A browser-based event display for the CMS Experiment at the LHC using WebGL

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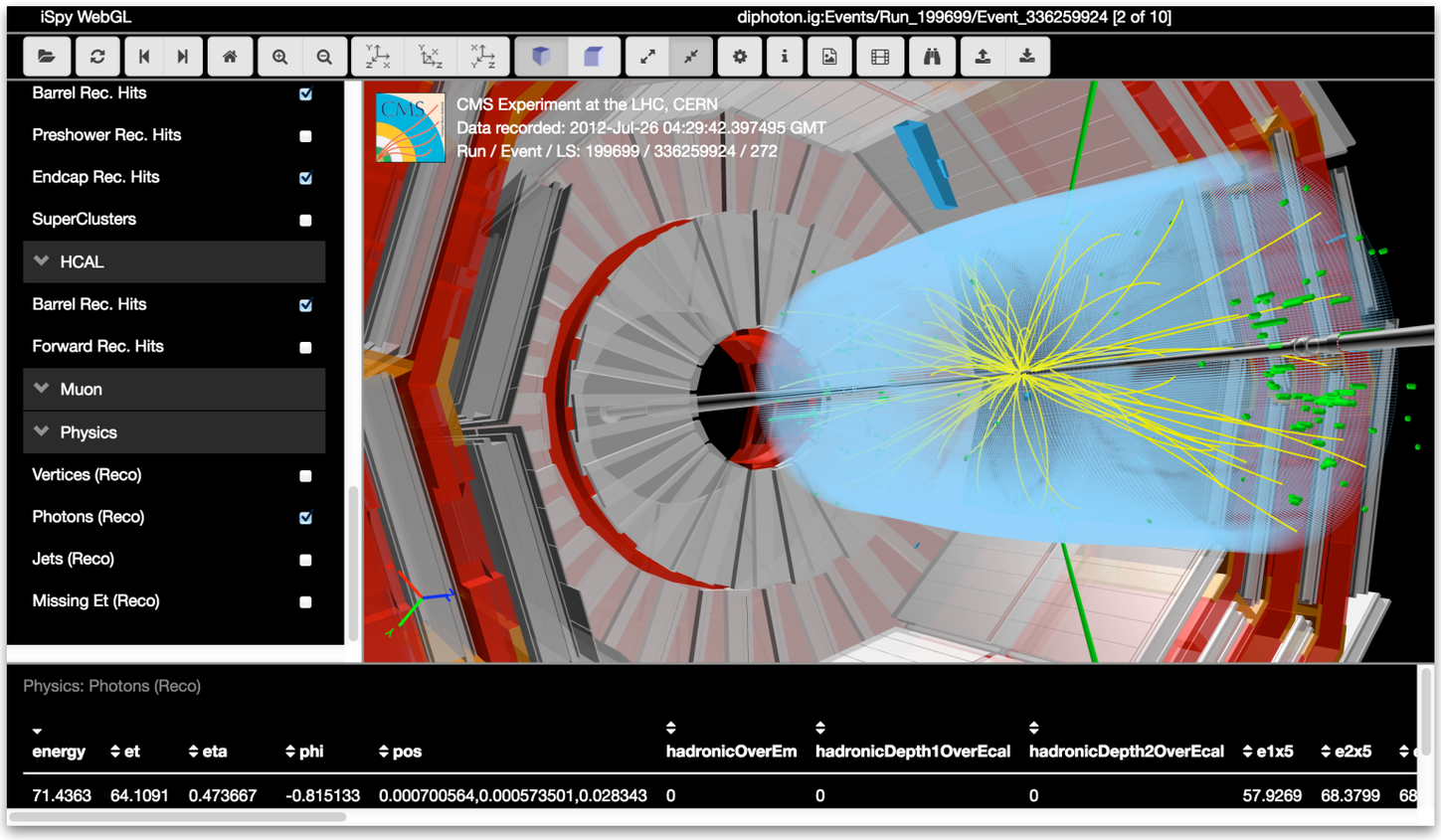
Requirement: an easy-to-use and easy-to-distribute event display that can produce high-quality event images and be used by the public
Solution (partly): create an application for use in the browser using JavaScript, HTML, CSS, and WebGL (a 3D graphics API exposed in HTML5 canvas) via the three.js library



