Solar Orbiter

Remote Sensing Instruments

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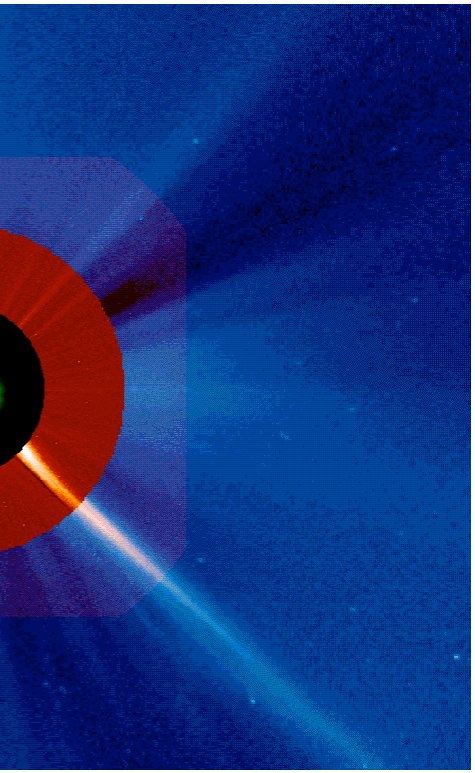
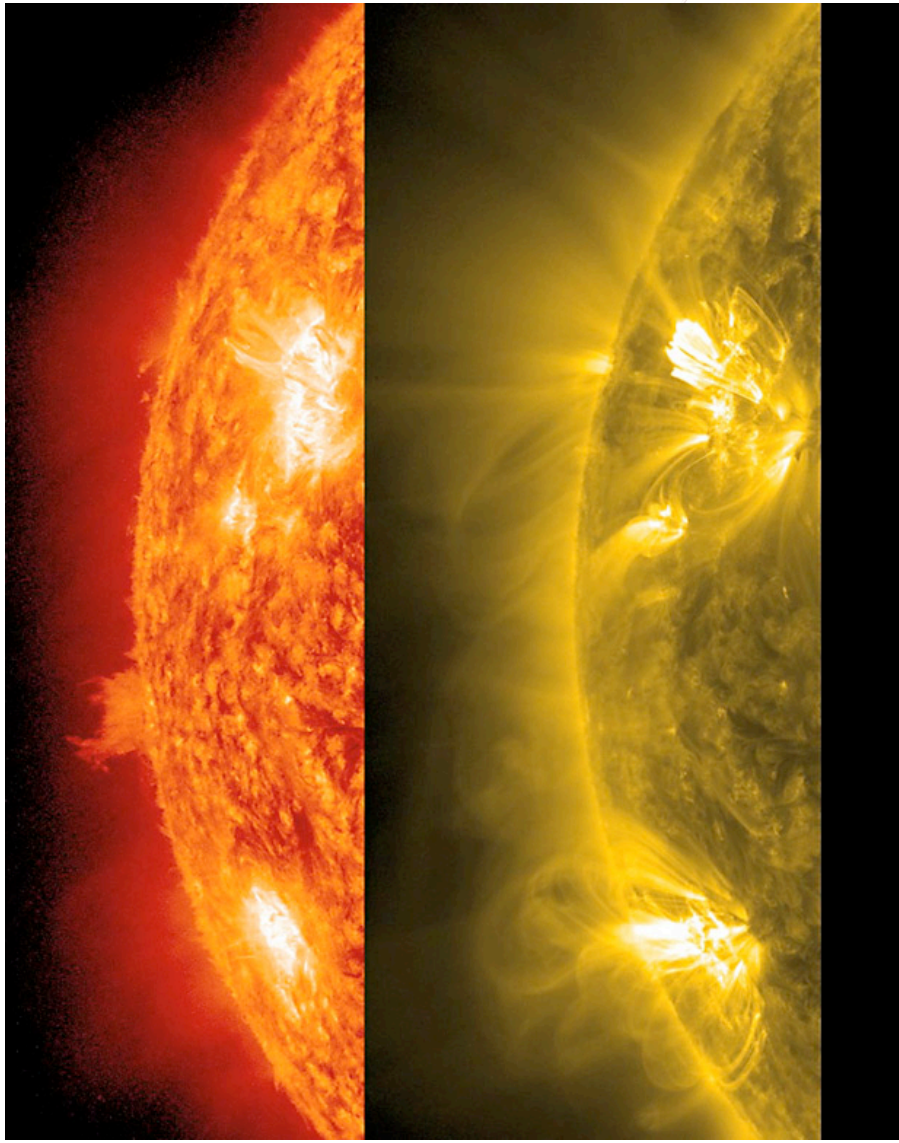
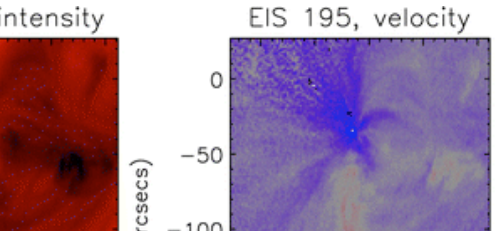
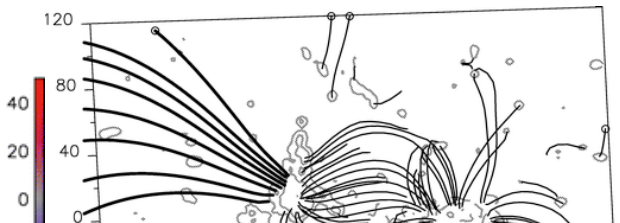
& the Solar Orbiter team

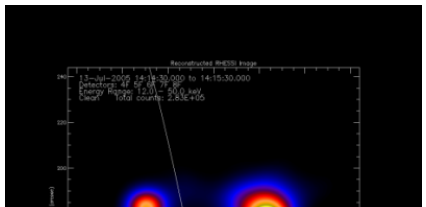
ar corona, wind and magnetic activity
dynamic heliosphere







