Status of KAGRA DetChar

July 9th, 2021
KAGRA International Workshop
Takahiro Yamamoto on behalf of KAGRA Collaboration
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• Role of DetChar

• 03GK
  • Production of Data Quality Information
  • DQ sharing among LVK

• 04 Observing Run
  • Update plans toward O4
  • Commissioning Test
Role of DetChar

Observation

metric

GW propagation

Interferometer diagnostic

Auxiliary signals

main IFO signal

KAGRA O3
- ~20,000 channels are recorded

GW searches

Theoretical waveform

Search Parameter estimation

Noise evaluation Noise removal Event validation

Search groups use only GW channel
Online Data Quality

- DQ flags were provided as a real-time process (16Hz)
- Online DQ was used for estimating duty factor, BNS ranges, low-latency DQ by CAL etc.
- Online DQ was shared as a part of LL-frames (1-sec) with LIGO and Virgo.

<table>
<thead>
<tr>
<th></th>
<th>Observation Time [s]</th>
<th>Duty Factor</th>
</tr>
</thead>
<tbody>
<tr>
<td>GEO</td>
<td>940133 (11 days)</td>
<td>80%</td>
</tr>
<tr>
<td>KAGRA</td>
<td>628135 (7.3 days)</td>
<td>53%</td>
</tr>
<tr>
<td>Coincident</td>
<td>551340 (6.4 days)</td>
<td>47%</td>
</tr>
</tbody>
</table>

JGW-G2011688
Data Quality Sharing

- DQ flags were shared among LVK within a few minutes cadence.
- Data sharing was performed via low-latency frame files.

Gravitational Wave Detector Network
Operational Snapshot as of May 26, 21:35 UTC

<table>
<thead>
<tr>
<th>Detector</th>
<th>Status</th>
<th>Duration</th>
</tr>
</thead>
<tbody>
<tr>
<td>GEO 600</td>
<td>Observing</td>
<td>0:49</td>
</tr>
<tr>
<td>LIGO Hanford</td>
<td>Calib issue</td>
<td>&gt;4:52</td>
</tr>
<tr>
<td>LIGO Livingston</td>
<td>Down</td>
<td>&gt;4:52</td>
</tr>
<tr>
<td>Virgo</td>
<td>Info too old</td>
<td>&gt;4:42</td>
</tr>
<tr>
<td>KAGRA</td>
<td>Down</td>
<td>&gt;4:42</td>
</tr>
</tbody>
</table>

Detector status summary pages
LVK links
https://ldas-jobs.ligo.caltech.edu/~gwistat/gwistat/gwistat.html
https://monitor.ligo.org/gwstatus
Offline Data Quality

- Glitches due to the DAQ checksum errors were occurred (totally 4 files in science segments)
- These files were removed from science mode as an offline data quality evaluation.
- It haven’t been solved and we need to solve this problem until O4 observing run.
Offline Data Quality

IFO was locked when GRB occurred.

At this time, data was not flagged as science mode
because of the maintenance of the green laser system.
The green laser system doesn’t affect the final IFO status with IR lock.
So this data period can be used for the GW searches.

GRB200415A

K1 online DQ
Segment information

- Data Quality Segments are provided with the 15min. cadence for the low-latency DetChar analysis such as glitch trigger searches.
- They were shared among LVK with the 1 day cadence for the offline GW searches

DQ Segment information
- Science segment
- Locked segments
- Unlocked segment
- Overflow segment
- DAQ errors
DQ shift During O3GK

18 people joined the remote shift during O3GK mainly by data analysis working group folks

