

Describing Collections with the

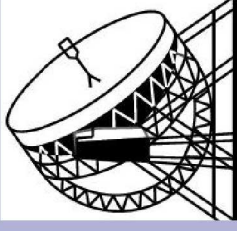
Observation Data Model

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M.D.Allen, F. Bonnarel, M. Louys, B. Vollmer (CDS);
P.Lamb, R.Power (CSIRO); AstroGrid and IVOA WG's

- Introduce suggestions
 - Catalogues
 - Processing pointers
 - Composition (combined data, new properties)
 - Characterisation
- Motivation from archives
 - INT Wide Field Survey, VISTA, LEDAS
 - ALMA
 - HDF(N) MERLIN+VLA
 - Radio interferometry (Lamb)
- Proposals

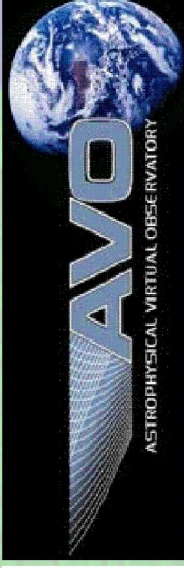
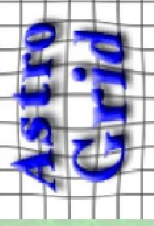


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Observation DM 0.23

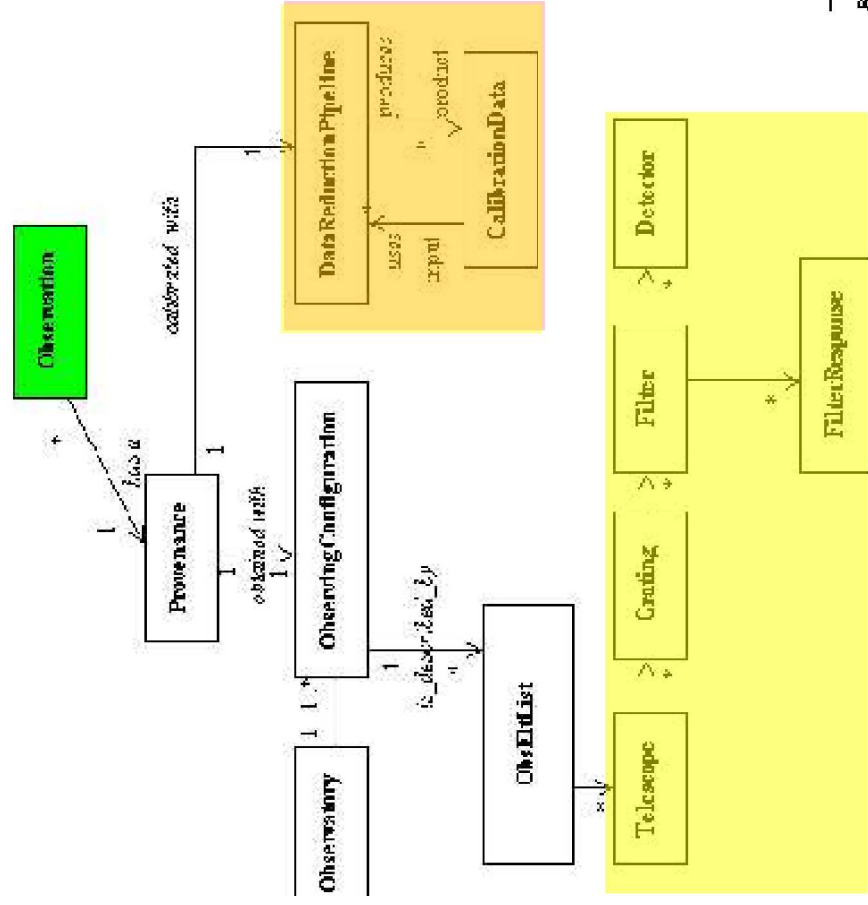


Fig. 6 (Jonathan)

Differences yellow/gold

New pink

Also new on ObsData side

Data Type, Measured Quantities

Trivial:
Provenance=Observatory?
ObsEltList=
ObservingConfiguration?

