A new method for the development of manufacturing processes for injectable drug product

Prof. Geoff Smith

10th International Workshop on Impedance Spectroscopy
28-29th September 2017, Chemnitz, Germany

(From drugs molecules to products)

Man-made drugs – small molecules (chemical synthesis) to large molecules (biotechnology)

Aspirin
21 atoms

Hormone
~3000 atoms

Antibody
25,000 atoms

Production

Product available in the market

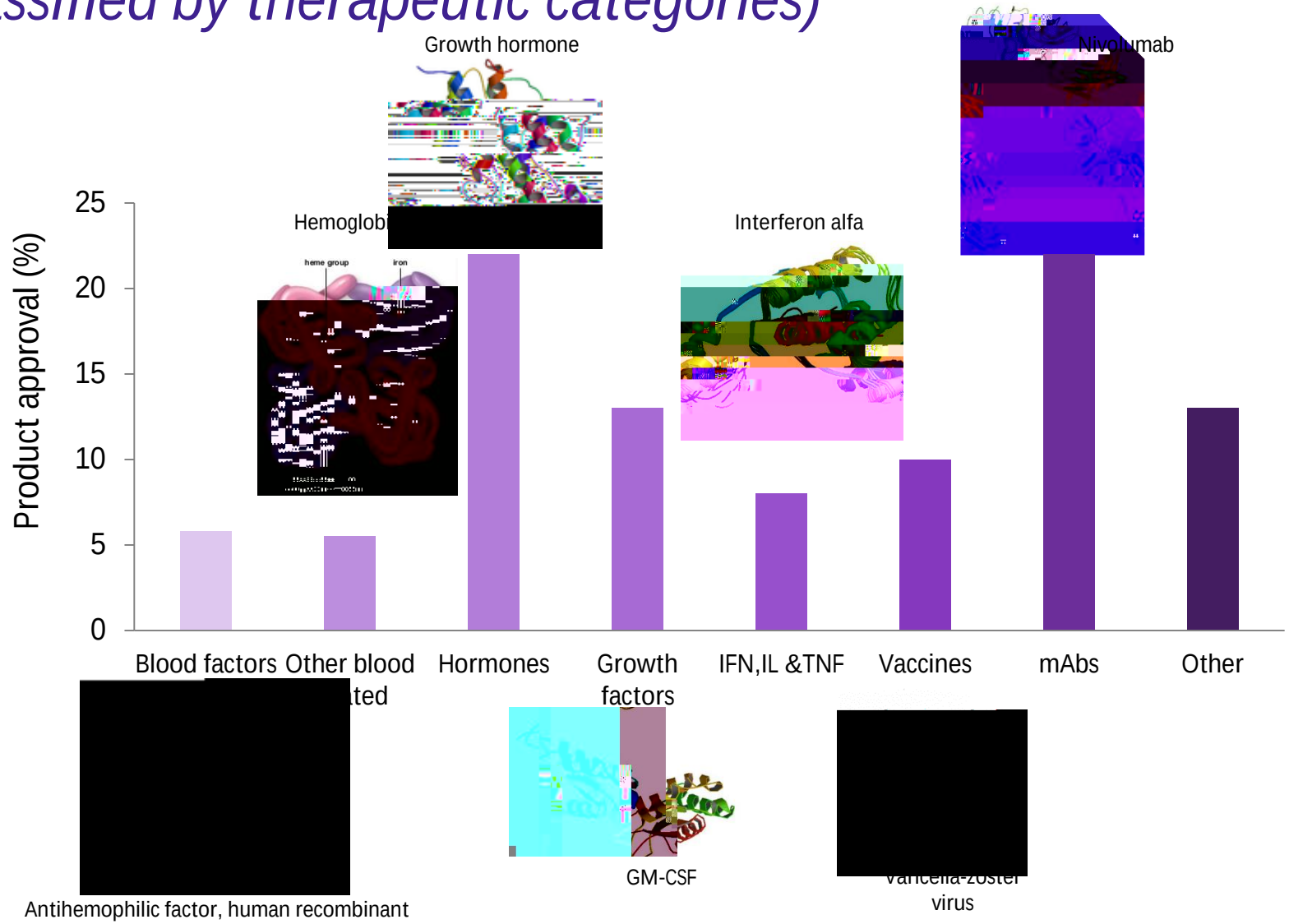
- Quality: Safety & Efficacy

QC Pharmacopoeial tests

