GGIG

GAMS Graphical Interface Generator

Wolfgang Britz

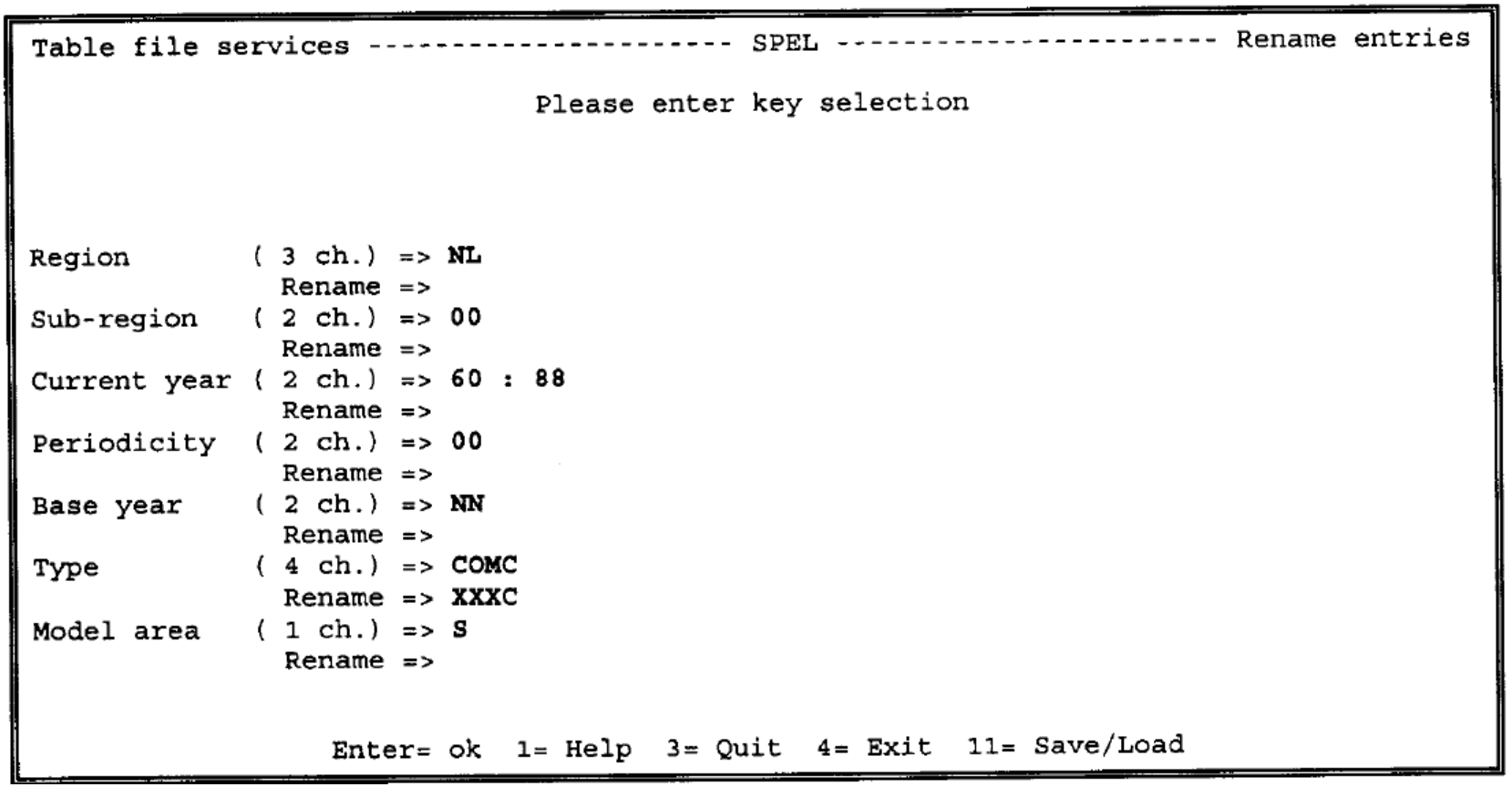
Why GUIs for economic models?

- Steer the applications with a known Touch & Feel – reduce need to know details about software and specific implementation
- Exploit the results – often not nicely supported by the modeling languages
- GUI development supports a good structure of the applications themselves

Some history

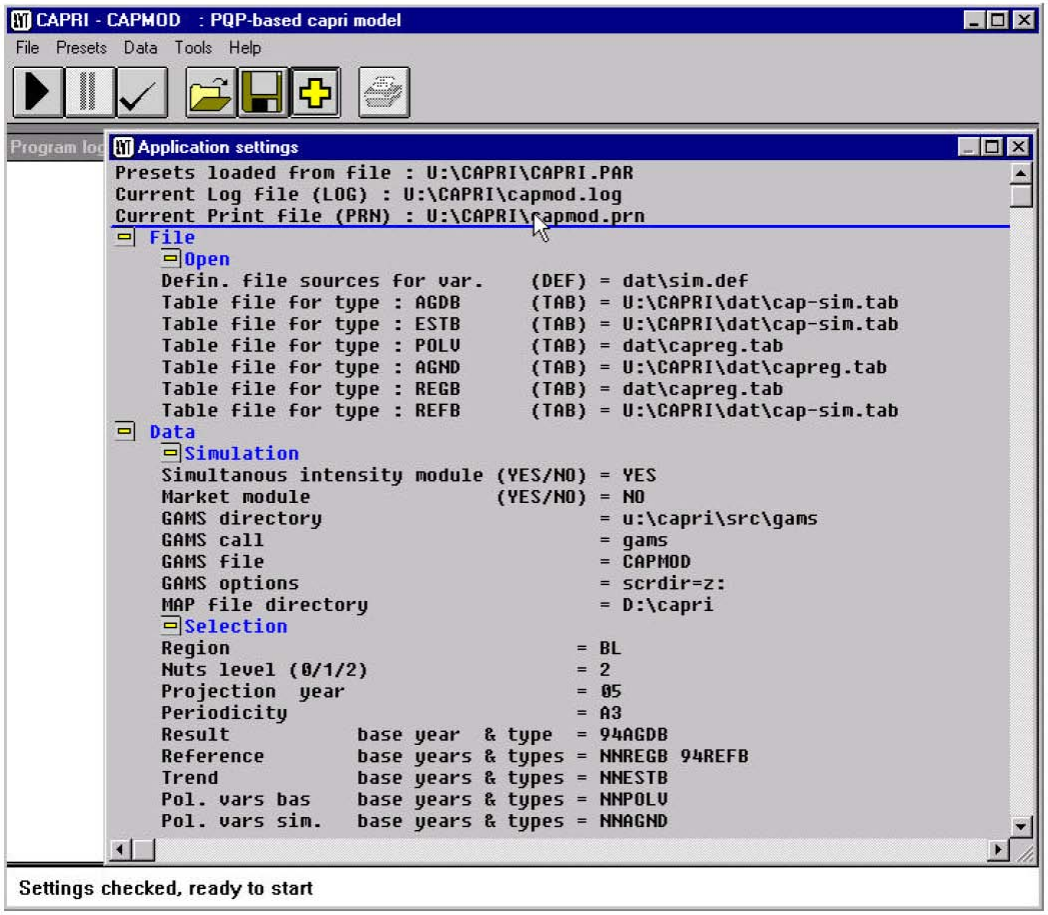
- Graphical User Interfaces (GUI) to steer economic simulation models exist at the institute for food and resource economics since the 70ties:
  - Already for terminals to connect to mainframe
  - Sequence of dialogues (one dialogue = one full screen page)
  - Supported where text fields

