

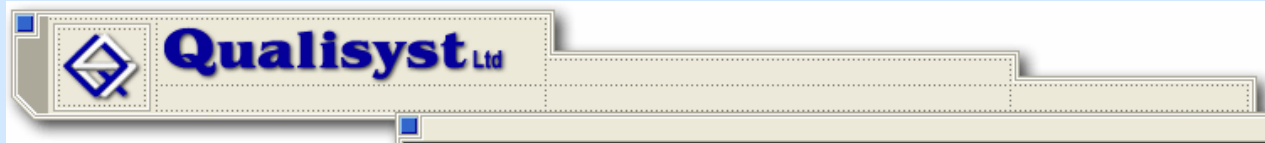
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# Commercial software

**Sarajevo, Bosnia and Herzegovina**  
**29<sup>th</sup> September to 1<sup>st</sup> October 2010**

**Stephan Mieke**

# commercial software – ready to use



[http://www.qsyst.com/qualisyst\\_en.htm](http://www.qsyst.com/qualisyst_en.htm)

**GUM/GUF and GUM S1**



[http://www.metrodata.de/index\\_en.html](http://www.metrodata.de/index_en.html)

**GUM/GUF (only)**



Sidekick.exe.Ink



Type B Calculator.exe.Ink



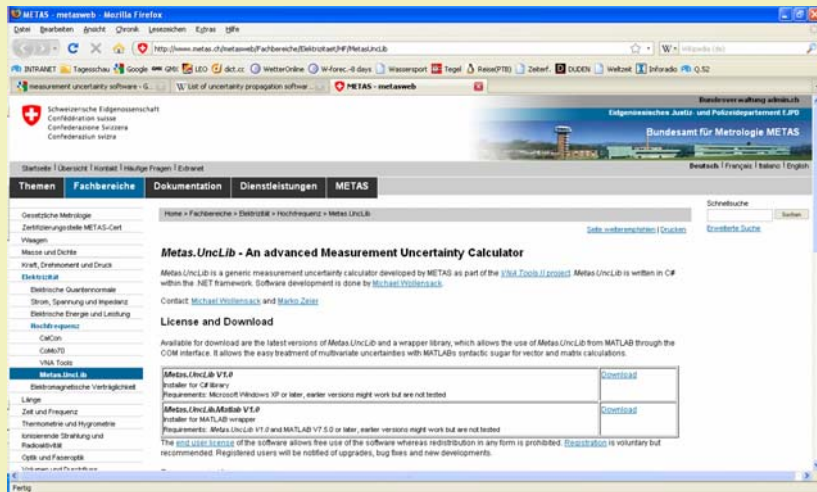
[http://www.isgmax.com/uncertainty\\_freeware.htm](http://www.isgmax.com/uncertainty_freeware.htm)



UnCal3.2.exe.Ink

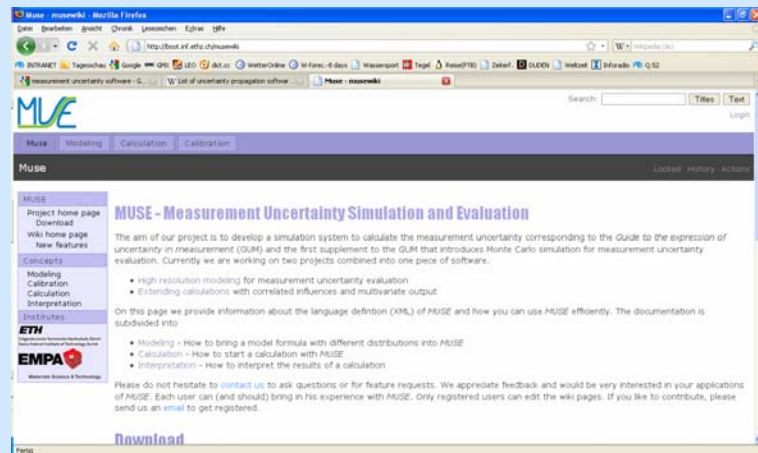
<http://www.callabmag.com/freeware.html>

# commercial software – free program tools



GUM/GUF

<http://www.metas.ch/metasweb/Fachbereiche/Elektrizitaet/HF/MetasUncLib>



GUM S1

<http://boot.inf.ethz.ch/musewiki>

# commercial software



UnCal3.2.exe.Ink



Sidekick.exe.Ink



Type B Calculator.exe.Ink

# commercial software - Metrodata

**Metrodata GmbH** Datenverarbeitung für Messtechnik und Qualitätssicherung

Search:

## GUM Workbench Professional Version 2.4

GUM Workbench Professional Version 2.4 supports the evaluation of measurements with multiple results and multiple budget tables. In Addition to Version 2.3 it supports the import of pictures and graphics and offers the possibility to generate simple plots based on the calculated results. Version 2.4 can run a Monte Carlo simulation on the model.