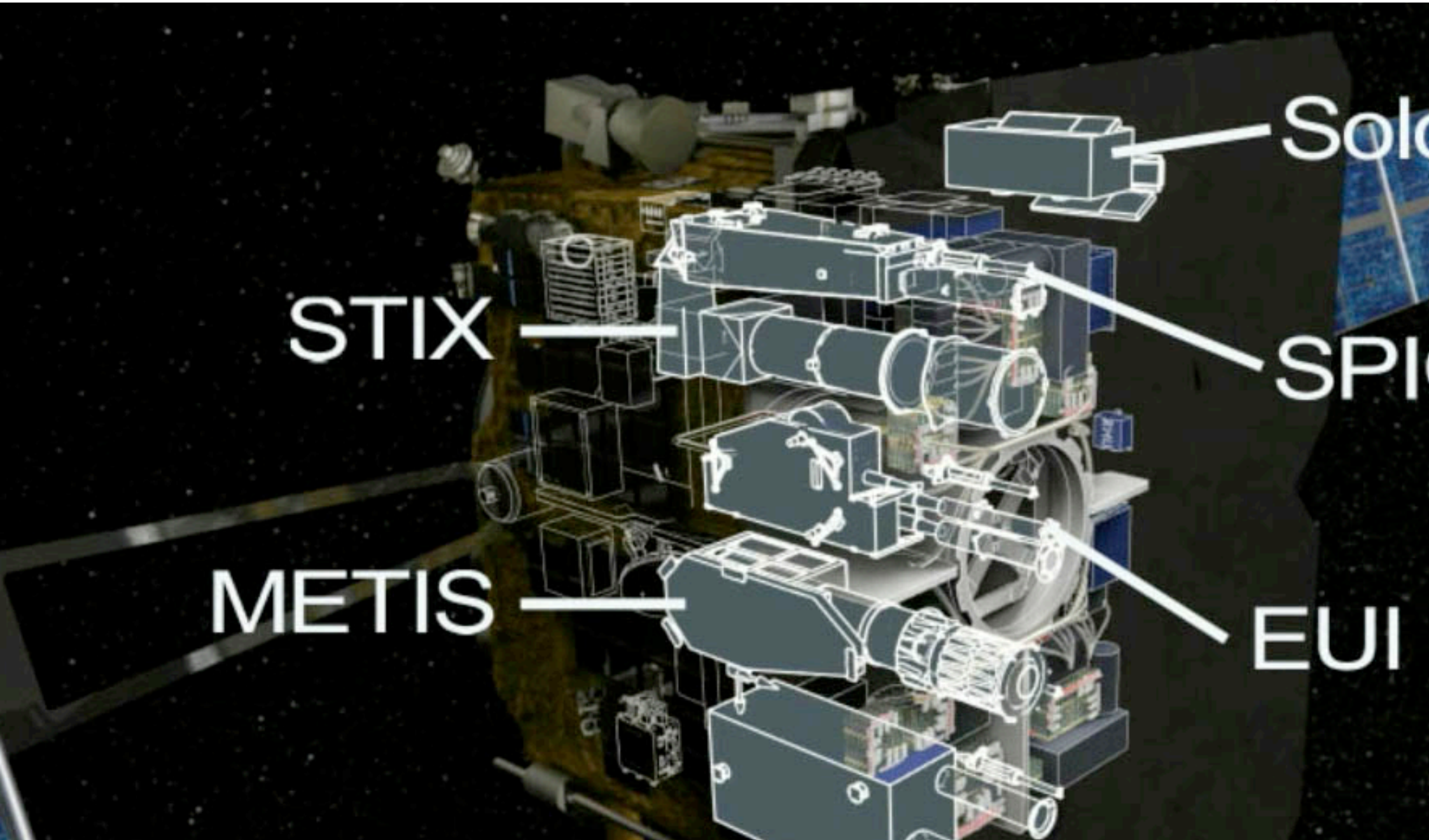




e remote sensing instruments

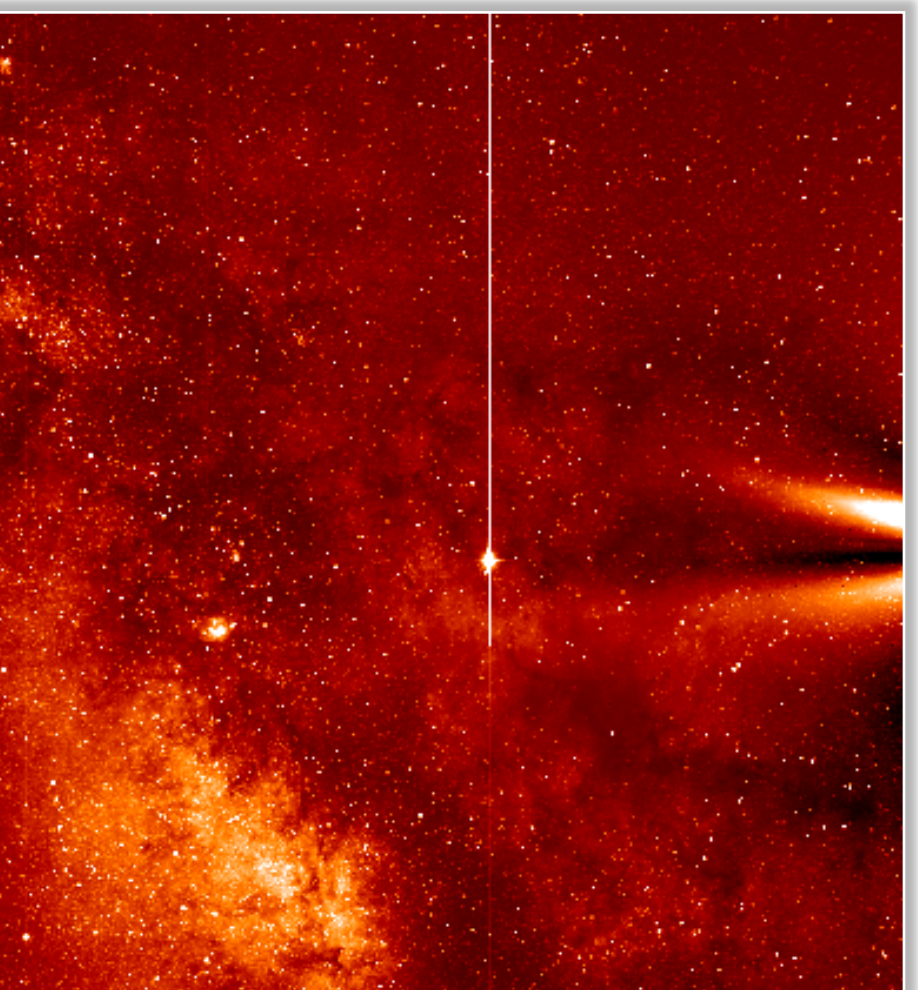
stigation	PI	Countries involved	Measurement	Technique
metric and eismic Imager	S. Solanki (MPS)	D, E, F	Vector magnetic field and line of sight velocity in the photosphere	High resolution telescop axis Ritchey-Chretien, Fu telescope, refractor, Fabr Perot filtergraph.
mager (EUI)	P. Rochus (CSL)	B, UK, F, D, CH	Full disk EUV and high resolution EUV and Lyman α imaging of the solar atmosphere	Full Sun imager: dual ban off axis Herschelian, 2 hig resolution imagers, EUV α off axis Ritchey-Chert
spectrometer ope (STIX)	A. Benz (FHNW)	CH, PL, D, CZ, F	Solar thermal and non-thermal X-ray emission (4-150 keV)	Fourier transform imagin CZT detectors
nagraph (METIS)	E. Antonucci (INAF-OATo)	I, D, CZ	Visible, UV and EUV imaging of the solar corona.	Externally occulted coronagraph
pheric Imager HI)	R. Howard (NRL)	USA	White light imaging of the extended corona	Wide angle lens with ape stop
al Imaging of the nal Environment E)	Consortium lead: A. Fludra	ESA facility instrument F, D, N, CH, UK	EUV spectroscopy of the solar disk and low corona	Off axis parabaloid telesc TVLS grating spectrograp

