Temporal Event Analytics with EventFlow: A Case Study of the Response to Fatal Incidents

Baltimore Region, 2014 – 2016

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8th International Visualization in Transportation Symposium
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Overview

- What is Eventflow?

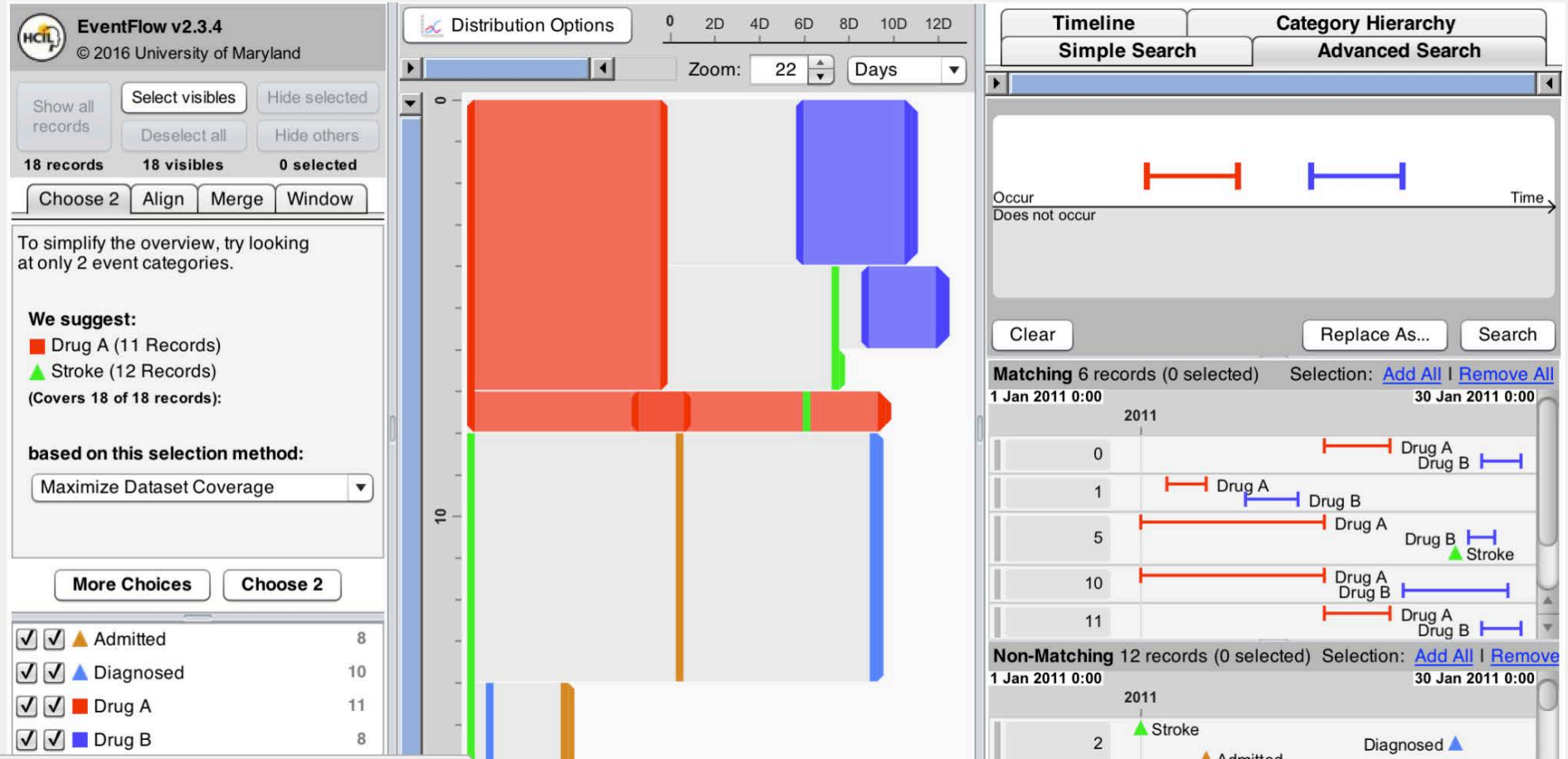
- Case study using state fatal crash data for Baltimore region from 2014 to 2016:
  What can we learn from the visualizations?

- Observations

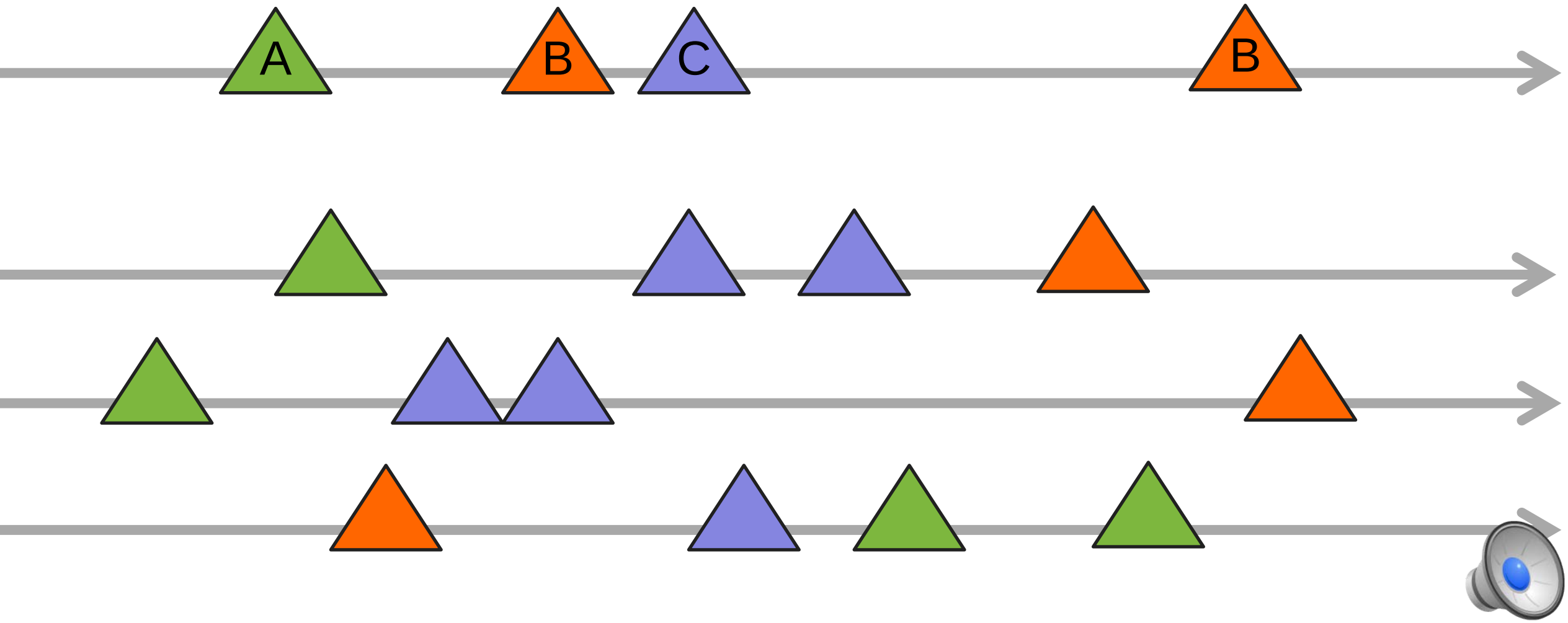
What is Eventflow?

EventFlow: Visual Analysis of Temporal Event Sequences

JUMP TO: FEATURES | PARTICIPANTS | PRESENTATIONS | VIDEOS | DOWNLOAD & LICENSING | USER SUPPORT | PUBLICATIONS | PRESS | RELATED PROJECTS



Event Analytics



Many application domains

Electronic Health Records: symptoms, treatment, lab test

Student records: course, paper, proposal, defense, etc.

Web logs, usability logs, security etc.

