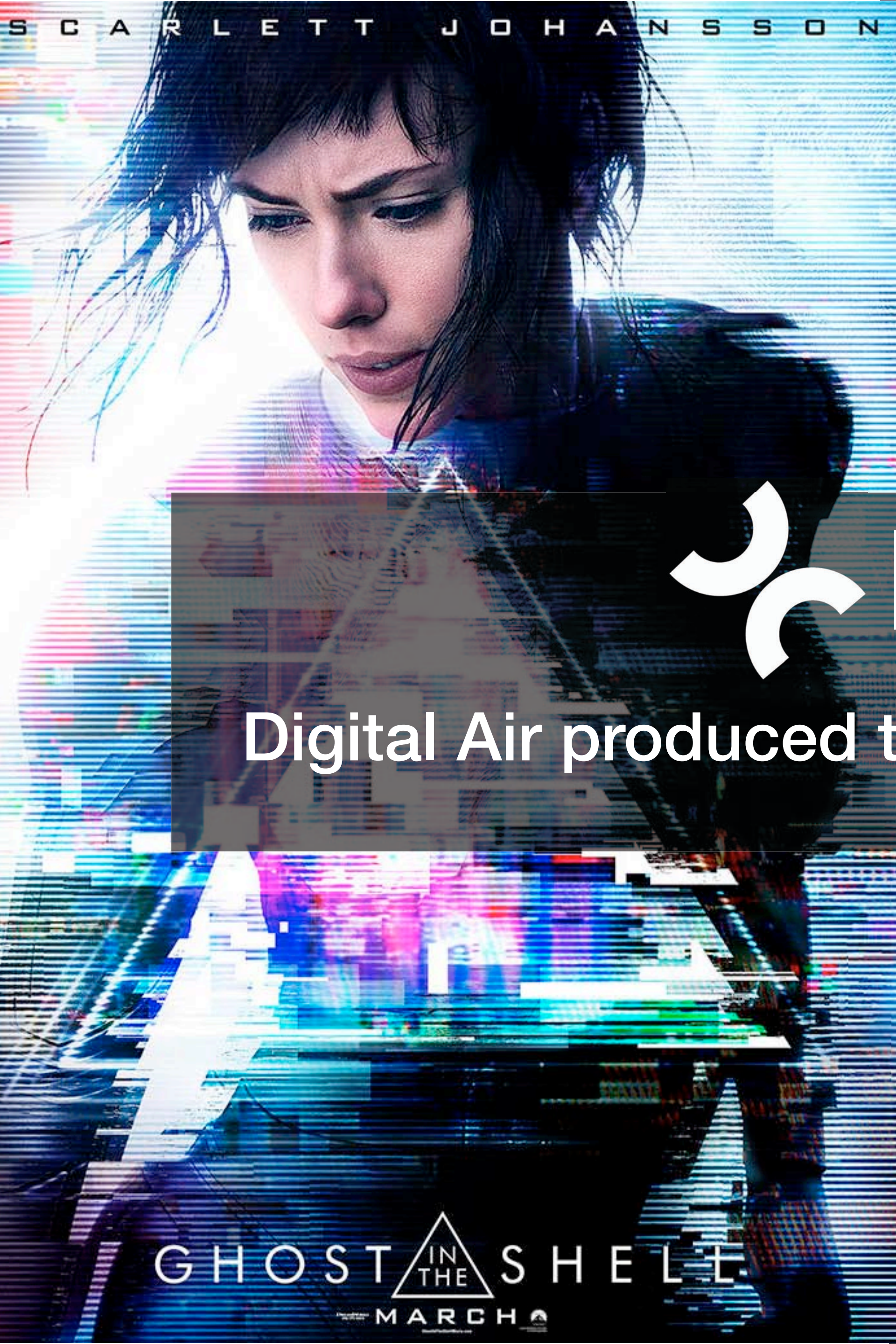




Proposal to produce 4D Human Datasets for Open Source 4D
Research and Standards Development

S C A R L E T T J O H A N S S O N



Digital Air

after

Digital Air produced the 4D Humans in GHOST IN THE SHELL

before



GHOST  IN THE SHELL
MARCH

Digital Air  4D humans in GHOST IN THE SHELL (2017) digitalair.com

Purpose of Grant

The Grant will be used to produce two hundred rights-free 4D shots (200 frames each, 40,000 obj files) of humans in motion.



