MBTA Status

November 17, 2009

T. Accadia, D. Buskulic, F. Marion, B. Mours

VIR-0712A-09

Summary

- ## Purpose of the MBTA pipeline:
  - ◆ Provide online triggers for Virgo (and LIGO) data quality studies
  - ◆ Search for HLV coincidences to provide alerts
- ## News:
  - ◆ More online plots and checks with the hardware injections
  - ◆ Start a software injection pipeline on surrogate data
  - ◆ Sky localization: first maps
  - ◆ MBTA Review on-going
    - » **Andrea Viceré**, Craig Robinson, Emma Robinson, Gabriele Vedovato
    - » https://www.lsc-group.phys.uwm.edu/ligovirgo/cbcnote/MBTApipelineReview
- ## To do list

More online plots

Check with double coincidences
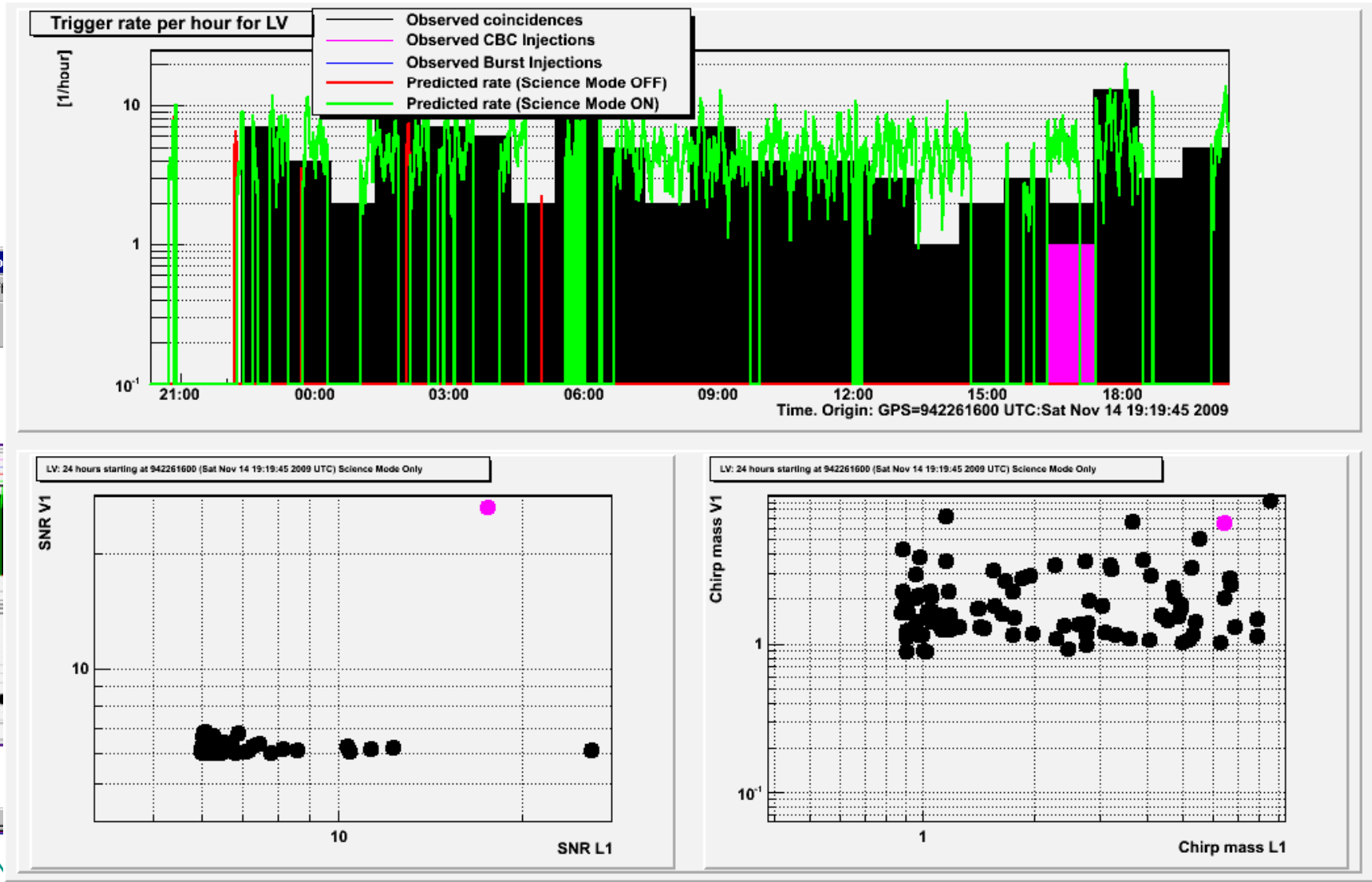
Trigger rate per hour for LV

