

Data Acquisition Backbone Core I4FC

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GSI, Experiment Electronics: Data Processing group

Motivation and use cases

Core design: dataflow, modules, manager object

Application plug-in mechanism

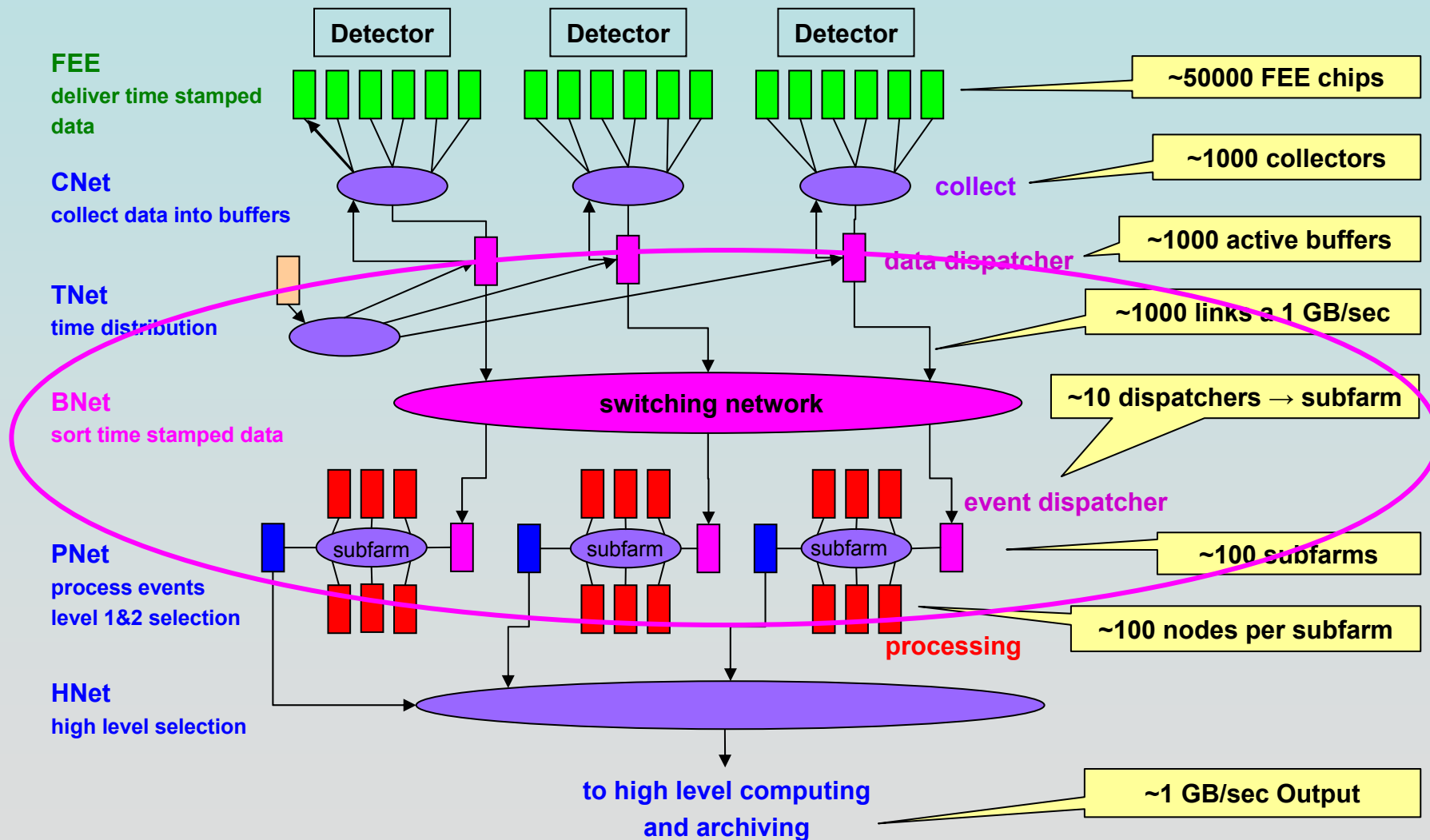
Controls and configuration interface

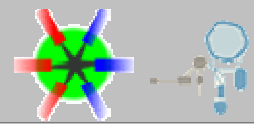
Status and Outlook

Presentation: DABC live demo

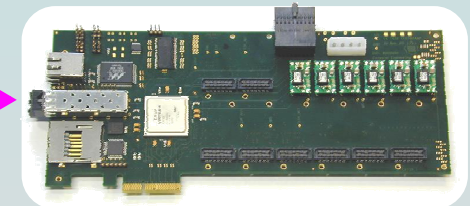
Work supported by EU RP6 project JRA1 FutureDAQ RII3-CT-2004-506078

W.F.J.Müller, 2004





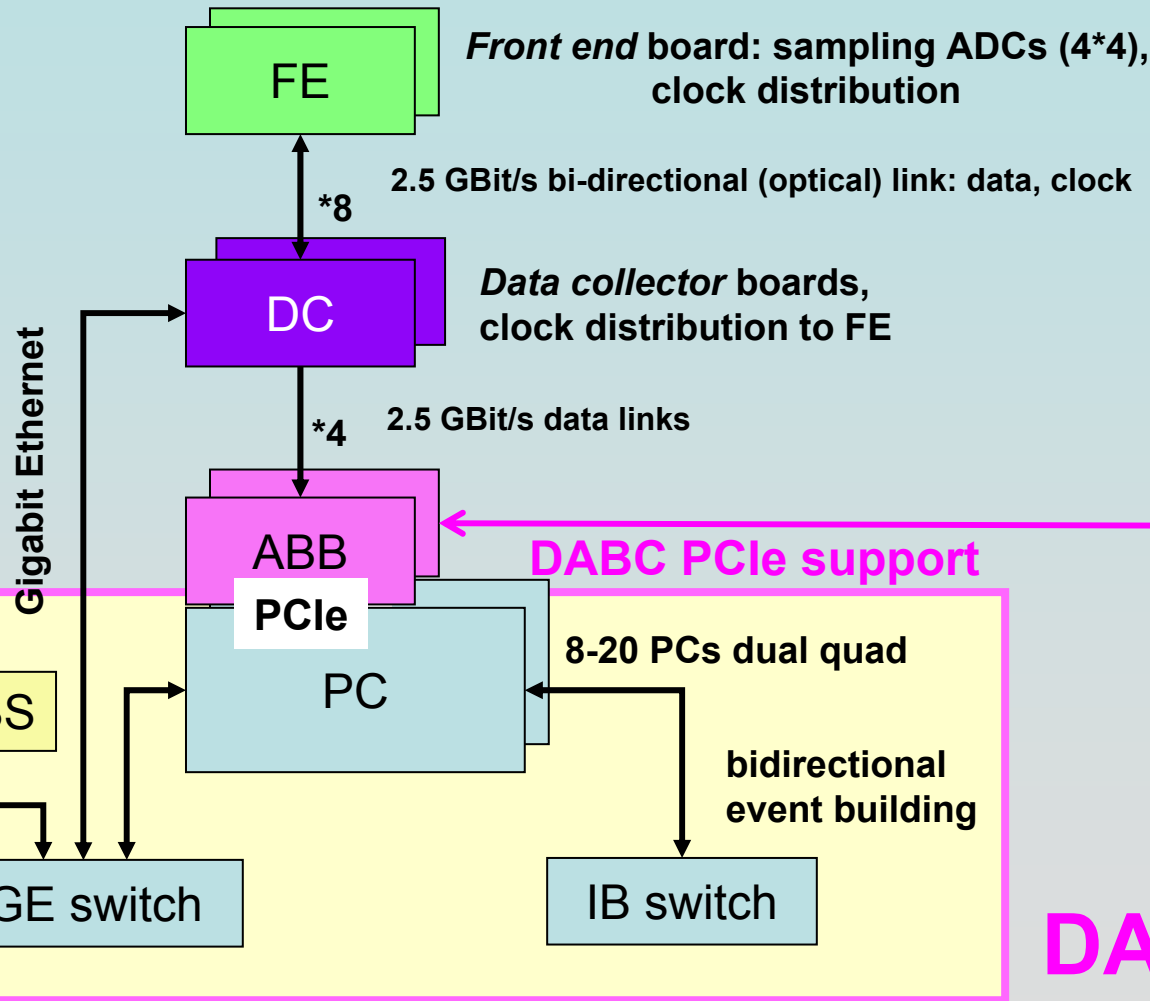
FE: Frontend board
DC: Data combiner board
ABB: Active Buffer board
GE: Gigabit Ethernet
IB: InfiniBand
MBS: MultiBranchSystem

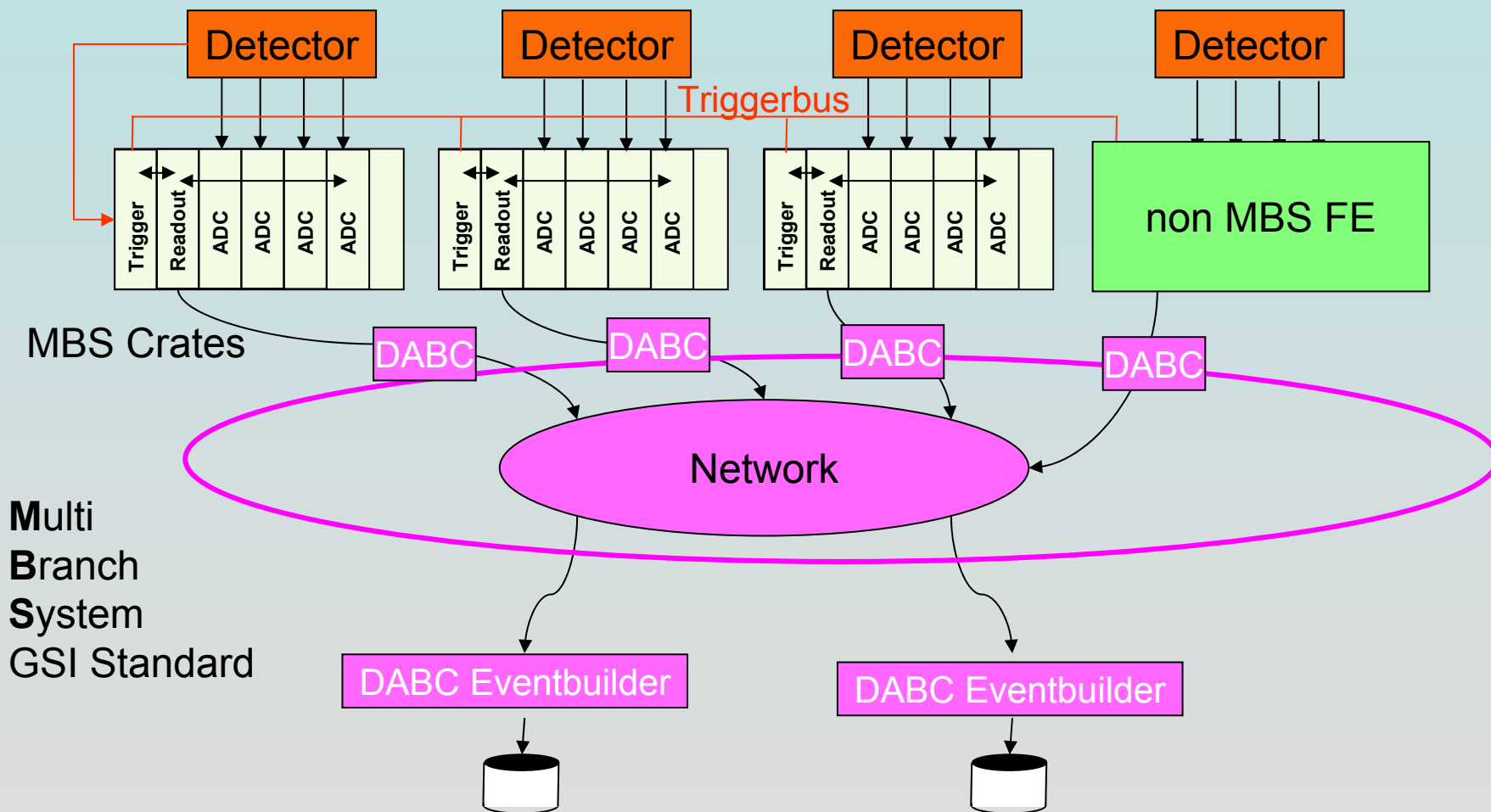
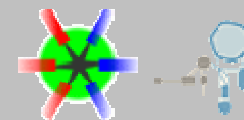


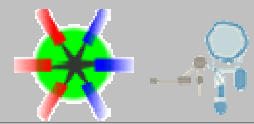
**Active Buffer Board*:
PCI express card**

•A.Kugel, G.Marcus, W.Gao,
•Mannheim University Informatics V

DABC







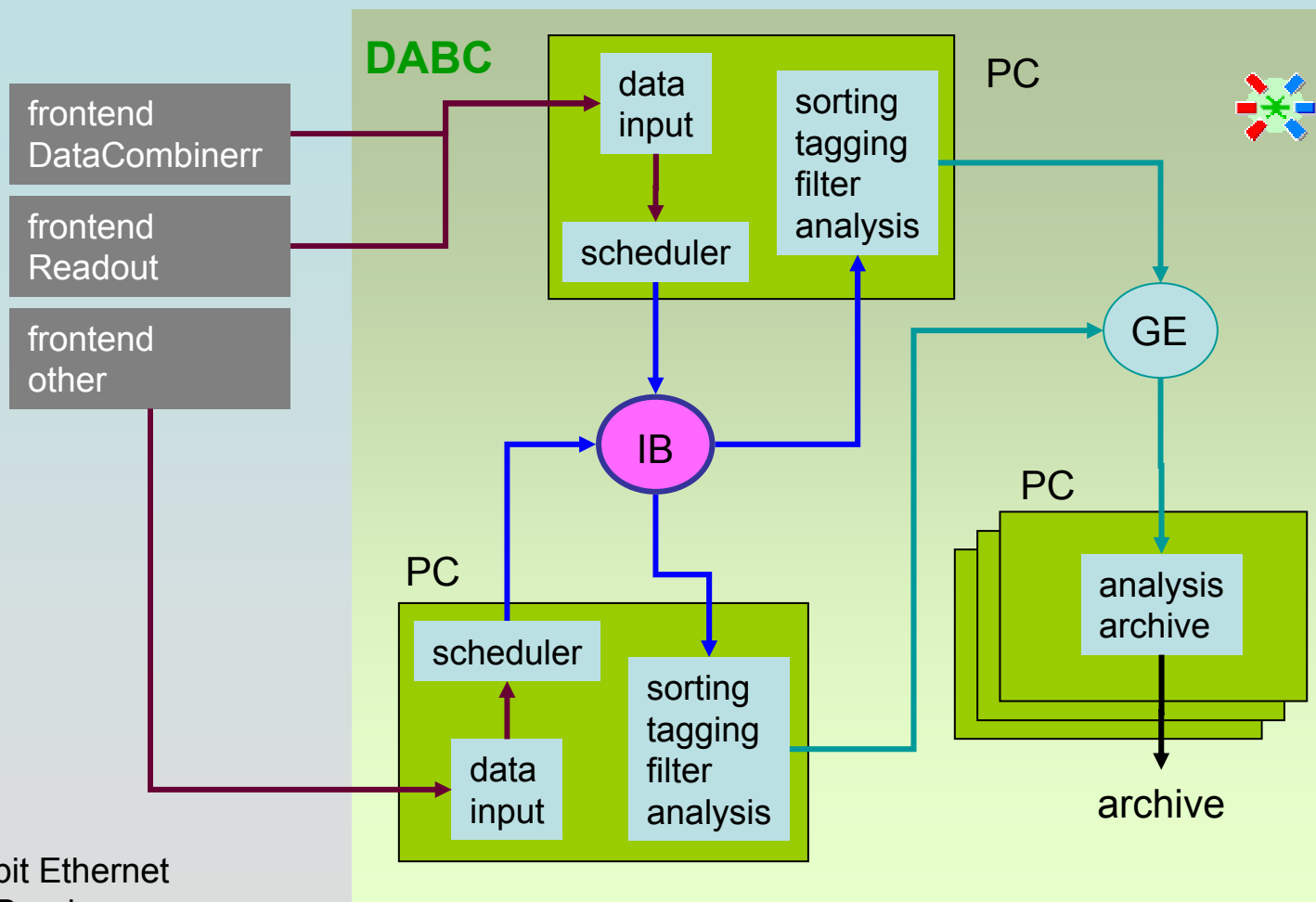
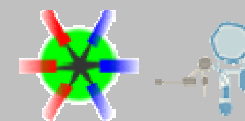
Use cases:

- CBM {
- Detector tests
 - FE equipment tests
 - Data transport tests
 - Time distribution tests
- GSI {
- Switched event building
 - MBS event builder

Requirements:

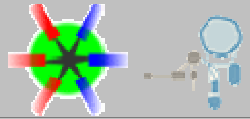
- build events over fast networks
- triggered or self-triggered front-ends
- time stamped data streams
- data flow control (to front-ends)
- connect (nearly) any front-ends
- interface for application plug-in code
- connect MBS readout or collector nodes
- interface for several controls frameworks