Traffic incident logs: confirmed, unit arrived, lane closed etc

Visualize a single accident

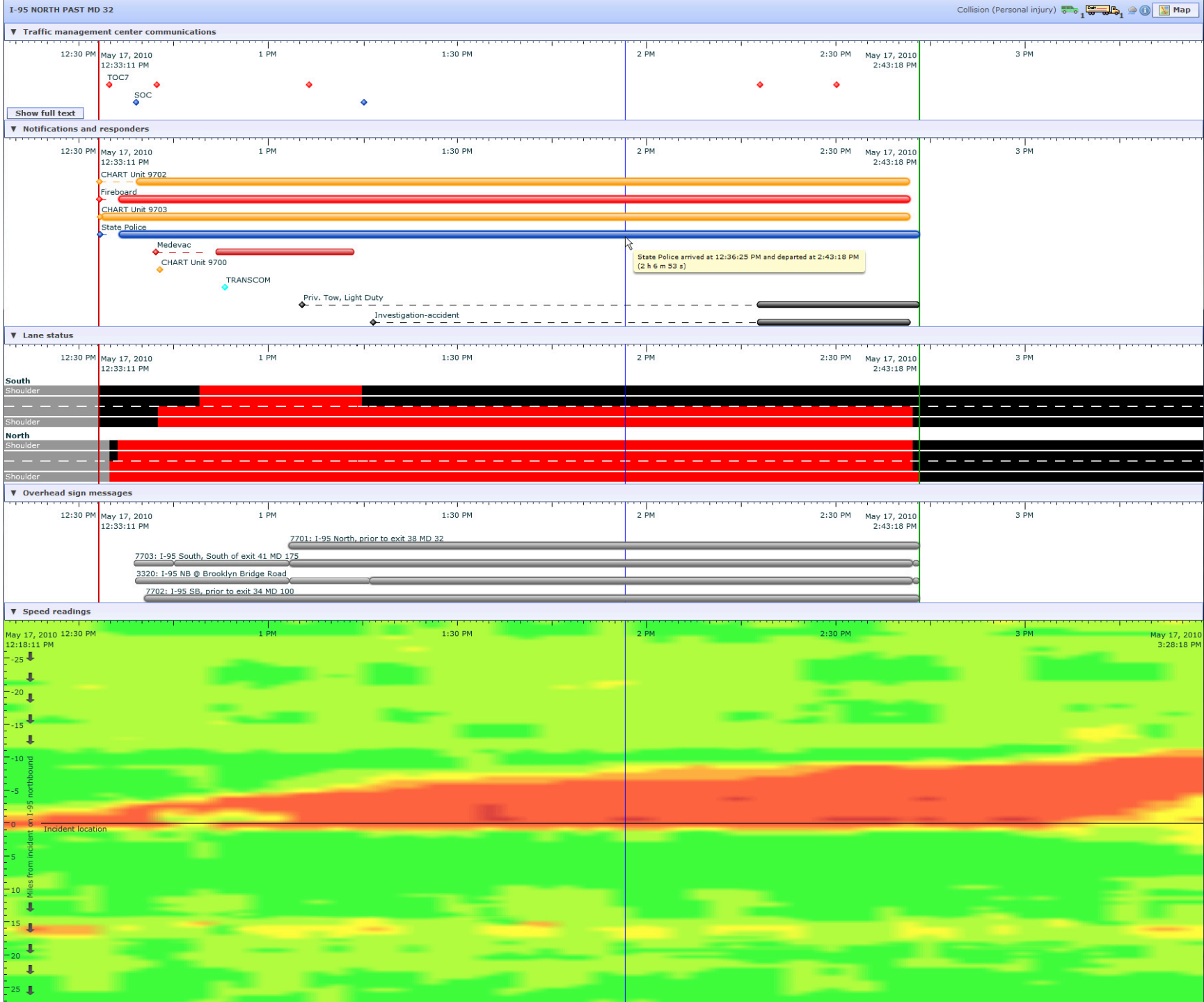
Communications

Notifications and responders

Lane status

Overhead message signs

Speed readings

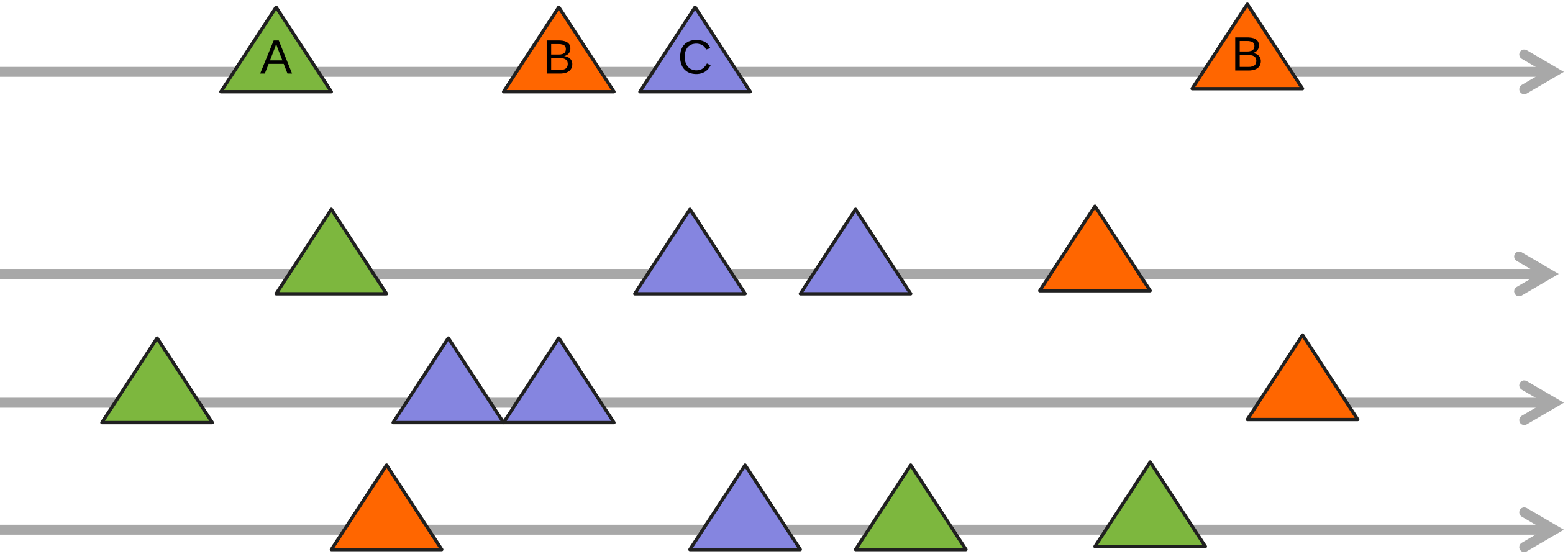


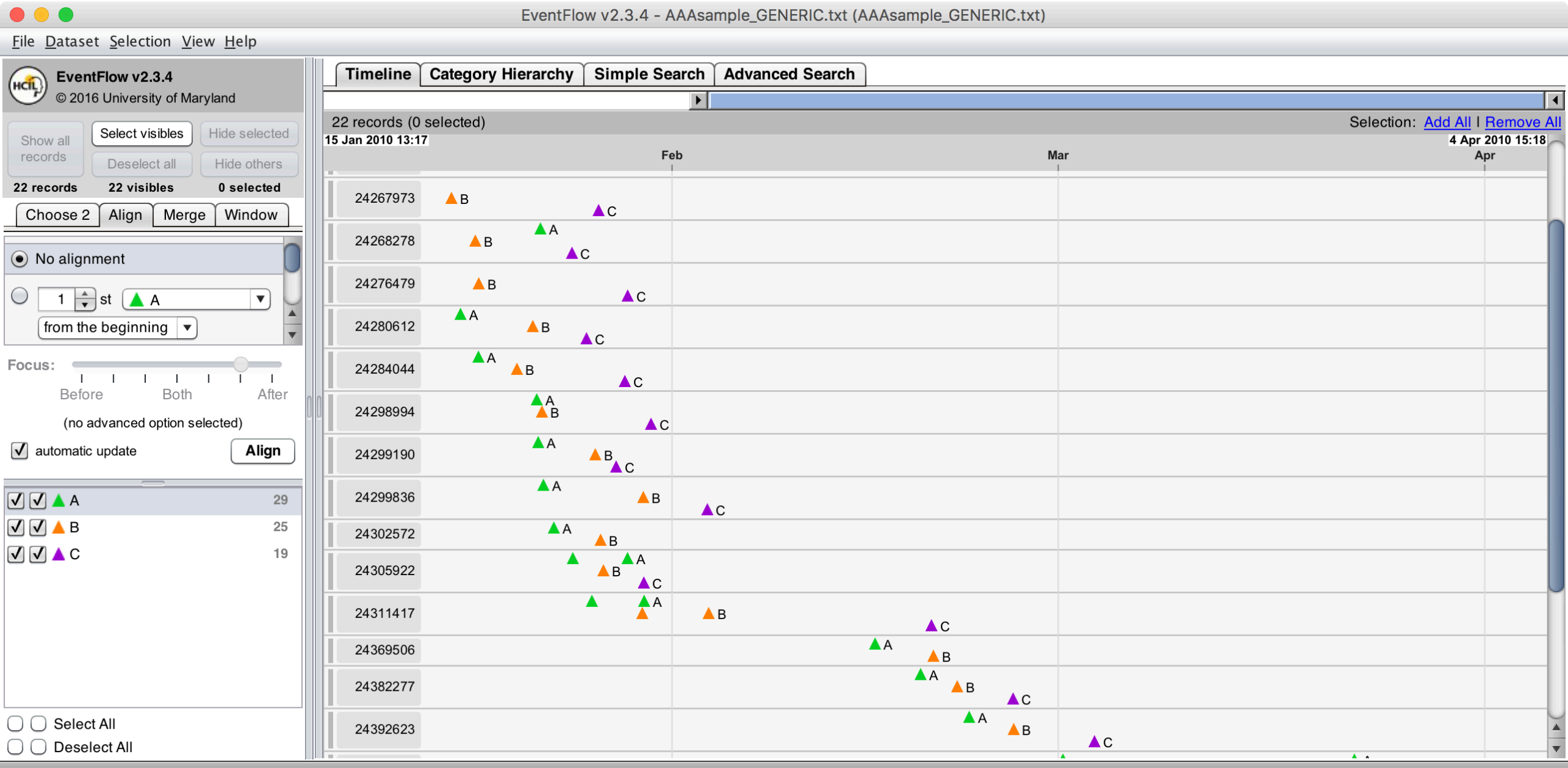
http://www.cattlab.umd.edu/?portfolio=timeline

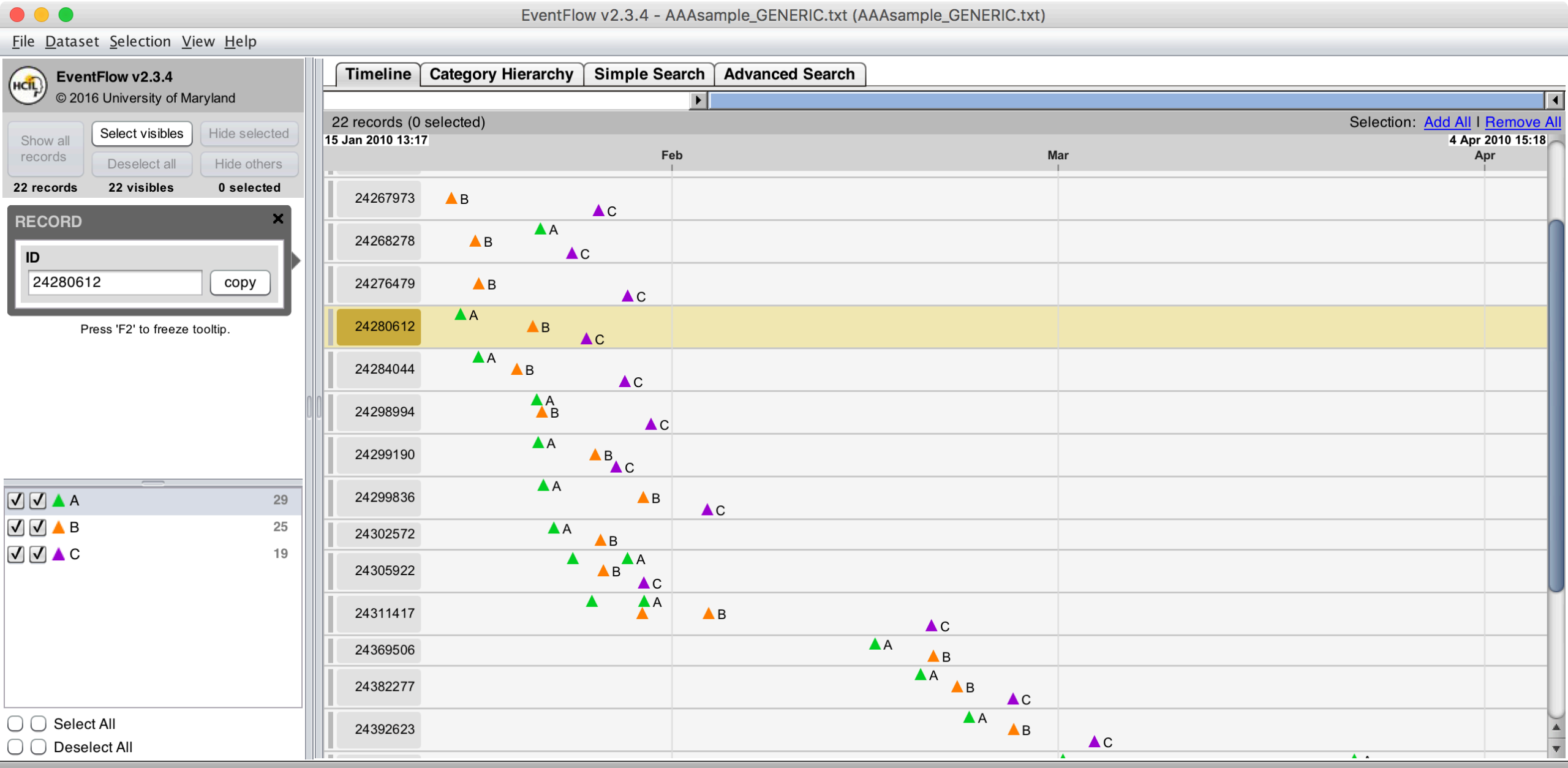

I-95 NORTH PAST MD 32
Traffic management center communications
12:30 PM
May 17, 2010
12:33:11 PM
1 PM
1:30 PM
2 PM
2:30 PM
May 17, 2010
2:43:18 PM
TOC7
SOC
Show full text
Notifications and responders
CHART Unit 9702
Fireboard
CHART Unit 9703
State Police
Medevac
CHART Unit 9700
TRANSCOM
Priv. Tow, Light Duty
Investigation-accident
State Police arrived at 12:36:25 PM and departed at 2:43:18 PM
(2 h 6 m 53 s)
Lane status
South
Shoulder
Shoulder
North
Shoulder
Shoulder
Overhead sign messages
7701: I-95 North, prior to exit 38 MD 32

How to analyze
temporal patterns
in a **set of incidents**
?

Event Analytics




EventFlow v2.3.4 - AAAsample_GENERIC.txt (AAAsample_GENERIC.txt)
File Dataset Selection View Help
EventFlow v2.3.4
© 2016 University of Maryland
Show all records
Select visibles
Hide selected
Deselect all
Hide others
22 records
22 visibles
0 selected
Choose 2
Align
Merge
Window
No alignment
1 st A
from the beginning
Focus:
Before
Both
After
(no advanced option selected)
automatic update
Align
A 29
B 25
C 19
Select All
Deselect All
Timeline
Category Hierarchy
Simple Search
Advanced Search
22 records (0 selected)
Selection: Add All | Remove All
15 Jan 2010 13:17
4 Apr 2010 15:18
Feb
Mar
Apr
24267973
24268278
24276479
24280612
24284044
24298994
24299190
24299836
24302572
24305922
24311417
24369506
24382277
24392623


