Designing Control Software and Graphical User Interfaces for ViSP Mechanisms

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New instrumental capabilities are needed to meet the challenge of validating sophisticated models and theories in the field of solar physics.
The Daniel K. Inouye Solar Telescope is set for completion in 2019. It will have broad impacts on astronomy, plasma physics, and solar-terrestrial relations.

http://dkist.nso.edu/node/2220

http://dkist.nso.edu/node/2764
A total of five science instruments receive light from the First Light Coudé Beamsplitter, including the Visible Spectro-Polarimeter (ViSP)
The ViSP will provide precise measurements of all four Stokes parameters (I, Q, U, & V) at wavelengths from 380-900 nm.
All four ViSP-unique mechanisms require robust software to run properly.

Figure 1 ViSP Instrument (5263-SW-1000) Iso View, Components Labeled (2450 kg)
ViSP mechanisms can be activated either through the Instrument GUI or the Engineering GUI.
ViSP distributes tasks to several managers that then delegate tasks to the workers they control.
ViSP Main Engineering GUI provides monitoring and control capabilities for every subsystem in the instrument.
Slit Station
Very narrow entrance slit to be placed in the ViSP optical beam; slit is then physically moved laterally over the image plane in order to capture the desired field of view.

Grating Station
Used to hold and position the diffraction grating in the optical path of the ViSP instrument.
Desired slit aperture is selected and slit selection stage moves desired slit in front of a mask. This mask blocks all light from non-active slits, while allowing light through the active slit to pass.

Slit Substation, FM Substation, and Slit Stage Selector move simultaneously
- Slit Substation moves the same distance as the desired slit aperture, while the FM substation moves half this distance
ViSP Slit Station GUI

**Slit Manager**
- Identifies limit switch status via EtherCAT I/O connection
  - Notifies user if limit switch is triggered, stops all movement
- Delegates movement to SlitSelect if current slit width is not desired slit width
- Delegates movement to SlitTransit and MirrorTransit, respectively, if current slit and FM substation positions are not required slit and FM substation positions (for desired slit width)

**SlitSelect**
- Moves desired slit in front of mask

**SlitTransit**
- Moves slit substation to required position

**MirrorTransit**
- Moves FM substation to required position
Slit Station simulated with two motors via Delta Tau PPMAC and Beckhoff I/O connections on EtherCAT

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Essential functions of Grating Station:

- Verify current diffraction grating ‘ID’
- Position and hold the diffraction grating in the optical path of the ViSP
ViSP Grating Station GUI

**Grating Manager**
- Identifies grating via EtherCAT I/O connection
  - Notifies user if grating is not in place, stops all movement
- Identifies limit switch status via EtherCAT I/O connection
  - Notifies user if limit switch is triggered, stops all movement
- Delegates movement to GratingRotate if expected grating is present and current angle is not desired angle

**GratingRotate**
- Rotates to desired angle
We completed several fundamental, overarching goals of the HAO Prototyping Plan, and also made significant progress in specific mechanism software.

HAO Prototyping Plan (2014), A. Lecinski and B. Larson

- Test Setup and Robustness of Copley Amplifiers on EtherCAT
  - Network has been scheduled and is up and running
  - Controlling 2 Axes on EtherCAT
- Test Setup and Robustness of Beckhoff I/O on EtherCAT
- Test switch communications from Copley to Delta Tau

Next steps:
- **Finalize Slit Station software**
  - step size, number of steps, intensity mode
- **Focus Station software**
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Questions?