

Specification Sheet

MARCTM

Resin Calibrator

Beta Version 1.0

Managing Accurate Resin Curing



MARCTM Resin Calibrator – A unique instrument that enables dental manufacturers and researchers to precisely monitor and control the amount, rate and type of energy delivered to resin specimens.



CuringResin.com

About the MARC™ Resin Calibrator

The MARC™ Resin Calibrator (MARC™-RC) is one of two scientifically accurate and clinically relevant intraoral energy measurement systems offered by BlueLight analytics inc. (the other is the MARC Patient Simulator). Specifically, MARC™-RC enables dental researchers and manufacturers to:

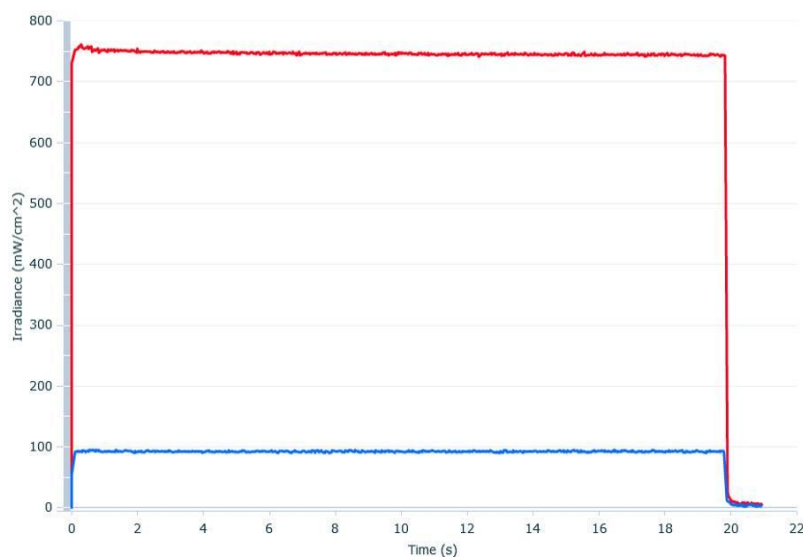
- Precisely control the amount, type and rate of energy delivered to the top surface of composite resin specimens; and
- Monitor how much and what type of energy passes through the bottom surface of that same increment of resin.

Specific Applications

MARC™-RC enables dental researchers and manufacturers to better understand and manage the delivery of energy to resin composites. Specifically, MARC™-RC enables them to:

- Conduct research on 4-mm diameter specimens (or 6-mm diameter specimens of composite resins with a 4-mm area of interest) after they receive clinically relevant amounts of energy.
- Monitor how much of what type of energy reaches the bottom surface of an increment of resin.
- Accurately identify the optimal amount, type and pace of energy required by different brands and shades of resin.
- Provide clinicians with clinically relevant curing times for restorations in different locations in the mouth.
- Accelerate the pace of research because MARC™-RC is easy-to-use and provides accurate, immediate and exportable results.

Precise Energy Measurements



The image on the left is of a test where MARC™-RC was used to position a curing light to deliver 15J/cm² in 20 seconds to the top surface (red line) of a 4-mm wide specimen of resin contained in a Delrin® ring. Only 1.8J/cm² reached the sensor just below the bottom surface (blue line) of that same 2-mm thick increment. The rate of energy delivery can be easily adjusted with the MARC™-RC by adjusting the distance between the curing light and the specimen. This enables the same amount of energy to be delivered in more or less time.

Components

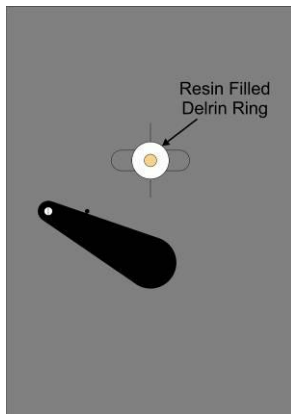


MARC™-RC Assembly

All of the sensitive laboratory-grade optical components in this calibrated and NIST-referenced light energy measurement system are securely contained within a specially designed aluminum box. A movable cover is placed over the unused sensor when measurements are taken.