EventFlow v2.3.4 - AAAsample_GENERIC.txt (AAAsample_GENERIC.txt)
File Dataset Selection View Help
EventFlow v2.3.4
© 2016 University of Maryland
Show all records
Select visibles
Hide selected
Deselect all
Hide others
22 records
22 visibles
0 selected
RECORD
ID
24280612
copy
Press 'F2' to freeze tooltip.
A 29
B 25
C 19
Select All
Deselect All
Timeline
Category Hierarchy
Simple Search
Advanced Search
22 records (0 selected)
Selection: Add All | Remove All
15 Jan 2010 13:17
4 Apr 2010 15:18
Feb
Mar
Apr
24267973
24268278
24276479
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24311417
24369506
24382277
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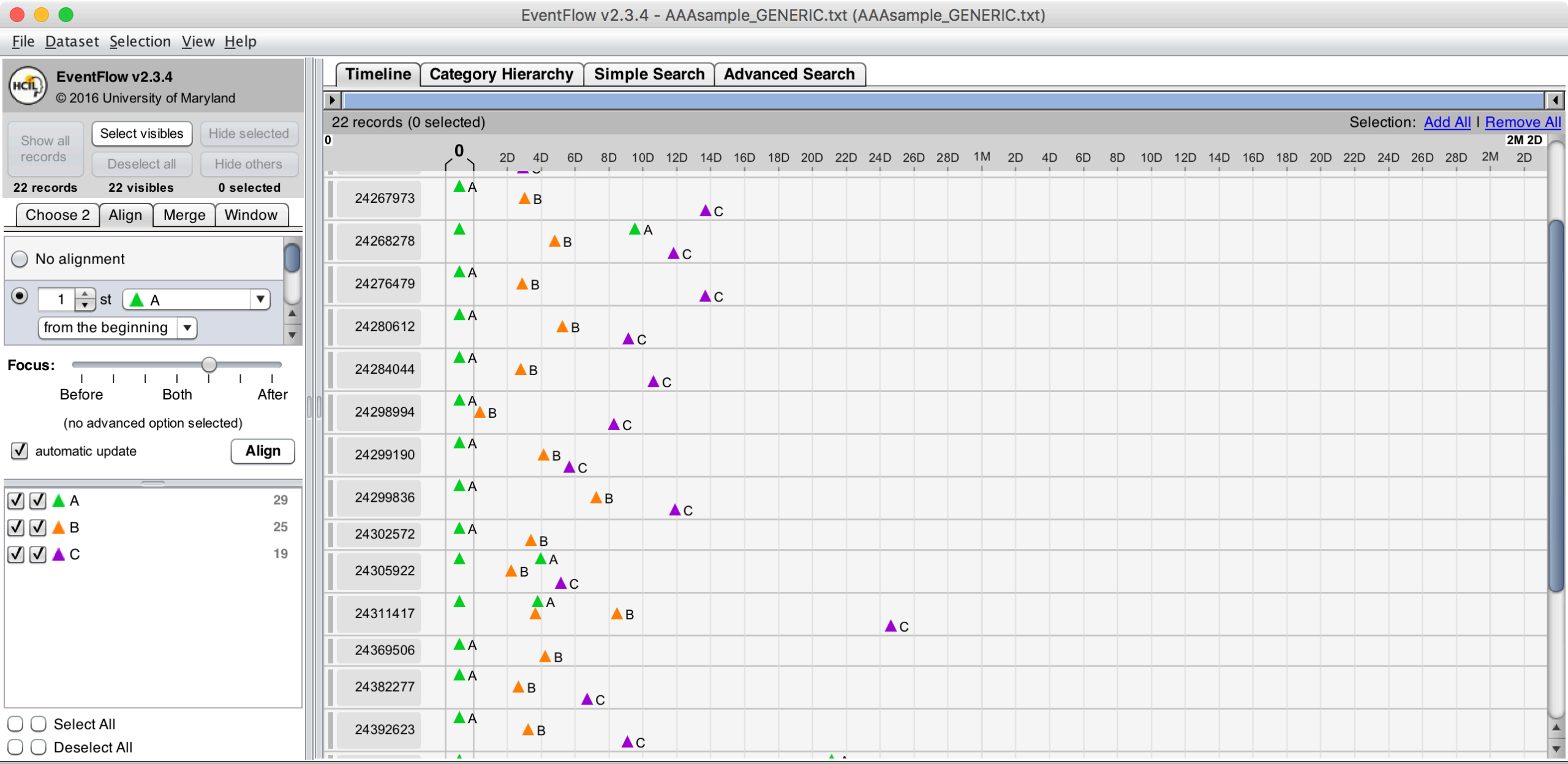
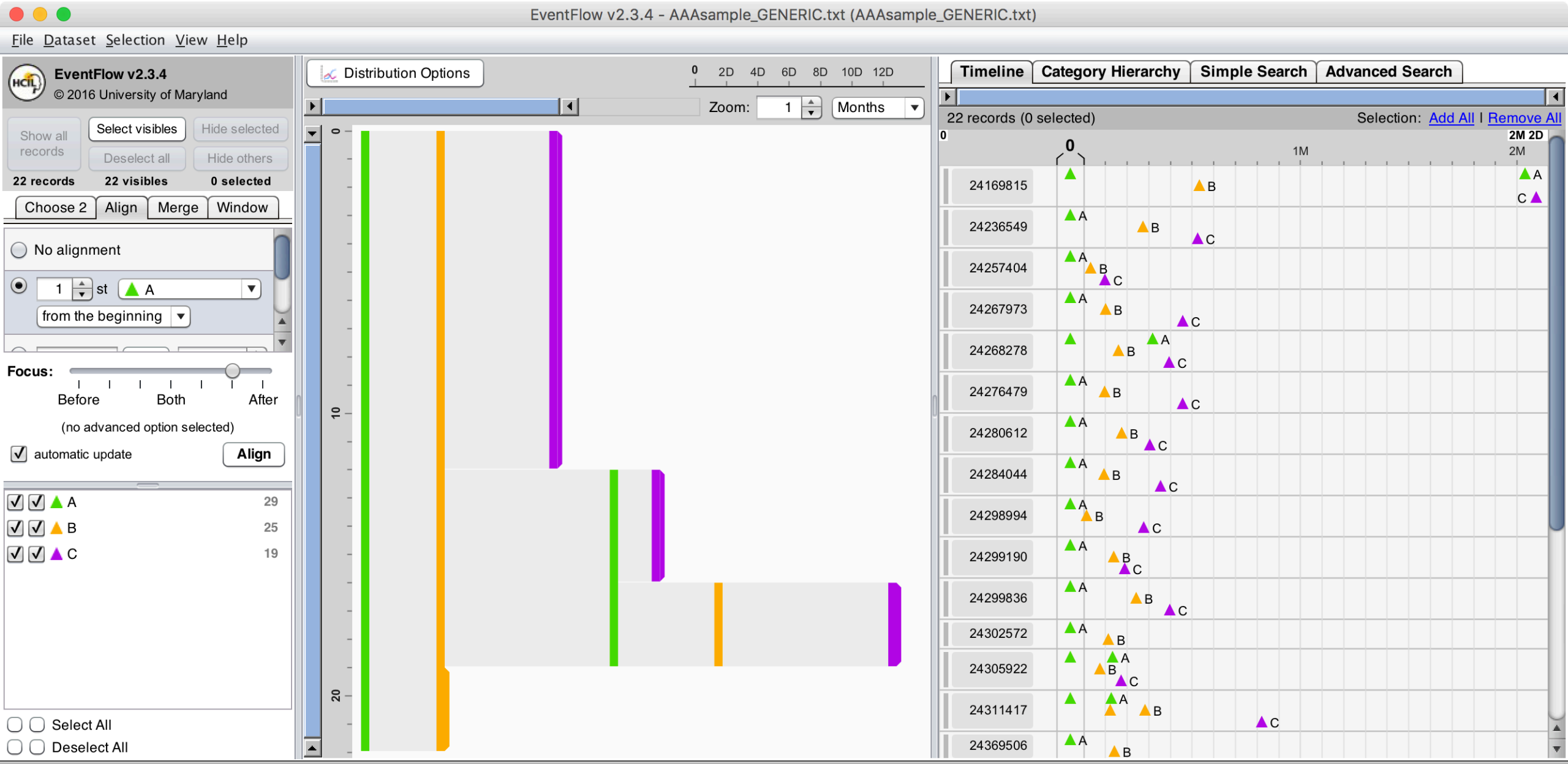
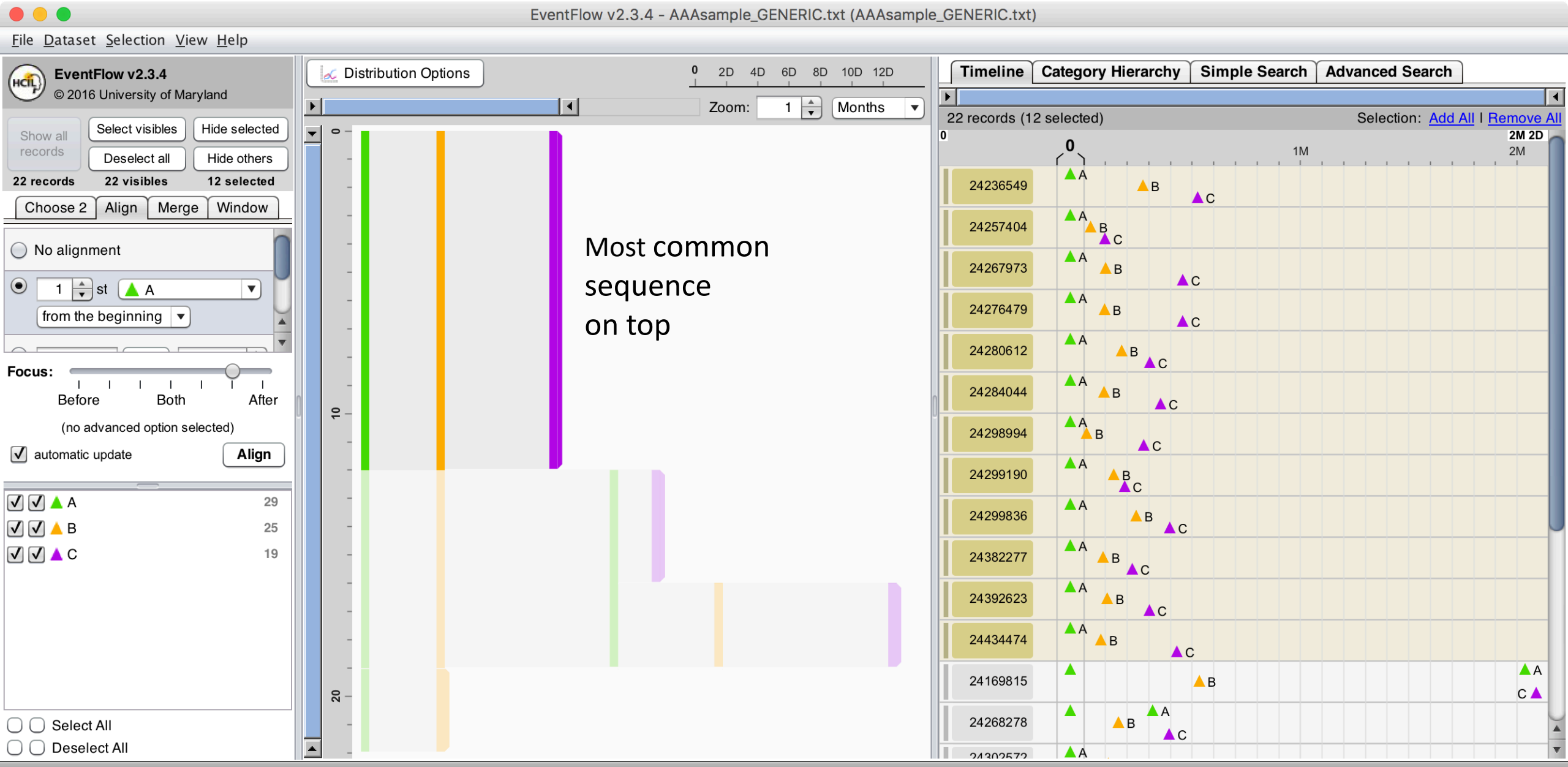


All records aligned event A



overview of all sequences


EventFlow v2.3.4 - AAAsample_GENERIC.txt (AAAsample_GENERIC.txt)
File Dataset Selection View Help
EventFlow v2.3.4
© 2016 University of Maryland
Show all records
Select visibles
Hide selected
Deselect all
Hide others
22 records
22 visibles
12 selected
Choose 2
Align
Merge
Window
No alignment
1 st A
from the beginning
Focus:
Before
Both
After
(no advanced option selected)
automatic update
Align
A 29
B 25
C 19
Select All
Deselect All
Distribution Options
0 2D 4D 6D 8D 10D 12D
Zoom: 1 Months
Most common sequence on top
Timeline
Category Hierarchy
Simple Search
Advanced Search
22 records (12 selected)
Selection: Add All | Remove All
0 1M 2M
2M 2D
24236549
24257404
24267973
24276479
24280612
24284044
24298994
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24299836
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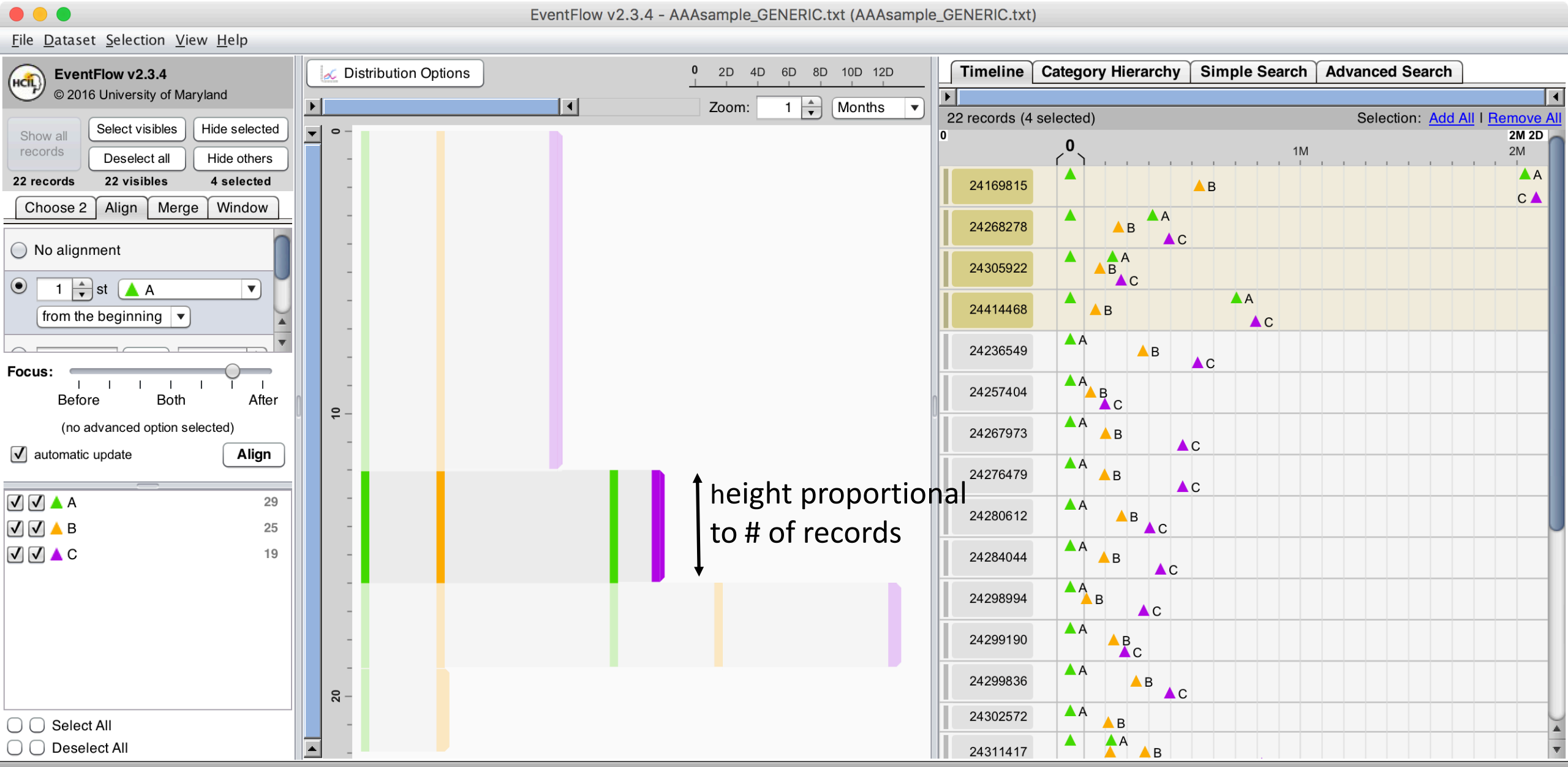
24268278


EventFlow v2.3.4 - AAAsample_GENERIC.txt (AAAsample_GENERIC.txt)
File Dataset Selection View Help
EventFlow v2.3.4
© 2016 University of Maryland
Show all records
Select visibles
Hide selected
Deselect all
Hide others
22 records
22 visibles
4 selected
Choose 2
Align
Merge
Window
No alignment
1 st A
from the beginning
Focus:
Before
Both
After
(no advanced option selected)
automatic update
Align
A 29
B 25
C 19
Select All
Deselect All
Distribution Options
0 2D 4D 6D 8D 10D 12D
Zoom: 1 Months
height proportional to # of records
Timeline
Category Hierarchy
Simple Search
Advanced Search
22 records (4 selected)
Selection: Add All | Remove All
0 1M 2M
2M 2D
24169815
24268278
24305922
24414468
24236549
24257404
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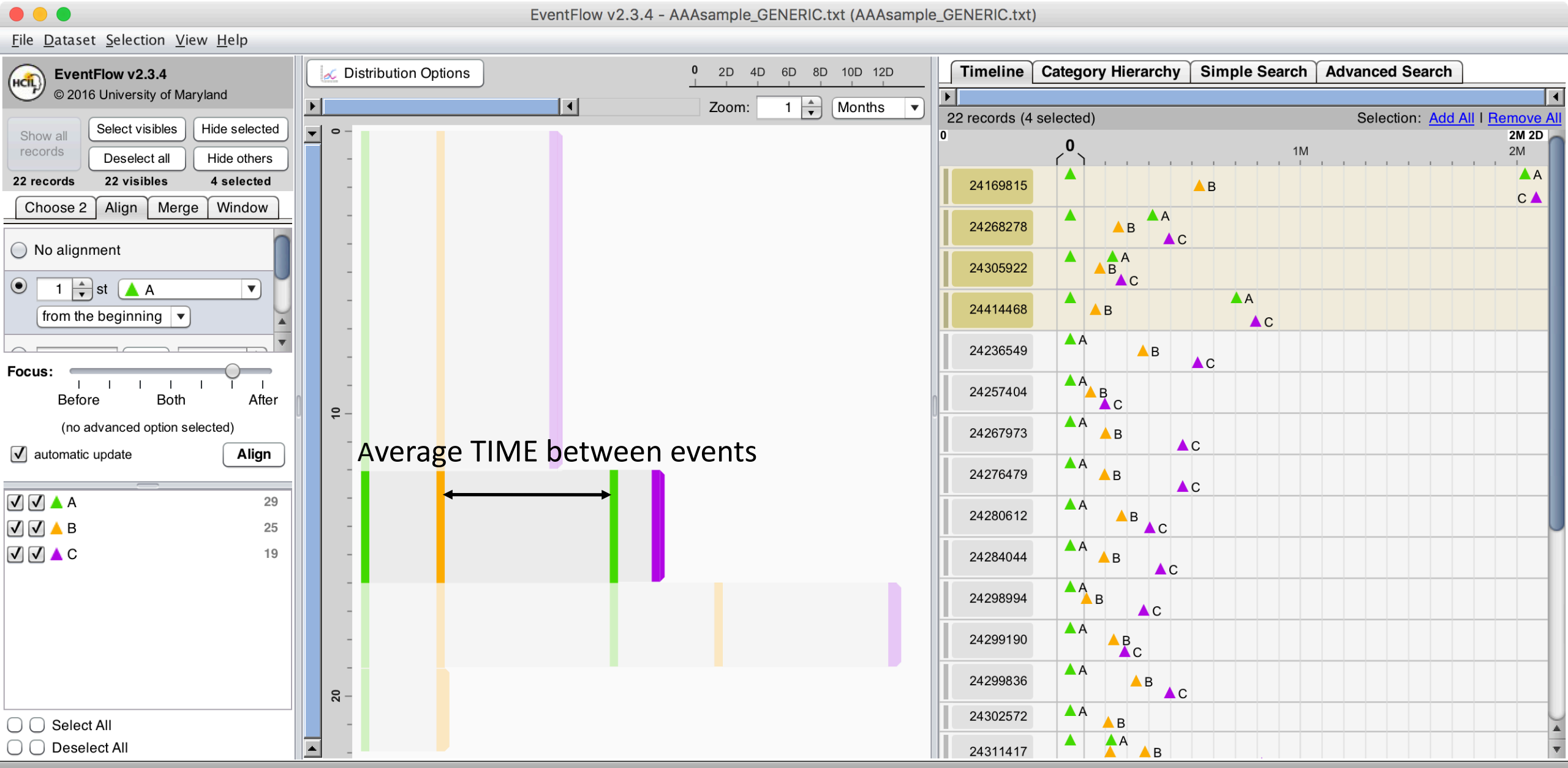
24298994
24299190
24299836
24302572
24311417