=> DABC for CBM DAQ testing and as future „general purpose“ DAQ system



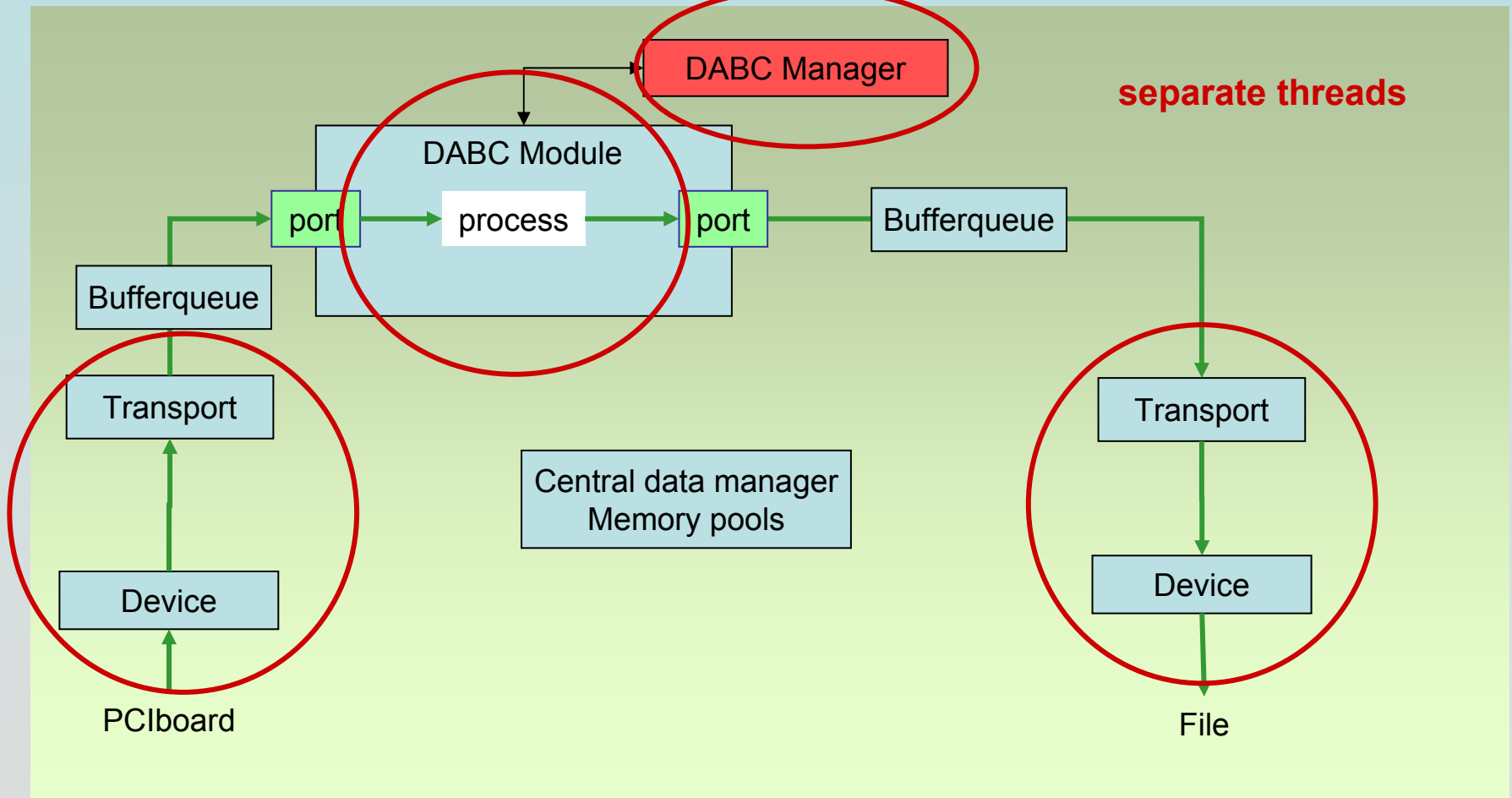
GE: Gigabit Ethernet
IB: InfiniBand

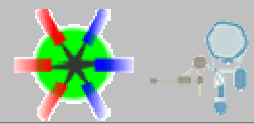
➤ DABC data flow



A *module* processes data of one or several data streams.

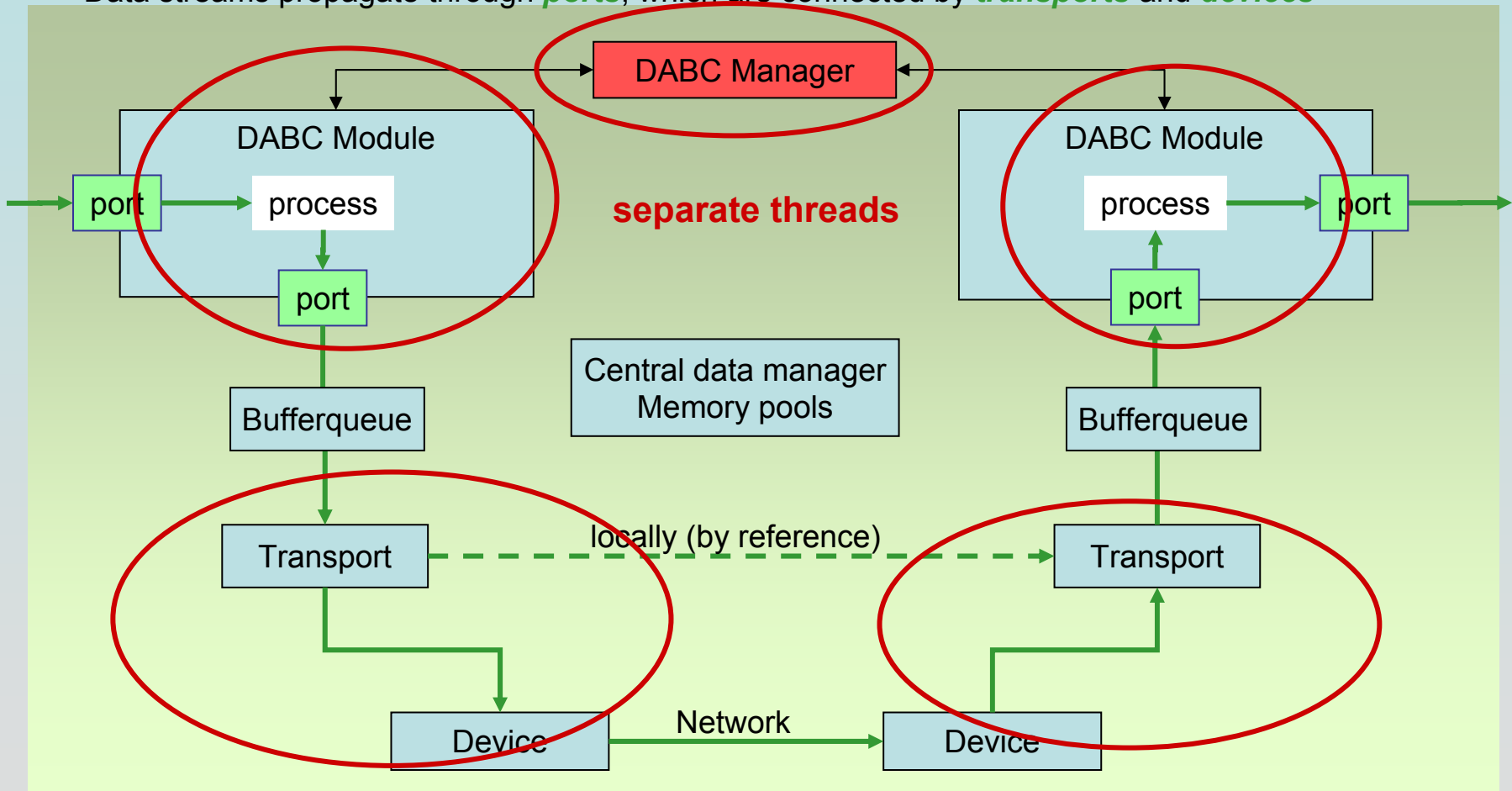
Data streams propagate through **ports**, which are connected by **transports** and **devices**

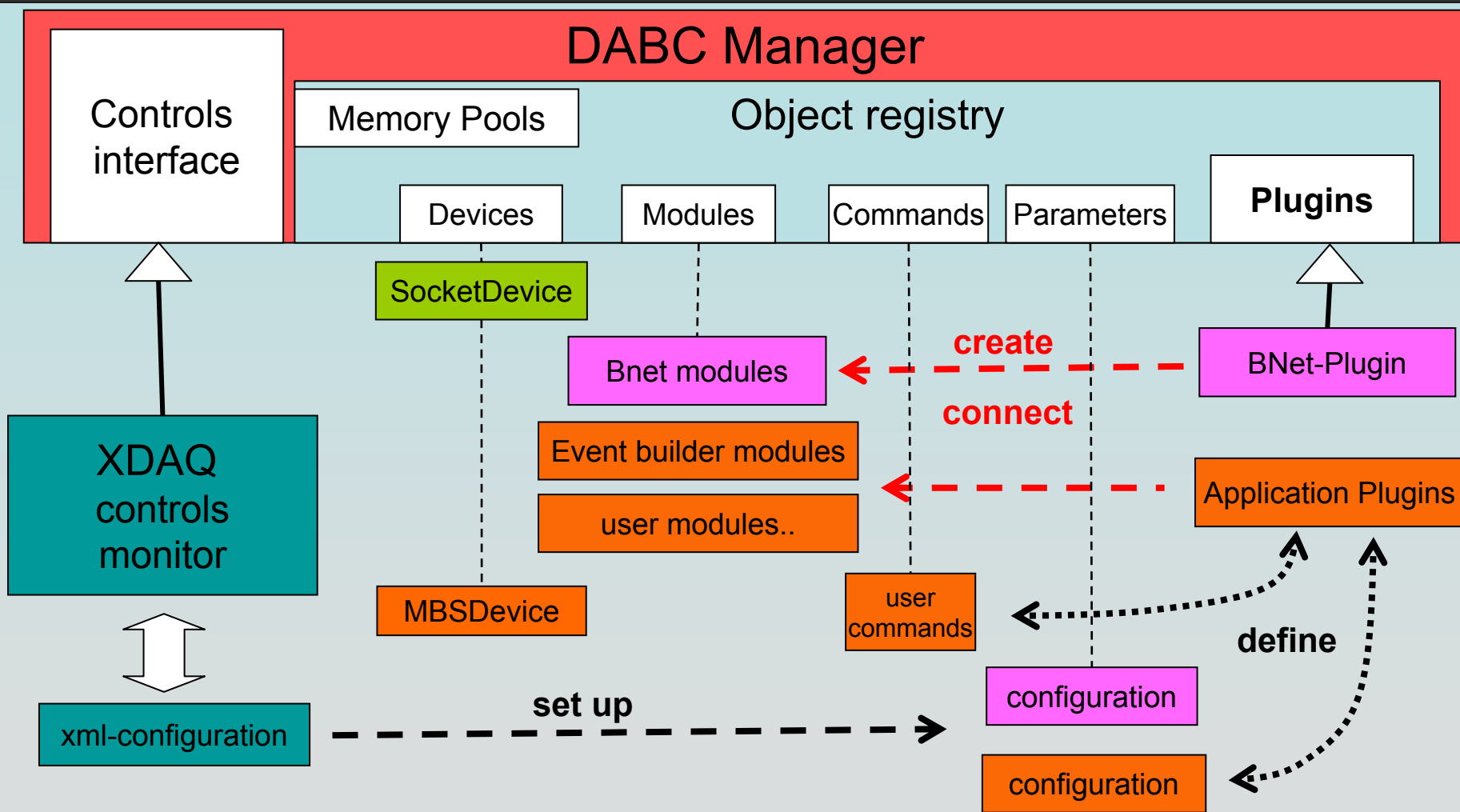
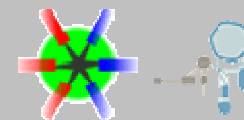


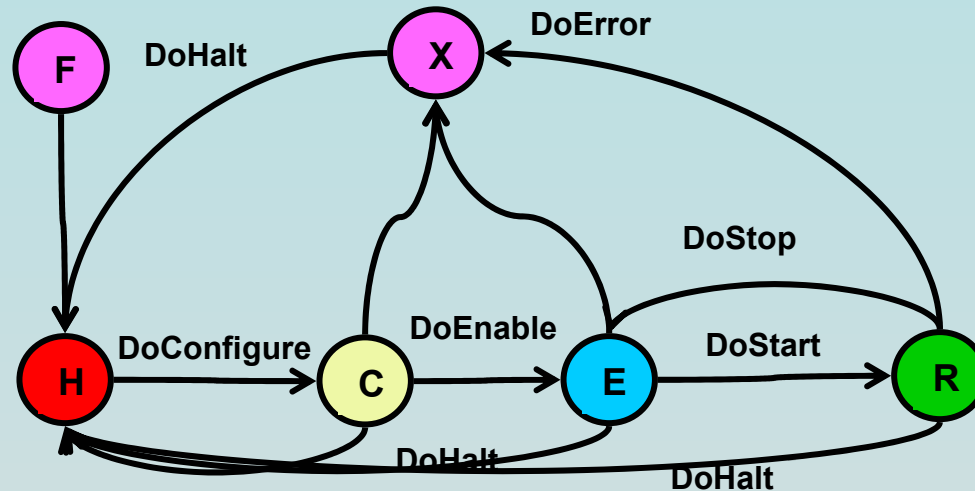
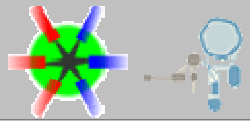


A *module* processes data of one or several data streams.

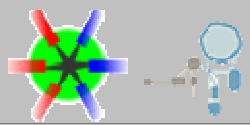
Data streams propagate through **ports**, which are connected by **transports** and **devices**







- State machine is **defined by controls interface** of DABC core
- **ApplicationPlugins** implement state transition actions („user code“)
- Nodes in B-net may set up **state machine hierarchy**:
(e.g. 1 master node, n worker nodes)



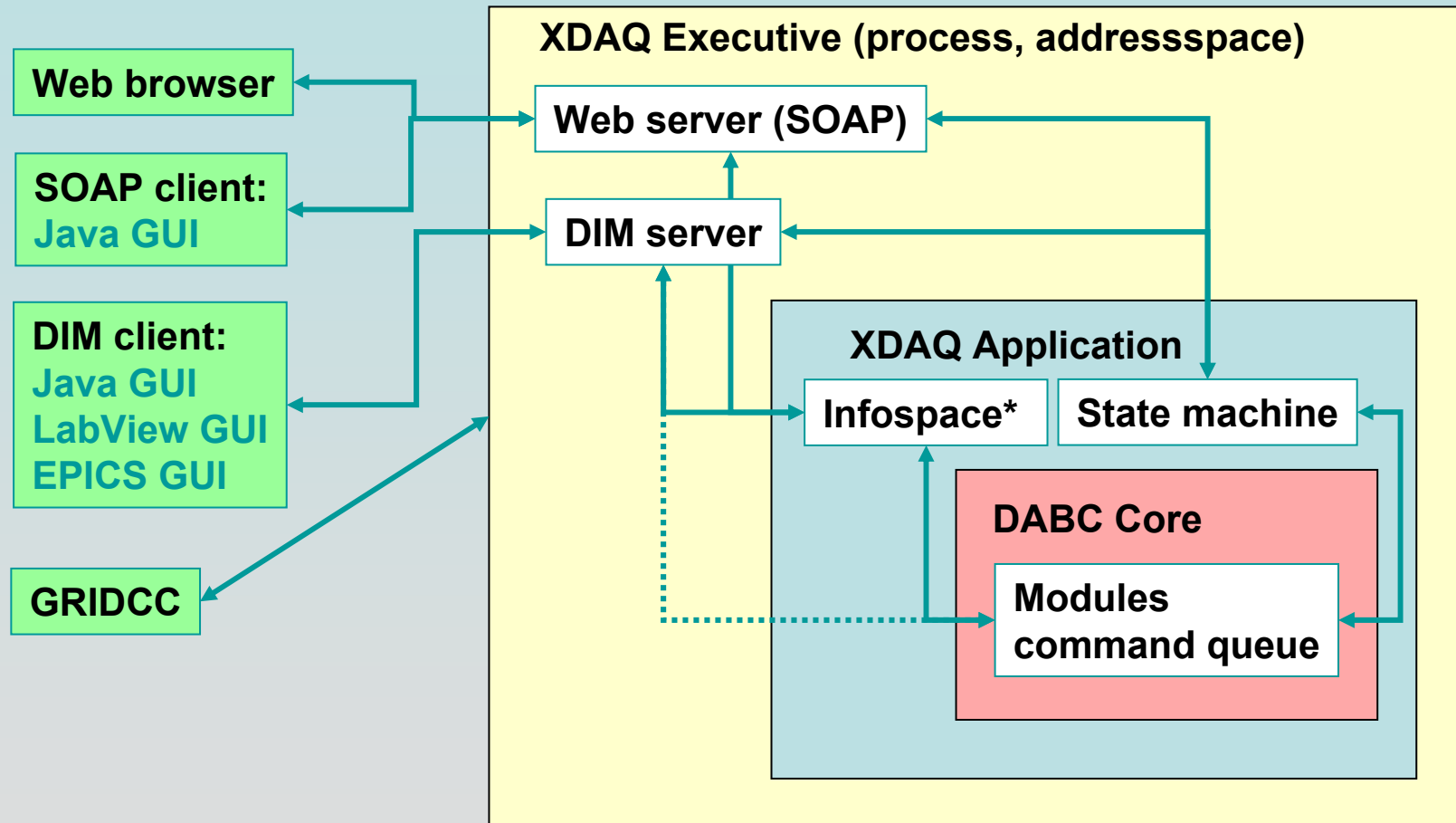
Parameters:

- Registered by **plugin** or device class
- **DIM** field service with **naming convention** and **DABC structure**
- Also: SOAP/ **XDAQ infospace** representation, web interface, **xml input**
- Recognized by **generic GUI**, automatic graphical presentation
- Types: Simple, Status, Rate, Histogram, Info, Command description,...

