# Event Analysis Tool

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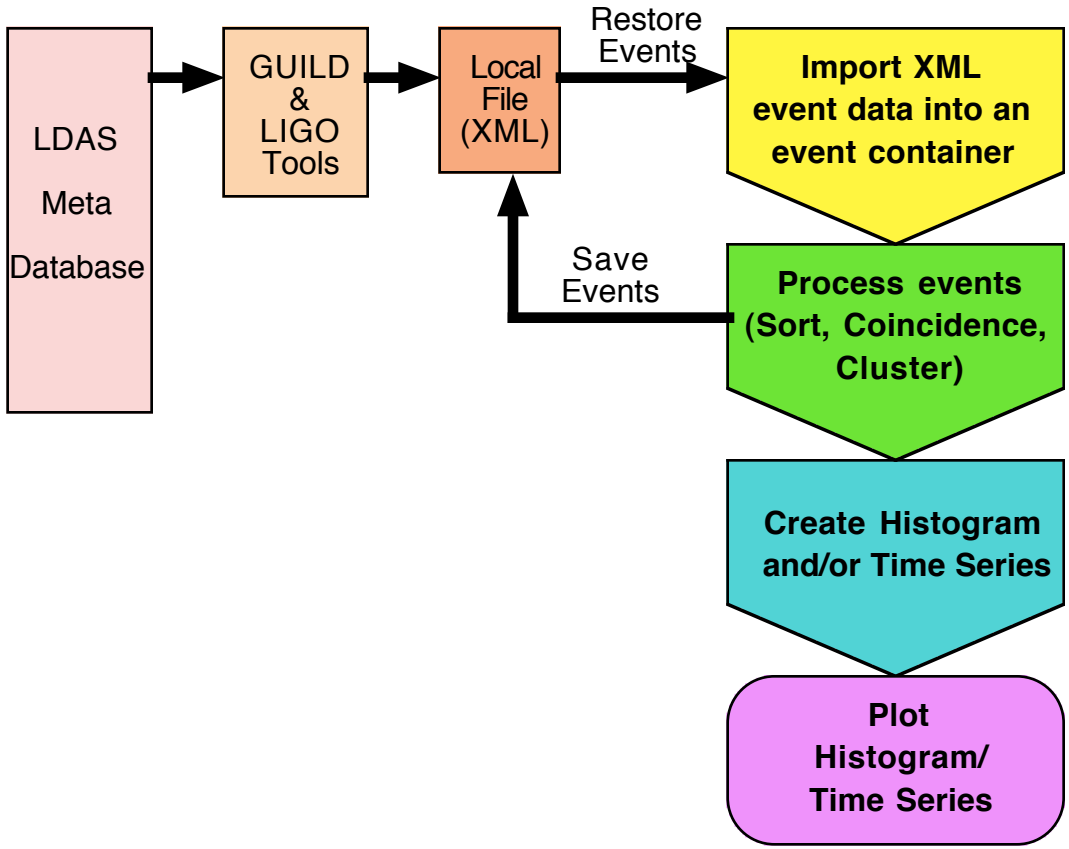
# Purpose

- Provide various analysis algorithms and make the analysis easier.

