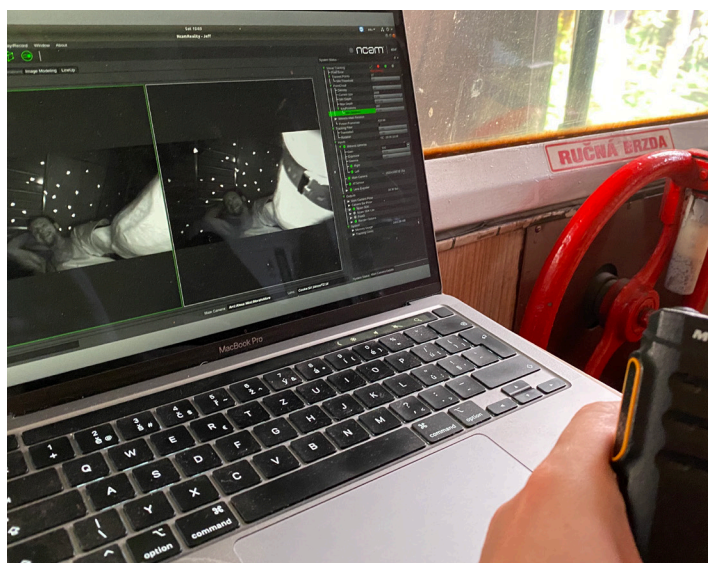


## Case Study

# Getting on Track with In-camera VFX

How 85% of Jiří Havelka's upcoming film—  
set almost entirely on a train — was created  
with virtual production tech







On February 19, 2019, a train in Czechia's Highlands flashed a brake warning light. The driver got out to try and fix the issue. Suddenly, the train began to move. Due to gravity and faulty brakes, the train was suddenly rolling its way back through the highlands — with no driver at the helm and all the passengers still inside.

This incredible true story inspired acclaimed theatre director, Jiří Havelka, to make a feature film: *Extraordinary Event*. Set for release in 2022, the film tells the story of the passengers inside the unmanned train, which was fortunately stopped safely after several kilometers.

Behind the scenes, the making of the feature is almost as extraordinary as the story that inspired it. The film's action is based almost entirely in a train carriage, and the *Extraordinary Event* team quickly learned that lensing on a real train was impossible.

With a real train, the crew would need to go back every time a shot was complete, to keep consistency in the background for the next take. That would triple the length of the production schedule, which was set at 13 shooting days. The visual effects artists at VFXR couldn't use green screens, either — there were simply too many reflections on the inside and outside of the carriage to make the result look real.

That's when the team approached local virtual production expert Vojtěch Horký. Together, they built a *Mandalorian*-style LED virtual production (VP) wall that would help recreate the



film's exteriors. By production's wrap, the technology was used on almost 90% of the finished feature, making it one of the first movies of its kind in Europe.

### A Virtual Train Ride

Horký and the More.is.More crew began work by testing different stage setups. In little more than a day, the technical script — which was written without VP in mind — was fully redesigned to account for a new solution featuring Unreal Engine and Ncam camera tracking, enabling the team to track in any environment, on any camera, with any lens or rig.

The state-of-the-art stage involved a train carriage flanked by 18 x 3.5 meter Kvant LED side walls, and an 18 x 1.5 meter front wall. There were also LEDs built on top of the carriage, to simulate the sun without additional equipment. Pre-shot 8k video plates were stitched into 360-degree spherical panoramas, before being projected onto the LEDs in real time throughout production. Combined with Ncam tracking, this meant the team could visualize live CGI environments, set extensions and CGI elements directly in-camera.

"The workflow allowed us to save a lot of time in post," Horký explained. "Not only did we avoid the risk of green spill, we also had in-built natural lighting and photoreal scenery that the crew could control at the click of a button."

Even the grading process was more efficient. In order to fine-tune the pre-shot plates, the team decided to stream from DaVinci Resolve so they could grade each scene live on set using mattes.



These would control the exposure, contrast, and tone to reflect the DP Martin Stepanek's vision in minutes. All graded footage was then fed back into Unreal Engine as an 8K texture inside of a sphere. A wireframe model of the carriage and LED wall mesh were then used as a digital reference inside the rendered sphere.

### Working in Tight Spaces

The *Extraordinary Event* team's next biggest challenge was tracking the on-set camera in order to ensure the VP footage was captured at the right angle, all within a train carriage model space.

With his background as a theatre director, Jiří Havelka aimed to capture the film in chronological order, which meant changing camera positioning after almost every shot. On top of that, the carriage was a tiny space crowded with actors and crew, so the floor couldn't be used for tracking.





Luckily, using Ncam's Mk2, the team was able to get as close as 50 cm to the markers, which were triangular reflective points Horký put on the ceiling of the train set. Using computer vision techniques to define a 3D point cloud representation of the surrounding environment, the Ncam software automatically determined the optimum tracking algorithm at any given point in time, leading to greater reliability and accuracy in the challenging environment.

The camera-mounted sensor was also tilted 60 degrees upwards, so Stepanek had the flexibility to stand while still maintaining the depth needed for an accurate track. Using this setup, even a single operator could get up and running in moments, as well as consistently ensure an accurate track even when changing between camera rigs.

"There were several advanced camera rigs we switched between on set," said Horký. "We had a dolly on rails, and at one point a camera that weighed 18 kgs! But throughout it all, I knew the team could shoot confidently knowing that the tracking was robust. When the crew built the rails, I could go out for a coffee rather than spend time setting up Ncam for a new rig."

### Extraordinary Results

By the end of the 13-day *Extraordinary Event* shoot, the workflow was a complete success. "Everyone loved how fast the work was," Horký said. "With Ncam, everything was efficient. The DP could move onto the next shot without waiting for a new camera tracking setup."

"Jiří Havelka could also see and control the outdoor scenery for every shot directly on set. He could change the lighting and complete color grading live, too, getting as close as possible to a finished result without waiting for post. *Extraordinary Event* may have been one of the first movies of its kind — but thanks to the spectacular results we saw using VP technologies, it won't be the last."

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