

GRIM 3

GLASS REFRACTIVE INDEX MEASUREMENT

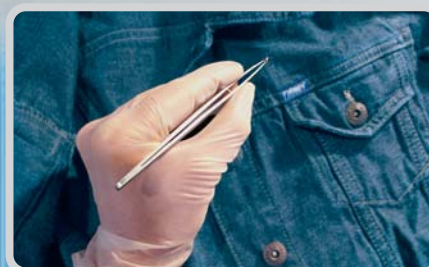
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GRIM3-a new system for the forensic examination of glass fragments

NEW FEATURES INCLUDE:

- Multiple RI measurements for greater efficiency
- Improved temperature stability
- Enhanced casework documentation
- Network facilities for remote supervision
- Choice of operating languages
- Data export facilities



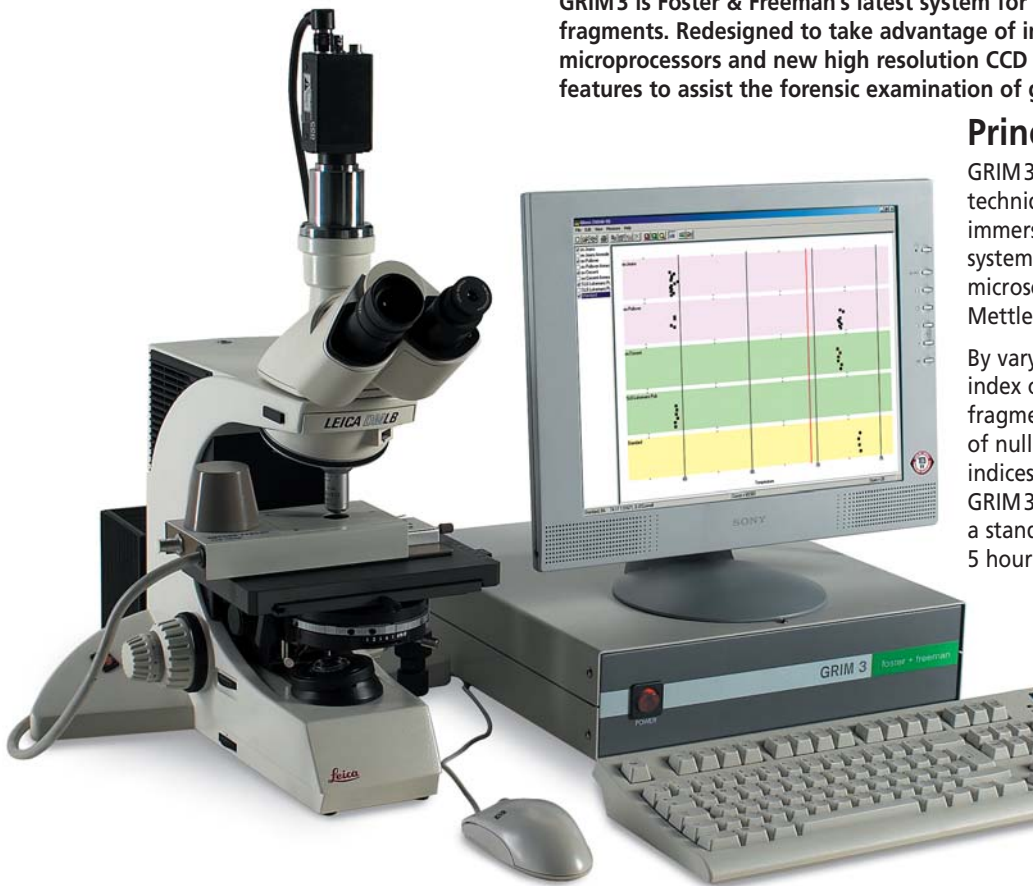
GRIM 3 an advanced workstation for glass refractive index measurement

GRIM 3 is Foster & Freeman's latest system for measuring the refractive indices of glass fragments. Redesigned to take advantage of improved operating systems, faster microprocessors and new high resolution CCD imaging devices, GRIM 3 offers new features to assist the forensic examination of glass.