Commands:

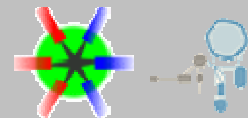
- **DIM** (and SOAP) implementation
- **State machine** commands
(generic, with **overwritten standard callbacks** in plugins)
- **Framework** commands (generic, e.g. „SetValue“)
- User defined **module commands** (registered by plugin or device):
 - execution in **user callback**
 - recognized by **generic GUI** via command description
 - **command streamer and description (XML)**
independent from controls implementation!

DABC core decoupled from XDAQ environment!



* Infospace: remotely accessible parameters

➤ MBS connection

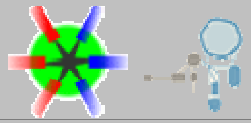


Achieved

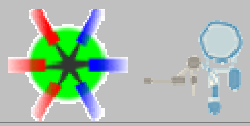
- Core infrastructure
- Data flow engine
- XDAQ runtime environment
- Generic Java GUI
- PCI(e) support
- MBS event building
- Programming Interface definitions

Todo

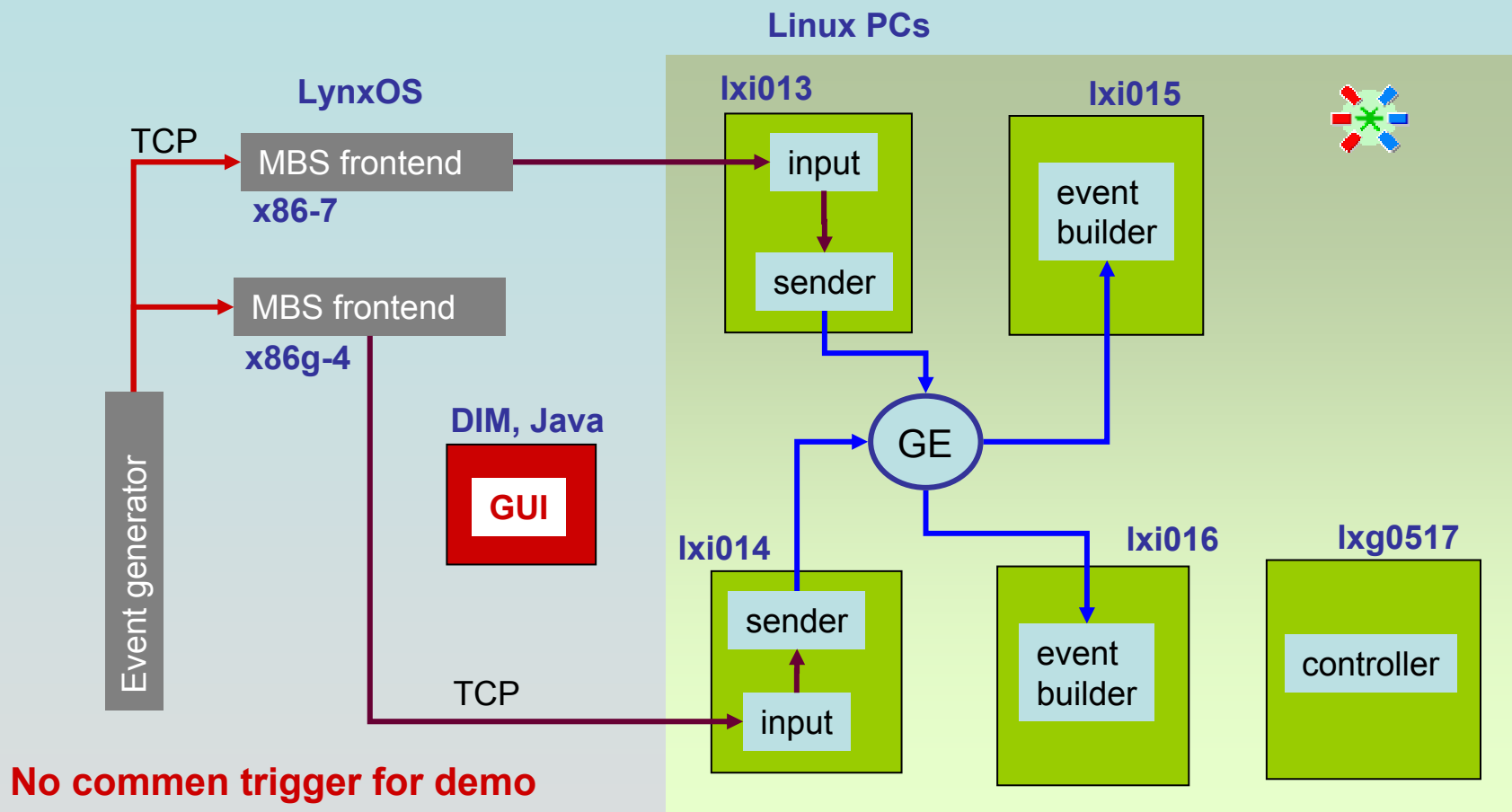
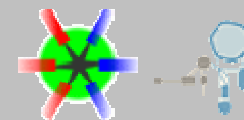
- Controls, GUI c't
- Data formats
- Combiner / time sort
- Event building
- Programming Interface implementation c't
- Configuration DB
- Packaging and deployment
- Documentation



- MBS upgrade for DABC
- DABC plugins
- Control standard stand alone MBS with DABC GUI
- Control MBS frontends with DABC event builder

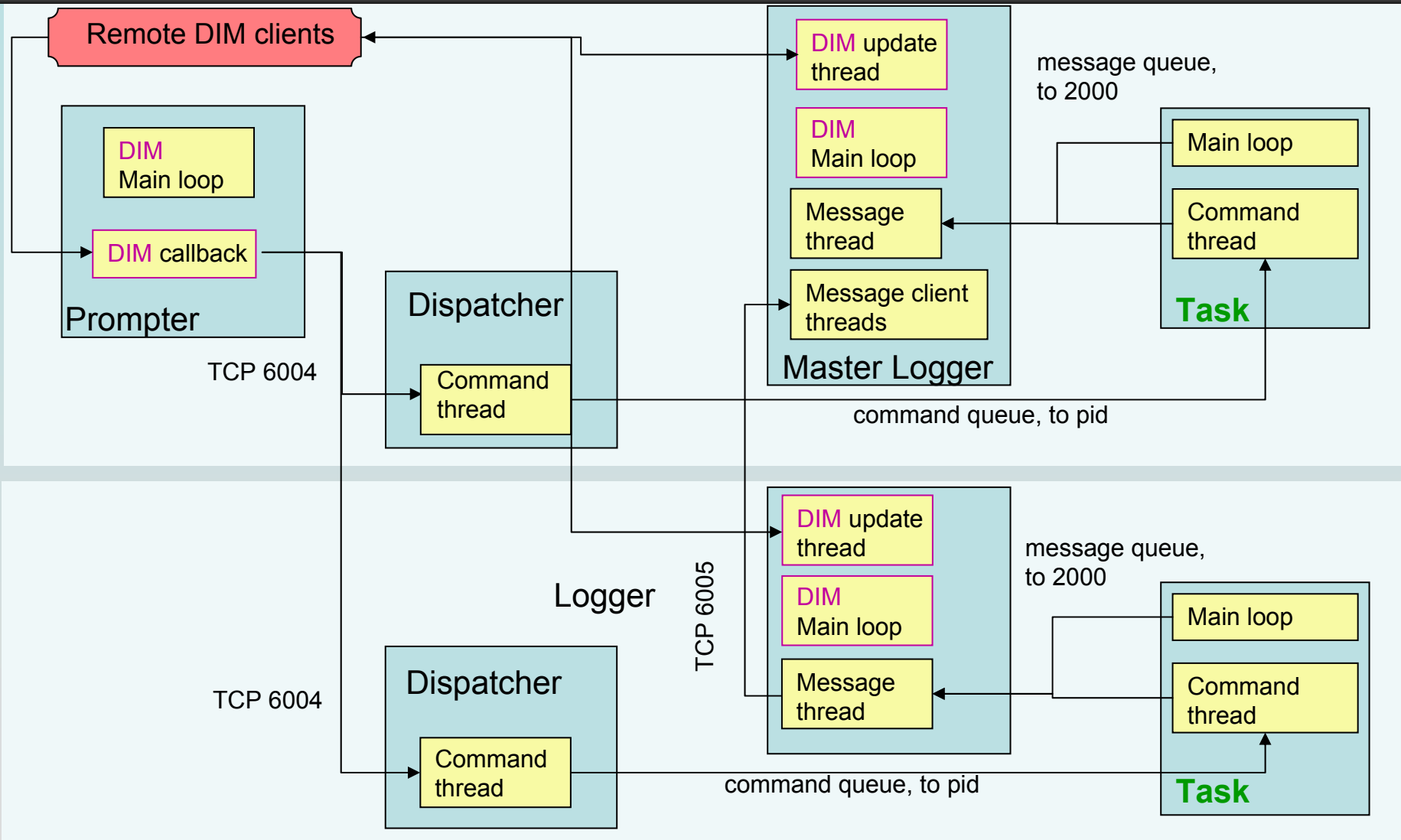
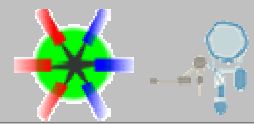


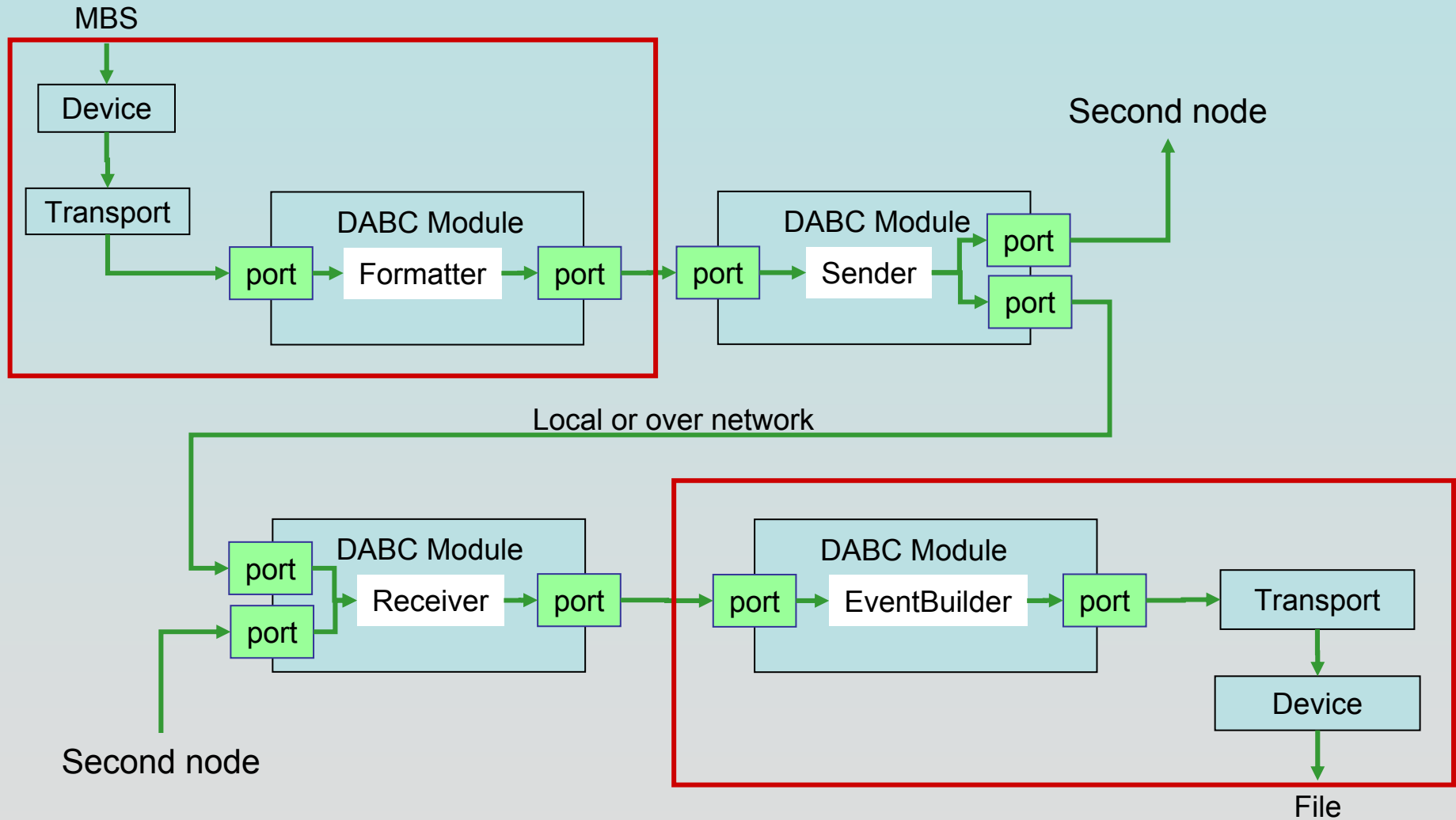
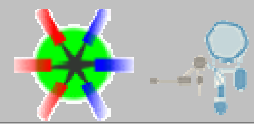
- **General upgrades**
 - ☑ Large buffers (up to now 32K limit) in MBS.
 - ☑ Large buffers in LMD files.
 - ☑ Remote control of MBS via **DIM** by DABC Java GUI
- **DABC specific mode**
 - ☑ MBS transport in **DABC mode blocks**, if no DABC is connected.
 - ☑ MBS transport sends variable sized buffers.
 - ☑ Using large buffers and one buffer per stream: no event spanning.
- **New LMD file format**
 - ☑ No buffer structure.
 - ☑ File header, data elements, index table (random access).
 - ☑ No size limit (> 2 GB).
 - ☑ Supported by event API.
- **To do**
 - Event server in DABC

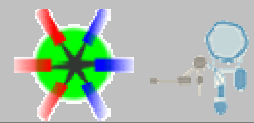


GE: Gigabit Ethernet

➤ DABC structure







DABC Device

MbsFrontend

MbsFrontend ()

Create commands
Register parameters

CreateTransport (port)

Create MbsRead

DABC Transport

MbsRead

MbsRead (port)

Connect MBS transport
Register port

GetBufferSize ()

Return buffer size

Read (buffer)

Read header
Read data
Return

~MbsRead ()

Disconnect MBS

Thread

DABC Module

MbsFormatter

MbsFormatter ()

Create commands
Register parameters
Create ports (1 x input, 1x output)

MainLoop ()

Wait input port 1
Get empty buffer
Loop: Add subevent ref. to buffer
Size > max? Put buffer to port
Return

EndLoop

~MbsFormatter ()

Thread

DABC Module

MbsEventBuilder

MbsEventBuilder ()

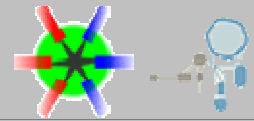
Create commands
Register parameters
Create ports (1 x input, 1x output)

MainLoop ()

Wait input port 1
Get empty buffer
Build event from input list
Put event to buffer
Put buffer to port (file store)

~MbsEventBuilder ()

Thread



DABC Module

MbsCombiner

MbsCombiner ()

Create commands
Register parameters
Create ports (1 x input, 1x output)

MainLoop ()

Wait input port 1
Get empty buffer
Loop: Add data ref. to buffer
Size > max? Put buffer to port
Return

EndLoop

~MbsCombiner ()

Thread

DABC Module

BNetSender

BNetSender ()

Create commands
Register parameters
Create ports (1 x input, n x output)

MainLoop ()

Wait input port 1
Put buffer to next output port

~BNetSender ()

Provided by DABC

Thread

DABC Device

BNetNetworkDevice

BNetNetworkDevice ()

Create commands
Register parameters

CreateTransport (port) ()

Create BNetNetworkTransport

DABC Transport

BNetNetworkTransport

NetNetworkTransport (port)

Register port

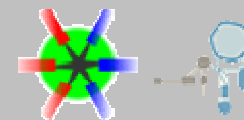
Write (buffer)

Send fragments

~BNetNetworkTransport ()

Provided by DABC

Thread



DABC Device

BNetNetworkDevice

BNetNetworkDevice ()

Create commands
Register parameters

CreateTransport (port)

Create BNetNetworkTransport

DABC Transport

BNetNetworkTransport

BNetNetworkTransport (port)

Register port

Read (buffer)

Receive fragments

~BNetNetworkTransport ()

Provided by DABC

Thread

DABC Module

BNetReceiver

BNetReceiver ()

Create commands
Register parameters
Create ports (n x input, 1 x output)

MainLoop ()

Wait for all input ports
Add input buffers to output list
Put list to output port

~BNetReceiver ()

Provided by DABC

Thread

DABC Module

MbsEventBuilder

MbsEventBuilder ()

Create commands
Register parameters
Create ports (1 x input, 1x output)

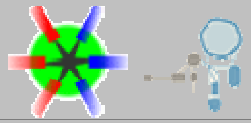
MainLoop ()

Wait input port 1
Get empty buffer
Build event from input list
Put event to buffer
Put buffer to port (file store)