Legend:
- Observed coincidences
- Observed CBC Injections
- Observed Burst Injections
- Predicted rate (Science Mode OFF)
- Predicted rate (Science Mode ON)

[1/hour]

Time. Origin: GPS=942261600 UTC:Sat Nov 14 19:19:45 2009

LV: 24 hours starting at 942261600 (Sat Nov 14 19:19:45 2009 UTC) Science Mode Only

SNR V1 vs SNR L1

Chirp mass V1 vs Chirp mass L1

CBC H. Injections seen by MBTA

| ITF	H1	L1	V1	HL	HLV
MBTA duty cycle	94%	96%	97%	93%	92%
MBTA & ITF locked duty cycle	41%	40%	86%	23%	22%
Injections scheduled	95	87	189	53	49
Injections found	35	25	43	11	5

BUDAPEST SLIDE

- Period: July 7 to Sep 18
- Number of scheduled injections: 220
- Remarks:
  - The "MBTA duty cycle" correspond to the full pipeline from the DMT h(t) generation, LIGO to Virgo data transfer, up to the writing of the event on the Virgo files system. It does not take into account the transfer back to LIGO (raw trigger or MBTA alert) and is computed for the lowest mass process.
  - Not all scheduled injections were performed. This effect is not included in this estimation
  - 4 out the 5 triple coincidences were submitted to GraceDB.
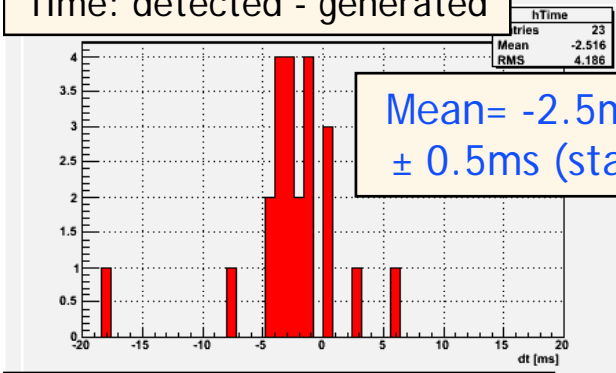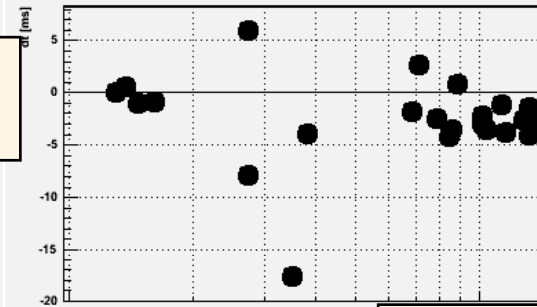 - MBTA SNR threshold is 6.

