



To a Billion and Beyond

**How to Visually Explore, Compare and Share
Large Quantitative Datasets [with HiGlass](#)**

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Genomics

where we come from

Principal Challenges

Multiscale

Patterns arise at various resolutions

Genomic Data

Multimodality

Different data types and synchronized viz

Time Series Data

Multiple comparable datasets

Insights arise from differences

Geospatial Data

Collaborative Exploration

Share exploratory state, not the end result

Image Data

Architecture

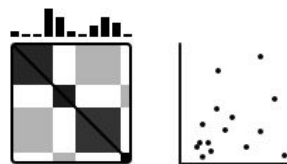
Data



API

THE GOAL

Image



Viewer

Data



API

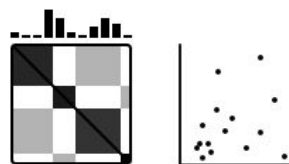


Tileset

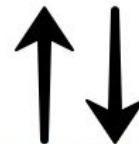
THE GOAL



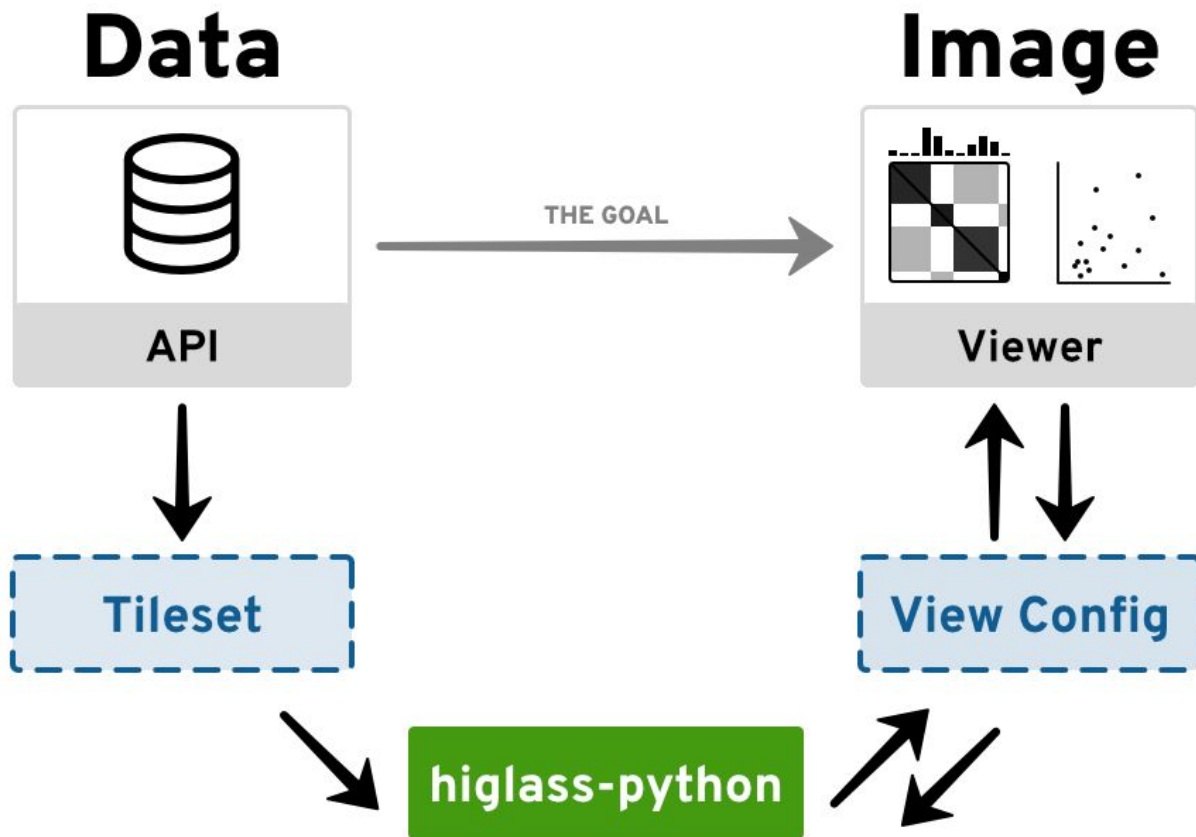
Image



Viewer



View Config

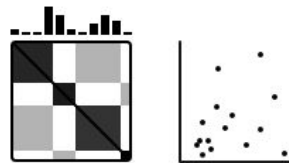


Data



API

Image



Viewer

THE GOAL

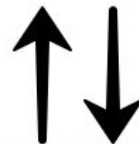


Clodius

Tileset

View Config

higlass-python

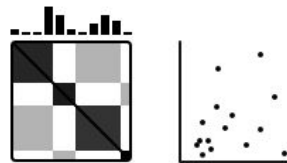


Data



API

Image



Viewer

THE GOAL



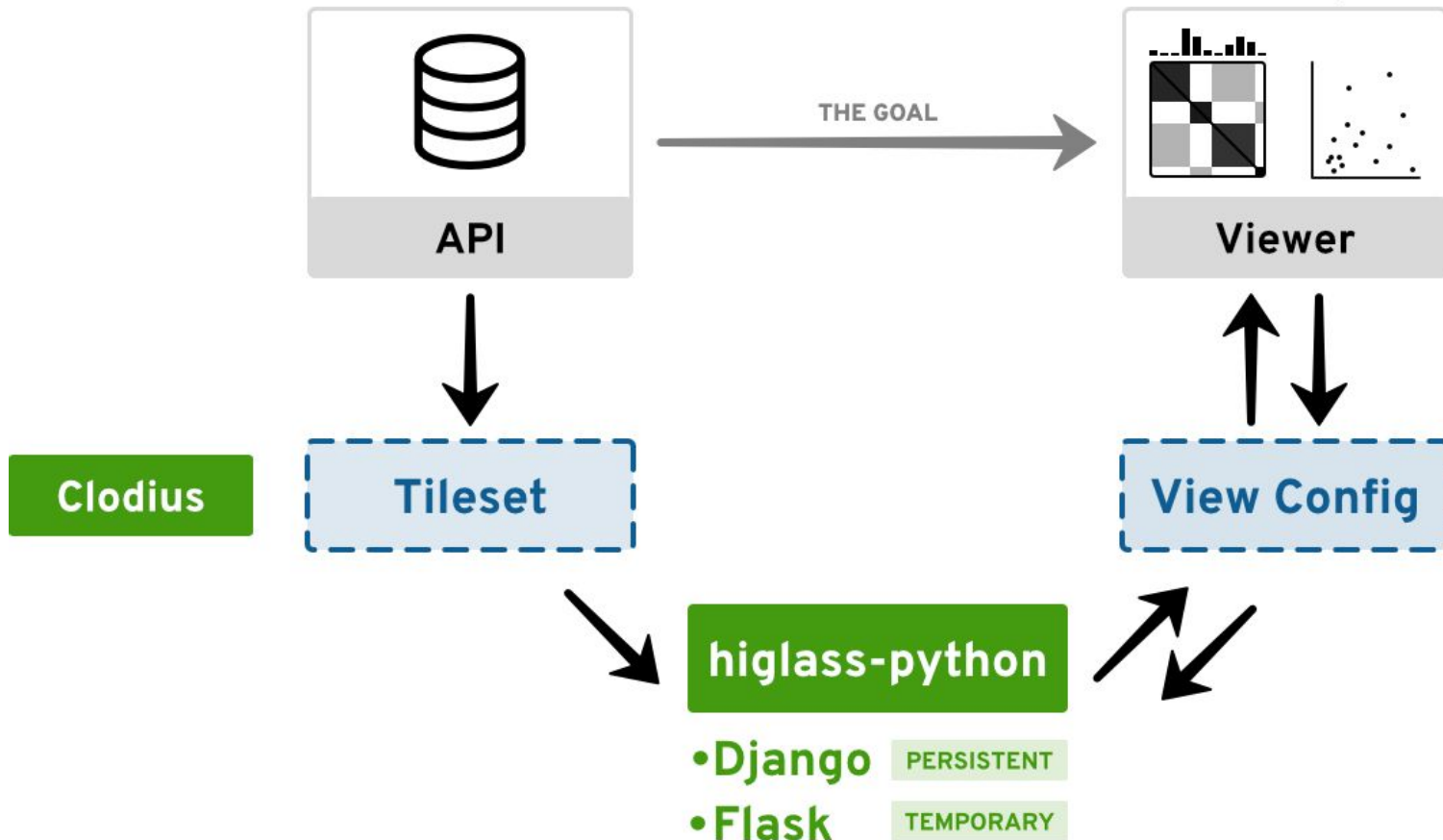
Clodius

Tileset

View Config

higlass-python

- Django PERSISTENT
- Flask TEMPORARY



Data



API



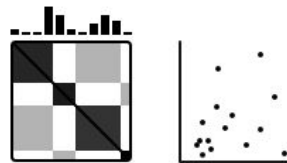
Tileset

Clodius

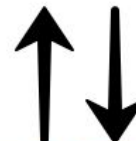
THE GOAL



Image



Viewer



View Config

- WebGL
- Canvas
- SVG

higlass.js

- JSON



