3D2008 Workshop – ESO – Garching – 12 Jun 2008

Visualisation and analysis of 3D datasets in the Virtual Observatory

follow-up of the talks at ADASS-2005 and Spec&VO-2007

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Introduction: what VO is

- Virtual Observatory is a concept of providing transparent access to astronomical data and data analysis tools
- The main mission of the VO is to increase scientific output of astronomical data
- The Rosetta stone of the VO is ***interoperability*** — that's what IVOA is responsible for
- The success of the VO will be its entire transparency for scientific users

3 Cornerstones for 3D data in VO

1. Data Model
2. Data Access Services
3. Client Applications

Characterisation DM

The basic part of the most general data model: Observation DM
Provides a physical characterisation of a dataset

Level 1	Coverage	Resolution	Sampling
Spatial (pos)	Location	Ref.Value	Ref.Value
Temporal (time)	Location	Ref.Value	Ref.Value
Spectral (em)	Location	Ref.Value	Ref.Value
Observable (phot)	Location	Ref.Value	Ref.Value

Characterisation DM

The basic part of the most general data model: Observation DM
Provides a physical characterisation of a dataset

Level 1	Coverage	Resolution	Sampling

Level 2	Coverage	Resolution	Sampling
Spatial (pos)	Bounds	Bounds	Bounds
Temporal (time)	Bounds	Bounds	Bounds
Spectral (em)	Bounds	Bounds	Bounds
Observable (phot)	Bounds	Bounds	Bounds

Characterisation DM

The basic part of the most general data model: Observation DM
Provides a physical characterisation of a dataset

Level 1	Coverage	Resolution	Sampling

Level 2	Coverage	Resolution	Sampling

Level 3	Coverage	Resolution	Sampling
Spatial (pos)	Support	Support	Support
Temporal (time)	Support	Support	Support
Spectral (em)	Support	Support	Support
Observable (phot)	Support	Support	Support

Characterisation DM

The basic part of the most general data model: Observation DM
Provides a physical characterisation of a dataset