Hardware Injections
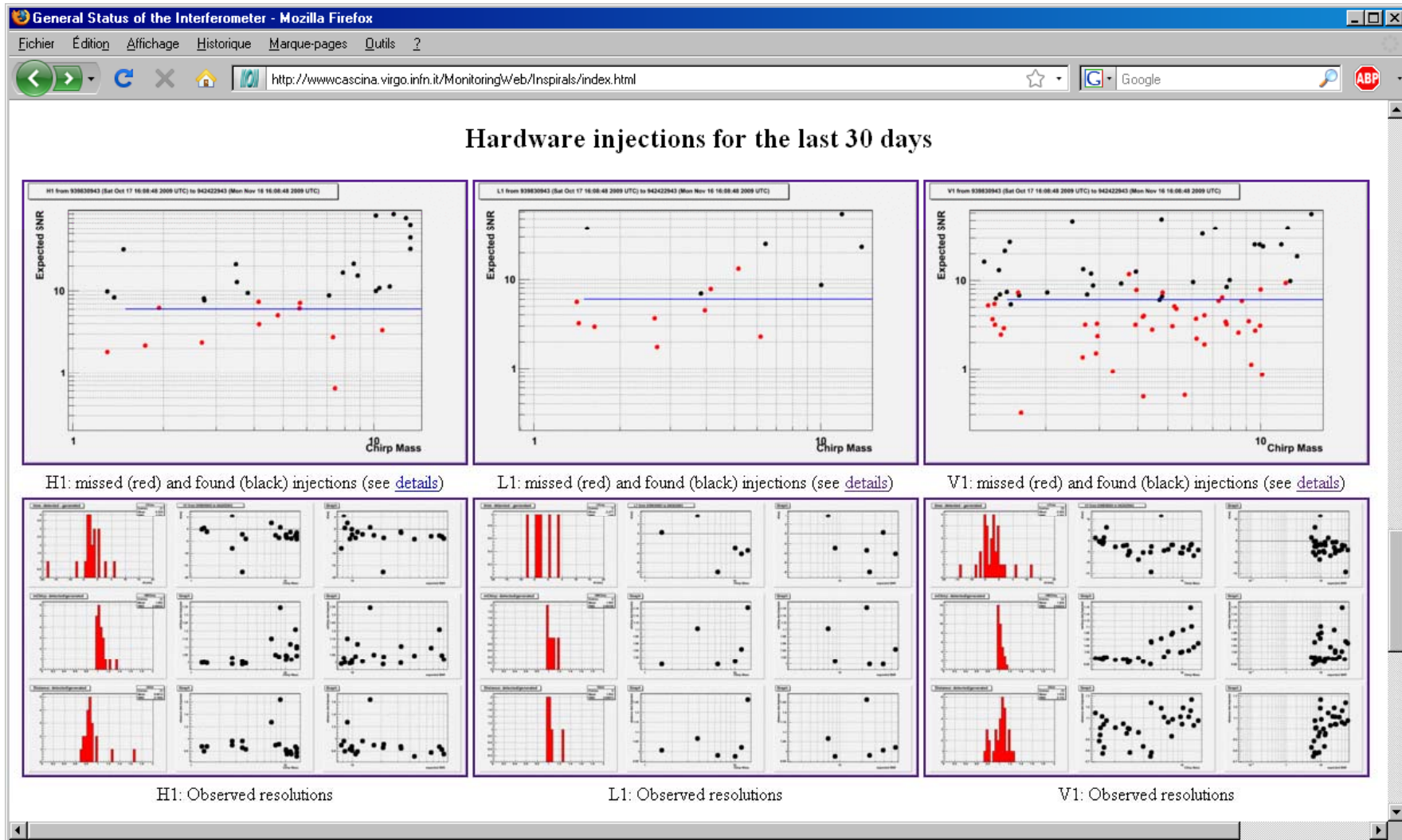
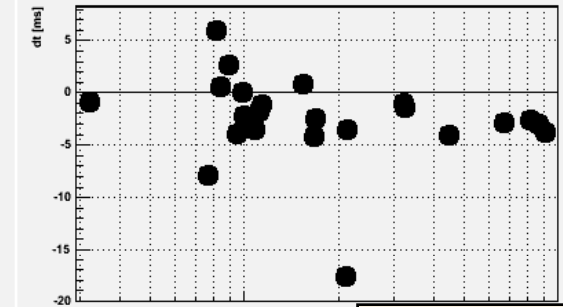# Last Month Hardware Injections (H1)

Time: detected - generated

Mean= -2.5ms ± 0.5ms (stat)

MChirp: detected/generated

Mean = 1.06 ± 0.01 (stat)

Distance: detected/generated

Mean = 0.88 ± 0.04 (stat)

