TOW2025 — Correlator Workshop

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- ➢ Some history: Fourth Correlator Workshop
  - ▪ TOW2019: May 9–10, 2019 (in person)
  - ▪ TOW2021: May 6, 2021 (virtual)
  - ▪ TOW2023: May 4–5, 2023 (in person)
- ➢ TOW: always with a Correlator Feedback class (for the stations)
- ➢ VGOS correlation until end of 2018 by HAYS only
- ➢ Phasing in of several correlators after knowledge transfer in 2019
- ➢ Dedicated telecon series: Correlator Group on 4th Tuesday of month
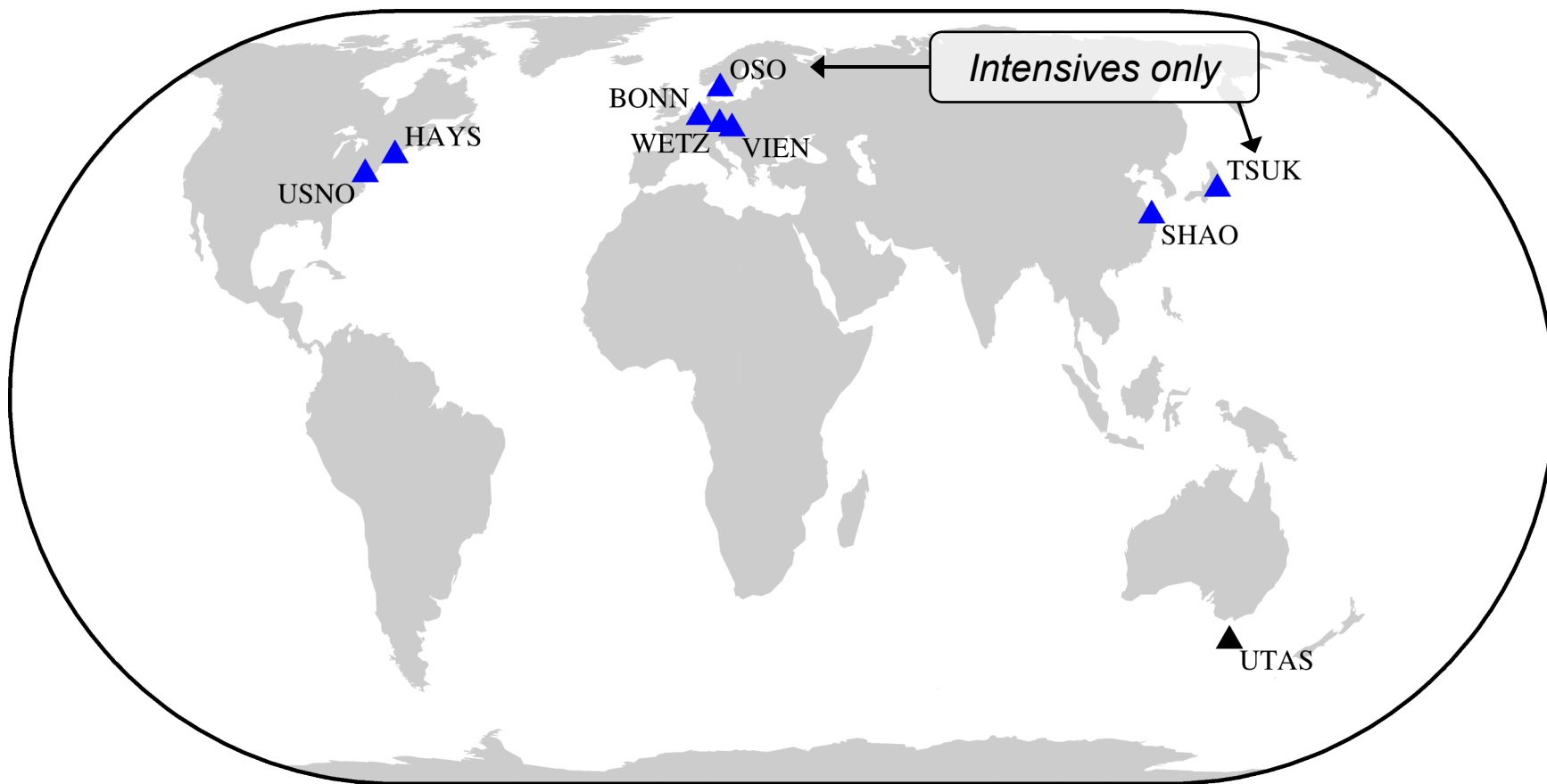
VGOS Observing Sessions 2019–2025