Some history



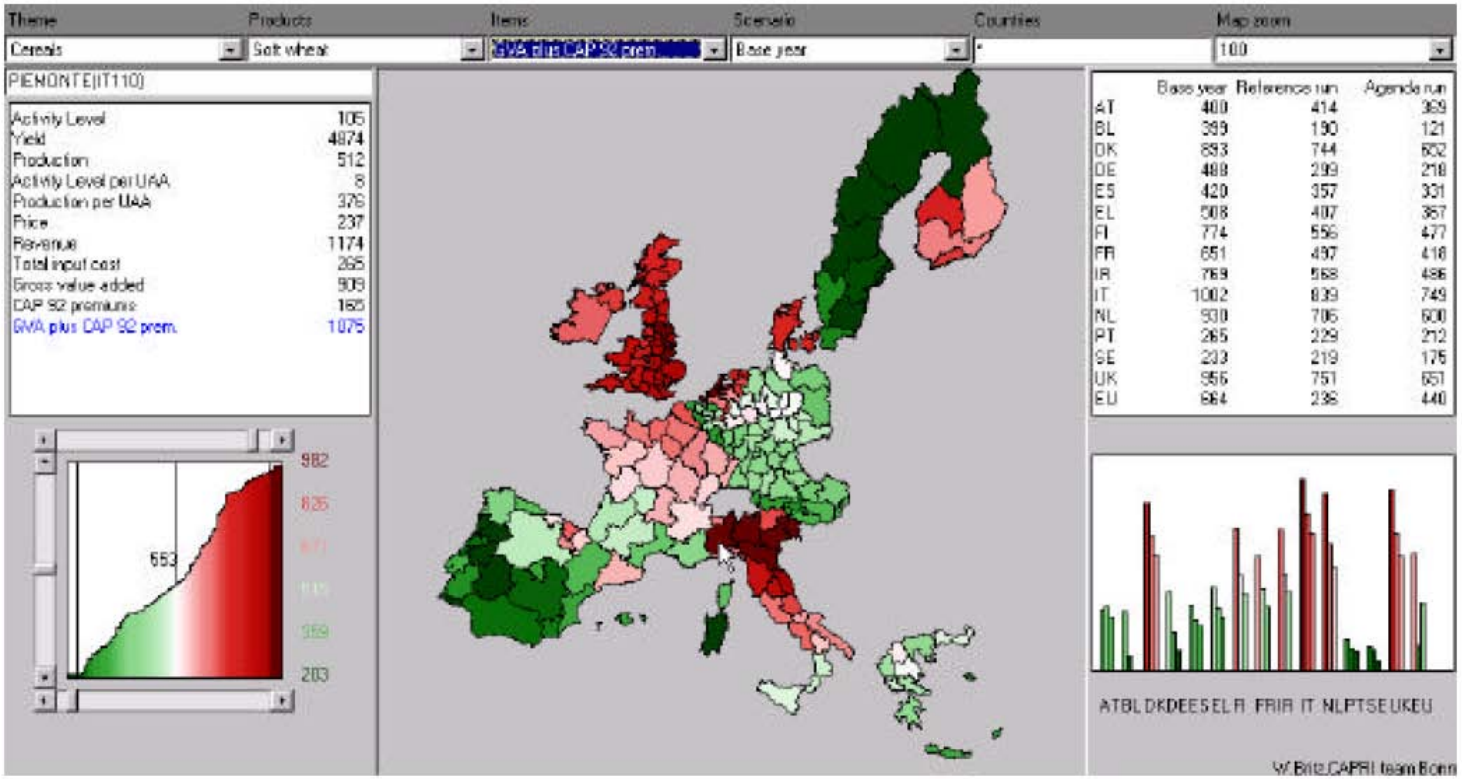
Some history

- First GUI of CAPRI based on C/FORTRAN



Some history

- 1999: Mapping tool in Java



Some history

- Since CAP-STRAT(2001-2004), CAPRI GUI in Java
- Use of the CAPRI exploitation tools
  - e.g. in Multi-Commodity model for Benin (BenImpact) and Drâa valley river basin model (mid of nineties)
  - by staff members when at OECD, FAO …
  - Table definitions in XML allowed to port functionality of CAPRI GUI (tables, maps, graphics …) to other models' outputs

=> Same idea now for model steering

What is the GAMS Graphical Interface Generator (GGIG)?

- Compiled Java code
- which generate from a XML based text file (no Java programming needed)
  - a Graphical User Interface
  - with user operable controls such as check boxes, selection lists, tables
  - which translate the settings of these control into GAMS/R code in a include file
  - which can start GAMS/R programs, shows the log in a window
- allows to exploit the results stored in GDX files, explore them as tables, graphics, maps

Why GGIG

- No Java programming needed to generate or modify a GUI:
  - Interfaces efficient also for smaller projects
  - Easy to add options
  - Interface portable also to other platforms where GAMS and Java are running, such as MACs
- Some useful utilities accessible

Why GGIG: GAMS side

- Supports structured programming in GAMS:
  - Clear distinction between user input and processing code
  - "One entry point" strategy via include file to define run specific settings including definition of counterfactuals
- No manual edits in GAMS to change settings
- Meta information (who, when, what) automatically generated as a GAMS set
- GAMS code can still be run without the interface

Why GGIG

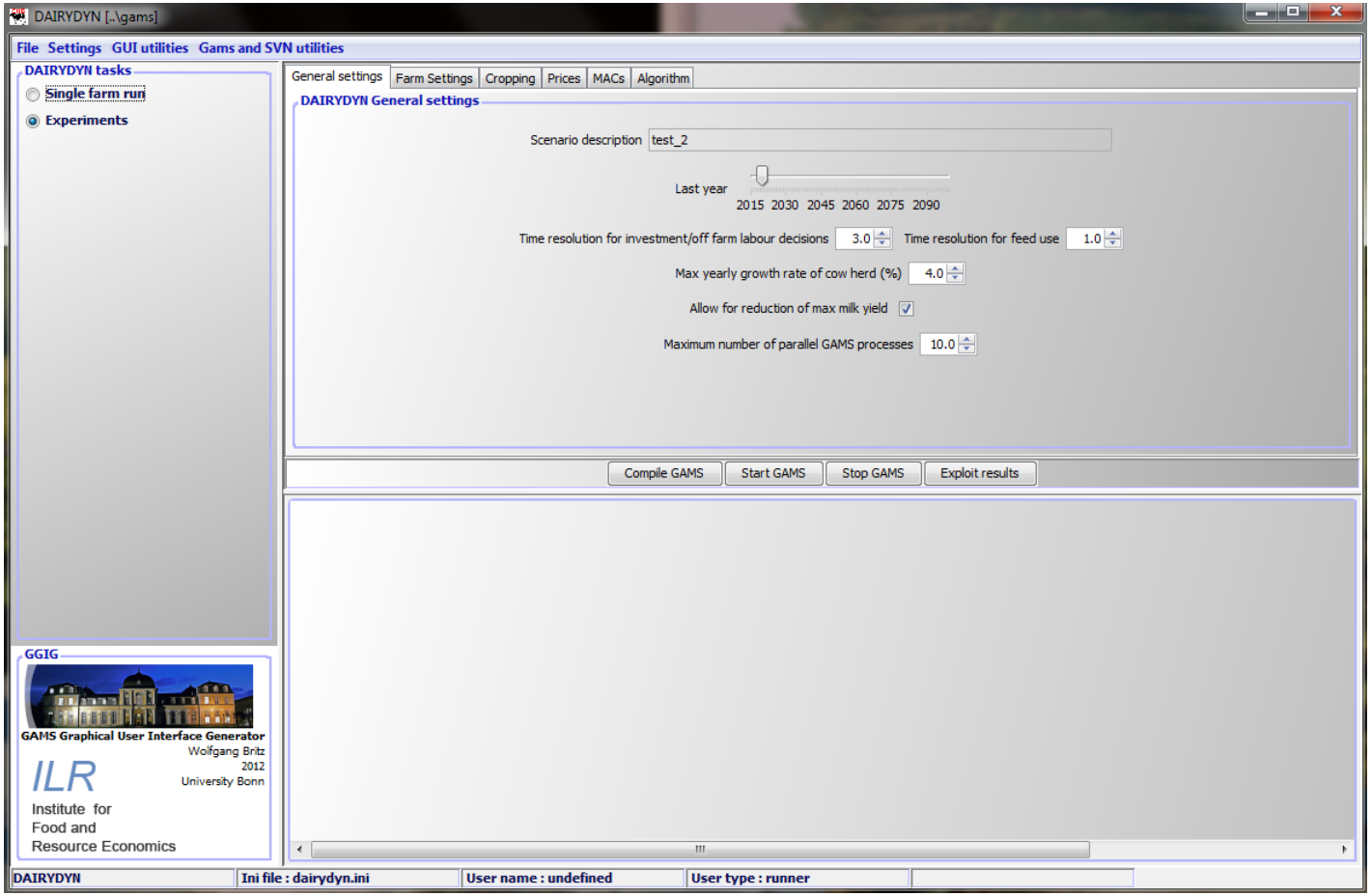
- Functionality of CAPRI GUI ported to other projects
  - distribute maintenance costs
  - existing utilities from CAPRI GUI become available: code documentation in HTML, exploitation tools, GDX Viewer, batch execution, equation and variable viewer …
  - common touch & feel, especially important for the exploitation tools

Why GGIG

- Full functionality of CAPRI exploitation tools:
  - Based on pre-defined views stored in XML
  - Tables: pivot, select, show differences, statistics and outlier detection, hyperlinks to other tables, hide/show empty rows …
  - Maps: different classification options, shapefile converter
  - Graphs: many types
  - In-built machine-learning package
  - Clipboard exports of tables, maps and graphs, e.g. to EXCEL or Word
  - Links to chapter in pdf-files possible
  - ….

