

Rcrust: A Tool for Calculating Path-Dependent Open System Processes

M. J. Mayne^{1,2}, J. -F. Moyen², G. Stevens¹ & L. Kaislaniemi³

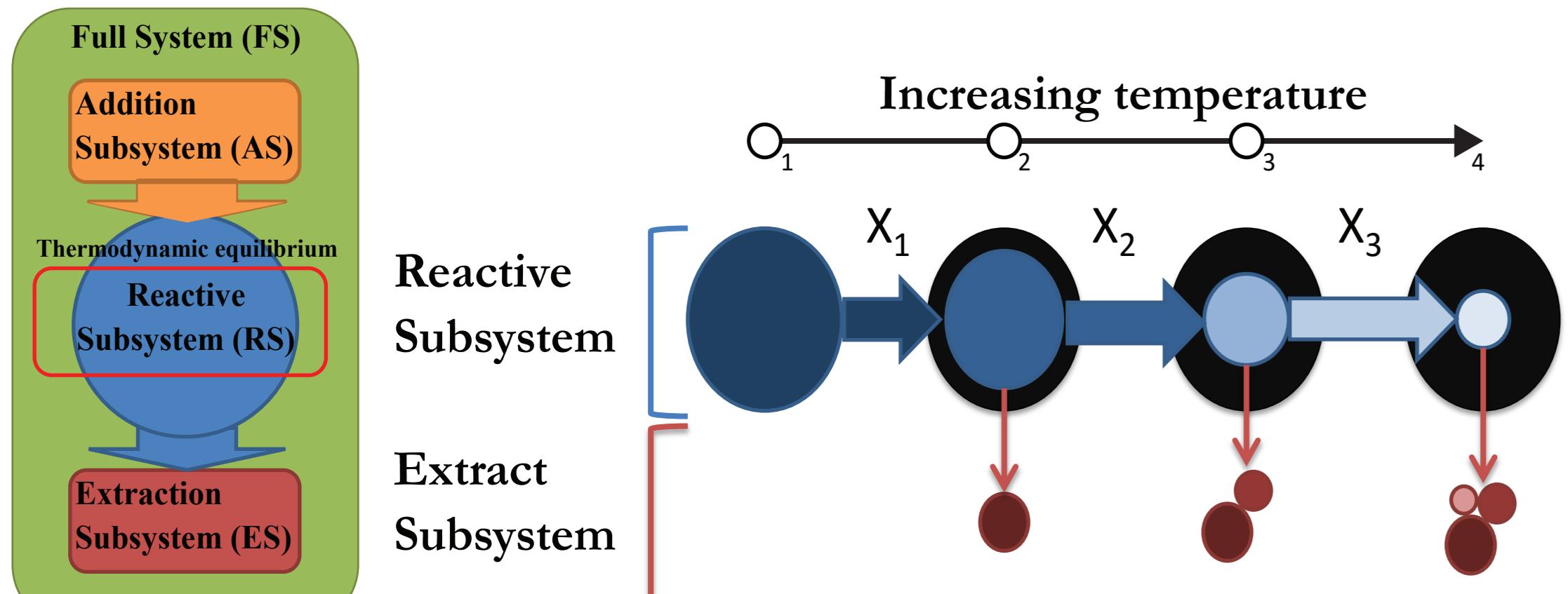
AUVERGNE – RhôneAlpes*

1 Department of Earth Sciences, Stellenbosch University, South Africa
✉ mjmayne@outlook.com

2 Laboratoire Magmas et Volcans, Université Jean Monnet, France

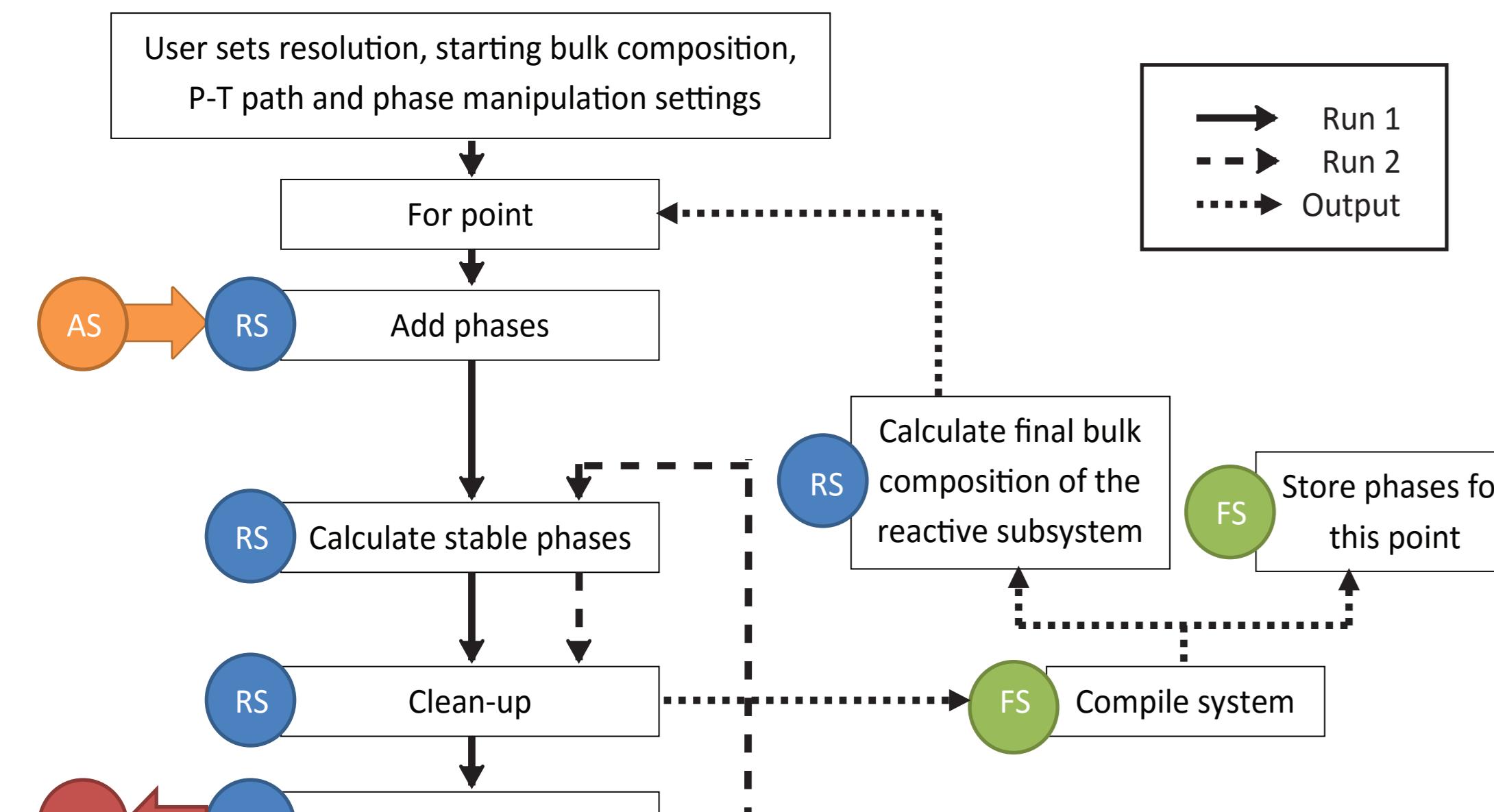
3 Department of Geosciences and Geography, University of Helsinki, Finland

What is path dependence?



The Reactive Subsystem (RS) is kept in thermodynamic equilibrium. Phases are progressively added into and/or extracted from the RS along a path. Thus, the bulk composition (X) of the system is dependent on previous points in the path.

How do we do it?



The Rcrust software determines phase stabilities with path dependence by considering two calculation loops. Phase additions occur in the first loop and phase extractions in the second.

