DKIST CSP Workshop
Washington, DC
8 January 2018

DKIST Critical Science Plan Workshop:

Magnetic connectivity through the solar atmosphere

Introduction to the Critical Science Plan; and Life cycle of a Science Use Case

- DKIST Critical Science Plan – context, resource locations
- Workshop focus – Science Use Case development (JIRA, FIDO, IPCs)
- The future – transition to Observing Proposals

DKIST Critical Science Plan (CSP):

Aim: to be ready, *as a community*, by science first light to execute a set of observations that take advantage of the DKIST capabilities to address critical compelling science in the first two years of operations (2020, 2021)

As a community we must:

- understand forthcoming capabilities
- define science goals
- compile Science Use Cases
- coordinate to form a complementary set of PI lead teams
- convert Science Use Cases into PI led Observing Proposals

This will enable:

- Service Mode observations
- Scientific analysis
- PI led publication of first-light results


Untitled — Edited

dkist.nso.edu/CSP

Web of Scien...lection Home Homepage - A...ata Analysis Noteshelf AirTransfer DKIST Critical... Plan | DKIST Album: images SpectroWeb

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DKIST Critical Science Plan

The DKIST Critical Science Plan (CSP) is being formulated (these pages). It will define critical science goals for the first or two years of DKIST operations, and in the process help refine data handling procedures and science operations. The aim is to be ready by start of operations to execute a set of observations that take advantage of the DKIST capabilities to address critical compelling science. The Critical Science Plan will be built up from a set of PI led Science Use Cases (team or individual efforts). These will be converted into Observing Proposals for consideration by the DKIST Time Allocation Committee (TAC) before first light.

Most CSP observations will be conducted in *Service Mode*, though *Access Mode* will also available to support specific needs. Along with standalone DKIST projects, coordinated observations with other observing facilities or platforms are encouraged and will be supported to meet the science goals.

As scientific goals are expected to evolve between now and DKIST first light, we anticipate that the development of the CSP will be an iterative process subjected to adjustment and revision. The development steps curently envisioned:

1. Submission of Science Use Cases (**Science Use Case Preparation**) by a broad range of community members, to include:

   a. a statement of the scientific goals
   b. a definition of the required instrument suite to be employed
   c. an assessment of the multi-instrument configuation compatibility
   d. a description of the basic data needs (image or spectra, wavelengths, cadences, and photometric, spectroscopic and polarimetric precisions)
   e. a summary of the observing strategy and any joint facility coordination needs

2. Coordination of Science Use Cases (**Science Use Case Preparation**), to include:

   a. reformulation of DKIST Critical Science Plan based on Science Use Cases submissions
   b. self organization of Science Use Cae teams to consolidate effort
   c. identification of Science Use Case team leads (to serve as Observing Proposal PIs)

This coordination phase aims to minimize overlap of individual Science Use Cases. It is not required, and overlapping proposals can be submitted to the TAC for review. The goal is to formulate, as a community, a complimentary set of PI led Science Use Cases (team or individual efforts) that together, as the Critical Science Plan, capture the most compelling critical science.

3. Conversion and translation of Science Use Cases into DKIST Observing Proposals

4. Observations at the DKIST following approval by the Time Allocation Committee (TAC)

5. Analysis and publication, to include:

   a. analysis of science data
   b. feedback to project (for analysis package development)
   c. PI led team publication of scientific results, as appropriate, in special volumes highlighting critical DKIST first-light science results

http://dkist.nso.edu/CSP

Critical Science Plan Structure:

Research Areas

Research Topics

Science Use Case

Observing Proposal

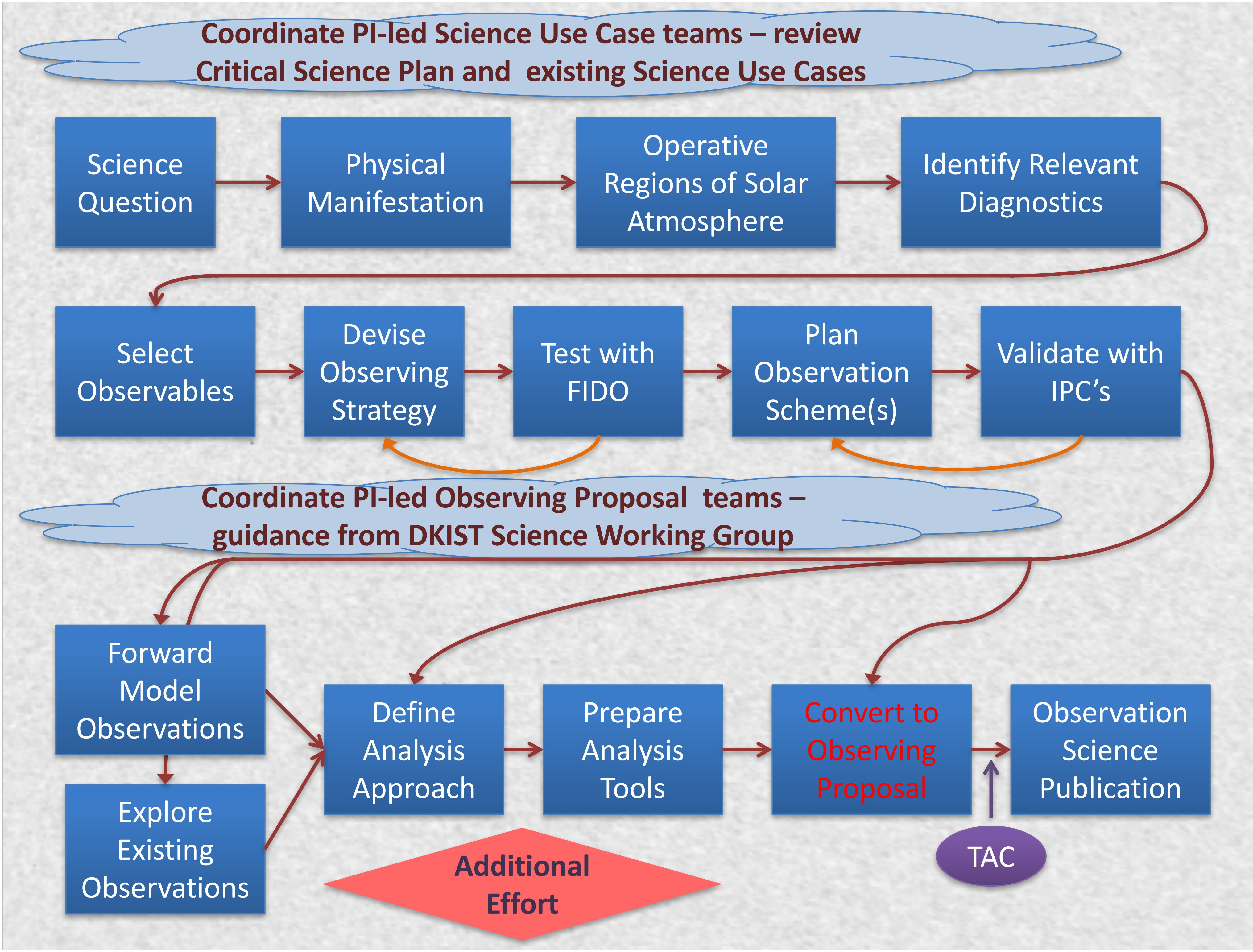
Bottom-up approach:

CSP is built on community led Science Use Cases *some of which* will be executed as Observing Proposals

Important Points:

