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# Advanced Virgo DQ Model

Virgo detchar group

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**[Virgo note VIR-0261A-15](#)**

→ Target = search groups



## Rule #1: Keep it simple

Searches only need 2 inputs:

1/ when to run: **“Valid time segments”**

2/ what to discard: **“Veto”**

## Rule #2: Optimize

Limit the use of generic DQ input

→ be search-specific: **one search = one set of vetoes**

## State flags = DQ flags monitoring the Virgo experiment

- high-level detector status (science, locked...)
- sub-system status (Detector Monitoring System)
- environment (Band-limited RMS)
- processes (h(t) reconstruction, frame generation/transfer...)
- hardware injections

## How are they used?

1/ For detector noise investigations

2/ To define valid time segments for analyses

3/ To define a veto recipe (not recommended)

*Old-fashioned language: valid segments = (science – CAT1 flags – injections)*

## Input for online analyses

- A relevant selection of state flags is provided in a 16-bit state vector (@1Hz)
- An appropriate bit mask is to be applied by online searches to define valid time segments

## Input for offline analyses (transient & continuous)

- All the state flags will be uploaded in DQSEGDB
- A relevant selection of state flags is to be downloaded from DQSEGDB and combined to define valid time segments

## A veto is defined by 3 ingredients

1/ **a veto recipe**: set of conditions (solely based on aux. data). The veto is **ON** if all conditions are met, **OFF** otherwise

2/ **a veto procedure**: when a veto is ON, a search trigger is rejected if a set of conditions using the trigger parameters is checked

3/ **a veto validity period**: a veto recipe/procedure is only valid for a limited time.

In general, a veto is no longer a pre-defined list of time segments. It should be seen as another rejection cut in an analysis pipeline (no associated dead-time!)

**Veto procedure** → mainly search group's responsibility

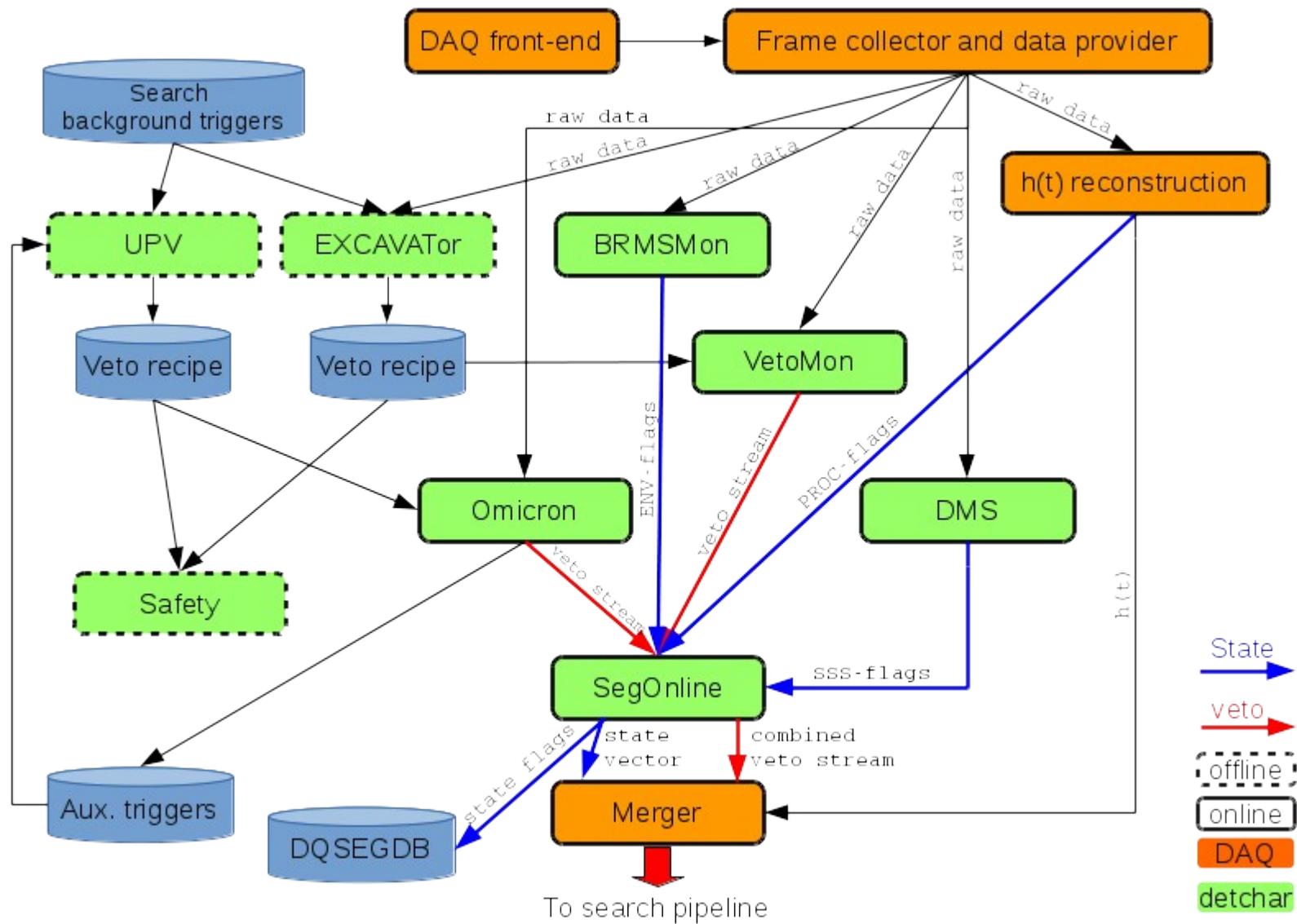
**Veto recipe** → “cooked” for every search

Statistic tools (UPV+EXCAVATor) over the search background triggers

**Veto safety to be checked systematically!**

## Online searches: *“we provide the best we can”*

- one veto stream/pipeline (V1:MBTA\_VETO, V1:CWB\_VETO...) sampled @100Hz taking 3 values: 1 = the veto is ON, 0 = the veto is OFF, -1 = UNKNOWN
- the veto recipes are tuned offline using the most recent search triggers over the last 2 or 3 days.
- the veto recipes are applied to online raw data and triggers (omicron) → veto streams
- all the veto streams are combined into one: V1:[PIPELINE]\_VETO



## **Offline searches:** *“vetoes must be optimal”*

- develop search-specific veto procedures
- tune and apply the veto recipe on the same data set.
- tailor ad-hoc vetoes based on the experience of the run
- define veto validity periods based on the noise stationarity
- tune the vetoes for every LIGO-Virgo searches. Search group's involvement is mandatory

- Topic still in discussion in the Virgo detchar group
- Lines are tracked by NoEMi and stored in a database (LineDB)
- Lines are identified individually
- Search pipelines must query LineDB to discard false candidates