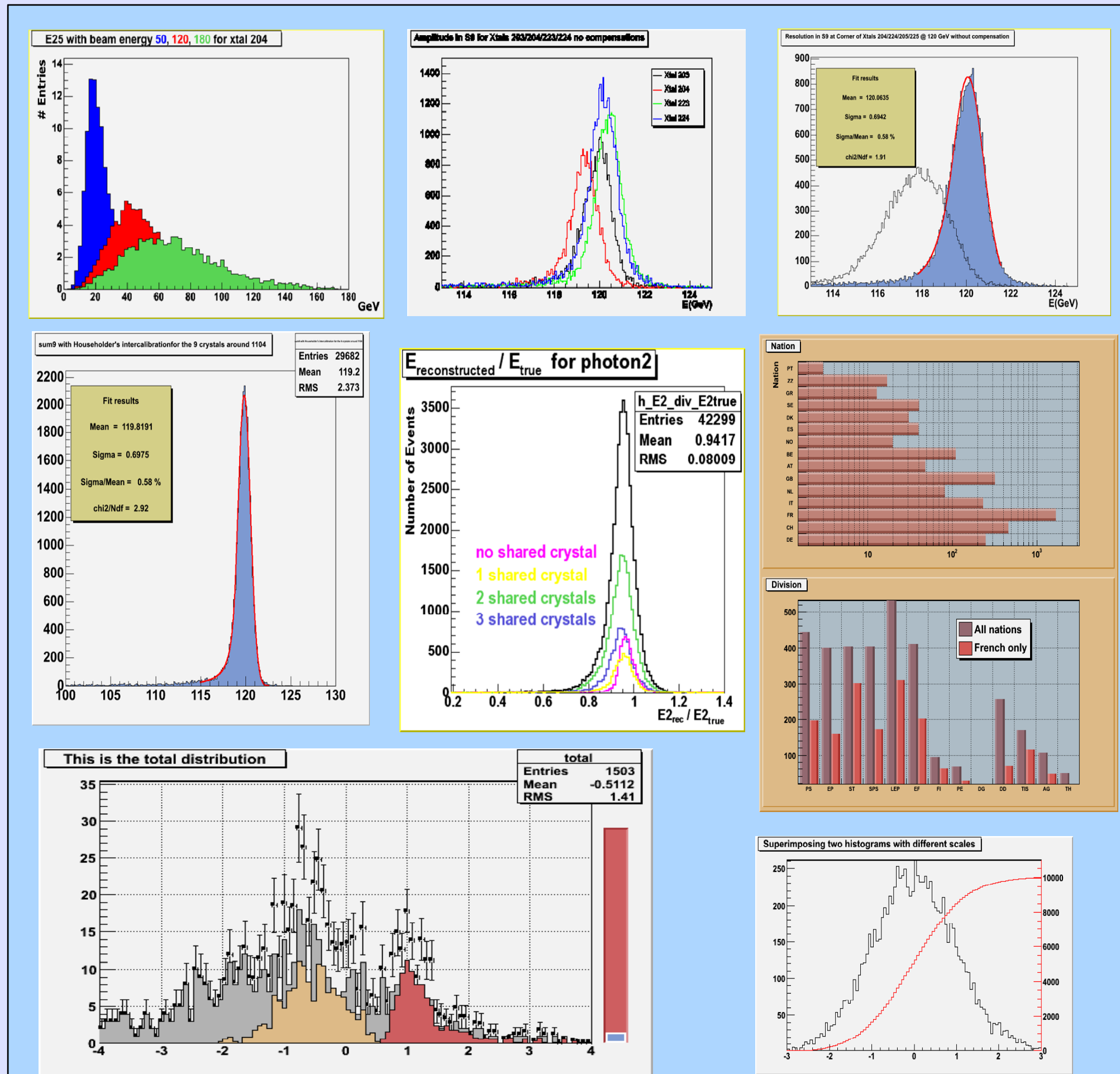