1. This process will likely be iterative – CSP structure (that you see on the website) is intended as a helpful but non-rigid framework and the science will evolve.
2. The CSP process is not exclusive (all welcome) nor unique (direct submission of observing proposals to the NSO DKIST Time Allocation Committee (TAC) under a standard submission and review process will also be possible). The CSP (and this workshop) advantage is informational.
3. Observing proposals developed as a result of participation in the DKIST Critical Science Plan effort (including this workshop) will be reviewed by the NSO DKIST TAC along with proposals submitted outside of the CSP structure.
4. There is *no* automatic conversion of Science Use Cases to Observing Proposals – success is dependent on continued engagement beyond this workshop proper and beyond the completed Science Use Case.
5. The development of the CSP in advance of the start of operations helps the project beyond science definition – it helps in the development of essential operations and data management tools

Science Use Case → Observing Proposal → TAC review → Observations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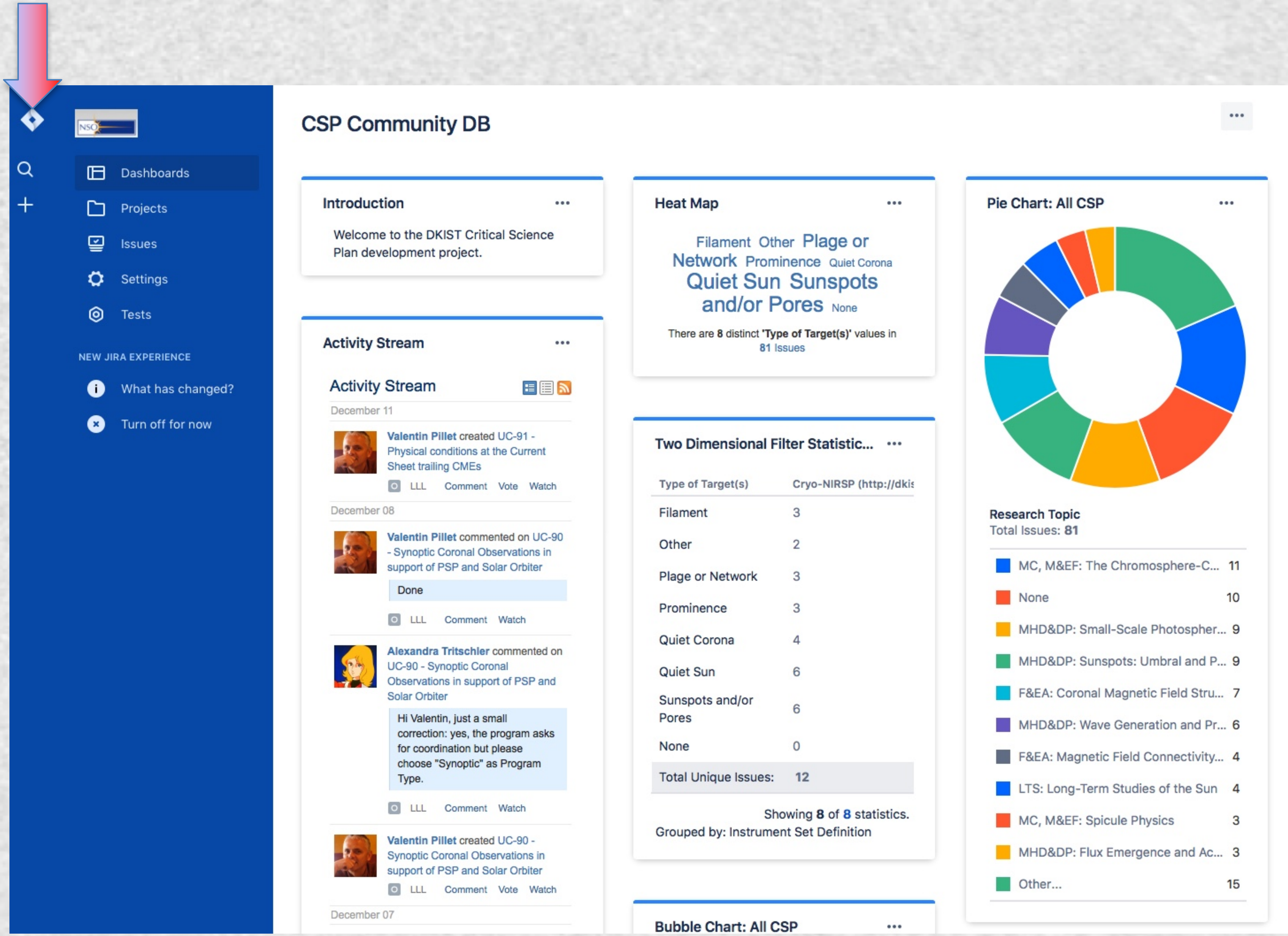
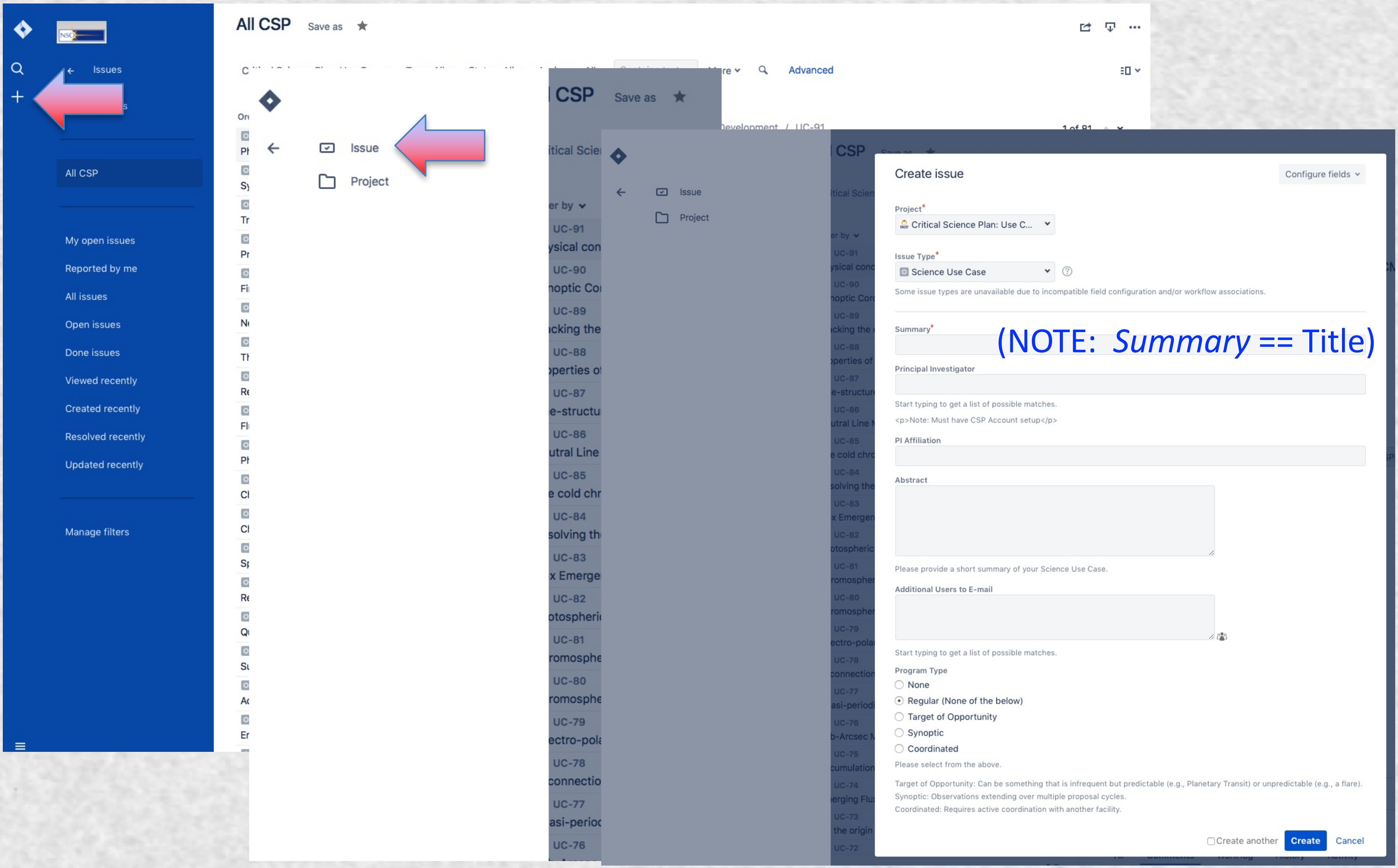
DKIST CSP JIRA Site (https://nso-atst.atlassian.net/secure/Dashboard.jspa)