<table>
<thead>
<tr>
<th>Date</th>
<th>Link to report</th>
<th>Volunteers</th>
<th>Operator’s klog</th>
</tr>
</thead>
<tbody>
<tr>
<td>Apr 7 (8:00-24:00 UTC)</td>
<td>klog14325</td>
<td>Irene Fiori, Kyujin Kwak</td>
<td>klog14025, klog14031, klog14036</td>
</tr>
<tr>
<td>Apr 8 (0:00-24:00 UTC)</td>
<td>klog14321</td>
<td>Irene Fiori, Zhoujlan Cao</td>
<td>klog14046, klog14049, klog14053</td>
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<tr>
<td>Apr 9 (0:00-24:00 UTC)</td>
<td>klog14312</td>
<td>Sharan Banagiri, Shichao Wu</td>
<td>klog14066, klog14072, klog14075</td>
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<tr>
<td>Apr 10 (0:00-24:00 UTC)</td>
<td>klog14295</td>
<td>Chun-yu Lin</td>
<td>klog14094, klog14098, klog14104</td>
</tr>
<tr>
<td>Apr 11 (0:00-24:00 UTC)</td>
<td>klog14323</td>
<td>Sumeet Kulkarni, Jishnu Suresh</td>
<td>klog14106, klog14117, klog14118</td>
</tr>
<tr>
<td>Apr 12 (0:00-24:00 UTC)</td>
<td>klog14299</td>
<td>Nami Uchikata</td>
<td>klog14119, klog14129, klog14130, klog14132</td>
</tr>
<tr>
<td>Apr 13 (0:00-24:00 UTC)</td>
<td>IFO was down</td>
<td>N/A</td>
<td></td>
</tr>
<tr>
<td>Apr 14 (0:00-24:00 UTC)</td>
<td>klog14322</td>
<td>John J Oh</td>
<td>klog14151, klog14159, klog14132</td>
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<tr>
<td>Apr 15 (0:00-24:00 UTC)</td>
<td>klog14356</td>
<td>Kentaro Mogishii, Solchiro Morisaki</td>
<td>klog14180, klog14174, klog14165</td>
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<tr>
<td>Apr 16 (0:00-24:00 UTC)</td>
<td>klog14339</td>
<td>Jaewan Kim</td>
<td>klog14218, klog14210, klog14198</td>
</tr>
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<td>Apr 17 (0:00-24:00 UTC)</td>
<td>klog14306</td>
<td>Kuo-Chuan Pan</td>
<td>klog14232, klog13230, klog14222</td>
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<tr>
<td>Apr 18 (0:00-24:00 UTC)</td>
<td>klog14301</td>
<td>Tatsuya Narikawa</td>
<td>klog14239, klog14237, klog14233</td>
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<tr>
<td>Apr 19 (0:00-24:00 UTC)</td>
<td>klog14293</td>
<td>Gang Wang</td>
<td>klog14241, klog14245, klog14244</td>
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<tr>
<td>Apr 20 (0:00-24:00 UTC)</td>
<td>klog14294</td>
<td>Wenbiao Han</td>
<td>klog14256, klog14254, klog14252, klog14251</td>
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</table>

https://dac.icrr.u-tokyo.ac.jp/KAGRA/Observations/O3GK/DQshift
Update plans toward O4

- Low-latency activities
  - Reducing the cadence of Segment sharing
    - 1 day cadence (O3GK) $\Rightarrow$ ~minutes (O4)
  - Event validation mainly for Rapid Response Team (RRT)
Update plans toward O4 (Cont’d)

- Offline activities

  - Data category (at least CAT1) will be provided for each search group.

  - Data validation for offline searches will be performed.

  - During O3GK, we cannot find efficient auxiliary channels. So we need to (re-)consider to choose the aux. channel list.
O4 commissioning

- Commissioning test with IMC is now ongoing.
  - Non stationary coherence between frequency noise of IMC/PMC_PLL and sound noise.
  - Too many glitches on OpLevs for MC suspensions.

Detailed will be discussed in Hirotaka’s talk
Summary

- Online DQ flags and Offline segments were shared among LVK during O3GK observation.
- KAGRA’s science mode is available as K1-SCIENCE_MODE

- Segment production with shorter cadence will be required for the low-latency activities during O4
- Data Category information also required by GW searches using the KAGRA strain signal.
- KAGRA is in the commissioning test with a part of IFO and noise hunting is now ongoing.