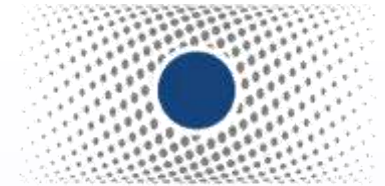




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# Tar Content and Composition in Producer Gas of Fluidized Bed Gasification of Wood – Influence of Temperature and Pressure

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# Introduction

At **Vienna University of Technology** (VUT) **various** gasification **processes** are **investigated** and, therefore, a **large data pool** of GCMS measured tar is available for comparison.

In **thermo-chemical** biomass **conversion** processes, especially gasification, the **tar** content and composition is a **major subject**.

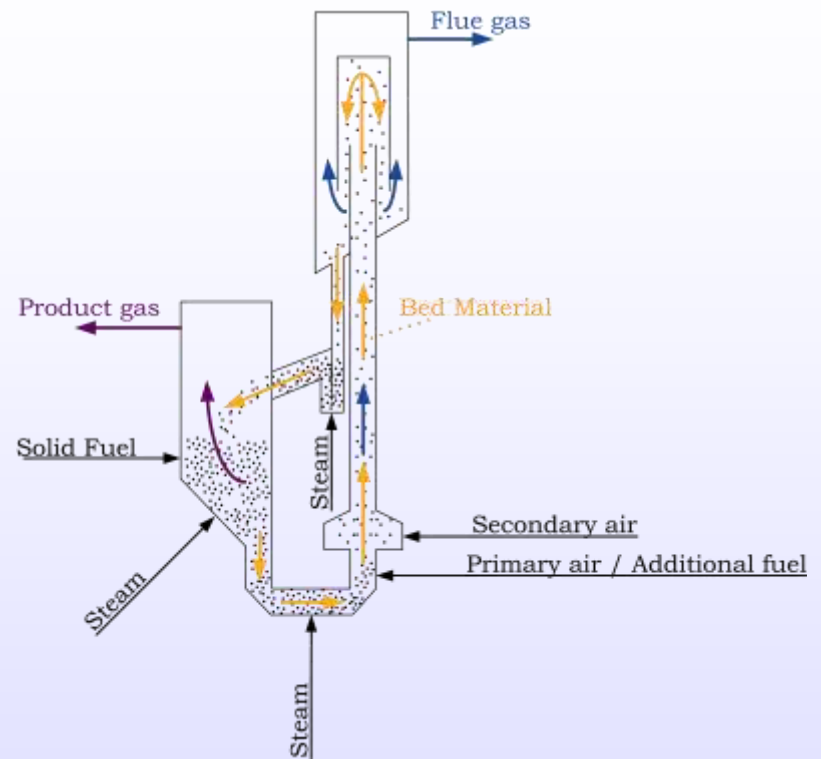
These speech should give a **further insight** into tar composition and formation.

Gasification Process which would be compared:

- 100kW Dual Fluidized Bed Gasifier Pilot Plant (DFB)
- 70kW Pressurized Research Unit (PRU)

# 100kW Dual Fluidized Bed Gasifier Pilot Plant (DFB)

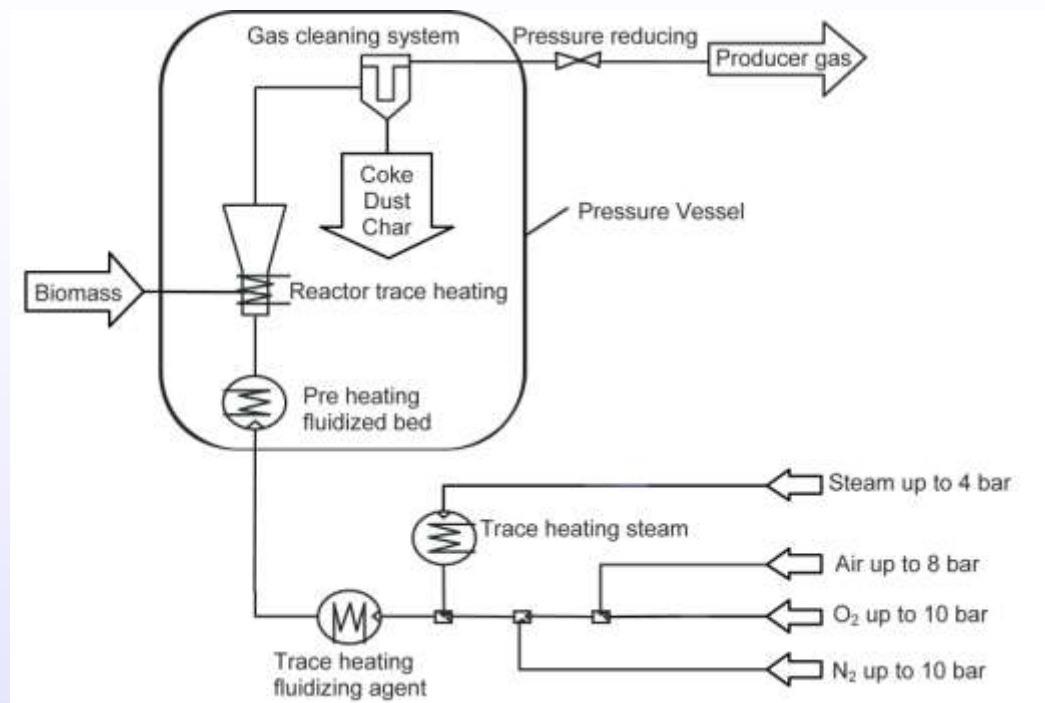
	Gasification zone	Combustion zone
Height [m]	2	5
Diameter [m]	0,31	0,15
Fuel feed dry	Biomass 20 kg/h	Light fuel oil 2 kg/h
Air flow	-	55 SCM
Steam flow	21 SCM	-
Temperatures	700 C...870 C	800 C...950 C
Bed material	Olivine	
Pressure	Atmospheric	



CO	CO <sub>2</sub>	CH <sub>4</sub>	H <sub>2</sub>	C <sub>2</sub> H <sub>4</sub>	C <sub>2</sub> H <sub>6</sub>	C <sub>3</sub> H <sub>8</sub>	tar GCMS	dust	quick coke
[vol%dry]							[g/SCM dry]		
17...	18...	8...	32...	0,58...	0,03...	0,10...	4,5...	8,0...	12,2...
25	28	11	42	2,87	1,68	0,34	18	20	28,4

# 70kW Pressurized Research Unit (PRU)

	Gasifier
Height [m]	0,35
Diameter [m]	0,08
Fuel feed	Wood pellets 4...6 kg/h dry fuel
Air flow	7,2 SCM
Bed material	Olivine
Pressure	1 bar...5 bar
Temperature	750 C...900 C



CO	CO <sub>2</sub>	CH <sub>4</sub>	H <sub>2</sub>	N <sub>2</sub>	tar GCMS
[vol% dry]					[g/SCM dry]
8...	14,5...	3...	6...	38...	1,7...
22	18,5	6	20,5	66	4,5