EventFlow v2.3.4 - AAAsample_GENERIC.txt (AAAsample_GENERIC.txt)
File Dataset Selection View Help
EventFlow v2.3.4
© 2016 University of Maryland
Show all records
Select visibles
Hide selected
Deselect all
Hide others
22 records
22 visibles
4 selected
Choose 2
Align
Merge
Window
No alignment
1 st A
from the beginning
Focus:
Before
Both
After
(no advanced option selected)
automatic update
Align
A 29
B 25
C 19
Select All
Deselect All
Distribution Options
0 2D 4D 6D 8D 10D 12D
Zoom: 1 Months
Average TIME between events
Timeline
Category Hierarchy
Simple Search
Advanced Search
22 records (4 selected)
Selection: Add All | Remove All
0 1M 2M
2M 2D
24169815
24268278
24305922
24414468
24236549
24257404
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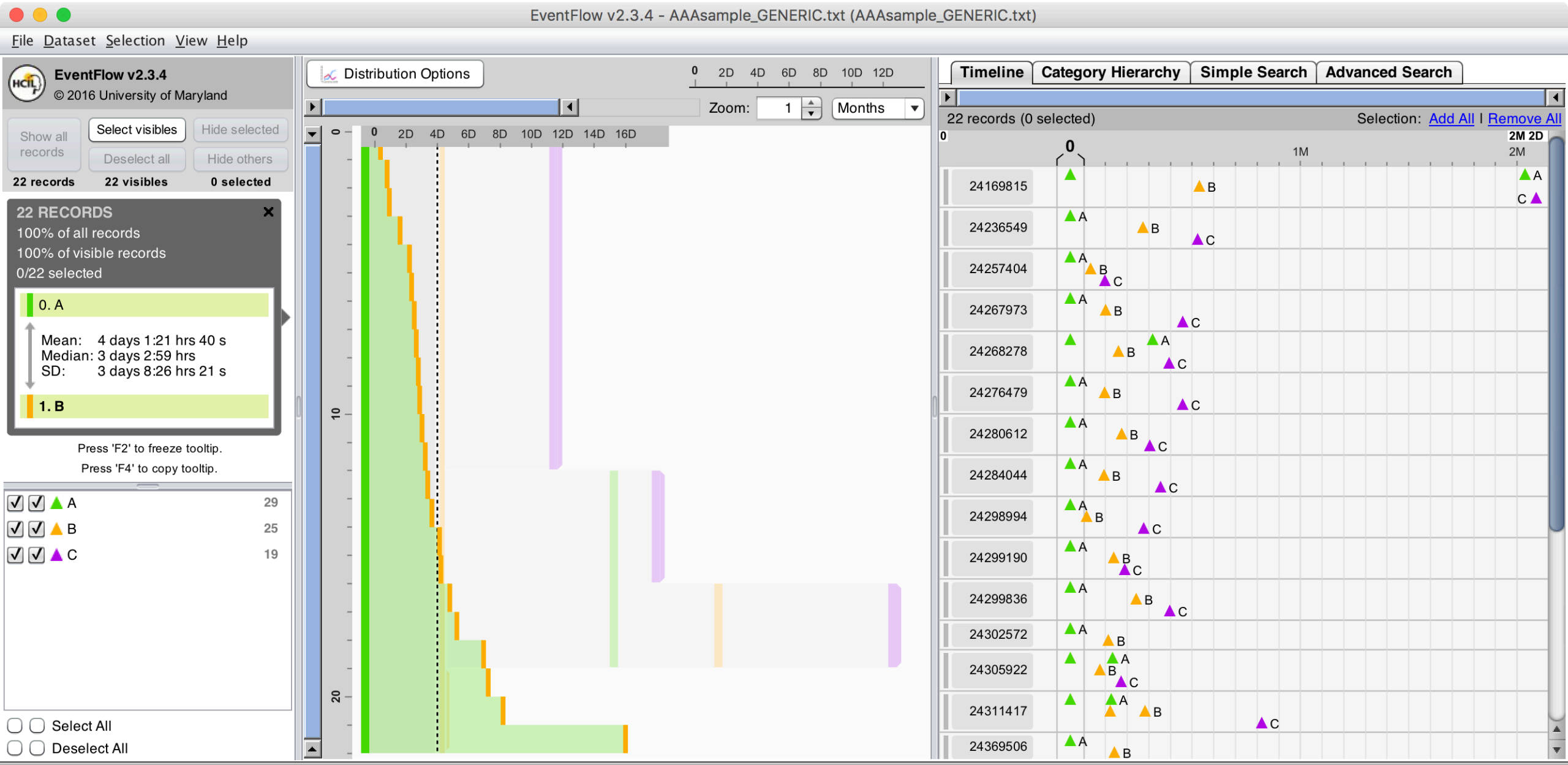
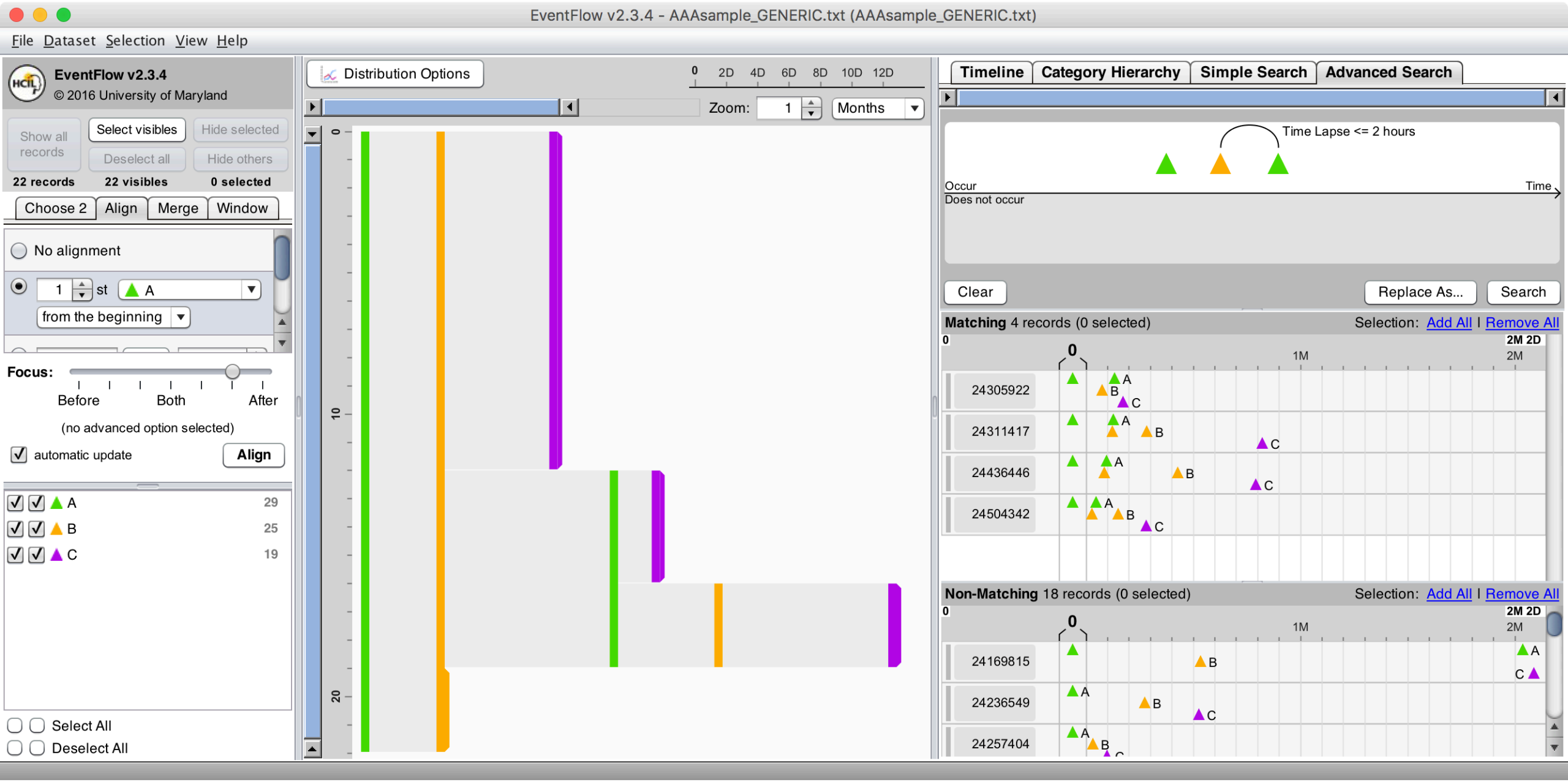
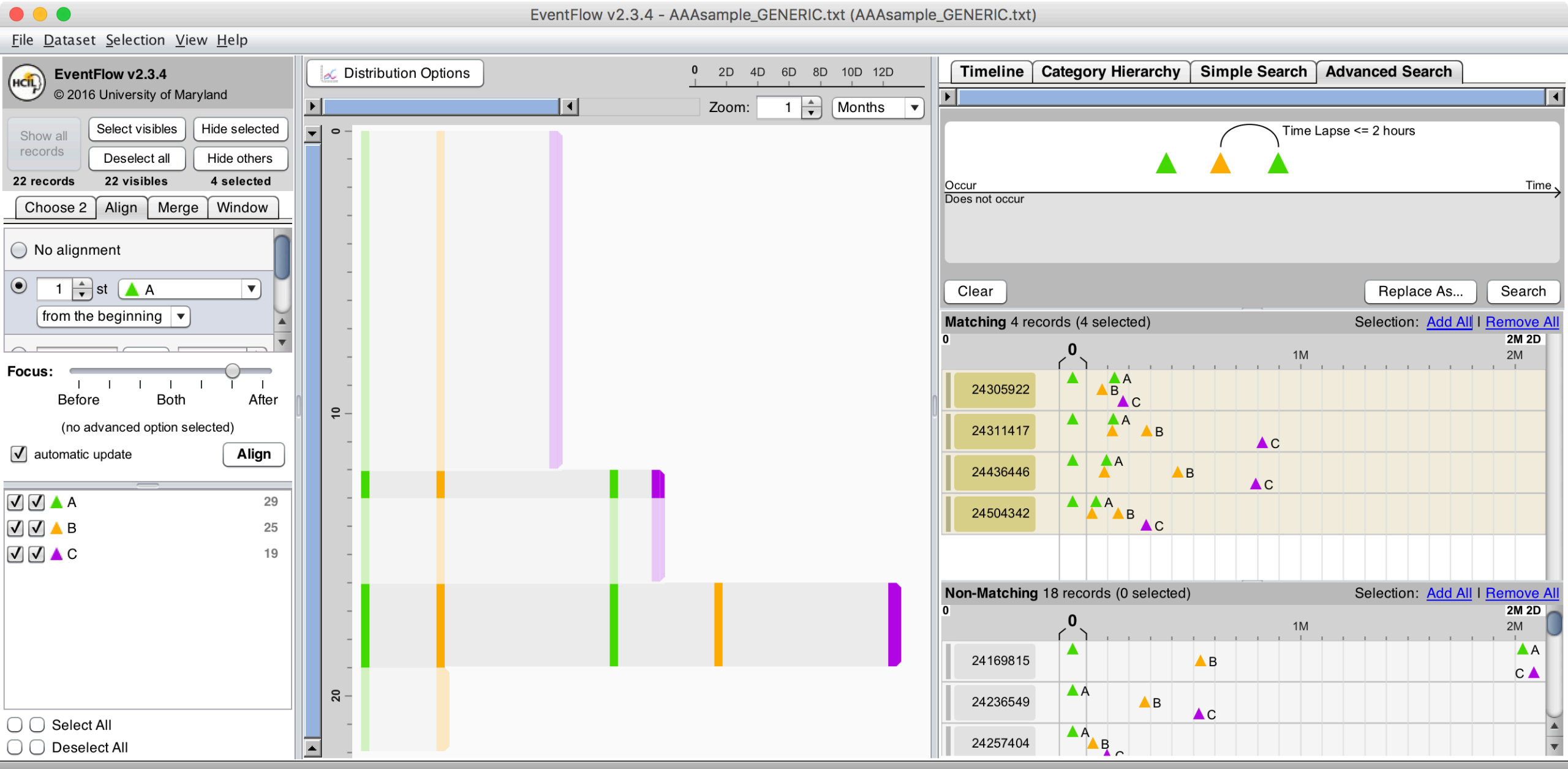
24298994
24299190
24299836
24302572
24311417



Show distribution of time between events

Graphical search with temporal constraint

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EventFlow v2.3.4
© 2016 University of Maryland
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Deselect all
Hide others
22 records
22 visibles
4 selected
Choose 2
Align
Merge
Window
No alignment
1 st A
from the beginning
Focus:
Before
Both
After
(no advanced option selected)
automatic update
Align
A 29
B 25
C 19
Select All
Deselect All
Distribution Options
0 2D 4D 6D 8D 10D 12D
Zoom: 1 Months
0
10
20
Timeline
Category Hierarchy
Simple Search
Advanced Search
Time Lapse <= 2 hours
Occur
Does not occur
Time
Clear
Replace As...
Search
Matching 4 records (4 selected)
Selection: Add All | Remove All
2M 2D
1M
2M
24305922
24311417
24436446
24504342
Non-Matching 18 records (0 selected)
Selection: Add All | Remove All
24169815
24236549
24257404

hcil.umd.edu/eventflow/

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EventFlow: Visual Analysis of Temporal Event Sequences