higlass-python

- Django PERSISTENT
- Flask TEMPORARY



Python API

All demos are available at
github.com/higlass/scipy19

HiGlass in Jupyter

(see [temperature.ipynb](#))

Tileset API

Tileset API

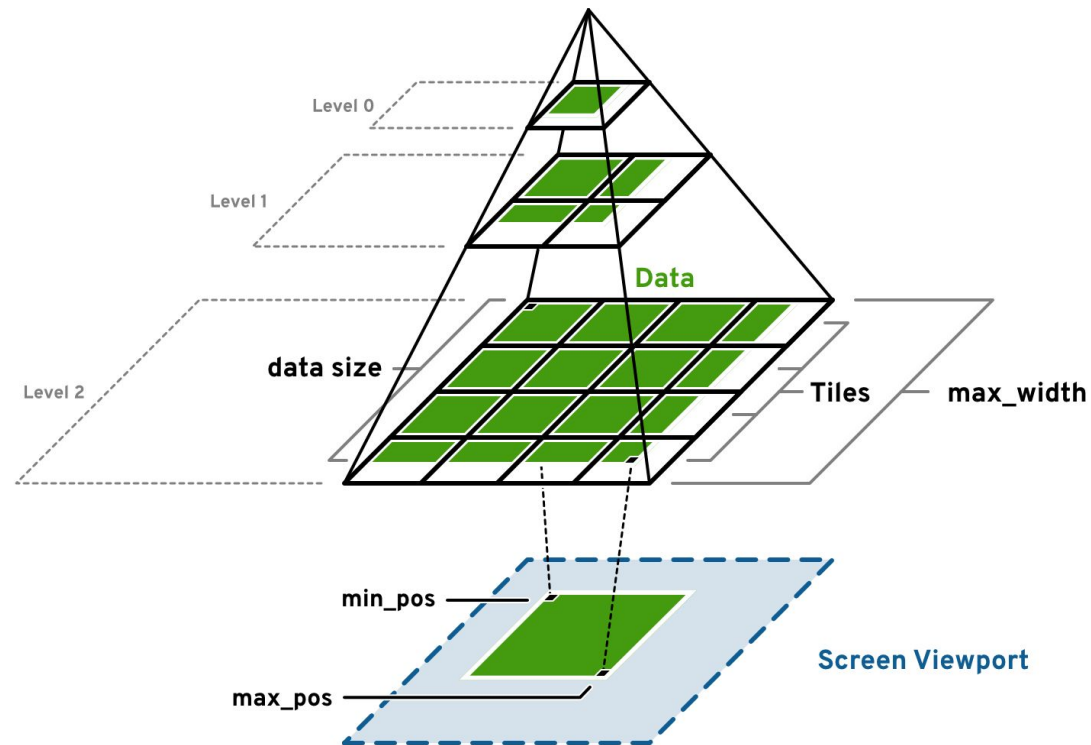
Generates or fetches 1D or 2D data tiles

tileset_info()

- min_pos & max_pos: relative to the scene
- tile_size: size of the tiles (in pixels)
- max_zoom: $\lceil \log_2(\text{tile mesh size} / \text{tile size}) \rceil$
- max_width: $\lceil \text{tile mesh size} / \text{tile size} \rceil$

tiles(tile_ids)

- ← [`<uuid.z.x.y>`, ...]
- {`<uuid.z.x.y>`: {
 dense, min_value, max_value, dtype
}}, ...}



Tileset API

Generates or fetches 1D or 2D data tiles

tileset_info()

