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Editorial Review:	EPFL: Guy Willis, Lauren Orwin		
Abstract:	This document describes the initial HBP internal accessible release of the Neuromorphic Computing Platform (v1 - as of 31 July 2015) and the remote accessibility of the platform.		
Keywords:	neuromorphic compute platform, brain-inspired computing, Collaboratory		

DISCLAIMER: More detailed information on the results and/or performance obtained and their use is available in the Subproject's subsequent Deliverable (D9.7.4) and/or Periodic Report.



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1. The aim of this document

Deliverable D9.7.3 is the HBP internal release of the Neuromorphic Computing Platform (version 1) and the access to the Platform via the HBP Collaboratory.

This document is mostly a reference to the extensive documentation, that has been produced during the construction of the Platform hardware and software. The content of these documents is not repeated here.

The key references for this deliverable are these continuously updated documents:

- The Neuromorphic Computing Platform specification document (HBP Deliverable D9.7.1). A publicly accessible version of the [document is available here](#).
- The [HBP Neuromorphic Computing Platform Guidebook](#) (also available as a [downloadable .pdf version](#))

1.1 The Neuromorphic Computing Platform

The HBP Neuromorphic Computing Platform offers a unique infrastructure of two complementary neuromorphic computing hardware architectures accessed through a single user-friendly software portal. No detailed knowledge of the hardware architectures is required for use, which is an important step in developing neuromorphic computing into a research and development instrument similar to traditional computers.

The platform offers two ways to use neuromorphic systems: Remote access to large scale facilities located in Manchester and Heidelberg and the acquisition of smaller portable evaluation systems that can be handed out to interested users for local experiments in their own labs.

Documentation of the systems including hardware description, software tools and tutorials can be found in the publicly accessible [HBP Neuromorphic Computing Platform Guidebook](#), which is an important part of this deliverable. The Guidebook is also available [within the Collaboratory](#).

This document describes the status of the platform on 31st July 2015. Remote access to both systems is routinely possible and portable evaluation systems are in the hands of users. The actual construction of the two large-scale systems has not been fully completed due to delays in the manufacturing of components and delayed availability of installation space. Subsets corresponding to 20% of the complete systems are fully installed and available for use today.

2. How to access the HBP Neuromorphic Computing Platform

2.1 Direct access

The HBP Neuromorphic Computing Platform contains two very different neuromorphic hardware systems - NM-PM-1 (“physical model”) and NM-MC-1 (“many core”) - but has a single interface.

Jobs are written as Python scripts using the PyNN API, submitted to a queue server, then executed on one of the neuromorphic systems. On job completion, the user may retrieve the results of the simulation/emulation.

There are several ways of interacting with the queue server. The neuromorphic computing platform can be accessed at <https://www.hbpneuromorphic.eu/>.

2.2 Access via the HBP Collaboratory

The Neuromorphic Computing Platform can be accessed via the HBP Collaboratory at <https://collab.humanbrainproject.eu/#/collab/51/nav/1073>. Figures 1 and 2 illustrate the usage of the web interface.

3. Platform user instructions

After logging in with your HBP credentials (cf. Sections 2.1 and 2.2), the user will see a list of simulation jobs they have submitted to the platform. The first time a user connects, this list will be empty. Experiments, or “jobs”, are assigned to a “project” and “platform”. Projects can be shared between multiple users. After creating a job, it will be submitted to the queue, and will appear in the list of jobs with a “submitted” label. The user will receive e-mail notifications when the job starts running and when it completes. Once the job is completed, the user can click on the magnifying glass icon to see the job results and download the output data files.

The Python client allows scripted access to the Platform. The same client software is used both by end users for submitting jobs to the queue, and by the hardware systems to take jobs off the queue and to post the results.

For user instructions, the Neuromorphic Computing Platform user guidebook is publicly available:

- As an online (html) documentation at <http://electronicvisions.github.io/hbp-sp9-guidebook/>
- As a [single downloadable .pdf file](#)
- [Within the HBP Collaboratory](#)

For in-depth information about the platform technology and software, the public version of the Neuromorphic Computing Platform specification deliverable document [D9.7.1](#) is available [in this directory](#) for download.

