

Multi-dimensional Data Priority Area

Mark Allen

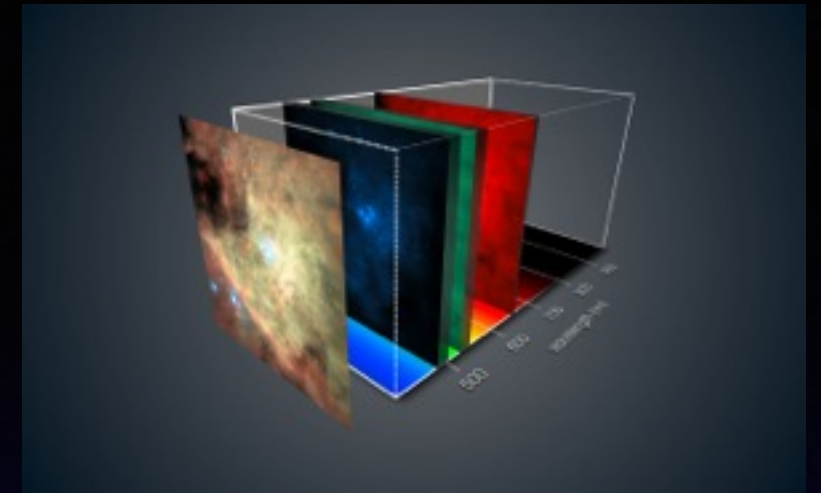
Technology Forum Trieste, May 11, 2014



CoSADIE Project



Science Priority Areas



Multi-dimensional Data

Radio astronomy, Integral Field Spectroscopy, high energy, polarization, simulation, data mining datasets + ...

- Need to ensure that these are accessible and useable within the VO

Status

- Focus Sessions (Heidelberg May 2013)
 - engagement with projects, minimal requirements
- Prototype demos (Hawaii Sept 2013)
 - Multiple approaches, ~agreement on stds. needed
- 1st stds. to satisfy minimal requirements
- aiming for RFCs < May Interop 2014
- Follow-up Focus Session (Madrid May 2014)

Projects engaged

- ALMA
- LOFAR
- SKA
- ASKAP
- JVLA / NRAO
- MUSE
- CALIFA
- LSST
- CTA



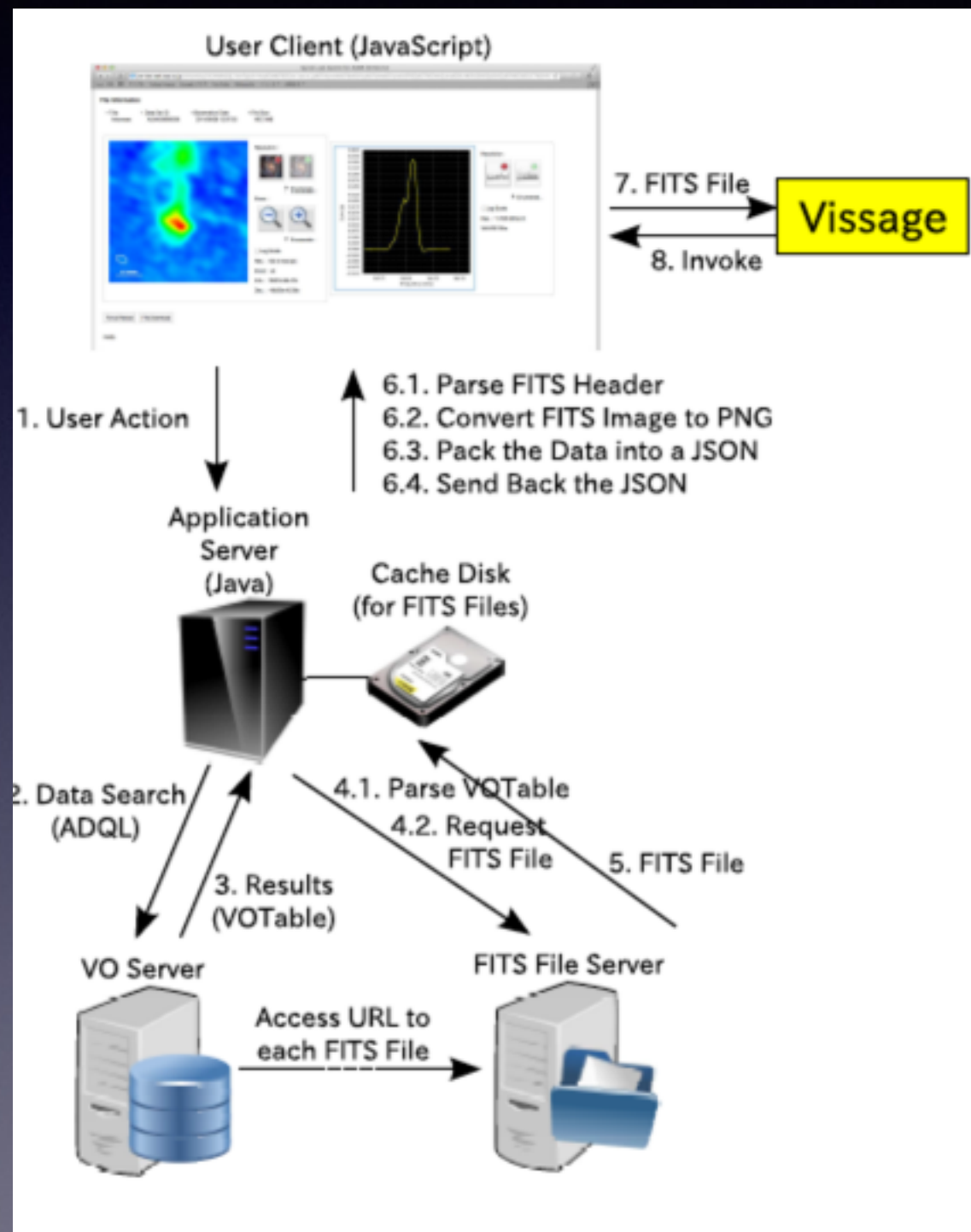
VO already in use/plans

- ALMA - using OpenCADC TAP, voview, will use SAMP, ObsCore, SIAPv2
- CyberSKA - VO access option via CADC
- CALIFA - data access via TAP and SSA
- MUSE - VO publishing via AstroWise
- ASKAP - all data through VO protocols
- CoRoT - avail from SVO, Kepler - avail from MAST
- LOFAR - VOEvent broker

