

# APEX DATA TO PIs WITHIN 2 DAYS

Credit: ESO/B. Tafreshi

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# Outline

- APEX in a nutshell
- Old data flow system: disadvantages
- New data flow system: advantages
- Challenges for the future

# APEX in a nutshell

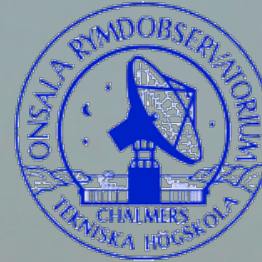


Max-Planck-Institut  
für  
Radioastronomie

50%



27%



23%



Host

## APEX in a nutshell

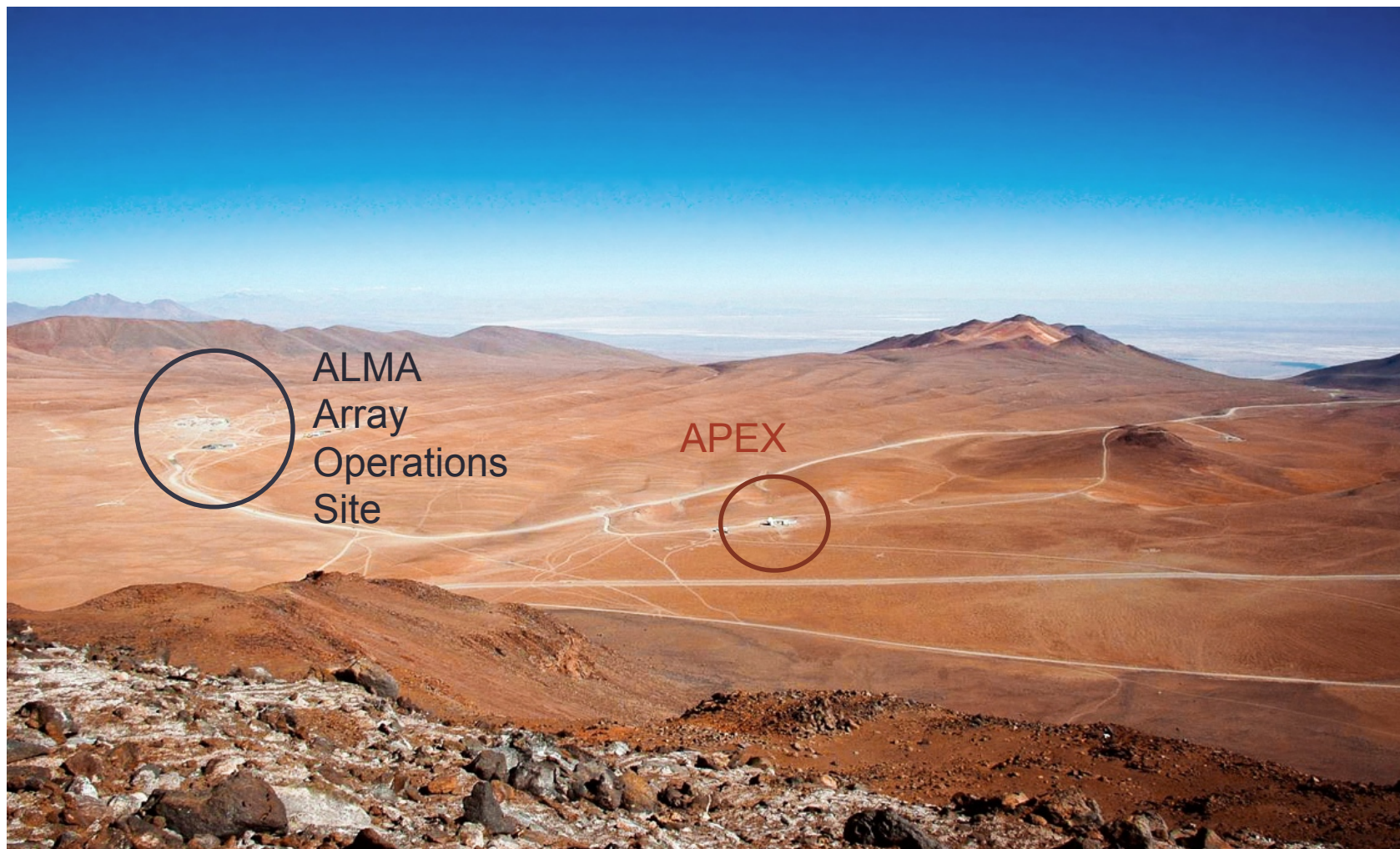


# APEX in a nutshell

- 12-m sub-mm telescope based on ALMA prototype (Vertex)
- Chajnantor plateau @ 5100 m
- Started operations in 2004. Commitment till 2015 (likely 2017)
- Mature project:
  - 24-hours operations (3 shifts)
  - Up to 500 h on-sky / month