CC-3 Sensors

The two cosine corrector sensors are fixed within the MARC™-RC. They are 3.9 mm in diameter and are similar in size to a Class I preparation. These sensors are connected to the spectrometer with a bifurcated fibre optic cable.

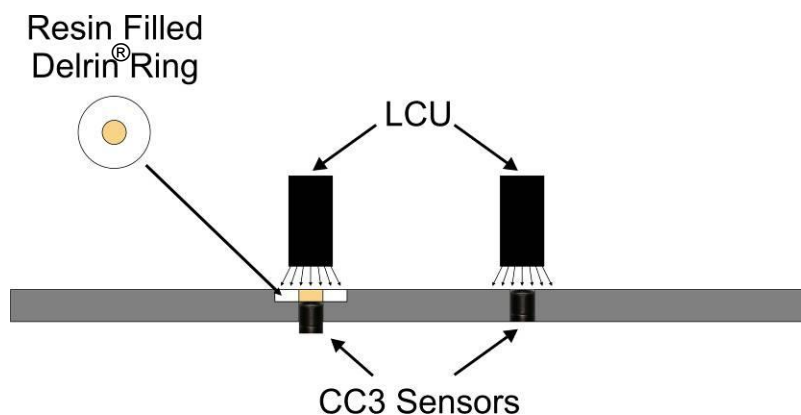
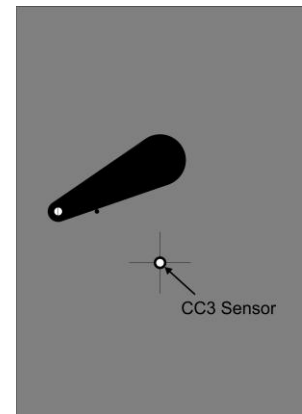


Bottom Surface Sensor

This sensor measures the amount and rate of energy received immediately below the bottom surface of a composite resin specimen.

Top Surface Sensor

This sensor measures the amount and type of energy received by the top surface of a composite resin specimen.



The MARC™-RC is calibrated so that a curing light placed immediately above and at 90° to the “top surface” sensor will generate the same irradiance readings as the Anterior sensor of the MARC™ Patient Simulator (MARC™-PS).

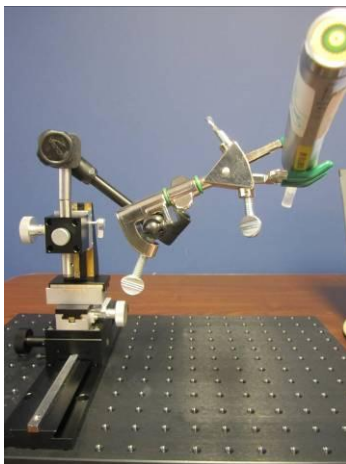
Spectrometer

A NIST-referenced USB4000™ spectrometer (Ocean Optics) that features a 3648-element Toshiba linear CCD array for increased signal-to-noise and enhanced electronics for controlling the spectrometer and accessories. The USB4000™ is custom configured to the specifications required by BlueLight™ and optimized to measure wavelengths between 360 – 540 nm. It is mounted inside the MARC™-RC and is connected to the CC-3 cosine corrector sensors using a bifurcated fibre optic cable. As with all laboratory grade spectrometers, the USB4000™ requires periodic recalibration in order to maintain NIST referenced accuracy.



Laptop Computer

MARC™-RC includes a pre-configured laptop computer using Microsoft Windows 7® operating system. The laptop is preloaded with the custom MARC™ software that fully integrates data gathering, storage, exporting and reporting into one easy-to-use graphical user interface. This laptop is dedicated to running the MARC™ software and is specially configured to manage the large volumes of data that are produced during testing.



benchMARC™ - *Optional Accessory*

A specially designed bench-top accessory has been developed by BlueLight for use in combination with the MARC™-RC and/or MARC™-PS systems. The benchMARC™ includes components from four different suppliers integrated into one highly adjustable device. It includes a clamp to hold various types of curing lights, a universal adjustable arm attached to an XY pinion jack and linear translation stage, with the entire unit attached to a bench plate. Together, the benchMARC™ assembly enables the operator to precisely control the position of the curing light over a sensor, and move the curing light between sensors without re-adjusting the height.