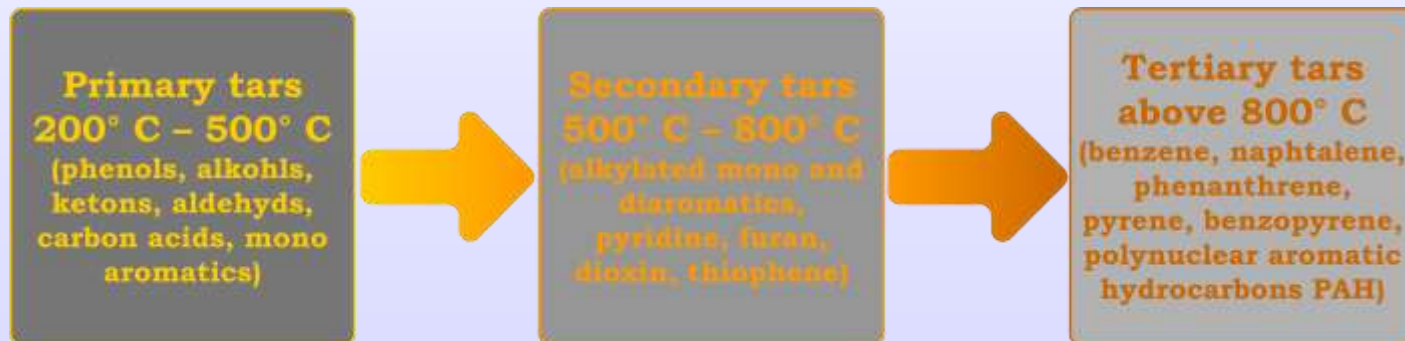
# Tar Classification / Definition

**Hydrocarbon containing mixtures**, which can form **liquid** or **highly viscose to solid deposits** by cooling of the gaseous phase down to ambient temperature, are generally **called tars**.

Containing elements: carbon, hydrogen, oxygen,  
nitrogen, sulfur (depend on fuel)

## Tar formation

For the tar classification various ways are accessible for instance the division in **primary**, **secondary** and **tertiary** tar.



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## Tar formation

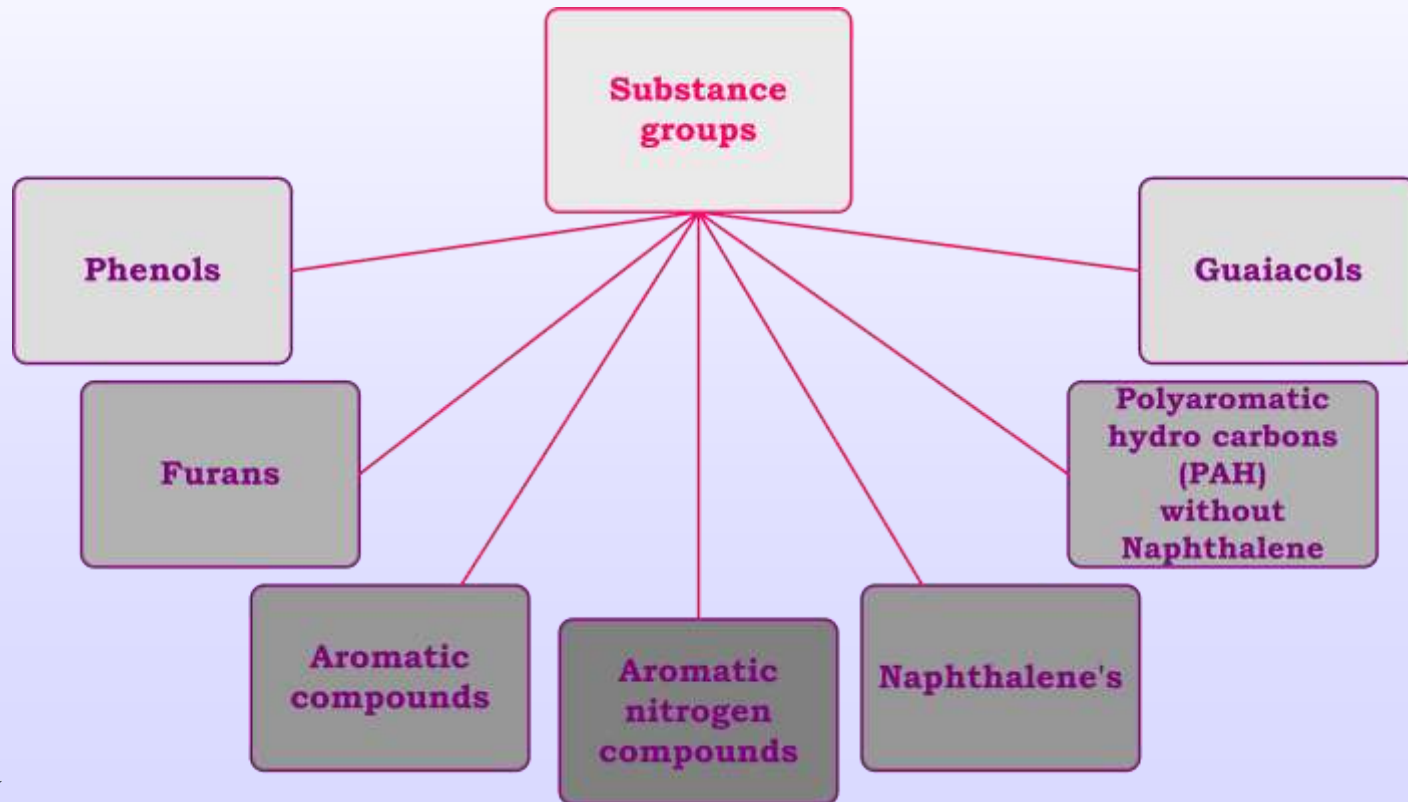
For the tar classification various ways are accessible  
Or classification based on **molecular weight**



# Tar Classification chosen in this work

For a better and easier interpretation of the GCMS results the measured components were classified in **substance groups**.

The substance groups were chosen due to the related **chemical structure and properties** as well as formation groups.