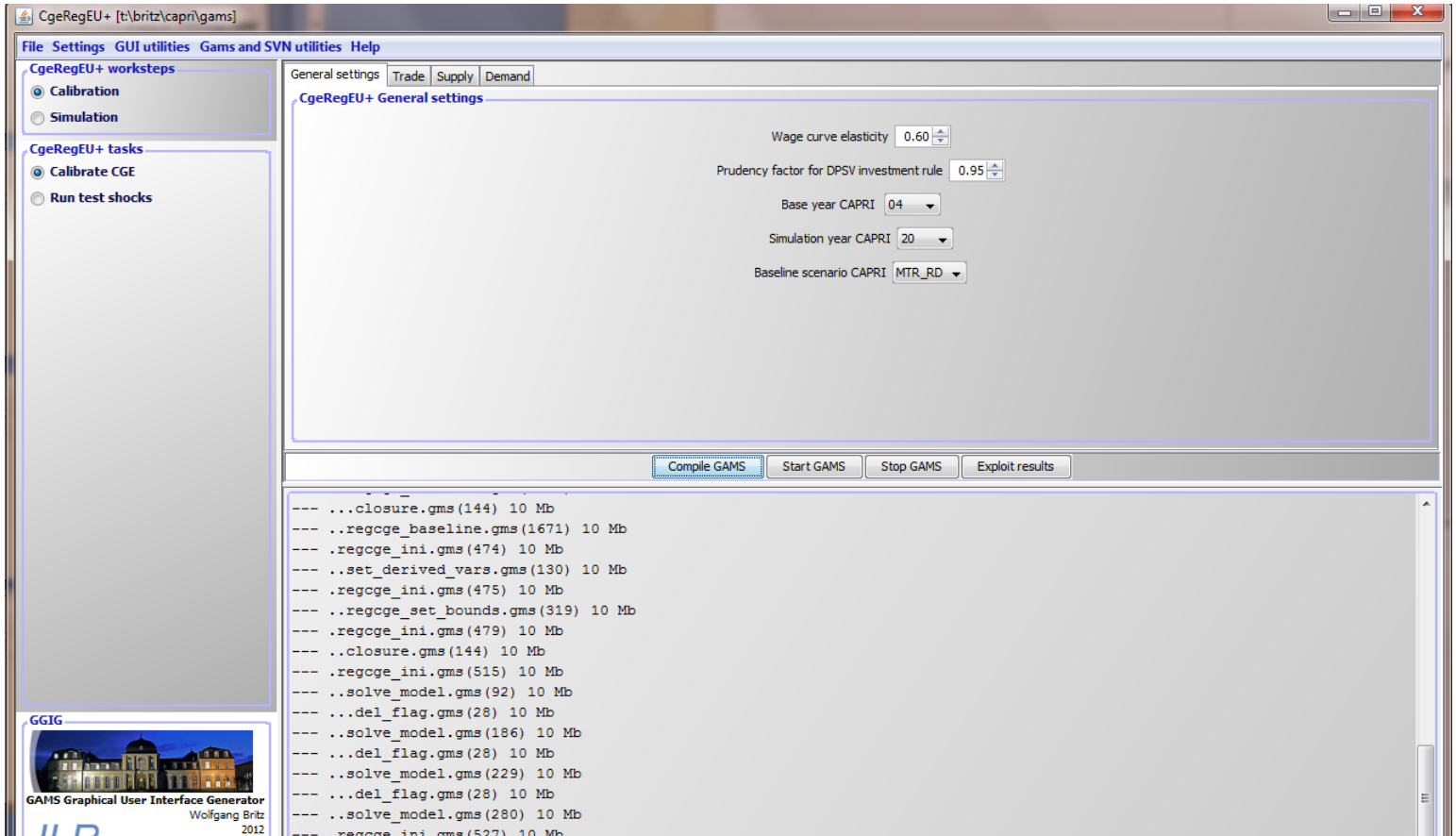
Where is GGIG currently used

- DairyDyn with Bernd Lengers



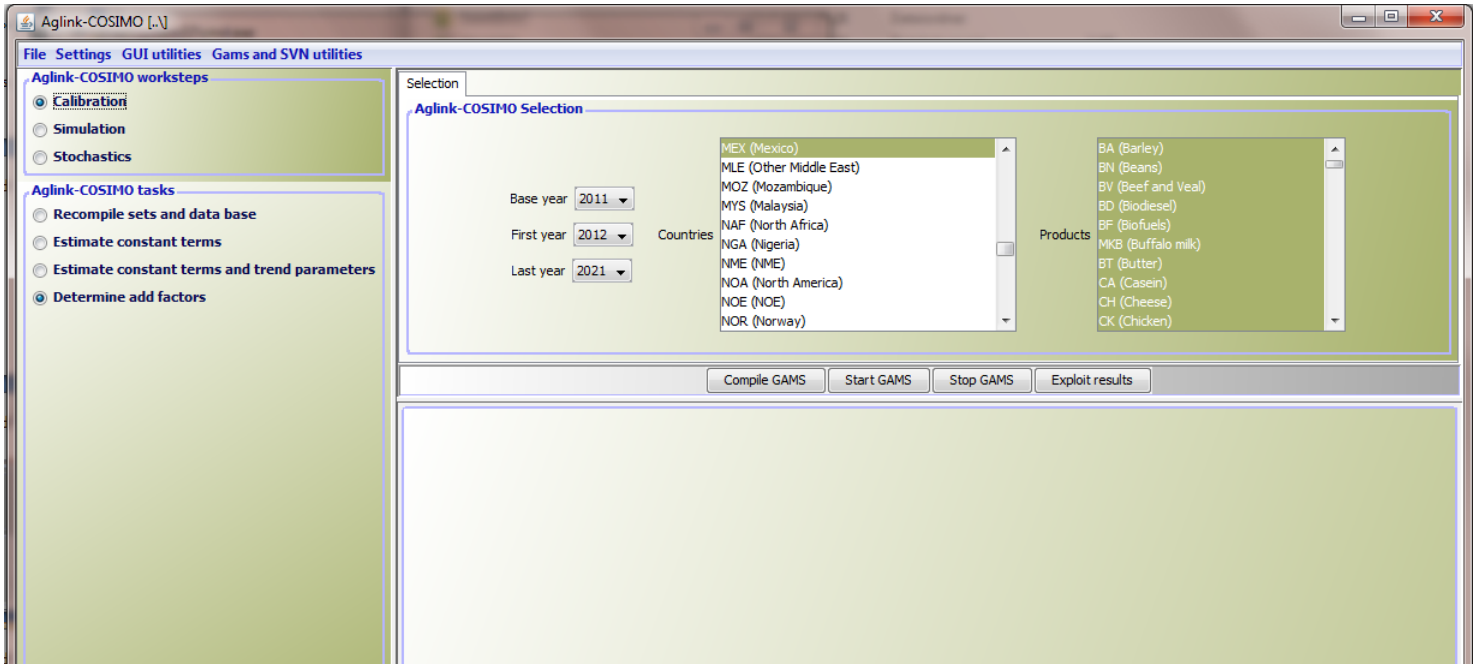
Where is GGIG currently used

- DairyDyn with Bernd Lengers
- RegCge stand-alone



Where is GGIG currently used

- DairyDyn with Bernd Lengers
- RegCge stand-alone
- AGLINK-COSIMO in GAMS stand-alone (future not clear, sensitive issue)