4. Help and user feedback

The [user guidebook](#) lists methods to get help and to provide feedback on the [Getting Help page](#).

A. Annexes

A.1 Tools & Features Available in this Platform Release

For the feature description of the platforms please see the [HBP Neuromorphic Computing Platform Guidebook](#). A 'snapshot' of that document is attached to this deliverable.

A.1 Milestones

With this release, SP9 reached the following milestones

- Initially due in M18, moved to M22 (July 2015):
 - M174: NM-PM-1 construction completed. 6 of 20 systems are operational, see details in Appendix A.3 (page 8).
 - M178: NM-MC1 construction completed (details in Appendix A.4 (page 14)).
 - M186: Platform ready for internal release.
- Due in M24 - reached ahead of schedule. Documented in section 2.1 and 2.2
 - M175: NM-PM-1 remotely accessible.
 - M179: NM-MC-1 remotely accessible.

A.2 Details: Interface to the Collaboratory

The [user guidebook](#) contains the description of the user-facing part of the Platform (with how-to descriptions). It is a 'living' document, maintained in a Git repository, so the contents are evolving.

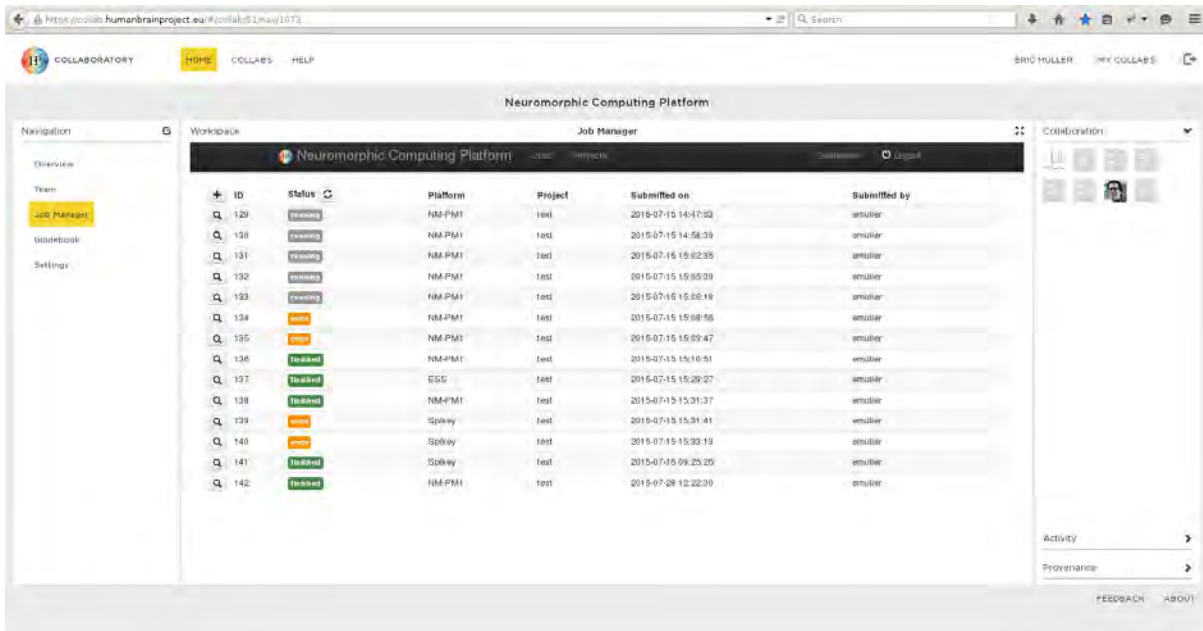


Figure 1: The Collaboratory SP9 Platform Interface: <https://collab.humanbrainproject.eu/#/collab/51/nav/1073>