MARC™ Software

The fully integrated MARC™ software controls the spectrometer and includes a simple, easy-to-use graphical user interface. The user interface provides the operator with the ability to individually control and assess data delivered to each of the two sensors.

Unique Functionality

When MARC™-RC is used in combination with a benchtop set-up for stabilizing and adjusting the position of a curing light.(e.g., benchMARC™), the MARC™ software enables the operator to adjust the height of the curing light so that it delivers the desired level of irradiance for the specific period required to meet the energy target identified for that resin specimen.

MARC™ Software has the following features:

1 – Easy Data Gathering

Set test parameters then “Confirm”. Then press “Run Test”. MARC™ begins to gather data as soon as the curing light triggers the optical sensor.

2 – Quickly Set Parameters

Auto fill functions help the MARC™ operator to quickly insert the specific curing light and mode (Figure 1). The database includes all test parameter data along with the resulting time, irradiance and spectral emission data. This allows for detailed future analysis.

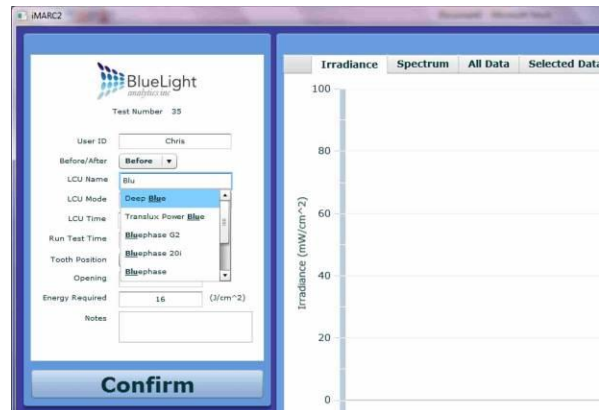


Figure 1

3 – Scientific Accuracy Made Easy

Data collection is automated to ensure scientific accuracy in simple steps. These include:

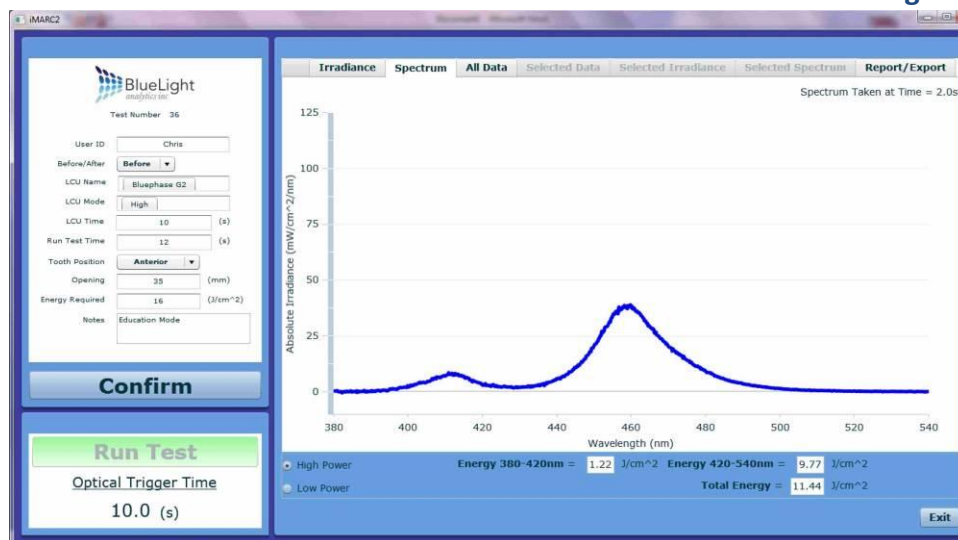
Automatic zeroing – Immediately prior to each test, the spectrometer is automatically zeroed to account for changes in ambient light (e.g., turning the operatory light on or off).

