Fusion Plasma and Augmented Reality

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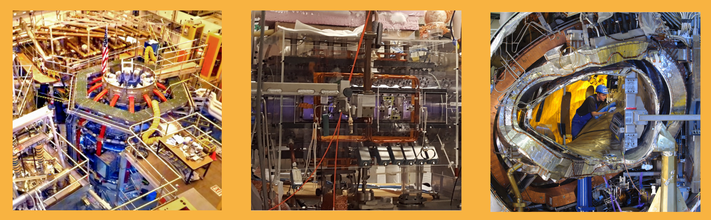
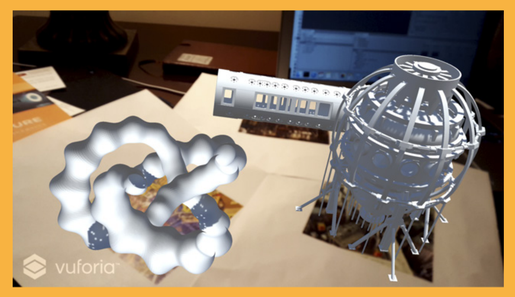
Plasma Physics Trading Cards



Our Vision

To enable one million users to hold a world-class fusion experiment in the palm of their hands.



(QR Link to Android App Download)

Vuforia

A software package for AR tracking i.e. key-value pair association for image targets and 3D CAD models.

MagnetometerAR

Modern smartphones carry magnetometers with precision to one tenth of a Gauss.

We propose simultaneously accessing magnetometer B-vector and AR positioning X-vector and rotation quaternion measurements to dynamically populate any static magnetic field.

Image from "3D Compass" app developed by PlainCode

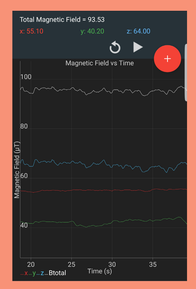
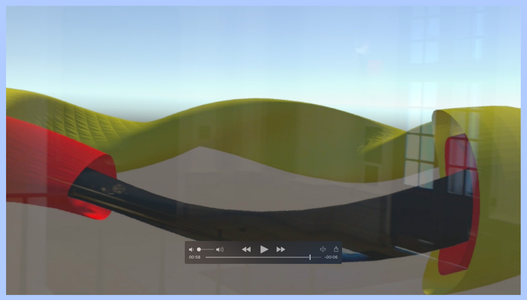


Image from Physics Tool BoxSensor Suite developed by Vieyra Software

This flashlight is a magnet. We demonstrate using AR to measure a rotation corrected magnetic field

StellaratorAR

Engineering: NSTX Plasma Facing Components



Physics: W7-X Magnetic Field Isosufraces

Scientist and Engineer experience Hololens

Surface Generator Equations: $S^2 \mapsto R^3$

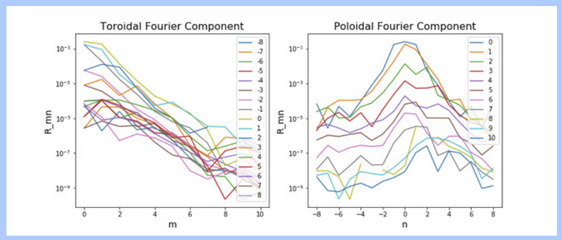
$$X(\phi,\theta) = \left[R_{major} + \sum_{m,n} R_{mn}\cos(N_{turns}\cdot m\phi - n\theta)\right]\cos\phi$$

$$Y(\phi,\theta) = \left[R_{major} + \sum_{m,n} R_{mn}\cos(N_{turns}\cdot m\phi - n\theta)\right]\sin\phi$$

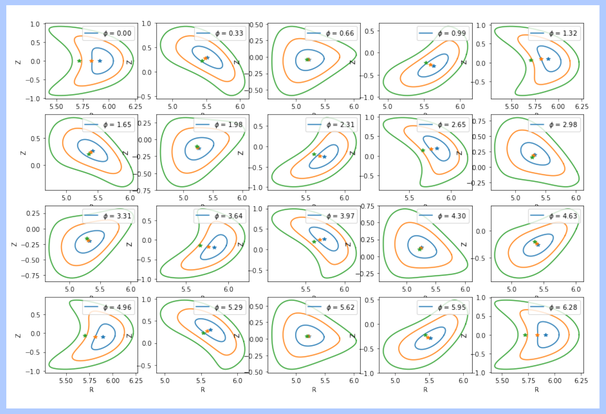
$$Z(\phi,\theta) = \sum_{m,n} Z_{mn}\sin(N_{turns}\cdot m\phi - n\theta)$$

where $R_{major} = 5.3$ m, $N_{turns} = 5$,

and (m,n) index the toroidal and poloidal fourier numbers respectively.



Log Plot of Fourier Components



Equilibrium magnetic isosurfaces, measured at multiple toroidal cross-sections

Next Steps

Launch website to scale CAD uploads and card creation
Animate 3D models and apply color

Dynamically generate B-field representation
Include interpolation algorithm to smooth B-vector measurements

Trace single-particle orbits in FPS perspective
Expand W7-X surfaces to model magnetic islands

Acknowledgements

The authors would like to thank Eliot Feibush for providing Hololens equipment and experience. We are also grateful to Allan Reiman for providing the magnetic field Fourier components.

Tokens of gratitude are owed to Atiba Brereton, Scott Doskoczynski, and Charles Swanson for creative inspiration.

This research is supported in part by the Department of Energy SULI grant.

References

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