Python/Qt Graphics in Antelope

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Outline

- Introduction
- Review of Qt Graphics Introduced in 5.5
- Rewrite of Qt Graphics for 5.6
- Python-Qt Bridge Development
- Coding Examples
- Plans for Further Development

INTRODUCTION – KMI TEAM

KINEMETRICS

Designs and manufactures sensors and digitizers – Provides complete systems design, installation and operations

QUANTERRA®

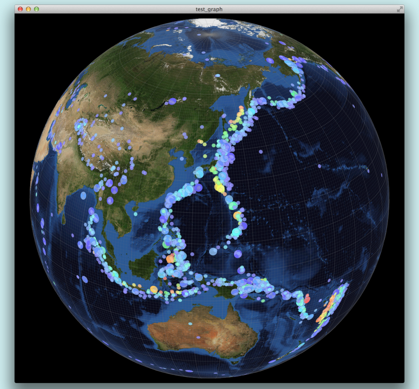
Designs High-End Digitizers

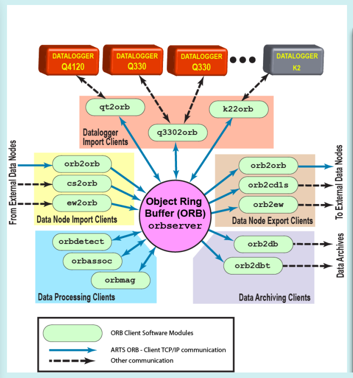
metrozet

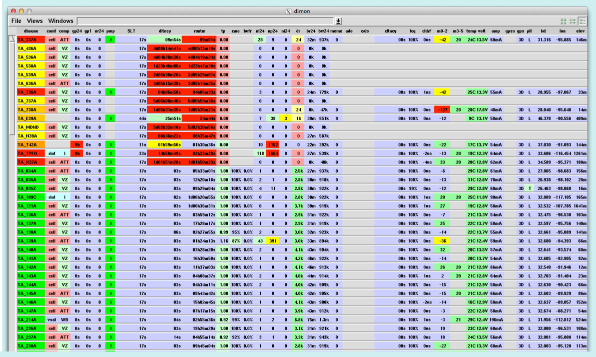
Designs High-End Sensors

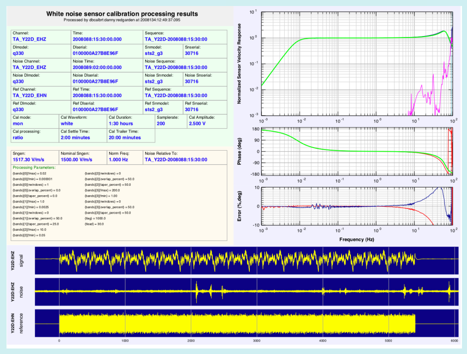
BRTT

Antelope Software









Kinemetrics/BRTT – Comprehensive hardware, software and services

Kinemetrics Systems Solutions

- Turnkey complete systems including enterprise-class computing centers and full communications

Kinemetrics Hardware Manufacturer

- World class Kinemetrics and Quanterra dataloggers
- World class Kinemetrics, Metrozet and Streckeisen sensors

BRTT Software Developer

- World class acquisition software for all Kinemetrics hardware products
- Proven track record for large networks with difficult remote deployments (USArray)
- World class, comprehensive automated and interactive seismic processing software
- Data neutral architecture for support of non-seismic environmental monitoring networks
- Extraordinary Command & Control capabilities with SOH displaying