# APEX in a nutshell



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Sequitur base: San Pedro de Atacama (facilities, night observations)



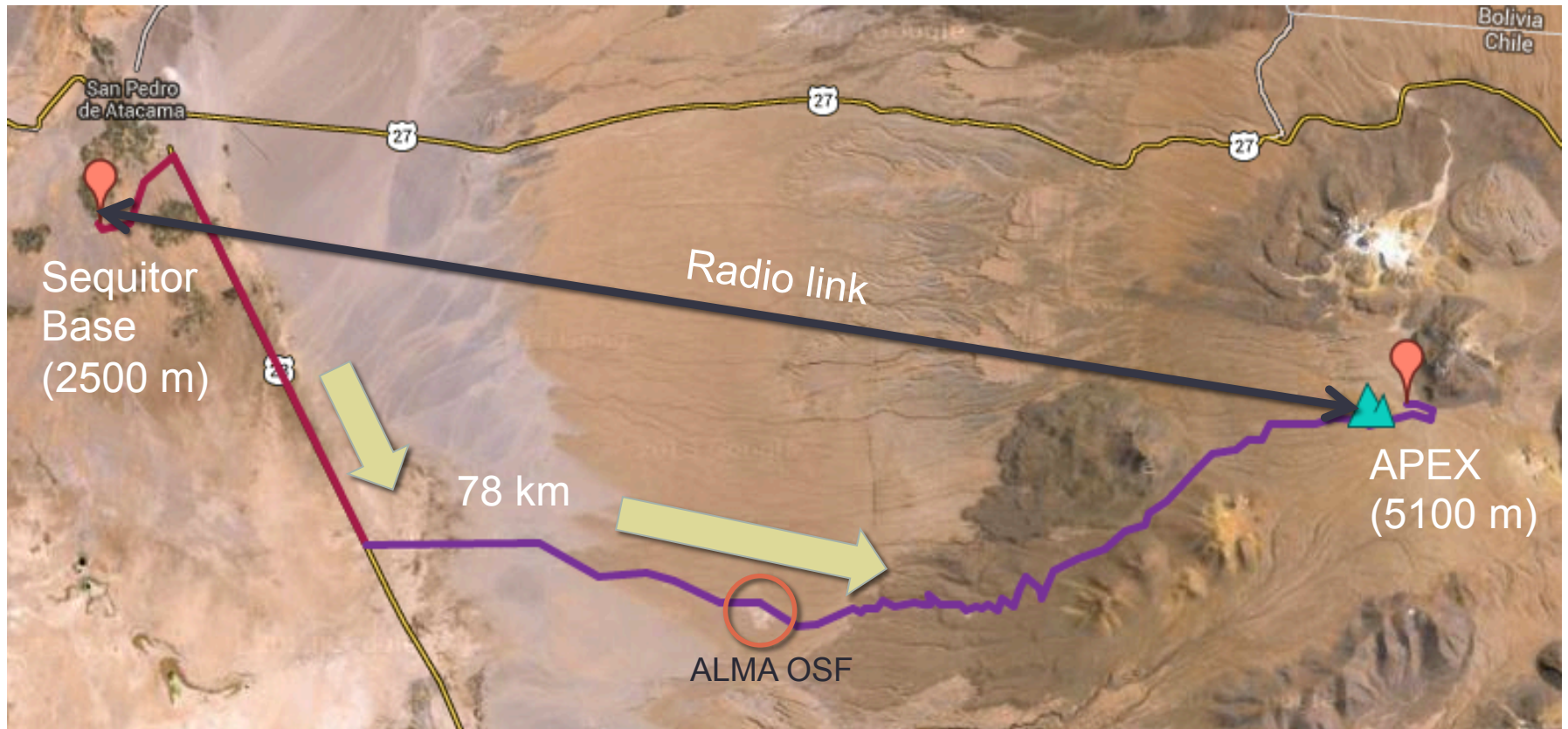
# APEX in a nutshell

Chajnantor site: Control room + telescope (morning and afternoon operations)



