Jon Fauer, ASC www.fdtimes.com Feb 2024 ZEISS NP

FILM AND DIGITAL TIMES

Art, Technique and Technology in Motion Picture Production Worldwide

ZEISS Nano Prime Special Report

ZEISS Nano Primes (NP)

AFC Micro Salon, Feb 7-8. BSC Expo Feb 16-17. ZEISS launches Nano Primes: Full Frame, fast (T1.5), lightweight and compact cine lenses. They have nice ZEISS notoriously accurate lined focus scales and marks and are amazingly affordable.

There are 6 focal lengths in the set: 18mm, 24mm, 35mm, 50mm, 75mm, and 100mm.

Nano Primes come in E-mount. What, not PL or LPL?

Familiar to users of Sony Cinema Line cameras and alpha still cameras, the E-mount has a flange focal depth of 18 mm, which is much shallower than PL (52 mm) and LPL (44 mm). The E-mount diameter is 46.1 mm (PL is 54 mm, LPL is 62 mm).

Also called mirrorless because they were made for cameras without spinning mirror shutters or mirror reflex viewing, shallow flange depth lenses like E-mount come with various advantages in optical design and economy, as described in the following pages.

The mirrorless market is vast, something ZEISS surely noticed when embarking on this adventure. There are hundreds of thousands of E-mount, L-Mount, Z-Mount, X-Mount and RF Mount cameras out there—many beckoning for cine-style geared and expanded focus and iris rings.

Nano Primes initially ship in Sony E-mount. Conveniently, because they employ the ZEISS IMS (Interchangeable Mount System) familiar from CP.3 lenses, additional mounts can be attached with 4 screws and adjusted with included shims. ZEISS has not announced these mounts yet, so presumably it is up to users to weigh in.

Electronics are built into each mount, enabling the lens and its metadata to communicate directly with the camera: focal length, focus distance, aperture and additional metadata. It's not eXtended Data but will work in a similar way. Distortion and vignetting data is available for ZEISS CinCraft, CinCraft Mapper and the CinCraft Scenario camera tracking system.

Focus and iris rings are all in the same place relative to the mount. Deliveries begin in May 2024. Nano Primes can be ordered as a set for $25,950 / €23,000 (plus VAT) or individually at an average price of about € $4,000 to € 4,500 each (plus VAT).

www.zeiss.com/cine/nanoprime

ZEISS Nano Prime Specs

Nano Prime	18mm	24mm	35mm	50mm	75mm	100mm
T-Stop	T1.5 -T16	T1.5 -T16	T1.5 -T16	T1.5 -T16	T1.5 -T16	T1.5 -T16
Close focus (mm)	250 mm	350 mm	450 mm	500 mm	750 mm	1000 mm
Close focus (in)	9.8 in	13.8 in	17.8 in	19.7 in	29.5	39.4
Length (mm)	112 mm	89 mm	89 mm	89 mm	112 mm	112 mm
Length (in)	4.5 in	3.5 in	3.5 in	3.5 in	4.5 in	4.5 in
Front diameter	95 mm	95 mm	95 mm	95 mm	95 mm	95 mm
Screw-in filter	M86 x 1	M86 x 1	M86 x 1	M86 x 1	M86 x 1	M86 x 1
Weight, with lens mount (g)	1,192 g	876 g	871 g	924 g	1,125 g	1,255 g
Weight, with lens mount (lb)	2.6 lb	1.9 lb	1.9 lb	2 lb	2.5 lb	2.8 lb
Angle of focus scale	280°	280°	280°	280°	280°	280°
Angle of iris scale	90°	90°	90°	90°	90°	90°
Number of iris blades	12	12	12	12	12	12
Focus gear diameter	100 mm	100 mm	100 mm	100 mm	100 mm	100 mm
Aperture gear diameter	80 mm	80 mm	80 mm	80 mm	80 mm	80 mm
Focus & Iris gear pitch	0.8 mm	0.8 mm	0.8 mm	0.8 mm	0.8 mm	0.8 mm

ZEISS Nano Primes (NP)

L-R: ZEISS Nano Primes on Sony a7, FX3, FX6, FX9, BURANO, VENICE.
ZEISS Nano Primes cover Full Frame, come in E-mount, and fit Sony's entire Cinema Line as well as Sony a7 series, a9 series, and a1.

ZEISS Nano Primes come in this custom cutout, wheeled Pelican Air 1535 Case at no additional charge when you purchase the set of 6 lenses.

The carry-on case measures 21.96 x 13.97 x 8.98 in / 55.8 x 35.5 x 22.8 cm (Exterior dimensions L×W×D).

ZEISS Nano Primes

Mount Fuji was watching over a whisper room in Makuhari where ZEISS Nano Prime lenses were revealed in an especially appropriate FDT lens testing and Kaiseki tasting.

Arato Ogura, Shin Yoneyama and Masako Misako (who named us "Film and Delicious Times" in Japan) unpacked a Pelican Case containing a set of pre-production Nano Primes and a Sony FX6 (courtesy of owner-filmmaker Hiro Matsuzaki).

Things quickly became clear. These Full Frame, E-mount cine lenses are small and lightweight. The entire set of 6 fits nicely in a small carry-on underseat case. They focus extremely close. Why else would Masako have arranged for Kaiseki close-ups? The lenses have gentle focus fall off with impressionistic bokeh and a beautiful look with silky smooth skin tones. Photos on these two pages were all taken with ZEISS Nano Primes on a Sony a7R4.

ZEISS Nano Primes

L-R, with ZEISS Nano Prime set: Shin Yoneyama, Project Manager for Nano Prime; Masako Misako, Marketing Manager Cine, Asia and Oceania; Arato Ogura, Regional Cine Manager, Asia and Oceania.

Christophe Casenave on ZEISS Nano Primes

Christophe Casenave. Photo by Andreas Bogenschütz.

Christophe Casenave is Head of Product Management and Sales at ZEISS and Product Manager of the new Nano Prime Lenses.

Jon: Where did the idea of Nano Primes come from?

Christophe: It started around the time we were developing the Supreme Prime lenses, which were introduced in June 2018.

But let's take a quick detour back in time. We introduced the CP.3 Primes in April 2017. *(Christophe was the Product Manager for those as well.)* They are excellent lenses, affordable, Full Frame, with interchangeable mounts, 95 mm front diameters, with XD data on the CP.3 XD models. But their apertures are slower, at T2.9 for the 15, 18 and 21 mm lenses and T2.1 for the rest.

