

Supporting Pointing Optimization and Open-Use Planning for PFS Observations at Subaru

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Prime Focus Spectrograph (PFS) and Its Operation Flow

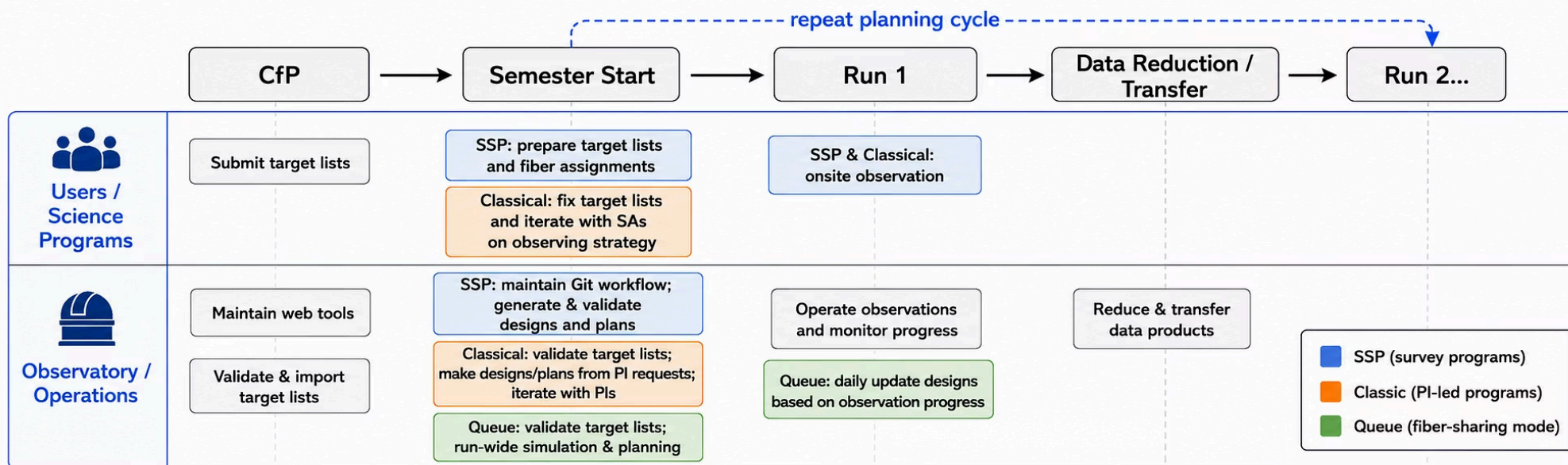
Observe ~2,400 targets simultaneously

over a 1.3-degree diameter field of view.

Open-use operations

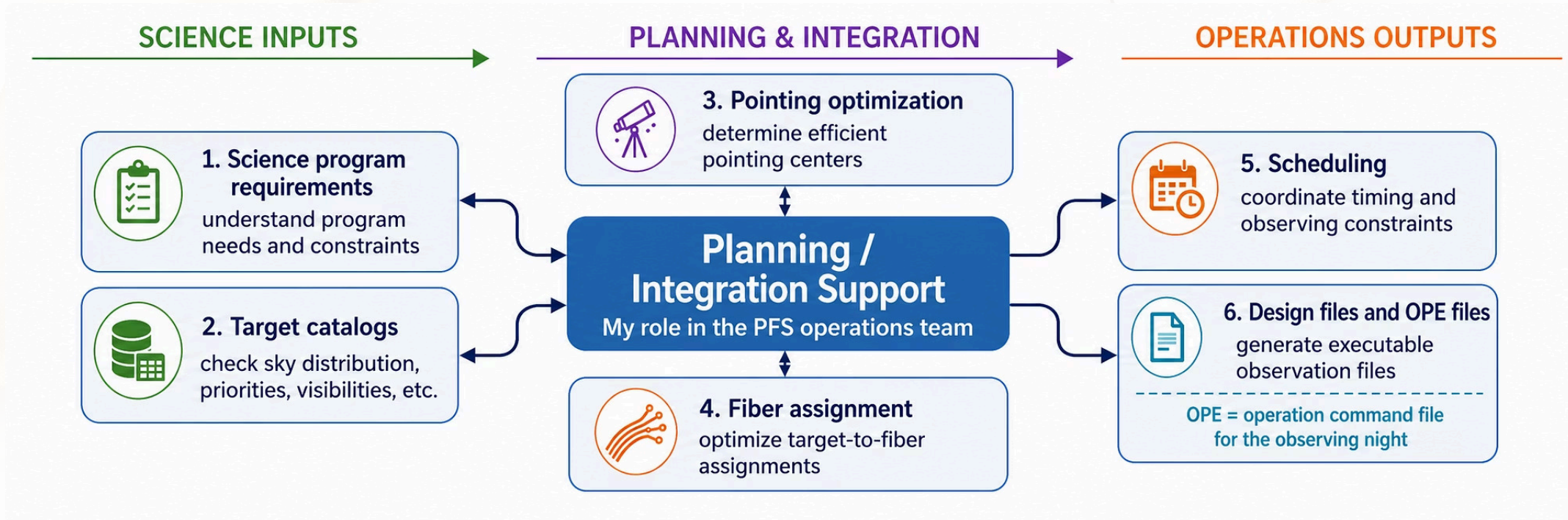
Fibers are shared among multiple programs, so careful planning is required before night execution.