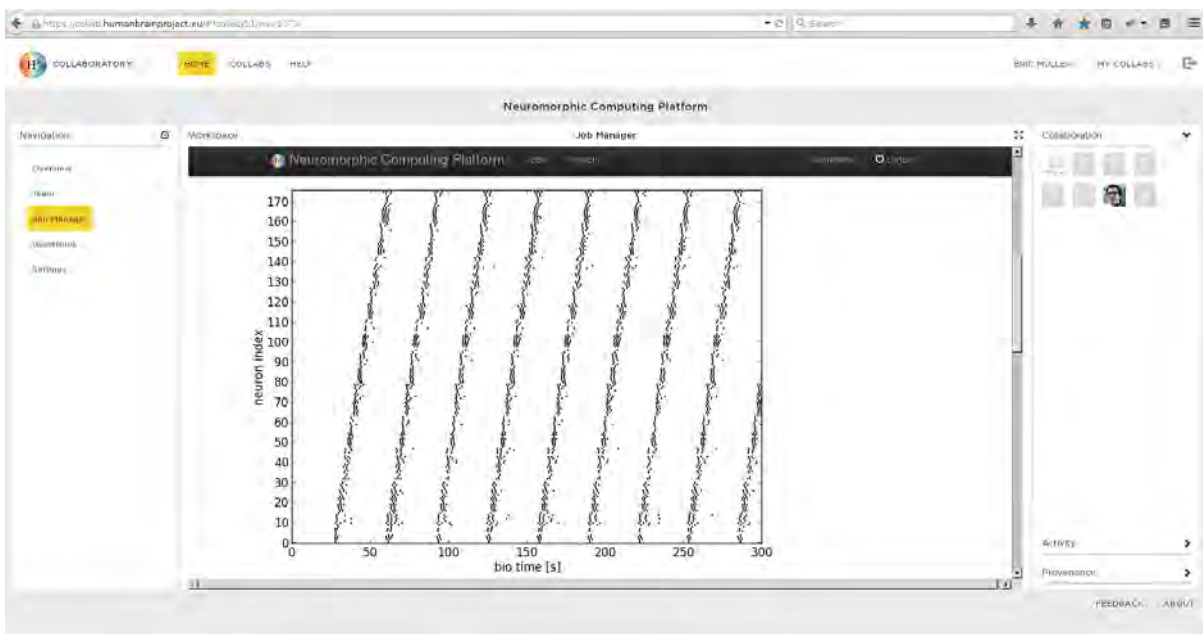
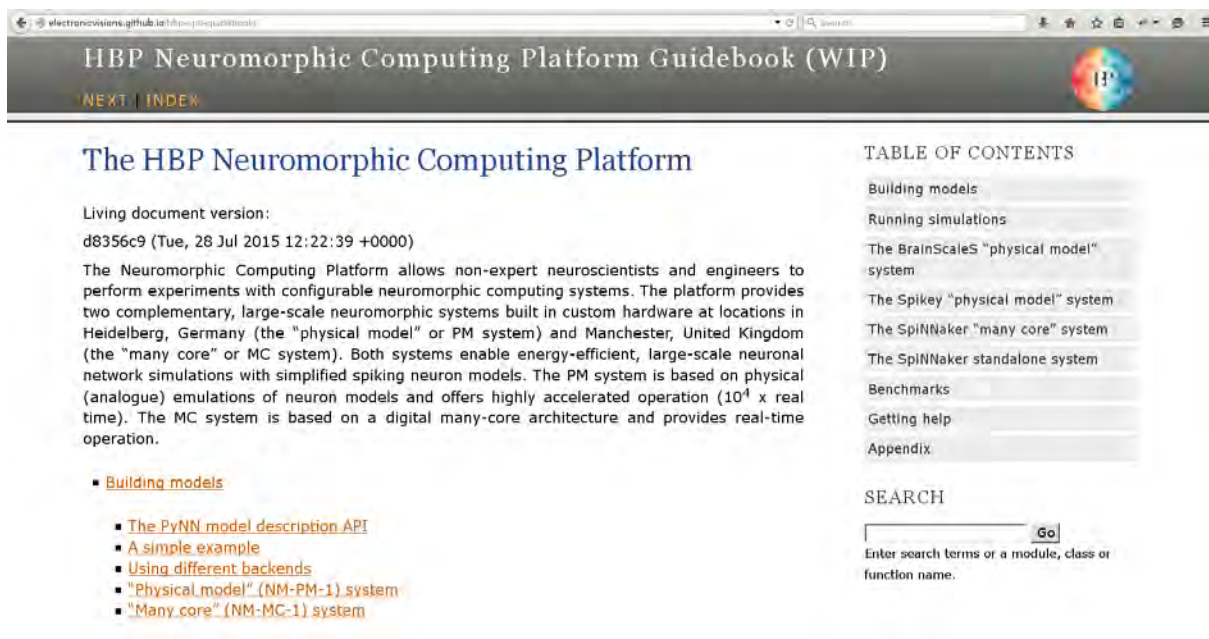