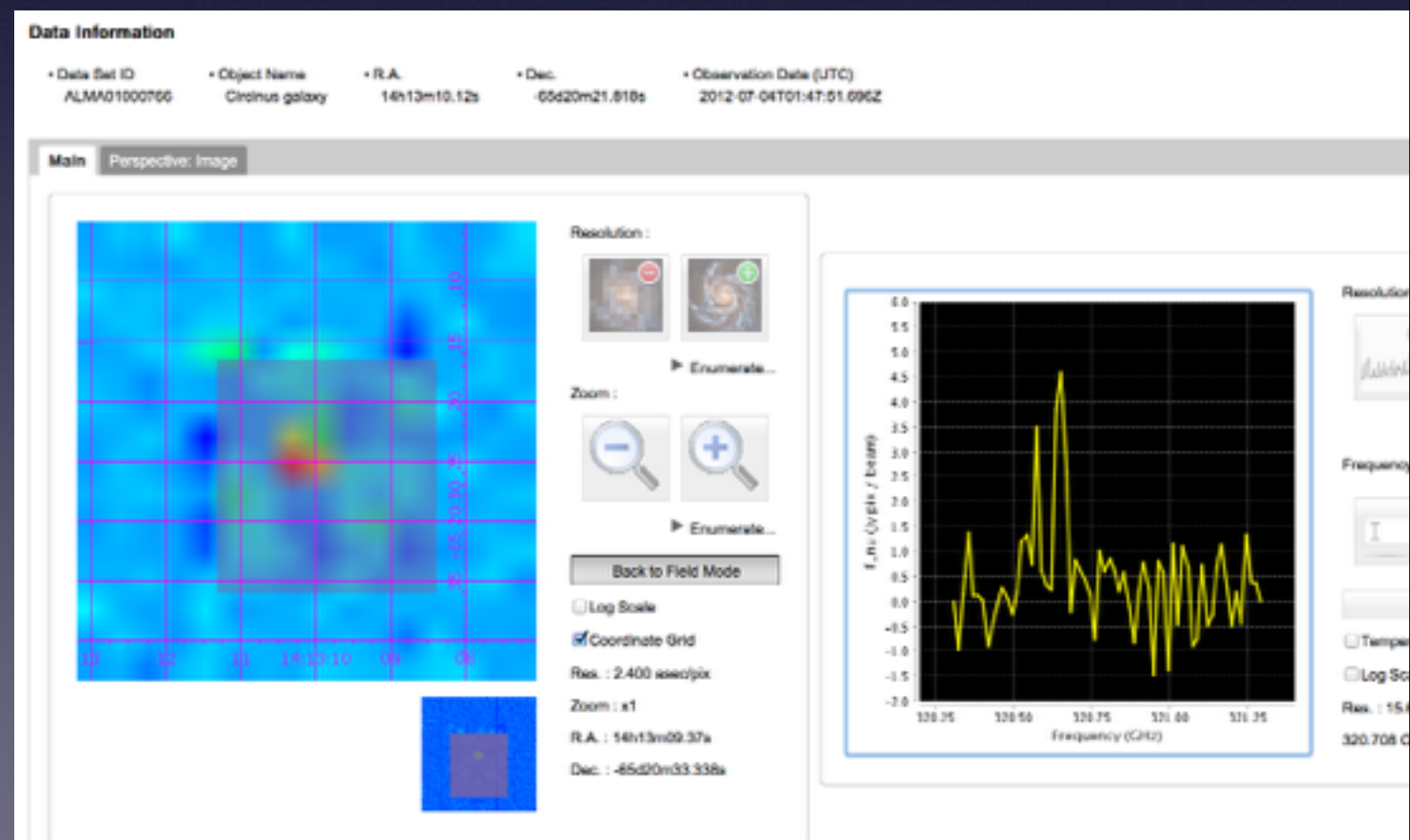
- Identify implementation hurdles
 - description/access to cubes
 - query by time parameters
 - expense
- mismatch of expectations/approach
 - implementation of 'standards' cf. 'libraries'
 - *"Rough consensus and running code"*
 - Java and Python...
 - Importance of ...