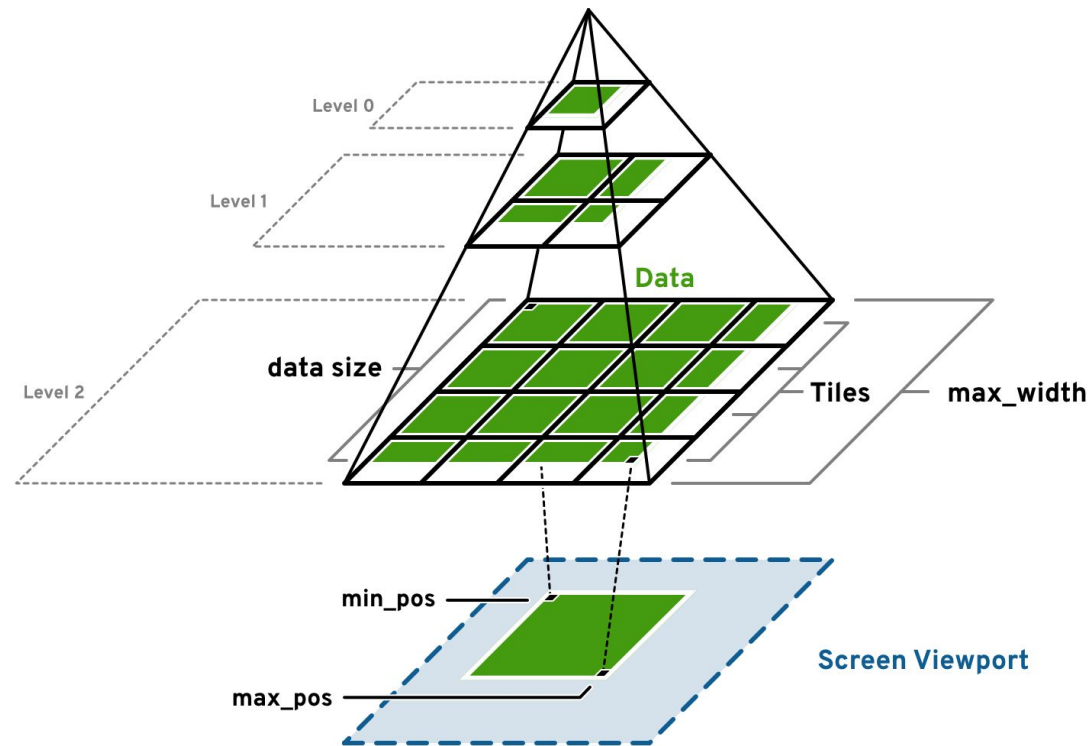
- min_pos & max_pos: relative to the scene
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tiles(tile_ids)

← [`<uuid.z.x.y>`, ...]

→ {`<uuid.z.x.y>`: {
 dense, min_value, max_value, dtype
}, ...}

Base64-encoded raw data



Tileset API Demo

(see [point-data.ipynb](#))

View Configs

View Config

- Views

Shared location and zoom

- Layout
- Tracks

- Locks

For view synchronization

- Globals

Server URLs, editability

```
1.  {
2.    "views": [
3.      {
4.        "uid": "aa",
5.        "initialXDomain": [0, 100],
6.        "initialYDomain": [0, 100],
7.        "layout": {
8.          "x": 0, "y": 0,
9.          "w": 12, "h": 6,
10.        },
11.        "tracks": {
12.          "top": [],
13.          "left": [],
14.          "center": [],
15.          "right": [],
16.          "bottom": []
17.        }
18.      }
19.    ],
20.    "zoomLocks": { ... },
21.    "locationLocks": { ... },
22.    "valueScaleLocks": { ... },
23.    "editable": true,
24.    "zoomFixed": false,
25.    "trackSourceServers": ["/api/v1"],
26.    "exportViewUrl": "/api/v1/viewconfs"
27.  }
```

