

# ACCELERATOR CONTROL DATA VISUALIZATION USING GOOGLE MAP

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## A Picture Is Worth A Thousand Words

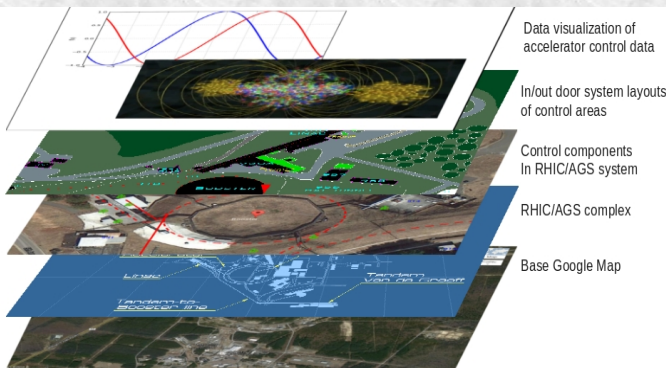
Visualizing live accelerator control data with geological data on a local map can give Main Control Room operators a convenient way to monitor the accelerator control system and provide visual cues to the exact location of a condition or problem. Google's Map API provides an easy way to visually insert many kinds of control data into the Google Map with dynamic symbols, animations and a visualization API. This paper describes details of how live control data visualization can be implemented for displaying live beam status, chipmunk beam loss data, and RHIC complex building temperature data in the AGS/RHIC Control system.

## Location Matters

Considering Google Map as a base virtual canvas, many geological related (indoor or outdoor) control data, system layouts, or controls flowcharts can be added (or drawn) onto a canvas and visually presented at different levels of map zoom. This integration of control data with Google Map provides powerful tools for application developers to develop rich web applications.

One key step for data visualization using the Google Map API is to get the precise geolocation for any accelerator control data to be visualized. Due to the ellipsoidal shape of the Earth, there is no accurate way to calculate the distance between two given geolocation points with very high precision. However, when working within a small region, the effect of the ellipsoidal shape of the Earth becomes insignificant and can be ignored, allowing for a reasonably high degree of precision. The following three steps can help to get geolocation data within a small target area:

1. Define a target area by getting the top-left and bottom right corner geolocation data (the boundary data) in latitude and longitude coordinates in decimal degrees (i.e. 40.6984703, -73.9514422). This can be done with Google Map API;
2. Use units of "fractional part of the decimal degree" for "x" and "y" dimension data of the target area.
3. Apply any mathematical method to calculate geolocation data within the target area, and then add the integer part of the boundary geolocation data to get the right geolocation data.



Once geolocation data has been defined, any control data can be presented at the geolocation with the desired visualization.

The control data to be visualized can be pulled from client side or pushed from server side with an http connection. The pictures on the right show different kinds of RHIC control data that can be presented onto a Google Map.

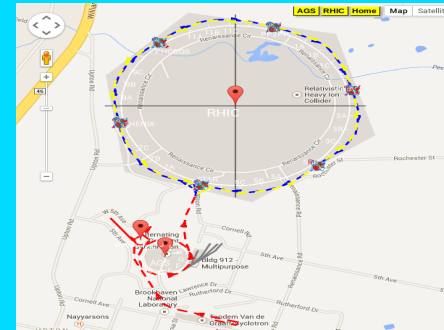


Figure 1. Live status of RHIC/AGS control system

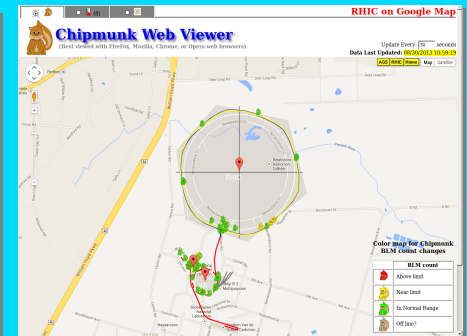


Figure 2. Chipmunk beam loss of RHIC/AGS

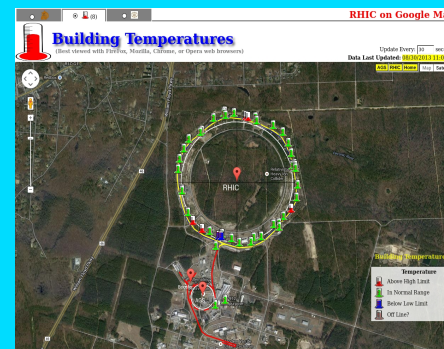


Figure 3. Live building temperatures of RHIC complex

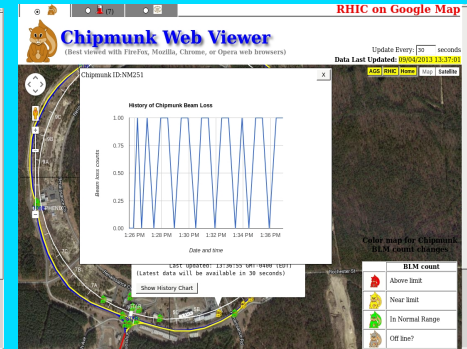


Figure 4. Detail information showed as map zoom level changes and GUI responses with user interactions.

## Summary

The Google's Map API provides an easy way to visually represent many kinds of control system data onto a Google Map with dynamic symbols and rich GUI animations. An easy way to use this technology has been presented in this paper. The web API technology provides the possibility to create many different kinds of live control web applications for accelerator control systems. Google's Map API presents an infrastructure for developing accelerator control web interactive applications which may be integrated with traditional stand alone applications. The techniques used in this work can be easily extended to other similar implementations.