

# MASTER in view of a ESABASE2/Debris developer and user

1<sup>st</sup> MASTER Workshop



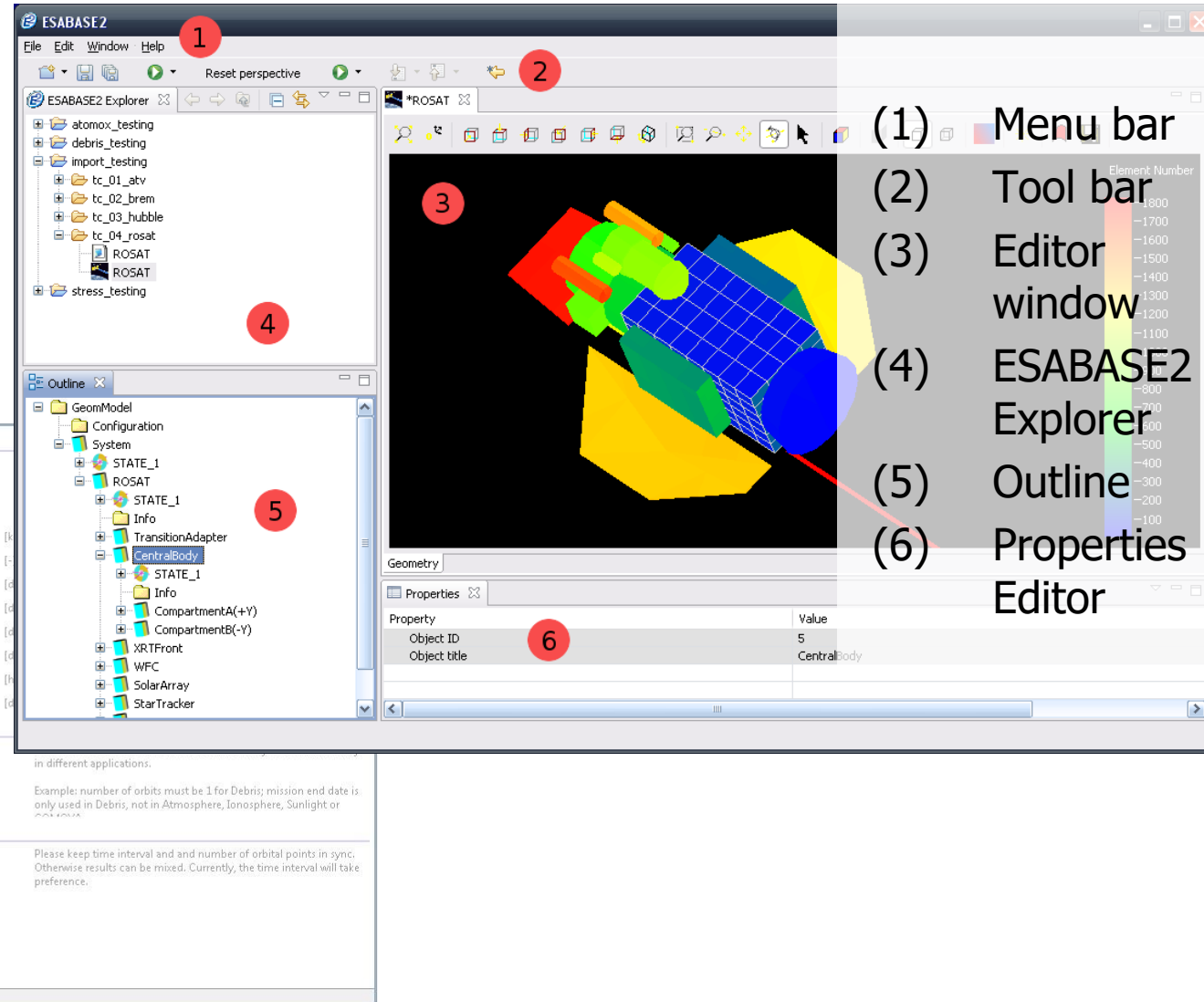
