PFSの課題 (観測所の観点から)

Challenges of PFS
(from observatory's viewpoint)

2015/07/10 I. Iwata (Subaru Telescope, NAOJ)

History
(in terms of interaction with community / NAOJ)

- Jan. 2011 Subaru users meeting, Subaru Advisory Committee
  - Endorsement of the PFS project, with conditions
- Jan. 2013 Subaru users meeting
  - Early decommission of FMOS (for using TUE-IR floor for PFS spectrographs)
- April 2013 PFS NAOJ review
- Nov. 2013 Reply from PFS PO to NAOJ review committee
- Jan. 2014 NAOJ director's letter on NAOJ's commitment
- FY2014: NAOJ commitment to PFS development
- Jan. 2015 Subaru users meeting
  - Instrument planning, including FMOS decommission
- Jan. 2015 formation of Subaru's PFS acceptance review committee
- FY2015: Subaru budget crisis
- July 2015: Subaru's review on PFS progress
  - Decision of FMOS decommission

Responsibilities

- PFS Collaboration / Project Office (PO):
  - Development of the PFS instrument
    - Bring the instrument to Subaru
    - Carry out Subaru Strategic Program (SSP)
- Subaru Telescope / NAOJ:
  - Telescope / Enclosure modifications
  - Form acceptance review committee
- Hand-over of the instrument
  - Complete the instrument (confirmation of performance)
  - Technical documents, Maintenance manuals, Training of observatory staff

SAC recommendation to PFS (Jan. 2011)

Collateral conditions

- PFS must satisfy instrument specifications agreed by the Japanese community.
- A firm management structure should be built in Japan to develop PFS, including the assignment of a Japanese project manager.
- SAC representative(s) should participate in important decision-making stages about international collaboration.
- There must be a framework for young Japanese students/researchers to get involved in the PFS instrumentation.

Premises

- The survey program by the PFS collaboration will be carried out after reviewing processes, under the Subaru Strategic Program framework. The PFS collaboration will include both the Japanese community and international partners.
- PFS will become a Subaru common-use instrument, available to the entire Japanese community, once the instrument is completed.

April 2013

NAOJ PFS Review

- H. Takami (Chair), H. Kobayashi, S. Iguchi, T. Usuda
- Requests:
  - to PFS PO: Feasible plan within the secured budget incl. contingency
    - + Future development (recovery) plan
  - to Subaru / SAC: should start further discussions on scientific merit, commissioning and operation plan, SSP plan based on the above feasible plan
  - to Subaru and PFS PO: project management plan
  - to PFS PO: Enforcement of management and system engineering staffing
- Endorsement of telescope modifications will be made after receiving feasible plan
- Decision on Further commitment of NAOJ depends on recovery plan, budgetary situation of the consortium

Nov. 2013

Reply from PFS PO to NAOJ review committee

- No descope plan
  - If number of fibres is reduced, it is difficult to add fibres later.
  - Reducing number of spectrographs does not reduce development cost significantly.
    - If IR arms are removed, Princeton/JHU will leave PFS collaboration.
- Additional partners
  - MPA, (Canada, Australia)

Subaru UM FY2013 (Jan. 2014)