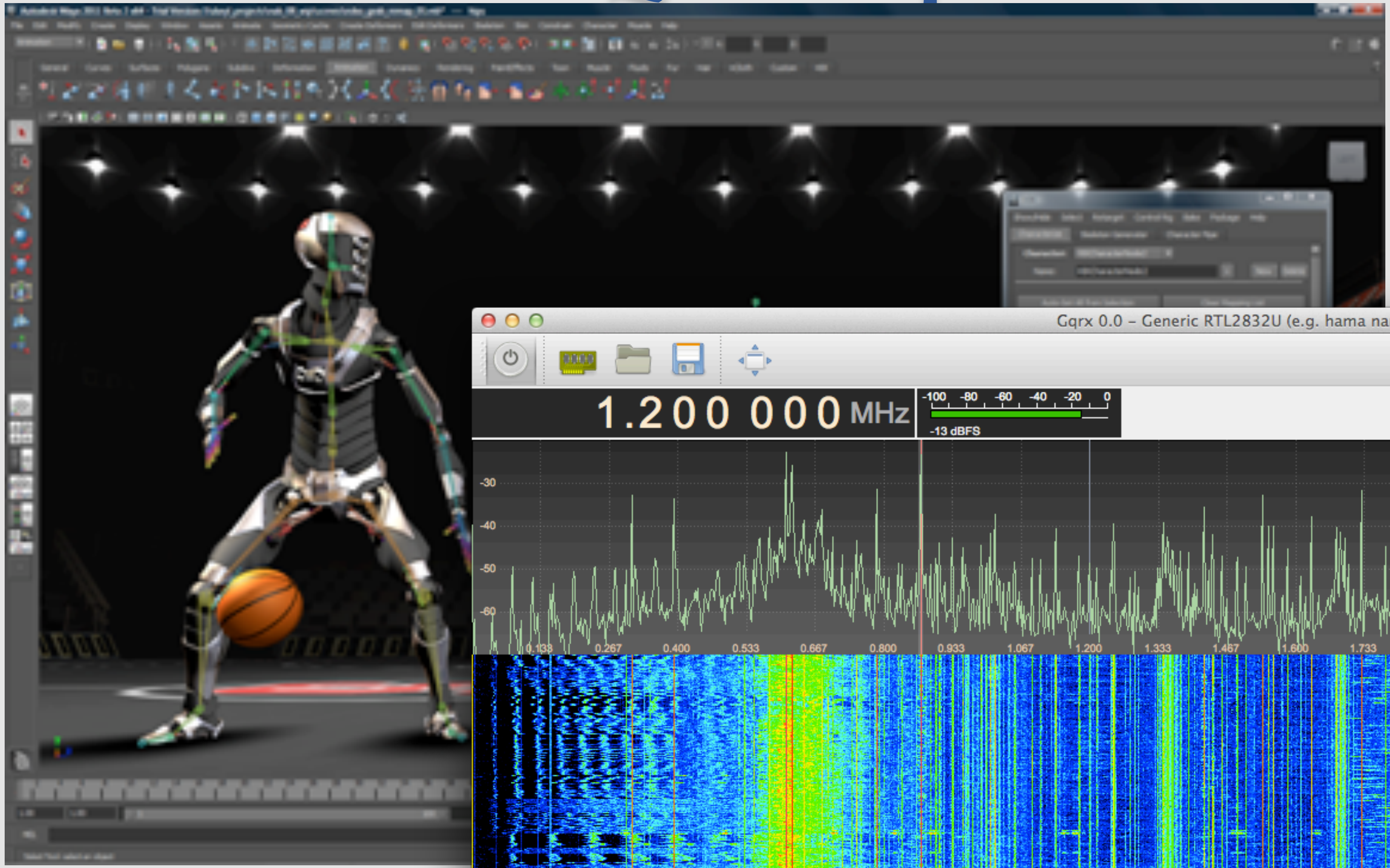
Kinemetrics Services

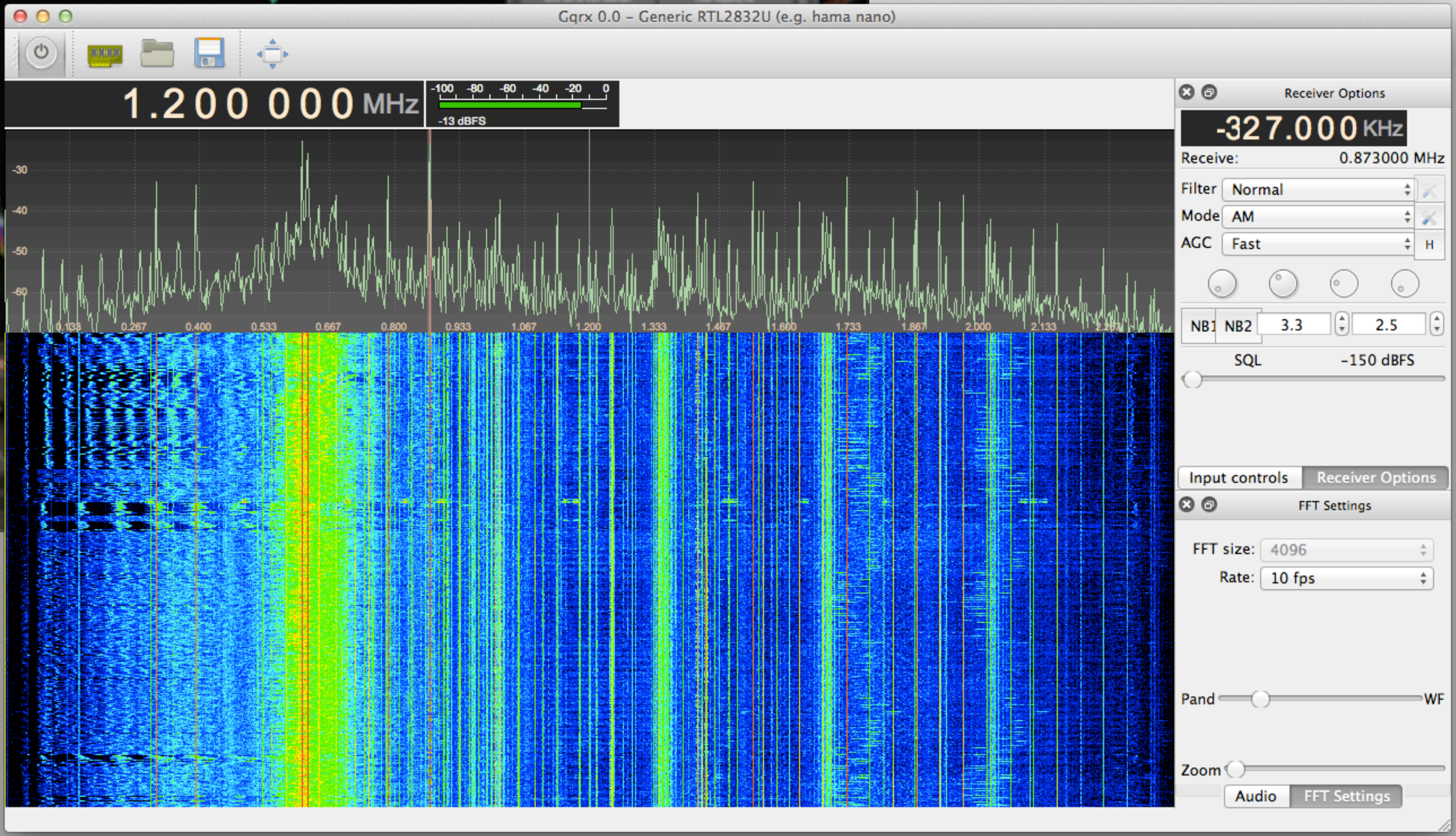
- Complete systems procurement, installation and training including all aspects of both hardware and software
- Network operations