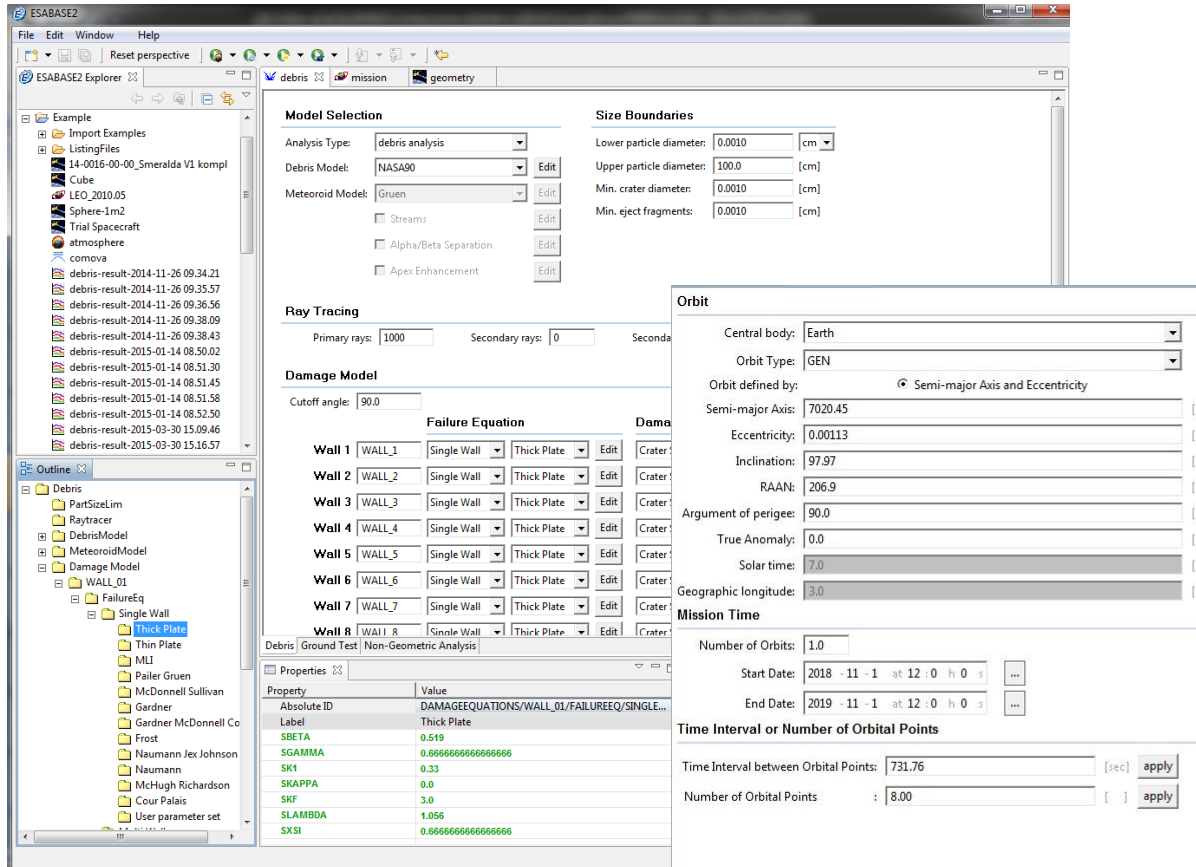
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# ESABASE2 and MASTER

