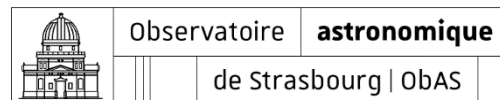


First temporal HiPS3D

Görlitz – IVOA Interop Oct 2025

Pierre Fernique, Thomas Boch
Mark Allen, Matthieu Bauman,
Caroline Bot, François-Xavier Pineau

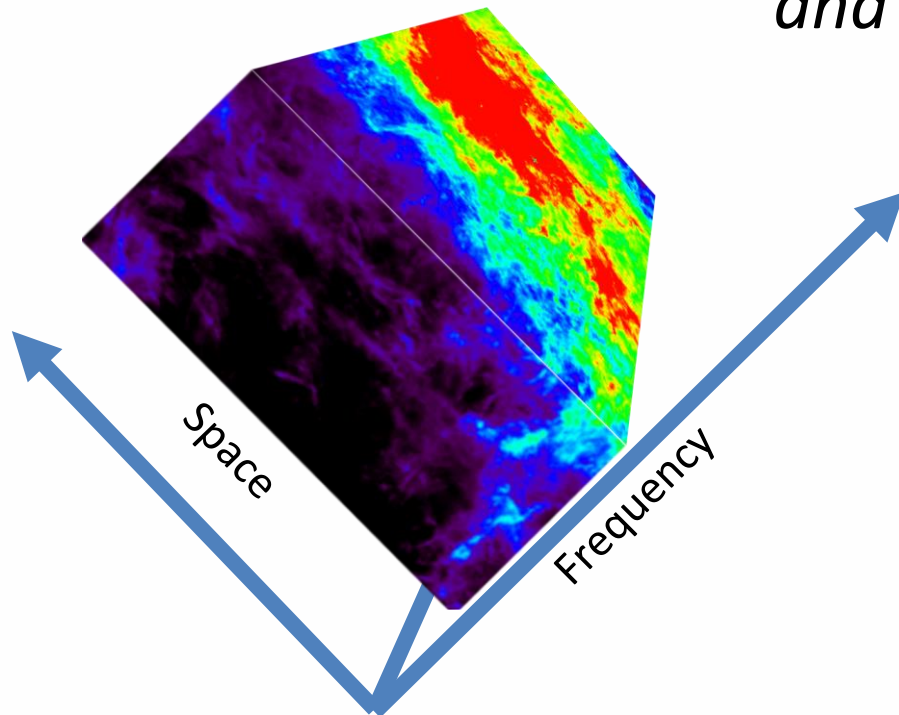


□ HiPS3D idea reminder



*Extend the current HiPS towards a **HiPS 3D***

*i.e. use a **hierarchical partition in each physical dimension**
and based on absolute physical units
and reference frames.*



