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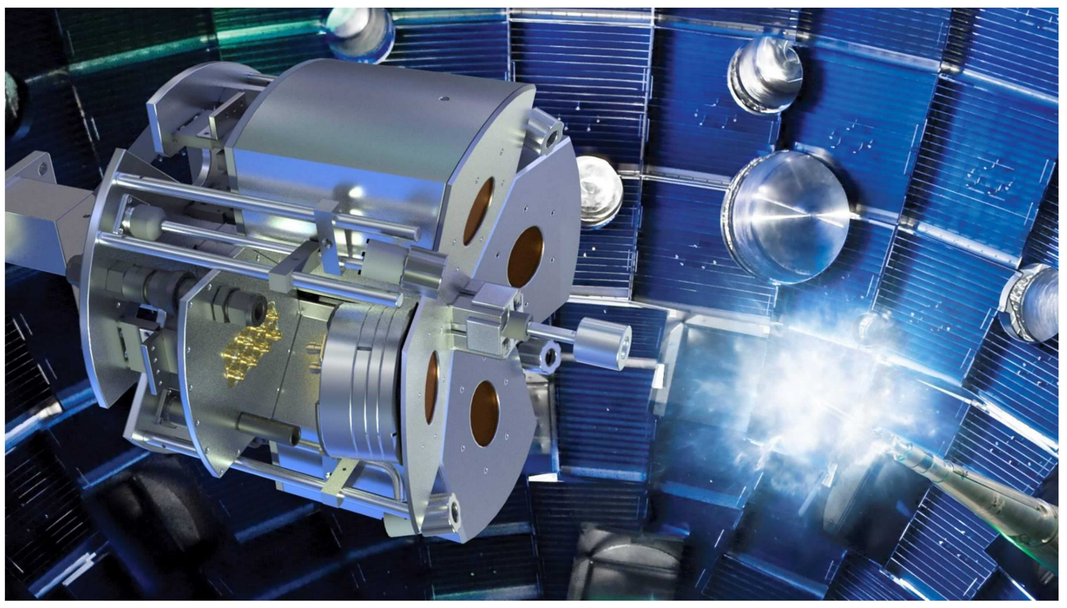
Augmented Reality Visualization of EMPIRE Simulations for Transmedia Learning

EXASCALE COMPUTING PROJECT

Elaine M. Raybourn, Keith L. Cartwright, Daniel Gomez, Brad Carvey, Chris H. Moore, Nick Roberds, Tim D. Pointon, and Peggy J. Christenson

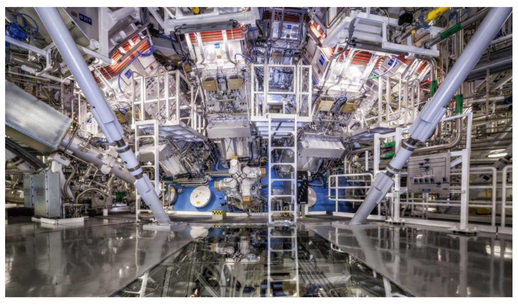
Does the display of virtual elements alongside the real world deepen our learning, memory, and understanding of information?

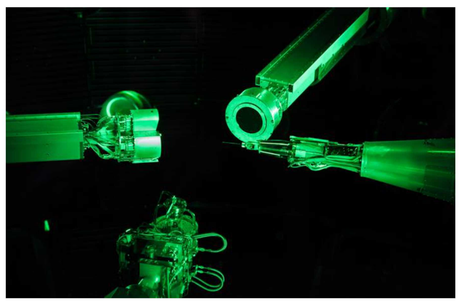
Augmented Reality (AR) superimposes digital assets (models, text, data, etc.) onto the real-world environment. We created AR visualizations and videos of high-fidelity simulations of photoelectrically-generated cavity plasma experiments simulation results generated using EMPIRE, an electromagnetic plasma physics application being developed for exascale simulation on next-generation hardware architectures. Our effort focused on the use of AR to facilitate deeper understanding of scientific phenomena such as simulations, discoveries, and data analytics via transmedia learning. Transmedia learning [1] is the scalable system of messages that represents a narrative or core experience that unfolds from the use of multiple media, engaging learners by involving them personally in the story.

