Feedback on generating very large HiPS for PanSTARRS and HiPS from Gaia DR2 catalogue

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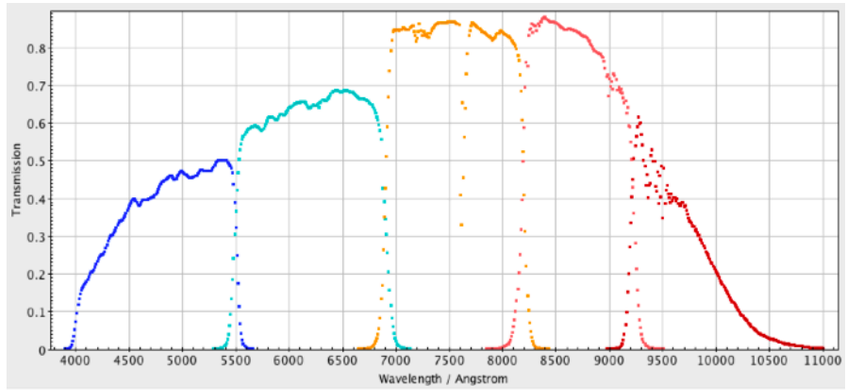
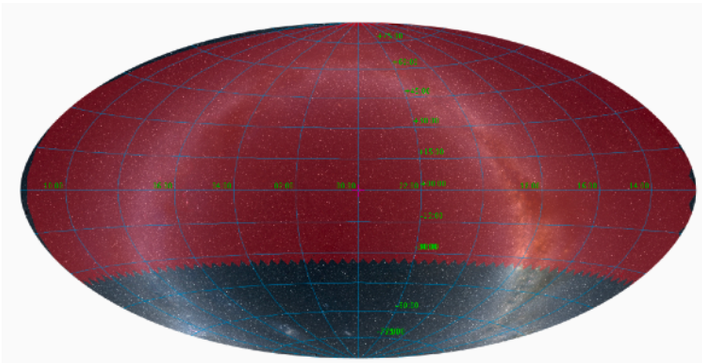
PanSTARRS HiPS (1/4)





- Pan-STARRS PS1 images
  - 5 bands: g, r, i, z, y
  - coverage: 3/4 of the sky
  - *Rice* compressed
  - resolution: 0.25"/pixel
  - 15 TB per band
- HiPS generation
  - resolution: 200 mas (HEALPix order 20)
  - with 512x512 tiles: 47 million tiles to be generated
  - 10 trillion pixels per band

PanSTARRS HiPS (2/4)

- Pan-STARRS *band g* HiPS creation process
  - download from STScI (Thanks to C. Brasseur et T. Donaldson)
  - uncompress (in parallel)
  - FITS tiles generation (with Hipsgen)
  - JPEG tiles generation (with Hipsgen)
  - transfer on production machine
    - slow: 12 MB/s —> 1 TB/day
- HiPS total size: 25TB
  - splitted across two 15TB disks
  - many symbolic links
    - not convenient
    - error prone

PanSTARRS HiPS (3/4)

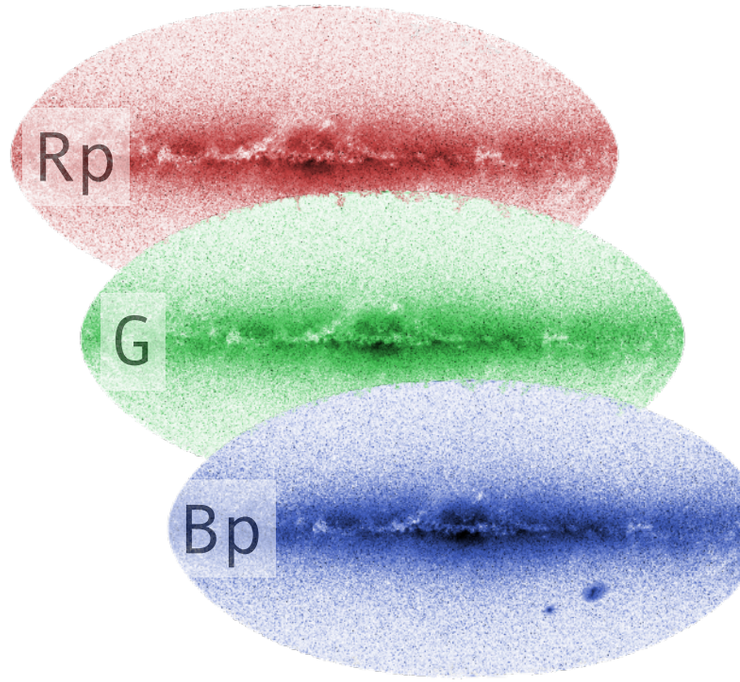
- Improvement for Pan-STARRS *band z* HiPS generation
  - download from STScI
  - direct generation of FITS tiles from *Hipsgen*
    - no longer need to uncompress Rice FITS images
  - **parsync** for file transfer - parallel rsync wrapper
    - 8 to 12-fold improvement: 80 to 120 MB/
  - transferred on one 25TB disk
  - JPEG tiles created on the fly
    - Python service
    - Apache rewrite rule
    - under test and evaluation

