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“His pattern indicates two-dimensional thinking.” Spock, *Star Trek II: The Wrath of Khan*

Incorporating 3D Graphics into Electronic Publications

Experimental science is replete with multi-dimensional information which is often poorly represented by the two dimensions of presentation slides, print media, and, yes, even this poster presentation. Past efforts to disseminate such information to a wider audience have failed for a number of reasons, including a lack of standards which are easy to implement and have broad support. The latest extensions to Adobe's Portable Document Format offer a promising solution to this problem.

Distribution

- ❖ Publication is undergoing a revolution due to the 21st Century multimedia explosion.
- ❖ In academia, education, and in public, trend is towards enhanced media.
 - Digital publication of research journals becoming standard.
 - Rich internet applications such as animations, movies and interactive demonstrations becoming the norm.
- ❖ To-date, utilization of 3D capabilities of PDF has been largely relegated to engineering applications incorporating CAD designs.
- ❖ Would like to encourage wider use within the physics community.

Adobe PDF

- ❖ Adobe's Portable Document Format (PDF) has in recent years become the de facto standard for secure, dependable electronic information exchange.
- ❖ It has done so by creating an open format, providing support for multiple platforms and being reliable and extensible.
 - de facto standard for document interchange.
 - free reader available on multiple platforms
- ❖ By providing support for the ECMA standard U3D and the ISO standard PRC file formats in its free Adobe Reader software, Adobe has made it easy to distribute and interact with 3D content.
- ❖ By providing support for scripting and animation, temporal data can also be easily distributed to a wide audience.

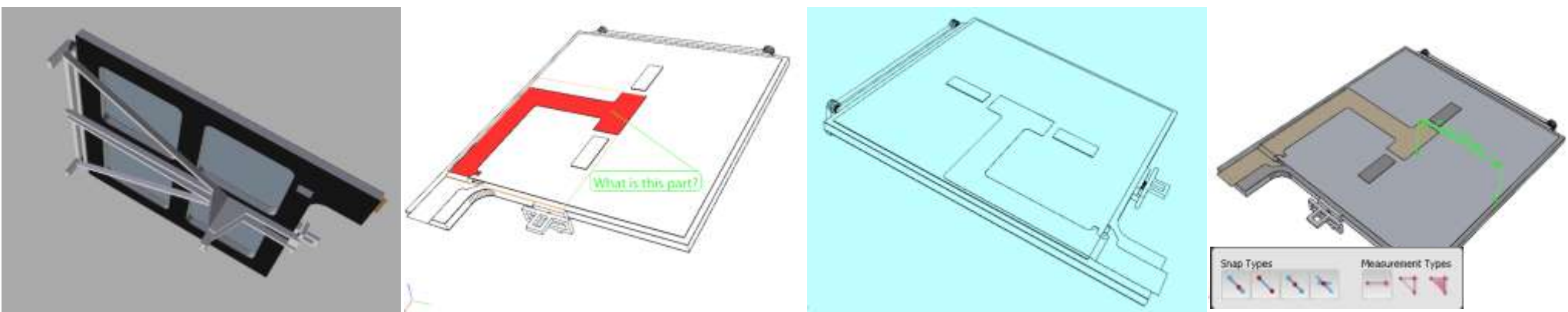
U3D & PRC

- ❖ Universal 3D (U3D)
 - Animations, domain-specific compression, extensibility
- ❖ PRC (ISO 14739-1)
 - Stored in BREP or tessellated formats, allowing re-export .
- ❖ Importing CAD models was possible using Adobe Acrobat 9.
- ❖ In 2010, Adobe transitioned development and support to TechSoft3D, which licenses its SDK. A number of programs becoming available to convert standard CAD and 3D file formats into 3D PDF, & most CAD software can export.
- ❖ Users of Acrobat X now need to purchase 3D PDF Converter from Tetra4D to import 3D content.

Use Cases

Model Rendering & Assembly Animation

- ❖ User is able to select appropriate rendering mode, orientation, lighting, etc. and select and query elements of the model
- ❖ Annotate using any of the PDF markup tools.

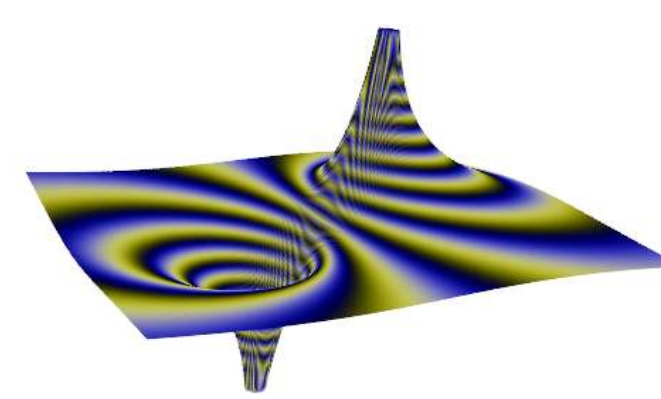


- ❖ Assembly procedures can be animated, with full control of viewpoint, rendering mode, etc.

