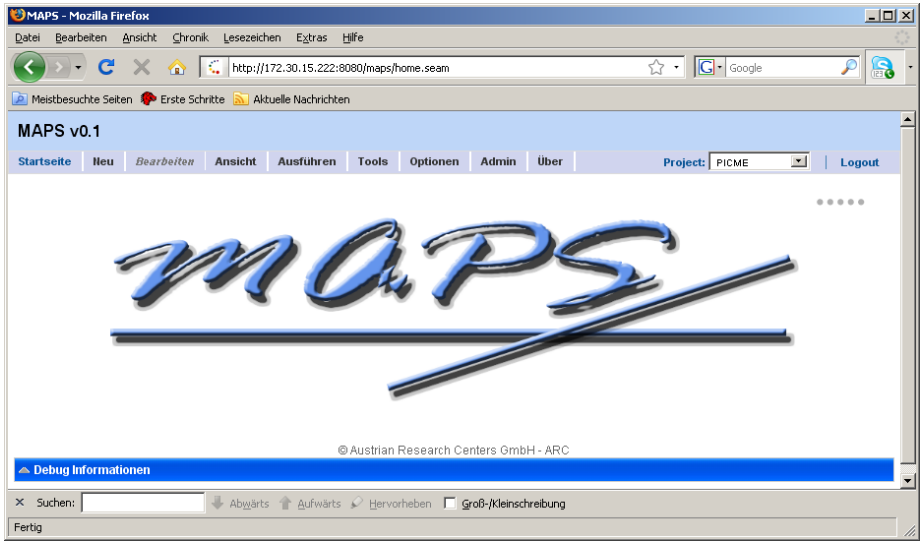
A flexible Laboratory Management System (LIMS) for R&D Labs

AUSTRIAN RESEARCH CENTERS



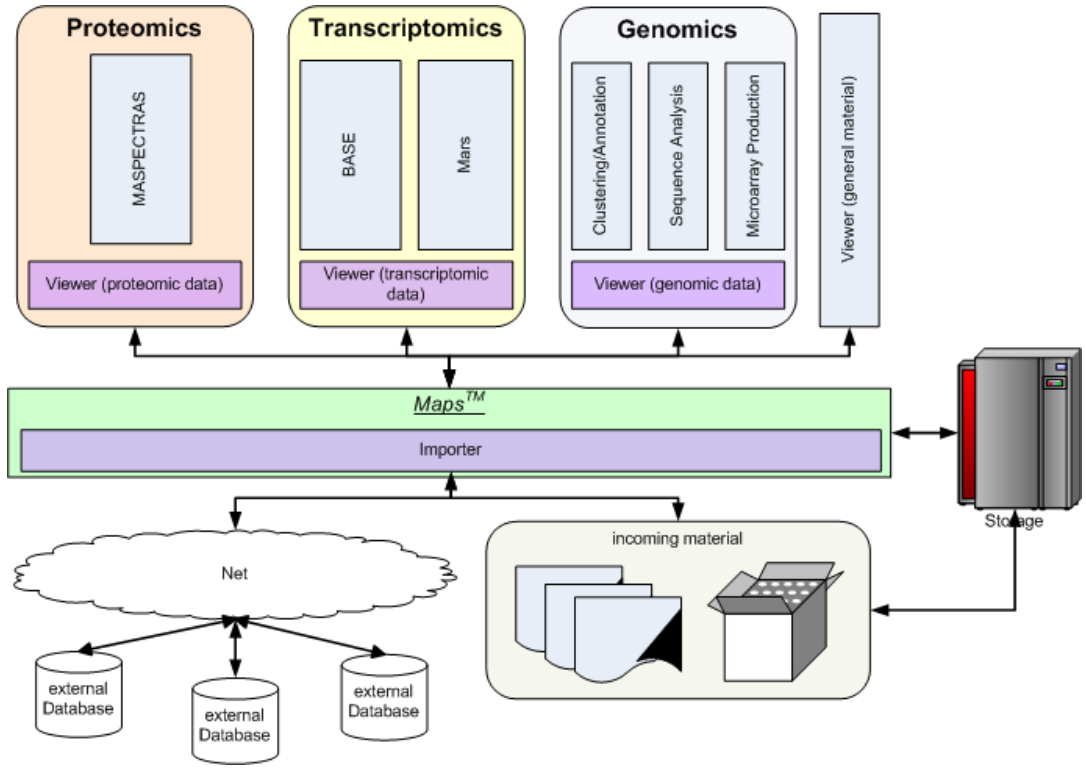
Maps™ **(Material Administration and Preparation System)** is a powerful and flexible Laboratory Information Management System (LIMS) tailored at R&D laboratories. It specifically addresses the need for a permanent adaptation to changing requirements in research.