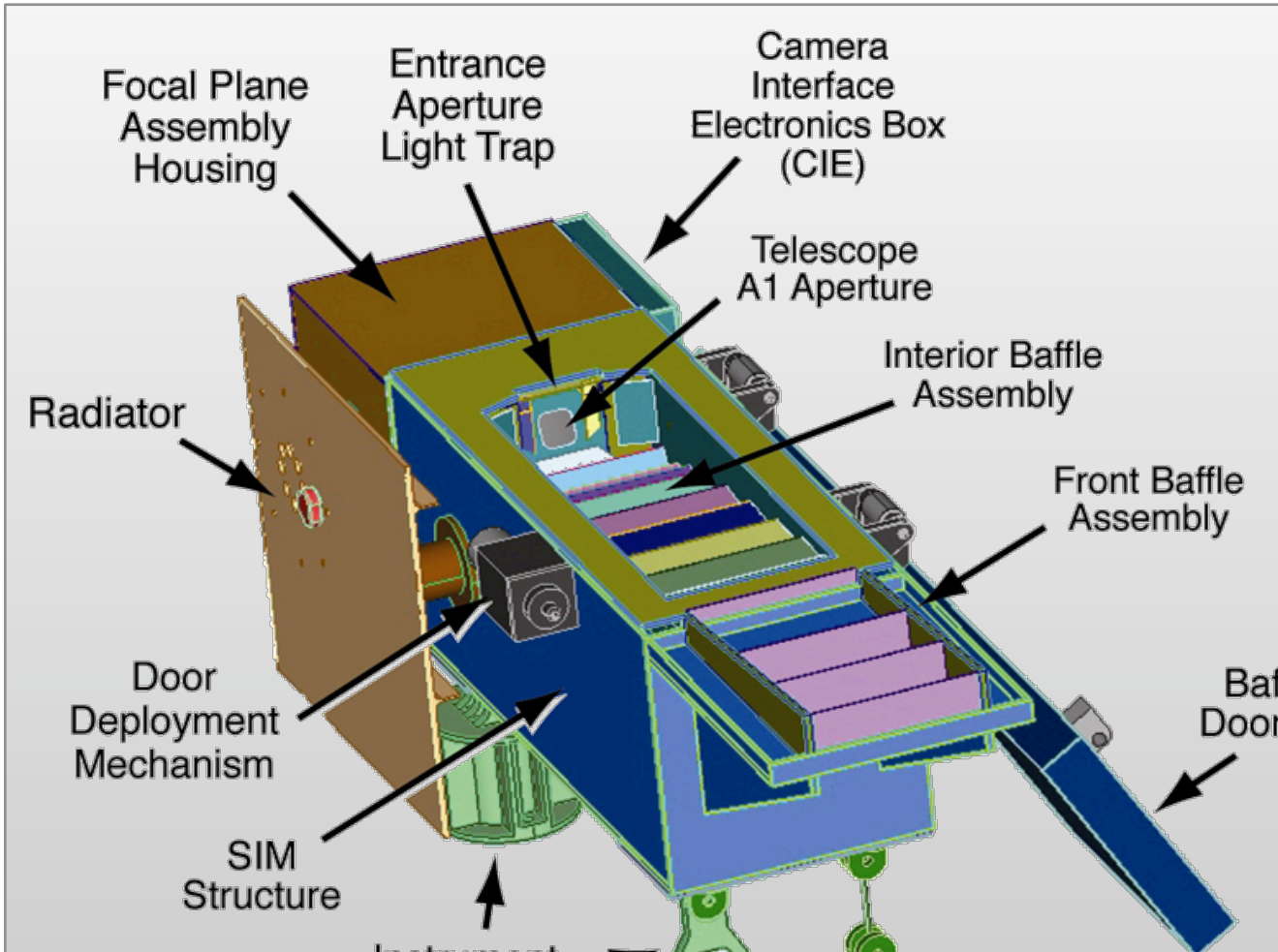
mote-sensing Instruments



oHI – heliospheric imager

de-Field Imager of the Heliosphere From 5 to 45 deg From the Sun
ble Light Observations
ple Telescope: No Mechanisms Other Than One-Shot Door
xt-Generation 4Kx4K APS Sensor





olar Orbiter Heliospheric Imager (SoloHI)
verview

oHI is an evolution of the heliospheric imager developed f
he STEREO SECCHI instrument.
e field of view of SoloHI is 40 degrees, twice that of SECC
II-1. At perihelion it will have resolution comparable to
ASCO/C2 with the C3 field of view
s a visible-light telescope that images the light scattered fr
ee electrons in the solar wind plasma
us it observes solar wind structures – streamers or plasma
heets, CMEs, density fluctuations, comets, etc.

…3 = multi-element telescope for Imaging Spectroscopy

xternally occulted coronagraph designed for:

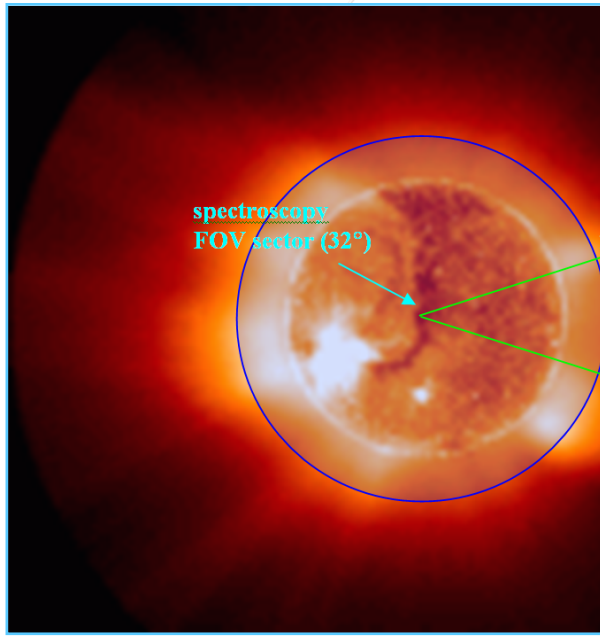
d-band imaging - polarized VL K-corona
ow-band imaging - UV corona (HI Lyα, 1216 Å)
ow-band imaging - EUV corona (HeII Lyα, 30.4 Å)