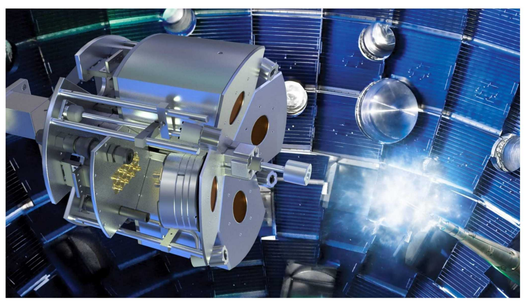


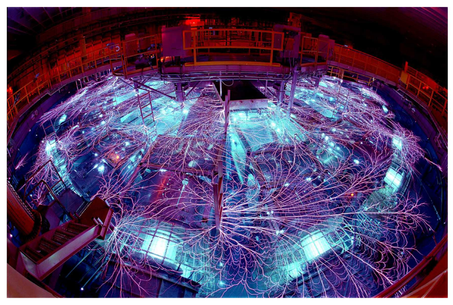
Class of Experiments Performed on Z and NIF

Initial simulation/experiment comparison of EMPIRE focused on photo electron emission in a vacuum 1mm gap. Ranked order variability seen in experiment: Yield is strongest driver (95% CI), Pulse shape is second strongest, and spectrum is least driver.









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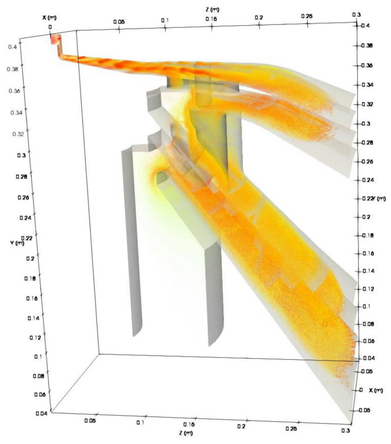
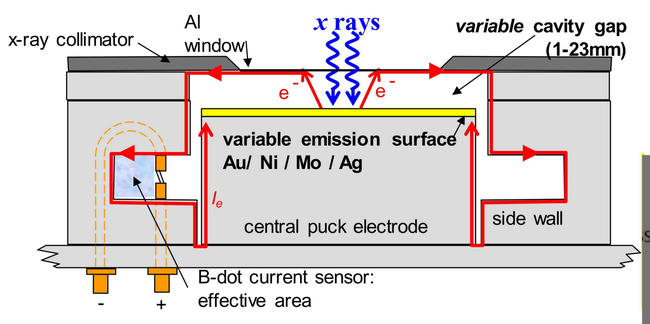
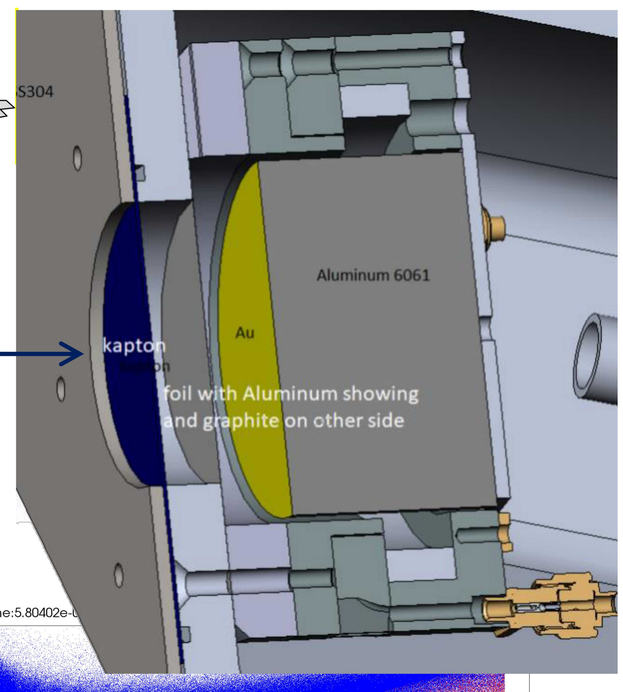
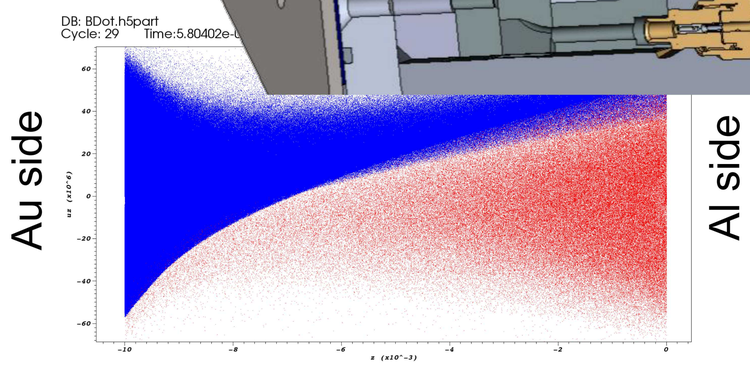


