# Options for VGOS observations and analysis in 2020
(and beyond)

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# Some VLBI Definitions

- **observation**: VLBI-time delay measured by two network stations (one baseline)
- **scan**: multiple VLBI-time delays measured by more than two stations simultaneously on the same source (> two baselines)
- **session**: collection of VLBI observations or VLBI scans within a continuous time interval (i.e. 24h)
- **experiment**: session exploring the VLBI method (with the risk of failing)

# Current VLBI vs. VGOS observations

- S/X band
  - 2.2-2.35, 8.1-8.9 GHz
- session based
  - i.e. R1, T2, R4, ...
  - 400 scans/24h

- broadband
  - 2-14 GHz
- initially session based, later continuous obs.
  - ≥2880 scans/24h

If we would produce
continuous VLBI data streams,
what would be the
meaning of a VLBI session?

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  - TRF
  - CRF

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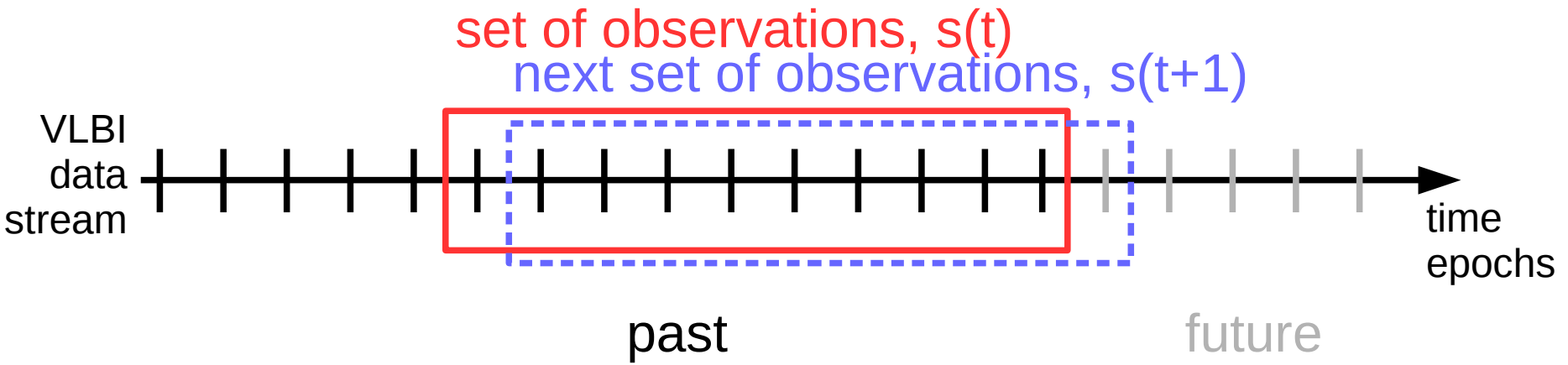
But we need more than one observation in order to estimate parameters!