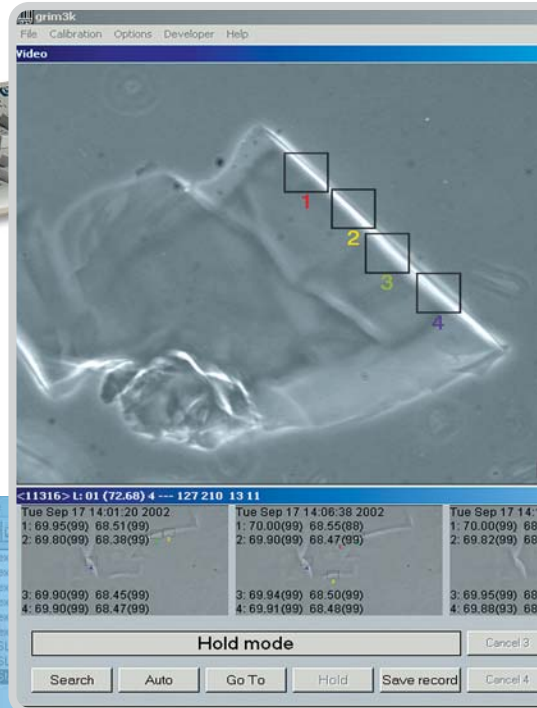
Principle of operation

GRIM 3 retains the widely accepted laboratory technique of glass RI determination, the oil immersion/temperature variation method. The system operates through a standard laboratory microscope with phase contrast optics and a Mettler hotstage, for temperature control.

By varying temperature to alter the refractive index of a calibrated oil, the RI of an immersed fragment of glass can be determined at the point of null refraction, the point at which the refractive indices of glass and immersion oil match. Using GRIM 3, repeat measurements produce results with a standard deviation of, typically, 0.00002RI over a 5 hour period and 0.00003RI over a 5 day period.



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In a motoring offence glass samples from the suspect vehicle are compared to fragments of glass recovered from the victims clothing.



The comprehensive casework database allows all glass data to be retained, including images and edge contrast versus temperature traces.

Glass: 21048-95

Fragment	Description	Operator	Calibration
<input checked="" type="checkbox"/> ex Jeans		grahame-t	Oil B 583nm
<input checked="" type="checkbox"/> ex Jeans Anneale	4/2	grahame-t	Oil B 583nm
<input checked="" type="checkbox"/> ex Pullover	5/1	grahame-t	Oil B 583nm
<input checked="" type="checkbox"/> ex Pullover Annee	5/2	grahame-t	Oil B 583nm
<input checked="" type="checkbox"/> ex Crescent	6/1	grahame-t	Oil B 583nm
<input checked="" type="checkbox"/> ex Crescent Annee	6/2	grahame-t	Oil B 583nm
<input checked="" type="checkbox"/> SLS Lukemans Pu		grahame-t	Oil B 583nm
<input checked="" type="checkbox"/> Standard		grahame-t	Oil B 583nm
ex Pullover, Surface debris, Shakings, Float Laminated, No original, c			
1/1		grahame-t	Oil B 583nm
1/2		grahame-t	Oil B 583nm
2/1		grahame-t	Oil B 583nm
2/2		grahame-t	Oil B 583nm
3/1		grahame-t	Oil B 583nm
3/2		grahame-t	Oil B 583nm
4/1		grahame-t	Oil B 583nm
4/2		grahame-t	Oil B 583nm
5/1		grahame-t	Oil B 583nm
5/2		grahame-t	Oil B 583nm
6/1		grahame-t	Oil B 583nm
6/2		grahame-t	Oil B 583nm
ex Crescent, Window, Shakings, Float Laminated, No original			
1/1		grahame-t	Oil B 583nm
1/2		grahame-t	Oil B 583nm
2/1		grahame-t	Oil B 583nm
2/2		grahame-t	Oil B 583nm
3/1		grahame-t	Oil B 583nm
3/2		grahame-t	Oil B 583nm
SLS Lukemans Pub, Window, Shakings, Float Laminated, Curved			
1/1		grahame-t	Oil B 583nm
1/2		grahame-t	Oil B 583nm
2/1		grahame-t	Oil B 583nm
2/2		grahame-t	Oil B 583nm
3/1		grahame-t	Oil B 583nm
3/2		grahame-t	Oil B 583nm
Standard, B6 74.17.1.51671, D.O'Connell			
1/1		grahame-t	Oil B 583nm