Qt Graphics in 5.5

- Cross platform API (MacOSX, LINUX, Windows, iOS, Android, Windows Mobile)
- Commercially supported and licensed (Qt Company)
- High level support for modern graphics hardware (fonts, spatial antialiasing, alpha blending, 3D rendering, etc.)
- Very large user base (Nokia, KDE, Android apps, embedded devices) plus sophisticated extensions such as Marble
- QTWebkit and QTWebsockets plus XML interpreter
- Up to OpenGL API levels

Qt Graphics in 5.5




Gqrx 0.0 – Generic RTL2832U (e.g. hama nano)

1.200 000 MHz

-13 dBFS

Receiver Options

-327.000 KHz

Receive: 0.873000 MHz

Filter: Normal

Mode: AM

AGC: Fast

NB1 NB2 3.3 2.5

SQL -150 dBFS

FFT Settings

FFT size: 4096

Rate: 10 fps

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What is Qt?

- Graphics/Interaction middleware
- C++ API with ~500 classes
- High performance at various levels
- High functionality at various levels
- Cross platform API with common application code base for MacOSX/Cocoa, MaxOSX/Xquartz/X11, Linux/X11, iOS, Android, Windows
- Both GPL and commercially licensed through Qt Company

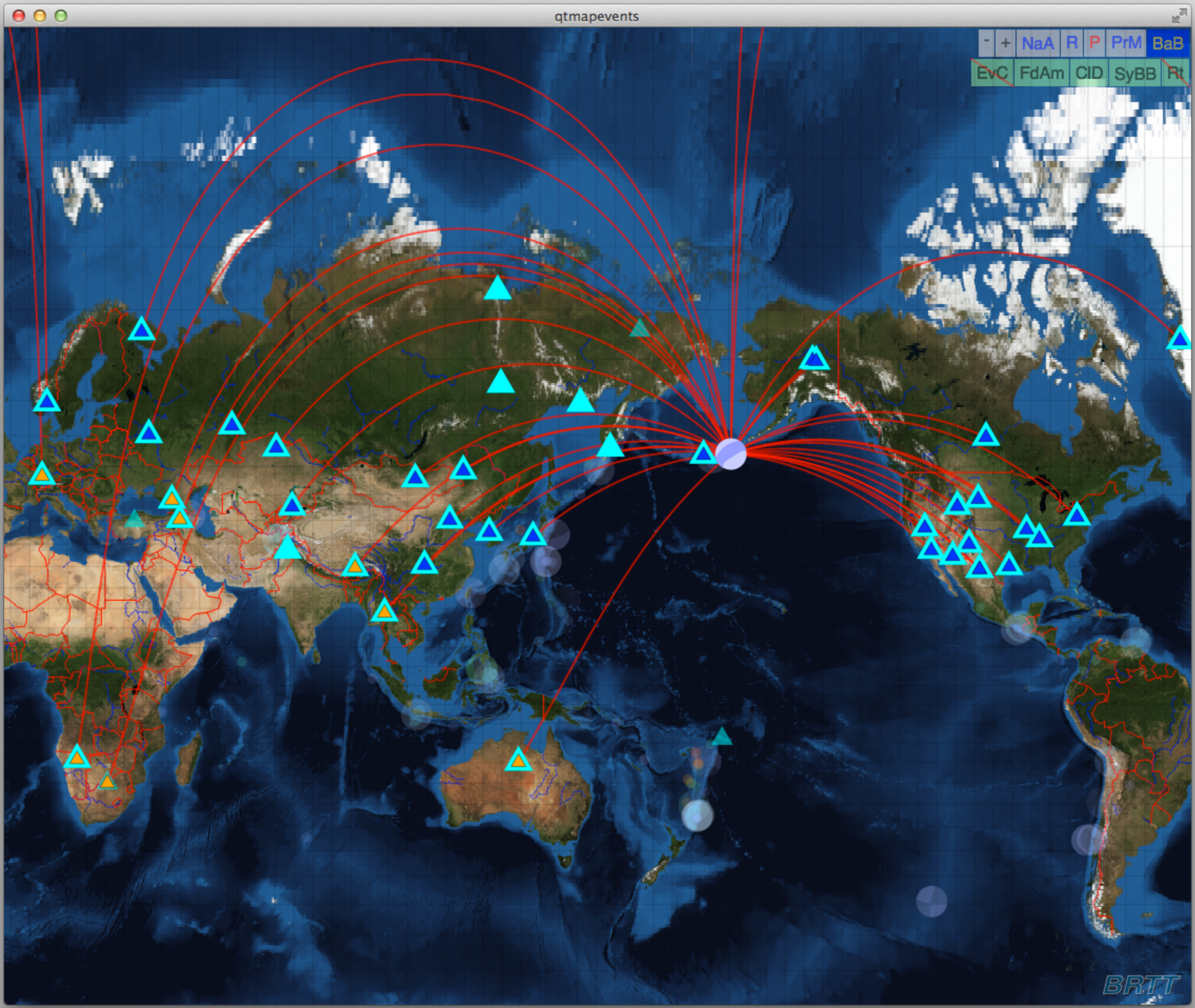
5.5 Graphics Development

- BRTT stopped all graphics/GUI development that uses X11/Tk. This included the TCL, perl and python extensions we have used and developed in the past.
- Starting with 5.5, new graphics/GUI software will be developed only using Qt
- Although there is a dual GPU/commercial PyQt python extension library for Qt, BRTT will not use PyQt for the 5.5 release (we have experimented with making our own version of PyQt)
- New BRTT developed graphics/GUI software written in c++

Qt-related Developments Introduced in 5.5

- New `Qt-based` library that introduces BRTT plot extensions into Qt (not available for development by our users)
- New Qt-based `dbe` prototype
- Rewrite of BRTT map display software
- Support for continuously scalable display transformations of image data such as NASA's Bluemarble earth image data
- High performance map projection transformations through threading
- New BRTT Map Data (bmd) format that supports multiple resolution and tiled image and vector data in both native compressed and uncompressed formats
- `qtmapevents`

5.5 - qtmapevents



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5.5 - qtmapevents

- 180 lines of c++ closed-source code
- Because of commercial Qt licensing restrictions, no user access to BRTT-developed Qt library
- The 5.5 prototype version of the Qt graphics library was developed through minimal changes to the existing Tk/X11 based graphics library

5.6 – first production version of Qt graphics library - `bqplot`

- Complete rewrite
- 5.5 prototype version did not take advantage of c++ coding capabilities – 5.6 production version takes full advantage of c++ coding capabilities resulting in code maintainability
- 5.6 **`bqplot`** library consists of 20 new classes that implement high level graphics function, 20,000 new lines of code and documentation
- Although derived from the old Tk/X11 buplot code, this version adds major new coding constructs that will ease development of further graphics capabilites.