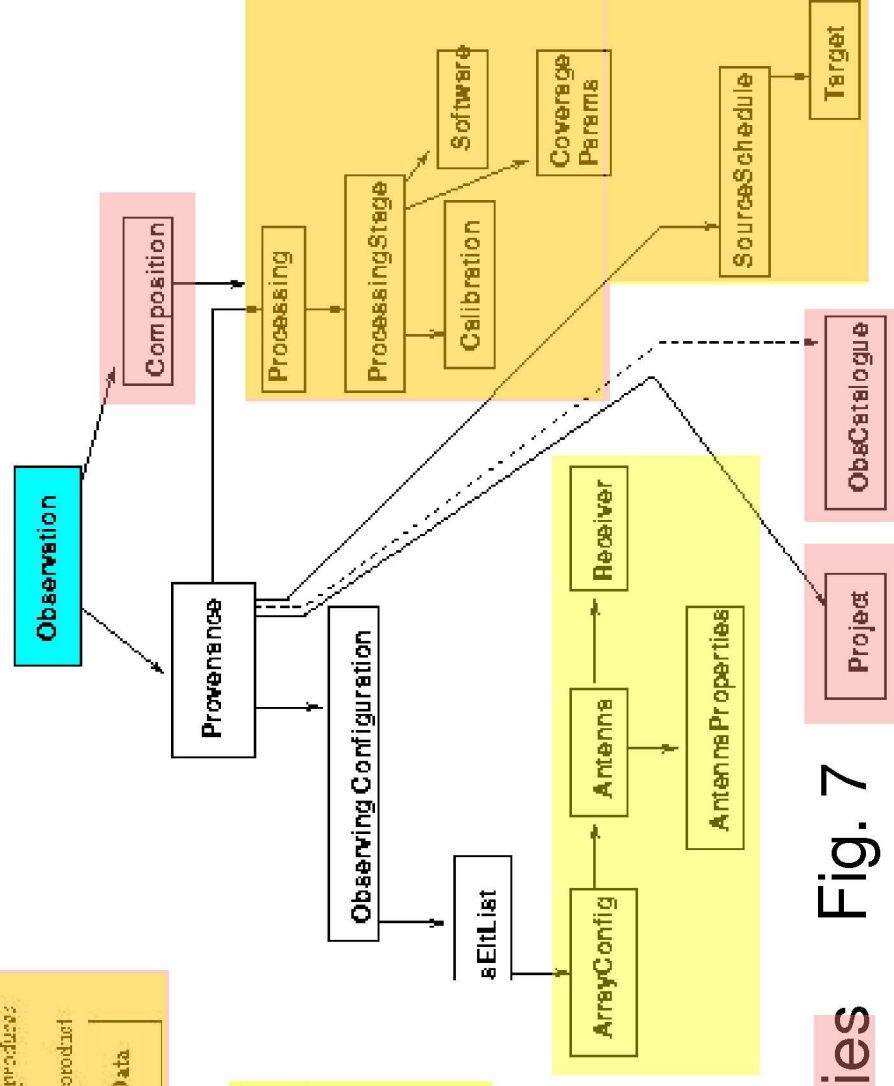
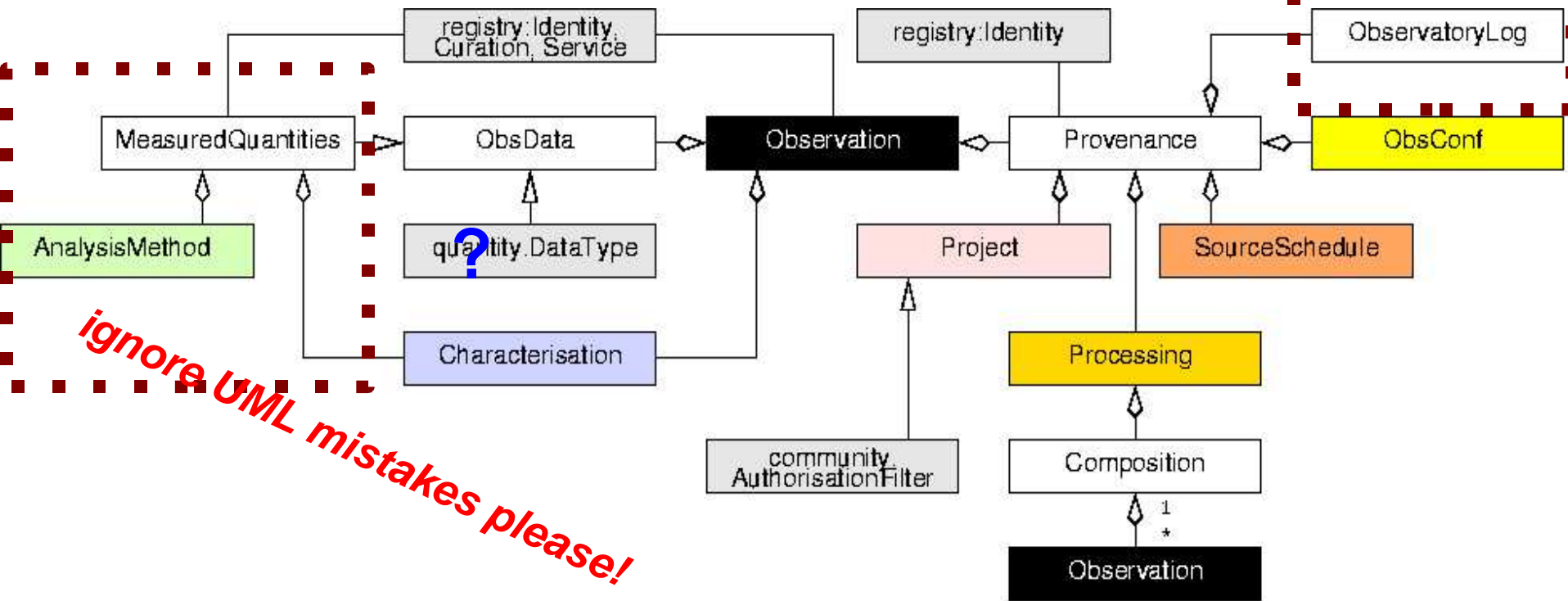


Fig. 7

General Observation DM



Tabular data

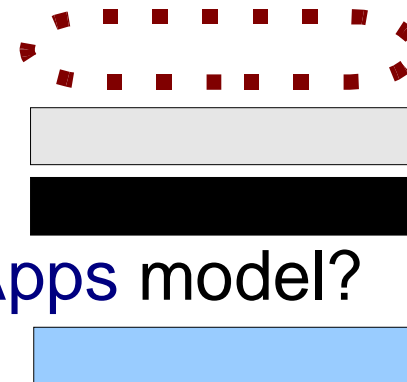
Share with standard models

Can be composited, change properties

Not shown: pointers to new processing - Apps model?