Key Issues in R&D Labs

- No restrictions on material storage and organization
- SOP (Standard Operating Procedure) support
- Adaptability of SOPs by lab staff
- Openness and adaptability to changing scientific requirements by lab staff
- Web technology for installation-free usage
- Interfacing to software being commonly used within the scientific community
- Single installation for multiple lab environments

Maps™ Material and Data Flow

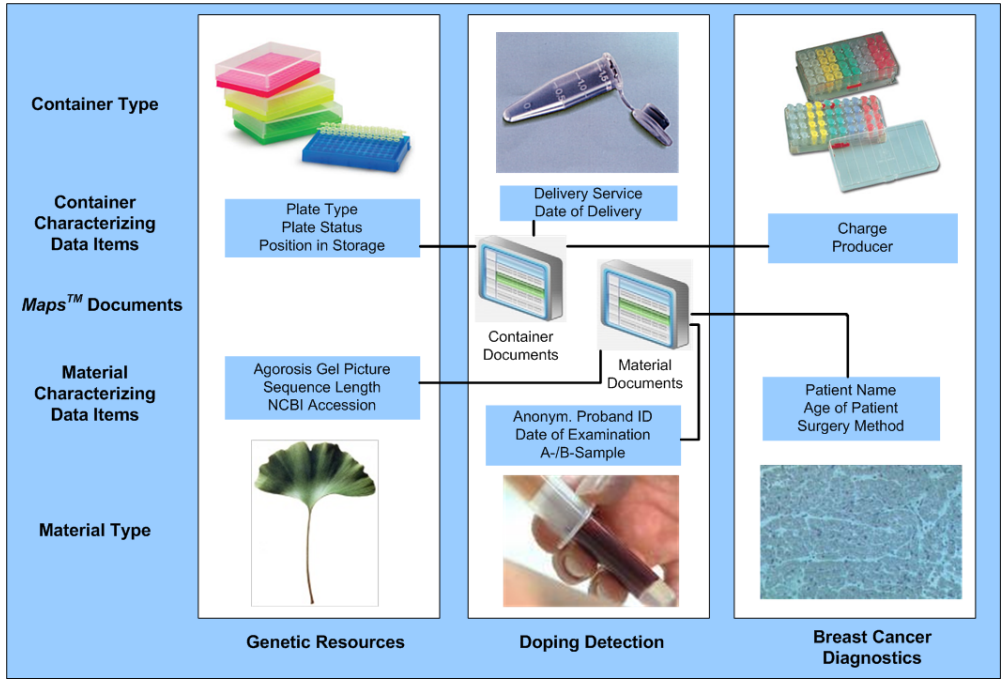
- Maps™ classifies data into
  - Information in the Maps™ database on local material
  - Information in external databases being related to local material
  - Processed domain-information
- Information in the Maps™ database
  - Any chunk of information on material
  - Any additional information on the containers storing material
  - All information on material processing and manipulation
- Information in External databases
  - Any external data source holding information about locally stored material can be references with links within Maps™



- Processed Domain-information
  - Omcis-data being produced from the material and data stored within Maps™ can be linked using interfaces or application-integration-techniques