Formulation development

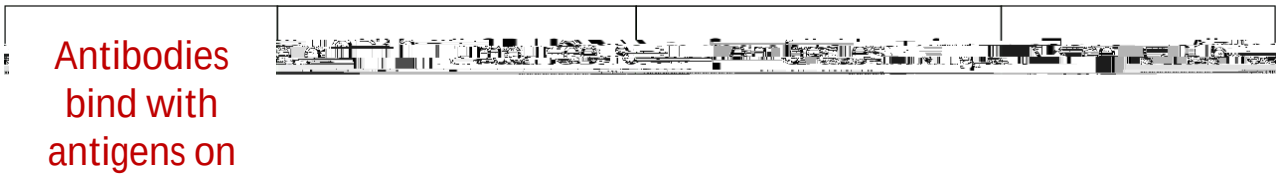
- Drug products (i.e. dosage form: tablets, injections) etc.
- Healthcare and cosmetics product (i.e. nutrition)

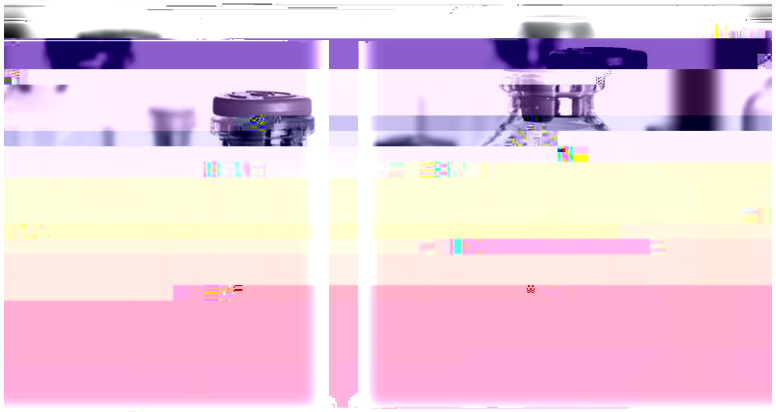
(classified by therapeutic categories)



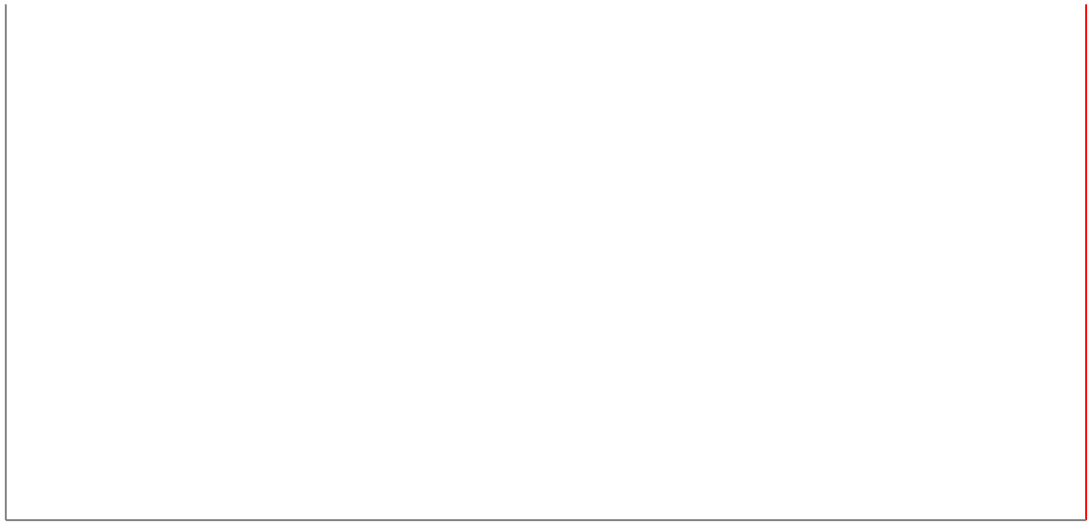
Newrzella A. (

- A monospecific immunoglobulin
- Medicinal application of mAbs
  - Diagnostic application (i.e. immunoassay, immunoscintigraphy), e.g. Prof.Abdelhamid
  - Therapeutic applications (i.e. Cancer, Transplantation, Immune disease etc.)

