

Exiv2 - Feature #816

Enable detection of Sigma 55-200mm lens

18 Mar 2012 15:39 - Simon Harhues

Status:	Closed	Start date:	18 Mar 2012
Priority:	Normal	Due date:	
Assignee:	Robin Mills	% Done:	100%
Category:	lens	Estimated time:	17.00 hours
Target version:	0.26		
Description			
exiv2 doesn't detect my Sigma lens right. Following output: simon@laptop:~/fotos\$ exiv2 -pt 12-03-05_thinkpad_tastatur/IMG4432.PEF grep -i lens Exif.Pentax.LensType Byte 2 SIGMA Exif.Pentax.LensInfo Undefined 36 3 255 0 0 40 148 71 152 80 6 241 65 237 153 88 36 1 76 107 251 255 255 255 0 0 80 6 241 0 0 0 0 0 0 0 simon@laptop:~/fotos\$ exiftool 12-03-05_thinkpad_tastatur/IMG4432.PEF grep -i lens Lens Type : Sigma Lens (3 255) Lens F Stops : 8.5 Lens ID : Sigma 55-200mm F4-5.6 DC I'll will attach the raw file if you need more information.			
Related issues:			
Related to Exiv2 - Bug #1143: Unable to extract embedded preview from jpg for...		Closed	24 Dec 2015
Related to Exiv2 - Feature #1145: Respect Sony/Minolta lenses with shared Len...		Closed	27 Dec 2015

Associated revisions

Revision 4012 - 11 Nov 2015 10:25 - Robin Mills

#816. This is the framework from Abhinav's patch from which we can derive the fix. Explanation in issue report.

Revision 4013 - 11 Nov 2015 20:54 - Robin Mills

#816 Added Phil's Perl code PrintLensID (see issue report). I'll have to convert this into C++ and then report the output.

Revision 4014 - 11 Nov 2015 21:11 - Robin Mills

#816. Correction to 4012. Fix msvc build breaker

Revision 4016 - 12 Nov 2015 11:20 - Robin Mills

#816. Fix submitted. Will ask Simon to test this ask his permission to use his metadata in the test suite.

Revision 4018 - 13 Nov 2015 18:43 - Robin Mills

#816. Fix submitted. Thank you Simon for working with me on this and for providing test files.

Revision 4019 - 13 Nov 2015 19:32 - Robin Mills

#816 Correction to r4018 to deal with segmentation fault on test file _IGP9034.JPG

Revision 4135 - 20 Dec 2015 21:31 - Robin Mills

#816. Fix for Pentax K-3 Camera.

Revision 4136 - 21 Dec 2015 17:23 - Robin Mills

#816. Correction to msvc buildbreaker in r4135

History

#1 - 20 Mar 2012 19:28 - Andreas Huggel

- Category set to metadata
- Assignee set to Abhinav Badola
- Target version set to 0.23

#2 - 26 Mar 2012 14:19 - Abhinav Badola

- File `pentaxmn.cpp.diff` added

I tried but was not able to crack the mechanism to detect the proper LensInfo.
For now this is a patch in which I have added all the lens listed in the exiftool Pentax information.

#3 - 13 Apr 2012 13:17 - Abhinav Badola

- File `pentaxmn.cpp.diff2` added

Here is another updated patch to the same issue. I have called a function "printPentaxLensType" for handling, additional lens information. As such the framework is still incomplete, so it still needs some more work to be done later.

#4 - 15 Apr 2012 04:21 - Abhinav Badola

- File `pentaxmn.cpp.diff3` added

A revised patch.

#5 - 20 Apr 2012 20:58 - Andreas Huggel

- Target version deleted (0.23)

#6 - 25 Apr 2012 22:14 - Abhinav Badola

- File `pentaxmn.cpp.diff4` added

Added another function `resolvePentaxLensType`, to print/detect correct lens.

#7 - 24 Jul 2013 16:06 - Robin Mills

- Status changed from New to Assigned
- Target version set to 0.25

Deferred for 0.25

#8 - 28 Apr 2015 13:23 - Robin Mills

Abhinav

I think you have dealt with this - however the code isn't in the repos.

```
626 rmills@rmillsmbp:~/gnu/exiv2/trunk/samples $ exiv2 -pa -g Lens ~/Downloads/IMGF4432.PEF
Exif.Pentax.LensType           Byte          2 Sigma Lens
Exif.Pentax.LensInfo          Undefined     36 3 255 0 0 40 ...
627 rmills@rmillsmbp:~/gnu/exiv2/trunk/samples $
```

I see you've provided 4 patches. I'm not sure if they are to be applied one at a time or if the 4th is all that is required.