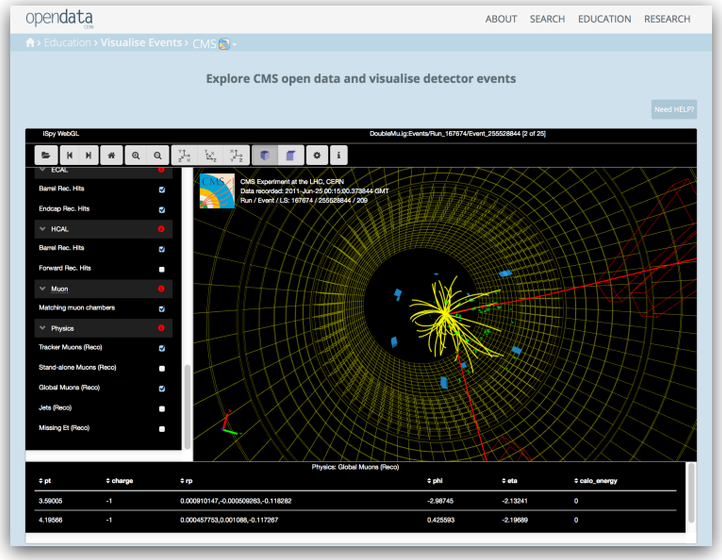
http://cern.ch/ispy-webgl

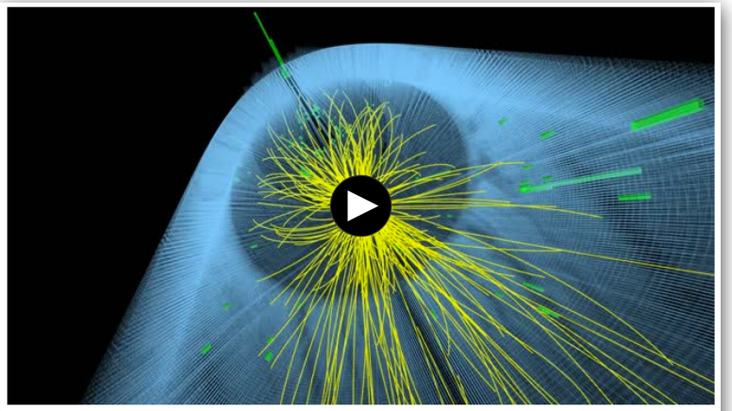
Features

- Standard event display controls: load event, prev/next event, start view, zoom in/out, view along axes, perspective/orthographic views
- Can be run completely client-side and offline, with local file loading via FileReader API
- Reads a JSON-based data format extracted from CMS data
- Tree, 3D, and sortable table views
- Correlated (between table and 3D views) picking of physics objects
- Touch events (one-finger to rotate, two-finger zoom, and three-finger panning) enabled so works on mobiles, tablets, and touch screens in the browser
- Switching between WebGL, canvas, and SVG renderers
- bootstrap.js used for layout and therefore scaleable for mobile devices
- Default animation sequence
- Import/export of 3D files
- Stereo view for use with Google Cardboard in mobile browser

Usage

- Production of event display and animations for the public in Run 2 of the LHC
- Version used in CMS masterclasses (where students conduct simplified analyses of CMS data using visualization of events)
- Application in the CERN Open Data Portal: http://opendata.cern.ch/visualise/events/CMS
- As an Invenio previewer plugin for the ig file format: *e.g.* http://opendata.cern.ch/record/626
- The CSC muon subdetector of CMS uses the display for detailed technical examination of individual collision events to better understand event kinematics and detector behavior, and to explore muon track segment reconstruction algorithms
- Production of high-resolution animations for public exhibits and use: *e.g.* for "Uncertainty" exhibition at Alyce de Roulet Williamson Gallery, Pasadena (http://williamsongallery.net/uncertainty)





Higgs boson candidate event from 2012 data (8 TeV) recorded by the CMS experiment: ZZ to four electrons

Event recorded with the CMS detector in 2012 at a proton-proton centre of mass energy of 8 TeV. The event shows characteristics expected from the decay of the SM Higgs boson to a pair of Z bosons, both of which subsequently decay to a pair of electrons. The event could also be due to known standard model background processes.