Early Decommission of FMOS

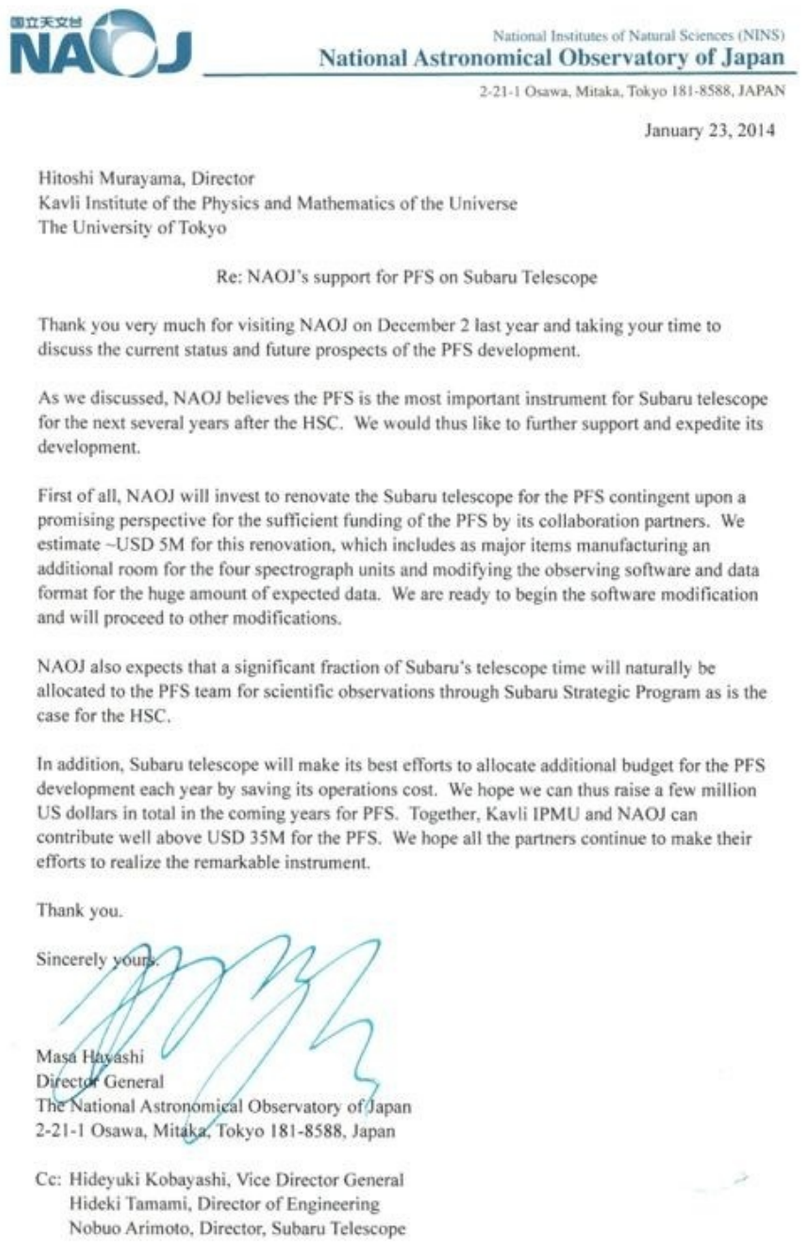
- Use TUE-IR floor for PFS.
- Start modifications once PFS Project Office finds firm prospect of the completion of PFS and commissioning plan.
- When will FMOS decommission happen?
    - It depends on financial situation and plan of PFS. There's a possibility of successful fundraising in FY2014.
    - There's a possibility of the end of FMOS open-use by the end of S15A (July 2015).
- Subaru Telescope should try to minimize a risk of long absence of 'Prime Focus MOS' capability.
    - Expected minimum duration between decommission of FMOS and beginning of open-use of PFS is 3.5 yrs.

Jan. 23, 2014

NAOJ director's letter to IPMU director

- PFS is the most important instrument for Subaru after the HSC.
- NAOJ will invest to renovate Subaru for accepting PFS (~5M USD).
- 'Significant fraction of Subaru's telescope time will be allocated to the PFS team for SSP'.
- 'Subaru telescope will make its best efforts to allocate additional budget for the PFS development. We hope we can raise a few million US dollars in total'.

→ 2.7M USD investment to PFS development from NAOJ in FY2014.
The goal of NAOJ's contribution to PFS development is 500M JPY.



National Institutes of Natural Sciences (NINS)
National Astronomical Observatory of Japan
2-21-1 Osawa, Mitaka, Tokyo 181-8588, JAPAN

January 23, 2014

Hitoshi Murayama, Director
Kavli Institute of the Physics and Mathematics of the Universe
The University of Tokyo

Re: NAOJ's support for PFS on Subaru Telescope

Thank you very much for visiting NAOJ on December 2 last year and taking your time to discuss the current status and future prospects of the PFS development.

As we discussed, NAOJ believes the PFS is the most important instrument for Subaru telescope for the next several years after the HSC. We would thus like to further support and expedite its development.

First of all, NAOJ will invest to renovate the Subaru telescope for the PFS contingent upon a promising perspective for the sufficient funding of the PFS by its collaboration partners. We estimate ~USD 5M for this renovation, which includes as major items manufacturing an additional room for the four spectrograph units and modifying the observing software and data format for the huge amount of expected data. We are ready to begin the software modification and will proceed to other modifications.

