

# **VSLM**

## Introduction

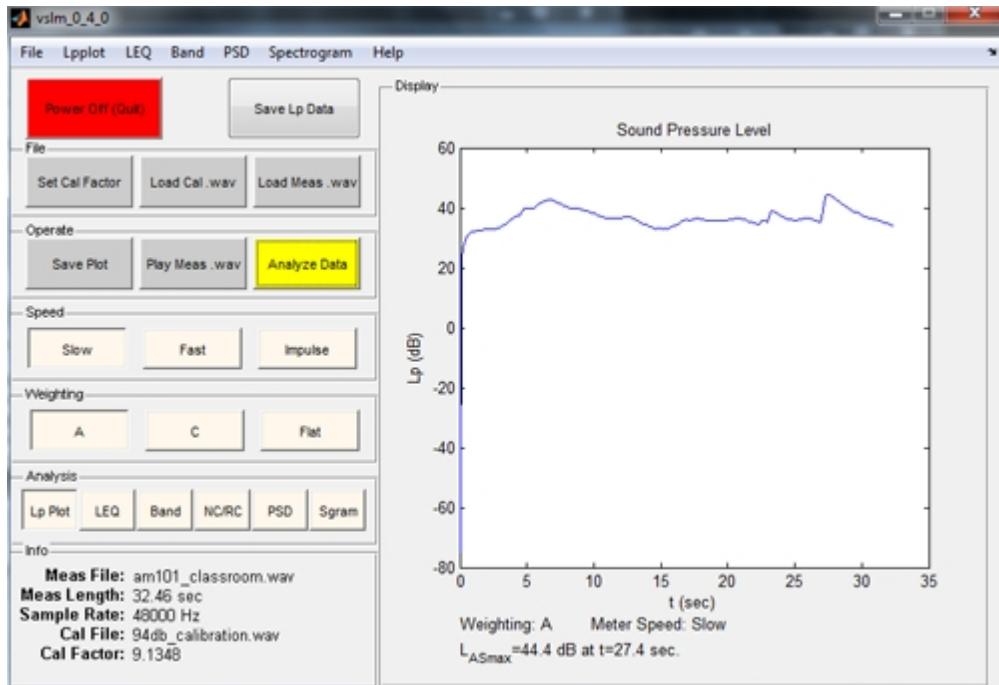


## Introduction

Welcome to VSLM, the virtual sound level meter. The purpose of this program is to provide students, educators, researchers and consultants with a tool for acoustic analysis of calibrated sound level recordings. The basic idea came out of a desire to allow students to analyze acoustic signals without the need for expensive full featured sound level meters. Instructors or students would make calibrated digital sound recordings of acoustic questions for analysis and analyze them on software. In this manner educators could present students with a series of differing acoustic signals and let them hear the signals and then see the analysis of the signals. The VSLM software would let the students "play" with the analyzers and see what differing settings do to the analysis of the signal.

Because the VSLM follows ANSI acoustic measurement and analysis standards for most analysis, the results obtained with VSLM should match the results that would be obtained with other measurement software or equipment.

The current version of VSLM is limited to basic integrating, 1/3 octave band/FFT sound level meter functions. The plan is to expand the capabilities to include impulse response analysis, and multichannel coherence and cross correlation analysis among other features.



## Welcome

## About VSLM

The purpose of the Virtual Sound Level Meter (VSLM) program is to provide students, educators, researchers and consultants with a tool for acoustic analysis of calibrated sound level recordings. The basic idea came out of a desire to allow students to analyze acoustic signals without the need for expensive full featured sound level meters. Instructors or

students would make calibrated digital sound recordings of acoustic questions for analysis and analyze them on software. In this manner educators could present students with a series of differing acoustic signals and let them hear the signals and then see the analysis of the signals. The VSLM software would let the students "play" with the analyzers and see what differing settings do to the analysis of the signal.

VSLM was initially developed using Python but was rewritten using MATLAB V7.10.0.499 (R2010a) with the Signal Processing Toolbox V6.13 (R2010a). The MATLAB files have been compiled for Windows using the MATLAB compiler.

<http://www.mathworks.com/>  
[http://www.mathworks.com/products/signal/?s\\_cid=global\\_nav](http://www.mathworks.com/products/signal/?s_cid=global_nav)  
[http://www.mathworks.com/products/compiler/?s\\_cid=global\\_nav](http://www.mathworks.com/products/compiler/?s_cid=global_nav)

## What's new

---

### What's New

#### What's new in V 0.4.1:

This is the initial release of VSLM so everything is new!

## Sponsor

---

### Sponsor

This project was sponsored through a generous grant of Theodore John Schultz grant For Advancement of Acoustical Education from the Robert Bradford Newman Student Award Fund.

<http://www.newmanfund.org/>

Robert Bradford Newman, a founding member of Bolt Beranek and Newman Inc., was a faculty member of the School of Architecture and Planning, MIT, and of the Graduate School of Design, Harvard University for thirty years. He was widely known as a teacher with extraordinary ability to communicate the essentials of architectural acoustics.

A committee of his friends has developed this program to honor outstanding students at schools of architecture and architectural engineering throughout the world. Students selected for the Newman Medals must have demonstrated excellence in this discipline and in the application of acoustical design principles in the course of their study.

The fund will annually provide individual medal awards at qualifying institutions. It will also strive to support the development of improved teaching methods which promote the study of architectural acoustics, a discipline to which Bob Newman dedicated his life.

**Users of this software are encouraged to make a donation to the Newman Fund to support future development of educational materials for acoustics education.**

## Future Work

---

### Future Development

This software was initially developed with support from a grant from the Newman Fund. The software has been released to the public using the GNU Public License (GPL) and it is hoped that others will join in the further development of the

software.

Anyone wishing to work with the developers on bug fixes and future development of VSLM should go to the Sourceforge web site and request to join the development team

<http://sourceforge.net/projects/vslm/>

# Copyright

---

## About VSLM

Copyright (C) 2011 by Ralph T. Muehleisen and Brent McQuillan

This software is copyrighted under the [GNU Public License \(GPL\)](#)

This program is free software: you can redistribute it and/or modify it under the terms of the GNU General Public License as published by the Free Software Foundation, either version 3 of the License, or (at your option) any later version. This program is distributed in the hope that it will be useful, but WITHOUT ANY WARRANTY; without even the implied warranty of MERCHANTABILITY or FITNESS FOR A PARTICULAR PURPOSE. See the GNU General Public License for more details. You should have received a copy of the GNU General Public License along with this program. If not, see <<http://www.gnu.org/licenses/>>.

Users with questions about licensing should contact the primary author at [vslm.info@gmail.com](mailto:vslm.info@gmail.com)

## GPL

---

### GNU GENERAL PUBLIC LICENSE

Version 3, 29 June 2007

Copyright (C) 2007 Free Software Foundation, Inc. <<http://fsf.org/>>

Everyone is permitted to copy and distribute verbatim copies  
of this license document, but changing it is not allowed.

#### Preamble

The GNU General Public License is a free, copyleft license for  
software and other kinds of works.

The licenses for most software and other practical works are designed  
to take away your freedom to share and change the works. By contrast,  
the GNU General Public License is intended to guarantee your freedom to  
share and change all versions of a program--to make sure it remains free  
software for all its users. We, the Free Software Foundation, use the  
GNU General Public License for most of our software; it applies also to  
any other work released this way by its authors. You can apply it to  
your programs, too.

When we speak of free software, we are referring to freedom, not  
price. Our General Public Licenses are designed to make sure that you  
have the freedom to distribute copies of free software (and charge for  
them if you wish), that you receive source code or can get it if you  
want it, that you can change the software or use pieces of it in new  
free programs, and that you know you can do these things.

To protect your rights, we need to prevent others from denying you  
these rights or asking you to surrender the rights. Therefore, you have  
certain responsibilities if you distribute copies of the software, or if  
you modify it: responsibilities to respect the freedom of others.

For example, if you distribute copies of such a program, whether  
gratis or for a fee, you must pass on to the recipients the same  
freedoms that you received. You must make sure that they, too, receive  
or can get the source code. And you must show them these terms so they  
know their rights.

Developers that use the GNU GPL protect your rights with two steps:  
(1) assert copyright on the software, and (2) offer you this License  
giving you legal permission to copy, distribute and/or modify it.

For the developers' and authors' protection, the GPL clearly explains  
that there is no warranty for this free software. For both users' and  
authors' sake, the GPL requires that modified versions be marked as

changed, so that their problems will not be attributed erroneously to authors of previous versions.

Some devices are designed to deny users access to install or run modified versions of the software inside them, although the manufacturer can do so. This is fundamentally incompatible with the aim of protecting users' freedom to change the software. The systematic pattern of such abuse occurs in the area of products for individuals to use, which is precisely where it is most unacceptable. Therefore, we have designed this version of the GPL to prohibit the practice for those products. If such problems arise substantially in other domains, we stand ready to extend this provision to those domains in future versions of the GPL, as needed to protect the freedom of users.

Finally, every program is threatened constantly by software patents. States should not allow patents to restrict development and use of software on general-purpose computers, but in those that do, we wish to avoid the special danger that patents applied to a free program could make it effectively proprietary. To prevent this, the GPL assures that patents cannot be used to render the program non-free.

The precise terms and conditions for copying, distribution and modification follow.

#### TERMS AND CONDITIONS

##### 0. Definitions.

"This License" refers to version 3 of the GNU General Public License.

"Copyright" also means copyright-like laws that apply to other kinds of works, such as semiconductor masks.

"The Program" refers to any copyrightable work licensed under this License. Each licensee is addressed as "you". "Licensees" and "recipients" may be individuals or organizations.

To "modify" a work means to copy from or adapt all or part of the work in a fashion requiring copyright permission, other than the making of an exact copy. The resulting work is called a "modified version" of the earlier work or a work "based on" the earlier work.

A "covered work" means either the unmodified Program or a work based on the Program.

To "propagate" a work means to do anything with it that, without permission, would make you directly or secondarily liable for infringement under applicable copyright law, except executing it on a computer or modifying a private copy. Propagation includes copying, distribution (with or without modification), making available to the public, and in some countries other activities as well.

To "convey" a work means any kind of propagation that enables other parties to make or receive copies. Mere interaction with a user through a computer network, with no transfer of a copy, is not conveying.

An interactive user interface displays "Appropriate Legal Notices" to the extent that it includes a convenient and prominently visible feature that (1) displays an appropriate copyright notice, and (2) tells the user that there is no warranty for the work (except to the extent that warranties are provided), that licensees may convey the work under this License, and how to view a copy of this License. If the interface presents a list of user commands or options, such as a menu, a prominent item in the list meets this criterion.

##### 1. Source Code.

The "source code" for a work means the preferred form of the work for making modifications to it. "Object code" means any non-source form of a work.

A "Standard Interface" means an interface that either is an official standard defined by a recognized standards body, or, in the case of interfaces specified for a particular programming language, one that is widely used among developers working in that language.