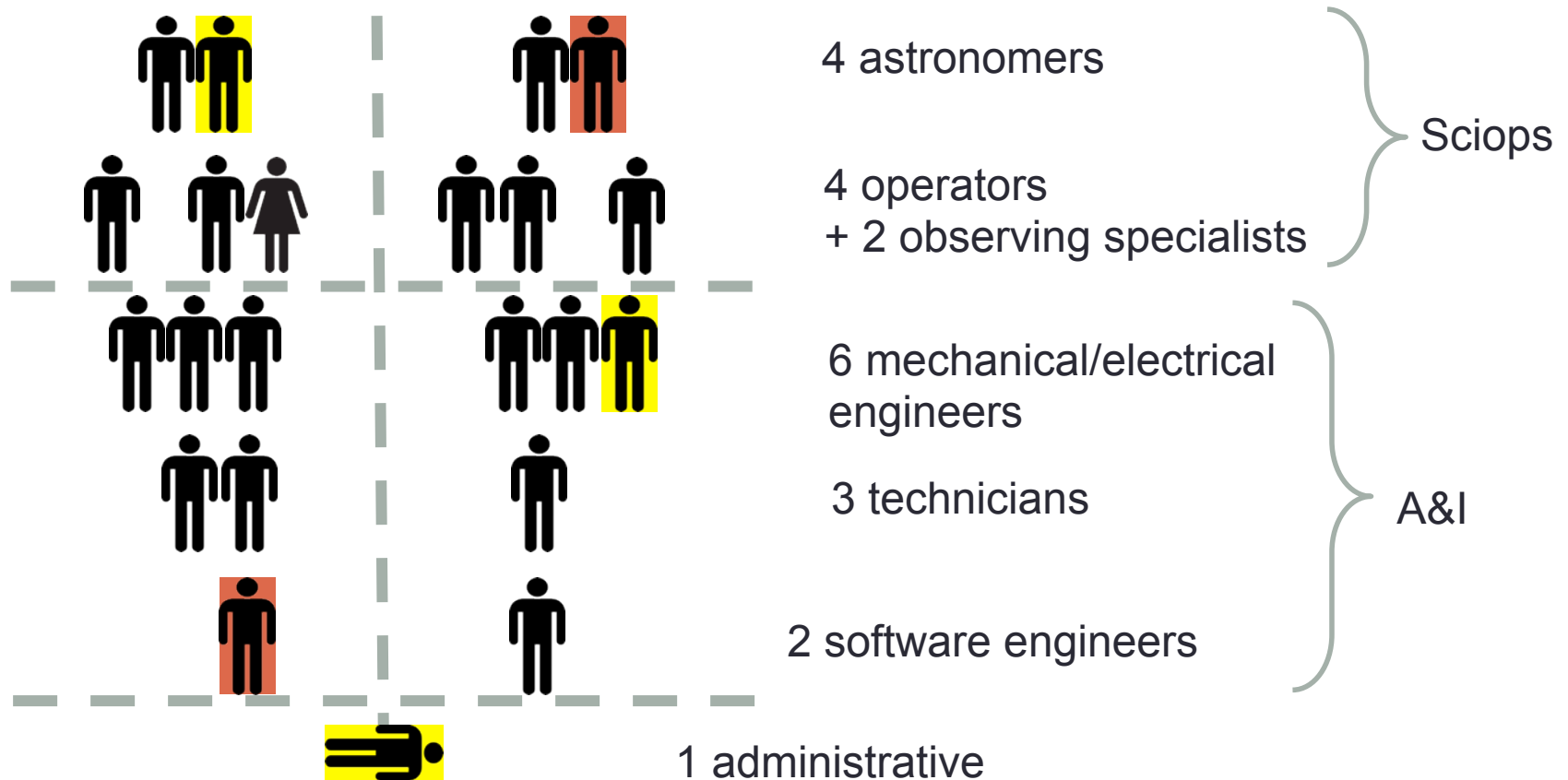


# APEX in a nutshell



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Little staff distributed in **2 shifts** (8 days)