NAOJ also expects that a significant fraction of Subaru's telescope time will naturally be allocated to the PFS team for scientific observations through Subaru Strategic Program as is the case for the HSC.

In addition, Subaru telescope will make its best efforts to allocate additional budget for the PFS development each year by saving its operations cost. We hope we can thus raise a few million US dollars in total in the coming years for PFS. Together, Kavli IPMU and NAOJ can contribute well above USD 35M for the PFS. We hope all the partners continue to make their efforts to realize the remarkable instrument.

Thank you.

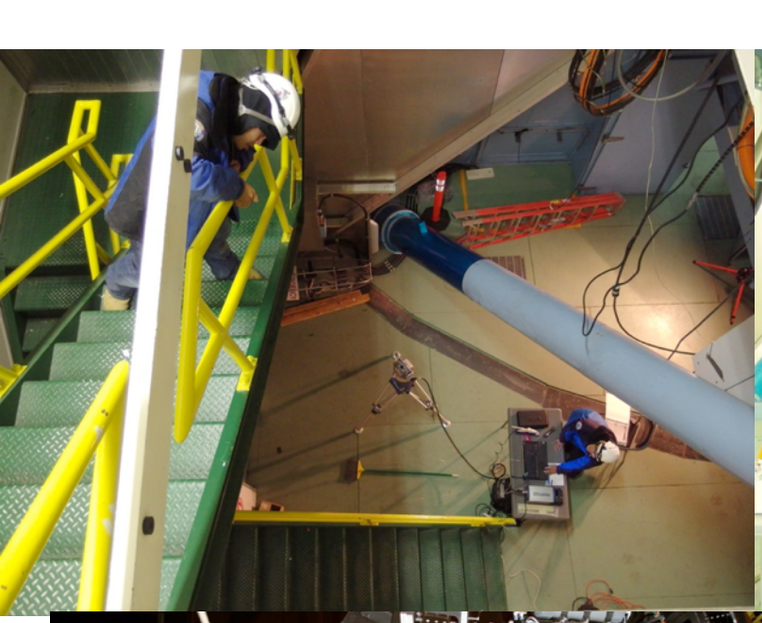
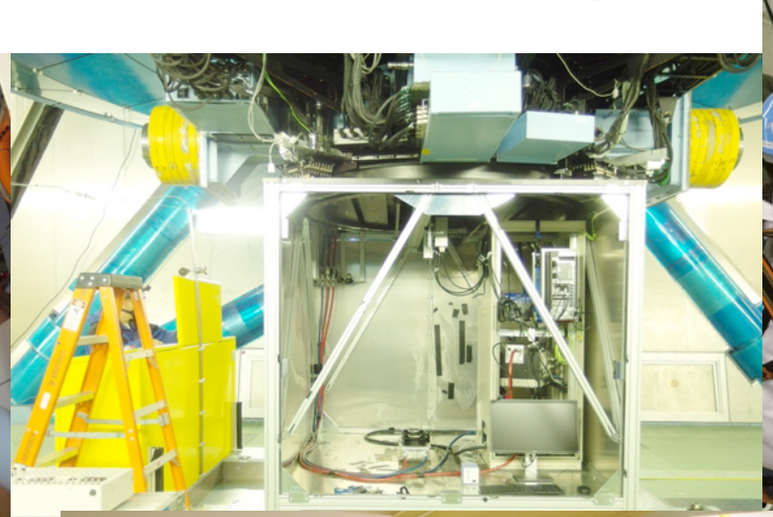
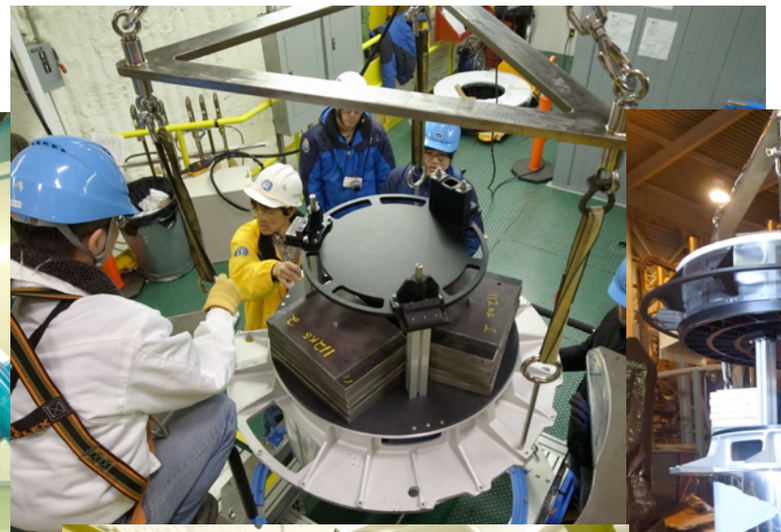
Sincerely yours,