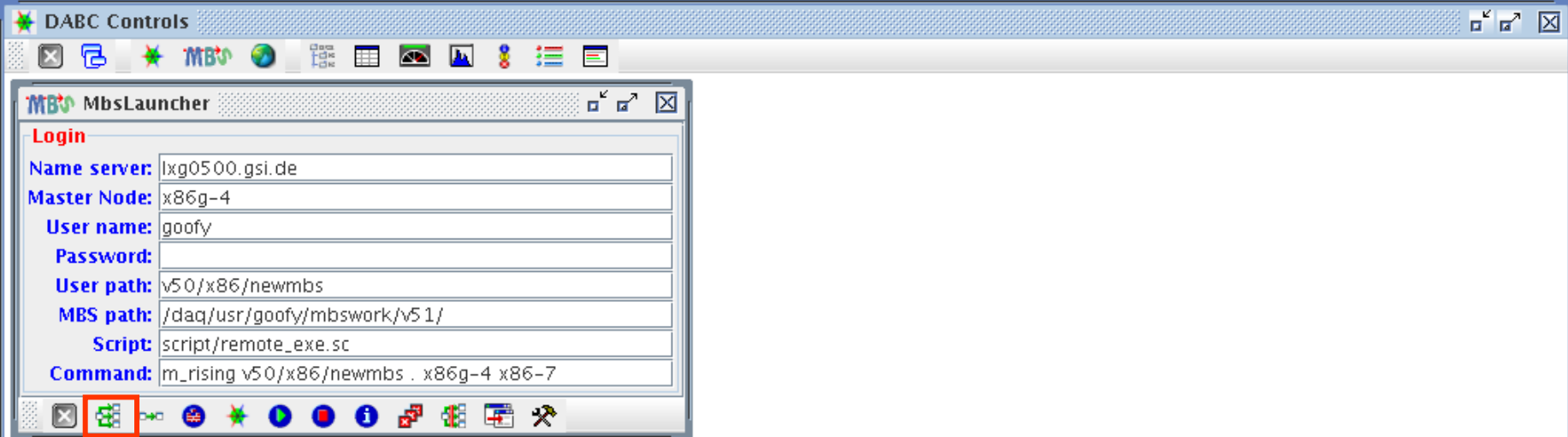
~MbsEventBuilder ()

Thread

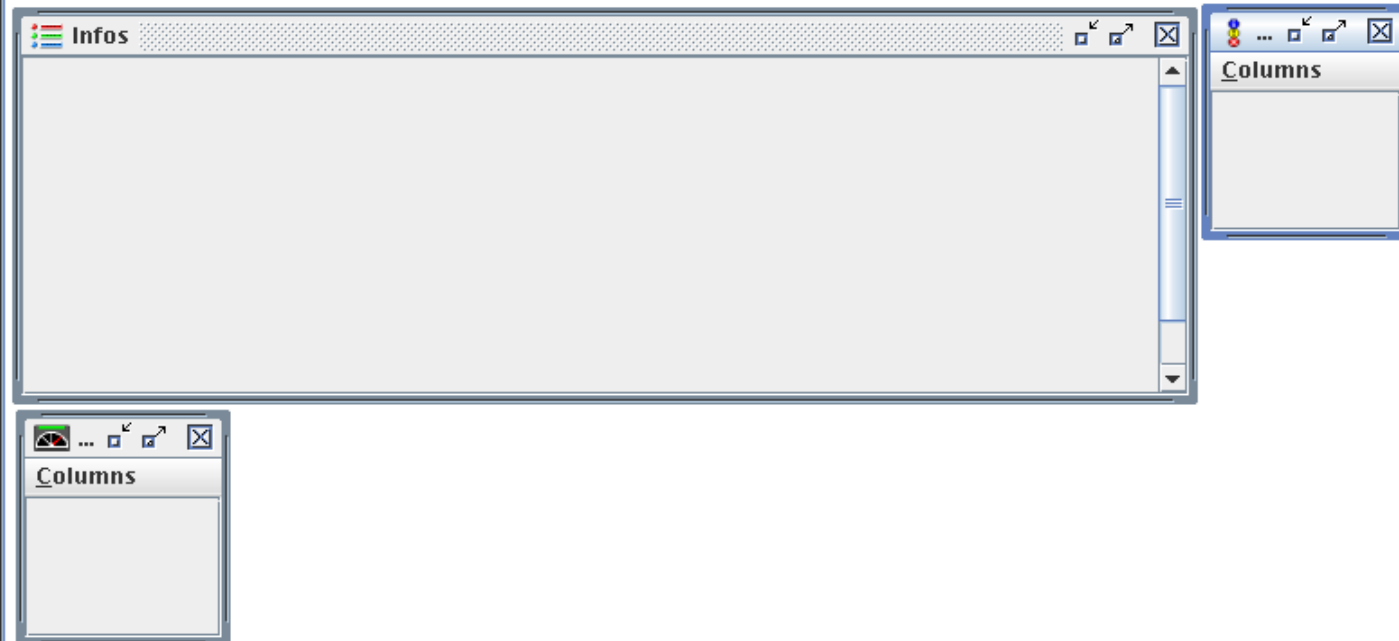
➤ DABC setup

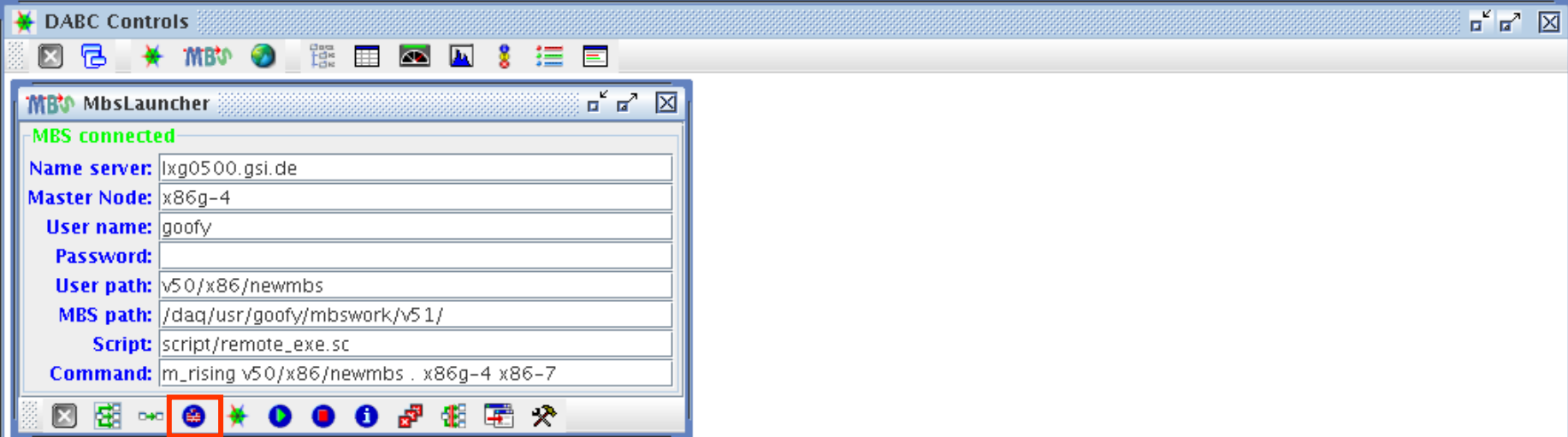


Just in case the DEMO does not work!

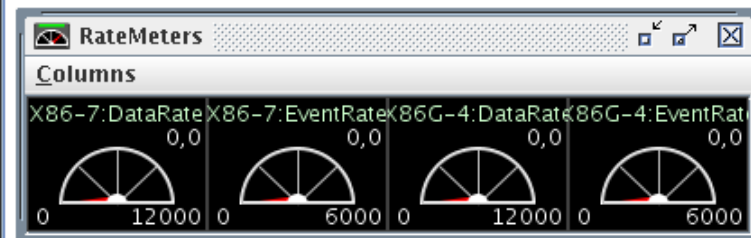
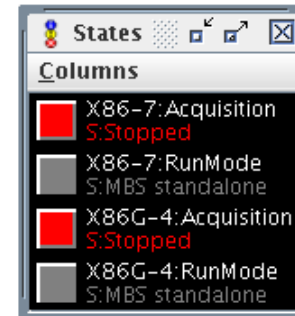
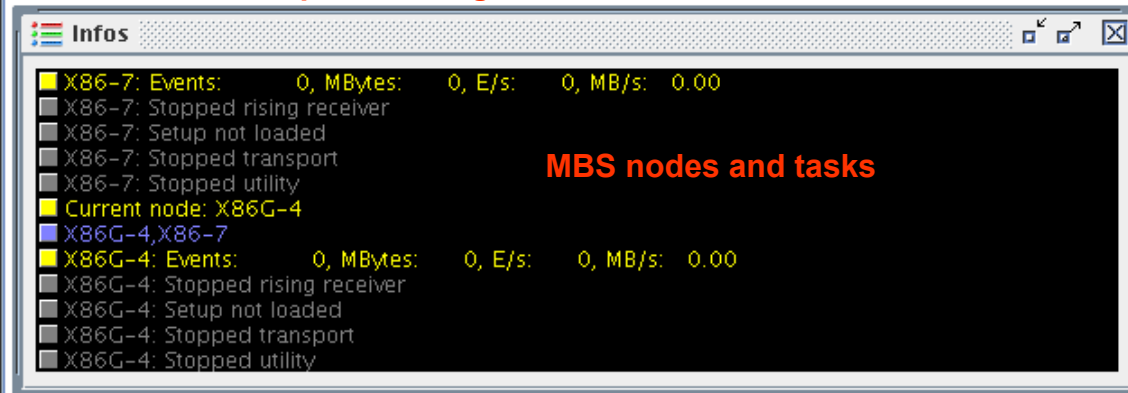


Launch MBS





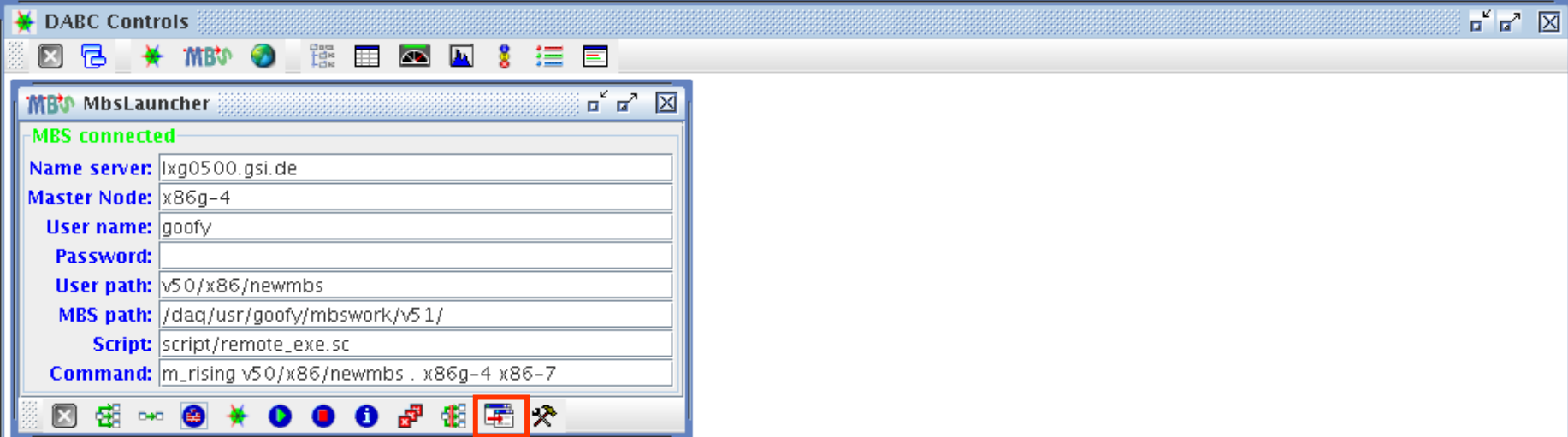
Startup and configure MBS



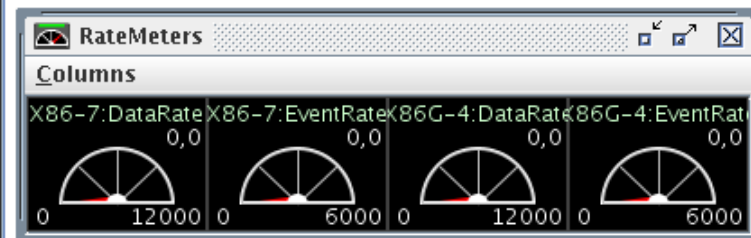
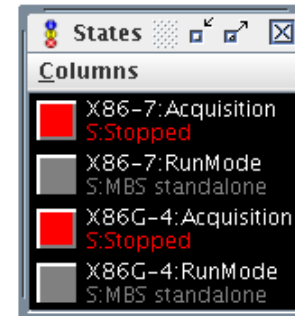
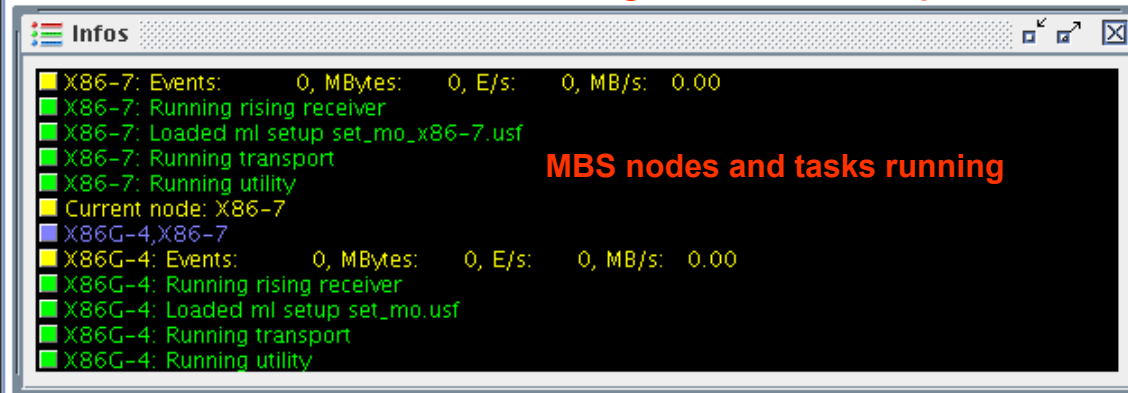
MBS rate meters

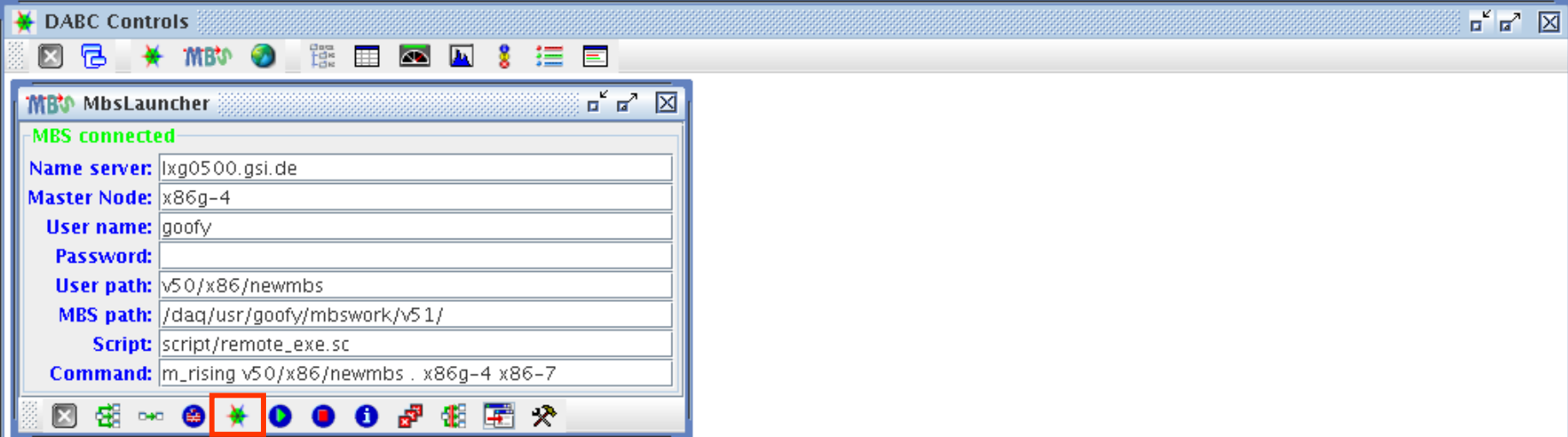
MBS DIM servers

DIM servers: DIS_DNS X86G-4.MSG X86-7.MSG X86G-4.PRM

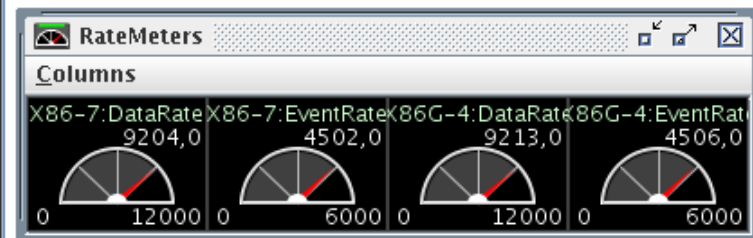
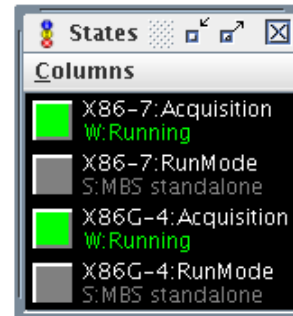
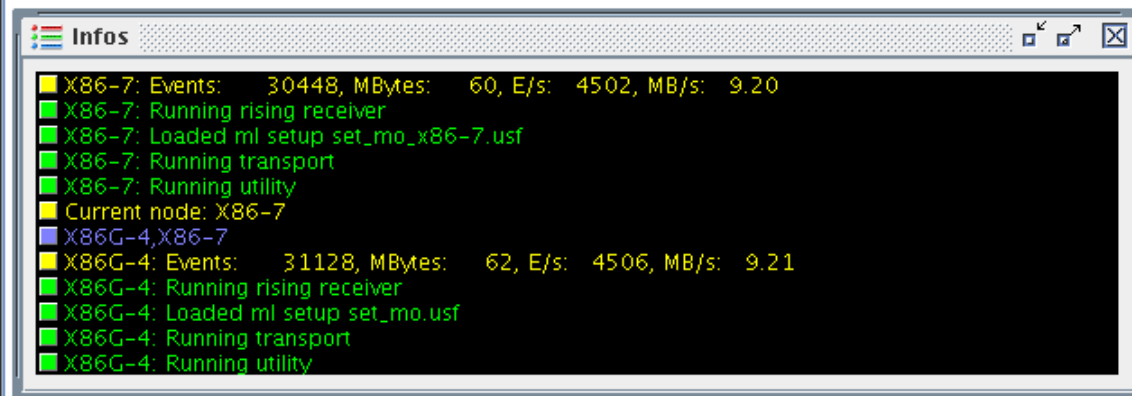


