

# RASICAM I/O proposal



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# Outline

**Meeting purpose: Get direction for RASICAM interfacing design from those who will interface with it.**

[3] What RASICAM is

[4] What RASICAM can do

[5] RASICAM Status

[6] Data tiers proposal:

Live data

Stored data

[7-14] Data access proposals:

[7-12] Operator Display

[13] User Display

[14] Permanent Storage



# What RASICAM is

[the black box perspective]

- **Radiometric All-Sky Infrared CAMera:**

- Real-time cloud monitor
- Radiometric thermal IR
- All-sky coverage from location at CTIO
- Automated and web-controlled
- Automated Weather enclosure

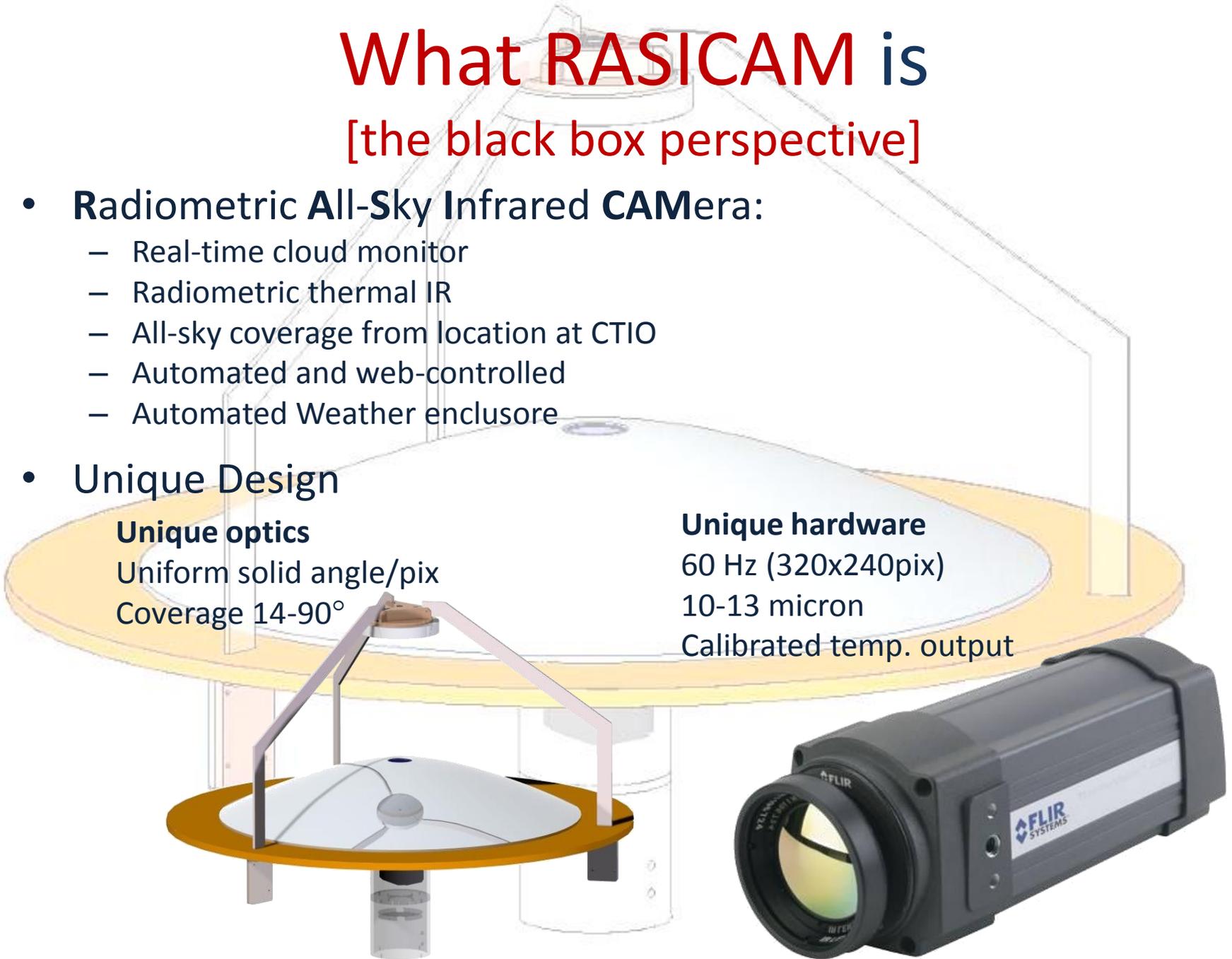
- **Unique Design**

**Unique optics**

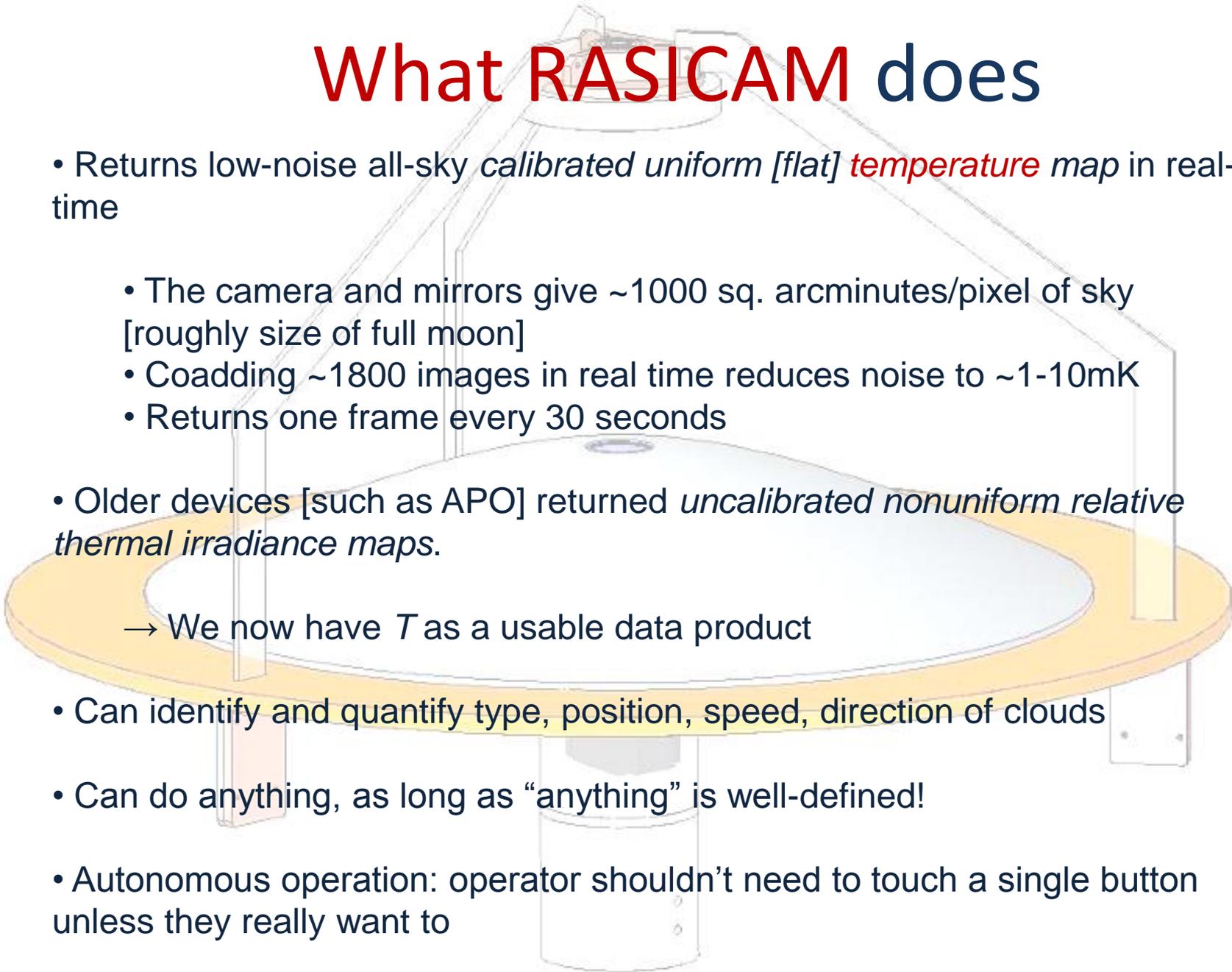
Uniform solid angle/pix  
Coverage 14-90°

**Unique hardware**

60 Hz (320x240pix)  
10-13 micron  
Calibrated temp. output



# What RASICAM does

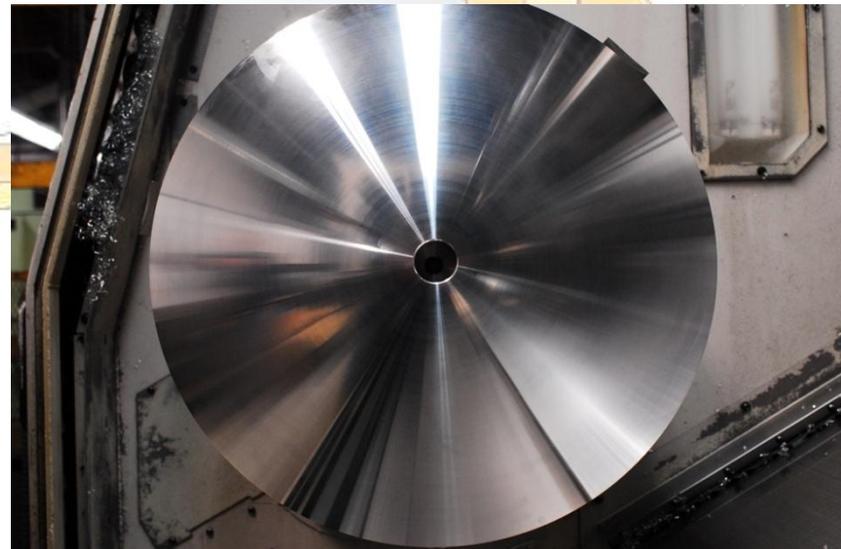


- Returns low-noise all-sky *calibrated uniform [flat] temperature map* in real-time
  - The camera and mirrors give ~1000 sq. arcminutes/pixel of sky [roughly size of full moon]
  - Coadding ~1800 images in real time reduces noise to ~1-10mK
  - Returns one frame every 30 seconds
- Older devices [such as APO] returned *uncalibrated nonuniform relative thermal irradiance maps*.
  - We now have  $T$  as a usable data product
- Can identify and quantify type, position, speed, direction of clouds
- Can do anything, as long as “anything” is well-defined!
- Autonomous operation: operator shouldn't need to touch a single button unless they really want to

# RASICAM status

- All hardware acquired
- Optics designed and validated
- Camera Module assembled/tested
- Mirrors machined + polished (24", 5.2" diam.)
- Camera control software written
- Assembly / fabrication **incomplete** but on-target for summer installation
- Data product generation software **incomplete** [pending feedback from this meeting] but on-target for summer installation [functions covering almost all of necessary computation and data management tasks have been written]
- User/operator interface software **undreamt-of** [pending this meeting]. Will be written and ready for installation for summer installation.