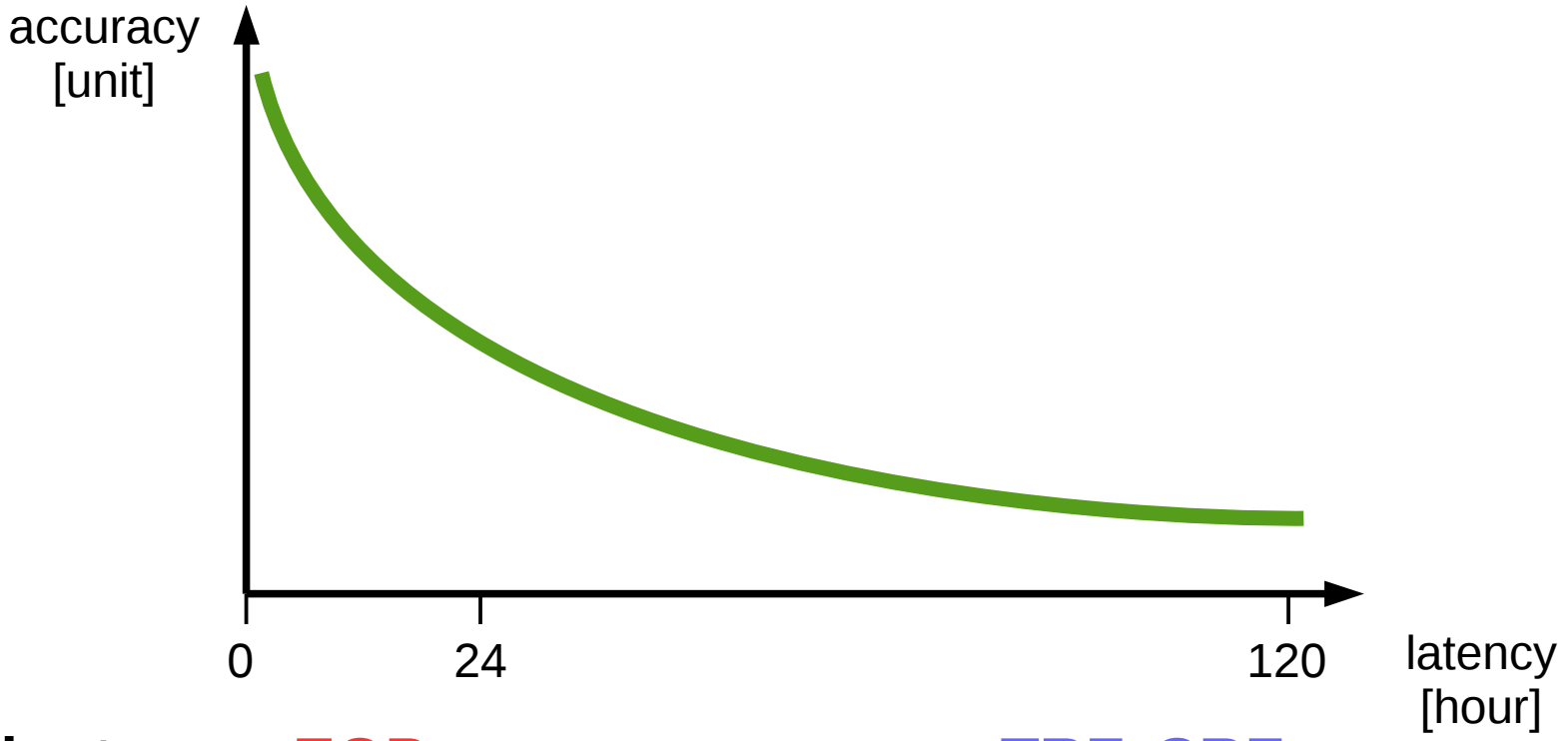
# How to process continuous VLBI data streams?

1. Select a set s(t) of most recent VLBI observations from the correlator output data base.
2. Perform a parameter estimation at epoch t.
3. Add an incoming new VLBI observation to the set s(t+1), remove the eldest one from the set.
4. new epoch (t = t+1), go to step 2.



# Accuracy vs. Latency
## in IVS products

- **Latency**: time interval between availability of observables and availability of IVS product