Open-use observations require coordinated planning by users and the observatory before and during each observing run.



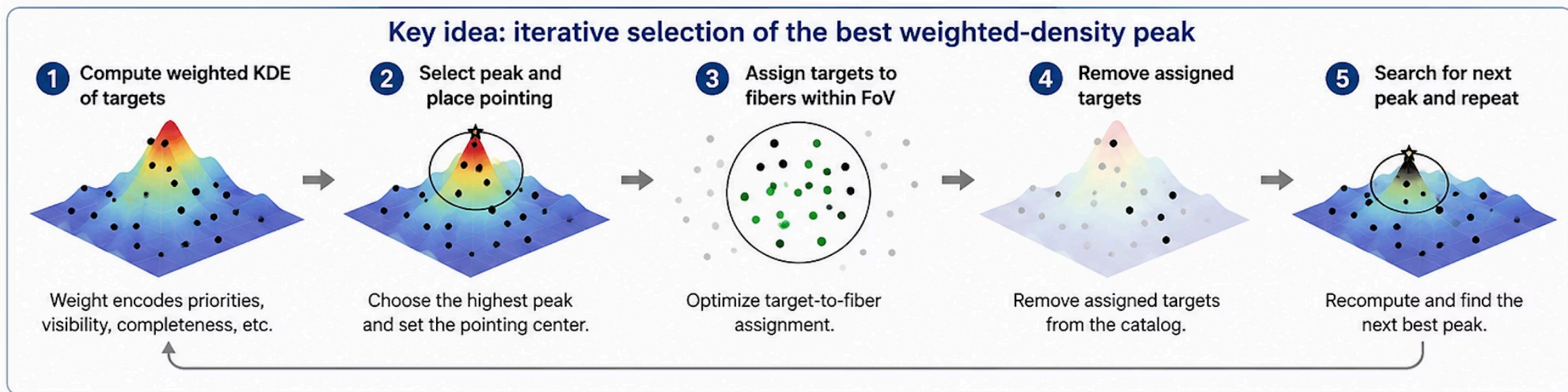
Where My Role Fits

- My work sits between science requests, software tools, and actual telescope operations
- Science plans become executable observation plans through coordination and optimization