The Version 2.3 was developed according to the same guidelines as [Version 1.3](#) and [Version 2.3](#). In addition, the in Version 2.4 integrated Monte Carlo simulation was developed according to the guide published by BIPM [Guide to the Expression of Uncertainty in Measurement, Supplement 1: Propagation of distributions using Monte Carlo method](#).

GUM Workbench 2.4 supports all functions of [Version 2.3](#) and in addition the following functions:

- Graphics and pictures in reports and exports
- Integrated plotting-tool for simple diagrams based on the calculated results
- Monte Carlo simulation
- Symbolic derivatives
- Unit validation
- Correlation matrix validation

**Screen views**

A demo of the GUM Workbench Professional Version 2.4 is available in the [Download Section](#) free of charge.

[PDF version of this page](#)

Fertig

# commercial software - Metrodata

The image displays two screenshots of the GUM Workbench Pro software interface, showing the 'Title' and 'Model Equation' tabs. Red circles highlight specific fields and the equation table.

**Top Screenshot (Title Tab):**

- Title: CO2 - Emission
- Reference: [empty]
- Date: 05/18/2010
- Version: [empty]
- Author: Stephan Mieke
- General Description: Determination of the CO2 emission from the burnt coal.

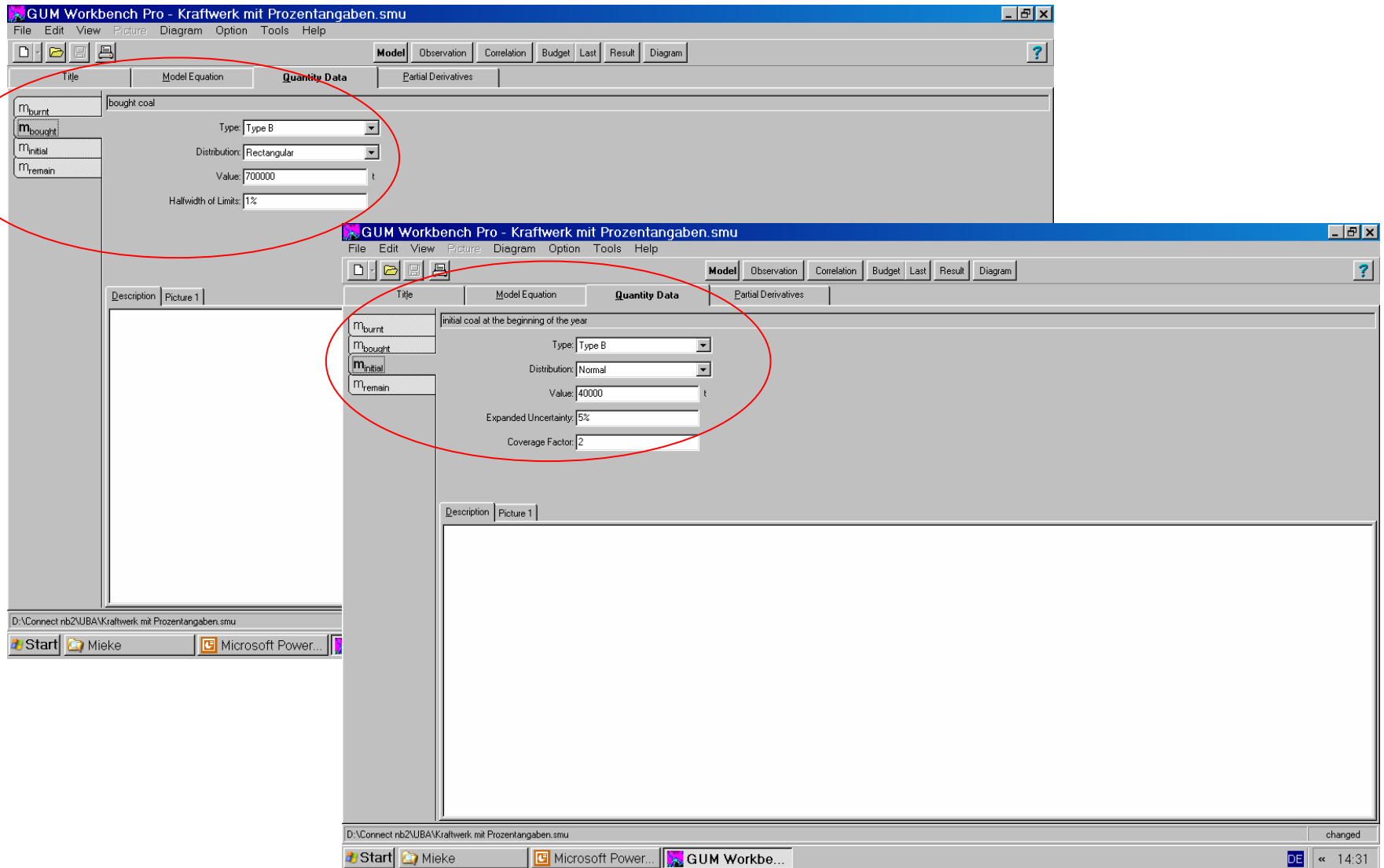
**Bottom Screenshot (Model Equation Tab):**