**Products**: **EOP** **TRF, CRF**

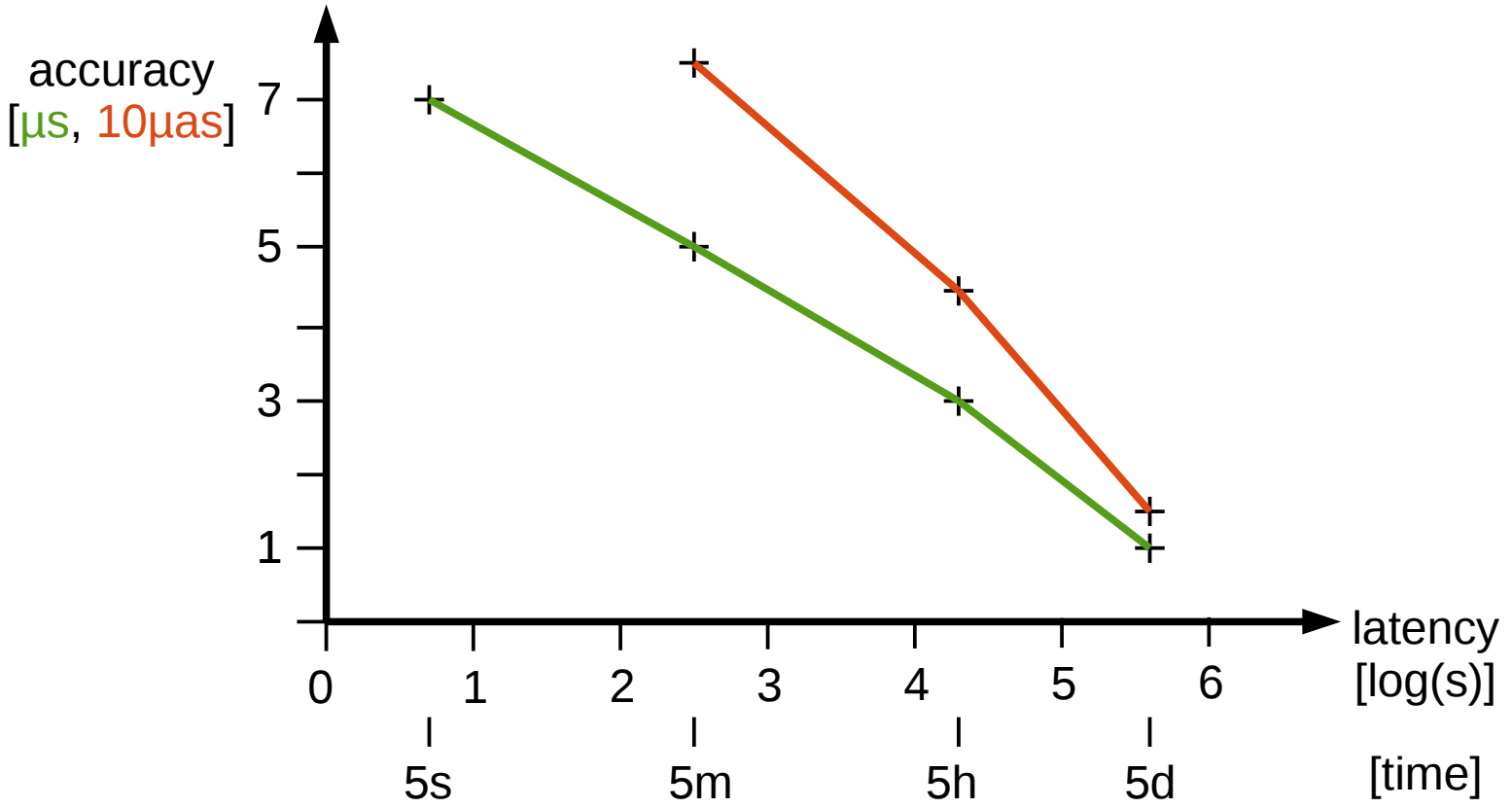
# Product classes, latency, accuracy

| Product class | Product epoch | Update interval | Epochs to be updated | Latency | Sub-product | expected accuracy (WRMS) |
|---|---|---|---|---|---|---|
| **Ultra rapid** | every 10' | every 10' | t, t-10'...50' | 5 s | UT1-UTC | 7 µs |
| **Rapid** | every 1h | every 1h | t, t-1h...5h | 5 min | UT1-UTC | 5 µs |
| | | | | | $x_P$, $y_P$ | 75 µas |
| | | | | | nutation offsets | 75 µas |
| **Intermediate** | every 6h | every 6h | t, t-6h...18h | 5 h | UT1-UTC | 3 µs |
| | | | | | $x_P$, $y_P$ | 45 µas |
| | | | | | nutation offsets | 45 µas |
| **Final** | every 12h UT | every 24h | t | 5 days | UT1-UTC | 1 µs |
| | | | | | $x_P$, $y_P$ | 15 µas |
| | | | | | nutation offsets | 15 µas |
| | | | | | telescope coordinates | 3 mm |
| | | | | | source position | 15 µas |