Optical timer triggers – Time data are calculated using optical triggers that capture the precise start and stop times of the dental curing light.

Disaggregated total energy – The amount of energy delivered in the 360 – 420 nm range and in the 420 – 540 nm range are presented separately, in addition to the total energy delivered between 360 – 540 nm (Figure 2). This is important because some composite resins require specific amounts of energy to be delivered in each of these spectral ranges in order to be adequately cured and achieve the desired properties.

Errors can be immediately corrected – Specific test data can be easily removed from the database when errors in data collection occur.

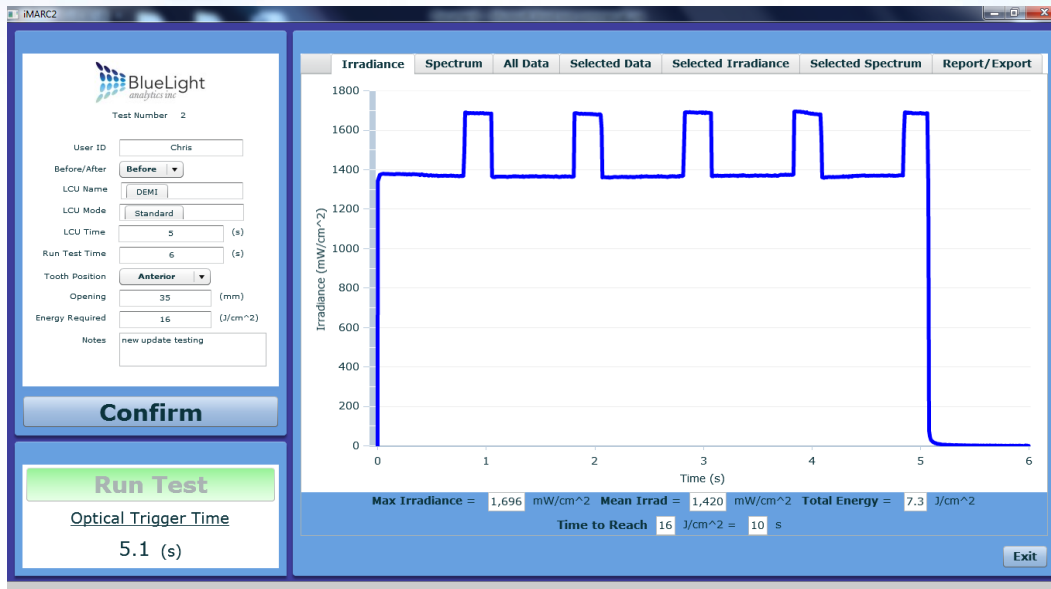
Figure 2



4 – Accurate Data Display

Irradiance and spectral emission data are displayed in a manner that provides immediate feedback on the user's performance. For example, Figure 3 shows a curing light that has a pulsing feature. The optical trigger time (that starts when the curing light hits the sensor and calculates when the curing light turns off) is displayed in the bottom left corner of the interface and recorded in the data.

