MariTime

with *Marathon* and *Remote start* (*under development*)

for HD/HDMI cameras

Timing/Photofinish
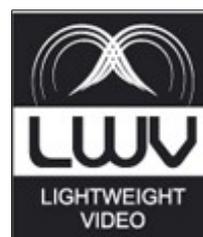
N.B.
This manual is for version 5 of MariTime/HDMI which introduces some new functions in MariTime/HDMI.
Among them are functions for Marathon racing and also functions for Remote start client (using Internet link)

The Marathon and remote start functions are still under development, but their status is that they are (hopefully) fully functional for testing.
All feedback (error reports and/or suggestions) are of course very welcome!

Feed-back

If you find any errors or omissions is this document, or want to contact the author for any other reason, you are encouraged to send your message to info@lightweightvideo.com

MariTime-HDMI User manual last modification at 31/05/17

Preface

About this document

This document is intended to supply all the needed information for

- Evaluation

- Installation

- Use

of the MariTime program.

Reading this document will hopefully bring a good understanding of MariTime.
Better yet is of course to use the software in practice. On the MariTime website you can download the free version of MariTime together with some sample files, hopefully allowing you to get a good initial hands-on experience.

Table of Contents

What is MariTime?

MariTime is a system that has the capability to assist organizers of races for canoe, rowing, dragon boat and similar events.
It is suited both for racing on individual courses, and also for marathon racing
MariTime is a computer program intended to run on a consumer PC running Windows.

An earlier version of MariTime used so called *mini-DV* cameras with the *Firewire* standard for transferring video to the PC

The current version MariTime uses instead a standard consumer *HD/HDMI* video camera as its primary input.
By processing the input from the HD camera, MariTime can produce accurate timing combined with visual documentation (photo finish) of the races.

HD stands for *High Definition*, and this refers to the (relative to older types of video cameras) high number of pixels used. which is1920*1080 (X*Y).

HDMI stands for *High-Definition Multimedia Interface* . This is a standard that defines physical and electrical specifications for transferring high-quality video information.

And so, a video camera that uses both of these standards is often called a *HD/HDMI* camera.

Two program versions!

MariTime comes in two versions:

1. **The full version**
    This has all the functionality (both video capture and file processing), and normally needs an attached Control Box (described later in the document) to function properly.

2. **The free version**
    MariTime_free (so named, because it really is free) can not capture video, but has all the file processing functionality

In a race situation it is common to have the two version cooperate.

One PC with the full version only captures the heats in succession, and one (or more) PC:s with the free version handle the post-processing (assigning times etc.). The PC:s normally communicate via "shares" on a LAN.

How to get started

Delivered items
The following items are delivered with the full version of MariTime:

- A **Control Box** with USB cable
  The controlbox is used to enter start and capture commands to the program

- A **Ball Head (with mounting bolt)**
  The Ball Head is used to mount the video camera in an optimum way for the race

- **A 10 meter HDMI cabl**e (tested) & 2 HDMI adapters

- A 1/4" "**Phono plug**" for connection to "remote start"

- A printed version of the **HDMI user manual**

Items to acquire
In order to get started with MariTime, there are a number objects that you need to acquire yourself:

Running the full version
- **You need a suitable PC running Windows**. This is described on page 71
- You need to acquire and install suitable **HDMI capturing hardware**.
  Info about this on page 76
- You need a suitable **HD/HDMI video camera**. Info on page 74

Testing the free version

If you only want to install and test the free version, the only hardware you need is a suitable PC

Installing MariTime

Both the full and free version of MariTime come as a compiled setup program (a single .exe file).
All you should need to do is to execute this program.
If you don't have very good reasons for doing so, you should accept the default values as proposed
by the installation.

Updates

If an update is needed (e.g. to fix a reported program error) an updated MariTime .exe file might be
made available (mailed directly to a customer and/or published on the web site).

In such cases the recommended procedure is to manually put the new updated .exe in the same
folder that was created during the initial installation. The new .exe will have a unique file name,
meaning that the two (or even several) .exe files can coexist without conflict.

Preparing for the race

To prepare for a race there are a number of activities that should be performed.

- Physical installation and set-up of the camera
- Entering race specific data into MariTime

Placing the camera

To get a good view of the finish line, the camera should ideally be placed as high as possible. The camera should be well protected from rain and wind.

Try to avoid having a glass or plastic window in front of the camera lens

The video camera used for MariTime needs to be mounted free of movement and vibrations. Therefore, use of a good tripod and/or the **Ball Head** delivered with MariTime is recommended. In many cases , the camera will be positioned in its "normal" position. There can however be situations (see page 79) where the camera will be tilted 90°.

Illustration 1: HD camera tilted 90° using a Ball-head

Please note that both the HDMI cable and the power cable are run in a loop around the tripod as a precaution. It is easy for a person to accidentally trip over one of these cables, resulting in damage to the camera.

Arranging some kind of strain relief is strongly recommended!

The initial set-up of the camera can be done by looking in the viewfinder or at the fold-out LCD screen. However, to get the optimum set-up it is best to view the picture on the computer screen. It is now time to start the program!

Starting MariTime

You start MariTime just as any other Windows program, typically by double-clicking its icon.

After starting the full version of MariTime, you will see the *Startup form*:

Illustration 2: MariTime/HDMI startup form

Above is the startup screen. (The background picture may vary...)

MariTime will display the (most important) **Current parameters**.
Often, a user will want to use MariTime in the same way as last time, and so **Go** is the most used option on the start form.
However, if you want to change the running mode, you should click Change Parameters.

N.B, MariTime stores a multitude of settings in a so called .ini file. However, when started for the first time this file does not exist. Therefore you will see this message:
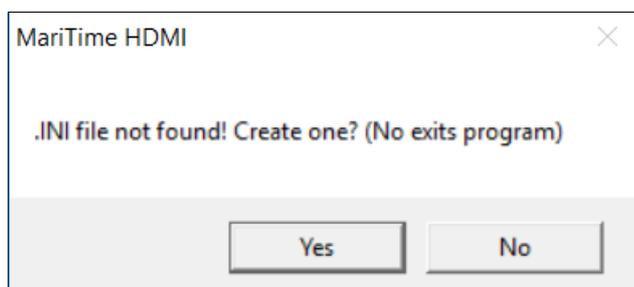
Many parameters will be given a reasonable default value, but you need to select a video capture

source/property as shown in this message:
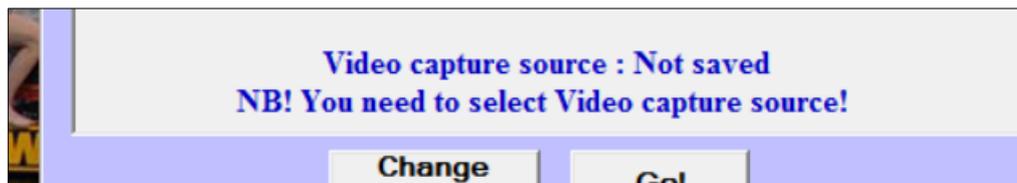
This leads us to parameter settings!
Click Change Parameters, and you should see the following:
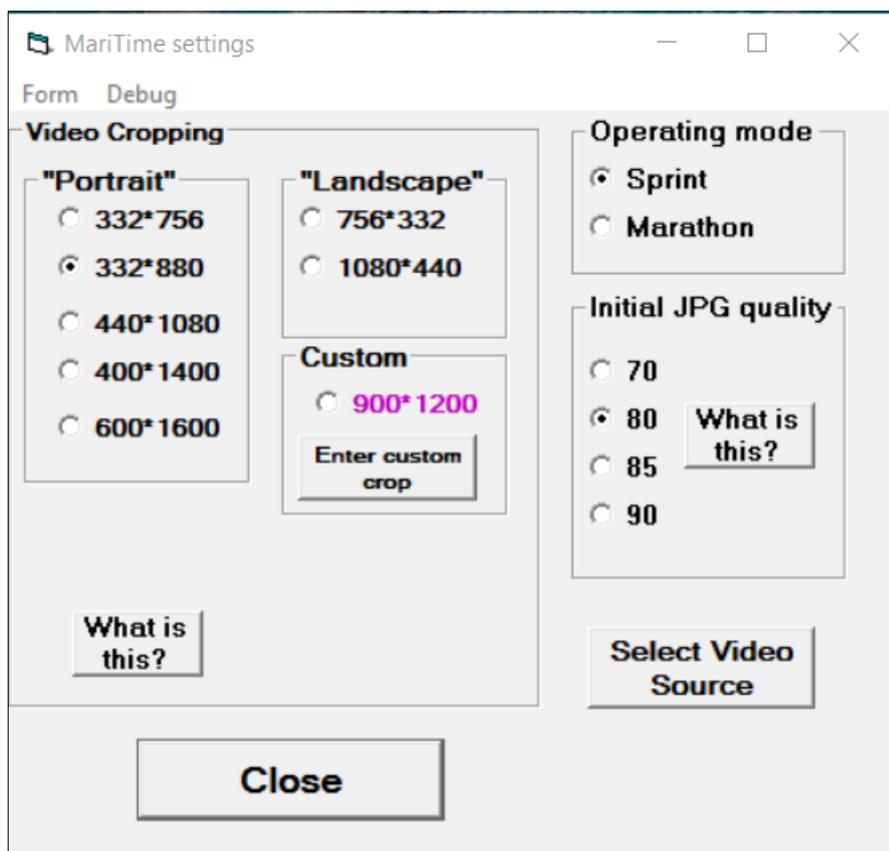
The **Operating mode** can be either *Sprint* or *Marathon*.

The **Cropping options** are described in the section **Understanding Crop size** at page 79
Please read this section before you change the crop setting!
It is assumed that *Portrait* cropping settings will be used for Sprint racing, and that *Landscape* cropping is preferred for Marathon, and based on user feedback the predefined cropping values can be changed/added

Initial JPG quality is described in "About video compression" at page 80

Selecting the video source is described on page 88

If/when you change some parameters and click Close, you will see the startup form again with the new parameters.
If you then click **Go,** the program will begin in replay mode, thus displaying the Video replay form. Depending on the current operating mode (Sprint/Marathon) this form will have different

appearance as described later.

If you want the capture video files, you just click "Video capture" at the bottom of the replay form, and the multi-capture form should appear:
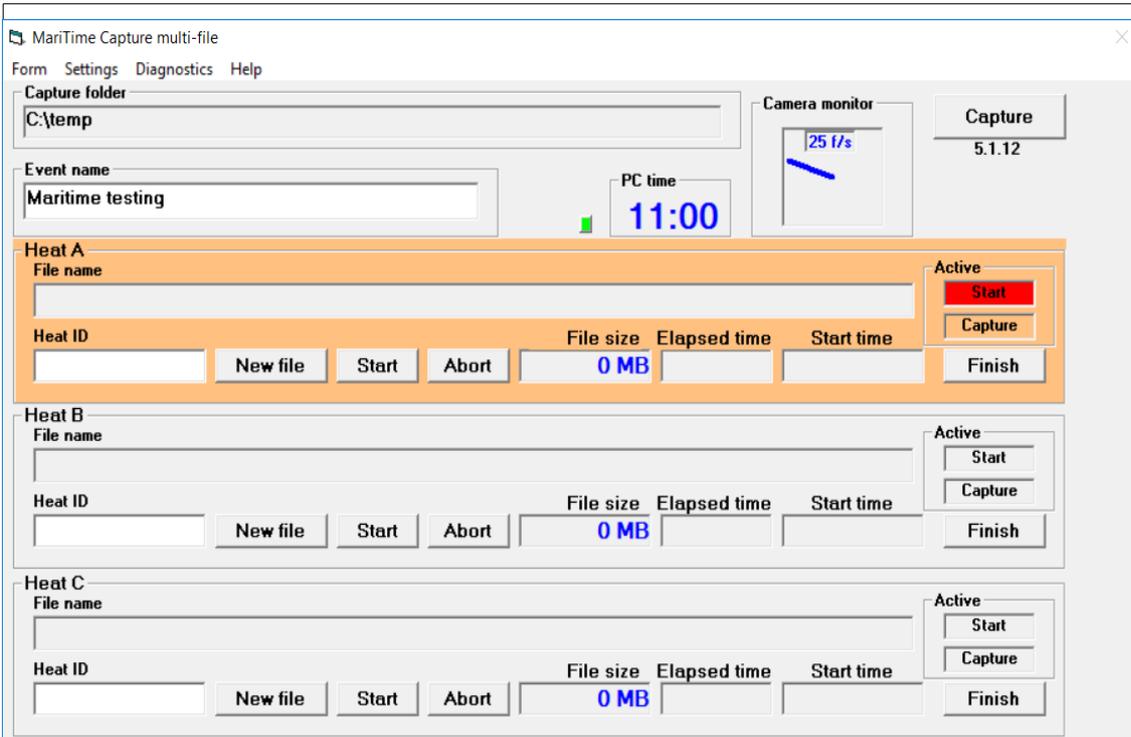
Illustration 3: MariTime multi capture form

N.B: In the (hopefully rare, but unfortunate) event that MariTime terminates with running heats, it will notice this on a restart and display the following:
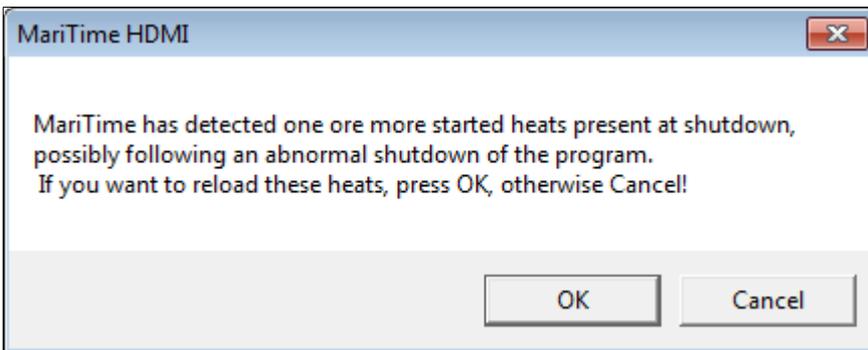
Selecting **OK** will reload the heats from the settings (.ini) file. **Cancel** will clear the saved heats.

Provided that the camera is switched on and connected, you should now see a rotating blue arm in the frame named **Camera monitor**

This indicates that the program is receiving video data from the camera.
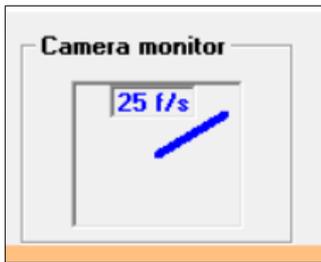
It is important that the little window above the rotating arm shows 25 f/s (with eventual minor variations).
The reason for this is explained in the section about camera settings at page 85

If the camera is connected and switched on and you still can not see the rotating arm, you will have to carry out problem solving as described on page 90

Preview Form

From the *Capture* form you can easily switch to the *Live Preview* form.
This is done by pressing Control-V (or **choosing Video preview** on the **Form** menu).

Switching back to the *Capture* form is done by clicking the Close button on the Preview form..

As the name implies, the *Live preview* form will show live video from the camera.

N.B! *You will only see the portion of the video frames defined by the current* <u>*Crop selection*</u>*!*

Make sure that you are satisfied with the settings of the camera with respect to:

- Pan (horizontal position)
- Tilt (vertical position)
- Zoom
- Focus

Illustration 4: A well-aligned goal line view (with boats arriving from left)

With the boats coming from the left, you probably want a preview window looking like this:

All lanes should be visible, but it is not necessary to show much water outside of the lanes.

This is also a good time to ensure that the video camera parameters are set up correctly.
See page 85!

Setting up lanes

With the HD camera installed and set up correctly, further preparation for the race can be made.

On the **Live preview** form you will see a frame called **Options,** with a number of controls:

Illustration 5: Lane setup options

- **Show lane markers** will show/hide the lane markers

- **Flip lane markers** will flip the lane markers to accommodate boats coming in from the left or the right

- **Show goalline** will show/hide the electronic goal line

- **Number of lanes** has an up/down control allowing you to select the number of lane markers that will be shown

- **First lane** gives you the option to indicate that there is a lane numbered **0**. Normally lanes start with **1,** but in the event that you want a lane **0**, this is the way to do it.

Positioning lanes and goal line

On the **Live preview** form you should now position the lane markers and the goal line.
They can easily be moved by *dragging* them (hold down mouse pointer in goal line handle or in the lane marker circle and move).

Once you are satisfied you should click the **Save options** button.
Now, all the settings (options/positions etc.) are saved in the MariTime settings (.ini) file.

In PC lingo this file is often called an *.ini file*.
MariTime does not use the Windows registry for saving settings data.

If you restart MariTime and/or re-enter **Live preview**, you will notice that all the settings you have made remain as you left them.
The positions of lane markers and goal line will also be included in all the video files that will be captured during racing.
Therefore, when these files are replayed on any PC, the positions of lanes and goal line will reflect the settings done during initial set-up!