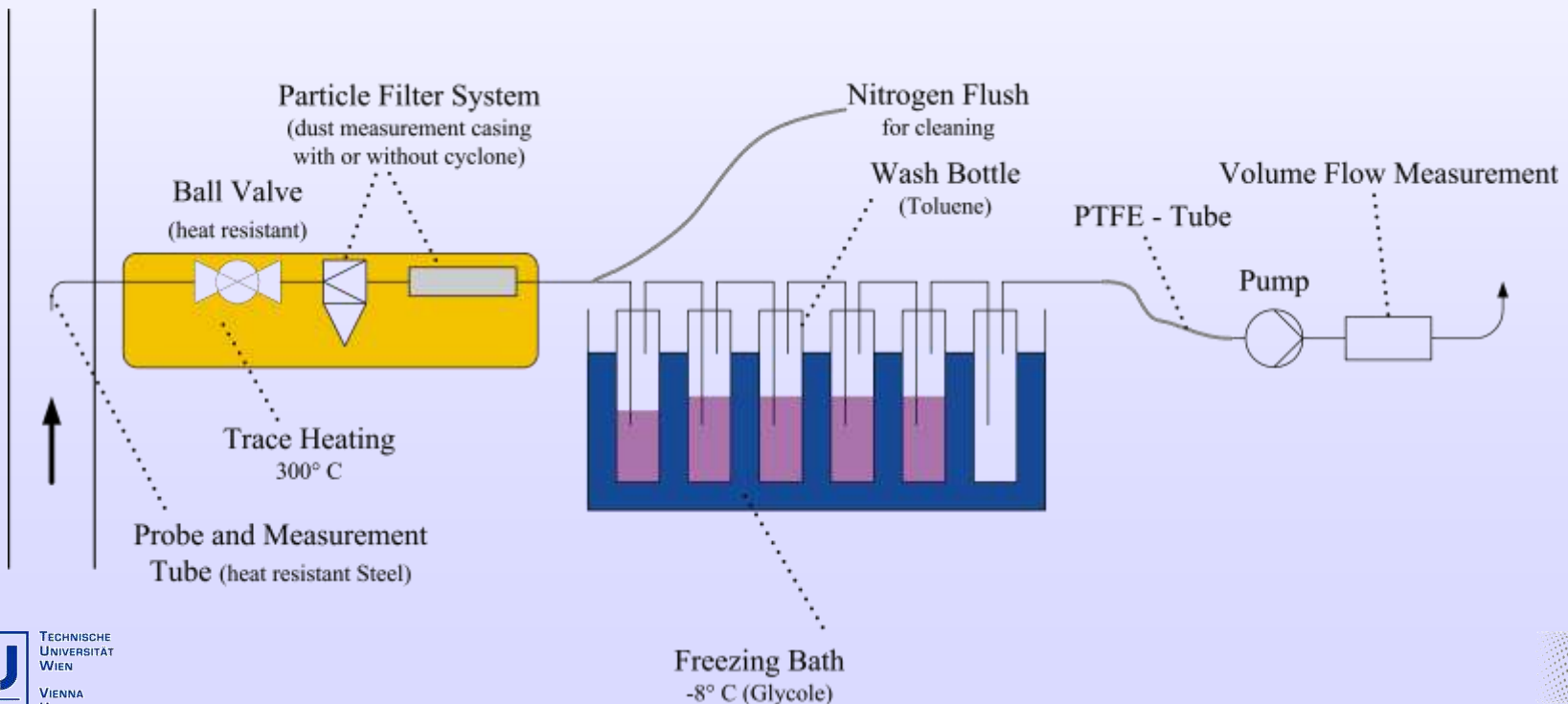


# Tar Measurement Technique

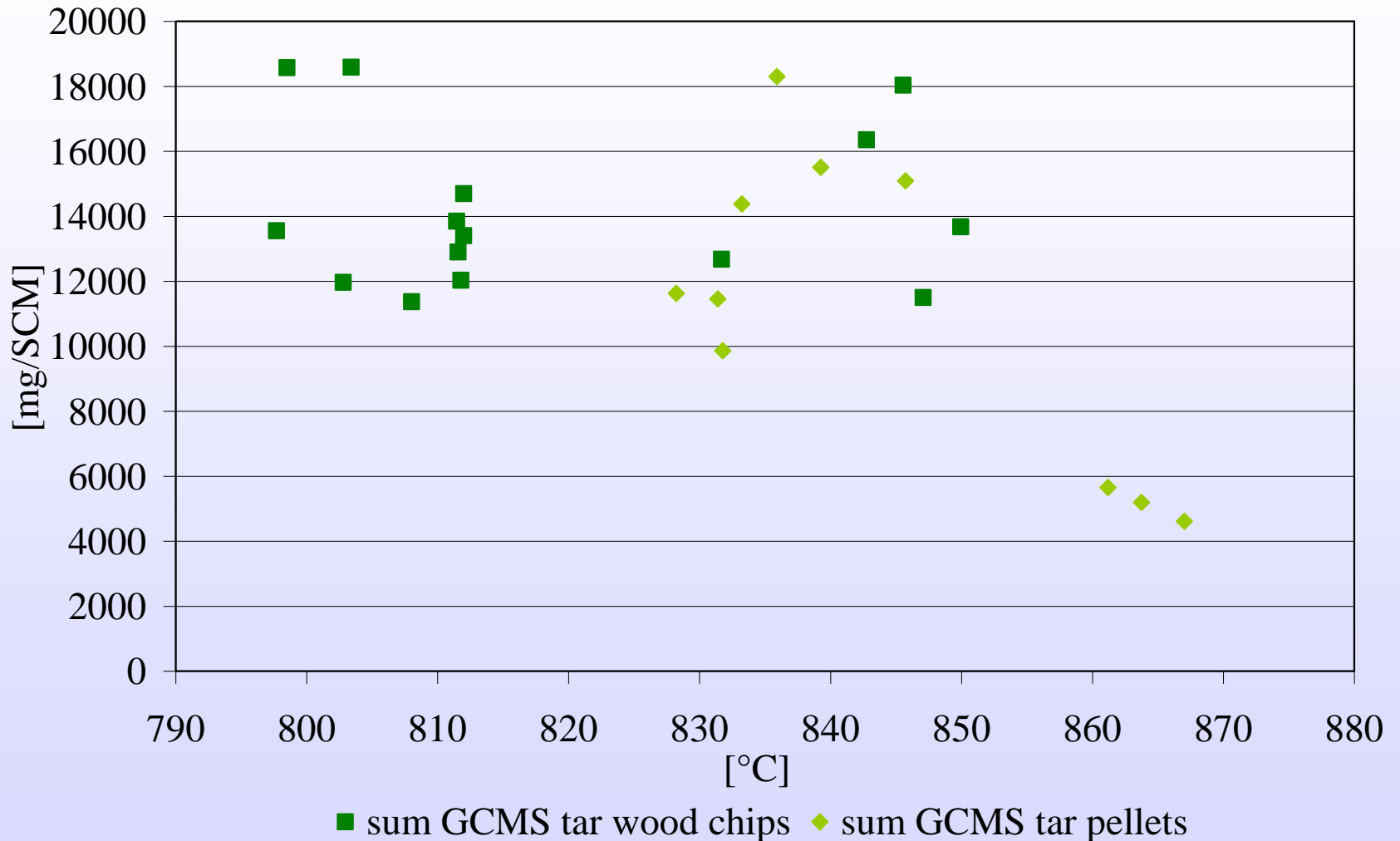
The analysis, calculation and sampling for GCMS tar follows the CEN/TS 154 39:2006 biomass gasification – tar and particles in product gases – sampling and analysis (**Tar guideline**).

The method has been adopted for the possibilities and needs at VUT

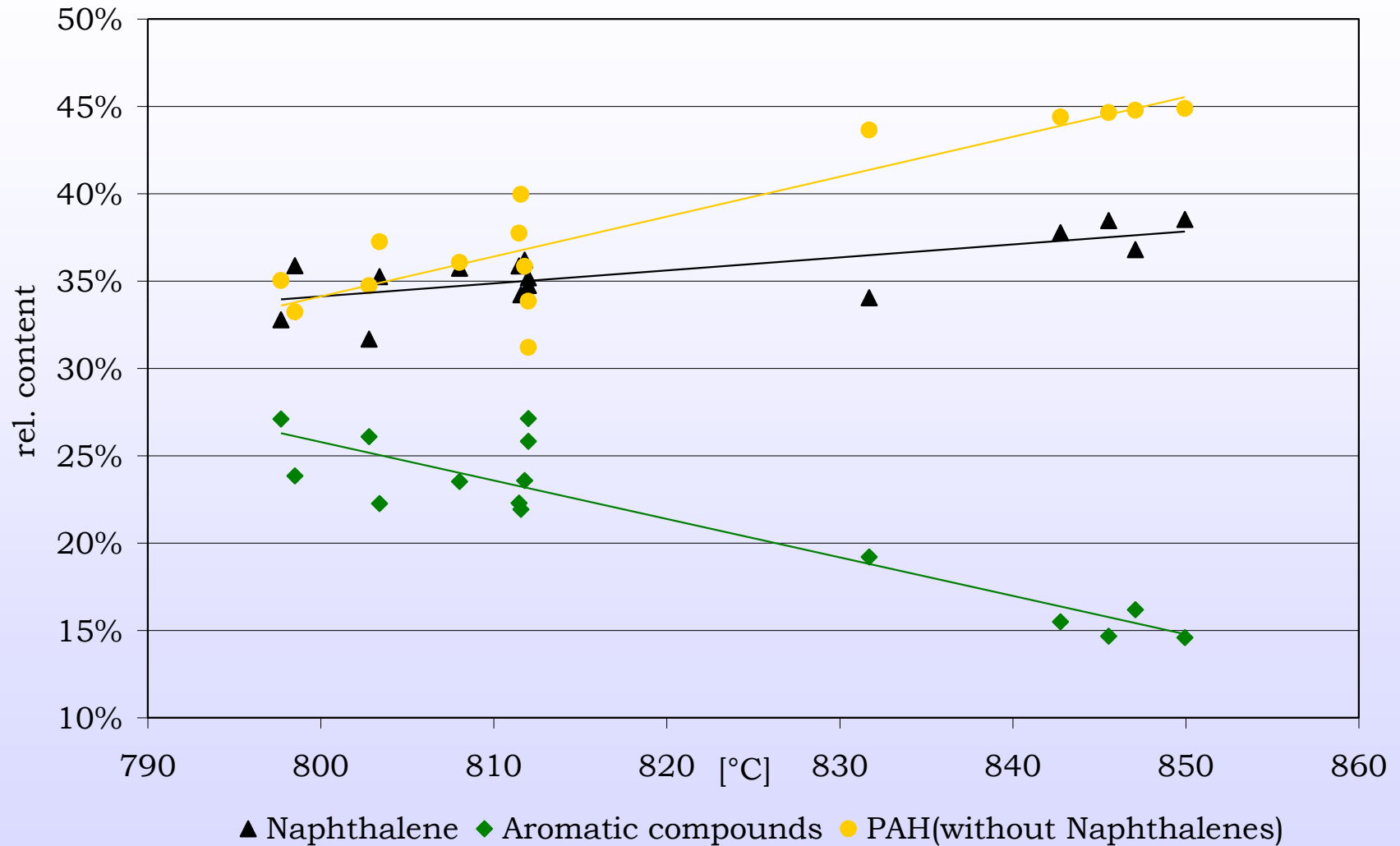
Tar sampling scheme:



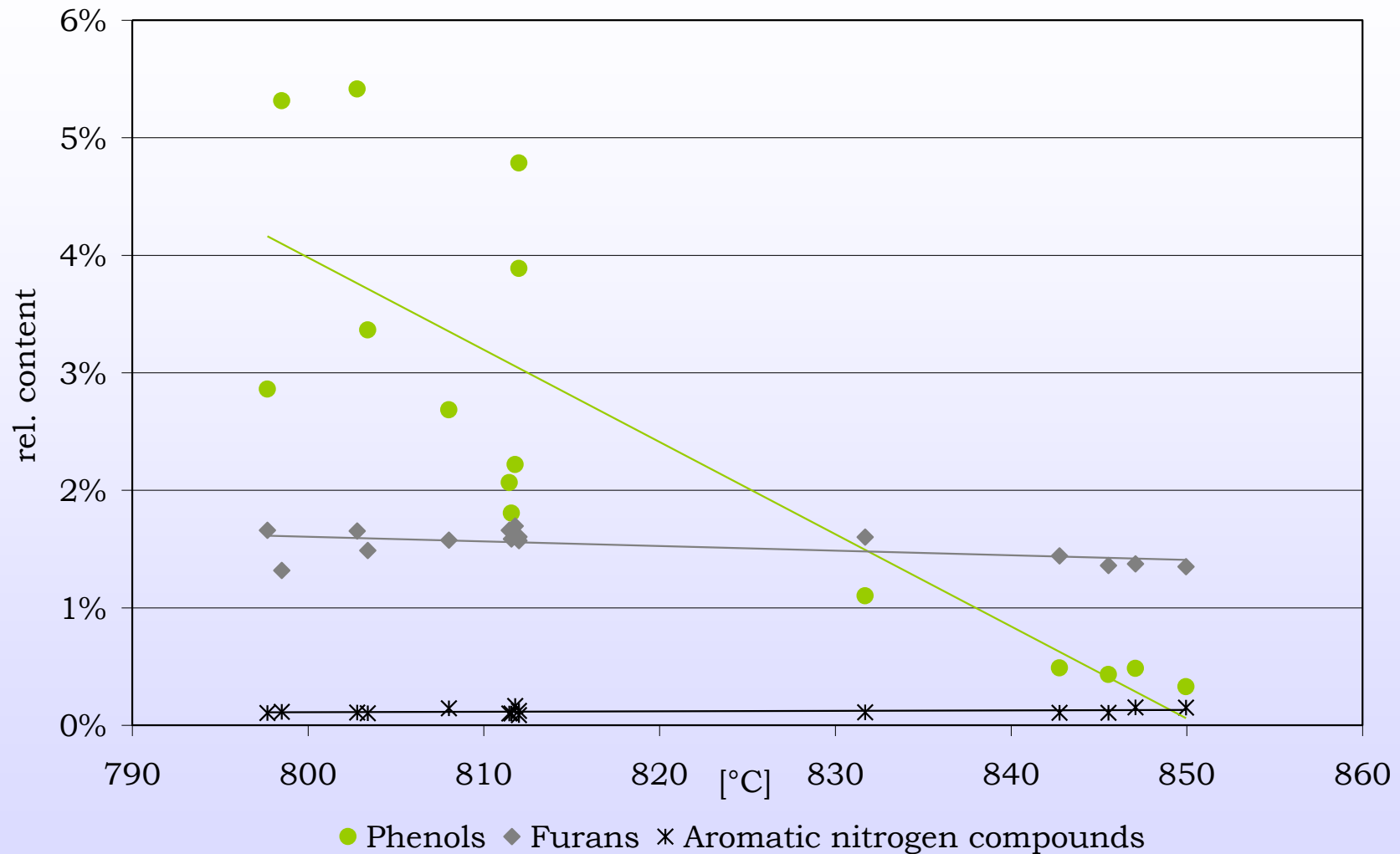
# DFB Tar content in producer gas



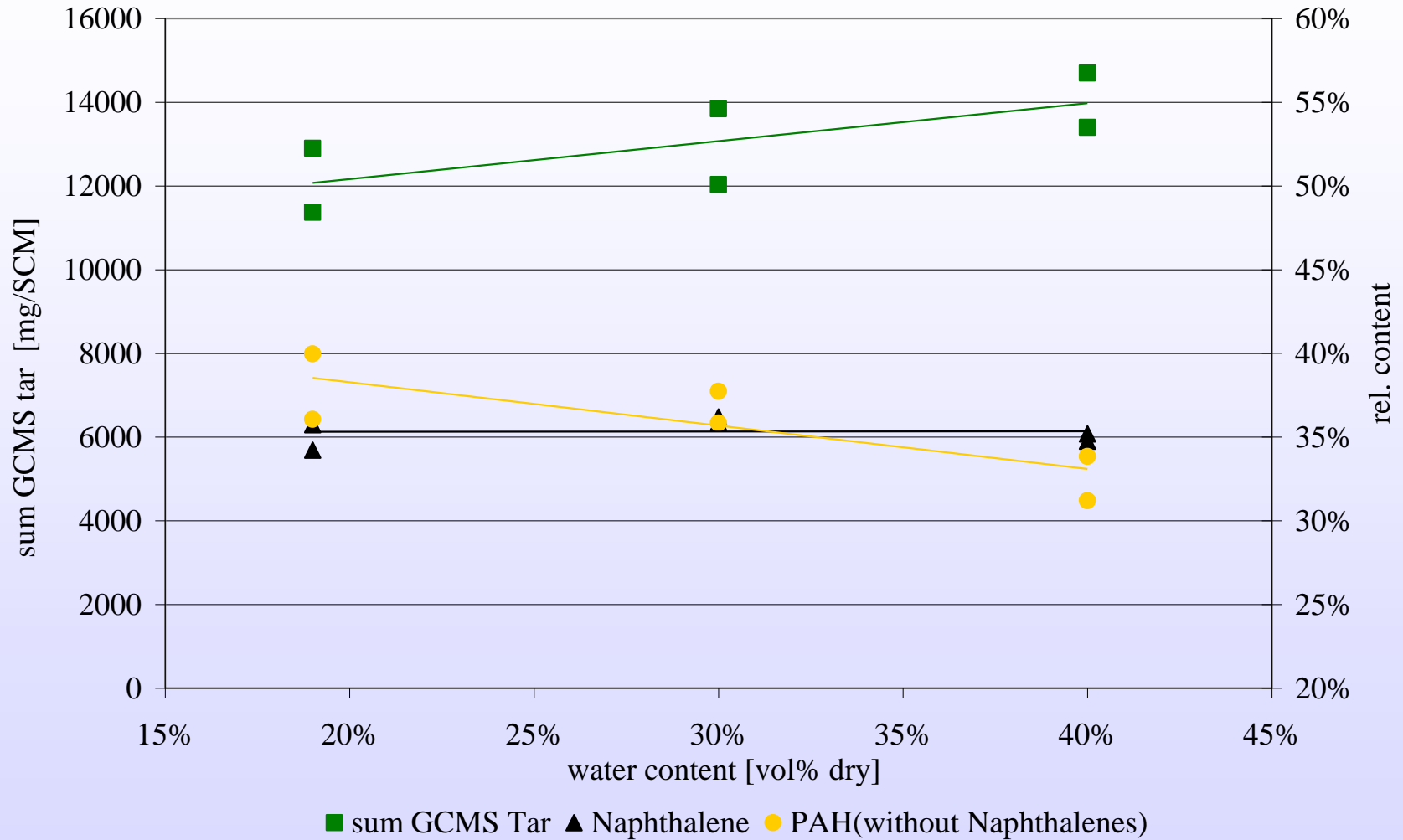