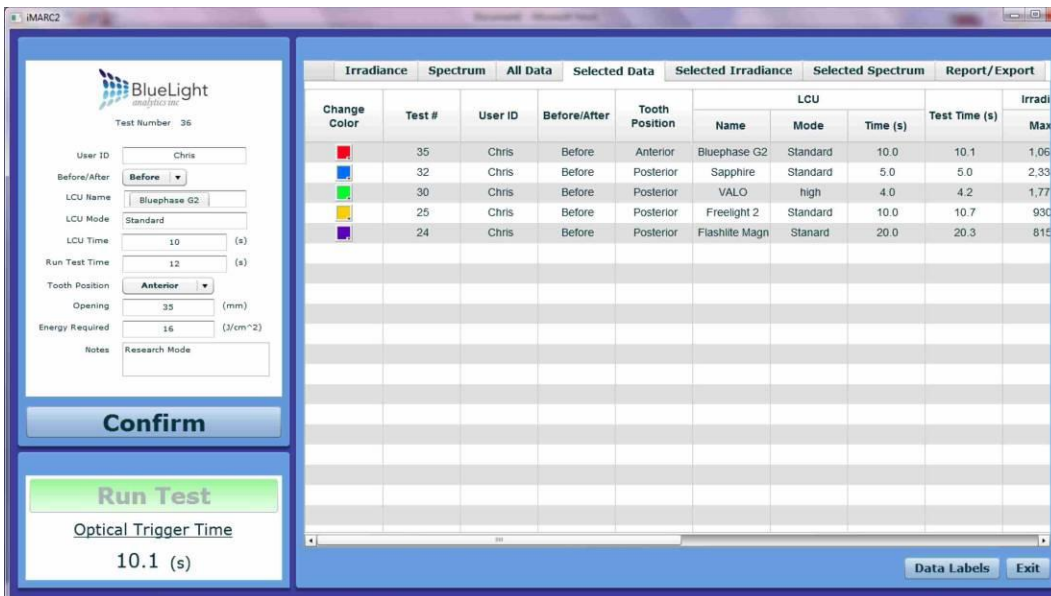
Figure 3



6 – Immediate Data Reporting

Test data can be immediately viewed in a datasheet outlining specific results that can be selected for graphical display by curing light or other parameter (Figure 4).

Figure 4



7 – Simple Data Graphing and Comparisons

Specific selected data can be immediately viewed (Figure 5) with up to 17 user-defined pop-up data labels (Figure 6) providing reference or additional data as desired. Graphs are immediately available for both irradiance and spectra (Figure 7 on the next page). To accommodate for the wide range in curing light outputs, the Y-axis scale in the spectra view can be adjusted to accommodate low or high power curing lights. In the irradiance view, the Y-axis auto-scales.