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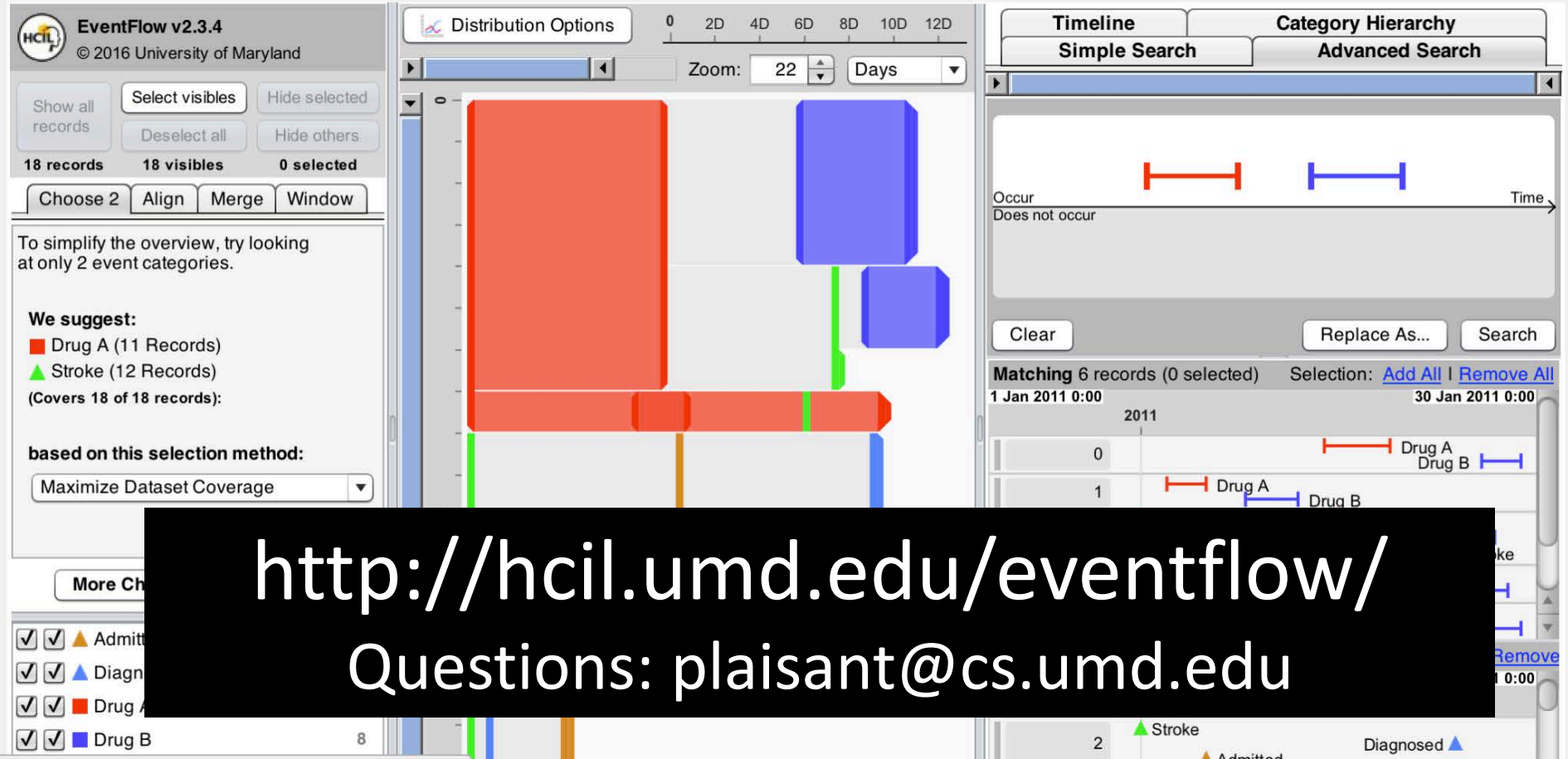


http://hcil.umd.edu/eventflow/

Questions: plaisant@cs.umd.edu

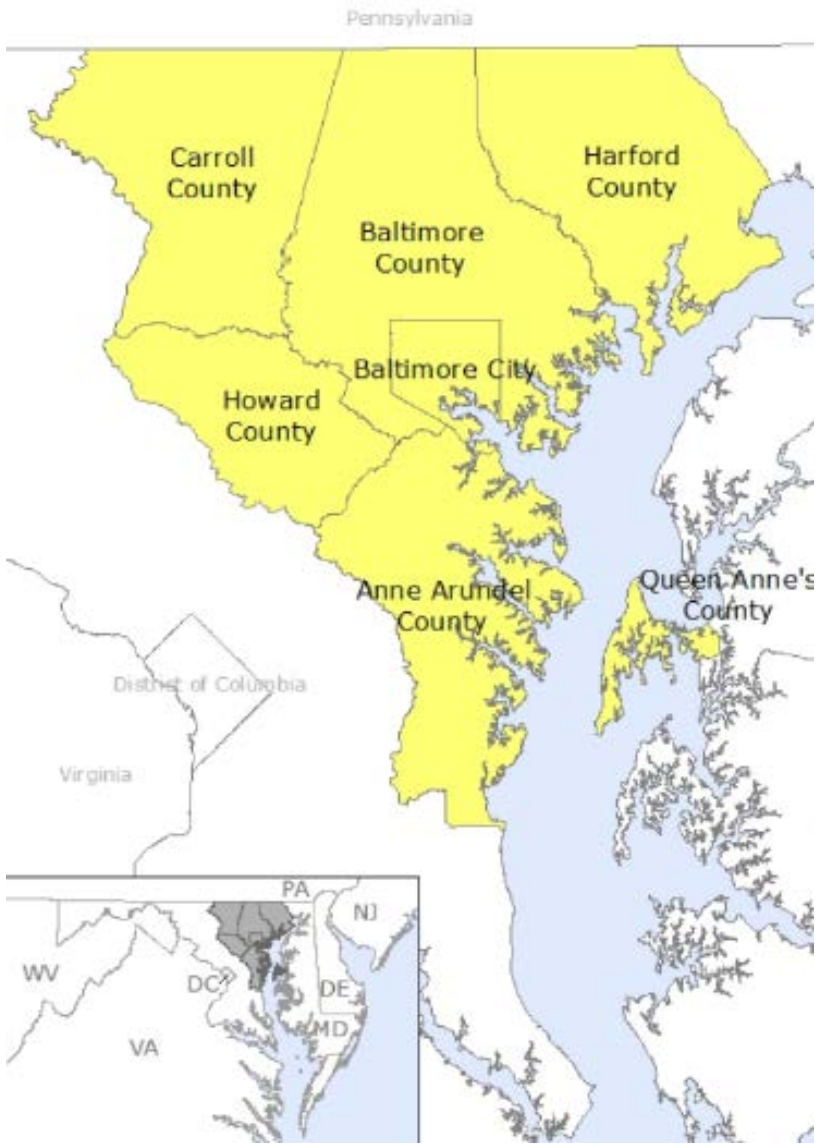
Case Study: Fatal Crash Data for Baltimore Region, 2014 - 2016

- Baltimore Region Traffic Incident Management Committee investigating ways to decrease incident clearance time
- Why start with fatal crashes?
  - longest average clearance time
  - Involve more responders
- Starting in 2014, data entry into State traffic management (CHART) system became much more uniform, therefore easier to analyze without first cleaning

Fatal Crash Data for Baltimore Region

- 219 fatal crashes for 2014 – 2016
- Only records from State CHART system
- Most Baltimore City crash records not in state system
  - City maintains most of its roads

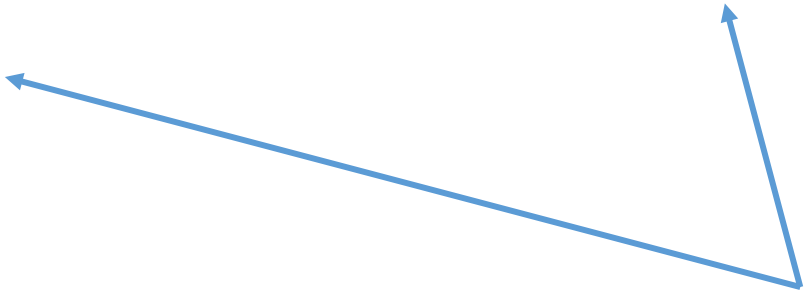
	2014	2015	2016
Baltimore City	2	2	5
Anne Arundel Co	22	19	25
Baltimore Co	16	25	23
Carroll Co	5	9	6
Harford Co	11	15	10
Howard Co	4	9	11
TOTAL	60	79	80



Note: data for Queen Anne's Co was not included

Responder Categories That Most Impact Fatal Crash Clearance Time

- Investigation-accident (Police Crash Team)
- Medical Examiner
- Private Tow
  - Heavy Duty
  - Light Duty

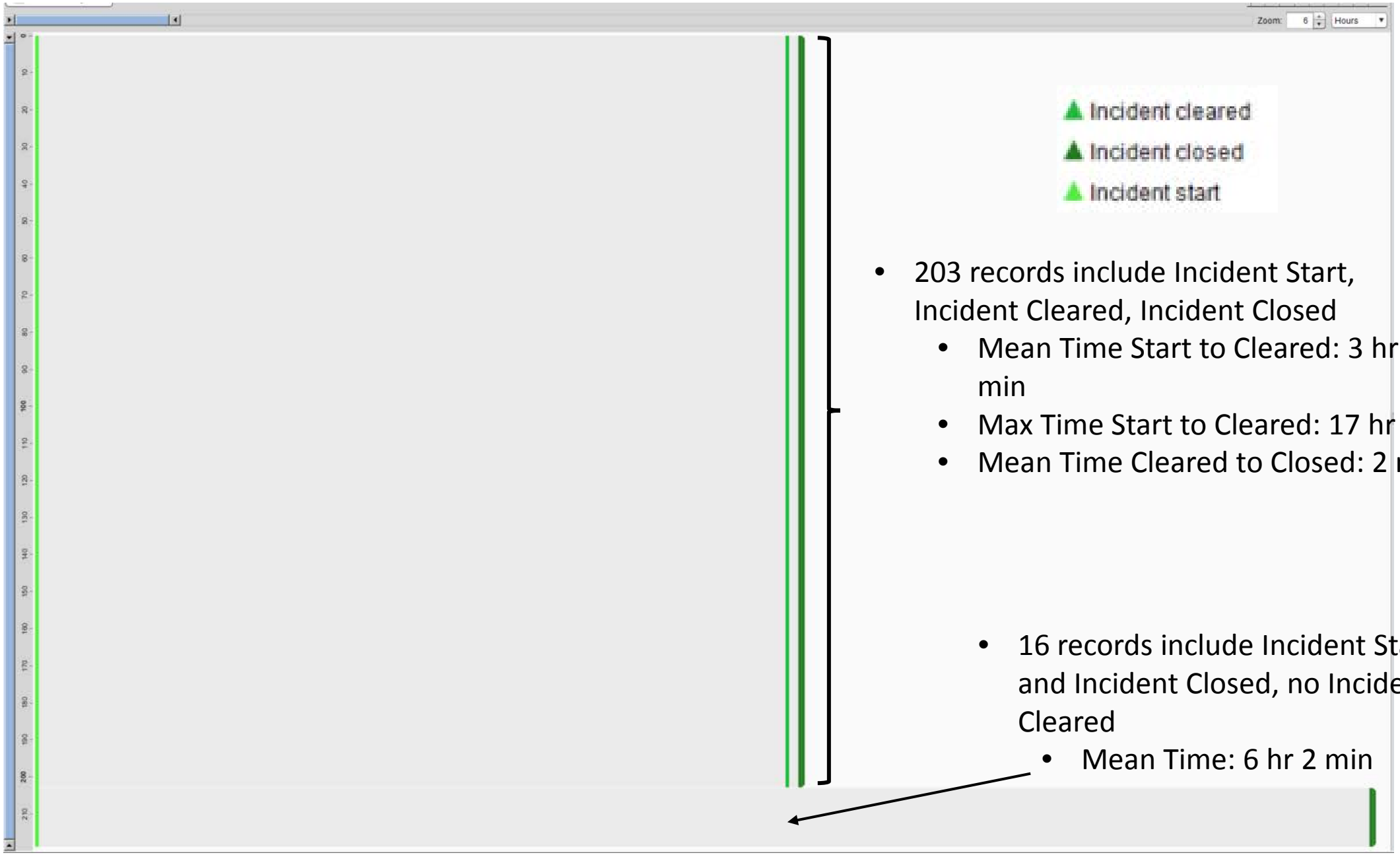


Case study focused on these categories

Incident Clearance Time: 2014 - 2016

Time

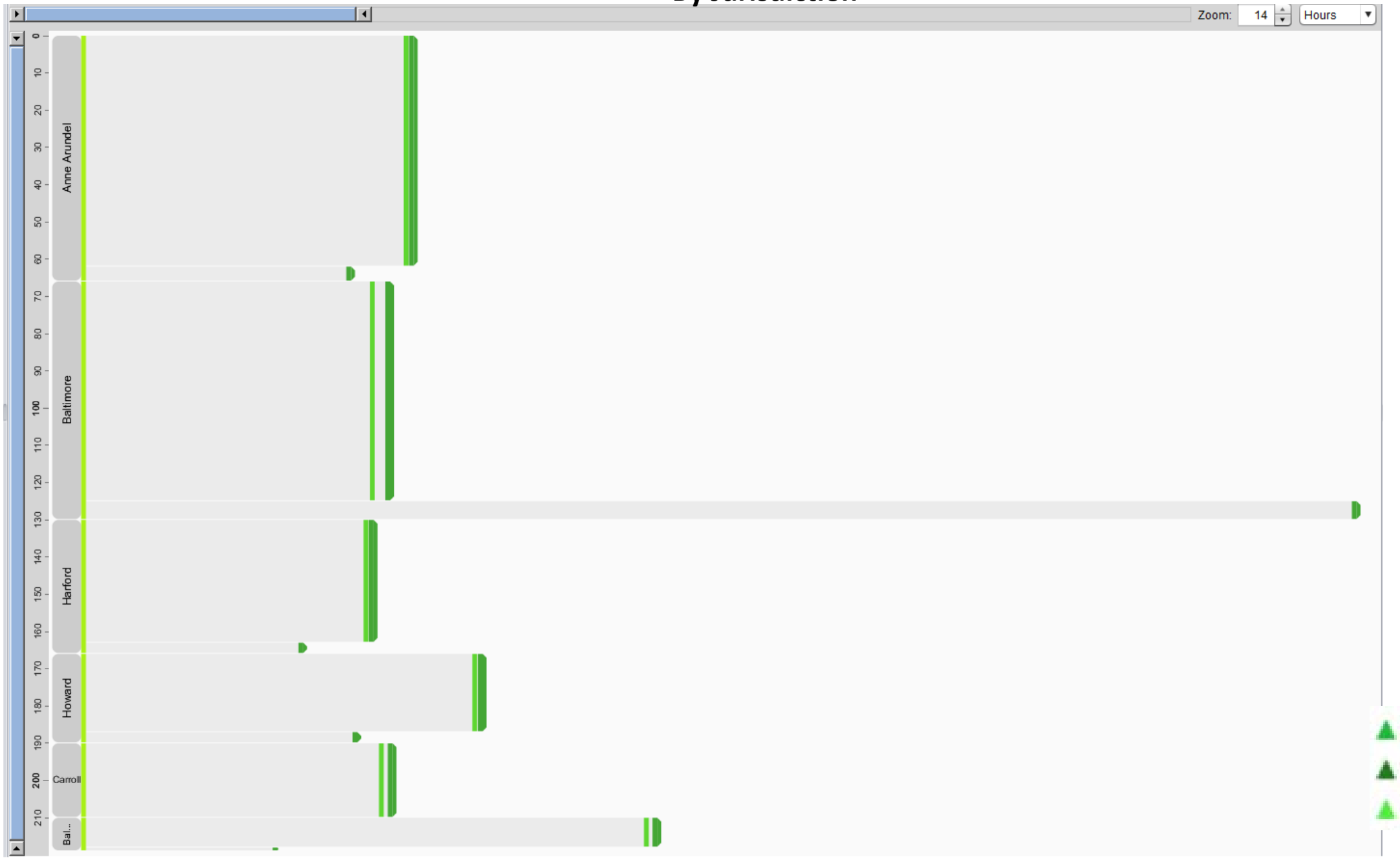
Number of records



- 203 records include Incident Start, Incident Cleared, Incident Closed
  - Mean Time Start to Cleared: 3 hr 23 min
  - Max Time Start to Cleared: 17 hr
  - Mean Time Cleared to Closed: 2 min

