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Link to the slides:
<https://aladin.u-strasbg.fr/AladinLite/IVOA2023/>

RCW 36
Type: HII
[Query in CDS portal](#)



Aladin Lite: a brief summary over the years





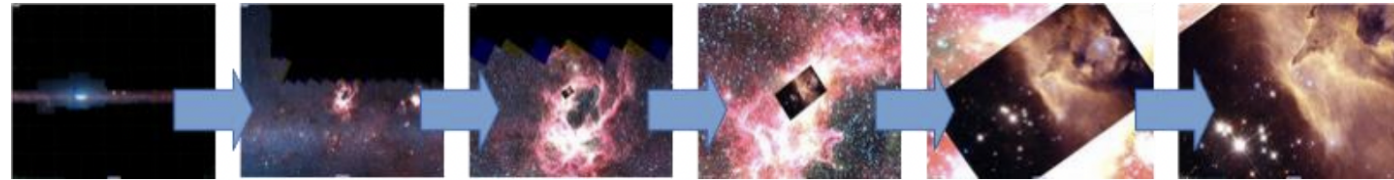
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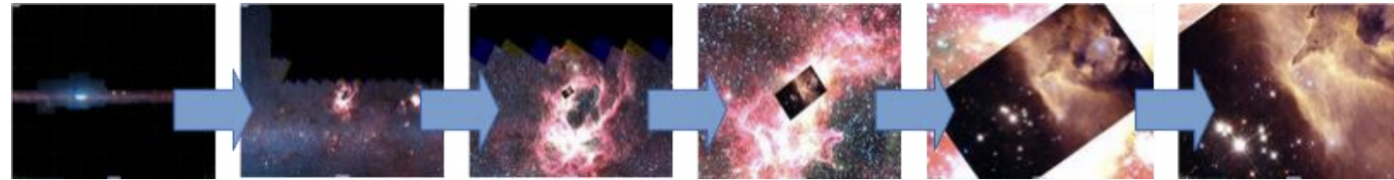
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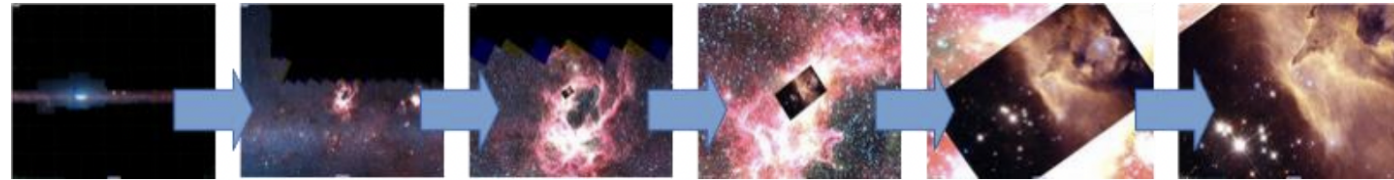
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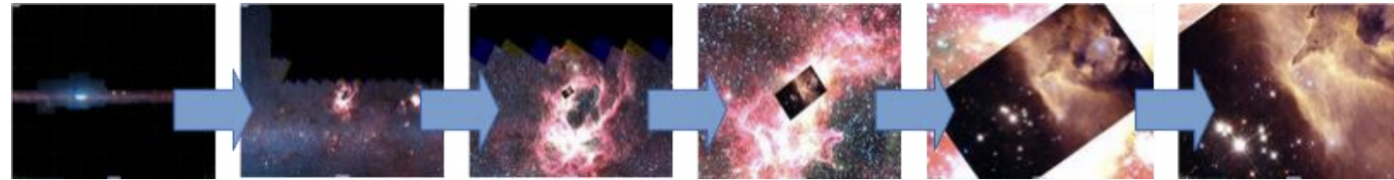
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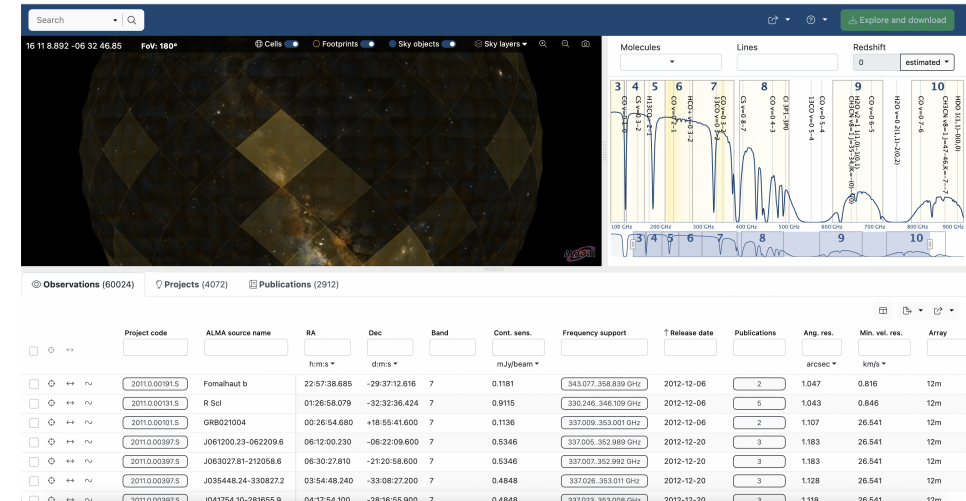
- JS Canvas 2D rendering
- Lightweight: less than 100kB at the time when gzipped and minified
- Easy to embed
 - No plugins, installation required
 - Just a few JS snippet of code to use
 - JS API aiming to be simple and very light CSS (can be overridden easily)

- ESASky
- LIGO/Virgo for gravitational wave regions display

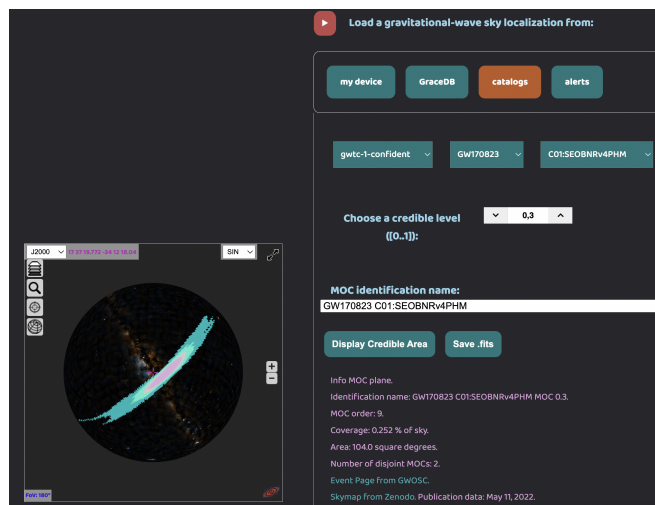
- ALMA Science ESO portal
- JAXA JUDO2 portal