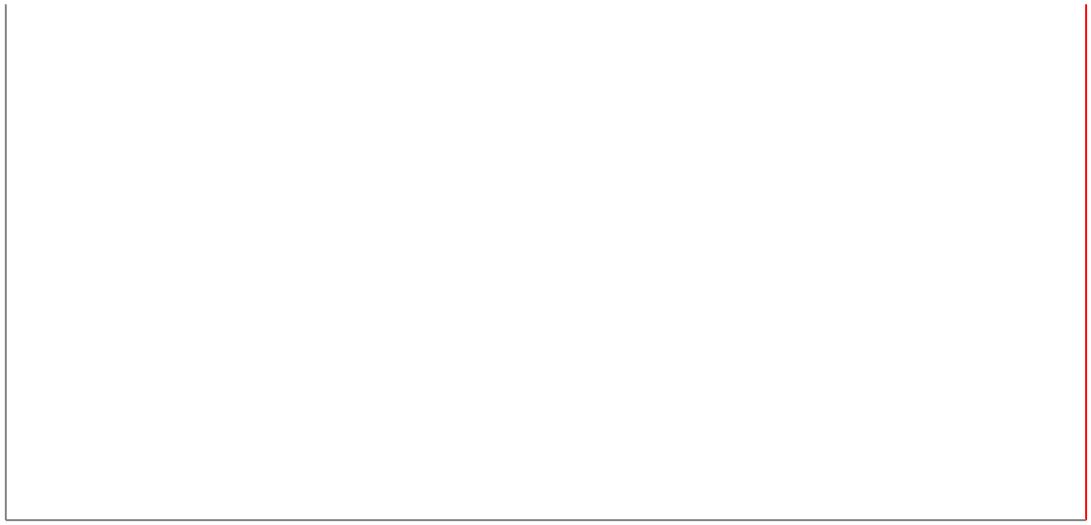




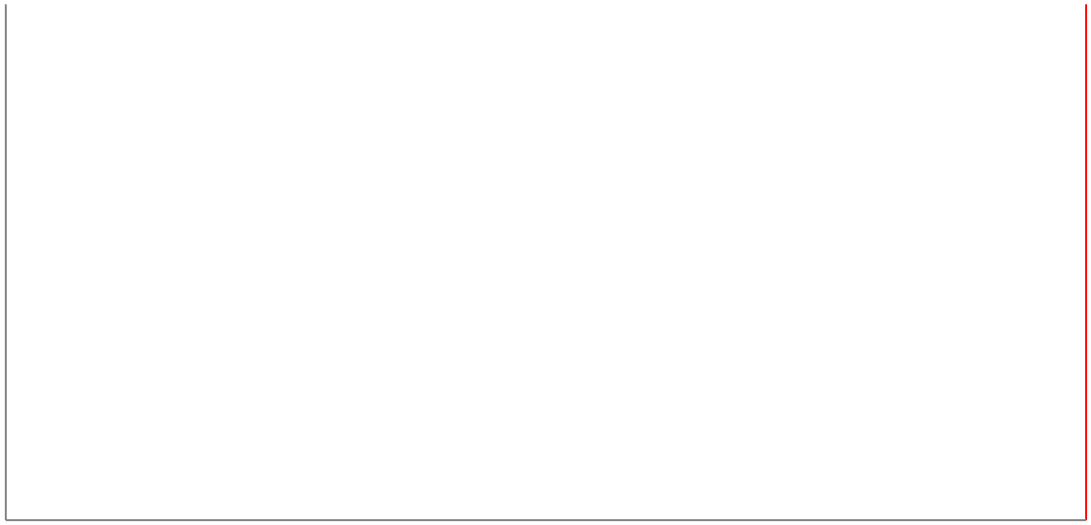
- A technique which dries product at low temperature through sublimation process
- It consists of three main steps : , and