Resetting positions

You may find yourself in the situation that one of the handles of the goal line is outside of the screen, or that one or more of the lane markers has become "lost". One possible reason for this to happen is that you have changed the Crop size.. To cope with this situation there are two items on the menu of the preview form as shown here:
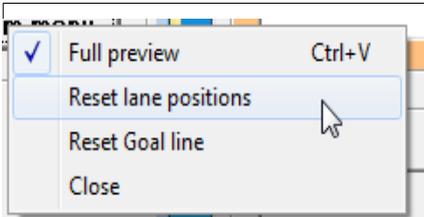
Illustration 6: Preview form menu

Reset lane positions will positions all the lane markers in close formation starting from the top left of the screen

Reset Goal line will position the goal line centered vertically on the screen.
After you have used these functions you can re-position the lane markers and goal lines manually. Don't forget to save the new positions!
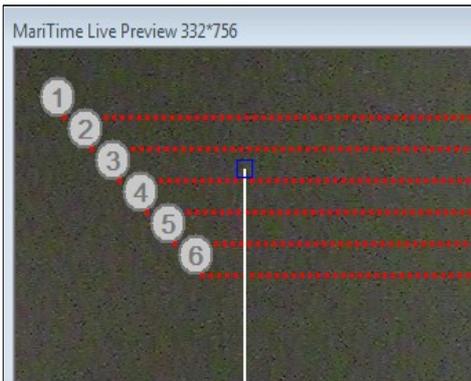
After resetting the lane positions, this is how they will positioned.

About goal lines

One version of a traditional goal line used by race officials is constructed by a string positioned in front of the glass windows in the goal house. Officials are seated on several tiers, aligned to view the boats "through" the string.
It is possible to place the video camera in this position looking "through" the string.
However, due to optical restrictions it is impossible for the camera to exactly focus both on the string and the boats.
If focus is on the boats (which must be considered a natural priority) the picture will look like this.

Illustration 7: A "physical" goal line (a black string)

The goal line string is noticeable out of focus, albeit still useful.
We can compare this to an digitally rendered goal-line which can look like this:
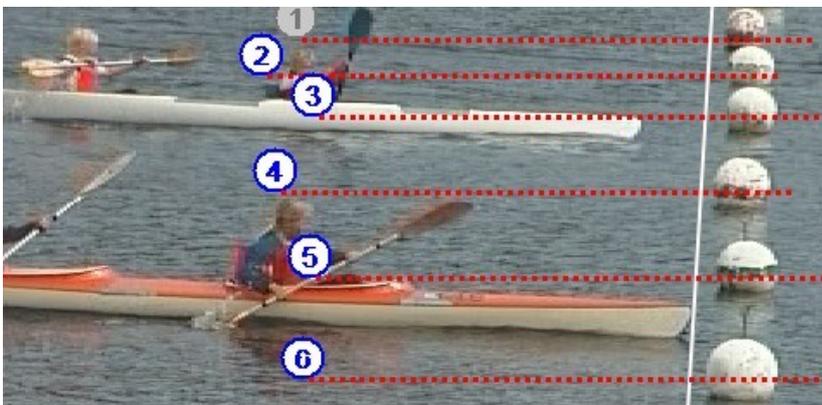
Illustration 8: A digitally rendered goal line

Entering event name

A race meeting may have a <u>name</u> that you want on printouts and displays.
On the Capture form you simply enter the event name into the event name field as shown here:
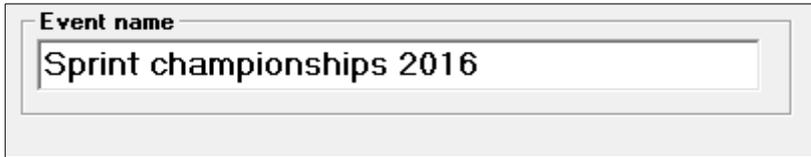
In case that no event name has been entered (and no old event name remains stored) NOEVENT will be used.

Selecting the Capture folder

The video files that are captured need to be placed somewhere. You therefore have to designate a Capture folder.

In the capture form, you just click in the Capture folder. This will bring out a folder browser dialog box where you can select (or create) a suitable folder.
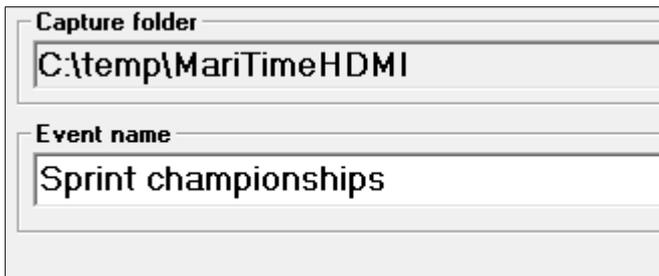
Capturing heat data

Introduction

Capturing video/data files is the core function of MariTime.
Video capture is a task that is entirely separated from the post-processing, and many users prefer to perform post-processing on a dedicated computer. (Using the free version of MariTime)

Preparation

It is assumed that all race preparations (Camera set-up etc.) have been performed as described earlier in this document .
To be ready for the first heat of the race, you should ensure that:

- The camera is set up correctly and sending data to the computer
  (as indicated by the rotating blue arm)

- You are satisfied with the picture transmitted from the camera

- The lanes and goal line have been set up correctly

Heat operations

For each heat, the MariTime operator has a number of tasks to attend to:
- Entering heat data
- Initiate a new file
- Indicating heat start
- Activating video capture (one or more times)
- Indicating heat finish

Entering heat data

A walk-through of all the elements on the form

Heat frame

On the form there are 3 identical frames.
This is because MariTime offers the possibility to handle 3 concurrent running heats if needed.

Each *Heat frame* has the following contents:

- **Heat ID**
  This is the ID of the heat

- **New file**
  This button creates a new file for the heat, ready for video capture

- **Start**
  This button indicates start for the heat.
  More often the start signal is entered via the Control box.

- **Abort**
  This button is used to abort a heat, often as a result of a false start.
  An alternative method for aborting a heat is to press the *Esc* key on the keyboard.

- **File size**
  This field shows the current size of the file.
  For each video capture, the file grows in size. The field also shows the number of segments that comprises the file. Each time capture is performed, a new segment is added to the file

- **Elapsed time**
  For a started heat, this field continually shows the elapsed time.

- **Start time**
  At heat start, the current PC time is displayed in this field.

- **Finish**
  When a heat is finished and all video capture is done, this button is used to initiate some "cleaning-up" routines

- **File name**
  This field displays the file name that is generated for the heat.

Each file captured by MariTime is assigned a unique file name.
The file name will be constructed from

- The event name (see page 21 for entering the event name)

- The heat ID

- The current date and time

Clicking **New file** will initiate the creation of a new file

Capture

This button activates the actual capture of video data.

Capture is normally activated by toggling a switch on the **Control box**, but this screen button has the same effect. Capture should normally only be active when (or rather immediately before) boats are actually passing the goal line.

As soon as capture is deactivated again, the captured video is written from the initial RAM memory buffer to the designated file on the hard disk. This file-writing process is illustrated by a progress bar. This progress bar will only be visible during the actual writing of the disk file.

Heat frames

As you can see, the Capture form contains three identical **Heat frames**. They are named A,B & C. Often, one such frame is all that is needed. The reason for there being three frames is that sometimes you need to be able to handle more than one heat running at the same time. This procedure is described later on page 25

In the **ID** field you should enter the **heat identification.** Often this is a numerical value, but MariTime also allows alphabetical input.

Now, you await the start of the heat. For the time being it is assumed that the start will be input manually. A common procedure is that the starter and the goal house are in radio contact. When you hear the starting signal (a shot, a siren or similar) you push the start button on the control box. **Elapsed time** starts counting immediately. You can also see the exact time-of-day for the start of this heat.

This is a **Heat frame** with a newly started heat: No capture has been made yet, and the file has a (rounded) size of 0 and 0 video segments.

To ensure accurate start time reference is important that the PC on-board clock is correct. If the PC is connected to the internet, this will normally be taken care of automatically. If not, underline manual setting of the PC clock may be necessary! The actual race result timing is not affected by the PC clock, but rather the time-of-day references.

False starts

In case of a false start, all you have to do is to press the **Esc** key on the keyboard. (Or click the **Abort** button)

 If you want to abort the heat you should click the **OK** button, otherwise you press **Cancel.**
(The Cancel button has focus, meaning that pressing **Return** will also mean Cancel)

An aborted heat will result in this display:
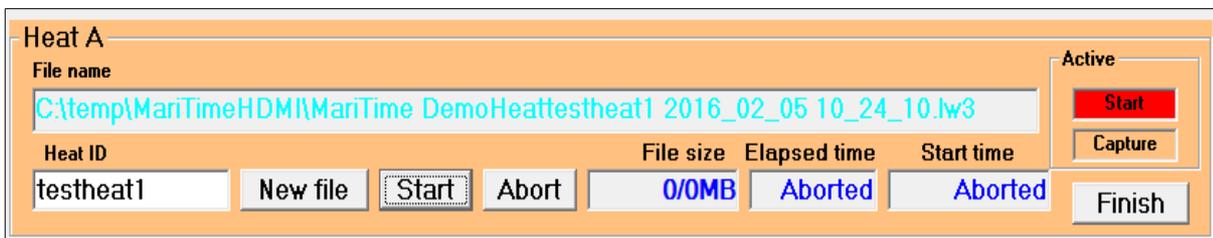
The heat is now awaiting a re-start.
This procedure (starting/aborting) can be repeated indefinitely.

Active Heat (running multiple concurrent heats)

As you will notice, clicking in a heat frame will change its colour to orange, and this denotes that this is the <u>Active Heat.</u> An active heat is the heat that is affected by <u>events</u> such as the **Start** event and the **Capture** on/off event (from the control box or via on-screen click)

But, consider the following situation:

You have a number of 1000 meter heats. Since they take a rather long time you will want to run several heats simultaneously. Now, we may find ourselves in the situation that Heat M1 has been running for some time, and the we will soon want to do some video capture for it. But, at the same time we also expect the start of Heat M2.
Here is what to do:

- Initiate both files
- Make M1 active just as usual and start it
- Ctrl/click in the Start button (in the Active frame) for M2
  This will change its color to red, but the Heat frame for M1 will still be orange

Here is what we should see now:
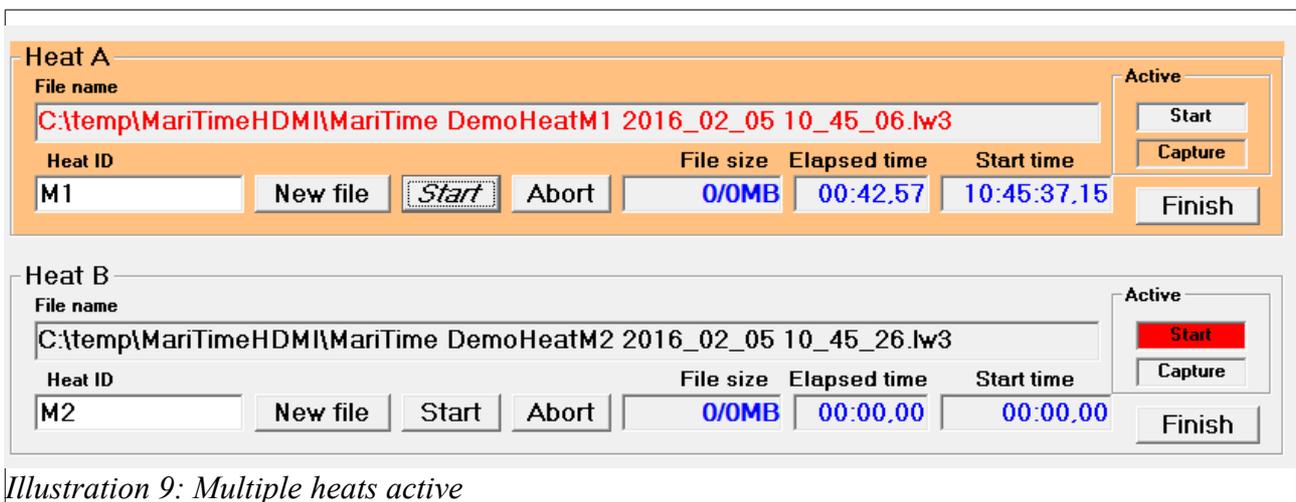
Illustration 9: Multiple heats active

Heat M1 in frame A is active for video capture.

However, a Start event will affect heat M2 in frame B.

It is recommended that you really take some time and practice this "at home" before using it at your first event! Things might get a little "hectic" and you need to "know what you are doing"...

Capturing video

Illustration 10: Capture toggle switch

Initially after the heat start the goal line will be empty, and there is no need to capture any video.
When the first boats approach the goal line, you should activate the actual video capture. This is done by flipping the right toggle switch on the control box to the **on** position..

When this switch is in the **on** position, every video frame coming from the camera is stored in the RAM memory.

In the ***Camera monitor*** frame you can observe during capture that:

- The rotating arm changes to **red**
- **A frame count is incremented as shown here**
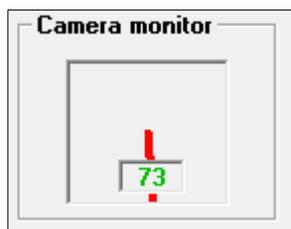
When there is no longer any activity at the goal line, flip the capture switch back to its inactive (**off**) position again. This action will trigger MariTime to write (append) the captured video to the file on the hard disk.

It is important to understand that the captured video frames will be appended to the file in the active Heat frame. Thus, if there are two heats running you have to ensure that you have the correct Heat frame selected when boats are approaching the goal line.

The video data that has been stored in the RAM memory is *appended* (i.e. written at the end) of the file. This procedure of activating and de-activating the video capture is often repeated several times during a heat (or group of heats).
The post-processing of the captured video data will be more effective if the file only contains "action" video, and not an idle goal line.
Every time that video data is appended to the hard drive file it grows in size.
The field ***File size*** displays the current size of the file, and also the number of video segments making up the file

The Control Box

About the Control Box

The Control Box is central to the functions of heat capture.

- The *full version* of MariTime <u>can not</u> operate without the Control Box.

- The *free version* of MariTime <u>does not need</u> the Control box.

NB: The MariTime Control Box comes in two main versions.

- **Version 1** had <u>3 individual start buttons</u> for starting multiple simultaneous heats

- **Version 2 (and onwards)** has only <u>one start button</u>, since the method for handling simultaneous heats has been changed in the MariTime program

Using the version 1 box means that you only use start button 1 for all heat starts

Connections

At the front of the Control Box you can see 2 connections

USB is used to connect the Control box to the computer using a standard USB cable.

Remote is used to connect a *remote start* signal (if available).

This input uses a 6.3 mm (1/4") phono plug (mono)

A detailed description on using this input can be found on page 31

Controls

Push buttons

The Start button is used to enter heat start manually if remote start is not used.

Illustration 11: Control Box, version 2

Toggle switches

Capture

The toggle switch at the right is used to activate *video capture*.
When there is activity on the goal line that you want to capture, flip this switch to the **on** position.
With no activity on the goal line, flip the switch to the **off** position.

Remote

When this switch is in the *off* position MariTime does not react to any changes on the remote input.
When switched *on*, the remote input is active as described on page 31

Remote Start Client program

A new function is now being developed, meaning that the start function can be executed from a remote location using a special clint program.
More info about this follows later in this document.

Testing the Control Box

On the *Capture form*, select *Test Control Box* from the *Form* menu as shown:
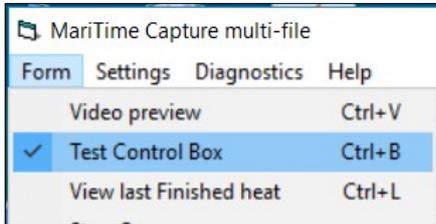
This will bring up a frame at the bottom of the **Capture form** as shown here:

Flipping the toggle switches or pressing the push button will be reflected by the corresponding action on the form.

At the upper left you can see a field that indicates the present status of the remote input.

At the lower right you can see a frame that indicates the present status of the Control Box and the serial number of the box.

If you press the left button with the pointer inside the LED above the Remote switch, this will light up the yellow indicator LED.

Selecting the menu item again hides the Control Box validation frame.

NB! MariTime will <u>not operate properly</u> with the test frame visible. This is because all the events that emanate from the control box will be "intercepted" and not reach their intended targets within the MariTime code. So, *hide the test frame when you are finished*!

Using Remote start input

A remote start signal can have one of two different behaviours

- **N/O** (Normally **open/not-conducting**).
  This means that the circuit is normally open, and upon start the circuit <u>closes.</u>

- **N/C** (Normally **closed/conducting**)
  This means that the circuit is normally closed, and upon start the circuit <u>opens</u>.
  (this is the preferred behaviour of remote start equipment)

Above the **Remote** toggle switch you will find a yellow LED.
This LED indicates the current status on the remote input.
A lighted (glowing yellow) LED indicates that the remote input is *Closed*, and consequently a dark LED indicates that the remote input is *Open*.

If you intend to only use manual start, the **Remote** switch should <u>always be in the **off** position</u>.

The procedure for using Remote Start is as follows:

- Position the **Remote** switch in the **off** position

- Ensure that the remote start equipment (not supplied with MariTime) is functioning properly. This can be done by observing the indicator LED

- When you are satisfied with the status on the remote input, put the remote switch to the **on** position.
  At the flip of the **Remote** switch, MariTime will store the status of the Remote input as the *Remote idle status*

- As soon as the status on the Remote input changes from the *Remote idle status* this is interpreted as a start signal for the current active heat.
  If you are running multiple heats, you must therefore ensure that the correct heat is active for start as described earlier in this document!.

Processing captured files

When MariTime has captured a file with video and timing information from a heat, it is time to process the file.
This processing can be performed by the same program (on the same computer) that captured the file, or the processing can take place on a separate computer.

In an actual race situation running in a dual computer set-up i.e. separate front-office and back-office computers is definitely preferred.
The post-processing of a capture file does not need the full version of MariTime. — the free version is fully sufficient for this.

After opening a file for processing, you are faced with two forms side-by-side:

The two forms are

- The **Playback** form
- The **Result** form

The Playback form

The main feature on the playback form is the playback window where the video file is displayed. In the example we can see the marking buoys and the goal line but no boats (yet). This is because the capture was activated a few seconds before the first boat became visible.