**User/operator interface design should be user/operator-driven. Data generation and storage should be data user-driven. Feedback needed for next topics!**



# Proposal 1: Data tiers

Tier 1:

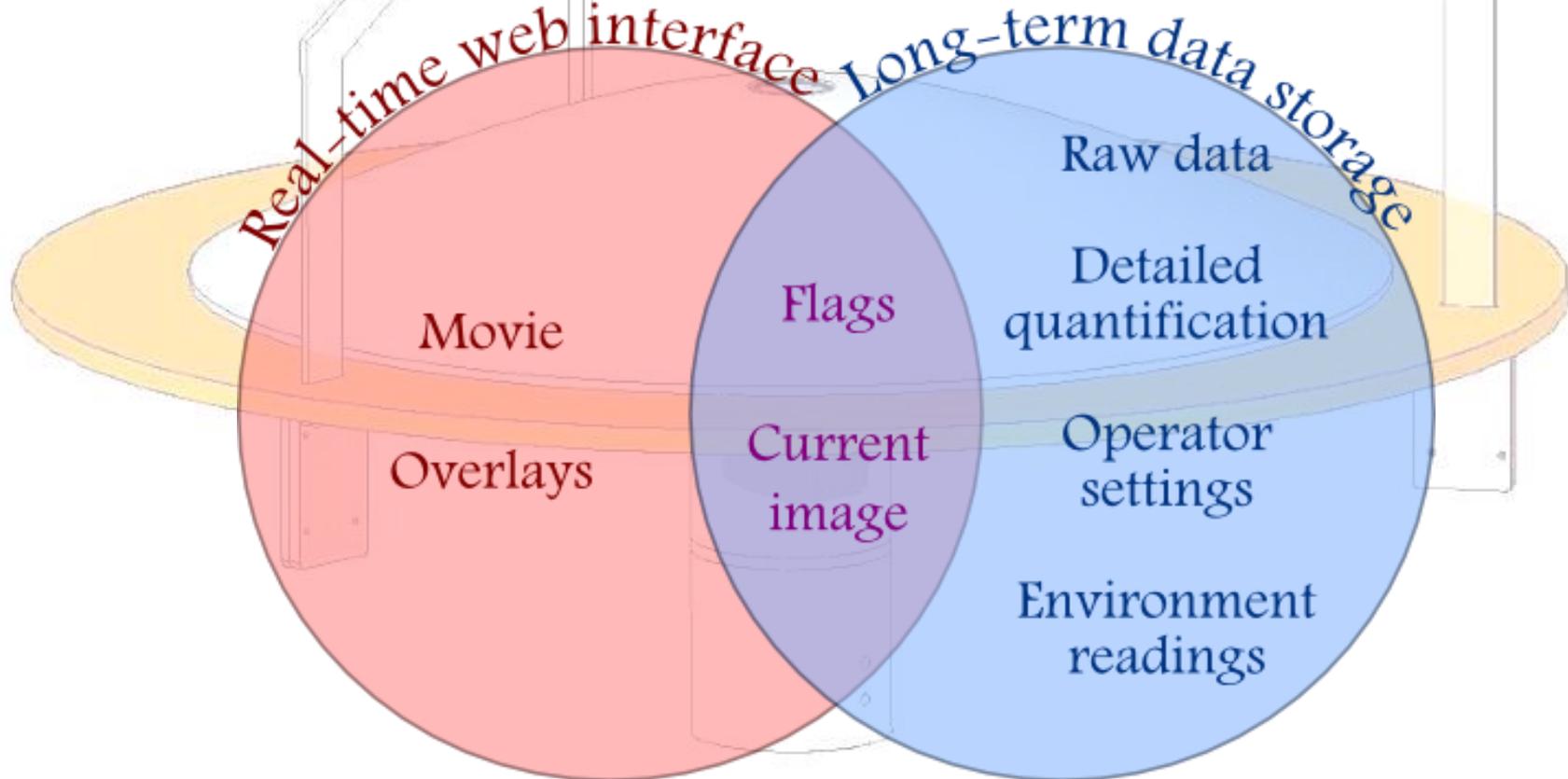
**Live-only data**

Purpose: inform operator of current conditions, warn of impending changes in cloudiness

Tier 2:

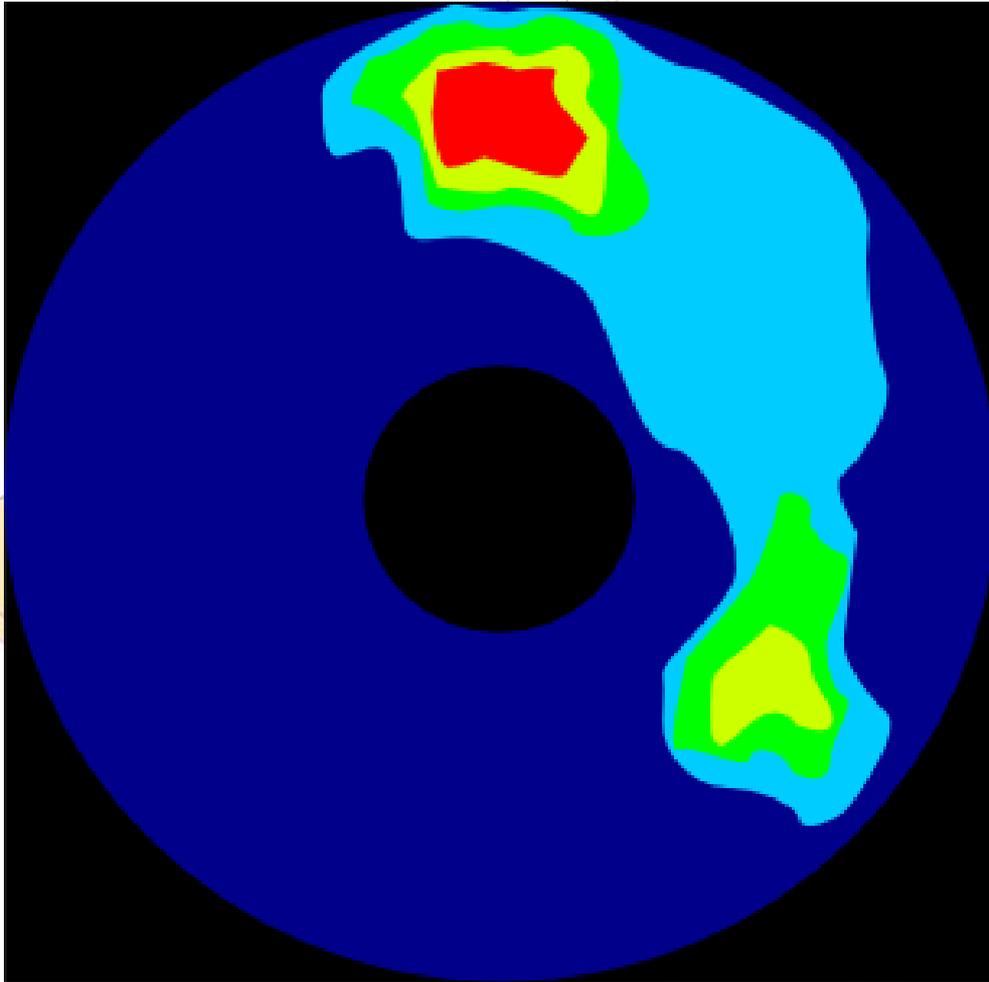
**Storage-only data**

Provide data for long-term performance studies and for conditions correlations with DES observations



# Proposal 2: Data access

## The operator web interface



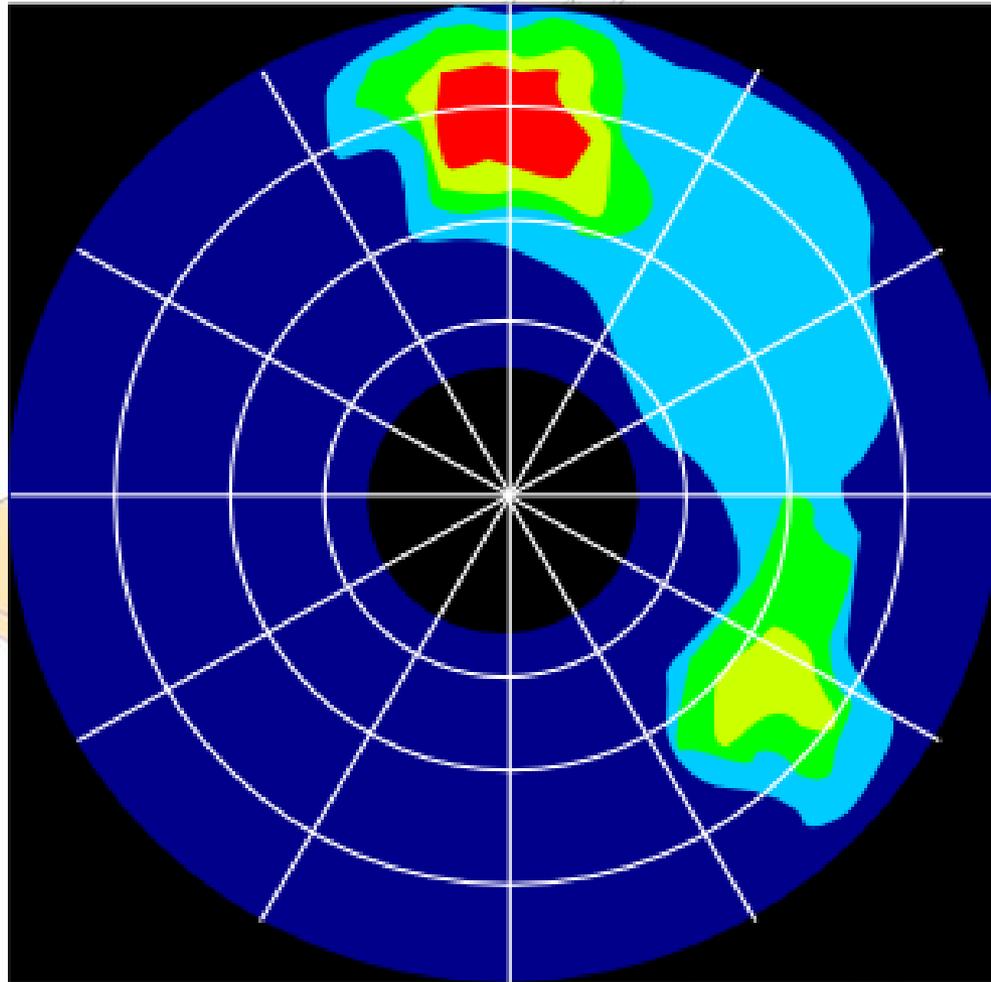
Current all-sky temperature map.

Buildings, structure and moon will be removed with an automatic software mask.