The "System Libraries" of an executable work include anything, other than the work as a whole, that (a) is included in the normal form of packaging a Major Component, but which is not part of that Major

Component, and (b) serves only to enable use of the work with that Major Component, or to implement a Standard Interface for which an implementation is available to the public in source code form. A "Major Component", in this context, means a major essential component (kernel, window system, and so on) of the specific operating system (if any) on which the executable work runs, or a compiler used to produce the work, or an object code interpreter used to run it.

The "Corresponding Source" for a work in object code form means all the source code needed to generate, install, and (for an executable work) run the object code and to modify the work, including scripts to control those activities. However, it does not include the work's System Libraries, or general-purpose tools or generally available free programs which are used unmodified in performing those activities but which are not part of the work. For example, Corresponding Source includes interface definition files associated with source files for the work, and the source code for shared libraries and dynamically linked subprograms that the work is specifically designed to require, such as by intimate data communication or control flow between those subprograms and other parts of the work.

The Corresponding Source need not include anything that users can regenerate automatically from other parts of the Corresponding Source.

The Corresponding Source for a work in source code form is that same work.

## 2. Basic Permissions.

All rights granted under this License are granted for the term of copyright on the Program, and are irrevocable provided the stated conditions are met. This License explicitly affirms your unlimited permission to run the unmodified Program. The output from running a covered work is covered by this License only if the output, given its content, constitutes a covered work. This License acknowledges your rights of fair use or other equivalent, as provided by copyright law.

You may make, run and propagate covered works that you do not convey, without conditions so long as your license otherwise remains in force. You may convey covered works to others for the sole purpose of having them make modifications exclusively for you, or provide you with facilities for running those works, provided that you comply with the terms of this License in conveying all material for which you do not control copyright. Those thus making or running the covered works for you must do so exclusively on your behalf, under your direction and control, on terms that prohibit them from making any copies of your copyrighted material outside their relationship with you.

Conveying under any other circumstances is permitted solely under the conditions stated below. Sublicensing is not allowed; section 10 makes it unnecessary.

## 3. Protecting Users' Legal Rights From Anti-Circumvention Law.

No covered work shall be deemed part of an effective technological measure under any applicable law fulfilling obligations under article 11 of the WIPO copyright treaty adopted on 20 December 1996, or similar laws prohibiting or restricting circumvention of such measures.

When you convey a covered work, you waive any legal power to forbid circumvention of technological measures to the extent such circumvention is effected by exercising rights under this License with respect to the covered work, and you disclaim any intention to limit operation or modification of the work as a means of enforcing, against the work's users, your or third parties' legal rights to forbid circumvention of technological measures.

## 4. Conveying Verbatim Copies.

You may convey verbatim copies of the Program's source code as you receive it, in any medium, provided that you conspicuously and appropriately publish on each copy an appropriate copyright notice;

keep intact all notices stating that this License and any non-permissive terms added in accord with section 7 apply to the code; keep intact all notices of the absence of any warranty; and give all recipients a copy of this License along with the Program.

You may charge any price or no price for each copy that you convey, and you may offer support or warranty protection for a fee.

#### 5. Conveying Modified Source Versions.

You may convey a work based on the Program, or the modifications to produce it from the Program, in the form of source code under the terms of section 4, provided that you also meet all of these conditions:

- a) The work must carry prominent notices stating that you modified it, and giving a relevant date.
- b) The work must carry prominent notices stating that it is released under this License and any conditions added under section 7. This requirement modifies the requirement in section 4 to "keep intact all notices".
- c) You must license the entire work, as a whole, under this License to anyone who comes into possession of a copy. This License will therefore apply, along with any applicable section 7 additional terms, to the whole of the work, and all its parts, regardless of how they are packaged. This License gives no permission to license the work in any other way, but it does not invalidate such permission if you have separately received it.
- d) If the work has interactive user interfaces, each must display Appropriate Legal Notices; however, if the Program has interactive interfaces that do not display Appropriate Legal Notices, your work need not make them do so.

A compilation of a covered work with other separate and independent works, which are not by their nature extensions of the covered work, and which are not combined with it such as to form a larger program, in or on a volume of a storage or distribution medium, is called an "aggregate" if the compilation and its resulting copyright are not used to limit the access or legal rights of the compilation's users beyond what the individual works permit. Inclusion of a covered work in an aggregate does not cause this License to apply to the other parts of the aggregate.

#### 6. Conveying Non-Source Forms.

You may convey a covered work in object code form under the terms of sections 4 and 5, provided that you also convey the machine-readable Corresponding Source under the terms of this License, in one of these ways:

- a) Convey the object code in, or embodied in, a physical product (including a physical distribution medium), accompanied by the Corresponding Source fixed on a durable physical medium customarily used for software interchange.
- b) Convey the object code in, or embodied in, a physical product (including a physical distribution medium), accompanied by a written offer, valid for at least three years and valid for as long as you offer spare parts or customer support for that product model, to give anyone who possesses the object code either (1) a copy of the Corresponding Source for all the software in the product that is covered by this License, on a durable physical medium customarily used for software interchange, for a price no more than your reasonable cost of physically performing this conveying of source, or (2) access to copy the Corresponding Source from a network server at no charge.
- c) Convey individual copies of the object code with a copy of the written offer to provide the Corresponding Source. This alternative is allowed only occasionally and noncommercially, and only if you received the object code with such an offer, in accord with subsection 6b.
- d) Convey the object code by offering access from a designated

place (gratis or for a charge), and offer equivalent access to the Corresponding Source in the same way through the same place at no further charge. You need not require recipients to copy the Corresponding Source along with the object code. If the place to copy the object code is a network server, the Corresponding Source may be on a different server (operated by you or a third party) that supports equivalent copying facilities, provided you maintain clear directions next to the object code saying where to find the Corresponding Source. Regardless of what server hosts the Corresponding Source, you remain obligated to ensure that it is available for as long as needed to satisfy these requirements.

e) Convey the object code using peer-to-peer transmission, provided you inform other peers where the object code and Corresponding Source of the work are being offered to the general public at no charge under subsection 6d.

A separable portion of the object code, whose source code is excluded from the Corresponding Source as a System Library, need not be included in conveying the object code work.

A "User Product" is either (1) a "consumer product", which means any tangible personal property which is normally used for personal, family, or household purposes, or (2) anything designed or sold for incorporation into a dwelling. In determining whether a product is a consumer product, doubtful cases shall be resolved in favor of coverage. For a particular product received by a particular user, "normally used" refers to a typical or common use of that class of product, regardless of the status of the particular user or of the way in which the particular user actually uses, or expects or is expected to use, the product. A product is a consumer product regardless of whether the product has substantial commercial, industrial or non-consumer uses, unless such uses represent the only significant mode of use of the product.

"Installation Information" for a User Product means any methods, procedures, authorization keys, or other information required to install and execute modified versions of a covered work in that User Product from a modified version of its Corresponding Source. The information must suffice to ensure that the continued functioning of the modified object code is in no case prevented or interfered with solely because modification has been made.

If you convey an object code work under this section in, or with, or specifically for use in, a User Product, and the conveying occurs as part of a transaction in which the right of possession and use of the User Product is transferred to the recipient in perpetuity or for a fixed term (regardless of how the transaction is characterized), the Corresponding Source conveyed under this section must be accompanied by the Installation Information. But this requirement does not apply if neither you nor any third party retains the ability to install modified object code on the User Product (for example, the work has been installed in ROM).

The requirement to provide Installation Information does not include a requirement to continue to provide support service, warranty, or updates for a work that has been modified or installed by the recipient, or for the User Product in which it has been modified or installed. Access to a network may be denied when the modification itself materially and adversely affects the operation of the network or violates the rules and protocols for communication across the network.

Corresponding Source conveyed, and Installation Information provided, in accord with this section must be in a format that is publicly documented (and with an implementation available to the public in source code form), and must require no special password or key for unpacking, reading or copying.

## 7. Additional Terms.

"Additional permissions" are terms that supplement the terms of this License by making exceptions from one or more of its conditions.

Additional permissions that are applicable to the entire Program shall be treated as though they were included in this License, to the extent that they are valid under applicable law. If additional permissions apply only to part of the Program, that part may be used separately under those permissions, but the entire Program remains governed by this License without regard to the additional permissions.

When you convey a copy of a covered work, you may at your option remove any additional permissions from that copy, or from any part of it. (Additional permissions may be written to require their own removal in certain cases when you modify the work.) You may place additional permissions on material, added by you to a covered work, for which you have or can give appropriate copyright permission.

Notwithstanding any other provision of this License, for material you add to a covered work, you may (if authorized by the copyright holders of that material) supplement the terms of this License with terms:

- a) Disclaiming warranty or limiting liability differently from the terms of sections 15 and 16 of this License; or
- b) Requiring preservation of specified reasonable legal notices or author attributions in that material or in the Appropriate Legal Notices displayed by works containing it; or
- c) Prohibiting misrepresentation of the origin of that material, or requiring that modified versions of such material be marked in reasonable ways as different from the original version; or
- d) Limiting the use for publicity purposes of names of licensors or authors of the material; or
- e) Declining to grant rights under trademark law for use of some trade names, trademarks, or service marks; or
- f) Requiring indemnification of licensors and authors of that material by anyone who conveys the material (or modified versions of it) with contractual assumptions of liability to the recipient, for any liability that these contractual assumptions directly impose on those licensors and authors.

All other non-permissive additional terms are considered "further restrictions" within the meaning of section 10. If the Program as you received it, or any part of it, contains a notice stating that it is governed by this License along with a term that is a further restriction, you may remove that term. If a license document contains a further restriction but permits relicensing or conveying under this License, you may add to a covered work material governed by the terms of that license document, provided that the further restriction does not survive such relicensing or conveying.

If you add terms to a covered work in accord with this section, you must place, in the relevant source files, a statement of the additional terms that apply to those files, or a notice indicating where to find the applicable terms.

Additional terms, permissive or non-permissive, may be stated in the form of a separately written license, or stated as exceptions; the above requirements apply either way.

#### 8. Termination.

You may not propagate or modify a covered work except as expressly provided under this License. Any attempt otherwise to propagate or modify it is void, and will automatically terminate your rights under this License (including any patent licenses granted under the third paragraph of section 11).

However, if you cease all violation of this License, then your license from a particular copyright holder is reinstated (a) provisionally, unless and until the copyright holder explicitly and finally terminates your license, and (b) permanently, if the copyright holder fails to notify you of the violation by some reasonable means prior to 60 days after the cessation.

Moreover, your license from a particular copyright holder is reinstated permanently if the copyright holder notifies you of the

violation by some reasonable means, this is the first time you have received notice of violation of this License (for any work) from that copyright holder, and you cure the violation prior to 30 days after your receipt of the notice.

Termination of your rights under this section does not terminate the licenses of parties who have received copies or rights from you under this License. If your rights have been terminated and not permanently reinstated, you do not qualify to receive new licenses for the same material under section 10.