To the right of the playback window is a frame marked **Time** as shown here:

Delta Time is used to measure the difference between boats. A more detailed description comes further down

Start time is the time-of-day (as derived from the PC clock) for heat start

Elapsed time is described further down!

On the form you can also see a frame called ***Video Play***:

There is a **Play** button and a ***scroll bar*** (sometimes called a *slider*). Clicking the **Play** button will start the replay of the captured video from the beginning of the file. If not interrupted, the replay will continue until the file ends.

You will notice that the playback will be interrupted if you press any key on the keyboard or on the mouse.
By dragging the knob on the scroll bar, you can move quickly back and forth in the file.

Another practical way to view the the file is to use the *arrow keys* on the keyboard. The layout of your specific keyboard may vary slightly from the following illustration:
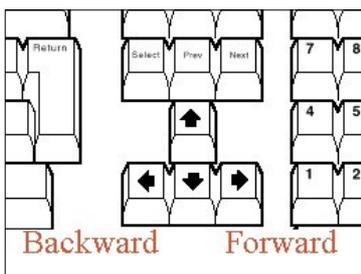
Pressing the <u>left</u> arrow key will move the file *backward* in time.

Pressing the <u>right</u> arrow key will move the file *forward* in time.

By pressing an arrow key once, the file moves *a single frame* in the desired direction. If you keep an arrow key pressed down the movement will be continuous.

Sometimes you may want the video to play be faster while keeping an arrow key pressed.
This can be accomplished if you first hold down the ***Ctrl*** key and then press the arrow key. This will move the file in increments of 4 frames, increasing the effective speed

One thing that can lead to initial confusion is the fact that as the left arrow key moves the file backwards in time, the actual boat on the playback windows may move to the right. This obviously depends on whether the boats come in from the left or from the right.

Elapsed time

In the **Time** frame, you can see a field named **Elapsed time.**
As you move around in the file you can see that this field changes its value. For each video frame the time changes 1/50th of a second. This means that the basic timing resolution of MariTime is 0.02 seconds[1].

As will be described later on page 36, you have an opportunity to assign times with a resolution of 0.01 (1/100th) seconds.

The Elapsed time starts from 00.00.00 when MariTime gets a start signal, either from a button on the **Control Box** or via an electric signal from the starting equipment.
For a detailed description of the time display format, see page 66

Delta Time

This field is used to show the difference in time between boats. You can use it in the following way:

If you have positioned the file so that a boat just passes the goal line, click with the mouse pointer inside the **Delta time** field. You will notice that it changes its value to *00.00.00.* If you continue to move forward and let another boat reach the goal line, the Delta time field will show the difference in time between the two boats.

In the illustration above you can see "83%" in large blue lettering. This figure tells us that there was not enough vertical space on the screen to display the full height of the captured video. Sometimes the vertical resolution is too big for the available space, and you will then see a smaller percentage displayed in a similar fashion.

---

1   See Appendix for a technical description of the timing resolution

Assigning times

The most common task in replay mode is to scroll through the file and assign times to all the participants in the heat. A suggested way of doing this is taking these steps:

- Open the relevant file
- Press **Play**
- When the first boat approaches the goal line, press one of the arrow keys. This halts the playback. Now, use the arrow keys to position the first boat exactly on the goal line. The playback window will look like this:
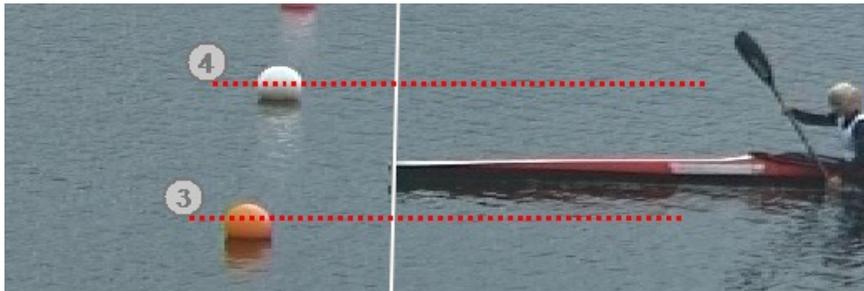
Illustration 12: First boat at goal line

- The quickest way to assign time is to press the corresponding numeric key (e.g. for lane 4 press 4.)
- Another way that offers a few more options is this:
  With the mouse, right-click in the numbered circle for the lane (lane number 3 in this example) for this boat. This will bring up a menu as shown here:

Illustration 13: Assign times

pop-up menu
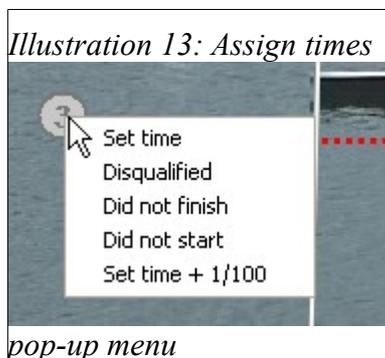
- Select "**Set time**"
  This action will assign the current **Elapsed time** to the boat in lane 3. You will notice that in the **Result form** (to the right), the result for lane 3 is immediately added to the results list.

- Continue to move through the file using the arrow keys and assign times to all the participants. In the file used for this description (Heat 54 from the Nordic Canoe Championships 2007) there were 4 boats (K4).
After all the times are assigned, the result form looks like this:

Illustration 14: The result form with assigned times

Additional timing functions

As you can see in the illustration above, the pull-down menu for assigning times contains several items.

Disqualified, Did not finish and **Did not start** are hopefully all self-explanatory.

Set time + 1/100 has the following meaning:
The basic timing resolution of MariTime is 1/50 (0.02 seconds). This means that for each single step through the recorded file, the time increments 1/50 of a second. Normally this timing resolution is fully sufficient to separate the boats in a race, but sometimes situations occur where the basic resolution is too coarse.
As an example, look at this illustration:

Neither the first or second picture has the bow of the boat exactly on the goal line.
What you can do in a situation like this is to position the file with the boat in the first position (at time 01.46.14). At that position select **Set time + 1/100.**
This will assign the time 01:46,15.

It is also important to know that if two or more boats are assigned exactly the same time, the result list will be sorted according to the actual time-of-day when the lanes were assigned their times. The lane assigned first will be positioned first (among the group of boats with the same time) in the result list.

Zoom

Sometimes you may want to get a more detailed view of a boat and the goal line.
In such cases the *Zoom function* is useful. The zoom function can be activated in two ways:

1. Press **Ctrl-Z**
    or

2. Select **Zoom** from the **File** menu

To disable the Zoom, just press **Ctrl-Z** again.
When Zoom is activated you will see a zoom rectangle with a yellow border.
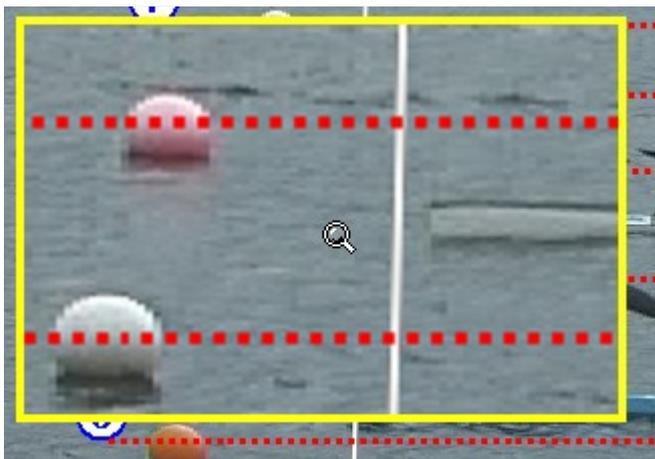
Illustration 15: The Zoom rectangle

This rectangle can be dragged to the desired position. Just place the mouse pointer inside the Zoom box (the mouse pointer changes to a magnifying glass) as shown above.

Hold down the mouse button and drag the Zoom box to the desired location.
The Zoom box will also be included in a printout. This feature can come in handy when documenting a "close call".

There is also another option:

On the form menu you can find this option:
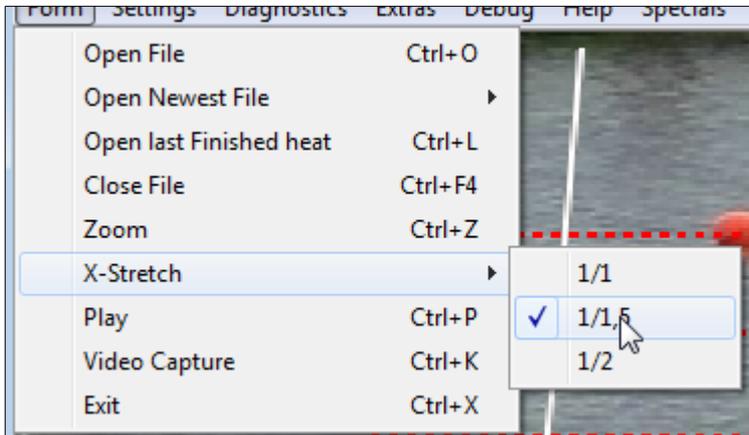
1/1 gives a normal picture, but selecting any of the other two will give a picture that is stretched horizontally. This can be helpful in "tight" situations.

Illustration 16: Picture Stretched 1/2
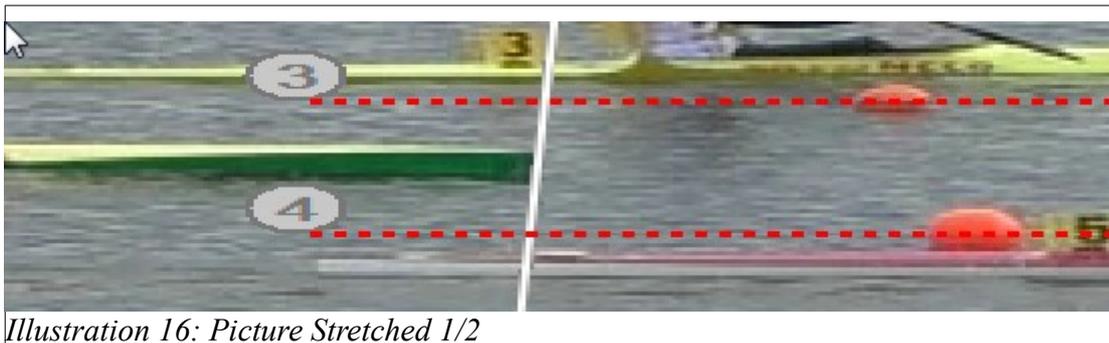
Using a second display

Most laptops offer the possibility to extend the built-in screen with a secondary screen with a larger resolution. This has been found to be useful when running MariTime/HDMI with high vertical resolution.

Here´s what you can do:

Connect and activate a second screen as an "extended display" (the exact wording may differ, but the functionality is that the second screen is not just a copy of the first, but instead works separately).

- Open a captured file.

- Drag the form with the open file to the second screen and re-size it

- Select "Use this size/position" as shown here
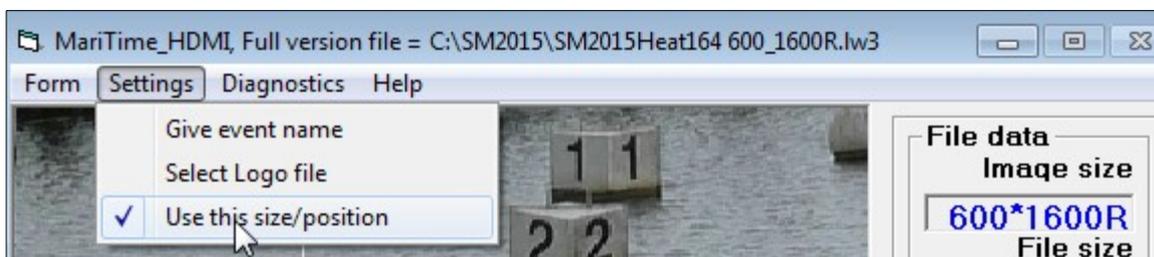
MariTime will now remember the current size & position of the form, and until restarted will use it for all subsequent file openings.

Rotated second screen

A very useful feature (if available on your computer..) is to have the second screen <u>rotated</u>.
This will give us a much improved (and sometimes needed) vertical resolution.
Here is a picture of my own tests with such a set-up:
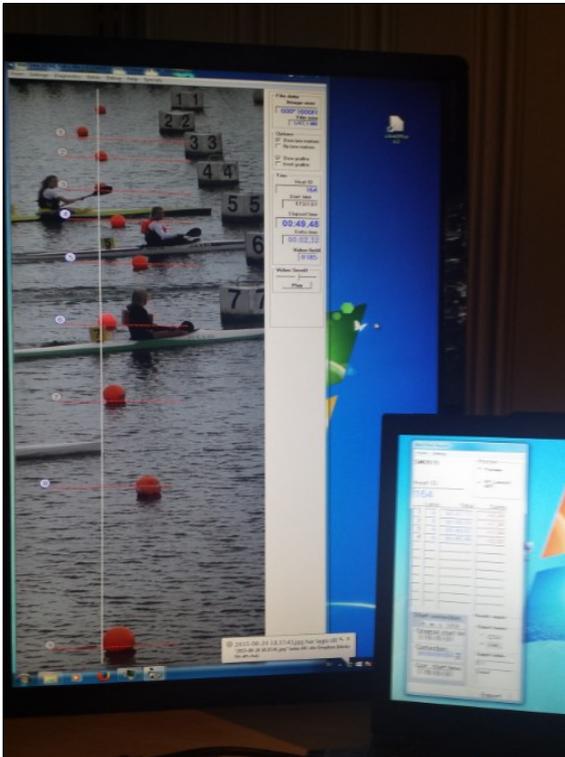
(The video is 1600 pixels vertical and showing at 100%. Very impressive...)

Note that the **Results** form is in this example <u>not</u> (as per default) "docked" to the video form.
The **Settings** menu now has an option to "Undock" it as shown here: (uncheck the Dock option)
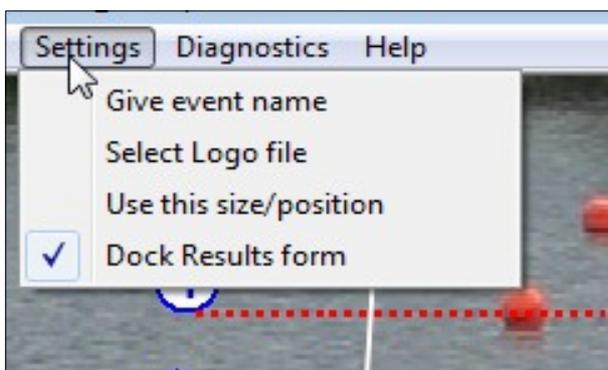
Processing the results

As soon as a time is assigned (using the procedure described above), the assigned time is stored in the data file. This means that if the file is re-opened later, all the data remains in place and this will be reflected in the **Result form.**

MariTime does not handle names or other information about competitors.
Data that MariTime handles and can report is:

- The name of the event

- The heat ID

- The time and place for each lane

The task of connecting the heat and lane data with the participants lies on the race administration system. MariTime is not such a system.
Therefore, MariTime offers a number of ways to publish and export its information.

Printouts

On the **Result form** there is a standard pull-down menu named **Form**.

When activated, it shows these menu items offering a number of printout options.

About the printer
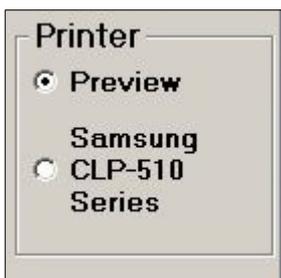
MariTime offers two alternative destinations for the printed output.
In this frame there are two *option buttons*.

- **Preview** means that the printed output is shown on a *preview form* on the screen (and not actually printed).

- The other option button has the name of the *Default printer*.

One printer is always denoted by Windows as the *Default printer*.
This printer is the one that MariTime will use.
However, for trying out the printing functions described here, starting with *preview mode* is recommended.

Print picture series

This command will give a printout as shown here:

Illustration 17: Picture series printout

The printout contains the heat results listed in order followed by a picture of each boat as it passes the goal line.

Print results

This will give the same printout as above but <u>without the picture series</u>.

Print single picture
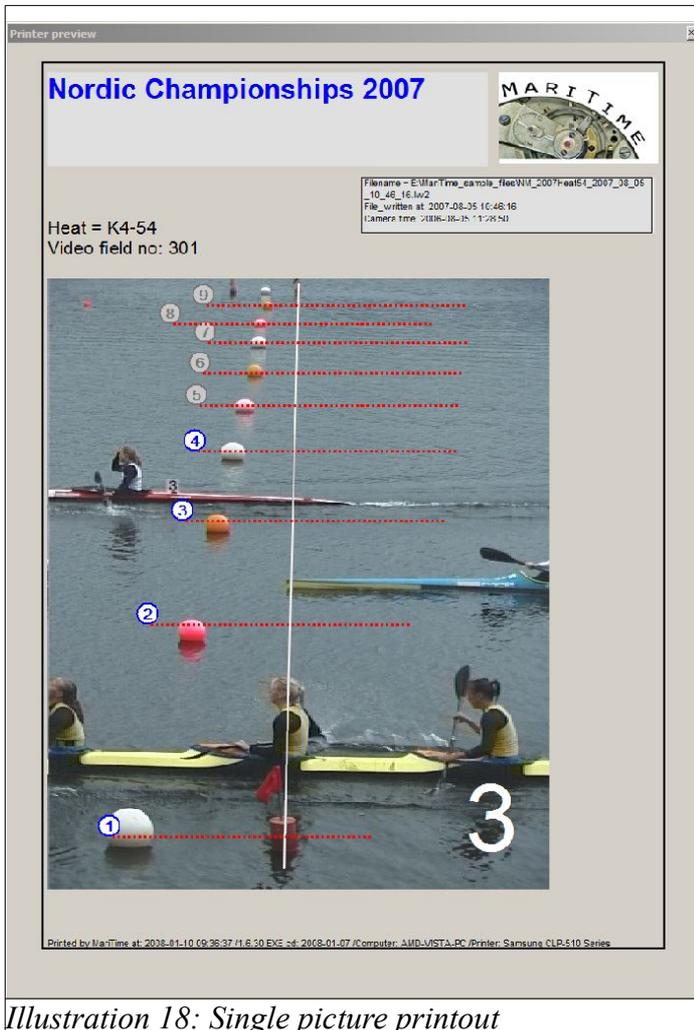
Illustration 18: Single picture printout

Event logotype

If the event has a logotype, it is possible to include this image in the printouts.