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## ESABASE2/Debris



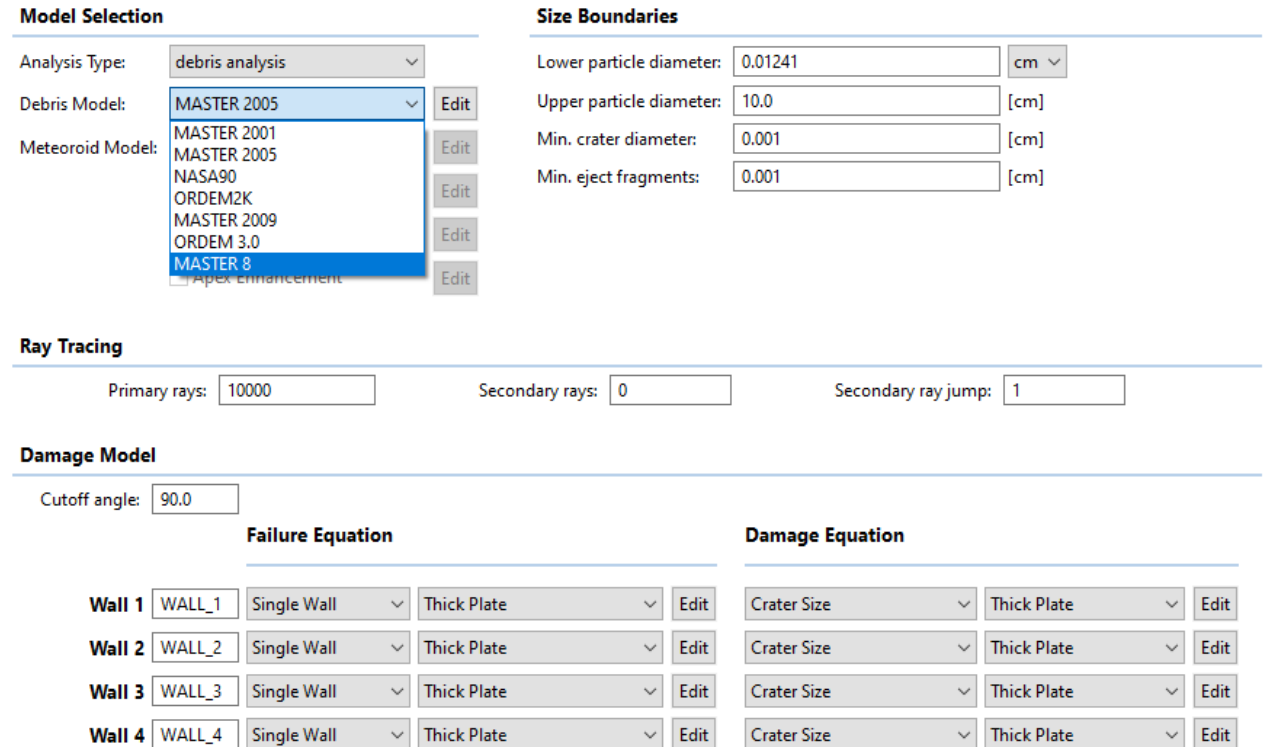
## MASTER Models in ESABASE2

### – Long history

- MASTER 2001
- MASTER 2005
- Divine-Staubach
- MASTER 2009
- MASTER 8

### – Implementation evolution

- M2001: Direct code implementation
- M2005: Blackbox + 2D-distributions results
- M2009: Blackbox + STENVI : better cross-dependency consideration, but bin limit
- M8: Blackbox + STENVI (Compiler not compatible for API) : bin limit normally not reached any more



The screenshot displays the configuration interface for MASTER models in ESABASE2, organized into several sections:

- Model Selection:** Includes dropdowns for Analysis Type (set to 'debris analysis'), Debris Model (set to 'MASTER 2005'), and Meteoroid Model (with a list including MASTER 2001, MASTER 2005, NASA90, ORDEM2K, MASTER 2009, ORDEM 3.0, and MASTER 8). Each dropdown has an 'Edit' button.
- Size Boundaries:** Contains input fields for Lower particle diameter (0.01241 cm), Upper particle diameter (10.0 cm), Min. crater diameter (0.001 cm), and Min. eject fragments (0.001 cm).
- Ray Tracing:** Features input fields for Primary rays (10000), Secondary rays (0), and Secondary ray jump (1).
- Damage Model:** Includes a Cutoff angle input field (90.0).
- Failure Equation and Damage Equation:** Two columns of settings for four walls (WALL\_1 to WALL\_4). Each wall has a Failure Equation (Single Wall, Thick Plate) and a Damage Equation (Crater Size, Thick Plate), with 'Edit' buttons for each.

## Accidental beta-tester

### – Early contact with model

- Both ESAs tools
- High demand for the model
- Implementation direct after release (M2009), or even shortly before (M8)
- New features need to mature

### – Test driven development

- Lot of testing during Model implementation
- Test reveal sometimes unexpected or unconsidered behaviour

### – Good communication

- Fruitful discussions concerning bug reports  
→ e.g. considerably improved MASTER 8 release, especially concerning STENVI consideration