# DFB Tar composition from wood chips gasification



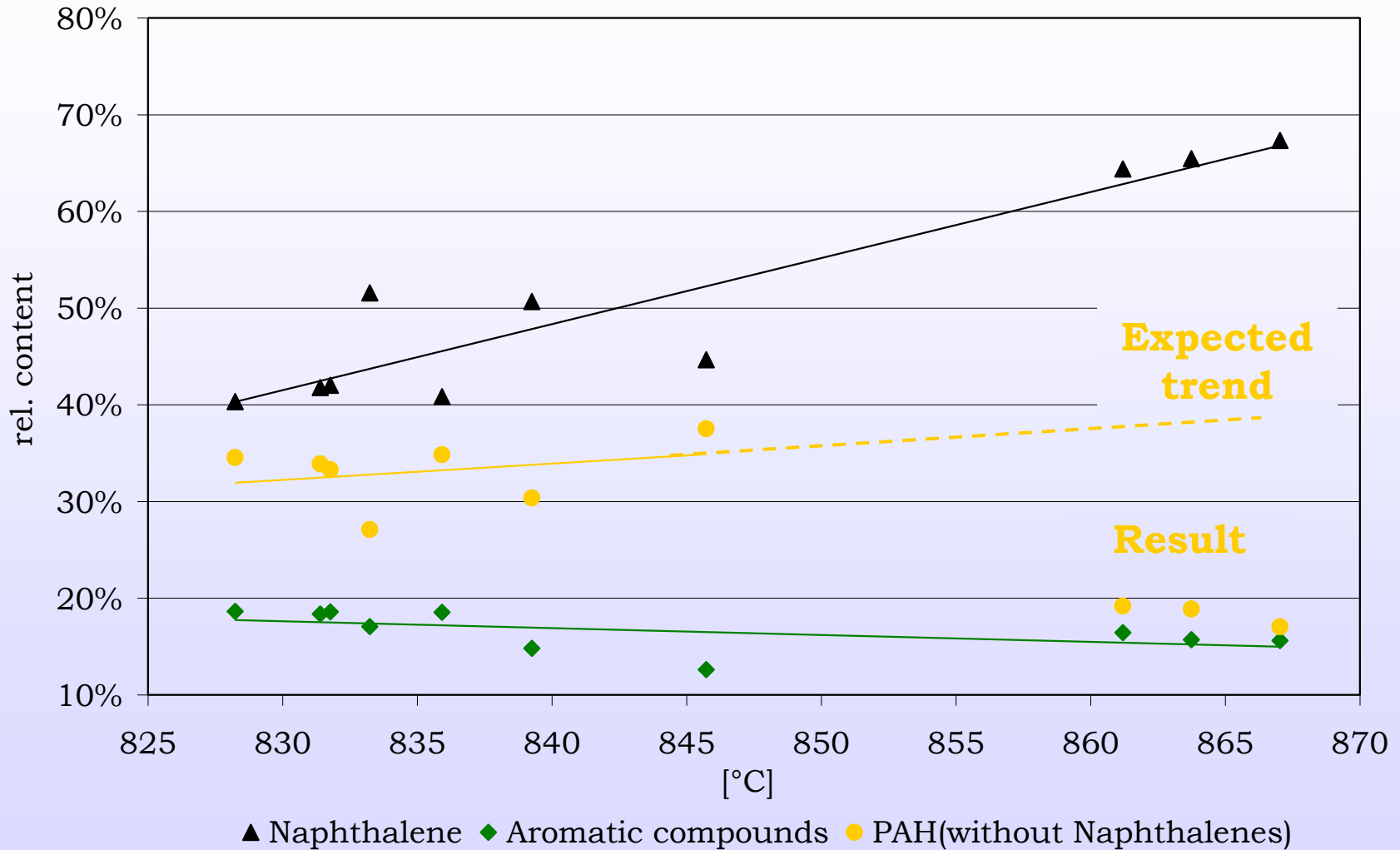
# DFB Tar composition from wood chips gasification