Figure 2: Neuromorphic Platform web interface showing the experiment job result view. In this example, a rasterplot illustrates synfire-chain-like activity.



electronvisions.github.io/hbp-sp9-guidebook/

HBP Neuromorphic Computing Platform Guidebook (WIP)

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The HBP Neuromorphic Computing Platform

Living document version:
d8356c9 (Tue, 28 Jul 2015 12:22:39 +0000)

The Neuromorphic Computing Platform allows non-expert neuroscientists and engineers to perform experiments with configurable neuromorphic computing systems. The platform provides two complementary, large-scale neuromorphic systems built in custom hardware at locations in Heidelberg, Germany (the "physical model" or PM system) and Manchester, United Kingdom (the "many core" or MC system). Both systems enable energy-efficient, large-scale neuronal network simulations with simplified spiking neuron models. The PM system is based on physical (analogue) emulations of neuron models and offers highly accelerated operation (10^4 x real time). The MC system is based on a digital many-core architecture and provides real-time operation.

- [Building models](#)
 - [The PyNN model description API](#)
 - [A simple example](#)
 - [Using different backends](#)
 - ["Physical model" \(NM-PM-1\) system](#)
 - ["Many core" \(NM-MC-1\) system](#)

TABLE OF CONTENTS

- Building models
- Running simulations
- The BrainScaleS "physical model" system
- The Spikey "physical model" system
- The SpiNNaker "many core" system
- The SpiNNaker standalone system
- Benchmarks
- Getting help
- Appendix

SEARCH

Enter search terms or a module, class or function name.

Figure 3: The SP9 Neuromorphic Platform Guidebook: <http://electronvisions.github.io/hbp-sp9-guidebook/>. Updates to the guidebook are continuously integrated and uploaded to the web page.



A.3 Details: The NM-PM machine Platform components

The technical setup of the NM-PM1 system is described in the Deliverable D9.7.2 (internal living document). A shortened publicly accessible version of that document is [available here](#).

Six of the total planned 20 wafer modules are currently assembled, four of them are in their final location (figure 5).

The following table shows the number of the components needed for the full 20 wafer system NM-PM1 Platform and the number available as of 31 July 2015. The number of additionally parts produced for contingency is not reported in this table.

Description	amount needed	amount produced	comment number	figure
Server rack with 42 U height installed	7	7		
Air conditioning system with 20 kW	2	2		
Cooling drawer for the WMOD rack	20	20		
Elastomeric Connector	16000	16000		11
Spartan6 Flyspi Board	60	60		13b
Post-processed HICANN wafer	20	20		12
Assembled Main-PCBs	20	20		6
Aluminium Top Cover electrosilvered and coated	20	20		9a
Aluminium Bracket	20	20		9b
Control Units for Reticles (Cure)	160	160		7b
Positioning Mask for Elastomeric Connectors	20	20		11
Main Power Supplies (PowerIt)	20	6	1	10b
Additional Power Supply PCBs (AuxPwr)	40	12	2	10a
Wafer-IO-Board (horizontal and vertical orientation)	20+20	20+20		8
FPGA Communication PCB (FCP)	960	960		7a
Analog Breakout Boards (AnaB)	40	12	3	13a
Rack power supply 220V to 48V	5	5		
Raspberry Pi for system control	20	20		
Wafer Modules installed into racks	20	4	4	5

Comments:

1: An update of the PowerIt board has been designed. The PCB has been produced and prototypes are in the assembly process at UHEI. After the testing of the prototypes an order over the complete amount will be placed at an external producer.