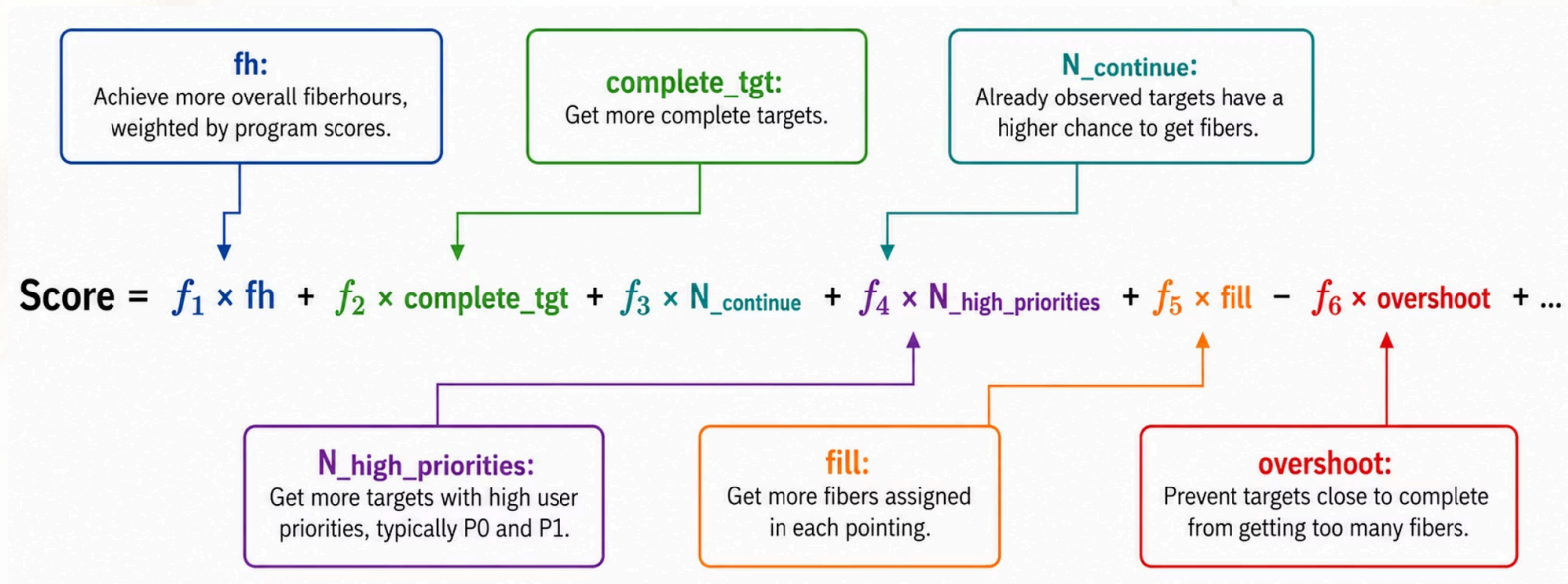
Integration Codes: Key Idea

- We developed integration codes to connect planning steps into one workflow.
- The key idea is to put pointings at the weighted KDE peak



Integration Codes: Scoring Function to maximize

- A scoring function evaluates each candidate pointing
- The best solution will be obtained by maximizing the scoring function
- The scoring function keeps to be updated, and factors are adjusted depending on progress



fiber-hours = number of fibers × exposure time per fiber (e.g., 10 fibers × 1 hour per fiber = 10 fiber-hours)

complete target = achieved exposure time reaches the requested exposure time

Integration Codes: Support for CfP & SSP preparation

- A simplified version of the simulation has been integrated into the PFS Target Uploader to help users estimate the requested number of observing nights.
- A dedicated script has also been developed to support SSP programs in generating design files and OPE files.

PFS Target Uploader

Your total request is 10.7 h

- You have requested **28 PFS pointing centers (PPCs)**.
- The optimized PPCs correspond to **134.8 fiber hours**.
- The **exposure time** to complete 28 PPCs (without overhead) is **7.0 hours** (28 x 15.00 minutes).
- The **requested observing time (ROT)** including overhead is **10.7 hours**.
- The expected **completion rate for low-resolution mode is 100%**.
- The expected **completion rate for medium-resolution mode is 100%**.

Number of PFS pointing centers (adjustable with the sliders)

Export the results: Low-resolution mode: 13 Medium-resolution mode: 15

Download

resolution	N_ppc	Texp (h)	Texp (fiberh)	time (h)	Used fiber fraction (%)	Fraction of PPC <30% (%)	P_all	P_0	P_1	P_2	P_3	P_4	P_5
low	13	3.25	61.25	4.92	0.787	100.0	100.0	100.0	100.0	100.0	100.0	100.0	100.0
medium	15	3.75	73.50	5.68	0.819	100.0	100.0	100.0	100.0	100.0	100.0	100.0	100.0
Total	28	7.00	134.75	10.61	1.606								

Low-resolution mode

Medium-resolution mode

Achieved fiberhours / total fiberhours

Completion rate (%)

N(fully complete targets) / N(targets)