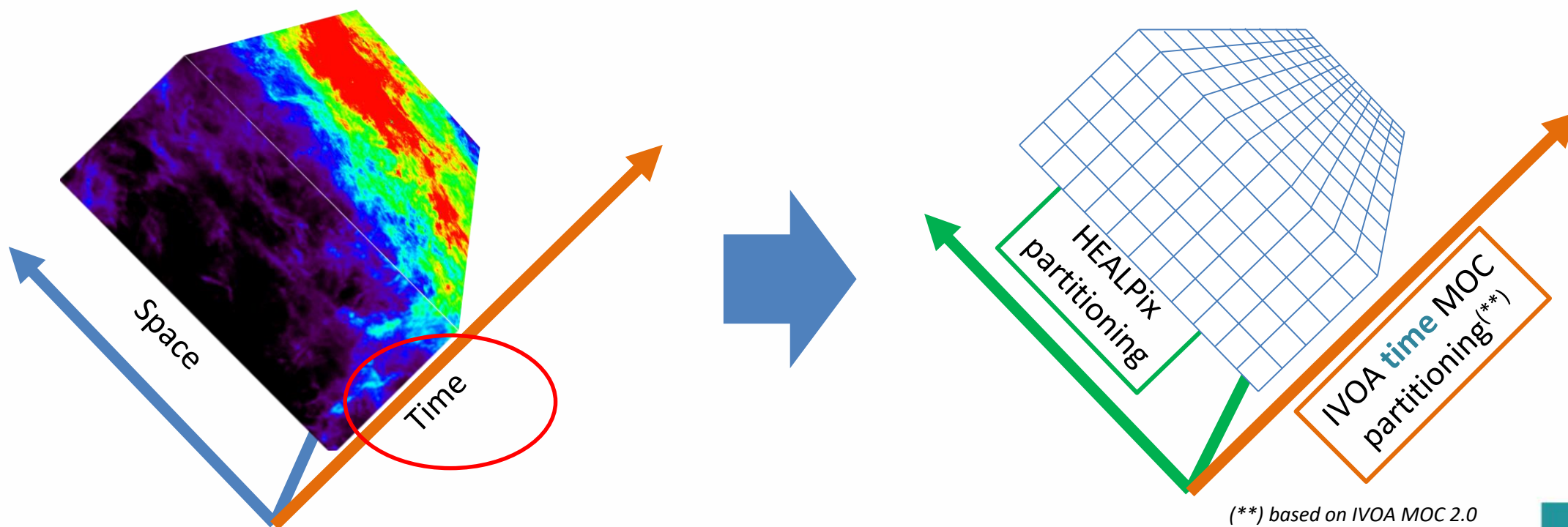
Successfully tested on **spatio-frequency**
cube collections
-> See ADASS talk



□ What about Time axis ?



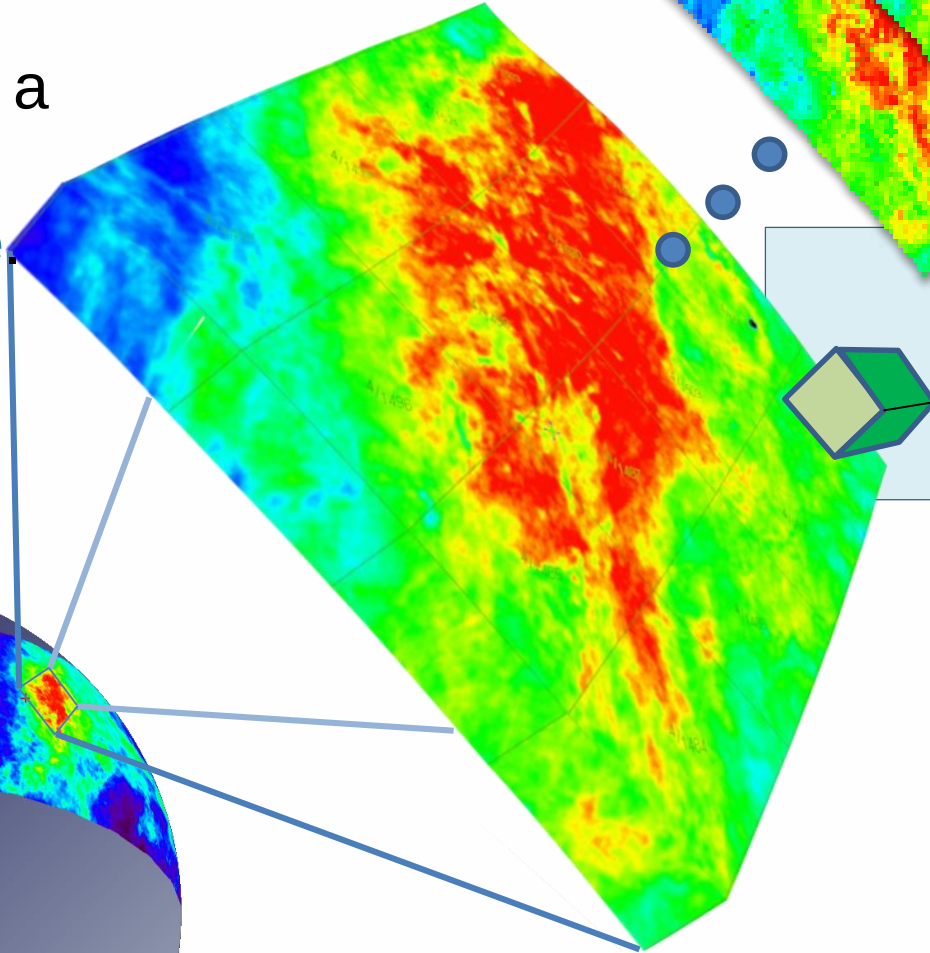
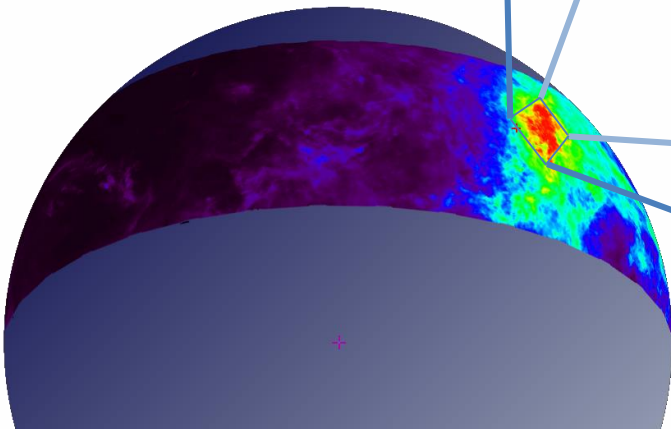
*We could reuse the same idea
for a time axis instead of a frequency axis.*