	24-hour VGOS	1-hour VGOS Intensives [VGOS-INT-?]						Correlators
2019	26 VGOS-TEST							HAYS
2020	24 VGOS-OPS	26 A · 12 B						HAYS, BONN, OSO
2021	26 VGOS-OPS 1 VGOS-RD	126 A · 17 B · 8 C						HAYS, WASH, BONN, GSI, WETZ, VIEN, SHAO
2022	42 VGOS-OPS 6 VGOS-RD	198 A · 46 B · 42 C · 10 G	·	42 S				HAYS, WASH, BONN, GSI, WETZ, VIEN, SHAO
2023	24 VGOS-OPS 4 VGOS-RD	227 A · 62 B · 62 C ·	7 M · 32 S					HAYS, WASH, BONN, GSI, WETZ, VIEN, SHAO
2024	31 VGOS-OPS 5 VGOS-RD	227 A · 92 B · 92 C · 25 G · 44 M · 33 S						HAYS, WASH, BONN, GSI, WETZ, VIEN, SHAO
2025	28 VGOS-OPS 8 VGOS-RD	226 A · 80 B · 80 C · 51 G · 39 M · 40 S						HAYS, WASH, BONN, GSI, WETZ, VIEN, SHAO

24-hour VGOS Sessions
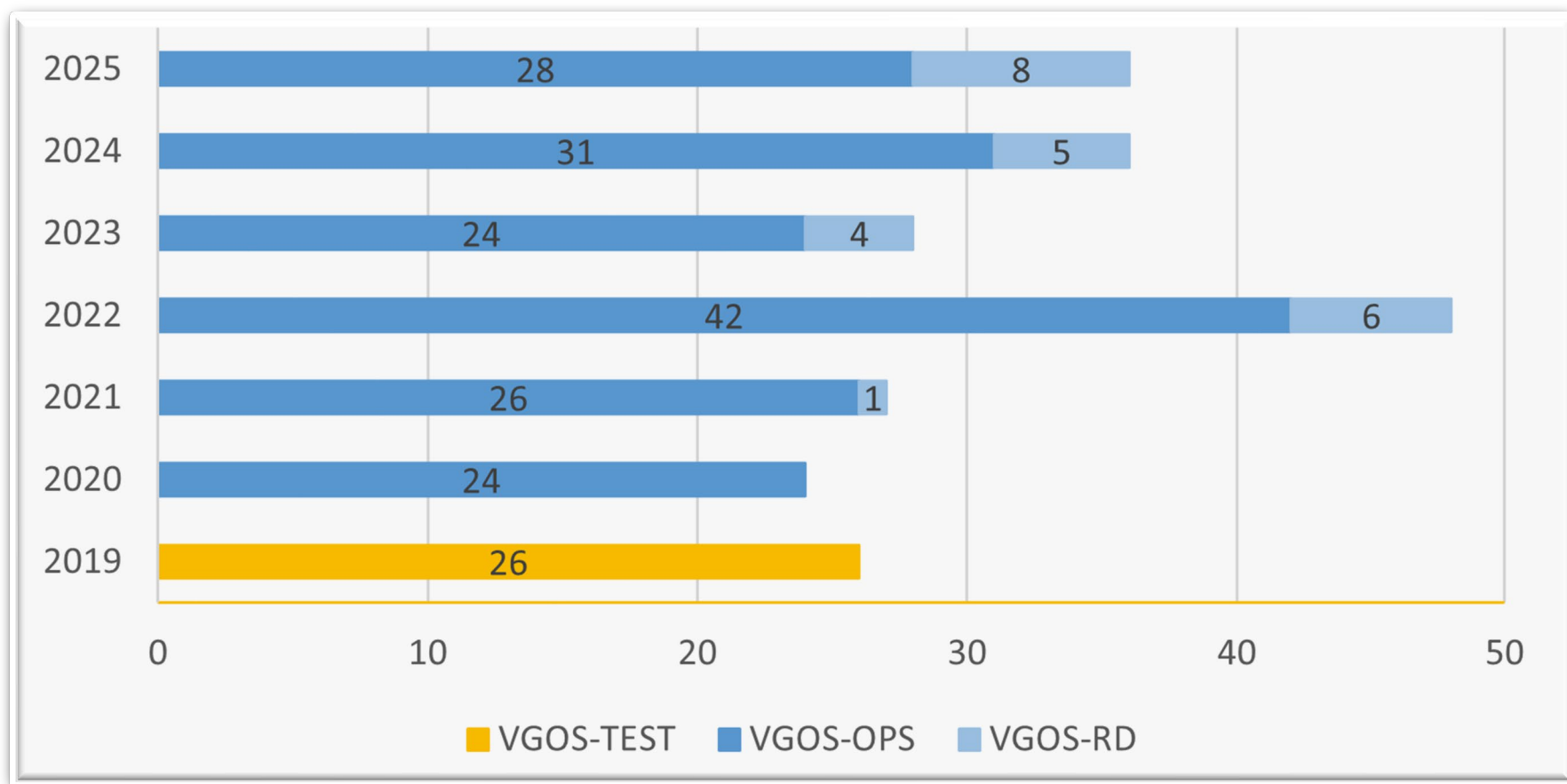
1-hour VGOS Intensives
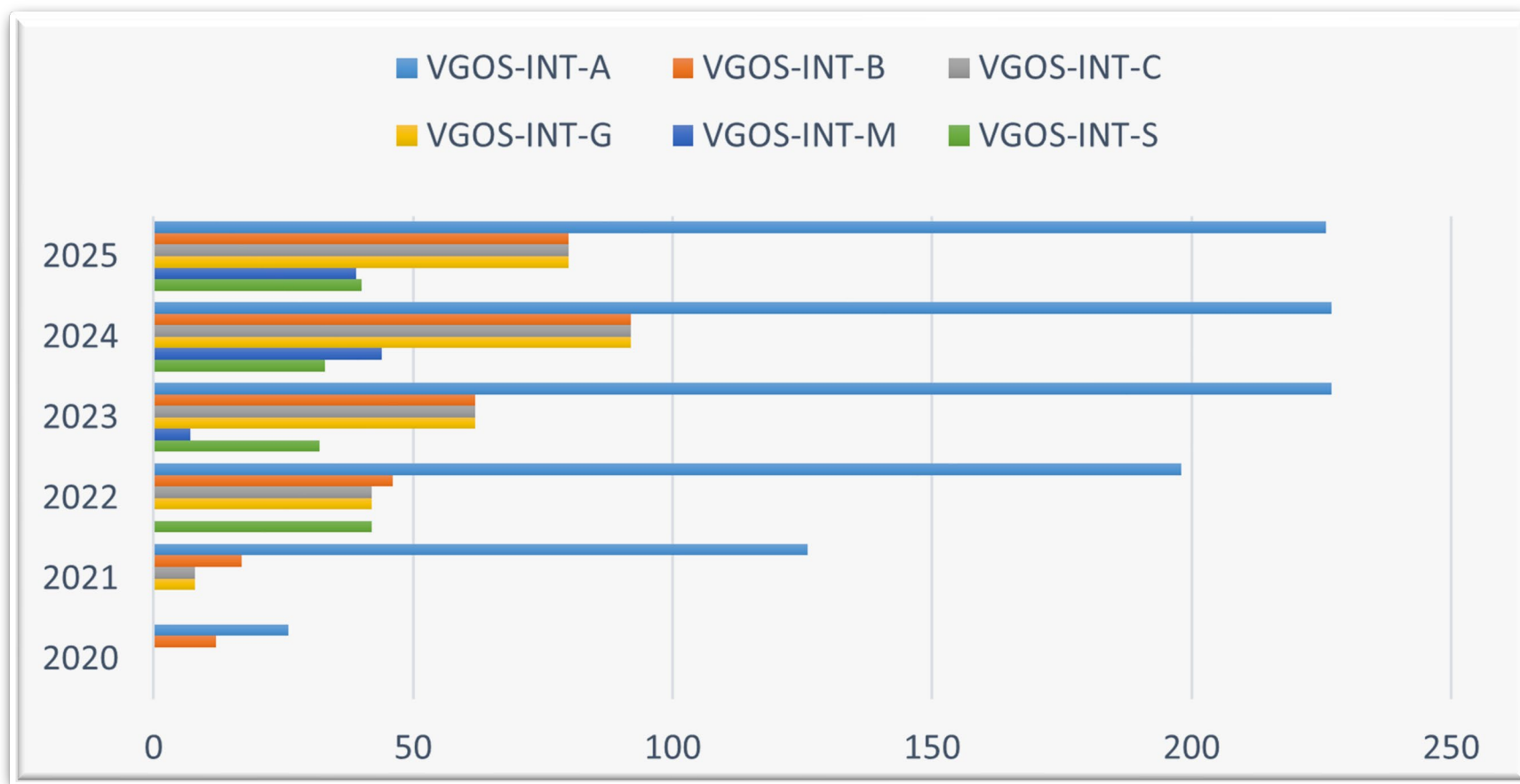
- ➢ **2019:** Knowledge Transfer
  Agenda and presentation material (zip file) at:
  https://www.haystack.mit.edu/conference-2/past-conferences/10th-ivs-technical-operations-workshop/
- ➢ **2021:** Mixed-mode Correlation à la Haystack
  Agenda and presentation material at:
  https://www.haystack.mit.edu/conference-2/past-conferences/tow2021/
- ➢ **2023:** Refinement, Standardization, and Quality Control
  https://www.haystack.mit.edu/conference-2/tow2023/tow-2023-12th-ivs-technical-operations-workshop-notebook/