#### 9. Acceptance Not Required for Having Copies.

You are not required to accept this License in order to receive or run a copy of the Program. Ancillary propagation of a covered work occurring solely as a consequence of using peer-to-peer transmission to receive a copy likewise does not require acceptance. However, nothing other than this License grants you permission to propagate or modify any covered work. These actions infringe copyright if you do not accept this License. Therefore, by modifying or propagating a covered work, you indicate your acceptance of this License to do so.

#### 10. Automatic Licensing of Downstream Recipients.

Each time you convey a covered work, the recipient automatically receives a license from the original licensors, to run, modify and propagate that work, subject to this License. You are not responsible for enforcing compliance by third parties with this License.

An "entity transaction" is a transaction transferring control of an organization, or substantially all assets of one, or subdividing an organization, or merging organizations. If propagation of a covered work results from an entity transaction, each party to that transaction who receives a copy of the work also receives whatever licenses to the work the party's predecessor in interest had or could give under the previous paragraph, plus a right to possession of the Corresponding Source of the work from the predecessor in interest, if the predecessor has it or can get it with reasonable efforts.

You may not impose any further restrictions on the exercise of the rights granted or affirmed under this License. For example, you may not impose a license fee, royalty, or other charge for exercise of rights granted under this License, and you may not initiate litigation (including a cross-claim or counterclaim in a lawsuit) alleging that any patent claim is infringed by making, using, selling, offering for sale, or importing the Program or any portion of it.

#### 11. Patents.

A "contributor" is a copyright holder who authorizes use under this License of the Program or a work on which the Program is based. The work thus licensed is called the contributor's "contributor version".

A contributor's "essential patent claims" are all patent claims owned or controlled by the contributor, whether already acquired or hereafter acquired, that would be infringed by some manner, permitted by this License, of making, using, or selling its contributor version, but do not include claims that would be infringed only as a consequence of further modification of the contributor version. For purposes of this definition, "control" includes the right to grant patent sublicenses in a manner consistent with the requirements of this License.

Each contributor grants you a non-exclusive, worldwide, royalty-free patent license under the contributor's essential patent claims, to make, use, sell, offer for sale, import and otherwise run, modify and propagate the contents of its contributor version.

In the following three paragraphs, a "patent license" is any express agreement or commitment, however denominated, not to enforce a patent (such as an express permission to practice a patent or covenant not to sue for patent infringement). To "grant" such a patent license to a party means to make such an agreement or commitment not to enforce a patent against the party.

If you convey a covered work, knowingly relying on a patent license, and the Corresponding Source of the work is not available for anyone to copy, free of charge and under the terms of this License, through a publicly available network server or other readily accessible means, then you must either (1) cause the Corresponding Source to be so available, or (2) arrange to deprive yourself of the benefit of the patent license for this particular work, or (3) arrange, in a manner consistent with the requirements of this License, to extend the patent license to downstream recipients. "Knowingly relying" means you have actual knowledge that, but for the patent license, your conveying the covered work in a country, or your recipient's use of the covered work in a country, would infringe one or more identifiable patents in that country that you have reason to believe are valid.

If, pursuant to or in connection with a single transaction or arrangement, you convey, or propagate by procuring conveyance of, a covered work, and grant a patent license to some of the parties receiving the covered work authorizing them to use, propagate, modify or convey a specific copy of the covered work, then the patent license you grant is automatically extended to all recipients of the covered work and works based on it.

A patent license is "discriminatory" if it does not include within the scope of its coverage, prohibits the exercise of, or is conditioned on the non-exercise of one or more of the rights that are specifically granted under this License. You may not convey a covered work if you are a party to an arrangement with a third party that is in the business of distributing software, under which you make payment to the third party based on the extent of your activity of conveying the work, and under which the third party grants, to any of the parties who would receive the covered work from you, a discriminatory patent license (a) in connection with copies of the covered work conveyed by you (or copies made from those copies), or (b) primarily for and in connection with specific products or compilations that contain the covered work, unless you entered into that arrangement, or that patent license was granted, prior to 28 March 2007.

Nothing in this License shall be construed as excluding or limiting any implied license or other defenses to infringement that may otherwise be available to you under applicable patent law.

#### 12. No Surrender of Others' Freedom.

If conditions are imposed on you (whether by court order, agreement or otherwise) that contradict the conditions of this License, they do not excuse you from the conditions of this License. If you cannot convey a covered work so as to satisfy simultaneously your obligations under this License and any other pertinent obligations, then as a consequence you may not convey it at all. For example, if you agree to terms that obligate you to collect a royalty for further conveying from those to whom you convey the Program, the only way you could satisfy both those terms and this License would be to refrain entirely from conveying the Program.

#### 13. Use with the GNU Affero General Public License.

Notwithstanding any other provision of this License, you have permission to link or combine any covered work with a work licensed under version 3 of the GNU Affero General Public License into a single combined work, and to convey the resulting work. The terms of this License will continue to apply to the part which is the covered work, but the special requirements of the GNU Affero General Public License, section 13, concerning interaction through a network will apply to the combination as such.

#### 14. Revised Versions of this License.

The Free Software Foundation may publish revised and/or new versions of the GNU General Public License from time to time. Such new versions will be similar in spirit to the present version, but may differ in detail to address new problems or concerns.

Each version is given a distinguishing version number. If the

Program specifies that a certain numbered version of the GNU General Public License "or any later version" applies to it, you have the option of following the terms and conditions either of that numbered version or of any later version published by the Free Software Foundation. If the Program does not specify a version number of the GNU General Public License, you may choose any version ever published by the Free Software Foundation.

If the Program specifies that a proxy can decide which future versions of the GNU General Public License can be used, that proxy's public statement of acceptance of a version permanently authorizes you to choose that version for the Program.

Later license versions may give you additional or different permissions. However, no additional obligations are imposed on any author or copyright holder as a result of your choosing to follow a later version.

#### 15. Disclaimer of Warranty.

THERE IS NO WARRANTY FOR THE PROGRAM, TO THE EXTENT PERMITTED BY APPLICABLE LAW. EXCEPT WHEN OTHERWISE STATED IN WRITING THE COPYRIGHT HOLDERS AND/OR OTHER PARTIES PROVIDE THE PROGRAM "AS IS" WITHOUT WARRANTY OF ANY KIND, EITHER EXPRESSED OR IMPLIED, INCLUDING, BUT NOT LIMITED TO, THE IMPLIED WARRANTIES OF MERCHANTABILITY AND FITNESS FOR A PARTICULAR PURPOSE. THE ENTIRE RISK AS TO THE QUALITY AND PERFORMANCE OF THE PROGRAM IS WITH YOU. SHOULD THE PROGRAM PROVE DEFECTIVE, YOU ASSUME THE COST OF ALL NECESSARY SERVICING, REPAIR OR CORRECTION.

#### 16. Limitation of Liability.

IN NO EVENT UNLESS REQUIRED BY APPLICABLE LAW OR AGREED TO IN WRITING WILL ANY COPYRIGHT HOLDER, OR ANY OTHER PARTY WHO MODIFIES AND/OR CONVEYS THE PROGRAM AS PERMITTED ABOVE, BE LIABLE TO YOU FOR DAMAGES, INCLUDING ANY GENERAL, SPECIAL, INCIDENTAL OR CONSEQUENTIAL DAMAGES ARISING OUT OF THE USE OR INABILITY TO USE THE PROGRAM (INCLUDING BUT NOT LIMITED TO LOSS OF DATA OR DATA BEING RENDERED INACCURATE OR LOSSES SUSTAINED BY YOU OR THIRD PARTIES OR A FAILURE OF THE PROGRAM TO OPERATE WITH ANY OTHER PROGRAMS), EVEN IF SUCH HOLDER OR OTHER PARTY HAS BEEN ADVISED OF THE POSSIBILITY OF SUCH DAMAGES.

#### 17. Interpretation of Sections 15 and 16.

If the disclaimer of warranty and limitation of liability provided above cannot be given local legal effect according to their terms, reviewing courts shall apply local law that most closely approximates an absolute waiver of all civil liability in connection with the Program, unless a warranty or assumption of liability accompanies a copy of the Program in return for a fee.

END OF TERMS AND CONDITIONS

## Getting Started

---

### Getting Started



The most current version of the VSLM software will usually be available at the source forge web site:

<http://sourceforge.net/projects/vslm/>

## Installation

---

### Installation

VSLM has two versions: MATLAB source code and a complied .exe file available for Windows XP, Vista or Windows 7. The software can be obtained from Sourceforge

<http://sourceforge.net/projects/vslm/files>

The MATLAB source code is found in the file vslm\_source\_xxx.zip where xxx is the version number. This source code needs no special installation, but the MATLAB signal processing toolbox is required.

The two files vslm.m and vslm.fig must be in the same directory.

Documentation, including the source code used by HelpNDoc can be found in the vslm\_help\_xxx.zip file. This file should be unzipped in the same directory as the source files for proper access. Help files were generated using the HelpNDoc software package which is free for non-commercial use. You can get more info at  
<http://www.helpndoc.com/>

For windows users who do not have Matlab and the Signal Processing Toolbox, a compiled executable package vslm\_setup\_xxx.exe is available. This setup package contains the MATLAB runtime library in addition to the vslm executable software. Users should download this package and place in the directory of interest and run vslm\_setup. This will unpack the software and run the MATLAB runtime library install.

Once the MATLAB runtime library

## System requirements

---

### System Requirements

The .exe version of this software requires Windows XP, Vista or Windows 7 with at least 1 G of RAM.

The MATLAB version of this software requires Matlab R12 or later with the Signal Processing toolbox.