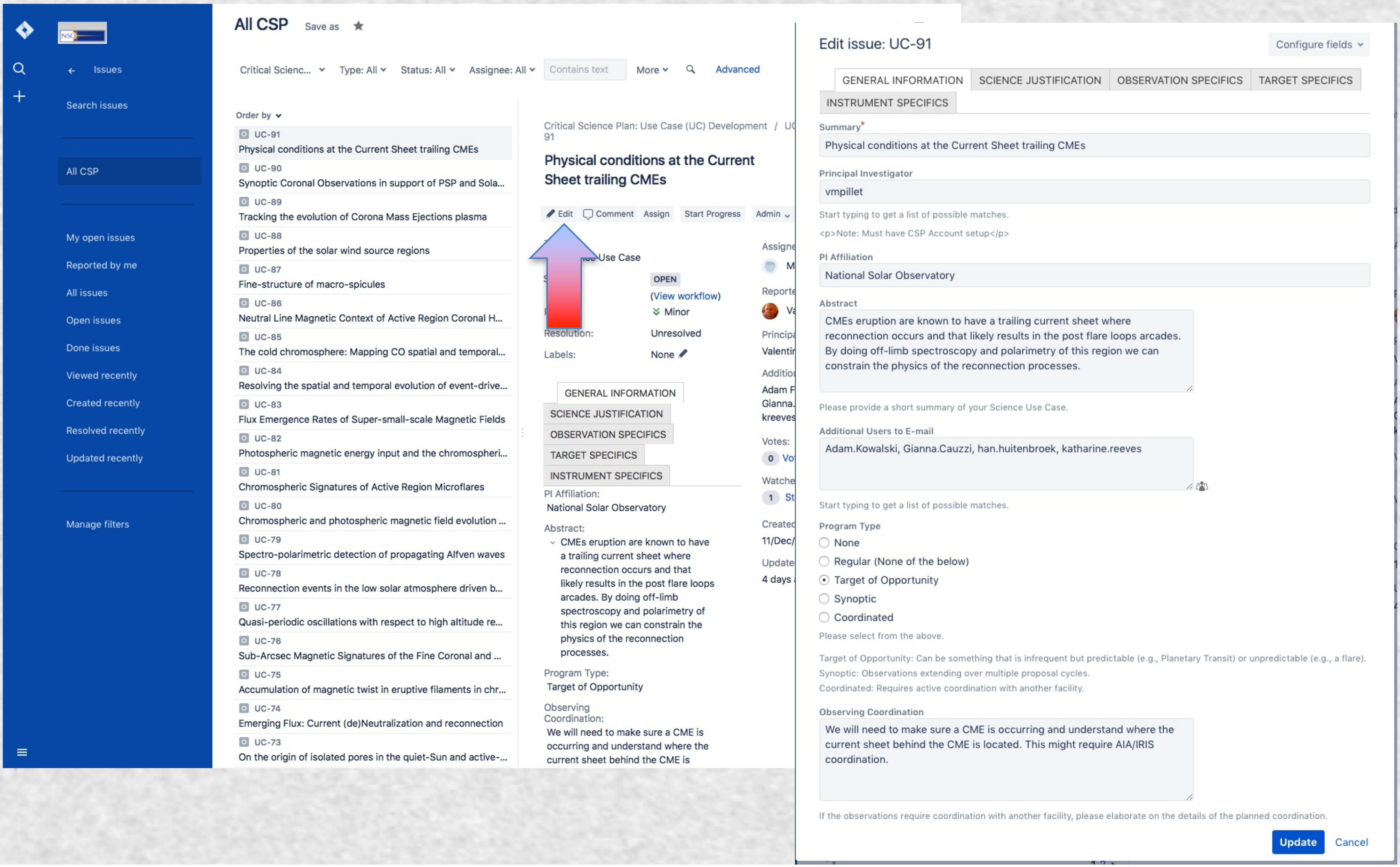


DKIST CSP: JIRA User's Guide
Create a new Science Use Case



DKIST CSP: JIRA User's Guide

Editing your Science Use Case (PI, Co-I)



DKIST CSP Science Use Case development strategy:

1. Formulate science context and goals

   (JIRA form tabs – General Information, Science Justification, Target Specifics)

2. Identify observational needs (spectral lines of interest, pattern, cadence, sensitivities)

   (JIRA form tab – Observation Specifics, Instrument Specifics)

3. Determine useful DKIST instrument suite

   (JIRA form tabs – Observation Specifics, Instrument Specifics)

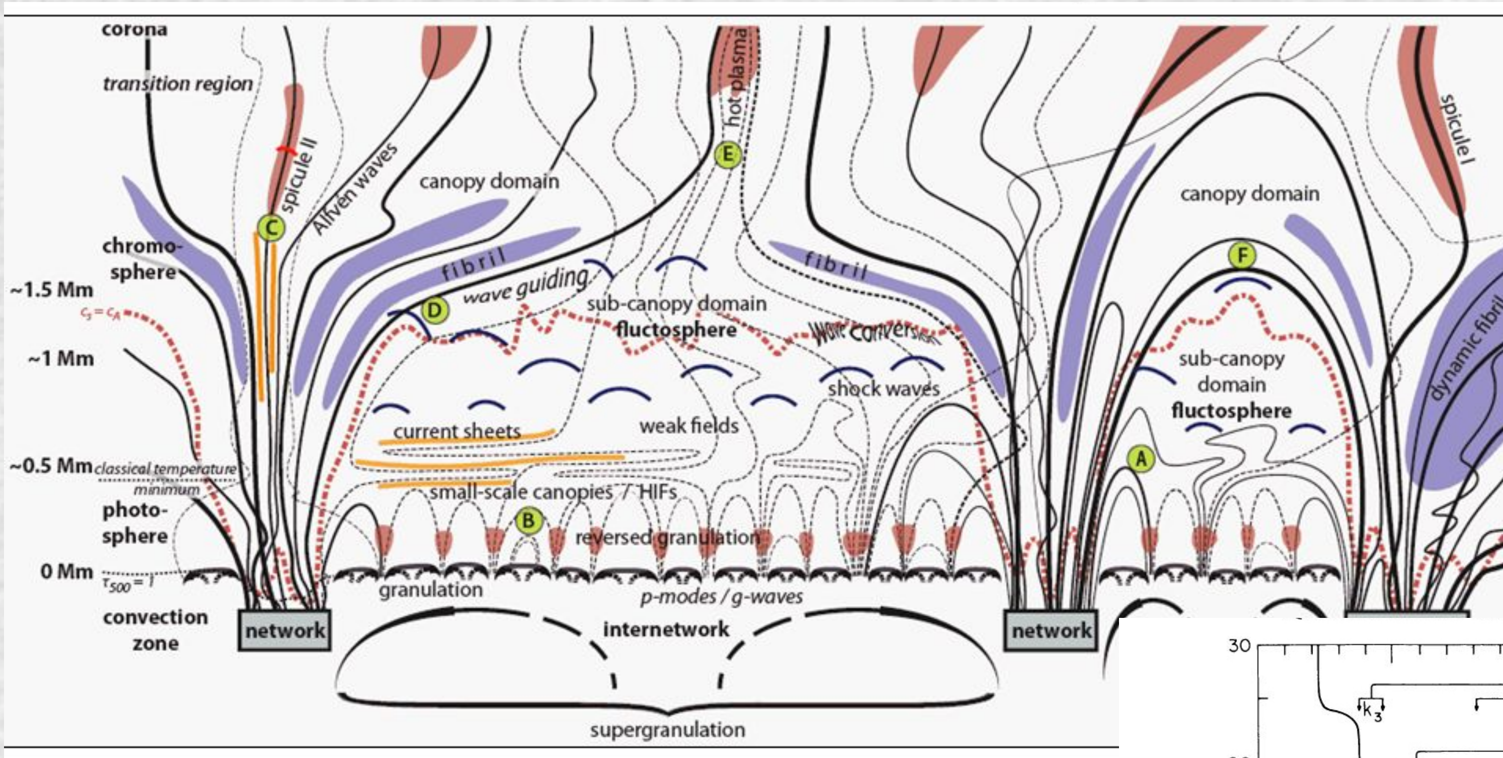
   FIDO – aka Coudé configuation and Data Rate tool, aka Beam Splitter Tool

