



# **CARMEN: Code Analysis, Repository and Modelling for Neuroscience**

**e-Science Pilot Project**



**CARMEN**

ENHANCING COLLABORATION  
IN NEUROSCIENCE

## CARMEN: Introduction

- 4 year project funded via the UK EPSRC research council
- Running September 2006 – September 2010
- £4.5 million funding, across consortium of 12 academic institutions, plus industrial partners
- Funded by UK e-Science programme



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## CARMEN: Objectives

- To overcome the limitations of the traditional “single lab” approach
  - CARMEN is creating a grid-enabled, real time ‘virtual laboratory’ environment for neurophysiological data
- To expose experimental data to the full spectrum of available analysis
  - CARMEN is developing an extensible, client-defined ‘toolkit’ for data extraction, analysis and modelling
- To make the results of publicly funded science available to everybody
  - CARMEN is developing a repository for archiving, sharing, and integration and discovery of data



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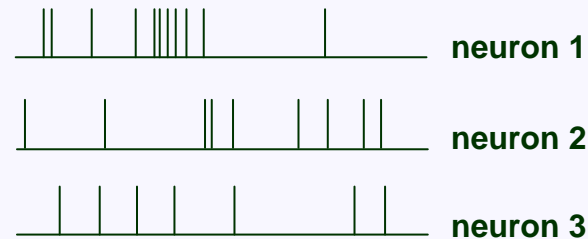
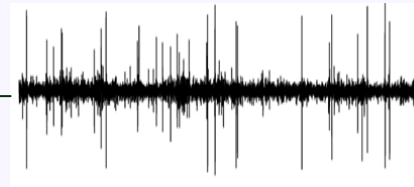
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## Neurophysiology Data

*Understanding the brain  
may be the greatest  
informatics challenge of  
the 21<sup>st</sup> century*



- raw voltage signal data collected by patch-clamp and single & multi-electrode array recording
- novel optical recording, particularly the activity dynamics of large networks