Chirp mass

Expected SNR
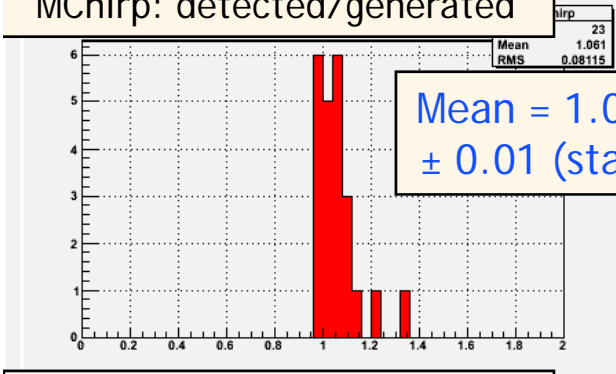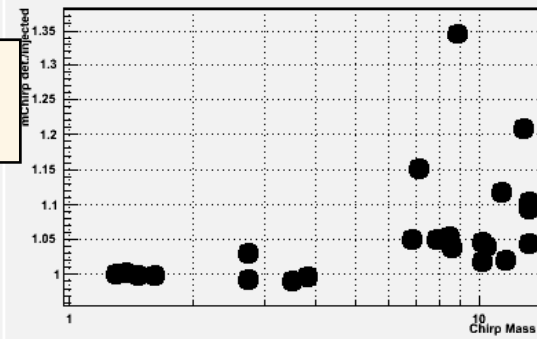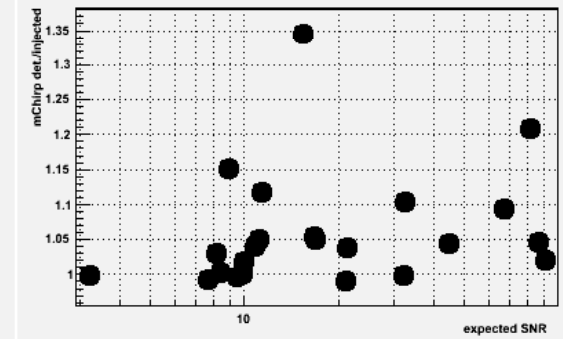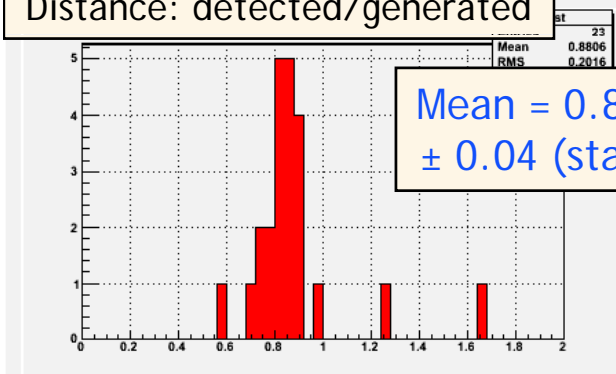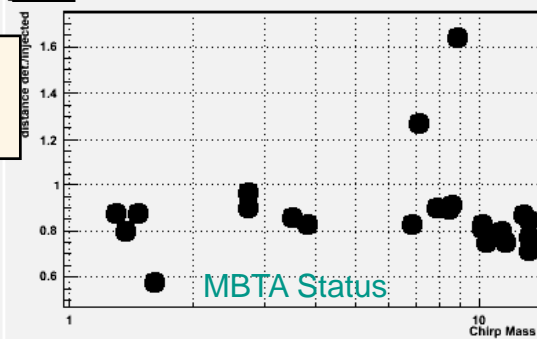
MBTA Status