What is 4D?

3D Models Captured Over Time (i.e.: 24fps)

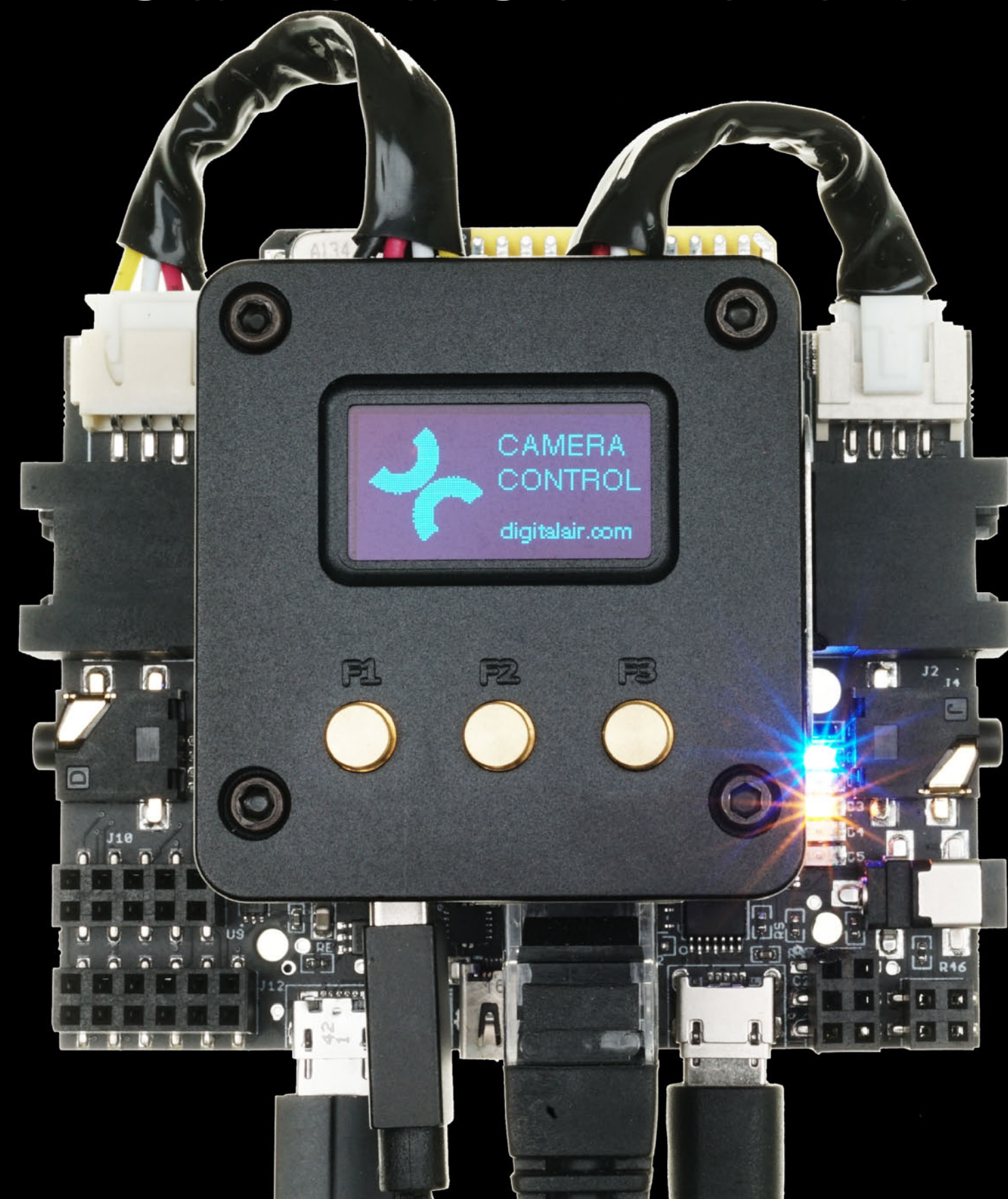


Why is the Grant Needed?