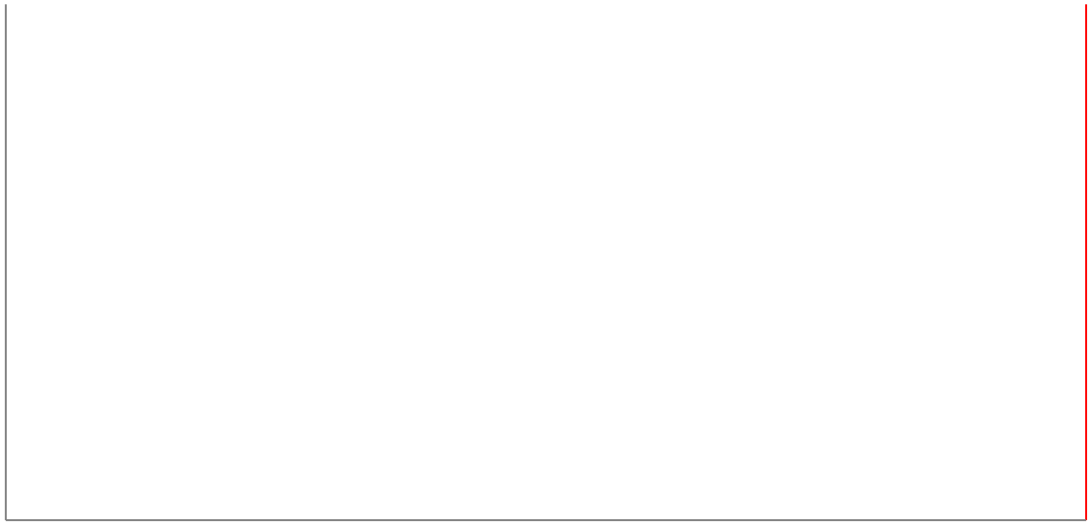
- A technique which dries product at low temperature through sublimation process
- It consists of three main steps : , and



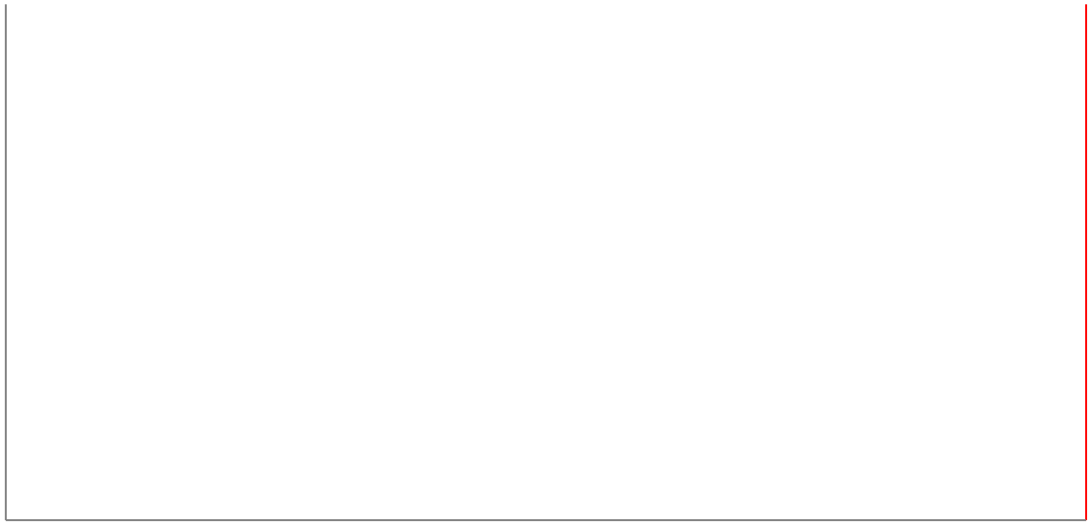
- A technique which dries product at low temperature through sublimation process
- It consists of three main steps : , and