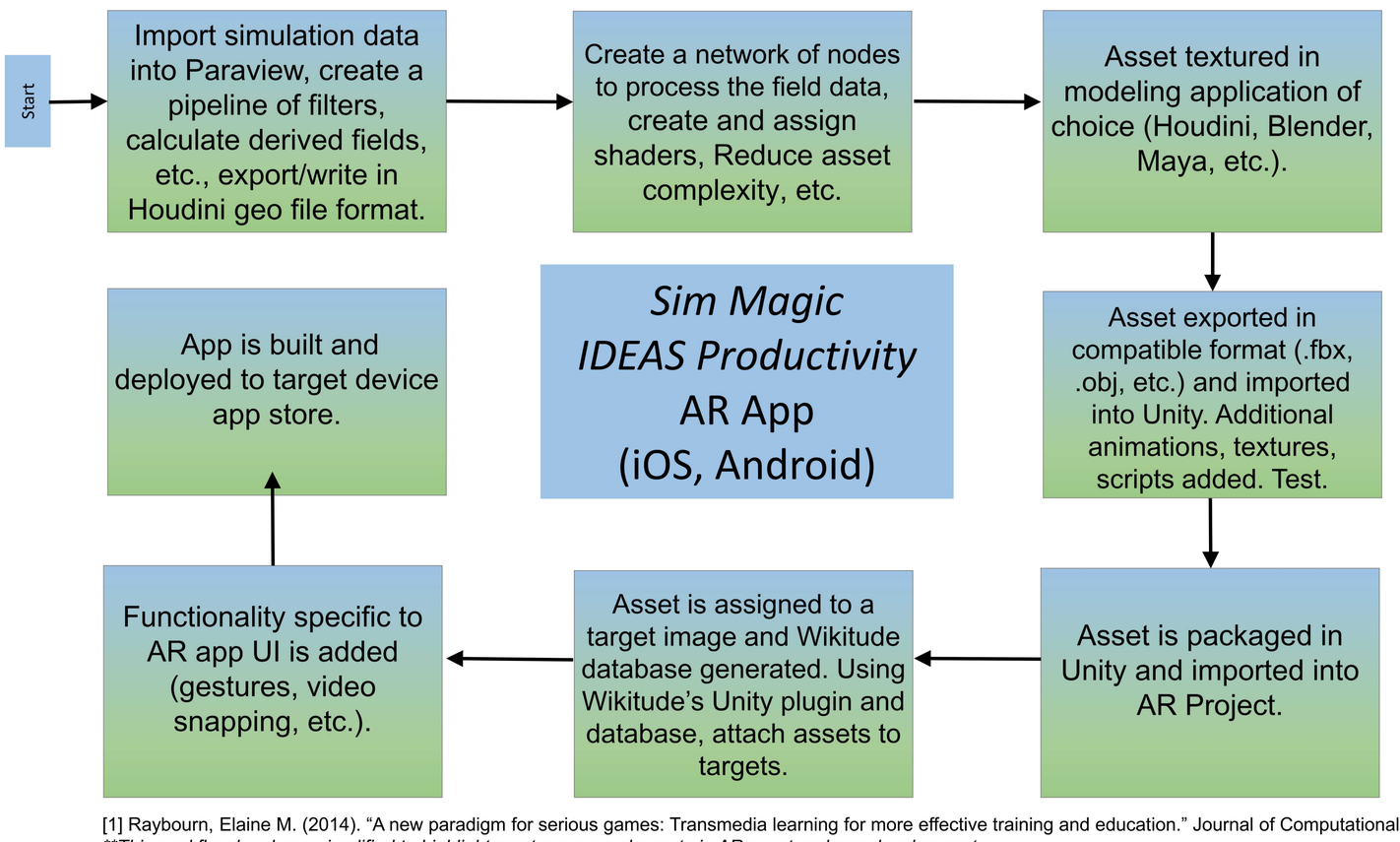
AR Development Workflow**

We developed iOS and Android AR apps from high-fidelity EMPIRE simulation results by using technologies such as Paraview, Houdini, Unity game engine, and Wikitude.









[1] Raybourn, Elaine M. (2014). "A new paradigm for serious games: Transmedia learning for more effective training and education." Journal of Computational Science, 5,3, 471- 481.

***This workflow has been simplified to highlight most common elements in AR asset and app development.*

**IDEAS-ECP aims to socialize best practices through the Better Scientific Software site (https://bssw.io), and tools to improve scientific software productivity, quality, and sustainability.*

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