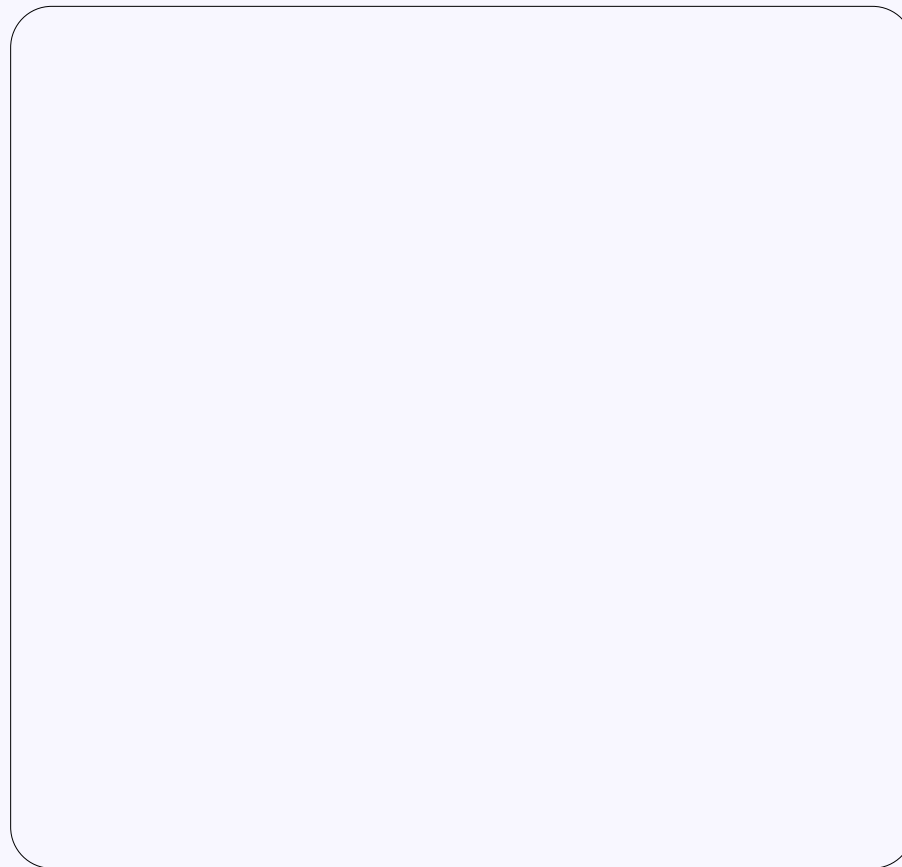


- resolving the 'neural code' from the timing of action potential activity



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## Infrastructure Challenges

- Long term archiving of experimental data & metadata
- Data Mining and visualisation capability at raw signal level
- Search and data mining at data and metadata level
- Security
- Workflow and Service deployment
- Providing mechanisms to migrate laboratory code onto the CAIRNS (Carmen nodes)
- Strong re-use of existing e-Science software output

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## Data Archiving – SRB/iRODS

- Data storage and replication is being managed across the CAIRNS by the use of Storage Request Broker (SRB) from SDSC
- SRB provides means to completely virtualise the location of data within CARMEN as well as providing data management protocols;
  - Back-up
  - Replication
  - Fast data transfer



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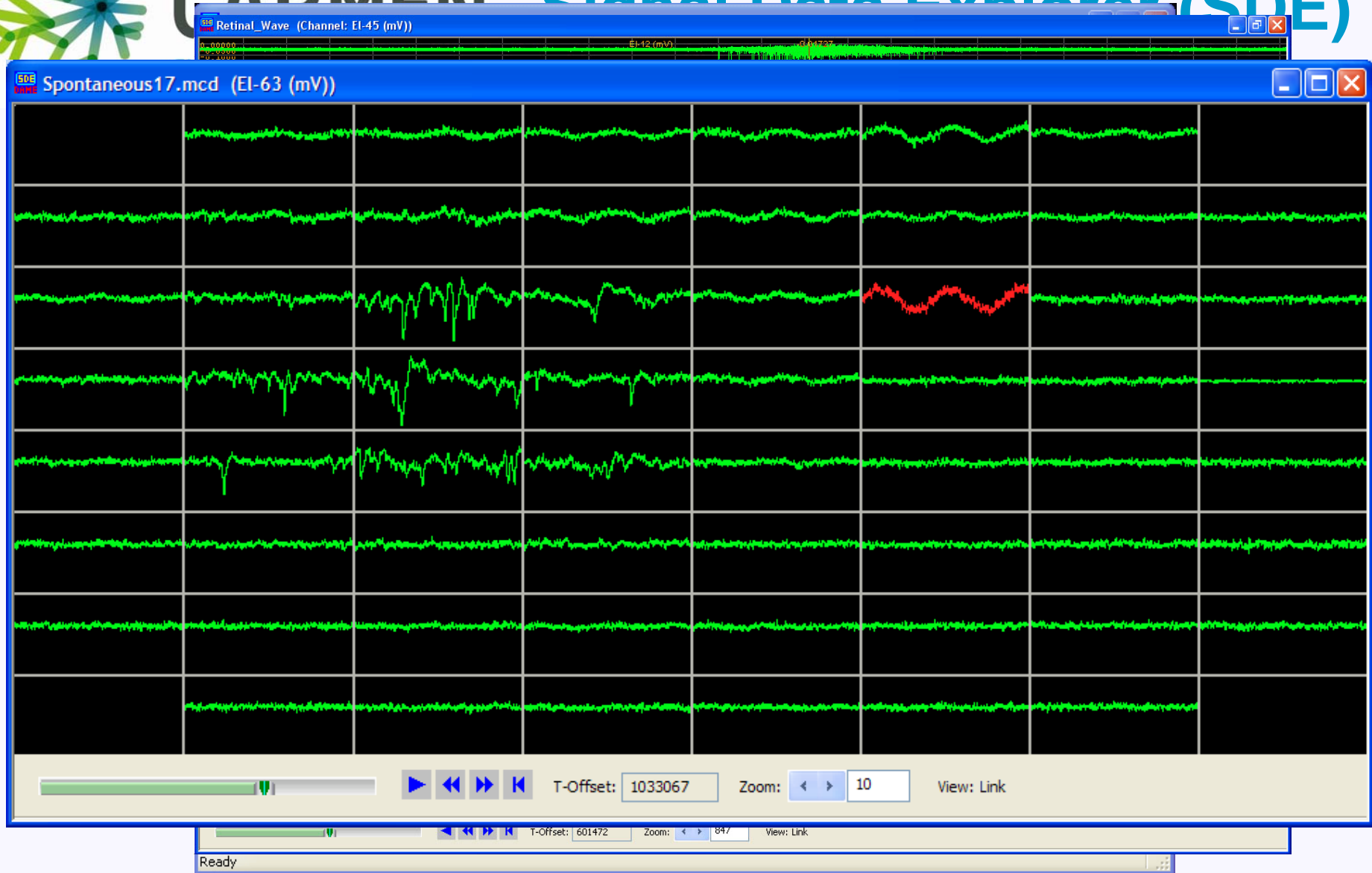
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## Data Mining Objectives