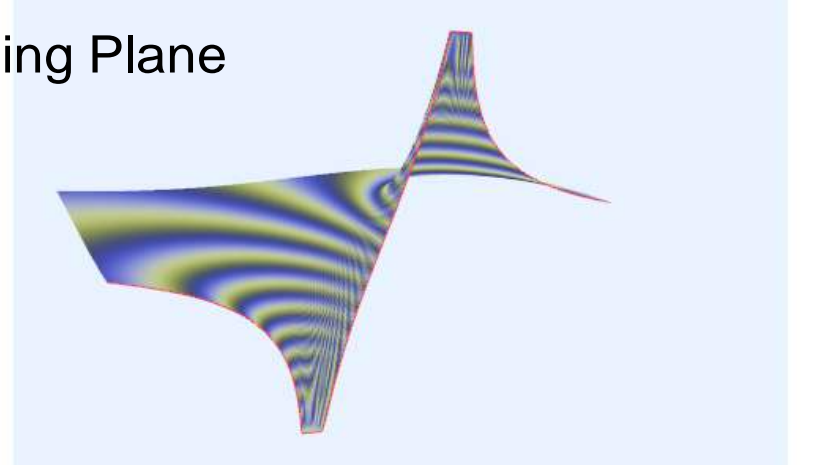


3D Data

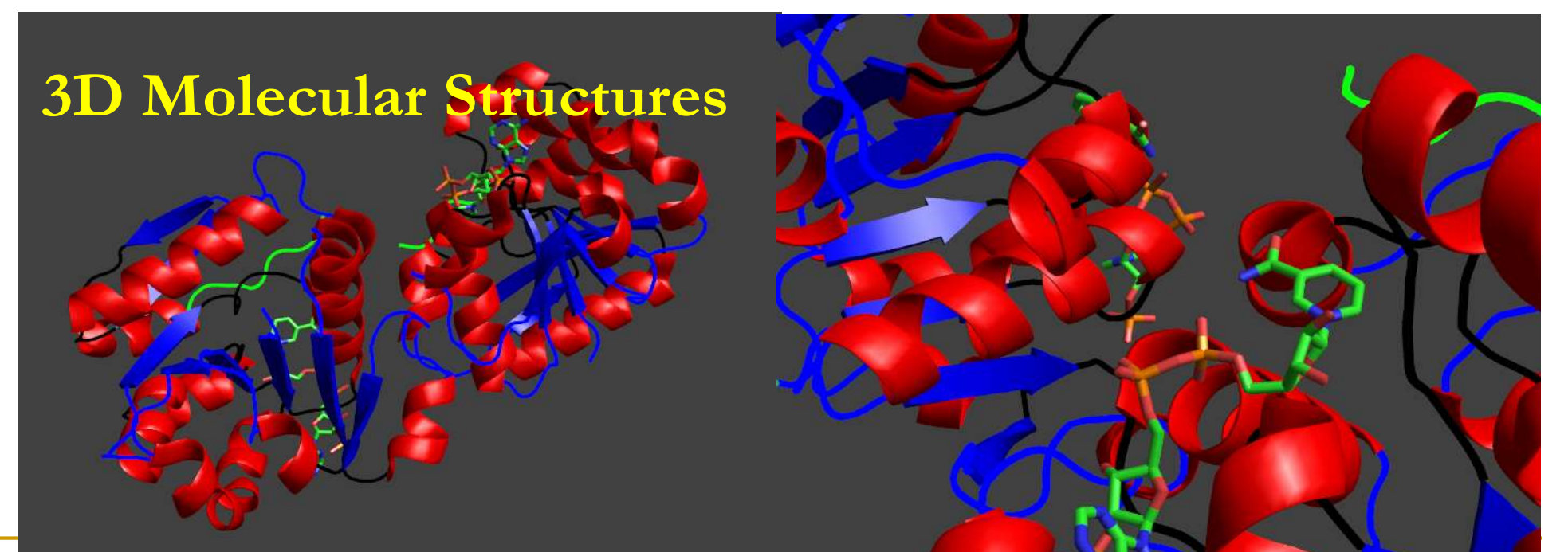
- ❖ Mathematical Functions or Fits to Data



Using Clipping Plane



3D Molecular Structures



Incorporating 3D Graphics into Your PDF File

Commercial Software

- ❖ Export pdf directly from CAD software
- ❖ Adobe Acrobat X + Tetra4D 3D PDF Converter
 - Convert native 3D CAD files
 - 3DS, DAE, Catia, IGES, PRC, Pro/ENGINEER, Solid Edge, SolidWorks, STEP, STL, U3D, VRML, etc.
 - Use 3D Reviewer to prepare CAD data before publishing to PDF
 - Export to neutral 3D file formats directly from a 3D PDF document
 - Include PMI (Product Manufacturing Information)

Open Source Software

- ❖ Create or export model in U3D or PRC format from CAD.
- ❖ Create/export 3D model as tessellated object, e.g. STL, VRML
 - Convert to U3D with meshlab (<http://meshlab.sourceforge.net>)
 - open source, portable, and extensible system for the processing and editing of unstructured 3D triangular meshes.
 - provides direct conversion of 3D meshes into the U3D format
 - import: PLY, STL, OFF, OBJ, 3DS, COLLADA, PTX, V3D, PTS, APTS, XYZ, GTS, TRI, ASC, X3D, X3DV, VRML, ALN
- ❖ Write your own data directly in U3D or PRC format
- ❖ Include U3D or PRC model in LaTeX document
 - pdfLaTeX will produce pdf file with embedded 3D model.

Example LaTeX file

```

\documentclass{article}
\usepackage{media9}
\begin{document}

\includemedia[
width=0.5\linewidth,height=0.5\linewidth,
activate=pageopen,
3Dtoolbar,
add3Djsript=somescript.js,
3Dviews=myviews.vws,
3Dmenu
]{}{u3d}
\end{document}

```

← Add arbitrary javascript

← Add predefined views