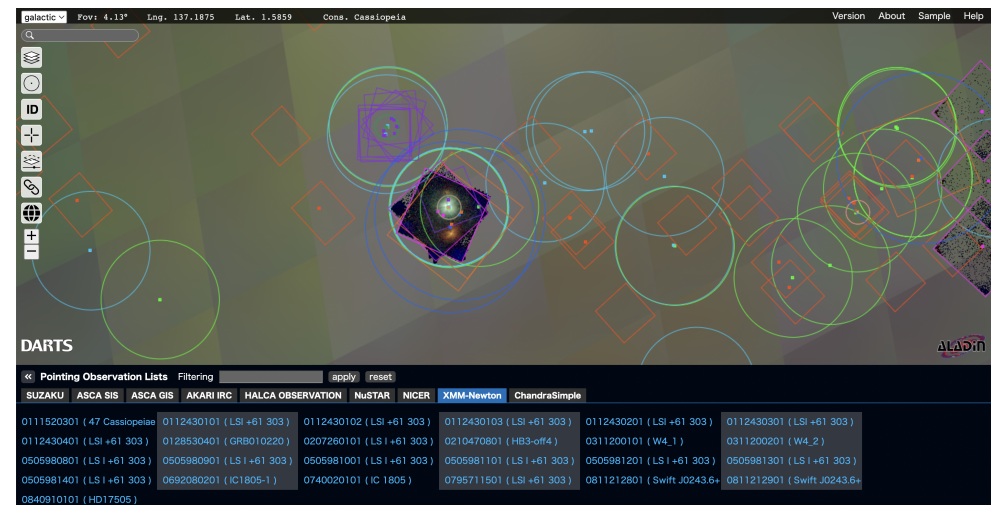
ESASky



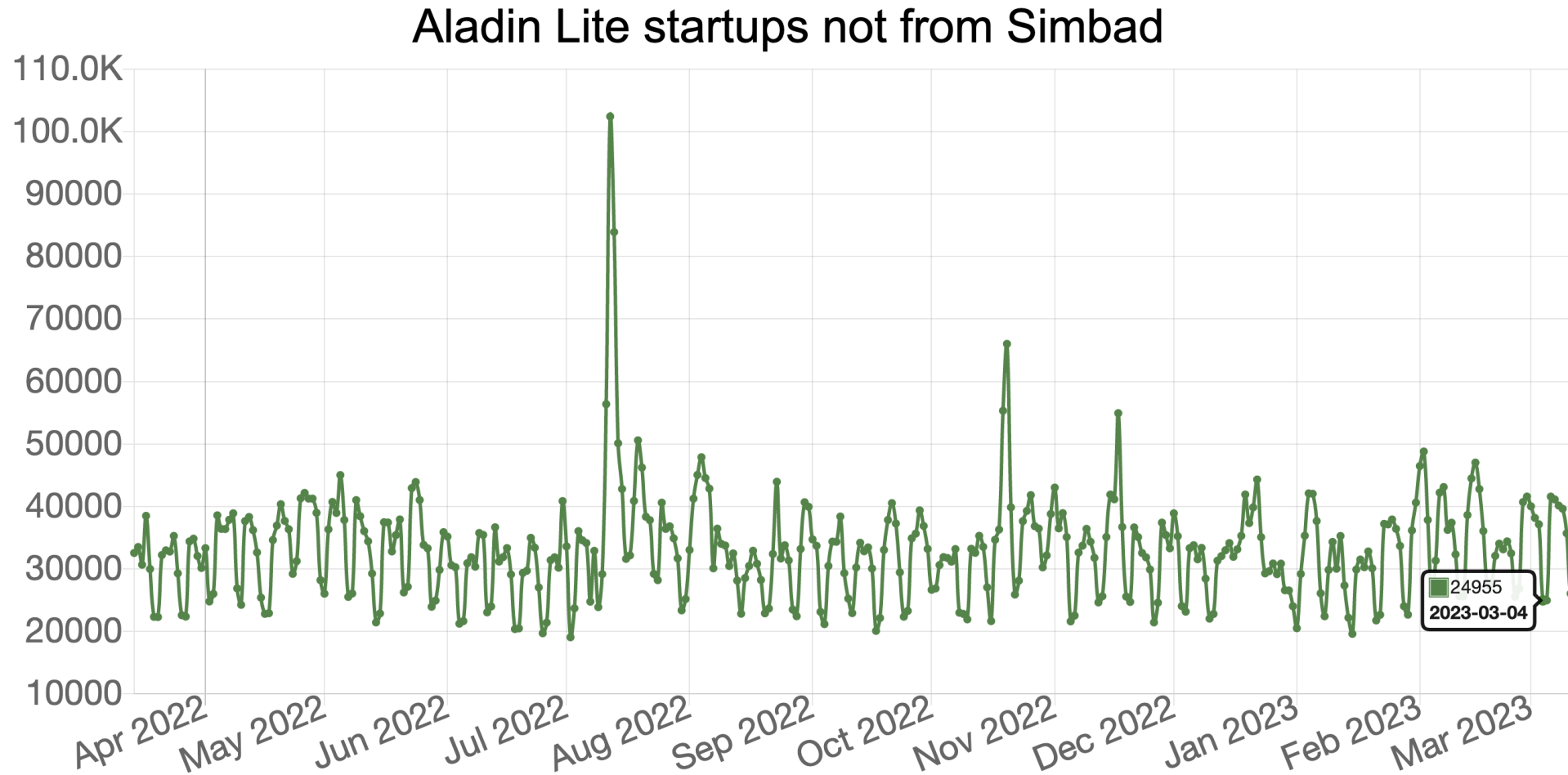
ALMA science portal



Virgo - Gravitational Wave Sky Localizations



JAXA JUDO2 portal



- ~30000-40000 startups per day
- Some over-usage during special events (e.g. 100k startups when the first JWST image was released)



Aladin Lite: a brief summary over the years

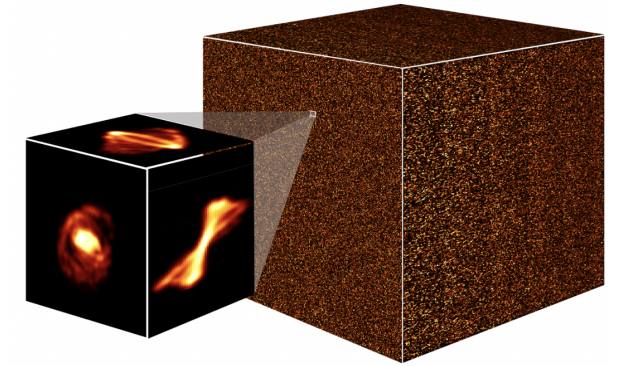


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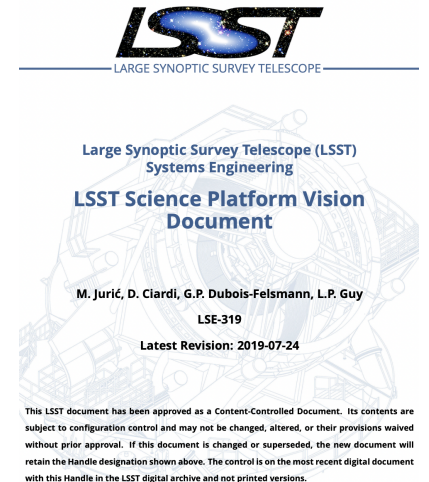
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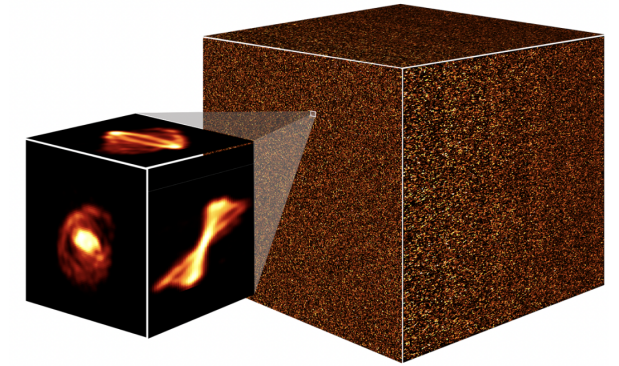
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 - Big FITS image support needed
 - Big data cube e.g. SKA data challenge2: 1TB simulated datacube



The simulated datacube, before noise and instrumental effects are added. Covering a sky area of 20 square degrees and featuring nearly a quarter of a million galaxies, the cube represents an SKA observation of neutral hydrogen – or "HI" – emission.