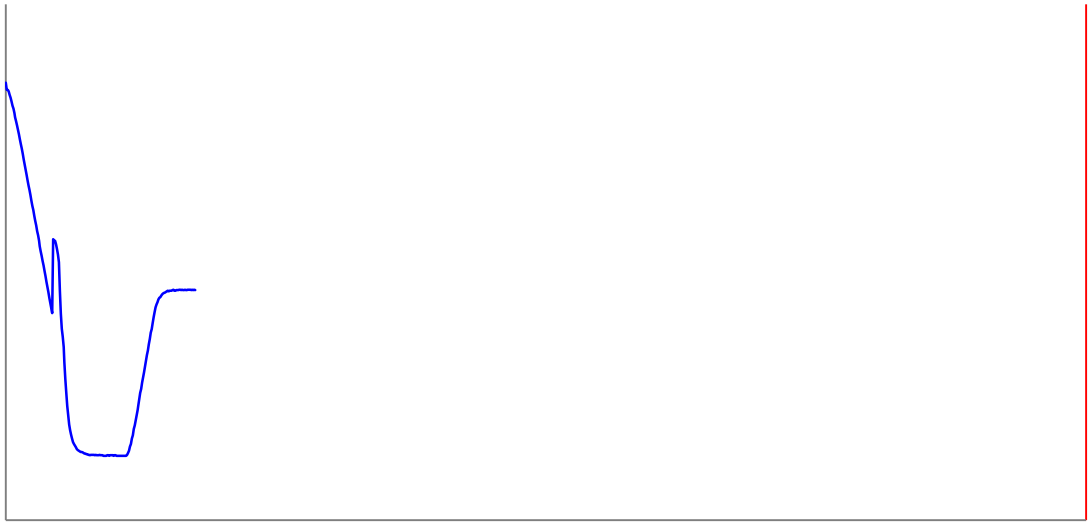
- A technique which dries product at low temperature through sublimation process
- It consists of three main steps : , and



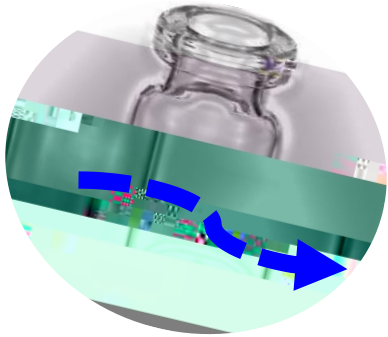
- A technique which dries product at low temperature through sublimation process
- It consists of three main steps : , and



- A technique which dries product at low temperature through sublimation process
- It consists of three main steps : , and



- Impedance spectroscopy characterizes the ability of materials to conduct



Through Vial Impedance Spectroscopy (TVIS)

Introduction

- Through Vial Multi Channel Impedance Analyzer
- Impedance measurement specially optimized for lyophilization experiments (contact method)
- Five sequentially measuring impedance

- An equivalent electrical circuit model is created by combining the circuit elements which includes the solution resistance ( ) and the capacitances of the glass-solution interface ( ) and the solution ( ) in an appropriate configuration of series and parallel elements.