- 2: The missing AuxPwr boards have been ordered and will arrive in the beginning of September
- 3: The missing Analog Breakout Boards are currently in the assembly process and will arrive approximately at the middle of August.
- 4: The assembled and installed Wafer Modules are currently under test. The missing Wafer Modules are in the assembly and testing process at UHEI. When all missing components arrive at UHEI they will be installed into the already prepared racks.

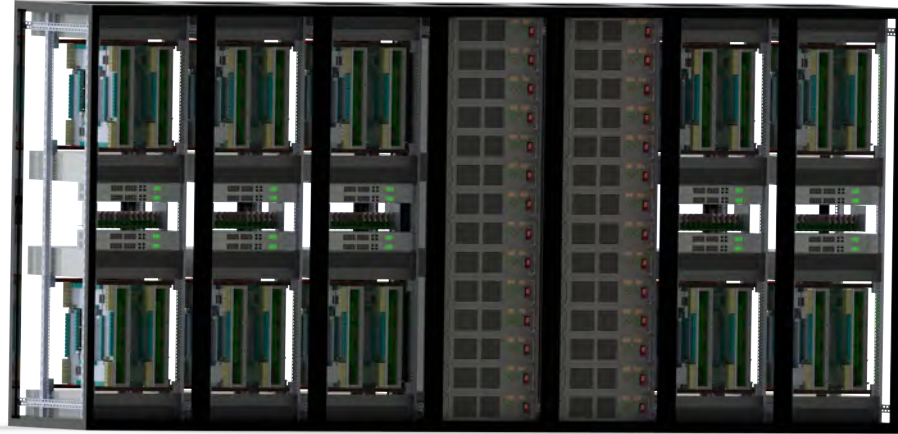


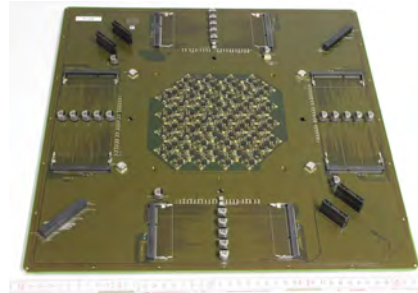
Figure 4: A computer generated picture of the fully equipped NMPM1 installation racks



Figure 5: The Wafer Modules that are currently installed into the NM-PM1 installation racks

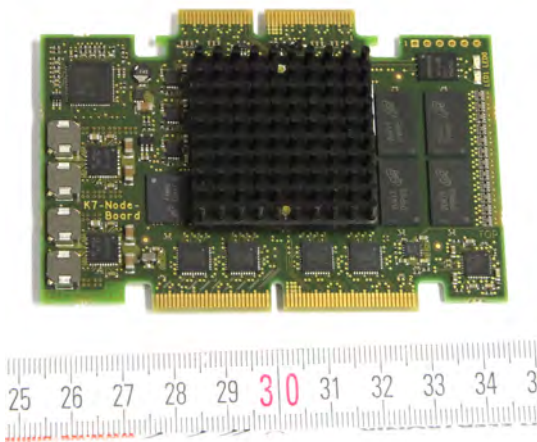


(a) Wafer side with covered pad area and slots for 48 FPGA boards.