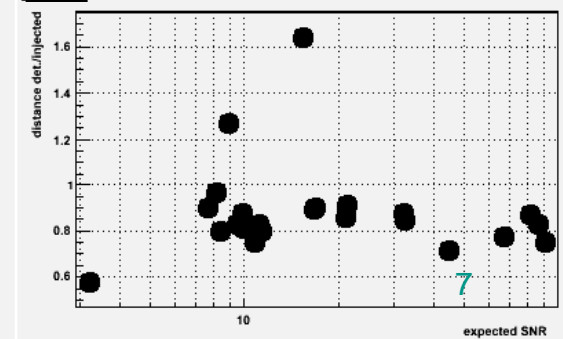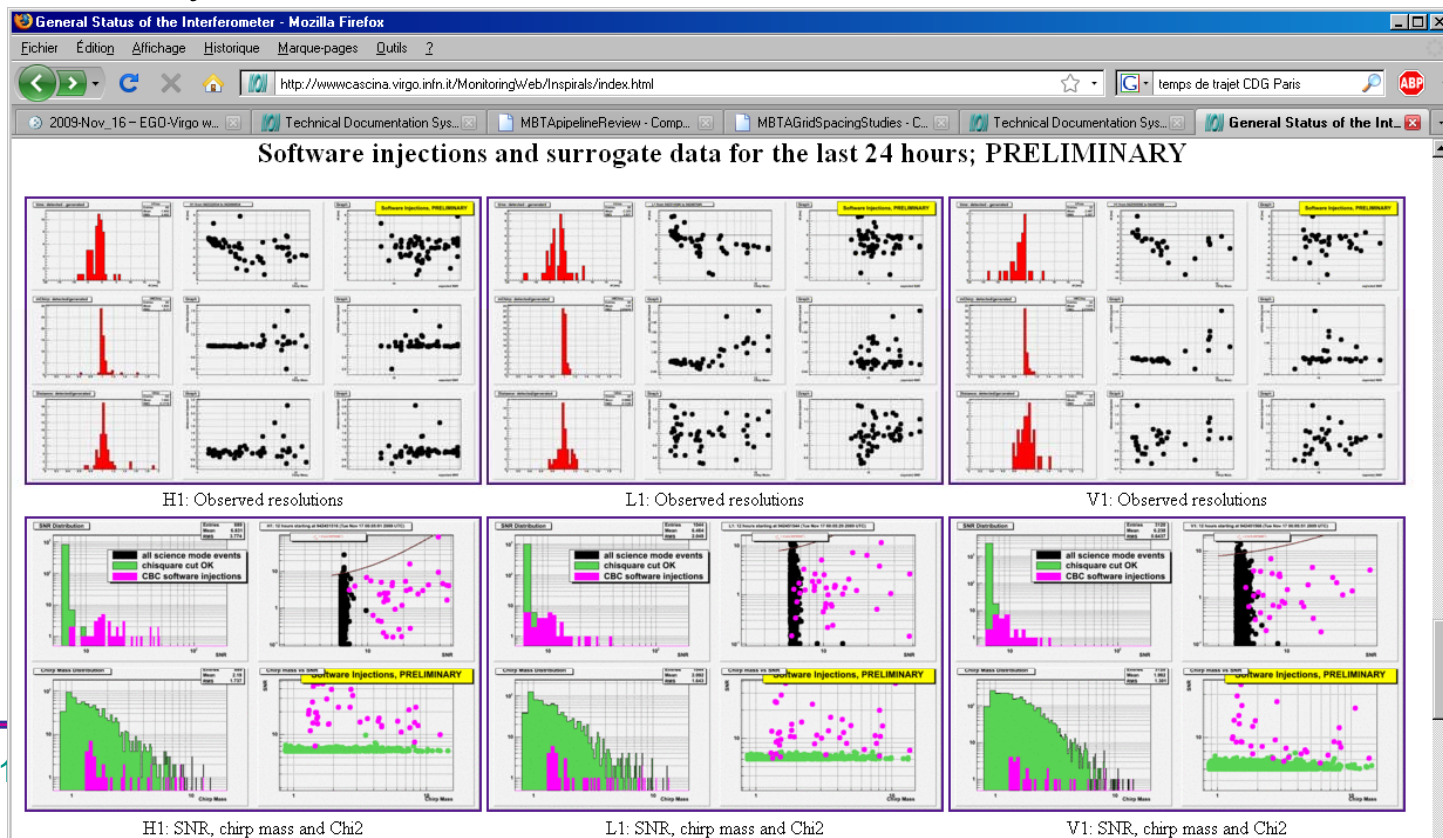7

