charm-mesytec-emulator - CHARMing Software Suite

14.6.2021.

Purpose of the CHARMing software suite (https://github.com/zweistein-frm2/CHARMing) is to transfer neutron data over the network (via the entangle protocol) to the Nicos client.

As the real CHARM or SANS1 detector is often busy in real measurements, testing time is always limited.

The charm-mesytec-emulator software emulates the behavior of the real device, CHARM or mesytec (SANS1) and therefore testing of other parts in the data processing chain can be done without interfering with the real detector's usage schedule.

Simulated Neutron data is sent over the network interface (Ethernet) the very same way the real device would send data over Ethernet.

Download for Linux, Windows or Raspberry Pi.

https://github.com/zweistein-frm2/CHARMing_binaries/raw/master/linux/x86_64/charm-mesytec-emulator

https://github.com/zweistein-frm2/CHARMing_binaries/raw/master/windows/charm-mesytec-emulator.exe

https://github.com/zweistein-frm2/CHARMing_binaries/raw/master/linux/armhf/charm-mesytec-emulator

example command line parameters: [Events per second] [format]

```
./charm-mesytec-emulator 1K
```

This sends data in MPSD8 format, 1000 Events per second

```
./charm-mesytec-emulator 1K --ininame=slot0
```

This sends data in MPSD8 format, 1000 Events per second but uses the configuration from ~/.CHARMing/slot0.json

```
./charm-mesytec-emulator 1K MDLL
```

This sends data in MDLL format, 1000 Events per second

```
./charm-mesytec-emulator 1K CHARMDLL
```

This sends data in CHARM format, 1000 Events per second

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

The charm detector can consist in several variants, each having a different number of single detector panels. To emulate all possible detector variants a configuration file

`~/.CHARMing/charm-mesytec-emulator.json` is read in.
You can specify a different name though still in the same directory by adding `-ininame=yourname` to the command line.

Content of charm-mesytec-emulator.json :

```
{
  "MesytecDevice": {
        "port": "54321",        // udp port to be used
        "n_charm_units": "2",   // charm : number of segments
                                // of detector
                               // 0 for other formats

        "devid": "0"           // must be 0 for charm device
                                    // device id for mesytec
        "Networkcard": ""       // ip address of network card to be
                          //used (only when multiple network
                          // interfaces are present
    }
}
```

You can edit the charm-mesytec-emulator.json to fit your needs.

Note: although a data rate has to be defined at startup, data will not be sent until a START command is received from the control software. Data rate can be changed by sending a SETNUCLEORATEEVENTSPERSECOND command. See https://github.com/zweistein-frm2/CHARMing/blob/master/charm/Mcpd8.enums.hpp

Special case : setting up a SANS1 emulator

The SANS1 detector consists of 2 MPSD8 detectors, hence to emulate the detector it is necessary to install charm-mesytec-emulator on 2 computers.

Source code: See https://github.com/zweistein-frm2/CHARMing/tree/master/charm-mesytec-emulator

An alternative installation is presented here using a docker environment: Inside the docker environment 2 charm-mesytec-emulator processes are running and emulating mesytec.
The docker image is build using the command https://github.com/zweistein-frm2/CHARMing_binaries/blob/master/linux/docker-build.sh

and the shell script https://github.com/zweistein-frm2/CHARMing_binaries/blob/master/linux/docker-sans1.sh will run the SANS1 emulator.

Here an example where the 2 mesytec devices are at ip 172.17.0.4 and 172.17.0.5

```
localadmin@delopc2:~$ ./docker-sans1.sh
kernel.sched_rt_runtime_us = -1
net.core.rmem_max = 26214400
running with docker --net=host
docker_nic=docker0
network=172.17.0.2
next_serv=172.17.0.4
next_serv2=172.17.0.5
main_nic=enp0s25
RTNETLINK answers: File exists
RTNETLINK answers: File exists
RTNETLINK answers: File exists
Commands supplied:
        [charm --mesytecdevice]
        [entangle-server ERWIN_sans1.res]
$1
root@delopc2:/#
```

