Recent Progress in the VAMOS-Project: Vacuum glass as Alternative for Window Retrofit

U. Pont, P. Schober, M. Wölzl, M. Schuss, J. Haberl, K. Hauer

Sen.Sci. DI. Dr.techn. Ulrich Pont

Department of Building Physics and Building Ecology
TU Wien & Holzforschung Austria

ISEC 2nd INTERNATIONAL SUSTAINABLE ENERGY CONFERENCE 2022

05 – 07 April 2022
Congress Graz
Austria

Table of Content

- Introduction & Challenges
- Vacuum Glazing
- The project VAMOS and its relatives
- Demo Sites & Monitoring
- Some results
- Where do we go?

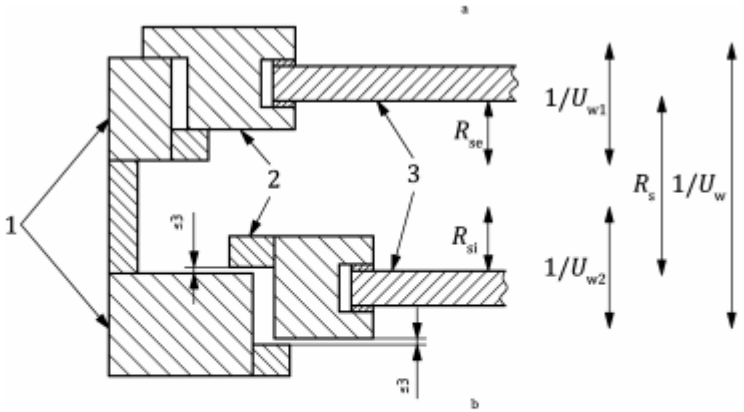
Introduction & Challenges

Traditional Facades & Casement Windows:

- Attractive facades
- Casement windows ➔ constitutents of buildings
- Heat insulation / Condensation / …
- 3D-appearance/effect of facades
- Thin profiles…
- Traditional wood work / carpentry…
- Very durable construction, if properly maintained

Introduction & Challenges

- Kastenfenster / Casement window / Box type window
  - Zweischaliges Fenster mit parallelen Fensterflügeln, die sich nacheinander öffnen und schließen lassen. Der Name ergibt sich aus der umlaufenden Zarge (dem umlaufenden „Gewände“), das dem Fenster die Erscheinung eines Kastens gibt.
  - Two layered window construction, with sequential opening; Perimeter = casement ➔ „box“.