Perhaps you could revisit this and submit what's required to the trunk *and* add a test to `test/bugfixes-test.sh` Thanks.

#9 - 02 Jun 2015 23:11 - Alan Pater

- Category changed from metadata to lens
- Target version changed from 0.25 to 0.26

#10 - 10 Nov 2015 10:42 - Simon Harhues

Just wanted to ask for the current state as I still use the lens... :)

#11 - 10 Nov 2015 13:18 - Robin Mills

- Assignee changed from Abhinav Badola to Robin Mills

Simon

I'm very surprised we haven't dealt with this. It has inexplicably "slipped over the side". My apologies. The output from exiv2 is still the same as I reported 7 months ago. I see exiftool knows about this:

```
517 rmills@rmillsmbp:~/Downloads $ exiftool IMG4432.PEF | grep Lens
Lens Type           : Sigma Lens (3 255)
Lens F Stops        : 8.5
Lens Focal Length   : 147.5 mm
Lens ID              : Sigma 55-200mm F4-5.6 DC
518 rmills@rmillsmbp:~/Downloads $
```

Our team member who dealt with makernotes has returned to college and I've agreed to deal with makernotes. There's quite a learning curve for me, so I ask for your patience while I work on this.

#12 - 10 Nov 2015 14:42 - Simon Harhues

Robin, Thanks for your kind reply. Looking forward to be able to use it in darktable (automatically) one day.

#13 - 10 Nov 2015 15:04 - Robin Mills

Simon

I'm working on it right now. Abhinav provided a patch a couple of years ago for this. It's totally non-trivial patch. I'm going to get it to work against the code at that time, then figure out how to drag it into the current code base.

#14 - 10 Nov 2015 15:22 - Simon Harhues

Thanks for your effort! :)

#15 - 10 Nov 2015 16:38 - Robin Mills

Ungood news. I've applied the patch to [r2718](#) (v0.23) and here's the output:

```
565 rmills@rmillsmbp:~/gnu/exiv2/trunk.2718 $ exiv2 -V
exiv2 0.23 001700 (64 bit build)
Copyright (C) 2004-2012 Andreas Huggel.
```

```
This program is .... deleted ....
```

```
Boston, MA 02110-1301 USA
```

```
566 rmills@rmillsmbp:~/gnu/exiv2/trunk.2718 $ exiv2 -pa ~/Downloads/IMG4432.PEF | grep Lens
```

```
Exif.Pentax.LensType           Byte      2  SIGMA
Exif.Pentax.LensInfo           Undefined 36  3 255 0 0 40 ...
```

```
567 rmills@rmillsmbp:~/gnu/exiv2/trunk.2718 $ svn info .
```

```
Path: .
```

```
Working Copy Root Path: /Users/rmills/gnu/exiv2/trunk.2718
```

```
URL: svn://dev.exiv2.org/svn/trunk
```

```
Relative URL: ^/trunk
```

```
Repository Root: svn://dev.exiv2.org/svn
```

```
Repository UUID: b7c8b350-86e7-0310-a4b4-de8f6a8f16a3
```

```
Revision: 2718
```

```
Node Kind: directory
```

```
Schedule: normal
```

```
Last Changed Author: robinmills
```

```
Last Changed Rev: 2718
```

```
Last Changed Date: 2012-04-22 08:21:02 +0100 (Sun, 22 Apr 2012)
```

```
568 rmills@rmillsmbp:~/gnu/exiv2/trunk.2718 $
```

For sure, I'm not going to retrofit a 3 year old complex patch with unknown side effects. I'm going to have to put on my scuba kit, dive in and figure how this code works. Then I will fix it "properly".

Oh, how I miss Niels. He was such a great pair of hands in dealing with MakerNotes.

The patch calls Abhinav's new function `printPentaxLensType()`. For sure there's something to debug here. There's always hope!