Equation:

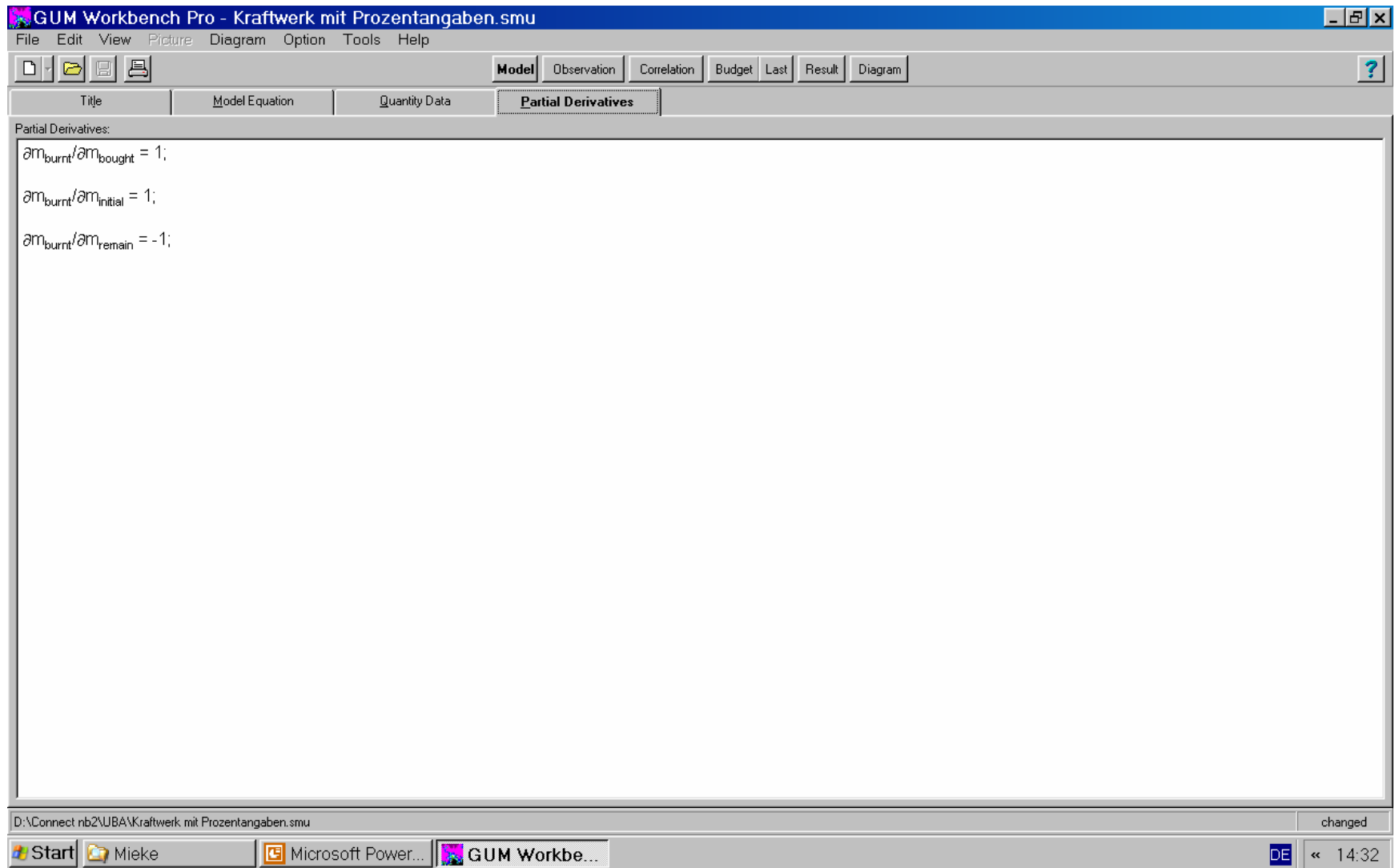
$$m_{\text{burnt}} = m_{\text{bought}} + m_{\text{initial}} - m_{\text{remain}}$$

Quantity	Unit	Definition
$m_{\text{burnt}}$	t	burnt coal
$m_{\text{bought}}$	t	bought coal
$m_{\text{initial}}$	t	initial coal at the beginning of the year
$m_{\text{remain}}$	t	remaining coal at the end of the year

