LIÈGE université
GIGA
Consciousness

COMA
SCIENCE GROUP

Principles of [18F]FDG Tracer Kinetics

Tommaso Volpi

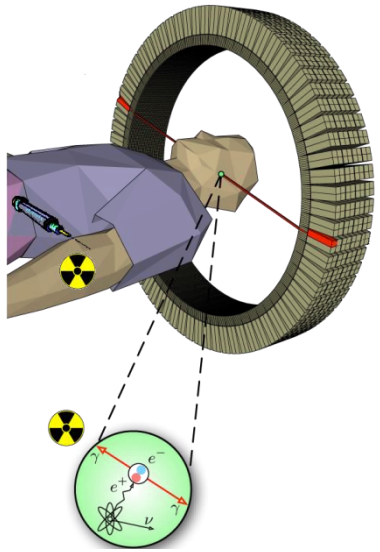
PADOVA
neuroscience
CENTER

FAIR
functional and anatomical imaging research

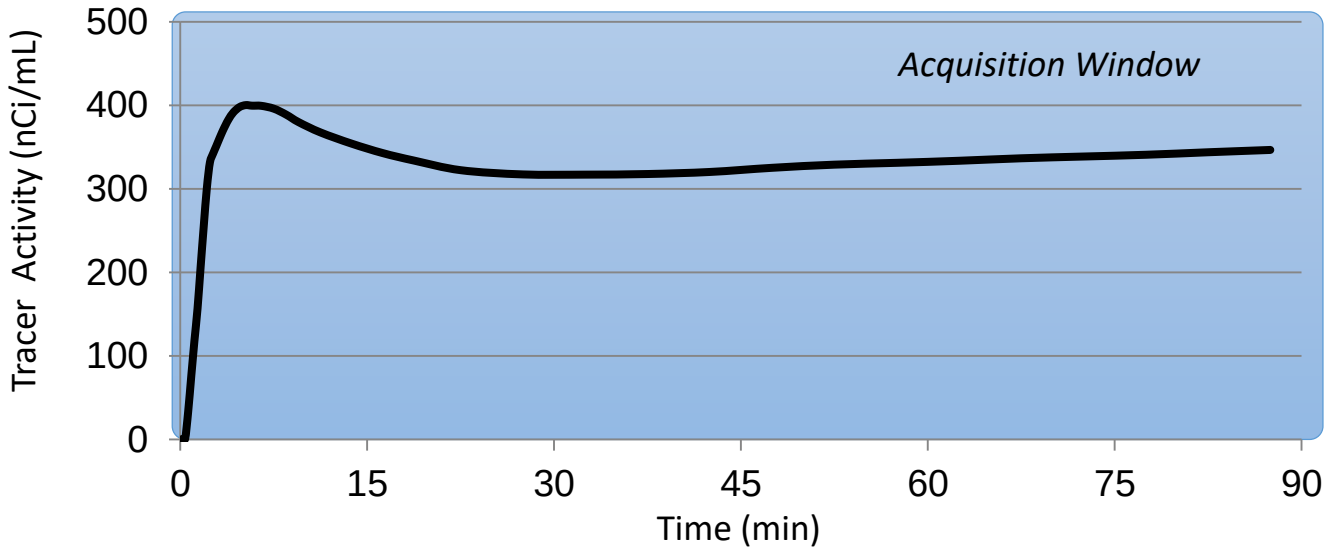
Static vs. Dynamic PET imaging

Dynamic PET imaging

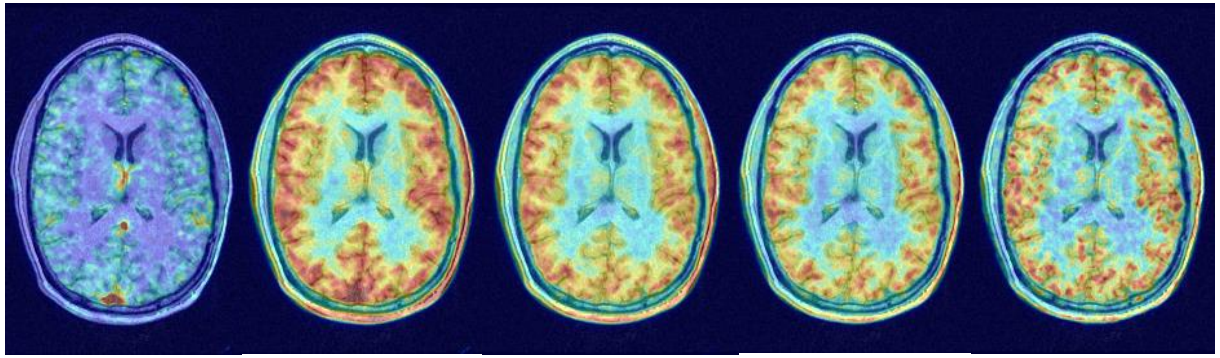