Masa Hayashi
Director General
The National Astronomical Observatory of Japan
2-21-1 Osawa, Mitaka, Tokyo 181-8588, Japan

Cc: Hideyuki Kobayashi, Vice Director General
Hideki Tamami, Director of Engineering
Nobuo Arimoto, Director, Subaru Telescope

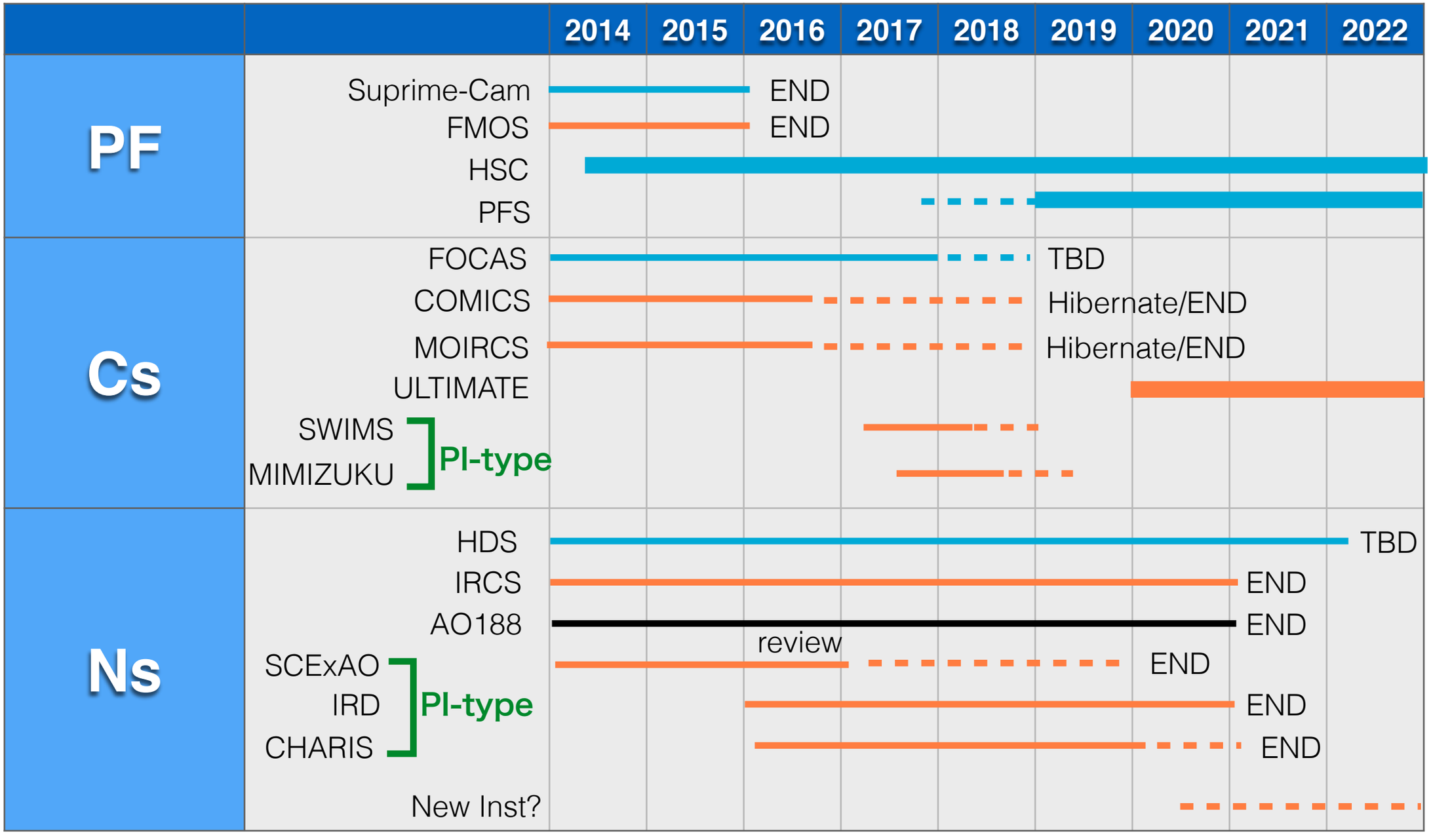
Subaru's involvement to PFS

- Since FY2014 much involvement of Subaru telescope staff has started.
  - Telescope software modifications
  - PFI testing, Metrology camera testing
  - POpt2 throughput measurements
  - TUE-IR floor modification planning


Subaru UM FY2014 (Jan. 2015)

Subaru Instrument Plan

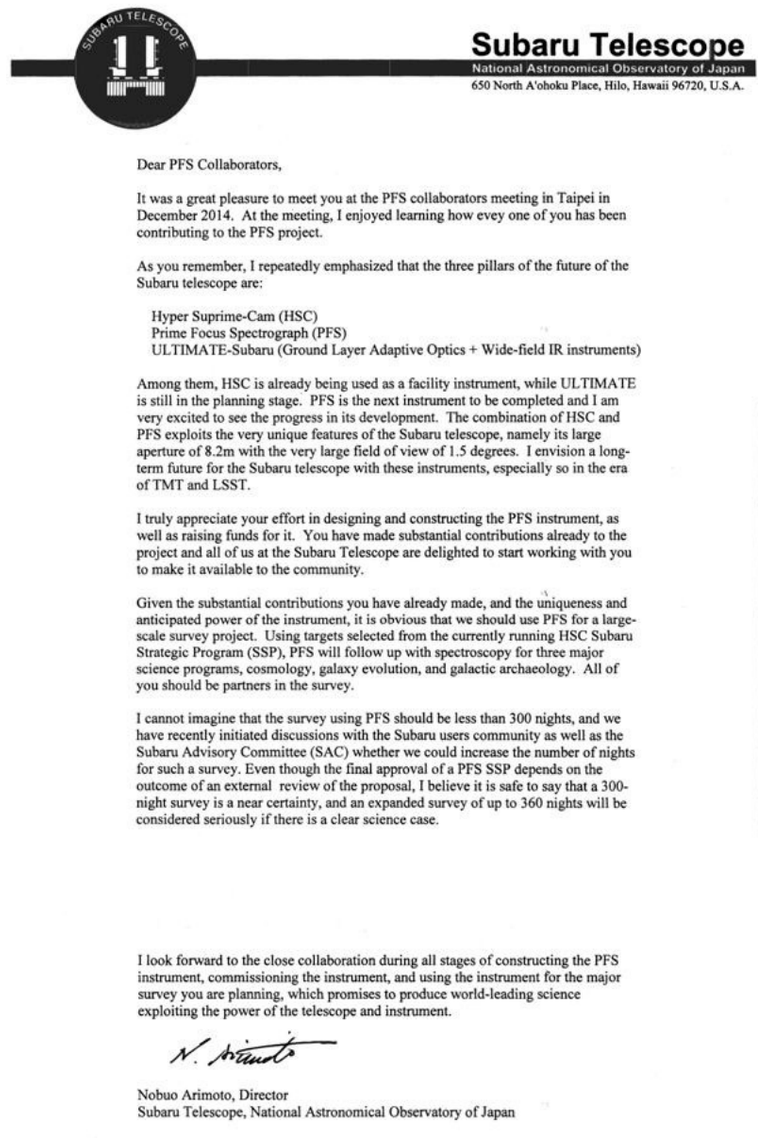


- There was a request to extend FMOS operation by April-May 2016. PFS PO said it is fine with the PFS project.

Feb. 2015

Director Arimoto's letter to PFS collaborators

- 'I cannot imagine that the survey using PFS should be less than 300 nights, and we have recently initiated discussions with the Subaru users community as well as the Subaru Advisory Committee (SAC) whether we could increase the number of nights for such a survey. Even though the final approval of a PFS SSP depends on the outcome of an external review of the proposal, I believe it is safe to say that a 300-night survey is a near certainty, and an expanded survey of up to 360 nights will be considered seriously if there is a clear science case.'



Subaru Telescope
National Astronomical Observatory of Japan
650 North A'ohoku Place, Hilo, Hawaii 96720, U.S.A.