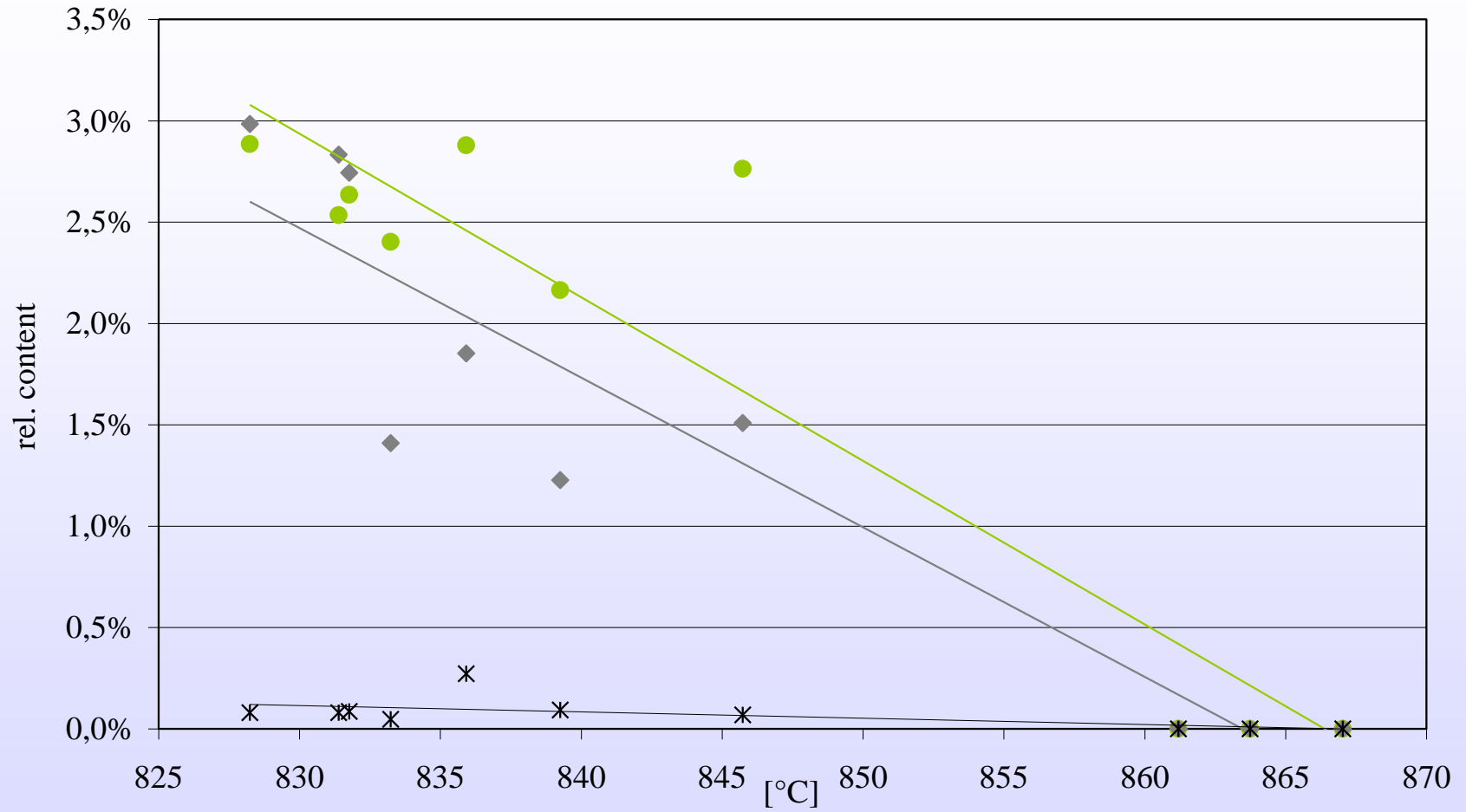
# DFB Dependency of wood chips water content and GCMS tar content



# DFB Composition of tar from wood pellets gasification



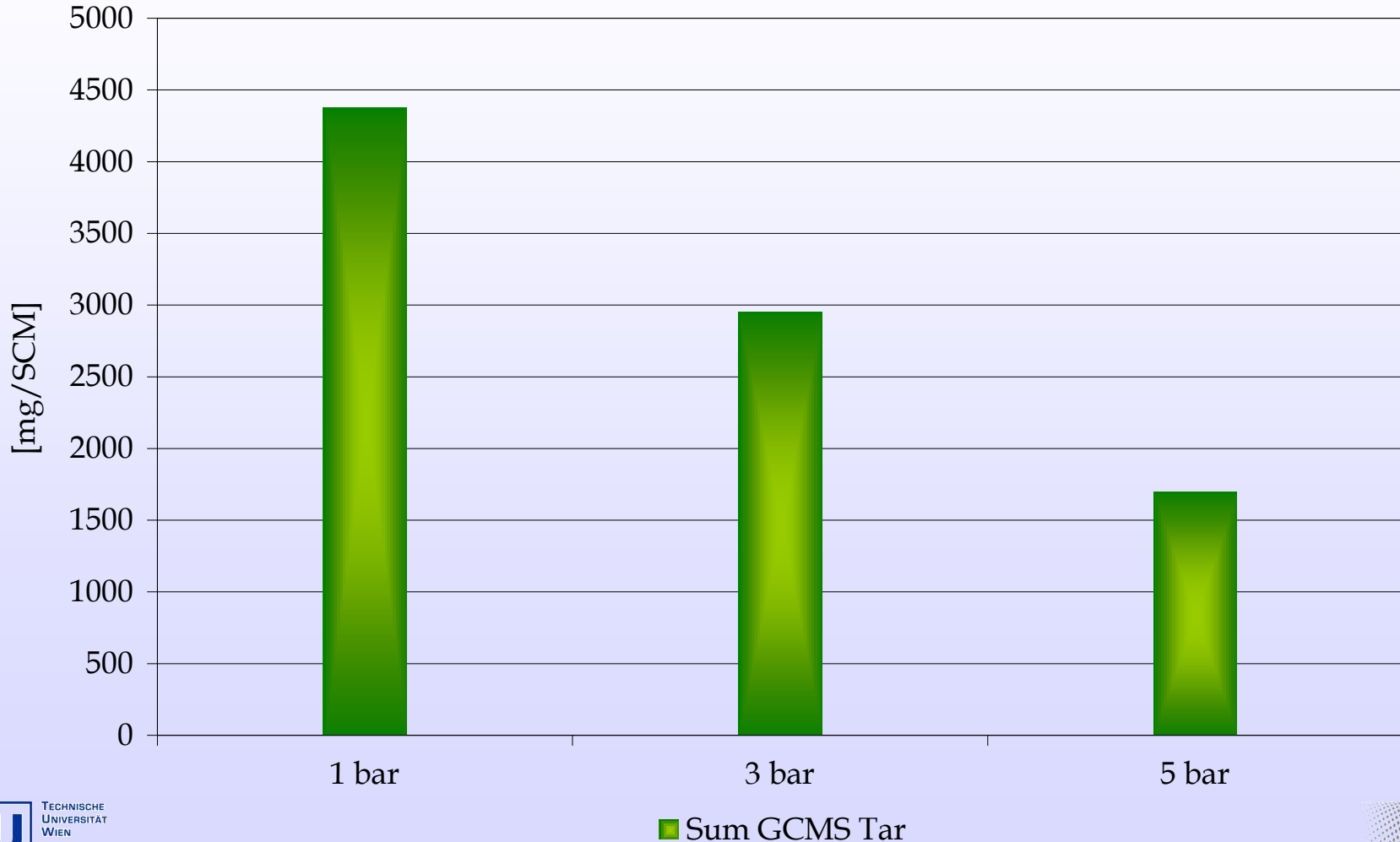
# DFB Composition of tar from wood pellets gasification