User defined applications

Compositional change due to magma segregation

Introduction of contaminant fluids/phases

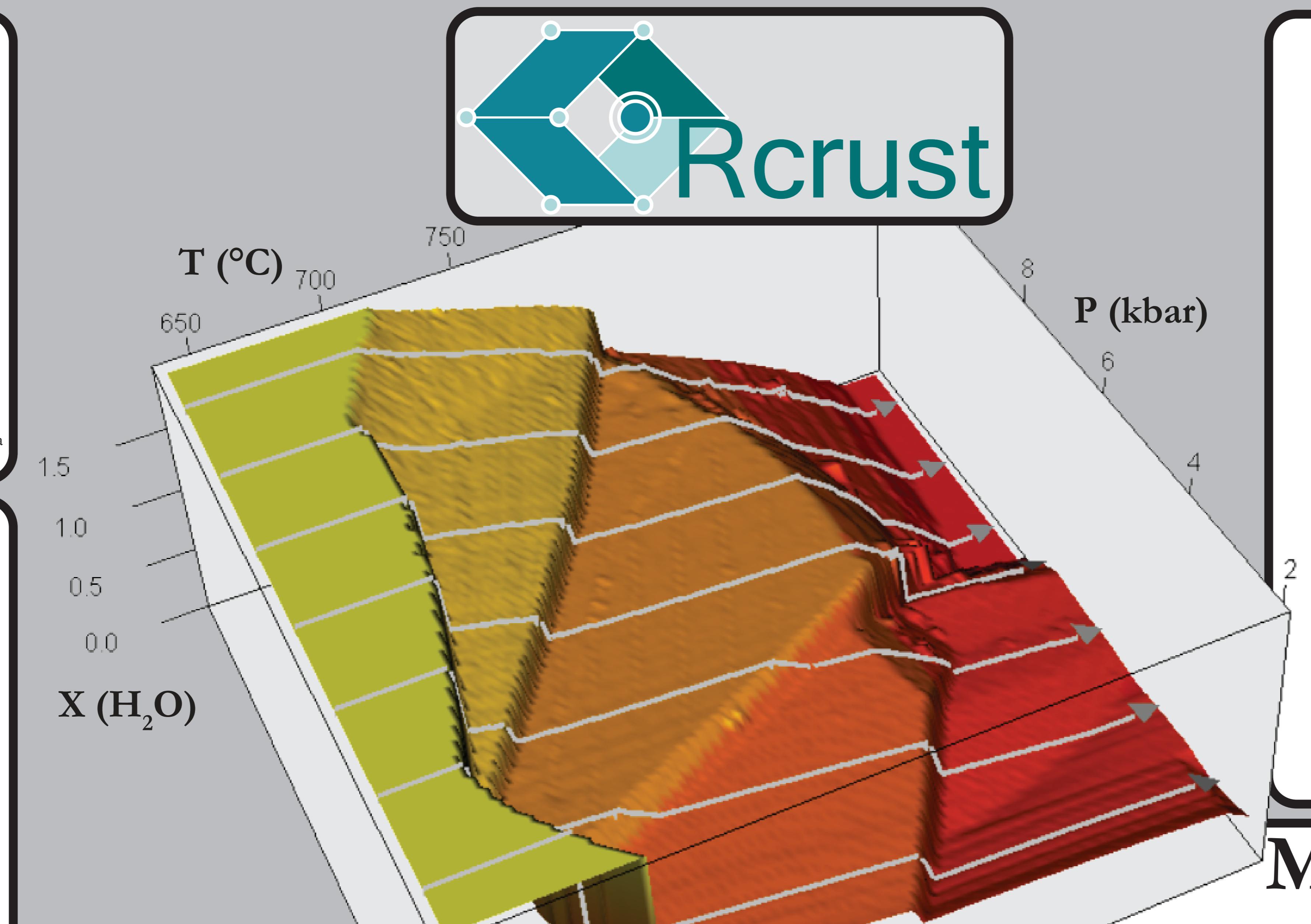
Shielding slow diffusing phases