	A	B	C	D	E	F	G	H	I	J	K
1		0.000001 m			0.000005 m			0.00001 m			0.00005 m
2		Master8	Esabase2	Δ%	Master8	Esabase2	Δ%	Master8	Esabase2	Δ%	Master8
3	2011 leading	6.7033E+02	6.7150E+02	0.17	3.1289E+02	3.1360E+02	0.23	3.3017E+01	3.2960E+01	-0.17	3.1354E+01
4	space	2.1922E+02	2.1990E+02	0.31	1.0210E+02	1.0200E+02	-0.10	1.6888E+01	1.6850E+01	-0.23	1.4361E+01
5	trailing	4.2231E+00	4.3030E+00	1.89	1.9184E+00	1.9440E+00	1.33	1.4251E+00	1.4470E+00	1.54	1.1029E+00
6	earth	2.1557E+02	2.1590E+02	0.15	1.0080E+02	1.0080E+02	0.00	1.6670E+01	1.6700E+01	0.18	1.4048E+01
7	left	2.4911E+02	2.5090E+02	0.72	1.2333E+02	1.2390E+02	0.46	2.1885E+01	2.1980E+01	0.43	1.8638E+01
8	right	2.2320E+02	2.2430E+02	0.49	1.0731E+02	1.0720E+02	-0.10	1.7613E+01	1.7620E+01	0.04	2.0117E+01
9											
10	2013 leading	6.8113E+02	6.8200E+02	0.13	3.1324E+02	3.1400E+02	0.24	3.1320E+01	3.1330E+01	0.03	3.7869E+01
11	space	2.0961E+02	2.1000E+02	0.19	9.7885E+01	9.7970E+01	0.09	1.5254E+01	1.5330E+01	0.50	1.8006E+01
12	trailing	3.7006E+00	3.6870E+00	-0.37	1.7634E+00	1.7950E+00	1.79	1.3564E+00	1.3760E+00	1.45	1.0620E+00
13	earth	2.0738E+02	2.0760E+02	0.11	9.5292E+01	9.5610E+01	0.33	1.5274E+01	1.5300E+01	0.17	1.7716E+01
14	left	2.4304E+02	2.4480E+02	0.72	1.1569E+02	1.1630E+02	0.53	2.0117E+01	2.0140E+01	0.11	2.3371E+01
15	right	2.1633E+02	2.1710E+02	0.36	1.0101E+02	1.0120E+02	0.19	1.6643E+01	1.6630E+01	-0.08	2.2722E+01
16											
17	2015 leading	6.6349E+02	6.6500E+02	0.23	3.1676E+02	3.1740E+02	0.20	2.6857E+01	2.6880E+01	0.09	2.9194E+01
18	space	2.0525E+02	2.0520E+02	-0.02	9.6264E+01	9.6310E+01	0.05	1.4065E+01	1.4100E+01	0.25	1.6353E+01
19	trailing	4.1188E+00	4.0970E+00	-0.53	2.0345E+00	2.0550E+00	1.01	1.5074E+00	1.5350E+00	1.83	1.1389E+00
20	earth	2.0122E+02	2.0130E+02	0.04	9.5726E+01	9.5620E+01	-0.11	1.3963E+01	1.4010E+01	0.34	1.6085E+01
21	left	2.2471E+02	2.2620E+02	0.66	1.0800E+02	1.0860E+02	0.56	1.7793E+01	1.7840E+01	0.26	1.8726E+01
22	right	1.9768E+02	1.9890E+02	0.62	9.0505E+01	9.0800E+01	0.33	1.4477E+01	1.4470E+01	-0.05	1.9794E+01
23											
24	2017 leading	3.2474E+02	3.2340E+02	-0.41	2.3547E+02	2.3560E+02	0.06	8.2046E+01	8.1880E+01	-0.20	1.1059E+01
25	space	9.8316E+01	9.8190E+01	-0.13	6.9585E+01	6.9290E+01	-0.42	2.4810E+01	2.4830E+01	0.08	6.5055E+01

## The user

- MASTER works in background, thus not that much interactivity, but:
- Great! STENVI bin limit seem to be not a problem anymore (M8)
- Available future date only up to 2036, which feel very limiting
- Divine-Staubach limits

# STENVI

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## • Standard Environment Interface

- Provides particle distributions considering cross-dependencies, but
- Has different “Flavours”
  - 2005ESASP.587..607N (IMEM)
  - IADC Protection Manual (M8)
- Needs to be really standardised
  - Provided parameters
  - Defined alignment (coordinates)
  - Consideration interplanetary missions