[Simulated image; real image will have 216 colors corresponding to distinct calibrated temperature values]

# Proposal 2: Data access

## The operator web interface

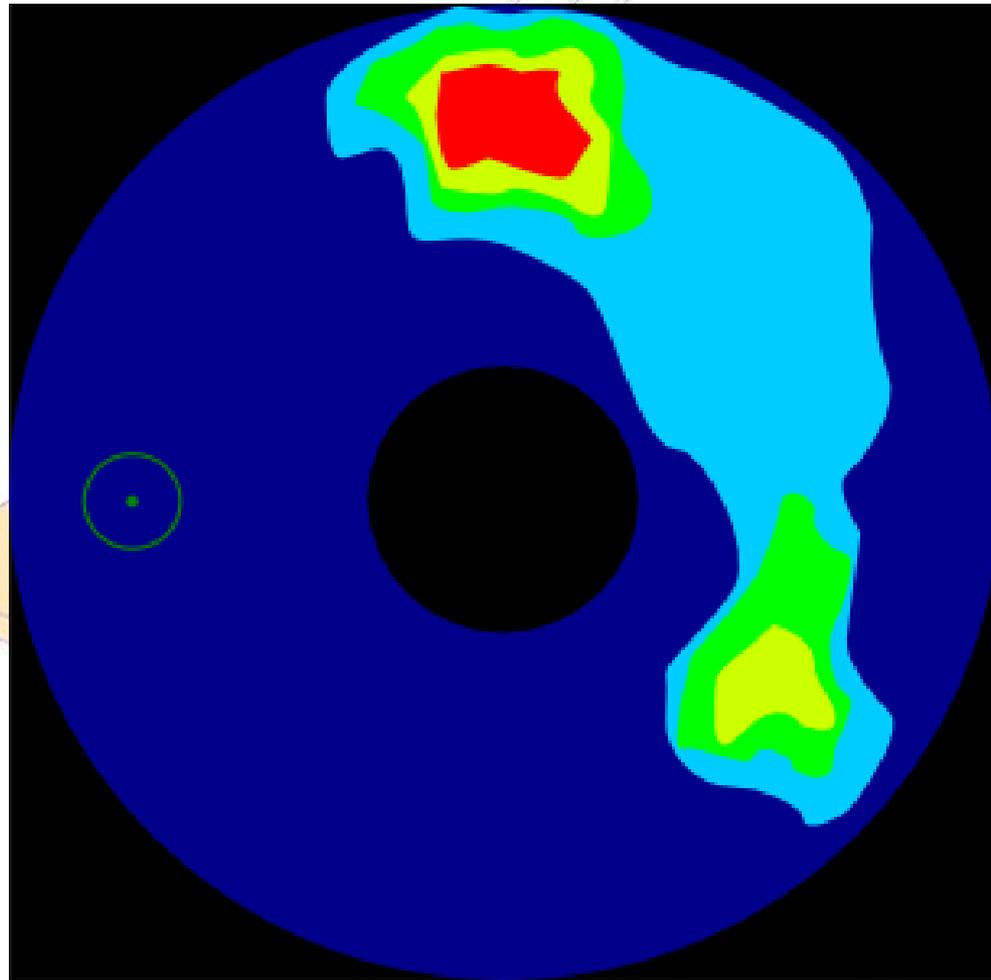


Sky map can be projected onto view. Useful or just distracting?

Show Grid

# Proposal 2: Data access

## The operator web interface

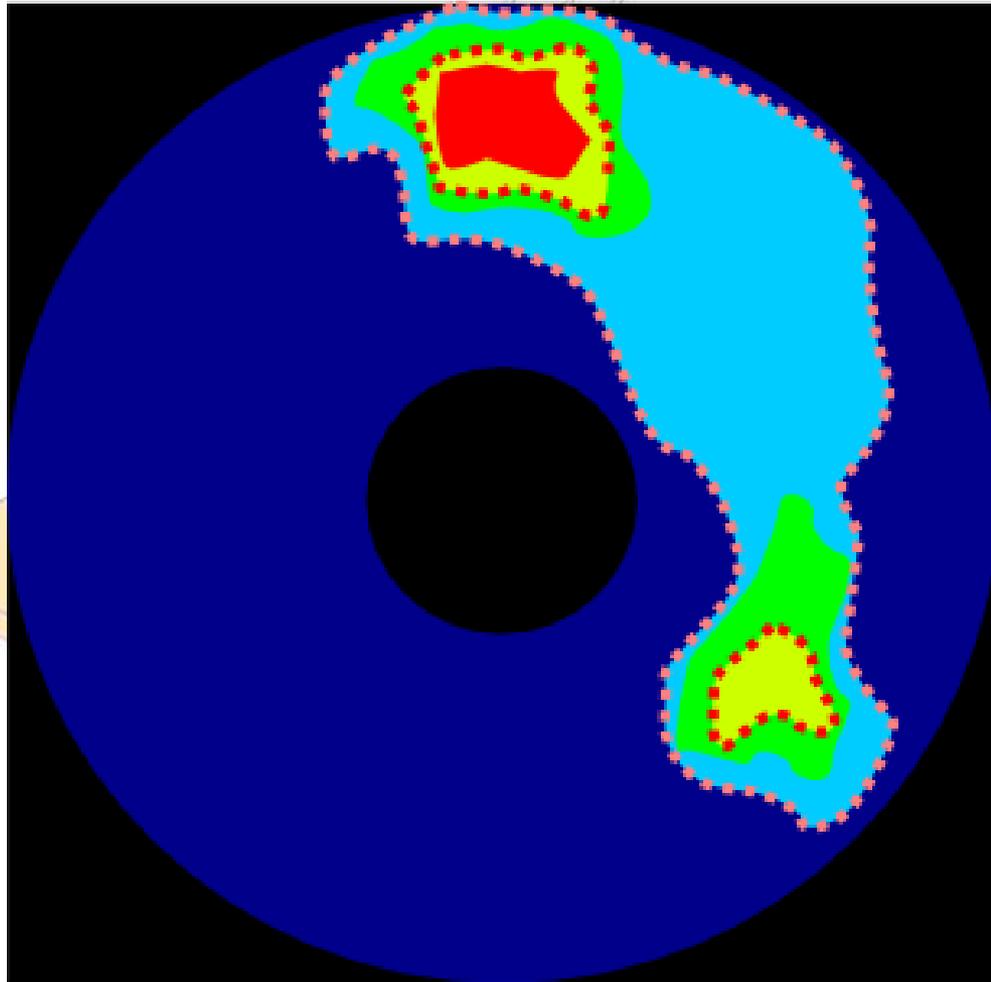


The current Blanco targeting location along with a buffer zone [the Blanco region of interest (ROI)] can be overlaid on the image. Even if not overlaid, this ROI is used for data products generation.