Match point detection

GRIM3 identifies a glass/oil refraction null point automatically by monitoring the edge of the immersed glass fragment as the oil is heated or cooled. When edge contrast drops to a minimum, the refraction null point is attained and the temperature is recorded. Phase contrast microscopy is used to enhance the edge.

Each recorded null point temperature is automatically labelled with a 'quality' code ranging from 0 to 99, which is a measure of the sharpness or resolution of the null point and provides evidence of accuracy in casework reports.

Multiple glass edge processing

The use of new high-speed processors enables GRIM3 to monitor up to four glass fragment edges per operation, speeding the casework examination process as well as reducing immersion oil calibration time.

The four image-processing windows, adjustable for size and shape, may be positioned independently over the edge of the examined glass fragment, allowing the operator to select the best edges and avoid impurities. With four null point temperature measurements per run, the number of runs required to provide an acceptable level of statistical accuracy is reduced, saving time.

Graphical presentations

Casework measurements may be displayed with distribution histograms and their mean and standard deviations for visual comparison.

Casework files and reports

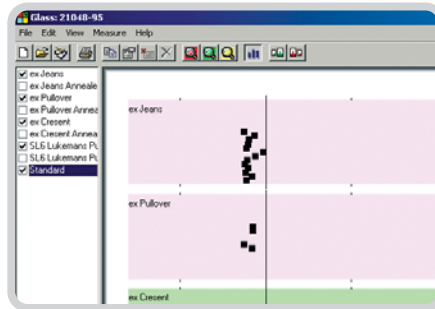
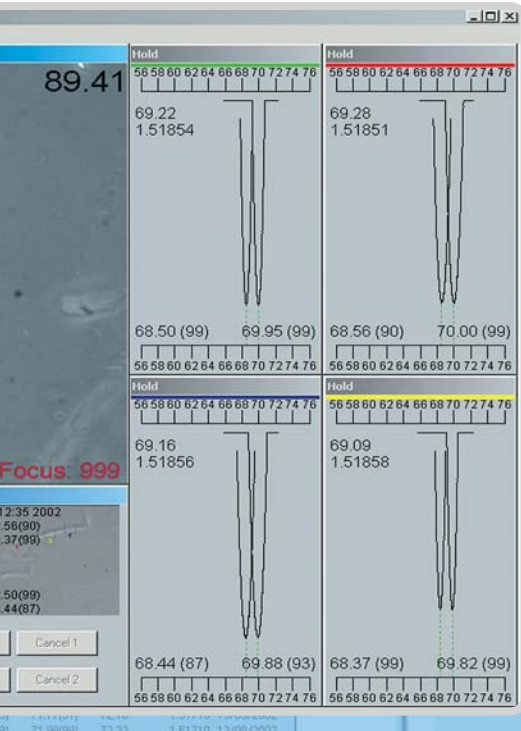
Casework management and database facilities have been improved.

GRIM3 ensures that casework results cannot be filed without essential information that identifies each fragment of glass examined, including its source and casework reference, and the identity of the operator.