# commercial software - Metrodata



# commercial software - Metrodata





# commercial software - Metrodata

GUM Workbench Pro - Kraftwerk mit Prozentangaben.smu

File Edit View Picture Diagram Option Tools Help

Model Observation Correlation **Budget** Lost Result Diagram

m\_burnt

burnt coal

Uncertainty Budget:

Quantity	Value	Standard Uncertainty	Distribution	Sensitivity Coefficient	Uncertainty Contribution	Index
m_bought	700.00·10 <sup>3</sup> t	0.58 % (rel)	rectangular	1.0	5.77·10 <sup>-3</sup> (rel)	89.1 %
m_initial	40000 t	2.5 % (rel)	normal	1.0	1.43·10 <sup>-3</sup> (rel)	5.5 %
m_remain	40000 t	2.5 % (rel)	normal	-1.0	-1.43·10 <sup>-3</sup> (rel)	5.5 %

m\_burnt 700.00·10<sup>3</sup> t 0.61 % (rel)

Result:

Value: 700.0·10<sup>3</sup> t Expanded Uncertainty: ± 8600 t Coverage Factor: 2.00 Coverage: 95% (normal)

D:\Connect nb2\UBA\Kraftwerk mit Prozentangaben.smu changed

Start Mieke Microsoft Power... GUM Workbe... DE << 14:32

# commercial software - Metrodata

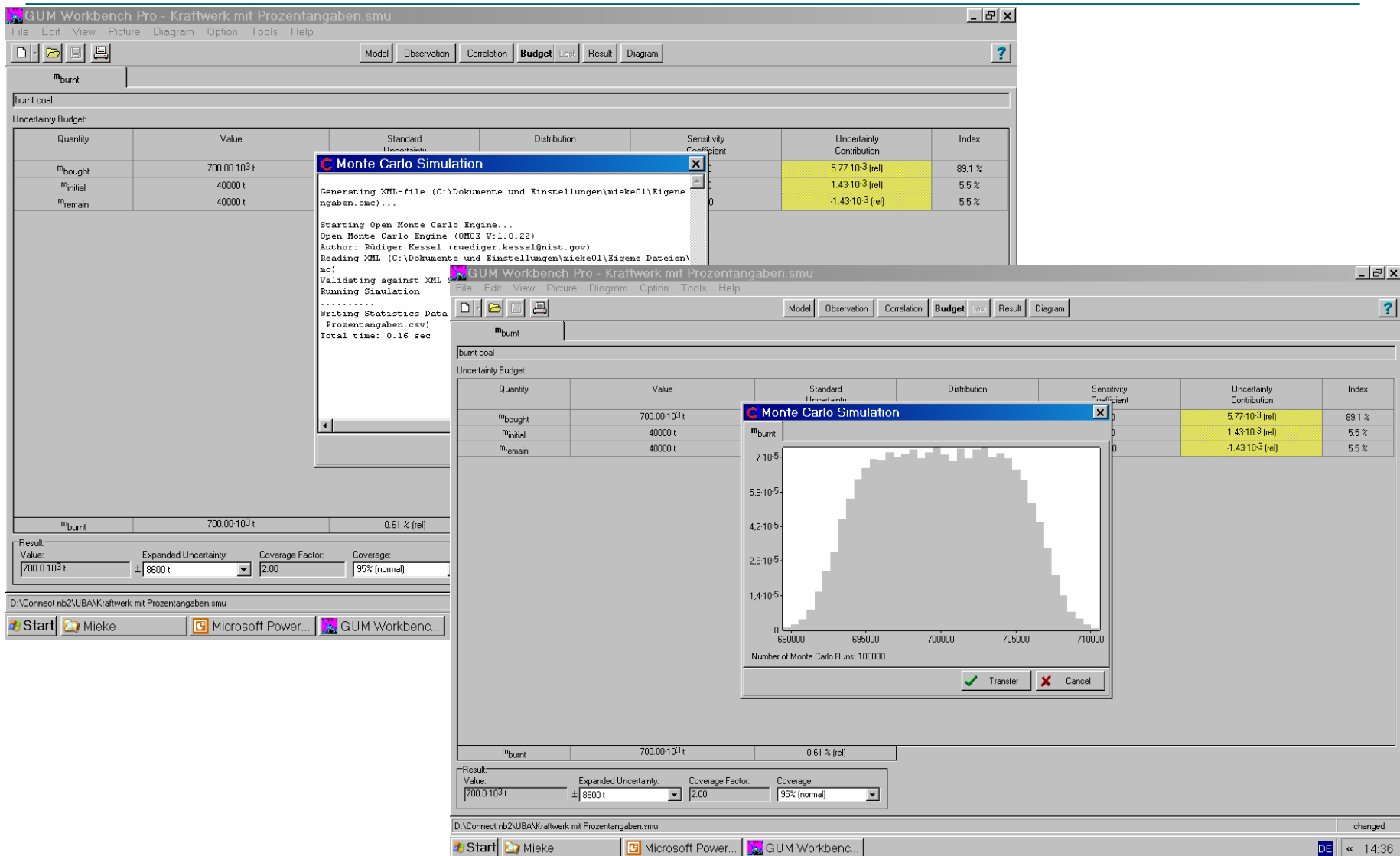
The screenshot displays the GUM Workbench Pro software interface. The main window shows a project titled "Kraftwerk mit Prozentangaben.smu". The "Tools" menu is open, and the "Monte Carlo Simulation..." option is highlighted. A dialog box titled "Monte Carlo Simulation" is open, showing the "Configuration" tab. The dialog includes options for "Select Monte Carlo Engine" (set to "Open Monte Carlo Engine"), "Monte Carlo Runs" (Manual, Number of Runs: 10 x 10000), "Adaptive" (Interval Probability: 0.95, Tolerance Divisor: 1), and "Histogram" (Number of Bars: 40, Probability of the Width: 0.99, Extension Factor: 1.2). The "Save Binary Data File" checkbox is unchecked. The "Run" button is highlighted.