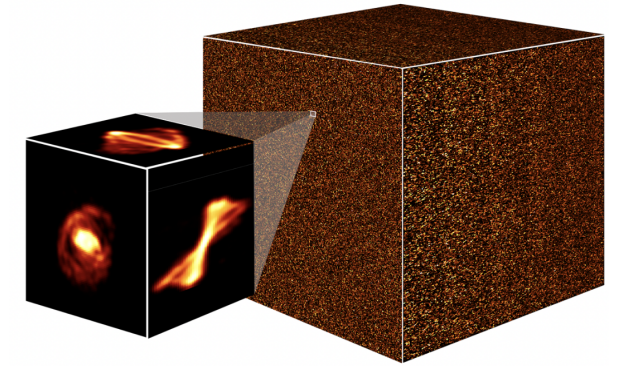
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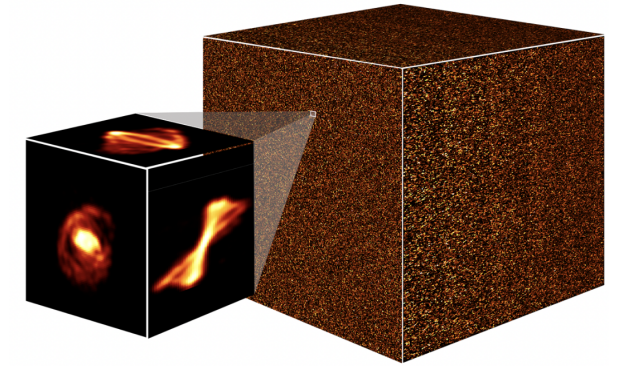
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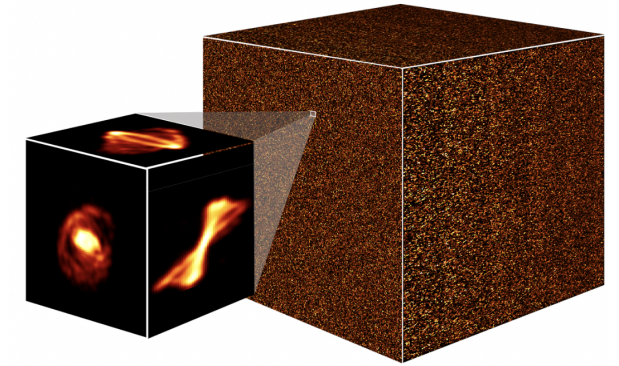
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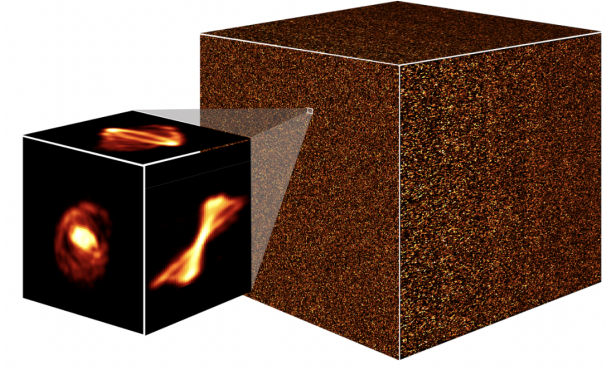
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- WebGL
 - Subset of OpenGL
 - Powerful tool to define 3D scenes
 - More complex to program
 - Some troubles on older machines/mobile browsers

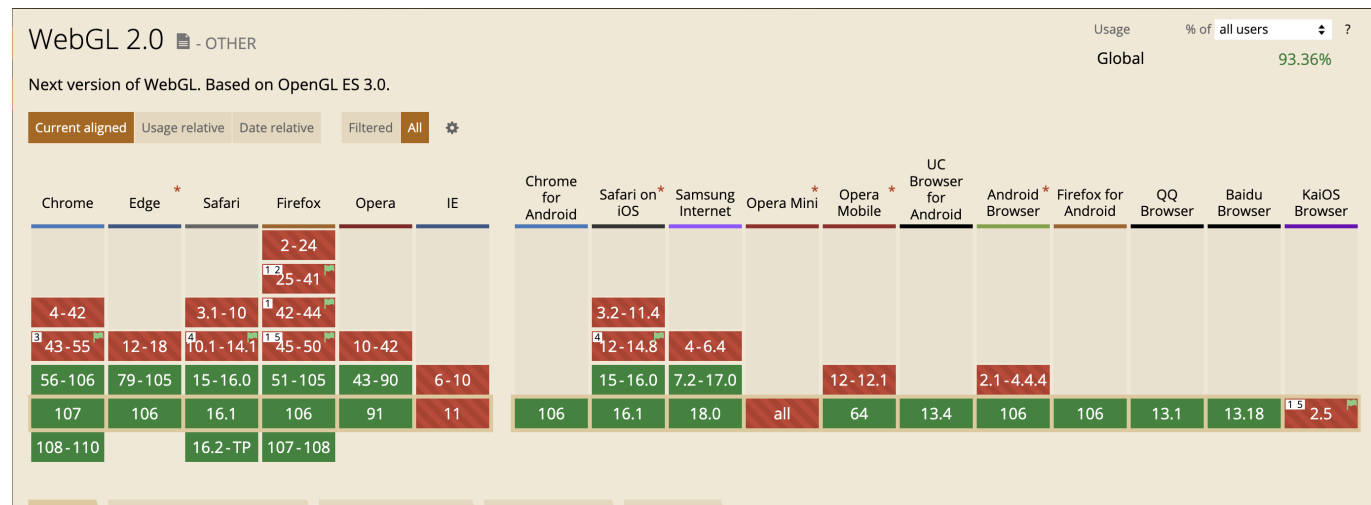
From Aladin Lite presentation, 2013, ADASS



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From caniuse.com, October 2022 (94,4% support in May 2023)

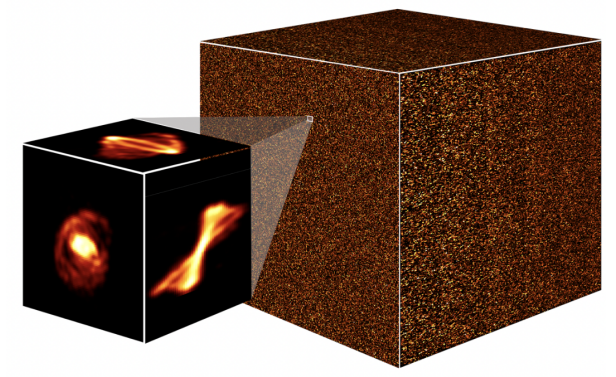
Large Synoptic Survey Telescope (LSST)
Systems Engineering

LSST Science Platform Vision Document

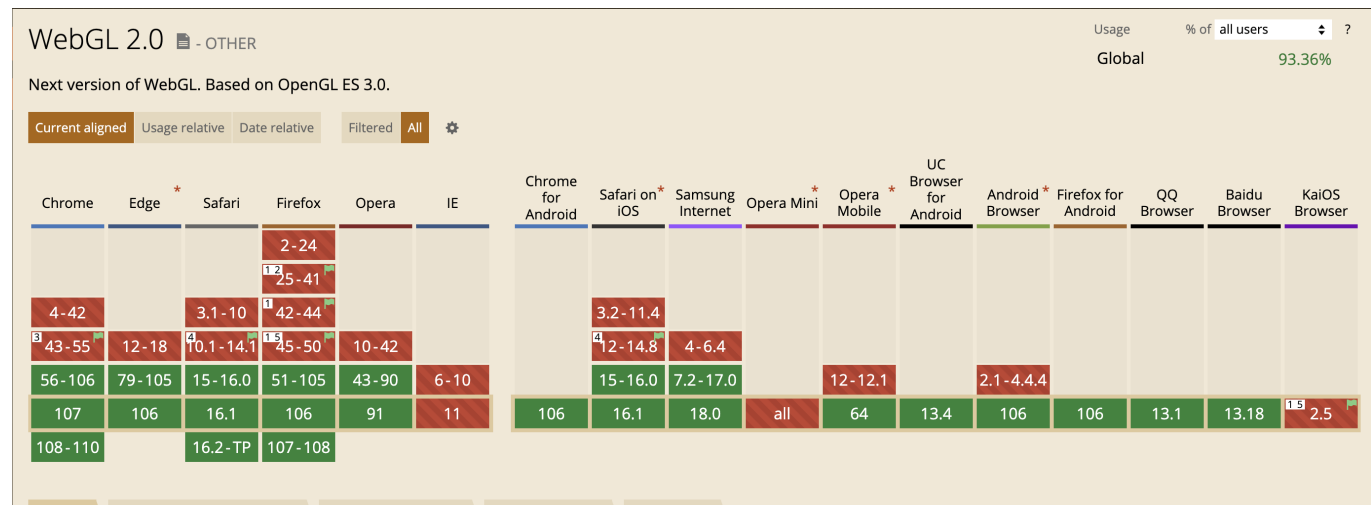
M. Juric, D. Ciardi, G.P. Dubois-Felsmann, L.P. Guy
LSE-319
Latest Revision: 2019-07-24

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- Rust, a new safe, performant system language, can be compiled to WebAssembly easily!