CP.3 lenses were the third iteration of ZEISS Compact Primes, the most widely distributed cine lenses in history. The original Compact Primes were introduced at NAB 2009. They initially came with PL mounts only.

I saw that Sony was very strong committed to their E-mount. When they launched VENICE with its PL mount in September 2017, few people took seriously that it had an E-mount underneath. It was essentially a high-end PL Mount camera with an E-mount as well. I was just thinking, imagine what you could do if you really used the power of the E-mount or any short flange focal depth mount. How much smaller could you make the lens or, if you kept it the same size, how much faster could it be? I wondered, if Sony takes the E-mount so seriously, why are most E-mount cine lenses essentially repurposed PL lenses with elongated mounts. That's like half an answer. There were two ways to go in an E-mount cine lens design. We could reduce the size and weight, making it very much smaller than the CP.3, but keeping the slower aperture.

Or we could redesign everything, maintain a T1.5 aperture throughout the set, keep the expanded focus scale and XD data, make the lenses lighter in weight and a bit smaller. It was a completely new design.

Although the concept went back five years, we had to find a time slot for the development resources. Two years went into finalizing the Supremes and then we did the Radiance Primes. Actually, the timing worked in our favor because Sony released more Full Frame E-mount cameras in the Sony Cinema Line: FX9 in 2019, FX6 in 2020, FX3 in early 2021, VENICE 2 in late 2021, and now BURANO in September 2023.

When it came to the design, we didn't want these lenses to compete with CP.3 because I still believe strongly that CP.3 are super lenses. If you want to shoot with ARRI cameras, which have PL or LPL mounts, but you are on a limited budget, then you have the CP.3 Primes in PL mount. There are many ALEXA Minis in the Certified Pre-Owned and second-hand markets for owners with CP.3 lenses. Those cameras will probably never break. They will continue to work.

We also did not want the new Nano Primes to compete with our Supremes. Rather, we wanted them to complement the Supremes, with a look that is similar or that goes in the same direction. The look of Supremes is well appreciated. We realized that the Nano Primes would be good on productions that could not afford Supremes or where the cinematographer wanted, for example, three sets of Supremes but the budget could only afford one or two sets and they needed to add a third. Or, perhaps they needed something smaller and lighter. So that's how we designed the lenses, defined the look and established the optical parameters.

Does having a short flange focal depth significantly affect the optical design in terms of size, speed, weight, etc?

Yes, it's quite significant, especially for the wider focal lengths—everything that's wider than 35mm. The Nano set includes 18, 24, 35, 50, 75 and 100 mm so far, all T1.5 and with a 95 mm front diameter. You couldn't design the lenses so small if they had a longer flange depth, like the PL mount. *(FFD of E-mount is 18mm. FFD of PL Mount is 52mm.*)

Why do you think Sony did not do this—make traditional 0.8M geared cine primes in E-mount and with lens metadata?

I think they have a consistent and good strategy, which is a commitment to technological progress in autofocus and auto-iris. This works for a large segment of their market, but it doesn't cover current applications in the field of cinema, which include 0.8M gears on lens barrels for wireless lens control.

There is a certain conservatism in cinematography and that's fully understandable. Everything new is a risk if things go wrong. Feature films and drama series will stay with more traditional ways of working for some time. Although, to be fair, it's not really tra-

ditional because most focus pullers probably use wireless lens controls from Preston, ARRI, cmotion, Teradek, Tilta or whoever. And they will be using wireless monitors to check focus. I don't know many assistants who still work alongside the camera with a mechanical follow focus drive.

Please take us through the development process of the NPs.

We wanted to achieve a similar look as the Supremes, but relaxed and calmed down a little bit. Nanos have a nice balance between being sharp but not too sharp, contrasty but not too contrasty, neutral but not too neutral. They are not clinical. The only thing neutral is the color, but all the rest is well balanced.

Actually, there was another constraint: I wanted to have only two sizes, not five or six different barrel lengths. Normally it would have been easier to make the 18mm a bit shorter, but that would have entailed having another size. I also wanted one consistent front diameter. Originally, we wanted to have an 80 mm front diameter, but that wouldn't have worked with the 100mm lens. We chose to have one 95 mm front diameter because it is faster and easier to change lenses on set when they are all the same front diameter. Optical design is indeed a series of choices and compromises.

CP.3 primes also have a 95 mm front diameter. And standard Supremes also have a 95 mm front, but the 15, 18, 135, 150 and 200mm lenses have 114 mm fronts. The new Nano Primes are smaller than Supremes. We achieved this in different ways. First of all, the short flange depth enables a lot of possibilities. Also, to keep them small, we decided not to have dual focus scales that invert to switch from meters to feet because that would have required a window in the barrel. So you don't just flip it, you exchange it. You can do that by yourself. It's easy and doesn't require a lens technician. That's how we kept them small.

Tell us about lens metadata.

We wanted consistency with what we did up to now. We have been involved with eXtended Data, CinCraft Scenario, CinCraft Mapper and VFX work, so ideally we would have wanted eXtended Data in the Nano Primes. But NPs conform to the E-mount communication protocol. We have implemented E-mount lens data precisely so it will communicate the same information with the same accuracy as on the Supreme or the CP.3 XD.

Focus and iris metadata goes through the E-mount. Furthermore, we wanted to offer the eXtended Data experience, and this is possible because we will include the Nano Primes in CinCraft Mapper and in the CinCraft Scenario tracking system. Basically, when you use CinCraft Scenario, the Nano Prime lens models are embedded. When you use a Nano Prime lens, the Sony camera reads and records the metadata and outputs it via SDI as well. CinCraft Scenario can grab the information and map it with the distortion and shading data. It works exactly like eXtendeDdata with the same benefits when using CinCraft Mapper.

Are you going to offer other mounts as you did with the CP.3?

We'll try. Nothing's confirmed, but everything is in place. The lenses have been constructed with all the electronic intelligence in the mount, not inside the lens. You only have the encoders to measure ring positions in the lens. That means, if we decide to do other mounts, we will be able to support the communication protocols of other cameras as well. It's designed so that users will be able to exchange the mounts on their own. They will not need to send the lenses back to the factory. It's as easy as the CP.3. Very simple.

Did you get feedback from DPs and rentals houses while planning the Nano Primes?