Software Injections

- Parallel pipeline with surrogate data + software injections
  - ◆ To provide minimal trigger rates
  - ◆ To study pipeline bias, efficiencies
  - ◆ Mass distribution uses the Nov-Dec hardware injections set (more BNS)
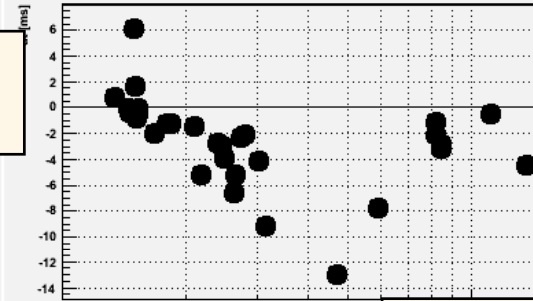 - ◆ Still preliminary

Software injections on V1

Time: detected - generated

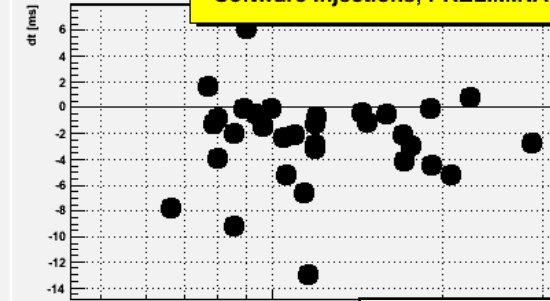Mean= -2.5ms ± 0.6ms (stat)

MChirp: detected/generated

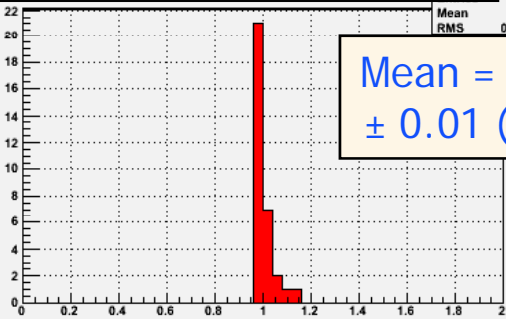Mean = 1.01 ± 0.01 (stat)

Distance: detected/generated
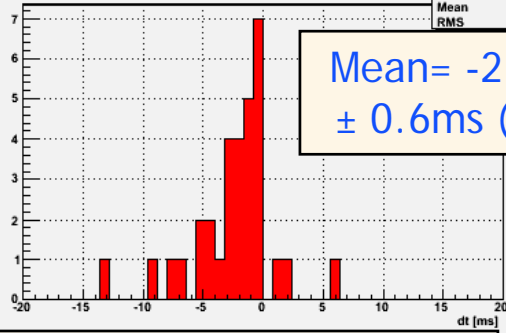
Mean = 1.01 ± 0.03 (stat)