#16 - 10 Nov 2015 20:18 - Robin Mills

I've made good progress with this. The reason for this issue is that there are many lenses which share the same ID (0x03ff) in `pentaxmn.cpp#756`

```
{ 0x03ff, "Sigma Lens" }, //0
{ 0x03ff, "Sigma 18-200mm F3.5-6.3 DC" }, //1
{ 0x03ff, "Sigma DL-II 35-80mm F4-5.6" }, //2
{ 0x03ff, "Sigma DL Zoom 75-300mm F4-5.6" }, //3
{ 0x03ff, "Sigma DF EX Aspherical 28-70mm F2.8" }, //4
{ 0x03ff, "Sigma AF Tele 400mm F5.6 Multi-coated" }, //5
{ 0x03ff, "Sigma 24-60mm F2.8 EX DG" }, //6
{ 0x03ff, "Sigma 70-300mm F4-5.6 Macro" }, //7
```

```

{ 0x03ff, "Sigma 55-200mm F4-5.6 DC" }, //8
{ 0x03ff, "Sigma 18-50mm F2.8 EX DC" }, //9
{ 0x03ff, "Sigma 18-50mm F2.8 EX DC Macro" }, //10

```

To differentiate, the code has to provide a function "resolveLensType". The default version of that is in the patch, however it's effectively empty and defaults to the first entry with that lensID. So the code says "Sigma Lens".

resolveLensType has access to all the metadata in the file which of course includes the information:

```

0x003f Pentax      LensType      Byte      2  3 255
0x0207 Pentax      LensInfo      Undefined 36  3 255 0 0 40 148 ...

```

So the recipe for the fix is to provide a working "resolveLensType" which would read the key Exif.Pentax.LensInfo. In there lies the secret. Regrettably the URL to the maker notes concerning Pentax is no longer valid - so I don't know how to decode the LensInfo record which would enable us to be certain it's your lens!

from page: <http://www.exiv2.org/makernote.html> Reference 11
broken link: <http://www.gvsoft.homedns.org/exif/makernote-pentax-type3.html>

There's another minor issue that the code to actually do the printing is a tricky little MACRO that uses a C++ Template. A little head buster.

There are a couple of ways in which you could help:

1 Can you look at the key Exif.Pentax.LensInfo in lots of images
If it's always an array of the 36 integers above, that's fine. Or is there a subset that's the same in every image?

2 Can you have a google to see if you can find the current location of the Pentax MakerNote Spec?
There might be something on Phil's (he of exiftool fame) web site

I'm going to give up for today (it's 8:20pm in England). This is very interesting. I've learned a lot today about a part of the code in which I've hardly worked. I'm confident of success - however not tonight. I'd like to acknowledge and thank Abhinav for the work he did on this. Although he hasn't fixed it, his changes and comments in the code have revealed the road to the fix.

#17 - 10 Nov 2015 20:18 - Robin Mills

- % Done changed from 0 to 50
- Estimated time set to 12.00 h

#18 - 11 Nov 2015 11:18 - Robin Mills

I'm adding Phil to the watchers for this issue.

Phil:
Can you help me please? I can see on your web-site <http://www.sno.phy.queensu.ca/~phil/exiftool/TagNames/Pentax.html> that the lens-ID is listed as:

```
'3 255.8' = Sigma 55-200mm F4-5.6 DC
```

And this aligns perfectly with our code above.

What is 'Composite LensID tag'?

#19 - 11 Nov 2015 12:39 - Phil Harvey

The ExifTool Composite tags are derived from the values of other tags, and are documented here:
<http://owl.phy.queensu.ca/~phil/exiftool/TagNames/Composite.html>

The Composite LensID tag is an attempt to identify the lens using LensType and a number of other tags, specifically FocalLength, MaxAperture, MaxApertureValue, MinFocalLength, MaxFocalLength, LensModel, LensFocalRange, LensSpec, LensType2 and LensFocalLength.

The actual logic to do this is somewhat convoluted, but may be found at line 3582 here:
<https://sourceforge.net/p/exiftool/code/ci/master/tree/lib/Image/ExifTool/Exif.pm>

#20 - 11 Nov 2015 13:12 - Robin Mills

Thank You, Phil. What a helpful person you are. If you're visiting England, we'd be honoured by a visit (and we're offering free dinner, bed and breakfast). We're 40km from Heathrow Airport. http://dev.exiv2.org/projects/exiv2/wiki/Robin_Mills

I was very interested in a comment you made on your website about the undocumented nature of maker notes. It serves everybody's interest to share this information freely. The success of the internet is, in no small measure, due to its public development and RFCs. Apache is a miracle in the computer industry which loves competition, confusion, brand-loyalty and other business goals which are not compatible with cooperation. The camera business is even less interested in sharing. A huge **Vote of Thanks** to you for all your work to shine a light into this pit of darkness.