} in progress

Prototype demos

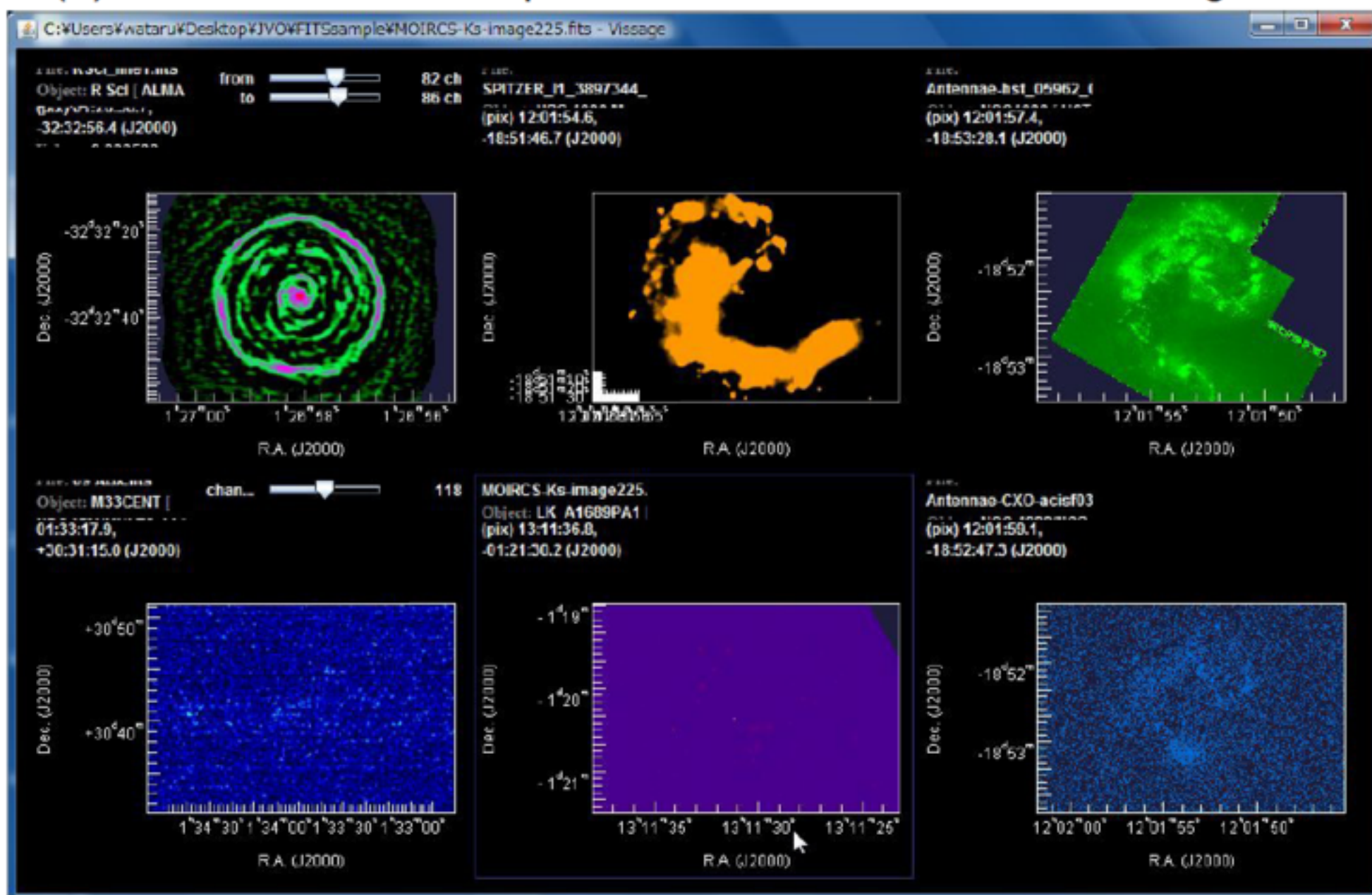


- JVO ALMA VO Portal and Vissage



Demonstration

(9) ALMA / NRO45m / Spitzer / Subaru / HST / Chandra images



ImageDM metadata for the cube: SIA2Query response

Data Info Frame

Display

CUBE_CO_NGC1022

Field name	UType	Value
Score	ImQuery.Score	1
AssocID	ImAssociation.ID	None
AcRef	ImAccess.Reference	http://slinda.u-strasbg.fr/Cubengc1022.dic
Format	ImAccess.Format	image/fts
DataModel	ImDataSet.DataModel	ImageDM
DataLength	ImDataSet.Length	1600000
ImageAxes	ImDataSet.Image.Axes	3
ImageAxis	ImDataSet.Image.Axis	256 256 25
Title	Observation.Identifier	CUBE_CO_NGC1022
Title	ImDataID.Title	CUBE_CO_NGC1022
Creator	ImDataID.Creator	ivo://aa/
ObservingProgramName	ImDataID.Collection	vo://aa/bodega/
CreatorIID	ImDataID.CreatorIID	ivo://aa/bodega#ngc1022/
CreatorVersion	ImDataID.Version	1.0
Instrument	ImProvenance.ObsConfig.Instrument	PicoVela
PublisherIID	ImCuration.PublisherIID	ivo://cds/
SpecFrameName	ImCoordSys.SpecFrame.Name	ICRS
TimeFrameName	ImCoordSys.TimeFrame.Name	TT
SpatialLocation	ImChar.SpatialAxis.Coverage.Location.Coord	39.636 -6.677deg
SpatialExtent	ImChar.SpatialAxis.Coverage.Bounds.Extent	1.3"
SpatialCalibration	ImChar.SpatialAxis.Accuracy.CalibrationStatus	Calibrated
SpatialResolution	ImChar.SpatialAxis.Resolution.RefVal	0.6"
TimeLocation	ImChar.TimeAxis.Coverage.Location.Coord	2008-11-01T10:36:05.3d
SpectralAxisUcd	ImChar.SpectralAxis.Ucd	em/freq
SpectralLocation	ImChar.SpectralAxis.Coverage.Location.Coord	1450000.0Hz
SpectralExtent	ImChar.SpectralAxis.Coverage.Bounds.Extent	500000.0Hz
SpectralStart	ImChar.SpectralAxis.Coverage.Bounds.Limits...	1200000.0Hz
SpectralStop	ImChar.SpectralAxis.Coverage.Bounds.Limits...	1700000.0Hz
SpectralCalibration	ImChar.SpectralAxis.Accuracy.CalibrationStatus	CALIBRATEDm
FluxAxisUcd	ImChar.FluxAxis.Ucd	phot.flux.density
MappingSpatialProjection	ImData.Mapping.SpatialAxis.Algorithm	SDR
MappingOrval	ImData.Mapping.RefValue	129.000000 129.000000 -45.0
MappingOrpix	ImData.Mapping.RefPix	39.636249 -0.677499 -250000.0
MappingCdMetric	ImData.Mapping.CDMetric	-0.000683333 0.000000 0.000000 0.000 0.0...

Stick FoV in stack LOAD Close

Frame ICRSd

Mouse controls:
 Left: source selection.
 Middle: quick panning.

Server selector

Others: File all VO Watch FoV... Tools...

Image servers

Catalog servers

All VizieR
 Surveys
 Missions
 SIMBAD
 NED
 MOC
 SkyBot
 Others..

User data access (Image/table/script/dir) ?

Specify a filename or an URL and press the SUBMIT button



Browse...

```

creator: ivo://aa/
collection: null null
CUBE_CO_NGC1022 0.0" x 0.0"
  
```

Reset Clear SUBMIT Close ?

- VAO development
- <http://vaosa-vml.aoc.nrao.edu/ivoa-dal/siav2query.html>


National Radio Astronomy Observatory


Wednesday, March 5, 2014

SIAPV2 Prototype Service
(VAO Test Data Collection)

Query Parameters (Debug ☐) ():

POS ("ra,dec" in degrees):	<input type="text" value="180.0,1.0"/>	SIZE (decimal degrees):	<input type="text" value="360.0"/>
BAND (meters):	<input type="text" value="1.0E-8/5.0"/>	TIME (ISO time):	<input type="text" value="1990-07-04/2014"/>
POL (state, "any", "stokes"):	<input type="text"/>	MODE ("archival cutout match"):	<input type="text" value="archival"/>
TYPE ("image", or "cube"):	<input type="text"/>	SUBTYPE (archive-specific):	<input type="text" value="SDM.BDF"/>
SPECRES (min spectral resolution):	<input type="text"/>	SPECRP (min spectral respower):	<input type="text"/>
COLLECTION (e.g., "alma,jvla"):	<input type="text"/>	ASTCALIB (e.g., "absolute"):	<input type="text"/>
PUBDID (dataset ID):	<input type="text"/>	MAXREC:	<input type="text"/>

Image Data Collections:
☐ Null/Echo Test
 ☒ VAO Cube Project Test Data

Output Data Formats:
☒ All available formats
 ☐ FITS image
 ☐ Graphics image

Query Response Format:
☒ VOTable
 ☐ Text
 ☐ CSV

Please direct [feedback and/or questions](#) concerning the DALServer toolkit to the author.

Minimal requirements

- **Data Discovery (Query)**
 - A service shall be able to receive queries regarding its data collection(s) from a client, with the client placing one or more of the following constraints:
 - RA,Dec
 - Frequency/wavelength
 - Polarization states
 - Spatial size
 - Angular resolution
 - Integration time
 - Time of observation
 - A service shall return to the client a list of observations, and the corresponding metadata for each observation, meeting the user-imposed constraints. In the event that the user places no constraints, the entire list of observations, and the corresponding metadata for each data set, shall be returned. In the event that no data meet the user's constraints, the service shall indicate the absence of any matches.
- **Data Access**
 - Once a user has the list of observations that satisfy the constraints, they select all or a subset of the observations and:
 - Download the complete science data for each of the selected observations (the service shall return the complete multi-dimensional science data and metadata for each selected observation) or;
 - Download simple cutouts of the science data for each of the selected observations (the service shall be able to extract and return a user-specified subset of the complete multi-dimensional science data and metadata for each selected observation).
- **Simple Cutout**
 - For a simple cutout, the user-specified subset is restricted to be a contiguous interval within each dimension of the multi-dimensional science data. The user should **not** be allowed to specify subsets with "gaps" or resampling or anything like that.
 - **Spatial: a circle (a coordinate and a radius)**
 - Energy: one interval (from energy1 to energy2)
 - Time: one interval (from time1 to time2)
 - Polarization: a list

Mostly accepted as reasonable requirements

- Data Discovery, Data Access

Some discussion about spatial cutout

- **Cutout:** For a simple cutout, the user-specified subset is restricted to be a contiguous interval within each dimension of the multi-dimensional science data. The user should **not** be allowed to specify subsets with "gaps" or resampling or anything like that.
 - **Spatial:** a circle (a coordinate and a radius)
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TCG to WGs :