Large Synoptic Survey Telescope (LSST) Systems Engineering

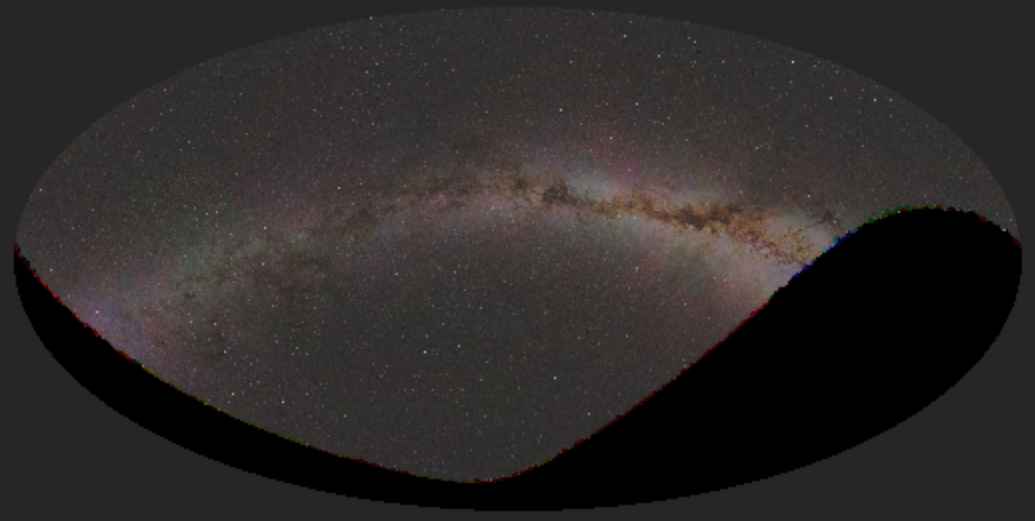
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Aladin Lite v3: The added value





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 - Many all-sky projections support: *Zenithal (Gnomonic, Sinus)*, *Cylindrical (Aitoff, Mollweide)*, *Conic*. (see [mapproj](#) Rust crate)
 - Multiple image survey overlays
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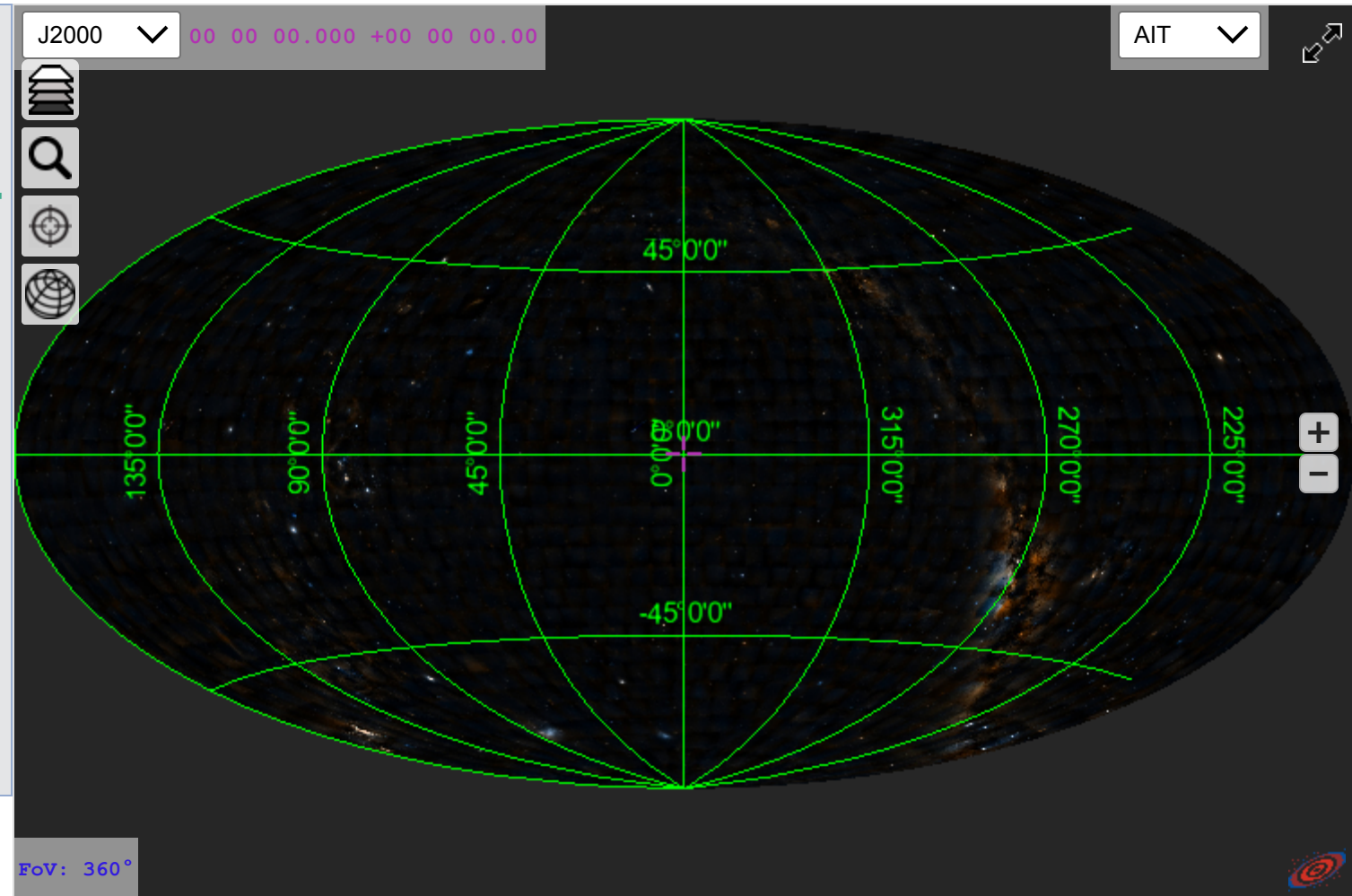
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 - $\sim 500\text{-}600\text{kB}$ for the whole project gzipped and minified, bigger than v2 but same order of magnitude

- Replacing v2 with the **v3** (line 7)
- Remove the need of the CSS and JQuery (they are contained in the aladin lite .js)
- Aladin instantiation wrapped inside a **init** promise (ensuring the WASM file is loaded) (lines 13-20)

```
1 <!doctype html>
2 <html>
3 <head></head>
4 <body>
5 <script type="text/javascript"
6   src="https://aladin.cds.unistra.fr/AladinLite/api/v3/latest/aladin.js"
7   charset="utf-8">
8 </script>
9 <div id="aladin-lite-div" style="width: 500px; height: 400px"></div>
10 <script type="text/javascript">
11   let aladin;
12   A.init.then(() => {
13     aladin = A.aladin('#aladin-lite-div', {
14       fov: 360,
15       projection: "AIT",
16       cooFrame: 'equatorial',
17       showCooGrid: true
18     });
19   });
20 </script>
21 </body>
22 </html>
23
```



- Change the projection: **setProjection**
 - Aitoff, Orthographic, Azimuthal, Mollweide, ...see *Representations of celestial coordinates in FITS*, Calabretta, M. R., Calabretta, M. R. paper
- Turn around the cursor: **setRotation**, zoom in/out: **setFov**, move to a location: **setRaDec**

