# The CHARMing Software Suite

In the last year I worked on implementing a new software (https://github.com/zweistein-frm2/CHARMing) for fast Data Acquisition of Neutron X-Y data. This software interfaces with the new Charm detector and with existing Mesytec hardware as used for example in the SANS1 detector. The software has been newly designed from scratch with the goal of highest data throughput, easy installation, highest reliability and full integration into the Entangle framework.

- The Nicos Interface: https://github.com/zweistein-frm2/CHARMing_binaries/blob/master/Nicos-Integration-The%20CHARMing%20Software%20Suite.pdf

- Installation and quick start: https://github.com/zweistein-frm2/CHARMing_binaries/blob/master/Charm-Testing%20detector-The%20CHARMing%20Software%20Suite.pdf

- More in depth I: CHARMing main components:
  The main components are the `/usr/local/bin/charm` executable and the entangle charming device found in the `entangle/device/charming` subdirectory. The entangle charming device consists of the libraries `charmsystem.so` , `mesytecsystem.so` and `listmodereplay.so` . Several helper files in python act as a glue layer between the [python based] entangle server and the mentioned .so files.

  Both systems, the charm executable and the charming entangle device have to be configured correctly for the charm/mesytec device which is connected via Ethernet and is communicating over the udp protocol. Both systems use the very same configuration file. The configuration file is `/etc/CHARMing/charmsystem.json` or `/etc/CHARMing/mesytecsystem.json`

- The configuration file explained : https://github.com/zweistein-frm2/CHARMing_binaries/blob/master/Configuration%20of%20devices%20-The%20CHARMing%20Software%20Suite.pdf

- Listmode writing:
  It is possible to write listmode files during data acquisition. Listmode files are saved in the format `YYmmdd_H-M-S.mdat` in the directory defined by the “DataHome” entry in the configuration file.
  Listmode files are written as memory mapped files, this is faster than normal files and causes less interference with high acquisition data rates. One needs to define the size of a memory mapped at creation time, in the CHARMing software the initial size is (free disk space - 10 GB) . Once the acquisition is finished the file size is reduced to the actual data written.
  Together with the listmode file the actual configuration file (used for data acquistion) is saved as `YYmmdd_H-M-S.mdat.json` .This is necessary to correctly detect the single device id streams contained in the listmode file at a later stage .

Dipl. Phys. Andreas Langhoff , 089-289-12132 andreas.langhoff@frm2.tum.de

- Preparing for high data rates:
  Linux:
  - sudo needed
  - udp buffer size is set higher
  - thread priority is set higher
  see https://github.com/zweistein-frm2/CHARMing/blob/master/charm/charm-sudo.sh
  and https://github.com/zweistein-frm2/CHARMing/blob/master/charm/entangle-server-privileged.sh
  and https://github.com/zweistein-frm2/CHARMing/blob/master/charm/Zweistein.ThreadPriority.hpp
  Consider a Windows machine as in my testing the windows systems performed better.

- More in depth II: The build process. Please see https://github.com/zweistein-frm2/CHARMing_binaries/blob/master/build-process%20The%20CHARMing%20Software%20Suite.pdf

- Helper Program: https://github.com/zweistein-frm2/CHARMing_binaries/blob/master/charm-mesytec-emulator%20The%20CHARMing%20Software%20Suite.pdf