Workshop Goals

- Correlator Comparison: Compare/discuss results of processing test data
- Review correlation/post-processing pipeline and VGOS data quality
- Analysis view on VGOS data quality
- Discuss feasibility of HAYS mixed-mode sessions
- Quasi-continuous Observing Campaign 2026 (QOC26)
- Introduce HOPS4 and other software updates
- Revisit to-do list from 2023 Correlator Workshop

Topics for entire group:

➢ **Schedule a telecon between correlators and analysts to understand the choice of CDMS vs PCMT   (invite analysts to Corr. telecon)**

➢ Establish thresholds for G,H codes: (**next Analysis Workshop?**)
  ▪ Can we make these band-specifc?
  ▪ Describe these in the postprocessing manual.

➢ Should note the reference station used for pcphase estimation in the correlator report:
  ▪ Currently some people keep track with comments in the cf; should preserve these.

➢ Need better diagnostic plots from ffres2pcp and fourphase:
  ▪ SNR/dTEC space for all scans/stations. (plot_dtec_minsnr)
  ▪ Accounting of rejected scans for each baseline. (resolved)

➢ **Build a database of control file parameters over time**

➢ How should IONEX a prioris be captured in the correlator report?

➢ Work out guidelines for choosing reference station for pcphase estimation
  ▪ Describe this in the postprocessing manual.

Topics for HOPS or DiFX codebase:

➤ Accelerate batch_fourfit job setup by using c-struct length when extracting cf hash in type-2 files (done, bigger computer)

➤ Make pcc_generate robust to scans with missing channels:
  ▪ This should be implemented. Will be available in the next HOPS release.

➤ Streamline post-processing scripts to use calibrator scans, check for redundancies in fourphase

➤ Include Frederic's ps2sampler2.awk script for sampler delays in the HOPS codebase or DiFX trunk (was distributed via email, changes?)

➤ Include Jan's script to relabel pols in SWIN files in the HOPS codebase or DiFX trunk:
  ▪ Simone says that polswapDiFX.py is now in the DiFX trunk!

➤ Plots sometimes appear black & white. Is this due to a collision between HOPS scripts and local matplotlib parameters?   (problem at BONN only, local issue?)

Things to bear in mind (add these to the postprocessing manual):

➤ **Use a-priori pcphases when available (e.g., a control file from a recent experiment). This will increase the SNR for calculating new pcphases (and possibly avoid local minima).**

➤ Run a pre-pass batch_fourfit job over XX,XY,YX,YY for inspection. This is a good way to catch problems.

➤ Ensure that initial control files pc_phases* statements are declared all on a single line (multiple lines will confuse the cf parsing in the postprocessing scripts).

- ➤ Discussion in Observing Program Committee (OPC)
- ➤ One of main goals of VGOS: continuous observing
- ➤ Currently: less than one 24-hour session per week
- ➤ Main impediment: data transport of large amount of data (plus storage)
- ➤ VGOS demonstration campaign during CONT17 (5 days)
- ➤ Data decimation technique tested in VGOS R&D sessions:
  - ▪ VR2501 on February 19, 2025 (storage need at 20% of regular VGOS-OPS)
  - ▪ VR2503 on May 21, 2025 (end-to-end operational test)
- ➤ Ground rules for correlators and stations
- ➤ Projected time frame for campaign:
  - ▪ Spring 2026 (likely March)
  - ▪ Length: 1–2 weeks (likely like previous CONTs: 15 days)
- ➤ Station qualification:
  - ▪ Include only vetted stations?
  - ▪ Include all stations?
- ➤ Work title: QOC26

There is no revelation. Axel had a code, dated in early 1990s, that computed Mathematical expectations of each "bad" observation based on results of a least solution. This basically observed_delay + contribution to delay from a least squares solution. Then a control file for fringe fitting utility is generated restricting fringe search in the vicinity of the mathematical expectation of group delay.

Sub-ambiguity is a result of the fringe fitting procedure catching a wrong maximum. This may happen for a number of reasons, but the main reason is error in the phase part of the complex bandpass. Due to phase errors the minor maximum becomes greater than the secondary maximum. Refringing around the mathematical expectation forces to find group delay in the vicinity of the true maximum.

A normal data analysis **requires** the second iteration. I just run through the refringing process all outliers regardless whether they look like sub-ambiguities, or ambiguities, or not. There are experiments, like ud017 campaign that I processed this week, that refringing restores only 0.1–0.2% observations. There are experiments that refringing restores 10–20% of flagged observations.

 Once again: this was known for at least three decades.   /Leonid