PET study



Evaluation of PET tracer activity



Acquired images

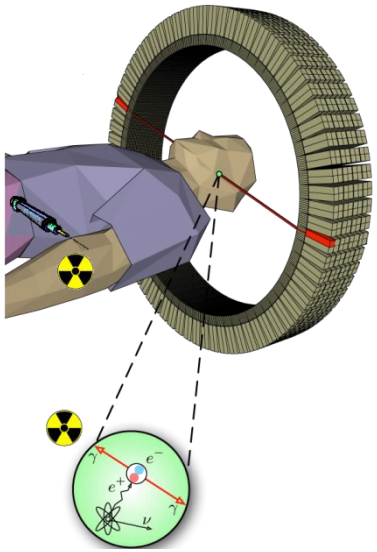


MULTI-FRAME REPRESENTATION OF TRACER KINETICS

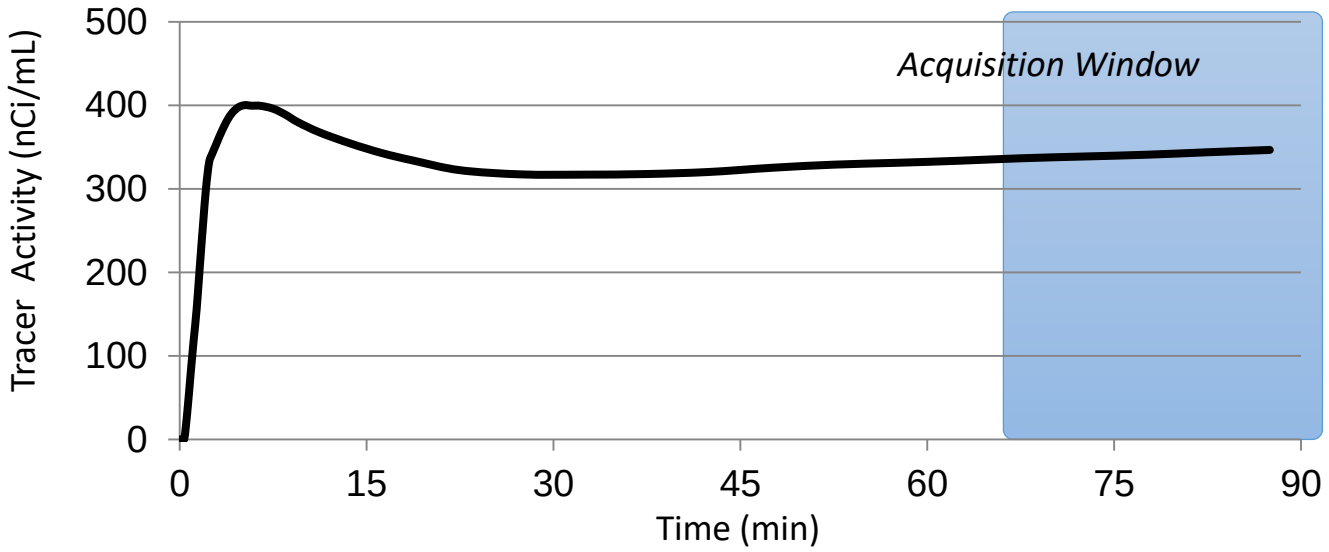
Static vs. Dynamic PET imaging

Static PET imaging

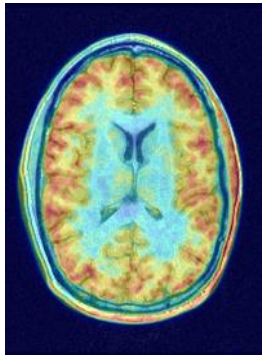
PET study



Evaluation of PET tracer activity