Characterisation matrix

Objects related to specialised models - other colours

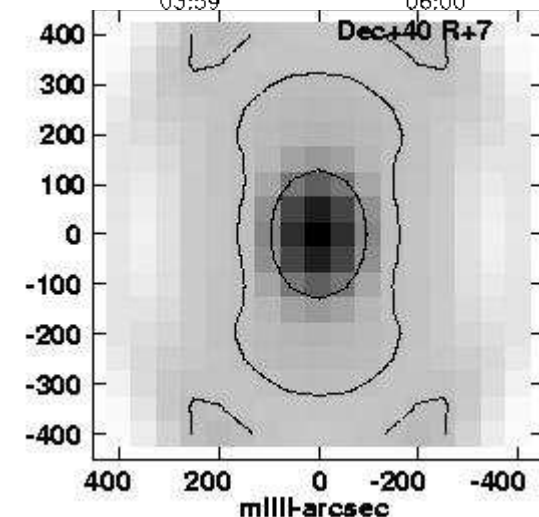
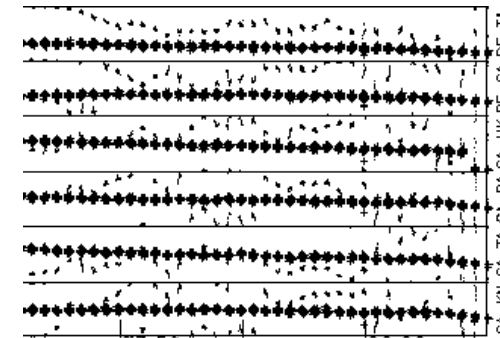
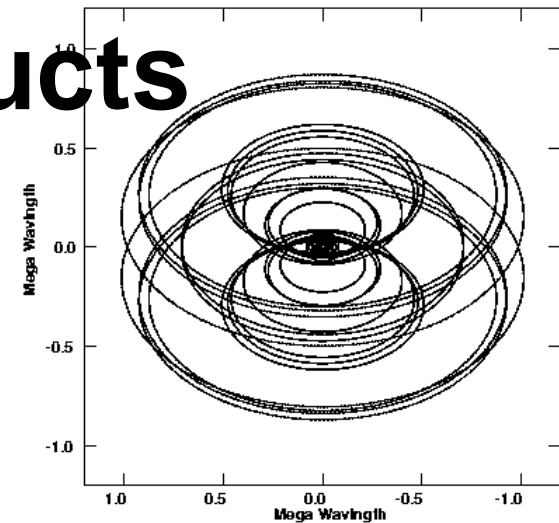


Info from data providers

- AstroGrid data providers
 - Isaac Newton Telescope Wide Field Survey model
 - VISTA (IR survey), LEDAS (x-ray) metadata
- IVOA radio data providers questionnaire
 - ATNF, BIMA, IRAM, JIVE, MERLIN, NRAO, JCMT, (ALMA, CARMA)
 - See RadioNet (EU+) and IVOA radiovo forum
- Can detailed models overlap with Observation model
 - Evaluate Characterisation parameters etc.
 - Data access methods
 - also Registry, Apps etc.
- Keep interface simple for data providers!