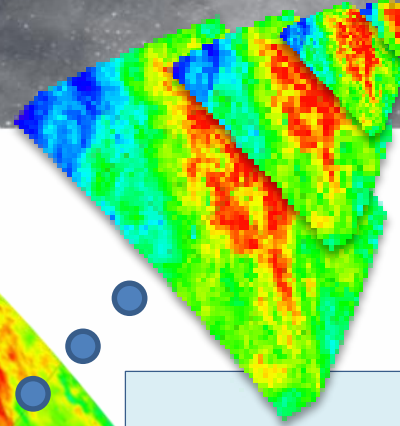
(**) based on IVOA MOC 2.0

□ In other words...

1. We **discretize** a sphere whose thickness is **time**.



2. And do this at **several resolutions**



Each 3D pixel in the pyramid has a unique HiPS3D address:
(OrderS/NpixS_OrderT/NpixT)

HEALPix
partitioning

IVOA time MOC
partitioning

□ “Just to see how it goes”

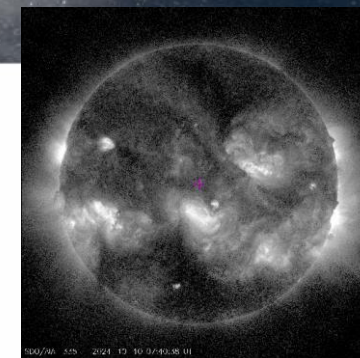
How to see what HiPS3D could do with **spatio-temporal** collections, without starting any specific development:

1. **Create FITS cubes** where the third dimension stacks temporal observations;
2. Include in these cubes **a “mock” frequency calibration** instead of a time calibration (not yet implemented);
3. **Generate a HiPS3D** from these cubes;
4. See **how the visualization method works** on this HiPS3D
5. **Do not worry about the unit** displayed (which will be in frequency rather than time)

□ A few trials...