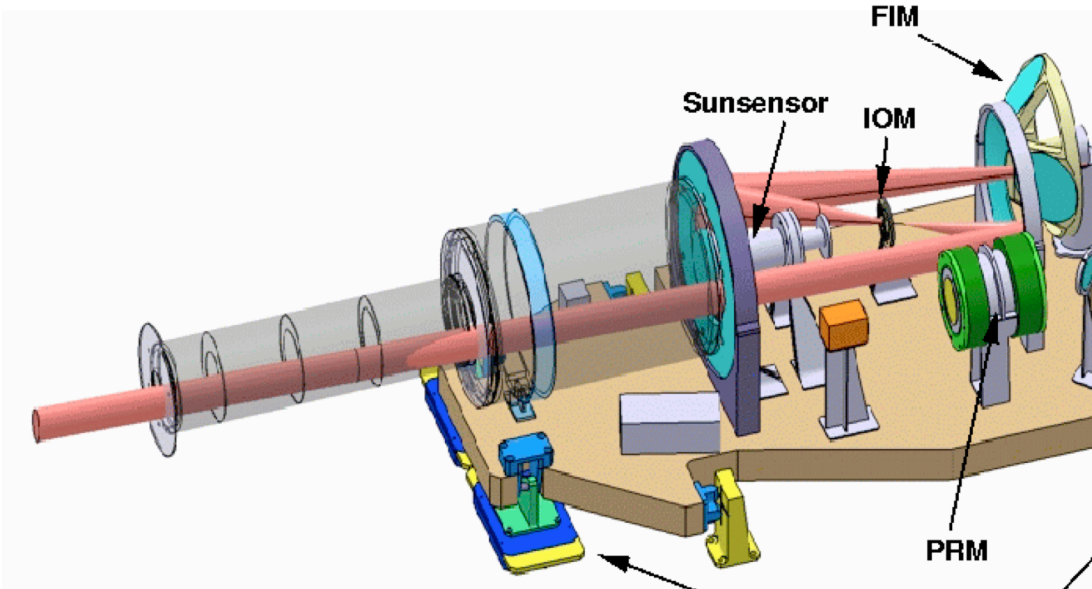
ar FOV: 1.5 - 3.0 $R_\odot$ at min perihelion 0.28 AU

ctro-imaging - HI, HeII lines

ronal sector (3 FOV) in UV/ EUV

aneous UV, VL coronal images





ETIS objectives

characterize the

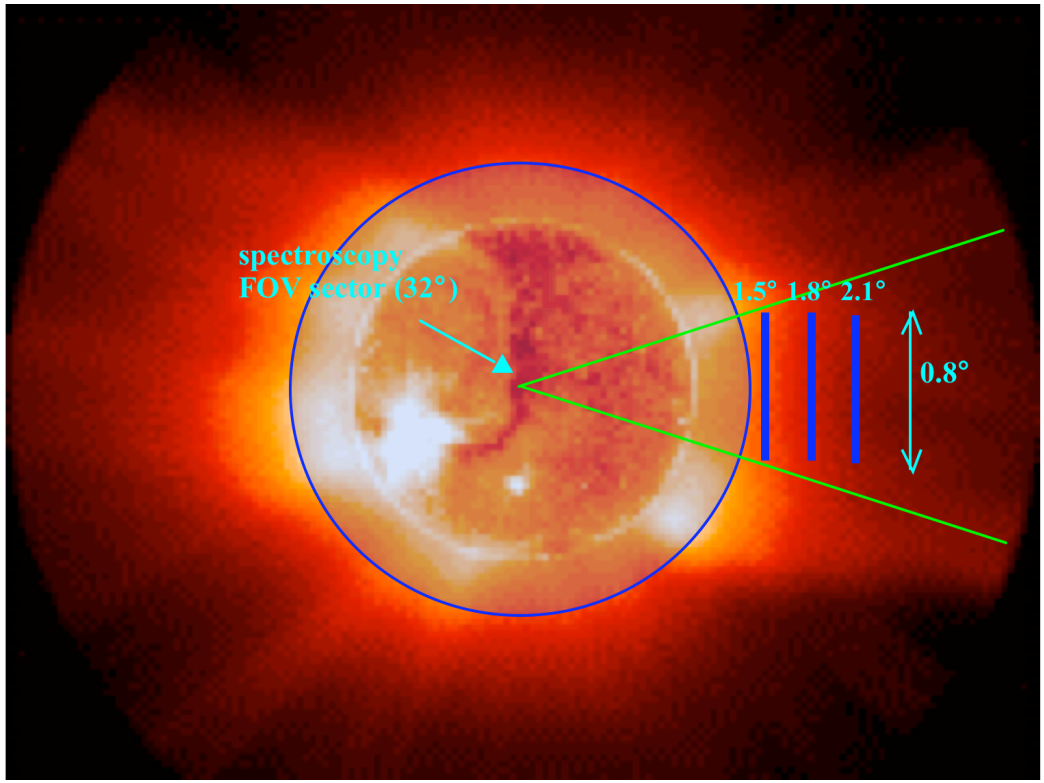
mics and composition of the major plasma components (e^-, H, He)

he corona and solar wind acceleration sites

ity/abundance maps H, He, e^-

ow velocity maps of H, He

ity distribution of H, He



STIX
ctrometer/Telescope for Imaging X-rays

STIX will play an important role in answering two of Solar Orbiter's main science questions:

How and where are energetic particles accelerated at the Sun and how are they transported into interplanetary space?

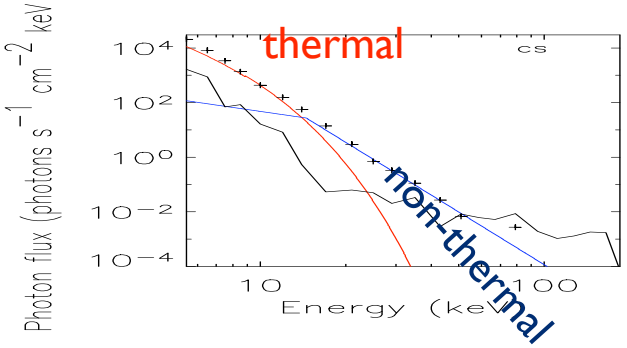
X-ray images → location flare of accelerated electrons

X-ray spectra → spectrum and intensity of electrons

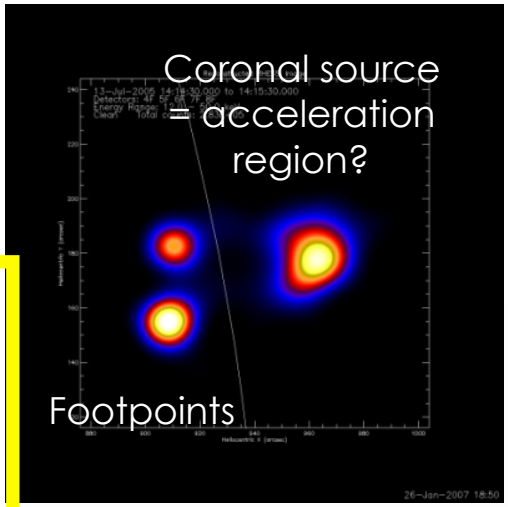
What is the magnetic connection from Solar Orbiter back to the Sun?