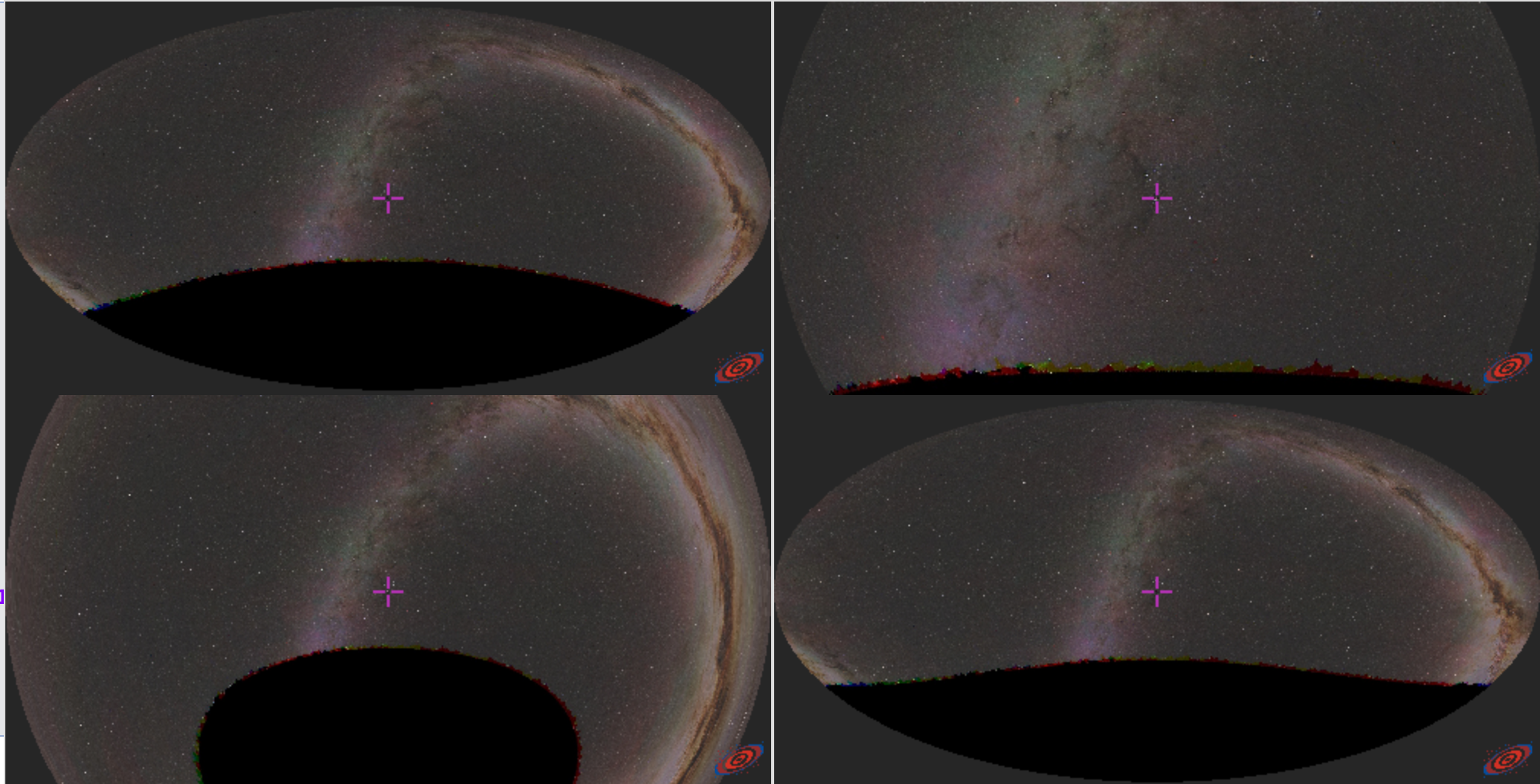
```

A.init.then(() => {
  // Aladin lite instance creation
  let aladin = A.aladin("#als4-a", {
    fov: 360,
    survey: 'PanSTARRS/DR1/color-i-r-g',
    projection: "AIT",
    cooFrame: 'equatorial',
  });

  let rotation = 0;
  // Callback executed every 10ms
  setInterval(() => {
    // Set the rotation around the cursor
    aladin.setRotation(rotation)
    rotation += 0.07;

    const t = Date.now() / 1000;
    let lambda = Math.sin(t/3) * 0.5 + 0.5;
    // lerp between an allsky and a 1deg fov
    const fov = lambda * 360 + (1 - lambda)*1
    // Set the field of view angle
    aladin.setFov(fov);
  }, 10);
});

```

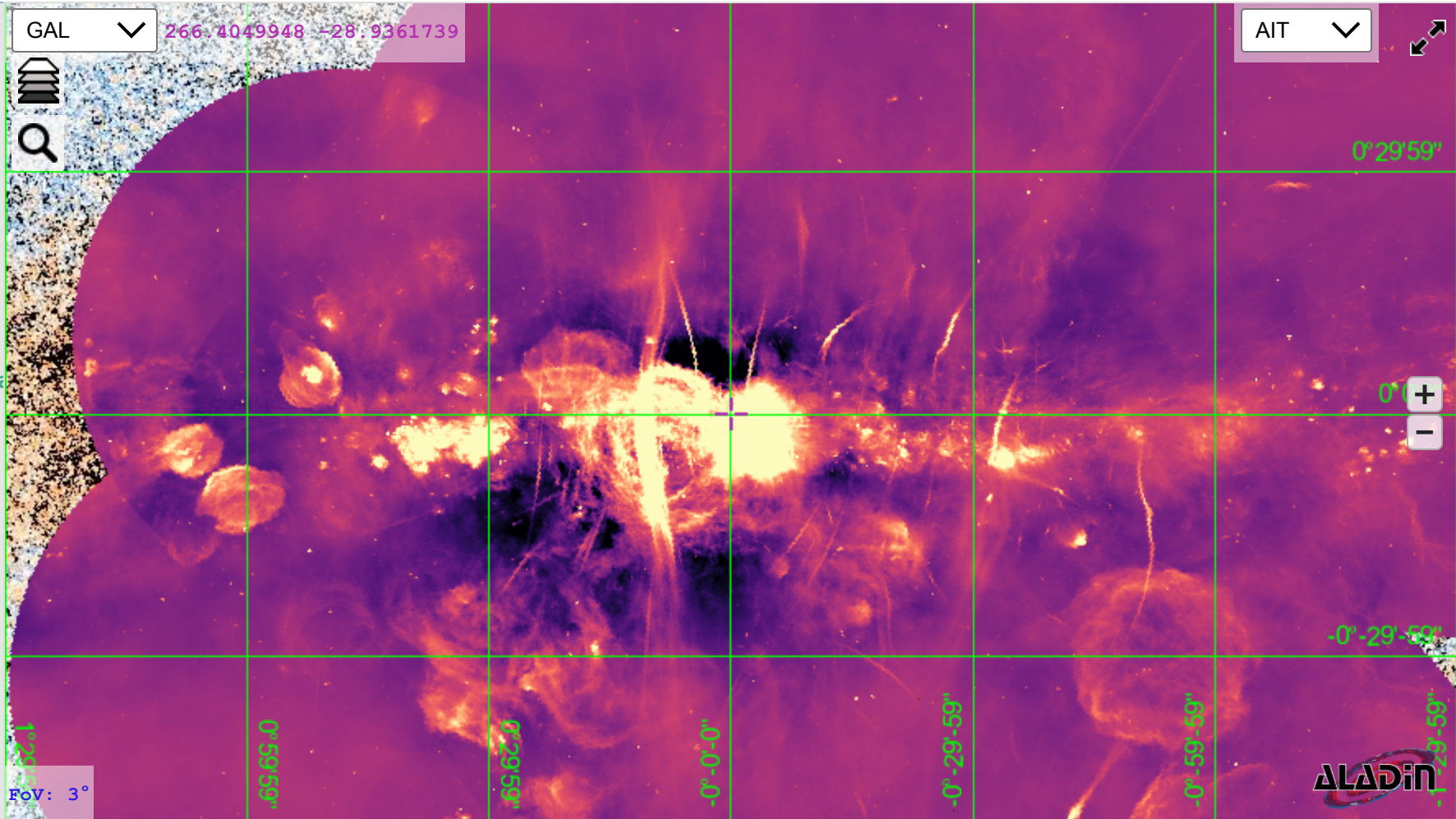


- `Aladin.createImageSurvey` returns an `HpxImageSurvey` object
- New methods are available on it: `setCuts`, `setColormap`, `setOpacity`, `toggle`
- Add multiple overlays with the `Aladin.setOverlayImageLayer` method

```

A.init.then(() => {
  let aladin = A.aladin("#als5", {
    fov: 3,
    survey: 'unWISE/color-W2-W1W2-W1',
    projection: "AIT",
    target: "galactic center",
    showCooGrid: true,
    cooFrame: 'galactic',
  });
  const meerkat = aladin.newImageSurvey(
    // Root url or a give the HiPS ID here
    "https://alasky.cds.unistra.fr/MeerKAT/CDS_P_MeerKAT_Gal",
    // A set of options
    { imgFormat: 'fits' }
  );
  meerkat.setColormap('magma', {stretch: "Asinh"});
  meerkat.setOpacity(1.0);
  setInterval(() => {
    const t = Date.now() / 1000;
    let lambda = Math.sin(t) * 0.5 + 0.5;
    let cut0 = -0.0004 * lambda + (1 - lambda) * -0.00132;
    let cut1 = 0.001 * lambda + (1 - lambda) * 0.05759;
    meerkat.setCuts(cut0, cut1);
  }, 10)
  // Add an image survey layer by passing the HpxImageSurvey