Dear PFS Collaborators,

It was a great pleasure to meet you at the PFS collaborators meeting in Taipei in December 2014. At the meeting, I enjoyed learning how evey one of you has been contributing to the PFS project.

As you remember, I repeatedly emphasized that the three pillars of the future of the Subaru telescope are:

Hyper Suprime-Cam (HSC)
Prime Focus Spectrograph (PFS)
ULTIMATE-Subaru (Ground Layer Adaptive Optics + Wide-field IR instruments)

Among them, HSC is already being used as a facility instrument, while ULTIMATE is still in the planning stage. PFS is the next instrument to be completed and I am very excited to see the progress in its development. The combination of HSC and PFS exploits the very unique features of the Subaru telescope, namely its large aperture of 8.2m with the very large field of view of 1.5 degrees. I envision a long-term future for the Subaru telescope with these instruments, especially so in the era of TMT and LSST.

I truly appreciate your effort in designing and constructing the PFS instrument, as well as raising funds for it. You have made substantial contributions already to the project and all of us at the Subaru Telescope are delighted to start working with you to make it available to the community.

Given the substantial contributions you have already made, and the uniqueness and anticipated power of the instrument, it is obvious that we should use PFS for a large-scale survey project. Using targets selected from the currently running HSC Subaru Strategic Program (SSP), PFS will follow up with spectroscopy for three major science programs, cosmology, galaxy evolution, and galactic archaeology. All of you should be partners in the survey.

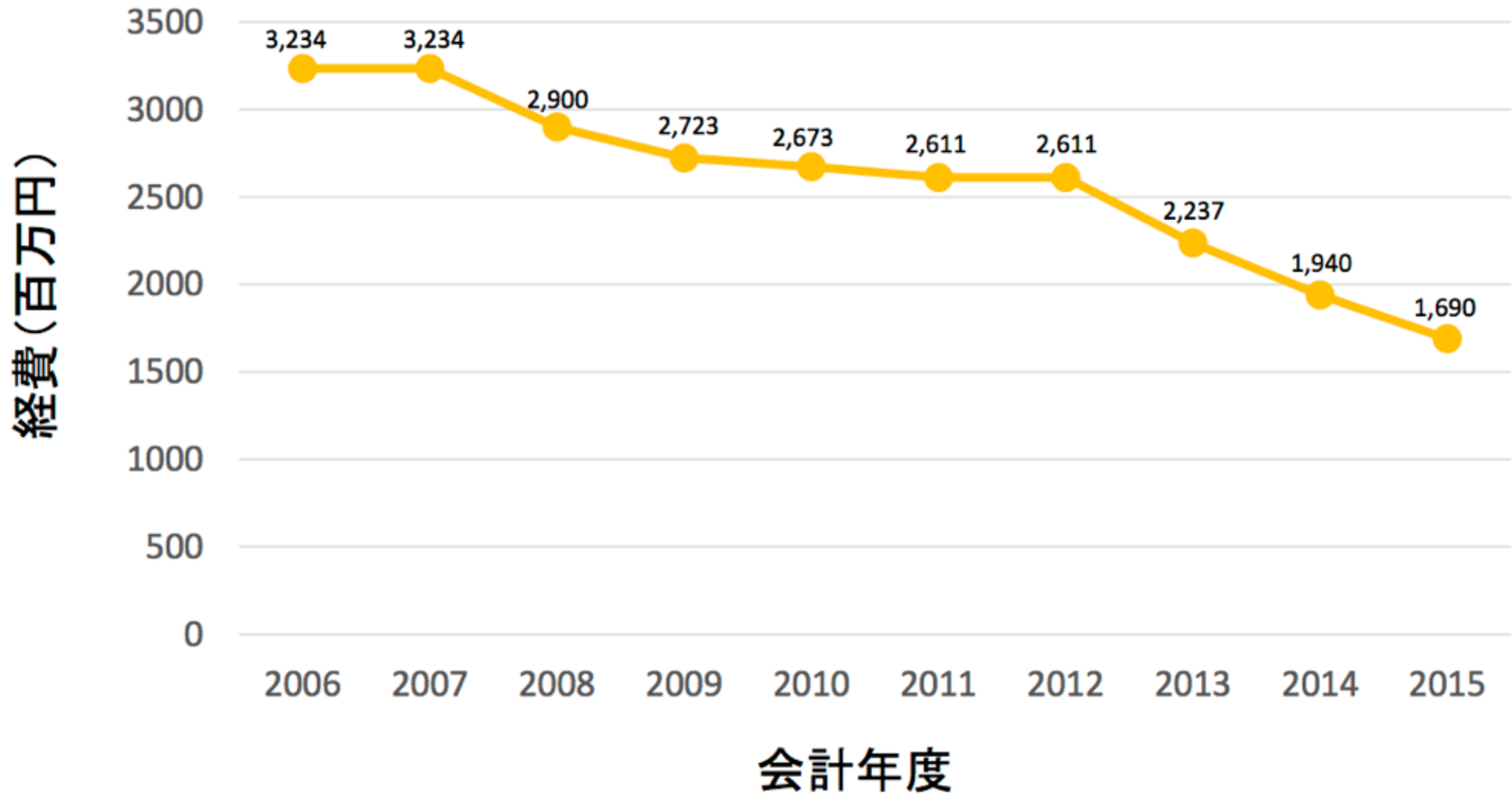
I cannot imagine that the survey using PFS should be less than 300 nights, and we have recently initiated discussions with the Subaru users community as well as the Subaru Advisory Committee (SAC) whether we could increase the number of nights for such a survey. Even though the final approval of a PFS SSP depends on the outcome of an external review of the proposal, I believe it is safe to say that a 300-night survey is a near certainty, and an expanded survey of up to 360 nights will be considered seriously if there is a clear science case.