## Basic Operation

---

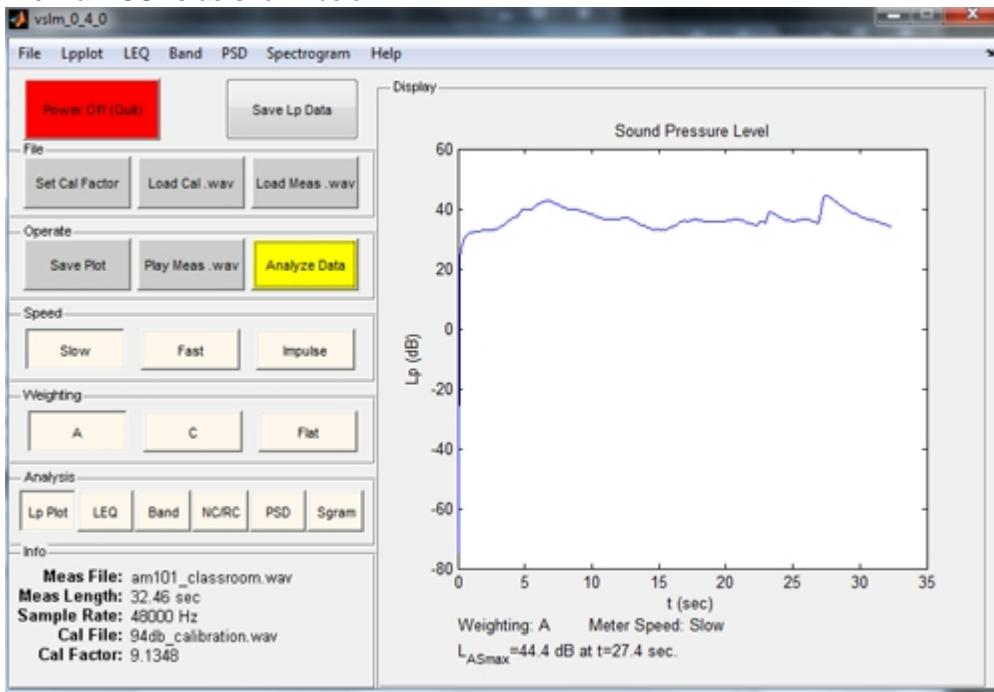
### Basic Operation

The basic operation of VSLM has five steps:

- 1) [Load a calibration file or set calibration](#)
- 2) [Load a measurement file](#)
- 3) [Select weighting](#)

- 3) [Select meter speed \(if applicable\)](#)
- 4) [Select an analysis mode](#)
- 5) [Run an analysis](#)

The software is run through a GUI interface that is meant to somewhat resemble a physical sound analyzer. The main GUI is as shown below:



As one can see there are four main regions:

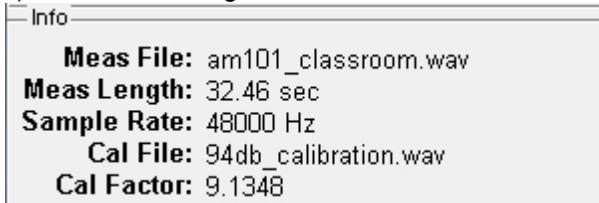
- 1) A menu system at the top that is used for setting user settings and for saving and loading those settings.

[File](#) [Lpplot](#) [LEQ](#) [Band](#) [PSD](#) [Spectrogram](#) [Help](#)

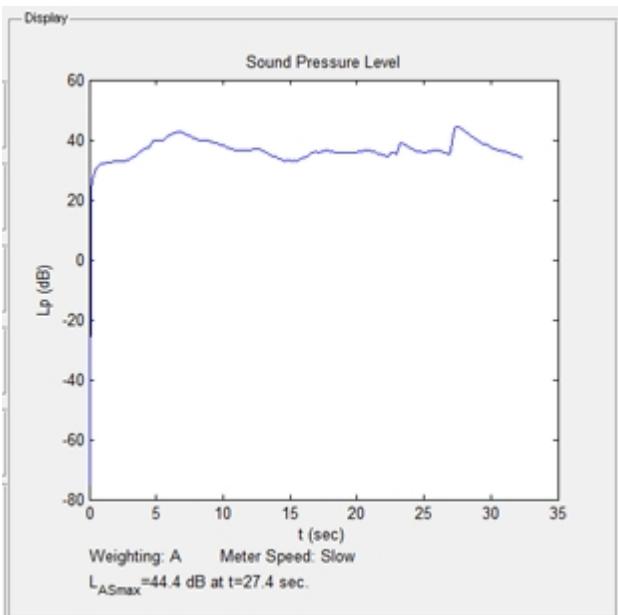
- 2) A set of analysis buttons that are used for actually operating the VSLM



- 3) An info box that gives some information about the currently selected measurement and calibration



- 4) A large display area to the right that displays the analysis plots and computed information.



## Getting help

---

### Getting Help

Because this software is being offered free of charge and source code is also freely available, there is no formal support for this software. Users are welcome to contact the main developer via email for assistance, but assistance with installation and use should not be expected.

#### Email Contact

Please send support emails to:

Bug Reports: [vslm.info@gmail.com](mailto:vslm.info@gmail.com)

Operating Questions: [vslm.info@gmail.com](mailto:vslm.info@gmail.com)

Installation Questions: [vslm.info@gmail.com](mailto:vslm.info@gmail.com)

#### Help Forums

Users are encouraged to use the VSLM help forums at sourceforge.net

<http://sourceforge.net/projects/vslm/forums/forum/1207792>

## Calibration

---

### Calibration

One of the first operations a user should do is to set the calibration constant for the analysis. The calibration constant is converts the .wav file inputs to pascals for analysis by VSLM. Typically .wav files are 16 or 24 bit integers, but if floating point .wav files are saved, the .wav file may already be calibrated in which case the calibration factor of VSLM should be set to 1.0

**Note:** VSLM defaults to a calibration factor of 1.0.

Usually this calibration constant is found by loading a calibration file - a digital recording of the output of an acoustic calibrator. These files should be short (20 to 30 seconds) and one channel (only the first channel of any multichannel recordings is used - the other channels are discarded).

There are two buttons devoted to Calibration operations:

[Load Cal .wav](#)

[Set Cal Factor](#)

### Load Calibration

---

Load Cal .wav



Load Calibration .wav

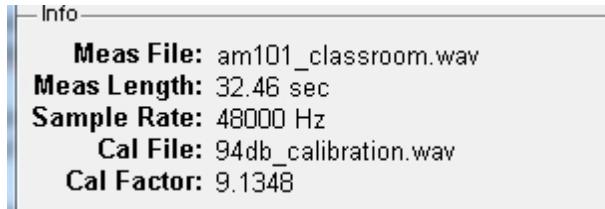
The user should use the "Load Cal .wav" button to load a .wav file that has a calibration recording.

After pressing the Load Cal .wav button a dialog opens to let you select the calibration recording to load. The program then prompts for the calibration level in dB. The program then computes the RMS value of the calibration file and sets the cal factor for the system accordingly.

Only the first 30 seconds of a calibration file will be analyzed. If the calibration file has multiple channels only the 1st channel is analyzed. Calibration files must be .wav format files at a sample rate of 22.05 kHz, 44.1 kHz, 48 kHz, or 96 kHz

Usually the calibration file is a recording from a sound level calibrator which will have a sound level of 94, 114 or 124 dB.

The calibration file name and the calibration factor are displayed in the info section of the main screen:



### Set Calibration

---

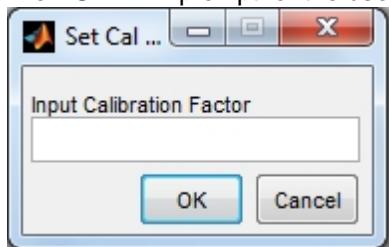
Set Cal Factor



The "Set Cal Factor" button is used to manually set the calibration factor. It will be used by users who do not have a

recording of a calibration but have some other way to estimate the calibration level have the option to set the calibration constant directly. This is especially useful when the user is re-analyzing measurements where the calibration constant is already known from loading a calibration file.

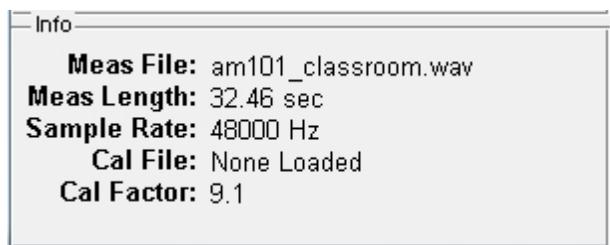
The VSLM will prompt for the user to input the calibration factor



If the users clicks cancel the current calibration factor is retained.

**NOTE:** The user must click "OK" after entering a number, pressing return will not close the window.

If the calibration factor is set manually, the calibration file information is set to none loaded and the calibration factor is displayed in the info section.



## Measurement

---

### Working With Measurement Files

The VSLM analyzes measurement .wav files. One of the essential first steps to analysis is to load a measurement file.

Measurement .wav files can be 16 or 24 bit integer format .wav or one of the standard floating point .wav format recorded at 22050, 44100, 48000, or 96000 Hz sampling rates. The .wav files can be multichannel, but only the first channel (usually the left in a stereo recording) is analyzed by the SLM at this time.

There are two action buttons directly related to measurement .wav files.

[Load Meas .wav](#)

[Play Meas .wav](#)

#### Load Measurement

---

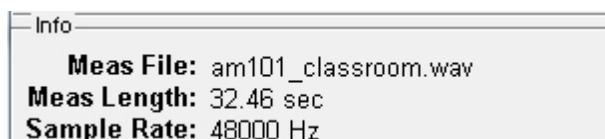


The load measurement button loads a .wav file for analysis.

The measurement file must be a standard .wav format audio recording at a sampling rate of 22.05 kHz, 44.1 kHz, 48 kHz or 96 kHz.

Only the first channel of a multichannel file is analyzed - the other channels are ignored.

Information about this file such as the file name, the file length (in seconds), and the sample rate are displayed in the info section of the screen



#### Play Measurement

---



Pressing the "Play Meas" button will start the windows media player to play the currently loaded measurement .wav file. The Play Measurement option is available on Windows computers only.

The program calls an external media player instead of using the windows built in audio player is to allow the listener more flexibility in listening to the file including the ability to start, stop, pause, fast forward, or rewind independent of the operation of the meter.

# Speed

## **Speed**

The Speed buttons: "Slow", "Fast" and "Impulse" apply the exponential time weighting functions Slow, Fast, and Impulse as described in ANSI S1.4-1983 and .

***NOTE: These weighting functions are only applied for the "Lp Plot" analysis. All other analysis modes apply no time weighting function.***

The exponential time weighting functions implement the exponential time window through a recursive digital filter of the form. An exponential time weighting function can be implemented fairly simply in a simple recursive filter of the form

$$y[n] = \alpha x[n] + (1 - \alpha)y[n-1] \text{ where } \alpha = \exp(-1/(f_s T)) \text{ and } T \text{ is the time constant.}$$

In accordance with ANSI S1.4, the signal is squared before the exponential time weighting filter is applied.

There are three temporal speeds:

[Slow](#)

[Fast](#)

[Impulse](#)

Reference:

ANSI, S1.4-1983 (R2006) *American National Standard Specification for Sound Level Meters*: American National Standards Institute, 2006.