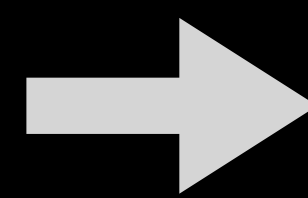
Rights-free 4D datasets will accelerate workflows, competition, and standards. However, producing datasets is expensive, which is why we're inviting Epic to assist us in their production with a Grant.

Our Hardware

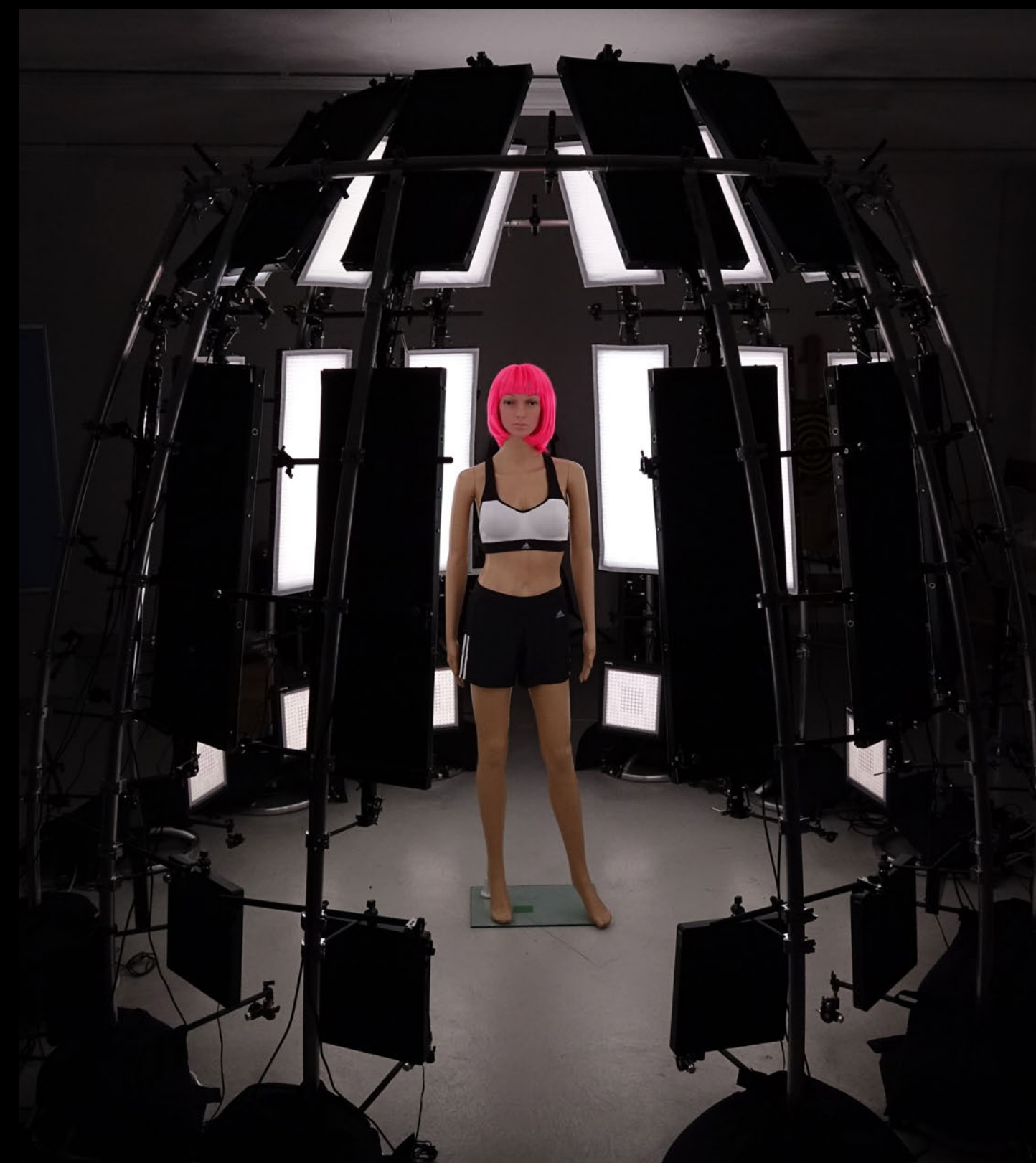
Camera Controllers



OEM / embedded version



4D Capture Systems



 Digital Air Camera Control Systems and Software

 Digital Air 4D Capture Systems and Services

digitalair.com

How will the Grant Help?