From the **Settings** menu, select **Select logo file**. This will give you a standard Windows file open menu were you can select a suitable file.

If a logo file has been selected, it will be included in the printouts replacing the event name as illustrated here:
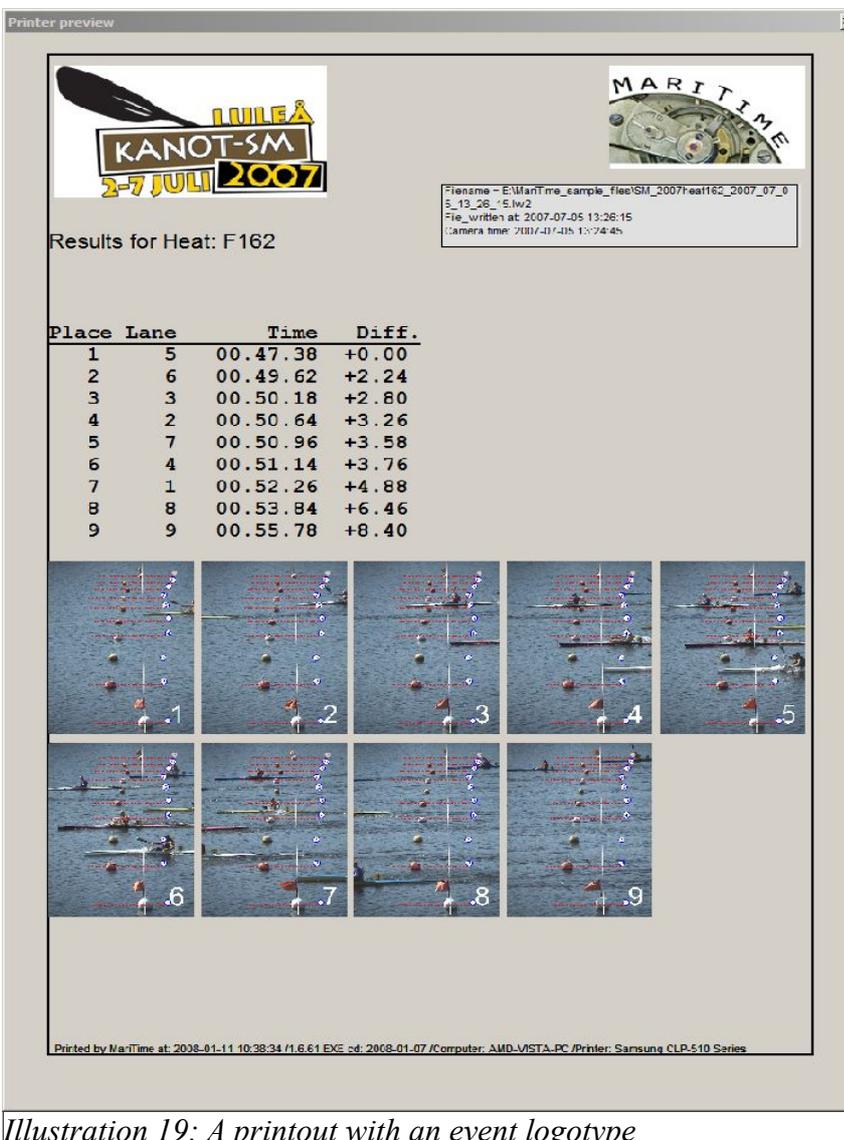
Illustration 19: A printout with an event logotype

Exporting results

It is possible to print out results for each heat and hand the printed pages over to the race administration to be typed in. However, a more efficient way is available.
MariTime is capable of exporting heat data as a *file* with a predefined format.
This file can then be read and "imported" by the race administration program.

For a detailed description of the export file formats, please see page 68

How to perform result export

On the Result form you will find the *Results export* frame:

Export format allows you to choose from the available formats[2] for exporting results.

Export folder allows you to choose a target folder where the exported result files will be written. Clicking the upper field gives you a form for choosing/creating a folder.
Since the folder will often be a shared folder on a remote computer (running the race administration system) there is a second field where the so called *UNC* of the remote folder is displayed. Clicking the **Export** button will initiate the writing of an export file.

When finished, a message like the following is displayed:

The name of the exported result file contains the heat ID making them unique.
Clicking **OK** hides the message.

---

2   (N.B.. If you need another format for results export, please contact me and I will try to add the format to MariTime!)

Start time correction

On the **Result form** you will see a frame called **Start correction**
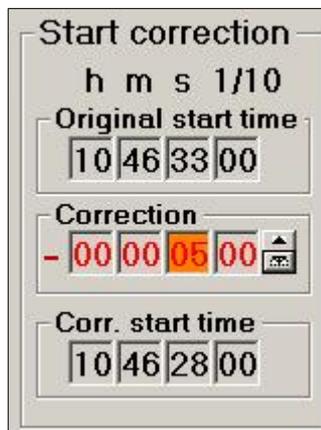
This function addresses the fact that the starting procedure at regatta races can at times be somewhat problematic, and the race officials can decide that a timing correction for a heat is needed.

A common start procedure is that the start pontoon is equipped with a communications radio. During the start procedure the officials in the goal house listen to the transmission and try to hear the transmitted start signal (typically a shot or a horn). The timing (either manual or electronic) is started from this audible reception.
Sometimes the start signal is lost due to radio problems or operator mistake.
This can in turn mean that the recorded start time is wrong.

MariTime therefore offers the ability to enter a correction to the start time. This correction is stored separately in the file, meaning that the start correction itself can be changed or even deleted at will. The originally recorded times always remain unchanged.
From the correction, all the displayed results are re-calculated .

Performing a start time correction

All three times (Original start time /Correction/Corrected start time) have sub-fields for hours/minutes/seconds/tenths of seconds. To enter a correction you click in the desired sub-field of
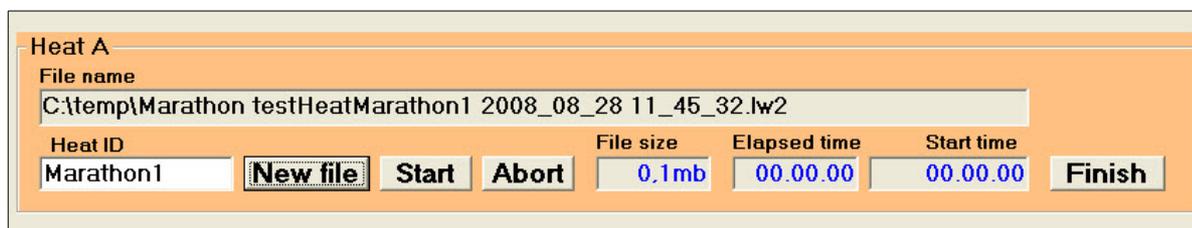
Correction.
Let us assume that you want a correction of -5 seconds (the officials have decided that the correct start time was 5 seconds earlier than the recorded start time).
Click in the **seconds** sub-field to make it active. (turning it orange)..
By clicking at the upwards or downwards arrow you can make the wanted correction. The field *Corrected start time* and all the result fields are immediately re-calculated.

A typical race setup using MariTime

The full version of MariTime has all the available functionality, meaning it can both capture race video files and process the captured video files after each heat.

The free version can only process files captured with the full version.

In many cases with large regattas there is simply not time enough to perform all the tasks on a single PC. Instead a setup as this one is often used:
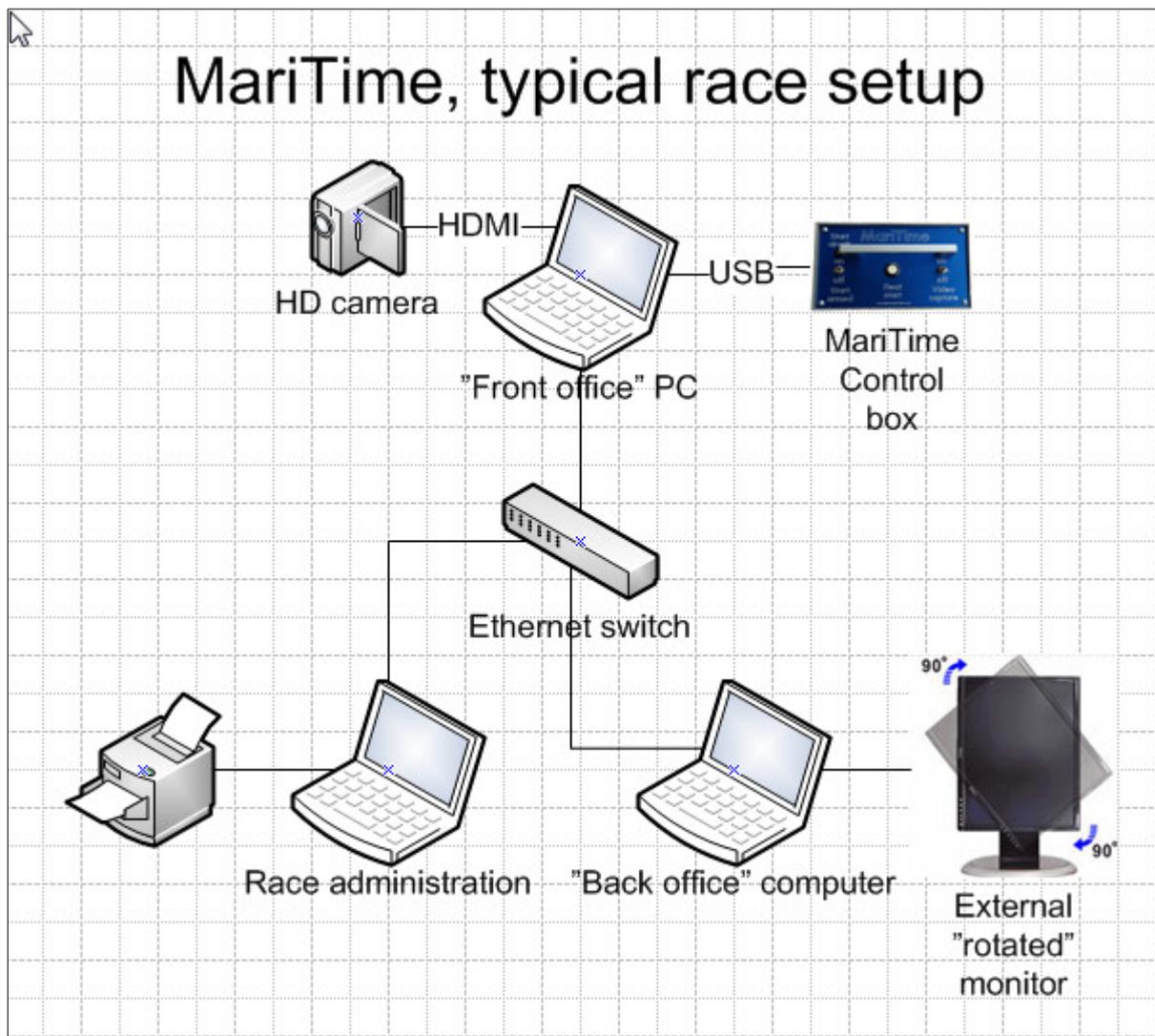
One dedicated PC (the "front office") has just one task, and that is to capture race video for the heats. It uses the full version.
One (or more..) "Back office" PC:s running the free version reads the captured files and processes them. The Race administration PC receives data from back office and imports results files.
The data transfer can be arranged like this (there are other ways of doing it, but I have personally been at races where the described method works fine)

- The front office PC writes video files to its own hard disk.
  (This is to avoid the possibility that video data can not be written to a remote disk because of some network problem. Writing to a local disk is much more "safe" in this respect)
  This local disk is shared with read access

- The Back office PC(:s) reads video files from the shared disk. The result files are written to folders on the race administration PC shared with write access. The amount of data here is almost negligible.

MariTime marathon functionality

Starting from version 5, MariTime/HDMI has functions for marathon racing.
Marathon racing does of course have functions in common with sprint racing, and therefore the two modes can coexist (and share significant parts of program code)

You can activate the marathon function by changing the working parameters from the start form.

A few things to note:

Video file capture uses the same form that is used for sprint. This leads to a slight "*ugliness*".

To capture a video file for marathon, you create a new file in the same way as for sprint.
Heat ID is of course not so relevant since a marathon video file often contains a mixture of many different heats/classes. So you can enter anything you like here.
Once the file is created it will automatically (only in marathon mode) be "started", and you can notice the Elapsed time incrementing. You need not pay any attention to this!
MariTime "wants" a video file to be "started" in order to perform video capture to it and to keep things simple this has not been changed for marathon.

Video replay has a different appearance from sprint.

- There are no lane numbers or markers

- There is no *Delta time*

- There is no *Start time* display. The video file will probably have competitors from many different classes, each with a different start time.

- There is no *Elapsed time* display.
  Instead there is a display of *Clock time.*This is the exact time-of-day (derived from the PC clock) stored with each captured video frame.
  When calculating time for a competitor the recorded Start time for a specific heat will be subtracted from the Clock time for an actual video frame rendering the elapsed time.

Video cropping for marathon

For Sprint mode it is assumed that a "Portrait" cropping will be used just as before.
However, for Marathon it is assumed that a "Landscape" cropping will be used.
The program has 2 pre-programmed suggestions for cropping, but it is also possible to enter a custom cropping. I just do not know at this stage what cropping will be optimal for Marathon.
A larger copped area will render higher image quality, but it will also give much larger files.
For sprint, the file size is normally not a problem, but for marathon, the files can become very large!

Initial JPG quality

Live video data from the HD camera comes uncompressed, and this means that MariTime will use video compression to reduce that amount of data to reasonable proportions.
The default compression quality that MariTime uses is 80, and this will give a compression of about 90% (the compressed image is 10% of the original size) and this with an almost un-noticeable loss of quality.
Using a higher quality setting will render higher image quality, but bigger files.
For Marathon a lower quality could be useful, since it will reduce the file sizes.
Feel free to experiment, but initially you may just let this parameter stay as it is!

Processing a Marathon video file

Above you can see the 3 forms that are used when processing a marathon video file:

As you can see, this file contains 5 segments, but in actual race conditions, this could go to hundreds.
Clock time is the actual time-of-day for each video frame and if we know that actual start time we can calculate true elapsed time.

Where does the start time come from?
It comes from the registration that you make in the Heat registration form.
The first thing to do in preparation for a race is to enter an Event name, and then **Create a new marathon file** from the Form menu.

For each class/heat in the race, you enter a line in the registration form.

The Start at field is used to enter actual start times as they get known.
You should enter the time in the form hh:mm or even hh:mm:ss. MariTime will expand entered times to the hh:mm:ss format as you can notice.
If you press the Ctrl button and click in a Start time, the current PC time will automatically be inserted.

High comp is added following suggestion of a german customer.
The idea is that if there are several classes in a race. the competitors have unique numbers so that it is known what is the highest competitor number for each class.
This has the effect that if you enter a competitor number in the set time form and click Find heat, the program will automatically find the relevant class on the registration form.

This function is of course optional, and you can still use the "normal method" that is to select the relevant heat on the registration form manually.

Marathon racing

Canoe/Kayak racing comes in basically two "flavours", namely *course racing* and *marathon racing*.

In course racing, each boat is assigned a private course and the number of participants is typically limited to about 10.

In marathon racing the number of participants can be very large, and often there are several heats of various length running simultaneously. Participants are not assigned dedicated courses.

For this reason, the functionality needed to handle marathon racing is quite different from the functionality for course racing.

The basic functionality of capturing video files and extracting timing information from them is the same, but there are also rather big differences.

For course racing, MariTime stores all the needed information in the unique video file for a heat.

For marathon, it is necessary to use <u>two files.</u>
One is the captured video file, and the other file is a data file.
The captured video file will have the exact clock time for every captured frame, but since the video file does not contain information about start times it is not sufficient to calculate results.

For the video files you are free to dedicate a folder for storage. For the marathon data files however, for simplicity these have a fixed location.
For information about file locations, please see "Where does MariTime put its files?" at page ???

When you first start to use the marathon functions, MariTime will check if this folder exists, and if not, create it. A message will be displayed about this.

In order to try out the marathon functionality, you proceed as follows (This description describes what happens the very first time you try it. Subsequent times some events will not occur).

- Start MariTime (full version) and go to the *Capture* form

- On the **Form** menu, select **Marathon**
  If this is the first time you try the marathon functions, you will see this message box:

  The folder needed for MariTime data files has now been created

- You will also see this message:

MariTime stores marathon data in a file called *marathon.xml*. Normally you will use an existing such file and update it with new information. However if no file is found, you will get the message above.

