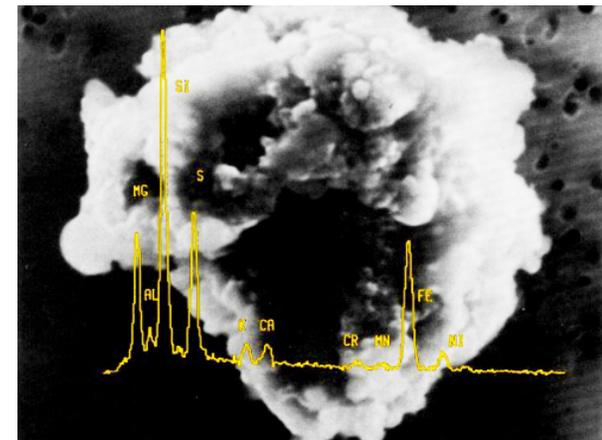
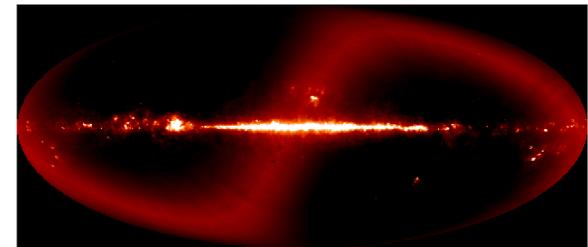

In-situ Measurements of Interplanetary and Interstellar Dust

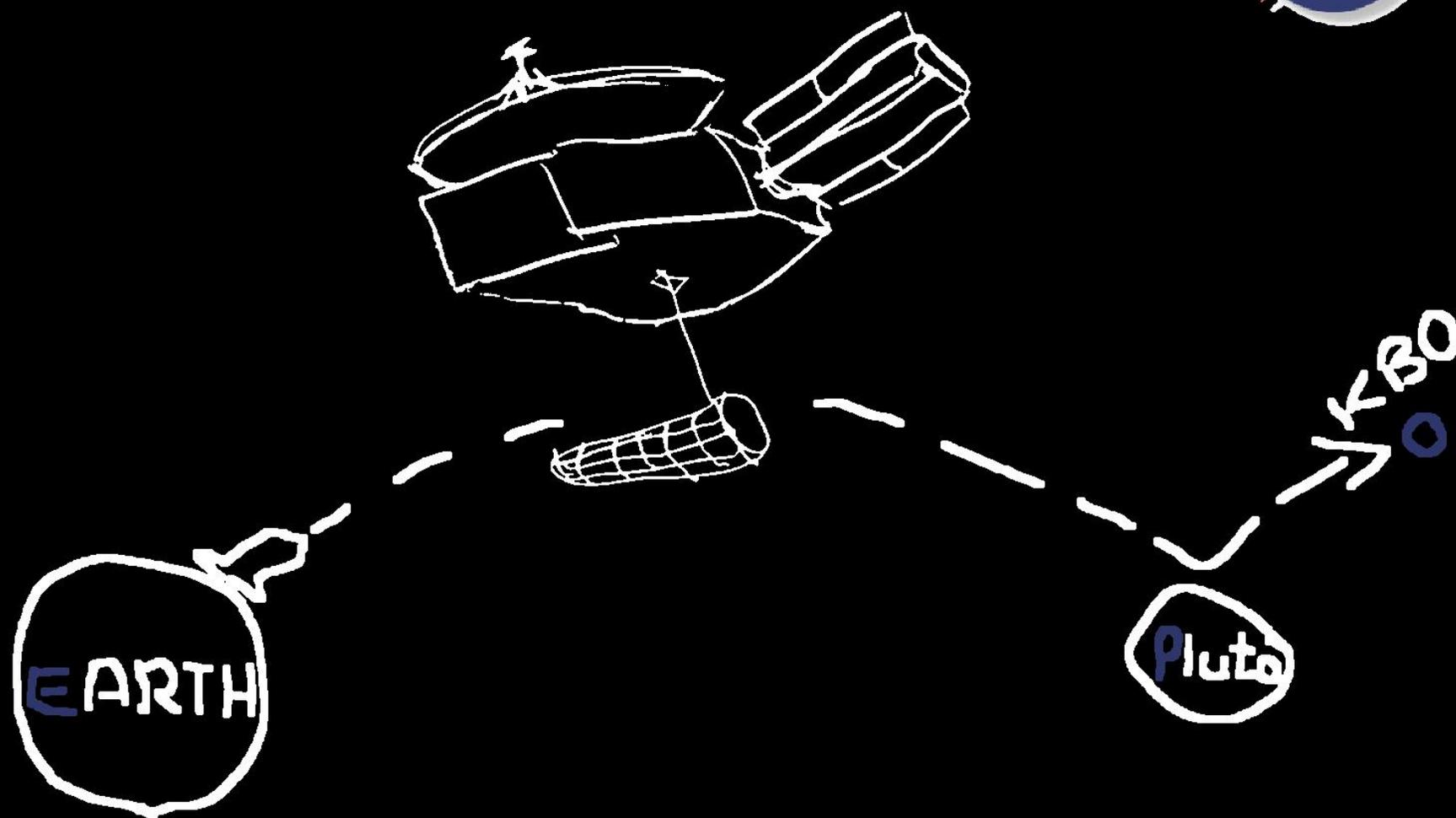
M. Horányi, E. Grün, A. Poppe, R. Srama*, Z. Sternovsky
LASP, U. of Colorado, Boulder
*MPI-K, Heidelberg, Germany

- 1) Student Dust Counter onboard the New Horizons Mission to Pluto
- 2) Dust Telescope Concept



LASTP

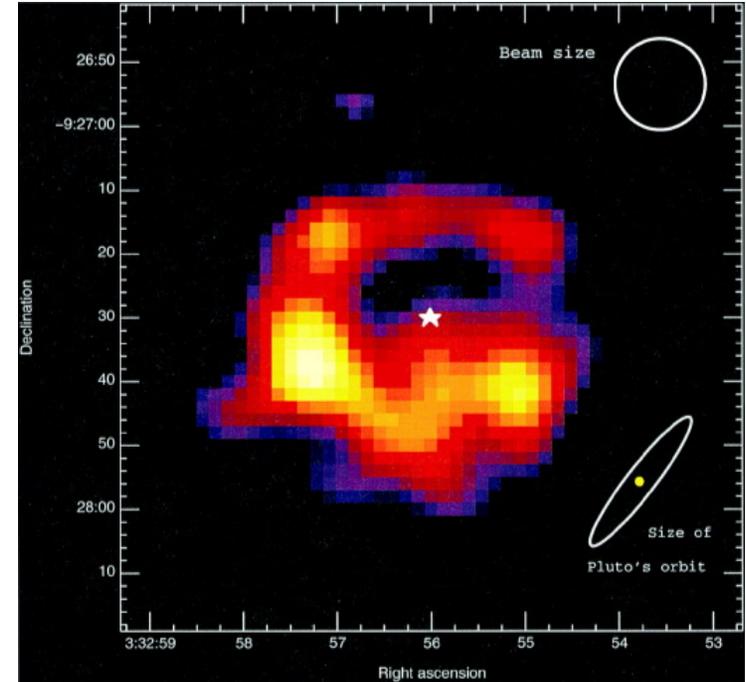
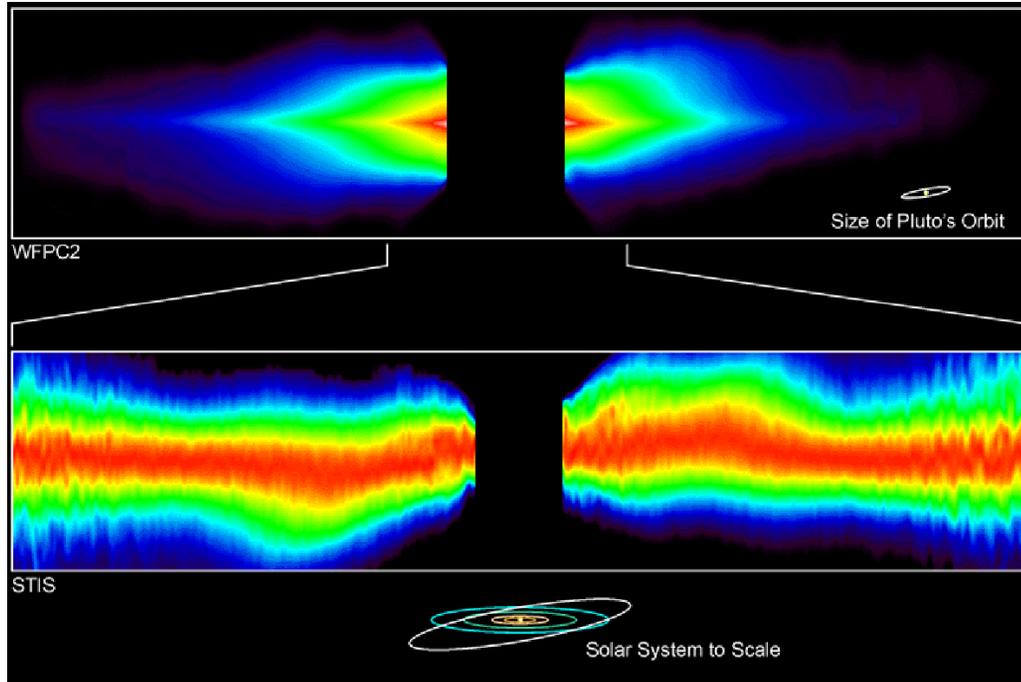
The Student Dust Counter