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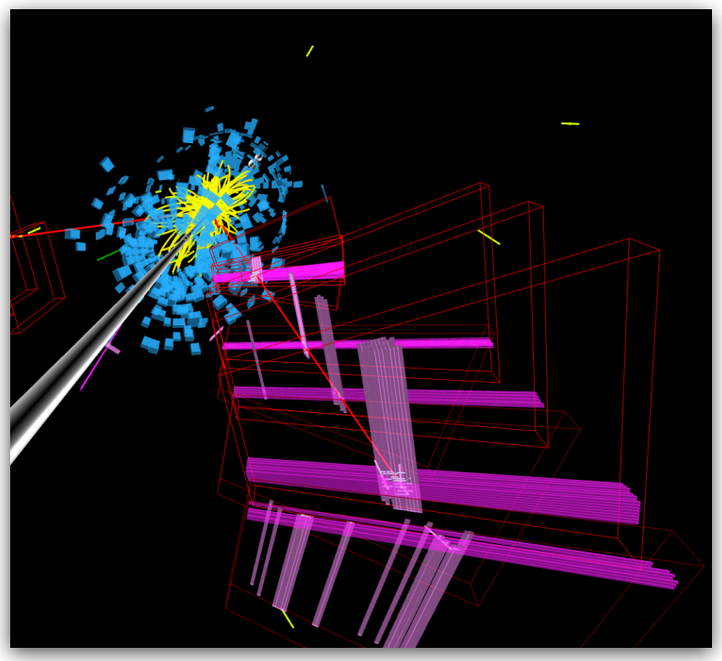

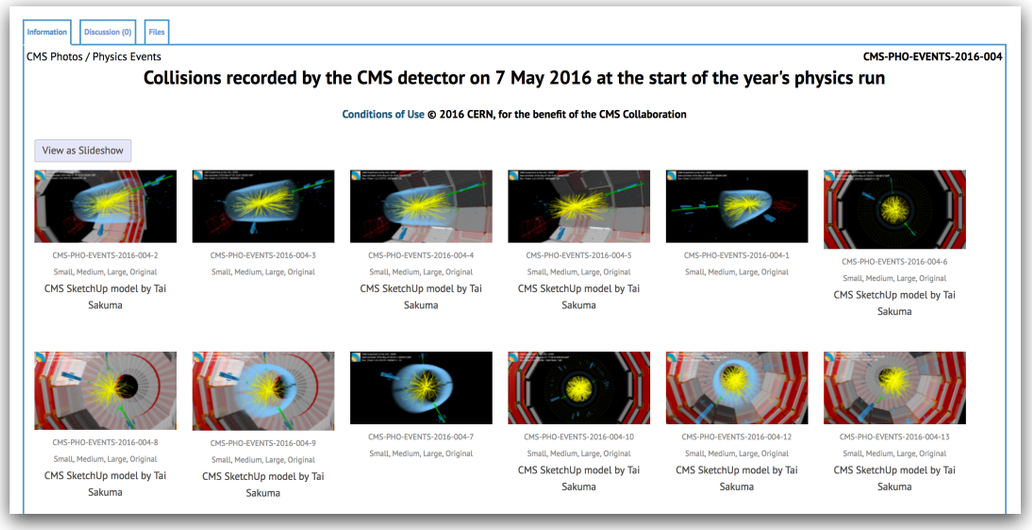

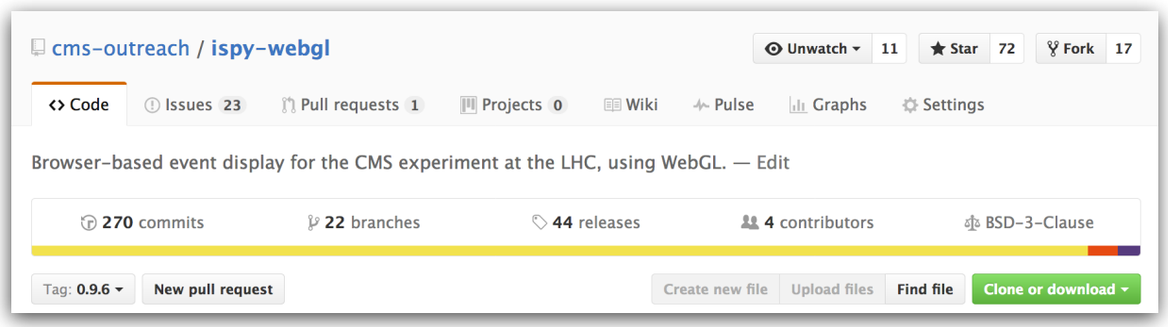

https://github.com/cms-outreach/ispy-webgl