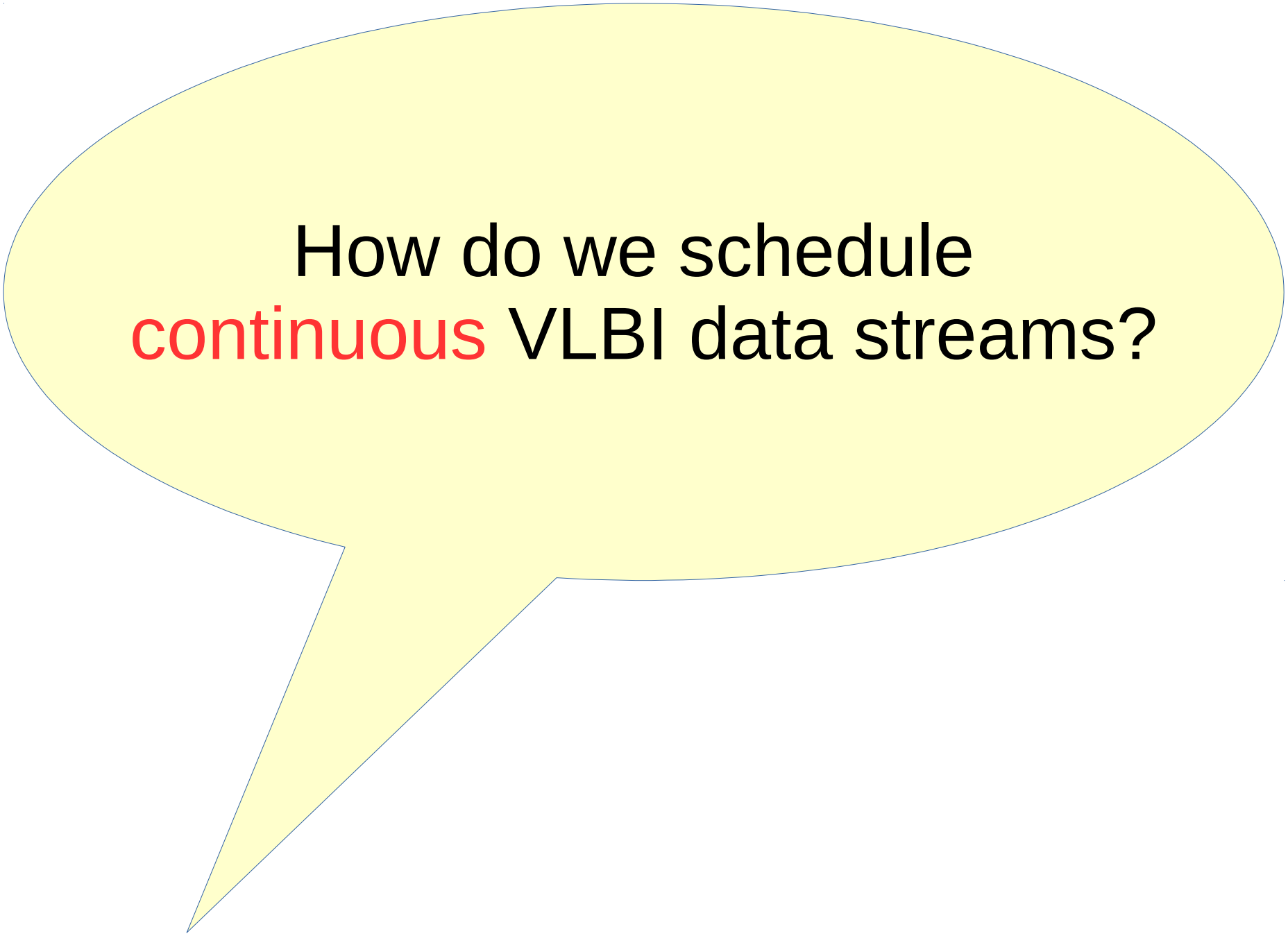
courtesy of A. Nothnagel

# Accuracy vs. Latency

## in IVS EOP products (LOD, pole, nutation)




- Low latency products require ***one*** reliable automated analysis center!


How do we schedule
continuous VLBI data streams?

# Scheduling of continuous VLBI data streams

- chance to close the feedback loop by scheduling on the fly by reacting on
  - stations fading in and fading out
  - product performance
  - data drain via communication line and correlator load
- new optimization algorithms
  - product oriented
  - sky coverage
  - (partially integration of non-VGOS stations)

# Conclusions:
## VGOS continuous data streams need

- New analysis strategies
  - automatization
  - VLBI-observation epoch oriented
  - (new treatment of auxiliary data)
  - (integration of non-VGOS observations)
- New scheduling strategies
  - scheduling on the fly
  - new optimization algorithms
- dedicated control and operation center(s)