One small step for man, one GIANT leap for students!!!



Student Dust Counter (SDC): Science Motivation

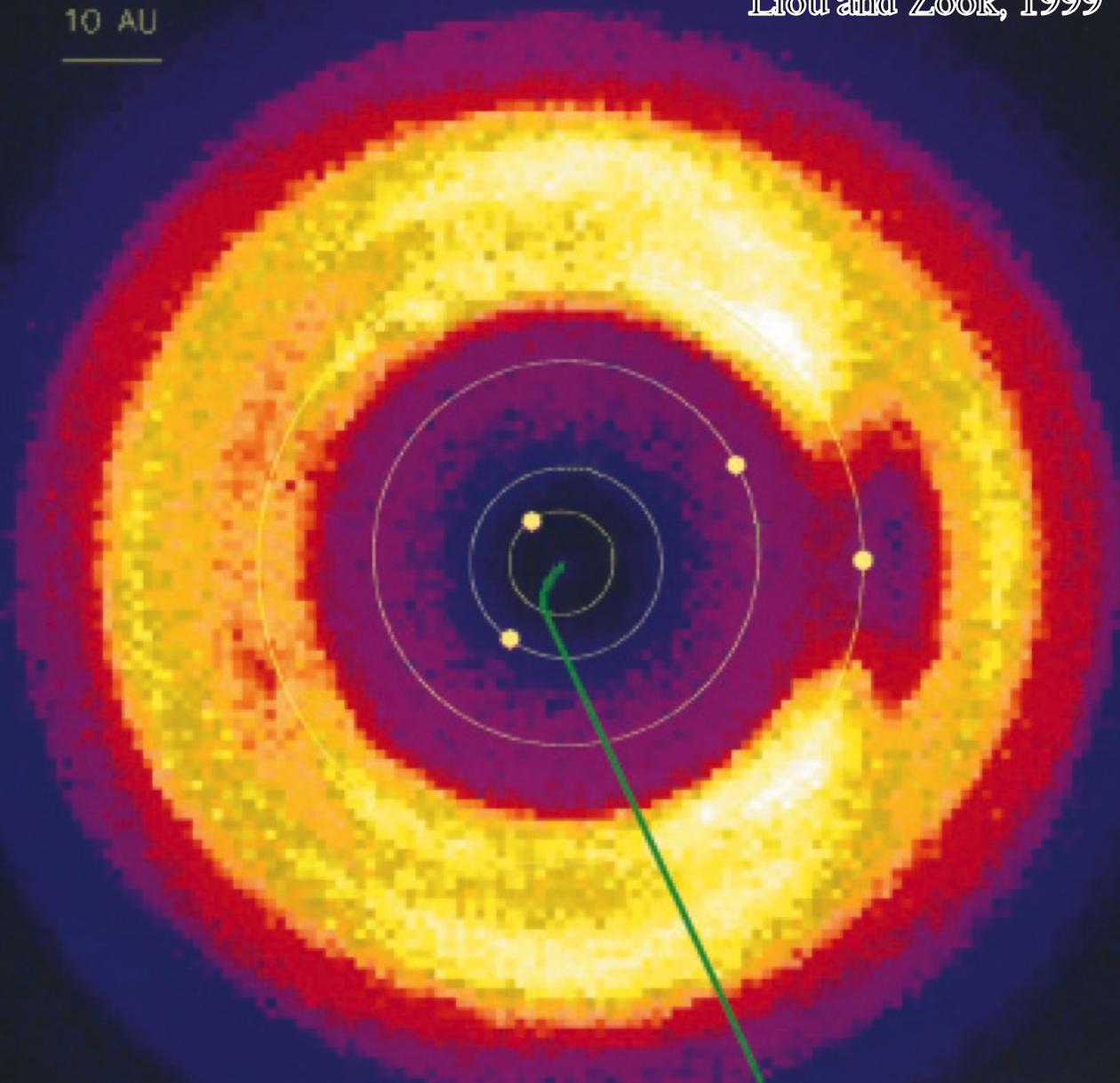


The View from 5 AU, UC Irvine, March 25-26, 2010



Liou and Zook, 1999

10 AU



0

200

400

600



Student Dust Counter (SDC): E/PO

E/PO Goal:

Give students a chance to design, build, operate, & study data from a planetary flight experiment. Students have the primary responsibility for the design and development of the SDC; over 20 “first generation” student involved at CU.

Science Goal:

Make the first dust density & size spectrum observations beyond 18 AU



The View from 5 AU, UC Irvine, March 25-26, 2010





Student Dust Counter (SDC): Milestones

PDR	6/2003
Heidelberg tests	7/2003
CDR	10/2003
PER	6/2004
PSR	8/2004
Ship	9/2004

Identical requirements to any other flight instrument!

Professional: Flight assembly, Q&A



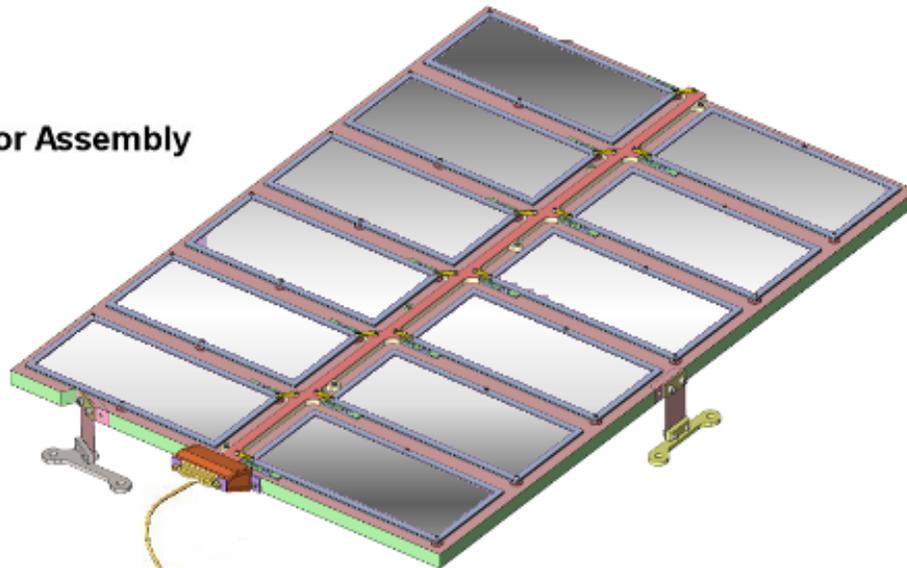
The View from 5 AU, UC Irvine, March 25-26, 2010





Student Dust Counter (SDC): Instrument Design

Detector Assembly



Intraharness



Electronics Box

Key Properties

Active Area of 0.1 m²

Consists of Three Assemblies:

1. Detector Assembly (18" x 12")
2. Electronics Box (5.4" x 8.25" x 1.825")
3. Intra-Harness

\$1.2 M

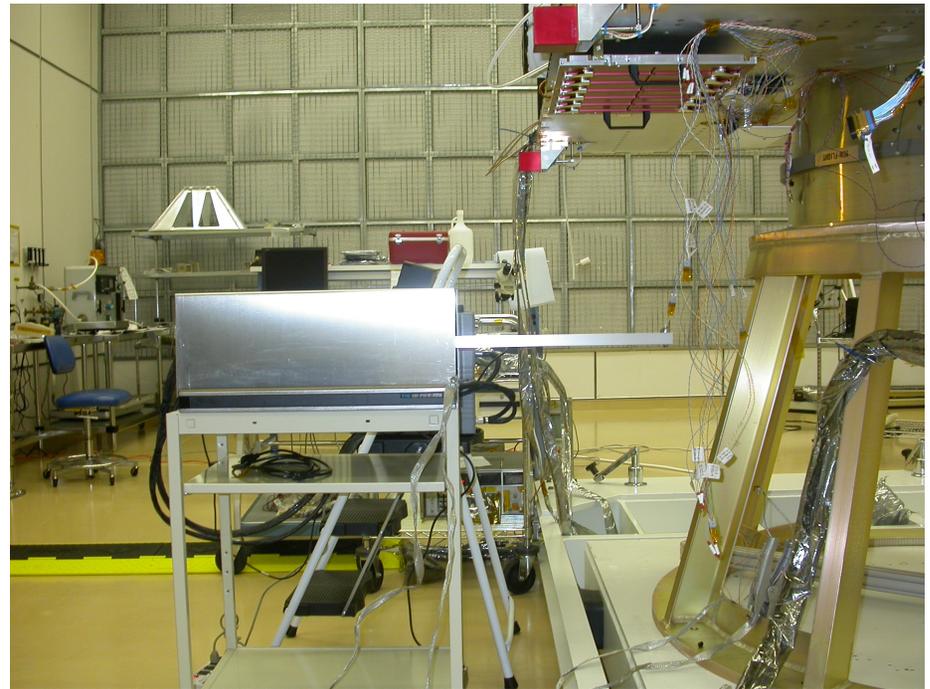
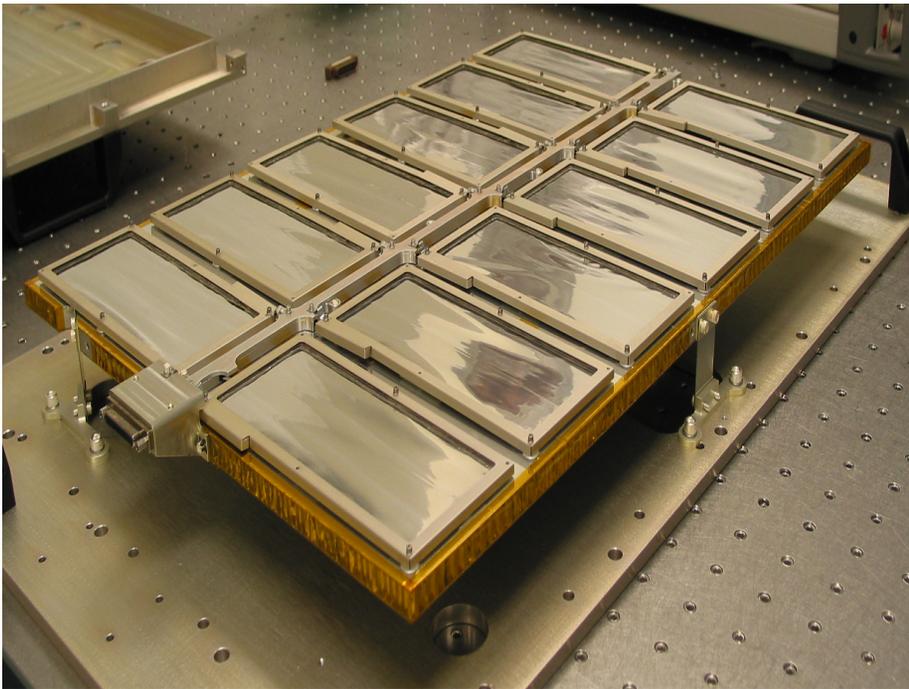
1.6 kg

5 w





Student Dust Counter (SDC): Instrument Delivery



APL 9/2004



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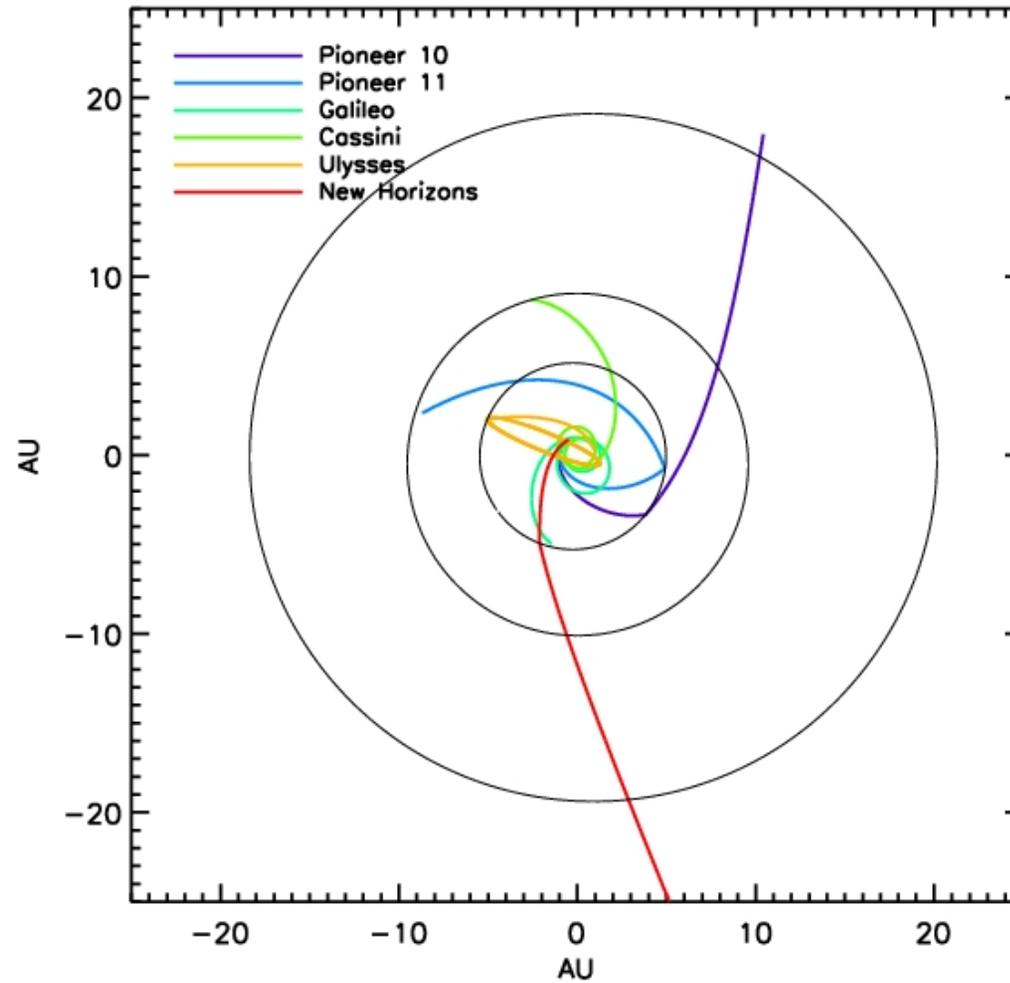