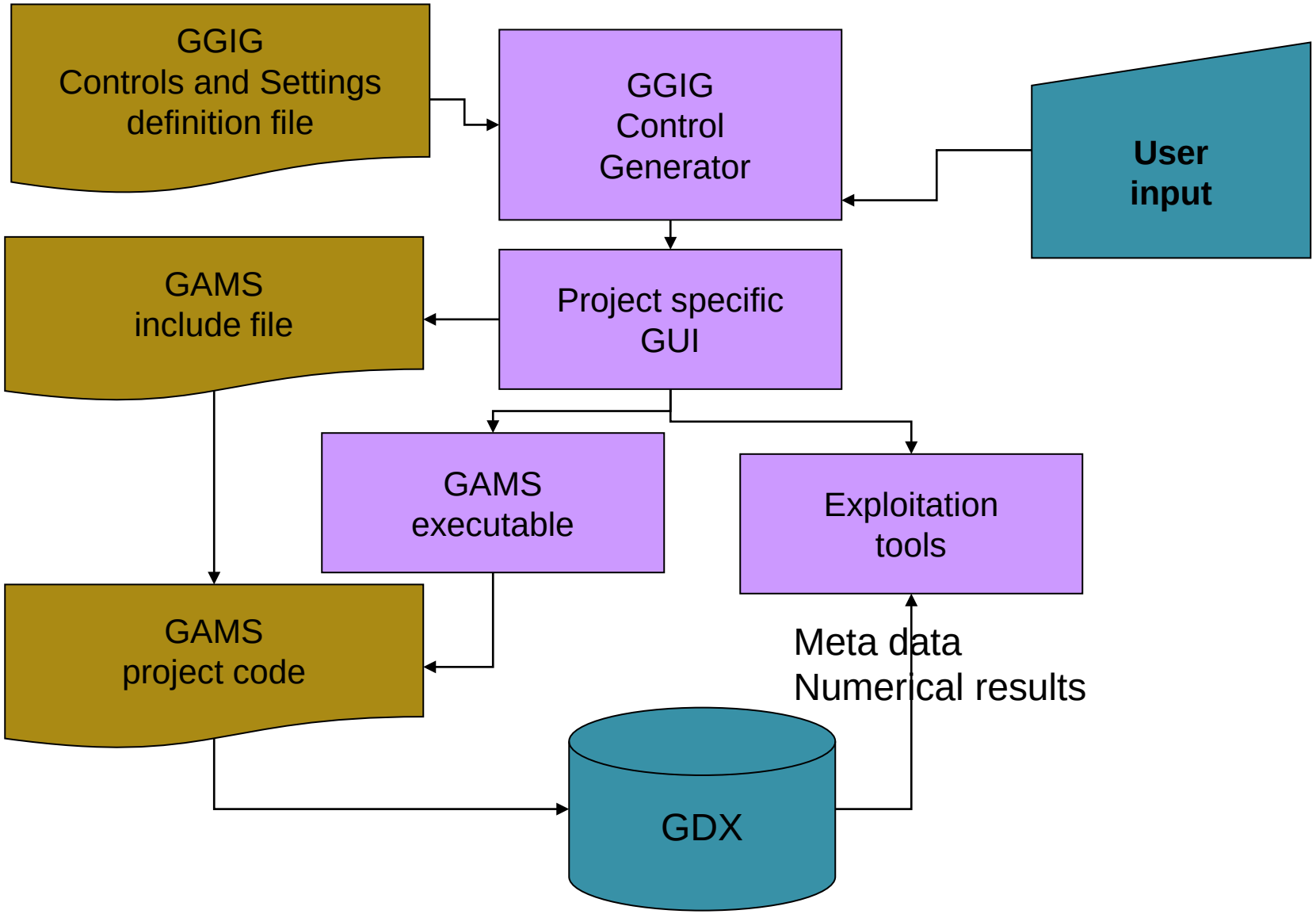
Where is GGIG currently used

- DairyDyn with Bernd Lengers
- RegCge stand-alone
- AGLINK-COSIMO in GAMS stand-alone (future not clear, sensitive issue)
- Latest CAPRI version, which includes the regional CGEs, spatial down-scaling to 1x1 km scales, farm types …

GGIG further use

- GTAPinGAMS
- FADNTOOL user interface (extension to run R-scripts included)
- Spatial poultry model from NTM-Impact
- Recursive-dynamic model for markets of forestry products
- Sector model for Norway
- Agent Based Model for structural change (uses controls/exploitation part with odel running in Java)

Basic functioning of GGIG

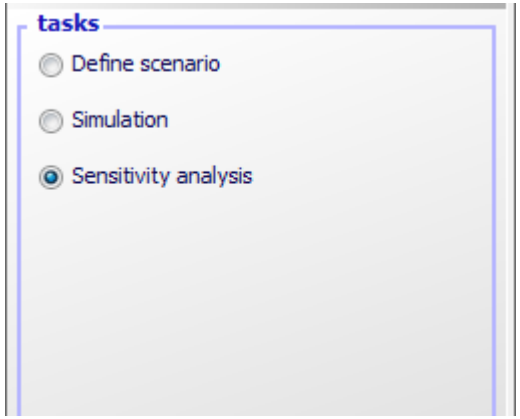


Basic concepts: Worksteps and tasks

- Work step: selection of task


```
<workstep>
   <name>Data base compilation</name>
   <pdflink>..\doc\GtapInGams with a GUI.pdf#Data base generation</pdflink>
         <tasks>Convert FlexAGG to GDX
                Convert GTAPAGG to GDX
                Filter out small values
                Split up products and sectors
         </tasks>
</workstep>
```

- Tasks




```
<task>
        <name>Simulation</name>
        <pdflink>..\doc\GtapInGams with a GUI.pdf#Running the scenario</pdflink>
        <gamsFile>mrtmcp</gamsFile>
        <incFile>model\mtrmcp_inc</incFile>
        <curDir>model</curDir>

        <regionDim>0</regionDim>
        <dim5Dim>1,Items</dim5Dim>
        <productDim>2</productDim>
        <activityDim>3,Sectors and institutions</activityDim>
        <dim6Dim>4,Origins</dim6Dim>
        <dim7Dim>5,Version</dim7Dim>
        <scenDim>6,Scenarios</scenDim>

        <resdir>run</resdir>
        <gdxSymbol>p_results</gdxSymbol>
        <filemask>.*gdx$</filemask>
</task>
```

Basic concepts: TASK

- name → `$SETGLOBAL TASK Prepare national database`
  `$SETGLOBAL WORKSTEP Build database`
- gamsfile: the file called, e.g. capmod(.gms)
- incFile: the name of the include file
- resdir: where to search for results
- filemask: regex to find file in resdir
- gdxSymbol: name of symbol with results
- regionDim …: position of logical dimensions in gdxSymbol
- filters: control e.g. to select regions, years when exploiting scenarios
- userLevels: to hide tasks

Basic concepts: controls

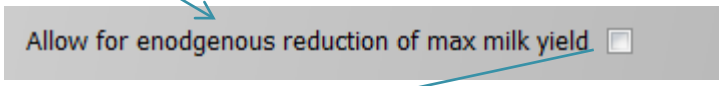
- type: checkbox, slider, table, singlelist, multilist ..
- title: description seen by user
- options: what the user can chose
- gamsname: $setglobal gamsname …
- tasks: which tasks use the controls
- disable: if true, control is blocked
- userLevls: to hide tasks
- some more special settings such as selection groups, tooltips, pdf links, dependencies with other controls, style options …

Example: introduce a check box

Ini file

```
<control>
        <Type>checkBox</Type>
        <Title>Allow for enodgenous reduction of max milk yield</Title>
        <Value>true</Value>
        <gamsName>mlkRed</gamsName>
        <tasks>Single farm run, Calculate MACs,Experiments dairy</tasks>
        <dependsOn>Farm branches:Dairy</dependsOn>
</control>
```