- You will now see the Marathon form like this:

- Since we have no *marathon.xml* file, we create one:
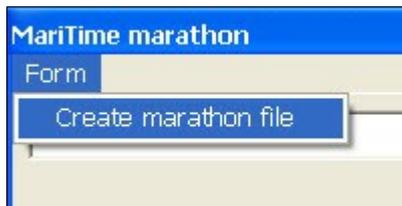
Now with the *marathon.xml* file created we can input some data. The data that we can input is:

- The name of the race event
- The ID (often numerical) for each heat/class to be run
- The name of each heat/class to run

After we have filled in some data, the form might look like this:

Illustration 20: Marathon form with some heats entered

We are now prepared for the start of the various classes. Often more than one class is started together. Then a short wait, followed by more starts.

The start time for each class is stored in the xml file. Later, when the video files are being processed, these start times will be compared to the time stamps in each video frame, and the elapsed times calculated.

To indicate start, you have a number of options:

- You can simply type in a start time (hh:mm(:ss)) in the *started* text box for a class.

- You can select the class and click the **Start** button on the form
  A class is selected by clicking in the heat ID field.
  If you hold down the *Ctrl* key you can select several classes simultaneously. Clicking in the form outside of the Heat ID will deselect all classes.

- You can press the leftmost button on the control box.

As you can see, for each started class the elapsed time field will start incrementing.

With four classes started in two groups, the display looks like this:

Capturing video for Marathon

Capturing video for Marathon racing uses the same basic functionality as for course racing. However, there are some differences that must be understood.

- The video files will contain goal passing sequences for may heats/classes

- The video files will normally be <u>much larger</u> than for course racing

- The video files <u>do not</u> contain any info about
  - Heats/classes
  - Start times

  (Such info is stored in the *marathon.xml* file)

The procedure for capturing Marathon video is as follows:

- On the Capture form, you enter a suitable file name and click New File:
  The result should look something like this:

```
Heat A
 File name
 C:\temp\Marathon testHeatMarathon1 2008_08_28 11_45_32.lw2
 Heat ID                              File size   Elapsed time    Start time
 Marathon1    New file  Start  Abort    0,1mb     00.00.00        00.00.00    Finish
```

   In this case, the Heat ID is really <u>fictional</u> and we can choose anything suitable.
   You <u>do not need to</u> click **Start**, since the registration of start times is done on the Marathon form.

- As boats pass the goal line you activate video capture in the normal way (switching the Capture toggle switch on the Control box)

- Eventually, you will have accumulated a rather big video file, and the display shows this:

```
Heat A
 File name
 C:\temp\Marathon testHeatMarathon1 2008_08_28 11_45_32.lw2
 Heat ID                              File size   Elapsed time    Start time
 Marathon1    New file  Start  Abort   259,1mb    00.00.00        00.00.00    Finish
```

You may now want to let the back-office function process the video file accumulated so far.

This can be done as follows:

- Click *Finish* for the present file

- Initiate a new file in another heat frame
  Now, we should see a display like this:

```
Heat A
 File name
 C:\temp\Marathon testHeatMarathon1 2008_08_28 11_45_32.lw2
 Heat ID                              File size   Elapsed time    Start time
 Marathon1    New file  Start  Abort   259,1mb    00.00.00        00.00.00    Finish

Heat B
 File name
 C:\temp\Marathon testHeatMarathon2 2008_08_28 11_59_11.lw2
 Heat ID                              File size   Elapsed time    Start time
 Marathon2    New file  Start  Abort    0,1mb     00.00.00        00.00.00    Finish
```

You are now set to continue capturing, and the video will be stored in the new file.

The file in Heat frame A is ready to be processed by the back office computer. Heat frame A is also ready to be re-used for a third file.

Processing Marathon files

Processing of captured video files is often done on a separate back-office computer.

This is common for both course racing and marathon.

There are a number of differences between the procedure for processing the two types:

	Course racing	Marathon racing
Files needed for processing	Only the captured video file	Both the captured video file and the ***marathon.xml*** file
Elapsed time calculated from	Difference between start time in video file header and the time stamps in the video frames	Difference between start time in ***marathon.xml*** file and the time stamps in the video frames
Results stored in	The file header in the video file	Dedicated result file in xml format

To process a marathon race, you need the following input

- A video file with marathon goal passings. This file is normally copied from the front-office PC to the back-office PC in the same way as for course racing.

- The *marathon.xml* file containing the heats for which the processing will be done.
  This file will be placed in the "User appdata" folder. More info on where to find this can be found at page 67.

During a day of marathon racing, the *marathon.xml* file will be continually updated with new start times on the front-end PC. But the back-office PC frequently needs an updated copy of this file. For this reason, MariTime has a function that makes it easy to get a fresh copy over from front-office to back-office.

Let us assume a Marathon race day with a computer setup as shown below:

Marathon race, typical setup

MariTime frontoffice,
heat registration and goal recording

Control
Box

Reg. file &
Video

LAN

MariTime backoffice
video file processing

MariTime backoffice
video file processing

Race administration
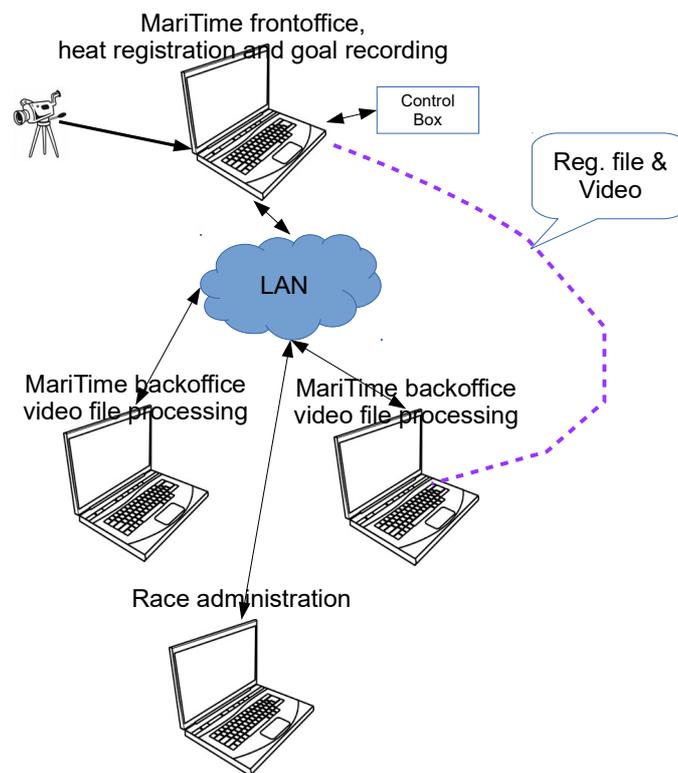
The front office MariTime will handle

- Heat/class registration (stored in the *marathon.xml* file)

- Video capture of goal passages (creating large video files (.lw3 type))

- The task of processing the video files is handled by 2 back office PC:s
  However, in this situation, the back office computers lack the data needed to fulfil their tasks.
  To perform their processing they need:

- Access to finished video files

- Access to relevant marathon registration file

The procedure works as follows.

- The front-office PC shares its *User appdata* folder with read access.
- The back-office PC maps the shared folder as a network disk.
  In the Marathon form, click as shown here:
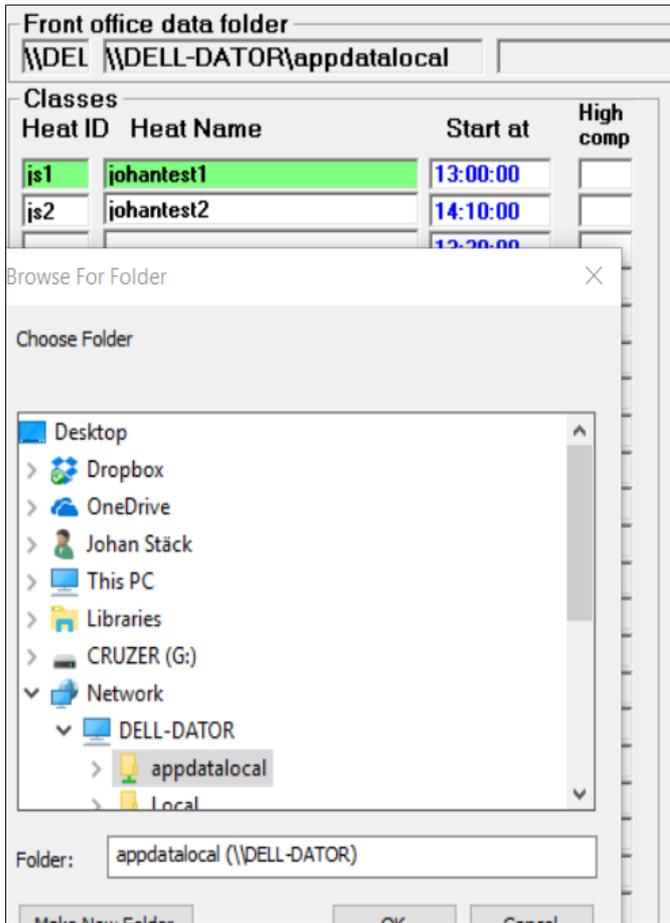
- In the "Browse for folder" form, you select the network share as shown in the example.
- Now, select *Copy recent xml file* as shown here:
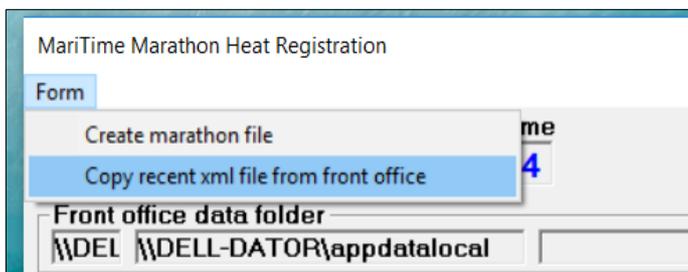
- In the Front Office data folder frame you will see that the rightmost field is updated. It shows the "last modified" date for the *marathon.xml* file in the front-office PC.

- Whenever needed, you can easily get a new updated copy of the xml file from the front-office PC.

Setting marathon times

To set times for marathon, you do as follows:

- Open a relevant video file
- MariTime will analyze the chosen file and will know if the file is a recording of sprint or marathon
- In the case of marathon you will have 3 active forms, namely
  - The *Player* form
  - The *Marathon* form
  - The *Marathon Set Time* form

The screen will look something like this:

The procedure for assigning times is now like this:

- Ensure that the correct heat is selected in the *Marathon form* (as indicated by color)
- Position the competitor at the goal line
- Enter the competitors number in the *Competitor* text box
- Click *Set time*

Illustration 21: Setting the time for a marathon competitor

Each time you click **Set time**, MariTime will add a new record in the marathon result file.

By default this file has the name *MariTimeMarathon_Temp.xml,* and this file is placed in the *User appdata* folder described on page 67

If the result file does not exist, it is created, and the first result record is written

If the result file already exists, the result record is appended to the existing file.

When you open a marathon video file, MariTime will check for the existence of a marathon results file.
If one is found, this will be read into memory and all subsequent entries will be added to it.
Each time that a new result is entered, the xml file is written to disk.

This means that if MariTime has to be restarted for any reason, no data will be lost.

As you can see in the illustration above there is a field that is continually updated with the number of result entries in the present file.

Duplicate entries

The result file will often contain results for competitors in several heats. The operator will identify the heat/competitor from the colour and number on the number-sign. As each result is about to be stored in the results xml file, MariTime will check to see if the heat/competitor is already entered.

Since there can only be one entry for each heat/competitor, in the event of a duplicate entry, you will see the following form:
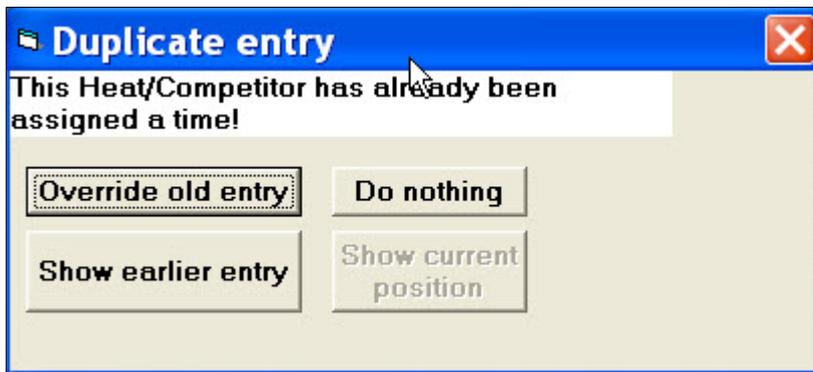
Now, the operator must try and find out the reason for the attempted duplicate entry.

If the present entry is correct, then the earlier entry for the same heat/competitor must be in error.

In order to verify this you can click the **Show earlier entry** button. This will show you the video frame for the earlier entry. **Show current position** will return to the current position in the video file. Once you have decided the reason for the attempted duplicate you can choose the desired alternative:

- **Override old entry**
  This will force the new entry to override the old erroneous entry

- **Do nothing**
  This will not enter any data, allowing you to correct the input causing the duplicate

As long as you keep adding entries to an existing file, Maritime will detect attempted duplicates.

Eventually you will reach a point when it can be a good time to close the present file and start with a new result file. A common reason for this is a desire to hand the result data over to the race administration system.

N.B. You can always hand a copy of the result file to be imported in the race administration system, even if it has not been formally closed. However, both the file name and its contents will reveal that it is a file in progress.

To close a file, you simply click the **Close(rename) result file** button.
Now the following will happen:

- The file will be updated to reflect its closed status

- The file will be renamed. The name will have the following structure "*MarathonResults090511092442 .xml*".
  As you can see the file name contains a timestamp taken at the moment the file is renamed.

- A new empty result file ready for adding results is created

Time display format

MariTime uses the **ISO 8601** standard for display of date & time.

Dates are displayed in the format YYYY-MM-DD. (Example *2010-02-18*)

YYYY = Year

MM = Month

DD = Day

Times are displayed in the format HH:MM:SS,FS (Example *1:02:43,54*)

HH = Hours

MM = Minutes

SS = Seconds

FS = Fractional seconds

Where does MariTime put its files?
(and, what are they…)

The largest files by far are the <u>video capture</u> files. These are placed in a folder that you can choose at will.

However, MariTime uses a number of additional files that are much smaller.
These files are all placed in a folder where Windows recommends that such small user files are placed.
Windows calls this folder "user appdata".
MariTime can assist you to find/open this folder:

- Select Help/About

- At the bottom you will se this:
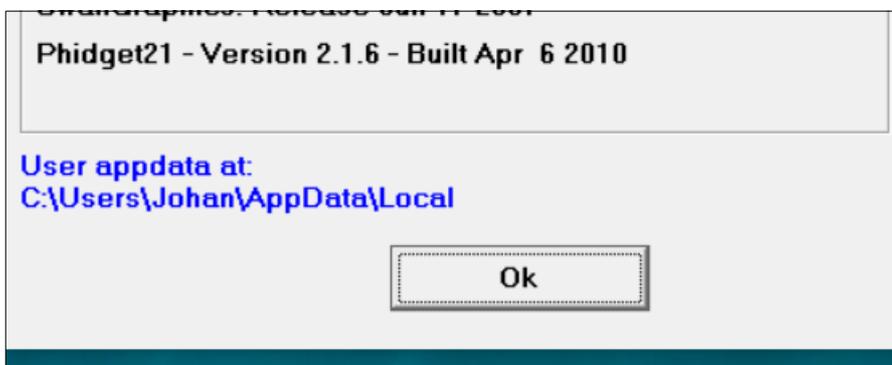
- The blue link is the address of "*User appdata*", and if you click this link, the folder will open.

In this folder you may find the following files:

- **MariTime_HDMI.ini**
  This is where MariTime stores various settings

- **MariTime_eventlog.txt**
  This a file where MariTime will store some basic information that sometimes can help in debugging. You might be asked to send this file to me in case of trouble.
  This file is always appended to so it grows slowly but steady. If you feel it grows to large, feel free to delete it! (a new file will be created when needed)

- **Marathon.xml**
  This the file where the registration of the various heats for a marathon race is stored.

- **MariTimeMarathon_Temp.xml**
  This is a result file that is being produced

- **MarathonResults170426131203 .xml** (date/time will vary)
  This is a closed marathon result file

Export file formats

Presently, MariTime offers two export formats described below.

The export functionality can easily be extended with any format desired, just let us know!

CSV file

Please note: The file format is called **csv** (**c**omma **s**eparated **v**alues).

