

Measuring the  $^7\text{Be}$  Neutrino Flux From the Sun:  
Calibration of the Borexino Solar Neutrino Detector

Steven E. Hardy

Dissertation submitted to the Faculty of the  
Virginia Polytechnic Institute and State University  
in partial fulfillment of the requirements for the degree of

Doctor of Philosophy

in

Physics

R. Bruce Vogelaar, Chair

Mark Pitt

Ramaswamy Raghavan

Tatsu Takeuchi

March 31, 2010

Blacksburg, Virginia

Keywords: Neutrino physics, calibration, source development

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----- Original Message -----

**Subject:**Re: Permission to use photos

**Date:**Tue, 09 Mar 2010 08:58:43 +0100

**From:**Marco Pallavicini <marco.pallavicini@ge.infn.it>

**To:**Steve Hardy <shardy@vt.edu>

**CC:**R. Bruce Vogelaar <vogelaar@vt.edu>

Ciao Hardy,  
Here it is:

-----  
I authorize S. Hardy to include in his PhD thesis all scientific pictures and plots that are available on the experiment's web site.

Marco Pallavicini  
Chairman of the Scientific Committee of Borexino Experiment

-----  
Marco

On Mar 8, 2010, at 8:22 PM, Steve Hardy wrote:

> Ciao Marco,  
>  
> I am in the process of completing my PhD dissertation, and the University requires that I obtain permission to use any photos or plots that I did not take/make myself  
> As head of the SC, can you respond with a sentence authorizing me to include any of the photos of the experiment (the ones on the bx web page) in my thesis?  
>  
> -Steve  
>  
> --  
> Steve Hardy  
> Graduate Research Assistant  
> Borexino Solar Neutrino Detector  
> shardy@vt.edu  
>  
> \*Virginia Tech Contact Information:  
> Lab: 10 Robeson Hall; Blacksburg, VA 24061  
> Lab Tel : 540-231-3078  
> Fax : 540-231-7511  
>  
> Gran Sasso Contact Information:  
> Office: 327 Hall di Montaggio, LNGS - INFN  
> Office Tel: +39-0862-437-316  
> Fax : +39-0862-437-406  
>  
> \* Current Location  
>

-----  
Prof. Marco Pallavicini  
Dipartimento di Fisica - Universita' di Genova  
e Istituto Nazionale di Fisica Nucleare (INFN)  
Via Dodecaneso, 33 I-16146 Genova (Italy)  
Work: +39 010 3536661  
Cell: +39 345 7005757  
-----

----- Original Message -----

**Subject:**Re: Permission to use image from your thesis

**Date:**Fri, 12 Mar 2010 10:45:44 -0800

**From:**Mike Leung <leungms@gmail.com>

**To:**Steve Hardy <shardy@vt.edu>

Steve,

You have permission to use Figure 1.4 or any other figure you wish from my thesis.

Good luck with your thesis!

Mike :)

On Fri, Mar 12, 2010 at 10:24 AM, Steve Hardy <shardy@vt.edu> wrote:

> Hey Mike,

>

>

> I am finishing up my dissertation this month and am now getting around to

> asking for permission to use photos from copyrighted works. To that end,

> can I have your permission to use Figure 1.4 from your thesis -- it's the

> plot of the fermion masses to show the discrepancy between the neutrino

> masses and everything else. If you don't mind if I use it in my

> dissertation for the same reason, can you just reply with a short statement

> giving me permission to do so -- the University apparently won't give me my

> degree unless I have written permission from the original author.

>

>

>

>

> Take it easy,

>

> ~Steve

>

> --

> Steve Hardy

> Graduate Research Assistant

> Borexino Solar Neutrino Detector

> shardy@vt.edu

>

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figure copyright permission

**Subject:** figure copyright permission  
**From:** Henning Olling Back <henning\_back@ncsu.edu>  
**Date:** Fri, 12 Mar 2010 14:14:41 -0600  
**To:** Steve Hardy <shardy@vt.edu>

To whom it may concern,

As author of "Internal Radioactive Source Calibration of the Borexino Solar Neutrino Experiment", a Ph.D. dissertation accepted by the Virginia Tech in September 2004, I give Steven Hardy full permission to use any figures for his Ph.D. dissertation at Virginia Tech.

Henning Back Ph.D (VT'04)

--

```
=====|
| Henning Olling Back - Research Assistant Professor |
|   North Carolina State University                 |
|-----|
| Proton Assembly Building, MS-351
| Fermi National Accelerator Laboratory
| P. O. Box 500
| Batavia, IL 60510-0500
| Phone - 630-840-2218
| Fax - 630-840-4263
|=====
```

----- Original Message -----

**Subject:**Re: Permission to use photos from your thesis

**Date:**Fri, 12 Mar 2010 12:44:38 -0800

**From:**Kevin B. McCarty <kmccarty@gmail.com>

**To:**Steve Hardy <shardy@vt.edu>

Hi Steve,

Yes, I hereby grant permission to use those images in your thesis, and anywhere else you may need them.

