EXCLAIM Star Camera System:
Prototypes and Integration

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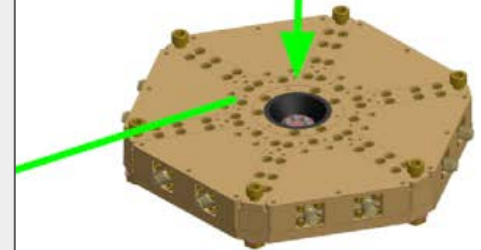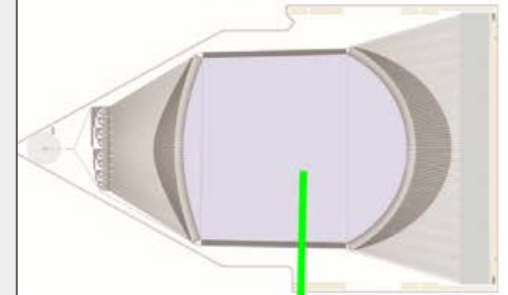
WHAT IS EXCLAIM?

EXperiment for **C**ryogenic **L**arge-**A**perture **I**ntensity **M**apping

- Cryogenic balloon-borne far infrared telescope mission

- Map carbon monoxide and carbon ion emission in the early universe.

- Summer work: design and test prototypes

EXCLAIM insignia

On-chip MKID spectrometer

Detector package
6× spectrometers
at 100 mK

3

STAR CAMERA SYSTEM

Component of EXCLAIM attitude determination + control system

Collects images + produces telescope fine pointing solution

Calibrate gondola magnetometer with horizon coordinate values

PROJECT GOALS

Phase 1

Exercise astrometry
to solve star field

Phase 2

Acquire image with
star camera

Phase 3

Design camera and
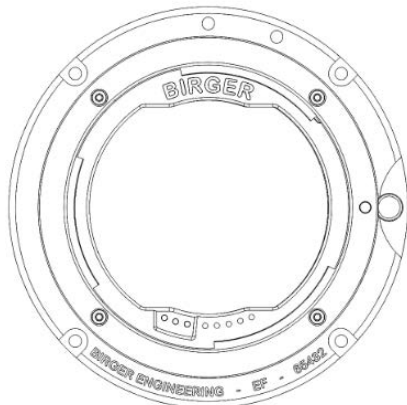test in the field

01

SOFTWARE

Camera Driver

iDS Software Suite
PyuEye

Developed class wrapper to collect images

Lens Controller

Birger Canon EF Lens Controller

Canon 200 mm f/2.8 Lens

Focuses and adjusts lens + aperture

Image Analysis

Astrometry.net

Developed prototype image capture program + class wrapper
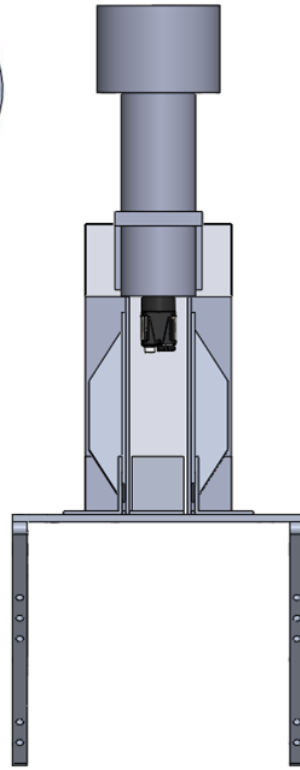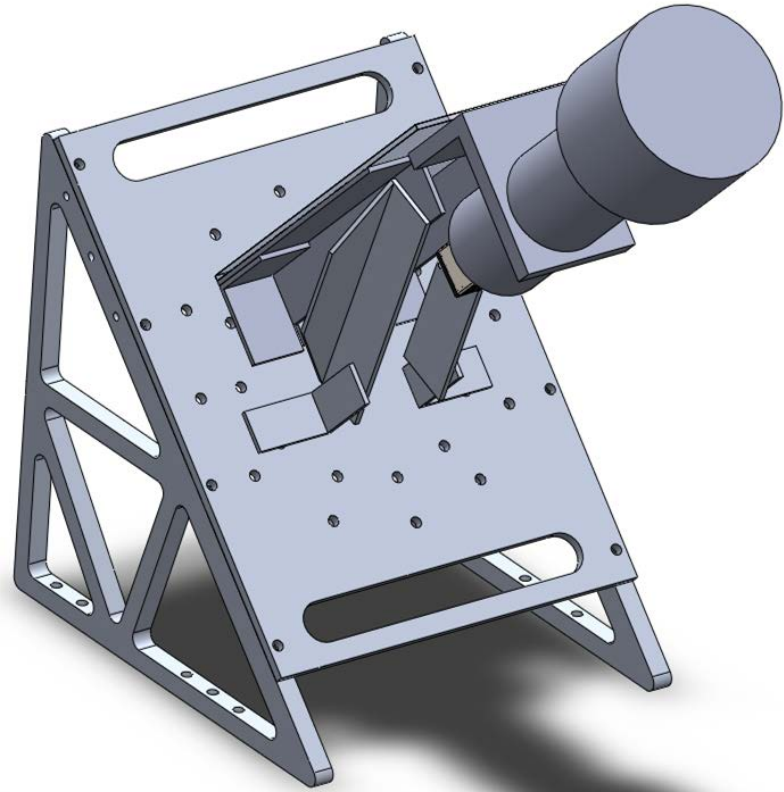
Imaging sensor