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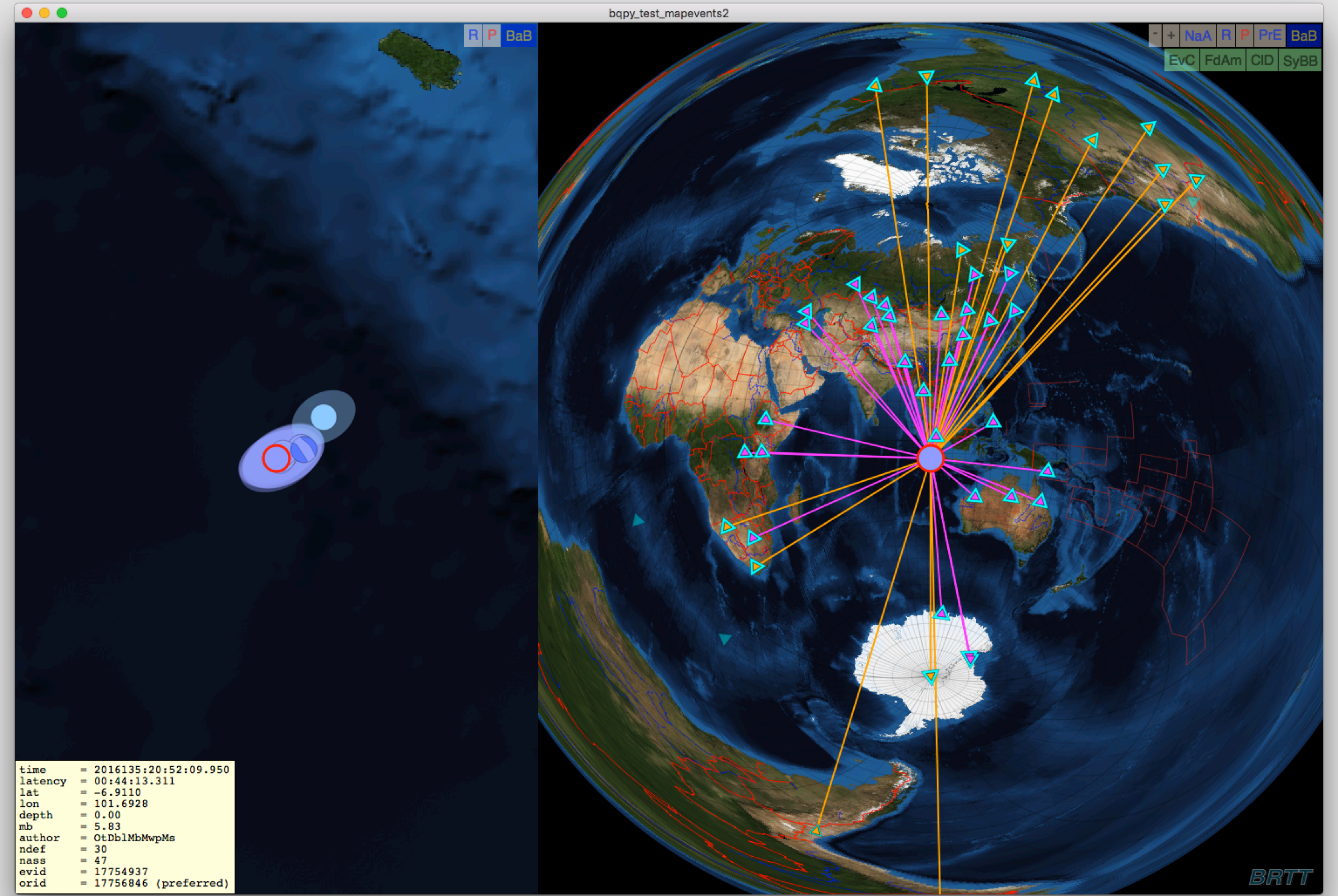
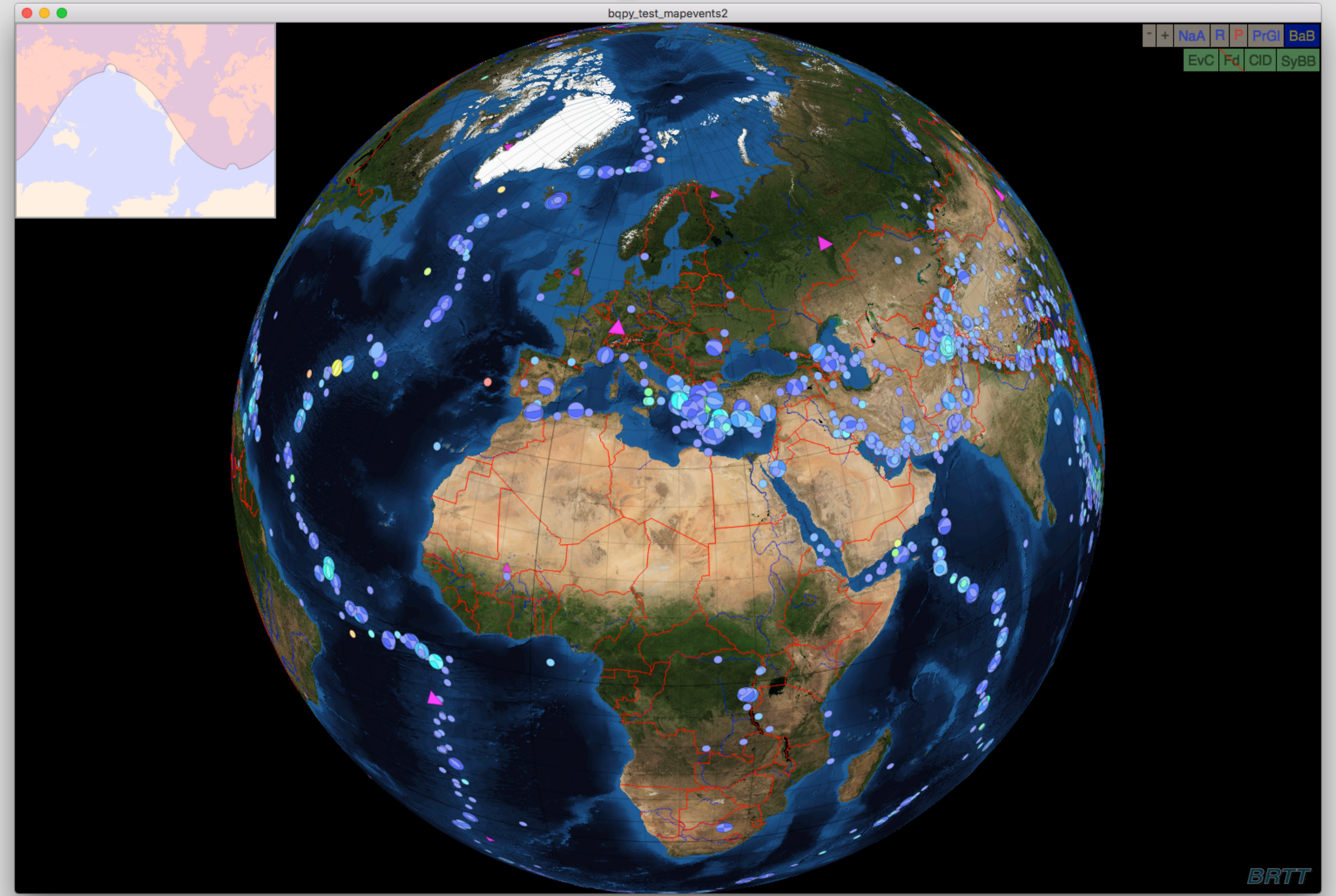
5.6 – BQMapevents class



```
time      = 2016135:20:52:09.950
latency   = 00:44:13.311
lat       = -6.9110
lon       = 101.6928
depth     = 0.00
mb        = 5.83
author    = OtDblMbMwpMs
ndef      = 30
nass      = 47
evid      = 17754937
orid      = 17756846 (preferred)
```