The command `charm --mesytecdevice` will launch the charm acquisition software. If running in an Xterm Window then there will be a graphical display of the histogram data.

```
root@delopc2:/# charm --mesytecdevice
CHARMing : 2.9.dde4308+_21-06-15_0842+0200
using MESYTEC device protocol
2021-Aug-31 16:54:20.747097 [info] - Using config
file:"/etc/CHARMing/mesytecsystem.json"
eventdataformat : possible values are  Undefined Mpsd8 Mdll
datagenerator : possible values are : Undefined Mcpd8 NucleoSimulator Charm
CharmSimulator
2021-Aug-31 16:54:20.747827 [info] - {
    "MsmtSystem": {
        "DataHome": "\/root\/",
        "BinningFile":
"\/etc\/CHARMing\/examples\/pos_cal_lut_2016_07_13.txt",
        "MesytecDevice0": {
```

```
        "mcpd_ip": "172.17.0.4",
        "mcpd_port": "54321",
        "mcpd_id": "0",
        "data_host": "0.0.0.0",
        "networkcard": "172.17.0.2",
        "eventdataformat": "Mpsd8",
        "datagenerator": "Mcpd8",
        "CounterADC0": "7 22",
        "CounterADC1": "7 22",
        "CounterADC2": "7 22",
        "CounterADC3": "7 22",
        "CounterADC4": "",
        "CounterADC5": "",
        "CounterADC6": "",
        "CounterADC7": "",
        "Threshold_and_Gains0": "40 102 016 107 103 104 97 96 93",
        "Threshold_and_Gains1": "40 94 106 93 100 104 98 110 101",
        "Threshold_and_Gains2": "40 85 101 99 97 92 94 76 93",
        "Threshold_and_Gains3": "40 84 92 96 89 94 90 88 94",
        "Threshold_and_Gains4": "40 86 89 99 96 94 101 98 99",
        "Threshold_and_Gains5": "0 96 97 85 92 89 100 89 95",
        "Threshold_and_Gains6": "40 99 98 90 89 90 97 102 90",
        "Threshold_and_Gains7": "40 77 96 94 91 94 102 97 99"
    },
    "CharmDevice0": {
        "n_charm_units": "0"
    },
    "MesytecDevice1": {
        "mcpd_ip": "172.17.0.5",
        "mcpd_port": "54321",
        "mcpd_id": "1",
        "data_host": "0.0.0.0",
        "networkcard": "172.17.0.2",
        "eventdataformat": "Mpsd8",
```

```
            "datagenerator": "Mcpd8",
            "CounterADC0": "7 22",
            "CounterADC1": "7 22",
            "CounterADC2": "7 22",
            "CounterADC3": "7 22",
            "CounterADC4": "",
            "CounterADC5": "",
            "CounterADC6": "",
            "CounterADC7": "",
            "Threshold_and_Gains0": "40 97 99 94 94 99 96 94 100",
            "Threshold_and_Gains1": "40 100 95 91 92 92 92 91 96",
            "Threshold_and_Gains2": "40 108 92 103 93 106 94 95 105",
            "Threshold_and_Gains3": "40 115 106 110 115 117 116 105 113",
            "Threshold_and_Gains4": "40  88 91 85 93 92 101 87 89",
            "Threshold_and_Gains5": "40 96 95 93 93 94 98 91 106",
            "Threshold_and_Gains6": "40 99 92 95 86 101 101 96 96",
            "Threshold_and_Gains7": "40 98 99 100 132 109 96 113 98"
        },
        "CharmDevice1": {
            "n_charm_units": "0"
        }
    }
}
```


```
2021-Aug-31 16:54:20.750031 [info] - ping: 64 bytes from 172.17.0.4:
icmp_seq=1 ttl=64 time=0.039 ms

2021-Aug-31 16:54:20.751568 [info] - ping: 64 bytes from 172.17.0.5:
icmp_seq=1 ttl=64 time=0.023 ms

2021-Aug-31 16:54:20.780194 [error] - Cannot set thread priority => check
permissions (sudo needed)

2021-Aug-31 16:54:20.902558 [info] - 172.17.0.4 DevId:0

2021-Aug-31 16:54:20.952983 [info] - 172.17.0.5 DevId:1

2021-Aug-31 16:54:21.053794 [info] - 172.17.0.4 MPSD8 MPSD8 MPSD8 MPSD8
MPSD8 MPSD8 MPSD8 MPSD8

2021-Aug-31 16:54:23.013697 [info] - 172.17.0.5 MPSD8 MPSD8 MPSD8 MPSD8
MPSD8 MPSD8 MPSD8 MPSD8
```

```
Ctrl-C to stop

2021-Aug-31 16:54:25.024159 [info] - 172.17.0.4 SETTIMING Master
sync_bus_termination

2021-Aug-31 16:54:25.074972 [info] - 172.17.0.5 SETTIMING Slave
sync_bus_termination

2021-Aug-31 16:54:25.075538 [info] - MESYTEC CONNECTED: +4328 milliseconds

2021-Aug-31 16:54:25.281554 [info] -
Zweistein::Binning::ReadTxt:/etc/CHARMing/examples/pos_cal_lut_2016_07_13.t
xt

2021-Aug-31 16:54:25.313577 [warning] - BINNING.shape()[1]=960 smaller than
detector sizeY(1024), detector partially unused.

2021-Aug-31 16:54:25.314245 [info] -
Zweistein::Binning::BINNING.shape(128,960)

2021-Aug-31 16:54:25.621304 [warning] - environment variable DISPLAY not
set.

| 0 Events/s, (0 B/s)   DAQ_Running sync_ok  elapsed:0 seconds     2021-
Aug-31 16:54:26.388879 [info] - TO CHECK: stray Neutron discarded (from
startup)

\ 115 Events/s, (0 B/s)/DAQ_Running sync_ok  elapsed:5 seconds
```