Combined observations with RPW and EPD

→ magnetic structure, field line length and connectivity

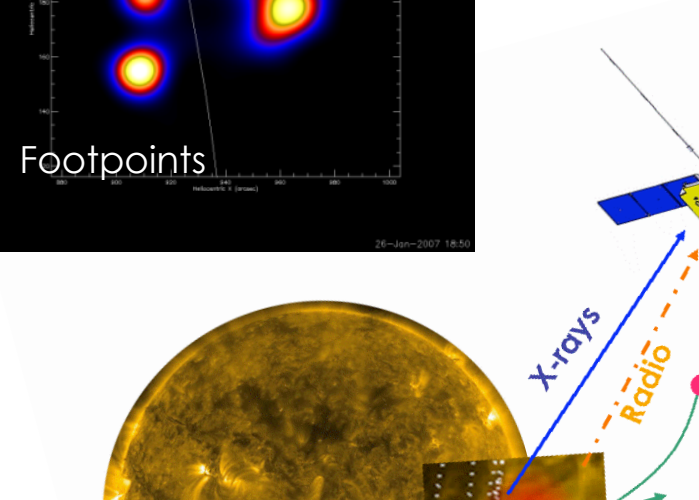


Typic
flare s

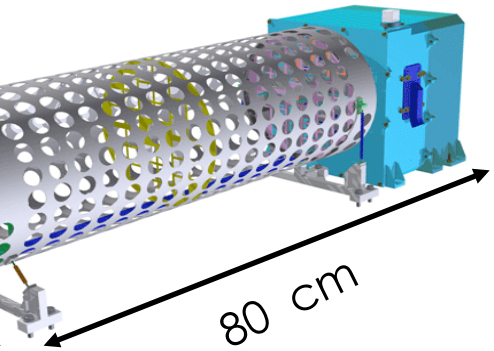


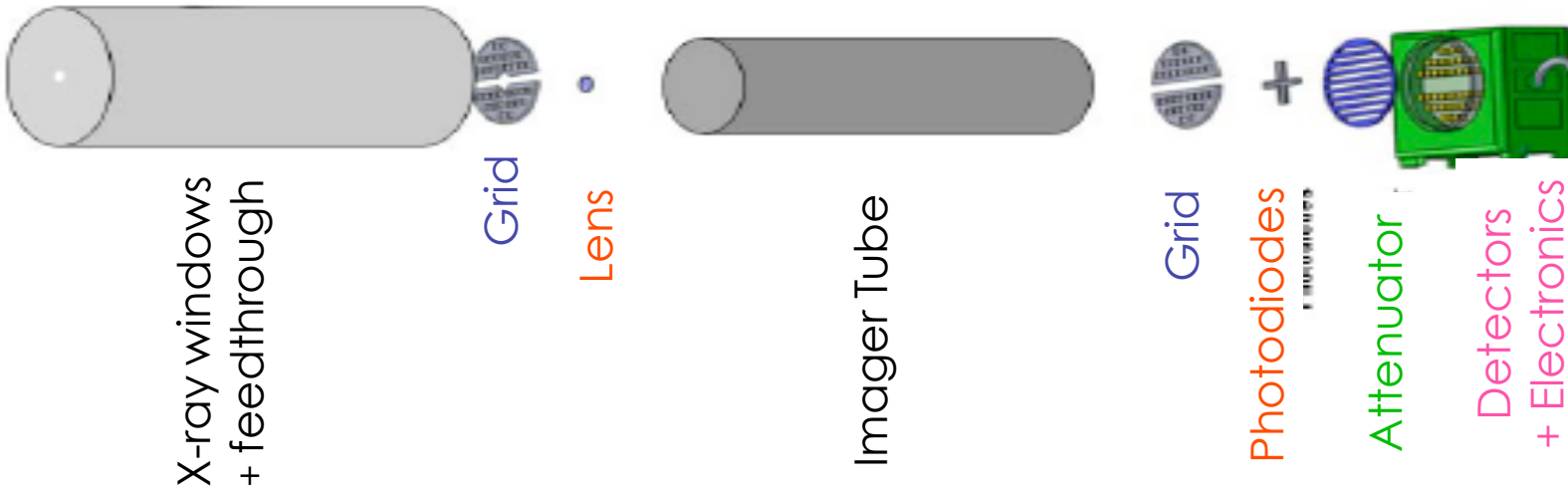
RHESSI
of a

TIX plays a key role in linking remote sensing and in-situ bservations on Solar Orbiter



STIX design





Cadmium-Telluride detectors → energy and timing of incident X-ray

- Wide energy range (4 – 150 keV)
- High spectral (1-15 keV) and temporal (≥ 0.1 s) resolution

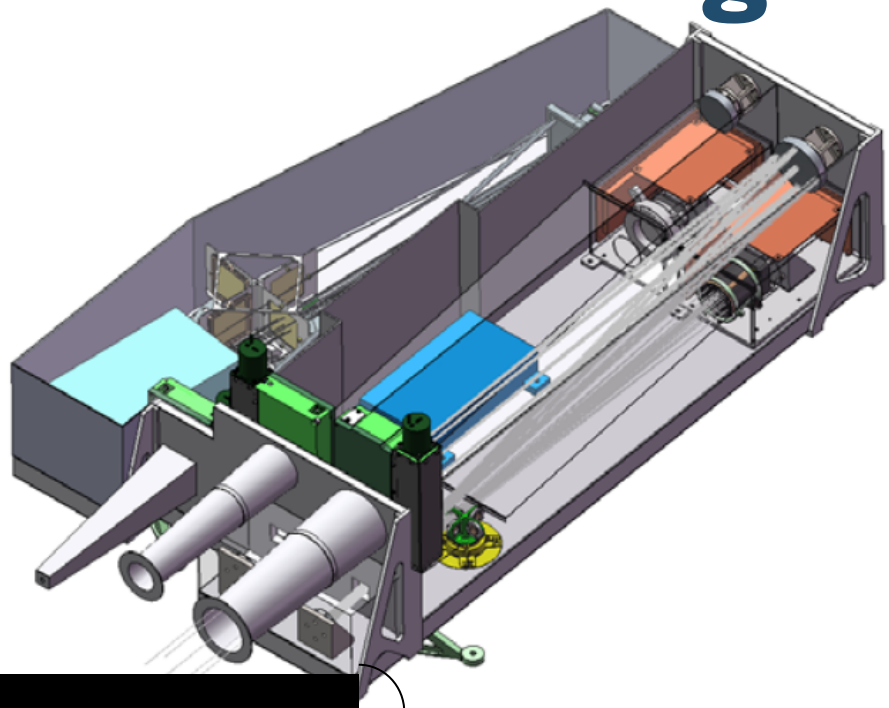
naging via Fourier technique (similar to Yohkoh HXT and related to R