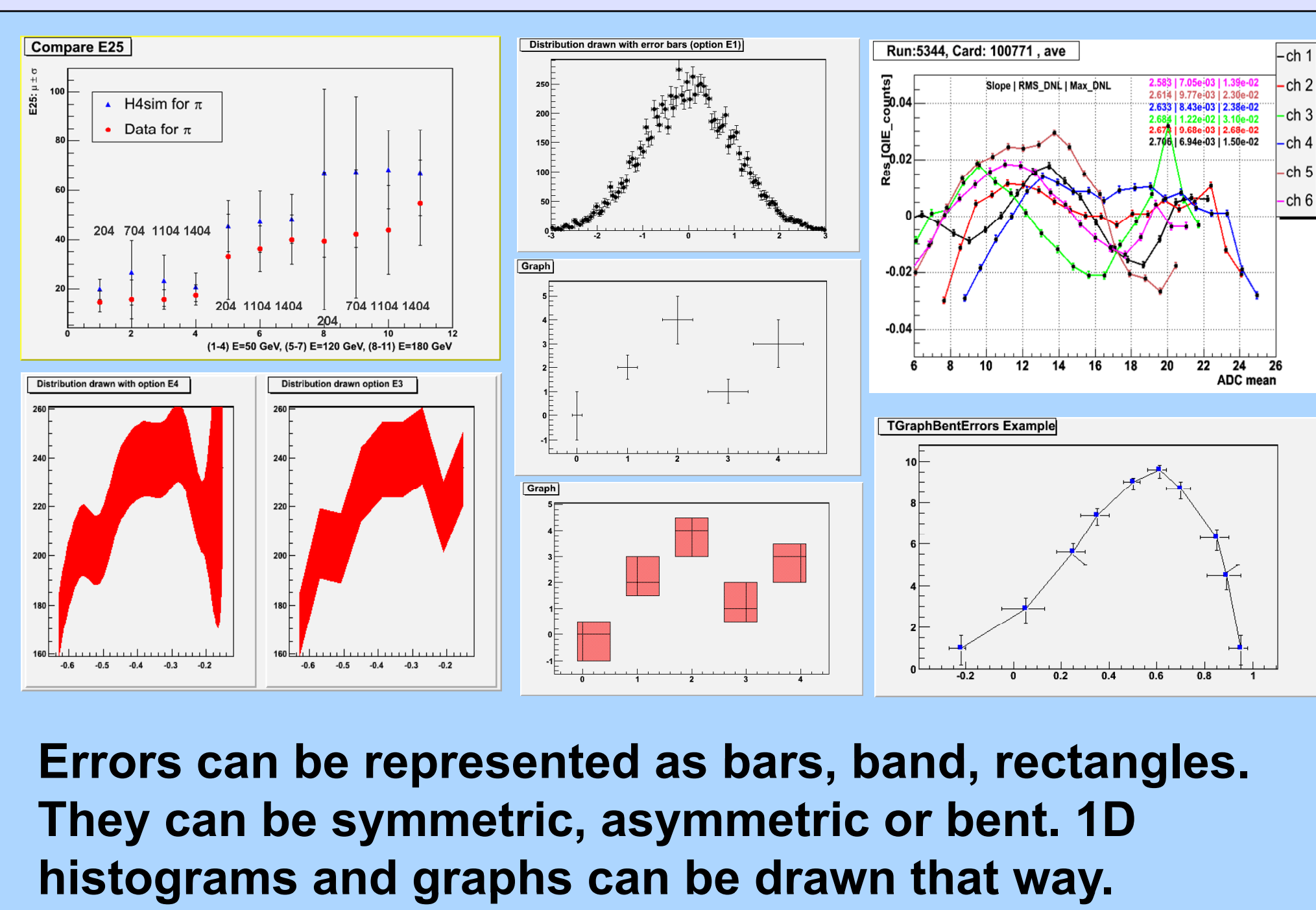