Heterogeneous crustal column subject to a geotherm

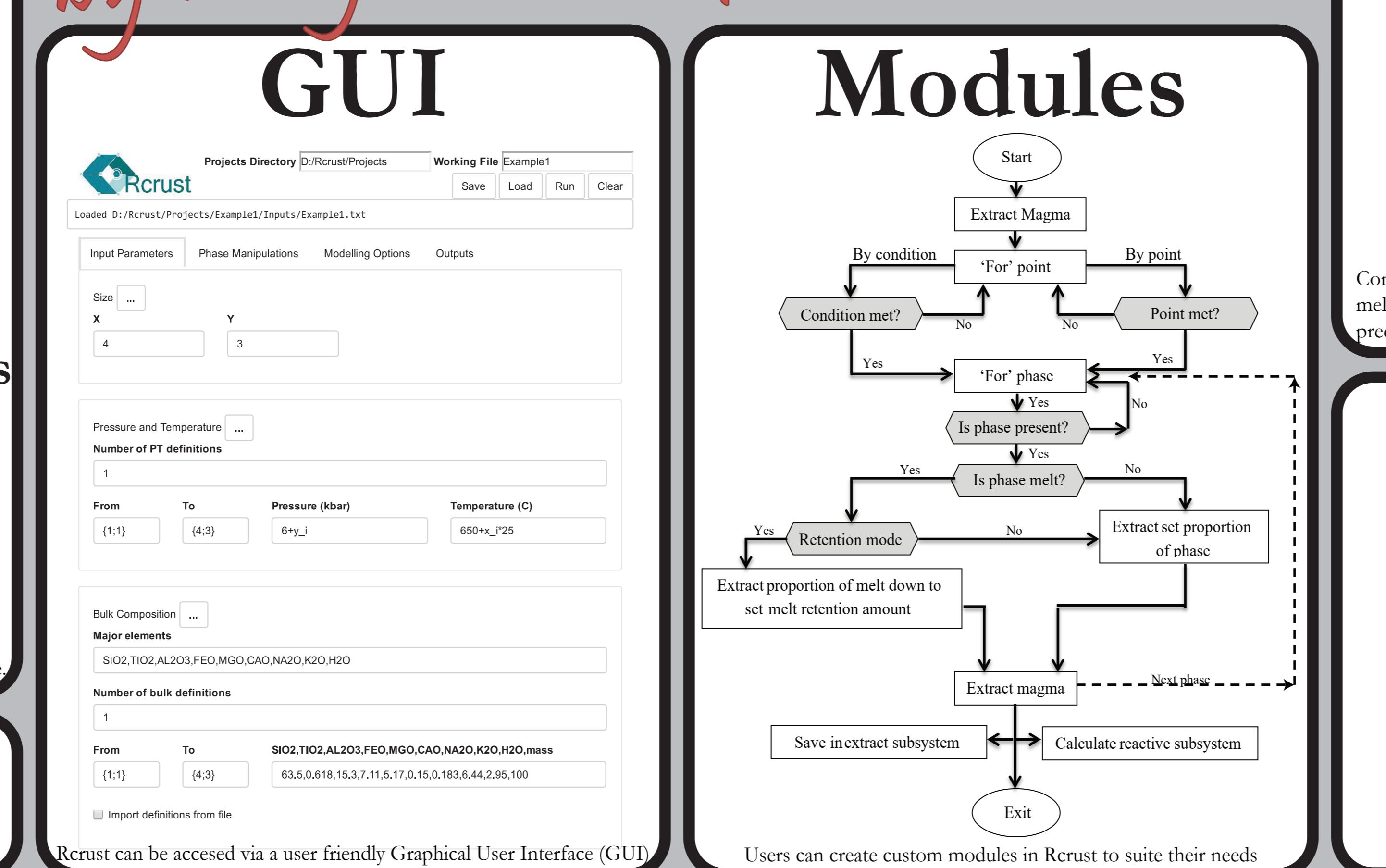
Path dependence allows new applications for thermodynamic calculations in which the bulk composition of the reactive subsystem can change.