+ 10 service staff (cooks, cleaning, car drivers, maintenance)

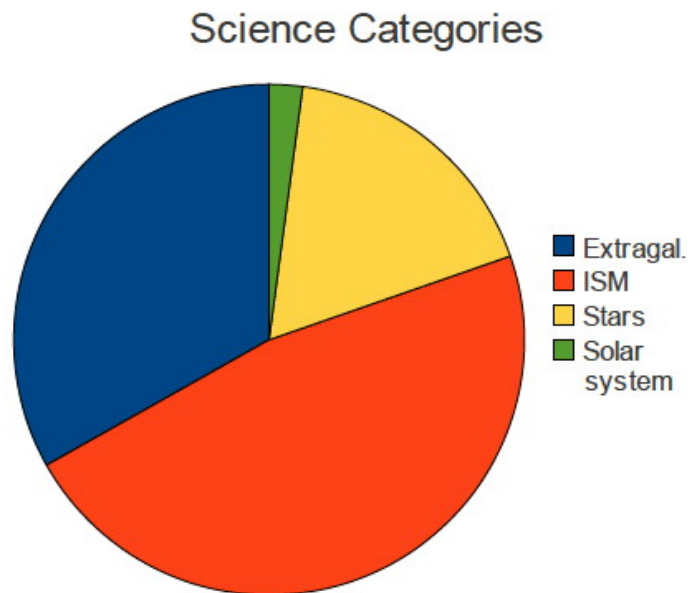
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Instrumentation: Variety of bolometer cameras & heterodyne instruments  
Test bed for state-of-the-art instrumentation

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Scientific topics:



Stutz + 2013 ApJ 767, 36



Swinbank + 2010 Nature 464, 733

Important role for:

- ALMA science preparation
- Herschel / Planck science follow up

# APEX in a nutshell

APEX data products:

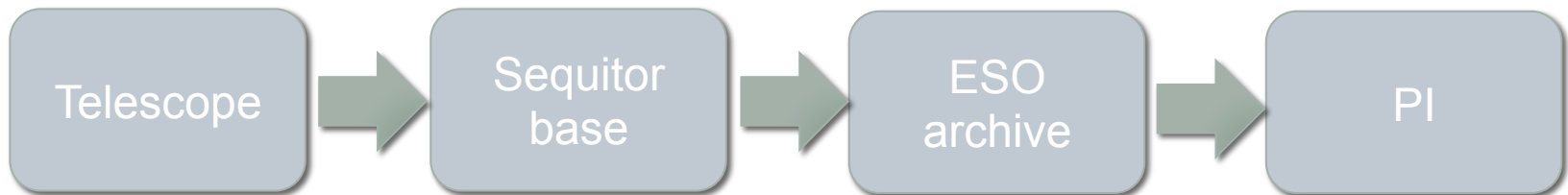
Raw data (Multi Beam FITS)  
Calibrated data (heterodyne)  
Metadata (logs, twiki)  
Quick reduction + scripts

# APEX in a nutshell

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Data flow:



# Old Data flow System

# Old Data flow System

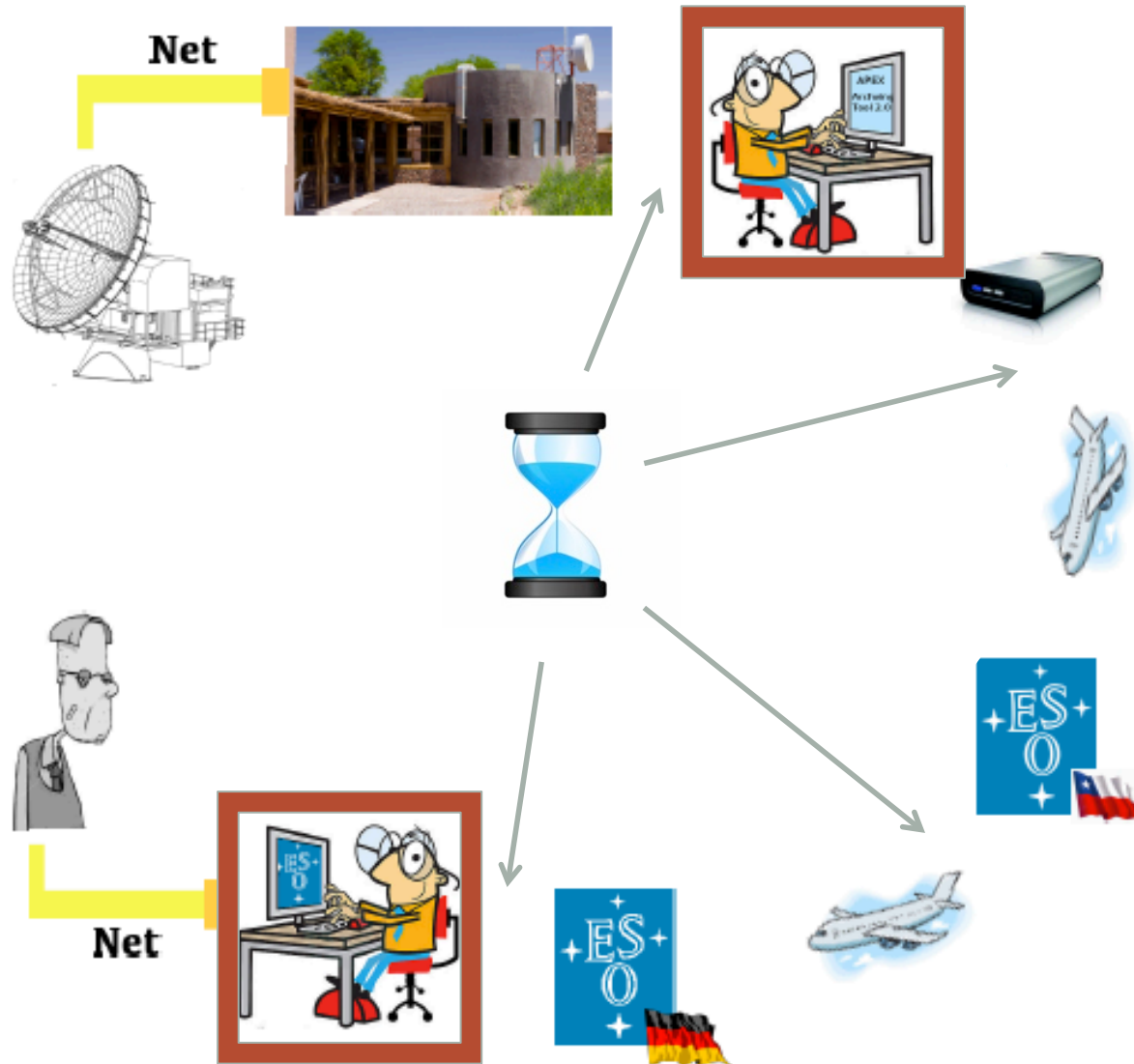
- Archiving Data Archiving document (C. de Breuck, 2006)

*“provides instructions to both the local APEX staff and the Data Flow Operations group in ESO Garching on how to send, archive and distribute APEX data”*

- Some rules to comply with ESO archive standards
- Contents/format of archival data packages
- Describes differences among partners
- Establish delivery procedures (USB disks)
  - **Total** APEX external bandwidth: 1 Mbps



# Old Data flow System



# Old Data flow System

## Disadvantages

- One/two shipments per run
- Manual intervention both at APEX and ESO (manpower, mistakes)
- Travel overhead too long
- PI gets data several weeks after observations
- PI cannot interact to decide while observations are going on
- Short time to reduce/publish data before next call