Student Dust Counter (SDC): Launch 1/19/2006





Student Dust Counter (SDC): Cross Calibration

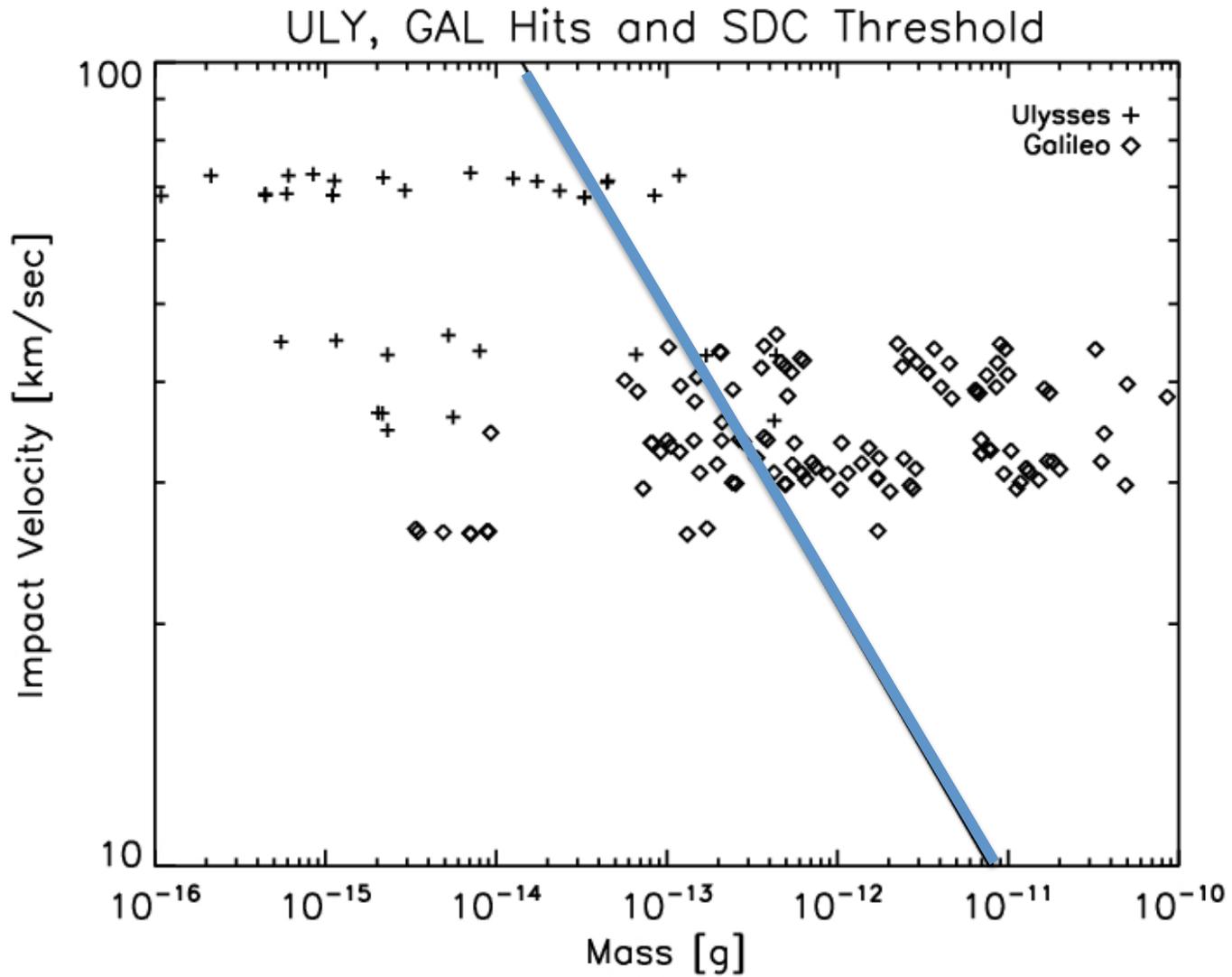


The View from 5 AU, UC Irvine, March 25-26, 2010



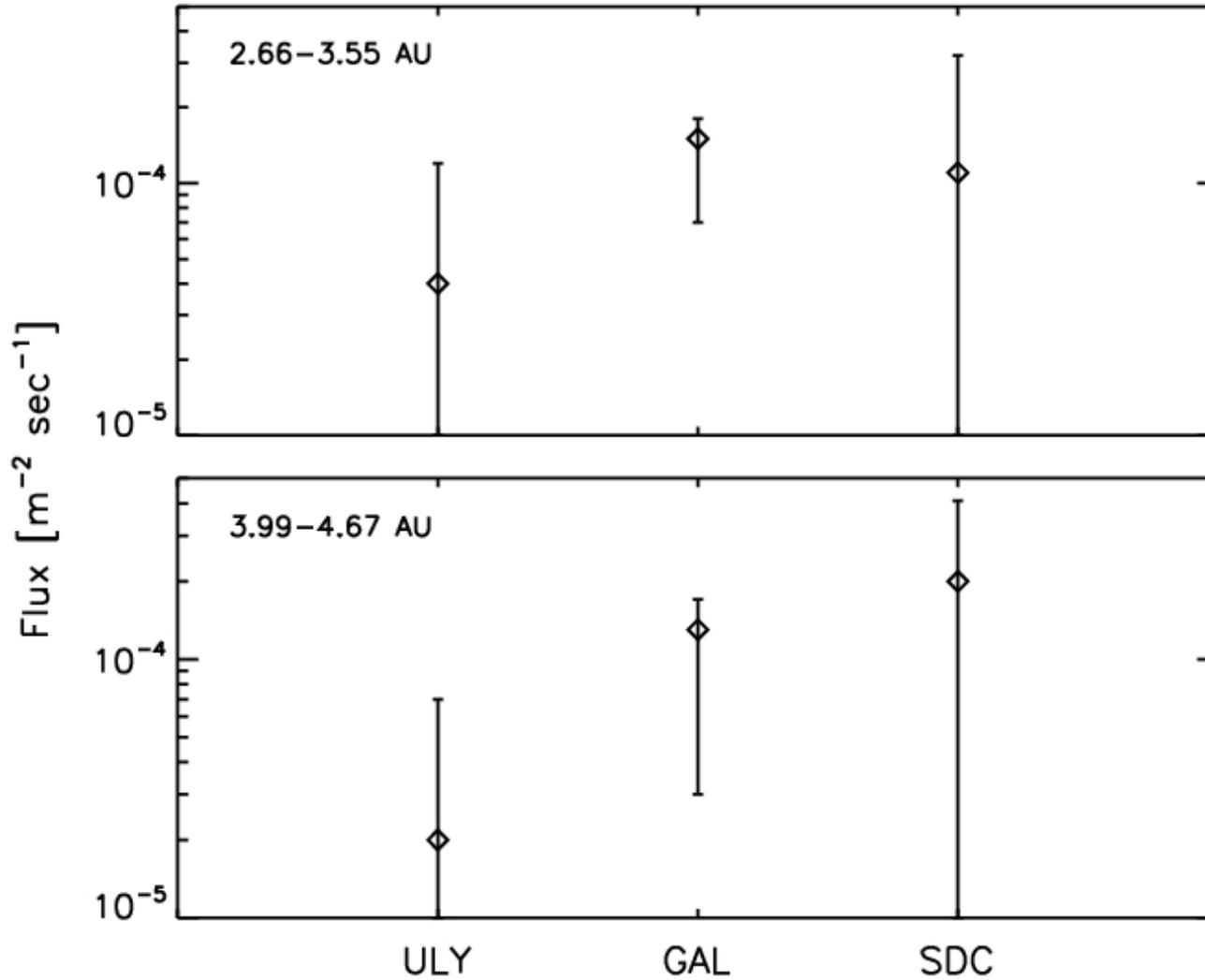


Student Dust Counter (SDC): Cross Calibration