5.6 – BQMapevents class



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5.6 – first production version of Qt graphics library - **`bqplot`**

- All **`bqplot`** classes are documented
- However, because of licensing restrictions, BRTT cannot provide a c++ Qt development environment as part of its distributions
- We needed to extend the new Qt graphics to a scripted environment like Python – would both ease our development tasks and provide our users development access to **`bqplot`**

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Development of Python interpreter for **`bqplot`**

- **`bqpy`** in the 5.6 release provides a Python interpreter that will act as a bridge to the **`bqplot`** graphics library
- **`bqpy`** runs an embedded Python interpreter in one thread and a special **`bqplot`** server in a separate thread
- The **`bqplot`** server accepts commands and data through a serialized pipeline that is fed by the Python interpreter in the other thread. Note that with this design the Python interpreter and the **`bqplot`** server could be in separate processes

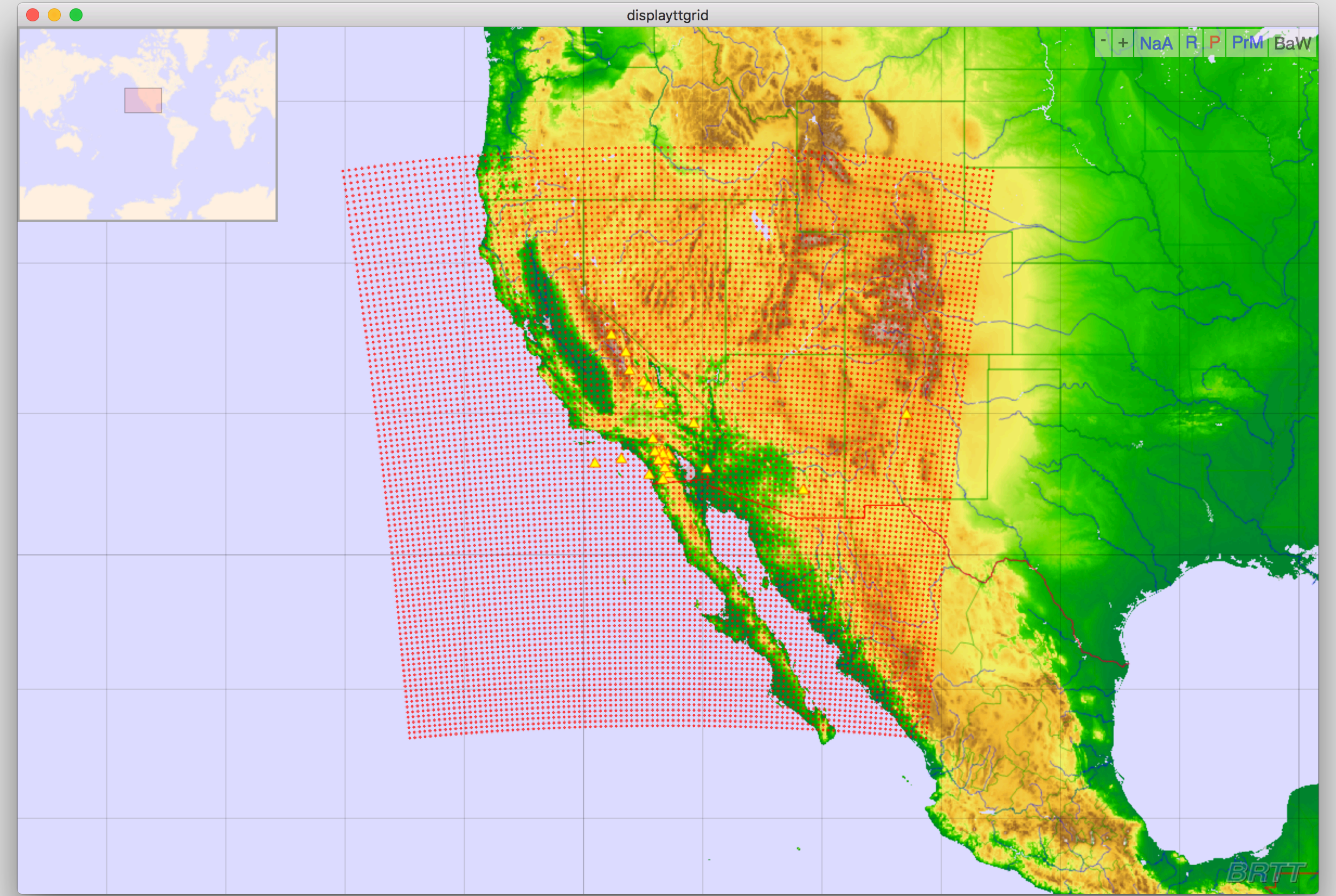
Development of Python interpreter for `bqplot`

- **`qtmapevents`** in the 5.6 release is now a 70 line open source Python script that runs **`bqpy`** (as opposed to 180 lines of c++ code in the 5.5 version)
- **`displayttgrid`** in the 5.6 release is now a 141 line open source Python script that runs **`bqpy`**
- **`dbevents_pre`** in the 5.6 release is now an open source Python script that runs **`bqpy`** and provides event graphics using the new Qt library
- BRTT will continue to convert old Tk/X11 based displays to Qt using this approach
- We encourage our users to develop graphics apps using this approach

```
from antelope.bqplot import *
from antelope.bueventview import *

def usage():
          print "usage: qtmapevents [dbname]"

nargs = len(sys.argv)
if nargs != 1 and nargs != 2:
          usage ()
          sys.exit (1)

dbname = None
if nargs == 2:
          dbname = sys.argv[1]

if dbname == None:
          map = Map ("toplevel")

          map.setdefaults ()
          map.configure ( \
                    "latr",   0.0, \
                    "lonr",   0.0, \
                    "range",  380.0 )

          tbmap = map.gettaskbar ()
          tbmap.configure ( \
                    "taskbar_exec", "projection=merc"
 )

else:
          ev = bueventview_create ()
          bueventview_configure (ev, "dbname", dbname )
          mapevents = Mapevents ("toplevel")

          mapevents.setdefaults ()

          map = mapevents.getmap ()
          map.configure ( \
                    "latr",   0.0, \
                    "lonr",   0.0, \
                    "range",  380.0 )

          mapevents.seteventview (ev)

          tbmap = map.gettaskbar ()
          tbmap.configure ( \
                    "taskbar_exec","projection=merc")
          tb = mapevents.gettaskbar ()
          tb.configure ( \
                     "taskbar_exec", "symbol=circle" )
          tb.configure ( \
                     "taskbar_exec", "rt=rtp" )

mw = Root()
mw.setgeometry (2500, 1.5, 1)

mw.show ()

mw.qtmainloop ()

mw.pymainloop()
```

Development of Python interpreter for `bqplot`

- `man bqplot`
- `man pythonbqplot`



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Further developments

- Continue **`bqplot`** Python extensions
- Add ability to ingest maps in other formats (gif, tiff, png, etc.)
- Add ability to ingest maps from Web Map Servers (WMS)
- Separate, standalone **`bqplot`** server
- Develop **`bqplot`** to add trace graphics and manipulation functions
- Develop **`bqplot`** to add simplified QUI widgets.