Interface



Name of global from ini file

Setting from interface based on user input

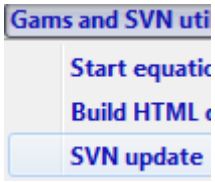
GAMS

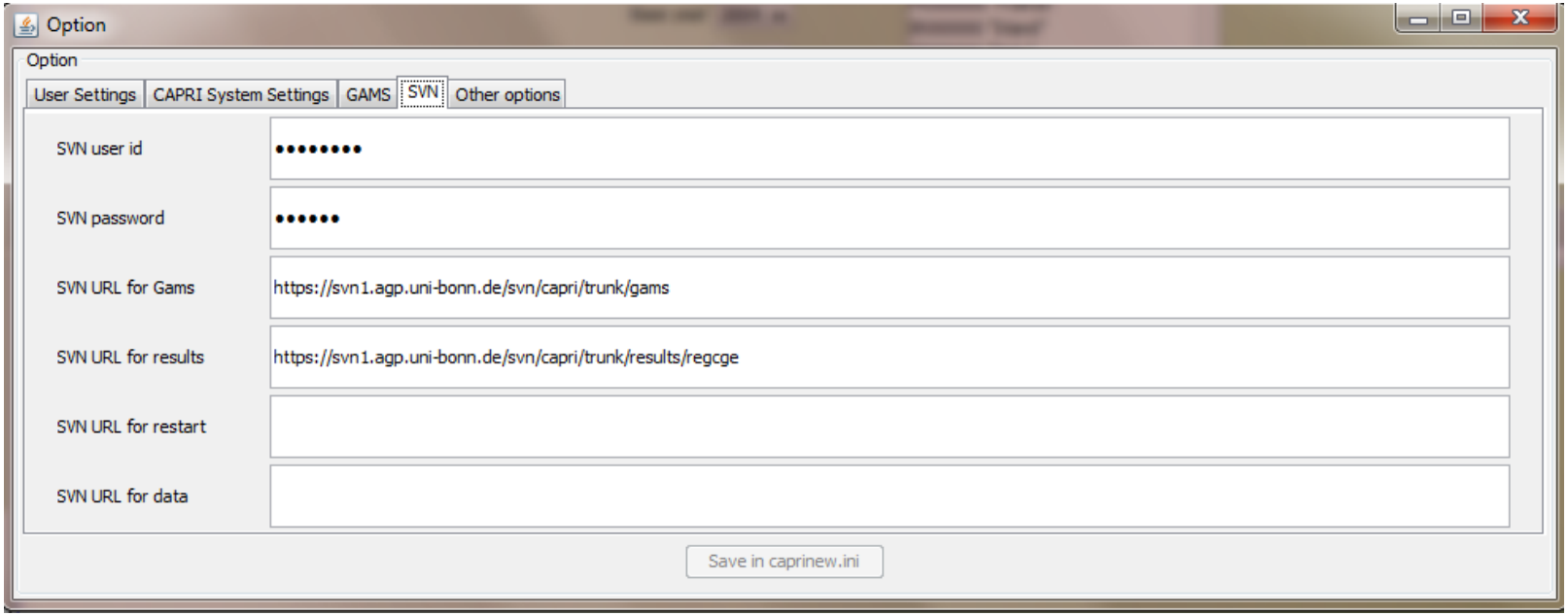
```
$SETGLOBAL mlkRed true

   All settings stored as textual information in s_META set
--------------------------------------------------------------------------------
SET s_META /
--------------------------------------------------------------------------------
'Allow for reduction of max milk yield' 'true'
```