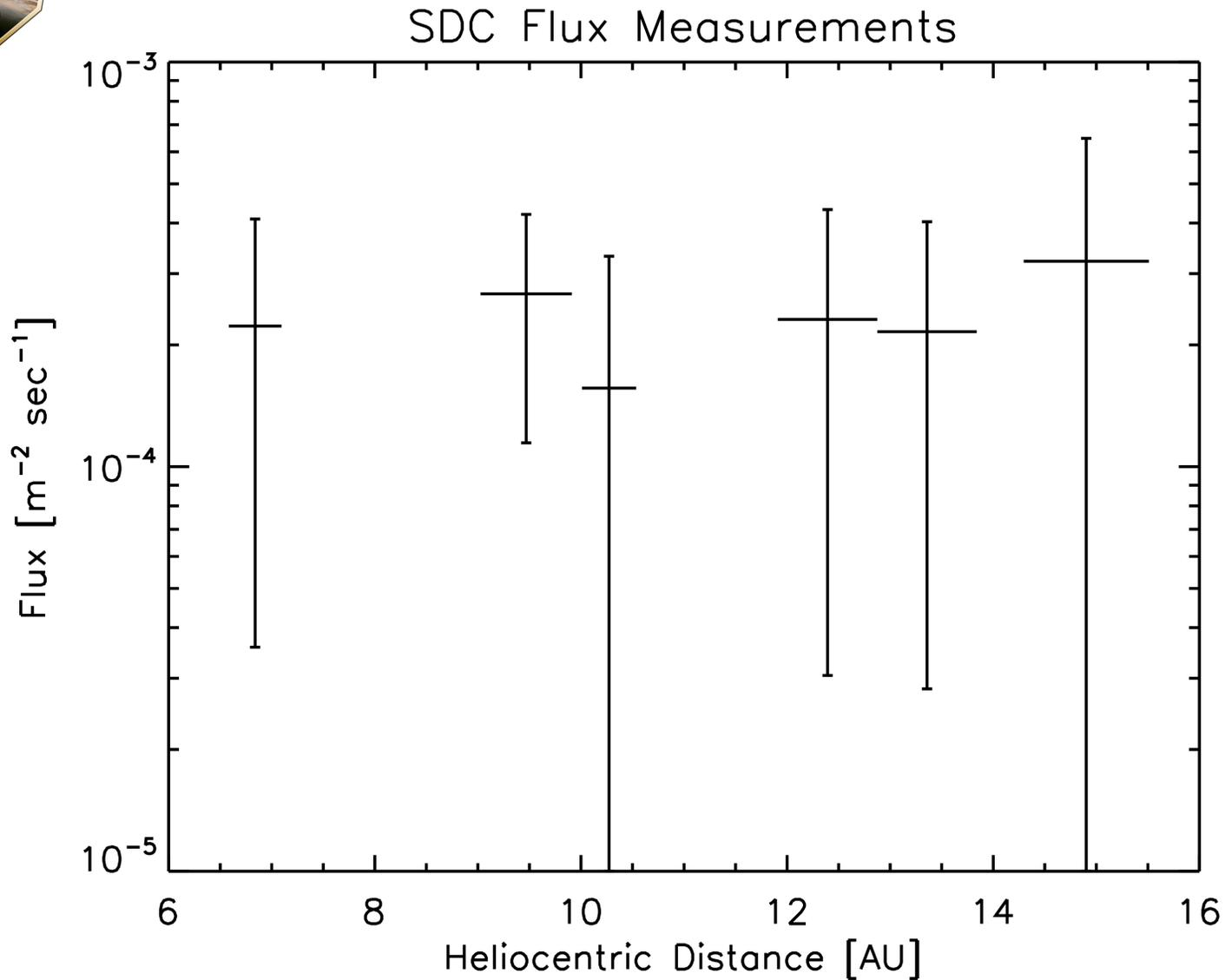


Student Dust Counter (SDC): Cross Calibration





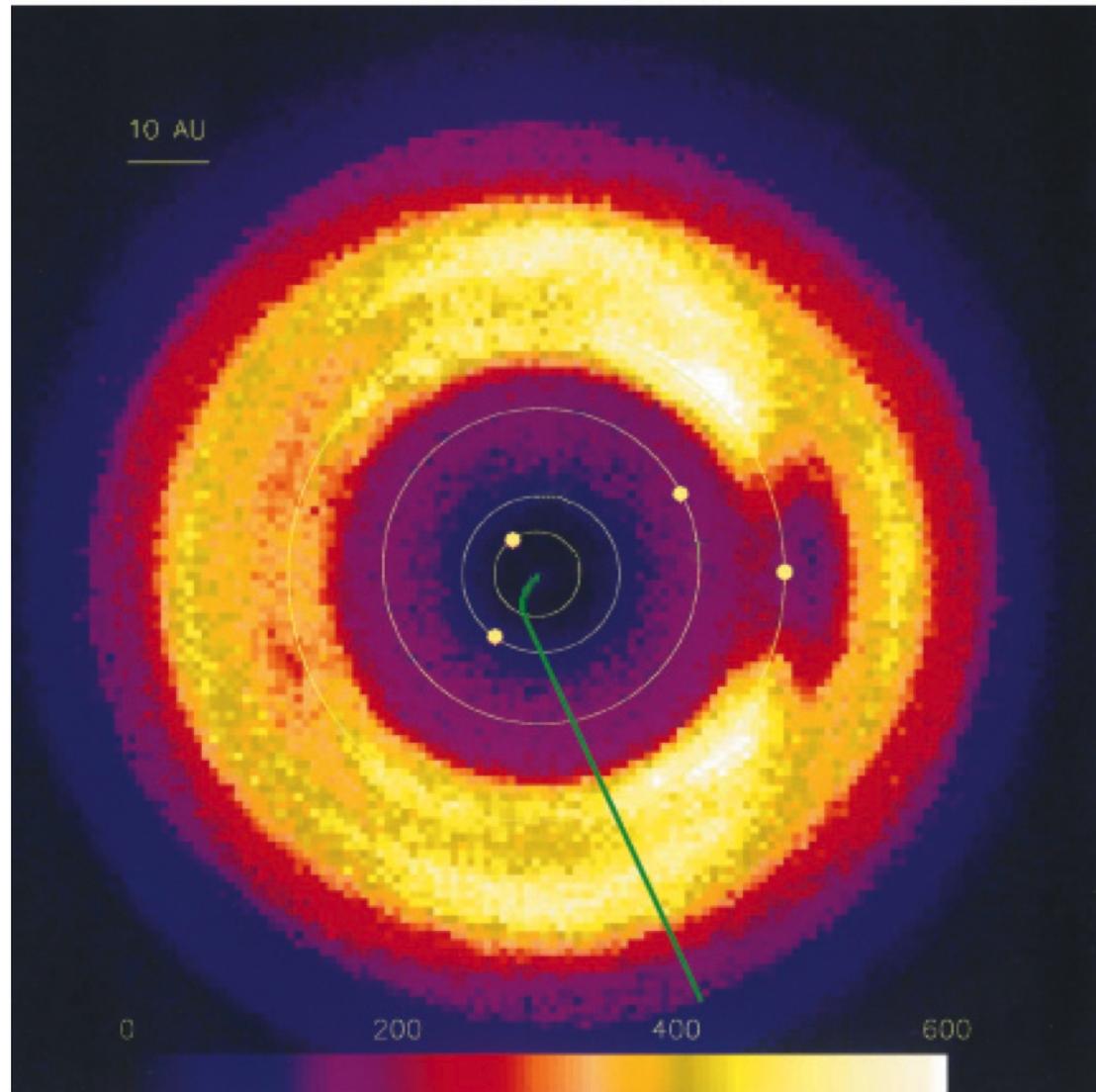
Student Dust Counter (SDC): Initial Results





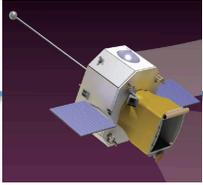
Student Dust Counter (SDC):