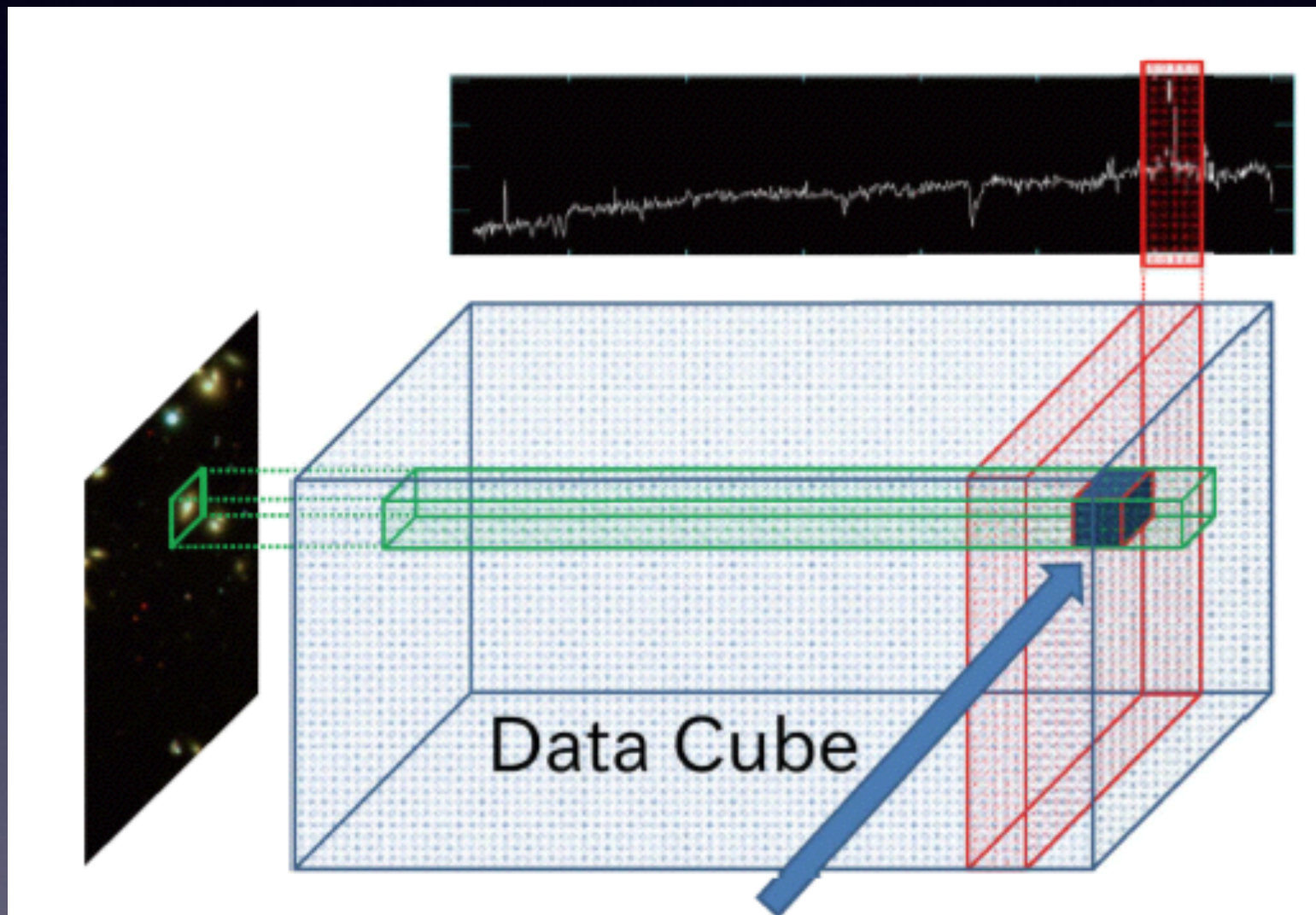
Practically speaking, the endorsement of the minimum requirements for the first version of the multi-dimensional data access standards means:

- The preparation of the standards cannot be held up by discussion of "features" that are not necessary to meet the minimum standards
- The WGs should be thinking in an agile sense where subsequent versions of a given standard with more "features" come rapidly after the first version.

Standards that need to be RFC-ready by the May InterOp:

1. SIAv2 (query capability only)
2. DataLink
3. AccessData (for simple cutouts only)

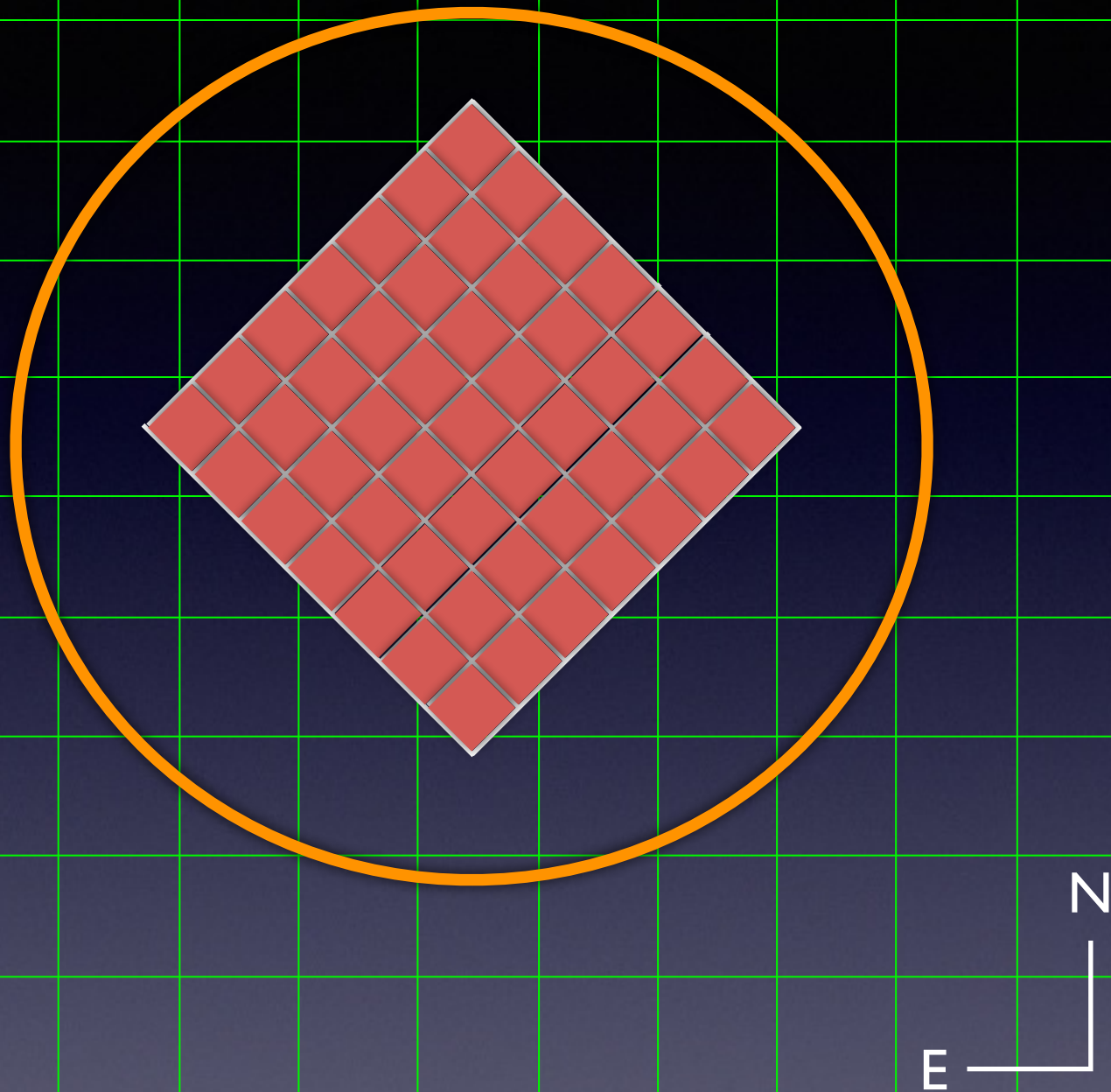
Cutouts

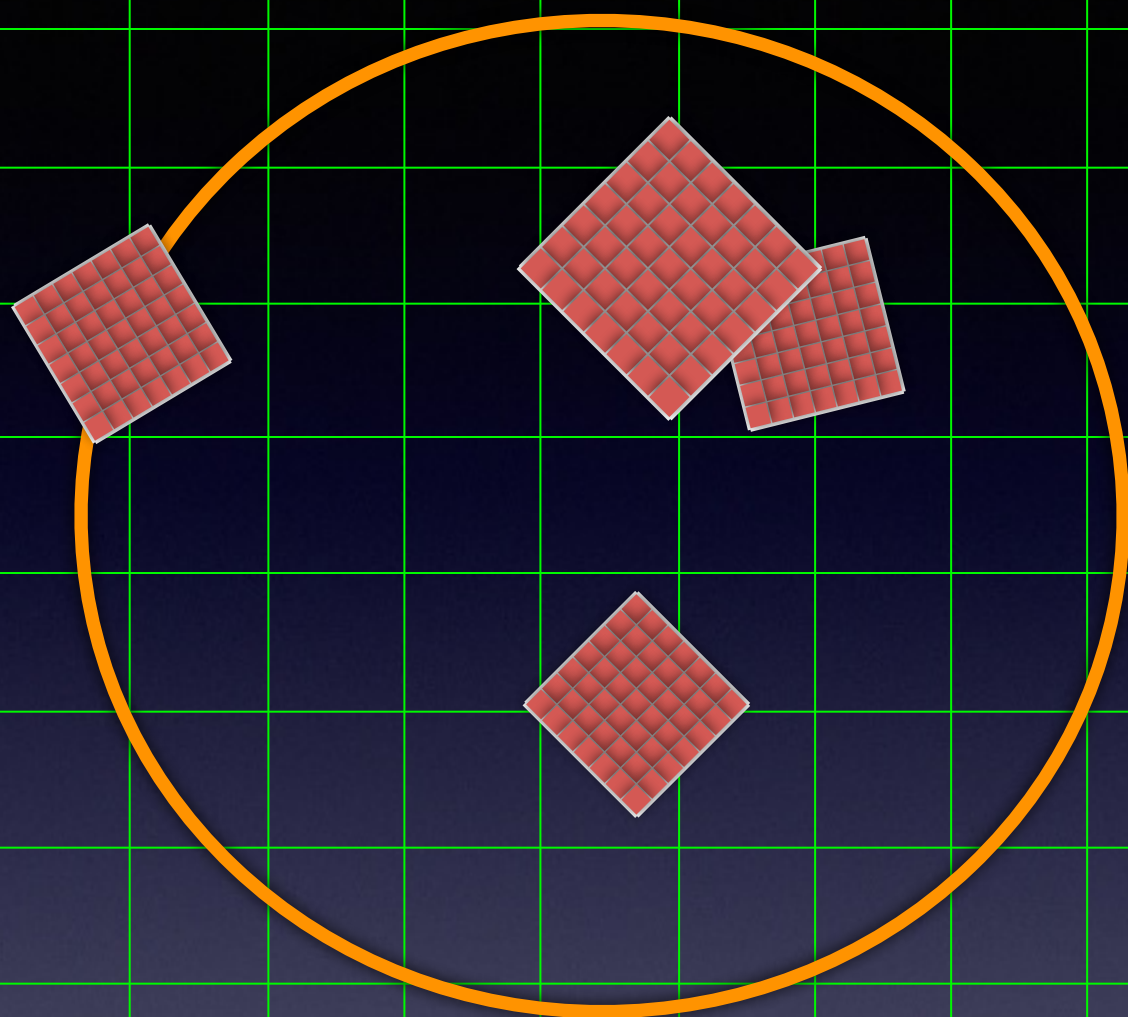


- simple cutout (without re-computing), along the cube axes, no gaps, transforms

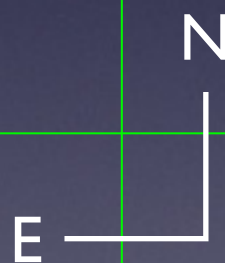
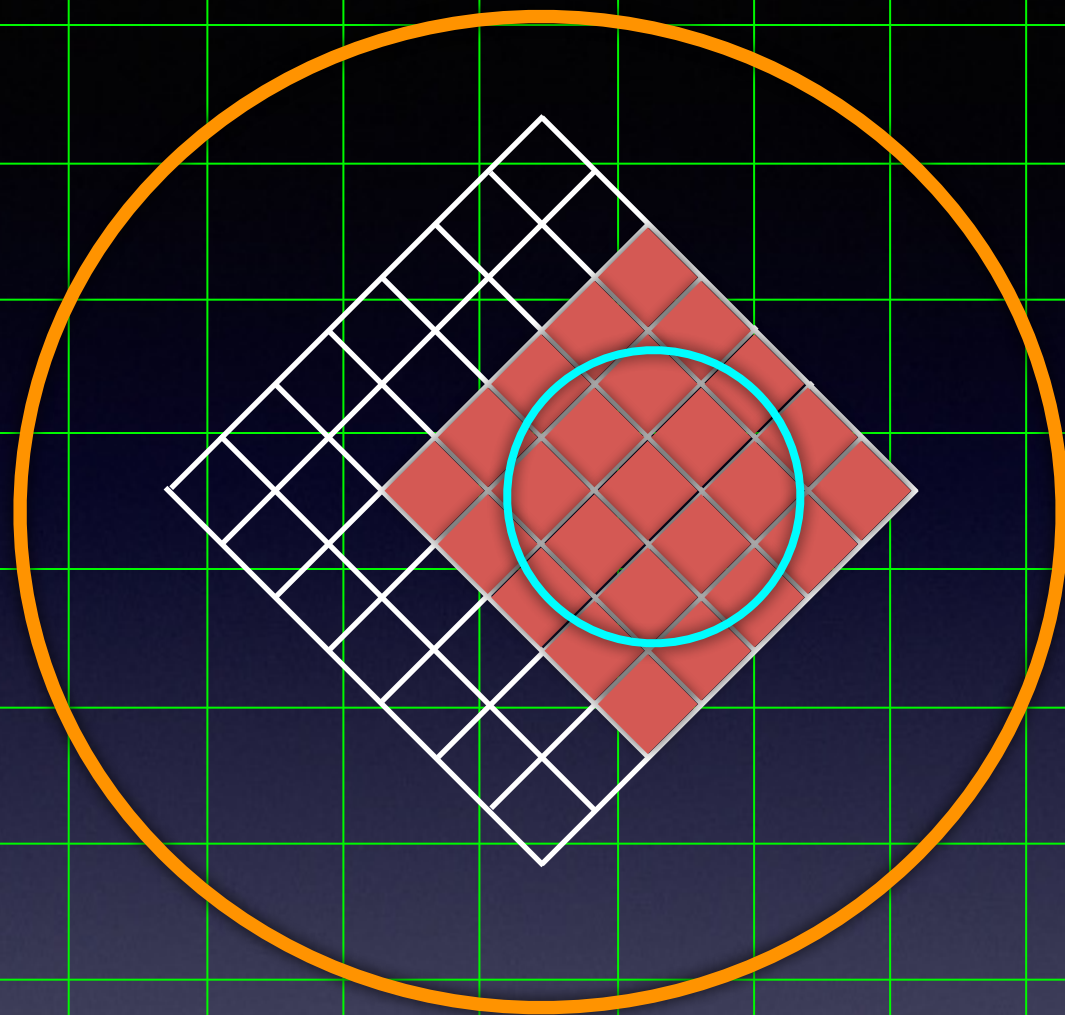
Considering cutouts simple to complex