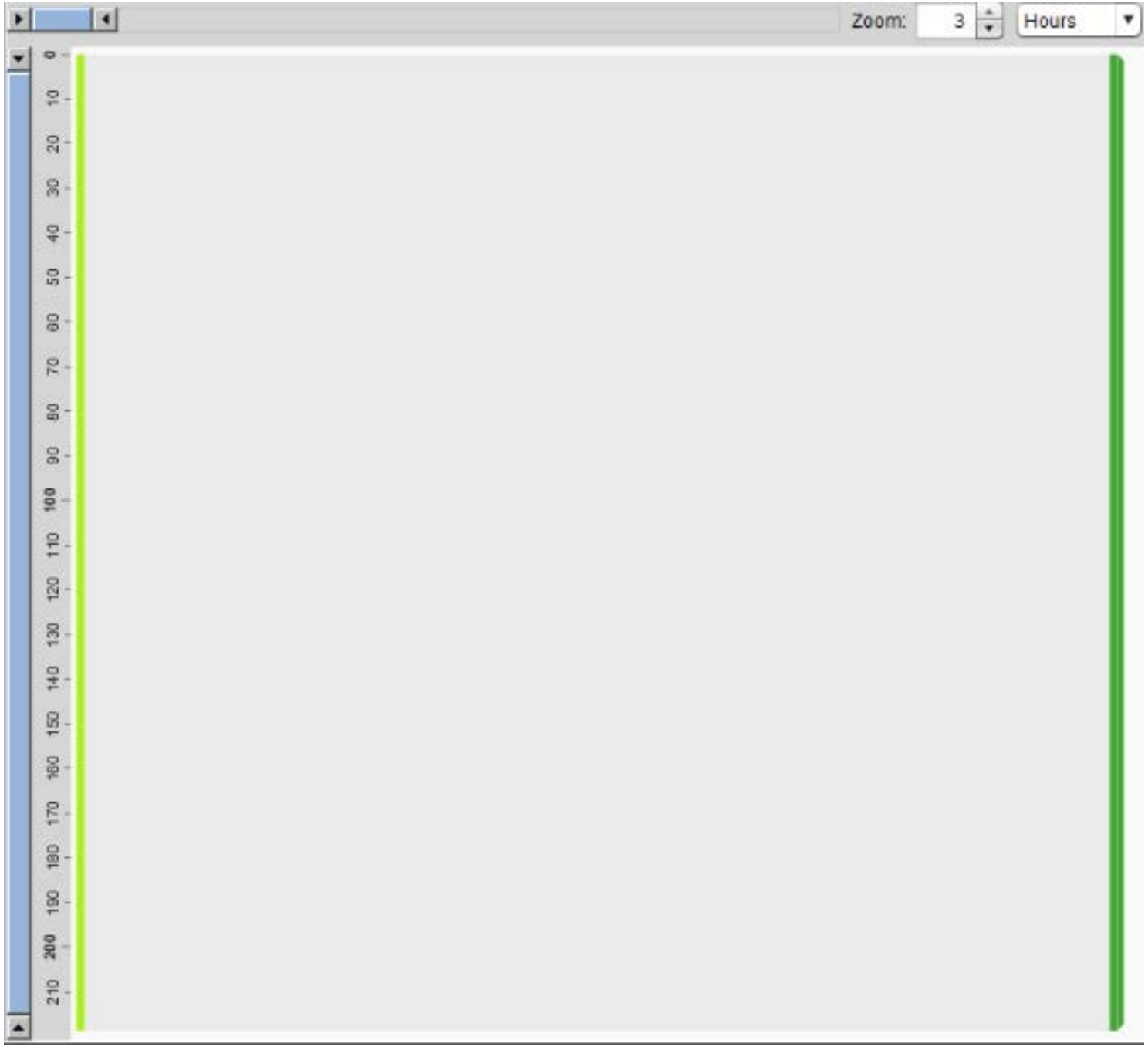
- 16 records include Incident Start and Incident Closed, no Incident Cleared
  - Mean Time: 6 hr 2 min

Incident Clearance Time: 2014 – 2016
By Jurisdiction



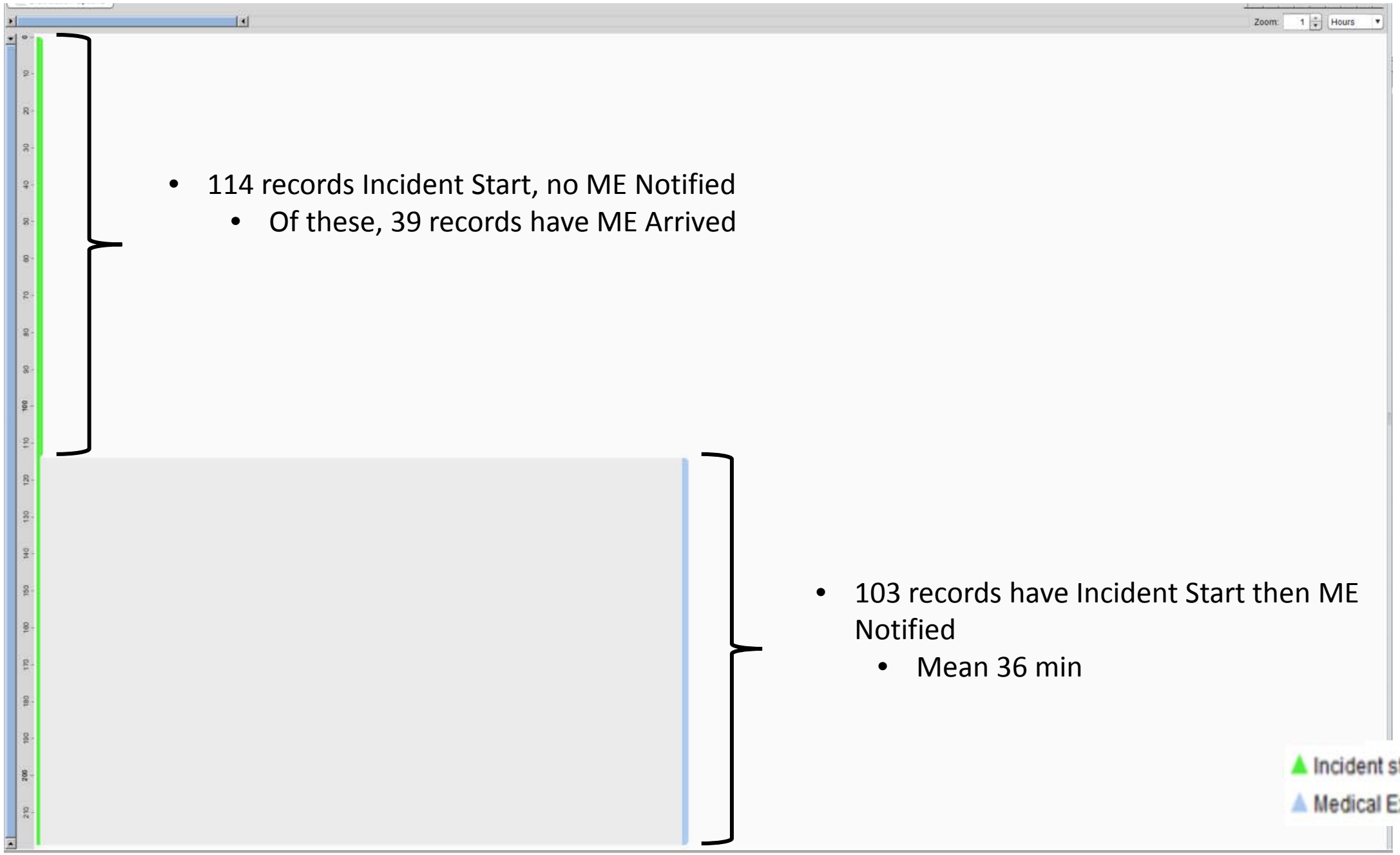
Incident Start to Incident Closed

Year	No. Records	Mean Time Incident Start to Incident Closed
2014	60	3 hr 12 min
2015	79	2 hr 59 min
2016	80	4 hr 33 min
2014-2016	219	3 hr 37 min



Medical Examiner Timeline

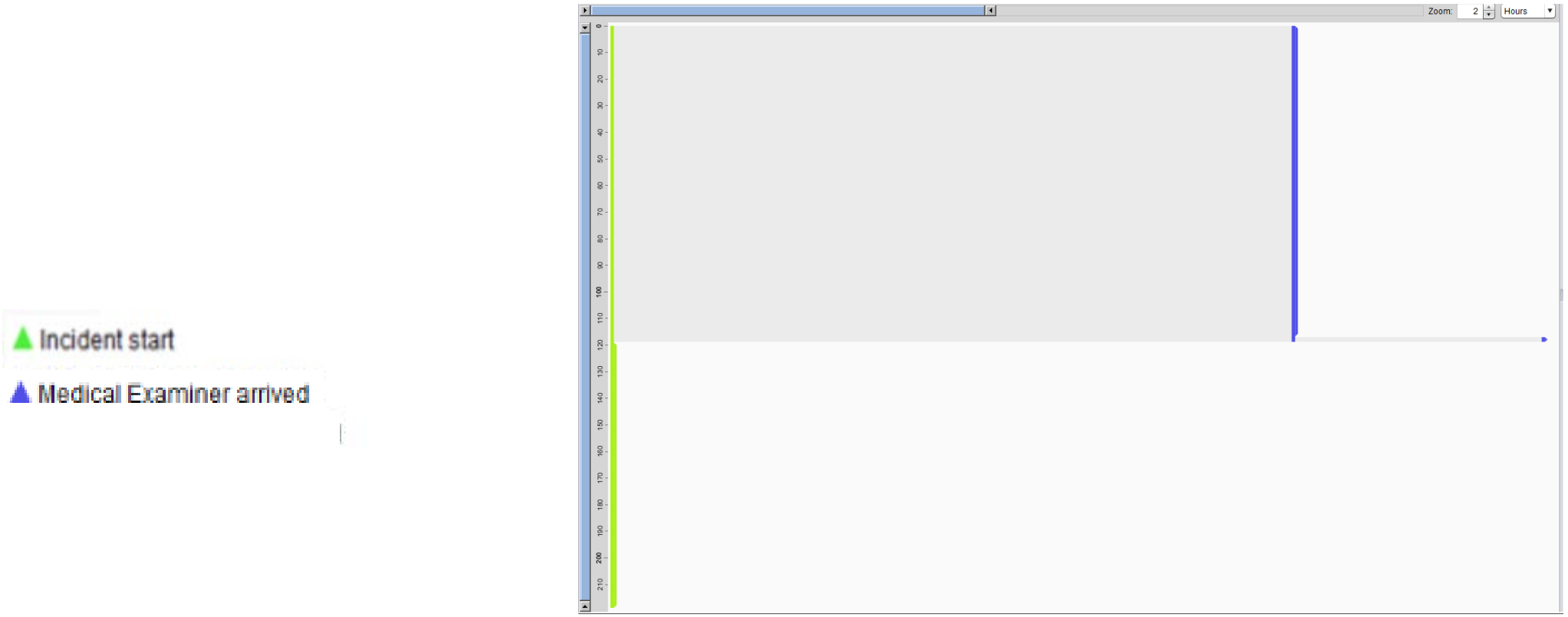
Medical Examiner Notified: 2014 - 2016



- 114 records Incident Start, no ME Notified
  - Of these, 39 records have ME Arrived

- 103 records have Incident Start then ME Notified
  - Mean 36 min

Medical Examiner Arrived: 2014 - 2016



Year	No. Records Incident Start and No ME Arrived	No. Records ME Arrived	Time from Incident Start to ME Arrived
2014	31	29	1 hr 50 min
2015	32	47	1 hr 47 min
2016	37	43	1 hr 51 min
2014-2016	100	119	1 hr 49 min

Incident Start and Medical Examiner Timeline: 2014 - 2016

Observations

- Consistent, Accurate, and Timely data entry are critical
  - Need consistent categories to facilitate analysis
  - Need correct category selected
  - Need accurate time stamps for notification, arrival, and departure
  - Missing data results in incomplete evaluation
- Better coordination and information flow between agencies is needed
- Operations beginning to rely more on data visualization and mining to make decisions
  - Make sure operations staff know what tools are available
  - Operations staff need to make sure data is being tracked accurately and in a timely fashion
  - Consider automated population of CHART data to EventFlow to enable real-time big picture visualization
- EventFlow can be a useful tool to analyze fatal crash data as well as data from other crash types