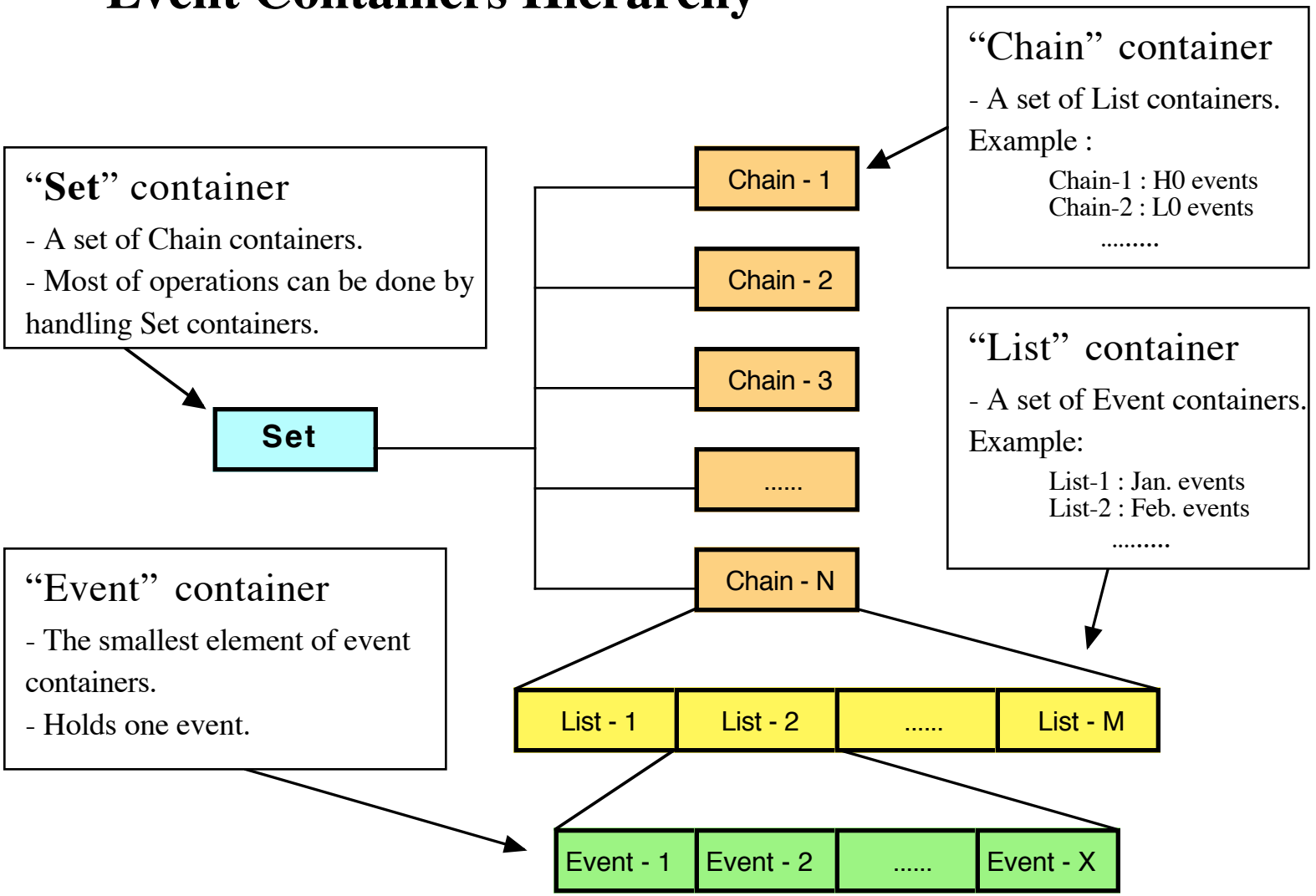
# Overview

- C++ Package.
  - A part of the gds tree.
  - `gds/Triggers/events`
- Run under ROOT.
  - ROOT command line environment.
  - Stand alone executable.
- Flexible column layouts.
  - Each event contains layout information.
- Import event data from LIGO database.
  - Import/Export XML event tables.
- Do analysis in a single line of code.
  - Select, Sort, Coincidence and Cluster.
  - Plot histogram and time series.

# Flow Chart


LDAS
Meta
Database
GUILD
&
LIGO
Tools
Local
File
(XML)
Restore
Events
Import XML
event data into an
event container
Save
Events
Process events
(Sort, Coincidence,
Cluster)
Create Histogram
and/or Time Series
Plot
Histogram/
Time Series

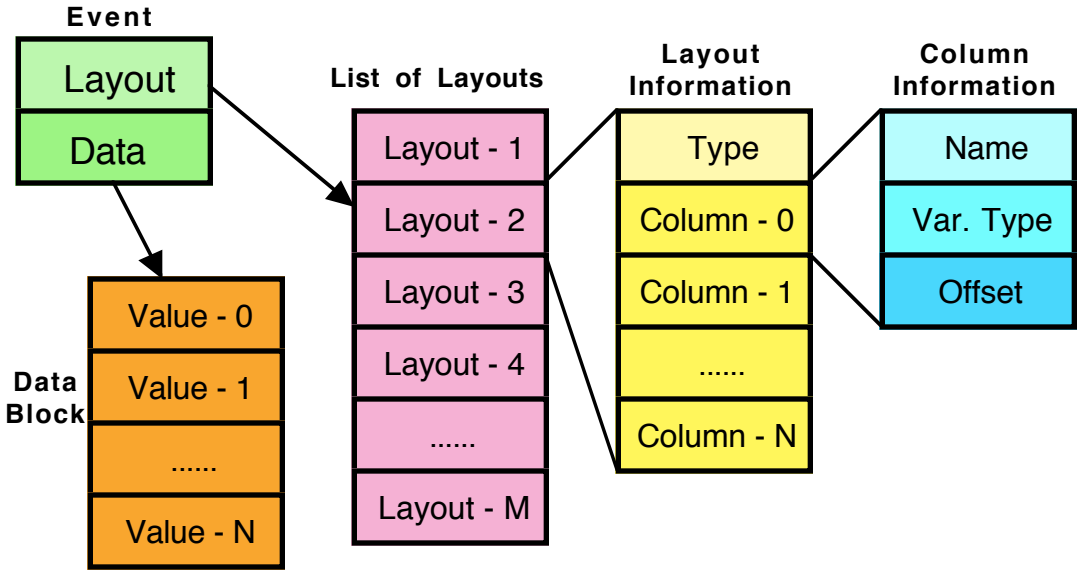
# Event Containers Hierarchy



# Event

- Column layout information.
  - Type.
  - Fixed columns (Time , Name and IFO).
  - Variable columns.
  - Can be extended.

- Column data.
  - Int, Real, Complex, Time, String and Event.



# Restore & Save Events

- XML Files

  - Support read/write LIGO-LW format.