The ROOT framework provides many techniques to visualize multi-variable data sets from 2 until N variables. This poster presents them all, highlighting the best use one can do of each of them.

2 variables visualization techniques are used to display Trees, Ntuples, 1D histograms, functions $y=f(x)$, graphs ...

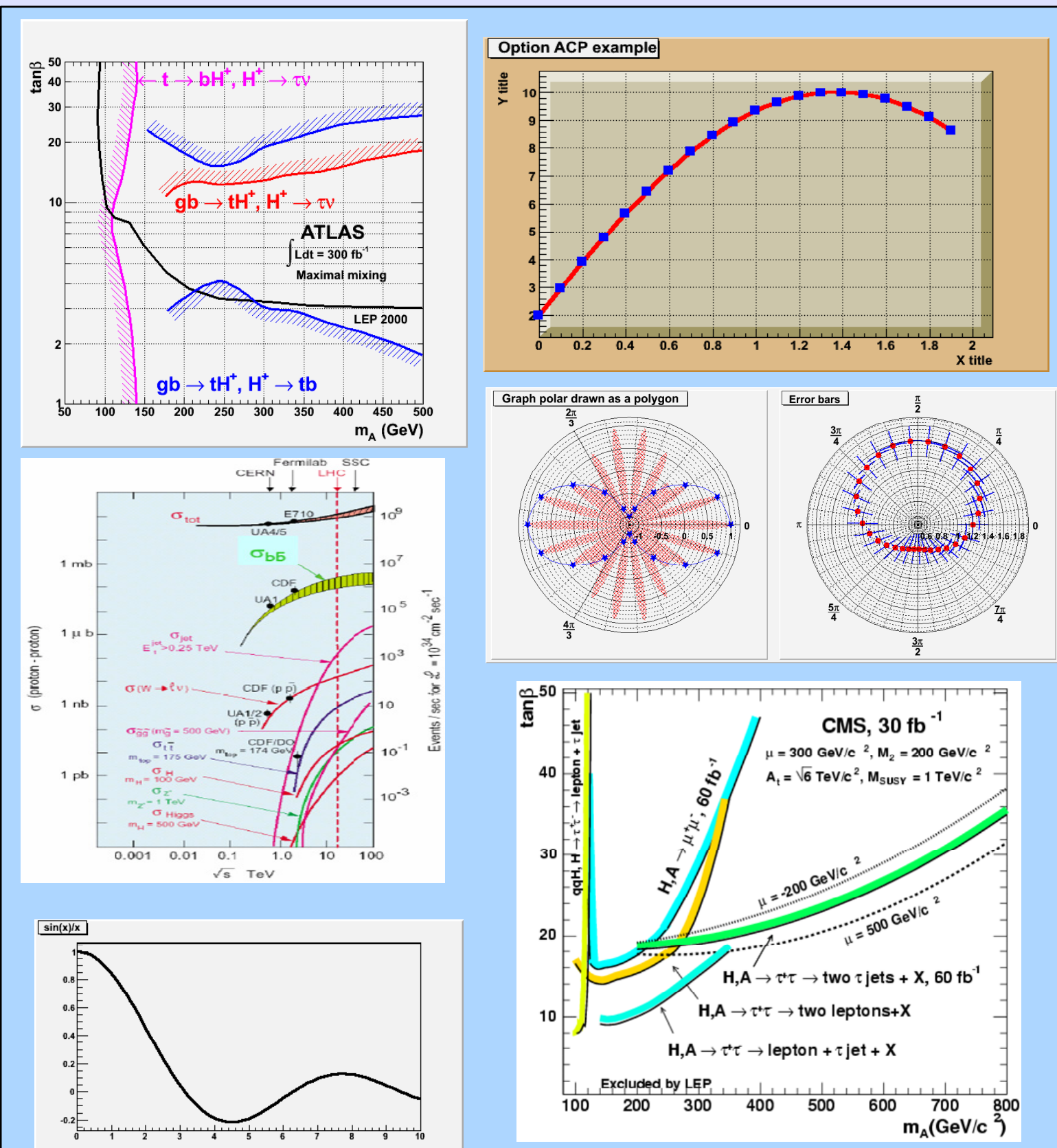
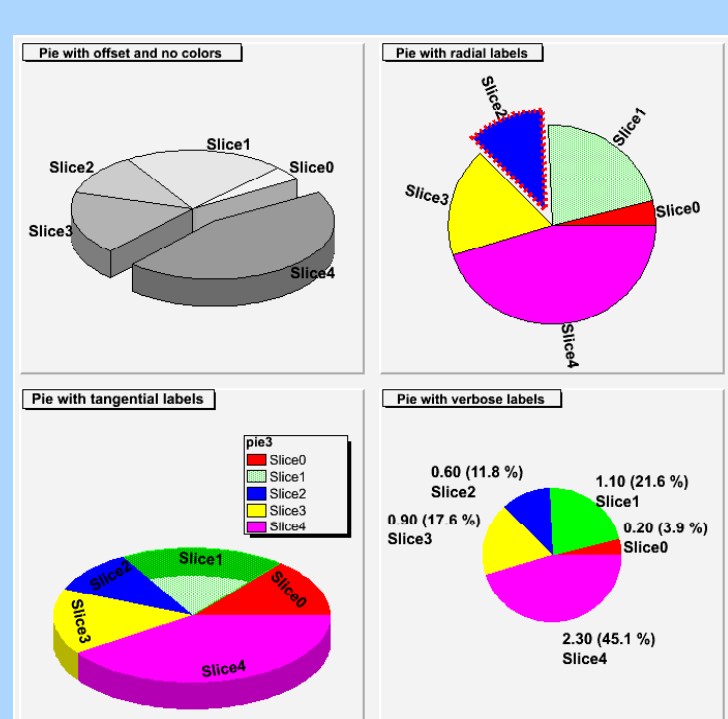


Bar charts and lines are a common way to represent 1D histograms.