Contacts

Crash Data

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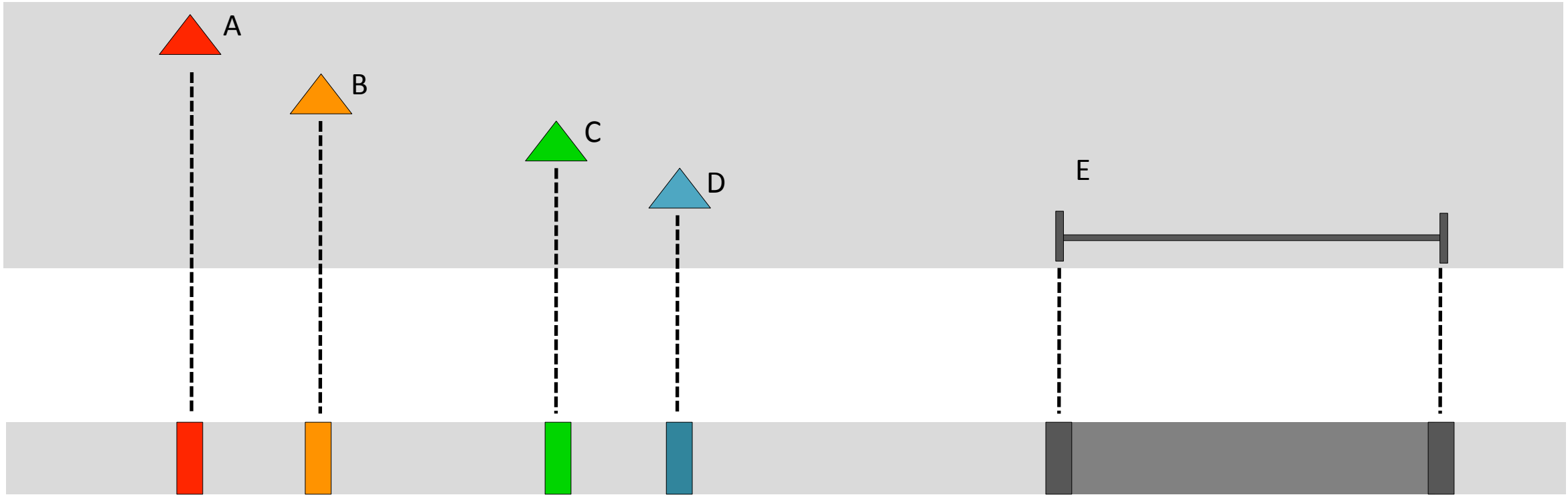
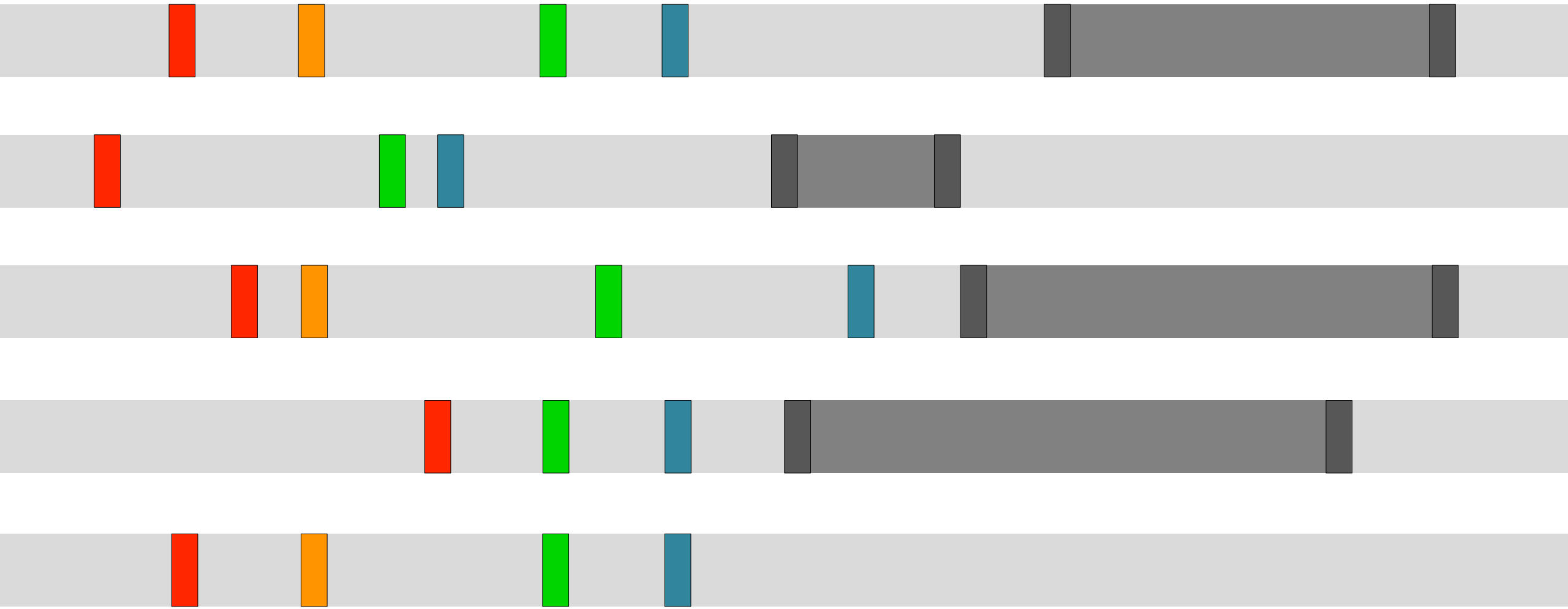
Catherine Plaisant
plaisant@cs.umd.edu