However, since the new time format contains a comma sign, the file now uses the semicolon (;) as separator as illustrated here.

```
SM 2007;F162;2007-07-05 13:26:15;JOHANSDUALCORE
1;6;00:49,60;+0,00
2;3;00:50,16;+0,56
3;2;00:50,60;+1,00
4;7;00:50,92;+1,32
5;4;00:51,10;+1,50
6;1;00:52,26;+2,66
7;9;00:55,74;+6,14
8;5;DSQ
9;8;DNS
10;10;DNF
end
```

The values on the first line are:
- Event name
- Heat ID (can be numeric or any string)
- Date/Time
- Name of the computer capturing the video file

The following lines are the results of the heat
- Rank (going from 1 upwards)
- Lane
- Time (MM:SS,FS) (the last to digits are second fractions) [3]
- Delta time (difference from the winner)

If a competitor does not get a valid time this field can be:

DSQ = Disqualified

DNS = Did not start

DNF = Did not finish

The file finishes with and "*end*" line

---

3 See description of time format on page 66

XML file

An **XML** file from the same race as above looks as follows:

```xml
<?xml version="1.0" encoding="utf-8"?>
<race>
    <raceinfo>
        <initiated_at>2010-02-19 15:17:06</initiated_at>
        <lastfile>True</lastfile>
        <event>SM 2007</event>
        <racetype>course</racetype>
        <capturehost>AMD-VISTA-PC</capturehost>
        <backofficehost>JOHANSDUALCORE</backofficehost>
    </raceinfo>
    <heats>
        <heat
            id = "F162"
            name = ""
            start_time = "13:26:23,00"/>
    </heats>
    <results>
        <result id = "F162">
            <competitor nbr = "6">
                <elapsed_time>00:49,60</elapsed_time>
                <delta_time>+0,00</delta_time>
                <place>1</place>
            </competitor>
            <competitor nbr = "3">
                <elapsed_time>00:50,16</elapsed_time>
                <delta_time>+0,56</delta_time>
                <place>2</place>
            </competitor>
            <competitor nbr = "2">
                <elapsed_time>00:50,60</elapsed_time>
                <delta_time>+1,00</delta_time>
                <place>3</place>
            </competitor>
            <competitor nbr = "7">
                <elapsed_time>00:50,92</elapsed_time>
                <delta_time>+1,32</delta_time>
                <place>4</place>
            </competitor>
            <competitor nbr = "4">
                <elapsed_time>00:51,10</elapsed_time>
                <delta_time>+1,50</delta_time>
                <place>5</place>
            </competitor>
            <competitor nbr = "1">
```

```
                <elapsed_time>00:52,26</elapsed_time>
                <delta_time>+2,66</delta_time>
                <place>6</place>
            </competitor>
            <competitor nbr = "9">
                <elapsed_time>00:55,74</elapsed_time>
                <delta_time>+6,14</delta_time>
                <place>7</place>
            </competitor>
            <competitor nbr = "5">
                <elapsed_time>DSQ</elapsed_time>
                <place>8</place>
            </competitor>
            <competitor nbr = "8">
                <elapsed_time>DNS</elapsed_time>
                <place>9</place>
            </competitor>
            <competitor nbr = "10">
                <elapsed_time>DNF</elapsed_time>
                <place>10</place>
            </competitor>
        </result>
    </results>
</race>
<!--XML file containg MariTime result data for course race. Produced by :
MariTime, Free version 3.0.1 Compiled at : 2010-02-15 18:48-->
```

Technical requirements

Operating system

MariTime is developed and tested in computer environments based on *Windows 7and Windows 10. Both 32 and 64 bit versions have been tested.*
No other OS:s are <u>guaranteed</u> to work, but it is probable that other 32/64-bit systems from Windows XP and onwards will also work.

Hardware

There is no specific limit on hardware where Maritime will or will not work.
All recent PC:s will run MariTime without problems.
As a rule-of-thumb, the following are what should be considered <u>reasonable</u> requirements for running Maritime:

PC

- **CPU:** 2 GHz or faster
- **Display:** 1280*960 pixels minimum
  NB: Since the HDMI version can use up to 1920 pixels vertically using a secondary (rotated) display is highly recommended!
- **Ram:** Full version: 4 G byte / Free version: 2 Gbyte
- **Disk:** 100Gigabyte free space
- **HDMI input**
  Needed for the full version to connect the camera
- **USB/ Ethernet connections**
  NB If you plan on using HDMI-to-USB3 converter, a USB3 port is of course needed!

Printer

MariTime will print on any Windows-compatible printer.
However, at large event the sheer volume of various printouts makes a laser printer the obvious choice.

Especially the printouts of pictures tend to take a long time (and consume lots of expensive ink) when printed on an ink jet printer.

A color printer is not necessary, but will of course look nice when printing pictures with MariTime

About HDMI

HDMI connectors come in several versions as shown here:
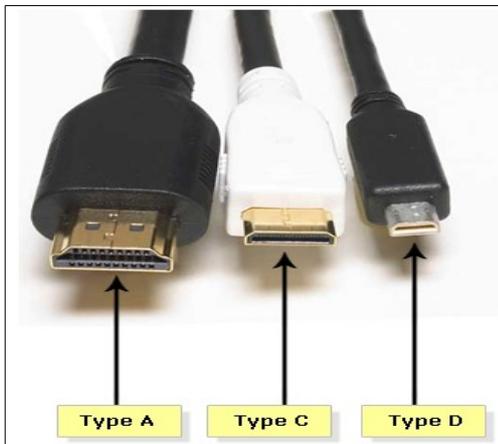
Type A is the most common one, and the HDMI cables available in most stores that sell them have type A connectors on both ends.

We must understand however that many HD cameras have type C or D connectors, and the same goes for some HDMI capture equipment.
This means that we will often require HDMI adaptors that can "translate" between the various types.

Here are some examples of HDMI adapters

Illustration 22: Type A to C adapter

Illustration 23: Type A to C adapter

On HDMI cable lengths

There is no formal specification on the "allowed" length of an HDMI cable. MariTime is delivered with a 10 meter cable. If you need to transfer the HDMI signal over longer distances, a good idea is to use a pair of HDMI extenders. These are interconnected via Ethernet (Cat6) cables and can transport the HDMI signal up to 120 meters. For longer distances, there are also extenders using optical (fibre) connections.

In case of trouble

General instructions

MariTime has been thoroughly tested during several large multi-day races and has proven itself as a reliable system.

However, as with all systems of some complexity, things <u>can</u> go wrong.

Software

MariTime is written in such a way that it tries to "catch" any software errors that might occur.

In such an event, an error form with relevant information about the error will be displayed
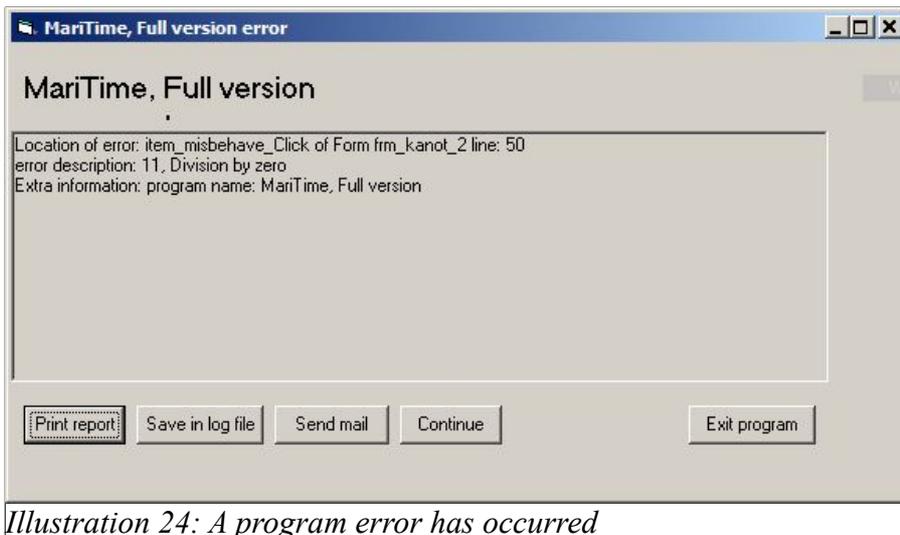
Illustration 24: A program error has occurred

As you can see there are a number of options available. If you want to report the error (which of course is desirable in the interest of program development) you have the options of

- **Printing** an error report
- **Mailing** an error report (given that the PC is connected to the Internet)
- **Saving** the error report in a log file (which can be printed or mailed later)

Of course, there is the chance that you will notice some unwanted behaviour, or perhaps you would like some specific extra functionality. In that case feel free to contact me!

Selecting a camera

In my actual testing of HDMI capture, I have been using a number of cameras.

I bought two new of the cheapest models available at the time, namely.

- Sony HDR-CX220

- Canon Legria HFR36

(The model numbers may actually be different in different markets)

In summary, they both do the job nicely.
Both cameras have plenty of optical zoom (especially at the telephoto end, where you really need it). There is however one (or two) factor(s) that puts the Canon camera ahead.

For our purpose we want to ensure that the camera uses a short shutter time.
Higher-range video cameras often have the ability so set the shutter time specifically (e.g. 1/1000 second). Cheaper cameras (such as the ones mentioned above) have only a number of exposure modes. *Sports mode* is common, and this mode ensures a short (albeit unknown) exposure time.

The Canon camera has a sports mode, but for unknown reasons the Sony camera does not offer it (it offers others modes such as *landscape/fireworks/waterside*). In actual use the auto mode seems to work fine giving a shutter time short enough, but I want to have somewhat better control over it...

The Canon camera also came with an AC adapter included (something you really need). For the Sony it is an add-on option (it charges through USB)

Over time, model names will change, but what you want to look for is a "brand" consumer HD/HDMI camera. Even the cheapest seem to work, but adding a few hundred Euros will certainly give you even better picture quality!

"Action cameras"

There are several "action cameras" with HDMI output. (E.G. **GoPro** and <u>many</u> others)
These are of <u>no use</u> for MariTime, and this is for several reasons

- **No optical zoom**
These cameras normally have a fixed wide angle (almost "fish eye") lens
We really want to use optical zoom to capture the "area of interest" at a race

- **No control of shutter time**
We need to get a short shutter time, and these actions cams do not seem to give us that

HDMI capture hardware

All recent PC:s seem to have a HDMI _output_ port (often used for connection to an external monitor or a TV.) but no PC.:s seem to have an HDMI _input_ port.
(I have seen reports about high-end laptops with HDMI-input ports, but I have never seen one in real life!)

This means that in order to get the HDMI video data into MariTime we must add HDMI capture (input) hardware/software to our PC.

Basic requirements.

Windows includes software for video processing called Direct Show. This means that our HDMI capture equipment must support Direct Show.
It is also necessary for MariTime to get the "raw" uncompressed video from the camera. There are some HDMI capture products that only produces compressed video, and this is not of any use to us.

Tested products

I have personally tested some HDMI capture products with MariTime.

Stationary PC

In my stationary PC (used for most of the development) I have installed a HDMI capture card like this:

This is a **TimeLeak HD72A** card, and I have had no problems with it.

This card (and several similar) are available on Ebay at a very reasonable price.

Portable (Laptop) PC

For a laptop there are basically two alternatives

1. An HDMI capture card for the Expresscard slot (if one is available)

2. An HDMI-to-USB3 converter

N.B! There are some HDMI-to-USB2 converters available for sale, but these are of no use to us, since they only output compressed video (and in some cases also do not support Direct Show!)

I have used an Expresscard like this:

This is a TimeLeak HD82 card.
The software installation can be a little tricky, but the capturing performance has been (mostly..)OK.

I have tried this HDMI-to-USB3 box:

It is the **SKYHD capture** box

I have never been able to really figure this one out. Sometimes it performs good, but sometimes the captured input becomes very erratic with lost frames etc.

Startech

Recently I have tested two products from the Startech company

The first one is an Expresscard: HDMI capture card (ECHDCAP)

And the second one is an HDMI-to-USB3 converter: (**USB3HDCAP**)

And I can truly say that I am impressed by these Startech products!
Software installation is very straightforward, and their capturing performance seems flawless.
Highly recommended!

On caveat though:
It seems that all USB3 controllers are not created equal, and the Startech documentation states that:
"Not compatible with ASmedia, or Etron USB 3.0 host controllers. "
but
"USB 3.0 host controller (Confirmed support with: Intel, Renesas (NEC), VIA, AMD, Fresco FL1100) "

I have no knowledge of which PC brands that use the non-supported USB3 controllers. But I know that my Dell Latitude E5440 works fine!

Understanding Crop Size

This has a function as follows:
A modern HD video camera has a pixel count of 1920*1080 pixels. The video comes uncompressed into our PC at 25 frames/second.(Older DV/Firewire cameras on the other hand used 720*576 pixels, and the data was compressed already in the camera).
This means that MariTime needs to perform video compression itself for the video that we use.
Using full video frames of data will normally be difficult for most PC:s to handle.
Therefore, the following has been implemented in the first version of MariTime_HDMI:
(*depending on user reactions, this may well change!*)
We use either tilted or a non-tilted camera.
Every frame that is received from Windows (with the full pixel count of 1920*1080) is immediately cropped (reduced) to a more suitable size. As you can see in the startup form, I have "hard-coded" some suggestions, these will probably be changed depending on initial user reactions/comments. It is my understanding that for course racing the "area of interest"is typically "vertical" (what is often called "*portrait mode*" as opposed to "*landscape mode*").

You can select one of the preset upper (black) crop sizes, or you can select the lower (colored) crop size. If the selected X size is larger than 1080 this will imply using a rotated/tilted camera, and the program will indicate this as shown above. The button "**Enter custom crop**" will open an input box where you can enter a crop size of your own.
N.B: You can only make crop selections if you have selected **Capture files** in the Prohgram optin frame to the left!

A larger cropped size will of course give a larger file size. It will also mean a higher CPU load.
DV frames when received are already compressed in the video camera. HD/HDMI frames come fully un-compressed. So, in order to have a reasonable file size these frames will be compressed by MariTime_HDMI down to about 10% in size. The compression method used (Intel JPEG library) seems to do this without serious quality loss. Especially red areas will have noticeable better quality than the old DV compression method.

About video compression

The "old" DV cameras had a feature meaning that even the live video feed (as well as the video recorded on tape) coming through the firewire port were compressed <u>in the camera</u>. The compression was made to a fixed 5:1 ratio.
The new breed of HD/HDMI cameras <u>do not compress</u> their live video feed that we use in MariTime. However, using un-compressed video data is too demanding for the average PC.
The amount of data becomes too much to process and store. Therefore, in addition to cropping the video frames from the camera, MariTime also performs video compression. The compression uses the JPG standard.

Video compression comes basically in 2 different versions, called *temporal* and *non-temporal* compression.

Temporal compression is the most common type of compression in use today. It is based on the (albeit somewhat simplified here..) principle that for a given video frame, it is only necessary to store the difference between the current frame and the frame before it. And, if two frames are very similar (as is often the case) this means that very little information will be stored. The temporal method works well in most cases, but it has one big drawback, and that is the fact that play back will only work well when playing forward. Playing a video file backwards, or displaying a single frame at random does not work well if the file is temporally compressed. For this reason, MariTime uses non-temporal compression, meaning that each frame is <u>compressed individually,</u> with no dependence on surrounding frames. From practical use, it seems that we can compress to a size of 10% of the original size with only marginal effect on image quality.

MariTime file sizes

Initial JPG quality

The default initial quality is set to 85, but on the startup form you can choose a number of other values. A higher value gives a higher quality, but also a larger file.

The file format that MariTime uses needs all compressed video frames to be the same size. This means that in some (albeit rare) instances, MariTime needs to compress individual frames using a lower qualiy than the initial quality used for the main portion of the file.

JPEG compression benchmark
Video compression is known to be quite <u>CPU intensive</u>.
Therefore MariTime offers a utility for analyzing this CPU load.
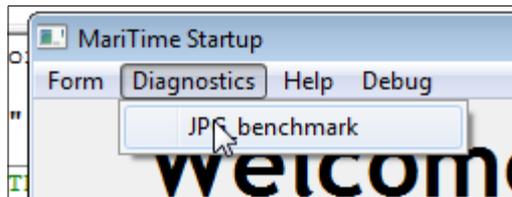
On the startup form you can select **JPEG benchmark** as shown:
When activated, a report like this will be shown: (N.B these are 2 different examples!)
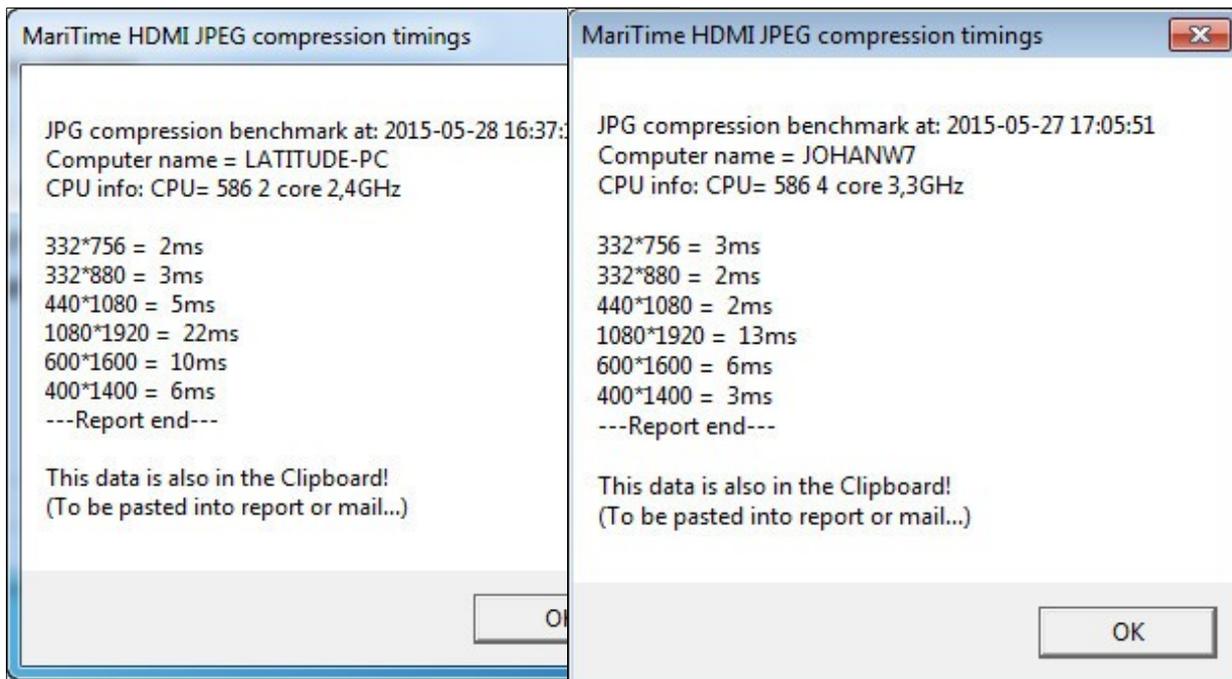
MariTime will iterate through all the available crop sizes (including the Custom size) and measure the time in ms to compress each image. As you can see, the compressing time varies with the image size, and also with the CPU speed. My experience with MariTime/HDMI so far shows that it is not recommended to run with a CPU load higher that 50%. In order to ensure this, it seems that one should not choose a crop size that takes more that approx. 6 ms to compress. (MariTime will receive a new HD frame every 40 ms) For the PC on the left (a Dell Latitude laptop) this matches hands-on experience well. 400*1400 seems to work well, but 600*1600 seems to cause CPU overload, with various un-wanted consequences!…

Measuring CPU load.

