse in cinema lenses, with an average cost of $16,000. They fall in mid price range among other Zeiss optics, displayed in the mid row at the Zeiss booth (right) at NAB show. Master Primes, on the other hand (upper row), have an average price of $25,000, while Compact Primes, (lower row) cost around $5,000 each.

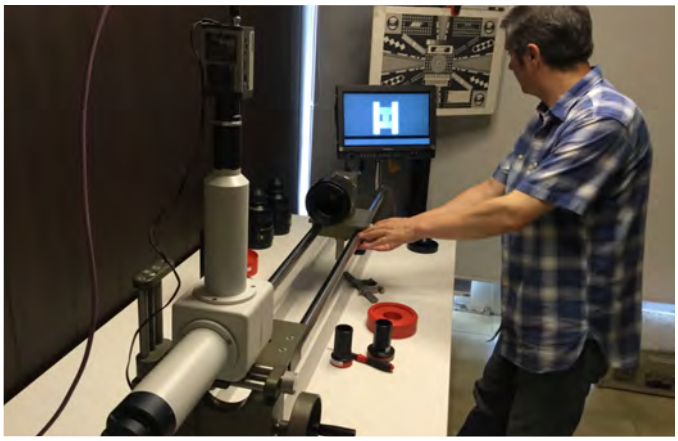
surprise, I found the same 200 lines per millimeter USAF target in their new Cooke projector as it is in our Pearl Projector back at OMiD museum. Some very useful features include motorized focus, and LED display of lens flange position. So many lens faults can be immediately found on the projection screen with the lens projector. Chromatic aberrations, image resolution, coma, pincushion or barrel distortion, and the the actual coverage of the lens. Older cine projectors such as Pearl covers 24.7x13.1 mm Super 35 format. The modern projector target size goes above 24x36 mm full frame format.

The second important test is MTF testing. PD Cine uses a MTF tester made by Carl Zeiss that measures the lens performance at its center. For those not so familiar with MTF testing, it is accomplished by projecting a number of lines/mm similar to a resolution target, but measuring their contrast on their line edges at the image plane. The line edges between bright, and dark on the test target are called a step function in optics. On the image plane, the step function ends up

Setting up the Gecko-Cam/Moller Wedel Autocollimator by precise centering of the optical projector with the test lens.

Setting the focus scale of test lens to infinity (left), and the back-focus mirror to zero (right). The non-rotating micrometer spindle has a flat mirror face to reflect back the autocollimator image to its CCD camera for infinity focus check.





For a new factory set lens, the two lines on the image are centered (above). Moller Wedel utilizes dual targets in the shape of an "**I**", and "**I I**" that are focused to infinity. Any deviation in lens back-focus results in a shift in the targets at the image plane. The central target "**I**" also fades to too sharp or less sharp (less focused).

having less sharp edges with less contrast, and it gets worse as the number of lines/mm increase. The sharper are the line edges on the image plane, the higher is the MTF. Page 23 shows MTF across field of view of Zeiss CP2 at f/2.

The final test that is performed on the lens is on its optical collimation, or infinity focus. The Moller Wedel collimator uses two closely spaced targets: One looks like a capital “I”, and the other looks like a Roman number two “I I”. When the image is in perfect focus, both targets would line up, and be centered correctly “III” (opposite page) When the lens back focus isn’t correct, the central “I” on the video screen would move to the right or left. For any deviation from proper back-focus, the lens mount is taken off, and shims are added or taken off to correct it. As all the efforts are made to service cine lenses, and cameras at PD Cine, film makers could rely on their knowledge, and experience to make better films.

Examining the optics before disassembly.

Removal tool for a Zeiss Master Prime frontal lens ring.

Removing the PL mount on a Zeiss Master Prime lens.

Disassembling a Zeiss CP2 lens for general repairs.

Zeiss CP2 lens components taken apart on the lens mat: Zeiss no longer utilizes helical screws in their cine lenses. Helical guides are utilized instead to translate internal lens elements. This design change, makes lenses much lighter but at the same time, more valnurable to drops. A damaged helical guide can not be repaired. It can only be replaced.