Digital Air's rights-free public datasets will include:

- Two hundred ten second long 24fps textured obj motion sequences: one hundred body, one hundred face. Face sequences will include full FACS expression range (including transitions).
- Original photographic source data for the above obj sequences. This can be used for testing core photogrammetry software workflows as well as emergent workflows based on deep learning, FACS expression detection, etc.



Hardware Specs

- 24 camera full 360 array for the 4D face capture
- 96 camera full 360 array for the 4D body capture
- source images: synchronous 5.5K (20MP) stills at 24fps



4D Face Capture System
Geneva, Switzerland
2019



4D Body Capture System
Geneva, Switzerland
2019

Why are Datasets Needed?

Synchronous photography and open source photogrammetry software is a solution that anyone can employ for 4D capture today. However, camera systems are expensive and therefore not available to most researchers.

Research is needed for enhancements in modeling based on large datasets and deep learning. This grant will make datasets for such research and development available to everyone, accelerating the overall development of 4D workflows.

Problems with Existing Datasets

Microsoft



Microsoft's dataset requires that its users license back to Microsoft any IP that they develop using the data. It is also too low resolution to solve well with photogrammetry without using Microsoft's IR noise images (on right).

Max Planck Institute



Meshcapade

The proprietary Max Planck datasets (licensed out by Meshcapade) have physical paint on the body models. They can not be used for clean texture workflow development as a result of these markings (see above).

Our Solution

For GHOST IN THE SHELL Digital Air developed a high-resolution markerless photogrammetry workflow for MPC and produced over one hundred shots of 4D humans.

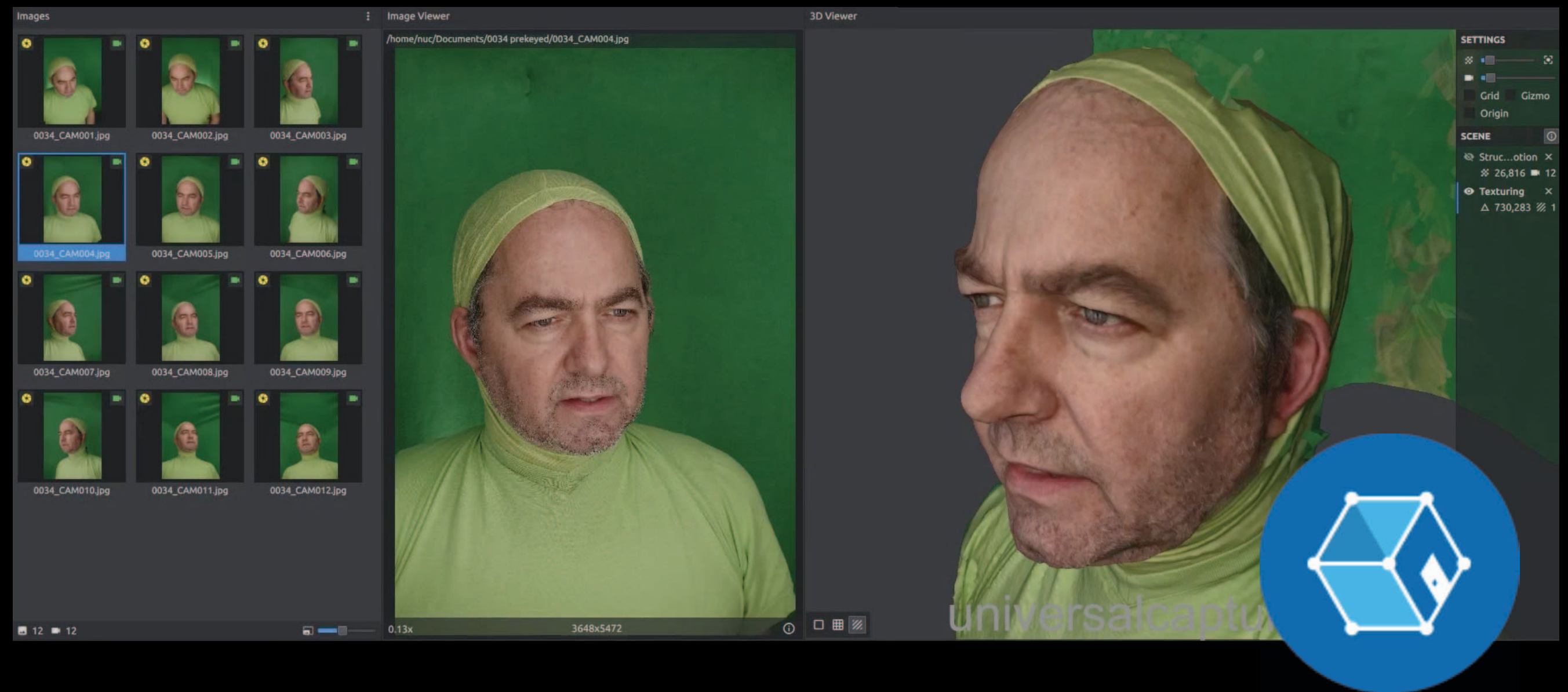
Since then, we have refined our methods and increased the resolution of our cameras by a factor of 10x, enabling even higher resolution markerless results.