● Show Grid ● Show Blanco

# Proposal 2: Data access

## The operator web interface

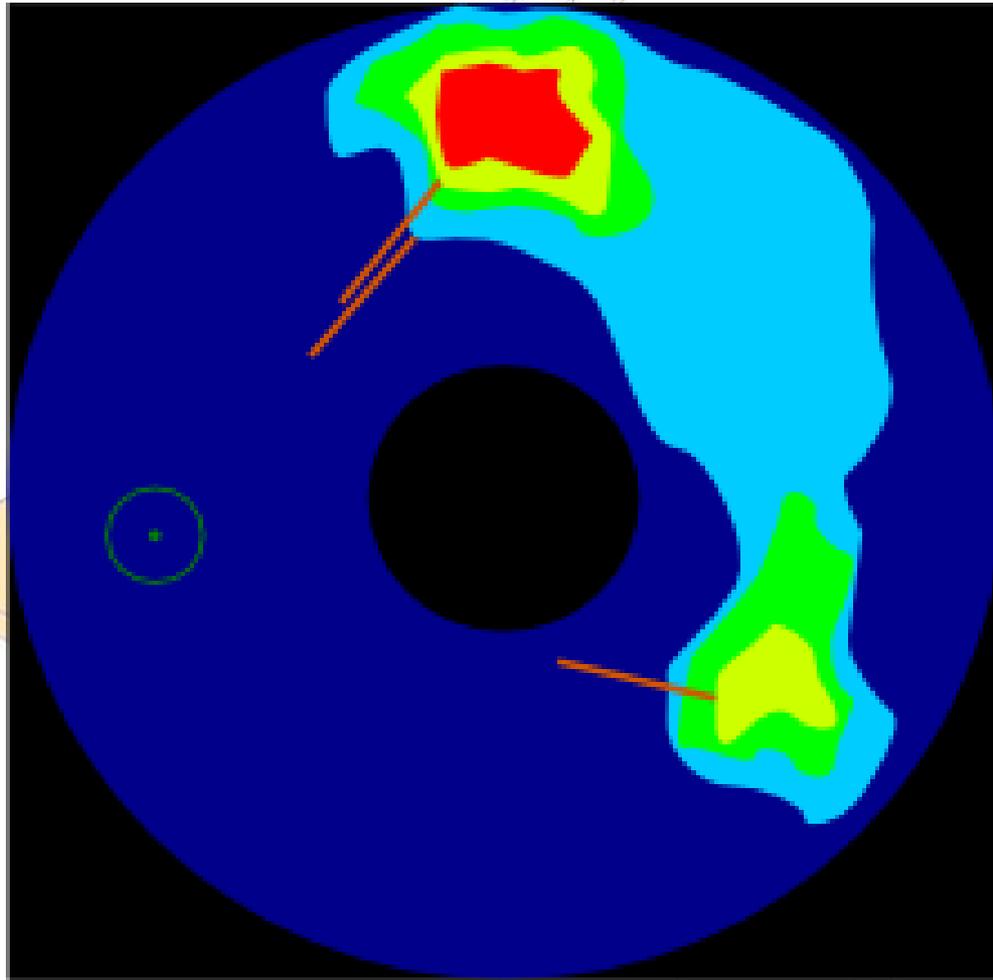


The two [or more?] thresholds that define thin and thick clouds [to differentiate between possible thin cirrus/contrails and lower, thicker clouds] can be overlaid in contour. Again, these thresholds are used for data product generation regardless of whether they are overlaid on the image.