Level 1	Coverage	Resolution	Sampling

Level 2	Coverage	Resolution	Sampling

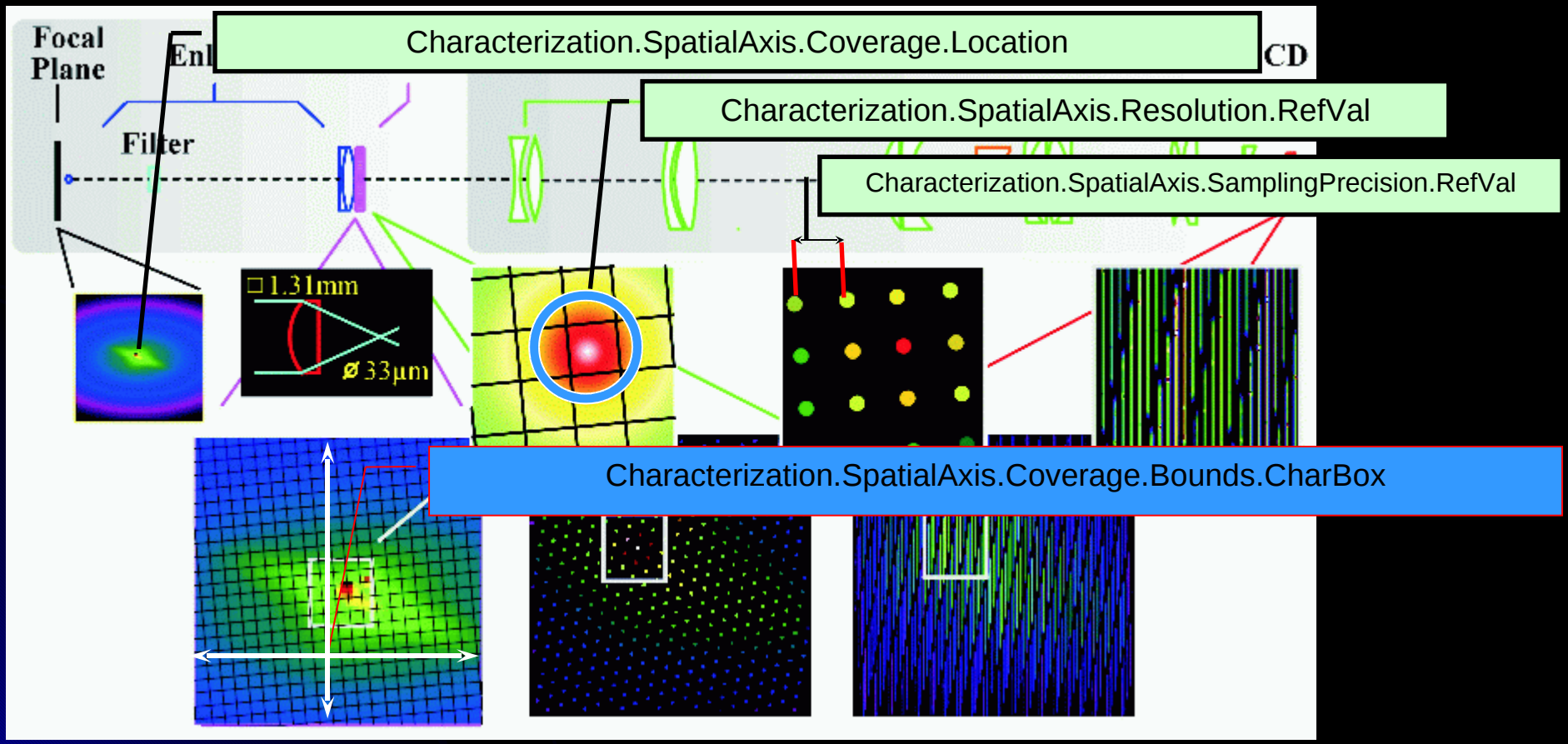
Level 3	Coverage	Resolution	Sampling

Level 4	Coverage	Resolution	Sampling
Spatial (pos)	Map	Map	Map
Temporal (time)	Map	Map	Map
Spectral (em)	Map	Map	Map
Observable (phot)	Map	Map	Map