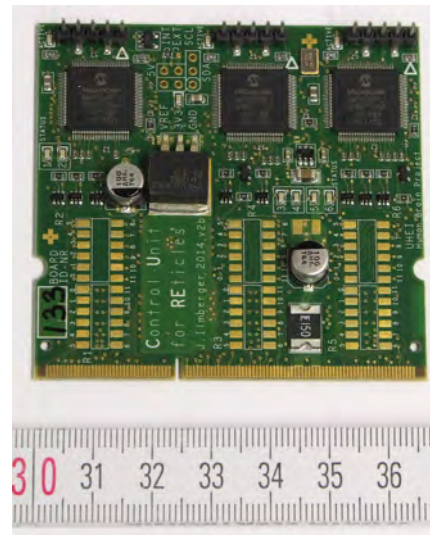


(b) Top side with power control circuitry and slots for power supply and monitoring boards

Figure 6: The Main Printed Circuit Board (Main-PCB).



(a) An FPGA board



(b) A 'CURE' board

Figure 7: FPGA board and Cure boards



(a) 'vertical'

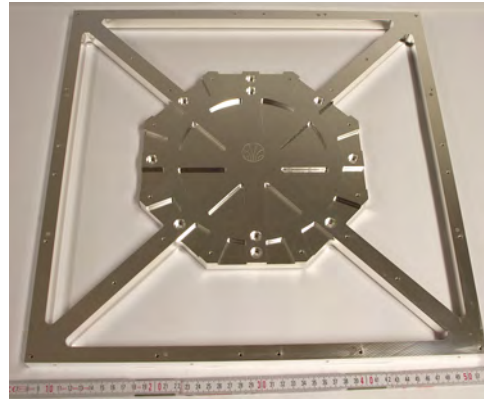


(b) 'horizontal'

Figure 8: Wafer-IO boards for 'horizontal' and 'vertical' orientation of the FPGA boards. Each holds 12 FPGA boards that are connected to the MainPCB with their opposite edge.