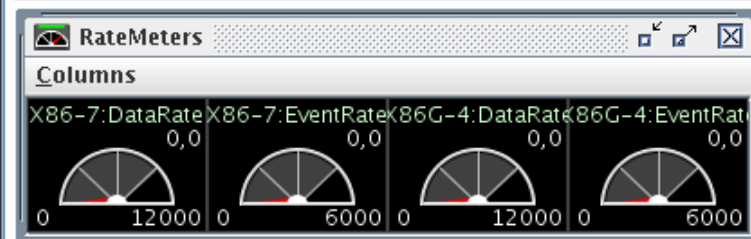
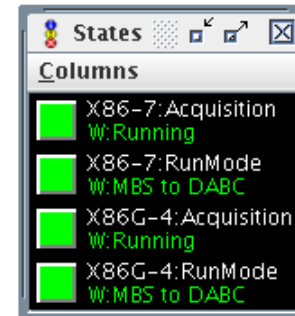
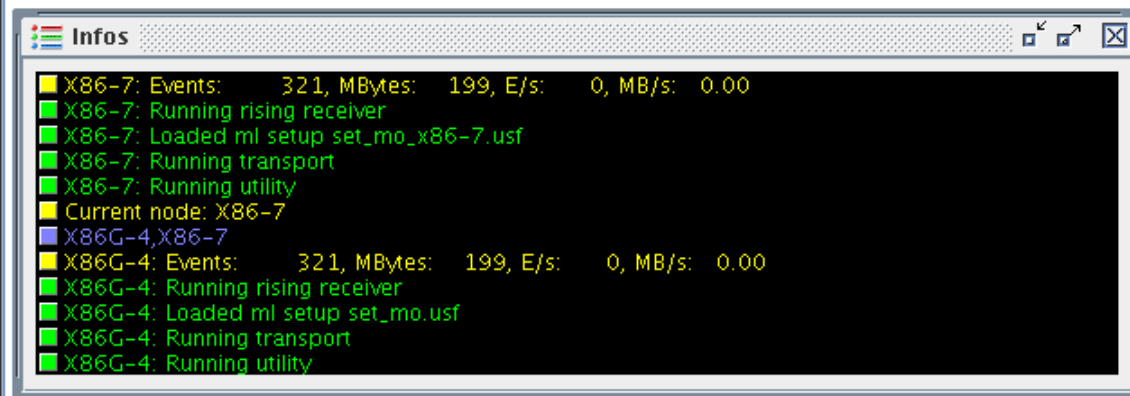
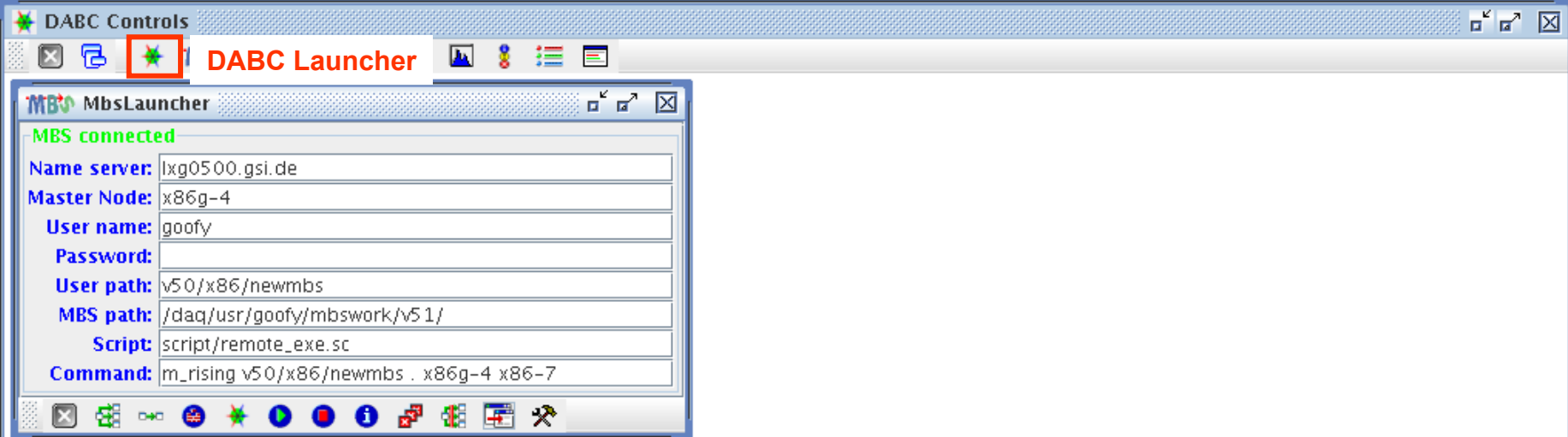
Start event generator starts acquisition





Set MBS as DABC client





MBS stops and waits for DABC

DABC Controls

MbsLauncher

MBS connected

Name server: lxg0500.gsi.de

Master Node: x86g-4

User name: goofy

Password:

User path: v50/x86/newmbs

MBS path: /daq/usr/goofy/mbswork/v51/

Script: script/remote_exe.sc

Command: m_rising v50/x86/newmbs . x86g-4 x86-7

Dabclauncher

Login

Name server: lxg0500.gsi.de

Master node: lxg0517.gsi.de

Master name: Controller: 41

User name: goofy

Password:

User path: /misc/goofy/sniff/dabcappl/config

DABC path: /misc/goofy/sniff/dabc/

Setup file: DABC_MBS_Setup.xml

Script: ps

Infos

X86-7: Events: 321, MBytes: 199, E/s: 0, MB/s: 0.00

X86-7: Running rising receiver

X86-7: Loaded ml setup set_mo_x86-7.usf

X86-7: Running transport

X86-7: Running utility

Current node: X86-7

X86G-4,X86-7

X86G-4: Events: 321, MBytes: 199, E/s: 0, MB/s: 0.00

X86G-4: Running rising receiver

X86G-4: Loaded ml setup set_mo.usf

X86G-4: Running transport

X86G-4: Running utility

Launch DABC

States

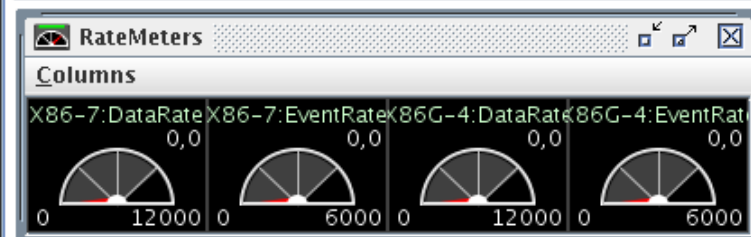
Columns

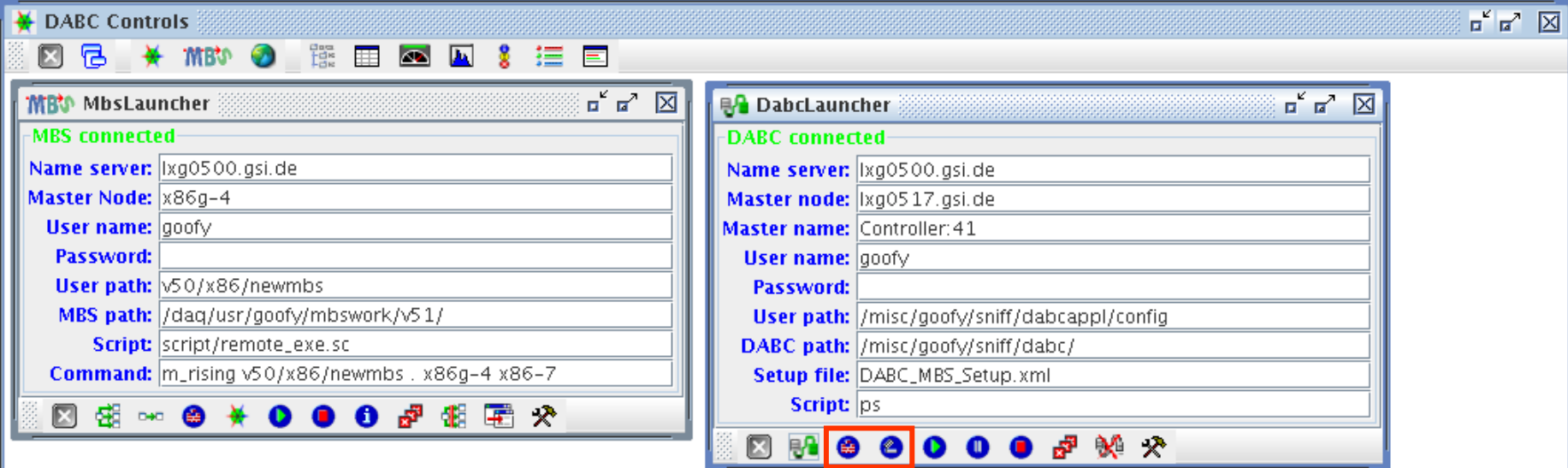
X86-7:Acquisition
W:Running

X86-7:RunMode
W:MBS to DABC

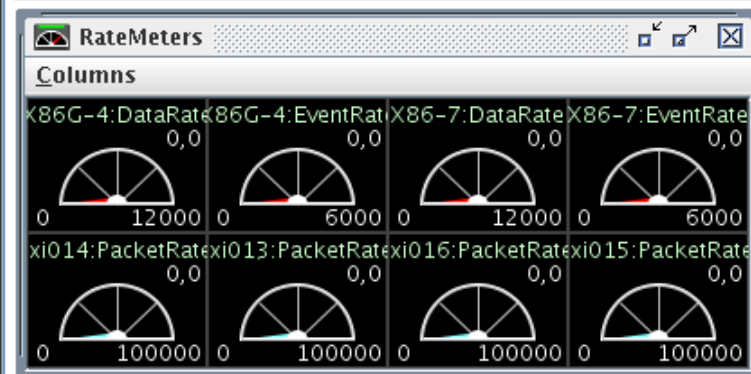
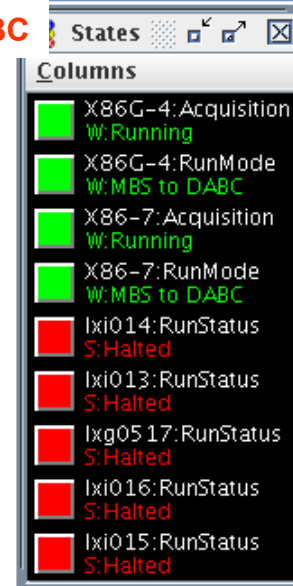
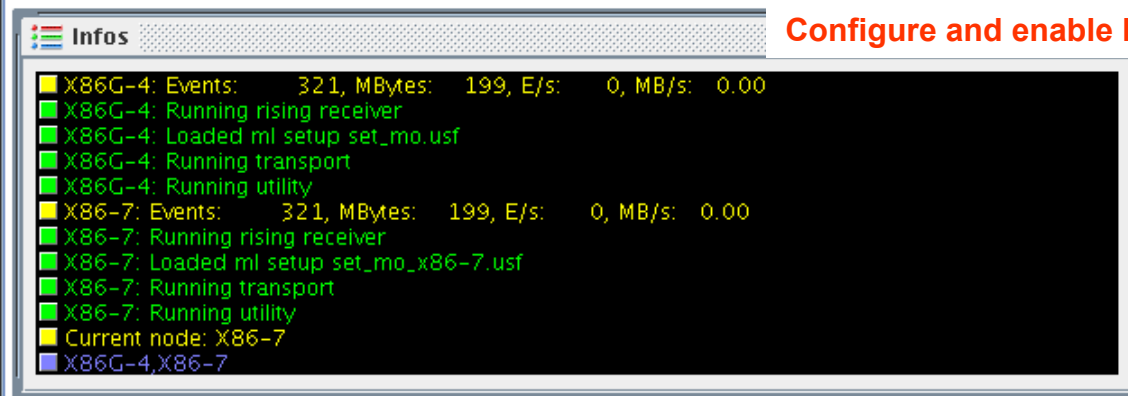
X86G-4:Acquisition
W:Running

X86G-4:RunMode
W:MBS to DABC





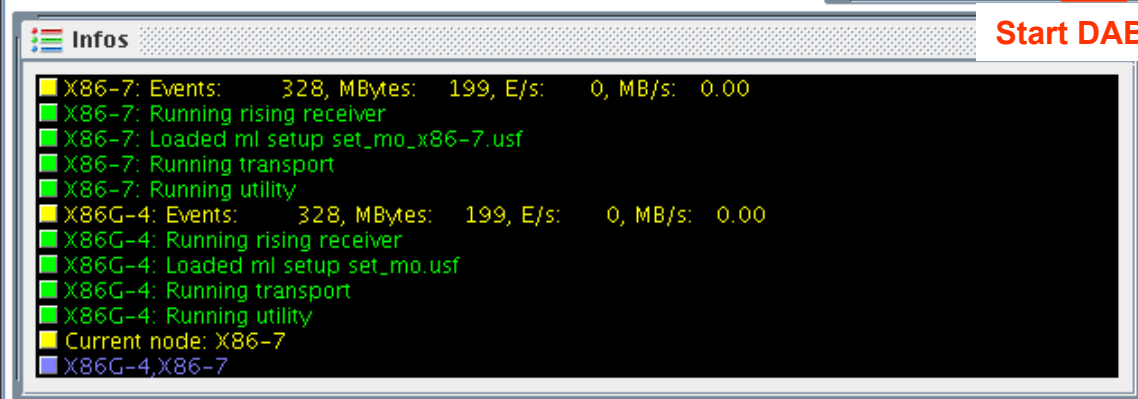
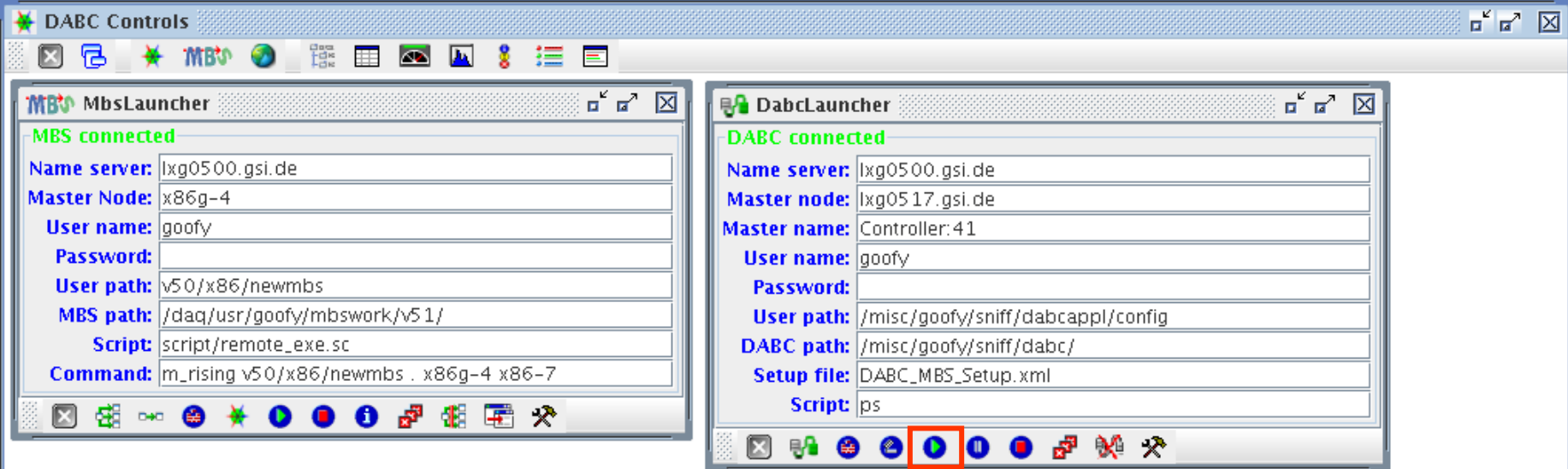
Configure and enable DABC