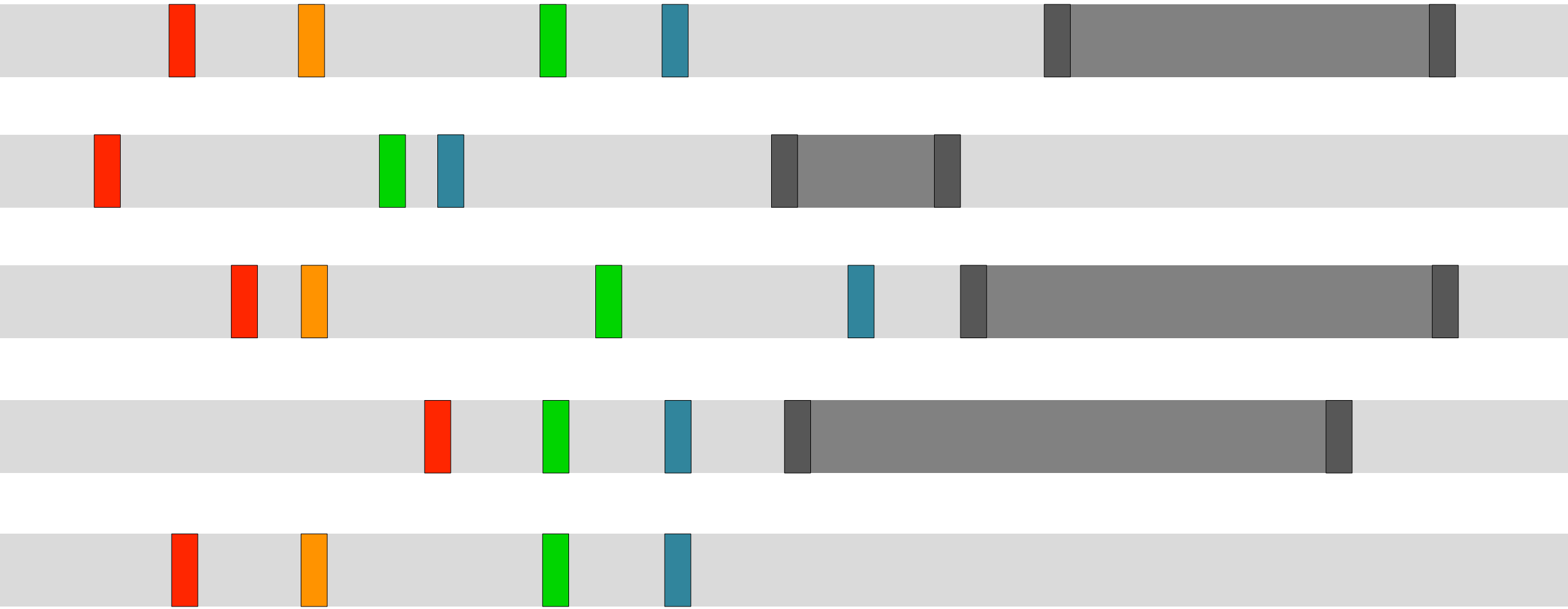
Fan Du
fan@cs.umd.edu

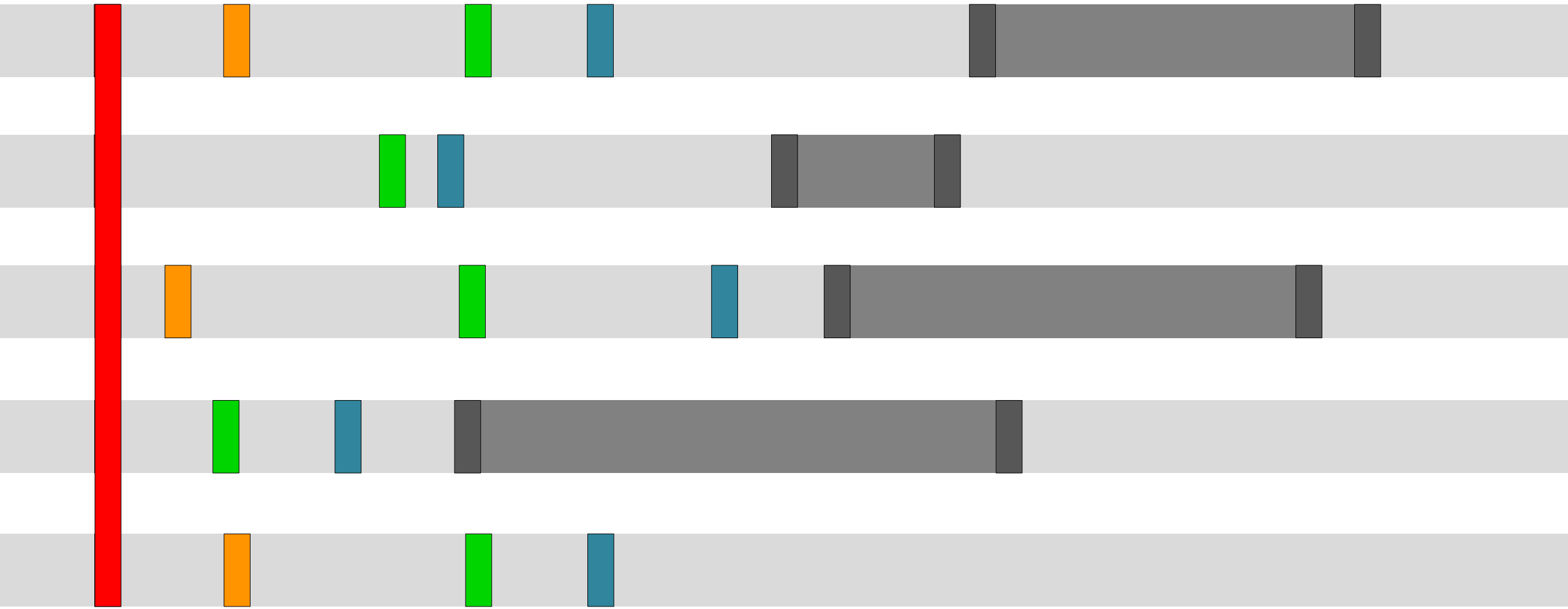
EXTRAS

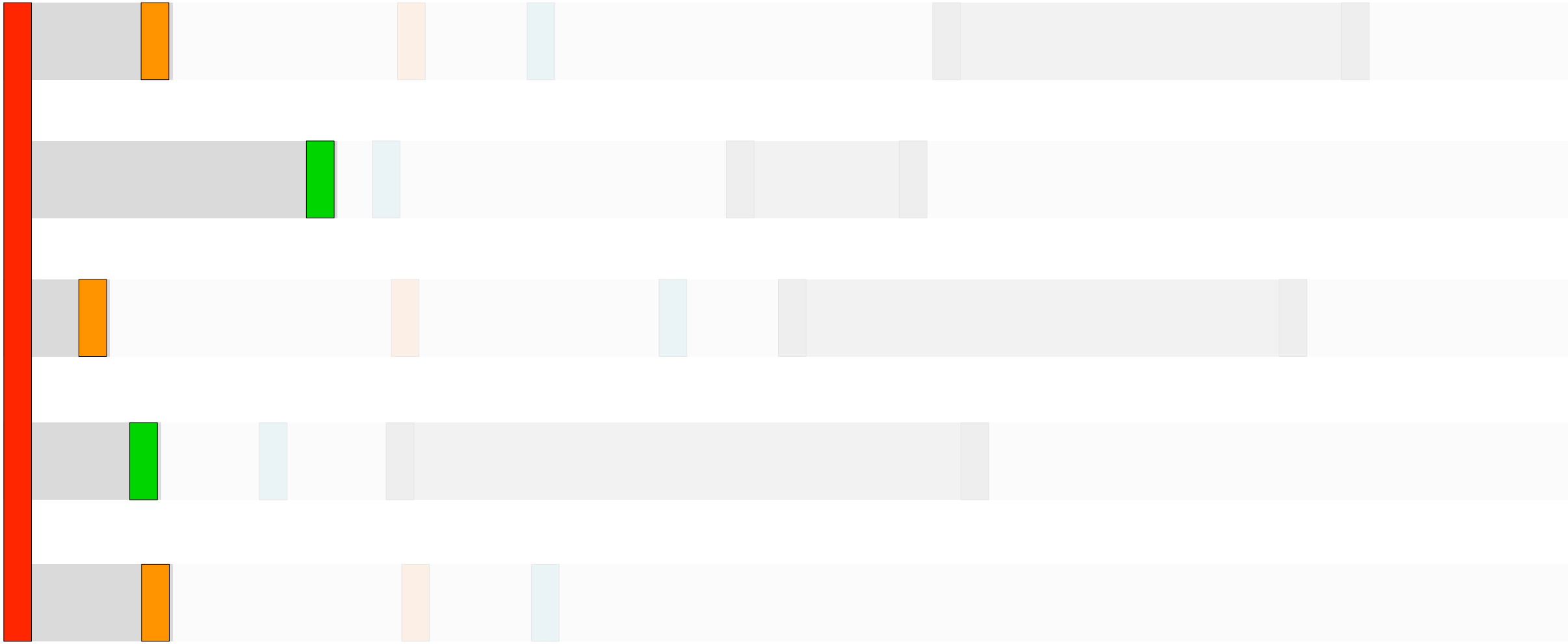
Constructing the EventFlow Overview

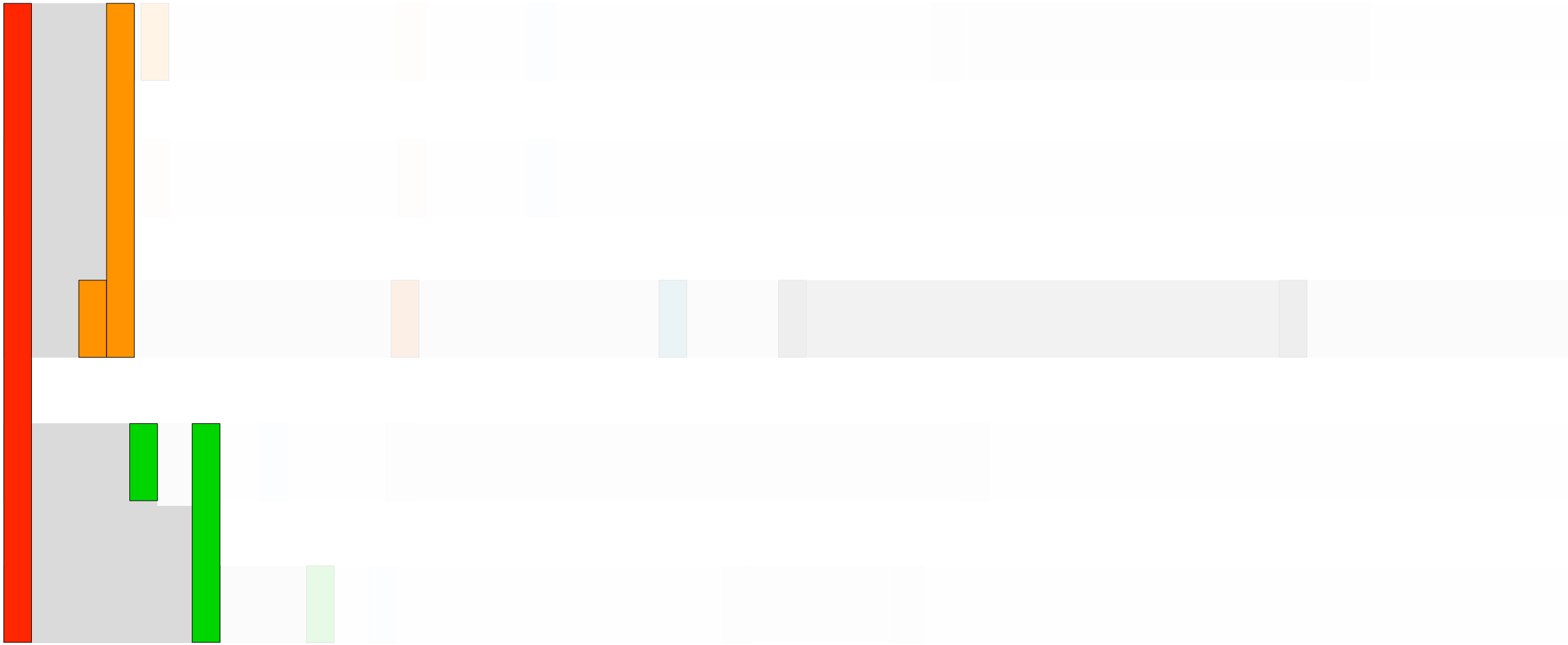


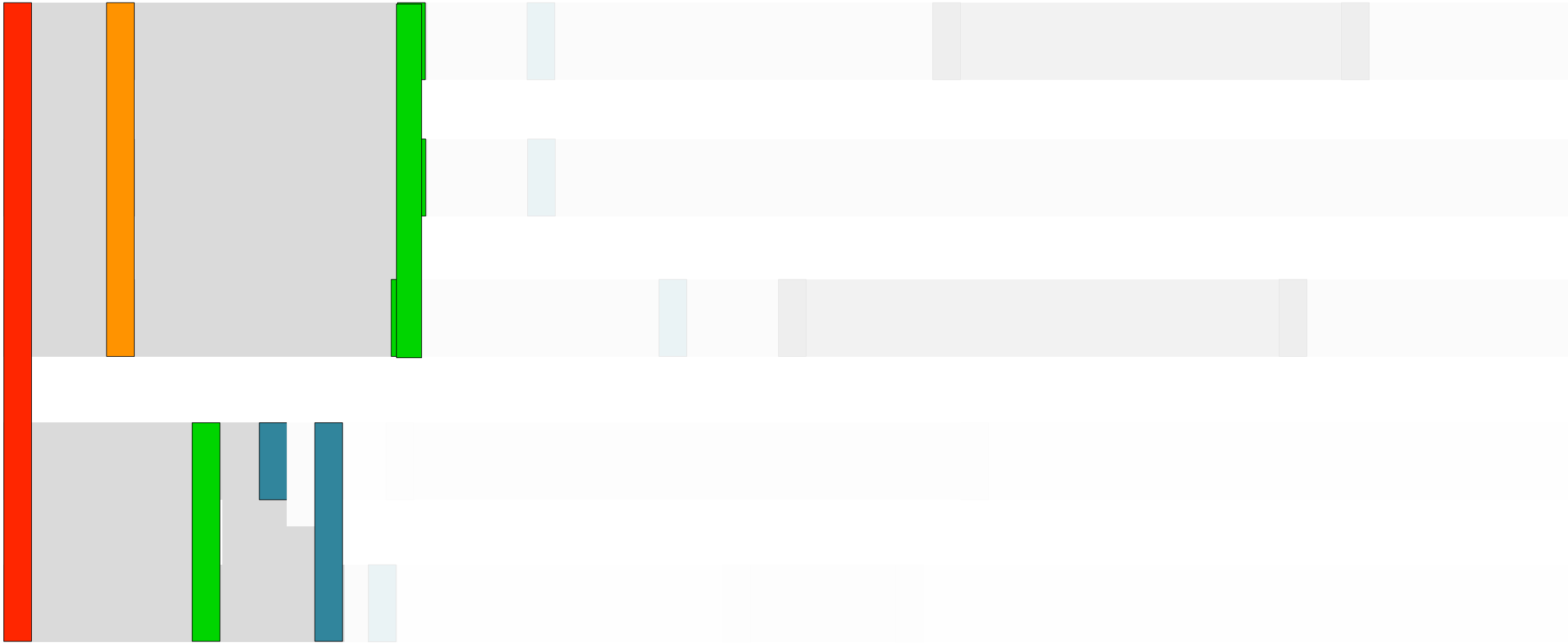


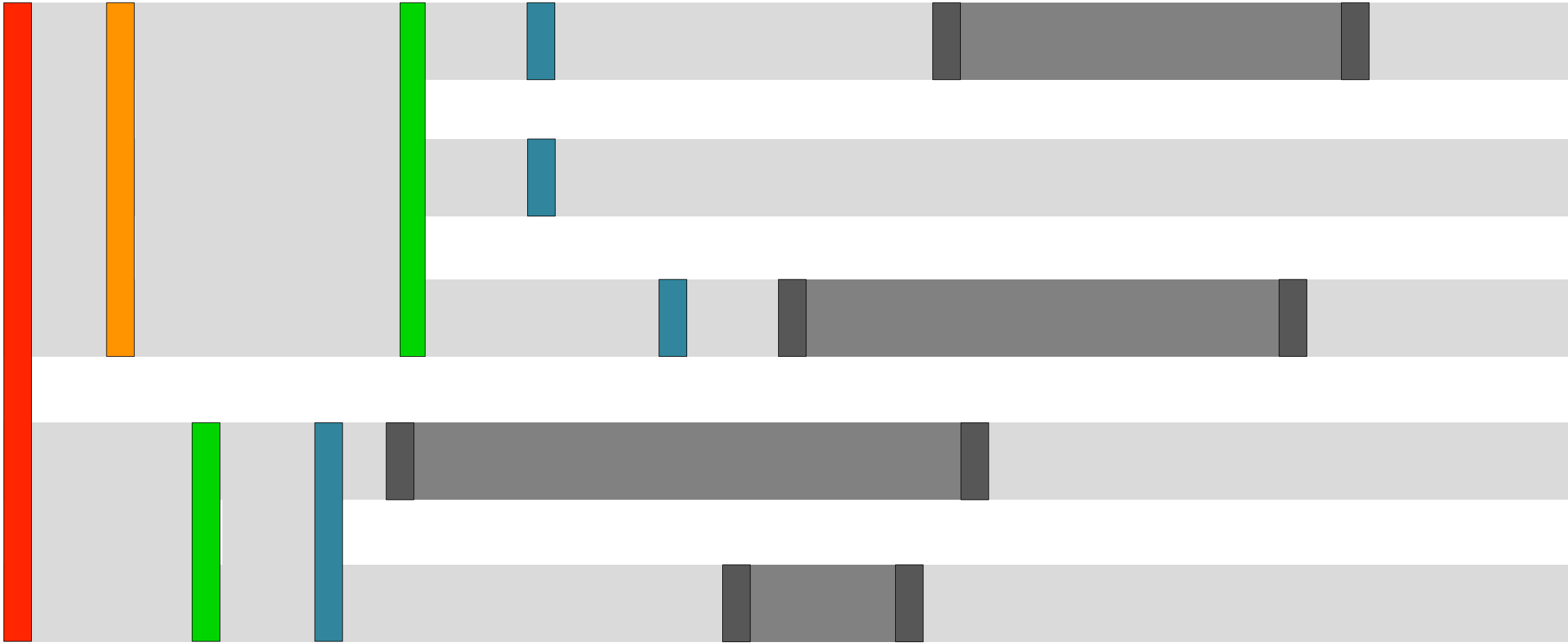


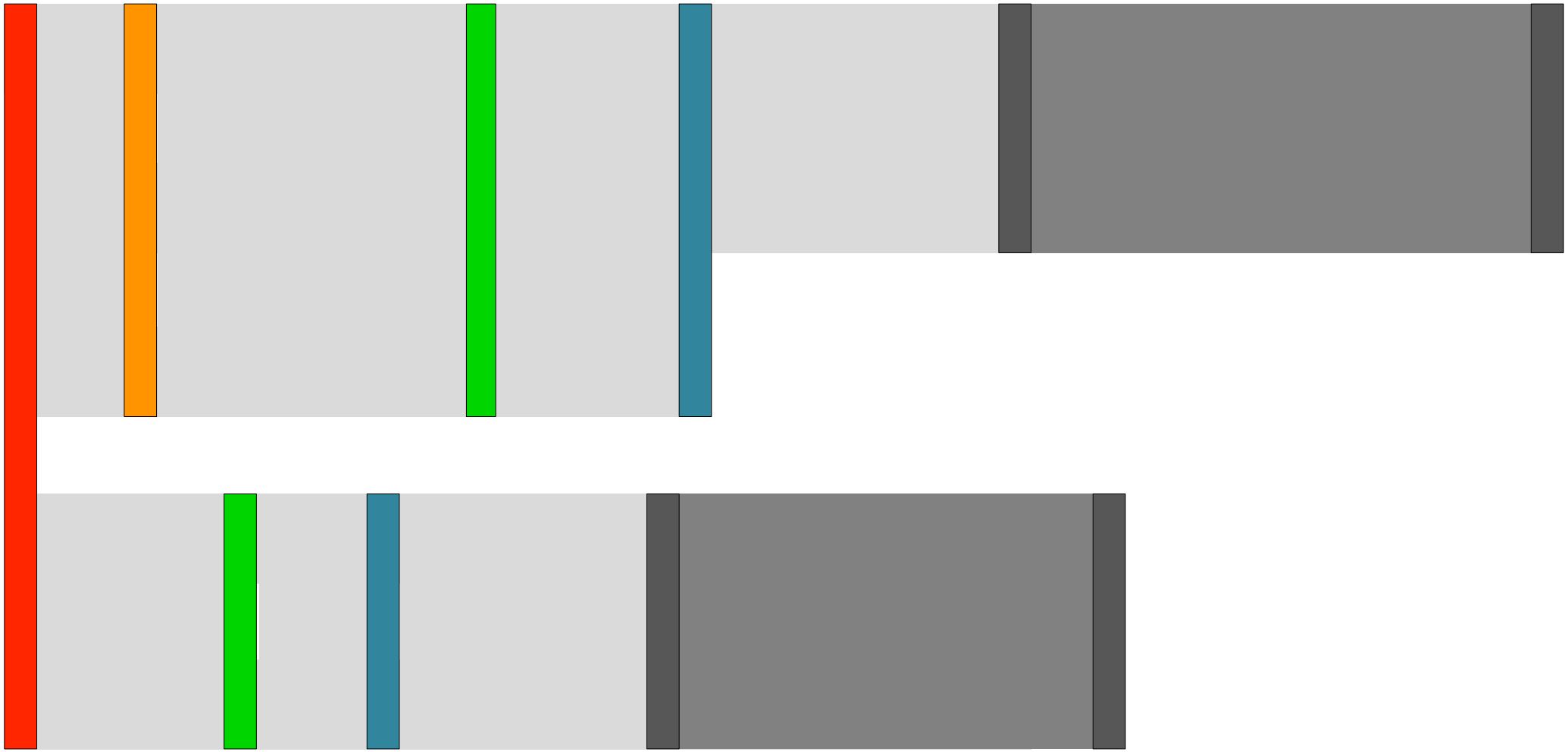


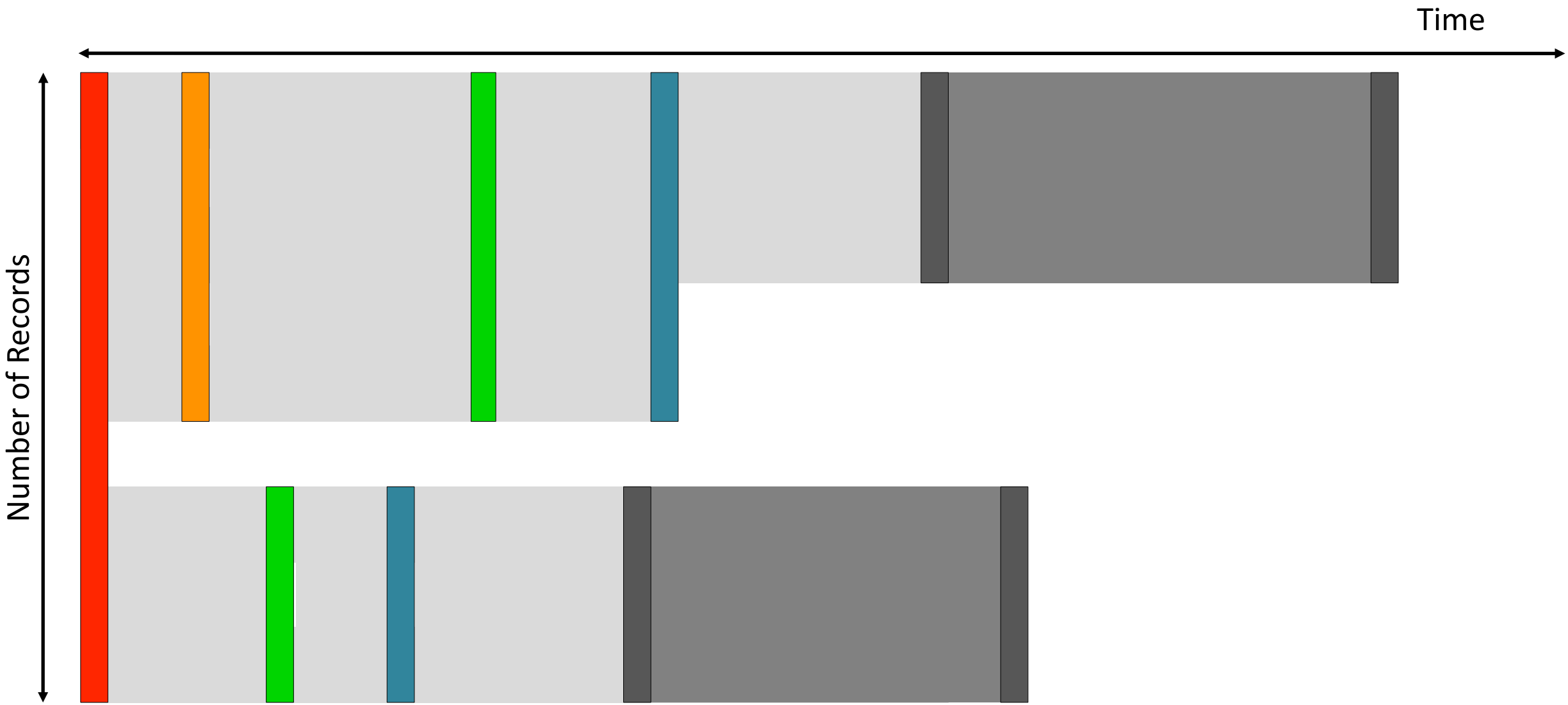











Time
Number of Records