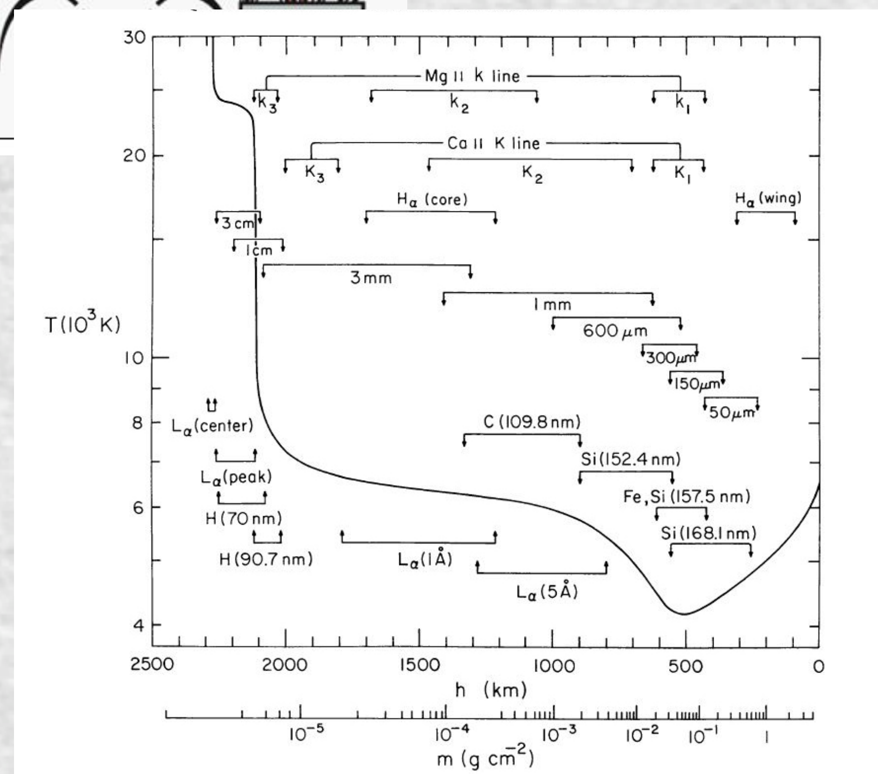
4. Assess instrument performance capabilities

   (JIRA form tabs – Instrument Specifics)

   Instrument Performace Calculators (IPCs)