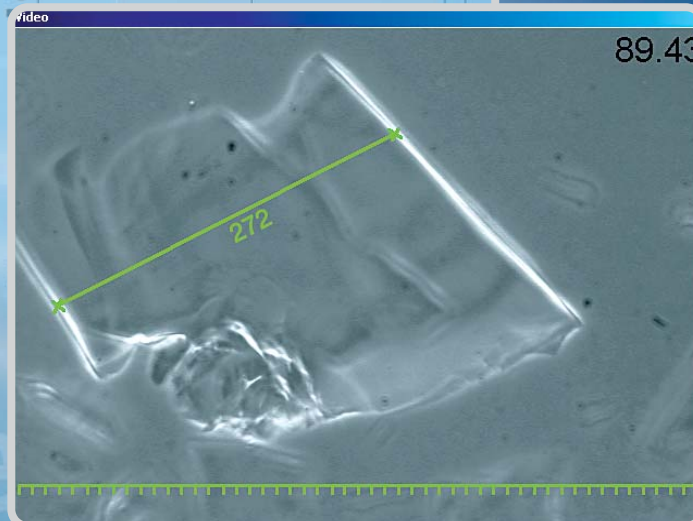
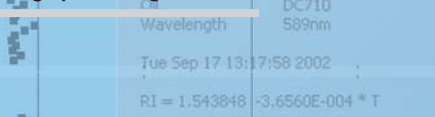
Glass fragment images and edge contrast traces may also be saved for reference and fragments may be sized using the on-screen scale. The operator may flag results as erroneous or deleted, but all results are retained in the databases. GRIM3 includes an Audit Trail feature to track data recording activity. Instrument and laboratory codes are cited on all printouts.

Basic statistics are generated including average, range, spread and standard deviation. Results may be displayed as scatter diagrams and formatted for export to Microsoft Office for additional analysis.

Networking facilities enable GRIM3 instruments to be accessed remotely, allowing casework reviews to be conducted by laboratory supervisors or reporting officers without interrupting operators.



The efficiency of GRIM3 is improved by the use of four glass edge processing windows.



GRIM3 can process glass fragments as small as 50 microns which can be measured using an on-screen scale.

Heating	Cooling	Mean	RI	Date	Comment
8.77(99)	59.07(99)	59.41	1.52181	13/09/2002	
8.88(99)	59.12(99)	59.50	1.52178	13/09/2002	
8.87(86)	59.00(99)	59.42	1.52181	13/09/2002	
8.98(99)	59.26(99)	59.61	1.52174	13/09/2002	
8.78(99)	59.13(99)	59.45	1.52180	13/09/2002	
9.2(99)	59.24(99)	59.63	1.52173	13/09/2002	
9.09(45)	59.19(99)	59.64	1.52173	13/09/2002	
9.24(99)	71.77(31)	72.10	1.51718	13/09/2002	
9.27(99)	71.98(99)	72.33	1.51710	13/09/2002	
9.71(33)	59.06(33)	59.39	1.52182	13/09/2002	
9.98(99)	59.28(99)	59.62	1.52174	13/09/2002	
9.27(33)	71.63(81)	72.08	1.51719	13/09/2002	
9.23(93)	71.43(99)	71.93	1.51725	13/09/2002	
9.24(99)	71.65(30)	72.04	1.51721	13/09/2002	
9.254(77)	71.82(99)	72.17	1.51716	13/09/2002	
9.244(30)	71.62(99)	72.03	1.51721	13/09/2002	
9.249(99)	71.78(98)	72.12	1.51717	13/09/2002	
9.44(99)	72.19(99)	71.81	1.51729	13/09/2002	
9.65(98)	72.39(98)	72.02	1.51722	13/09/2002	
9.52(98)	72.25(98)	71.88	1.51726	13/09/2002	
9.41(98)	72.29(98)	71.85	1.51727	13/09/2002	
9.66(98)	72.56(98)	72.10	1.51718	13/09/2002	
9.58(98)	72.49(98)	72.03	1.51721	13/09/2002	
9.95(99)	59.16(99)	59.55	1.52176	13/09/2002	
9.96(99)	59.24(99)	59.60	1.52175	13/09/2002	
9.97(99)	59.10(99)	59.53	1.52177	13/09/2002	
9.09(99)	59.17(99)	59.63	1.52174	13/09/2002	
9.89(99)	59.01(99)	59.45	1.52180	13/09/2002	
9.87(99)	59.07(99)	59.47	1.52179	13/09/2002	
9.79(54)	73.04(44)	72.41	1.51671	13/09/2002	

GRIM3



Improved accuracy

GRIM3 features a new hot stage controller which has improved the temperature stability of the system and reduced long term temperature drift.

High-speed processing (*minimum system requirement is 2GHz*) allows the operator to optimise the sharpness of focus, ensuring a more accurate resolution of the refraction null point.