#21 - 11 Nov 2015 13:33 - Phil Harvey

Glad to help. Thanks for the offer.


```

80 107 251 255 255 255 0 0 48 6 239 0 0 0 0 0 0 0
simon@laptop:12-03-24_regenbogen_veste_oberhaus$ exiv2 -pt IMG4479.PEF | grep Lens
Exif.Pentax.LensType          Byte          2  Sigma Lens
Exif.Pentax.LensInfo          Undefined     36  3 255 0 0 40 148 67 78 128 70 244 65 89 136 88 61
1 64 107 251 255 255 255 0 0 128 70 244 0 0 0 0 0 0 0
simon@laptop:12-03-24_regenbogen_veste_oberhaus$ exiv2 -pt IMG4480.PEF | grep Lens
Exif.Pentax.LensType          Byte          2  Sigma Lens
Exif.Pentax.LensInfo          Undefined     36  3 255 0 0 40 148 67 117 128 38 244 65 137 136 88 5
8 1 68 107 251 255 255 255 0 0 128 38 244 0 0 0 0 0 0 0
simon@laptop:12-03-24_regenbogen_veste_oberhaus$ exiv2 -pt IMG4481.PEF | grep Lens
Exif.Pentax.LensType          Byte          2  Sigma Lens
Exif.Pentax.LensInfo          Undefined     36  3 255 0 0 40 148 67 88 48 6 239 65 82 170 88 42 1
80 107 251 255 255 255 0 0 48 6 239 0 0 0 0 0 0 0
simon@laptop:12-03-24_regenbogen_veste_oberhaus$ exiv2 -pt IMG4482.PEF | grep Lens
Exif.Pentax.LensType          Byte          2  Sigma Lens
Exif.Pentax.LensInfo          Undefined     36  3 255 0 0 40 148 67 117 128 38 244 65 137 136 88 5
8 1 68 107 251 255 255 255 0 0 128 38 244 0 0 0 0 0 0 0

```

#30 - 13 Nov 2015 10:21 - Robin Mills

Thanks, Simon. Thanks for sending the extra files. The ones from Thursday have 69 bytes in the LensInfo and today's have 36. Different camera body - that explains that.

I have to go off to do a few errands today. I will look at this when I return. Very optimistic that we will get to closure on this today.

#31 - 13 Nov 2015 19:46 - Robin Mills

Fix submitted. [r4018](#) and [r4019](#). Thank You, Simon for working with me on this and for providing test data.

Simon:

May I ask you to build the HEAD of trunk ([r4019](#) or later) and run some tests.

I doubt if we have seen the last of this issue. The fix is based on detecting the Sigma Lens then inspecting the LensInfo to say "is this Simon's Lens?". And we've only used files from two camera bodies using this lens. Perhaps you know somebody with another model of Pentax camera.

I understand you want to use this in Darkroom. If you wish to rebuild the libexiv2 shared object with this fix, you'll probably have to patch an unmodified 0.25 with pentaxmn.cpp/r4019 and rebuild. The API of libexiv2.so/trunk is not binary compatible with libexiv2.so/0.25. I don't think simply copying a trunk build of the libexiv2 shared object will work. I can build the appropriate library on Ubuntu if required.

You have to replace the copy of libexiv2.so used by Darkroom. You might need to use a system monitor to inspect Darkroom to determine the path to the libexiv2.so in use.

#32 - 13 Nov 2015 20:56 - Robin Mills

Simon

I've built a 'vanilla' v0.25 and copied in trunk/src/pentaxmn.cpp. It builds on the Mac and passes the v0.25 test suite. Yeah!

```

1237 rmills@rmillssmbp:~/gnu/exiv2/0.25 $ exiv2 --verbose --version --grep svn
exiv2 0.25 001900 (64 bit build)
svn=0
1238 rmills@rmillssmbp:~/gnu/exiv2/0.25 $

```

svn = 0 is a tar-ball build! So this fix hasn't introduced any bad side-effects.

```

1240 rmills@rmillssmbp:~/gnu/exiv2/0.25 $ svn export svn://dev.exiv2.org/svn/tags/0.25/test
....
1241 rmills@rmillssmbp:~/gnu/exiv2/0.25 $ make tests
.....
all testcases passed.