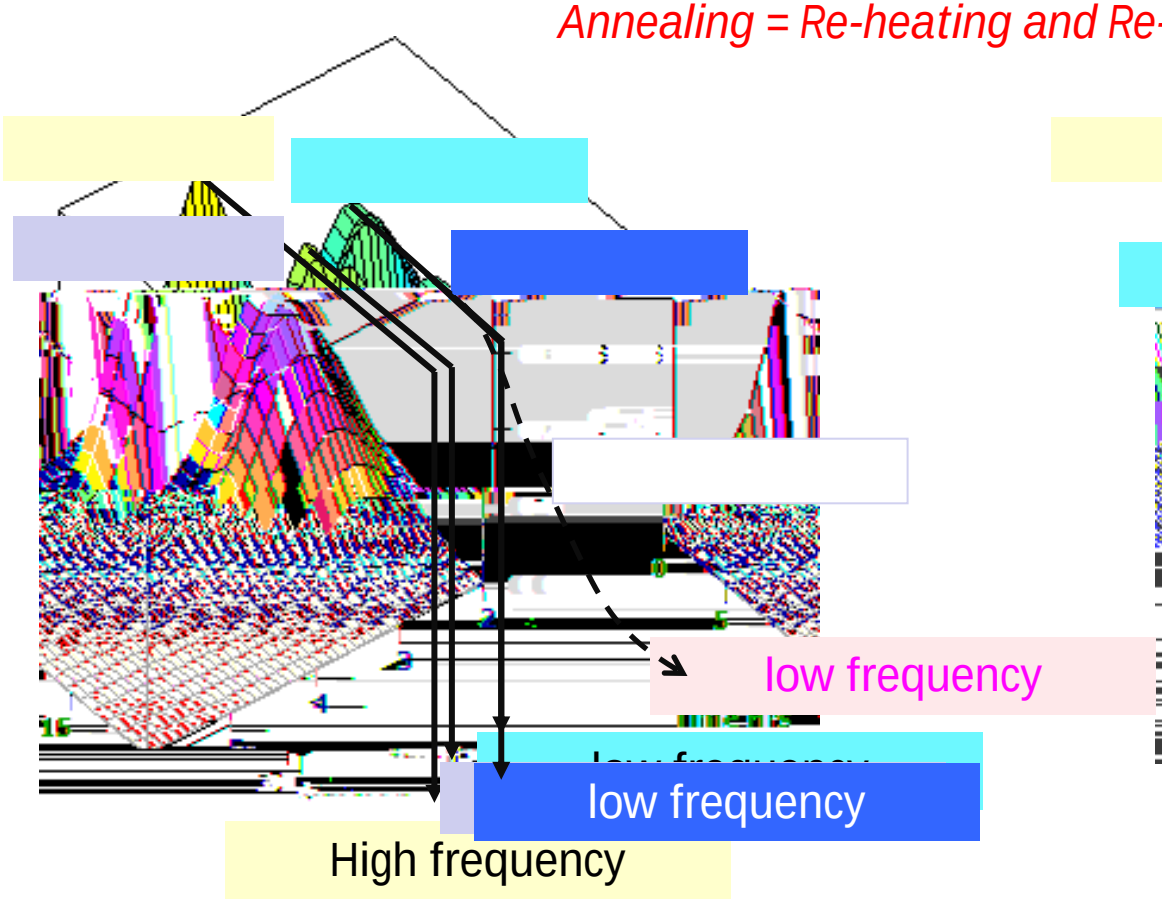
C_G is the capacitance of the glass-solution interface,

