analyse

keys:	**[from]**	*<number>*	source picture
	[to]	*<number>*	output picture (particle parameter list)
	ge	*<number>*	upper intensity threshold for particles
	le	*<number>*	lower intensity threshold for particles
	size	*<x>, <y>*	dimensions of subregion to be analysed
	position	*<x>, <y>*	position/offset of subregion
	area	*<n1>, <n2>*	minimum and maximum area for retained particles
	segment	*<number>*	output picture for segmented image
	mark	*<number>*	mark particle positions with symbols
		<yes *or* no>	
	mkmode	*<number>*	mark mode
	mksize	*<number>*	mark size
options:	**left/right, top/bottom**		position of subregion
	id		mark particle with identifier instead of symbol
	cm		mark centre of particle area instead of reference point
	verify		verify results at the console

Semper's facilities for particle analysis (object analysis, object feature measurement etc.) are centred on the **analyse** command. Briefly, you choose intensity thresholds to delineate particles, use **analyse** to count and measure them, and other commands to type, display or process the measured values. The **analyse** command scans a picture or subregion, identifying and measuring all connected regions satisfying the threshold conditions that you specify, and records the resulting *ppl* (*particle parameter list*) as a *Plist* picture. You then use other commands such as **ptype** to print, display or process the results.

Examples

```
analyse ge 100; phistogram area
```

This command counts and measures particles in the current picture with pixel values 100 or more, storing the results as *ppl* 998, after which the **phistogram** command displays a histogram of the area measurements

```
analyse 50 to 51 le 6.35 segment 52
```

The **analyse** command counts and measures particles with pixel values 6.35 or less, storing the results as *ppl* 51, and creating a segmented version 52 of the original picture 50 for use by later commands such as **pshow**.

analyse

```
analyse 1 ge 0 size 400 area 10,50 mark display id
```

This command analyses positive particles in picture 1, considering only particles whose centre of area lies within a central region 400 points square, ignoring particles with areas less than 10 and greater than 50. It marks identifiers for each particle on the current display.

```
analyse 3 ge 100 mark mkmode 2 mksize 3
```

This command analyses particles in picture 3 with pixel values of 100 or more, marking each particle with a diagonal cross (mark mode 2) with a symbol size of 3 pixels (mark size 3).

```
analyse 1 size 300 position 100, 50 noverify
```

This command analyses particles in picture 1 with intensity values which are greater than or equal to the middle of the picture range. Only particles that lie within a region 300 points square centred at the position *x*=100, *y*=50 are considered. The **noverify** option suppresses the listing of results at the console.

Description

The command **analyse** records 25 parameters for each particle found in a particle parameter list (*ppl*). These parameters are described in *Appendix D: Particle Parameters*.

Particles are connected regions of pixels (see *Appendix G, Pixel Connectivity*) with values that satisfy the threshold conditions specified by the minimum and maximum keys **ge** and **le**. If you omit both keys, a default value equal to the middle of the source picture range is assumed for the key **ge**.

The largest particle identifier is equal to the number of particles found. The **analyse** command also sets the variable **n** to repeat the number of particles found.

Particles that touch the picture border may be truncated, and lead to misleading measurements (for example, suggesting some undersized particles in a picture of entirely identical spheres). You can overcome this problem by specifying a subregion for analysis using the **size** key. Using this key, particles whose centres of area lie outside the subregion are then ignored, but other particles are recorded correctly even if part of their area lies outside the subregion. The **position** key allows you to specify the exact position of the subregion on the display. Alternatively, you can use the options **top, right,** etc. to indicate the position of the subregion. Refer to *Appendix C, Semper Keys* and *Options* for further details of the standard subregion keys and options.

If you want to exclude particles less than or greater than a certain area (to eliminate large numbers of spurious measurements as a result of noise in the image), use the key **area** to indicate the minimum and maximum area of interest to you.

If you supply a suitable output picture number via the key **segment**, a version of the source picture is produced in which background pixels (belonging to no particle) are set to zero, and pixels belonging to each particle are set to the corresponding particle identifier (1,2...) assigned by **analyse**.

If you indicate a display with the key **mark**, **analyse** marks the reference point of each particle found in the style/size specified by **mkmode/mksize**. For detail of the keys **mark, mkmode** and **mksize**

analyse

refer to *Appendix C, Semper Keys and Options.* If you use option **id**, the particle identifier assigned is marked instead, and if you use **cm**, the mark is placed at the centre of area rather than at the reference point.

The **verify** option displays information the **analyse** command at the console. Use the **noverify** option to suppress this information.

Note that **analyse** creates a small temporary picture to start with, and replaces it with successively larger ones as the analysis progresses. This means that a small number of particles requires little picture disc space but that a large number of particles requires much more space. **analyse** also creates a second, fixed-size temporary picture. If you see one of the following error messages when using **analyse**; *Insufficient free space on device n* or *Disc fragmented – can't open n*, try assigning a larger scratch disc or try **compress**ing the disc, to release free space.

Further information

The following Semper commands can be used following the **analyse** command. For a full description of each command refer to the information given under its command heading in this manual.

The following commands can be used to type, display or recover the measured values in the *ppl* (particle parameter list) produced by **analyse**:

phistogram	generates a histogram based on one of the particle parameters, for a selection of particles
pmark	marks selected particles or parameter values on the display
pset	returns selected particle parameter values in variables
ptype	types selected particle parameter values

If you specify the **segment** option with **analyse**, Semper generates a segmented version of the scanned picture, in which all pixels belonging to a given particle are set to a particle identifier (1,2,3...). This information is used by the following commands:

pcalculate	calculates further parameters for a single particle
pedit	edits contents of particle parameter list and/or segmented picture
pextract	generates picture containing image of a single particle
pferet	calculates up to 9 feret diameters for a single particle
pid	identifies the particle containing a given pixel
pshow	highlights selected particles on the display

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Notes

display marking:	particle reference points or centres	
multi-layer pictures:	layer 1 processed only	
forms used internally:	fp, integer	
variables set:	*pimage*	(source picture analysed)
	pplist	(output *ppl* number)
	psegment	(segmented output picture, if any)
	n	(number of particles found)

Defaults and Ranges

keys/options	defaults	range
[from]	current picture, held in variable *select*	valid picture number
[to]	998	valid picture number
ge	middle of source picture range	real number
le	*none*	real number
size	whole picture	less than or equal to the size of the picture (integers)
position	position 0,0	within bounds of the picture (integers)
area	0, picture area	within bounds of the picture (real numbers)
segment	no segmented picture	positive integer
mark	mark off	see *Appendix C*
mkmode	mark mode 1	integer in range 1 to 5
mksize	mark size 2	positive integer
verify	verification on	