View Config

- Views

Shared location and zoom

- Layout
- Tracks

- Locks

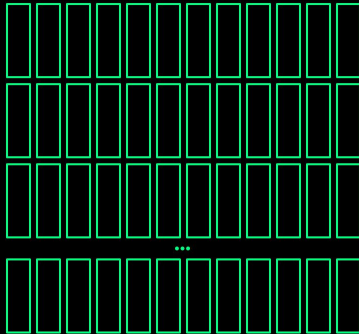
For view synchronization

- Globals

Server URLs, editability

```
1. {
2.   "views": [
3.     {
4.       "uid": "aa",
5.       "initialXDomain": [0, 100],
6.       "initialYDomain": [0, 100],
7.       "layout": {
8.         "x": 0, "y": 0,
9.         "w": 12, "h": 6,
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20.  "zoomLocks": { ... },
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23.  "editable": true,
24.  "zoomFixed": false,
25.  "trackSourceServers": ["/api/v1"],
26.  "exportViewUrl": "/api/v1/viewconfs"
27. }
```

12 Columns



View Config

- Views

Shared location and zoom

- Layout
- Tracks

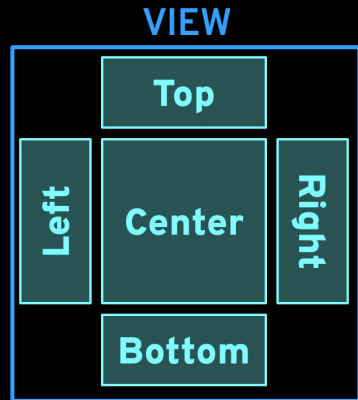
- Locks

For view synchronization

- Globals

Server URLs, editability

```
1. {  
2.   "views": [  
3.     {  
4.       "uid": "aa",  
5.       "initialXDomain": [0, 100],  
6.       "initialYDomain": [0, 100],  
7.       "layout": {  
8.         "x": 0, "y": 0,  
9.         "w": 12, "h": 12,  
10.      },  
11.      "tracks": {  
12.        "top": [],  
13.        "left": [],  
14.        "center": [],  
15.        "right": [],  
16.        "bottom": []  
17.      }  
18.    },  
19.  ],  
20.  "zoomLocks": { ... },  
21.  "locationLocks": { ... },  
22.  "valueScaleLocks": { ... },  
23.  "editable": true,  
24.  "zoomFixed": false,  
25.  "trackSourceServers": ["/api/v1"],  
26.  "exportViewUrl": "/api/v1/viewconfs"  
27. }
```



Track Config

- **Type**
general encoding
- **Server**
track data source
- **Tileset UID**
data identifier
- **UID**
track identifier
- **Options**
For styling, labeling, etc.

```
1.  {
2.    "type": "horizontal-line",
3.    "server": "//higlass.io/api/v1",
4.    "tilesetUid": "OHJakQICQD6gTD7skx4EWA",
5.    "uid": "my-very-fancy-line-plot",
6.    "options": {
7.      "name": "My Very Fancy Line Plot!",
8.      ...
9.    },
10. }
```

Advanced Features

Advanced Features

(see [nyc-taxi.ipynb](#))

Developer Features

Modular Codebase

Tiling, serving, and rendering are decoupled

E.g., viewer, server, tileset API, docker

Viewer Extensibility

Simple plugin architecture for new track types

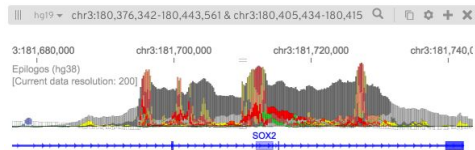
E.g., Epilogos, GeoJSON

JavaScript APIs for Integration

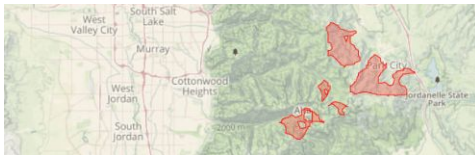
Library version, React component, JsAPI

E.g., HiPiler, Peax, cTracks

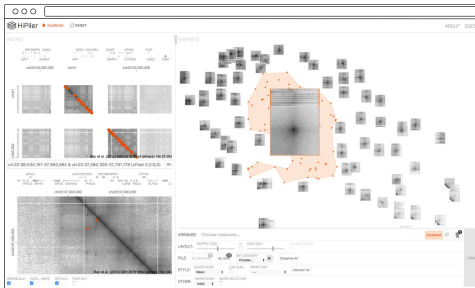
EPILOGOS



GEOJSON



HIPIER



PEAX



Communication & Collaboration

(see [genomics.ipynb](#))



HiGlass

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WEB: higlass.io

CODE: github.com/higlass/scipy19

TWITTER: [@higlass_io](https://twitter.com/higlass_io)