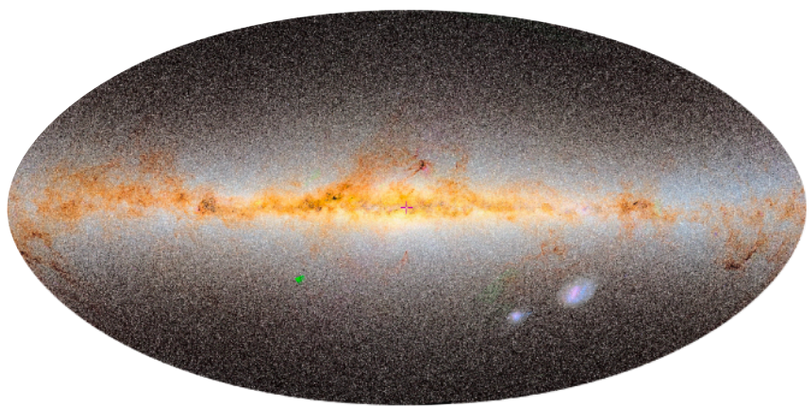
PanSTARRS HiPS (4/4)

- PanSTARRS color HiPS
  - **z** **0.5(z+g)** **g**
  - tiles generated by Python script
    - Lupton-like *arcsinh* stretch to maximize contrast
    - different parameters for small and large scales
- no control on JPEG quality from Python script
  - ImageMagick `convert` command-line tool to reprocess and reduce JPEG size
- demonstration
  - http://aladin.unistra.fr/AladinLite/showcase/PanSTARRS-DR1/

Gaia DR2 flux map

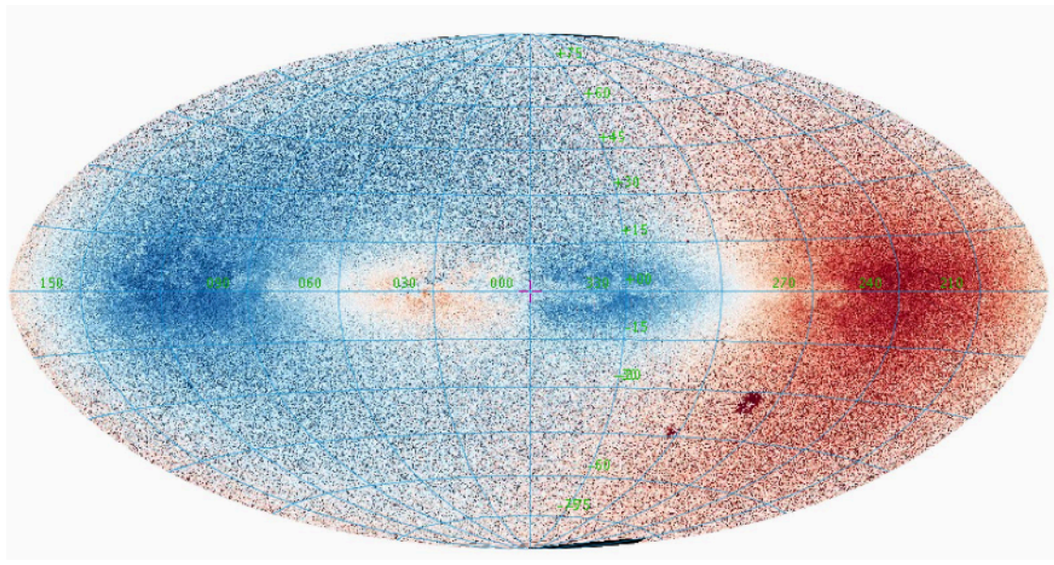
- HEALPix map for each band (integrated flux, weighted density map)
  - generated with *healpy* at `NSIDE=8192`
    - initial tests with Java unsuccessful:
      unable to create a 800 million items float array
  - map converted to HiPS with Hipsgen (order: 4)
  - alternative approach: generate individual G from TAP request
    - ```
      SELECT HEALPIX(ra, dec, 5+9) AS ipix,
      SUM(phot_g_mean_flux) as g, SUM(phot_bp_mean_flux)
      as b, SUM(phot_rp_mean_flux) as r
      FROM "I/345/gaia2"
      WHERE HEALPIX(ra, dec, 5)= 42
      GROUP BY ipix
      ```
- Color tiles
  - G, Rp, Bp bands map to green, red and blue channels
  - Python script with Lupton-like stretch to maximize contrast
- Demonstration