Core Maps™

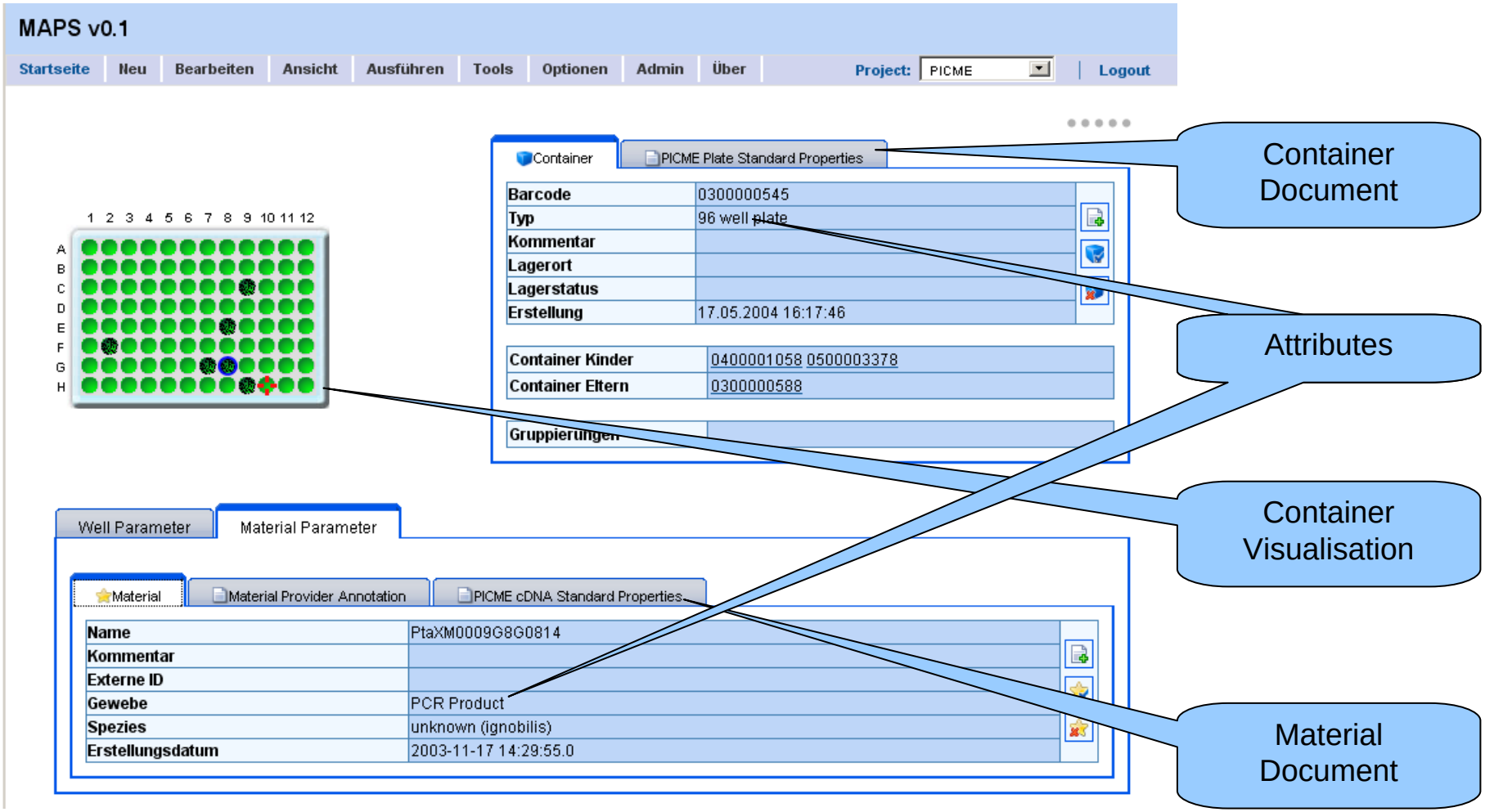
- Containers and Material are the core concepts of Maps™
- Both can be adapted to lab needs
- Both can be described by any kind of information, which is grouped into documents and attributes
- Documents and attributes are fully configurable for the lab staff by administration user interfaces



Concept of attachable documents and declarative attributes

- ***The concepts of attachable documents and declarative attributes allow Maps™ to be used for any field of research and development without having to be adapted by the manufacturer***
- ***Documents are represented at tabs in the user interface of Maps™***