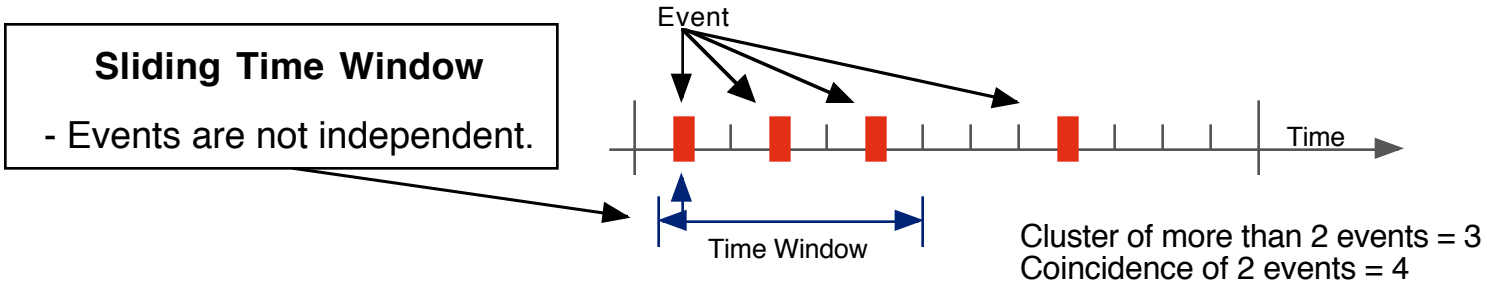
  - Built in layout types(see T990101) : *GDS_Trigger, Sngl_Inspiral, Sngl_Burst, Sngl_Ringdown, Sngl_Unmodeled and Sngl_DPeriodic*.

- ASCII Files

  - Support only importing GDS Trigger format generated by GUILD.

# Processing Events

- Select
  - Select events by specifying conditions.
- Sort
  - Sort events by a column or given function of columns.
- Coincidence
  - Find coincident events which fulfill conditions.
  - Capable of 2 to N multi-coincidences.
- Cluster
  - Find cluster events which satisfy certain conditions, time window and threshold.



# Make Histogram & Time Series

- 1-D and 2-D Histogram

  - Fill a DMT histogram container with a specified column or value of an event function.

  - Plot histogram with DMT graphics or ROOT graphics libraries.

- Time Series

  - Make a Time Series (DMT TSeries container) of the event rate, values of specified column or event function.

  - Plot time series with DMT graphics libraries.

# Example 1

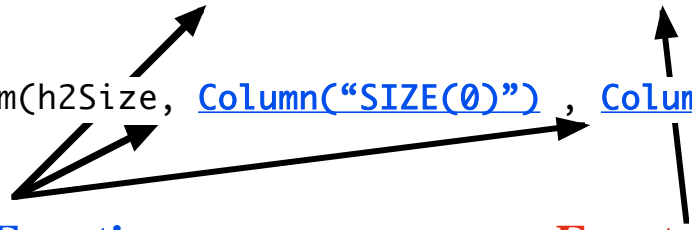
```
using namespace events;

Set eventset(“pemLVEA.xml”); // Import events from pemLVEA.xml.

TSeries tRate; // Make a time series container.
tRate.setName(“Event Rate”); // Give it a name.
eventset.TimeSeries(tRate, true); // Generate time series
                                  // of event rate.
Plot(tRate); // Plot time series.


Histogram1 hSize(“SIZE”, 30, 5.0, 20.0, “Size”, “# of Events”);
                                        // Make a histogram container.
eventset.Histogram(hSize, Column(“SIZE”), Column(“DURATION”) < 5.0);
                                        // Fill hSize.
PlotHistogram(hSize); // Plot histogram.
```

# Example 2

```
eventset.AddChain(“pemEX.xml”); // Import another set of events
                                // from pemEX.xml.
eventset.Sort(); // Sort events in chronological order.


eventset.Coincidence(TimeWindow(20.0, -10.0));
                // Find coincidence events and store the result.


Histogram2 h2Size(“Size”, 20, 0.0, 20.0, 20, 0.0, 20.0
                “Size-1”, “Size-2”);
eventset.Histogram(hDiff, Column(“SIZE(0)”), Column(“SIZE(1)”));

PlotRootHistogram(h2Size, “col”);
```

# Event Function & Condition

```
eventset.Histogram(hSize, Column("SIZE") , Column("DURATION") < 5.0 );

eventset.Histogram(h2Size, Column("SIZE(0)") , Column("SIZE(1)") );
```



## Event Function

- **Value** : Represents a constant value.
- **Column** : An access to column value of an event.
- **Info** : An access to layout information of an event.
- **Math Operation** : + , * ,& , << , sqrt , sin , conj and more.

## Event Condition

- **Operators** : ! , && , || , == , != , < , <= , > , >= , WithIn.
- **Filter** : An event filter by Type and Name information.
- **Veto/Coincidence** : Check for nearby events.
- **IFO Set** : Select events by IFO.
- **Cluster** : Count nearby events.

# Conclusion

- It's available. Use it.
- Add String operations.
  - Support regular expression.
- User feedback.
- Bug fixes.
- Support for time segments.
- Event look up through Lidax.
- Event classification by DMT Trigger environment.