Success with warnings

Pointing simulation started at 15:30:16 and last up for about 30 minutes

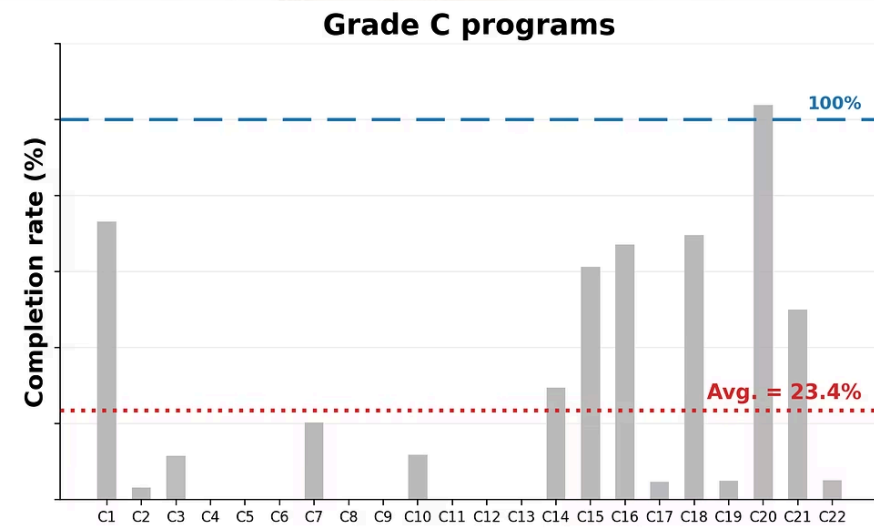
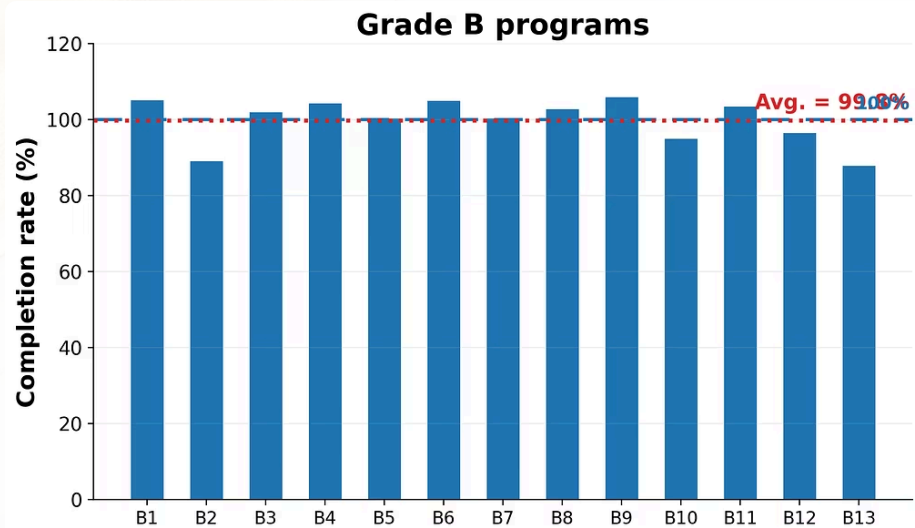
Achievements in S25A&B

Queue Programs

- Supported **18** programs in S25A and **17** in S25B (S26A in progress)
- Grade B accepted programs (**6 in S25A, 7 in S25B**) achieved completion rates **close to 100%**
- Grade C programs used as fillers — several gained substantial observing progress

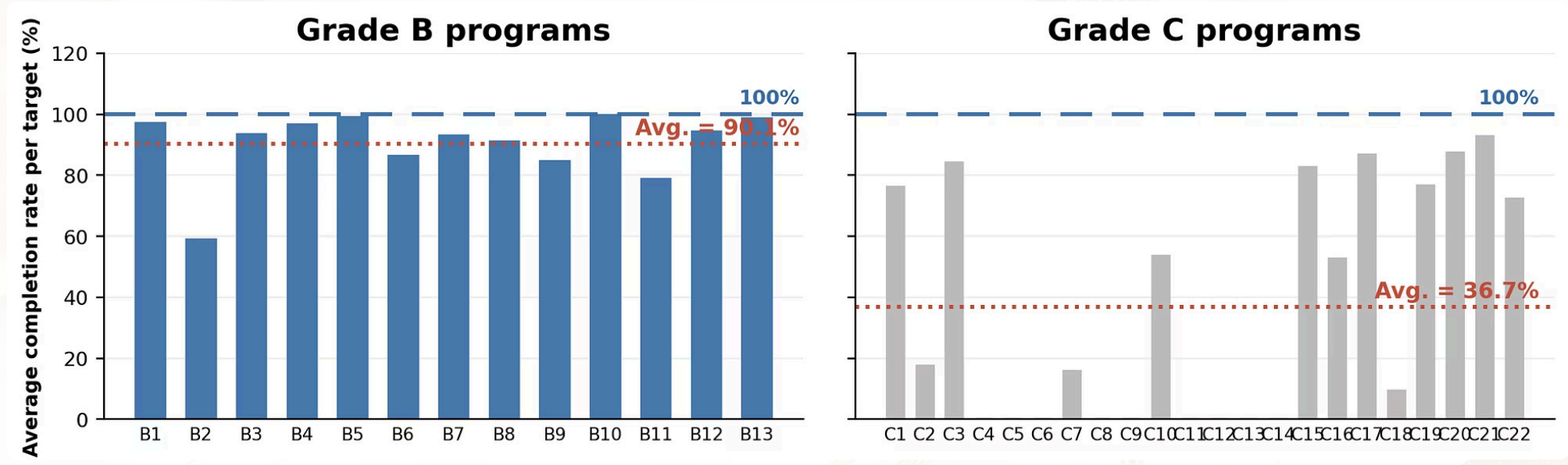
Classical Programs

- Supported **10** classical programs across S25A and S25B (5 UH, 1 Keck)