Figure 5

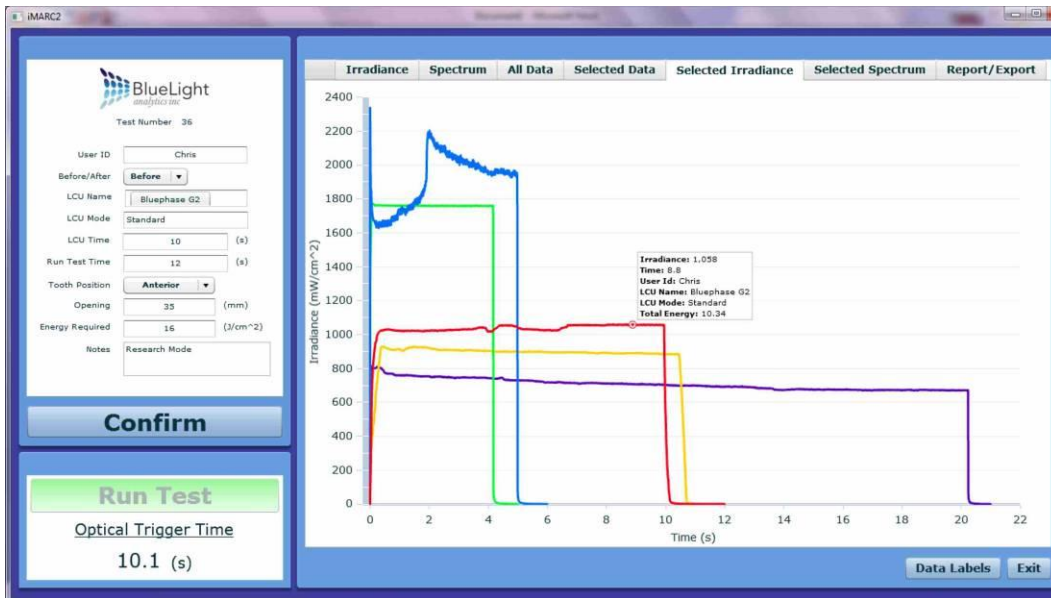


Figure 6

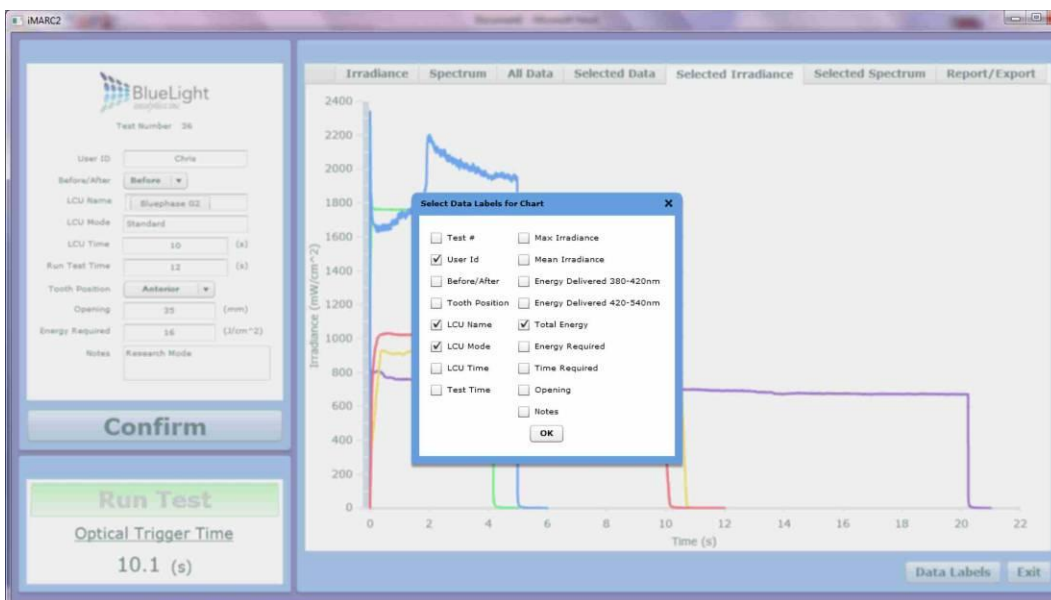
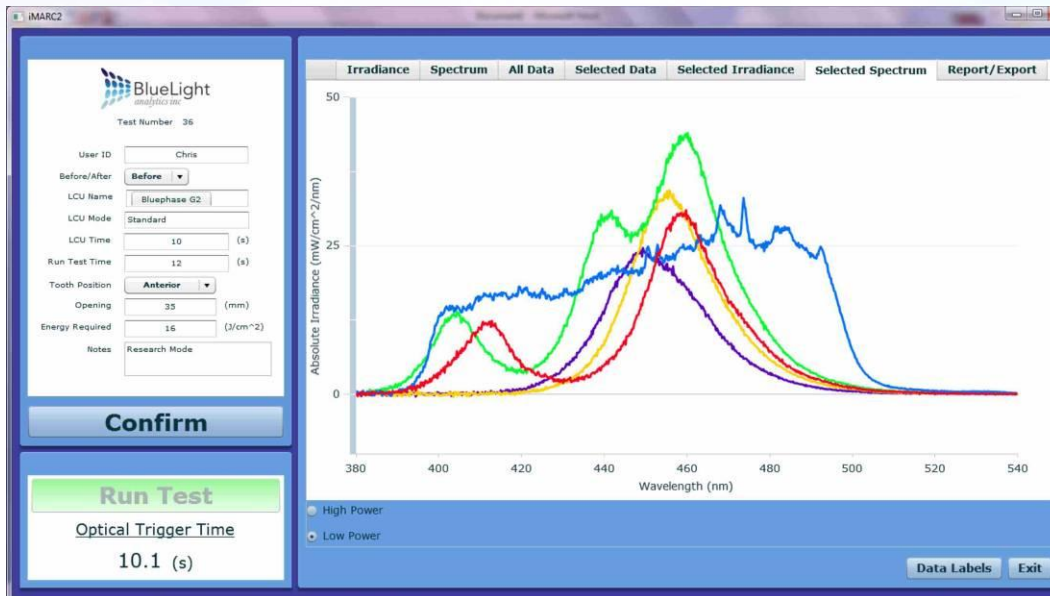