Document and Attributes in *Maps™*



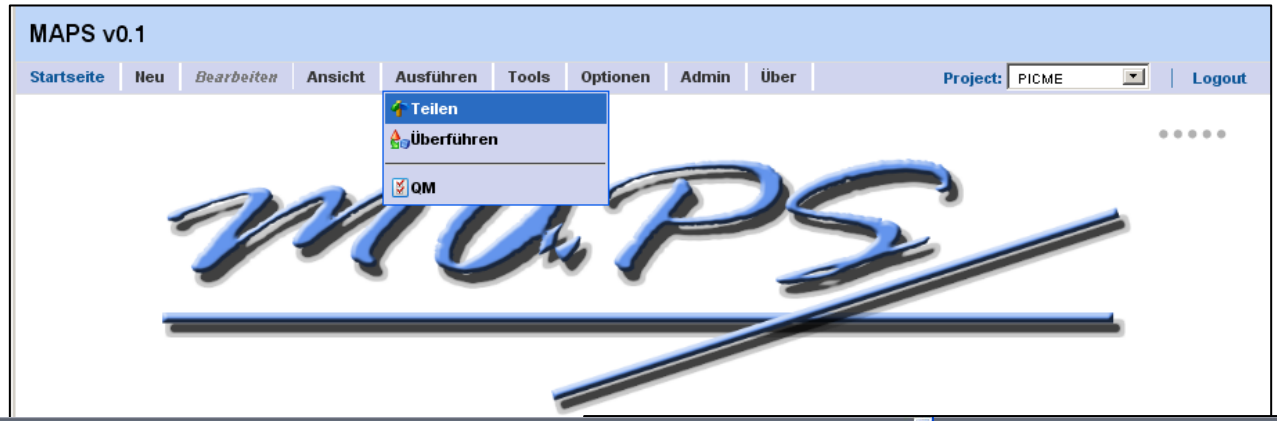
The Maps™ Workflow

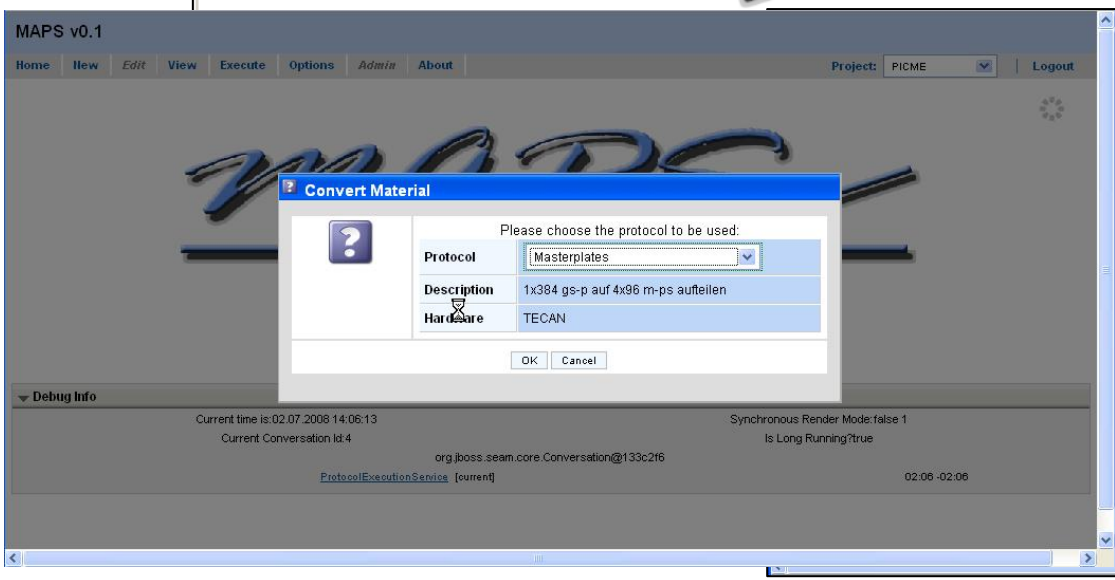
- Operations on material and containers are defined as tasks
- Tasks can be attributed with Standard Operation Procedures (SOP) as documents
- Tasks can be defined and adapted by lab staff
- Tasks can define supply usage from the underlying supply database
- Tasks can define operations on documents and attributes
- The execution of tasks is free to lab staff