● Phenols ◆ Furans \* Aromatic nitrogen compounds

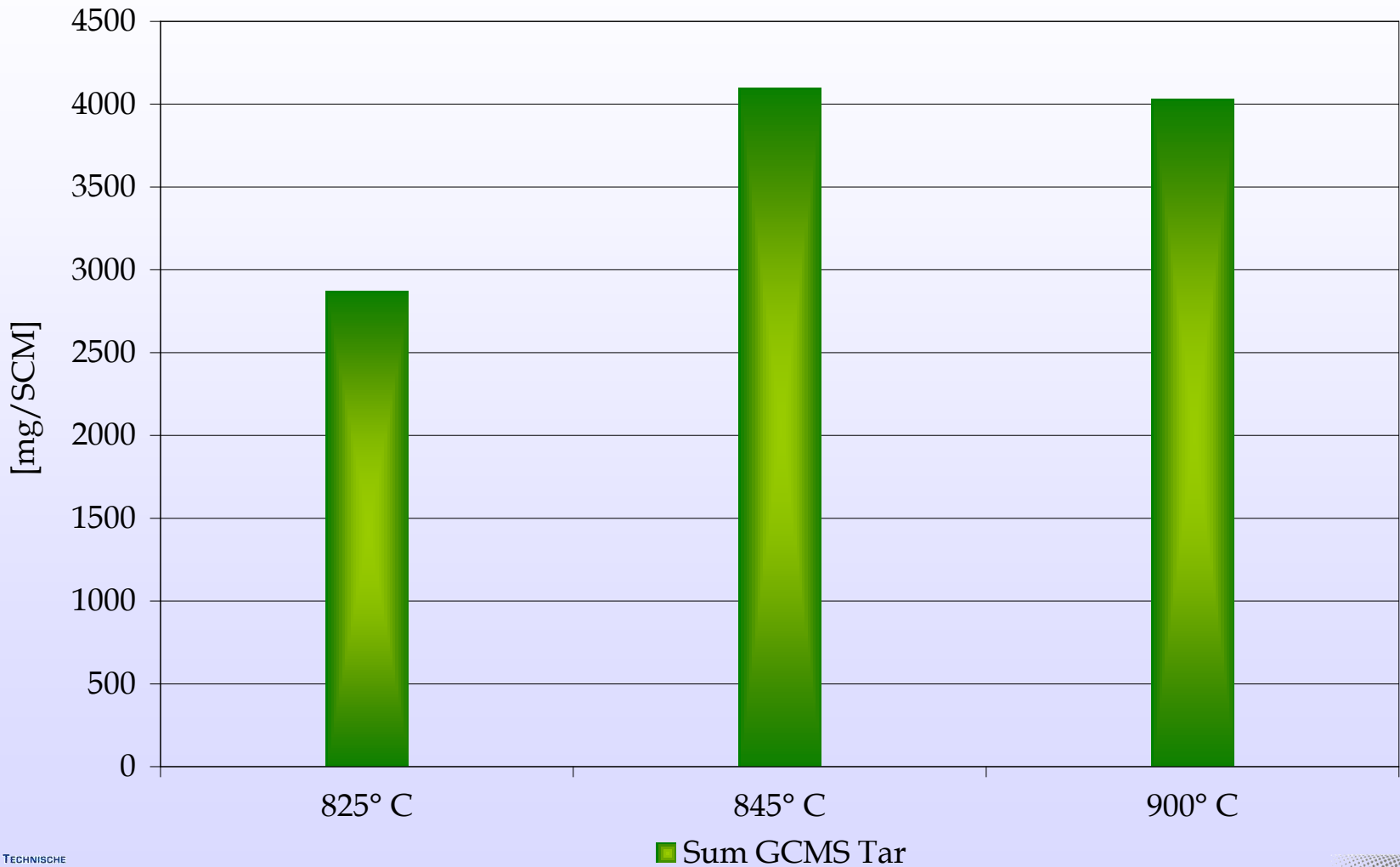
# PRU tar at different pressures

Fuel: wood pellets, Temperature 825° C



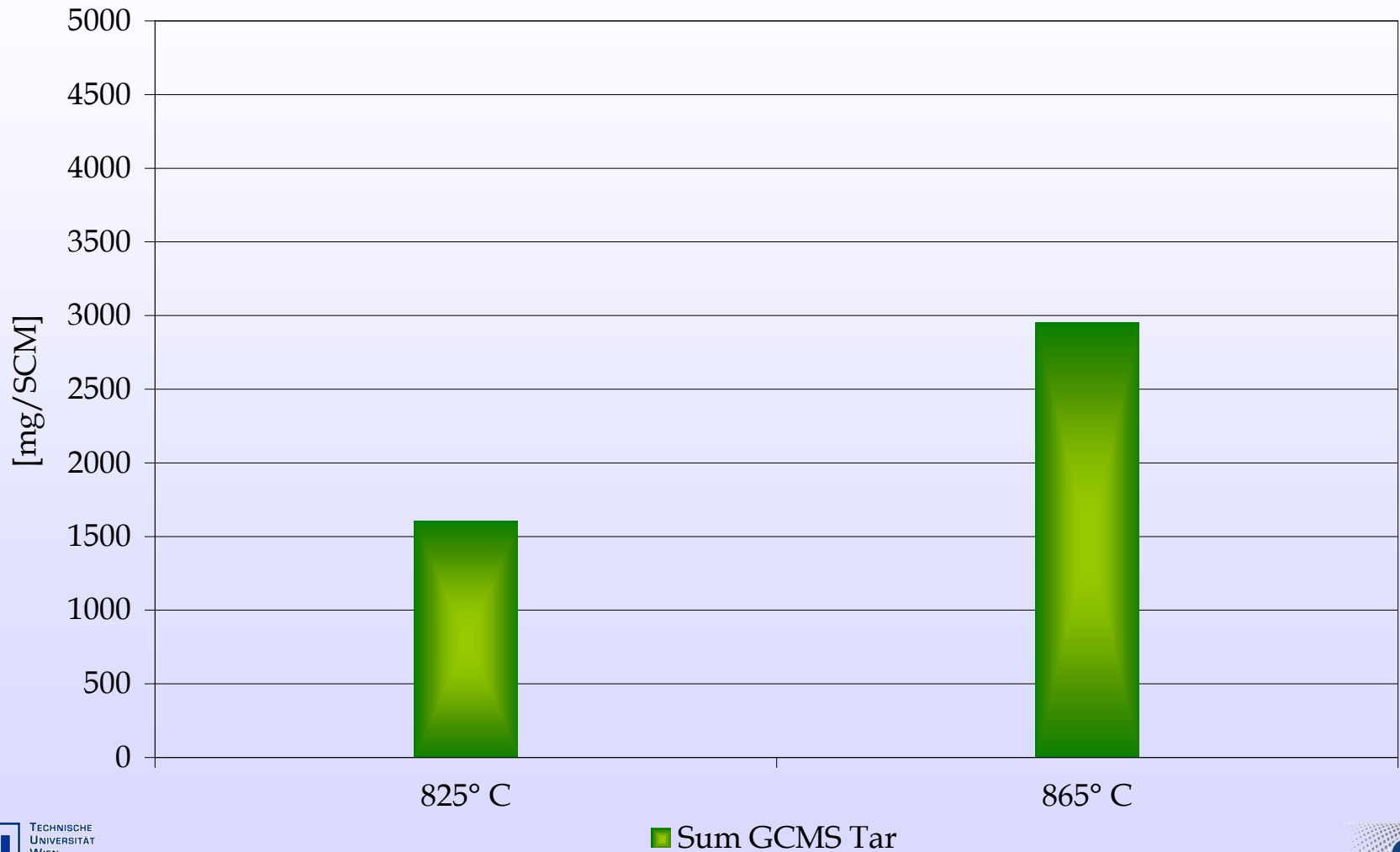
# PRU Influence of Temperature variation on tar content