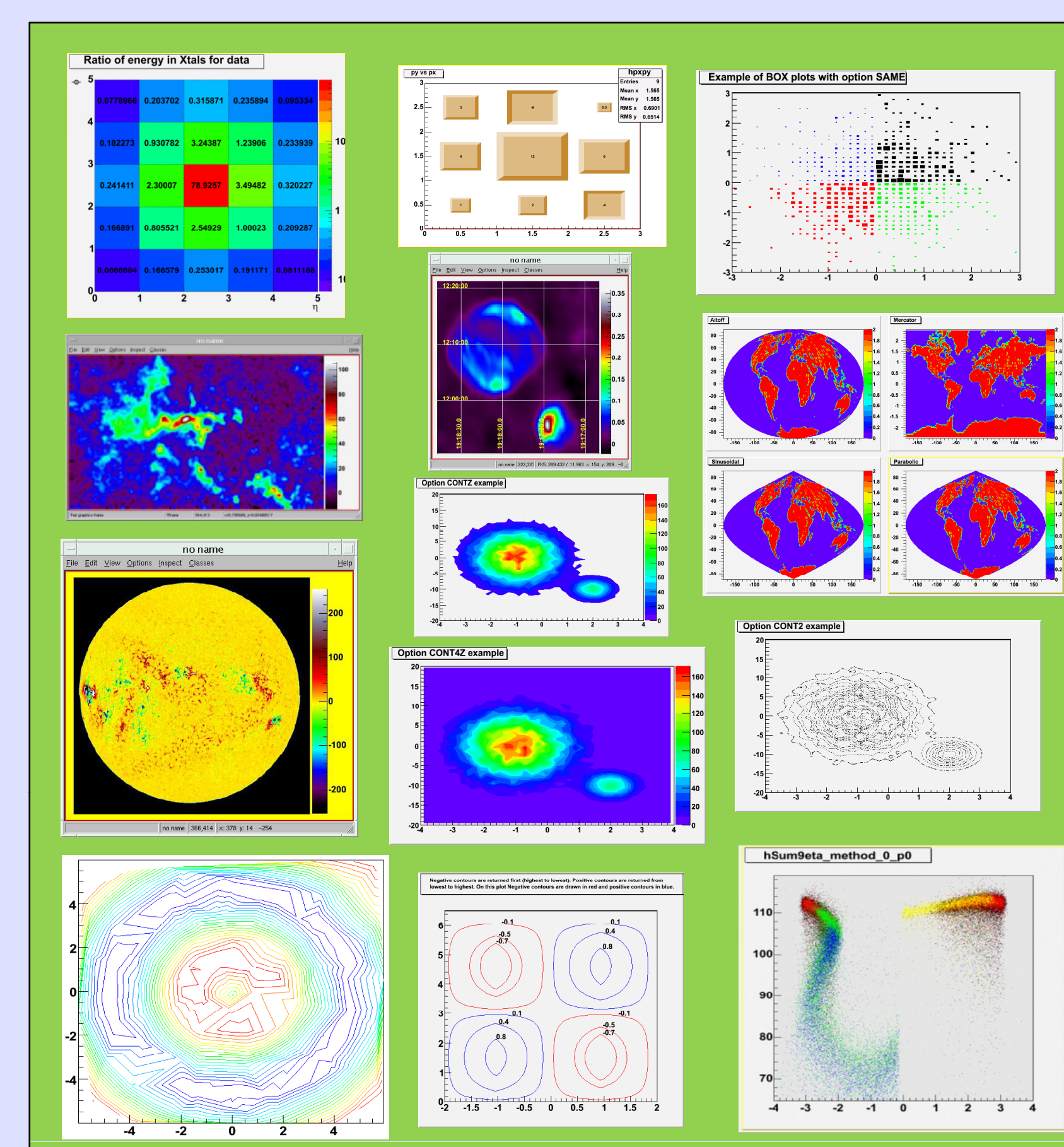
Errors can be represented as bars, band, rectangles. They can be symmetric, asymmetric or bent. 1D histograms and graphs can be drawn that way.