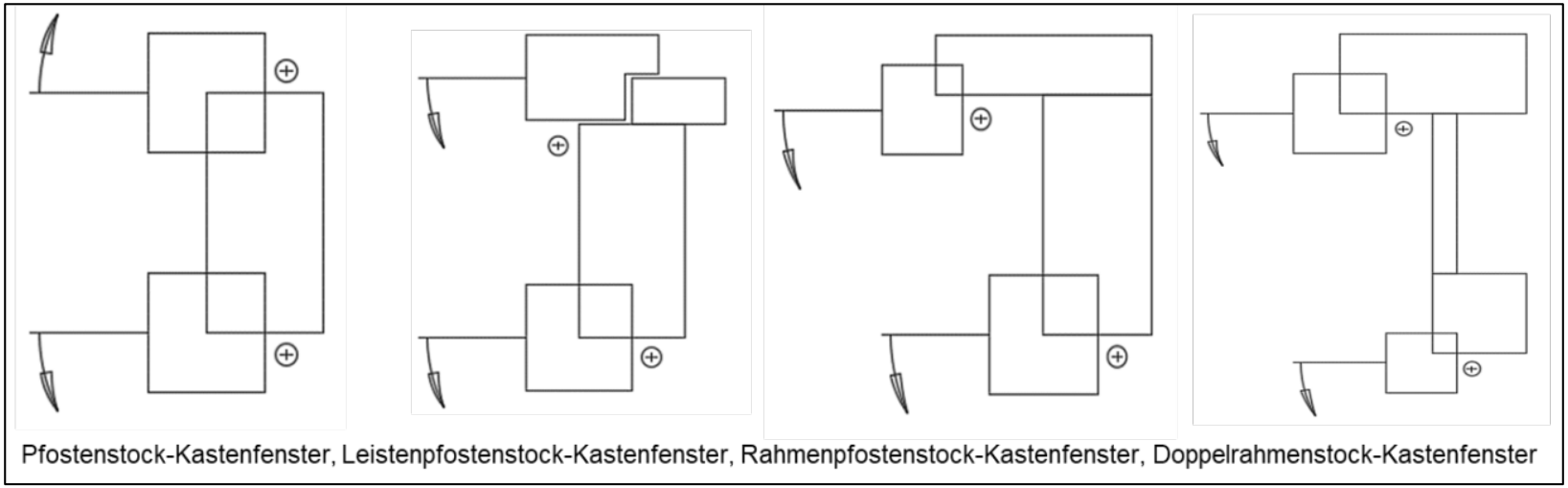
Legende

1 Rahmen (feststehend)
2 Rahmen (beweglich)
3 Verglasung (einfach oder mehrfach)
a raumseitig
b außenseitig

Abbildung EN ISO 10077-1, Foto: U. Pont

Introduction & Challenges

- Types of Casement Windows



Pfostenstock-Kastenfenster, Leistenpfostenstock-Kastenfenster, Rahmenpfostenstock-Kastenfenster, Doppelrahmenstock-Kastenfenster

  - Pfostenstock-Kastenfenster: „Alt-Wiener Kastenfenster“ / “Grazer Kastenfenster“ (ein Flügel öffnet nach innen, der andere nach außen)
  - Leistenpfostenstock-, Rahmenpfostenstock-, Doppelrahmenstockkastenfenster: „Wiener Kastenfenster“

Abbildung HFA / Fensterbau Svoboda

Challenges

- Retrofit regularly is window exchange ☹
- Arguments used:
  - Thermal performance
  - Maintainance
  - Air tightness issues
- From an circular economy AND heritage protection perspective this is suboptimal.
  - Update-Options are required.

Abbildung HFA / Fensterbau Svoboda

Introduction & Challenges

Condensation, Vienna, 31.10.2021

Abbildung Pont

Introduction & Challenges

Introduction & Challenges

Introduction & Challenges

- **Concepts of Maintenance**
  - Fittings
  - Glas-frame-detail improvement

- **Concepts of Repair**
  - Replacement of rotten parts
  - sealing

- **Concepts of „Modernisation“**
  - Comprehensive performance assessment
  - **Glass**, Seals, Fittings, Wooden pieces
  - In-Part-Replacement of Wings.