IADC Protection Manual

```

25 #-----< Definition of the output spectrum >-----
26 # Bin Min Max
27 AZIMUTH 36 -180.0 180.0 Azimuth [deg]
28 ELEVATION 1 -90.0 90.0 Elevation [deg]
29 VELOCITY 20 0.5 20.5 Velocity [km/s]
30 DIAMETER 6 1.D-05 1.0 Diameter [m]
31 LATITUDE 1 0.0 360.0 Argument of True Latitude [deg]
32 DENSITY 1 2.8 2.8 Density [g/cm^3]
33 #
34 #-----
35 # Impact Azimuth [deg]: Intervals
36 # No Lower Border Upper Border
37 DISTAZI 1 -0.180E+03 -0.170E+03
38 DISTAZI 2 -0.170E+03 -0.160E+03
: : : :
: : : :
71 DISTAZI 35 0.160E+03 0.170E+03
72 DISTAZI 36 0.170E+03 0.180E+03
73 #-----
74 # Impact Declination [deg]: Intervals
75 # No Lower Border Upper Border
76 DISTE1 1 -0.900E+02 0.900E+02
77 #-----
78 # Relative Velocity [km/s]: Intervals
79 # No Lower Border Upper Border
80 DISTVEL 1 0.500E+00 0.150E+01
81 DISTVEL 2 0.150E+01 0.250E+01
: : : :
: : : :
88 DISTVEL 19 0.185E+02 0.195E+02
89 DISTVEL 20 0.195E+02 0.205E+02
100 #-----
101 # Particle Diameter [m]: Intervals
102 # No Lower Border Upper Border
103 DISTDIA 1 0.100E-04 0.100E-03
104 DISTDIA 2 0.100E-03 0.100E-02
105 DISTDIA 3 0.100E-02 0.100E-01
106 DISTDIA 4 0.100E-01 0.100E+00
107 DISTDIA 5 0.100E+00 0.100E+01
108 DISTDIA 6 0.100E+01 0.100E+02
109 #-----
110 # Argument of True Latitude [deg]: Intervals
111 # No Lower Border Upper Border
112 DISTLAT 1 0.000E+00 0.360E+03
113 #-----
114 # Density [g/cm^3]: Intervals
115 # No Lower Border Upper Border
116 DISTDEN 1 0.280E+01 0.280E+01
117 #
    
```

Figure 2.6-3: Standard Environment Interface File: Defined Spectra

```

1 DATA ARRANGEMENT EXAMPLE
3 123456789-123456789-123456789-123456789-123456789-123
4 #-----
5 #-----STANDARDIZED-ENVIRONMENT-INTERFACE-----
6 #-----
7 STENVI-1.0
8 #-----
9 MODNAME NASA2K 1.0
10 #-----
11 #--COMMENTS-----
12 COMMENT LINE1 40 CHARACTERS
13 COMMENT LINE2 40 CHARACTERS
14 COMMENT LINE3 40 CHARACTERS
15 COMMENT LINE4 40 CHARACTERS
16 #-----
17 #--MISSION-PARAMETERS-----
18 # YEAR PERI APO INC NINT
19 MISSION 2004 400.0 400.0 51.6 12
20 #-----
21 #-----
22 #--DIAMETER-----
23 #-----
24 # NO DIA
25 DIAMET 1 1.0000E-03
26 DIAMET 2 1.0000E-02
27 DIAMET 3 1.0000E-01
28 : : :
29 #-----
30 #--FLUX/DENSITY-DISTRIBUTION-----
31 #-----
32 # INT NDIA FLUX DENS
33 DISTHD 1 1 3.1234E+03 2.800E+00
34 DISTHD 2 1 2.1234E+03 2.800E+00
35 DISTHD 3 1 3.5234E+03 2.800E+00
36 : : :
37 #-----
38 #--DIRECTIONAL-DISTRIBUTION-----
39 #-----
40 # BINS MIN MAX
41 AZIMUTH 36 -175.0 175.0
42 ELEVATI 18 -85.0 85.0
43 VELOCIT 23 0.5 23.5
44 #-----
45 # NO INT NDIA AZI ELE VEL PROB
46 DISTSET 1 1 1 1 2 2 5.1234E-07
47 DISTSET 2 1 1 1 1 1 2.1234E-06
48 DISTSET 3 1 1 10 15 5 6.1234E-08
49 DISTSET 4 1 1 1 1 1 3 3.1234E-07
50 : : : : : : :
51 : : : : : : :
52 #BOF-----
    
```

Figure 5. Example of a Standardized Interface File.



# Questions?

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