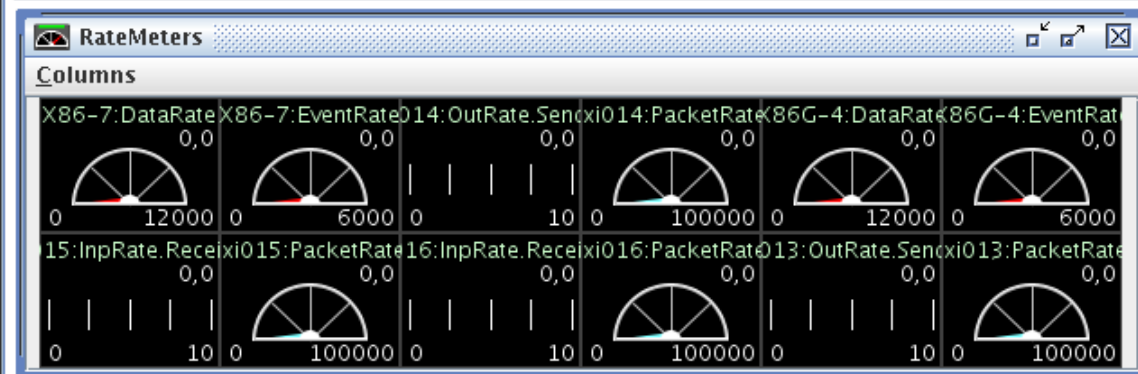
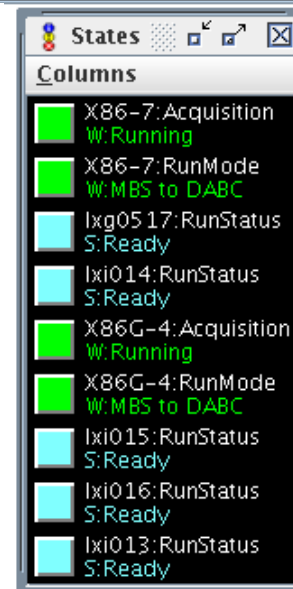
Rates of DABC

DABC DIM servers

DIM servers: DIS_DNS X86G-4.MSG X86-7.MSG X86G-4.PRM lxg0517:1968 lxi013:1972 lxi014:1972 lxi016:1972 lxi015:1972



Start DABC



More rates of DABC

MbsLauncher

MBS connected

Name server: lxx0500.gsi.de

Master Node: x86g-4

User name: goofy

Password:

User path: v50/x86/newmbs

MBS path: /daq/usr/goofy/mbswork/v51/

Script: script/remote_exe.sc

Command: m_rising v50/x86/newmbs . x86g-4 x86-7

Dabclauncher

DABC connected

Name server: lxx0500.gsi.de

Master node: lxx0517.gsi.de

Master name: Controller:41

User name: goofy

Password:

User path: /misc/goofy/sniff/dabcappl/config

DABC path: /misc/goofy/sniff/dabc/

Setup file: DABC_MBS_Setup.xml

Script: ps

Stop MBS

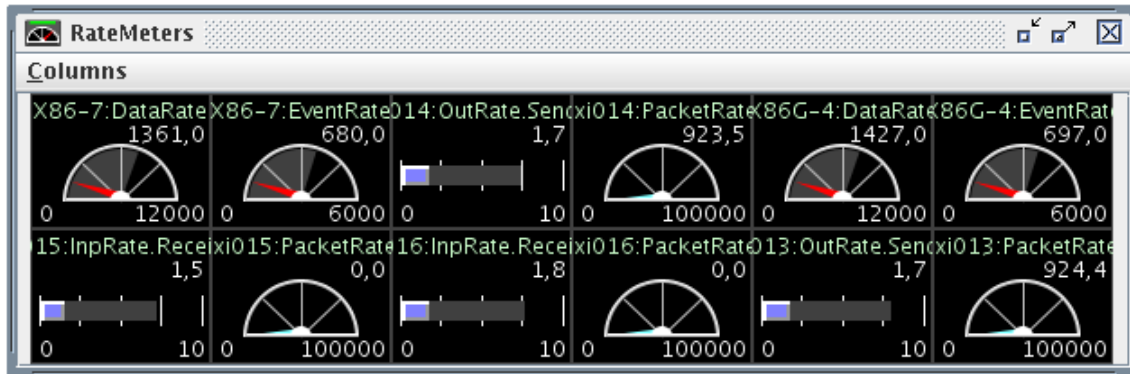
Infos

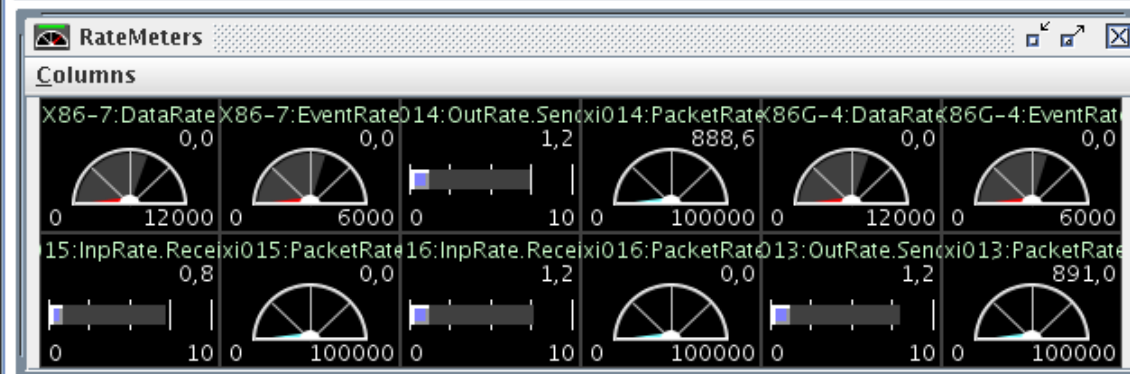
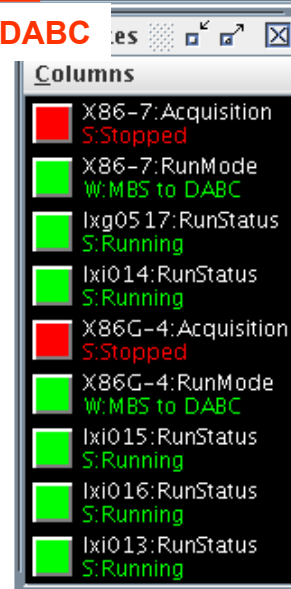
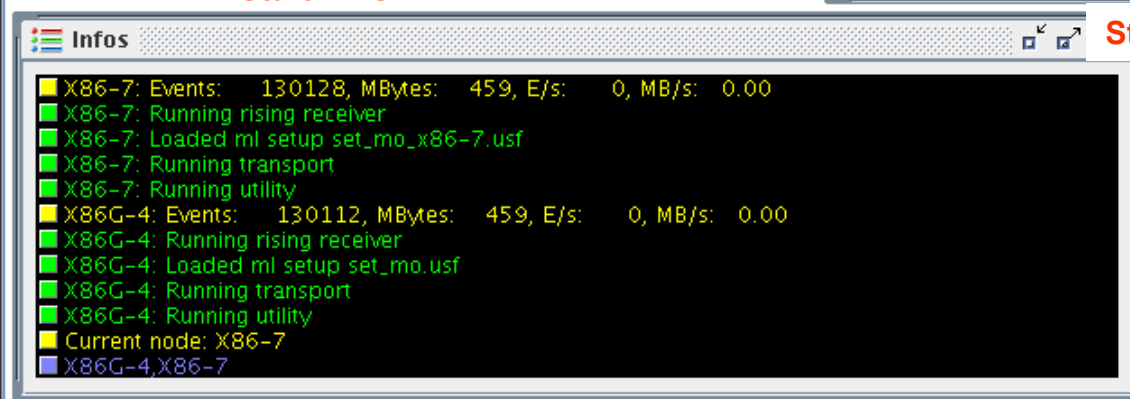
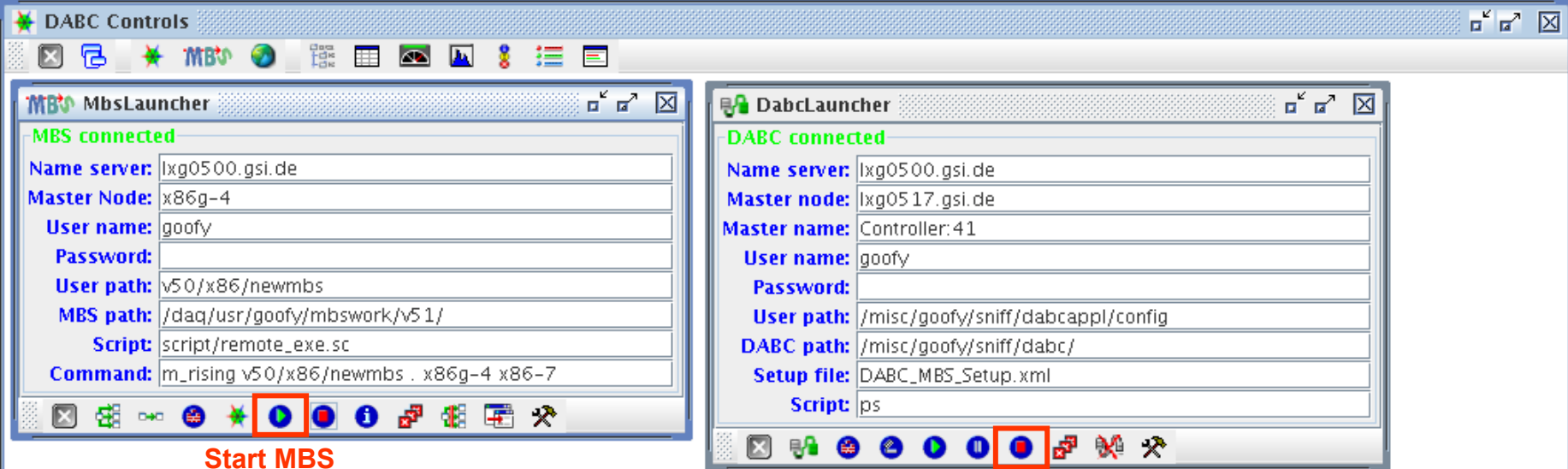
- X86-7: Events: 106448, MBytes: 411, E/s: 680, MB/s: 1.36
- X86-7: Running rising receiver
- X86-7: Loaded ml setup set_mo_x86-7.usf
- X86-7: Running transport
- X86-7: Running utility
- X86G-4: Events: 106456, MBytes: 411, E/s: 697, MB/s: 1.43
- X86G-4: Running rising receiver
- X86G-4: Loaded ml setup set_mo.usf
- X86G-4: Running transport
- X86G-4: Running utility
- Current node: X86-7
- X86G-4,X86-7

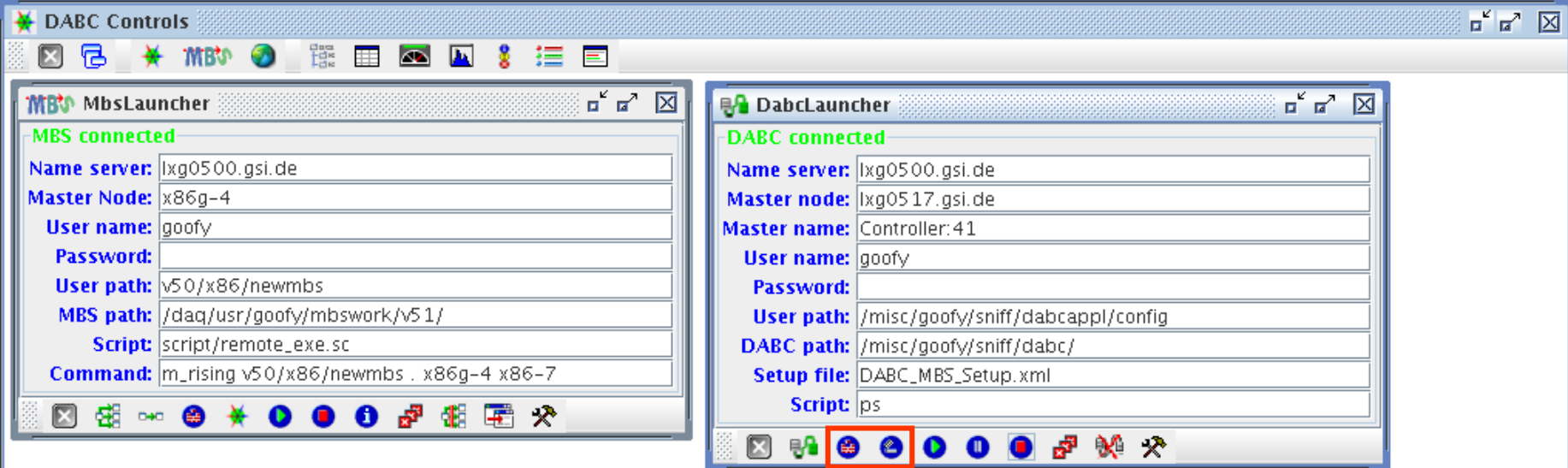
States

Columns

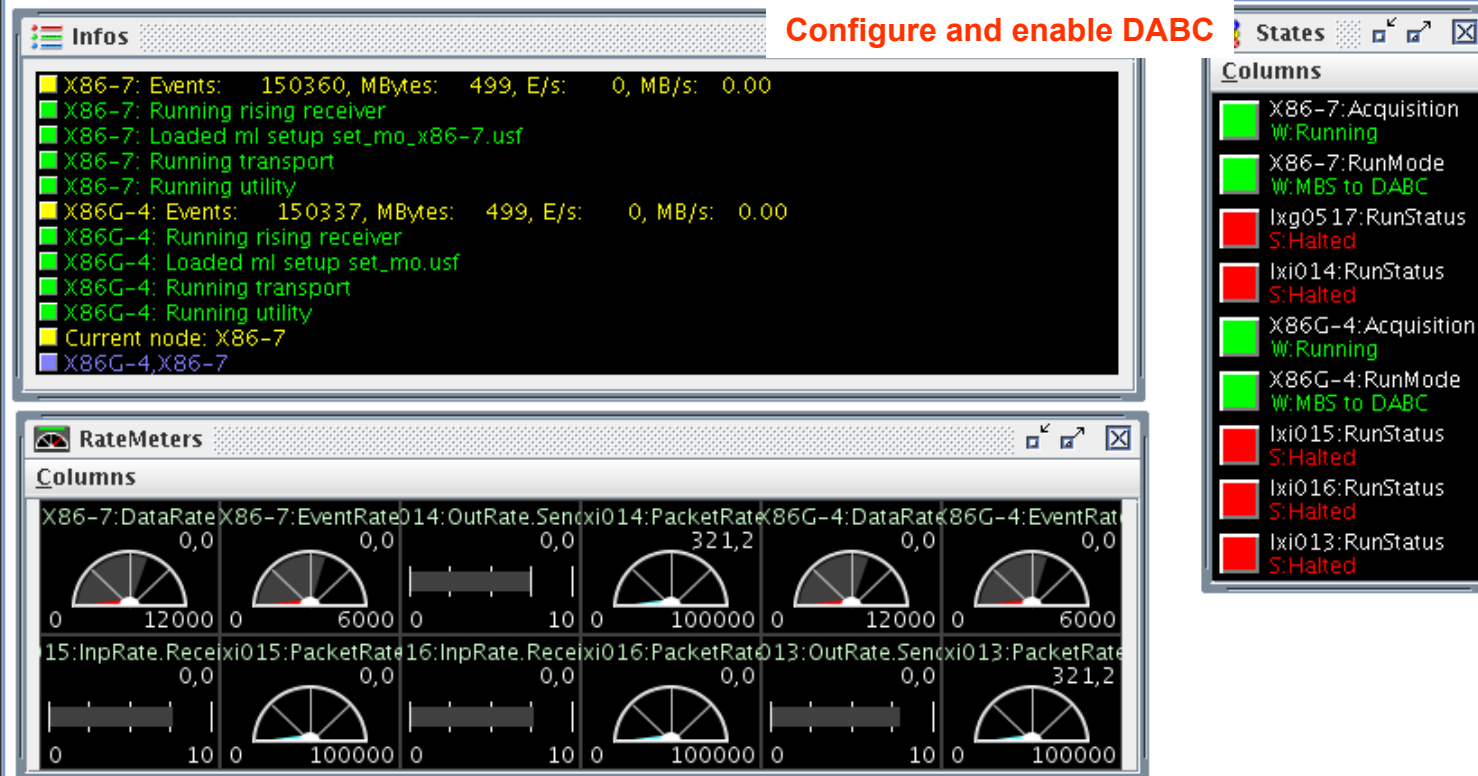
- X86-7:Acquisition W:Running
- X86-7:RunMode W:MBS to DABC
- lxx0517:RunStatus S:Running
- lxx014:RunStatus S:Running
- X86G-4:Acquisition W:Running
- X86G-4:RunMode W:MBS to DABC
- lxx015:RunStatus S:Running
- lxx016:RunStatus S:Running
- lxx013:RunStatus S:Running