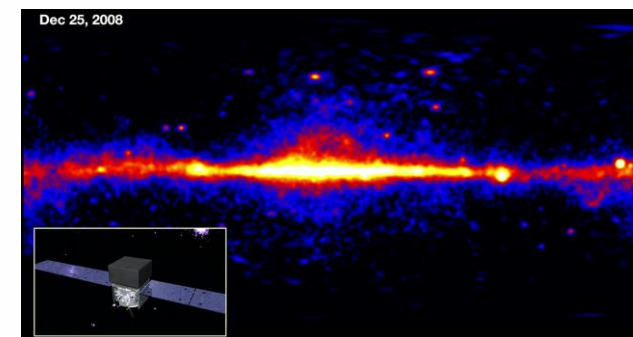
1. A few hours Solar observations

- Retrieval of 500 images of the Sun taken every 10mn [T.Boch]
- From these images, creation of a FITS cube with appropriate “mock” calibration
- Generation of a HiPS3D by Hipsgen



2. 17 years of FERMI observations

- Retrieval of an educational video covering 17 years of FERMI emissions in Cartesian projection [thanks J. Racusin]
- Split into 8,700 individual frames by ffmpeg
- From these frames, creation of 8 FITS cubes of 2GB, with appropriate “mock” calibration
- Generation of a HiPS3D by Hipsgen

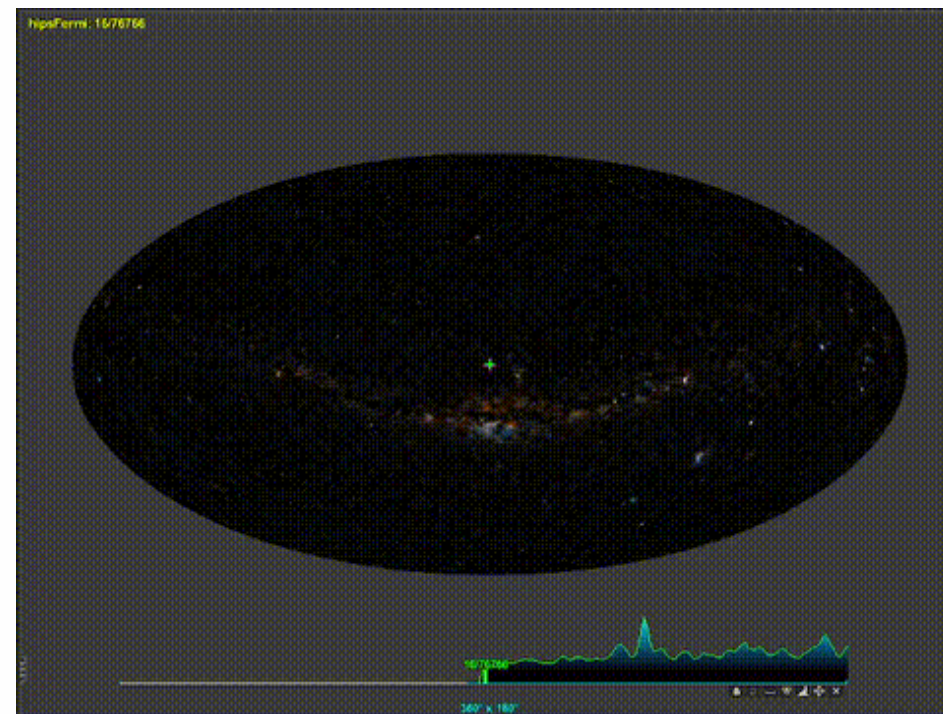


3. 10 years of MARCI Mars observations

- Retrieval of 3600 images of the Mars taken every day [T.Boch]
- Same process than 1

□ Live demonstration

- **Time HiPS3D distributed** by an HiPS node localized at **Strasbourg**/France
- Local client demonstration:
 - FERMI In **Aladin Desktop** [P.Fernique]
 - MARCI In **Aladin Lite** [T.Boch]



□ Lessons learnt

- It **works surprisingly well**. At least on these kind of observations
- The **zoom out actually highlights movements** (degradation of spatial and temporal resolutions through averaging - stroboscopic effect/blurring mentally associated with movement).
- But **we need more tests**, notably on **short event observations**
- The success of these tests convinced us that the specific **developments for time HiPS3D will be useful**.



Let's do it!