```



- Catalog overlays API: `A.catalog`, `Catalog.addSources`, `Aladin.addCatalog`
- `longitudeReversed` optional keyword: reverse the longitude axe for planetary surveys
- **New: planetary name resolver (ref T. Boch Solar System talk)!**. Demo available: [here](#)

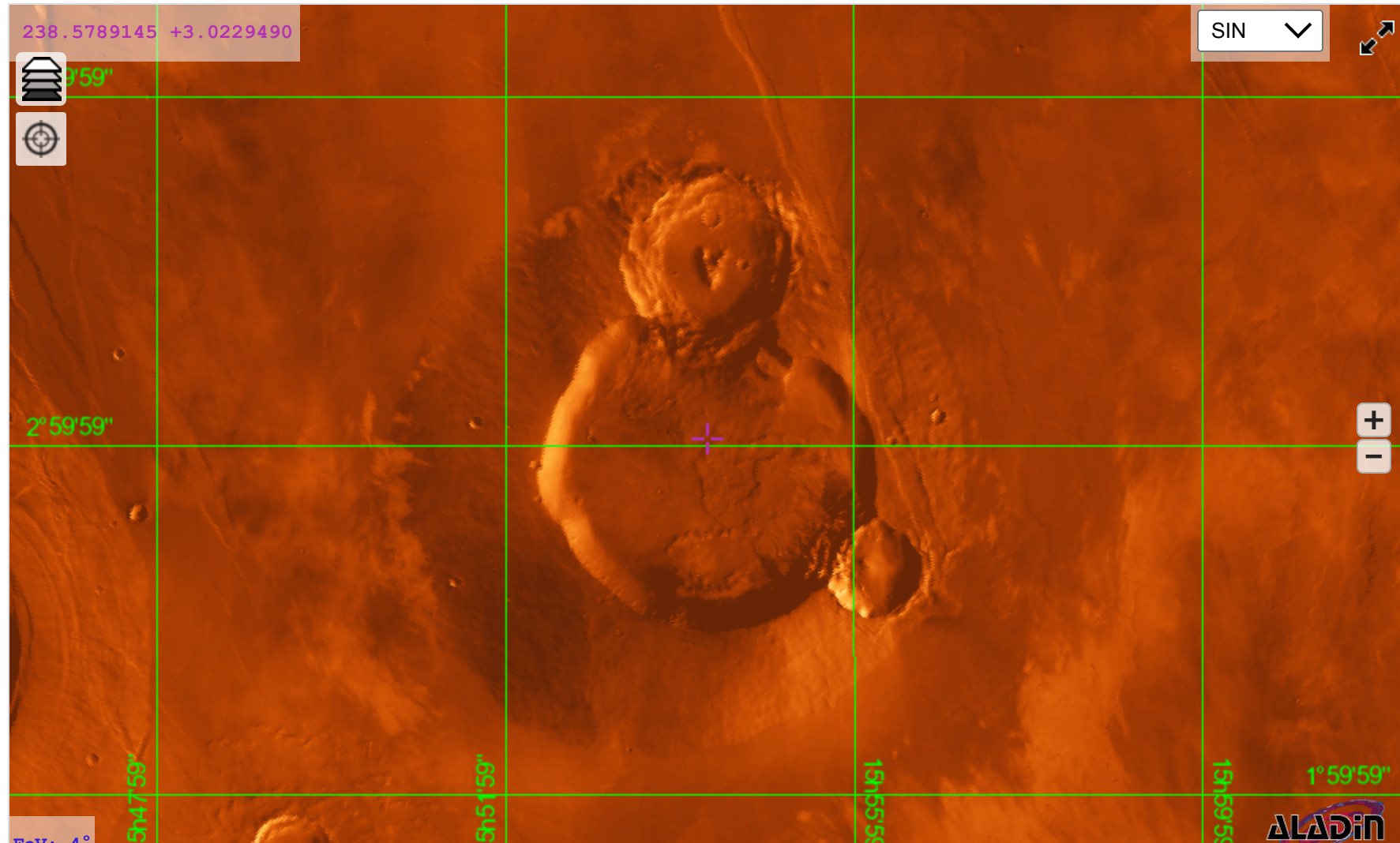
```

A.init.then(() => {
  let aladin = A.aladin('#al-mars-ctx', {
    fov: 40,
    target: '224.5386832 +39.1539126',
    cooFrame: 'j2000d',
    showFrame: false
  });
  var mars = alMarsCtx.newImageSurvey(
    'CDS/P/Mars/MRO-CTX',
    {imgFormat: "fits", longitudeReversed: true}
  );
  aladin.setImageSurvey(mars);

  mars.setColormap("ylorbr");
  mars.setCuts(1, 145);

  var geoFeatures = A.catalog({
    shape: (() => {
      var c = document.createElement('canvas');
      c.width = c.height = 11;
      var ctx = c.getContext('2d');
      ctx.beginPath();
      ctx.arc(5, 5, 4, 0, 2 * Math.PI, false);
      ctx.closePath();
      ctx.strokeStyle = '#ccc';
      ctx.lineWidth = 2;
    })
  });

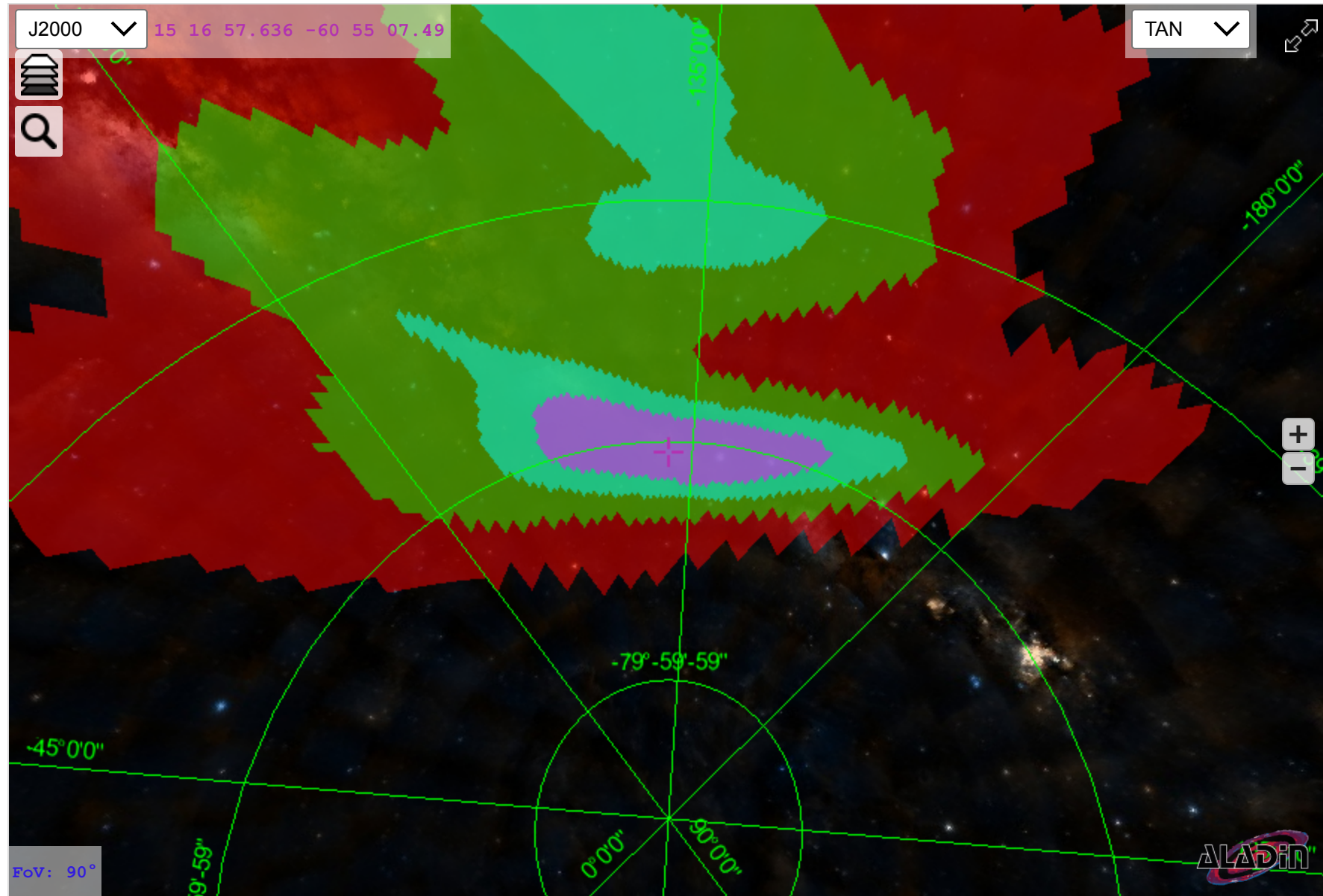
```