```

Your test files are working fine on this build.

```

1237 rmills@rmillssmbp:~/gnu/exiv2/0.25 $ exiv2 -pa --grep Lens ~/Downloads/IMG4432.PEF
Exif.Pentax.LensType          Byte          2  Sigma 55-200mm F4-5.6 DC
Exif.Pentax.LensInfo          Undefined     36  3 255 0 0 40 148 ...
1239 rmills@rmillssmbp:~/gnu/exiv2/0.25 $ exiv2 -pa --grep Lens ~/Downloads/*
/Users/rmills/Downloads/_IGP9032.DNG Exif.PentaxDng.LensType          Byte          3  Sigma 55-200
mm F4-5.6 DC
/Users/rmills/Downloads/_IGP9032.DNG Exif.PentaxDng.LensInfo          Undefined     69  131 0 0 255
0 40 148 ...
/Users/rmills/Downloads/_IGP9033.PEF Exif.Pentax.LensType          Byte          3  Sigma 55-200
mm F4-5.6 DC
/Users/rmills/Downloads/_IGP9033.PEF Exif.Pentax.LensInfo          Undefined     69  131 0 0 255
0 40 148 ...

```


I've forgotten exactly what this is about, however I had something similar today with a Canon Camera and Lens. #1140. I see you now have 128 bytes in PentaxDng.LensInfo and LensType now has 4 bytes. Quickly extracting from the three "kinds" of files:

```
$ exiv2 -pa --grep lens/i --grep model/i ~/Downloads/*.PEF ~/Downloads/*.DNG
/Users/rmills/Downloads/IMG4432.PEF Exif.Image.Model Ascii 20 PENTAX *ist DL
/Users/rmills/Downloads/IMG4432.PEF Exif.Pentax.ModelID Long 1 *ist DL
/Users/rmills/Downloads/IMG4432.PEF Exif.Pentax.LensType Byte 2 Sigma 55-200mm F4-5.6 DC
<--- 2 bytes
/Users/rmills/Downloads/IMG4432.PEF Exif.Pentax.LensInfo Undefined 36 3 255 0 0 40 148 71 152 80
6 241 65 ... <--- 36 bytes
/Users/rmills/Downloads/_IGP9032.DNG Exif.Image.Model Ascii 20 PENTAX K10D
/Users/rmills/Downloads/_IGP9032.DNG Exif.Image.UniqueCameraModel Ascii 12 PENTAX K10D
/Users/rmills/Downloads/_IGP9032.DNG Exif.PentaxDng.ModelID Long 1 K10D
/Users/rmills/Downloads/_IGP9032.DNG Exif.PentaxDng.LensType Byte 3 Sigma 55-200mm F4-5.6 DC
<--- 3 bytes
/Users/rmills/Downloads/_IGP9032.DNG Exif.PentaxDng.LensInfo Undefined 69 131 0 0 255 0 40 148 68 ..
. <--- 69 bytes
/Users/rmills/Downloads/IMG2220.DNG Exif.Image.Model Ascii 20 PENTAX K-3
/Users/rmills/Downloads/IMG2220.DNG Exif.Image.UniqueCameraModel Ascii 11 PENTAX K-3
/Users/rmills/Downloads/IMG2220.DNG Exif.PentaxDng.ModelID Long 1 K-3
/Users/rmills/Downloads/IMG2220.DNG Exif.PentaxDng.LensType Byte 4 Sigma Lens
<--- 4 bytes
/Users/rmills/Downloads/IMG2220.DNG Exif.PentaxDng.LensInfo Undefined 128 0 131 128 0 0 255 1 184 0 0
... <--- 128 bytes
$
```

So, the "PENTAX *ist DL", "Pentax K10D" and "PENTAX K-3", write 36, 69 and 128 bytes to PentaxDng.LensInfo (and 2/3/4 bytes into Pentax.LensType).

I've updated pentaxmn.cpp/resolveLensTypeSigma() to respect the 128/4 byte and now I get:

```
992 rmills@rmillsmbp:~/gnu/exiv2/trunk $ exiv2 -pa --grep Lens ~/Downloads/*.DNG
/Users/rmills/Downloads/IMG2220.DNG Exif.PentaxDng.LensType Byte 4 Sigma 55-200
mm F4-5.6 DC
/Users/rmills/Downloads/IMG2220.DNG Exif.PentaxDng.LensInfo Undefined 128 0 131 128 0
0 255 1 184 0 0 ...
/Users/rmills/Downloads/_IGP9032.DNG Exif.PentaxDng.LensType Byte 3 Sigma 55-200
mm F4-5.6 DC
/Users/rmills/Downloads/_IGP9032.DNG Exif.PentaxDng.LensInfo Undefined 69 131 0 0 255
0 40 148 68 ...
$
```