Pie charts can be used to visualize 1D histograms. They also can be created from a simple mono dimensional vector.

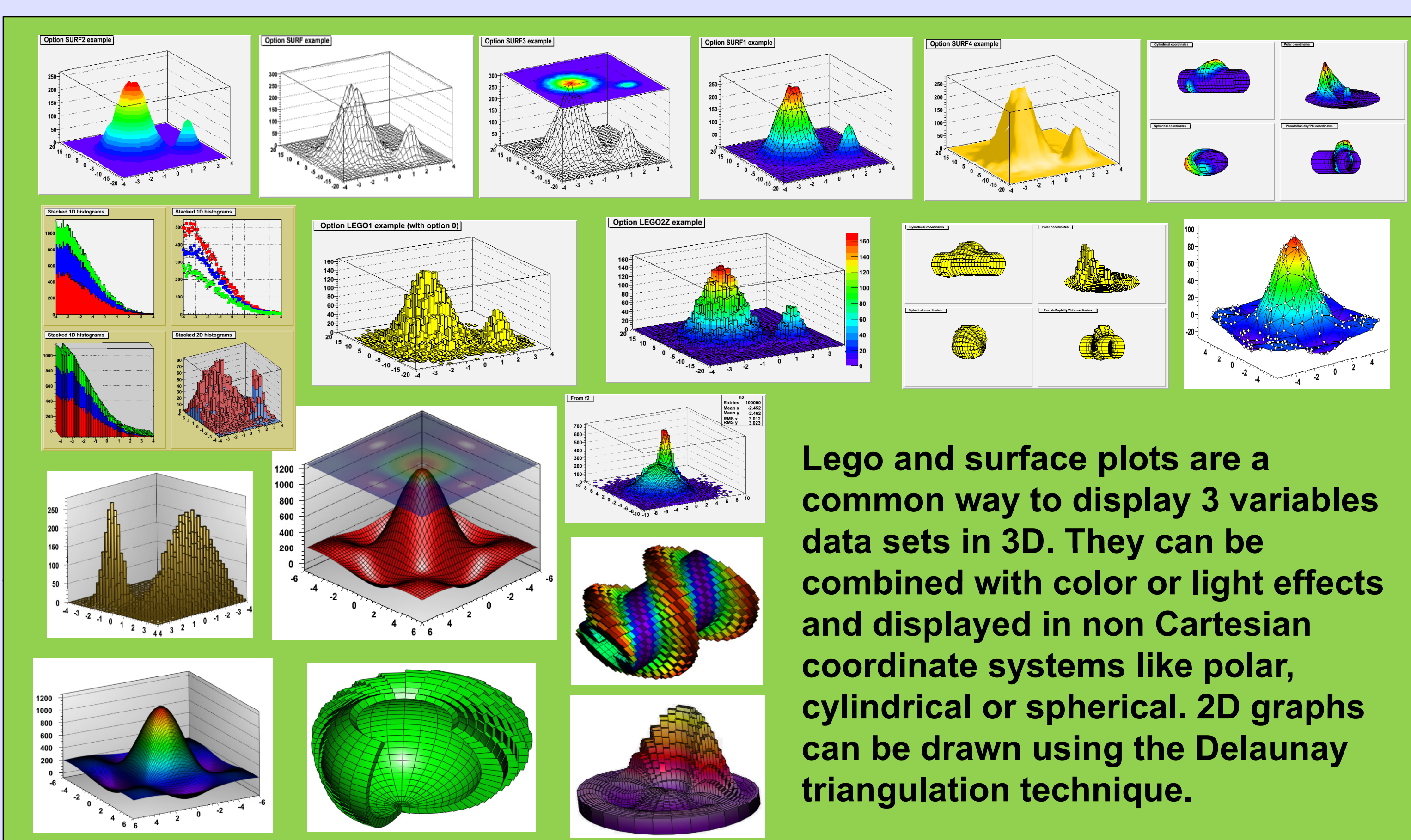


Graphs can be drawn as simple lines, like functions. They can also visualize exclusion zones or be plotted in polar coordinates.

3 variables visualization techniques are used to display Trees, Ntuples, 2D histograms, 2D Graphs, functions $z=f(x,y)$...