## Slow

### **Slow**

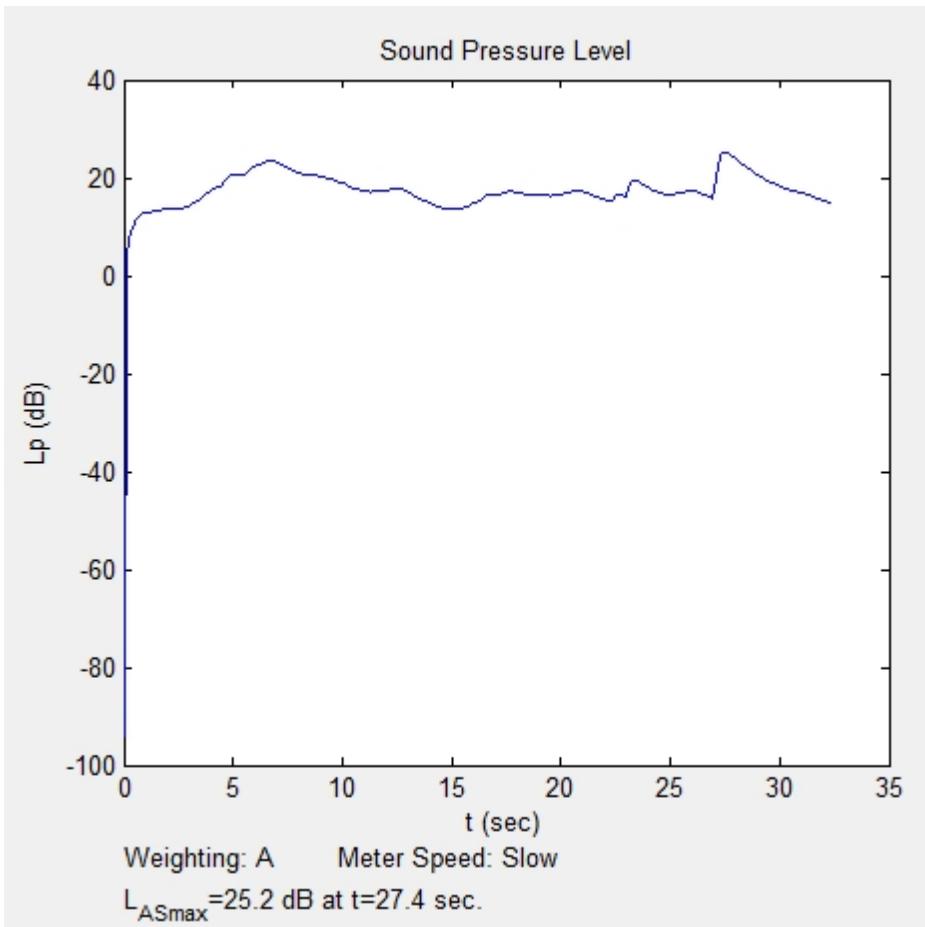


The "Slow" meter button applies the "Slow" time response with a time constant of  $T = 1.0$  seconds.

The slow meter setting is the most commonly used setting on most standard sound level meters. It provides a small amount of time averaging that allows one to better estimate the average sound level in sounds with a limited dynamic range such as speech.

The slow time response is explained in more detail in ANSI S1.4-1983.

An example of an analysis using the "Slow" meter setting is shown below



## Fast

---

### Fast

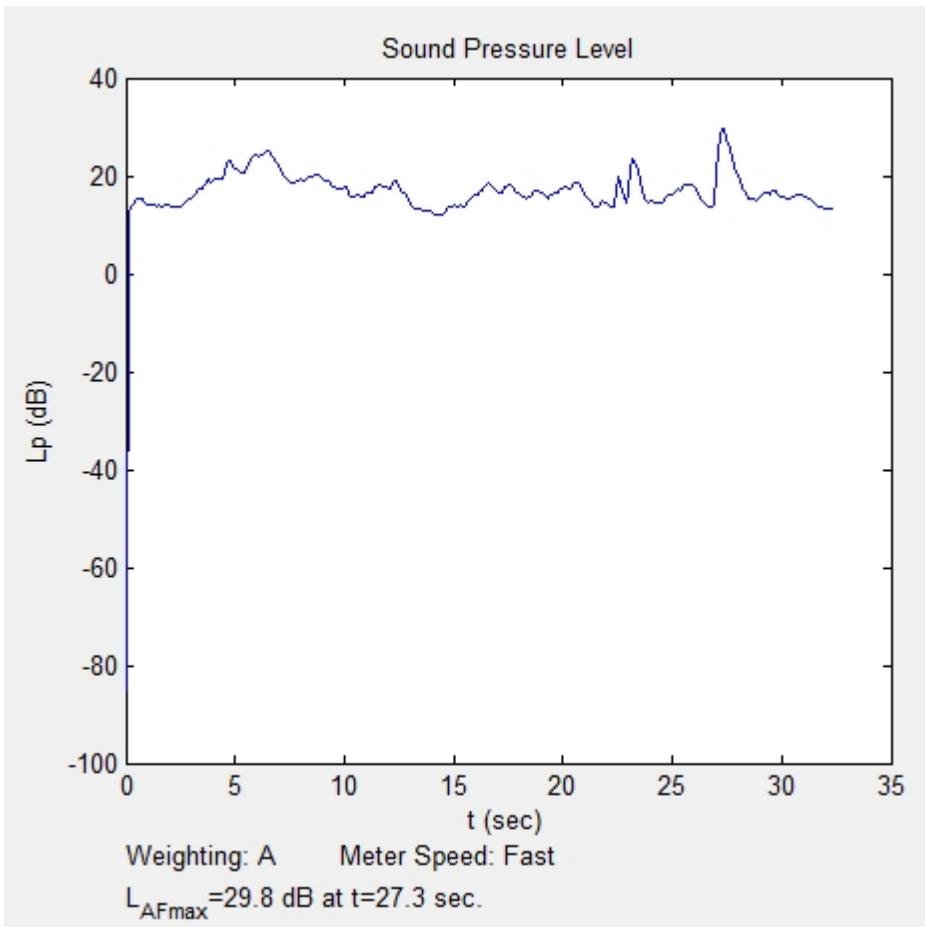
**Fast**

The "Fast" meter button applies the "Fast" time response with a time constant of  $\tau = 0.125$  seconds.

The "fast" time response is usually used when a source has a high dynamic range and fairly quick variations in the temporal response. There is much less averaging and smoothing than with the "slow" time response.

The fast time response is explained in more detail in ANSI S1.4-1983.

An example of an analysis using the "Fast" meter setting is shown below



## Impulse

### **Impulse**

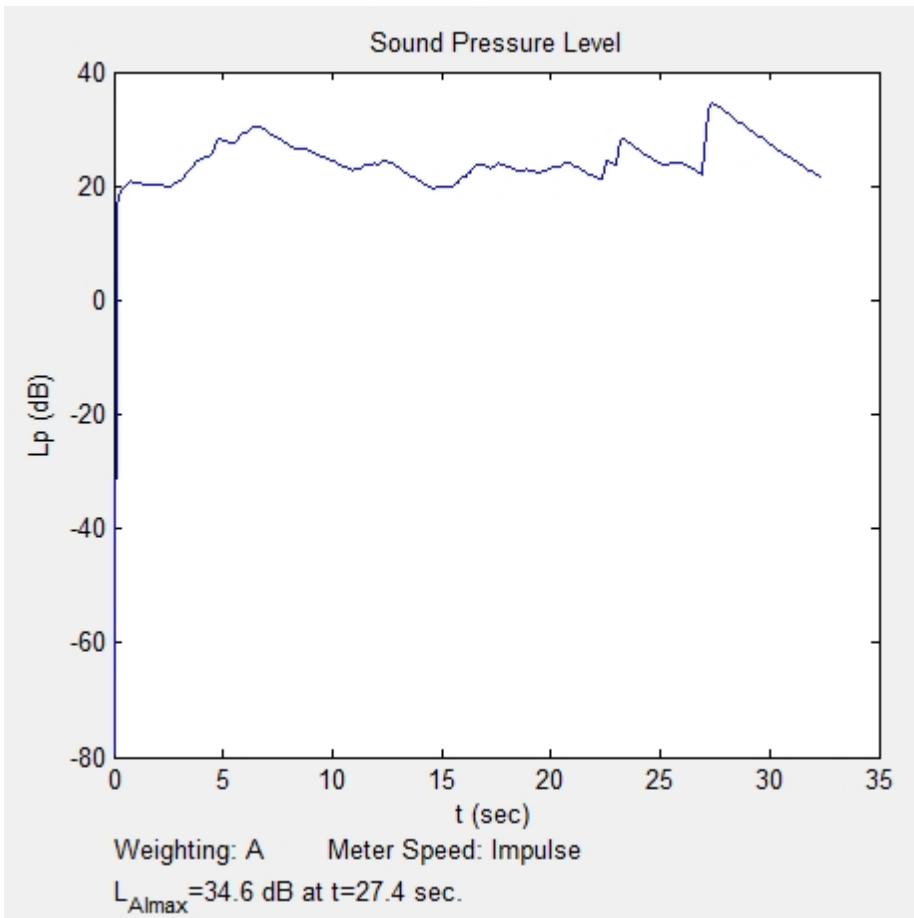
**Impulse**

The "Impulse" meter button applies the "Impulse" time response which has an  $\tau = 35 \text{ ms}$  time constant for rising signals and  $\tau = 1.5 \text{ sec}$  time constant for falling signals.

The impulse response is used to make sure the peak sound levels of impulsive noises such as gun shots or pounding equipment are accurately captured but that the peak level is held and displayed long enough for viewing.

The impulse time response is explained in more detail in ANSI S1.4-1983.

An example of an analysis using the "Impulse" meter setting is shown below



## Weighting

---

### Weighting

The Weighting buttons: "A", "C" and "Flat" apply the "A" weighting, "C" weighting as defined by ANSI S1.42-2001 or no weighting at all.

The weighting filters are custom designed digital filters

There are three weighting's available

[A Weighting](#)

[C Weighting](#)

[Flat Weighting](#)

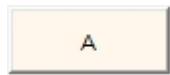
Reference:

ANSI, S1.42-2001 (R2006) *American National Standard Design Response of Weighting Networks for Acoustical Measurements*: American National Standards Institute, 2001.

### A Weighting

---

#### A-Weighting



The "A" weighting button selects the A-weighting filter.

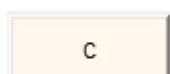
The A weighting filter is implemented as a custom designed digital filter obtained from using the MATLAB command `invfreqz` on the analog frequency response generated by the equations found in ANSI S1.42-2001.

The A-weighting filter is the most used frequency response filter in acoustic analysis. The A-weighting filter is designed as an approximation to the 40 phon equal loudness contour. As a result, A weighted sound levels are a better approximation to perceived loudness of low-to-moderate sound levels (under about 80 dB) than C or flat weighting is.

Most community and workplace noise ordinances are written in terms of A-weighted sound levels.

### C Weighting

---



The "C" weighting button selects the C-weighting filter.

The C weighting filter is implemented as a custom designed digital filter obtained from using the MATLAB command `invfreqz` on the analog frequency response generated by the equations found in ANSI S1.42-2001.

The C-weighting filter is the most used frequency response filter in acoustic analysis. The A-weighting filter is designed as an approximation to the 100 phon equal loudness contour. As a result, A weighted sound levels are a better approximation to perceived loudness of higher sound levels (over about 90 dB) than A weighted levels.

Few community and workplace noise ordinances are written in terms of C-weighted sound levels, but C-weighting is often used in conjunction with A-weighting to if there is significant low frequency content in the acoustic signal. A C-weighted level of more than 15 dB above the A-weighted level indicates that there must be significant low frequency energy in the signal.

## Flat Weighting

---

### Flat Weighting



The "Flat" weighting button selects the flat weighting filter.

Flat weighting is the absence of any frequency weighting. Flat weighting is usually applied when an octave or 1/3 octave band analysis is made, especially when NC or RC ratings are being made.

## Analysis Modes

---

### Analysis Modes

There are three main analysis modes in vslm: time domain, frequency domain and mixed domain.