Fuel: wood pellets; Pressure 5 bar



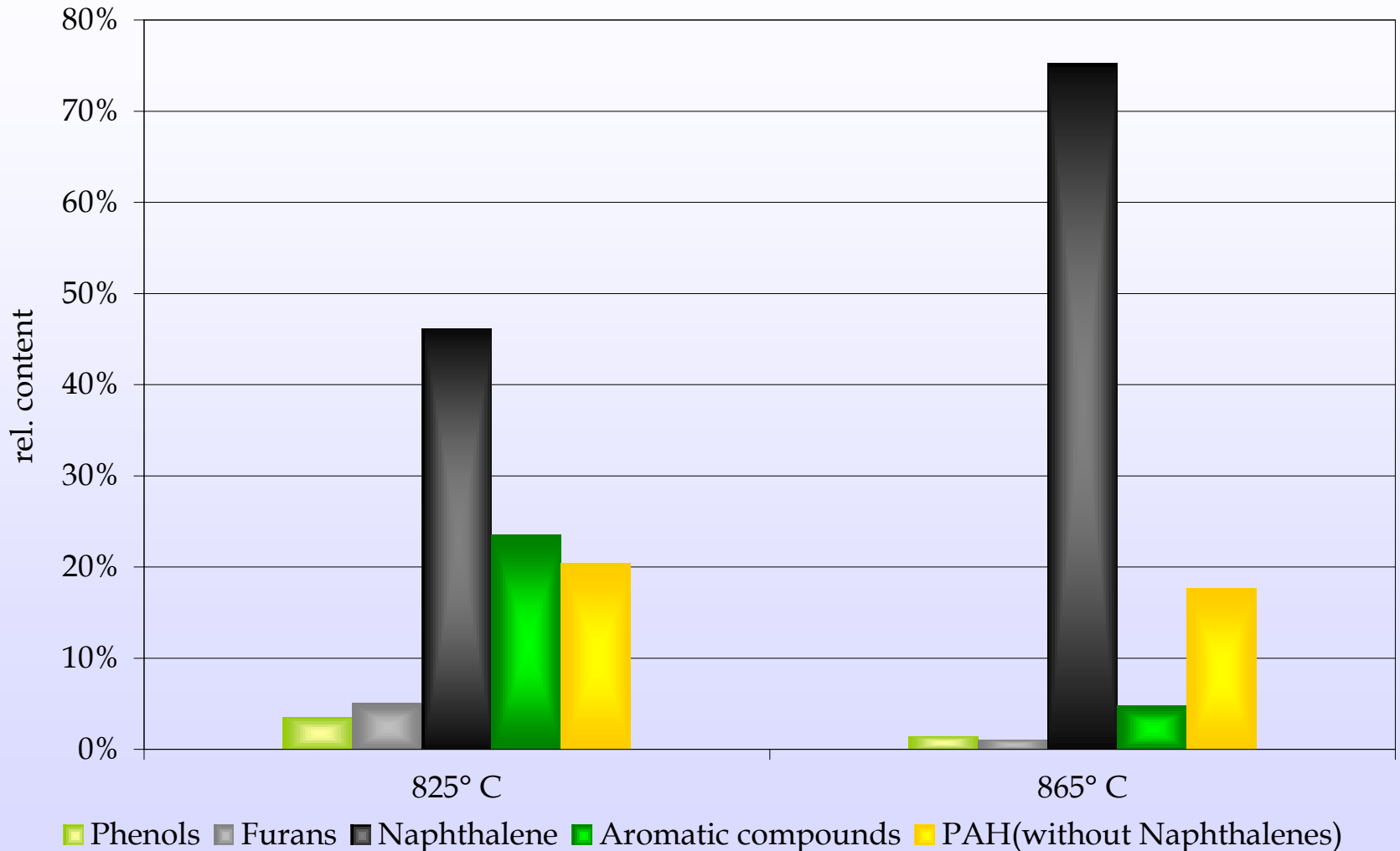
# PRU Influence of Temperature variation on tar content

Fuel: wood pellets; Pressure 3 bar

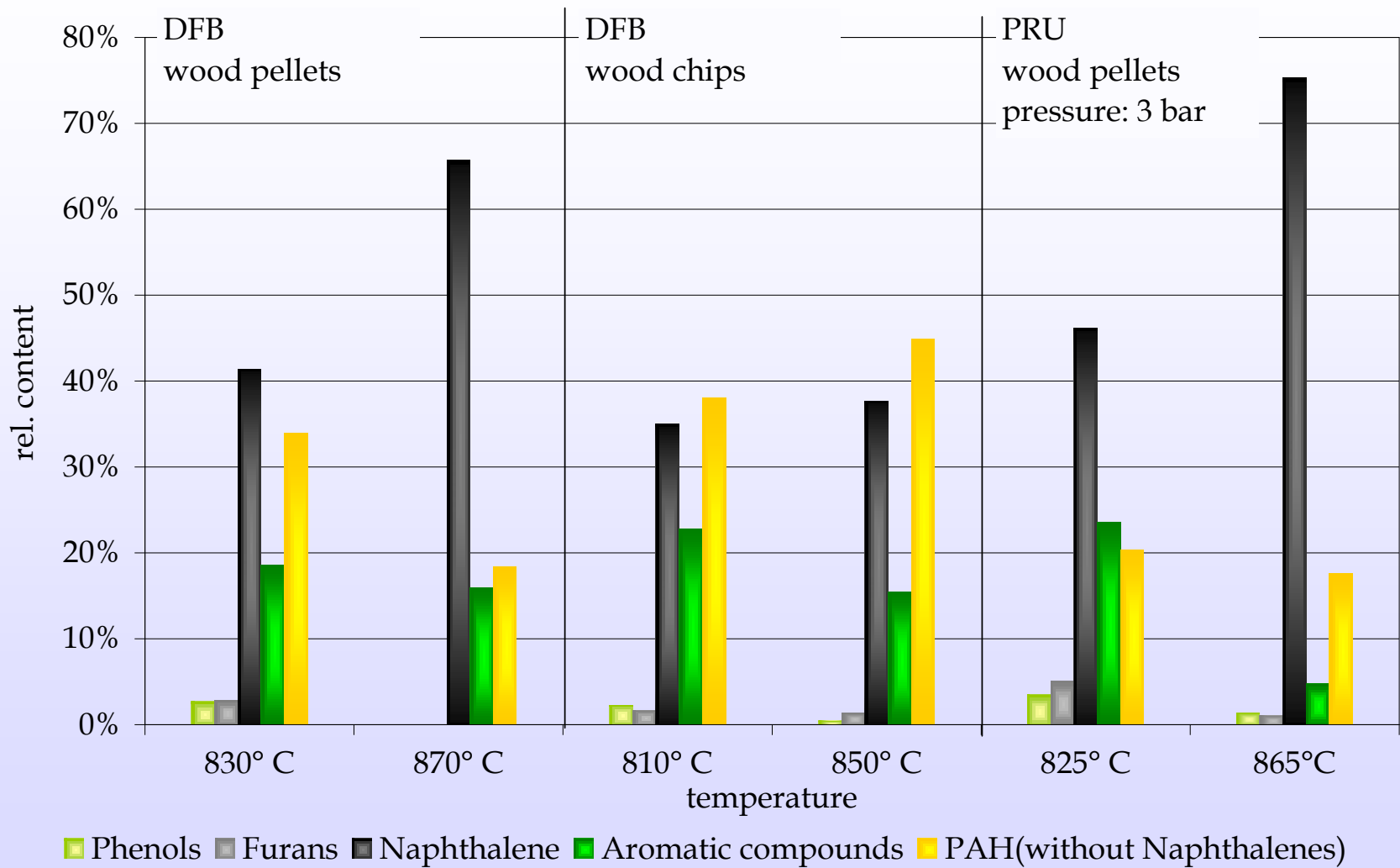


# PRU Influence on temperature variation on GCMS composition

Fuel: wood pellets, Pressure: 3 bar



# Summary



# Conclusion

## **DFB gasification**

- Main tar components: Naphthalene and PAH
- Relative Naphthalene content rising with increasing temperature
- Gasification of wood pellets showed a decrease of PAH with rising temperature
- Wood chips water content has a minor influence on tar amount and composition

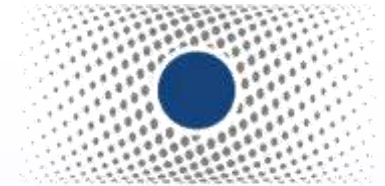
## **PRU gasification**

- Main tar components: Naphthalene and PAH
- Tar content decreasing with rising pressure
- Tar content increasing with rising temperature
- Tar composition similar to DFB steam gasification
- High influence of construction and process parameters



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Thank you for your attention

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