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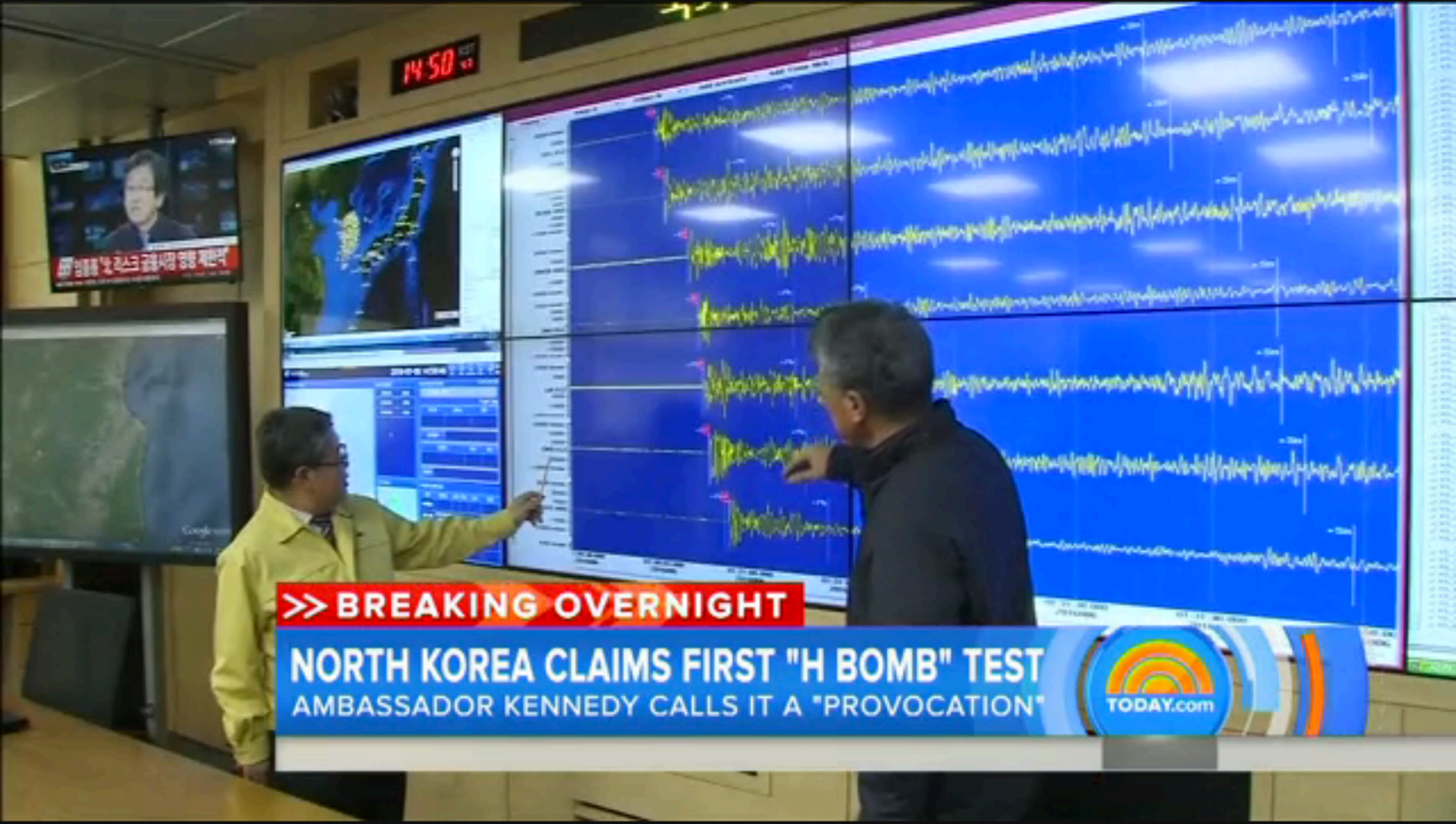
14:50
>> BREAKING OVERNIGHT
NORTH KOREA CLAIMS FIRST "H BOMB" TEST
AMBASSADOR KENNEDY CALLS IT A "PROVOCATION"
TODAY.com

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