SKYSCAN

GPU-enabled **GPUReconServer**:

A quick installation guide

The Graphics Processing Unit (GPU) accelerated reconstruction server is available as **GPUReconServer** from version 1.6.6.0 (release).

How to provide feedback:

As for all software programs, a screen image of the error message will be very helpful for troubleshooting.

Similar to our CPU server, an error log file exists also for the GPU server: GPUReconServer_error.log. This file records useful information for debugging when something goes wrong. It is located in the system folder as shown on the program window, see fig. 1. If NRecon has been run on the PC, the server shares the same system folder as NRecon (can be modified in the menu *Preferences* …); otherwise, the folder is the same as the folder from where the server program was started. Please note: if this system folder does not exist for some reason, you need to create it manually, or redirect it to an existing folder via the *Preferences* menu on NRecon; otherwise no error information will be recorded.

You can provide your feedback by mailing to info@skyscan.be. In case of problems, in addition to a short description of the problem, please also include the error log file, a screen image if possible, and the log file of the dataset you are having trouble with.
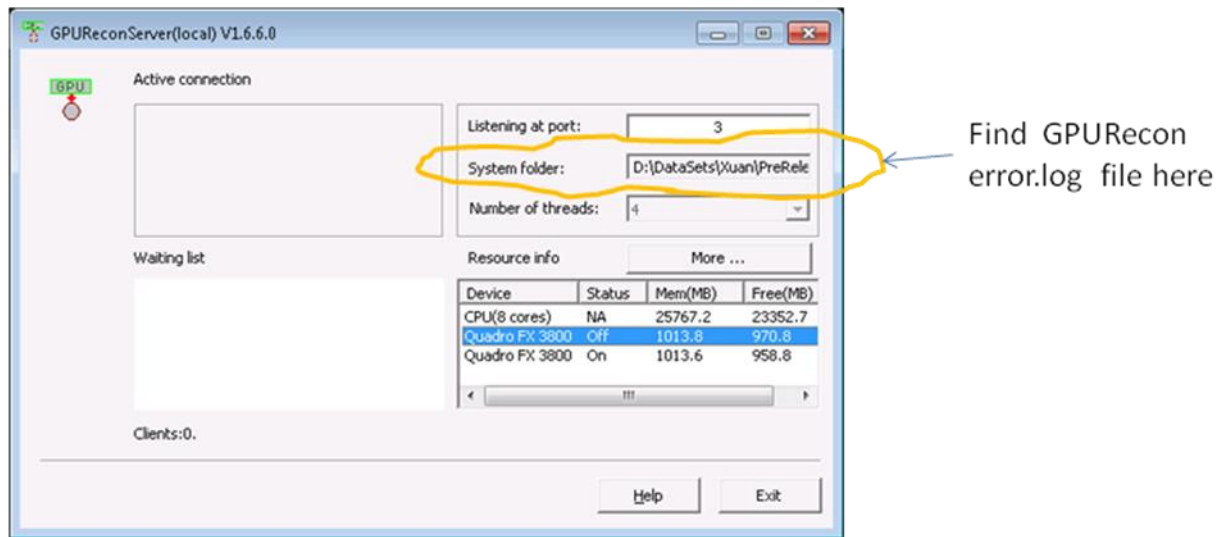
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Fig. 1   GPU reconstruction server.

<u>How to install</u>:

Simply download and copy all files into the folder where **NRecon** is located. **GPUReconServer** is supplied together with a few DLL's which should stay in the same folder as the program itself.

The **GPUReconServer** requires CUDA-enabled NVidia GPU's. You can find a recent list of these GPU's on NVidia website http://www.nvidia.com/.   The GPU reconstruction has been evaluated on a number of these GPU's with compute capability from 1.3 onwards. If you intend to update your computer with a faster GPU, we can advise you for suitable models. If you intend to upgrade your computer for fastest reconstruction by more powerful graphic card with two GPUs (like GTX590), check with computer producer that capacity of power supply is enough for such graphical card and that your power supply unit has compatible power connectors (dual-GPU card requires two special 8-way power connectors). Single GPU graphical cards (like GTX580) can be installed in most computers in proper slot with enough space around for graphical card. If connectors and space allow, two (identical) graphical cards can be installed in your PC.

The current version **GPUReconServer** can make use of all CUDA-enabled graphical cards found on the PC. However, it is not suitable if the GPU devices have different computation power. If you do have different GPU devices on one PC, it is advisable to disable the less powerful devices. This can be done by double-clicking on the GPU on the program window, see fig. 1.