We always gather feedback as we go around and talk to people. It was a mix of opinions. One analysis showed that there were no serious mirrorless mount cinema lenses. Others said there was a greater need for high speed lenses. A third concept showed the Sony cameras gaining large popularity and the E-mount ecosystem growing. It was a combination of analyzing all those things, getting feedback and hearing users ask, "Why aren't you doing E-mount cinema lenses?" Personally, I was not so enthusiastic about the E-mount because in some situations it is not as stable as a PL mount, for example with a huge 12:1 zoom lens. But the sweet spot is really for lenses that can be smaller than their traditional PL mount equivalents.

Is this lens intended for owner-operators or for rental houses?

The idea was to expand the owner-operator base. Actually, owner-operator is not the right term. It's more like small companies. It might involve two or three people who want to own their equipment because that's practical for them logistically. If it's a one-day shoot, they can grab the equipment and go.

But, there is also a path for these lenses at rental houses, not only to service jobs with lower budgets but also for big productions. If you look at equipment lists lately, the number of cameras (A, B, C, D and more) and lenses they use on some films is growing almost exponentially, but the budgets are not increasing proportionally.

For these scenarios, the idea was to define the Nano Primes with a look similar to the Supreme, but adapted to current budget trends, and smaller in size to complement smaller cameras. Even big-budget productions can benefit from NP lenses on scenes where they might have up to 20 cameras.

What do you tell customers who ask why the have to spend more for a Supreme than a Nano Prime?

The optical design of Nano goes in the direction of the Supreme, but you have several trade-offs. The first trade-off is making it with a shorter flange depth—because then you simplify the design. Nano has fewer lens elements. You have less glass, you simplify the design. Another trade-off is that the Nano will not fit on a PL mount camera, not even with an adapter.

The second trade-off, as I mentioned, is by avoiding focus rings with both Imperial and Metric scales that would otherwise add additional cost. Also, the focus and iris rings are marked with a laser, not engraved and painted like the Supremes. They are just as accurate, but laser etching saves a lot of money.

The concept of the Nano is: don't save on the glass, save on other things. It's like going to a restaurant. If they put all their efforts into a fancy decor but skimp on the food quality, your experience will not be good. The Nano Primes would be more like a nice Paris bistro that looks like nothing when viewed from the street outside, but you will get the best dishes there. Let's not make the savings on the ingredients, but rather on the decor.

Film and Delicious Times appreciates the tasty analogy. I look forward to lens tests in that bistro. Do Nanos have the typical ZEISS system of using different focus scales?

Same philosophy. But we have about 3 times fewer scales to reach the same accuracy. This is not only a big deal for the manufacturing, but it is also a big deal for film productions and VFX teams who might ask for six lenses of the same focal length that match.

Tell us about the team who worked on the Nano Prime project.

We had a very international team. The optical and mechanical designs were done in Oberkochen. Thomas Steinich is the lead optical designer. You met him on the Supreme, Master Anamorphic and Zoom projects. Dennis Meyer is the Systems Engineer. Uwe Weber is the mechanical designer. You remember him from his work designing the Master Primes. Shinichi (Shin) Yoneyama is the project leader. Working from our office in Tokyo, he coordinated design in Germany and manufacturing in Japan. We worked with our long-time manufacturing partner in Japan to keep the price at an acceptable level.

Once the designs were finished, we built prototypes and did all the qualification in Oberkochen in the same lab, headed by Stefan Ballmann, where we also test the Supremes, CP.3, Master Anamorphics, etc. It was really an international team. Benjamin Völker, (Dr. Ghost) reduced the ghosts.

How would you describe the Nano Prime look? Similar to Supreme? Gentle?

Yes. It goes in the same direction. Of course, it cannot be 100% the same. The focus fall-off is also very smooth and "slow." Slow focus fall-off means that the transition from being sharp and in focus to where you begin to go out of focus is gentle. For example, the actor's eye is sharp, but the nose is pleasantly softened a little bit. Because the fall-off is so smooth and slow, you have the impression it's in focus. You don't need to stop down to have the whole face in focus as the contrast goes down. You will find the same thing with the Supremes.

How did you come up with the Nano name?

That is a funny story. Normally you have an internal project code name. A company might choose names of fish, birds or cities. We said, "OK, because we want to make small cinema lenses, let's call the project Nano." Then came the point where we needed to give it a product name. The project leader said, "Well, Nano describes what the product is, so let's keep Nano." And so, the project name became the product name.

Do you plan to have more focal lengths if users ask for them?

We have designed 6 focal lengths that are well staggered so there should be no big gap for the vast majority of applications and customers, especially talking about smaller crews.

If specific needs arise we would of course consider making some additions … and we are always open to feedback.

I think your only headache will be to keep up with the demand.

I think it will be OK because we are the only ones to take the E-mount so seriously for cinema—with precise marks, expanded focus barrels, lens metadata, the look, the speed, the economy. The Nano is a true cine lens. It's not bridging the gap between photography, videography and cinema. It lets you do classic cinema style production with E-mount. That is really unique.

Certainly we recognize that a large number of E-mount users will continue to use autofocus simply because they don't have a team to work with. They work alone or they are doing a documentary. In summary, we could say that the Nano Primes are premium lenses for the immense group of E-mount users.

Thomas Steinich & Dennis Meyer on ZEISS Nano Primes

Thomas Steinich (left). Dennis Meyer (above). Photos: Andreas Bogenschütz

Thomas Steinich is the lead optical designer and Dennis Meyer is the systems engineer on the ZEISS Nano Prime project.

Please tell us about the optical design of the NP lenses.

Thomas Steinich: A new set of cine lenses is always an exciting, challenging road until you finally put the first prototypes on a projector and MTF measurement equipment to see your results. A whole team of optical designers worked on the NPs. The task was quite challenging: make it fast at T1.5, make it small and lightweight, and make it affordable without sacrificing our ZEISS cine standards. The intention of providing a compact set led to some discussion about the focal lengths, because we needed a smart choice of steps between 18mm and 100mm. For each of the 6 focal lengths, many different potential designs were generated, evaluated and rejected until we made our final selections. As usual, the shortest and longest focal lengths needed additional effort until we agreed on the final design.

How did you arrive at the "look?"