Probability confidence region plots of gravitational waves. Credits to [ESCAPE EGO/VIRGO](#) partner G. Greco

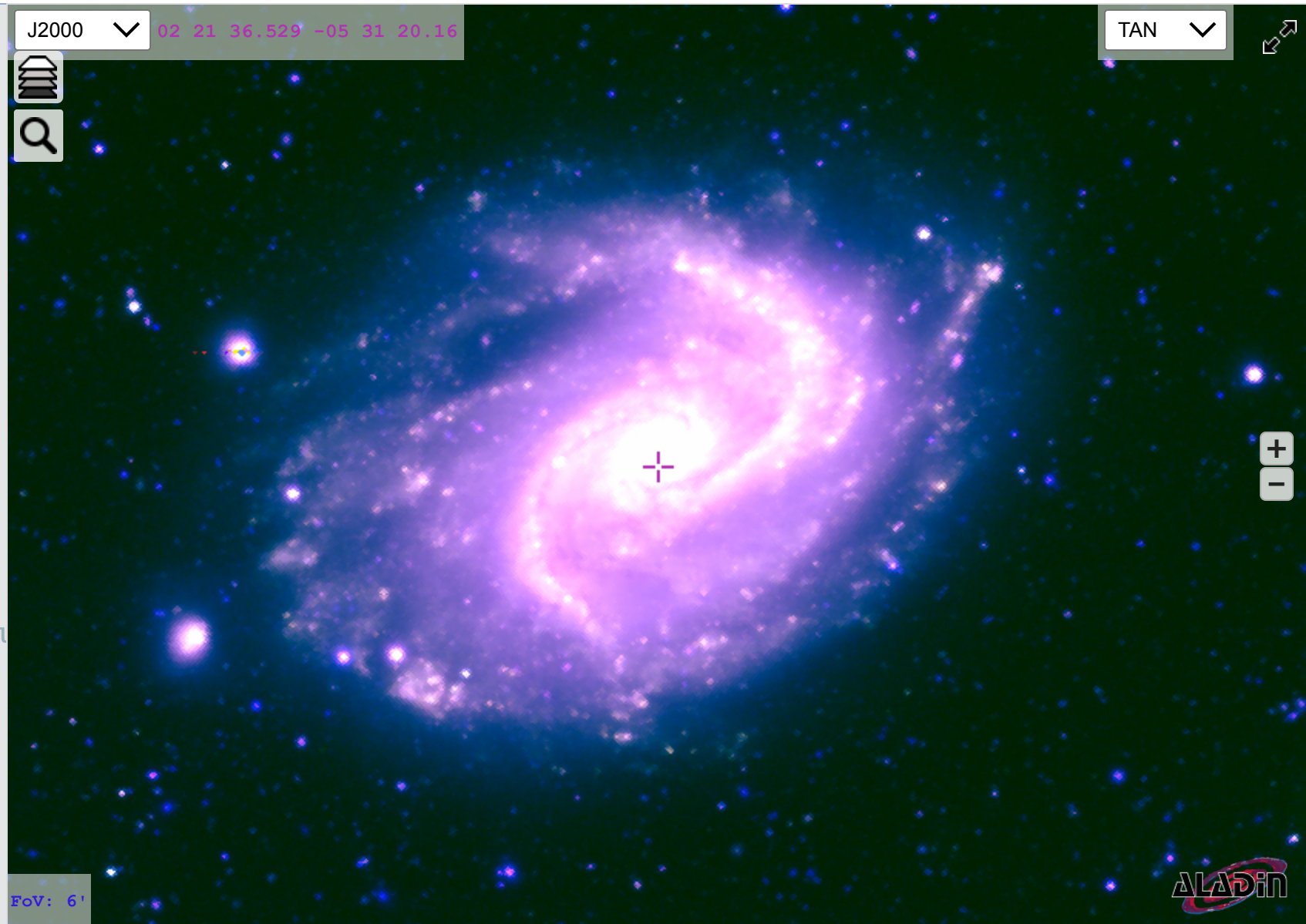
```
A.init.then(() => {
  let aladin = A.aladin('#al-moc-gw', {
    projection: "TAN",
    target: '15 16 57.636 -60 55 7.49',
    showCooGrid: true,
    fov: 90
  });

  aladin.addMOC(A.MOCFromURL("./img/gw_0.9.fits", {
    name: "GW 90%",
    color: "#ff0000",
    opacity: 0.5, lineWidth: 1,
    // Useful for moc containing lots of HPX cells
    adaptativeDisplay: true
  }));
  aladin.addMOC(A.MOCFromURL("./img/gw_0.6.fits", {
    name: "GW 60%",
    color: "#00ff00",
    opacity: 0.5, lineWidth: 1,
    adaptativeDisplay: true
  }));
  aladin.addMOC(A.MOCFromURL("./img/gw_0.3.fits",{
    name: "GW 30%",
    color: "#00ffff",
    opacity: 0.5, lineWidth: 1, adaptativeDisplay: false
  }));
  // ...
});
```



Add the colors of multiple image surveys together, with the optional **additive** keyword

```
A.init.then(() => {  
  let aladin = A.aladin('#aladin-lite-div', {  
    projection: "TAN",  
    survey: "P/HSC/DR2/deep/g",  
    target: '02 21 36.529 -05 31 20.16',  
    fov: 0.1  
  });  
  
  // Get the base layer  
  let hsc_g = aladin.getBaseImageLayer();  
  // Tell we want the FITS tiles  
  hsc_g.changeImageFormat("fits");  
  // Map it to a color  
  hsc_g.setColormap("green", { stretch: "asinh" });  
  
  const hsc_r = aladin.createImageSurvey(  
    'CDS/P/HSC/DR2/deep/r', // ID or the hips  
    'HSC red', // Name of the layer  
    null, // root url, here we give the HiPS ID instead  
    null, // frame, will be parsed from the properties HiPS file  
    null, // maxOrder, will be parsed from the properties HiPS file  
    {  
      imgFormat: 'fits',  
      colormap: "red",  
      minCut: 0.34228, maxCut: 2.75785,  
      additive: true,  
      stretch: "asinh"  
    }  
  );  
});
```