Further functionalities

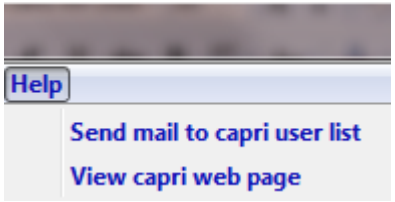
- SVN support



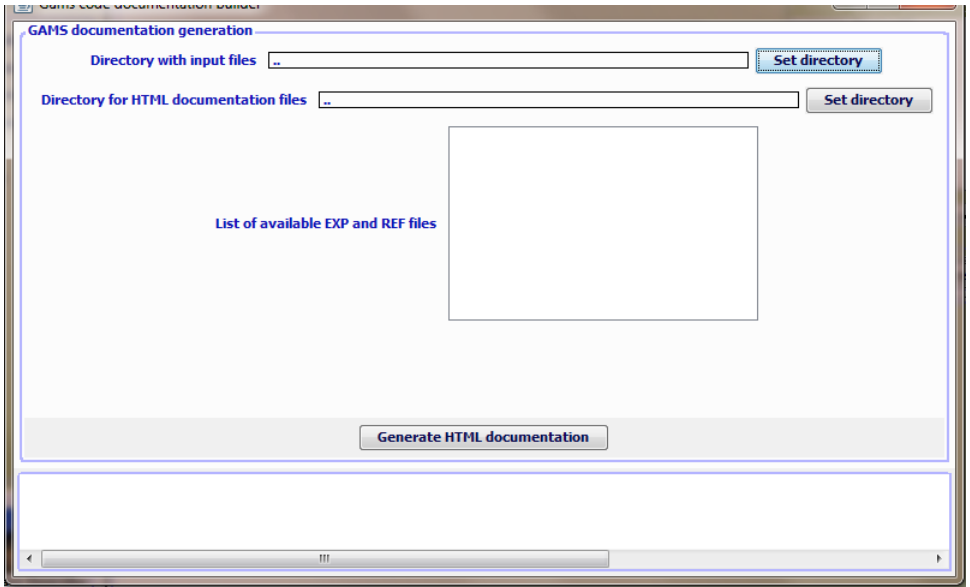


Further functionalities

- Editable menu items to send e-mail and open web pages

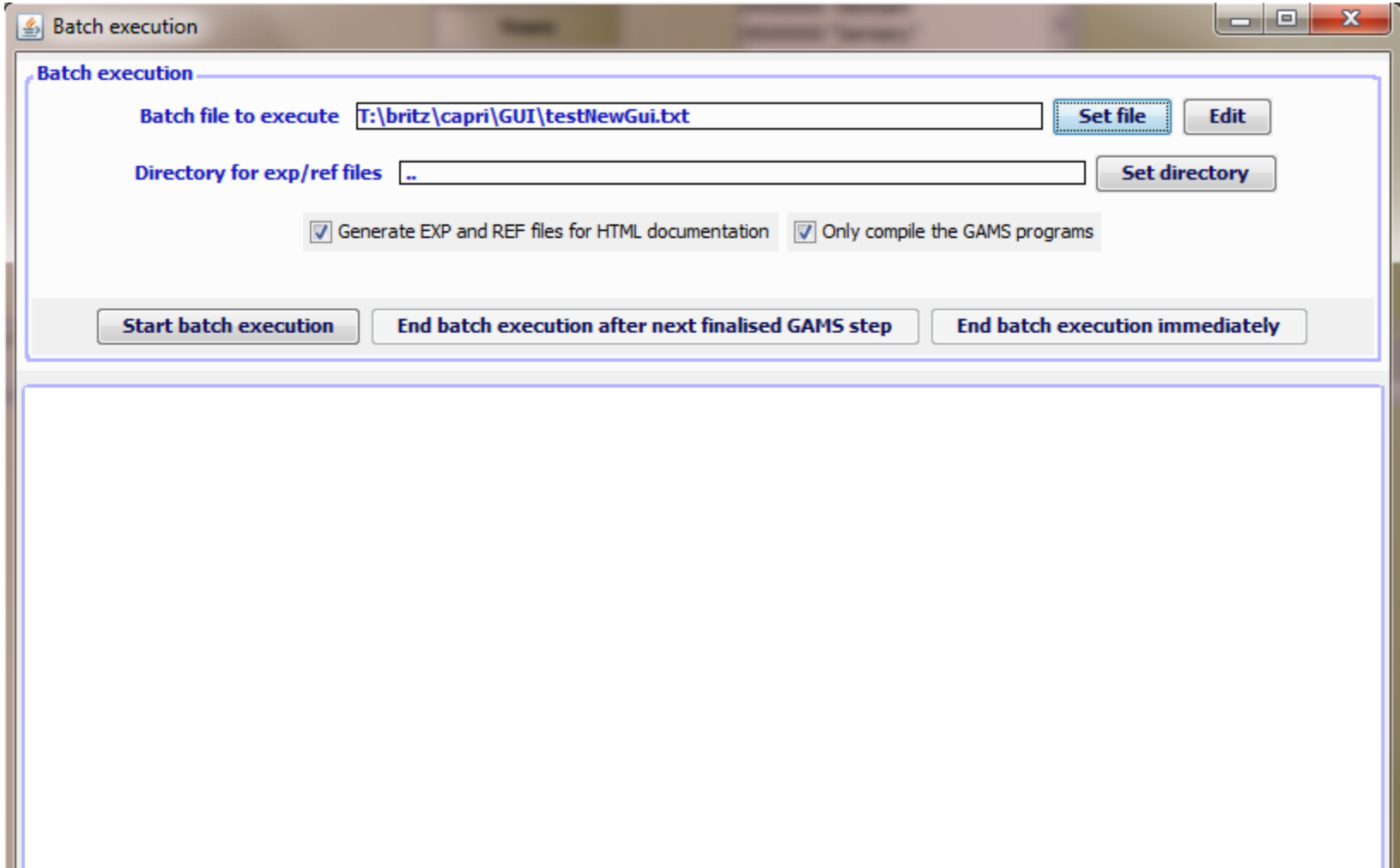


- Utility to build documentation of GAMS code in HTML



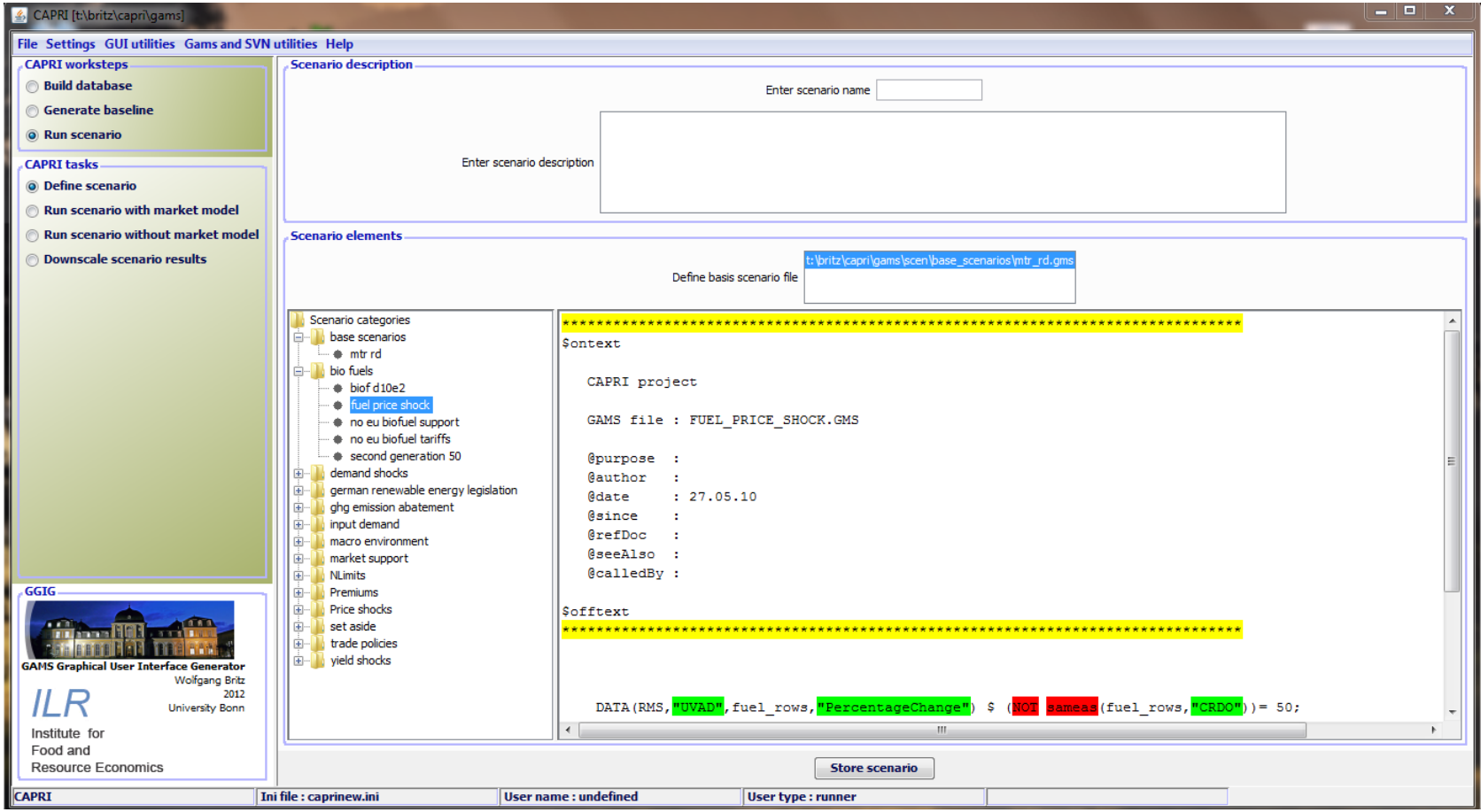
Further functionalities

- Batch execution



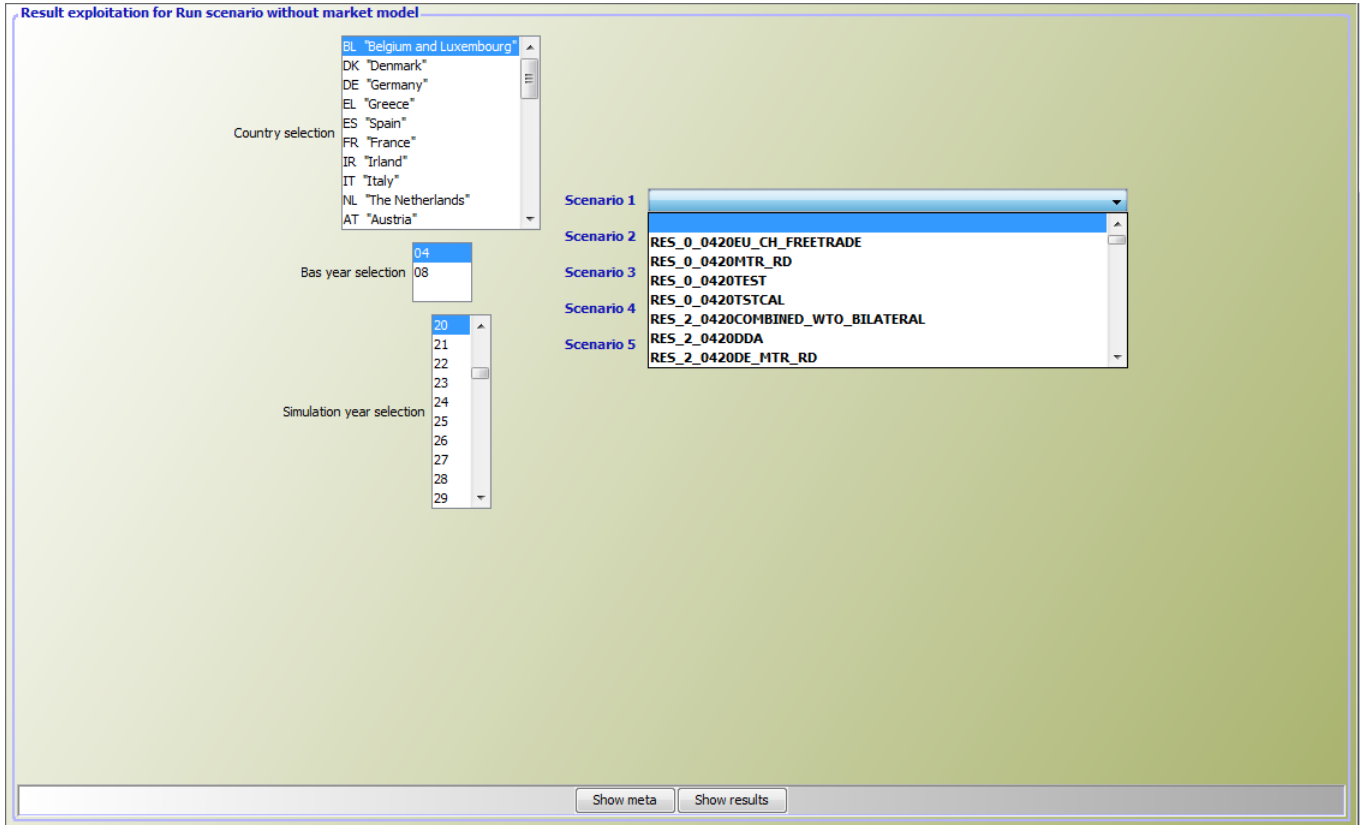
Further functionalities

- Build scenario file from code snippets



Further functionalities

- Filters for scenario selections resp. in GDX cube



Exploitation tools

- A relatively simple report generator for on-line views based on XML
- Support pivots, sorting, adding statistics, manual selection, relative/absolute differences to user chosen items …
- Larger sets of graph type (bar / line / pie charts, histograms, scatter plots …)
- Colored maps, flow maps
- Link to Machine Learning Package
- Export to clipboard and various file formats (GAMS, CSV, XLS, DBF …)