- Provide search and visualisation capability for feature detection in raw and derived data
  - E.g. allow neuroscientists to accurately correlate neuronal firing patterns with specific event stimulus.
- Integrate this technology within the CAIRN architecture for global data search capability



# GARMEN Signal Data Explorer (SDE)





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## Progress

- Aiming for 1<sup>st</sup> full release to consortium within a month.
- Main services:
  - Meta data entry
  - Science data upload
  - Data management
  - Security
  - Visualisation, Search etc. in SDE



# CARMEN Portal

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## Subsequent roll out

- Link into the *eScience Central* work at Newcastle
- Aim to provide by Q2 2009:
  - Workflows
  - Polished Portal
  - Blogging/Social Networks
  - Fixed services
  - Link to iRODS
  - Possible service management
  - Data interchange standard (NTF)



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## International engagement

- Links to:
  - US – BIRN
  - EU – INCF neuroscience coordinating facility
  - Japan – RIKEN brain institute
  - UK roll out backed by WRG eScience centre and via consortium partners



# CARMEN Consortium

## Leadership & Infrastructure

The Institute of Neuroscience

UNIVERSITY OF  
NEWCASTLE UPON TYNE

**Colin Ingram**

north-east regional e-science centre

neresc

**Paul Watson**

UNIVERSITY OF  
**STIRLING**

**Leslie Smith**

**White Rose**  
university consortium  
Universities of Leeds, Sheffield & York

**THE UNIVERSITY of York**

**Jim Austin**



## CARMEN Consortium

### Work Packages



The University of Manchester



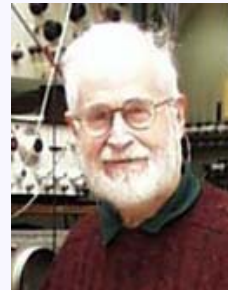


# International Partners



**Ad Aertsen**  
(Freiburg)

Neural network modelling  
and large-scale simulations



**George Gerstein**  
(Pennsylvania)

Analysis of spike pattern trains



**Sten Grillner**  
(Karolinska Institute)

Chairman of the OECD,  
International Neuroinformatics  
Coordinating Facility



**Shiro Usui**  
(RIKEN Brain Science Institute)

Lead for the Japan Node of the  
International Neuroinformatics  
Coordinating Facility



**Daniel Gardner**  
(Cornell)

Lead for the US NIH,  
Neuroscience Information  
Framework and Brain ML



## Commercial Partners



- applications in the pharmaceutical sector



- interfacing of data acquisition software



- application of infrastructure



- commercialisation of tools