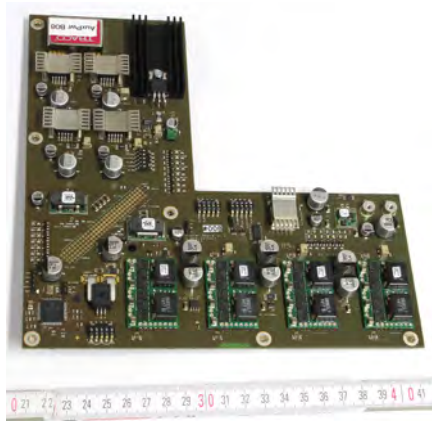


(a) Wafer top cover

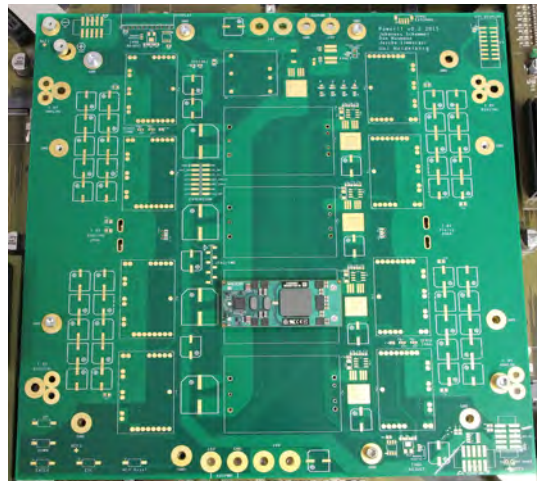


(b) Bracket

Figure 9: Top cover and bracket



(a) An AuxPwr board



(b) A 'Power IT' board

Figure 10: AuxPwr and PowerIT boards

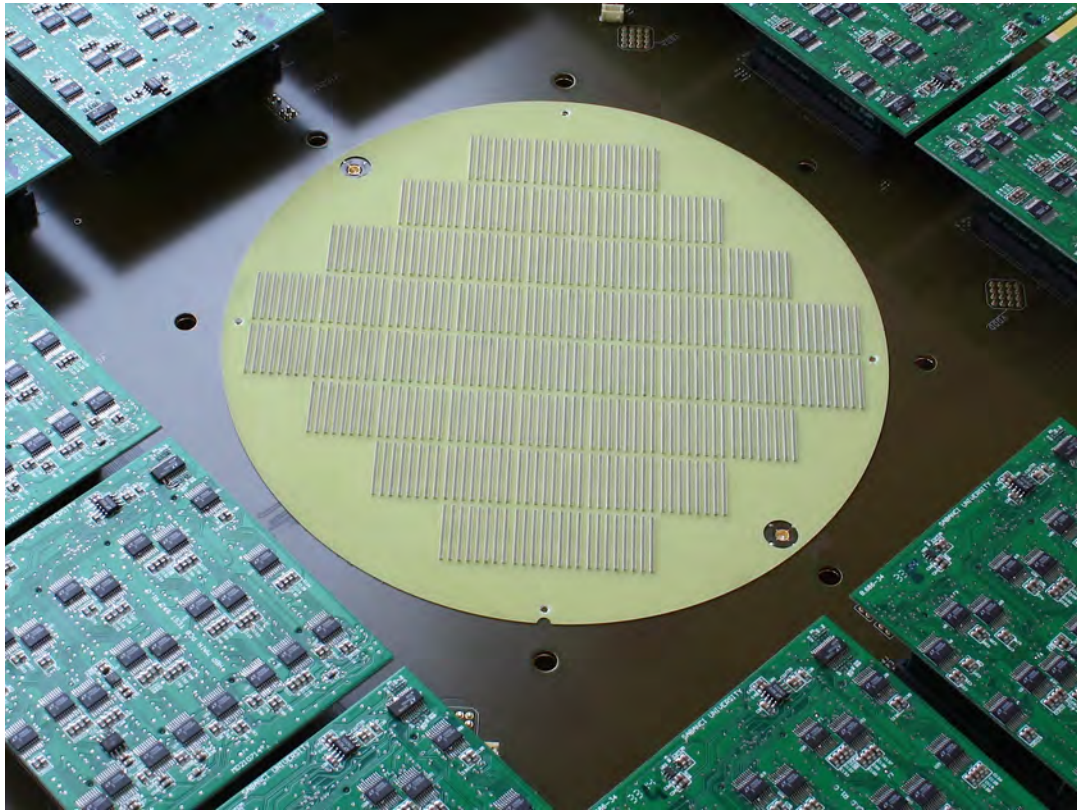


Figure 11: Positioning mask for elastomeric connectors, fully equipped with connectors, on the main PCB

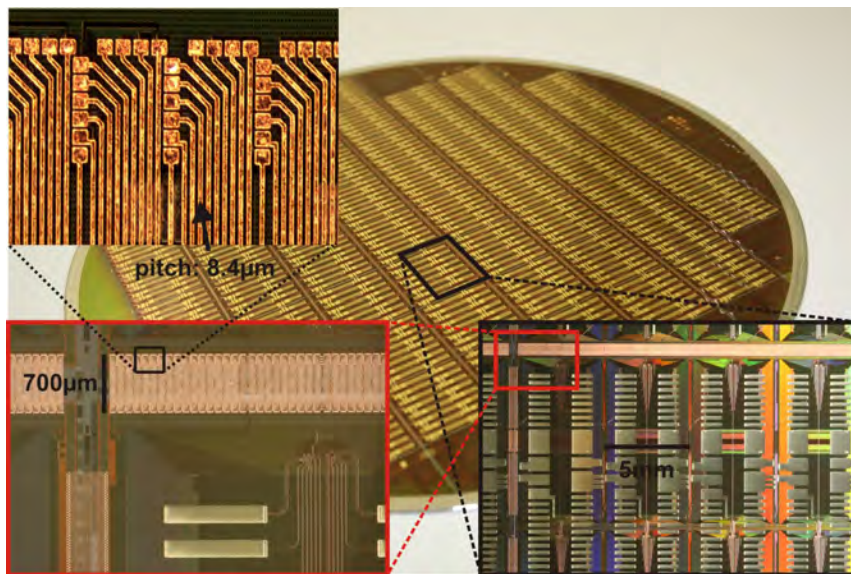
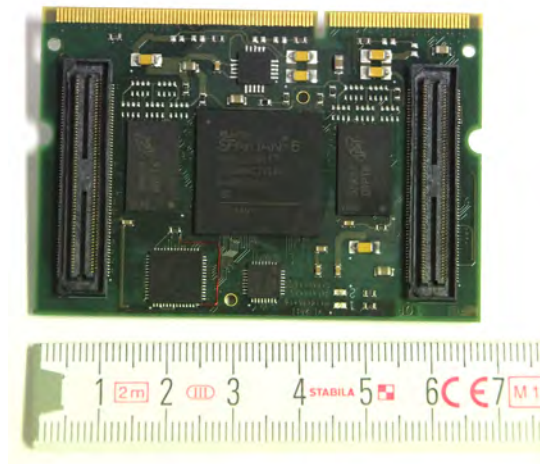