The two time domain analysis modes are Lp mode where the software mimics a simple sound level meter, and LEQ mode where the software mimics a more advanced integrating sound level meter that can compute equivalent sound levels (LEQ) and some statistics related to the sound level.

The two frequency domain analysis modes are Band mode where the overall LEQ is computed in each of the standard octave or 1/3 octave bands, and PSD mode where the overall power spectral density is computed.

The mixed domain mode is the Spectrogram mode where the time varying power spectral density is computed and displayed.

An analysis is completed by selecting an analysis mode by pressing an analysis button and then pressing the yellow "Analyze Data" button.

Analyze Data

If a measurement file has not been loaded, no analysis is performed and a warning is displayed.

**Cannot Analyze Data**

**No Measurement File Loaded**

For more information about the different analysis modes please see the individual help sections

[Lp Mode](#)

LEQ Mode

Band Mode

PSD Mode

Spectrogram Mode

### Lp Mode

---

#### Lp Mode

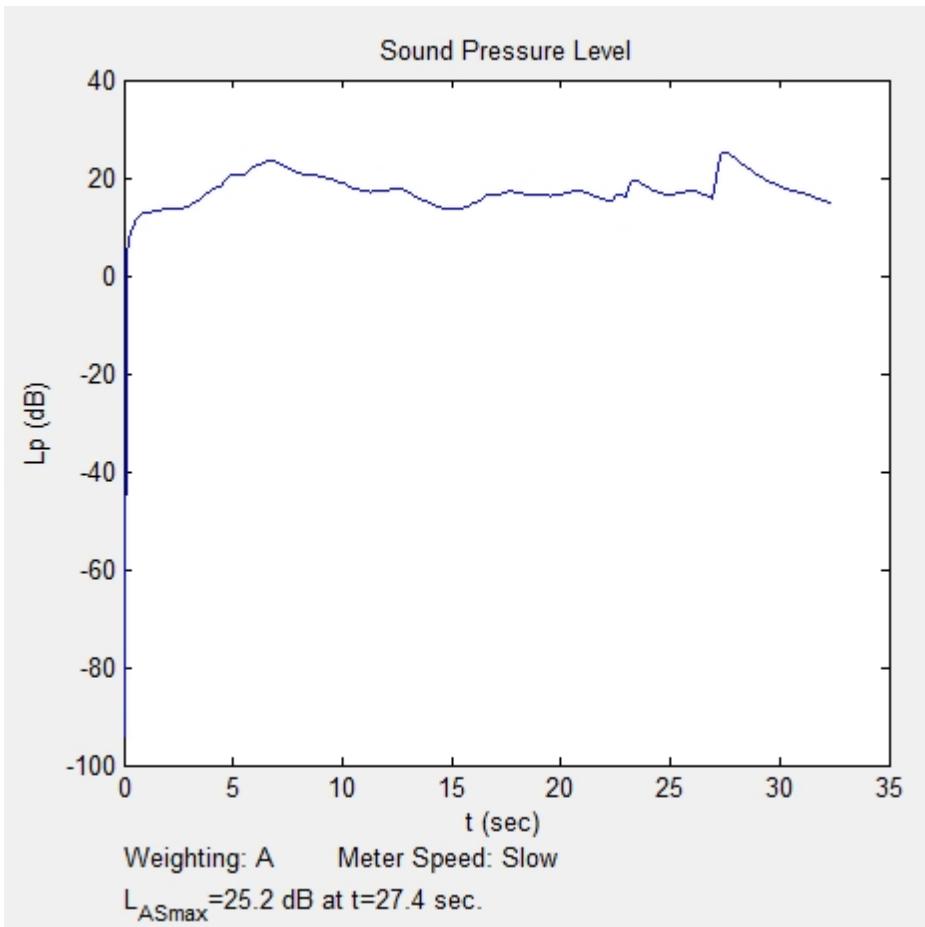
Lp Plot

The "Lp Plot" button selects the Lp analysis mode.

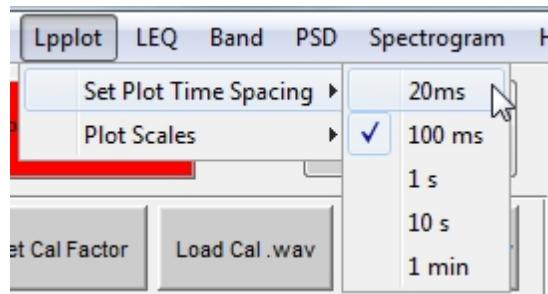
The Lp analysis mode is used to analyze the measurement file in a manner that mimics a standard non-integrating sound level meter. The Lp mode is selected by pressing the Lp Plot button and then the analysis button

The VSLM software uses digital filters to simulate the time and frequency response of a non-integrating sound level meter that meets the ANSI S1.4-1983 standard.

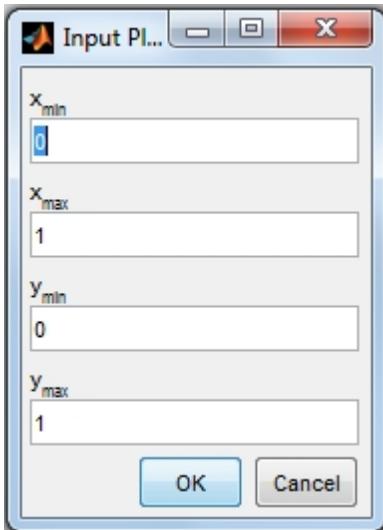
The output of the digital filters is then sampled and plotted. The peak value is computed. An example analysis using the Lp mode is shown below:



The user can choose to sample the simulated signal every 20 ms, 100 ms (default), 1 s, 10 s or 1 min. This sample rate can be selected from the Lpplot option of the main menu.



The other main option that can be set on the Lpplot menu item is the plot scale. The user can set the plot scale to "auto" where the system is set to autoscale or "manual" where the user is prompted for x, and y maximum and minimum values.



Reference:

ANSI, S1.4-1983 (R2006) *American National Standard Specification for Sound Level Meters*: American National Standards Institute, 1983.

## LEQ Mode

### LEQ Mode



The "LEQ" button selects the LEQ analysis mode.

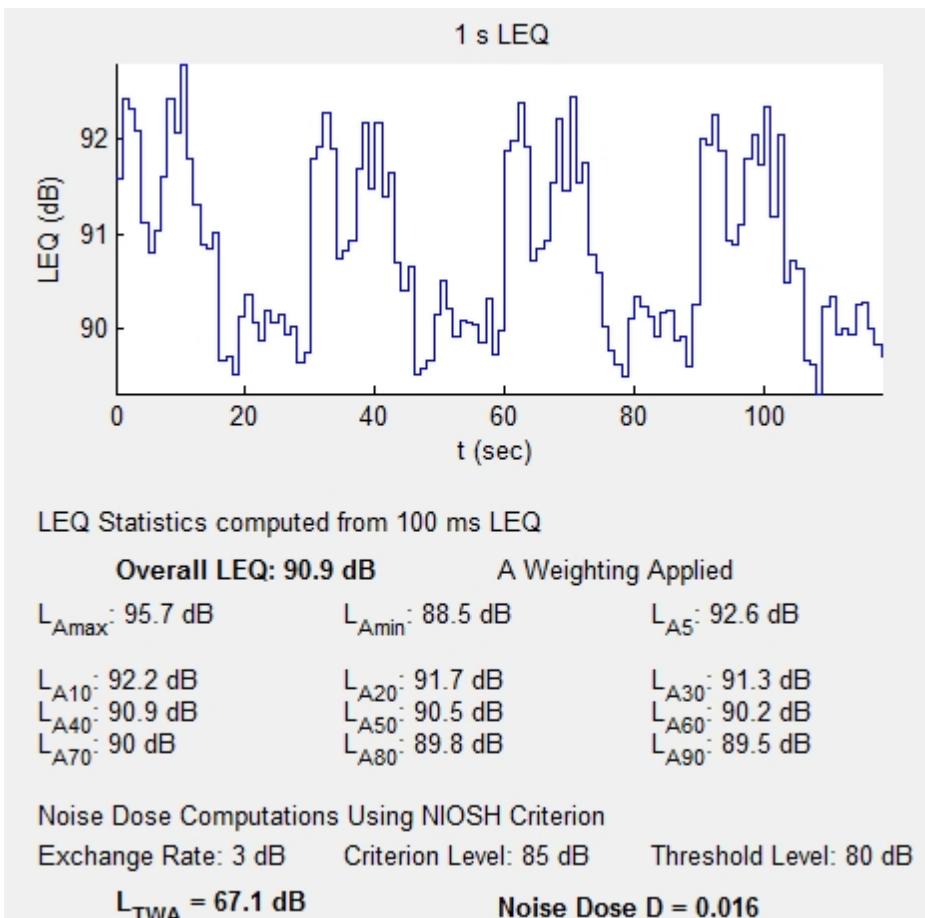
The Equivalent Noise Level or LEQ analysis mode is used to analyze the measurement file in a manner that mimics an integrating sound level meter as described in ANSI S1.43. The LEQ mode is selected by pressing the LEQ button and then the analysis button.

The LEQ will take the measurement file and compute a series of 100 ms LEQs applying the selected frequency weighting (A, C or Flat) before computing the LEQ. Any time weighting selected is ignored.

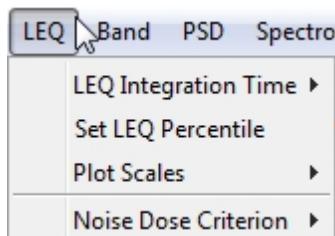
The 100 ms LEQ are then combined into longer term LEQ as selected by the user in the LEQ settings and plotted as shown below.

From the 100 ms LEQ statistics such as the overall LEQ, LEQ<sub>MAX</sub>, LEQ<sub>MIN</sub>, and LEQ percentile ( $L_{10}$ ,  $L_{20}$ ,  $L_{30}$ , ...  $L_{90}$ ) are computed.

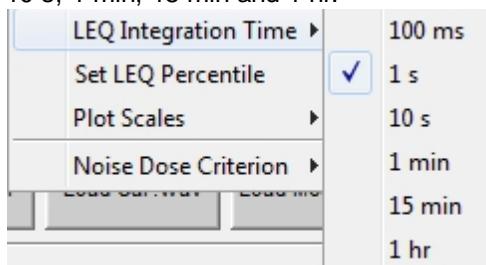
If A weighting is selected, the Noise Dose, D, and equivalent time-weighted noise level L<sub>TWA</sub> are computed as described in ANSI S12.19. An example output from the analysis is shown below



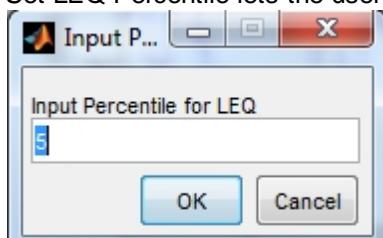
There are a number of user selectable settings that are found under LEQ menu entry



LEQ Integration Time sets the length of the LEQ integrations that are plotted and saved. Optional values are 100 ms, 1 s, 10 s, 1 min, 15 min and 1 hr.