Figure 7



8 – Simple Data & Image Exporting

All data can be quickly and immediately exported to a .CSV file (Figure 8) and can include all of the raw irradiance and spectral emission data if desired. This file type can be opened by most graphical and statistical programs (Figure 9 on the next page). User defined images displaying selected irradiance or spectral emission data can be exported just as quickly and easily.

Figure 8

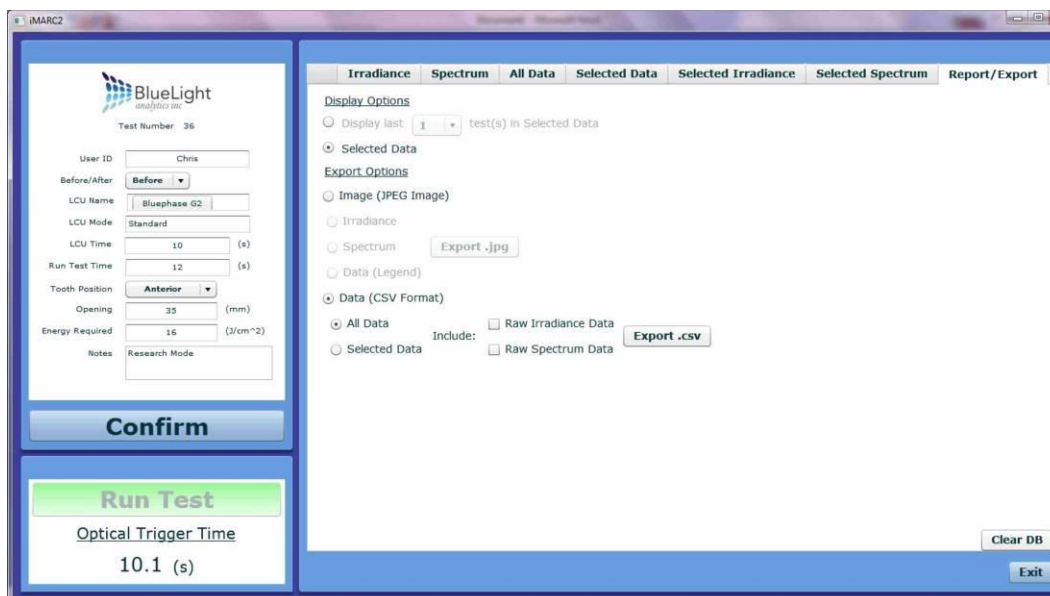


Figure 9

A	B	C	D	E	F	G	H	I	J	K	L	M	N	O	P	
1	id	testnumber	userid	toothpos	curinglight	mode	curingtime	energytime	runtime	energytotal	energy380	energy420	meanirrad	maxirrad	notes	timedelivery
2	1	1	Chris	Anterior	SmartLite IQ2	Standard	10	16	10.049	9.786321	0.007163	9.778154	974.457458	1005.848389	Startup Testing	16.349352
3	2	2	Chris	Anterior	DEMI	Standard	5	16	5.129	7.363681	0.025143	7.338545	1428.917725	1721.368896	Startup Testing	10.864132
4	3	3	Chris	Anterior	Elipar S10	Standard	10	16	10.201	17.381023	0.16211	17.218906	1701.95166	1836.129883	Startup Testing	9.205441
5	4	4	Chris	Anterior	Bluephase G2	High	10	16	10.194	10.983471	1.071817	9.911654	1078.256104	1116.918335	Startup Testing	14.567345
6	5	5	Chris	Anterior	FlashMax 2	Standard	3	16	3.082	9.647972	0.022594	9.62538	3125.338867	3264.1521	Startup Testing	4.975139
7	6	6	Chris	Anterior	Flashlite Magna	Standard	20	16	20.337	21.583794	0.143694	21.440065	1060.569336	1205.383545	Startup Testing	14.825939
8	7	7	Chris	Anterior	Freelight 2	Standard	10	16	10.781	15.270561	0.04541	15.225157	1422.429321	1572.245239	Startup Testing	10.477676
9	8	8	Chris	Anterior	Bluephase 20i	Turbo	5	16	5.105	10.272466	1.078872	9.193598	2018.999146	2166.657227	Startup Testing	7.787809
10	9	9	Chris	Anterior	Allegro	Standard	10	16	10.013	15.395794	0.121448	15.274351	1536.973999	1644.838013	Startup Testing	10.392448
11	10	10	Chris	Anterior	SmartLite IQ	Standard	10	16	10.013	8.244184	0.011092	8.233084	822.992615	847.372314	Startup Testing	19.407619
12	11	11	Chris	Anterior	SmartLite PS	Standard	10	16	10.154	13.437885	0.036209	13.401677	1329.040771	1407.049561	Startup Testing	11.906635