I look forward to the close collaboration during all stages of constructing the PFS instrument, commissioning the instrument, and using the instrument for the major survey you are planning, which promises to produce world-leading science exploiting the power of the telescope and instrument.

N. Arimoto

Nobuo Arimoto, Director
Subaru Telescope, National Astronomical Observatory of Japan

FY2015 Subaru Budget Crisis



- Initially there was no PFS budget (including telescope modifications)
- Small additional budget for telescope software modification has been allocated.

July 7, 2015

Subaru's review on PFS progress

- Technical risks - Fibre positioners, calibration system etc.
- Financial difficulty remains even though there's additional budget of Murayama-san's Kakenhi; About 3M USD deficiency *without* inclusion of contingency.
- <u>FMOS end of operation has been set in May 2015.</u>
  - Ensure sufficient time for assembly and testing of PFS spectrographs.
  - Operational load of FMOS is too large for Subaru with limited resources.

PFS as a Subaru's Facility Instrument

- PFSはHSCと並んで2020年代のすばるを支える観測装置
  - HSC + PFSは2020年代においても極めて強力かつユニーク
- サーベイ望遠鏡としてのすばるは、2020年代に何ができるか？
  HSC + PFS (+ ULTIMATE-Subaru)をどう使うか？
  - 従来のSSPの枠組みにとらわれず、2020年代のすばるの在り方を考えるべき時に来ている
- HSCやPFSへの機能の追加の可能性

Timeline

Slide by N.Tamura-san

- Apr 2011: Project Office was established. Design study activities were formalized.
- Mar 2012: Conceptual Design Review (CoDR) @ Hilo
- Feb 2013: Preliminary Design Review (PDR) @ Hilo
- Mar 2013 – Present: A hybrid of critical/final design phase & production phase
  - Critical Design Review (CDR) is held at subsystem level (instead no project CDR).
    - Mar 2014: Cable A & Spectrograph System (SpS) CDR -- ***Done***
    - Mar 2015: PFI, fiber positioner system, Cable C CDR -- ***Done***
    - Mid-Late 2015: Metrology camera, Cable B
- 2017-2018 : Subsystem delivery & AIT followed by system integration
- Early 2018: Engineering First Light
- Mid 2019: Start open use & SSP

Challenges of PFS (from observatory's viewpoint)

- Complete the instrument development and achieve goal performance
  - Securing budget for completion
  - Address technical issues
- The instrument should be stable enough for regular operations.
- Operations
  - Documents, Drawings, Manuals, Training
  - HSC and PFS share POpt2 / WFC. HSC camera and PFS/PFI exchange will be required regularly.
  - Queue-mode operations
  - Data Reduction Pipeline and data archive
- Subaru Telescope and PFS collaboration should work closely to overcome these challenges. Support from community is critically important.