- Data Discovery
- Available Data
- Download

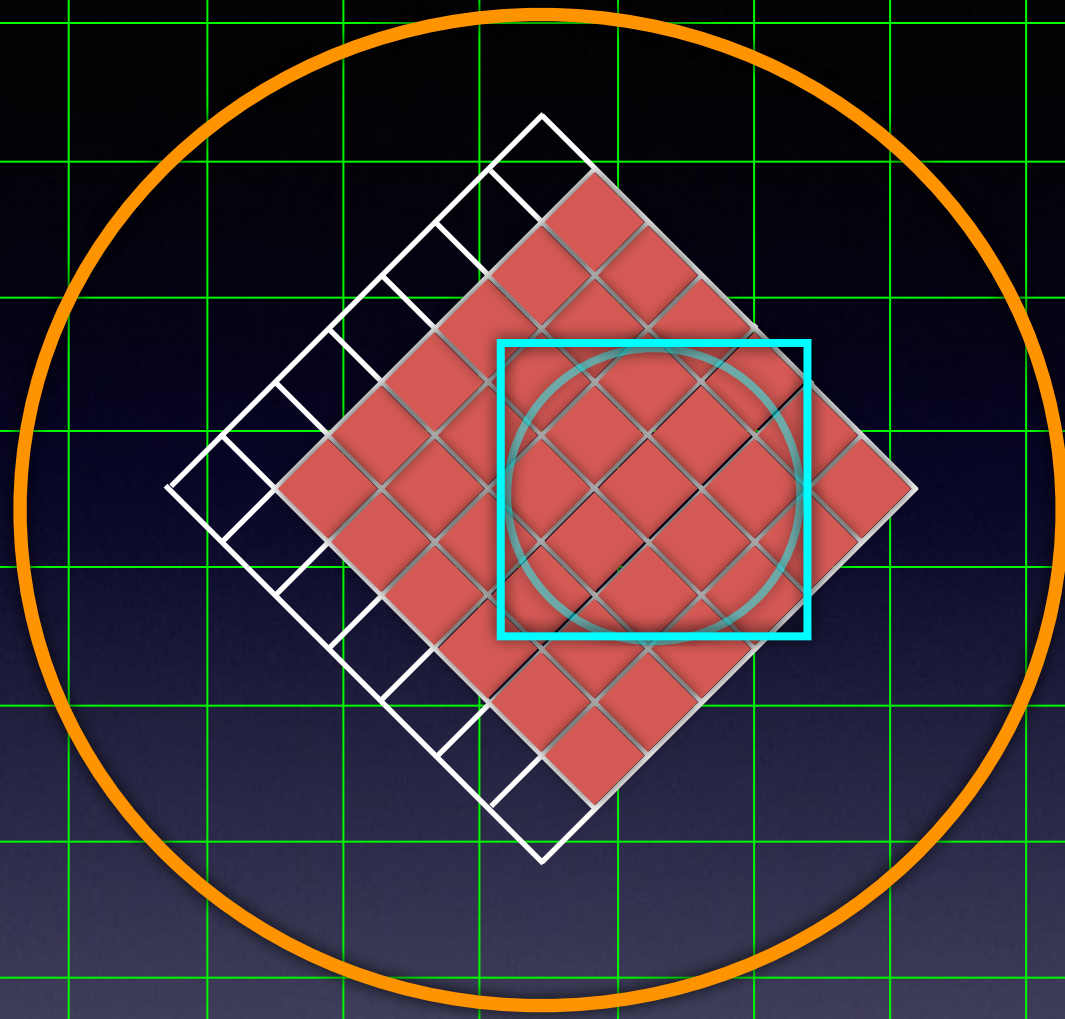




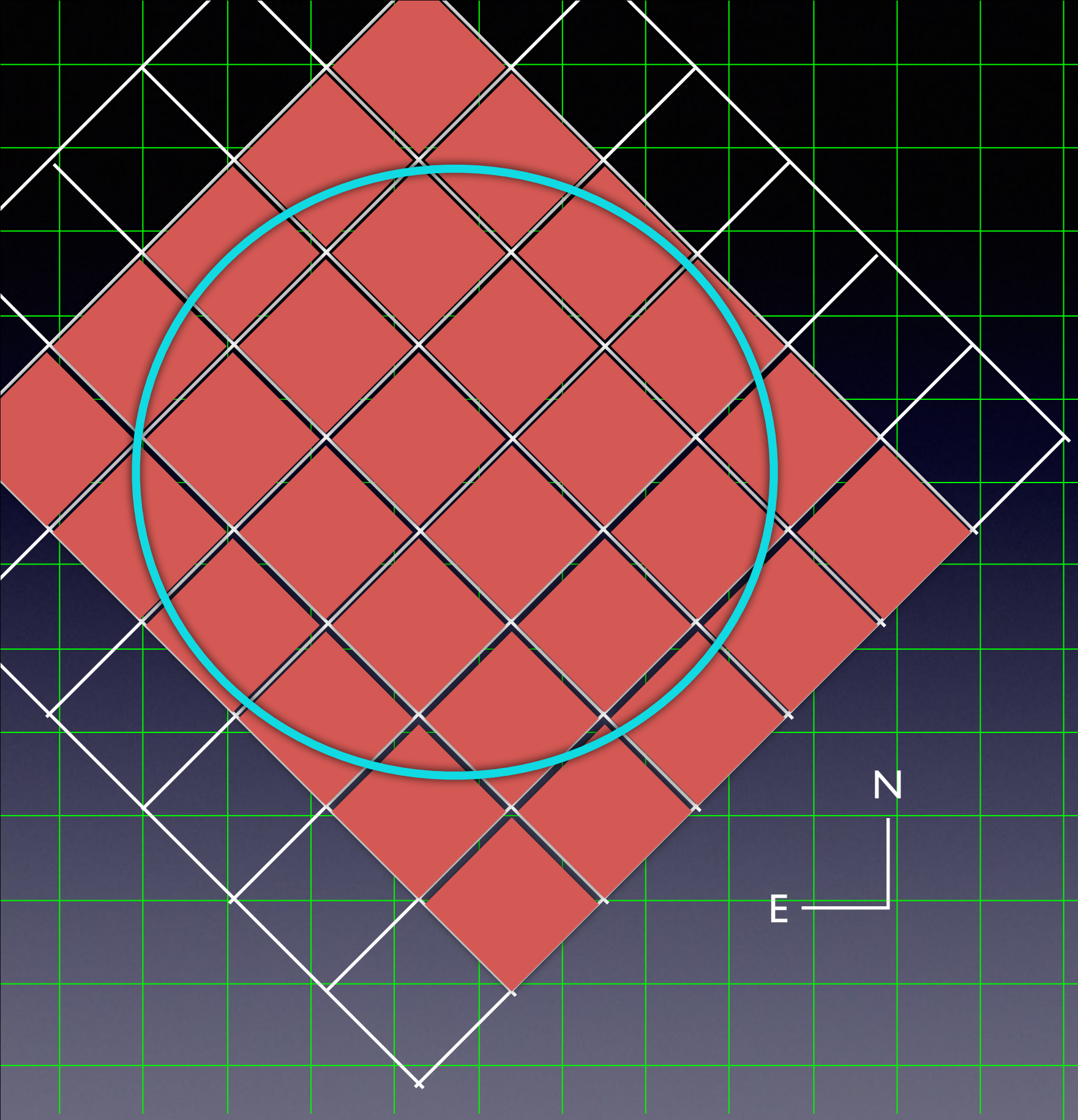
- Data Discovery
- Available Data
- Download