Figure 12: Postprocessed wafer



(a) Analog breakout board AnaB



(b) Spartan6 Flyspi board

Figure 13: AnaB and Flyspi boards

A.4 Details: The NM-MC machine components

A.4 Current NM-MC1 platform status

Access to the NM-MC1 SpiNNaker system via the the NM-portal was formally opened on 29 June 2015. Currently the system attached to the server is a toroid of three SpiNNaker 103 systems (= 2,592 cores); this is a smaller system than required by the Description of Work, which was a 518,400 core machine. There is also another machine on test, a SpiNNaker 105 machine with 103,680 cores. The main block to progress has been due to previously reported problems with accommodation for the machine. In short, having been promised space in the North West Regional Computing Centre, this has now been moved to alternative accommodation elsewhere, and there is no longer space for SpiNNaker. Instead a special purpose room has been commissioned and building work is underway (figure 14).



Figure 14: The room currently being prepared for the full scale NM-MC1 machine

In Figure 15 we have plotted the monthly ‘help-desk’ activity from September 2014 through August 2015 from the Google group <https://groups.google.com/forum/#!aboutgroup/spinnakerusers>

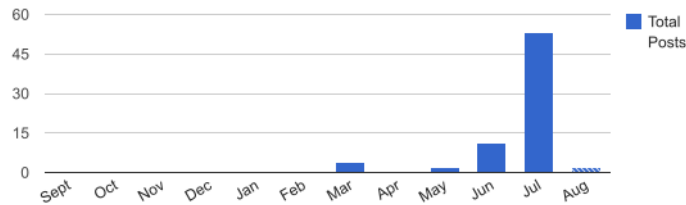


Figure 15: The monthly ‘help-desk’ activity from September 2014 through August 2015 from the Google groups <https://groups.google.com/forum/#!aboutgroup/spinnakerusers>

A.4 NM-MC1 hardware status

We have 475 fully tested boards of the required 600 already to hand. The material to construct a full half million core machine is on hand, but the room in which the machine build is to take place has not yet been completed. Just to be clear: we have the 600 boards required, all the power supplies, Ethernet switches, racking and cables, and when the room is completed we expect to have the full system available shortly afterwards.

In addition to the remotely accessible systems at Manchester we have the following systems out on long-term loan and/or sold to customers.

Status	Spin3 (4-chip board)	Spin 5 (48-chip board)	6x Spin 5
On Loan	48	15	
Sold		5	1

A.4 NM-MC1 software status

With the SpiNNaker Software release “Little Rascal”, of 1 May 2015, we have the capability to program a full one million core machine.

Although the code will execute on the full one million core SpiNNaker machine, at the moment the loading time is too slow to make this an everyday proposition. The issue concerns the place and route algorithm – which is sequential and is executed on the host server – which needs to be considerably faster to make the loading times acceptable. Thus the remaining time available to us on the ramp-up phase grant will be spent improving load times, using the so-called CSA techniques pioneered by Mikael Djurfeldt and Jochen Eppler. This work is in progress, but not yet at a reliability that makes it releasable.

A.5 HBP Neuromorphic Computing Platform Guidebook

The [HBP Neuromorphic Computing Platform Guidebook](#) is an online accessible ‘living document’. A .pdf snapshot as of August 2015 is appended here for documentation of the status at that time.