Formulate science context and goals, and observation strategy





Vernazza et al. 1981

Determine useful DKIST instrument suite

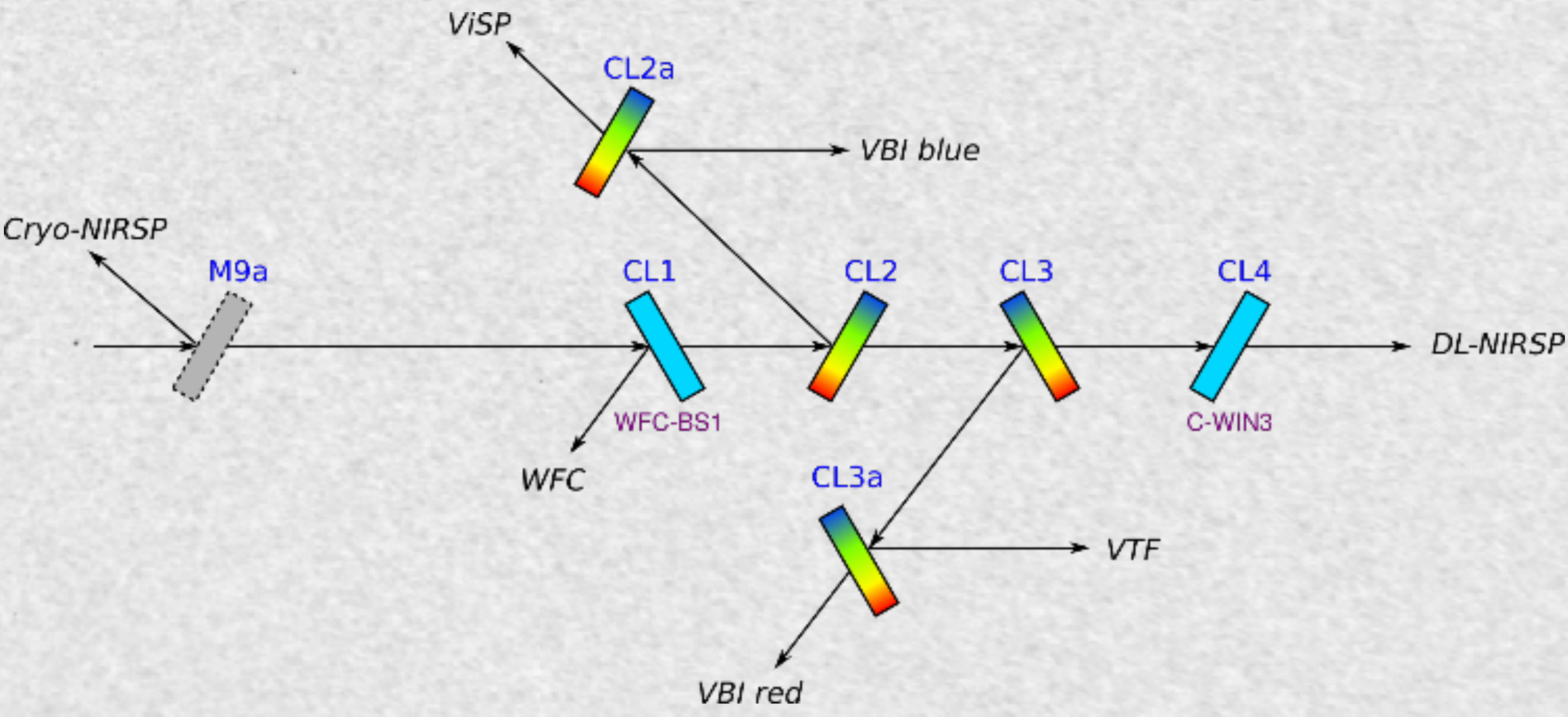
DKIST Instrument Summary Table

http://dkist.nso.edu/CSP/instruments

	Instrument type	Spectral range	Spectral resolution	Spatial sampling	Maximum Instantaneous Field of View	Maximum Sampled Field of View	Peak Cadence	Analogous Instruments
Visible Broadband Imager ***VBI (Blue)***	High Cadence, High Resolution Imager	390–550nm (sequential filter sequencing)	N/A	0.011″	45″ x 45″	2′ x 2′ (sequential field sampling)	3.2 sec (reconstructed) 0.03 sec (raw images)	ROSA, Hinode/BFI *High cadence, high spatial resolution*
Visible Spectropolarimeter ***ViSP***	Scanning Slit Spectropolarimeter	380-900nm (3 spectral windows at a time)	>180,000	0.0195″ (arm 1) 0.0236″ (arm 2) 0.0295″ (arm 3) [sampling along slit]	*5 slits* *Width* x *Length* 0.028″ or 0.041″ or 50″ (arm 1) 0.053″ or x 60″ (arm 2) 0.106″ or 75″ (arm 3) 0.214″	Slit length x 2′	0.5-10 sec per slit position (polarimetry) 0.02-0.2 sec per slit position (intensity-only)	SPINOR, Hinode/SP, IRIS, GRIS *Scanning spectrograph, high spectral fidelity*
Visible Tunable Filter ***VTF***	Fabry Perot Imaging Spectropolarimeter	520-870nm (sequential scans through multiple spectral lines)	FWHM 6-8 pm	0.014″	60″ x 60″	60″ x 60″	Typical scan times per spectral line: 0.5-2 s (intensity only); 2-10 s (polarimetry)	IBIS, CRISP, GFPI *Imaging spectropolarimeter*
Visible Broadband Imager ***VBI (Red)***	High Cadence, High Resolution Imager	600–860nm (sequential filter sequencing)	N/A	0.017″	69″ x 69″	2′ x 2′ (sequential field sampling)	3.2 sec (reconstructed) 0.03 sec (raw images)	ROSA, Hinode/BFI *High cadence, high spatial resolution*
Diffraction Limited Near Infrared Spectropolarimeter ***DL-NIRSP***	Integral Field Unit Spectropolarimeter	500–900nm 900–1350nm 1350-1800nm (1 filter band per channel)	125,000	0.03″ (high res) 0.077″ (mid res) 0.464″ (wide field)	2.4″ x 1.8″ (high res) 6.16″ x 4.62″ (mid res.) 27.84″ x 18.56″ (wide)	2′ x 2′	Depends on resolution and and total field of view. E.g. 6s for one tile, on-disk, high resolution, full polarimetry	SPIES *True Imaging Spectropolarimeter: simultaneous 2D FOV and spectral information using fiber-fed IFU*
Cryogenic Near Infrared Spectropolarimeter ***Cryo- NIRSP***	Scanning Slit Spectropolarimeter	1000-5000nm (1 filter band at a time. About 70 s to switch filters)	100,000 on-disk 30,000 off-limb	0.12″ [along slit] (no Adaptive Optics)	*2 slits* 0.15″ x 120″ slit 0.5″ x 240″ slit	4′ x 3′ (near limb) 5′ round (off-limb)	Heavily depends on signal to noise. Maximum frame rate is 10 frames per second e.g. 1s per slit position near-limb/ chromosphere	CYRA (BBSO) *Cryogenic, scanning spectrograph, novel diagnostics*
Cryo-NIRSP ***Context Imager***	Imager	1000-5000nm (1 filter band at a time, with fast switching time to support sequential observations during a single-band spectrograph scan.)	N/A	0.052″ (no Adaptive Optics)	100″ x 100″	4′ x 3′ (near limb) 5′ round (off-limb)	Heavily depends on signal to noise. Maximum frame rate is 10 frames per second e.g. 1s per slit position near-limb/ chromosphere	CYRA (BBSO) *Cryogenic, scanning spectrograph, novel diagnostics*

Facility Instrument Distribution Optics (FIDO):

- FIDO diverts short and *passes long wavelengths* with each successive beamsplitter encounter (a few exceptions)
- Changing from one optical configuration to another is a manual process that requires up to one day to complete
- An exception is the light distribution to the Cryo-NIRSP -- Cryo-NIRSP receives all the light, can not operate simultaneously with any of the other DKIST instrumentation or the adaptive optics system, can be accessed within several tens of minutes .



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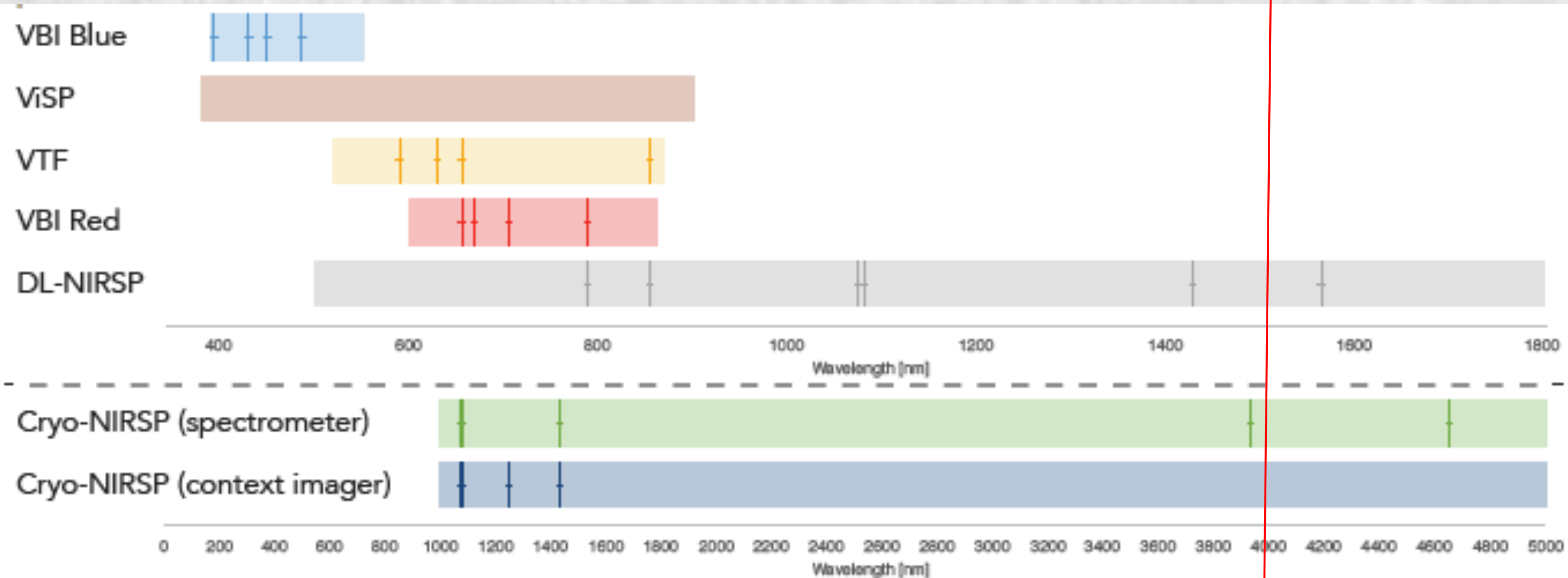