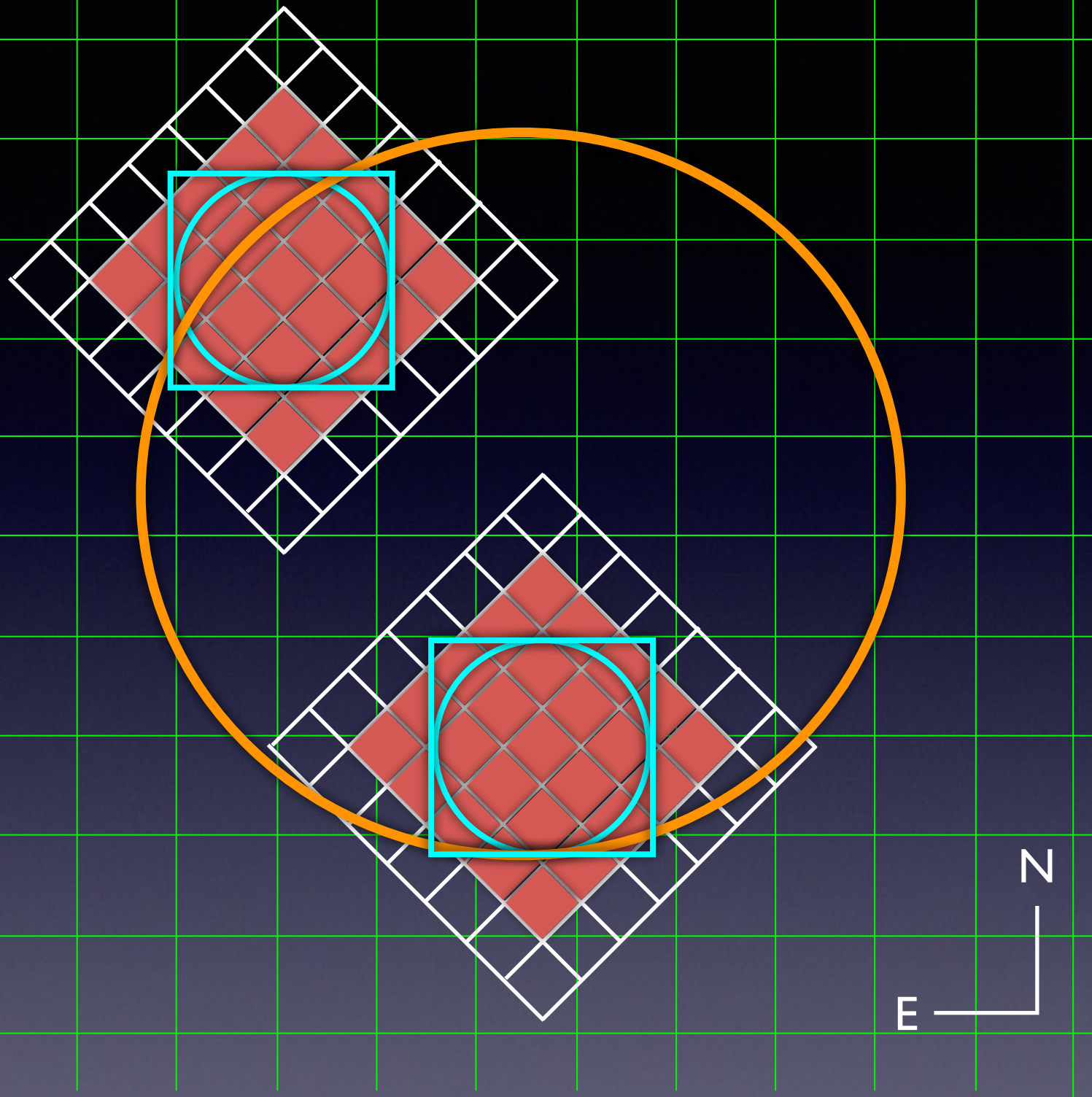
- Data Discovery
- Available Data
- Cutout (circle)
- Download



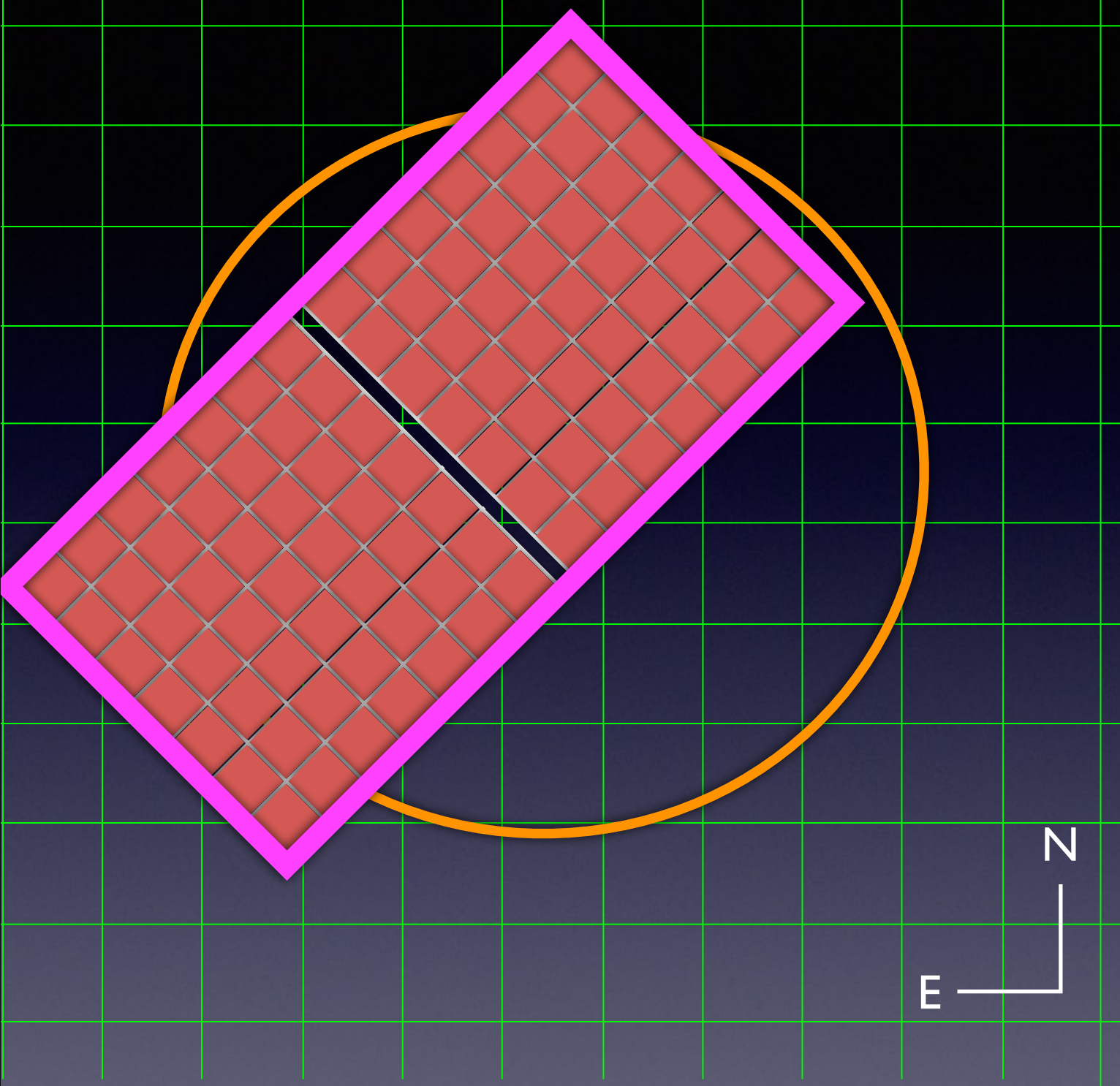
- Data Discovery
- Available Data
- Cutout (rectangle)
- Download