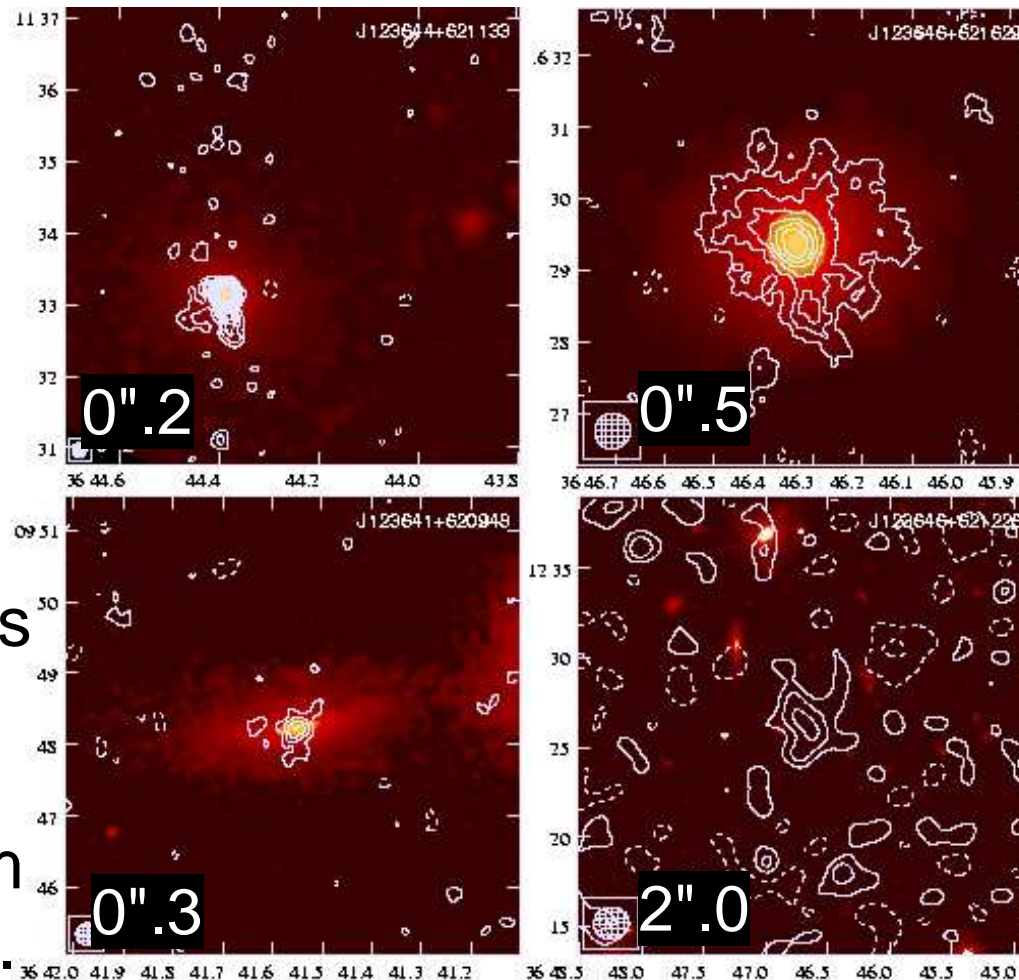
Interferometry Data Products

- Calibrated complex visibilities
 - Model fitting
 - 'Light' curves
 - Combine data from other arrays
- Image (FT, CLEAN) *selected regions*
 - Field of view determined by
 - Individual antenna radii (1^{ary} beam)
 - Channel width
 - Integration time
 - Quality - baseline coverage
 - Beam size - weighting
 - Sensitivity or resolution optimised
- Data cubes
- Spectra
- Polarization



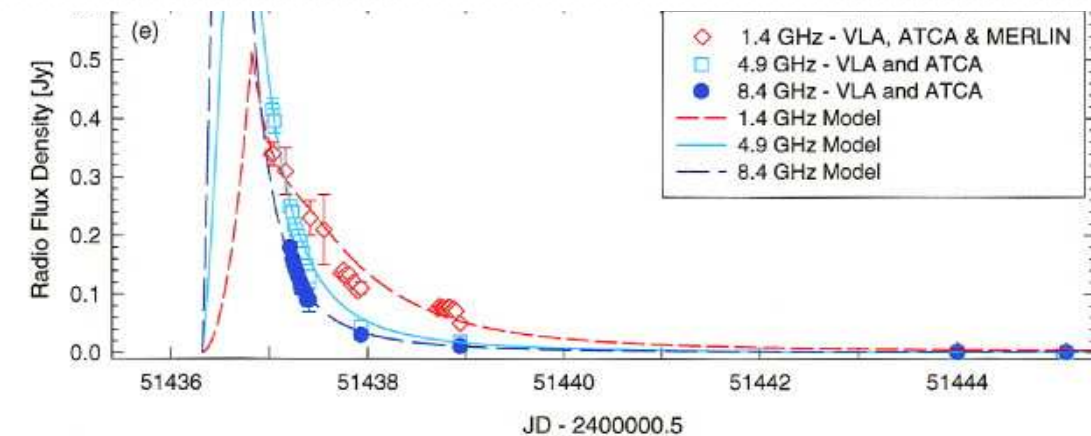
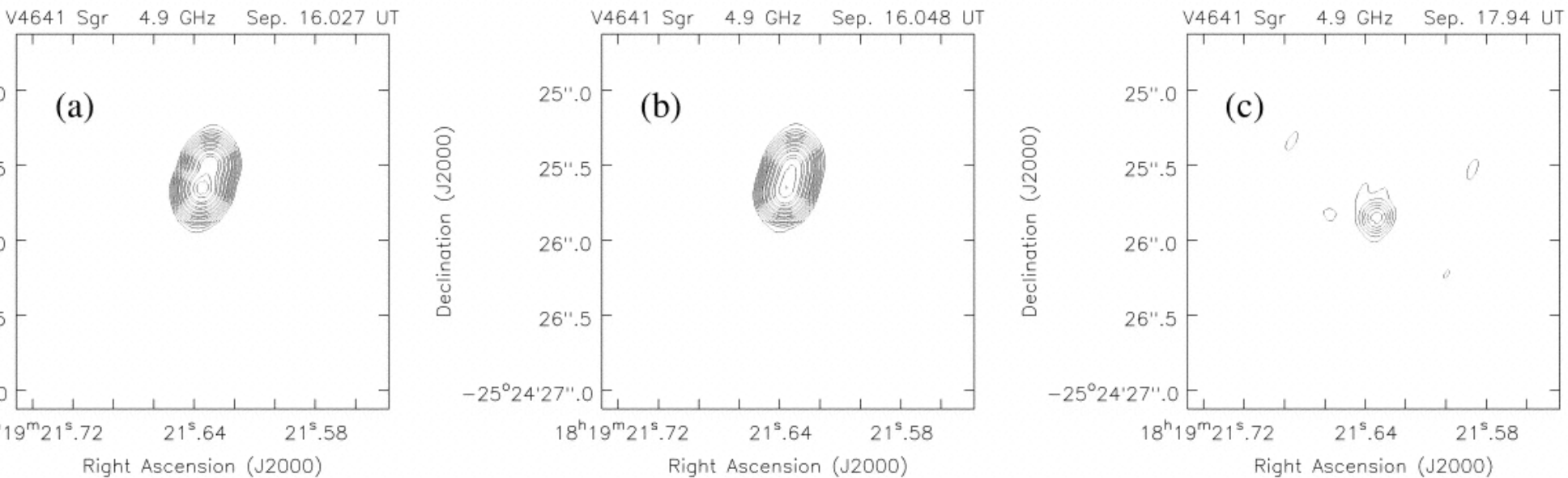
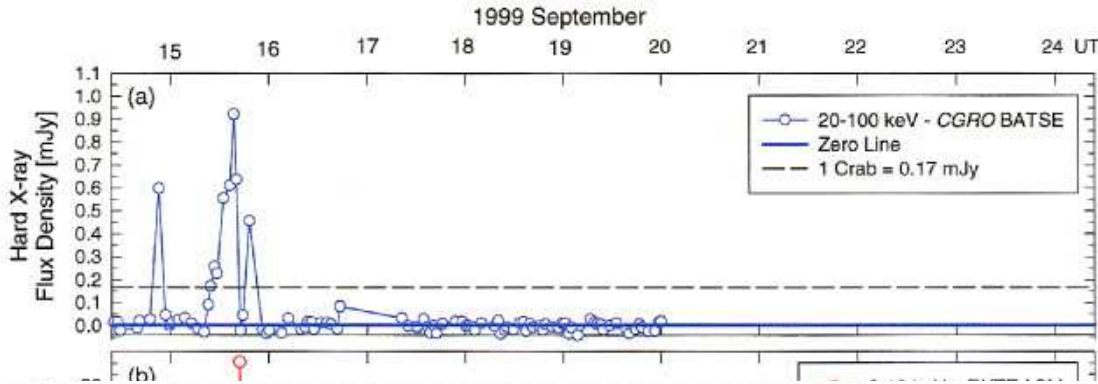
Composition and reprocessing