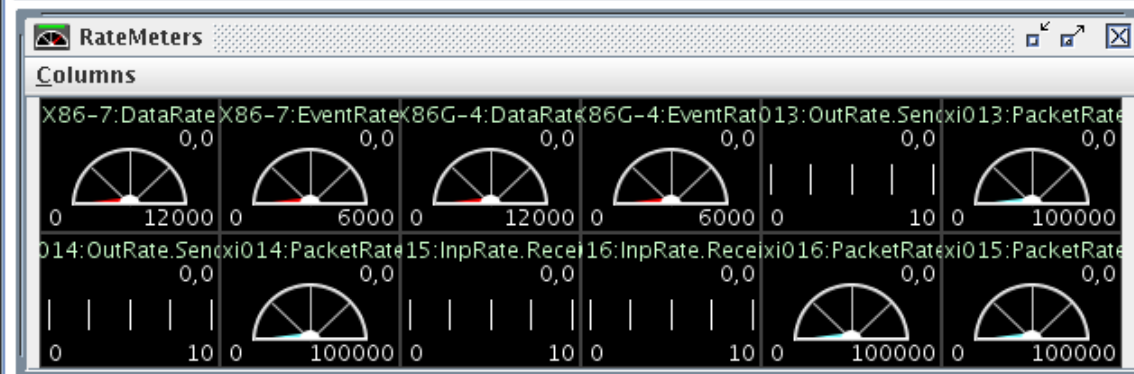
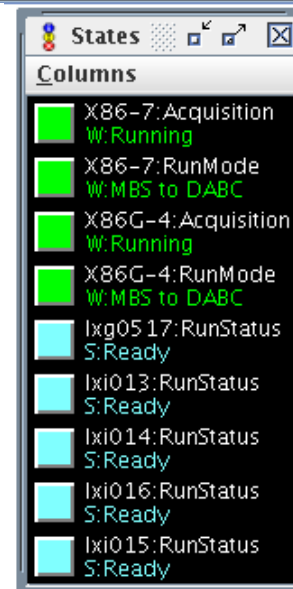
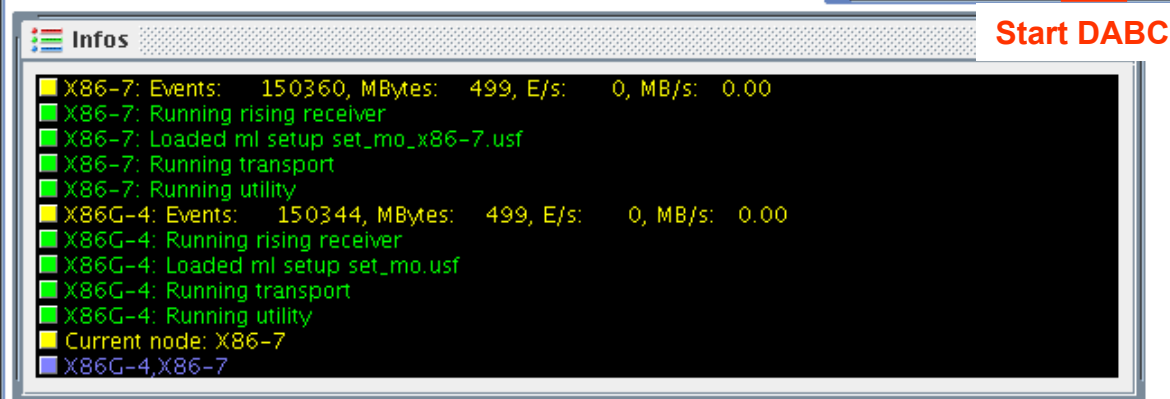
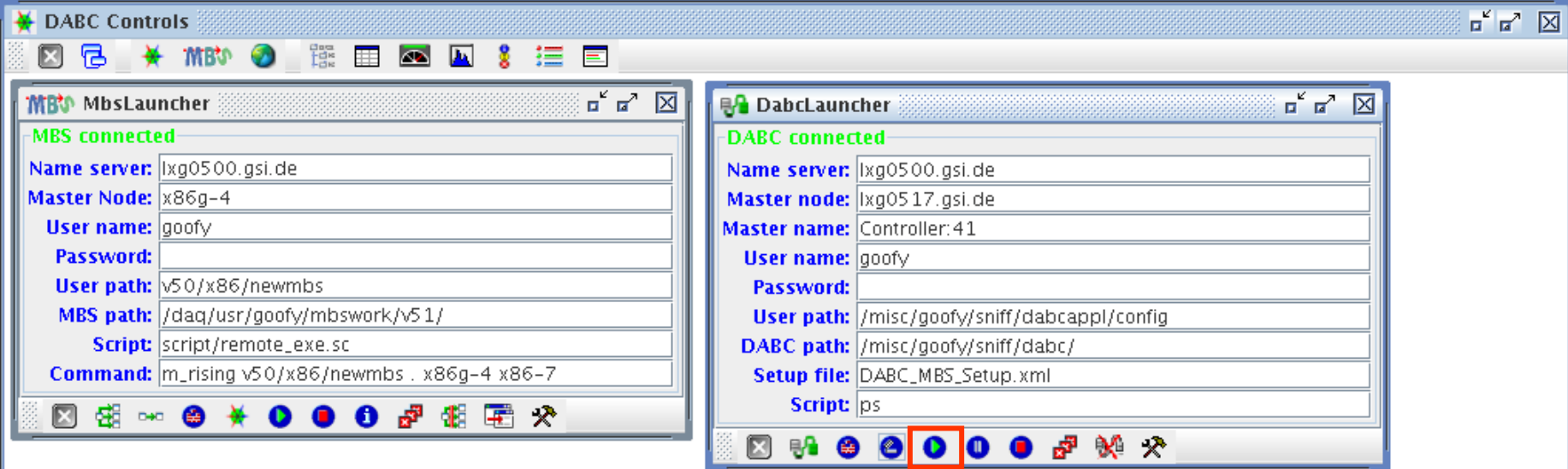






Configure and enable DABC





DABC Controls

MbsLauncher

MBS connected

Name server: lxg0500.gsi.de

Master Node: x86g-4

User name: goofy

Password:

User path: v50/x86/newmbs

MBS path: /daq/usr/goofy/mbswork/v51/

Script: script/remote_exe.sc

Command: m_rising v50/x86/newmbs . x86g-4 x86-7

DabcLauncher

DABC connected

Name server: lxg0500.gsi.de

Master node: lxg0517.gsi.de

Master name: Controller: 41

User name: goofy

Password:

User path: /misc/goofy/sniff/dabcappl/config

DABC path: /misc/goofy/sniff/dabc/

Setup file: DABC_MBS_Setup.xml

Script: ps

Infos

X86-7: Events: 181984, MBytes: 563, E/s: 19, MB/s: 0.00

X86-7: Running rising receiver

X86-7: Loaded ml setup set_mo_x86-7.usf

X86-7: Running transport

X86-7: Running utility

X86G-4: Events: 182248, MBytes: 563, E/s: 47, MB/s: 0.13

X86G-4: Running rising receiver

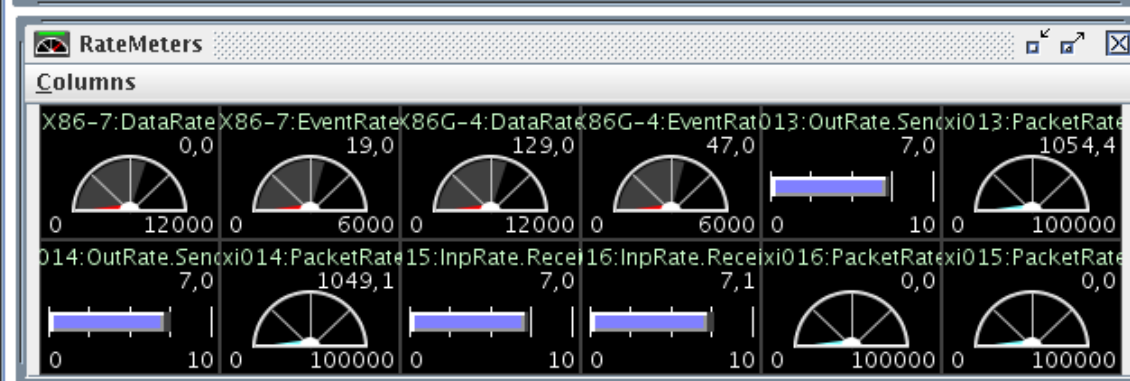
X86G-4: Loaded ml setup set_mo.usf

X86G-4: Running transport

X86G-4: Running utility

Current node: X86-7

X86G-4,X86-7



States

Columns

X86-7:Acquisition W:Running

X86-7:RunMode W:MBS to DABC

X86G-4:Acquisition W:Running

X86G-4:RunMode W:MBS to DABC

lxg0517:RunStatus S:Running

lxi013:RunStatus S:Running

lxi014:RunStatus S:Running

lxi016:RunStatus S:Running

lxi015:RunStatus S:Running

DABC Controls

MbsLauncher

MBS connected

Name server: lxg0500.g
 Master Node: x86g-4
 User name: goofy
 Password:
 User path: v50/x86/t
 MBS path: /daq/usr/
 Script: script/rem
 Command: m_rising v

Commands

- lxio15.gsi.de:1972
- lxio16.gsi.de:1972
- Readout:42
- DoEnable
- DoError
- DoHalt
- DoStart
- DoStop
- EXIT
- ManagerCommand
- MbsCommand
- MbsShell

Command MbsCommand, scope Common

Argument (C):

Commands of DABC and MBS

Infos

Columns

Logger

Logging

```

25.02.2008 17:37:51 |U| XDAQ/X86G-4/MSG/M: -X86-7 :rirc :-----
25.02.2008 17:37:51 |U| XDAQ/X86G-4/MSG/M: -X86-7 :rirc :buffer size: 0x10000, 1 buffer per stream, 10 streams
25.02.2008 17:37:51 |U| XDAQ/X86G-4/MSG/M: -X86-7 :rirc :stream segment base: 0x0, outmode: 1
25.02.2008 17:37:51 |U| XDAQ/X86G-4/MSG/M: -X86-7 :rirc :-----
25.02.2008 17:37:51 |U| XDAQ/X86G-4/MSG/M: -X86-7 :rirc :task m_rirc started
25.02.2008 17:37:51 |U| XDAQ/X86G-4/MSG/M: -X86-7 :transport :task m_transport started
25.02.2008 17:37:54 |S| MBS: *:enable dabc
25.02.2008 17:37:54 |U| XDAQ/X86G-4/MSG/M: -X86G-4 :transport :starting server in exclusive mode
25.02.2008 17:37:54 |U| XDAQ/X86G-4/MSG/M: -X86G-4 :transport :Set DABC mode, buffer format variable, type 100
25.02.2008 17:37:54 |U| XDAQ/X86G :for client (port 6000)
25.02.2008 17:37:54 |U| XDAQ/X86G :server in exclusive mode
25.02.2008 17:37:54 |U| XDAQ/X86G-4/MSG/M: -X86-7 :transport :Set DABC mode, buffer format variable, type 100
25.02.2008 17:37:54 |U| XDAQ/X86G-4/MSG/M: -X86-7 :transport :waiting for client (port 6000)
25.02.2008 17:38:04 |U| rsh x86g-4 -l goofy /daq/usr/goofy/mbswork/v51/script/remote_exe.sc /daq/usr/goofy/mbswork/v51/v50/x86/newn
25.02.2008 17:38:04 |U| [1] 5
25.02.2008 17:38:04 |U| XDAQ/X86G-4/MSG/M: -X86G-4 :rirc :tcp socket connection to RISING data sender node established
25.02.2008 17:38:04 |U| XDAQ/X86G-4/MSG/M: -X86-7 :rirc :tcp socket connection to RISING data sender node established
25.02.2008 17:38:05 |U| XDAQ/X86G-4/MSG/M: -X86G-4 :rirc :tcp thread: acquisition running
25.02.2008 17:38:05 |U| XDAQ/X86G-4/MSG/M: -X86-7 :rirc :tcp thread: acquisition running
25.02.2008 17:38:06 |U| XDAQ/X86G-4/MSG/M: -X86G-4 :rirc :main thread: acquisition running
25.02.2008 17:38:06 |U| XDAQ/X86G-4/MSG/M: -X86-7 :rirc :main thread: acquisition running
25.02.2008 17:38:37 |S| /misc/goofy/sniff/dabc/script/dabcstartup.sh /misc/goofy/sniff/dabc/ /misc/goofy/sniff/dabcappl/config DABC_MBS_Setu
25.02.2008 17:38:37 |U| ssh lxg0517.gsi.de -l goofy /misc/goofy/sniff/dabc/script/dabcstartup.sh /misc/goofy/sniff/dabc/ /misc/goofy/sniff/dab
  
```

Output of DABC and MBS

DIM servers: DIS_DNS X86G-4/MSG X86-7/MSG X86G-4/PRM lxg0517:1968 lxio13:1972 lxio14:1972 lxio16:1972 lxio15:1972

MBS connected

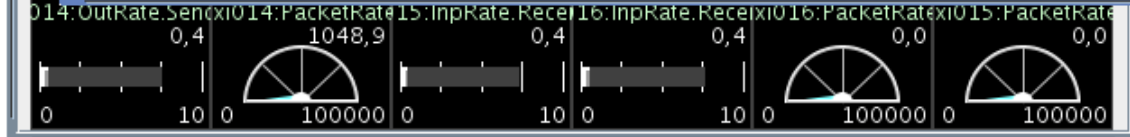
Name server: lxx0500.gsi.de

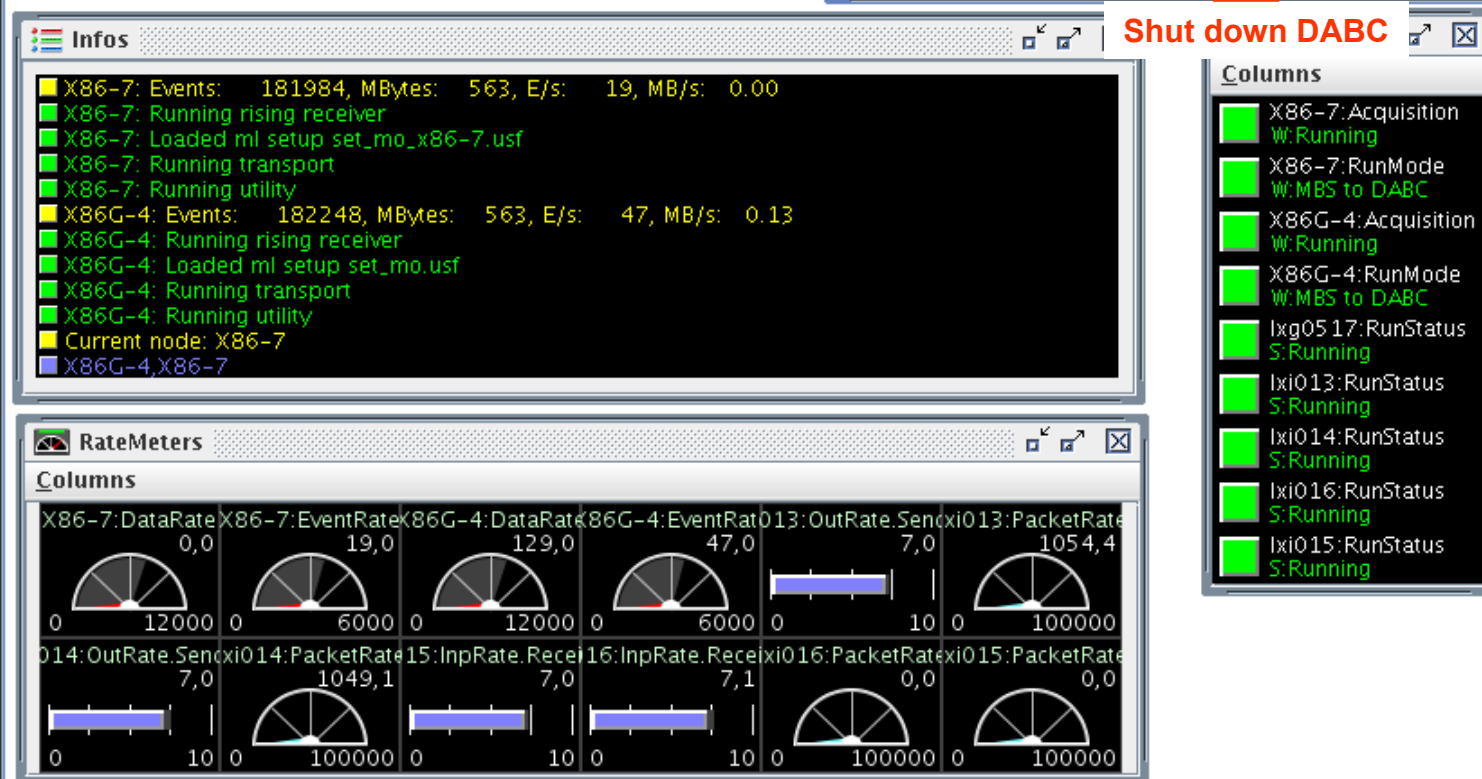
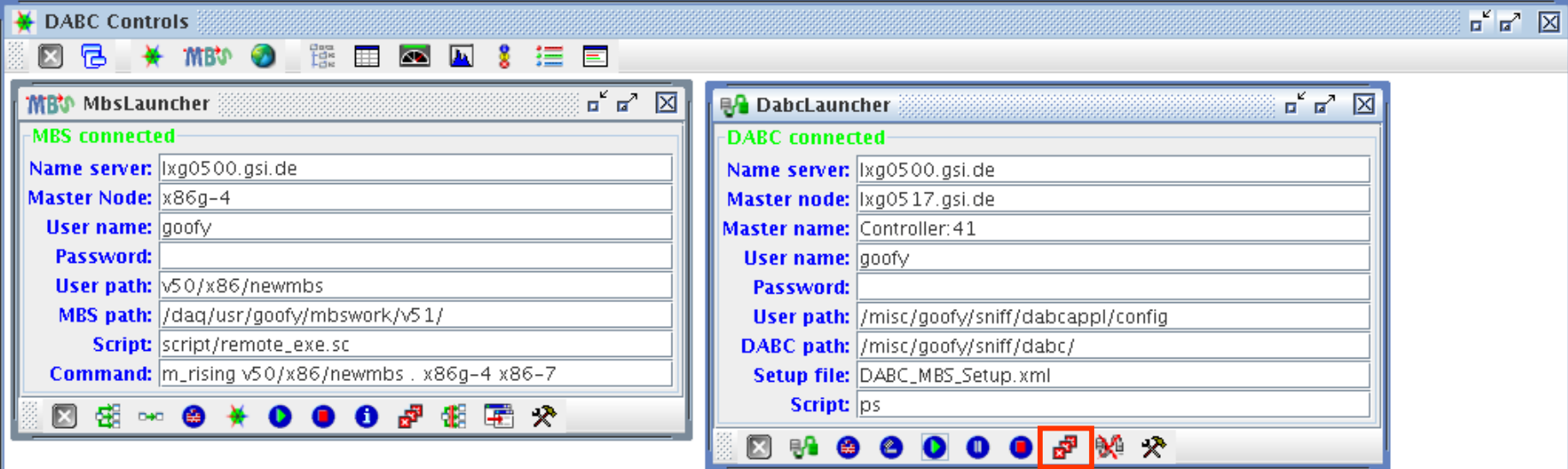
DABC connected