VBI Blue	ViSP	VTF	VBI Red	DL-NIRSP	Cryo-NIRSP	Cryo Context
Ca II K 393.327nm	Access to entire spectral range between 380-900 nm	Na D 589.6nm	H-alpha 656.282nm	Fe XI 789nm	Fe XIII 1074.7nm	Fe XIII 1074.7nm
G-band 430.52nm		Fe I 630.25nm	Continuum 668.423nm	Ca II 854.2nm	Fe XIII 1079.7nm	He I 1083nm
Continuum 450.287nm		H-alpha 656.3nm	Ti O 705.839nm	Fe XIII 1074.7nm	He I 1083 nm	J Band 1250nm
H-beta 486.1nm		Ca II 854.2nm	Fe XI 789.186nm	He I 1083nm	Si X 1430nm	Si IX 1430nm
				Si X 1430nm	Si IX 3935 nm	
				Fe I 1565nm	CO 4651nm	

This table is meant to give an idea of the capabilities of the DKIST first light instrument suite. It cannot capture the large trade space that is provided by the flexibility of the instruments. For more information, visit http://dkist.nso.edu/CSP/instruments

Visible light cameras for instruments are provided by a UK consortium.

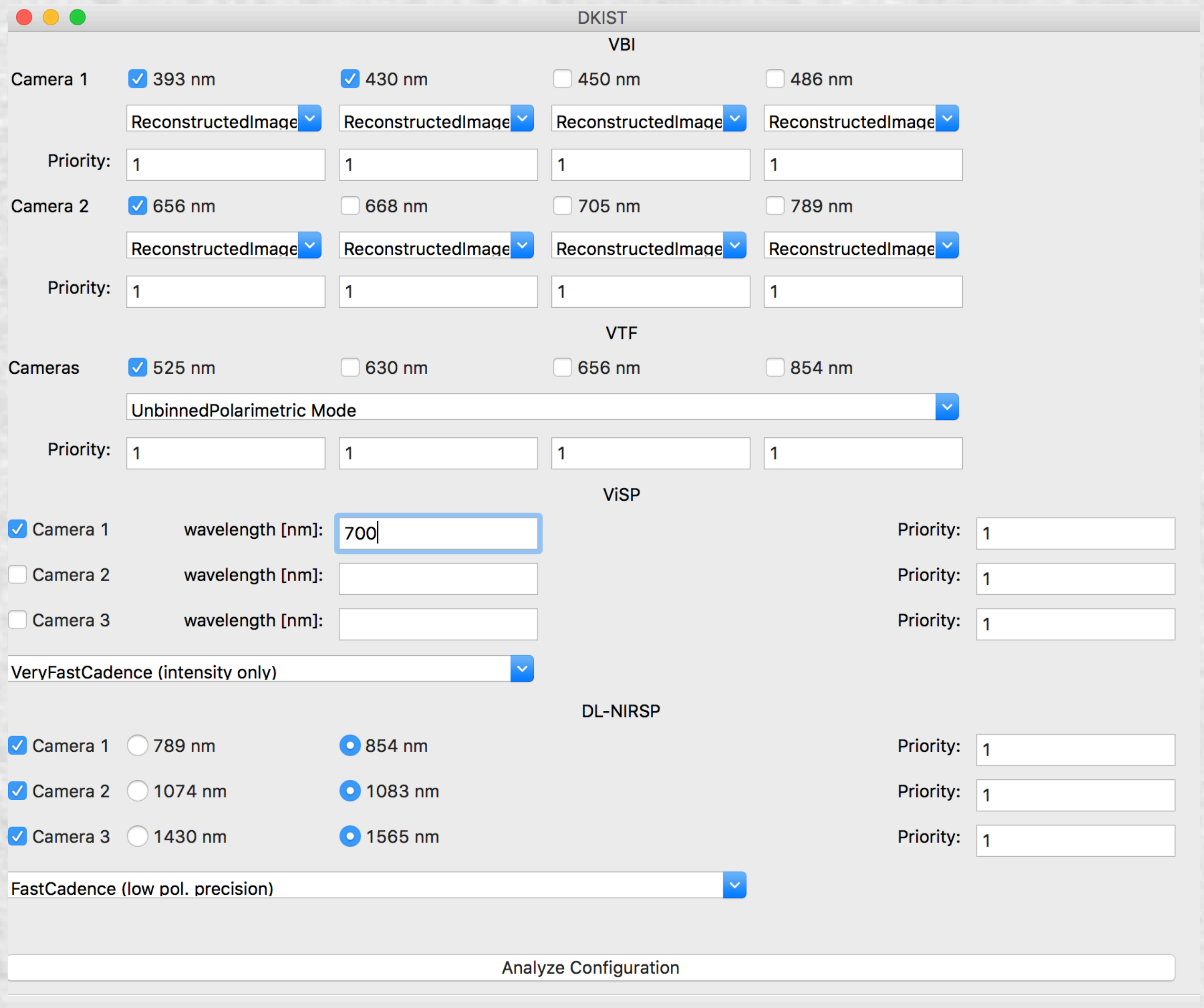
www.nso.edu Ver. 1.6 12/20/2017

[Beam Splitter and Data-rate Analysis Tool](http://dkist.nso.edu/CSP/instruments)

http://dkist.nso.edu/CSP/instruments

INPUTS:
Wavelengths and modes for each desired instrument

Priorities can also be used for optimization (instrument selection)