Characterisation Data Model is an IVOA Recommendation

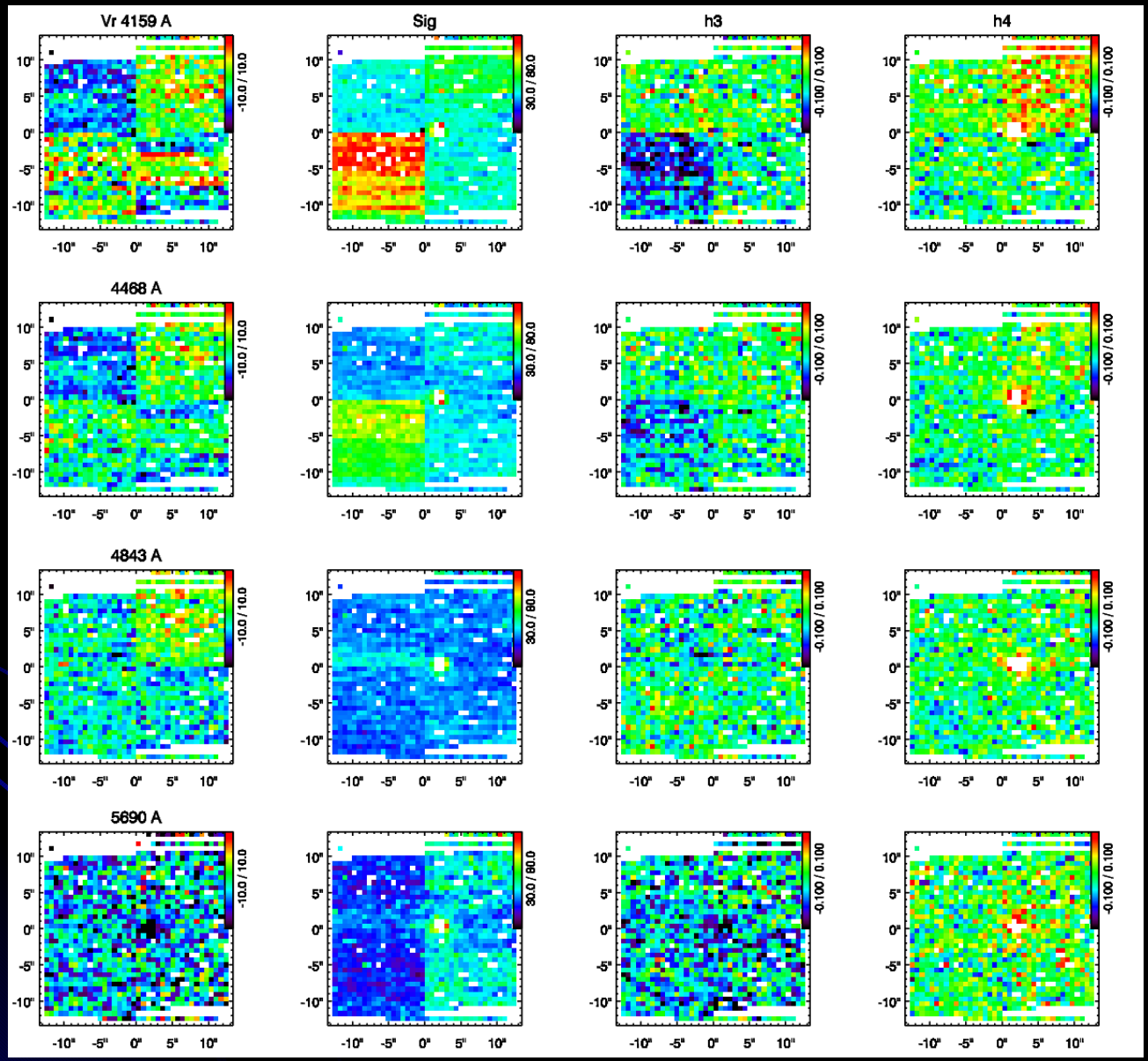
Characterising IFU datasets (1)

Levels 1 (Location) and 2 (Bounds)



Characterising IFU datasets (2)