Set LEQ Percentile lets the user input a level percentile for computation and display.



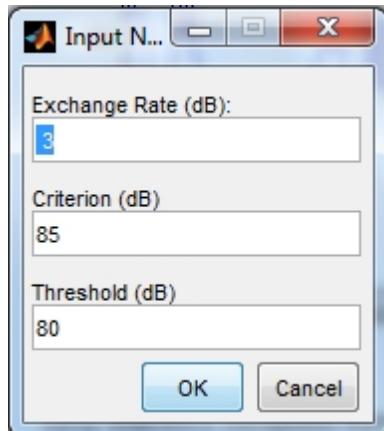
The Plot Scales option lets the user choose to have VSLM autoscale the plot or the user can input both x and y plot limits.

The Noise Dose Criterion lets the user select between NIOSH, OSHA and a user defined criterion.

In NIOSH mode the software uses a threshold of 80 dB, an 8 hour criterion of 85 dB and an exchange rate of 3 dB.

In OSHA mode the software uses a threshold of 80 dB, an 8 hour criterion of 90 dB, and an exchange rate of 5 dB.

In User mode the software lets the user input a threshold, an 8 hour criterion, and an exchange rate, all values in dB.



#### References:

ANSI, S1.43-1997 (R2007) *American National Standard Specifications for Integrating Sound Level Meters*: American National Standards Institute, 1997.

ANSI, S12.19-1996 (R2006) *American National Standard Measurement for Occupational Noise Exposure*: American National Standards Institute, 1996.

## Band

### Band Mode



The "Band" button selects the Band analysis mode.

The Band analysis mode is used to compute the overall LEQ in octave or 1/3 octave bands using one of two methods, FFT or ANSI Filters.

In FFT mode, VSLM breaks the measurement file into 65536 long segments computes the power spectral amplitude for each using a 66536 FFT and averages the spectral amplitudes. No windowing or overlap is used.

The FFT bins from the time averaged spectral amplitude are then combined into octave or 1/3 octave bands as selected by the user.

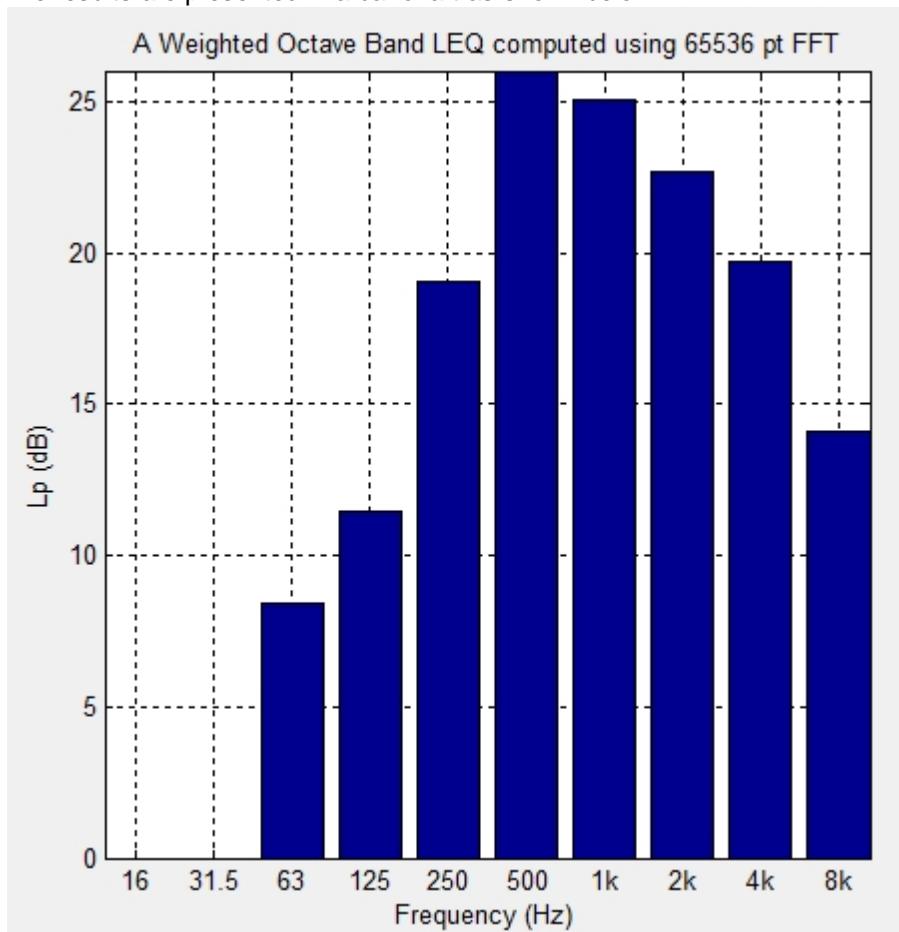
This FFT method does not follow any ANSI standard, but the results for bands with significant energy (within about 20 dB of the peak) are within 1 dB of the values obtained using the ANSI mode described below. The FFT method is significantly faster than the ANSI method, especially for computation of 1/3 octave band levels on long signals.

In ANSI mode, VSLM filters the time signal through 10th order Butterworth digital filters for octave or 1/3 octave that meet the ANSI S1.11 specification for Class 0, 1 and 2 filters. The filters are designed using the fdesign.bandpass routine in MATLAB.

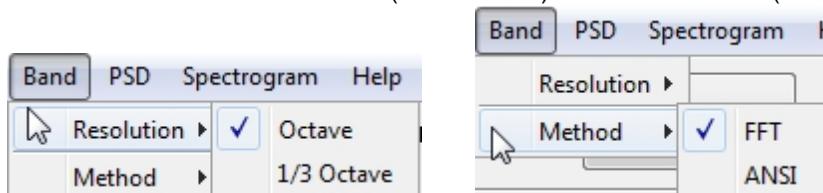
Note, the ANSI mode takes significantly longer than the FFT mode for large measurement files.

In either mode, bands are computed for bands with center frequencies up to  $fs/(2 \sqrt{2})$  where  $fs$  is the sampling frequency. Sound levels that are below 0 dB are set to 0 dB.

The results are presented in a bar chart as shown below



The user selects the Band Mode (FFT or ANSI) and the resolution (Octave or 1/3 Octave) from the Band Menu entry.



#### References:

ANSI, S1.11-2004: *American National Standard Specification for Octave-Band and Fractional-Octave-Band Analog and Digital Filters*: American National Standards Institute, 2004.

## NC/RC

### NC/RC Mode



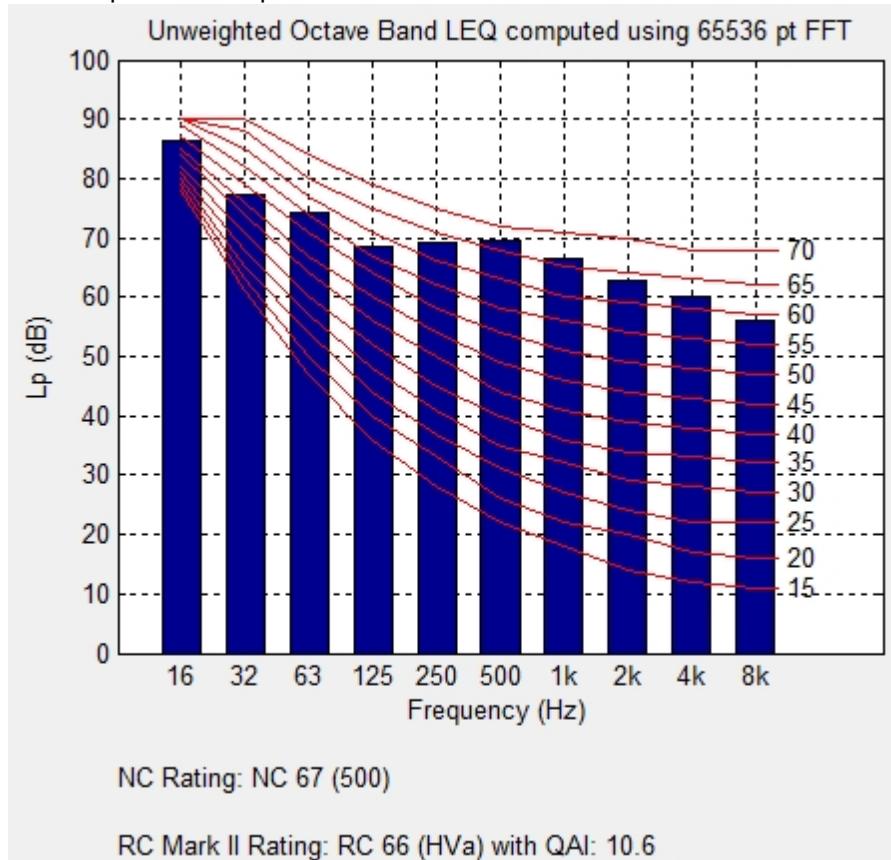
The "NC/RC" button selects the NC/RC analysis mode.

The NC/RC analysis mode is used to compute the Noise Criterion (NC) and Room Criterion (RC) Mark II ratings for the octave band, unweighted, LEQ spectrum of the measurement file.

The octave band LEQ are computed using the FFT method (see the Band Mode for more information on the FFT method for band analysis). A future version of this program will allow for computation using the ANSI Method but that option is not yet available.

The NC ratings are computing using the NC method as described in ANSI S12.2-2008. Note, this updated NC method is not quite the same as the one that is described in nearly every architectural acoustics book. The NC curves have been extended to lower frequencies and there is a Speech Interference Level (SIL) evaluation of the spectrum that has been added to the method. The RC Mark II rating uses the RC Mark II method as described in the ASHRAE 2007 HVAC Applications Handbook and the Blazier paper from the Noise Control Engineering Journal.

An example of the output is shown below:



There are no user selectable options for this mode.

#### References:

- ANSI, S12.2-2008: *Criteria for Evaluating Room Noise*: American National Standards Institute, 2008.  
ASHRAE, 2007 ASHRAE Handbook: HVAC Applications: ASHRAE, 2007.  
W. Blazier, "RC Mark II: A refined procedure for rating the noise of heating, ventilating, and air-conditioning (HVAC) systems in buildings," *Noise Control Engineering Journal*, vol. 45, pp. 243-250, 1997.