Acknowledgements

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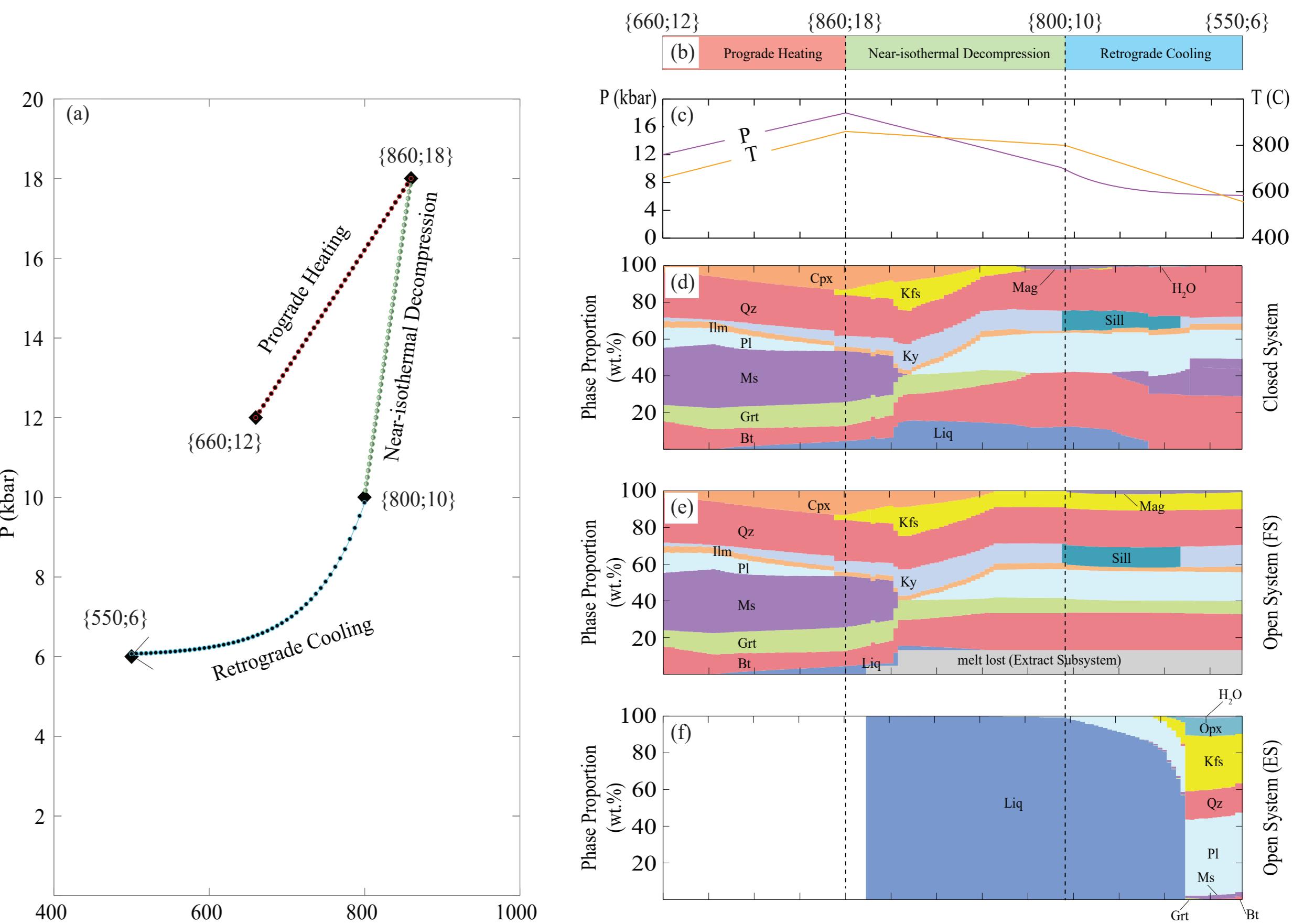