Exploitation tools, tables

Model properties [0]

Version

View type: Table

	NOSHOCK	USER_SCENARIOS_GFT
# of sectors	11.00	11.00
# of factors	5.00	
# of regions	10.00	
Model type	CNS	
# of equations	13332.00	
# of variables	13332.00	
# Iterations	4.00	
# seconds solution time	0.20	
Lab Market	sluggish	
skl Market	sluggish	
capital Market	sluggish	
res Market	sluggish	
Ind Market	sluggish	

Sector overview [0]

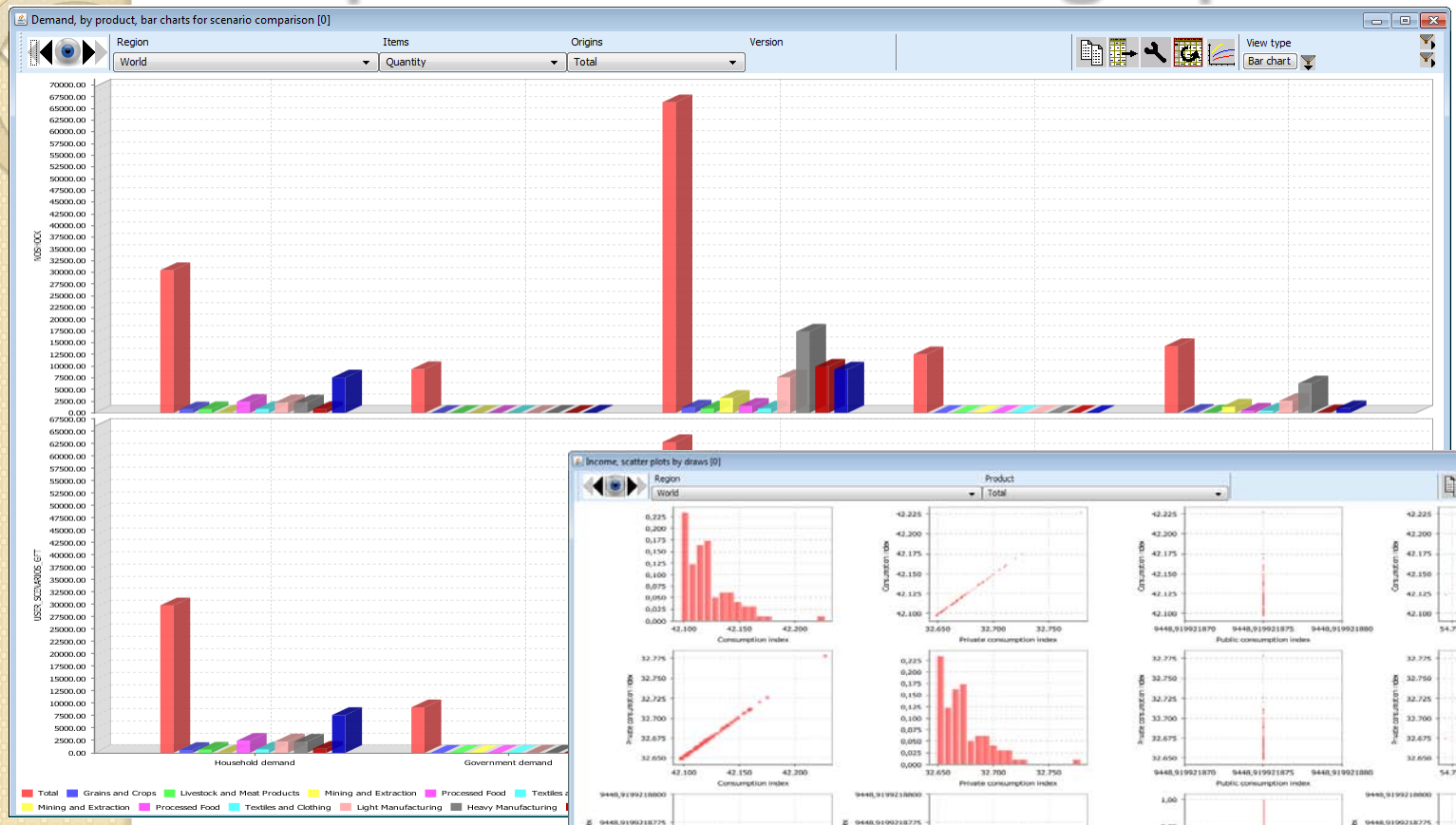
Region: World

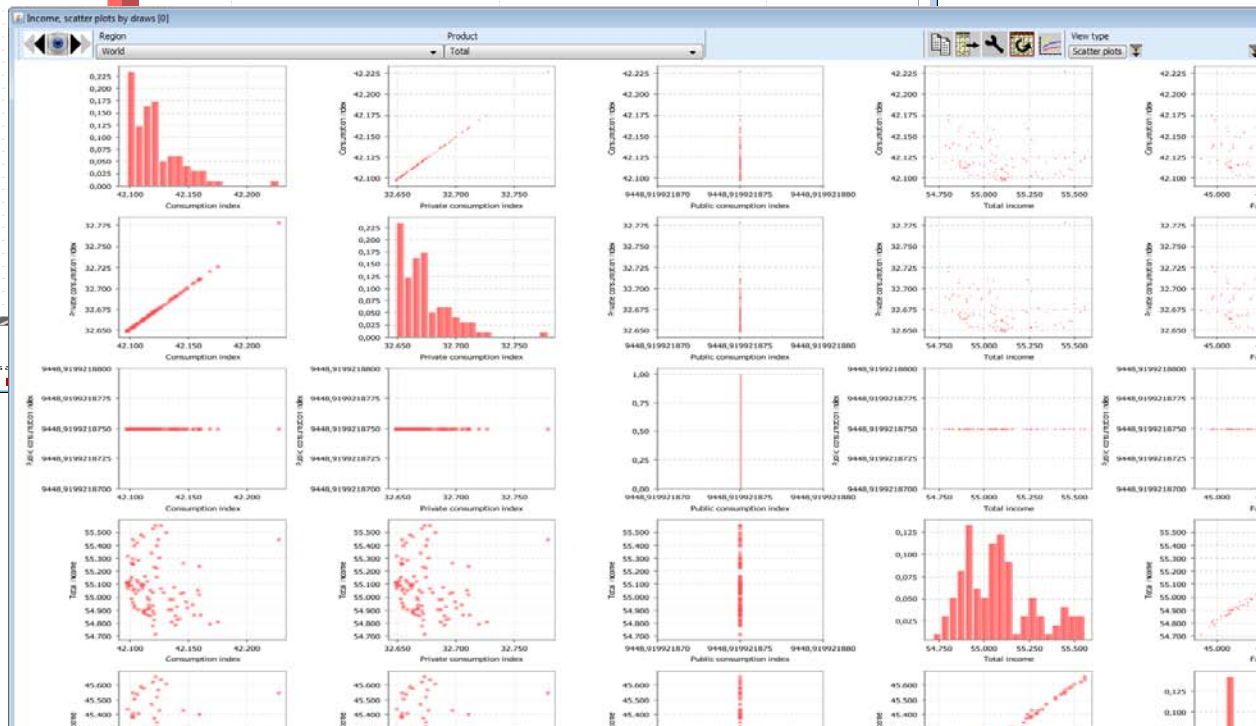
Items: Quantity

USER_SCENARIOS_GFT

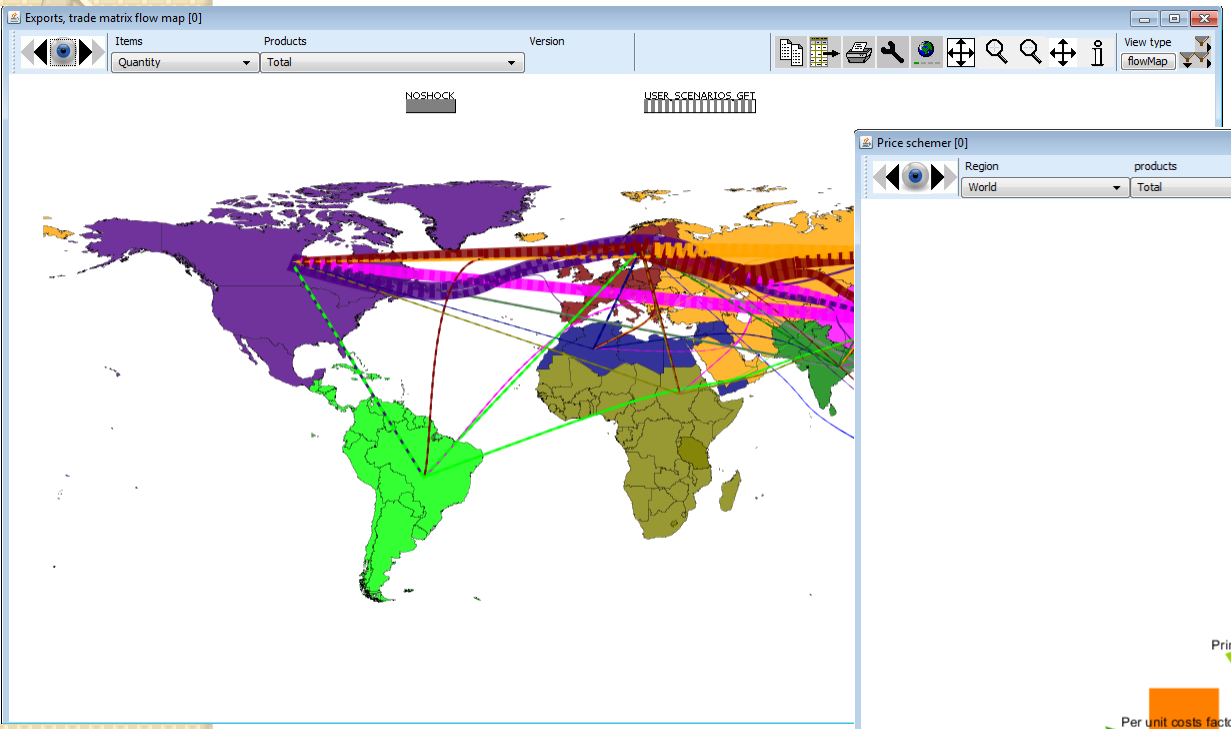
	Total	Grains and Crops	Livestock and Meat Products	Mining and Extraction
Total output	116626.70 -3.64%	1305.26 -32.51%	1330.99 -26.61%	2822. -13.9
Output taxes	1986.06 -3.30%	-15.80 10.18%	10.33 -18.78%	80. -16.2
Total intermediate	64336.36 -5.27%	485.09 -37.19%	825.64 -28.47%	839. -20.6
Total intermediate	836.61 -0.32%	-45.41 12.78%	-6.95 44.91%	6. -32.9