Windows has built-in functionality for various measurements, one of them is CPU load

- Type Ctrl/Alt/Delete
- Start **Task Manager**
- Select **Performance**

With MariTime running and receiving HD frames, you should ensure that the CPU load stays below 50%. Running with CPU overload will give some "ugly" effects.

It seems that Windows/Direct Show will start to buffer HD frames and soon the frames that MariTime receives will come at an uneven rate, and some will also be lost. performance

Measuring HDMI performance

From the MariTime multi capture form you can now select "**HDMI Performance**" as shown here:
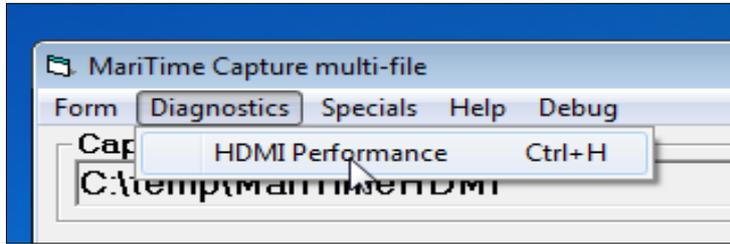
(*Ctrl+H* will also toggle this form.)

When the camera is running this will show a form like this:
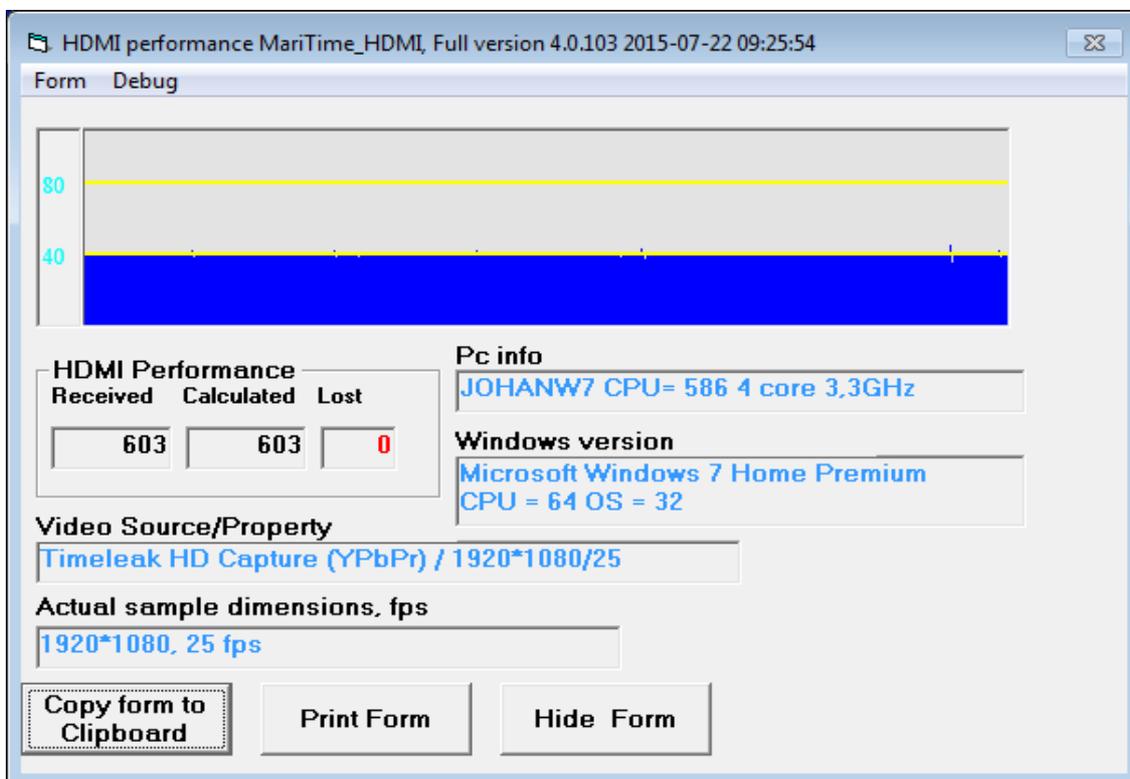
The blue picture will be scrolling from right to left as video frames are received.
It is showing the intervals between each received HD frame.
Since we are nominally getting 25 frames/second, this interval should be 40 ms.
As you can see, the interval actually fluctuates very little.
The program counts the number of actually received frames. It also has a calculated number derived from the start of the measuring up to the present time, and compares the two figures.
1 lost frame is trivial, and if it occurs it is just a rounding error. Several lost frames however is an indication that something is wrong!
The capture hardware used in this example is a plug-in capture board

Copy form to Clipboard will put a "screen capture" of this form on the clipboard. This can come in handy if for example you want to include it in a mail or other written documentation.
Print Form will do just that ; print the form on the default printer.
Hide Form will of course do just that!
Below you see a different situation:

Here, the capture hardware used is an HDMI->USB3 conversion box.
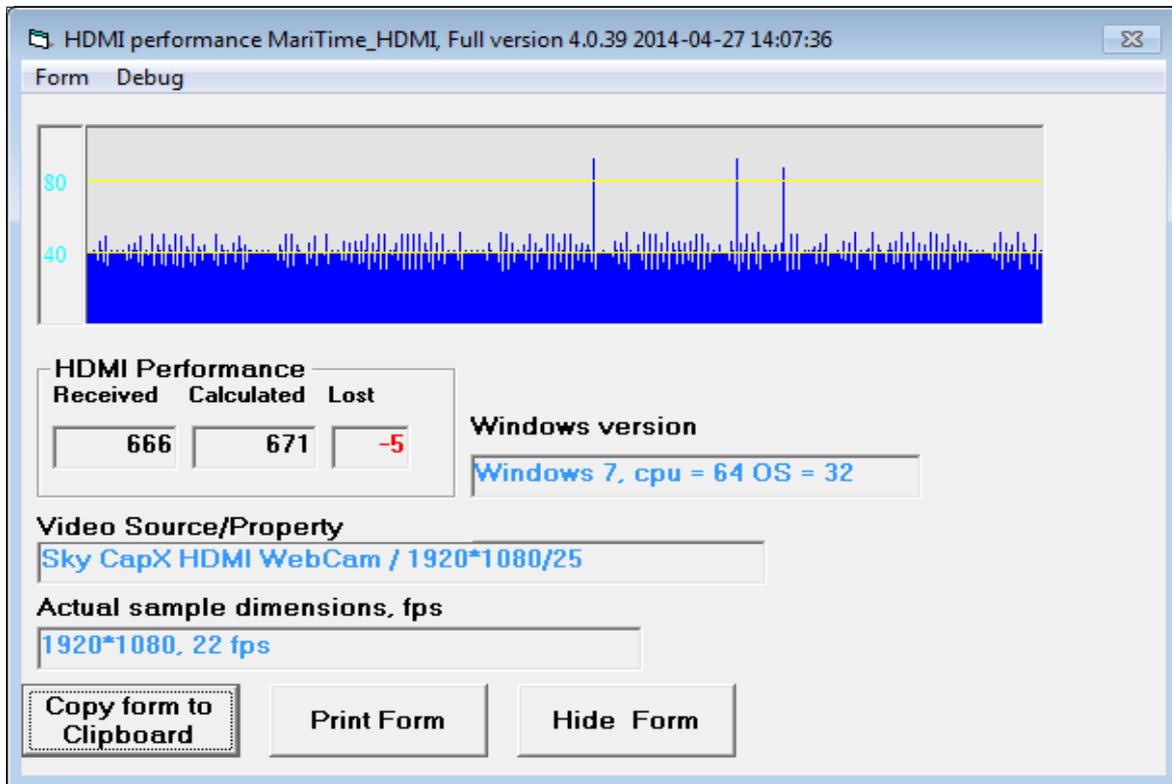
As you can see here there are lost frames, and the interval between received frames is showing a "jitter". This is typical for this capture hardware, and I have not yet been able to figure out why...

Camera settings

A vast majority of all consumer video cameras operate in the "full auto" mode, since this is the default setting.

This may be fine for most home video applications, but if you want to use your camera for a special purpose like MariTime, you can get much better results by setting up some of the camera functions manually.
Please note that these settings are done differently for different cameras.

You may need to *consult the manual* for your specific camera and learn how to perform these settings.

Running in "full auto" camera mode may lead to *unsatisfactory results* in when using MariTime.

These are the settings that you need to understand and perform:

- **Turn off "demo mode"**
  Many consumer video cameras enter a *demo mode* when left switched on for some time. This may well occur with MariTime, since the camera will be running for hours with no user interaction.

- **No auto focus**
  MariTime works best with *manual focus* selected.
  A drop of water on a window or a dust particle on the lens can cause the camera to start "hunting" for focus, with the picture repeatedly going in and out of focus

- **50i** mode
  Many HD cameras offer a number of recording modes. We want to use the most common one that gives us 25 frames/second.These frames are interlaced meaning that each *frame* will consist of 2 *fields.* 25 interlaced frames/second will give us 50 fields/second, and hence the denotion "50i". If you were to set the camera to "25p" this would mean that the camera will send out 25 progressive ("non-interlaced") frames/second, and that will not function well with MariTime.

- **Manual (fast) shutter**
  In auto mode, a camcorder will sometimes use a fairly long shutter time, typically 1/25 .
  MariTime works best with a short shutter time such as 1/500.
  Outside in daylight there is normally enough light to allow the camera to use very short shutter times.
  Some cameras have a function to manually set the shutter time within a range of specific values. Other cameras only have various "modes" to chose from.
  If your camera offers different modes, you should set the camera to *sports mode* since this seems to give the shortest shutter time.
  If given a choice of cameras, go for a camera with a true function for setting the shutter time. Even some of the cheapest cameras have this feature.

- **Disable "anti shake" (optional)**
  Almost all consumer cameras have a function for stabilizing the picture.
  When using the camera for MariTime it will be fixed on a tripod, and therefore you should disable the stabilizing function. In some cases this will lead to an improvement in picture quality.

- **Disable eventual "power save" feature**

Some cameras have an (optional) "power save" function. This can lead to the camera switching itself off after a long time of (what the camera considers to be..) inactivity

- **Clear On-screen displays**
  Often, the LCD display will show various technical symbols. These will normally also be included in the video signal that MariTime receives.
  Here is an example of such displays:
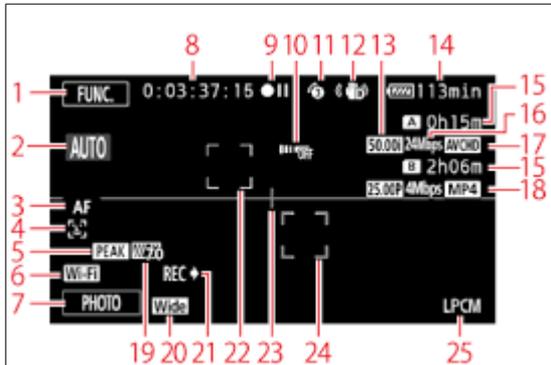
Most cameras have an option the clear these on-screen displays. You just have to study the manual to find them. Searching the Internet can also be helpful!

Leave the camera switched on

After successfully installing and setting up the camera for a race, you are strongly recommended to leave it switched on for the entire duration of the race! Since the camera has no tape. there are no mechanical parts active. My personal experience shows that the camera can remain switched on for weeks without harm.

There is also one other aspect to consider: After being switched off for some time, some camera models seem to "forget" their settings and revert to the default values. If this goes unnoticed it will result in bad quality video, and also means that the process of setting the camera parameters will have to be repeated.

Other aspects

- **Use a polarizing filter**
  MariTime will be used near water and (hopefully) in sunny conditions.
  This can sometimes lead to difficult light reflections.
  Using a polarized filter can remove much of this problem and improve the picture quality.

- **Arrange weather protection**
  If the camera is placed outdoors it needs protection from the elements.
  Moisture is not good for delicate electronic equipment like a video camera. A tempting solution is to wrap the camera in a simple plastic bag. While keeping the rain out, this method has a major drawback in that the camera will not be properly ventilated.
  The camera can get hot enough to cause a malfunction.
  A better method for weather protection is to arrange for a ventilated and weatherproof cover.

Grounded power outlet!!
(Not applicable to laptop computers running on a separate power adapter)

N.B. Please read the following and take the needed precautions!

When connecting a PC to a camcorder it is <u>imperative</u> that the PC is connected to a grounded outlet!

The reason behind this is that the construction of a PC is such that if the PC is <u>ungrounded</u>, half of the nominal power voltage (e.g. 220/2 volt = 110 volt) may be present on the PC chassis.

The voltage has what in technical terms is called "*a high internal resistance*", meaning that it is not harmful to people (but you can feel a "tickle"), but there is a high probability that the voltage will cause damage to equipment connected to the PC.

Therefore: ***<u>always connect the PC to a grounded power outlet.</u>***

Select Video Source
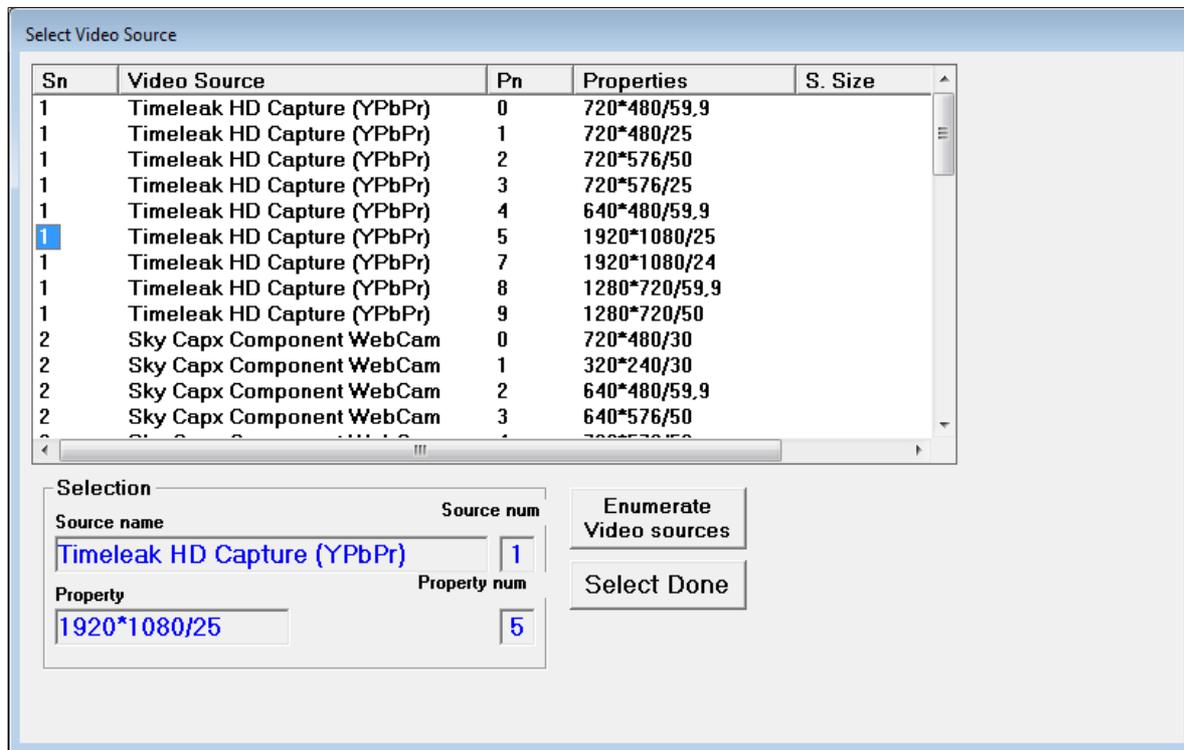
Windows contains a crucial component called **DirectShow** (**DS**). MariTime will "talk" to our HD video camera through DS. Depending on the situation there can be one or more Video Sources to choose from. Perhaps your PC has an integral video camera in addition to the HDMI camera used for MariTime.

If so, there will be 2 sources.

Each Video Source can expose one (or more often) several Video Properties. To make MariTime function correctly together with you camera you must select the correct combination of source& property.

You do this selection using the form showed here.

Normally, this will only need to be done once since your selection will be stored in the Maritime .ini-file.

The procedure (at the time of writing) is as follows

1. Click "Enumerate Video sources" (this should fill the listbox with all sources/properties)
2. Select the source/property combination that you want by clicking in the left column of your choice (see the blue marking!)
3. Click "Select Done"
4. Restart MariTime_HDMI

Which property to use?

I recommend that you set your HD camera to output 1920*1080i, and that you also select 1920*1080 as property in MariTime. In reality it does not seem to be of any significance what frame rate (24/25/59,9) you select in properties. It is still the actual frame rate output of the camera that will govern!