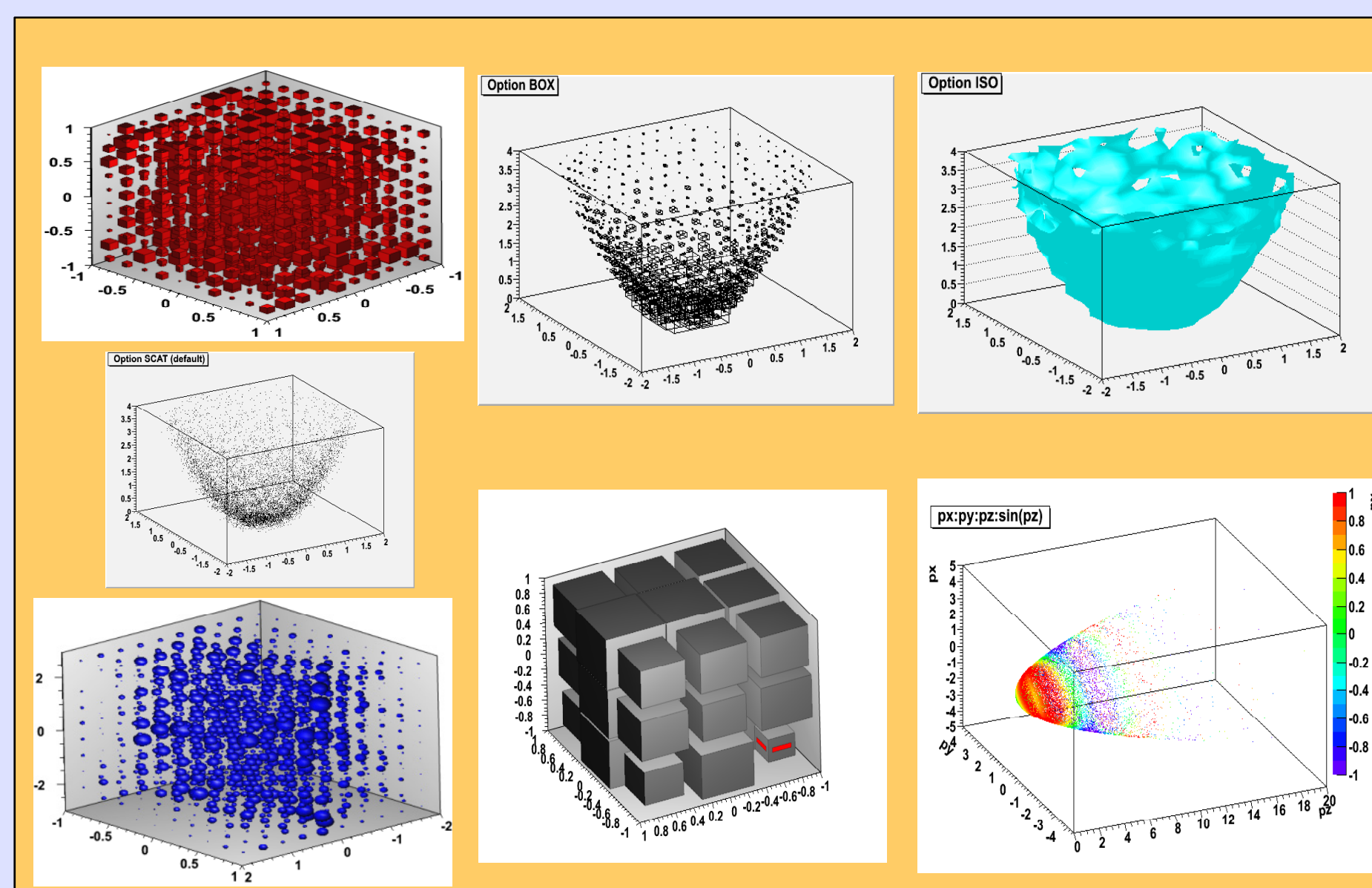


Several techniques are available to visualize 3 variables data sets in 2D. Two variables are mapped on the X and Y axis and the 3rd one on some graphical attributes like the color or the size of a box, a density of points (scatter plot) or simply by writing the value of the bin content. The 3rd variable can also be represented using contour plots. Some special projections (like Aitoff) are available to display such contours.