Our Workflow

Our 4D Capture Systems



Open Source
Photogrammetric Workflows



AliceVision Meshroom / Technicolor - MPC

 Digital Air 4D Capture Systems and Services

 Open Source software, our scripts and workflow

Open Source Software

Since GHOST IN THE SHELL, Technicolor (parent company of MPC) has taken over development of Alicevision Meshroom, an open source solution for photogrammetry. This opens up the use of the data that we will produce under the grant to anyone, at no cost, using Meshroom.

Meshroom is written in Python, and easily scriptable for custom Game and VFX pipelines (including rewriting the GUI).

Proprietary Solutions

Microsoft



Primarily focussed on codecs
Digital Air provided datasets
for research

4D Views



Spin-off from INRIA (France)
Digital Air participated in its
creation in 2007

Proprietary Solutions

Proprietary solutions are generally for non-technical clients that need end-to-end solutions.

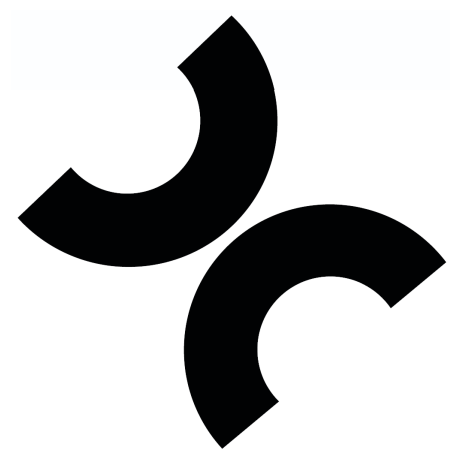
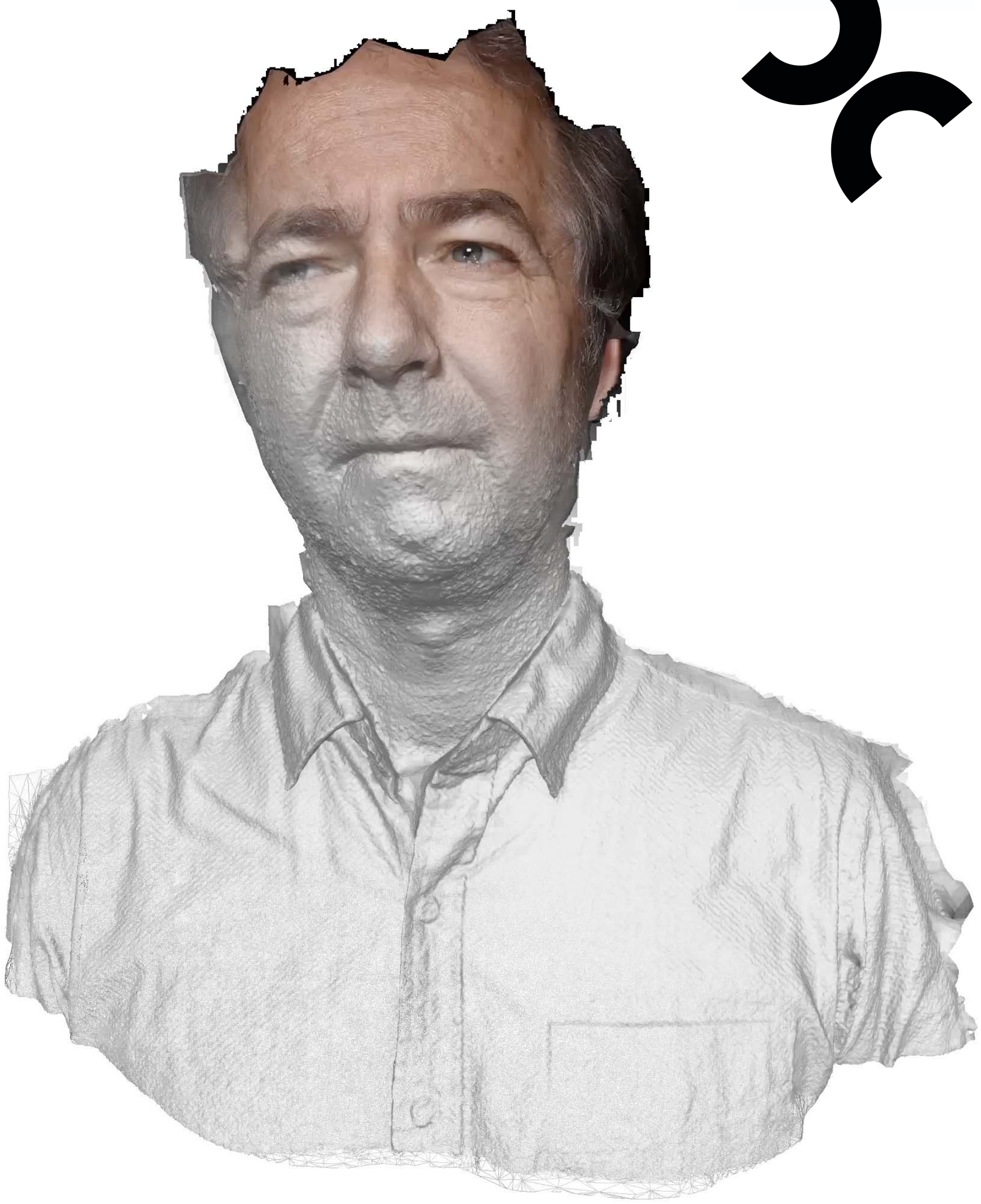
Open source solutions written in Python are very interesting to the Games and VFX industries, where innovative, pioneering pipelines are under constant development and open source, scriptable software is therefore not only highly valued, but in some cases, the only option.

Datasets

Datasets serve the purpose of helping researchers design new methods, and helping developers experiment with new technology prior to making the capital investment necessary to record data themselves.

One dataset (for example, of 40,000 frames, as we propose), can be used by hundreds of different research and development teams, thus accelerating not just one game or game developer, but as much of the industry as can use the data.

In this case, it also allows them to get familiar with 4D photogrammetry, 4D rendering, deep learning, and other emergent technology they might not otherwise experiment with due to the cost.



Dayton Taylor

Dayton Taylor formed Digital Air in 1995. His early published work was the reference for the “bullet-time” visual effects in THE MATRIX films. Following his work on Tony Scott’s DÉJÀ VU starring Denzel Washington (2006), Dayton received the 2007 Saxby Award for achievement in the field of three-dimensional imaging from the Royal Photographic Society in London. Dayton's original prototype Timetrack™ film camera (1994) is in the permanent collection of the Smithsonian National Museum of American History in Washington, DC.