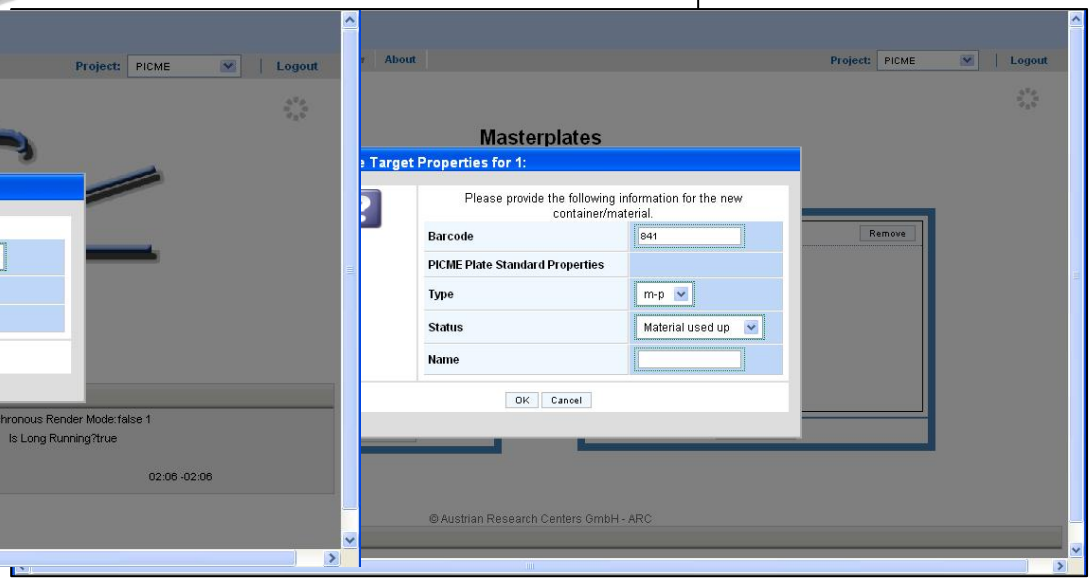
Guided Workflow Execution

- *Maps*™ can work in a guided workflow mode if required
- Tasks are aggregated into workflows, which are executed by a workflow engine
- All steps of the workflow execution are checked and logged in detail
- For this operation mode the *Maps*™ Experiment Directory (EDI) is available as additional component

Maps™ Task Execution







Maps^{TM} – Enterprise Concepts

Multiple Lab Support

- Multiple Labs can share a single *Maps*^{TM} instance by setting up virtual databases for every lab
- Virtual databases facilitate a) completely separated data pools for different labs or b) data sharing between distinct labs
- Access privileges can be set between virtual databases on a per container or material basis
- Datasets can be completely transferred from one virtual database to another (support for „test databases“)

GLP support

- All operations within MapsTM are recorded and stored in an application and data log
- All operations can be attributed by Standard Operation Procedures
- Every operation is therefore reversible and fully documented
- MapsTM can therefore help to build up a GLP certified environment

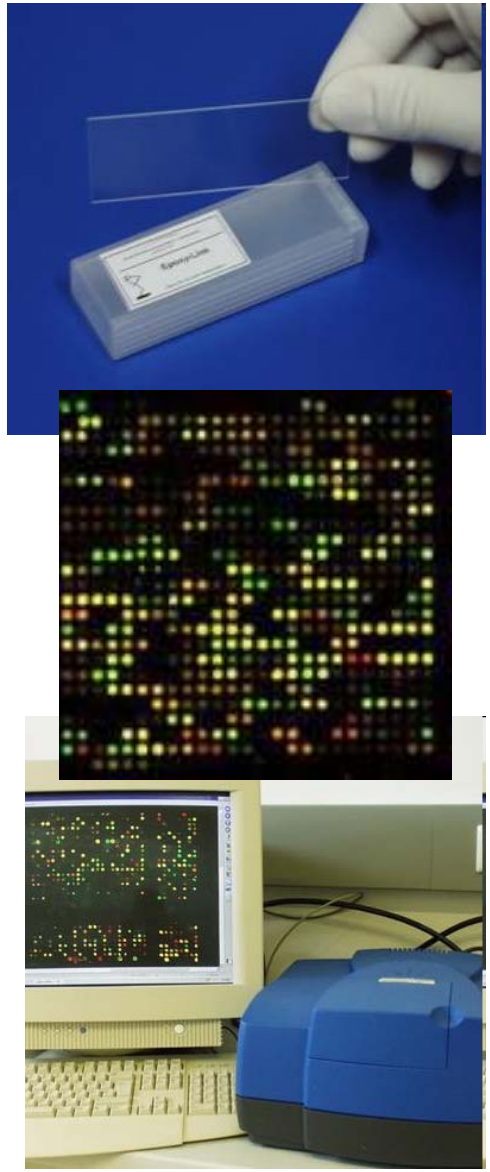
Data Mining and Extensibility

- MapsTM provides a plugin interface which can be used
  - For defining lab-specific and recurring data mining operations (e.g. a storage inventory)
  - For adding functionality to MapsTM by programming lab-specific services (an NCBI data retrieval plugin is already part of MapsTM)