      ```

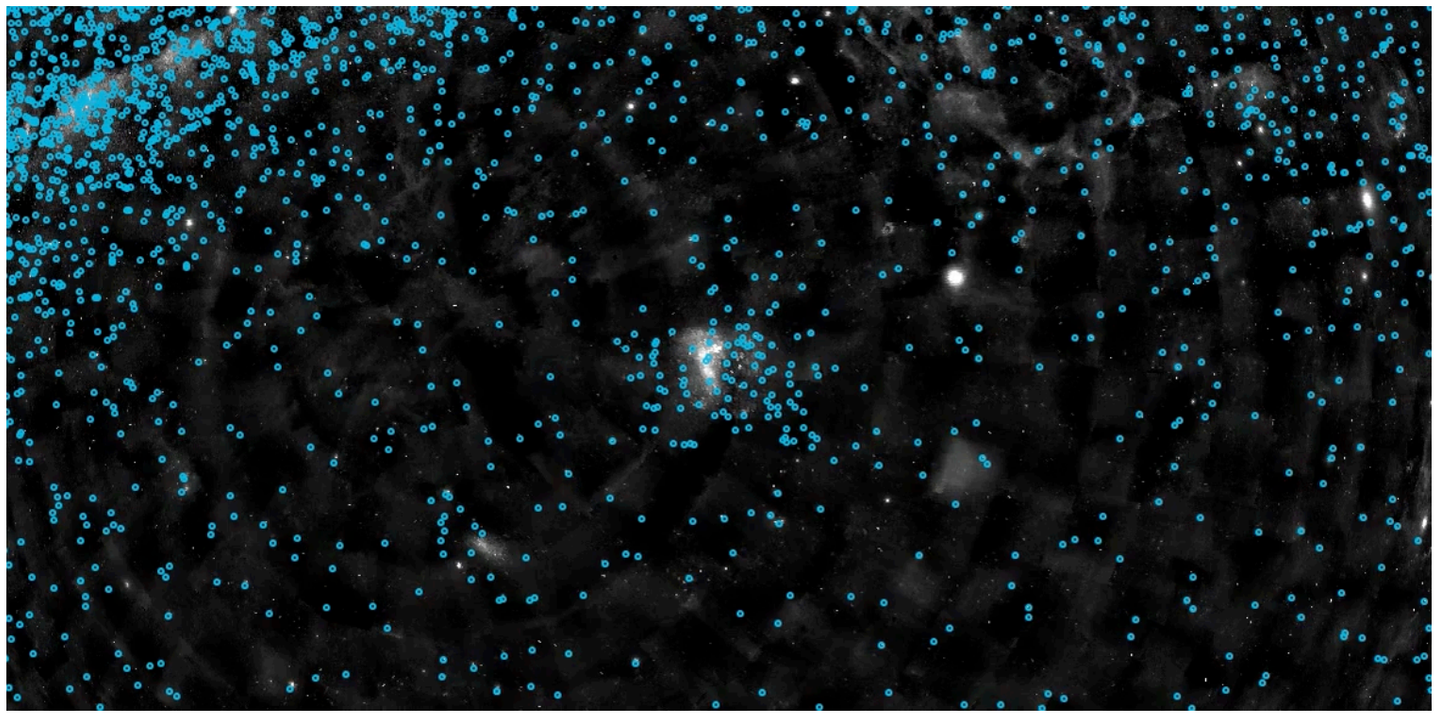
Gaia DR2 velocity map

- Median velocity computed for each HEALPix pixel
- Hipsgen to generate HiPS FITS tiles from HEALPix map
- Python script to generate JPEG tiles
  - matplotlib *RdBu* (red to blue) color map



Gaia DR2 HiPS catalogue

- Progressive view
  - large FoV: show brightest sources
  - zoom in: fainter sources appear
- ad-hoc binary format
- HiPS tiles served by Tomcat application
- http://cds.unistra.fr/Gaia/DR2/AL-visualisation.gml



Conclusion

- Generation of HiPS for large images surveys takes some time
  - Total generation time has decreased
    - Hipsgen improvement
    - *parsync* to transfer tiles
    - generation of JPEG tiles on the fly
- HiPS images useful tool for catalogues too
- Next steps:
  - dynamic generation of HiPS tiles for any catalogue for any parameter
  - hybrid HiPS parameter map / HiPS catalogue