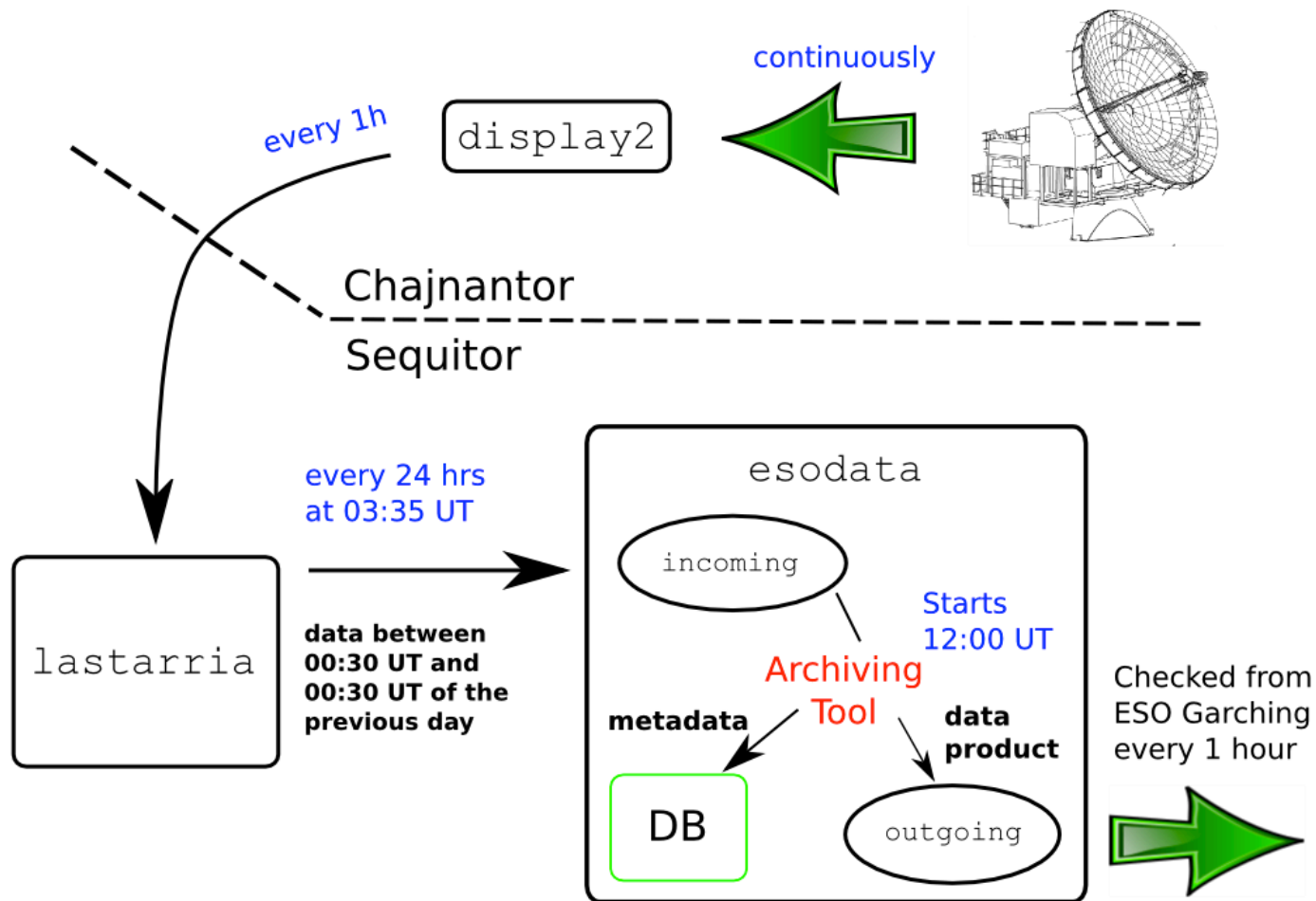
Improvements?