Domain Applications

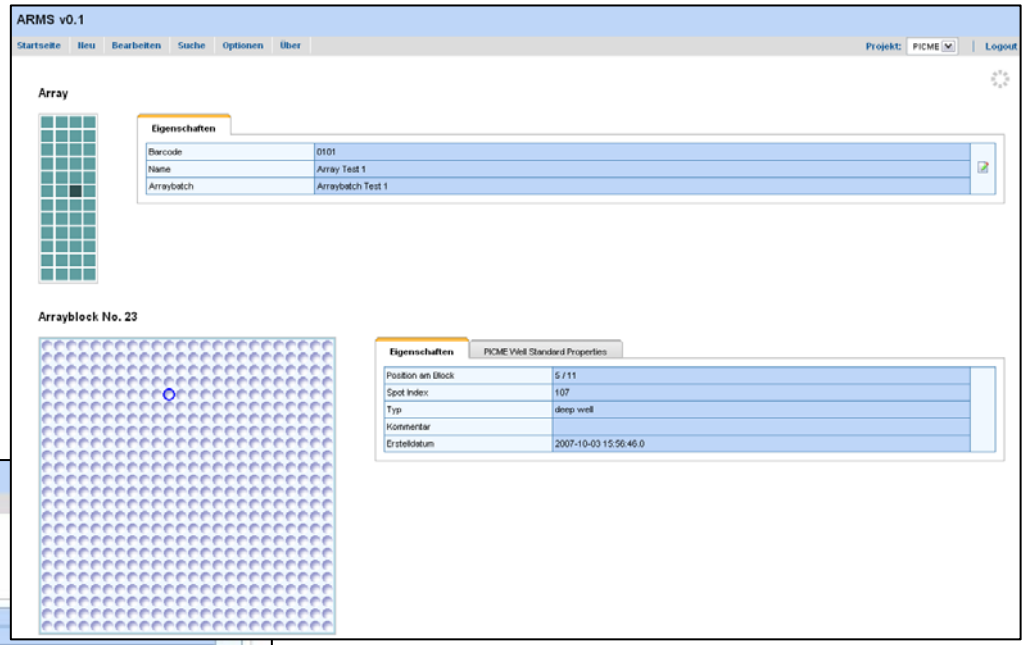
- Special purpose software can be linked to *Maps*™ using low-level database interfaces or high-level application interfaces
  - Genomics
  - Transcriptomics
  - Proteomics (planned)

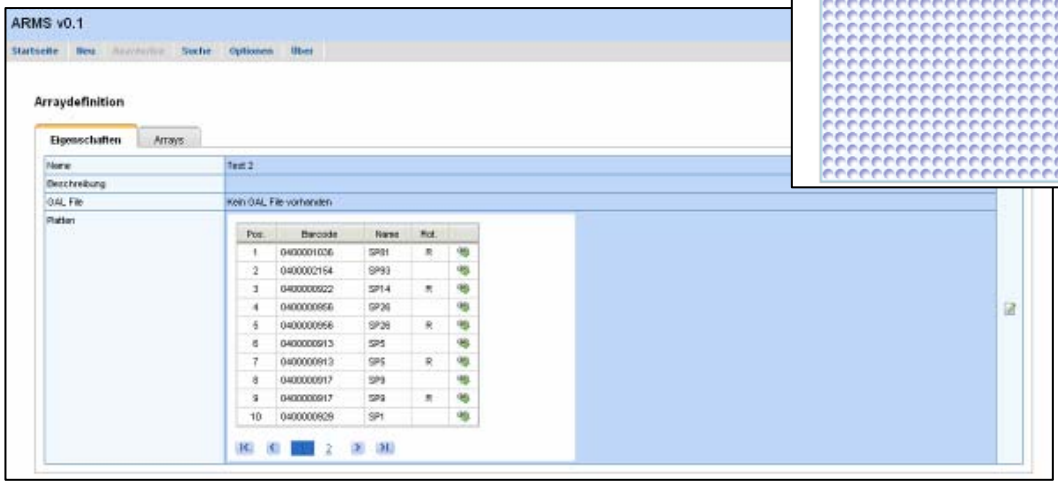
- Currently Available
  - BASE-II (BioArray Software Environment): The most widely used open source microarray analysis platform released by Lund University
  - ARMS (Array Management System): A microarray production support software released by ARC