The background window shows a table with the following data:

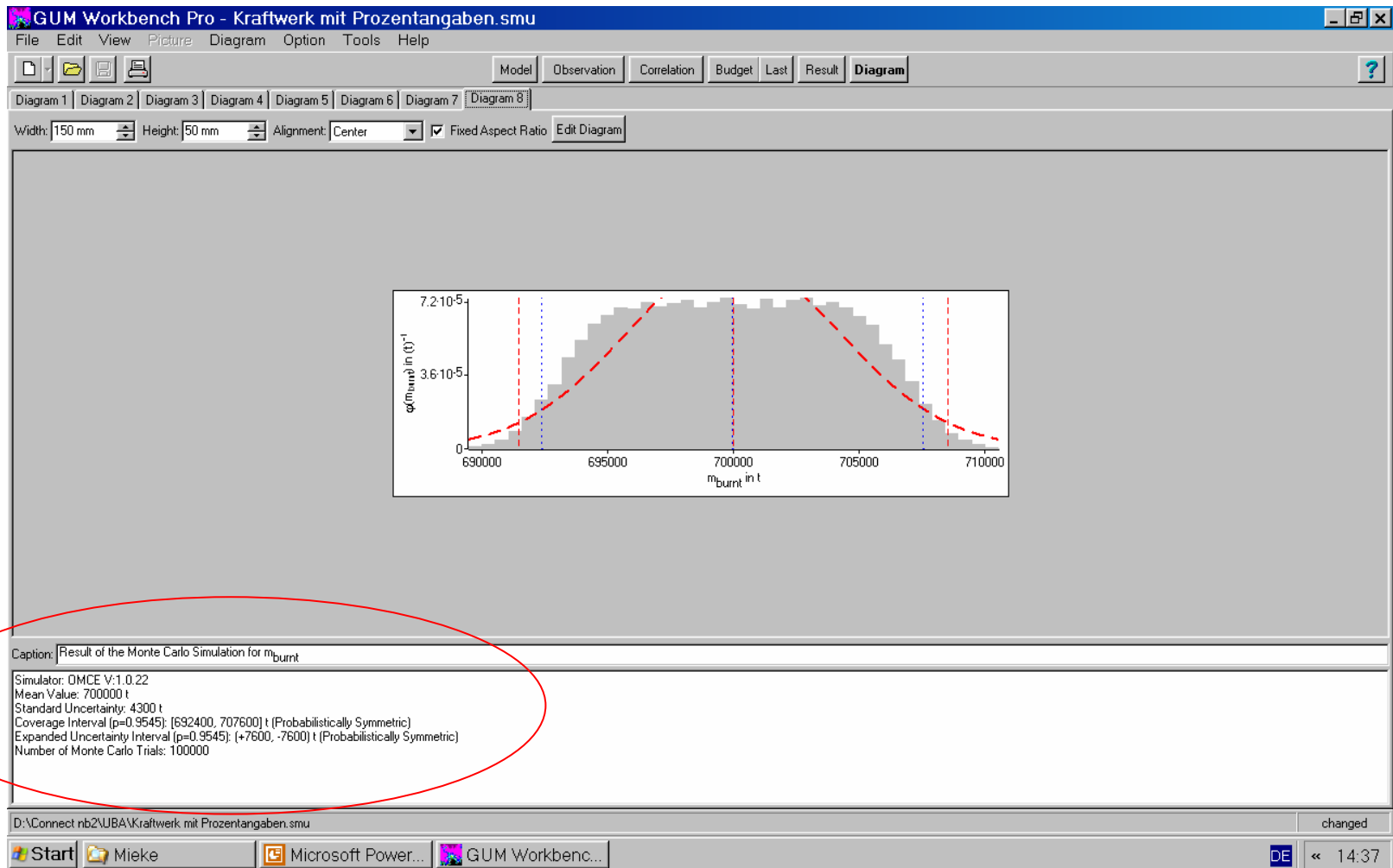
Quantity	Value	Standard Uncertainty	Distribution	Sensitivity Coefficient	Uncertainty Contribution	Index
m <sub>bought</sub>	700.00 t	0.36 % (rel)	rectangular	1.0	5.77 · 10 <sup>-3</sup> (rel)	89.1 %
m <sub>initial</sub>	40000 t	2.5 % (rel)	normal	1.0	1.43 · 10 <sup>-3</sup> (rel)	5.5 %
m <sub>remain</sub>	40000 t					