Modelling in P-T-X space
by using Path Dependence



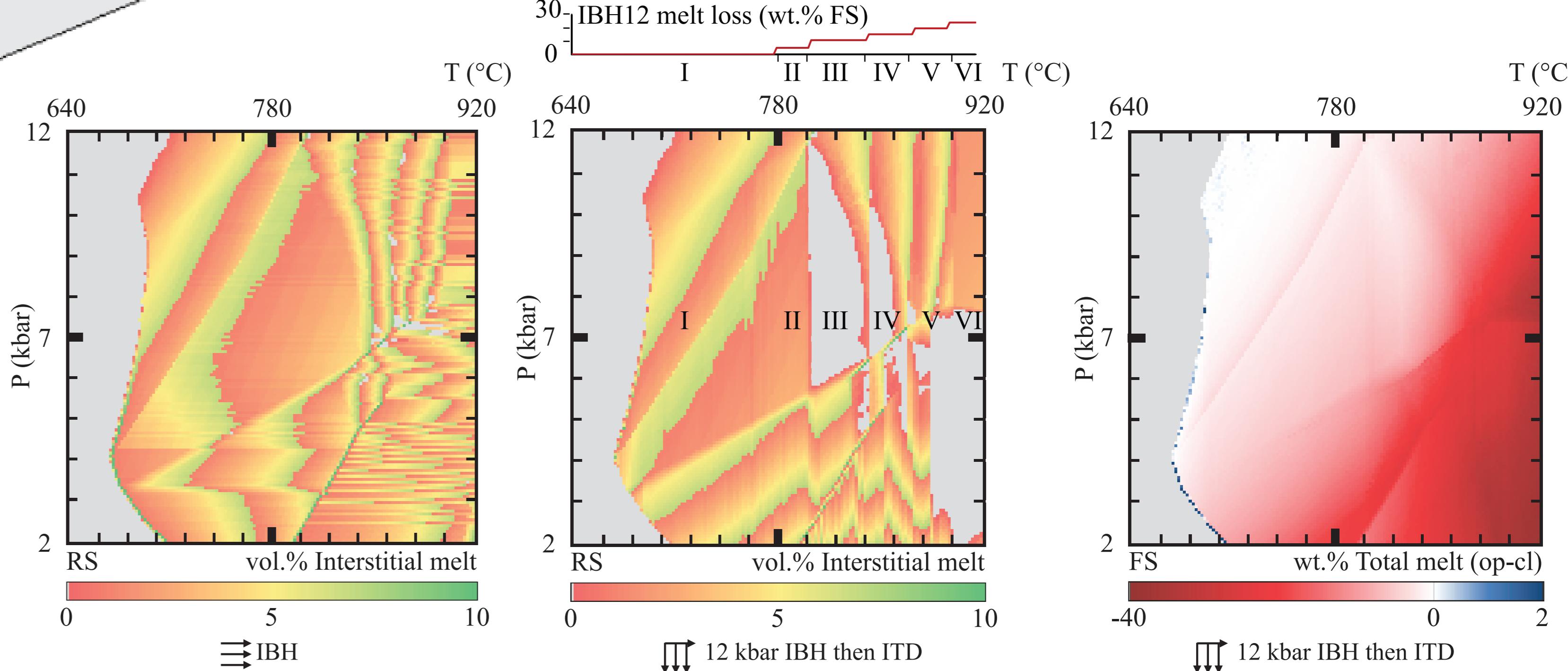
Users can create custom modules in Rcrust to suite their needs

Melt loss along a P-T path



An example of Rcrust's use: Phase extractions along a prograde P-T path reduce the amount of melt that can form upon subsequent decompression.

Melt loss inhibits further melting



Compilations of dependent paths create path dependent P-T mode diagrams. Isobaric Heating (IBH) and IBH at 12 kbar followed by Isothermal Decompress (ITD) produce zonal patterns of interstitial melt, however from the 2nd IBH12 melt loss event onwards (>800°C) ITD interstitial melt is greatly reduced. Total melt produced by the open system IBH is up to 27 wt.% less than the closed system.

Conclusions

- Rcrust enables modelling in PTX space with path dependence
- Open systems are less melt productive than closed systems
- Melt loss impedes decompression melting

In the Future:

Modelling + Experimentation + Field evidence = Internally consistent thermodynamically and kinetically constrained model for crustal anatexis