Thomas: The "look" of a cine lens is the sum of all the effort and decisions you make during the entire design process. It is not something that you can just switch on and off in your optical design software. There is no specific operand that you have to control to make "the look". All aberrations in and out-of-focus, coatings, ghosts and the accuracy level of production contribute to the final look that DPs hopefully will cherish. As I mentioned in our last interview for the SPs back in 2018, we have special in-house optical design software at ZEISS called OASE (a motivating name: German for "Oasis") with multiple features that are lacking in commercial optical design software packages. We can analyze the image in every detail during the optical design phase and "build" a virtual prototype that includes mechanics and stray light. These simulations are already very close to what we see and measure in the lab after actually building the hardware.

Is it my imagination or are skin textures even smoother on Nano Primes (NP) than Supremes (SP)?

Thomas: Skin textures are a big topic for all DPs. It is one of the characteristics that they look at right from the beginning of working with new lenses. And therefore, it is important to us. As an optical designer, skin textures primarily translate into MTF-resolution, resolution distribution over depth of focus, longitudinal color aberration and off-axis color fringing. You have to find an ideal balance between color-free smoothness and not being unsharp. That was an important goal during the development of the NPs.

Please talk about flares and ghosting—or lack thereof.

Thomas: This is one of our central ZEISS cine standards: to analyze and optimize ghosting in all our lenses. It is a crucial step during the optical design phase, and it can really change the lens setup and geometries if necessary. Therefore, it is not a final "thumbs up or down" check but an integral part of optical design. Ghosts and flare are well removed in the NPs to get a clear and excellent visual impression.

How would you describe the difference (or similarities) in look between NP, SP and other ZEISS cine lenses?

Thomas: Every ZEISS cine lens is optimized to have proper contrast within the plane of best focus with the aperture fully open, and not just in the middle of the sensor but across the field of view. There is a gentle fall off in contrast when you leave the plane of best focus to get a smooth cinematic look; color aberrations are small and ghosting is optimized. This holds true for the NPs, too. The differences between NPs and SPs, in terms of look, are small. The idea is to give film crews the option to even mix NPs and SPs on the same film set. To us, NPs are the connection between high-end/blockbuster and mid to entry-level cine lens equipment.

How is the Nano Prime optical design the same or different from Supremes, Master Primes, Master Anamorphics, Ultra Primes and CP.3?

Thomas: The main difference compared to all the other ZEISS cine lenses is the extremely small size of the optics and mechanics in which they fit. NPs are tailored to the E-Mount interface to benefit from all the advantages you have with a short flange focal distance. Furthermore, the NPs are designed for the entire Full Frame sensor, compared with Super35 MPs, UPs and MAs. And yet, NPs are still very fast. From an optical design perspective, all contradictory characteristics had to be combined in these new cine lenses: big sensor, high aperture, small size and affordability.

Are the T* coatings the same or different?

Thomas: The T* coatings are the same as with the Supremes. We did not sacrifice performance to get the cost down.

Iris? Bokeh?

Thomas: The mechanical iris consists of twelve blades to get a nice round shape to provide a proper cinematic bokeh. Again, our intention is to provide a real cinematic set of lenses for short flange-focal-distance cameras.

How does the short flange focal depth (E-mount=18mm) help or influence the optical design?

Thomas: In short: yes. The impact on optical design is most obvious with the shorter focal lengths. For example, Supremes and CP.3s had to provide a huge clearance on the image side to fit PL mount and SLR cameras. When you design an 18mm lens for such cameras, you have to implement a strong retrofocus design to get an image side clearance of approximately 2 times the focal length of your lens. This leads to big and heavy lenses, doublets, and special glass to correct color aberrations. You use big aspheres to address distortion and field dependent aberrations. In summary, weight, cost, and complexity are added. For the NPs, a flange focal depth of 18mm means you can design an 18mm focal length lens almost symmetrically. This is great news for the optical designer, because some field aberrations (e.g. distortion, lateral color and coma) get much smaller with almost symmetric optical systems. For longer focal lengths, the advantage of E-Mount is smaller. Still, your last optical element can be positioned closer to the sensor, but the optical designer is fighting more with longitudinal color and spherical aberration which have to be corrected at other positions within the lens.

Jon: What were the challenges getting the NP series so small, lightweight, 95mm front diameter, and yet very fast T1.5?

Thomas: Besides the advantages of the E-mount that I mentioned, one of the best options you have in optical design to reduce size and weight are aspheres. When I started my career as an optical designer more than 15 years ago, maybe one or two aspherical surfaces were acceptable in a cine lens because of complexity and cost. Today we have access to much cheaper asphere production capabilities. Therefore, multiple double-sided aspherical lenses are possible without horrendous cost. Additionally, getting the lenses small is not a one way street from the view of an optical designer. The mechanical designer, the entire production team and the assembly team have to agree on the final lens design with some rather thin lens elements. This is challenging for the whole production process along with some tight cost constraints. Dennis managed to get different working groups together technically to come up with a common view on what is really feasible.

Jon: Dennis, tell us about your role on the NP Project.

Dennis Meyer: As a Systems Engineer here at ZEISS and in the Nano Prime project, my primary role is to manage all aspects of the product requirements and implementation and to have an overview of the technical status of the project at all times.

My job starts at the beginning of the project by understanding the concepts of our Product Manager (in this case, Christophe). I then translate these technical requirements into a coherent and feasible system design. This involves collaborating with our engineers to develop a detailed understanding of the product's technical specifications and capabilities, and working with our Japanese manufacturing team to ensure the design can be realized effectively and efficiently. For Nano, we had around 150 technical requirements per focal length, defining all kinds of properties like T-stop, physical dimensions, maximum weight, exchangeable mount as well as all properties that affect the look and quality of the final product.

I am also responsible for verifying and validating the performance of the lenses against these requirements and the customers' expectations. This involves doing system tests together with our laboratory staff, analyzing the results and bringing necessary adjustments to optimize the system's performance into the development cycle. I also work closely with the quality assurance team and the service team. In summary, my role on the NP project and as a Systems Engineer at ZEISS is to ensure that our product is technologically sound, reliable, and meets both the company's and our customer's expectations.

Tells us about the mechanical design.