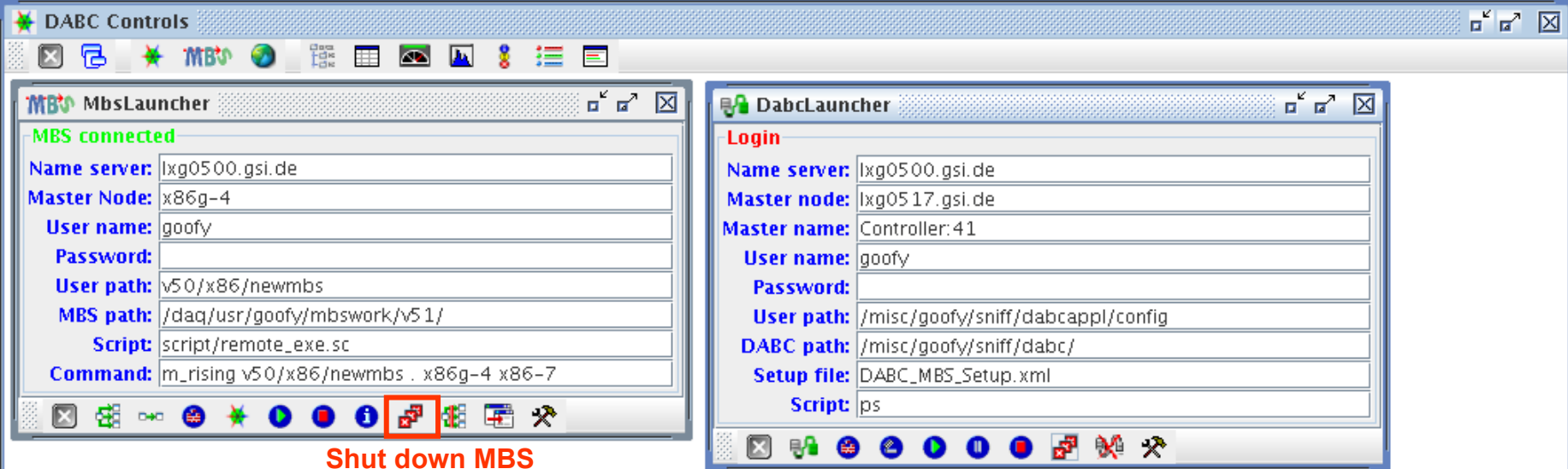
Name server: lxx0500.gsi.de

ID	Node	Application	Parameter	Current	Set value	Show
00030	X86G-4	MSG	RunMode	MBS to DABC	-	☒
00031	X86G-4	MSG	User	goofy	-	☐
00032	X86G-4	MSG	sPerform	Events: 208441, MBytes: 6...	-	☒
00033	X86G-4	MSG	sRising	Running rising receiver	-	☒
00034	X86G-4	MSG	sSetup	Loaded ml setup set_mo.usf	-	☒
00035	X86G-4	MSG	sTransport	Running transport	-	☒
00036	X86G-4	MSG	sUtility	Running utility	-	☒
00037	X86G-4	PRM	Current	Current node: X86-7	-	☒
00038	X86G-4				-	☒
00039	lxx0517.gsi.de			.06(Feb 22 ...	-	☐
00040	lxx0517.gsi.de				-	☐
00041	lxx0517.gsi.de:...	Controller:41	netDevice.Cust...	DOCKET	-	☐
00042	lxx0517.gsi.de:...	Controller:41	Nodelist	lxi013.gsi.de:1972,lxi014.gsi.de:...	-	☐
00043	lxx0517.gsi.de:...	Controller:41	RunStatus	Ready	-	☒
00044	lxx0517.gsi.de:...	Controller:41	State	Ready	-	☐
00045	lxx0517.gsi.de:...	Controller:41	controllerTid	41	-	☐
00046	lxx0517.gsi.de:...	Controller:41	debugLevel	1	-	☐
00047	lxx0517.gsi.de:...	Controller:41	heartbeatPeriod	5	-	☐
00048	lxx0517.gsi.de:...	Controller:41	nodeDNS	lxx0500.gsi.de	-	☐
00049	lxx0517.gsi.de:...	Controller:41	nodeId	0	-	☐
00050	lxx0517.gsi.de:...	Controller:41	portDNS	2505	-	☐
00051	lxx0517.gsi.de:...	Controller:41	runningTime	390	-	☐
00052	lxx0517.gsi.de:...	Controller:41	startTime	1203957518	-	☐
00053	lxx0517.gsi.de:...	Controller:41	statusMessage	State machine reached current st...	-	☐
00054	lxx0517.gsi.de:...	Controller:41	workerTid	42	-	☐
00055	lxi013.gsi.de:1...	Readout:42	CfgClusterMgr.B...	XDAQ/lxx0517.gsi.de:1968	-	☐
00056	lxi013.gsi.de:1...	Readout:42	CfgConnected.B...	1	-	☐
00057	lxi013.gsi.de:1...	Readout:42	CfgController.B...	0	-	☐
00058	lxi013.gsi.de:1...	Readout:42	CfgNodeId.Bnet...	1	-	☐
00059	lxi013.gsi.de:1...	Readout:42	CfgNumNodes...	5	-	☐
00060	lxi013.gsi.de:1...	Readout:42	CfgRecvMask.B...	000xx	-	☐

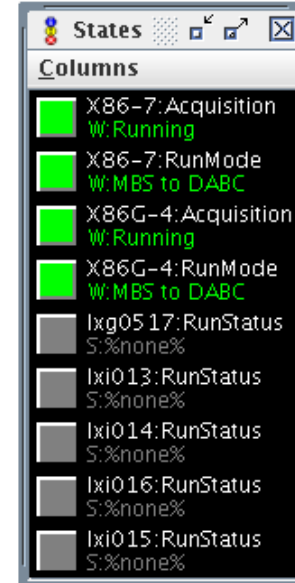
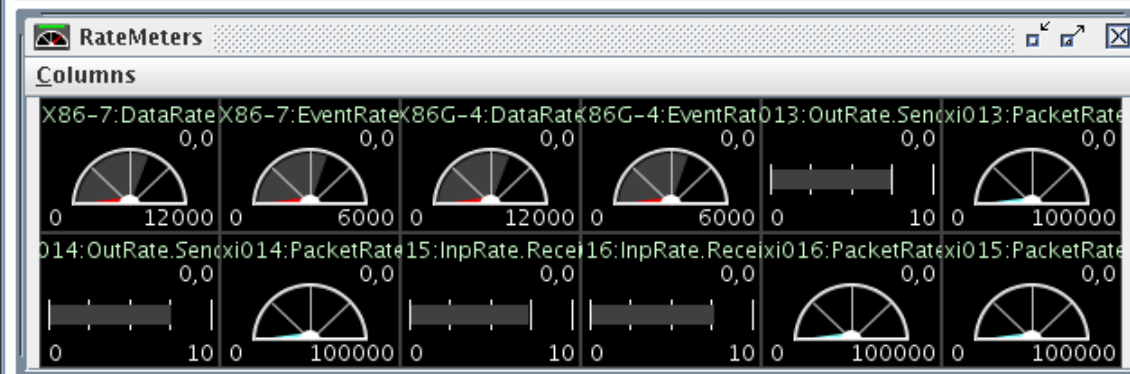
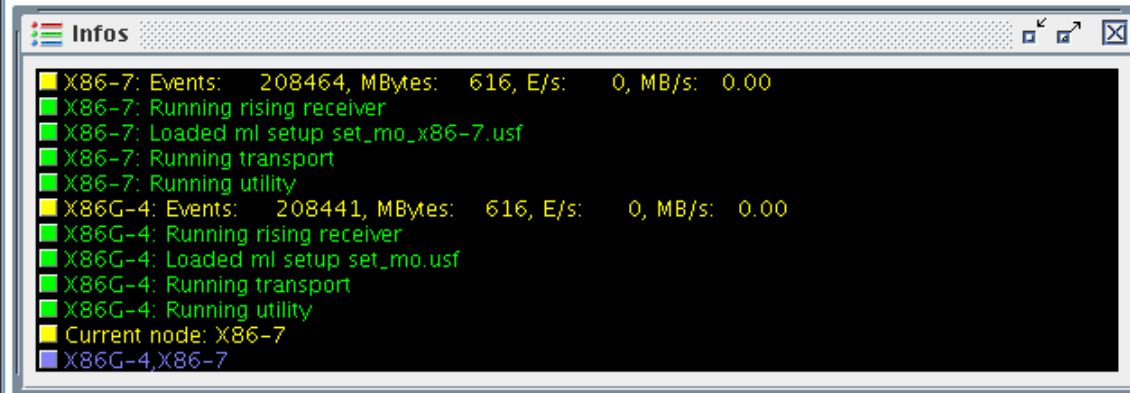
Full parameter table of DABC and MBS
Parameters can be set here, if not locked

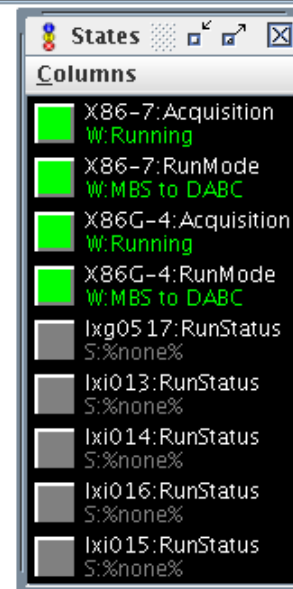
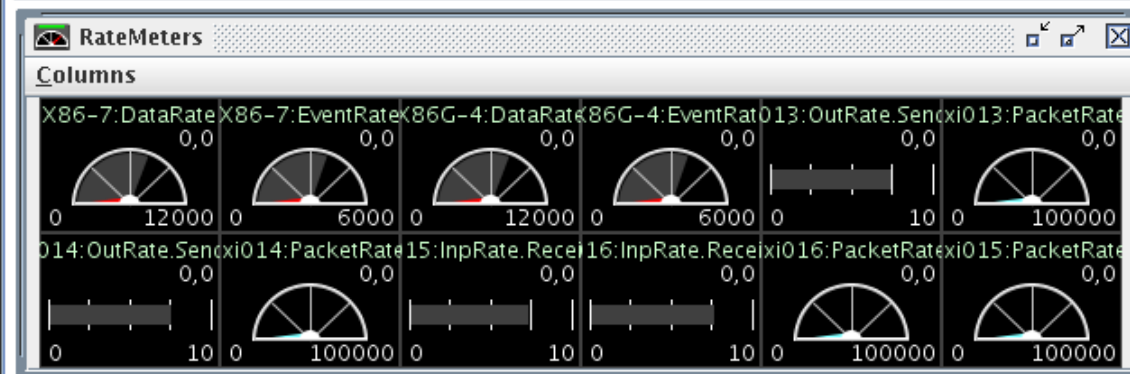
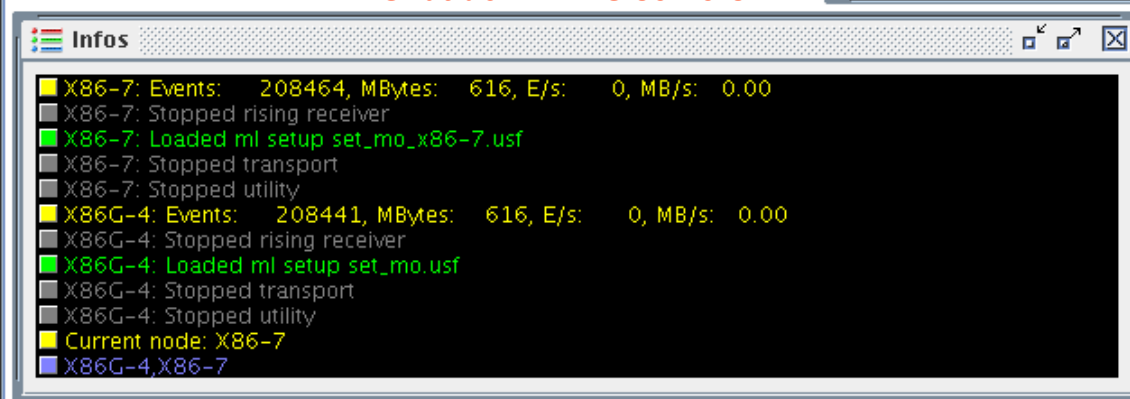
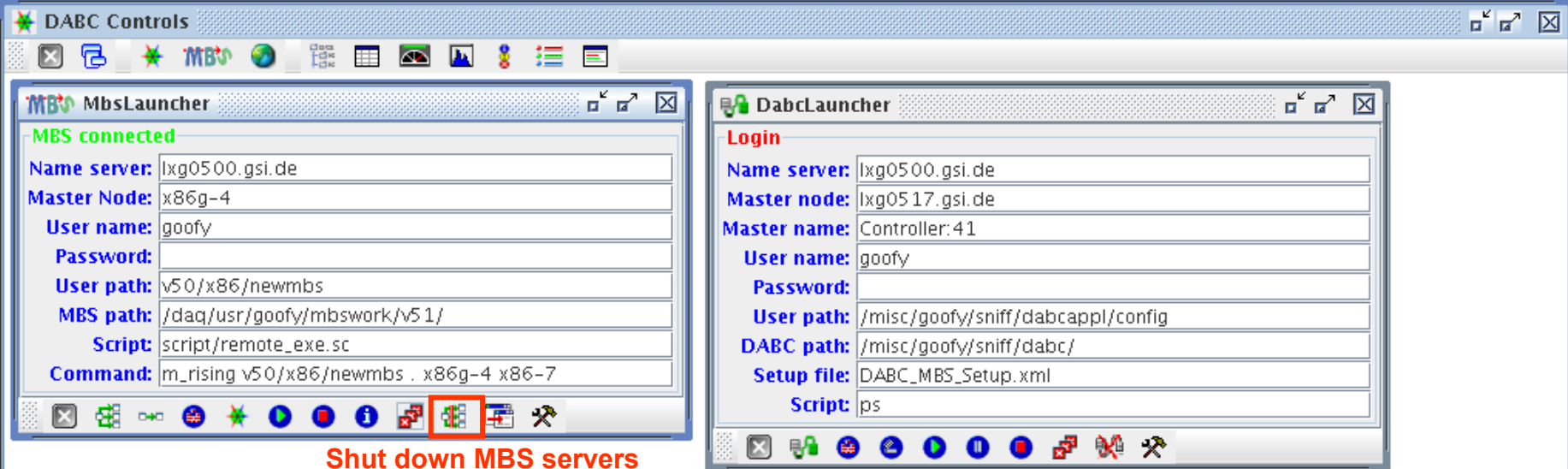






Shut down MBS





MbsLauncher

Login

Name server: lxg0500.gsi.de

Master Node: x86g-4

User name: goofy

Password:

User path: v50/x86/newmbs

MBS path: /daq/usr/goofy/mbswork/v51/

Script: script/remote_exe.sc

Command: m_rising v50/x86/newmbs . x86g-4 x86-7

DabcLauncher

Login

Name server: lxg0500.gsi.de

Master node: lxg0517.gsi.de

Master name: Controller: 41

User name: goofy

Password:

User path: /misc/goofy/sniff/dabcappl/config

DABC path: /misc/goofy/sniff/dabc/

Setup file: DABC_MBS_Setup.xml

Script: ps

Infos

All down!

%none%

%none%

%none%

%none%

%none%

%none%

%none%

%none%

%none%

%none%

%none%

States

Columns

X86-7:Acquisition
S:%none%

X86-7:RunMode
S:%none%

X86G-4:Acquisition
S:%none%

X86G-4:RunMode
S:%none%

lxg0517:RunStatus
S:%none%

lxi013:RunStatus
S:%none%

lxi014:RunStatus
S:%none%

lxi016:RunStatus
S:%none%

lxi015:RunStatus
S:%none%