# Improvements?

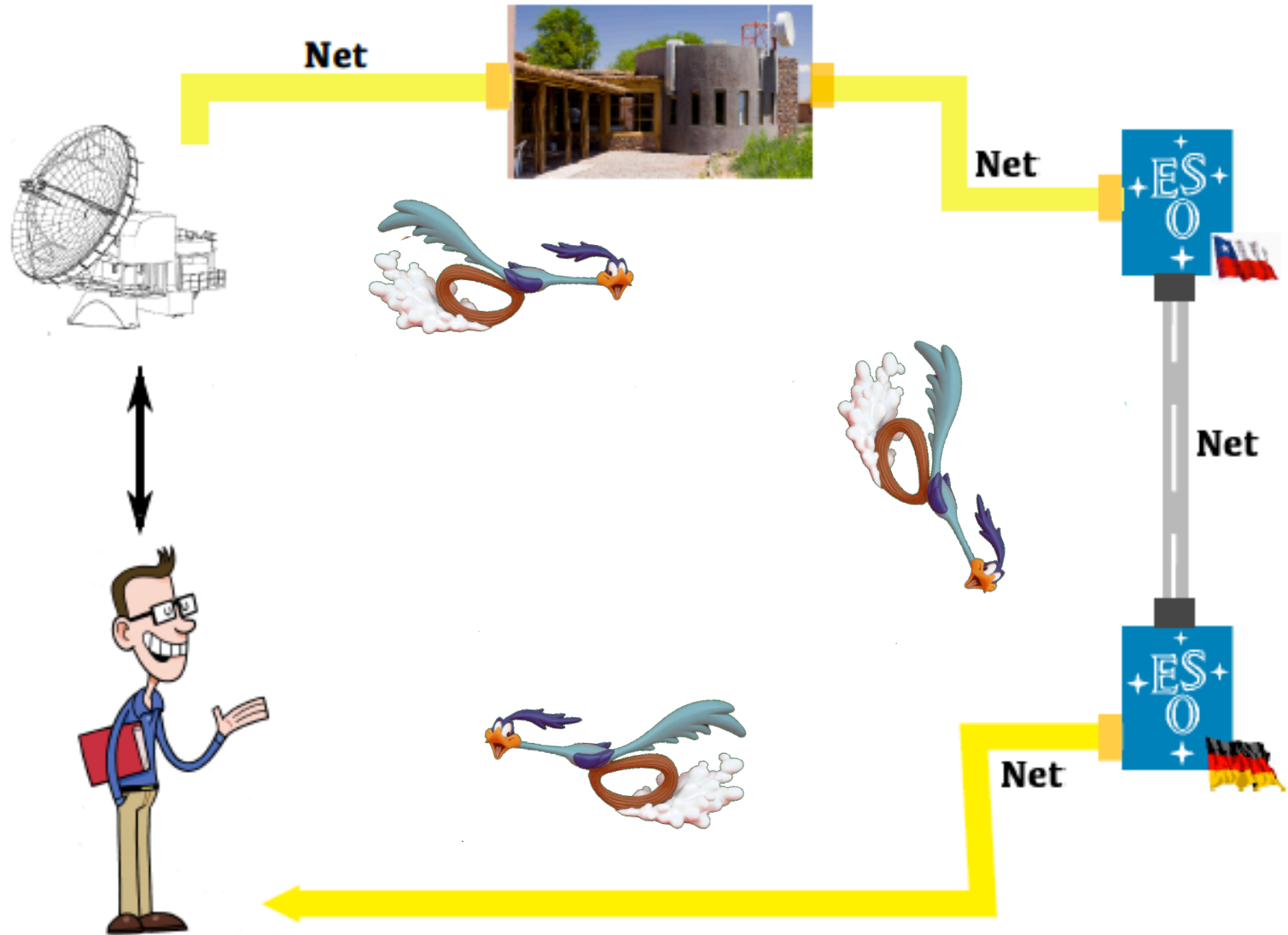
- 2010: Requirements for new procedures
- Aims:
  - Reduce substantially delivery time (weeks to days)
  - Completely automated system
  - Integrated as much as possible into the ESO data flow system
  - Little resources
- Considerations:
  - Data volumes generated (~ 3TB/year and increasing...)
  - Available infrastructure (renewal IP contract, usage of EVALSO)
  - Resources needed (bandwidth, hardware, software)
  - Advice from other LPO observatories
  - Coordination between APEX and ESO Archive staff

# Current Data flow System

# Current Data flow System



# Current Data flow System



# Current Data flow System

## Advantages

- One shipment every 24 hours
- Automated transfer: **minimum manual intervention**
- Implemented with **free software** (linux, bbcp, MySQL, Python)
- Fast internet connection APEX - Santiago - Germany
- PI gets data in ~ 2 days in his desk. Propriety period starts
- PI can take decisions before the observing run is finished
- Possibility to get **quick results** and publication!
- Higher possibility to get more time...
- **Community** also gets data earlier



# But still some challenges...

- Optimize timings
- Face the imminent increase of data volumes (new generation of instruments)
- Debugging procedures



Thank you!