Dennis: From the beginning of the project, Christophe had the idea of a real cine lens for E-Mount, not a hybrid between stills and cine or something similar. Tough requirements for the development team and me included having a compact housing with typical cine gears for focus and aperture positioned in the same position on all lenses to make on-set lens changes a breeze. Large rotation angles and standard front diameters were also important. We finally achieved these things with a completely new mechanical design that also passed all our strict ZEISS quality and environment tests like rapid heat changes, hot and cold temperatures, mechanical shock and so on. It is an uneasy feeling when you deliberately drop a lens prototype onto a hard floor. Yes, the lens survived.

When did you begin this project?

Dennis: Having recently completed my PhD in Experimental Physics, I joined ZEISS in October 2021 as a Systems Engineer, and Nano Primes became my first task. It felt a bit like diving headfirst into the deep end, but the exceptional colleagues here in Oberkochen and also in Japan made the transition smooth.

Shin Yoneyama, Arato Ogura and Masako Misaki presented the NPs to me a few weeks ago in Japan. As Systems Engineer, how did you coordinate with the teams in Japan?

Dennis: The biggest coordination effort was handled by Shin, who did an awesome job leading the teams, keeping a keen eye on schedule and budget and a lot more. My role in project coordination was more on the technical level.

Is QC done in Oberkochen?

Dennis: Prototypes were all qualified in Oberkochen and the serial production lenses are adjusted, measured, calibrated and quality-controlled in Japan, following the same protocol and procedures as our other cine lenses. The measurement equipment in Japan is also identical to the ones we use in Oberkochen. We carried out acceptance tests and training with the equipment on site. Our Japanese colleagues are renowned for their attention to detail, precision, and dedication to quality. A sampling of 25% of all lenses is again quality checked in Oberkochen by the same highly experienced colleagues who also ensure the quality of our Supreme Primes.

How can these lenses be delivered at such an affordable price :)

Dennis: Achieving an affordable price for the Nano Primes without compromising on quality and performance was a clear goal for our project team from the beginning. We focused on understanding the customers' needs and balancing costs, material and assembly efficiency with optimal performance and quality. This process requires a clearly defined product concept that excludes unnecessary features, along with the flexibility to investigate novel optical and mechanical designs. During the lens development, well-informed considerations and decisions need to be made, keeping in mind constraints as to budget, schedule and price.

For example, one area where we could reduce costs without sacrificing quality was in the focus and iris scale markings. Instead of using traditional stylus engraving, which is more time-consuming and requires a separate process outside the clean room, we chose to use laser etching for the Nano Primes. Laser etching not only saves time and streamlines the production process, but it also reduces costs without compromising the accuracy and readability of the markings. This also came with the advantage that the scale of the Nano can be fully parametric, meaning we can make the focus scale optimized for every lens.

You may notice that for the Nano we are not using the Supreme Prime style labels for the rings (L, N, NP, etc) but a combination of letter and numbers. This is due to the greater freedom of laser engraving and the fact that, although we save time and money with the process compared to stylus engraving, we can engrave each lens even more accurately.

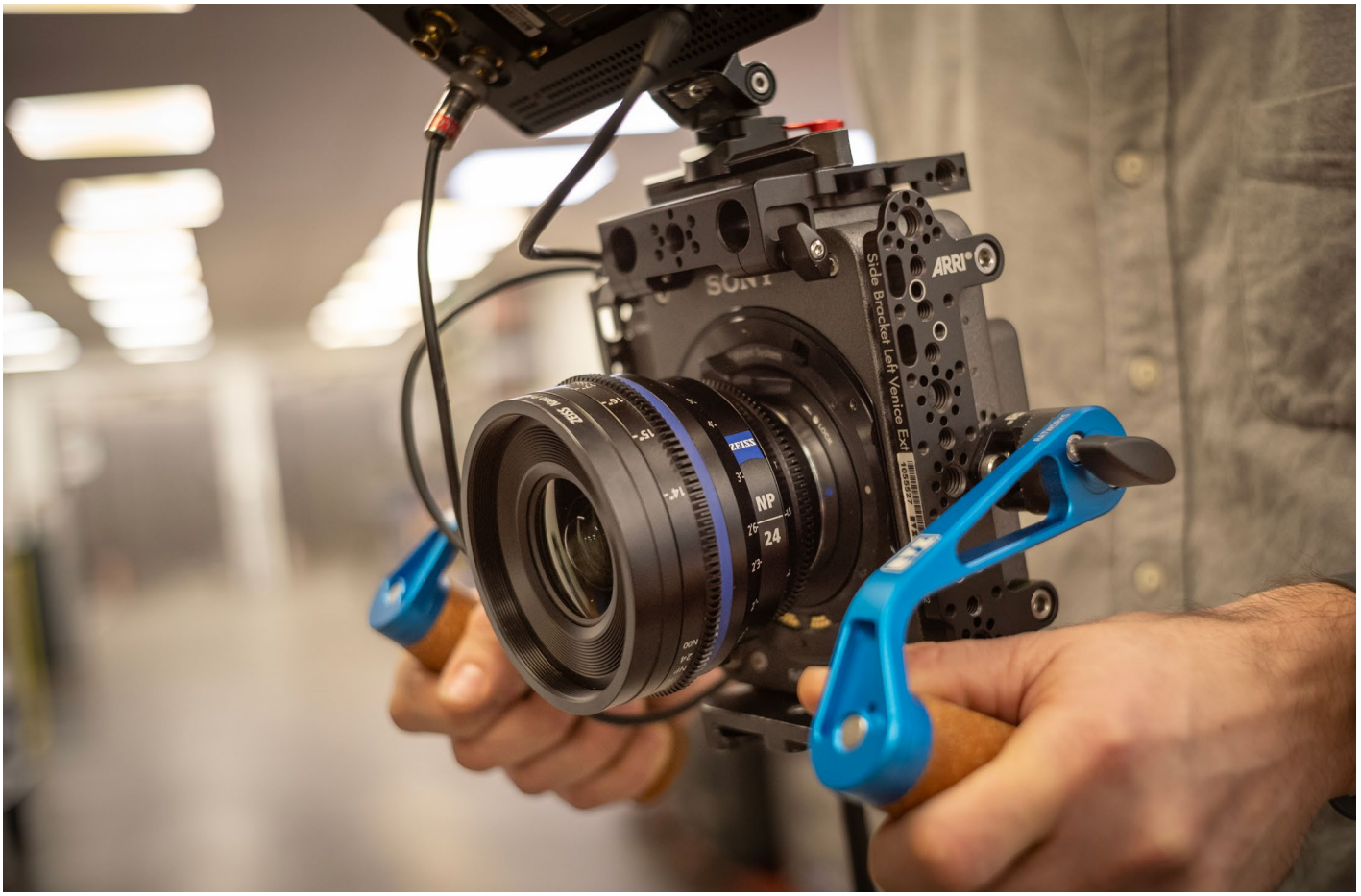
By considering each step in the development process and prioritizing the elements most important to our customers, we can provide the Nano Primes with exceptional performance and quality at a reasonable price.