2013

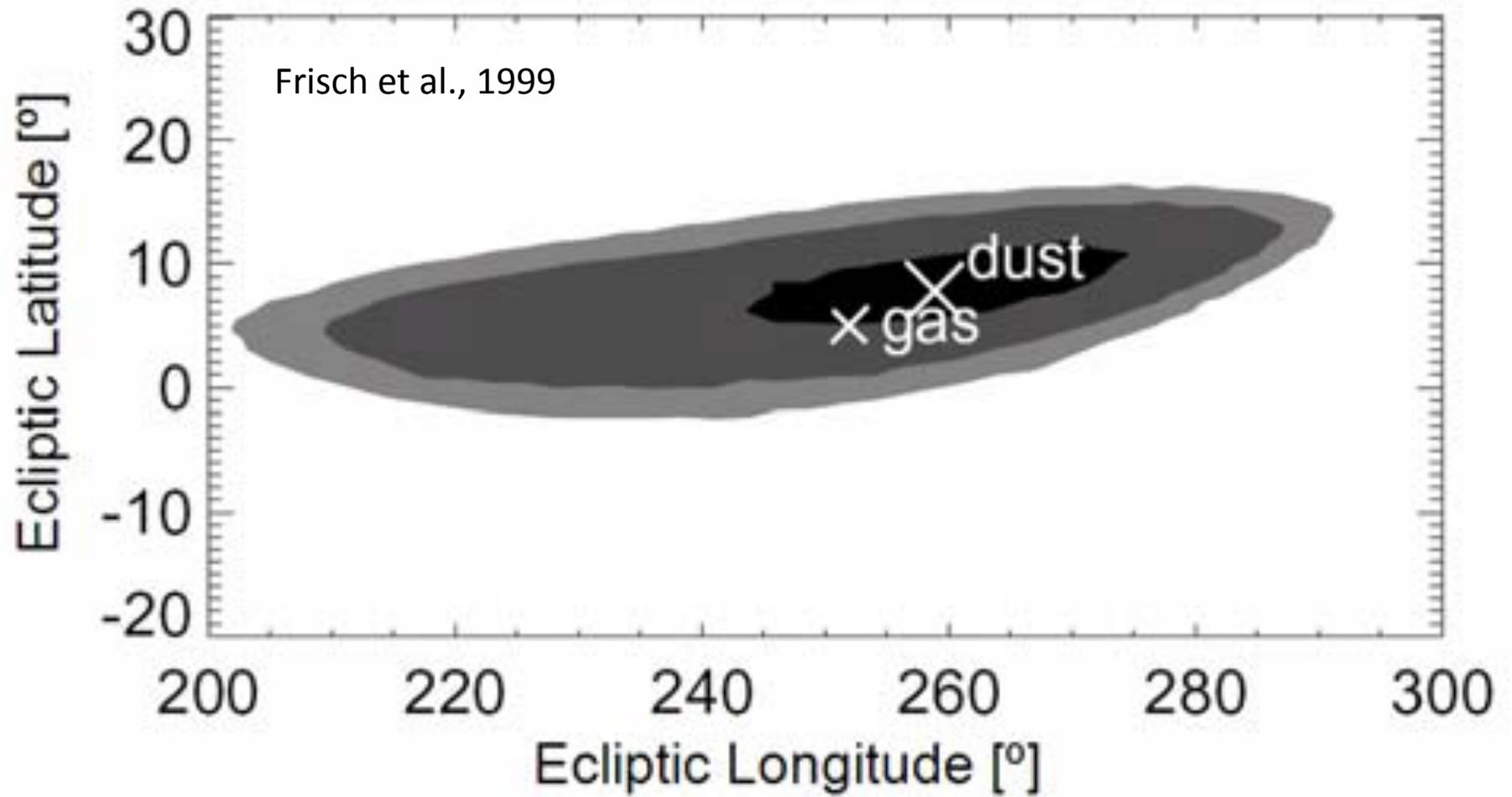


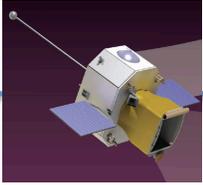
The View from 5 AU, UC Irvine, March 25-26, 2010