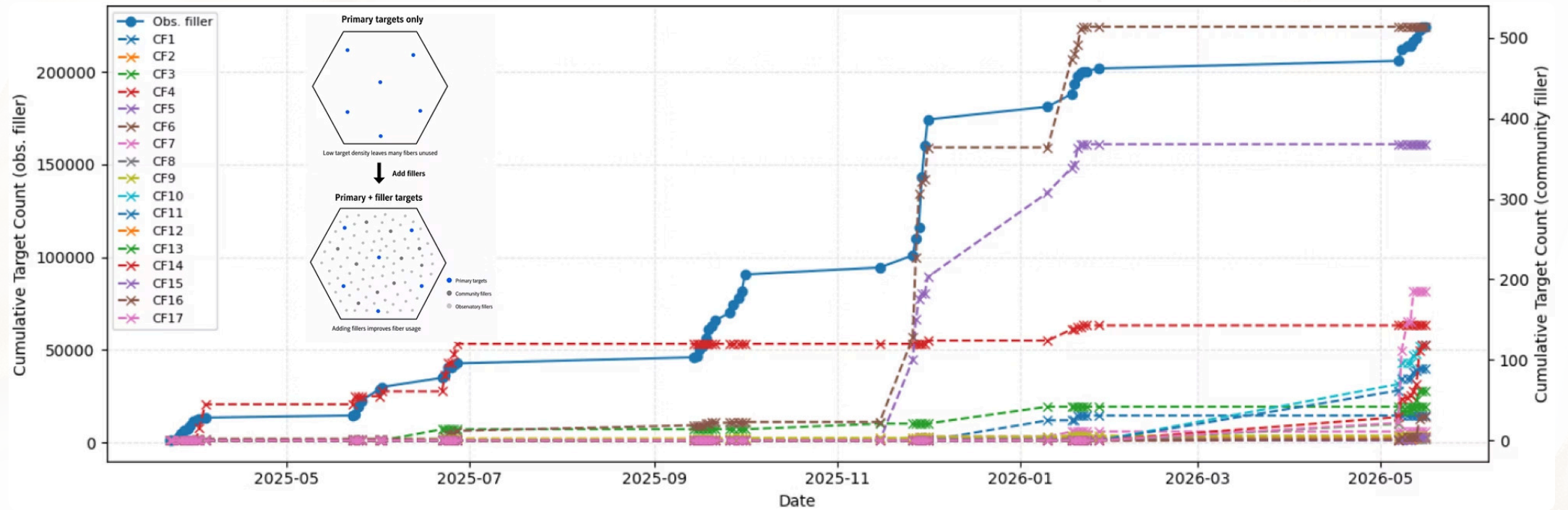
Practical Challenges in Open-Use Planning: Patial observation

- Even with optimization tools, open-use planning requires continuous adjustment.
- Some Grade B programs are found to have many partially observed targets (*achieved exposure time < requested exposure time*), which is most common for long-exposure targets and Grade C filler targets.
- We will be more careful with partial-observation issues by tracking remaining exposure time, penalizing unlikely-to-complete targets, and monitoring progress across runs.



Practical Challenges in Open-Use Planning: Low-Density Fields

- Some fields contain only a small number of Grade B targets, leaving many fibers unused.
- Filler targets (community fillers and observatory fillers) are added to increase fiber usage efficiency.



Summary

What we did

- Developed integration codes connecting pointing optimization, scheduling, design & OPE generation into one workflow
- Supported queue (18+17 programs), classical (10 programs) and SSP observations in S25A & S25B
- PFS planning is a multi-objective operational problem with many practical challenges, and we are continuing to improve the workflow
- Full automation is the goal, but manual monitoring and operational adjustments are still essential for now.

Thank you 🙏

I am deeply grateful to be part of this great project. Working with the PFS team has been an invaluable experience across science, software, and operations.

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