V1 from 942295058 to 942467858

Chirp mass

Software Injections, PRELIMINARY

Expected SNR
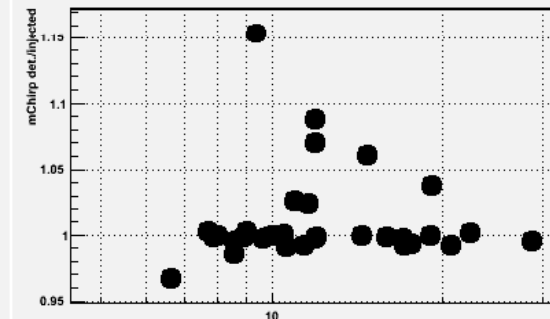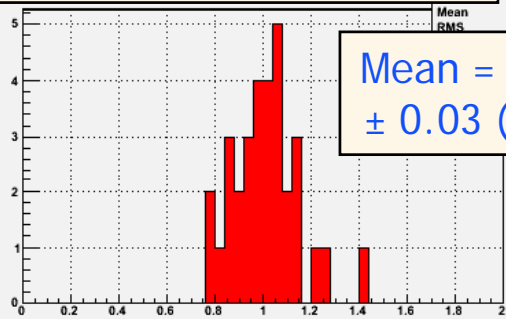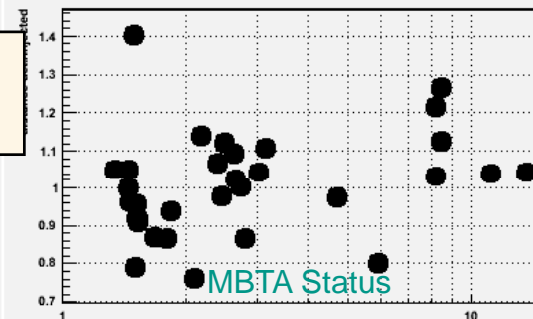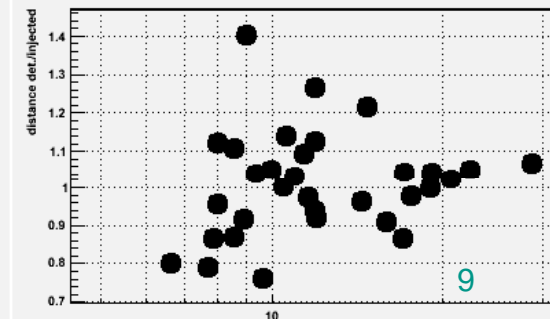
MBTA Status
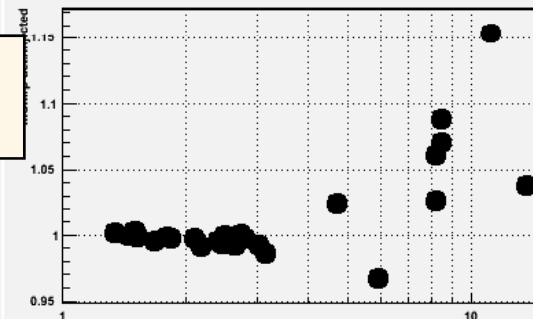
9

Triple Coincidences: Rate estimation

	July estimate	Typical value	Surrogate data
H1 trigger rate (Hz)	.04	0.15	0.03
L1 trigger rate	0.05	0.1	0.03
V1 trigger rate	0.10	0.1	0.07
H-L coincidence window	± 20ms	± 40ms	
H/L-V coincidence window	± 40ms	± 60ms	
Expected triple coinc./month	1.7	37	

A rough chirp mass test
will help reducing
the false alarm rate
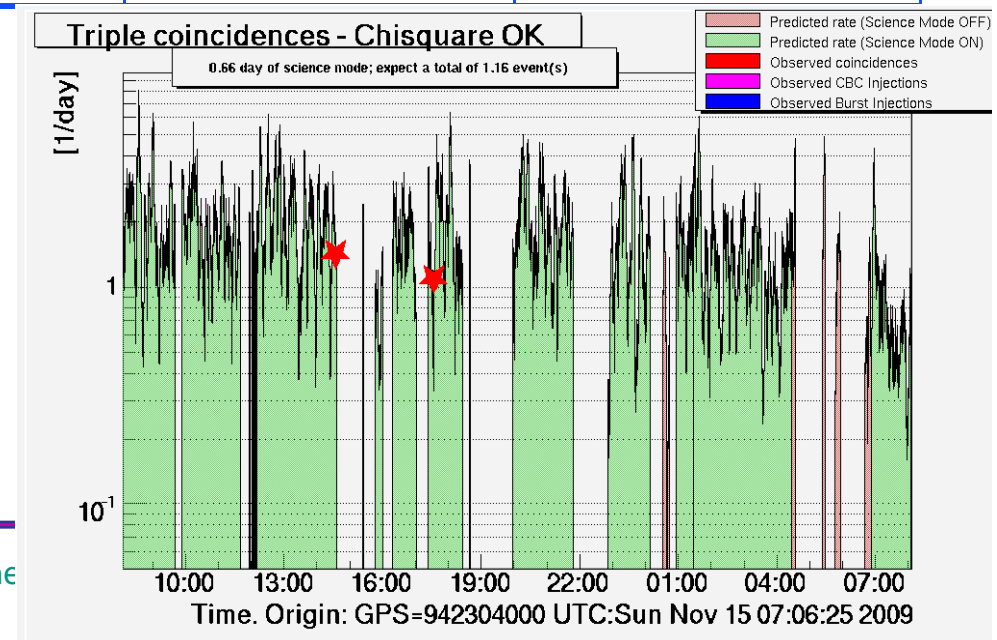
Sky localization