Level 4: Spectral Resolution



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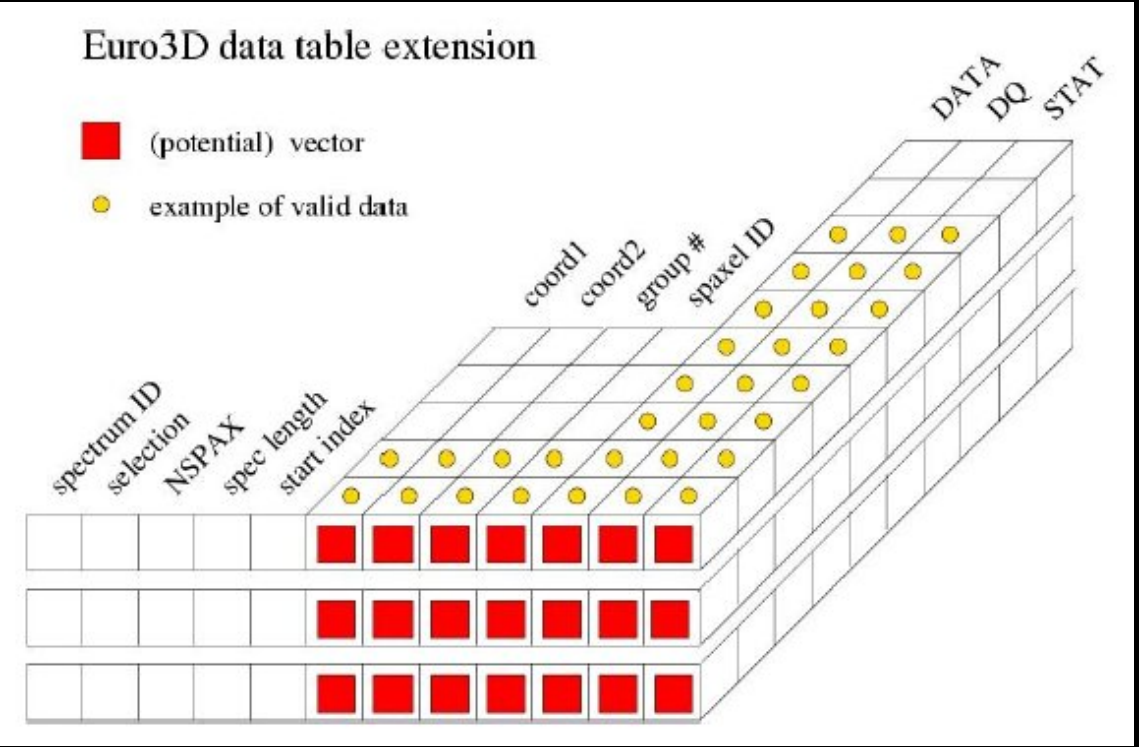
Storing 3D Data in FITS

- Pure 3D data cube (for IFP data and for some IFU)
- 2D-image (one spectrum per row) + binary table ⇨

Euro3D Format

Euro3D Format

- FITS binary data table: one row per spectrum
- Binary table describing shape of spatial elements (“spaxels”)
- Some mandatory metadata, including: common spectral WCS for all spectra, common spatial WCS for all spatial elements, meteo parameters during the observations, etc.



3D Data Access Services

- ASPID-SR @ SAO RAS
  - ~600 datasets including ~100 MPFS IFU datasets, ~70 IFP data cubes, long slit spectra (the rest)
  - Integration with VO tools using PLASTIC

    http://alcor.sao.ru/php/aspid-sr
- Giraffe Archive @ ObsPM
  - 700 optical MOS, IFU and multi-IFU datasets coming from FLAMES/Giraffe

    http://giraffe-archive.obspm.fr
- Canada Galactic Plane Survey (CGPS) @ CADC
  - Radio data cubes
- SAURON @ CDS – coming soon – stay tuned!

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VO-Paris Euro3D Client

- Open source tool, Java 5+
- Available as applet and Java WebStart
- I/O of Euro3D FITS (local or URL), Giraffe FITS
- Support for multiple files
- Extraction of spectra for individual fibers
- Export of extracted spectra in the VOTable serialisation of the IVOA Spectral DM 1.0
- Export of the catalogue of fiber positions as VOTable 1.1
- Communication with CDS Aladin and ESA VOSpec using PLASTIC messages for data visualisation

http://vo.obspm.fr/tools/Euro3D/

What is still missing?

- Sophisticated data visualisation tools
  - Easy to interface existing ones using PLASTIC
- Data analysis services (mostly 1D-specific)
  - Standards exist already, VO interfacing takes 1-2 days
  - Voronoi 2D binning (in 3-6 months)
  - PPXF: absorption-line kinematics (in 3-6 months)
  - Line strength indices computation (in 3-6 months)
  - SPIKEr: absorption-line kinematics and stellar populations using the nBursts technique (in 6-12 months)
  - other volunteers???

Summary

- VO contains all the infrastructural components (data models, data access protocols) needed to support 3D data
- There are already several operational services
- Simple visualisation tools exist
- Advanced visualisation and data analysis tools / services are still missing

If you are a data owner / service provider and wish to provide an access to your data and / or services within the VO you are welcome to contact us