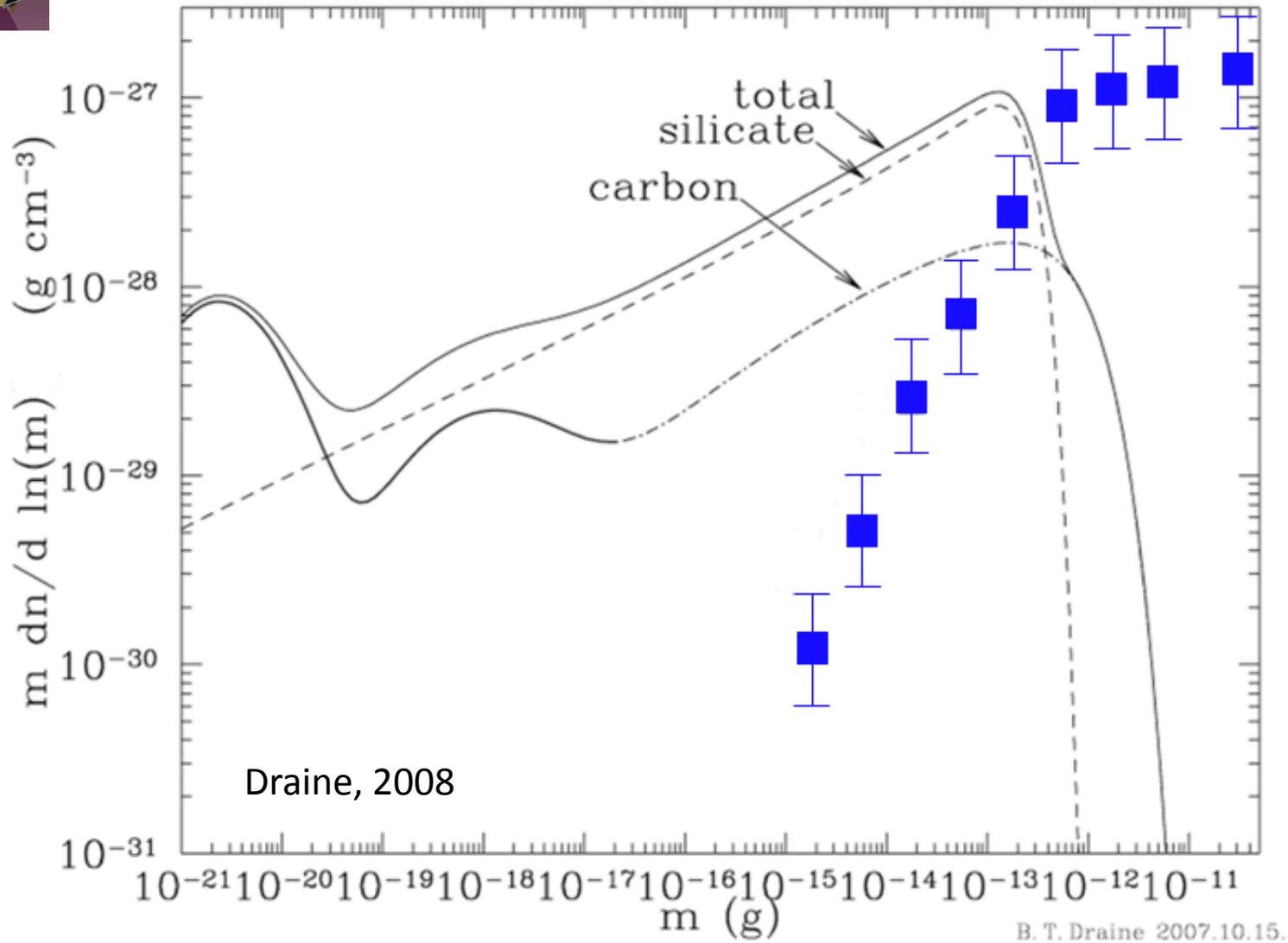


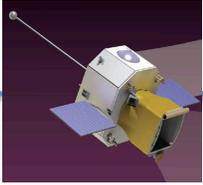
Interstellar Dust



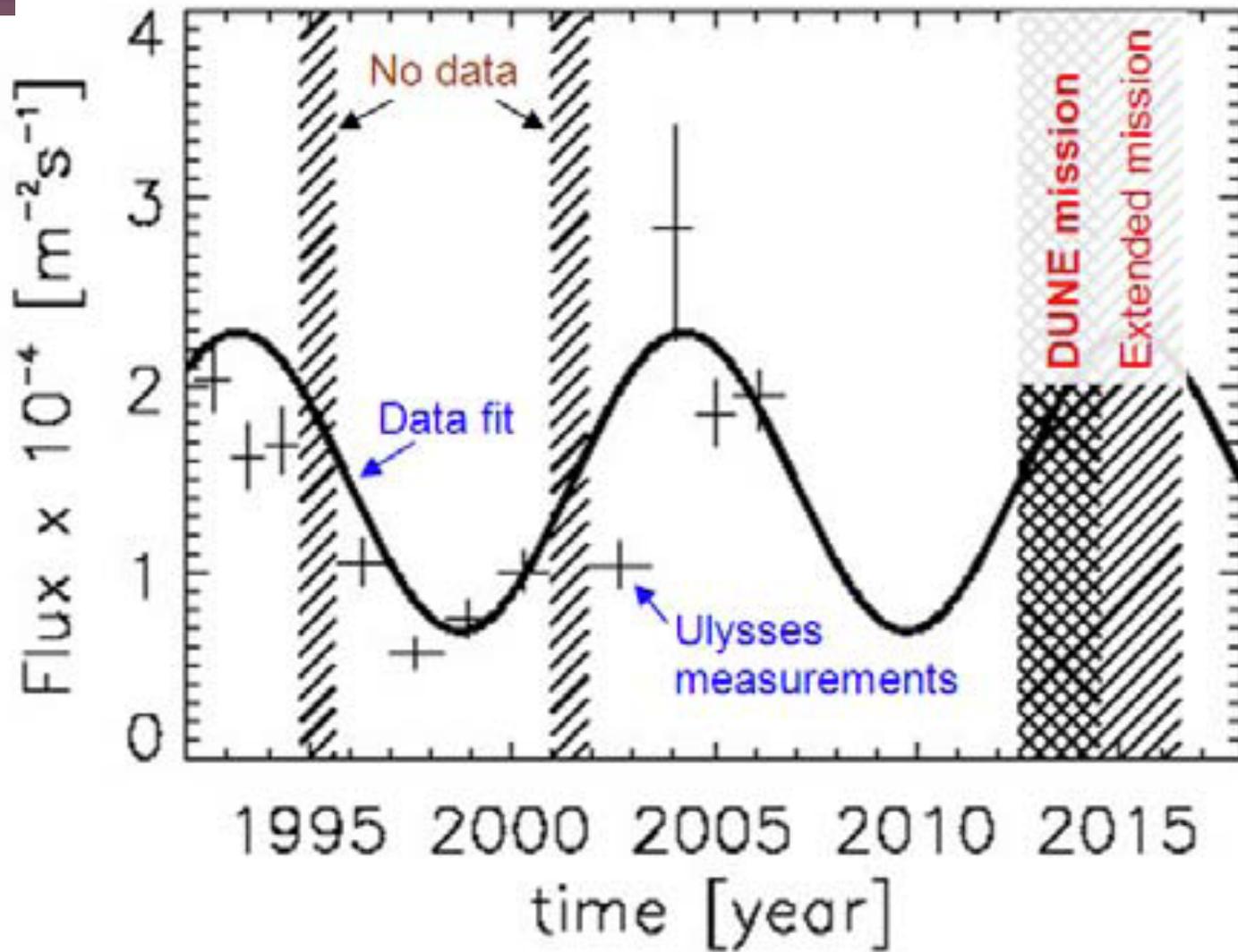


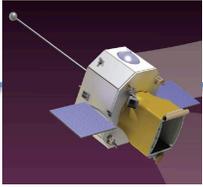
Interstellar Dust



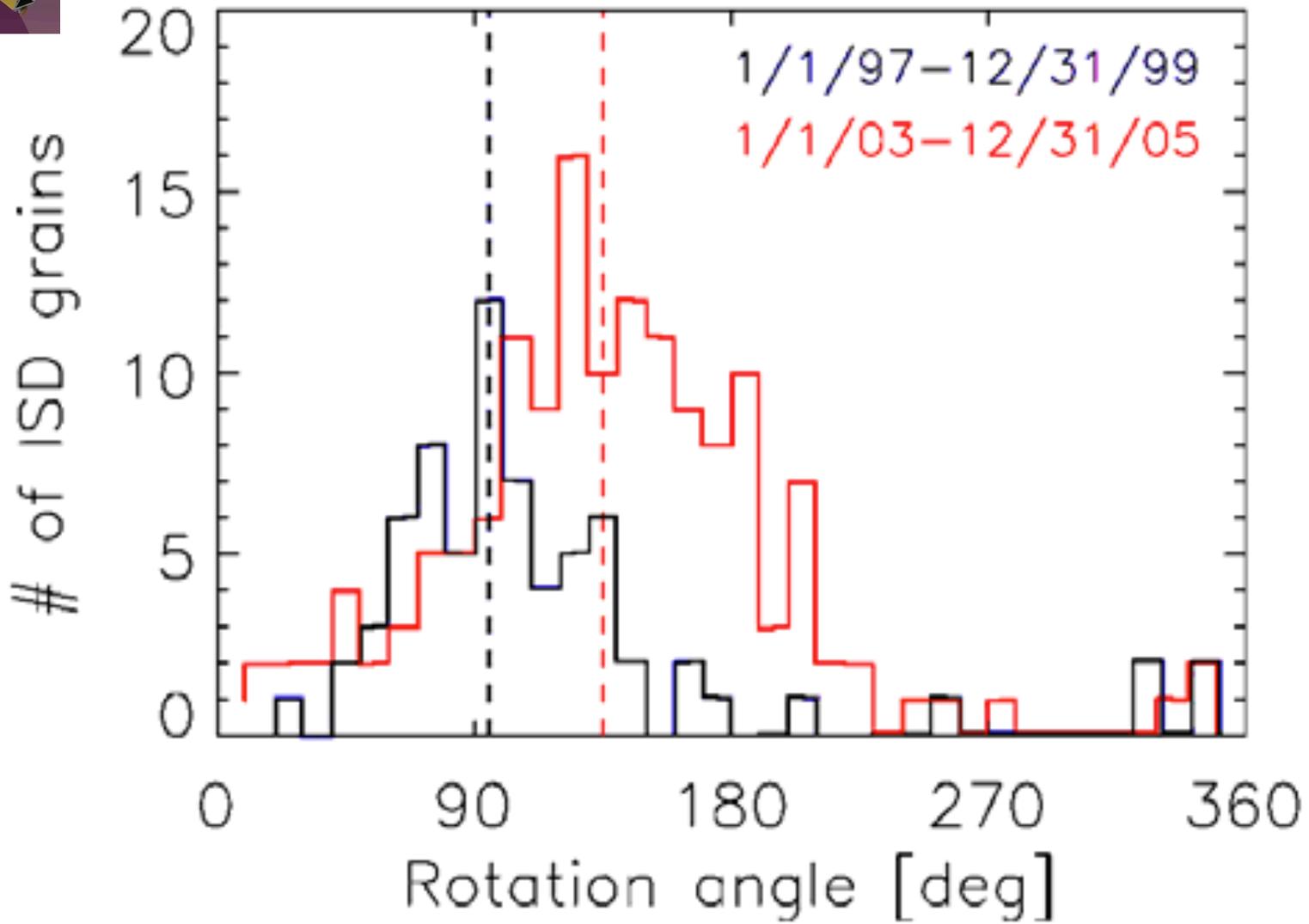


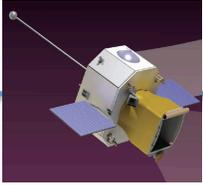
Interstellar Dust



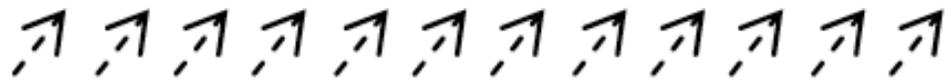
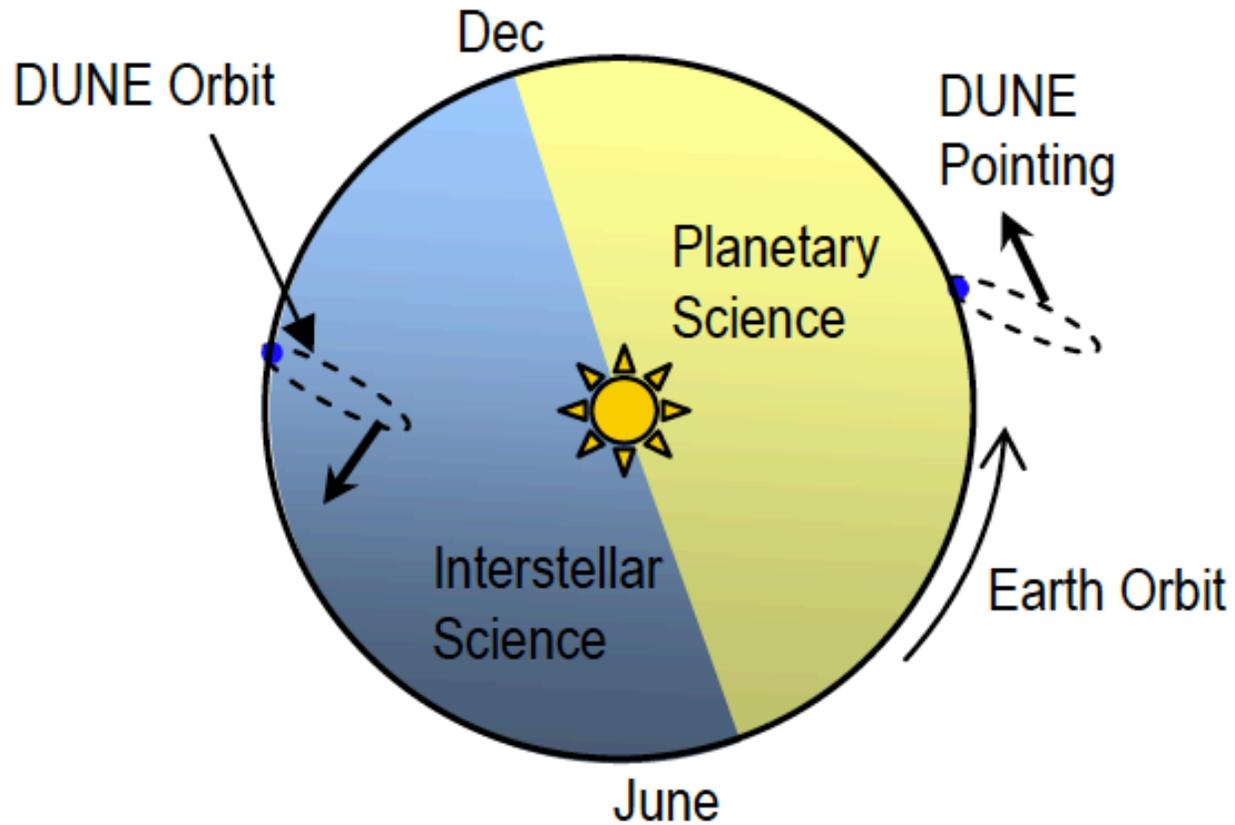


Interstellar Dust





Mission Concept

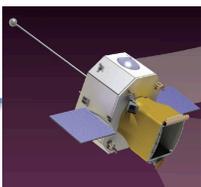


Incoming Interstellar Dust



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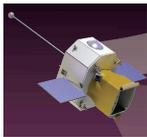




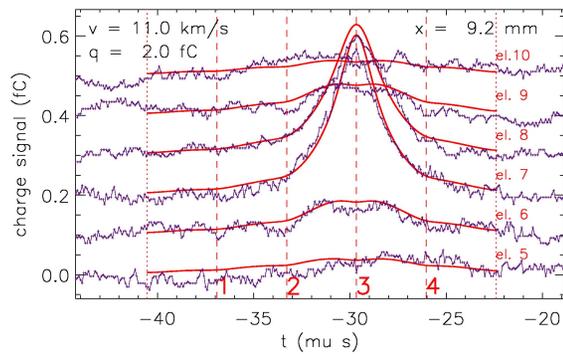
Dust Instruments

Instrument	M / ΔM	Area / cm ²	Trajectory
Helios	5 - 10	120	N/A
PIA/PUMA	~150	5	N/A
Galileo	N/A	1000	N/A
Ulysses	N/A	1000	N/A
CDA	20 - 50	100	Partial
CIDA	~ 250	90	N/A
DTS + LAMA	~ 200	600	Full

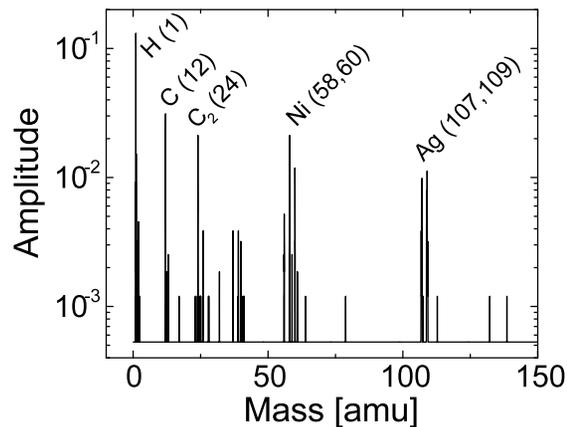




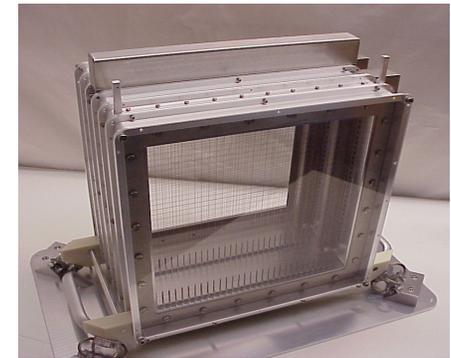
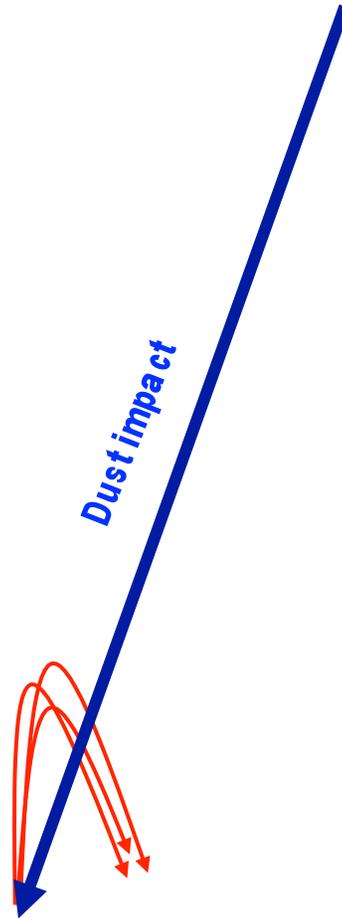
Instrumentation: Dust Telescope



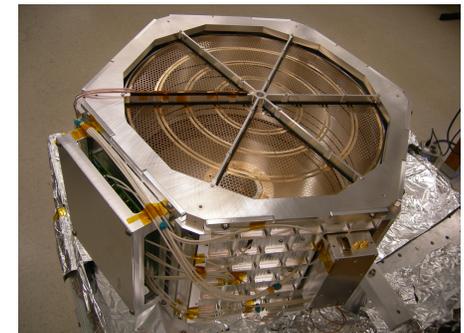
DTS Signals



Time of flight mass spectrum

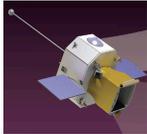


Dust Trajectory Sensor (DTS)



Large Area Mass Analyzer (LAMA)



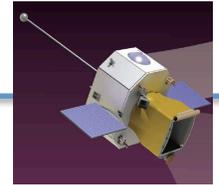


Dust Telescope Performance