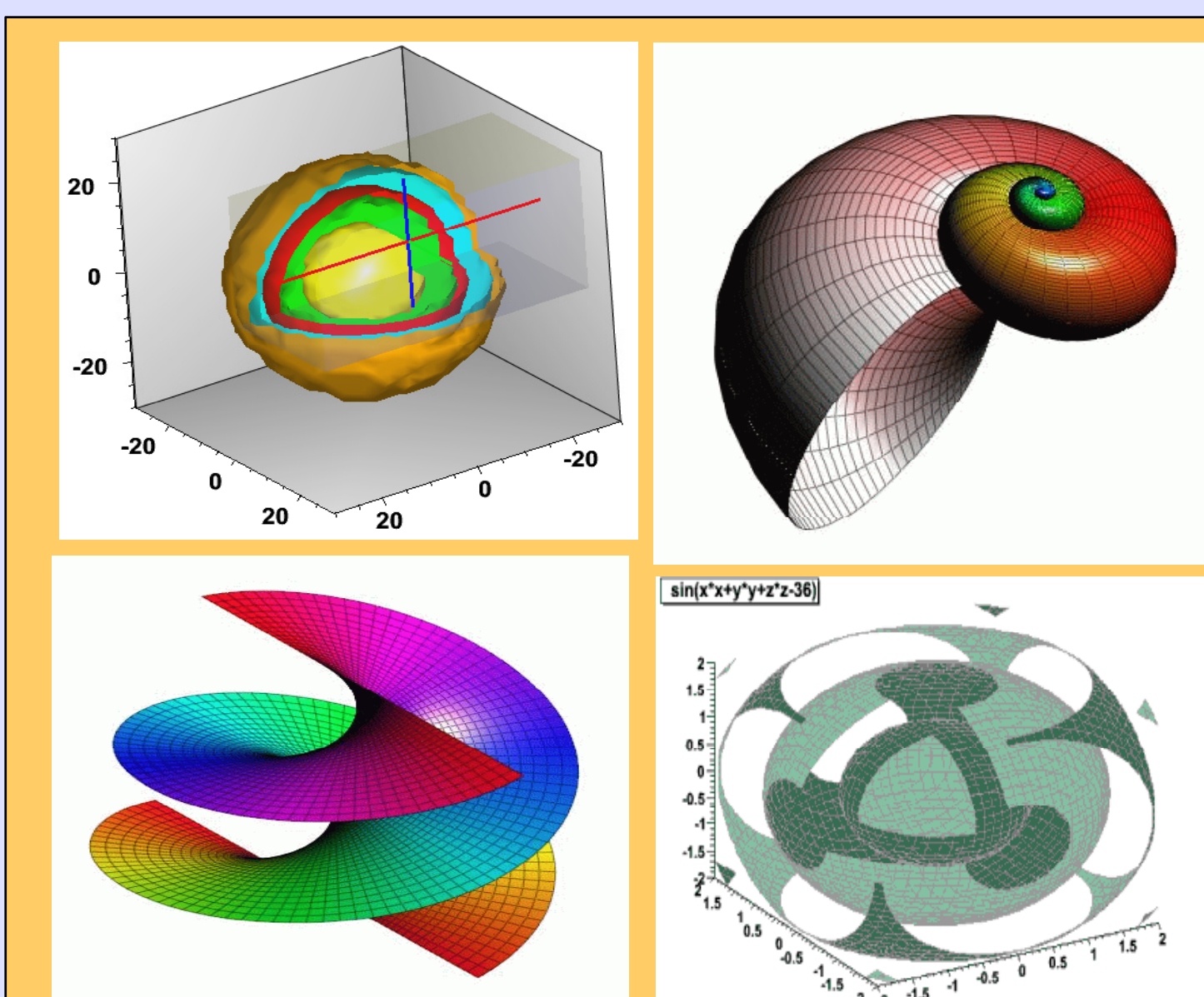


Lego and surface plots are a common way to display 3 variables data sets in 3D. They can be combined with color or light effects and displayed in non Cartesian coordinate systems like polar, cylindrical or spherical. 2D graphs can be drawn using the Delaunay triangulation technique.

4 variables visualization techniques are used to display Trees, Ntuples, 3D histograms, functions $t=f(x,y,z)$...