- Two separate calibrated visibility data sets e.g. HDF(N)
 - Single products valid
 - MERLIN resolution $\sim 0''.2$
 - Compact AGN
 - VLA resolution $\sim 2''.0$
 - Faint diffuse galaxy
 - Combine data for intermediate resolution
 - Use visibilities/dirty maps
 - Varying proportions
 - Characterisation *range*
 - uv coverage: simple sum
 - range of sensitivities etc.
 - Images may only be generated as demanded (easily!)
- how model ***Image = Visibilities+Pipeline tool interface***



Light curve

- Hjellming et al. 1999
XRB in outburst



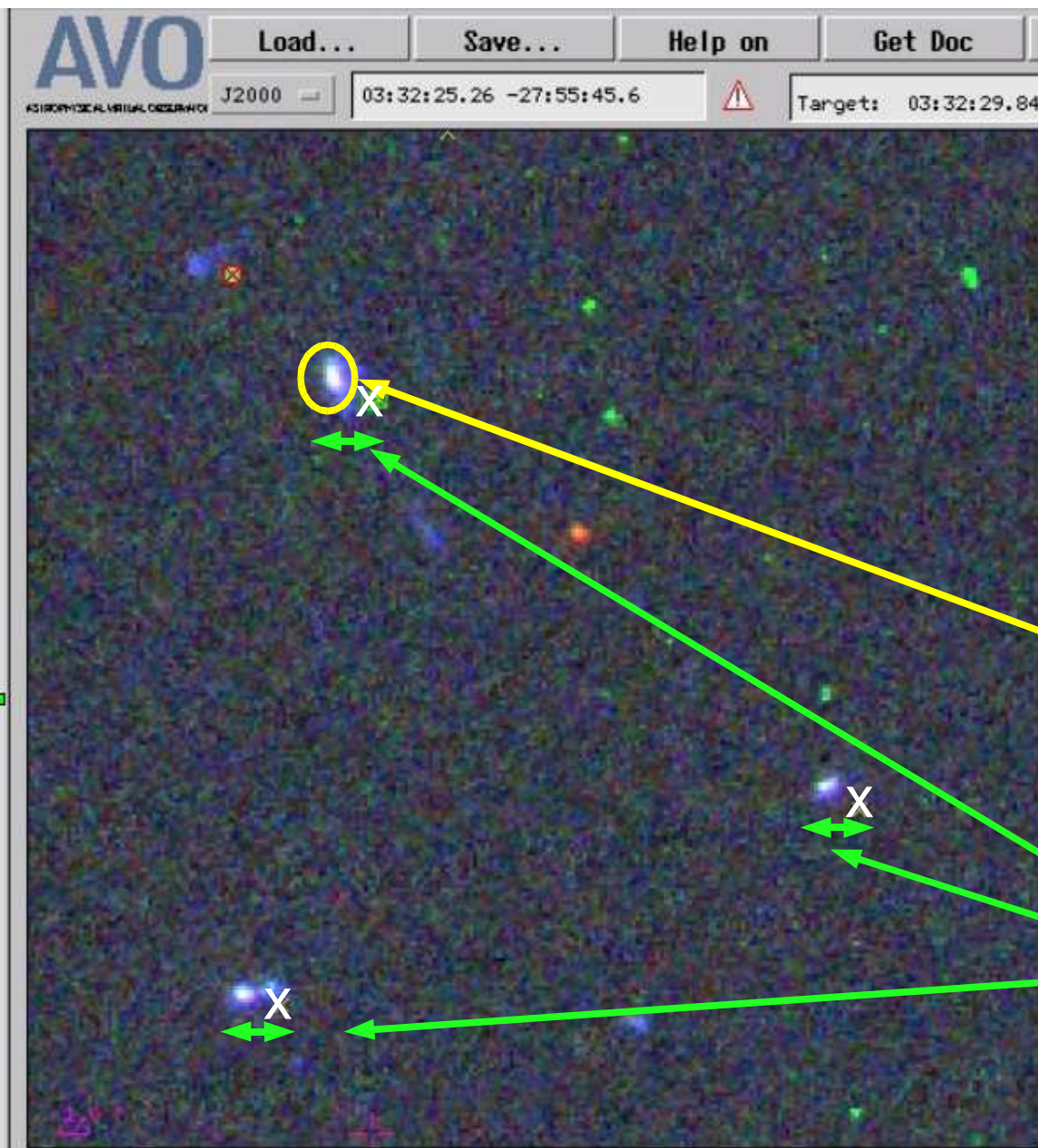
- Short averaging time of visibilities for light-curves
- Longer averaging time for synthesis imaging