Performance	Requirement	Capability	Margin
Target area (effective)	$\geq 500 \text{ cm}^2$	600 cm^2	20 %
Accuracy in velocity	$\leq 10 \%$	5 %	50 %
Accuracy in trajectory	$\leq 5^\circ$	1°	>100 %
Accuracy in mass	- 50% / + 100%	+/- 30 %	>20%
Mass resolution	> 100	200	100 %
Mechanical	Dimension (cm)	CBA Mass (kg)	Margin
Dust Telescope sensor	45 x 45 x 45	12.0	30 %
Electronics	20 x 20 x 3	2.3	30 %
Electrical		CBE Power (W)	Margin
Electronics (detectors & data processing)		30	30 %
Decontamination heater		20	> 50 %
Data Accumulation		Rate (Mbits)	Margin
Full resolution / dust impact		0.6	N/A
Allocation for DT per orbit (≤ 20 days)		70	20%



Summary



SDC onboard New Horizons is working well.

We expect to reach the 'dust wall' in 2013.

SDC will continue to make measurements after the Pluto encounter and map the dust size/density distributions in the Kuiper Belt.

The DT is a combination of a dust trajectory sensor and a large area mass analyzer. It is a new 'scalable' instrument to measure the trajectory, mass, chemical and isotopic compositions of both interplanetary and interstellar dust particles.

The DT opens a new field of research "Dust Astronomy."

A combination of optical/IR observations and in situ dust measurements could be the WINNING combination.