Here are some examples of source/properties for equipment that I have tested:
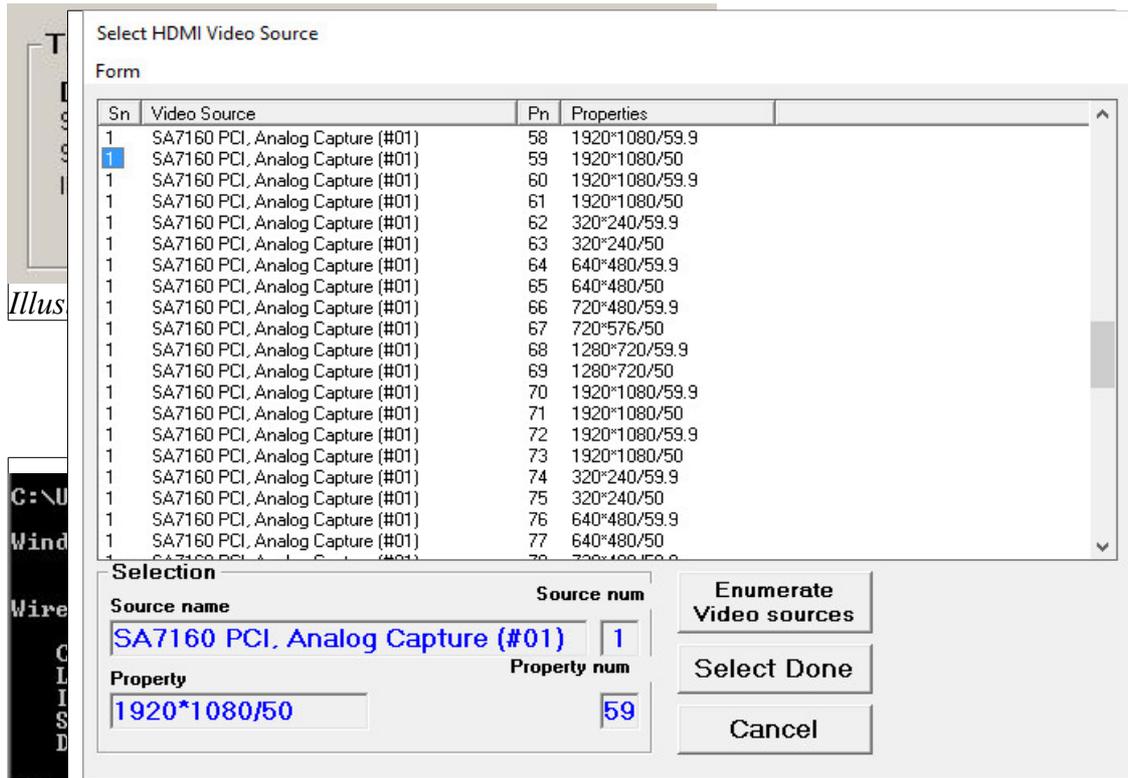
Illustration 26: Startech ECHDCAP
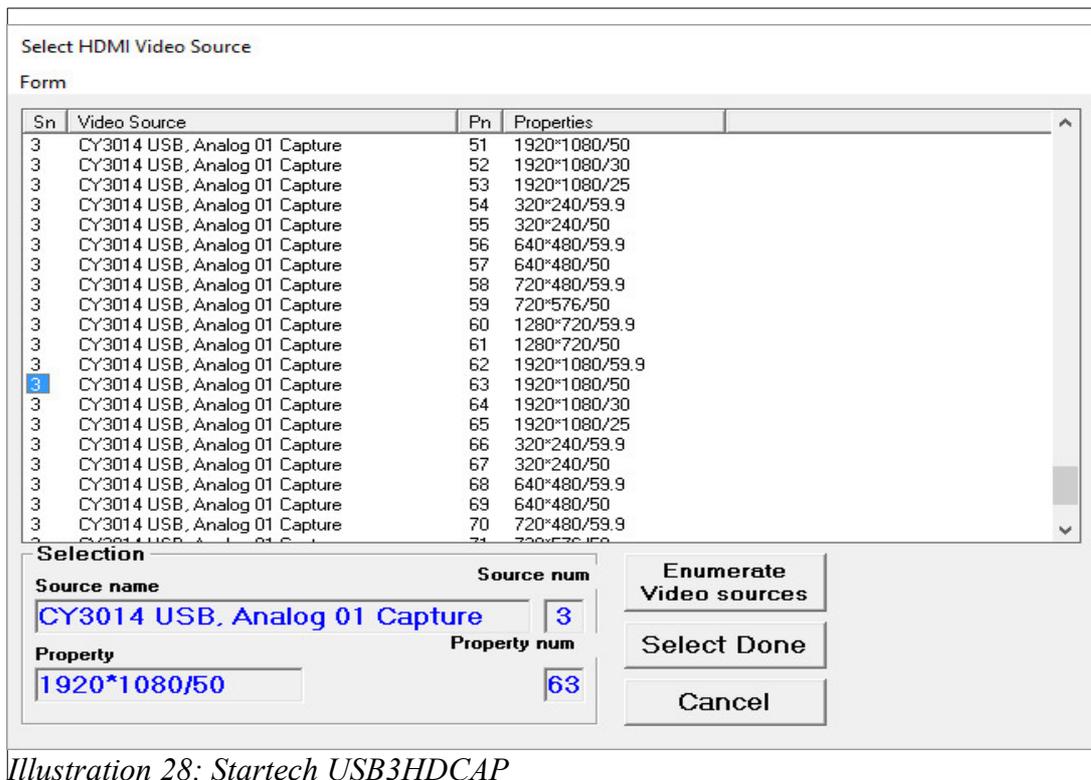
Illustration 28: Startech USB3HDCAP

Verifying the camera→PC connection

MariTime works with data coming from the HD camera through HDMI, and DirectShow (which is a fundamental component in Windows)

If this information chain is not working, MariTime will also not work.

There are a number of ways to verify the needed functionality.

HDMI capture utility program

My experience is that all HDMI capture equipment is delivered with some kind of "utility program" .
This program can be used to capture video from the HDMI input port and store it on disk. These programs also seem to have some kind of "live preview" function which will simply show live on screen the HDMI input (in our case probably live video from the camera…)

DirectShow/GraphEdit

MariTime gets its video data from a Windows sub-system called **DirectShow.**
Therefore it is necessary that the HDMI capture equipment that you use has support for DirectShow.
Not all video capture products do....
One way to verify this functionality and also perform some basic functionality tests is to use a Microsoft utility called *GraphEdit*.
You can download it from the lightweightvideo web site.

Here is a simple "walk-through":
- Start GraphEdit
- Click on the blue rectangle
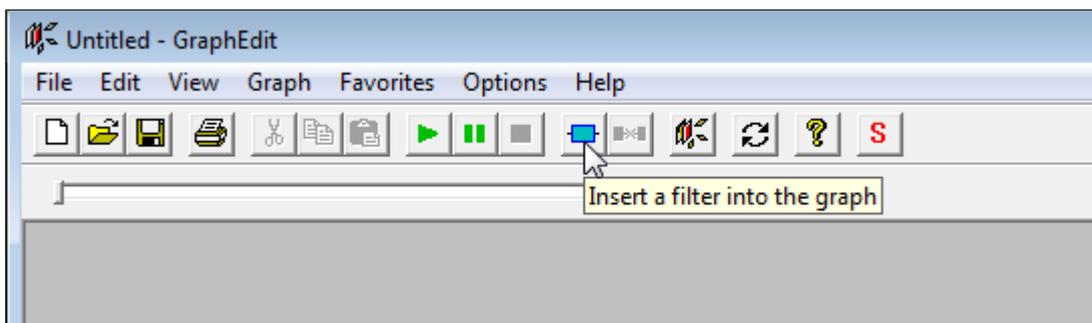
You will see a structure as shown here:
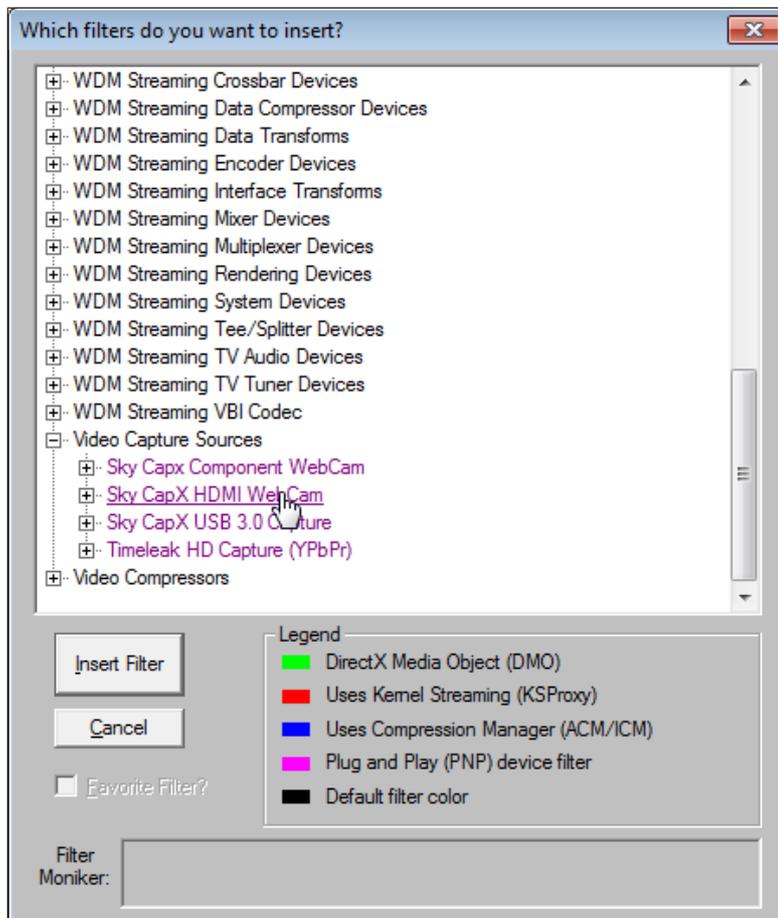
At the bottom you should see one (or more) Video Capture Sources. If you don't, something is wrong. Either the driver routine installation has failed, or there is no support for DirectShow

- Given that you have one or more Capture Sources, you select one. In our case, we select the one shown above (Click the **Insert Filter** button)
- Now you should see this: (GraphEdit has inserted the selected *Capture Filter and has started to construct what is called a Capture Graph)*)
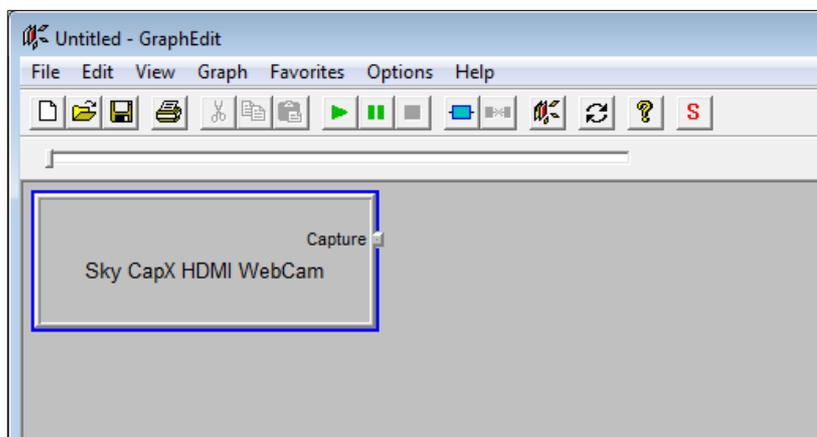
- We shall now continue building this Filter *Graph*. The simplest way in our case is to right-click the small rectangle named "**Capture**" and select "*Render pin*"
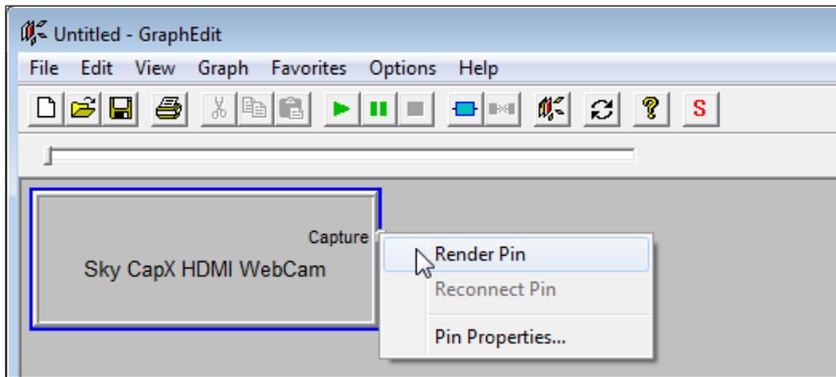
- DirectShow should now do its magic, and leave us with this:
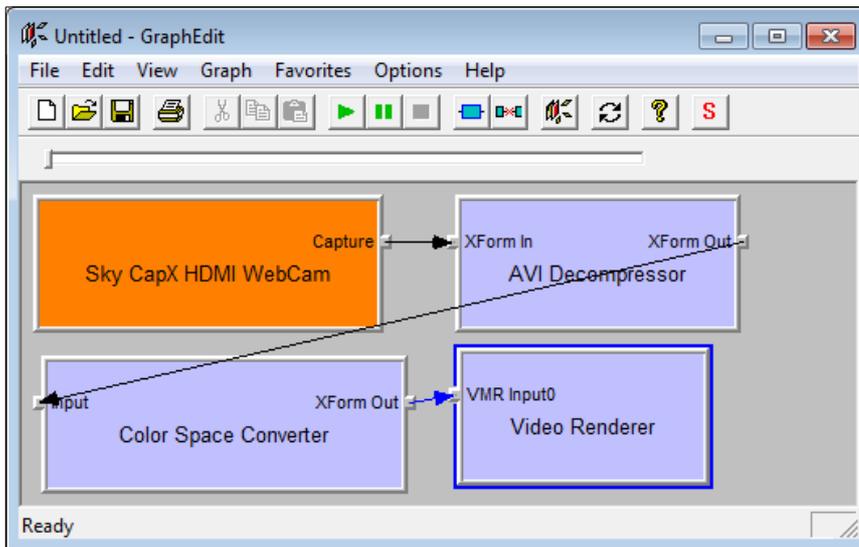
- As a matter of fact, the Filter Graph that GraphEdit has built for us can now be test run, simply by pressing the little green arrow. You should see an "Active Movie Window" with a live image from the camera. In this case a view of yours truly...
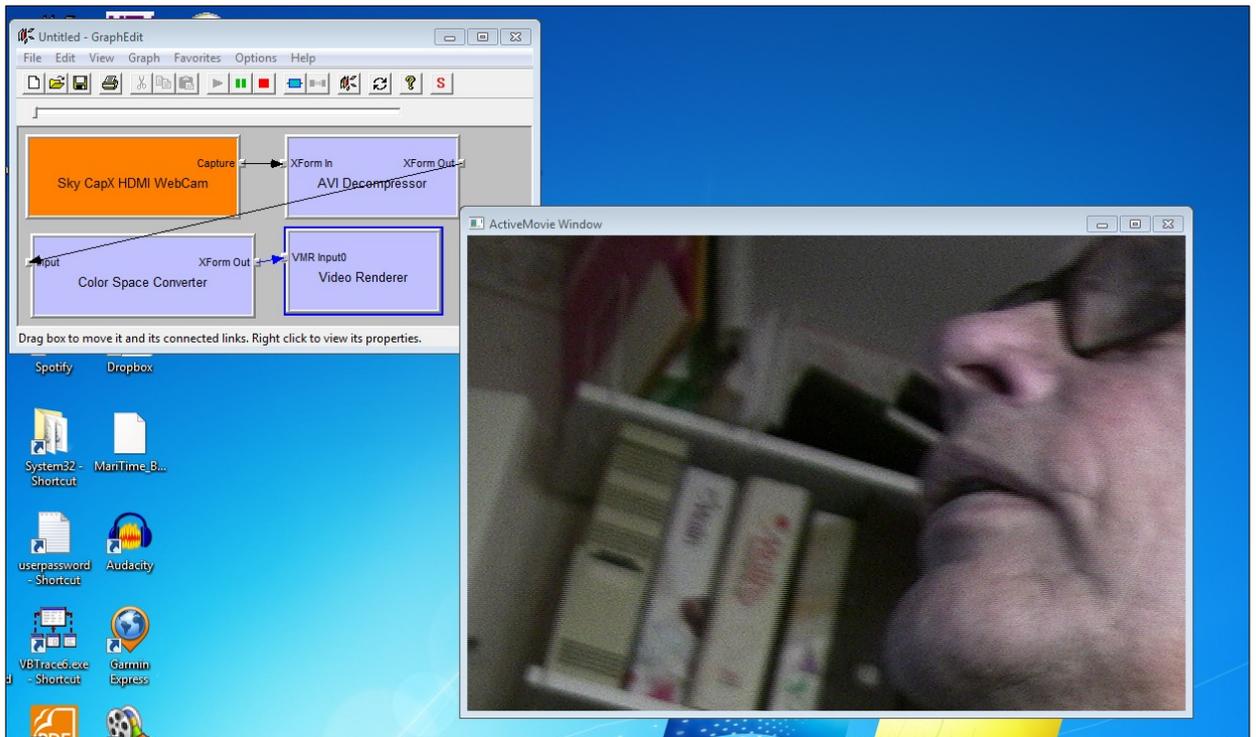
You stop the graph by clicking the red rectangle.

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