13	12	12	Chris	Anterior	VALO	Standard	10	16	10.209	12.092614	1.859469	10.233142	1184.039429	1210.243774	Startup Testing	13.231216
14	13	13	Chris	Anterior	VALO	high	4	16	4.301	7.251965	1.062964	6.188993	1682.597534	1754.988281	Startup Testing	8.825194
15	14	14	Chris	Anterior	VALO	plasma	3	16	3.231	9.722626	1.514584	8.208041	3013.620117	3129.497314	Startup Testing	4.936938
16	15	15	Chris	Anterior	Sapphire	Standard	5	16	5.089	9.139125	1.504097	7.635043	1797.319458	2267.734863	Startup Testing	8.753563
17	17	17	Chris	Anterior	Optilux 501	Standard	10	16	10.181	12.58554	2.188576	10.396961	1238.254761	1370.657959	Startup Testing 10mm	12.713002
18	18	18	Chris	Posterior	SmartLite IQ2	Standard	10	16	10.042	6.566069	0.022596	6.543469	653.403137	673.80011	Startup Testing	24.367699
19	19	19	Chris	Posterior	DEMI	Standard	5	16	5.12	6.85295	0.025249	6.827701	1337.863403	1592.959351	Startup Testing	11.673805
20	20	20	Chris	Posterior	Elipar S10	Standard	10	16	10.162	15.062042	0.136255	14.925808	1481.918457	1564.099628	Startup Testing	10.622729
21	21	21	Chris	Posterior	Bluephase G2	High	10	16	10.158	13.811186	1.242915	12.568264	1361.772217	1410.754399	Startup Testing	11.584813
22	22	22	Chris	Posterior	FlashMax 2	Standard	3	16	3.043	6.432592	0.015043	6.41755	2112.842773	2171.849609	Startup Testing	7.461999
23	23	23	Chris	Posterior	Bluephase 20i	Turbo	5	16	5.089	9.467267	1.330033	8.137239	1863.217407	1991.387939	Startup Testing	8.450169
24	24	24	Chris	Posterior	Flashlite Magna	Standard	20	16	20.301001	14.316759	0.115458	14.201311	704.662537	815.159668	Startup Testing	22.351427
25	25	25	Chris	Posterior	Freelight 2	Standard	10	16	10.737	9.435881	0.027273	9.408607	882.255188	930.170288	Startup Testing	16.956551
26	26	26	Chris	Posterior	Allegro	Standard	10	16	9.993	15.164908	0.135931	15.028977	1515.382935	1639.52478	Startup Testing	10.550673
27	27	27	Chris	Posterior	SmartLite IQ	Standard	10	16	10.001	7.137582	0.024395	7.113176	711.948975	865.984802	Startup Testing	22.416555

**How Much Energy:
...do you deliver?
...and does your resin need?**



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