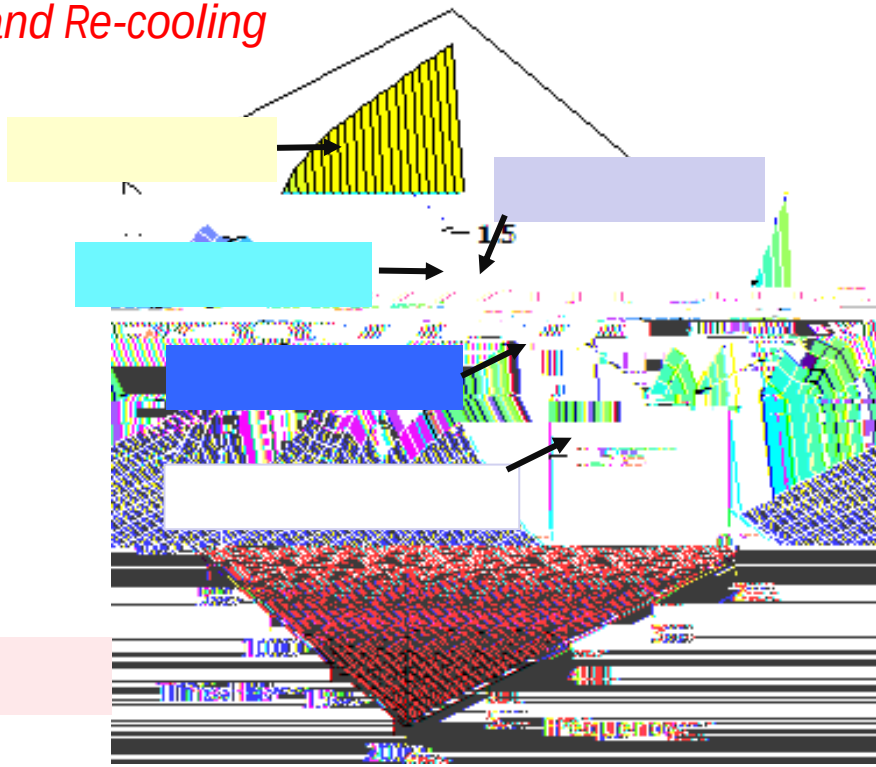
C_S

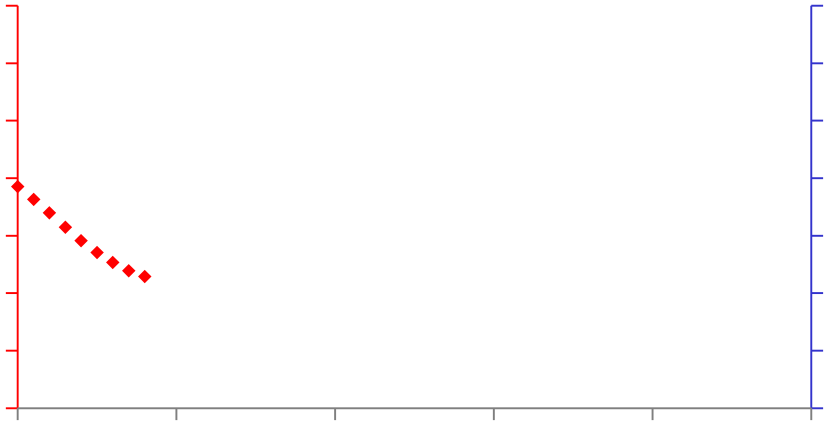
Imaginary Part of Capacitance

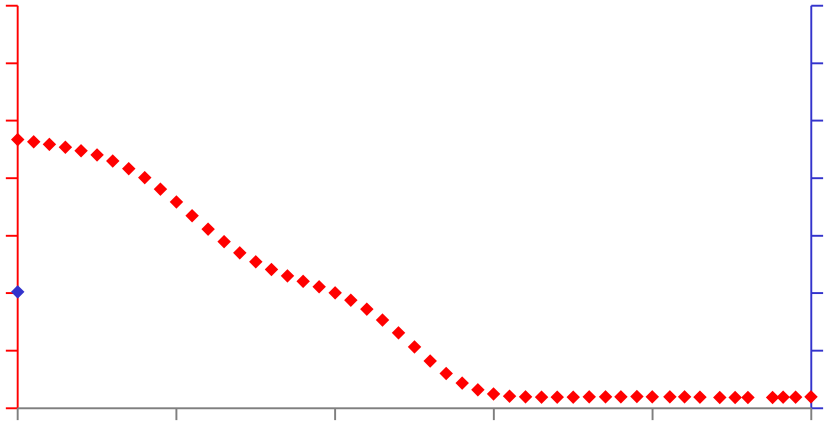
Real Part of Capacitance

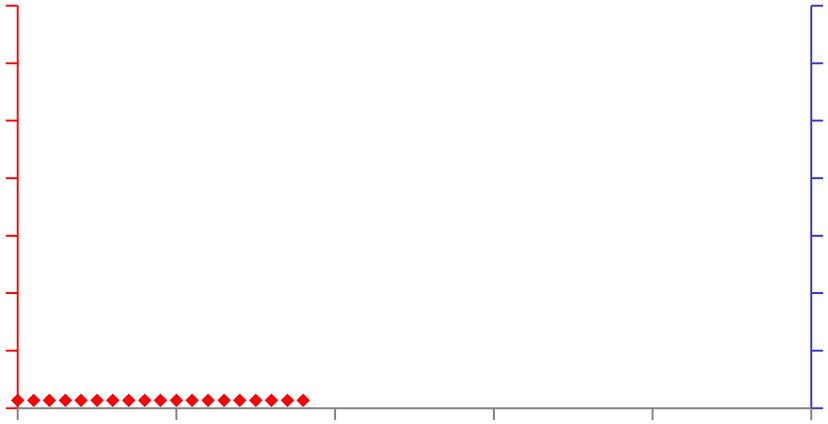
Annealing = Re-heating and Re-cooling



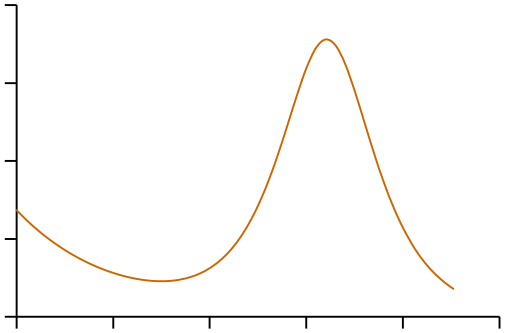


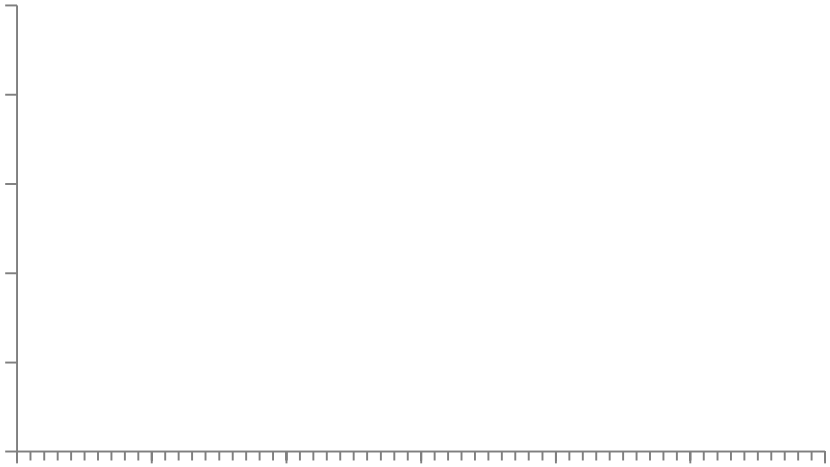






- TVIS measurement relate to both the *electrical resistance* and *electrical capacitance of the vial contents.*

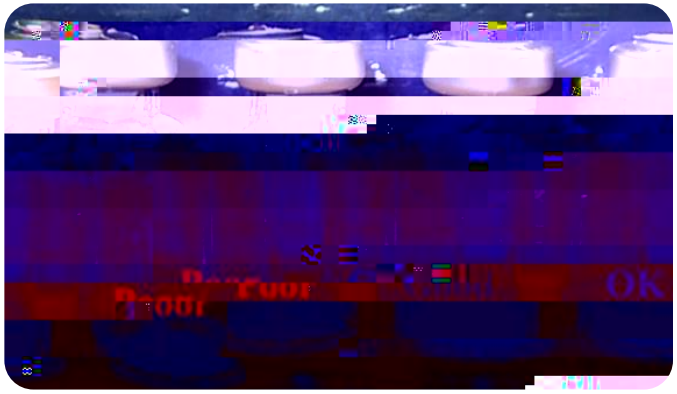




1

- Temperature calibration of the TVIS parameter ( ) for ice during an additional temperature cycling stage applied to a prediction of ice temperatures during the initial (few hours) of primary drying
- Temperature compensation of TVIS parameter ( ) allows for an accurate estimation of ice mass during primary drying as evidenced by comparable

- Development mapping a drying characteristics from lab scale to production
  - Determination of heat transfer coefficients ( )
  - Determination of dry layer resistance ( ) to predict drying efficiency



- Investigation the molecular dynamic of the unfrozen fraction
  - Monitoring product stability
  - Examine the mechanical strength of the freeze dried product (i.e. collapse behaviour)

- Develop (new) continuous drying technologies