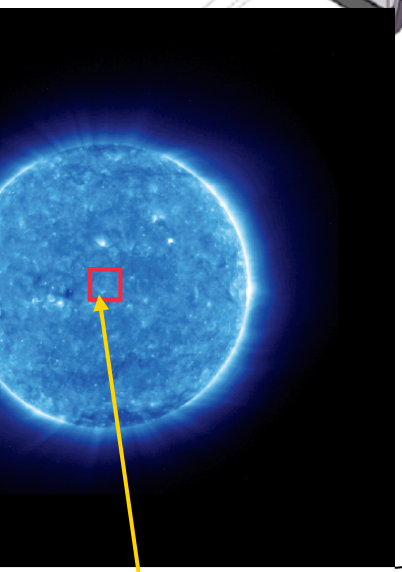
- Observes full solar disc at all times
- Flare locator → flare flag for other instruments on Solar Orbiter

Own aspect system to determine absolute pointing and relative poi
with respect to other Solar Orbiter instruments

X will have a higher sensitivity than RHESSI, with compara
ge quality and spectral and spatial resolution. It will be

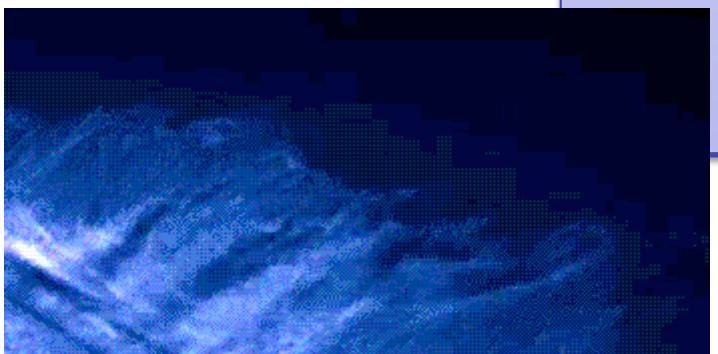
...I - EUV Imagers





FSI - full Sun imager

HRI - high lution imager



High Resolution Imager: Lyma

Subsec-100s cadence

Pixel=100km@ perihelion

High Resolution Imager:

Fe IX/X 17.4

1-100s cadence

Pixel=100km@ perihelion

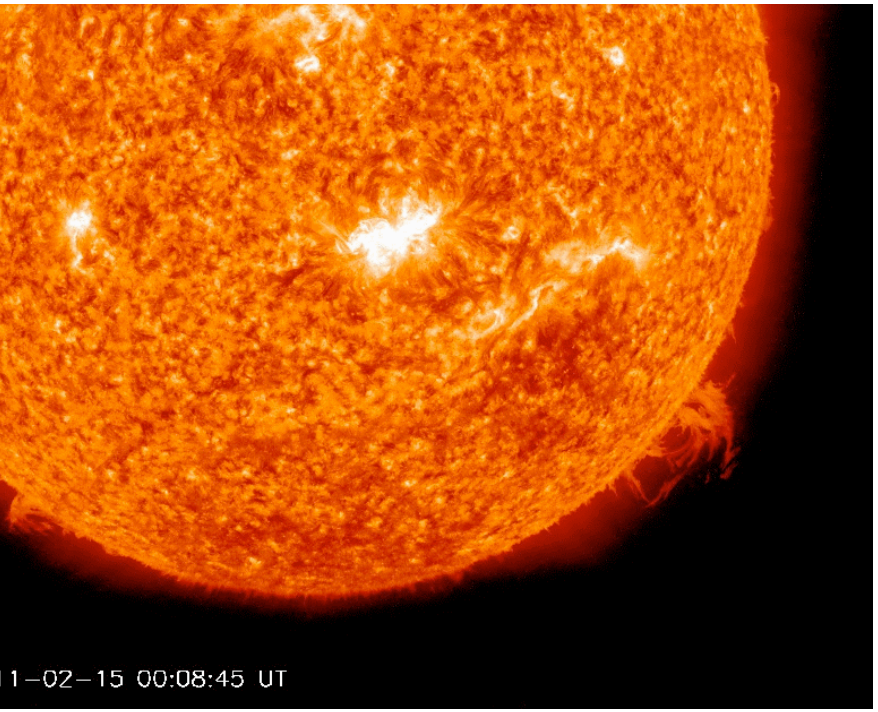
Full Sun Imager:

Fe IX/X 17.4 & He II:30.4

10-600s cadence

Pixel=860km@ perihelion

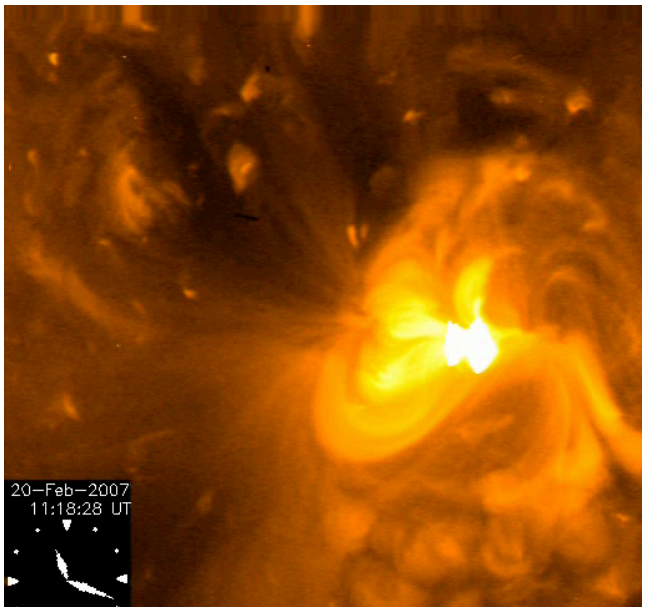
ng the Sun and inner heliosphere

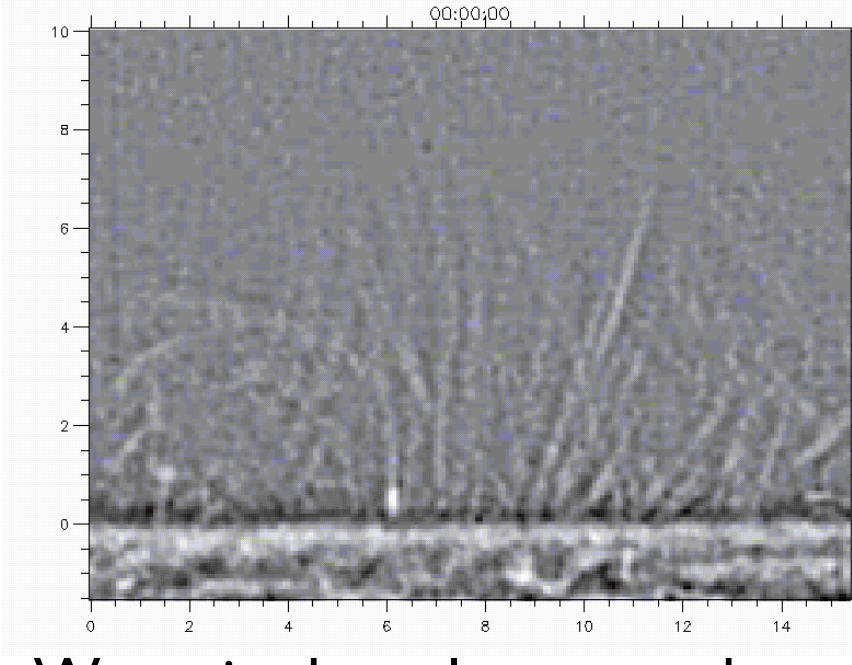


Coronal mass ejection source

≡ EUI FSI

EUI is a key instrument fo
interpreting in-situ data - E
captures both the origin of
steady solar wind and glob
eruptive events.



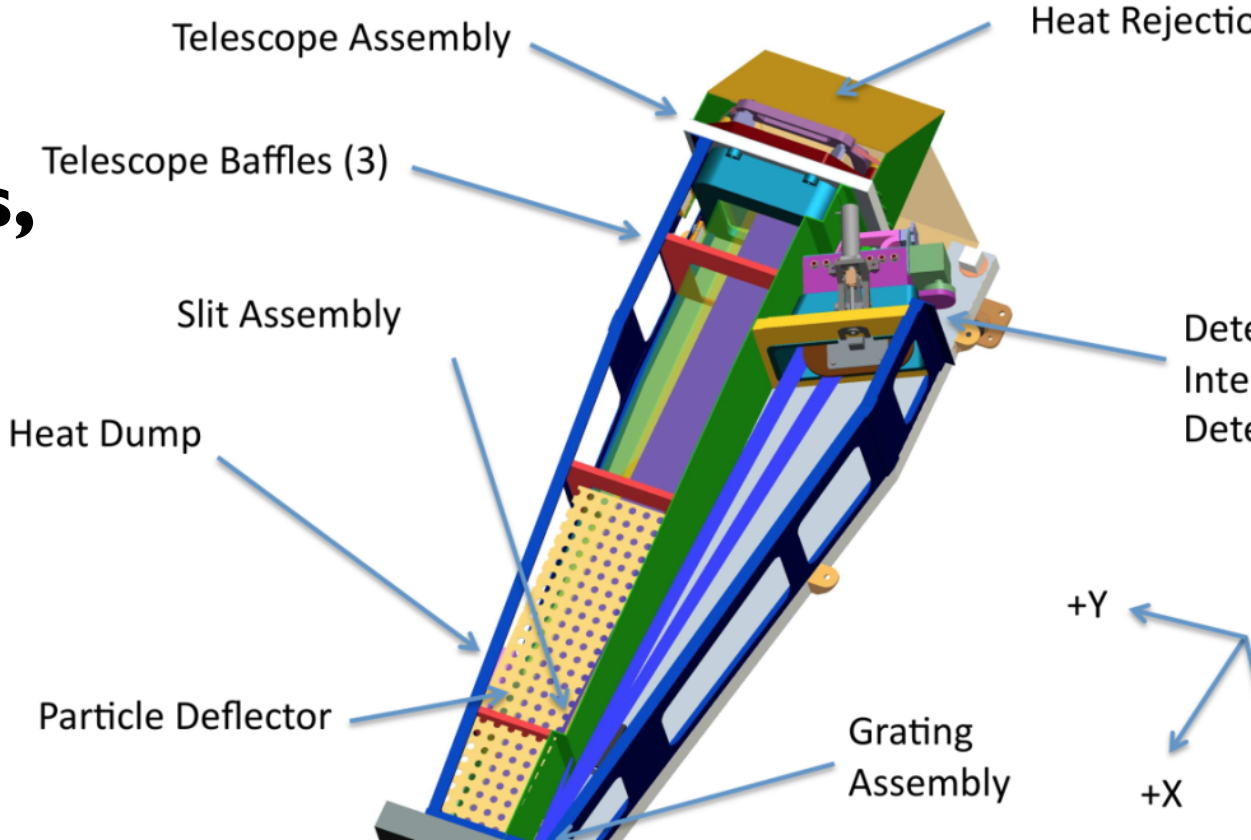


CE EUV Spectrometer

s 2D high resolution spectra &
tral images: 702-792 Å, 972-1050

intensities, Doppler
elocities, **line width**
nplete **temperature** coverage
om chromosphere to flaring
rona
es maps of **outflow velocities,**
M/Q ratio of surface
position features, connecting
to solar wind structures
rved by in-situ instruments
esolution chromospheric and
nal images

Optics: single mirror, toroida
grating
Three slits: 2"x16', 4"x16',
30"x16'. Maximum raster are
10'x16'
Exposure: 4s