Domain Applications – Array Management System (ARMS)

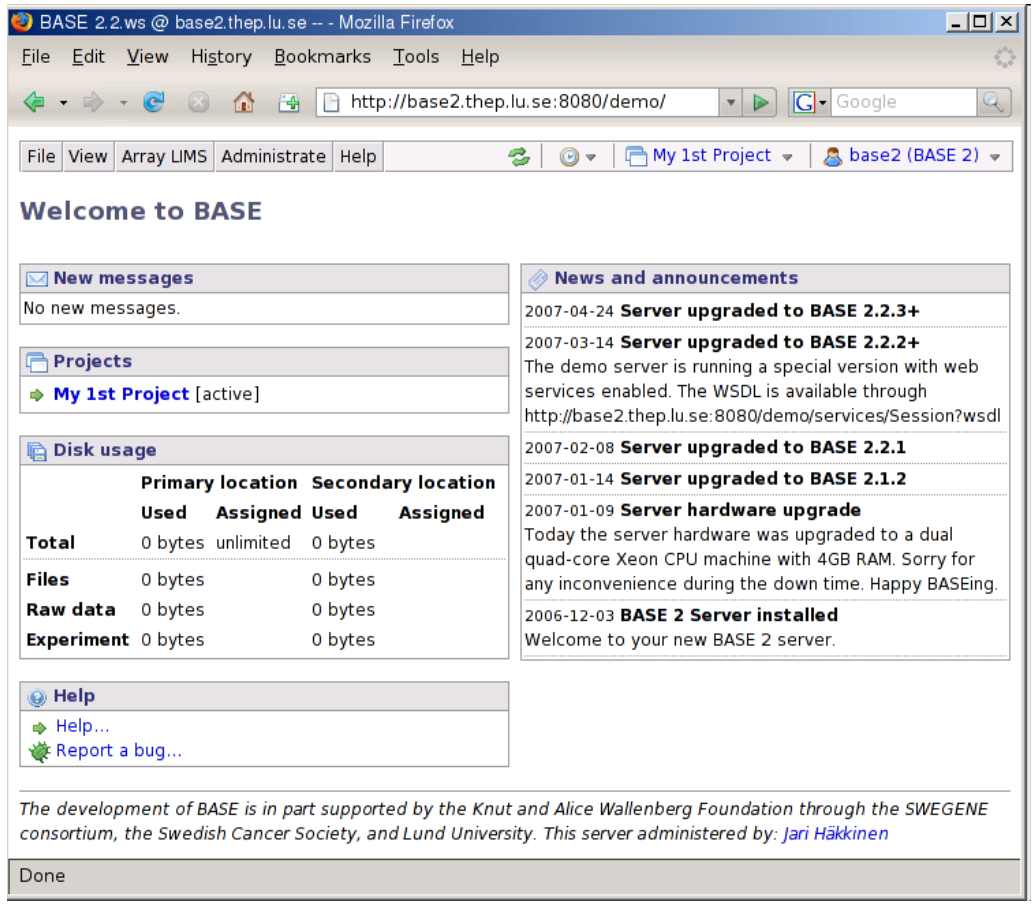
- Design of cDNA microarray templates
- Generation of spotter command files
- Administration and visualisation of slides and their properties
- Storage of quality control information (hybrdisiation images)