The bottom of the window shows the Windows taskbar with the Start button, Mieke, and Microsoft Power...

# commercial software - Metrodata



# commercial software - Metrodata



# commercial software - Qualisyst

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Measurement Uncertainty | QMSys GUM Enterprise | QMSys GUM Professional

**Editions of the QMSys software for the evaluation of the measurement uncertainty**

- ❖ **QMSys GUM Enterprise** is the ultimate software tool for analysis of the measurement uncertainty, using the two most powerful methods to calculate the measurement uncertainty - the GUM uncertainty framework and the Monte-Carlo method.
- ❖ **QMSys GUM Professional** offers evaluation of the measurement uncertainty according to GUM Uncertainty Framework and validation of results using a Monte Carlo method
- ❖ **QMSys GUM Educational** is a **freeware** for the classical calculation of the measurement uncertainty according to GUM Uncertainty Framework.

**Compliance with standards and guidelines**

The software is compliant with the demands of the standards:

- ❖ **ISO/IEC/EN 17025:2005** - General Requirements for the Competence of Testing and Calibration Laboratories.
- ❖ **ANSI/NCSL Z540.3-2006** - Requirements for the Calibration of Measuring and Test Equipment.

This is because the analysis and computations follow the rules of the official regulations and guidelines:

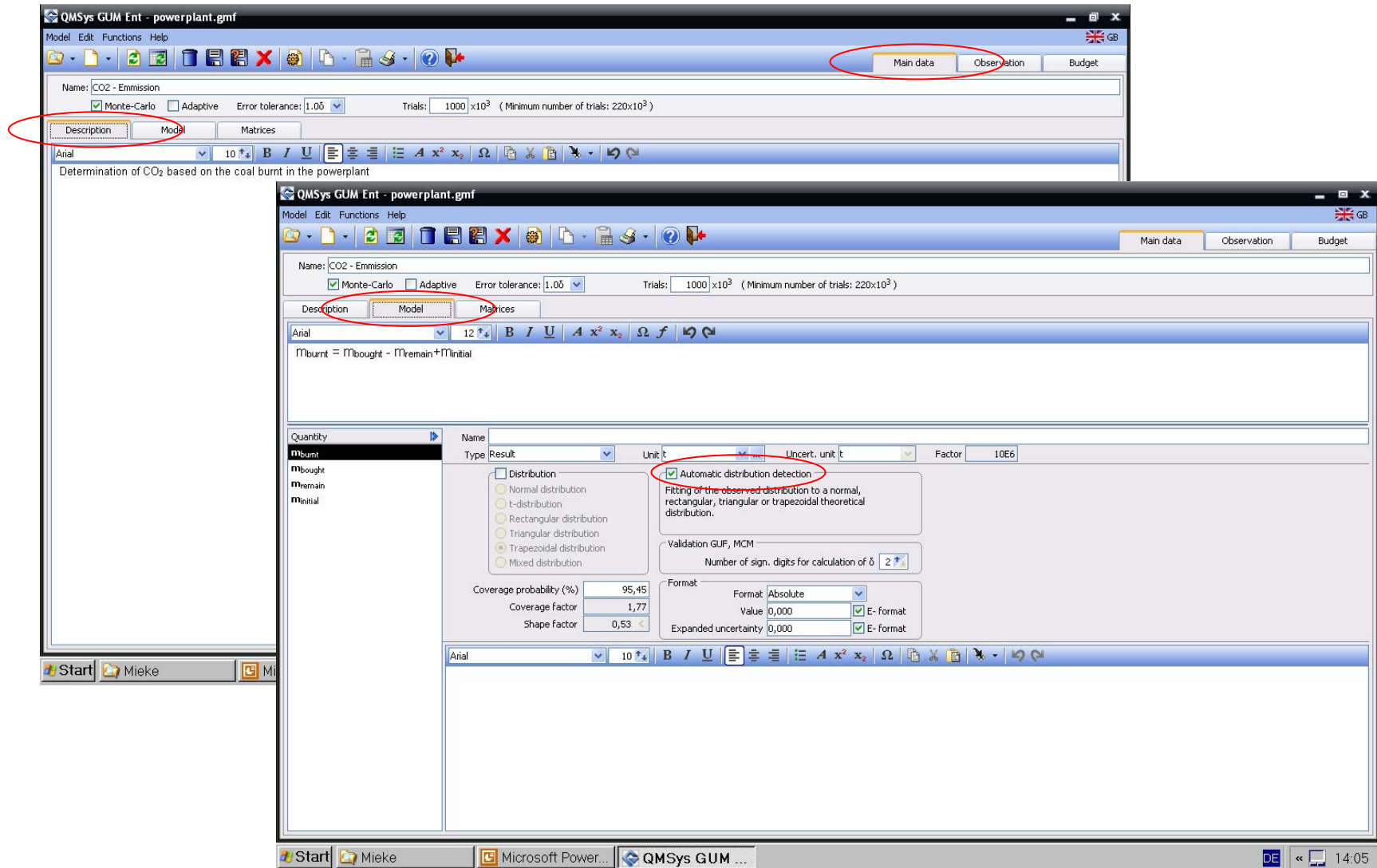
- ❖ **ISO ENV 13005:1999** Guide to the expression of uncertainty in measurement
- ❖ **JCGM 101:2008 Supplement 1 to the "GUM"** - Propagation of distributions using a Monte-Carlo method
- ❖ **ANSI/NCSL Z540.2** - U.S. Guide to the Expression of Uncertainty in Measurement
- ❖ **EA-4/02** Expression of the Uncertainty of Measurement in Calibration.
- ❖ **UKAS M3003** - The Expression of Uncertainty and Confidence in Measurement
- ❖ **DKD-3** - Expression of the Uncertainty of Measurement in Calibration
- ❖ **VDA Band 5** - Measuring Process Suitability
- ❖ **EURACHEM/CITAC Guide**, Quantifying Uncertainty in Analytical Measurement