NP at RVZ

Samuel Renollet, Camera Department Manager at RVZ in Paris, provided these photos of ZEISS Nano Primes paired with Sony VENICE Rialto.

With Rialto's PL Mount removed to reveal its native E-mount underneath, the NP primes enable a lighter, smaller and more nimble combination.

RVZ provided the Sony VENICE 2 and Nano Primes that Vincent Tartar and crew used on their short film for ZEISS, shown on the next page.



Vincent Tartar is a DP and member of the UCO (Union des Chefs Opérateurs), which is not a trade union but rather an active organization. Vincent used NP lenses on a ZEISS demo film and said, "They have a gentle sharpness. There was something very interesting about them between being precise and also having a separation from what was sharp and what wasn't. The skin tones are amazing. Nano Primes and E-mount cameras give you a wide range of products according to the production's possibilities and budget. I don't think that high-end equipment will disappear. But equipment such as the Nano Primes may allow some independent filmmakers to achieve high-end quality, maybe to reach new audiences and to produce a better quality of images. And so, we may all be able to reach other new heights of filmmaking."

NP with Valentine Lequet

Valentine Lequet is a French cinematographer working in Paris and London. She started as a camera assistant on features and commercials, and is one of the co-founders of the UCO (Union des Chefs Opérateurs) *unionchefsoperateurs.com*.

Valentine was the Director/Cinematographer using Nano Primes on a short demo film for ZEISS. ZEISS provided the NPs. Will Newman at Sony UK lent a pre-release Burano and Sunbelt supplied the rest.

Valentine said, "I use a lot of Supreme Primes, so I wanted to know if this series could be a new addition for a B camera or something like that. It was very interesting. I wanted to do a project about artists and musicians, so this was a very cool way to mix all these together, and try the Nano Prime lenses on this project.

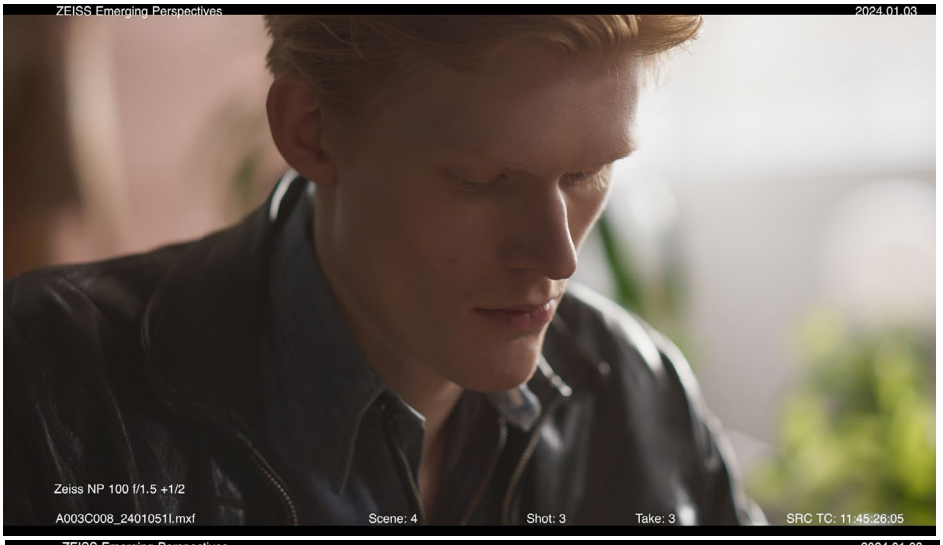
"The idea was to investigate how art is involved in society and how artists manage to live with it and to do it every day. It was a big question. The process was documentary style but we didn't want to only do interviews. There are moments of music, moments of sharing, and we wanted to have the opportunity to test the optics in different kinds of ambience.

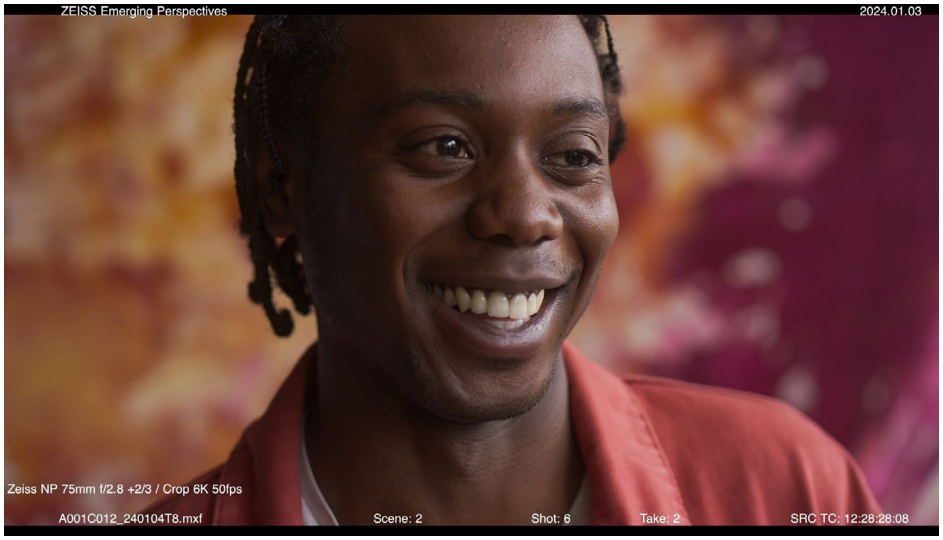
"The Nano Primes felt exactly like the little sisters of the Supremes. The skin tones are exceptional, and when the scene is backlit, when you are filming close-up on a face, it's very beautiful. The lenses are very light. That was the first thing I noticed.

I shoot a lot of commercials, some in a documentary style, with very light equipment. I think I can now go everywhere with these lenses, for sure, even on beauty commercials, because the skin tones are very beautiful. I was very happy because it's very hard to find small lenses with such good qualities.