Please find attached the original files so you don't need to cut and paste them out of the PDF. For figure 3.7, I'm attaching a bzip2-compressed copy of the GIMP .xcf file as well as the final .jpg. In case you need to edit or omit the text captions, you can use the GIMP's layer tools with the .xcf file.

Steve Hardy wrote:

> Hi Kevin,

>

>

> I trust you and your family are well. I am finishing my dissertation  
> this month and have to obtain authorization to use any figures/photos  
> from copyrighted works in my dissertation. To that end, I would like to  
> ask your permission to use the following two figures from your  
> dissertation:

>

> Figure 3.7 -- Photo of the south end region of the IV during construction  
> Figure 6.1 -- Dimensioned section view of the CTF2

>

>

> If you agree to let me include these two photos in my thesis, can you  
> just send me a statement authorizing me to do so -- I have to supply it  
> to the University with my dissertation. Thanks for your time.

> Cheers,

--

Kevin B. McCarty <kmccarty@gmail.com>

WWW: <http://www.starplot.org/>

GPG: public key ID 4F83C751

----- Original Message -----

**Subject:**Re: Permission to use figure from your dissertation

**Date:**Tue, 13 Apr 2010 02:15:36 +0200

**From:**Davide D'Angelo <davide.dangelo@mi.infn.it>

**To:**Steve Hardy <shardy@vt.edu>

of course, go ahead!

do you need me to do anything special about it?

On Mon, Apr 12, 2010 at 10:42 PM, Steve Hardy <shardy@vt.edu> wrote:

> Ciao Davide,

>

>

> I hope things are well with you. I have to submit my dissertation to VT on  
> Friday and they require that I prove that I am authorized to use all  
> figures/plots/photos that I did not create myself. I would like to include  
> figure 2.11 from your dissertation -- the figure that shows the energy  
> levels of pi electrons in an organic scintillator with the absorption,  
> fluorescence, and phosphorescence decays indicated -- may I have your  
> permission to do so?

>

> Thanks, hope to see you soon.

>

>

> ~Steve

>

> --

> Steve Hardy shardy@vt.edu

>

> \*Virginia Tech Contact Information:

> Lab: 10 Robeson Hall; Blacksburg, VA 24061

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----- Original Message -----

**Subject:**Re: Figures from your dissertation

**Date:**Tue, 13 Apr 2010 11:44:01 +0200

**From:**Marianne Göger <marianne.goeger@ph.tum.de>

**To:**Steve Hardy <shardy@vt.edu>

Dear Steve,

of course you can use pictures and plots from my dissertation.

Congratulations to your PhD!

Best regards,

Marianne

Steve Hardy schrieb:

> Hello Marianne,

>

> I have just recently defended my PhD here at VT and have to submit my  
> dissertation in a few days and I would like permission to use a few  
> photos from your dissertation if you don't mind. I wrote a brief  
> paragraph about the outer muon PMTs and included photos of the  
> encapsulation, profile view of the concentrator, and angular acceptance  
> of the concentrator -- may I have your authorization to use these photos  
> (the University requires that I show them I am allowed to use any  
> figures or photos that I did not create).

>

> Thank you for your time, and I hope you are well.

>

>

> Regards,

>

> ~Steve

>

----- Original Message -----

**Subject:**Re: Images from your dissertation

**Date:**Fri, 09 Apr 2010 14:01:23 -0400

**From:**Michael\_C\_Johnson@praxair.com

**To:**Steve Hardy <shardy@vt.edu>

Steve,

I will gladly give you permission to use the data from my thesis in your dissertation. If you would like the original data to make new figures instead of copies of mine, I might be able to find it.

Please say hello to Bruce for me.

Regards,

Mike

Michael C Johnson, Ph.D., PE  
Senior R & D Manager - Prepurification  
Praxair Inc.

[Michael\\_C\\_Johnson@praxair.com](mailto:Michael_C_Johnson@praxair.com)

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**Steve Hardy <shardy@vt.edu>**

04/09/2010 12:58 PM

To Michael\_C\_Johnson@praxair.com

cc

Subject Images from your dissertation

Hello,

I am a student of Bruce Vogelaar's at Virginia Tech and have just completed my PhD work on Borexino and am about to submit my dissertation to the University. To that end, I would like to use several figures from your dissertation -- plots of the absorption and emission spectra of pure PC and PC+PPO, but the University requires that I obtain permission from the author of any copyrighted work to do so. Do you have any objections to me reprinting those plots in my dissertation -- I would of course reference it and say "reprinted with permission....."?

Thank you very much for your time.

Regards,

Steve Hardy  
shardy@vt.edu

**Draft 09/01/2009**

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