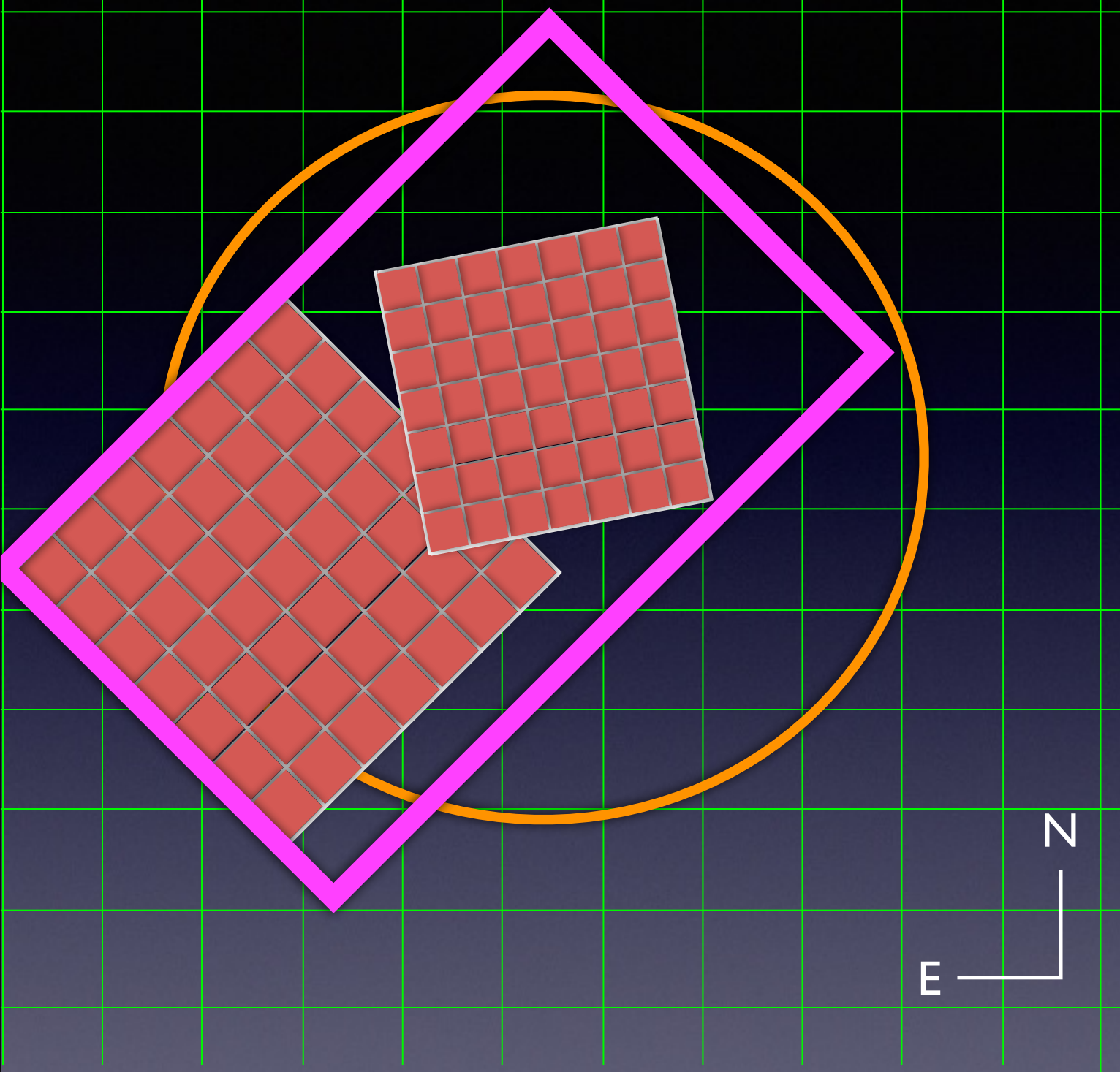
- Data Discovery
- Available Data
- Cutout = Data discovery cone
- Download



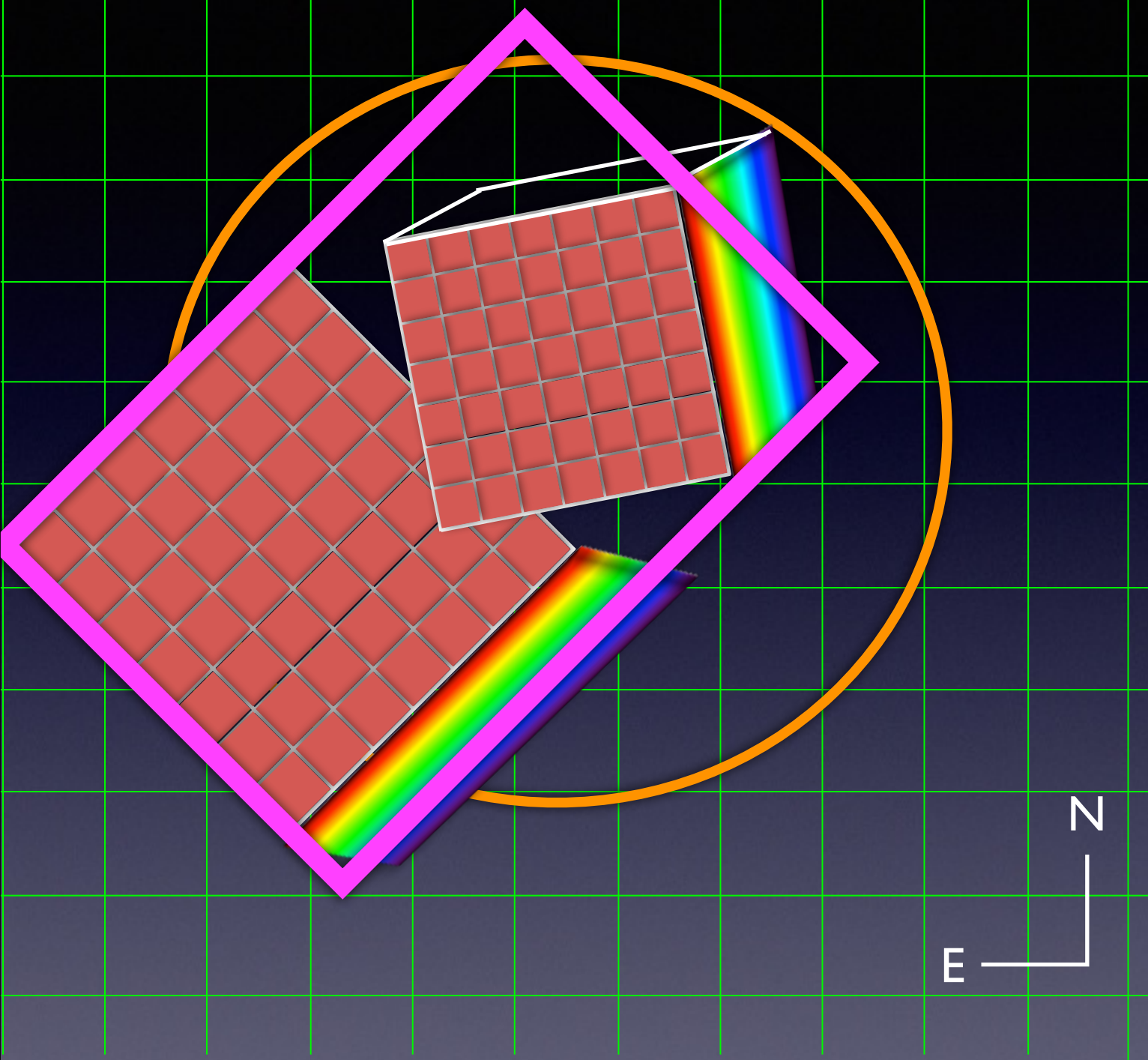
- Data Discovery
- Available Data
- Cutout (circle) - what's valid?
- Download



- Data Discovery
- Available Data
- Simple Mosaiced product
- Download



- Data Discovery
- Available Data
- More complex mosaiced product
- Download



- Data Discovery
- Available Data
- More complex mosaiced product
- Download

Focus Session Madrid

The topics of this focus session at the 2014 May IVOA Interoperability Meeting include

- Summary of the progress towards the protocols and prototype implementations.
- Identification of the next steps in the widespread adoption of the IVOA standards and services.
- Description of the additional functionality or enhancements likely to be needed. What are the highest priorities?
 - Invited presentations / Panel Discussion
 - Follow-on WG sessions and break-outs

expected topics

- Address the 'rough consensus and running code' needs of projects
- Implementation schedule
- Implementation assistance - what form?
- Tools - SAMP enable cube viz. tools
- Remote Visualisation goals