When selecting a glass edge for examination the operator is usually close to the null point temperature where image contrast is low and focussing is difficult. An unfocused image can generate results with lower 'edge counts' and a wider spread of results. The higher processing speed of GRIM3 enables a numerical value for image sharpness to be displayed in real time which the operator can use to optimise the focus.

Calibration

Easy to follow procedures enable immersion oils to be calibrated with up to 12 glass standards. GRIM3 automatically constructs a linear temperature versus RI conversion formula for each oil and calculates the correlation coefficient to qualify its accuracy. Calibration data for any number of oils and wavelengths may be stored and are password protected. Re-calibration may be undertaken at any time.

Oil Calibration										
Oil: DC710		Wavelength: 589nm			Date: Tue Sep 17 13:17:58 2002					
RI = 1.543848		-3.8560E-004 * T								
Correlation: -0.99998		Standard error: 0.000055								
Standard	Match temperature deg C					Mean temperature dRI				
B1 1.52912	40.32	40.19	40.29	40.28	40.32	40.29	-0			
B2 1.52381	54.97	54.92	55.06	54.94	54.96	54.97	+6			
B3 1.52249	58.29	58.31	58.26	58.28	58.29	58.29	-5			
B4 1.51856	68.98	68.95	68.98	68.29	69.51	69.53	+1			
B5 1.51863	68.73	68.81	68.70	68.83	68.61	68.74	-9			
B6 1.51671	74.18	74.22	74.19	74.17	74.16	74.18	-2			
B7 1.51467	79.93	79.95	79.90	79.95	79.93	79.93	+5			
B8 1.51166	88.14	88.11	88.17	88.11	88.15	88.14	+3			
B9 1.51048	91.16	91.18	91.08	91.18	91.18	91.16	-4			
B10 1.50962	93.70	93.93	93.79	93.93	93.96	93.86	+9			
B11 1.50566	104.47	104.50	104.46	104.47	104.50	104.48	+1			
B12 1.50226	113.61	113.65	113.60	113.53	113.61	113.60	-6			
NEW										

Choice of operating system

GRIM3 runs on Windows2000 and XP and is available in several languages. Networking facilities provide enhanced data communications.

After Sales Support

Foster & Freeman offer advice, installation, training and on-site maintenance. Please contact our Sales Department for further details of our products and services.

GRIM3: Basic Package

- GRIM3 processor unit with serial/USB interface for video and hotstage control, incorporating improved accuracy and temperature stability.
- Video camera interface, Matrox Meteor 2/4 (standard) PCI frame grabber.
- Monochrome CCD video camera (CCIR/EIA).
- Windows2000 or XP compatible software.
- Microsoft Office compatible database.
- New multiple edge measurement technology.
- GRIM3 software supplied on CD-ROM.

Required Ancillaries

Computer

Contact Foster & Freeman Sales Office for latest requirements/specification.

Microscope

Phase contrast optics.
Long working distance objective.
Phototube for mounting video camera.
100W light source.
Interference filter, 589nm peak wavelength, 10nm bandwidth.
Recommended system: Leica DM2500 or Leica DMLB phase contrast microscope.

Hotstage

GRIM3 is compatible with the Mettler hotstage model FP82HT.

Reference Glasses

Glass standards to cover the refractive index range 1.46 - 1.56 (data to 5 decimal places) within the temperature range 20° -120°C and wavelength range 436 - 656nm.

Immersion Oils

Purified silicone oils with the refractive index range 1.46 - 1.56 within the temperature range 20° -120°C.

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Head Office & UK Sales Office:

Foster & Freeman Limited
25 Swan Lane, Evesham, Worcestershire
WR11 4PE, U.K.

Tel: +44 (0) 1386 41061
Fax: +44 (0) 1386 765351

e-mail: sales@fosterfreeman.com
http://www.fosterfreeman.com

European Sales Office:

Tel: +49 (0) 7564 949 838
e-mail: europe@fosterfreeman.com

USA Sales Office:

Tel: 888 445 5048
e-mail: usoffice@fosterfreeman.com