● Show Grid ● Show Blanco ● Show contours

# Proposal 2: Data access

## The operator web interface



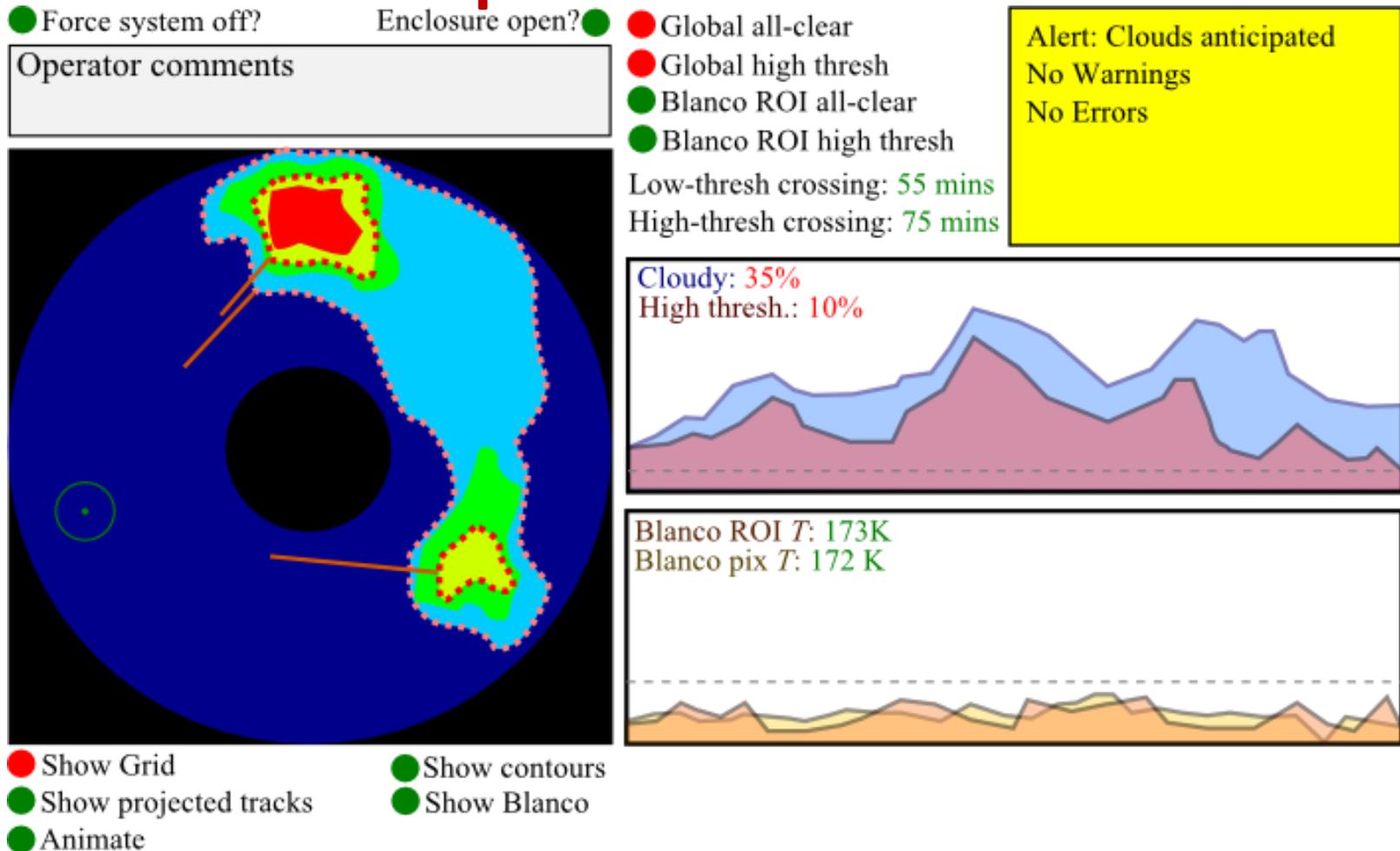
An edge-detection algorithm detects the closest cloud edges in each threshold, measures the movement over several frames and projects the motion forward ~10 minutes. Useful? How should this information be displayed?

This algorithm has been written but it can be adjusted to meet requirements.

- Show Grid
- Show Blanco
- Show contours
- Show projected tracks

# Proposal 2: Data access

## The operator web interface



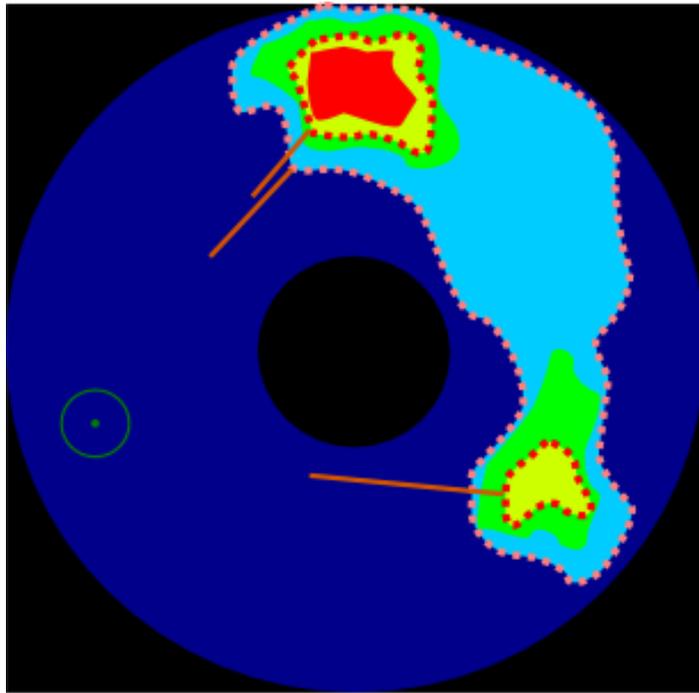
Keep in mind that almost anything is possible, but optimize:

1. Minimum observer attention required
2. Maximum useable information displayed

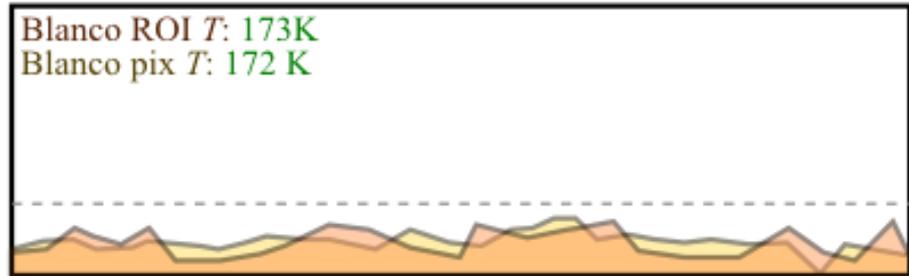
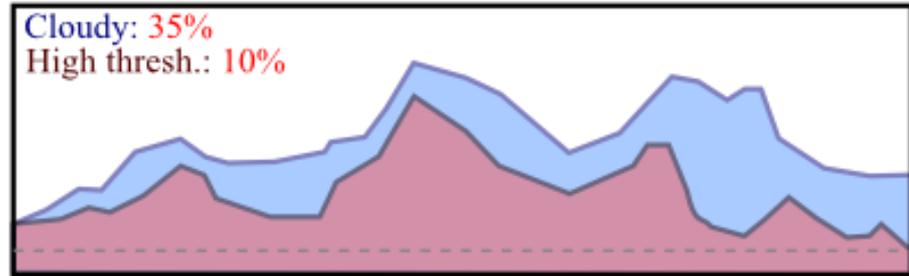
6 **WHAT DATA WOULD YOU LIKE DISPLAYED? FLAGS? OVERLAYS?**