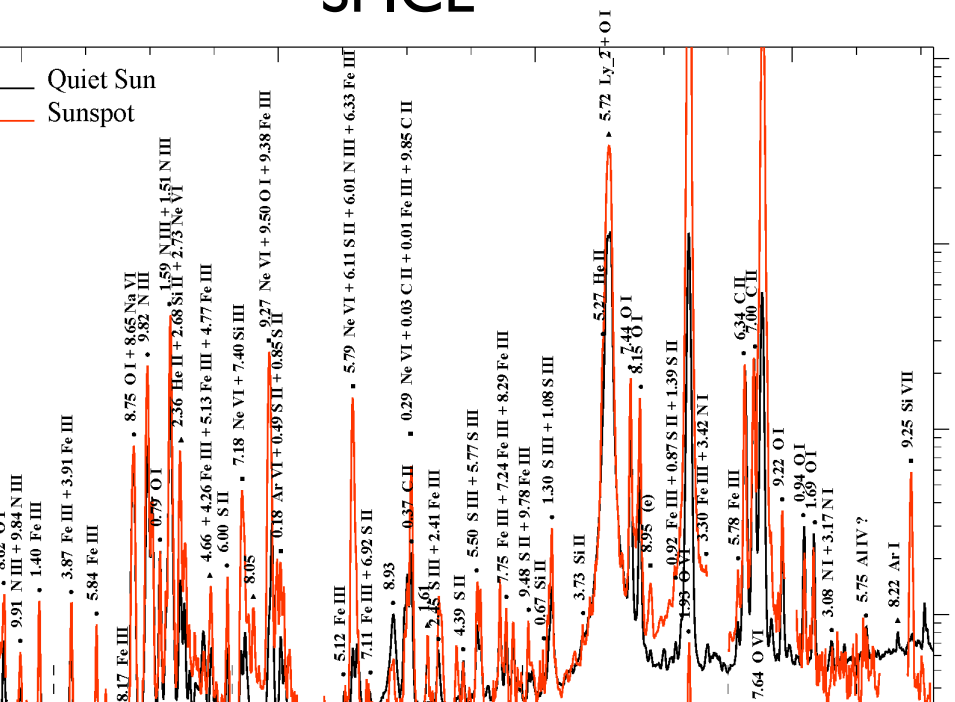
he SPICE Spectrometer

CE will provide detailed plasma diagnostic ability for studies of the solar atmosphere.

- Solar wind origin and accelerat
- Coronal Mass Ejections onsets early propagation
- Composition of plasma
- An understanding of energet particles – their source and acceleration

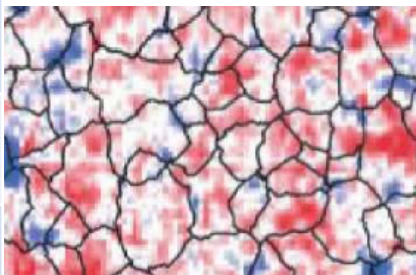
ers: Fludra et al: Science Goals of SPICE EUV Spectrometer

na & Mason: Spectral Diagnostics with SPICE



Ion	λ (A)	Log Te (K)
H I	1025	4.0
C III	977	4.5
O VI	1032	5.5
Ne VIII	770	5.8
Mg IX	706	6.0

First veloci of polar r



e SO/PHI instrument

sures magnetic vector & line-of-
ht velocity

telescopes:

T as refractor

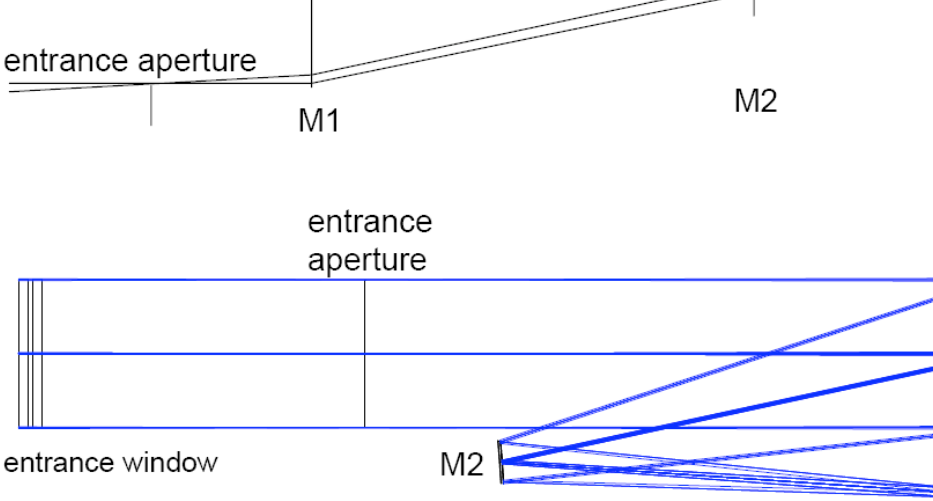
RT as oblique reflector

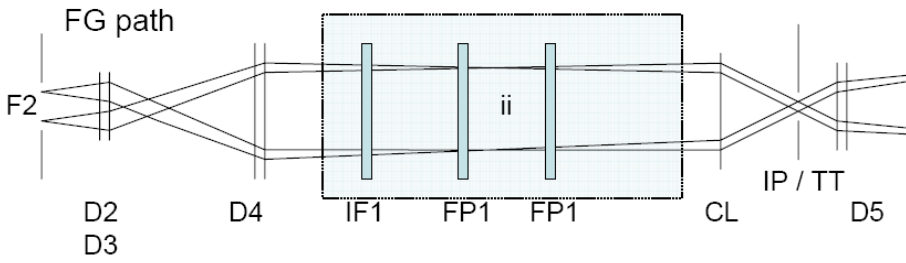
selection mechanism

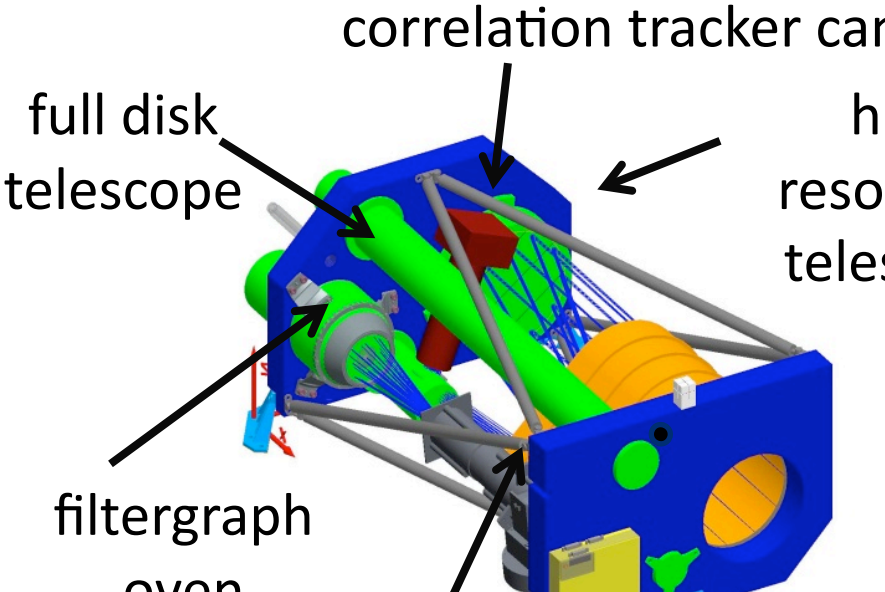
y Perot narrow-band filter with
NbO_3 etalon(s)

er important subsystems:

larisation modulation, APS







olarimetry and helioseismology on SO will ovide unique science

ide **B** to EUV imager and spectrometer, all observing at high atial resolution (up to 180 km): linkage science

decent view of magnetic and velocity field at poles

w surface and subsurface evolution of solar features (e.g. acti gions) without changing viewing angle

eoscopic helioseismology to better probe the interior

eoscopy of the photosphere

surement of the complete field of the Sun (360° view)

ide magnetic context for Solar Probe plus

[redacted]