Characterisation

	Spatial	Temporal	Spectral	Velocity	Obs'able
MappingFrame					
Location					
LocationUncertainty					
SensitivityBounds					
Support					
Filling					
SensitivityFunction					
Resolution					
SamplePrecision					

- Matrix not heirachy (see table in Observation DM 3.3)
- Data providers interpret terms e.g. Location.Spectral
 - Provide values (can be ranges)
 - Eventually relationships for VO harvesting/reprocessing
 - could inherit from Processing, ObservatoryLog etc.
- Velocity added (as differentiated by STC)
- LocationUncertainty is systematic error e.g. in photometry

SamplePrecision/LocationUncertainty



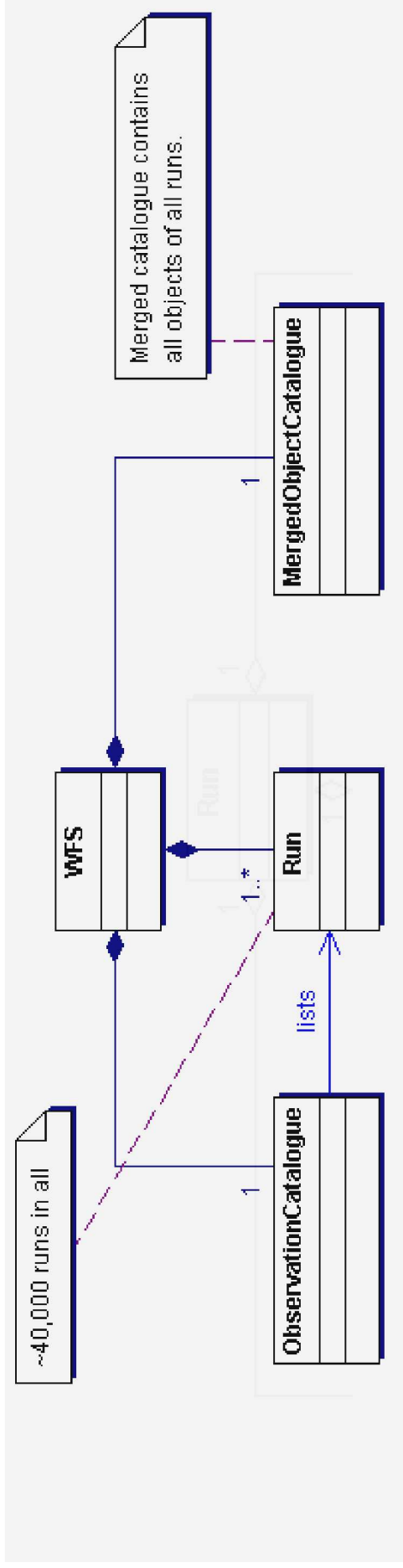
- **Random error**
 - HST F450, F606, F814 low relative uncertainty
 - Extracted sources in each filter well aligned, small noise errors
 - Limiting accuracy
- **Accurate RGB**
- **Systematic error**
 - Astrometric error wrt EIS catalogue
 - Systematic offset
 - One correction for whole dataset

Characterisation - MERLIN examples

VO uses values supplied by data provider e.g.