Before running **GPUReconServer**, it is advisable to update your GPU driver. This should be done via NVIDIA website. A not up-to-date GPU driver may cause program failure: unable to find a proper device or the program simply cannot be started. Fig. 2 shows a typical error window when the driver is not up-to-date.
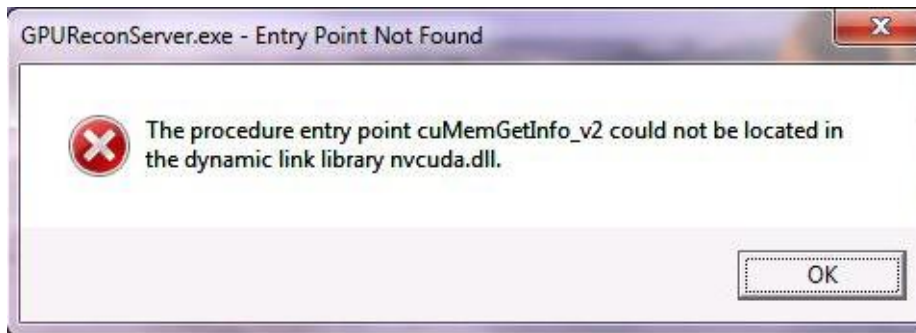

Fig. 2 Typical error window when the GPU driver is not up-to-date.

If the reconstruction GPU is also used for display, you need to disable the automatic time-out of the display device by modifying the registry. Otherwise you will experience black screens and failures during reconstruction. This can be done by double-clicking on the supplied program **gpu_reg.reg** and allows it to perform the modification in the registry of your computer (this step creates a new entry TdrLevel with value 0 at registry section HKEY_LOCAL_MACHINE\SYSTEM\CurrentControlSet\Control\GraphicsDrivers). You might need to restart your computer.

For GPU card with more than 1 device on it, e.g., GeForce GTX590, one has to disable the multi-GPU option as shown in fig. 3. Otherwise, you may experience very slow reconstruction for larger volumes. The NVIDIA Control Panel can be started by right-clicking on desktop.
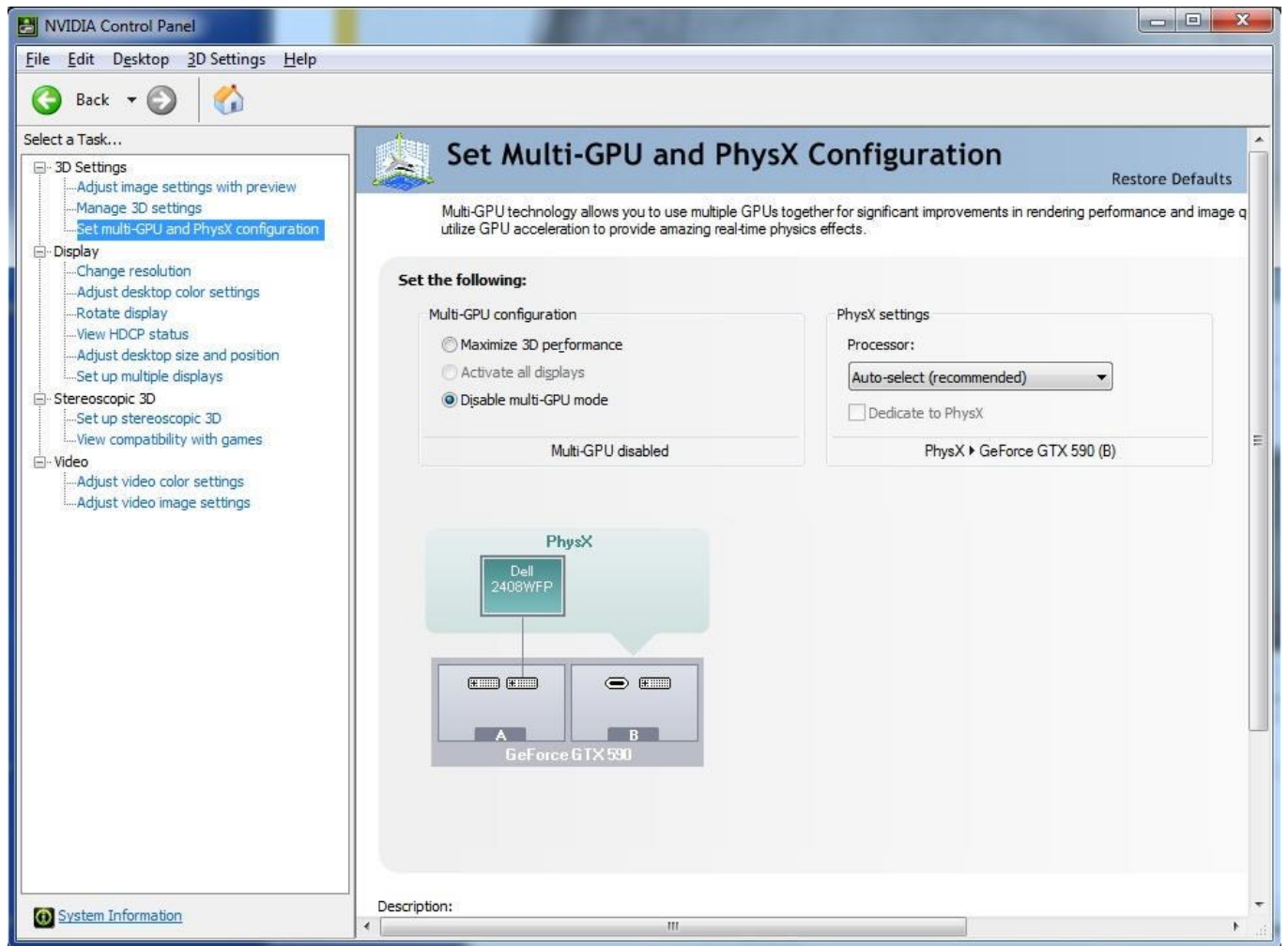
How to use:

This server works in the same way as the CPU version **NReconServer**: it has a local version and a cluster version. However, the GPU server is only provided in 64-bit. The usage of this server is thus straightforward for users who are already familiar with **NRecon/NReconServer**.

However, there are a few points one should pay attention to, if the GPU for reconstruction is also used for display. Simultaneous acquisition and GPU reconstruction is not impossible, but you may experience slow responses, and the chance for crashing due to exhausting resources is real. Running GPU reconstruction simultaneous with CTvox/CTvol should be avoided at all: both programs may crash. If possible, a safer work-around is to install 2 GPU's: one for display, one for reconstruction. Or, yet better, to have a dedicated reconstruction computer.

GPUReconServer makes use of GPU to accelerate the core part of reconstruction. Although it is the GPU counterpart of SkyScan's **NReconServer** on CPU, very small image differences do exist between the CPU and GPU version. The differences come mainly from 2 sources: **NReconServer** does the convolution in space domain, while GPU does the convolution in Fourier frequency space; **NReconServer** has slight approximation to accelerate back-projection, while **GPUReconServer** does exact back-projection. **GPUReconServer** and **NReconServer** should not be mixed in a cluster configuration: if this does happen, only the GPU server will be used.

For ease of comparison, it is possible to run **GPUReconServer**, **NReconServer** or InstaReconServer on the same PC by using different communication port, but they can not be connected simultaneously. If you want to use multiple servers, firstly change "Listening at port" value in the server programs to get all ports different, for example port 1 for **NReconServer**, port 2 for InstaRecon and port 3 for **GPUReconServer**. Use the same port numbers in "Network configuration" of **NRecon** program. By selecting a server type (in the shown screenshot, the GPUReconServer is selected), the given ports are used by **NRecon** to connect to the servers. You can switch between the different server types via menu "Options->Network configuration ...", as shown in the "Server configuration" window below.
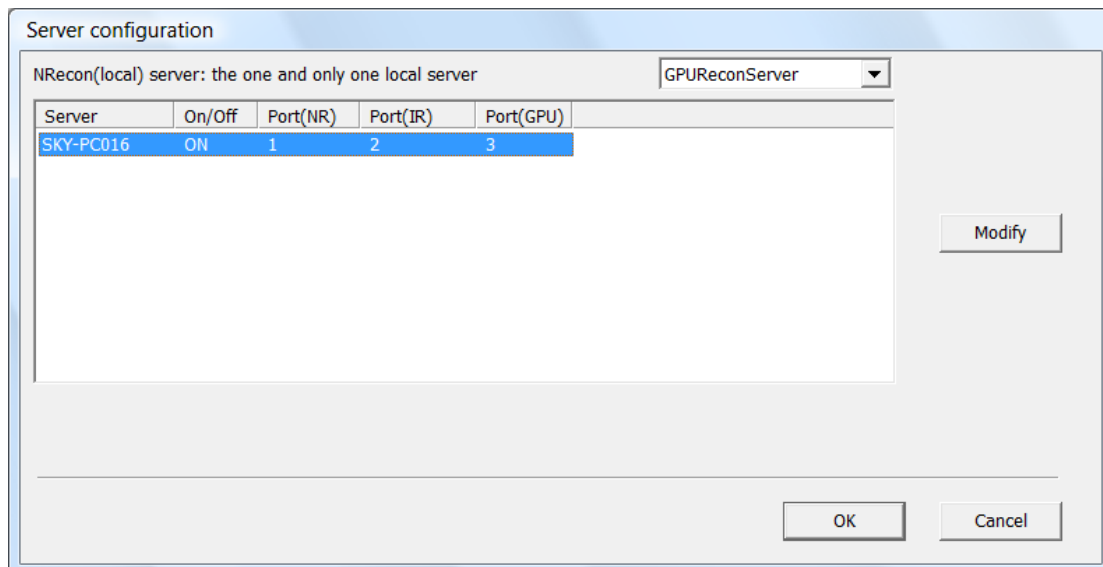
By selecting a server type (in the example, the **GPUReconServer** is selected), the given port (port 3 in the shown screenshot) is used by **NRecon** to connect to the server. You can change

the port numbers here using button "Modify" after having highlighted the line. If all servers are running, then you can easily switch between the CPU server and GPU server (or InstaRecon server) by selecting the current server type in the "Server configuration" window. To start all servers during starting of operation system, you can include shortcuts to the server programs into the Startup folder in the Start menu at left bottom corner of the screen.