- ❖ **NPL Report DEM-ES-010** Software specifications for uncertainty evaluation.
- ❖ **NPL Report DEM-ES-011** SSfM Best Practice Guide No 6: Uncertainty evaluation

The functionality of the different versions is shown in the following table:

**3D2F.COM**  
SOFTWARE DIRECTORY

[QMSys GUM Enterprise - an immensely powerful tool for measurement uncertainty analysis](#)

# commercial software - Qualisyst



The screenshot displays the QMSys GUM Ent software interface for configuring a model named 'CO2 - Emission'. The main window shows the 'Description' tab with the formula  $M_{burnt} = M_{bought} - M_{remain} + M_{initial}$ . The 'Quantity' list on the left includes  $M_{burnt}$ ,  $M_{bought}$ ,  $M_{remain}$ , and  $M_{initial}$ . The  $M_{bought}$  quantity is selected, showing its evaluation type as 'Error limit', distribution as 'Rectangular', value as '700000 t', and error limit as '1 % (relative)'. A smaller window titled 'QMSys GUM Ent - powerplant.gmf' is visible in the foreground, showing the same configuration for the 'mass or remaining coal at the end of the year' quantity.



**EURAMET**  
European Association of National Metrology Institutes



# commercial software - Qualisyst

QMSys GUM Ent - powerplant.gmf

Model Functions Budget Help

Name: CO2 - Emission

☒ Monte-Carlo ☐ Adaptive Error tolerance: 1.00 Trials: 1000 x10<sup>3</sup> (Minimum number of trials: 220x10<sup>3</sup>)

mbunt

Quantity	Value	Stand. uncert.	Distribution	Deg. of fr.	Sensit. coeff.	Uncert. contribution	Rel. contribution (Graph.)
m <sub>bought</sub>	700000 t	4000 t	Rectangular	∞	1,00	0,0040 t	
m <sub>remain</sub>	40000 t	1000 t	Normal	∞	-1,00	-0,0010 t	
m <sub>initial</sub>	40000 t	1000 t	Normal	∞	1,00	0,0010 t	
Value Comb. stand. uncertainty Effective degrees of freedom							
m <sub>bunt</sub>	700000 t	0,0043 t	∞				
Value Expanded uncertainty Coverage factor Coverage probability Distribution							
Result	700000,000 t	± 0,008 t	1,77	95,45 %	Trapezoidal (β=0,53)		

GUF validated: δ: Δ Result: Δ Comb. stand. uncert.: Coverage intervals: Unit [t]