## PSD

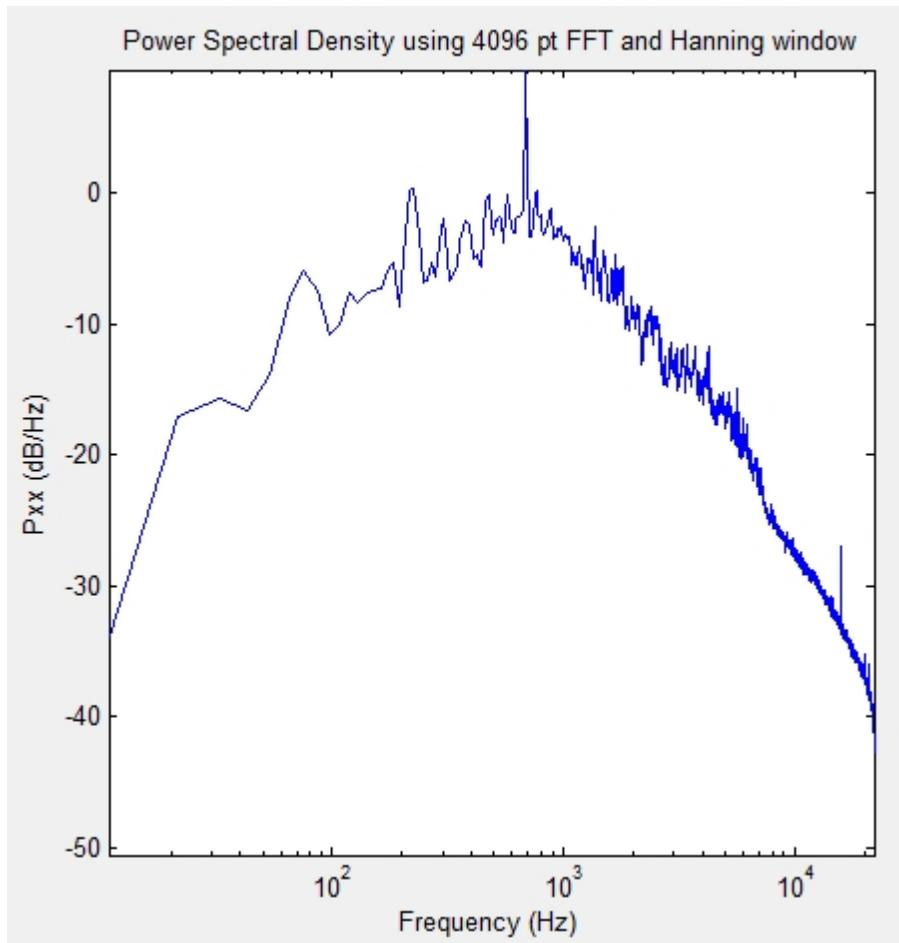
### PSD Mode

Band

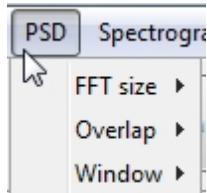
The "PSD" button selects the Power Spectral Density (PSD) analysis mode.

The Power Spectral Density (PSD) analysis mode is used to the overall power spectral density using a variation of the

Welch Modified Periodogram method. The measurement file is broken into segments of approximately 1.7 million samples. For each segment the Welch Modified periodogram is computed. The periodograms are then averaged at each frequency to get the estimated PSD for the entire measurement file. An example is shown below:



The user can use settings using the PSD menu items



Available setting are FFT size (256, 512, 1024, 2048, 4096, or 8192 pt fft), Overlap (0%, 25%, 50%, 75%, or 90%), and Window type (Hanning, Hamming, or Flattop).

More information about how the periodogram is computed can be found in the MATLAB documentation.  
<http://www.mathworks.com/help/toolbox/signal/spectrum.welch.html>

## Spectrogram

---

### Spectrogram Mode

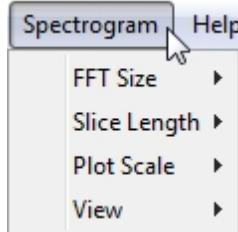


The "Sgram" button selects the Spectrogram analysis mode.

The Spectrogram analysis mode is used to the spectrogram .

The spectrogram analysis breaks the measurement file into small segments of a selectable size and computes the Welch Modified Periodogram method for each segment. The measurement file is broken into segments of approximately 1.7 million samples. For each segment the Welch Modified periodogram is computed. The periodograms are then averaged at each frequency to get the estimated PSD for the entire measurement file.

The user can change the default settings using the Spectrogram menu item



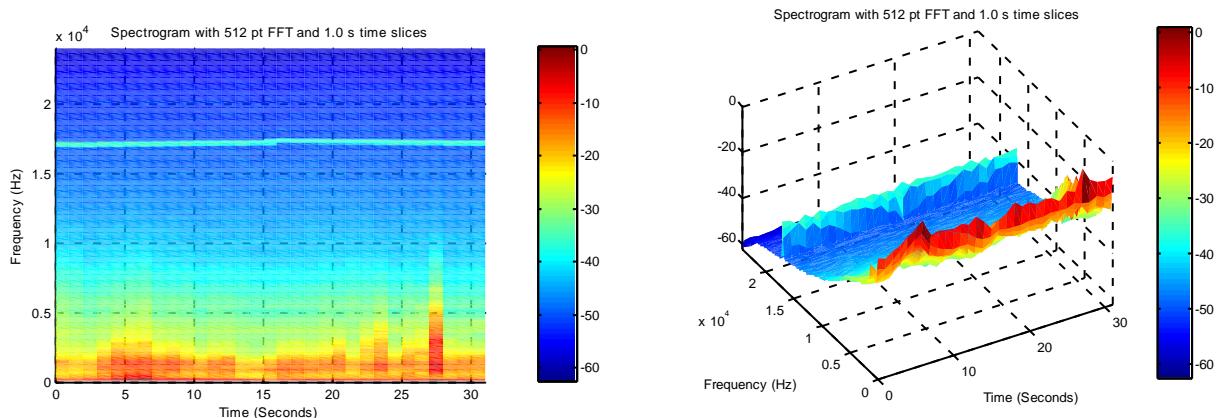
Available settings are FFT size (128, 256, 512, 1024, 2048, or 4096 pt fft), Slice Length (100 ms, 1s, 10 s), Plot Scale (30 dB, 50 dB, and auto), and View (2D or 3D).

The FFT size option sets the size of the FFT used in analysis. The default value is 512 points.

The Slice Length sets the size of the buffer used for each segment. The option is given in seconds.

The Plot scale sets the maximum dynamic range used in the plot. When 30 or 50 dB are selected the software truncates all data with a level more than 30 or 50 dB below the peak value. The auto scale lets the software choose the scaling.

The view option sets the system to display the resulting time-frequency plot as a 2-d figure or as a 3-d plot where amplitude is encoded as a height as well as a color. Examples of each plot are shown below.



More information about how the periodogram is computed can be found in the MATLAB documentation.

<http://www.mathworks.com/help/toolbox/signal/spectrum.welch.html>

## Saving Plots and Analysis

---

### Saving Plots and Analysis

Once an analysis has been made, the analysis results (plots and computations) can be saved.

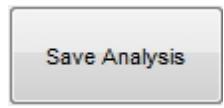
The [saving analysis](#) button will save the analysis to a text file.

The [saving plot](#) button will copy the display plot and text to a new MATLAB figure and start the matlab export figure subroutine.

#### Save Analysis

---

### Save Analysis



The Save Analysis button will save the most recent analysis to a text file. The data that is saved will depend upon the analysis mode.

A small header is included with each save and the main data is saved with each analysis.

For "Lp Plot" mode the time and Lp are saved.

For "LE" mode the time and LEQ are saved. The header will include the Ln statistics and Noise Dose info (if applicable).

For "Band" the center frequencies and band LEQ are saved.

For "NC/RC", the NC and RC levels and octave band LEQ are saved.

For "PSD" the frequency and power spectral density are saved.

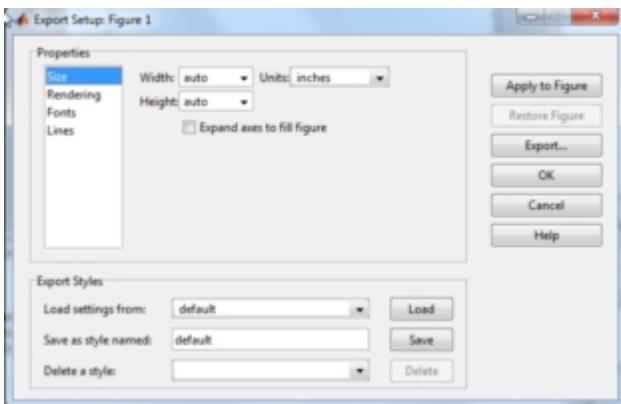
For "Sgram" there is too much data to save in a simple text file, so the display figure is copied to a new MATLAB figure and the figure export routine is called. This is the same thing that happens when the "Save Plot" button is pressed.

#### Save Plot

---



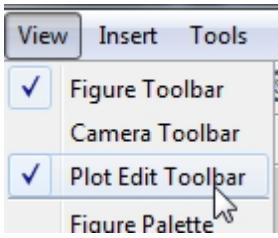
When the "Save Plot" button is pressed, the current display figure is copied to a new MATLAB figure and the export figure function is run. Users can then use the export fig options to alter the size and font of the figure and save the display in one of many formats including .eps, .jpg, .png, .pdf, .tif and more.



If you want to do more advanced editing of the figure (zoom, highlight data, add text), users can cancel the export (click the "Cancel" button) and then use the various MATLAB figure tools to alter the plot. The Figure toolbar is already visible and lets the user zoom in, out, pan, rotate, and highlight data points.



In order to add text and arrows to the drawing, the user can select to view the Plot Edit toolbar through the View menu



The following menu bar will be added to the figure.



After editing, users can save the figure as a MATLAB figure, or rerun the export function from the File menu on the figure.

For more information about manipulating the Matlab Figure Window, users are referred to the MATLAB documentation on the subject at

[http://www.mathworks.com/help/techdoc/creating\\_plots/f9-53405.html](http://www.mathworks.com/help/techdoc/creating_plots/f9-53405.html)

## FAQ

---

### Frequently Asked Questions (FAQ)

Here are some answers to frequently asked questions

#### Why Won't the Dialog Box Accept My Data Entry?

#### Why Does VSLM Take So Long To Start?

#### How Can I Contribute To Further Development?

## Enter Data

---

#### **Why Won't the Dialog Box Accept My Data Entry?**

If you have entered data into the dialog box and hit return and are wondering why the data is not accepted, it is because the MATLAB dialog box requires the user to actually click the "OK" button with the mouse or to hit the tab button before hitting return to force the input dialog to set focus on the "OK" button.

This is a "bug" or "feature" in the MATLAB inputdlg routine. There are no plans to try to change the GUI to correct this behavior.

#### Why Does VSLM Take So Long To Start?

#### **Why Does VSLM Take So Long To Start?**

Unfortunately, the MATLAB runtime library must load close to a full MATLAB session in order to run GUI software and as a result, the startup time is quite large. An attempt to minimize the startup time has been made by reducing the reliance on additional toolboxes as much as possible. However, this is one of the problems with using the MATLAB compiler.

Sorry!

## contributions

---

#### **How Can I Contribute to Further Development?**

The VSLM software has been released using the GPL license. Users are encouraged to modify, correct, and augment this software. You are free to download and modify the software as you see fit but are limited in your redistribution and commercial use by the requirements of the GPL.

If you have particular features you would like to have added and would like to contribute monetarily toward such new development, you are encouraged to contact the developers through the sourceforge project page

<http://sourceforge.net/projects/vslm/develop>