Vacuum Glazing

Research on vacuum glass

- for decades
- Durability? Upkeep of vacuum

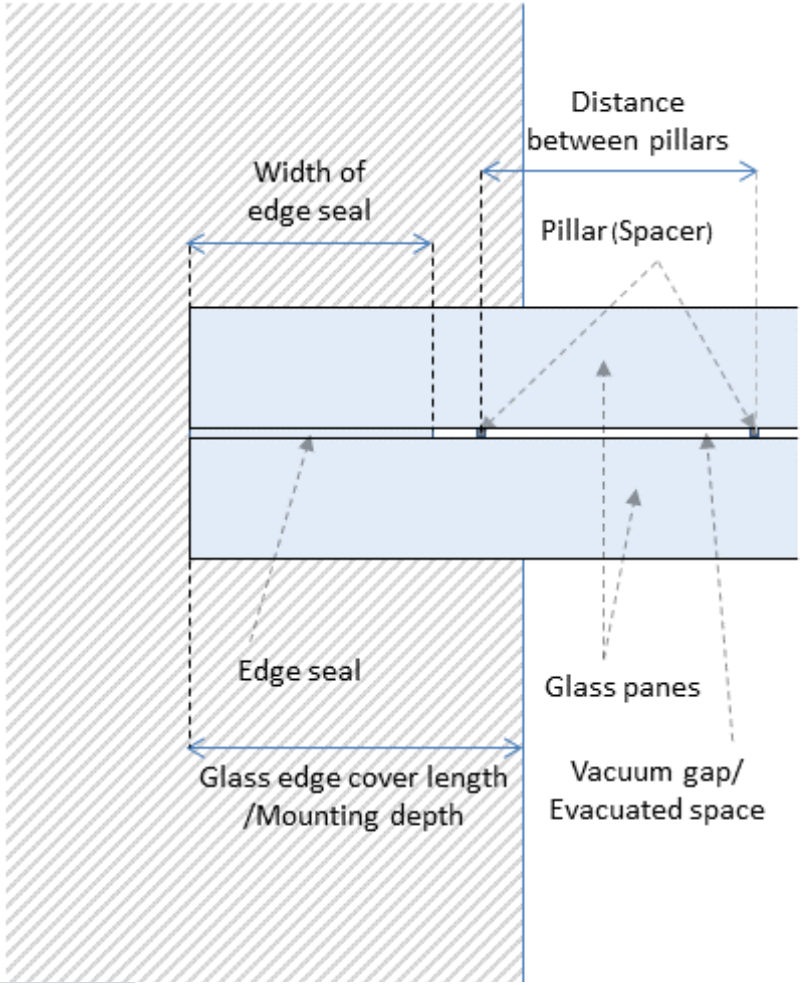
Properties

- Highly insulating (Ug-values: 0.4 – 0.7 $W.m^{-2}.K^{-1}$)
- Thin and light (e.g. 3mm – 0.15mm – 3mm)
- Severe reduction of conduction and convection

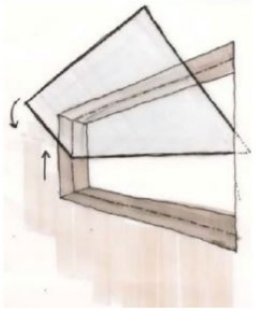
Research on vacuum-glass equipped window

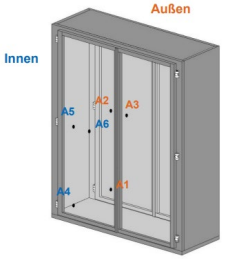
- Very little…

Vacuum Glazing



The project VAMOS and its relatives





Einordnung des Projektes VAMOS in die Landschaft von F&E-Projekten zur Thematik Fenster mit Vakuumglas

	FOKUS: Technische Entwicklung von Fenstern & Fenstertypen	FOKUS: Realisierung/Umsetzung und Monitoring
Typus: Sondierung	MOTIVE Proj.Nr.: 854690 (SdZ 3); VIG-SYS-RENO Proj.Nr.: 845225 (SdZ 1)	
Typus: Kooperatives F&E Projekt	FIVA Proj.Nr.: 867352 (SdZ 5)	VAMOS Antrag.Nr: 23331117 (SdZ 06)

