The ATLAS data acquisition and trigger system is designed to reduce the LHC bunch crossing rate from 40 MHz to an output rate of a few hundred Hz to disk. The online and offline monitoring procedures ensure successful data-taking. The online monitoring infrastructure allows experts in the control room to monitor data during operation, so that they can identify and then respond to any defects in data quality or algorithm performance. After data-taking is complete, a subset of recorded events are quickly processed and select histograms are displayed in the offline monitoring framework for review by the trigger experts.

**Reprocessing / Debug Stream**

- The debug stream collects events for which a timely trigger decision is not reached
  - Quickly identify issues with trigger system:
    - misconfiguration, timeouts, errors, software crashes, missing data, network problems, etc.
    - L2 and EF are re-run with the same configuration and conditions as online, but without any time limit
    - Event analysis to diagnose trigger indecision
    - Recovered events integrated into physics data streams

- Data are reprocessed to test and validate changes in:
  - Trigger menu
  - Software: thresholds, bug fixes, new algorithms, etc.
  - Conditions: alignment, calibration, etc.
- Data collected in the enhanced bias stream, in which only Level 1 trigger decisions are active, so that new L2 and EF configurations may be tested. Signal data (such as $Z \rightarrow ee$ skims) are used to validate the effect of changes on signal efficiencies.
- Trigger experts review monitoring and reconstruction output and sign off before deployment online

**Data Quality Monitoring Framework (DQMF)**

- Set of trigger-relevant histograms (data overlaid with reference) displayed with web-based monitoring tool for each physics stream
  - Trigger efficiencies, kinematic distributions (transverse energy/momentum, eta-phi maps, invariant mass)
- Configurable algorithms may be used to automatically flag problematic histograms
  - Follow up on suspect histograms
  - If inconsistent data is the result of the trigger, a trigger-specific defect is applied to the affected luminosity blocks for given run
  - Defects may be taken into consideration by analysis groups

**What?**

- The express stream, a subset of recorded data, is reconstructed immediately after running for data quality assessment

**Who?**

- Trigger experts: monitor data quality for each physics stream
  - Offline trigger shifter: monitors trigger rates, the debug stream, and overall trigger data quality
  - Daily meetings and discussion threads to assess data quality issues and sign off on runs

**How?**

- xml configuration is checked in test system, and then installed in the control room
- Updates are checked in to the online configuration database
- Perform automatic checks for selected histograms (compare to "reference histograms" from previous good runs)
- Histograms are flagged for quick identification of problems:
  - Red/Yellow/Green: Bad/Warning/Good
  - Undefined (during Standby)
- Example Algorithms:
  - Histogram Not Empty
  - Kolmogorov test (compare to reference)
- Data are viewed in an application in the control room or online

**Online Monitoring**

- Highly configurable: displays only the histograms to which it is subscribed
- Thousands of histograms are available
- Histograms can be viewed in an application in the control room or online

**Offline Monitoring**

- Real-time feedback to trigger experts and shift leader
- Data quality problems are found and dealt with quickly

- Set of trigger-relevant histograms (data overlaid with reference) displayed with web-based monitoring tool for each physics stream
  - Trigger efficiencies, kinematic distributions (transverse energy/momentum, eta-phi maps, invariant mass)
- Configurable algorithms may be used to automatically flag problematic histograms
  - Follow up on suspect histograms
  - If inconsistent data is the result of the trigger, a trigger-specific defect is applied to the affected luminosity blocks for given run
  - Defects may be taken into consideration by analysis groups

**Data Quality Monitoring Display (DQMD)**

- Performs automatic checks for selected histograms (compare to "reference histograms" from previous good runs)
- Histograms are flagged for quick identification of problems:
  - Red/Yellow/Green: Bad/Warning/Good
  - Undefined (during Standby)
- Example Algorithms:
  - Histogram Not Empty
  - Kolmogorov test (compare to reference)