- A few CBC hardware injections checked by Larry Price
  - ◆ https://www.lsc-group.phys.uwm.edu/ligovirgo/cbcnote/skyloc_with_mbta_s6vsr2
- Exemple: G0688

```
ITF End_time Eff_distance SNR    M1     M2 Mchirp Chi2  FAR[Hz]
H1:940147214.97695 15.58 78.66 13.21 13.48 11.62 99.04 0.0800
L1:940147214.97949 23.89 41.09 13.51 13.79 11.88 34.01 0.1067
V1:940147214.98447 44.36 18.08 11.10 16.34 11.68  3.34 0.1667
```

- Sky map:
  - ◆ Using time a the reference frequency
- Good start, but need:
  - ◆ more statistic ,
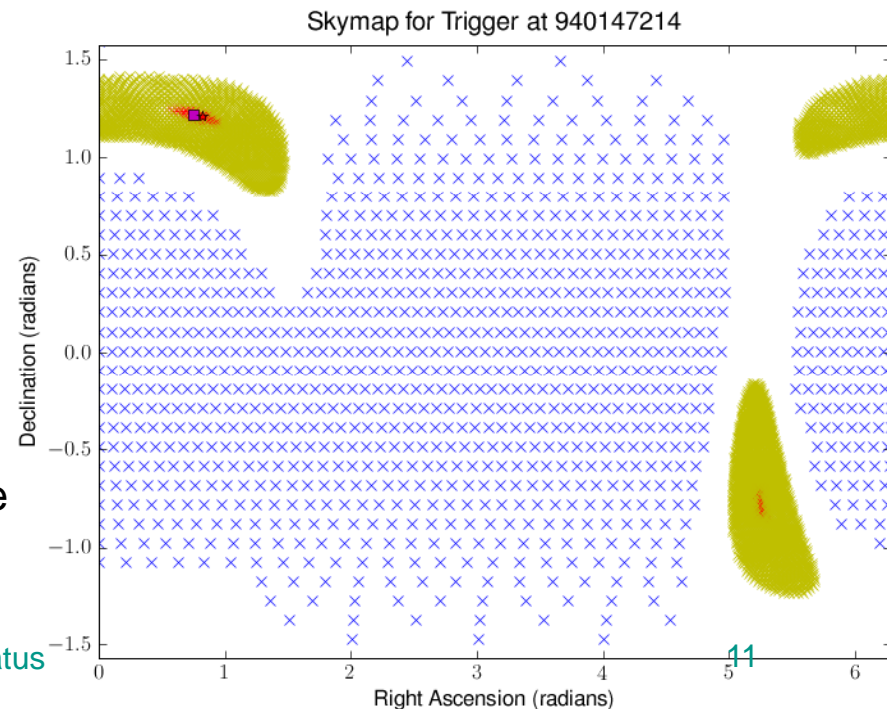 - ◆ software injection to confirm
- GraceDB still in development
  - ◆ Need the interface with the control rooms
    - » To offer the possibility to veto one event
  - ◆ Need to be interfaced to telescope/satellite
  - ◆ Development done by UWM + …

Skymap for Trigger at 940147214

Plans/To do list

- Study the software injections and surrogate data
  - ◆ Arrival time bias and resolution for sky localization,
  - ◆ Extract the error on the arrival time ?
- Improve the coincidence step: apply chirp mass cut
  - ◆ Check trigger rate estimate.
- Compute the triple coincidence equivalent range
  - ◆ To asses the potential of the search at the time of a trigger.
- Alert follow-up
  - ◆ Give more information on the ITF status for the submitted triggers,
  - ◆ Provide more links to the low latency data quality info,
  - ◆ Alert handling in the control rooms.
- Complete the review
- Start sending alert
- Study adjustable SNR thresholds to keep the trigger rates constant
- More offline systematic studies, especially with ihope comparison