Available through a **jupyter notebook python API**

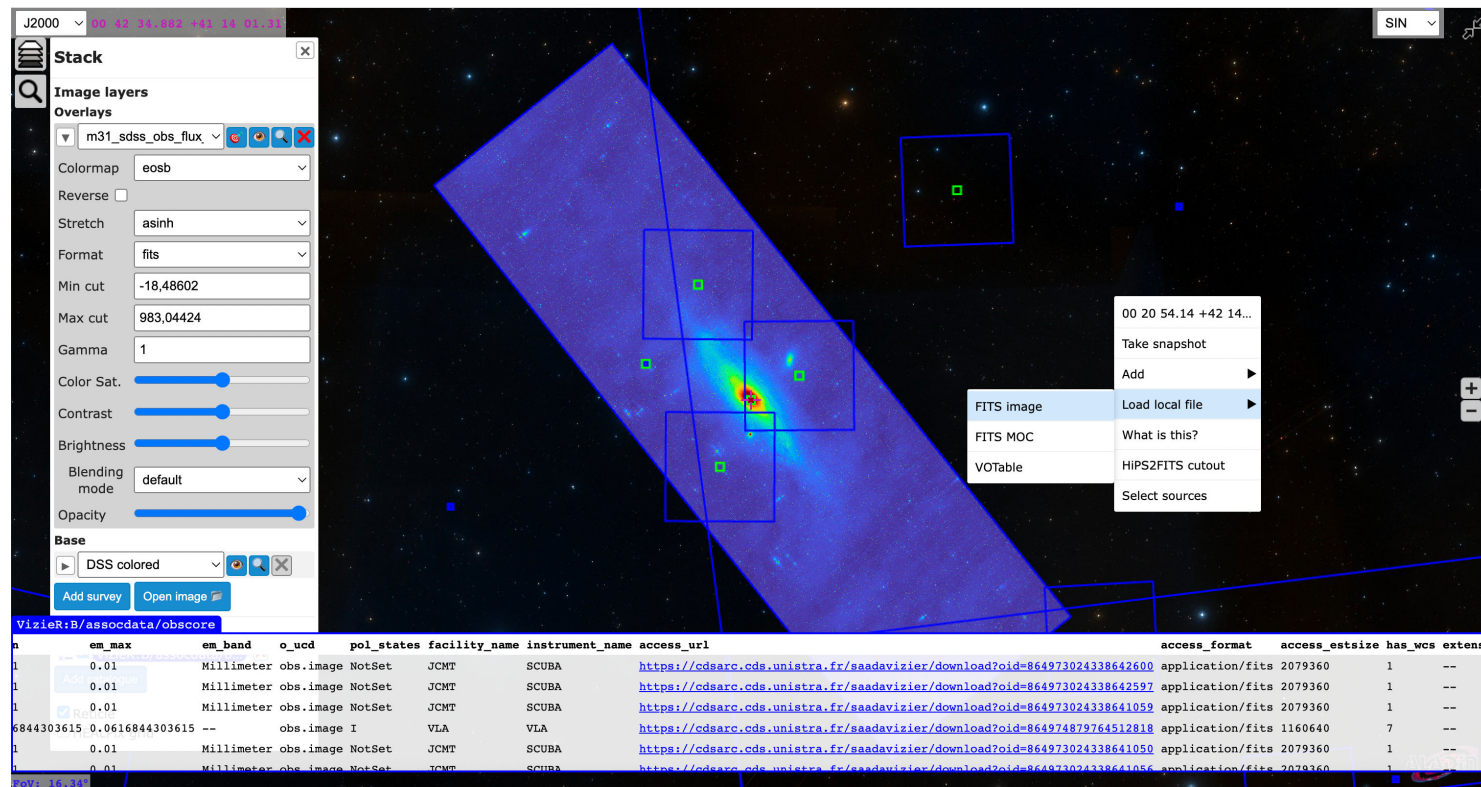


- ObsCore support:
 - Plot the STCS footprints located in the `s_region` field
 - `access_format` specific actions:
 - ``application/fits``, ``image/fits``: tries to parse the FITS and add it to the view
 - ``application/x-votable+xml;content=datalink`` downloads the datalink VOTable and displays all of its rows
 - Other `access_format` values triggers a download of the file.
- Very basic Datalink support
 - Possibility to go back to the ObsCore table
 - `access_url` specific actions:
 - ``application/hips``: adds a new survey to the view
 - ``application/fits``, ``image/fits``: tries to parse the FITS and add it to the view
 - Other `content_type` values triggers a download of the file.

following

- VOTable new full Rust parser
 - Developed at CDS (See *F.-X. Pineau talk*)
 - Enables new possible future improvements:
 - Parses VOTable containing **binary data** - *Not implemented yet in AL*
 - Parses a votable from a **ReadableStream** JS object - *Not implemented yet, needs an async version of the parser*
 - We encountered some issues [here](#)
 - The usage of **DEFINITIONS** is deprecated since 1.1 version but it was not clear if 1.2-1.4 votables are still valid if they contain it. Only looking at the .xsd certified us that it is.
- Demo available: [here](#)

- Relies on low-level Rust crates developed at CDS:
 - FITS image extension (and async!) parser: [fitsrs](#)
 - Zenithal/Cylindrical/Conic projections with SIP support: [mapproj](#)
 - A WCS library doing the bridge between [fitsrs](#) and [mapproj](#): [wcs](#)
- Demo available: [here](#)



The screenshot displays the VizieR interface for a FITS image. The main view shows a star field with a large blue rectangular region of interest. A control panel on the left allows for image manipulation, and a data table at the bottom lists the image's properties and associated data.

Stack Panel:

- Image layers: m31_sdss_obs_flux
- Overlays: eosb
- Reverse:
- Stretch: asinh
- Format: fits
- Min cut: -18,48602
- Max cut: 983,04424
- Gamma: 1
- Color Sat.:
- Contrast:
- Brightness:
- Blending mode: default
- Opacity:
- Base: DSS colored
- Buttons: Add survey, Open image

Data Table:

em_max	em_band	o_ucd	pol_states	facility_name	instrument_name	access_url	access_format	access_estsize	has_wcs	extensi
0.01	Millimeter	obs.image	NotSet	JCMT	SCUBA	https://cdsarc.cds.unistra.fr/saadavizier/download?oid=864973024338642600	application/fits	2079360	1	--
0.01	Millimeter	obs.image	NotSet	JCMT	SCUBA	https://cdsarc.cds.unistra.fr/saadavizier/download?oid=864973024338642597	application/fits	2079360	1	--
0.01	Millimeter	obs.image	NotSet	JCMT	SCUBA	https://cdsarc.cds.unistra.fr/saadavizier/download?oid=864973024338641059	application/fits	2079360	1	--
6844303615	0.0616844303615	--	obs.image I	VLA	VLA	https://cdsarc.cds.unistra.fr/saadavizier/download?oid=864974879764512818	application/fits	1160640	7	--
0.01	Millimeter	obs.image	NotSet	JCMT	SCUBA	https://cdsarc.cds.unistra.fr/saadavizier/download?oid=864973024338641050	application/fits	2079360	1	--
0.01	Millimeter	obs.image	NotSet	JCMT	SCUBA	https://cdsarc.cds.unistra.fr/saadavizier/download?oid=864973024338641056	application/fits	2079360	1	--

- Limitations (and there are!):
 - Only 2D images, cubes are not supported (display only the first slice)
 - FITS image must contain proper WCS keywords following [Representations of celestial coordinates in FITS](#), Calabretta, M. R., Calabretta, M. R. paper
 - CORS headers are often missing and it raises really hard time thinking and development for us:
 - Issue when getting a stream from our CORS proxy: [here](#)
 - Using a proxy usually slows down the download drastically.
 - GPU does not accept non CORS-trusted data! Less permissive as drawing into the JS canvas
 - For the moment, images not CORS-trusted are not accepted! We are working on workarounds (using proxy) but please, if possible, enable your CORS headers!
 - Up to a few gigabytes (3-4 GB FITS files max)
 - **...you are very welcome to test it with your own files and give us your errors**
 - **Aladin Lite previewer: <https://aladin.cds.unistra.fr/AladinLite/>**



Some last words



- Aladin Lite v3 is available

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 - You now have [instructions](#) how to use it
 - And how to [embed it](#)


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 - On the [official Aladin Lite repository](#)

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 - On the [official Aladin Lite repository](#)
- Development continues
 - FITS general image support, WCS parser & analyser, cubes - *never ending work*
 - Cube rendering support in the frame of SKA Science Region Centre visualization prototyping
 - OpenGL graphical rendering backend for making it a desktop application
 - Looking forward releasing a google play/apple store app

- The Aladin portal: <https://aladin.u-strasbg.fr/AladinLite/>
- Aladin Lite [documentation](#) (News, API, snippet examples)
- Link to the slides <https://aladin.u-strasbg.fr/AladinLite/IVOA2023> for you to play with it
- Our contact
 - By mail at: cds-question@unistra.fr
 - On the [official Aladin Lite repository](#)
- DOI link:  [DOI](#)

Thank you!