Total factor taxes	4854.85 0.82%	-125.01 7.77%	-5.53 -2546.88%	57. -20.6
Total factor demand	44671.32 -1.64%	996.98 -27.06%	507.82 -22.99%	1839. -10.1
Total intermediate	64336.36 -5.27%	485.09 -37.19%	825.64 -28.47%	839. -20.6
Grains and Crops	747.09 -37.27%	179.96 -14.05%	99.28 -41.49%	
Livestock and Meat Products	668.74 -33.07%	16.50 -21.77%	393.12 -13.93%	
Mining and Extraction	2968.29 -10.31%			99. -19.2
Processed Food	1273.83 -19.41%	2.21 -78.17%	147.44 -25.17%	7. -55.1
Textiles and Clothing	641.68 -35.13%			
Light Manufacturing	7675.46 -1.72%		7.04 -71.65%	30. -52.1
Heavy	17305.07	142.20	33.33	260.

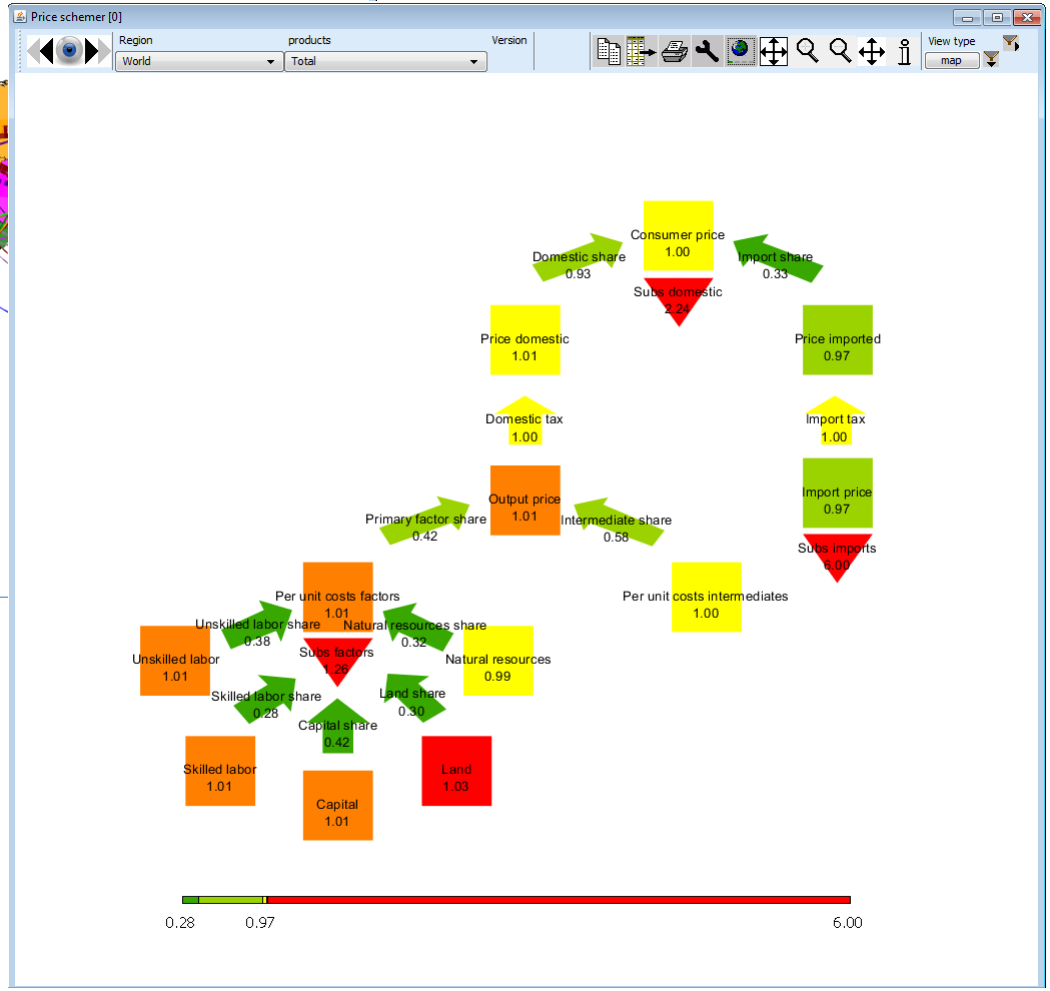
Exploitation tools, graphs





Exploitation tools, maps and schemers





Summary of GGIG

- Relatively easy to use tool to build an interface on a GAMS/R based model
- Powerful exploitation possibilities
- Benefits from 15 years developments for CAPRI