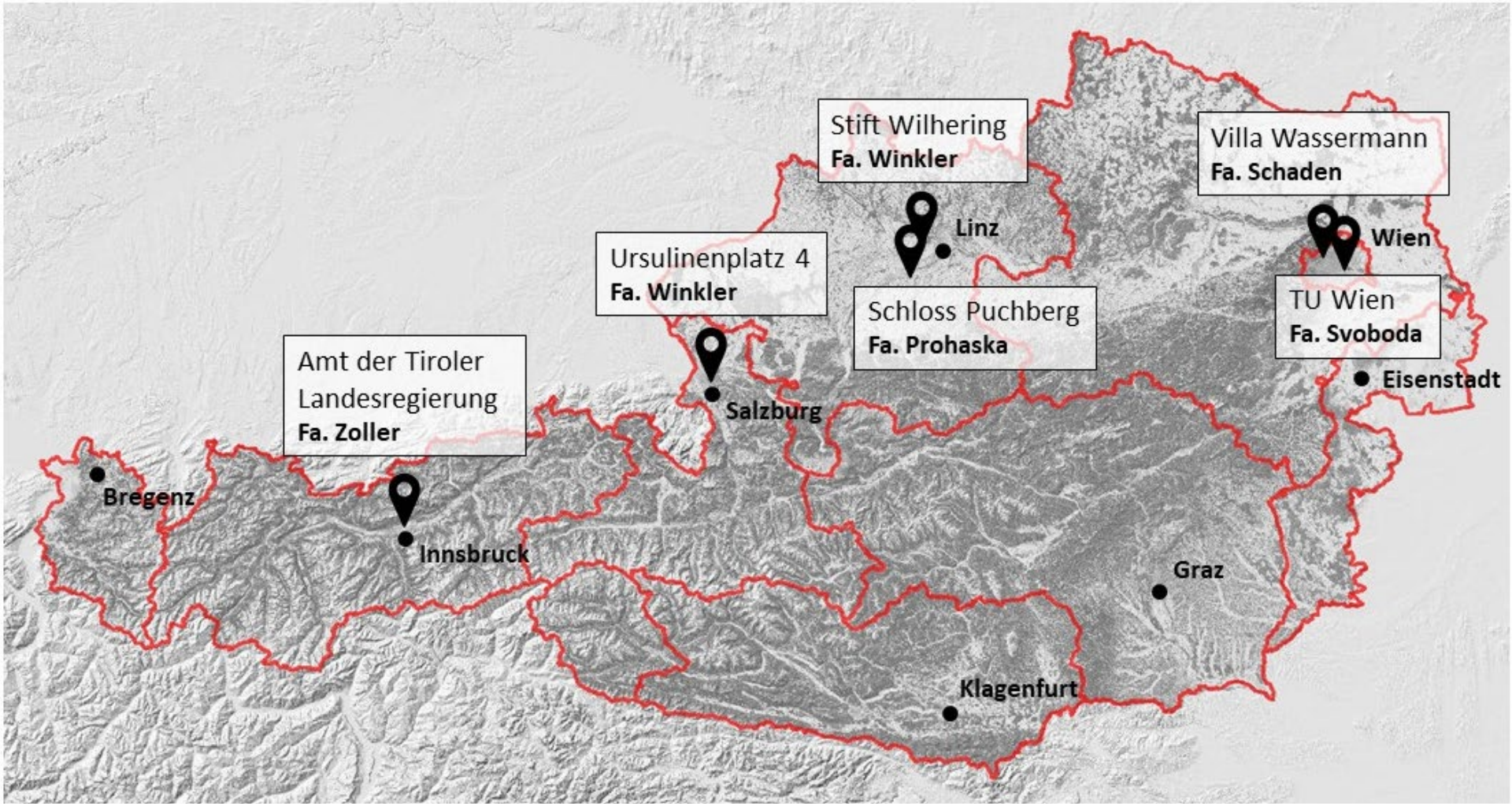
Fokus auf zeitgenössische, neue Fenster mit Vakuumglas

Fokus auf Bestandsanierung von architektonisch wertvollen Bestandsfenstertypologien