PRESENTERS:



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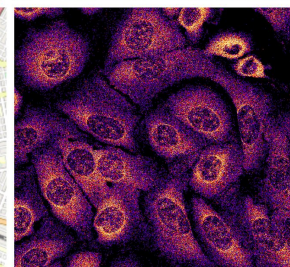
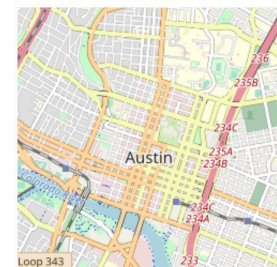
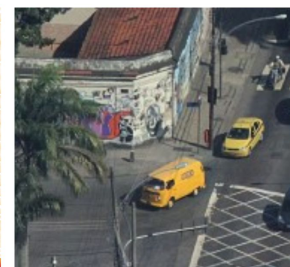
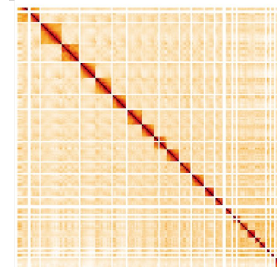
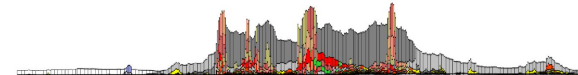
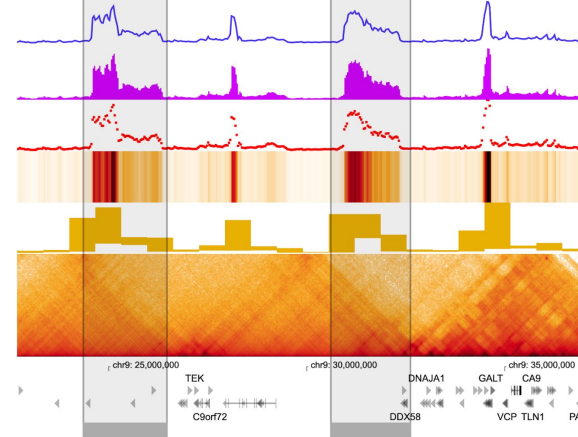


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Scipy Slack Channel
#higlass

This work is supported in part by the National Institutes of Health (U01 CA200059)





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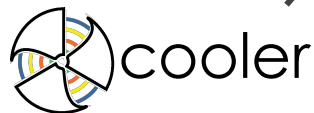
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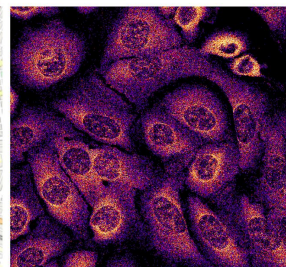
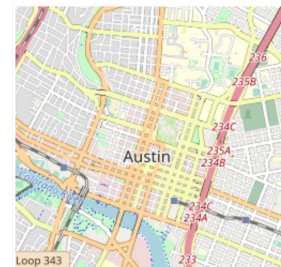
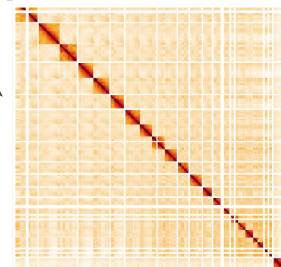
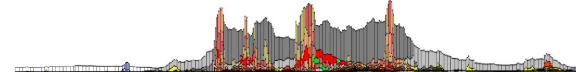
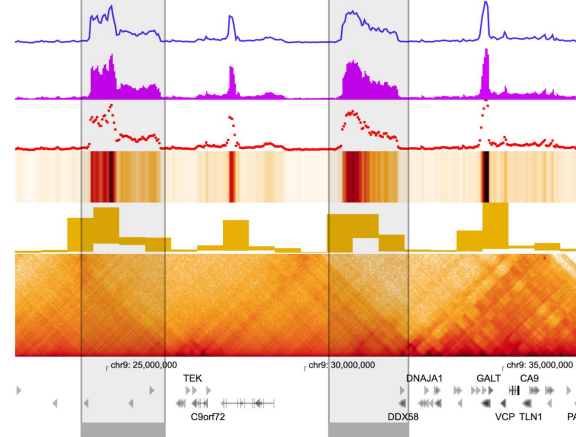


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4D Nucleome



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