



Science Requirements

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Primary Requirements (Level 1)



- **FAME Will Create a Catalog of Star Positions Based on a 2-1/2 Year Mission With:**
 - **A Measured Position, Parallax, and Proper Motion of Stars Between 5th to 9th Visual Magnitude to 50 Microarcseconds, 50 Microarcseconds, and 70 Microarcseconds Per Year Respectively; for Stars Fainter Than 9th Visual Magnitude the Mission Astrometric Accuracy Shall Degrade No More Rapidly Than Implied by the Photon Statistics, i.e., No More Rapidly Than the Inverse Square Root of the Apparent Brightness; at 15th Visual Magnitude the Mission Astrometric Accuracy Shall Be No Worse Than 500 Microarcseconds**
 - **Photometric Magnitudes for All Stars in the Wide Band Astrometric Bandpass As Well As the Sloan g' , r' , i' , and z' Filters**
 - **The Accuracy of Individual Observation Magnitudes Will Be From Millimagnitudes at 9th Magnitude to Four Hundredths Magnitude at 15th Magnitude; the Mission Magnitude Accuracies Will Be Tenths of a Millimagnitude at 9th Magnitude and Five Millimagnitudes at 15th Magnitude**
 - **The Above Accuracy Specifications Apply to 90% of the Unconfused Sources at a Given Magnitude, With the Other 10% Not Exceeding Twice the Accuracy Specification; the Coverage Is for $> 98\%$ of the Sky to Take Into Account Areas of Crowding**



Secondary Objectives



- **FAME Will Provide:**
 - **Calibration of the Luminosities of the “Standard Candles” (the Galactic Cepheid Variables and the RR Lyrae Stars) That Are Fundamental in Defining the Distance Scale to Nearby Galaxies and Clusters of Galaxies**
 - **Calibration of the Luminosities of Solar-Neighborhood Stars, Including Population I and II Stars, Thus Enabling Diverse Studies of Stellar Evolution and Other Interesting Science; in the Case of Population II Subdwarfs, This Will Allow the Determination of the Distances and Ages of Galactic and Extragalactic Globular Clusters With Unprecedented Accuracy**
 - **Definitive Determination of the Frequency of Solar-Type Stars orbited by Brown Dwarf Companions in the Mass Range of 10 to 80 M_{jup} With Orbital Periods up to a Little Longer Than the Duration of the Mission; This Will Include an Exploration of the Transition Region Between Giant Planets and Brown Dwarfs, Which Appears to Be in the Range of 10 to 30 M_{jup}**
 - **Proper Motions and Distances for Individual Stars in Star Forming Regions for Determination of Membership, Ages and Kinematics**
 - **A Study of Kinematic Properties of the Survey to 40 Million Stars Within 2.5 kpc of the Sun, and in Particular, Assess the Abundance and Distribution of Dark Matter in the Galactic Disk With Much Greater Sensitivity and Completeness Than Previously Possible**



Requirements, Goals, Floor (Astrometry, 1 of 2)



- **Fame Will Have the Following Accuracy Requirements, Goals, and Floor for the 2-1/2 Year Mission in UAS:**

	<u>Requirement</u>	<u>Goal</u>	<u>Floor</u>
1. Standard Candles			
@ 9 mag	50	50	200
@12 mag	100	100	400
@15 mag	500	500	1000
2. Solar Neighborhood Stars			
@ 9 mag	50		200
@15 mag	500		2000
3. Brown Dwarfs			
@ 9 mag	50	25	100
@15 mag	500	250	1000
4. Star Forming Region			
@ 9 mag	50	25	500
@12 mag	125		500
@15 mag	500		1000
5. Reference Frame			
@ 9 mag	50	20	500



Requirements, Goals, Floor (Astrometry, 2 of 2)



	<u>Requirement</u>	<u>Goal</u>	<u>Floor</u>
7. Stellar Astrophysics			
a. White Dwarfs			
@12 mag	100	60	500
@15 mag	500	300	2000
b. Planetary Nebulae			
@12 mag	100	60	500
@15 mag	500	300	1000
c. Subdwarf O/B Stars			
@12 mag	100	60	200
@13 mag	150	75	300
d. HB Stars			
@12 mag	100	60	300
8. Galactic Structure			
@9 mag	50		
@12 mag	100		400
@15 mag	500		2000
9. Relativity			
10. Solar System			



Requirements, Goals, Floor (Photometry, 1 of 3)



- **Fame Will Have the Following Accuracy Requirements, Goals, and Floor for the 2-1/2 Year Mission in Millimagnitudes (mmag):**
- **This Gives the Minimum Photometric Requirement That Would Be Usable; However, the Mission Would Still Be Useful Even Without Any Photometry At All, Because What Is Crucial Is the Astrometry and the Required Photometry Could Be Acquired From the Ground**

	<u>Requirement</u>	<u>Goal</u>	<u>Floor</u>
1. Standard Candles (Nonvariable Stars, Per Mission)			
g', r', i' @ 9 mag	0.5	0.2	5
g', r', i' @12 mag	2	0.8	5
g', r', i' @15 mag	8	3	10
2. Solar Neighborhood Stars			
@ 9 mag			
@15 mag			
3. Brown Dwarfs (Astrometric, Per obs)			
@ 9 mag	2	1	4
4. Star Forming Region (Per obs)			
@ 9 mag	2	1	10
@12 mag	8	4	2
(Per Observation All Filters)			
@ 9 mag	10		
@12 mag	10		
@15 mag	30		1000



Requirements, Goals, Floor (Photometry, 2 of 3)



	<u>Requirement</u>	<u>Goal</u>	<u>Floor</u>
5. Reference Frame			
@ 9 mag			
6. Photometry			
@ 9 mag (Per obs)	2	1	10
g', i', r' @ 9 mag (Per Mission)	0.5	0.2	5
7. Stellar Astrophysics			
a. Solar Type Stars (Per obs)			
@9 mag	2	1	20
@12 mag	8	4	20
b. Radial Pulsators (Per obs)			
@9 mag	2	1	30
@12 mag	8	4	30
c. Non-Radial Pulsators (Per obs)			
@9 mag	2	1	10
@12 mag	8	4	10
(Per Mission)			
g', i', r' @ 9 mag	0.5	0.2	5
g', i', r' @ 12 mag	2	0.8	10
g', i', r' @ 15 mag	8	3	10



Requirements, Goals, Floor (Photometry, 3 of 3)



	<u>Requirement</u>	<u>Goal</u>	<u>Floor</u>
g', i', r' @ 9 mag	0.5	0.2	5
g', i', r' @ 12 mag	2	0.8	10
g', i', r' @ 15 mag	8	3	10
8. Galactic Structure (Per Mission)			
@9 mag			
@12 mag			
@15 mag			
g', i', r' @ 9 mag	0.5	0.2	5
g', i', r' @ 12 mag	2	0.8	10
g', i', r' @ 15 mag	8	3	10

9. Relativity

10. Solar System

Note: Requirement Is the Specification to Which the Instrument and Spacecraft Are Designed
Goal Is What Is Desired if This Can Be Achieved Within Budget and Schedule
Floor Is the Value at Which It Is Not Worth Doing the Mission for This Scientific Purpose