Elise Filaferro, 1st AC (left) and Rodolphe De Quay, DIT (right) prepare the camera for filming.

Above: Valentine Lequet, Director/DP. Elise Filaferro, AC, in the monitor. Photo: Sundeep Reddy.
Non-graded framegrabs of singer-painter Huddie Hamper (below) and singer Ry-Guy (bottom).





NP with Jon Joffin, ASC and Brendan Steacy, ASC, CSC

What happens when you pair two top DPs together with ZEISS Nano Primes? Jon Joffin, ASC and Brendan Steacy, ASC, CSC had a set of NPs on sets in Vancouver. Keslow Camera supplied a Sony VENICE 2 and BURANO. Jon was the Director/DP and Brendan was the co-DP who modestly said, "I just joined Jon."

Jon explained, "We shot fashion and music video scenes in a film studio and on a volume stage, a skateboard sequence under an amazing bridge location, and underwater in a blacked-out swimming pool. It was a challenging shoot that was super interesting because the story is about two filmmakers. It's called "Shoot, Sleep, Repeat." They're bouncing out of bed every morning and they shoot three different scenarios each day. We wanted to have a rhythm where you're looking out the window and you see the sun rising, and CUT, they're out the door. Then at the very end, they win an award on the second night and then everything slows down as they bask in the glow of their achievement."

Brendan continued, "I thought the Nano Primes were really cool. They fit very nicely into every situation. The design of the NPs is really interesting. For a long time, it seemed manufacturers were trying so hard to make lenses perfect and eliminate veiling glare, and any aberrations, which has resulted in lenses that don't really flare, and are maybe a bit boring. The new ZEISS Nanos bring back some of that character - still in a modern style. They were flaring beautifully, but they were also sharp enough to render details well. They felt a lot like the Supremes, but also had enough character to make all those other situations feel organic and nice as well."

Jon added, "To echo what Brendan said, we carried a full set of Supremes and a full set of Radiance because we had a sunrise shot where we thought we might want more flare. We ended up shooting the whole sunrise, and in fact, the entire film with Nanos. They were that good. We have a scene against a shimmering wall background and I noticed that we got an almost Petzval effect with the bokeh in the background. They had a swirly spiral shape, which I love. I can never get enough of that. And then there were other interesting flares. We shot 97% of the film wide open at T1.5, which is a sweet spot that I thought looked great, stunning. That to me is the benchmark. I don't want to use a lens that I can't use wide open. I need that option."

Brendan said, "Nano Primes can work on high-end productions. They would cut well with the Supremes. But I don't think they're going to displace the Supremes. If we're shooting with a variety of PL or LPL lenses, we want the cameras to have those mounts. And the Nanos will be working on cameras with E-mounts. That's the difference.

Jon concluded, "It's worth noting that we did use the NPs full time on the Venice 2 and they performed flawlessly. The NPs are true cinema primes in every sense. They are reliable and have very pleasing character."

Brice Michoud on ZEISS CinCraft Scenario

Brice Michoud in classic Breton striped shirt. Decreed in 1858 by the French Navy: "21 white stripes and 20 to 21 indigo blue stripes."

I'm Brice Michoud. I'm from Lyon, France and now live in Brittany. I did my PhD at the University of Lyon where my thesis was about computer vision and marker-less human motion capture. I met the right people at the right time. That was 2011.

We created Ncam Technologies in the UK on January 1, 2012 to create systems engineered for cinema. The intention was to revolutionize how people would shoot movies, especially when they had heavy visual effects sequences. At that time, they were mainly shooting against green screen. Tennis balls were used to line things up and track where the CG elements would go, to make sure that the actors would be able to know where to look and where the action was. That's how it all started for us over 10 years ago. Our plan from day one was to eliminate the guesswork on set when shooting VFX scenes that would consume a lot of time if they were done wrong. That's how we started as Ncam Technologies.

When I created the original technology, it was a tool just for me, but it was not made for someone else to operate easily. If you want to make sure that the data captured on set will be useful in post-production, you need to ensure that it is easy enough to operate.

On our journey to develop the Ncam system, we needed to model lenses, and that's where the relationship with ZEISS began. If we wanted to render live CG elements and make sure they would stay in place or where they were expected to be, we had to mimic the lenses and their optical characteristics—distortion, aberrations, flare, focus fall-off, shading, depth of field, etc. We had to calibrate (map) each lens before a shoot to make sure it matched the background. This is a time-consuming effort and not always super accurate. When we started talking with a manufacturer like ZEISS, we realized they clearly had all this information because this is what they require to build their lenses.

Our journey with ZEISS began with a whiteboard and thinking as a user. It was like: "If we want to make this technology available to the cine industry, not just PhDs, but people who are really on the set, we need to make it something completely different, simple, starting from a different point of view, the customer." A user does not want to learn how to calibrate the lens. A user just wants to plug in a lens and get the system configured automatically.

Cincraft Scenario

Our new collaboration with ZEISS is different from what we've done before because it has been organized and planned with a lot of knowledge regarding customers and with a simple message. We want to give users a system that they can use almost everywhere to track a camera, record the data and use easily in post-production. The intention is really to optimize the way that data is captured and used for VFX scenes.

If you want to do VFX, you need to know where the camera is. So, you need camera tracking, you need to map and calibrate your lenses correctly and you need to do these things easily. You don't need to be a specialist in computer vision or optics.

The first Ncam customers were in North America. Our first movie was *White House Down* directed by Roland Emmerich, shot in Montreal. The first broadcaster to use Ncam was Fox Sports to add 3D graphics during live shows, including Superbowl.

A brief tour of how ZEISS CinCraft Scenario works

The "eyes of the system" are in the CamBar. It is a camera bar that can be mounted on almost any professional camera that has an SDI output and a stable clock. The second requirement is that we need to have an encoded lens so we know the exact positions of the focus, iris and zoom rings to be able to drive our virtual model with the real lens to make sure everything aligns together.

The "eyes" have a few machine vision cameras in the CamBar and do not have to be pointing at the set—only pointing at something that is stable. They are used to track the position in 3D space, using natural elements of the scene so you are not forced to put markers or anything in the environment. That gives you great flexibility. The system can work indoors, outdoors, in natural and artificial environments. We can work at the corners, edges, and with set extensions.