- ★ Mapping.Observable Jy/beam => Jy/arcsec²
- Location.Spectral Reference freq. in ref. channel
- Location.Velocity Vlsr in ref. channel in radio convention
- LocationUncertainty.Spatial Phase ref etc. position errors
- ★ SensitivityBounds.Obs'able Noise in CLEAN image σ_{rms}
 - Different limits in Stokes IQUV (could be $\pm\sigma_{\text{rms}}$)
 - Also e.g. polarisation angle error, spectral index error
- Support.Spatial Primary beam FWHM for uv data
- Support.Temporal Scan length (few min) for light curve
 - Synthesis time (many scans) for image
- SensitivityFunction.Spatial FoV radius 10% flux smearing
- ★ Resolution.Spatial Restoring beam for image
- ★ SamplePrecision.Spatial Beamsize/SNR function
- ★ *Ranges for images not yet extracted from uv data (but average for Registry!)*

INT Wide Field Survey (Opt/IR)

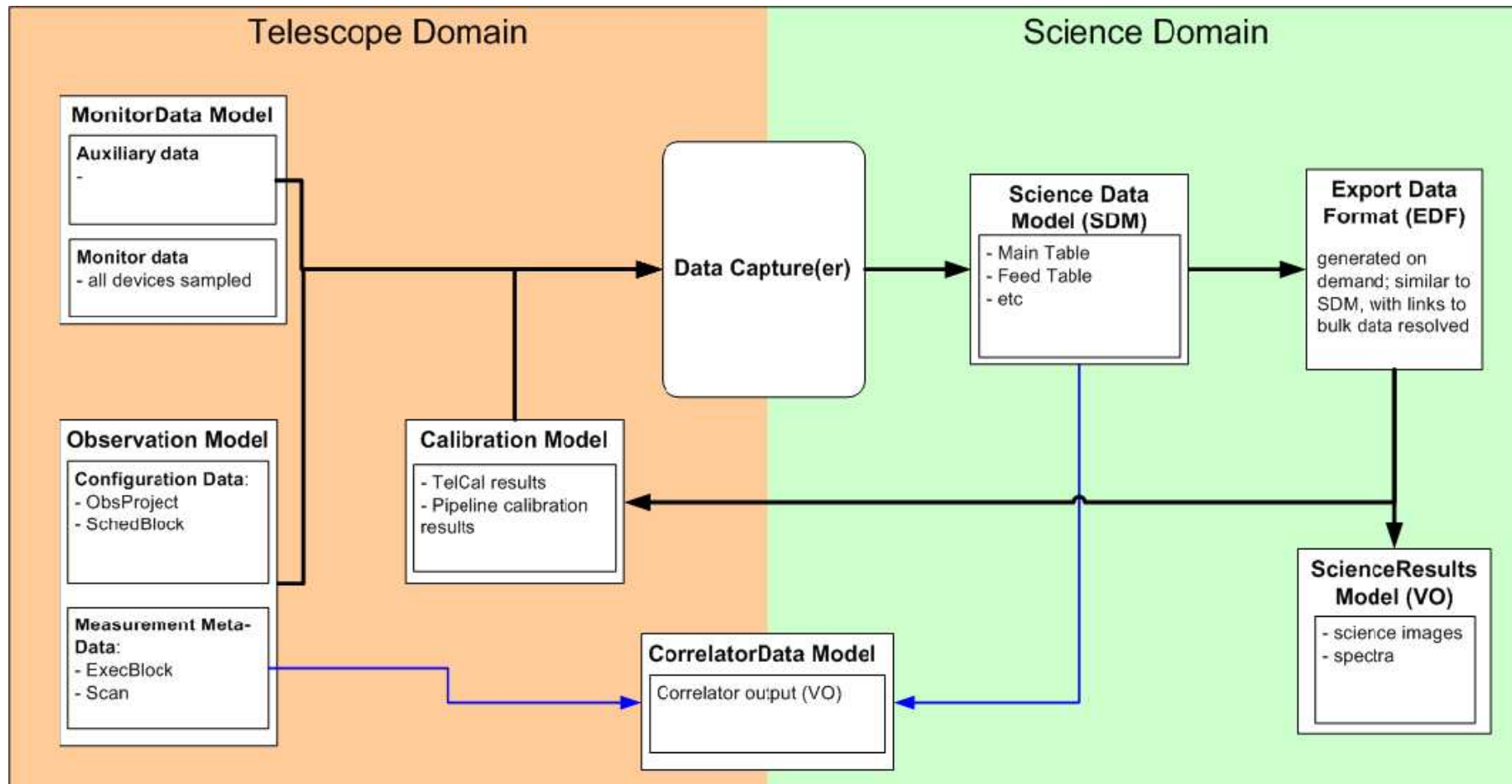


- ~40000 runs taken with 4-CCD camera
 - MEF images - need **Apps** to make VO-accessible?
 - Multiple wavebands, multiple visits to same regions
- Catalogue data:
 - ObservationDescription=**ObservingLog**
 - ObjectCatalogue=**MeasuredQuantities** (single run)
 - MergedObjectCatalogue=**MeasuredQuantities**
- Catalogues merged; images not merged
 - Could have **Composition** using resampling etc. **Apps**

VISTA and LEDAS

- Implications for Observation DM
- VISTA IR survey telescope
 - Coverage sparse
 - is Filling Factor good enough?
 - sky Indexing would be better?
 - Needs good spectral passband models
- LEDAS X-ray etc.
 - Date information
 - for science
 - + Authority info, for access permissions
 - 1XMM catalogue(s)
 - Observational details
 - Source properties
 - Cross-IDs with other catalogues/SIMBAD objects