Here's the new code:

```
if ( value.count() == 2 ) {
    // http://dev.exiv2.org/attachments/download/326/IMG4432.PEF
    // exiv2 -pv --grep Lens ~/Downloads/IMG4432.PEF
    NO CHANGE
} else if ( value.count() == 3 ) {
    // http://dev.exiv2.org/attachments/download/858/_IGP9032.DNG
    NO CHANGE
} else if ( value.count() == 4 ) {
    // http://dev.exiv2.org/attachments/download/868/IMG2220.DNG
    // 0x0207 PentaxDng LensInfo Undefined 128 0 131 128 0 0 255 1 184 0 0 0 0 0
    // 0 1 2 3 4 5 6
    if ( lensInfo->count() == 128 && lensInfo->toLong(1) == 131 && lensInfo->toLong(2) == 128 ) index = 8;
}
```

Thanks for the test data. I've extracted the metadata into test/data/exiv2-bug816e.exv and updated the test suite to inspect him as a regression detector.

Can I ask you to build and run some tests. I've chosen to test the length and bytes 1 and 2 - this could be a wrong guess. If you find files for which this doesn't work, please post them and I will investigate.

#38 - 21 Dec 2015 09:20 - Simon Harhues

Hi I can only recommend to add that lens and a couple of different bodies to your wish list to make sure that you're still busy on Saturday as well. :) But don't worry.

I recompiled and just went through all my photos of the last 14 months and checked them. The Sigma lens now gets always recognized correctly. That's great! I will try to shoot some more with the K3 body to have more test samples and come back to you then.

Note to myself:

```
find /tmp/fotos/ -name "*.PEF" -o -name "*.DNG" -exec sh -c 'exiv2 -pt {} | grep "Sigma"' \; -print > ~/raws
```

#39 - 21 Dec 2015 13:08 - Robin Mills

- Status changed from Assigned to Resolved
- % Done changed from 80 to 100
- Estimated time changed from 15.00 h to 17.00 h

That's great. I'm going to restore this to "Resolved 100%" until you say otherwise.

Here's the bill for my help. I'd like you to visit OpenHub.net and register (it's free). Give the Exiv2 project a great rating (4 or 5) and give me kudos.

Exiv2: <https://www.openhub.net/p/exiv2>
 Clanmills: <https://www.openhub.net/p/exiv2/contributors/60065117754297>

Happy Holidays. Always good to hear from you.

Robin - Build Master and Developer Support Engineer

Exiv2Logo.png

#40 - 22 Dec 2015 21:42 - Simon Harhues

Robin, I did a couple of new shots with the K3 body and they all get recognized. Great work, thanks! I believe we can keep it closed (until somebody comes around with a new body).
 BTW as I was a little afraid that you would get bored on Friday I created the two issues [#1141](#) and [#1142](#). ;)

Happy Holidays and thanks for your great support again!

#41 - 22 Dec 2015 22:02 - Robin Mills

I haven't closed the bug. It's marked 100% resolved. If nothing else surfaces, I'll marked it closed before we ship v0.26. Not sure I'll look at the new issues this week. However I will look at them.

I have never noticed that Simon Harhues is an anagram of "Santa Claus". Oh, thank you Santa, now I know you are real!

#42 - 13 Jan 2016 19:15 - Robin Mills

- Status changed from Resolved to Closed

Files

IMGP4432.PEF	9.96 MB	18 Mar 2012	Simon Harhues
pentaxmn.cpp.diff	12.1 KB	26 Mar 2012	Abhinav Badola
pentaxmn.cpp.diff2	14.1 KB	13 Apr 2012	Abhinav Badola
pentaxmn.cpp.diff3	13.6 KB	15 Apr 2012	Abhinav Badola
pentaxmn.cpp.diff4	14.1 KB	25 Apr 2012	Abhinav Badola
_IGP9032.DNG	16 MB	12 Nov 2015	Simon Harhues
_IGP9033.PEF	11.8 MB	12 Nov 2015	Simon Harhues
_IGP9034.JPG	3.09 MB	12 Nov 2015	Simon Harhues
IMGP2221.JPG	9.36 MB	20 Dec 2015	Simon Harhues