Lens controller

Telescope

Image analysis

OUTCOMES: SOFTWARE

25 Her

τ Her / 22 Her

Hercules

ξ CrB / 19 CrB

v2 CrB? 2J(CrB3

υ CrB / 18 CrB

σ CrB / 17 CrB

14 Her

φ Her / 11 Her

ι CrB / 16 CrB

υ Her / 6 Her

ρ CrB / 15 CrB

ι CrB / 14 CrB

λ CrB / 12 CrB

4 Her 2 Her

χ Her / 1 Her

ε CrB / 13 CrB

κ CrB / 11 CrB

Edasich / Ed Asich (ι Dra / 12 Dra)

δ CrB / 10 CrB

η CrB / 9 CrB

Ceginus (φ Boo / 54 Boo)

Corona Borealis

ζ1 CrB / ζ2 CrB / 7 CrB

μ CrB / 6 CrB

ν2 Boo / 53 Boo

ν1 Boo / 52 Boo

γ CrB / 8 CrB

θ CrB / 4 CrB

Alphecca / Gemma / Alphekka / Gnosia / Ashtaroth (α CrB / 5 CrB)

μ2Boonμ1/Boo/ Clava / Venabulum (μ1 Boo / 51 Boo A)

κ Boo / 47 Boo

Nusakan (β CrB / 3 CrB)

ι Boo / 44 Boo

50 Boo

η CrB / 2 CrB

39 Boo

ο CrB / 1 CrB

Thiba (δ Boo / 49 Boo)

Nekkar (β Boo / 42 Boo)

Merga (h Boo / 38 Boo)

χ Boo / 48 Boo

40 Boo

b Boo / 46 Boo

Asellus Primus (θ Boo / 23 Boo)

c Boo / 45 Boo

Aulad Ainathiat (ψ Boo / 43 Boo)

g Boo / 24 Boo

33 Boo

Bootes

Asellus Secundus (ι Boo / 21 Boo)

κ1κBoo /i1k1Boo/Boo/ Boo / 17 Boo A)

u Boo / 41 Boo

Xuange / Aulad Althiba (λ Boo / 19 Boo)

13 Boo

Seginus / Harts / Ceginus (γ Boo / 27 Boo)

68 UMa

02

HARDWARE
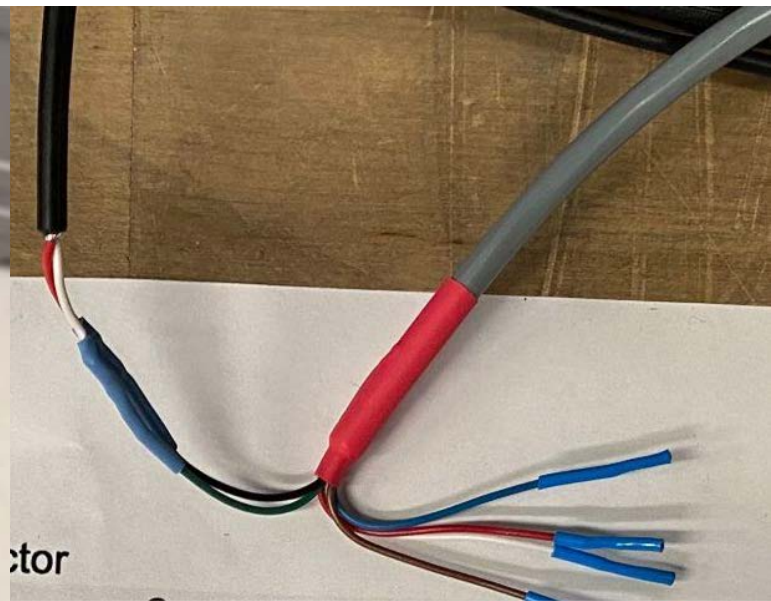
Star camera in the lab

Baffle

Lens Holder

1 foot

Soldered power supply

ctor

WHAT COMES NEXT?

FUTURE OF STAR CAMERA

- Integration
- 2 Cameras on gondola
- Build mount + use in test flight

FUTURE OF EXCLAIM

- Launches in 2023
- Spectrometer technology in future space flight missions

THANK YOU!

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You have all made this summer experience wonderful!

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