Output to be included under INSTRUMENT SPECIFICS tab on JIRA form

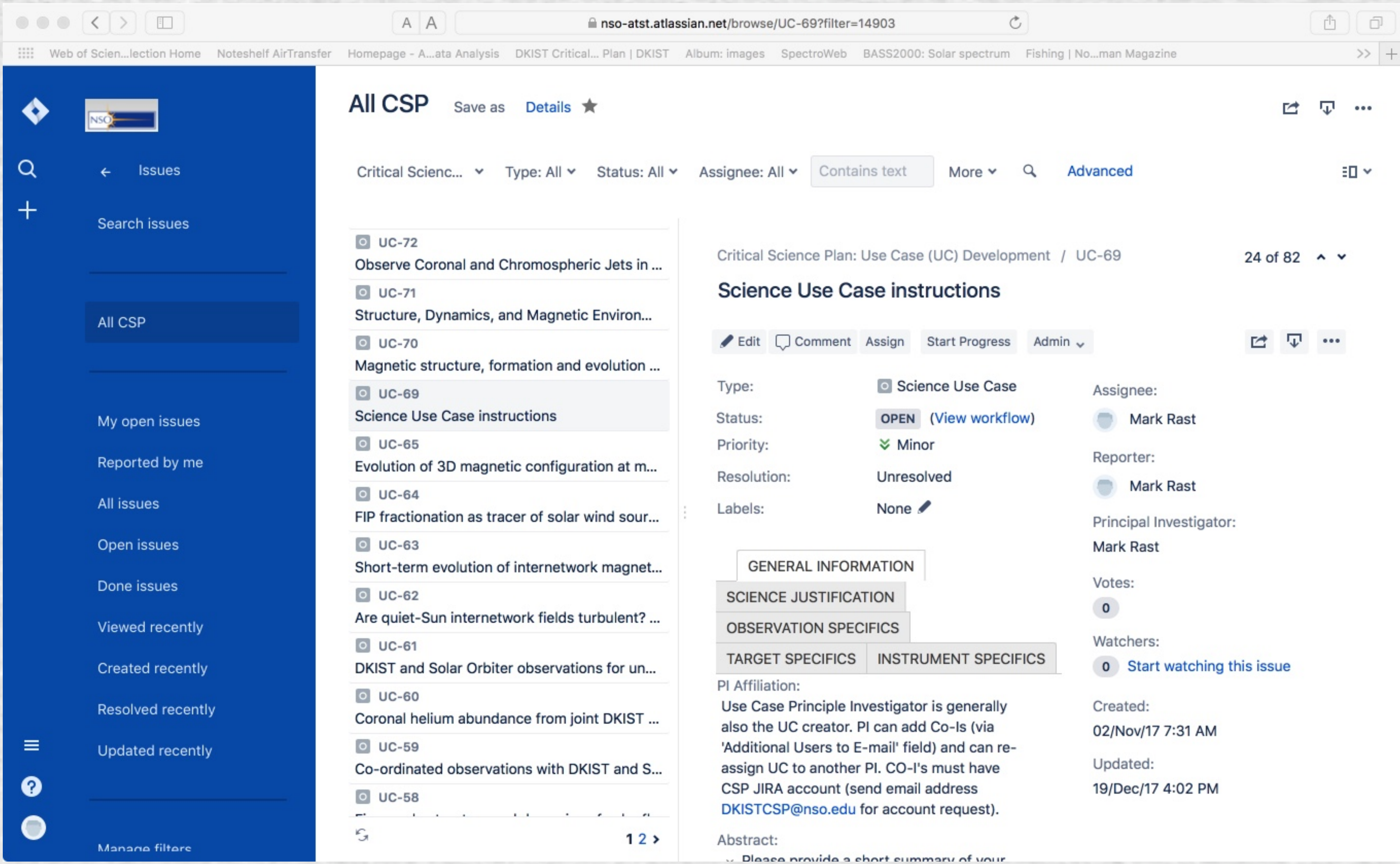
Instrument Performance Calculators

- Set of tools (i.e. software programs/applications) to explore instrument capabilities – e.g. line selection, exposure times, SNR etc.
- A *separate* IPC needs to be run for each instrument. VBI and VTF are Java applications (1.9); ViSP and DL-NIRSP run in IDL (8+). (The Cryo-NIRSP IPC unfortunately is not yet ready for distribution)

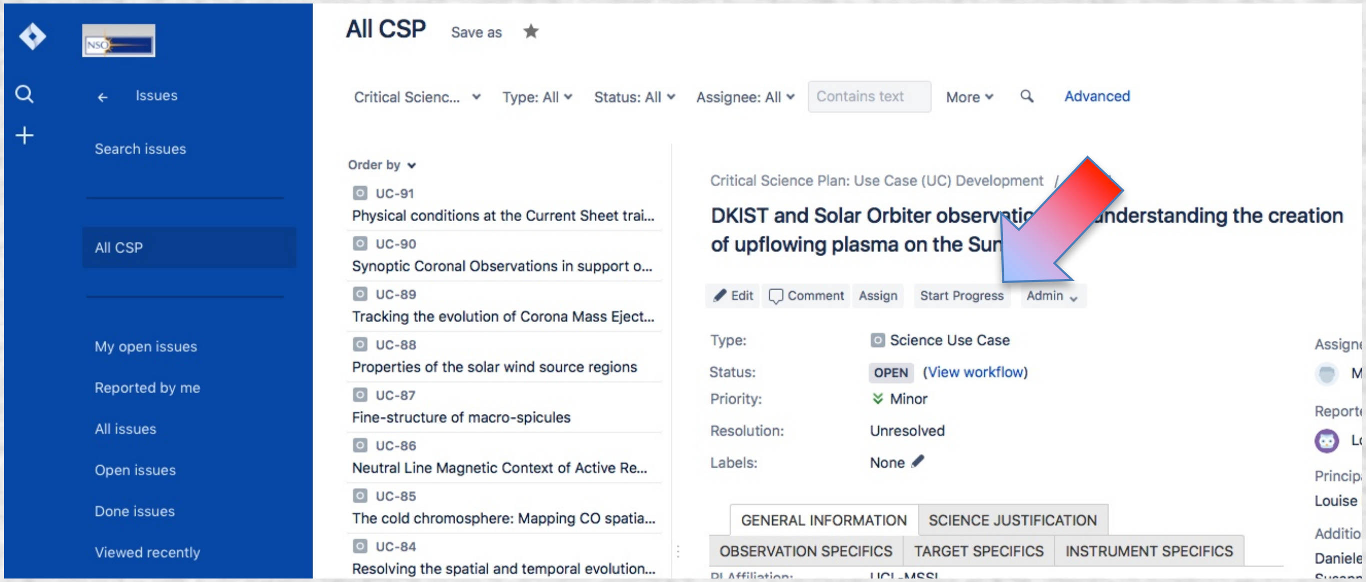
Instrument Performance Calculators:
http://dkist.nso.edu/CSP/instruments

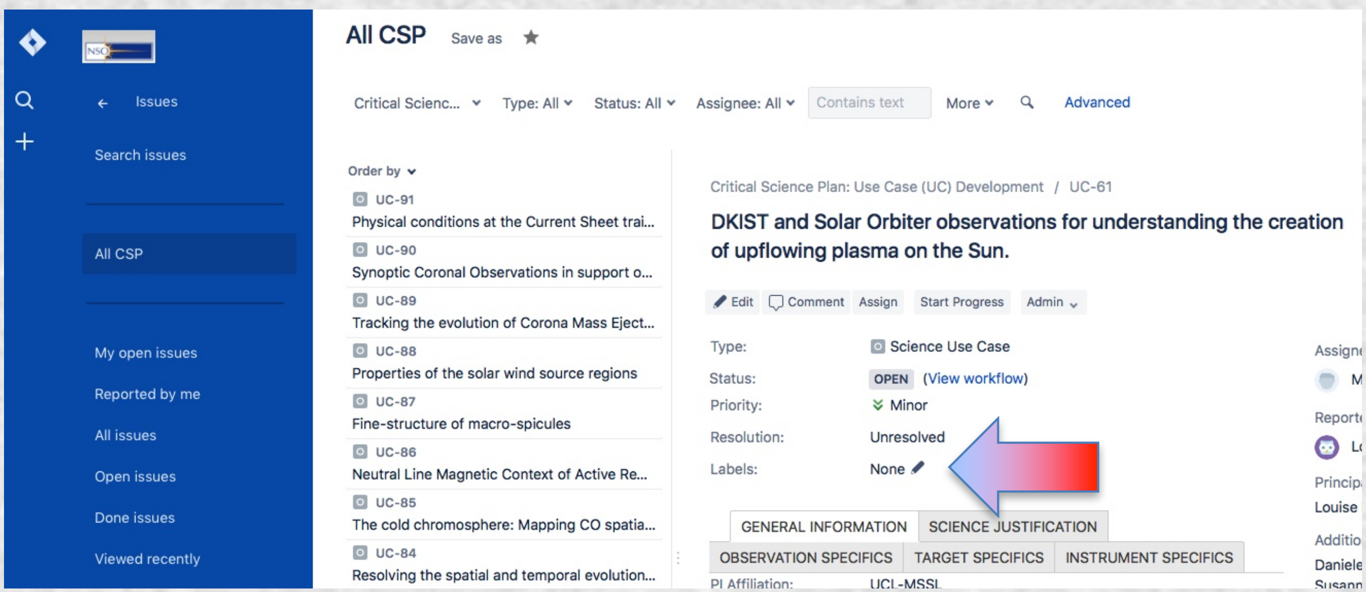
Output can be attached to JIRA form for sharing with team and for possible future Science Use Case development