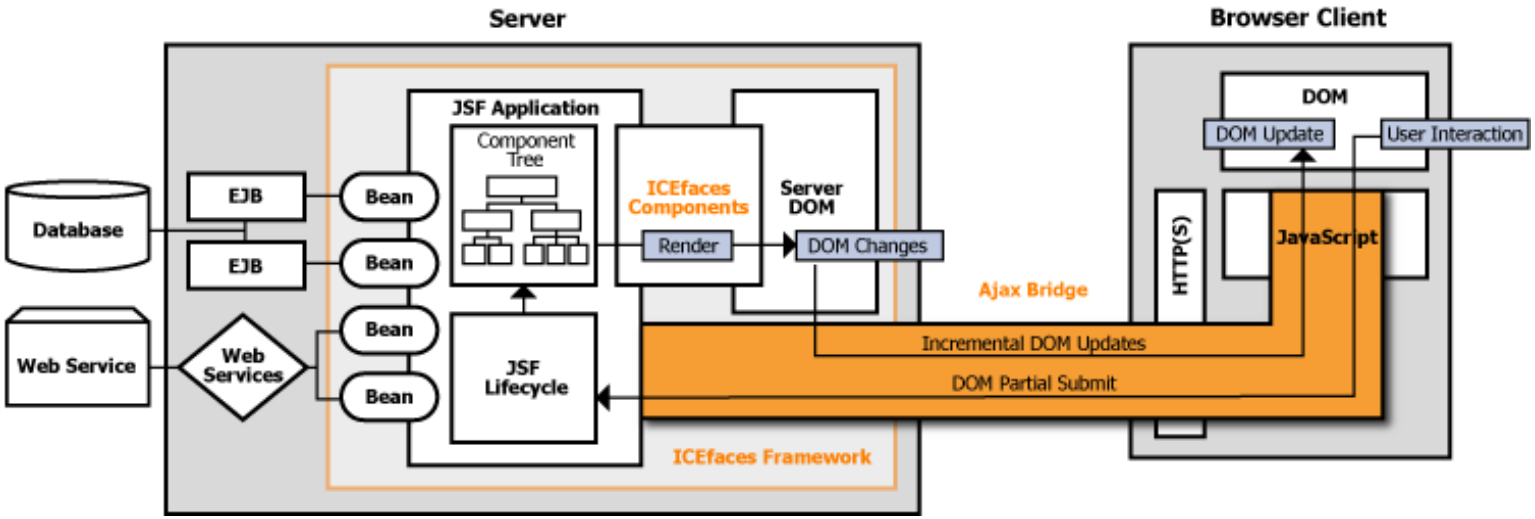
Domain Applications – Bioarray Software Environment (BASE)

- The most widely used open source microarray analysis platform (Lund University)
- http://base.thep.lu.se/
- Administration of samples, extracts, slides, scans, hybridisations, and experiments
- Direct access from BASE to the *Maps*™ slide and sample database (no data duplication – material reuse)



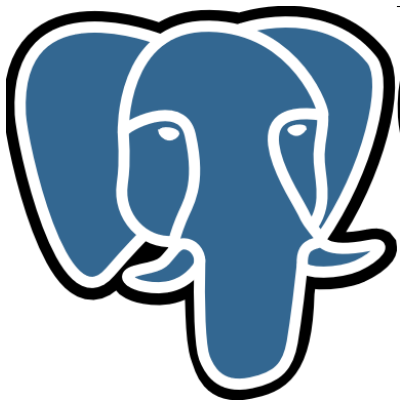
Truely Web-based Architecture

- *Maps*™ is organized as a truely web-based multi-tier application
- The *Maps*™ server is running at a dedicated server computer at the customers institute
- The *Maps*™ client is a standard web browser without any additional software component requirements
  - Current Internet Explorer and Firefox versions are supported



Open Source Technologies

- *Maps™* is completely based on open source technologies
  - ⇨ No expenses for third party components
- Multi Tier Architektur
  - Database Layer – PostgreSQL
  - Application Layer – EJB, SEAM, IceFaces, JSF, JSP
  - Presentation Layer – HTML, CSS
- jBPM Workflow-Engine



AUSTRIAN RESEARCH CENTERS

About Us

PICME (Platform for Integrated Clone Management) – http://www.picme.at – is a part of the Austrian Research Centers GmbH – ARC (http://www.arcs.ac.at), a non profit research organization which is ÖNORM EN ISO 9001:2000 certified.

PICME is a Plant EST Resource Centre and Repository working along the Open Source Principle of sharing our Products and Services with the General Public. We store and have organized a variety of Plant ESTs that have been provided to us by our partner network. These resources from different species can be accessed as microarays or single clones for research purposes. Our aim is to support the international plant research community.

Our 5-year experience in large scale data management and processing has led to the development of state-of-the-art data organization, mining and analysis software products being specifically useful for R&D institutions.

Mag. Silvia FLUCH
Biogenetics/Natural Resources - PICME
Austrian Research Centers GmbH – ARC
silvia.fluch@arcs.ac.at
+43-50550-3530
2444 Seibersdorf, AUSTRIA

Austrian Research Centers GmbH - ARC
Tech Gate Vienna
Donau-City-Straße 1
1220 Vienna, AUSTRIA

AUSTRIAN RESEARCH CENTERS