Obviously, there are limits. It's not magic. This is science, and that means the camera bar needs to be able to see something that is more or less constant. Trying to point your camera bar at the sky will not work well, but if it points at the floor or ceiling of a set or location, then it's almost constant. The system will be able to tell you about your movement, velocity and orientation at any given time, and ensure that the data is synchronized with the feed from the camera. We ensure that frame-accurate data is recorded and can be exported in various formats.

The camera bar is connected to the Origin, a "brain" that manages tracking and recording in real time. That information can be fed

into a render engine like Unreal Engine, for example, to do live visualizations of your scene.

Another application of our technology in CinCraft Scenario is something that we built on top of its tracking ability. It is a module to record the data. Just as with a camera, if you can't record your footage, what's the point? It seems obvious now, but it wasn't on the first day we thought about it. We needed to process the data. So, CinCraft Scenario comes with an embedded recorder that logs your takes.

Actually, there's another unit we can put in between the CamBar and the Origin to extend the distance, or to provide a lighter, smaller module on the camera. We call it Link. Even though Origin is small enough, it's still a micro computer, and it might be too heavy on a Steadicam, for example.

And then, we have a third element that we call CinCraft Export—to extract the data we record and make it available in the format you need. This is a translation element from our internal protocol to anyone else's protocol. Export is a piece of software that will run on a Windows platform initially. It's not running on the Origin. You take what was recorded on Origin and extract that data to the format you need. Then you'll be able to specify if you want UV maps, distortion maps, undistortion maps, and if you want the tracking information as well. We provide all that information for post-production usage. Really, the intention is to optimize the process.

(UV mapping maps input 2D coordinates in a picture to the output 2D coordinates. This is used to represent the 2D offset to distort or undistort the picture.)

In summary, just as ancient Gaul was divided by Caesar (but not by Astérix), into three parts, CinCraft Scenario also has three parts: live use, recording and exporting of data. Without those three elements, you can't really deliver value to the customer. What matters is capturing and using the data. To be fair, at Ncam, we tried doing something like this, but we did not succeed because it was not easy. I think what we have now with ZEISS will really make it succeed for users.

CinCraft Scenario provides more than what VFX teams have been receiving before. They were initially undistorting video plates, then doing match moves after that, for example. They need to know scaling, measurements, and then align what has been tracked with software to combine the CG elements. All of that will be managed by CinCraft. It's going to cover a very big portion of the practical scenarios. You will get tracking data plus lens data. You'll know the position of each focus, iris and zoom gear for every lens. At the same time, you will have field of view, distortion maps, and undistortion maps for every scene you shoot.

This is a far cry from the way things were. Too often, you spent a week or two shooting distortion grids in prep at a rental house. However, the usual procedure of measuring and mapping the lens for distortion with grids is never truly accurate. VFX teams are going to compensate for it, ultimately. With CinCraft Scenario, it's going to be just as easy as plug and play to get the right data for your lens and you know it's sub-millimeter or sub-pixel accurate without having to spend time fixing it in post.

Previously on set, you probably had a tape measure and wrote down the height of the camera and lens, what was the orientation, what was the speed, what was the lens focal length, etc. All of this information is now embedded and recorded for you. You are also reducing the possibilities of errors. This is really part of the optimization process. It's not just about those maps. We are not necessarily going to change the way you've been using data, but

we are going to give you data that you didn't have before.

What happens if you're using a lens that does not have eXtended Data? Even earlier ZEISS lenses like Master Primes, Ultra Primes, Super Speeds?

CinCraft works with various encoders. Of course, it works seamlessly with ZEISS eXtended Data encoded lenses like Supremes, Radiance and Nano Primes.

As part of the first release, we are going to support SDI-fed metadata. Certainly, we are going to support eXtended Lens Data. We'll also have the ability to support cmotion devices through LBUS and LCUBE. We'll support LCUBE-1. We'll be supporting Preston MDR-3 and 4. We are going to support Tilta Nucleus and Teradek RT. Worst case scenario, we will even have external encoders (to show the position of the gears) that you can attach to the lens rods. We plan to cover most combinations.

CinCraft Mapper

ZEISS has been building a database of lenses in CinCraft Mapper to provide information about distortion and other parameters. I think there are discussions to extend the library, and in the future we are thinking of providing templates for other lenses. Ultimately, we want the DP to be able to use any lens on set or location. Our product will evolve over time. The version at launch is the first release that will only work with ZEISS lenses. We'll add support for other lenses in the future and we'll start rolling out templates for other manufacturers' lenses as well. We don't want to be a closed system because that doesn't make any sense at all. Eventually, you will be able to use any lens from any manufacturer. Only the method of how you will be using it might differ because to really make it plug and play, we have to get into discussions with third parties.

Obviously, there are plenty of ZEISS lenses around the world, so we want to enable customers who bought those lenses to be able to use them very easily. We can really ensure excellent results with ZEISS lenses. We definitely don't want to prevent customers from using other lenses if they want to use a vintage Panavision lens, for example, or anything else.

No specialized operator neeeded

CinCraft Scenario only requires very simple training. We do not expect everyone to have complex training. To be fair, anyone who's in our industry and who's capable of using a camera is already a bit techy. This is the level of expectation we have. It's not going to be for my grandma, but it's definitely going to be easy enough. We are going to create tutorials and we are going to help our customers see how to do things, but the goal is not to require specialized people to use our technology. As mentioned earlier, it's really made for users, operators, camera crews and DPs, not for PhDs.

Saving time and budget

You'll be able to produce way more than what a team would have been able to produce before. I think this is what matters in the end. When we introduced CinCraft Scenario, I expected the first question to be, "How much are you saving me?" In many cases, we're going to save you time. In other cases, we are even going to provide skills that you might not have had before. An example would be a production with no budget for VFX. Now, with our technology, you put it on the camera, and you have camera tracking, data for VFX, and they can use it almost instantly, or very quickly with a free download of Unreal Engine. This opens a very different way of producing content. Of course, we are still very interested in A-list productions, but there are so many other productions as well that we want to reach. This tool will enable that ability.

We want to focus on the movie market. We are not going to stop working in the other markets and activities that we had, for example sports and broadcast, but this product is currently better suited for movie production.

In summary, it's all about the value we want to generate at the end for the user. For some users, we want to optimize data acquisition and distribution. For others, we are simply going to create something they couldn't do before. This is super exciting. This is the first thing I always wanted to do — make an impact on how people make movies.

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by Jon Fauer, ASC

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