Yes 500 [-2] [-2] GUF [692421:707579] MCM [692407:707597] Δ [14:-18]

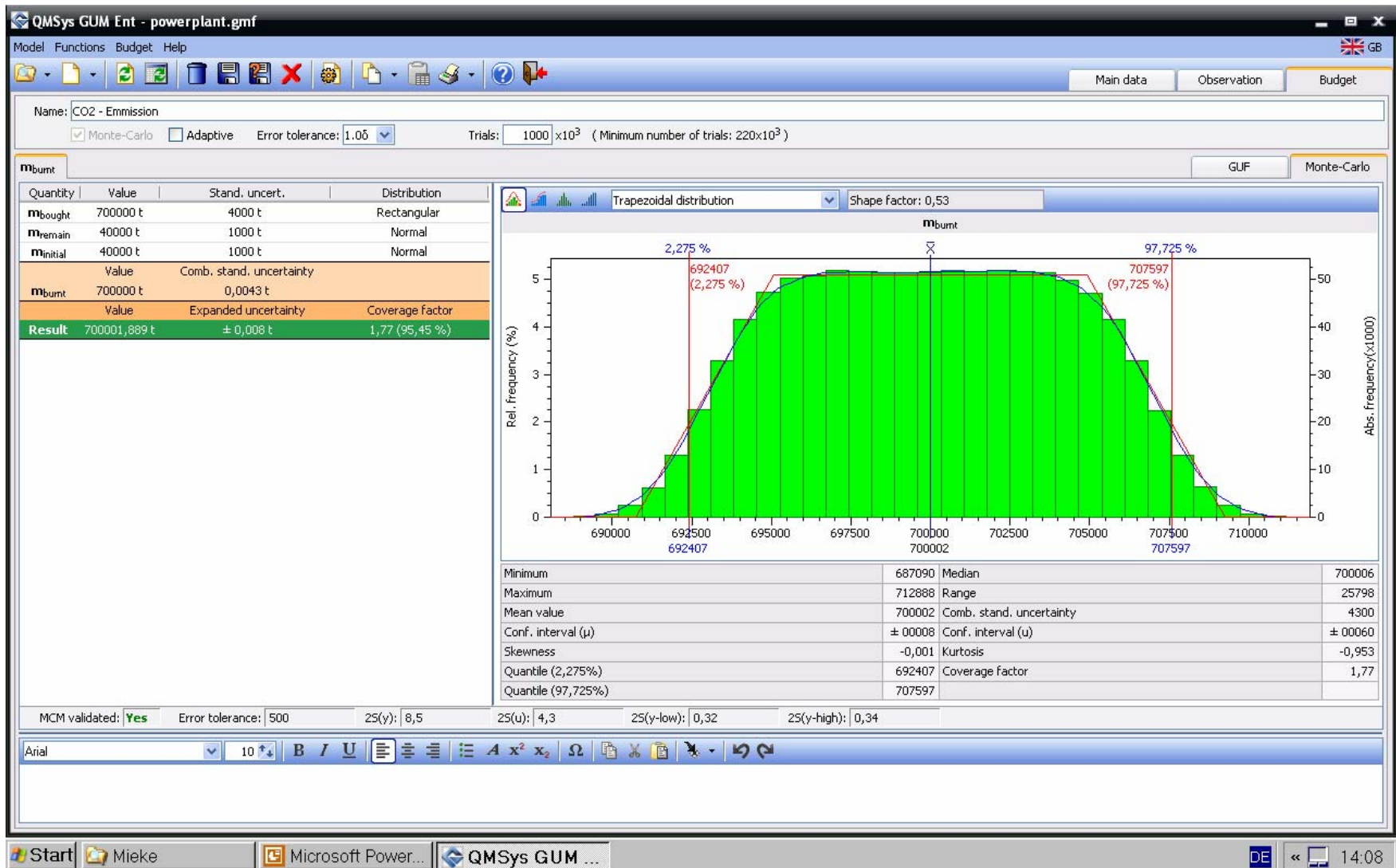
MCM: Value 700001,889 t Comb. stand. uncertainty 0,0043 t Expanded uncertainty ± 0,008 t

Arial 10 B I U

Start Mieke Microsoft Power... QMSys GUM ... DE 14:09



# commercial software - Qualisyst



# commercial software - conclusion

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## Conclusion

- commercial and non-commercial software is available
- non-commercial software offers program tools
- the latest commercial software packages include MCM\*
- software – especially when MCM\* is included – is a very helpful tool to determine the measurement uncertainty
- how do the manufacturer guarantee that their software is reliable?

in the case of MCM\* the user has not chance to verify the software

\* MCM: Monte Carlo Method

**Thank you for your attention.**

**Questions ???**

*stephan.mieke@ptb.de*