Demo Sites & Monitoring

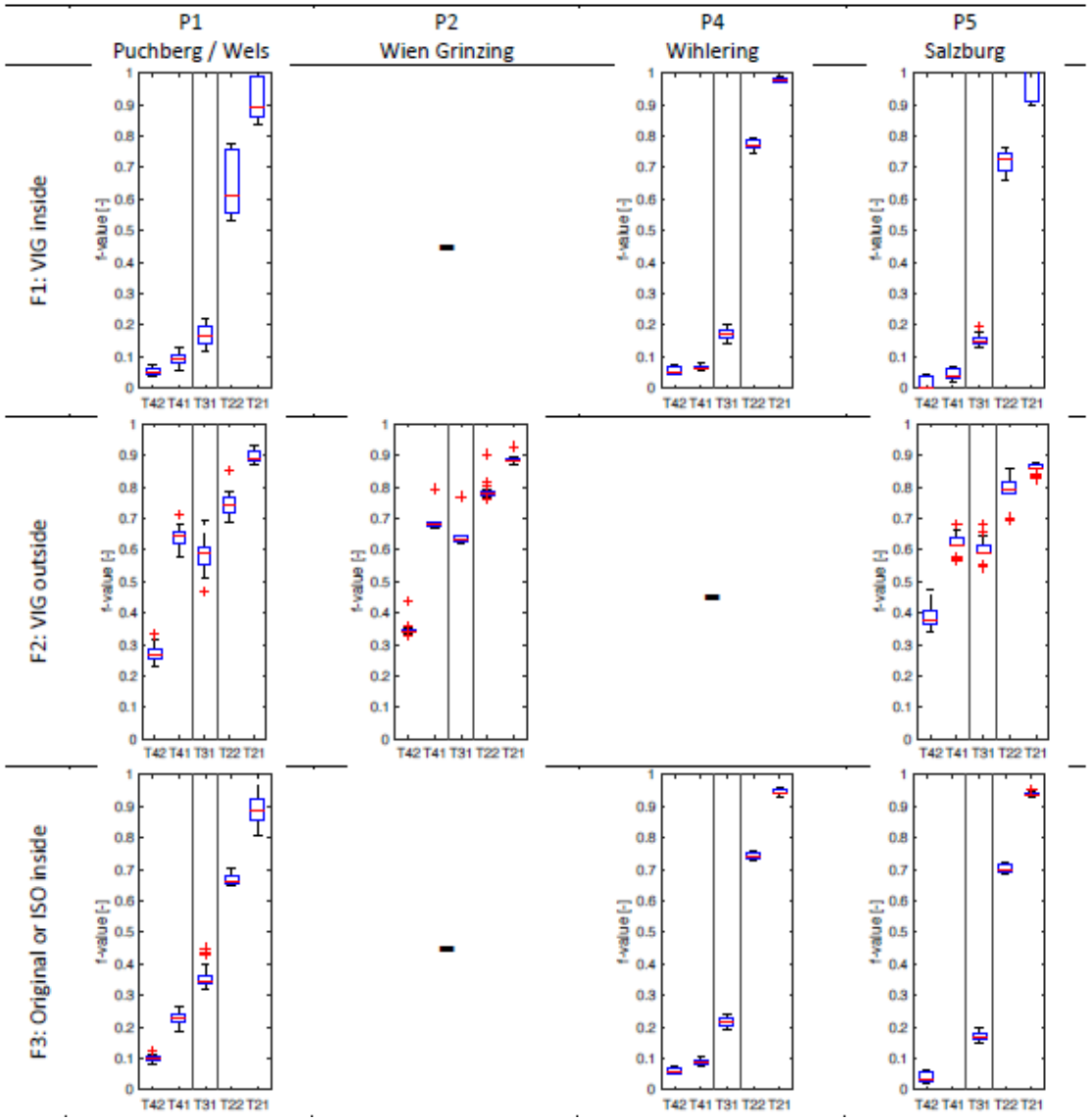
	Location					
	P1	P2	P3	P4	P5	P6
	Puchberg Wels	Wien Grinzing	Wien TU	Wilhering	Salzburg	Innsbruck
						
Retrofit action	Glass replacement	Refurbishment with new outer wings	Outer or inner wing replacement with VIG	New with Box-type windows VIG or ISO	New with Box-type windows VIG or ISO	New with Box-type windows VIG or ISO
Monitoring setting	standard	standard	detailed	standard	standard	Detailed
F1: VIG inside	✓	-	✓	✓	✓	VIG inside
F2: VIG outside	✓	✓	✓	-	✓	VIG outside
F2: reference	✓ Original float/float	-	✓ Original float/float	✓	✓ ISO inside	✓ ISO inside

Demo Sites & Monitoring



Demo Sites & Monitoring

Some results



Results

- In 5 of 6 projects: No Condensation!
- In 1 of 6 projects: Condensation.

(Reason: Faulty retrofitting / issues with the sealings!)

- Significant improvement of U-values. (<1.1 $W.m^{-2}.K^{-1}$)

Where do we go? Concluding remarks

What did we learn?

- U-Value improvement ➔ competitiveness of casement windows.
- Vacuum glass can be implemented in existing frames.
- Location of the vacuum glass is dependent onto a multitude of aspects (position of window, casement-material, wall-material, existance of seals, …)

Where do we need to go?

- Broad availability of vacuum glass
- Information campaign
- Set-Up of circumstances with stakeholders ➔ Information transfer is crucial.

Recent Progress in the VAMOS-Project: Vacuum glass as Alternative for Window Retrofit

U. Pont, P. Schober, M. Wölzl, M. Schuss, J. Haberl, K. Hauer

Sen.Sci. DI. Dr.techn. Ulrich Pont

Department of Building Physics and Building Ecology
TU Wien & Holzforschung Austria

ISEC 2nd INTERNATIONAL SUSTAINABLE ENERGY CONFERENCE 2022

05 – 07 April 2022
Congress Graz
Austria