http://nso-atst.atlassian.net/



DKIST CSP: JIRA User's Guide
Status and *Labels* Fields

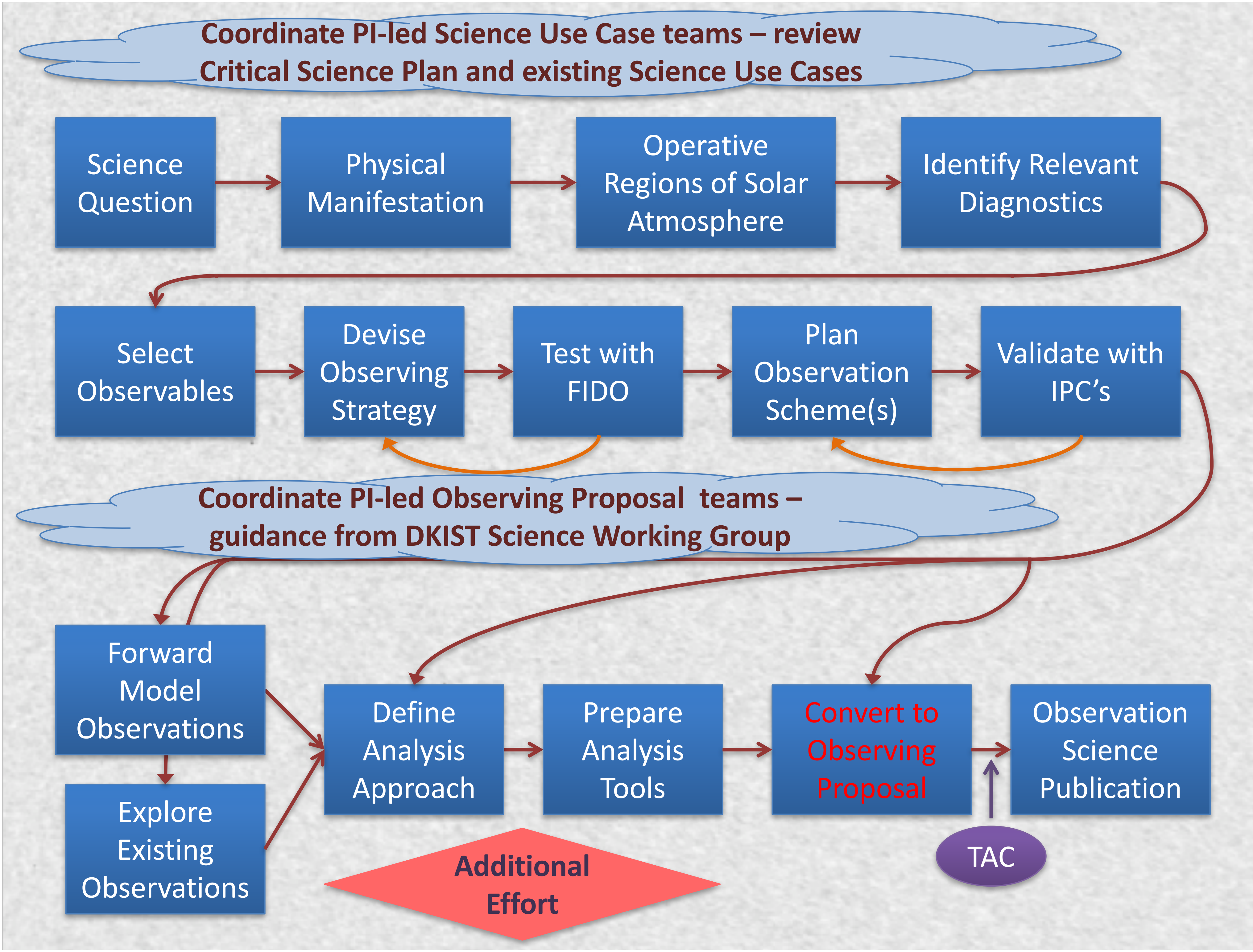




- For now please do not select *Start Progress* (which changes the *Status* field)

- If you worked on your Science Use Case as part of a DKIST CSP Workshop, please edit *Labels* as:
  - CSPW-SPD2016
  - CSPW-Huntsville
  - **CSPW-DC**
  - CSPW-Freiburg
  - CSPW-Nagoya
  - CSPW-JHU/APL
  - CSPW-Newcastle
  - CSPW-NMSU
  - CSPW-Rice
  - CSPW-Bozeman
  - CSPW-Synoptic

  as appropriate.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Forward Model Observations
Explore Existing Observations
Define Analysis Approach
Prepare Analysis Tools
Convert to Observing Proposal
Observation Science Publication
TAC
Additional Effort

DKIST Science Working Group (DKIST SWG)

1	Bello-Gonzales	Nazaret	KIS	Germany	Member
2	Cao	Wenda	NJIT	US	Member
3	Cauzzi	Gianna	AO	Italy	Member
4	Cranmer	Steve	U. Colorado	US	Member
5	da Costa	Fatima Rubio	Stanford	US	Member
6	DeLuca	Ed	Harvard	US	Member
7	dePontieu	Bart	Lockheed	US	Member
8	Fletcher	Lyndsay	U. Glasgow	UK	Member
9	Gibson	Sarah	HAO	US	Member
10	Jeffries	Stuart	Georgia St	US	Member
11	Judge	Phil	HAO	US	Member
12	Katsukawa	Yukio	NAOJ	Japan	Member
13	Landi	Enrico	Michigan	US	Member
14	Petrie	Gordon	NSO	US	Member
15	Qiu	Jiong	MSU	US	Member
16	Rast	Mark	U. Colorado	US	Member
17	Rempel	Mattias	HAO	US	Member
18	Rubio	Luis Bellot	IAA	Spain	Member
19	Scullion	Eamon	TCD	Ireland	Member
20	Sun	Xudong	IfA	US	Member
21	Welsch	Brian	Wisconsin	US	Member
22	Goode	Phil	NJIT	US	Co-I
23	Knoelker	Michael	HAO	US	Co-I
24	Rosner	Robert	U. Chicago	US	Co-I
25	Kuhn	Jeff	IFA	US	Co-I & Instrument PI
26	Rimmele	Thomas	NSO	US	Ex-Officio
27	Casini	Roberto	HAO	US	Instrument PI
28	Lin	Haosheng	IFA	US	Instrument PI
29	Schmidt	Wolfgang	KIS	Germany	Instrument PI
30	Woeger	Friedrich	NSO	US	Instrument PI

- SWG will try to articulate the community vision of essential DKIST science through the Critical Science Plan
- The SWG will identify Science Use Case overlap and suggest team consolidation
- The SWG will aim to minimize, NOT adjudicate, conflicts
- The SWG will assess whether the science proposed in the Science Use Cases requires DKIST capabilities
- DKIST Time Allocation Committee is final arbitrator, and will determine the order which the Observing Proposals are executed

http://dkist.nso.edu/CSP

- Critical science description (living document) with links to Science Use Case titles and abstracts, and ultimately their full text
- Links to Instrument and other summary documents
- Link beam-splitter configuration and data rate analysis tool

http://nso-atst.atlassian.net/

Collaborative JIRA environment for Science Use Case development, and ultimately Observing Proposal development

https://www.dropbox.com/sh/uzwdc03ayovxr5o/AABuZbWtCnfPqG8F2zHaeCFta?dl=0

Dropbox link with summary documents (Instruments, Data Handling System (DHS), Facility Instrument Distribution Optics (FIDO), JIRA User's guide), and Instrument Performance Calculators (IPCs)