ALMA



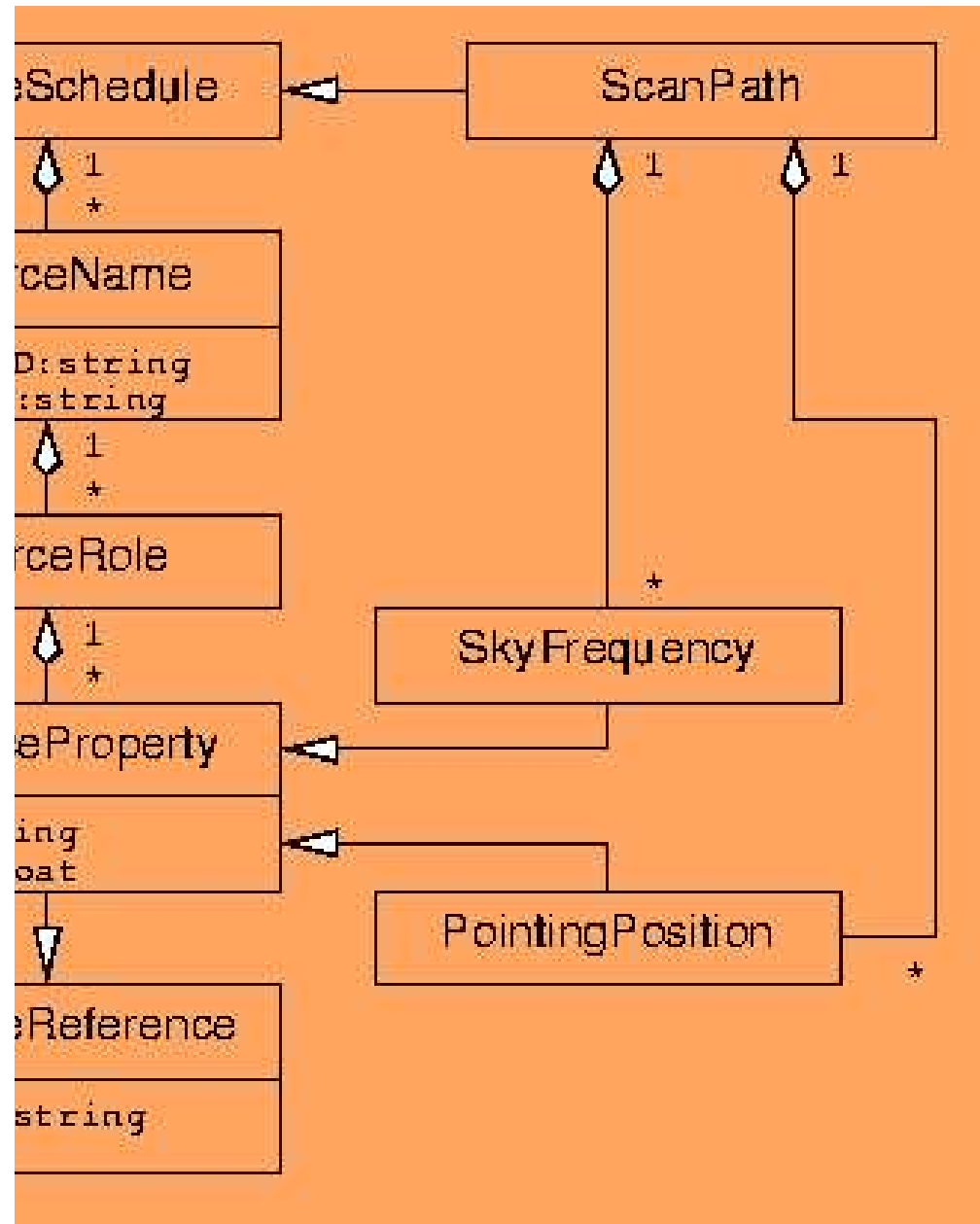
- Diagram shows the various proposed data models and domains.
- It says nothing about where the data is stored, even though we know that the correlator data will likely be stored in a part of the archive
- "Data flow" arrows show that data flows from one data model to another as part of a data transformation
- "Reference" arrows show that data of one model references data in another model, which means that the two models are rigorously speaking only one model...

— Data Flow →

— Referencing →

Radio Model interfaces

- More than enough detail for current VO standard
- Support development of Peter Lamb's detailed model
- Get feedback from radio data providers
 - Can it be populated from FITS headers/history?
- May need to reduce specificity
- Retain structure/ template
- A lot of work!
 - ALMA
 - RadioNet



Suggestions for Observation DM

- If not accommodated in Observation, where?
- Interact with other VO **standard models** e.g.
 - **Quantity**, **STC**, **Registry**: curation, identity etc.
 - **Community**? **AuthorisationFilter** (assoc with **Project**)
 - One path to data for all users
 - Archives are vivariums, not retirement homes!
- Understand relevant objects in specialised models
 - Characterisation (see previous summary)
 - Pointers to usable (re)processing - **Apps** model?
- Include tabular data
 - Much data are accessed via **ObservatoryLog**
 - **MeasuredQuantities** (?) inherits **ObsData** properties
 - Separate **AnalysisMethod** for convenience
- **ObsData** has **DataType** (visibilities, 2D image, etc)
 - Too complex & specific for **Quantity**?
 - Distinct from format e.g. FITS. which **Registry** needs