# Proposal 2: Data access

## The user web interface



Low-thresh crossing: 55 mins  
High-thresh crossing: 75 mins



Off-site data users have access to raw data and the basic current view to minimize bandwidth and processor usage.

Who will be using this data? What do they need?

# Proposal 2: Data access

## Permanent storage available to all

Hard disk space used per... ..event [MB] ...night [MB] ...10 years [TB]

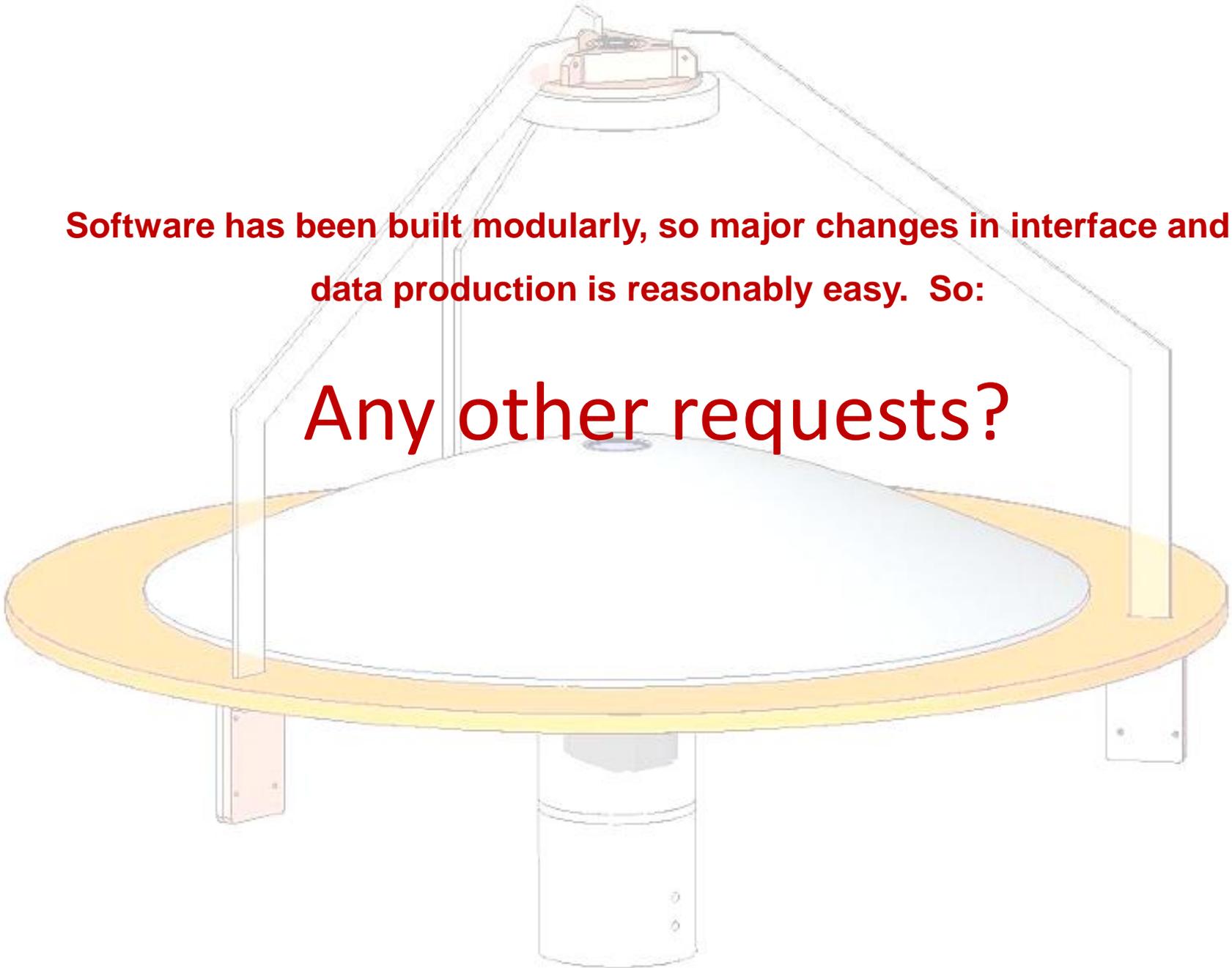
Hard disk space used per...	...event [MB]	...night [MB]	...10 years [TB]
Raw data	0.12	166	0.61
LUT table for counts→T conversion	0.26	377	1.38
Blanco position			
System environment readings [thermocouples, etc.]			
Operator comments			
Alerts, warnings, errors			
Status of all controls			
Timestamp			
<b>TOTAL</b>	<b>0.38</b>	<b>543</b>	<b>2</b>

**Exclude [but include executables to generate from raw data]:**

- Overlays
- Images
- Animations

**We will have up to 5TB of storage space. What else should we save?**

**Who will be using this? What will they be using it for?**



**Software has been built modularly, so major changes in interface and data production is reasonably easy. So:**

**Any other requests?**