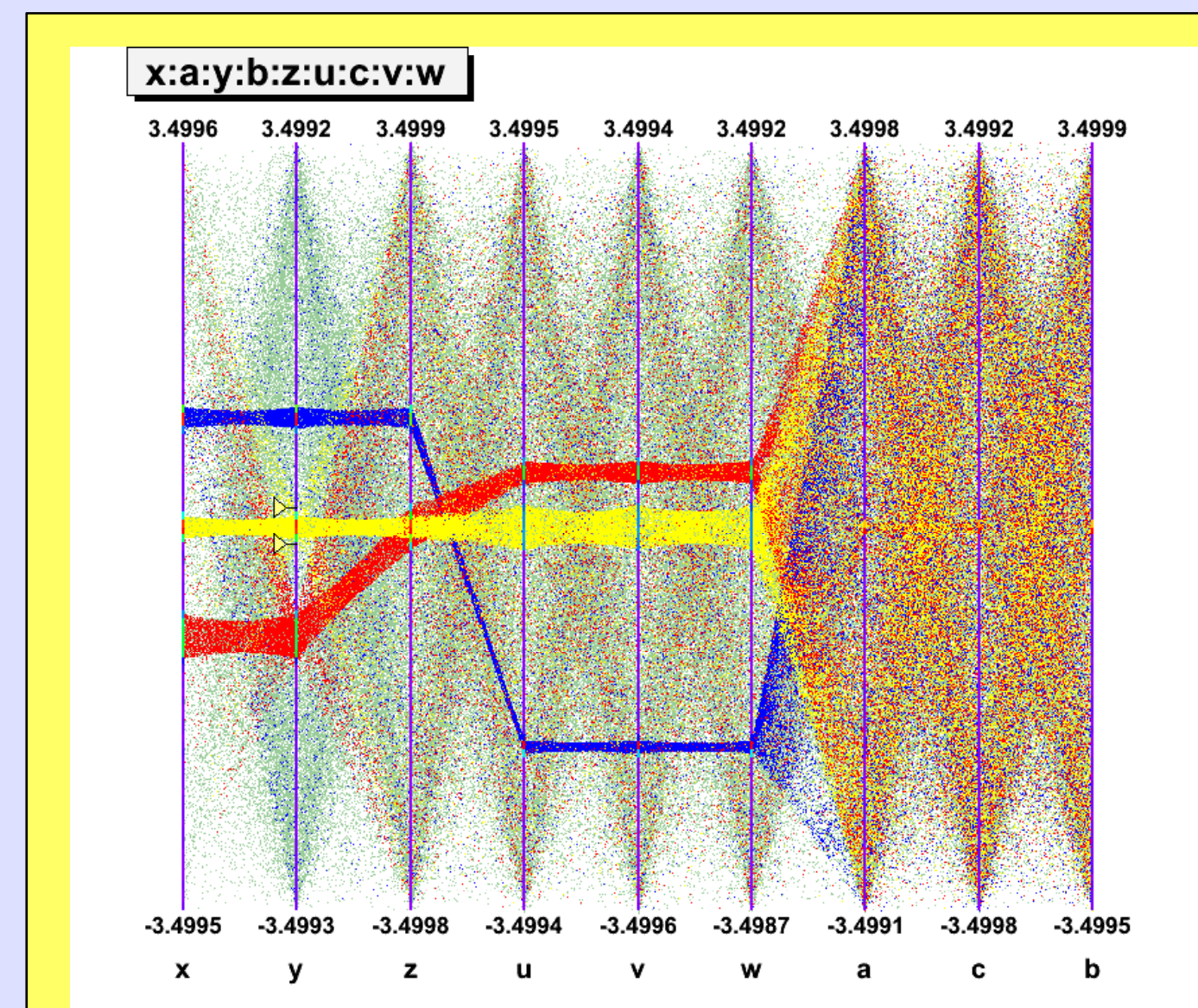


The 4 variables data set representations are extrapolations of the 3 variables ones. Rectangles become boxes or spheres, contour plots become iso-surfaces. The scatter plots (density plots) are drawn in boxes instead of rectangles. The 4th variable can also be mapped on colors. The use of OpenGL allows to enhance the plots' quality and the interactivity.



Functions like $t=f(x,y,z)$ and 3D histograms are 4 variables objects. ROOT can render using OpenGL. It allows to enhance the plots' quality and the interactivity. Cutting planes, projection and zoom allow to better understand the data set or function.

N variables visualization techniques are used to display Trees and Ntuples ...



Above 4 variables more specific visualization techniques are required; ROOT provides three of them. The parallel coordinates (on the left) the candle plots (in the middle) which can be combined with the parallel coordinates. And the spider plot (on the right also). These three techniques, and in particular the parallel coordinates, require a high level of interactivity to be fully efficient.