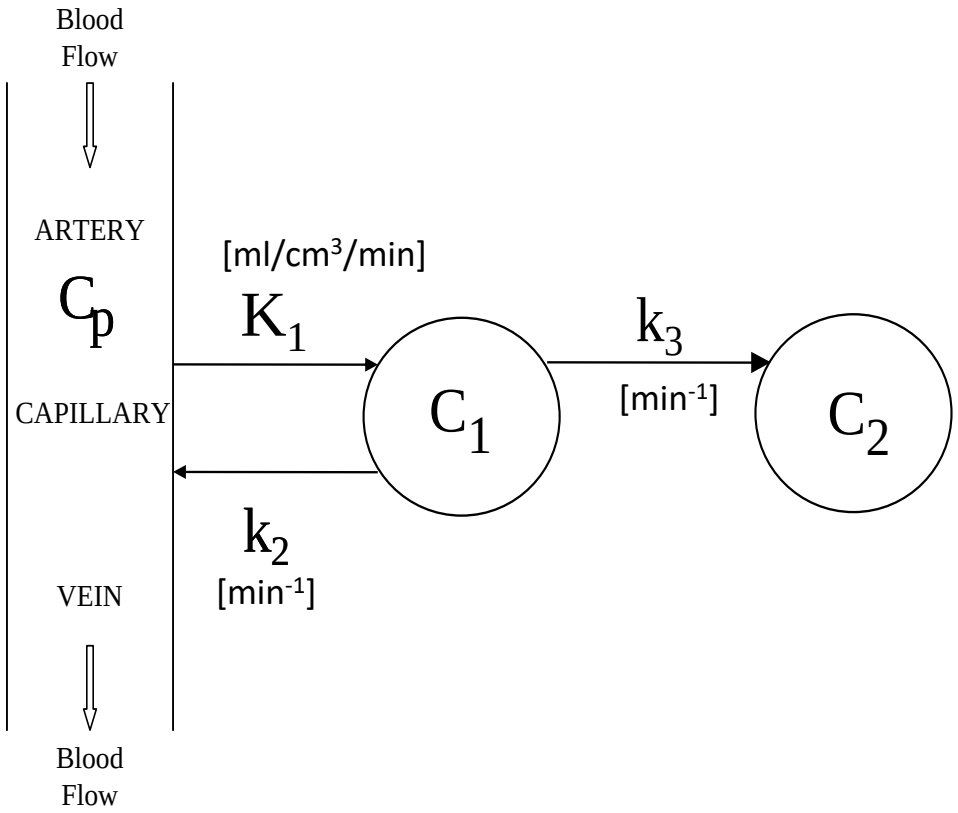


Acquired images



SINGLE-FRAME REPRESENTATION OF TRACER KINETICS

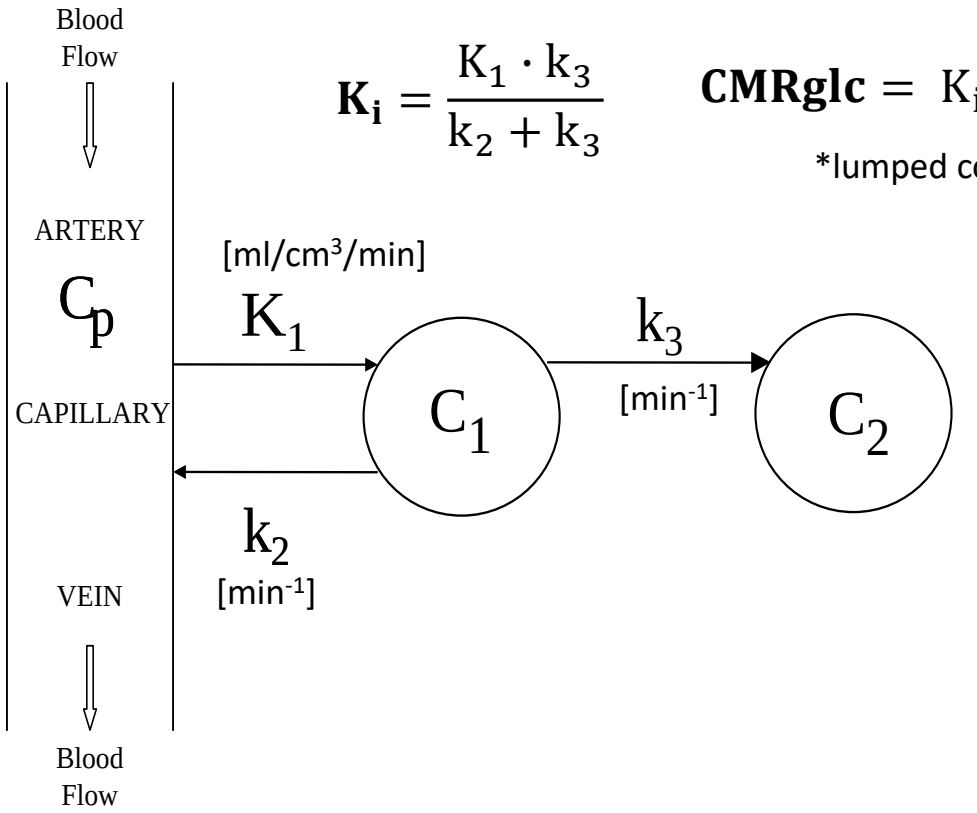
Quantification - Compartment Model



Two-tissue three-constant compartment model (2T-3K CM)

(*Sokoloff et al. J Neurochem 1977*)

Quantification - Compartment Model



$$\mathbf{K_i} = \frac{K_1 \cdot k_3}{k_2 + k_3}$$

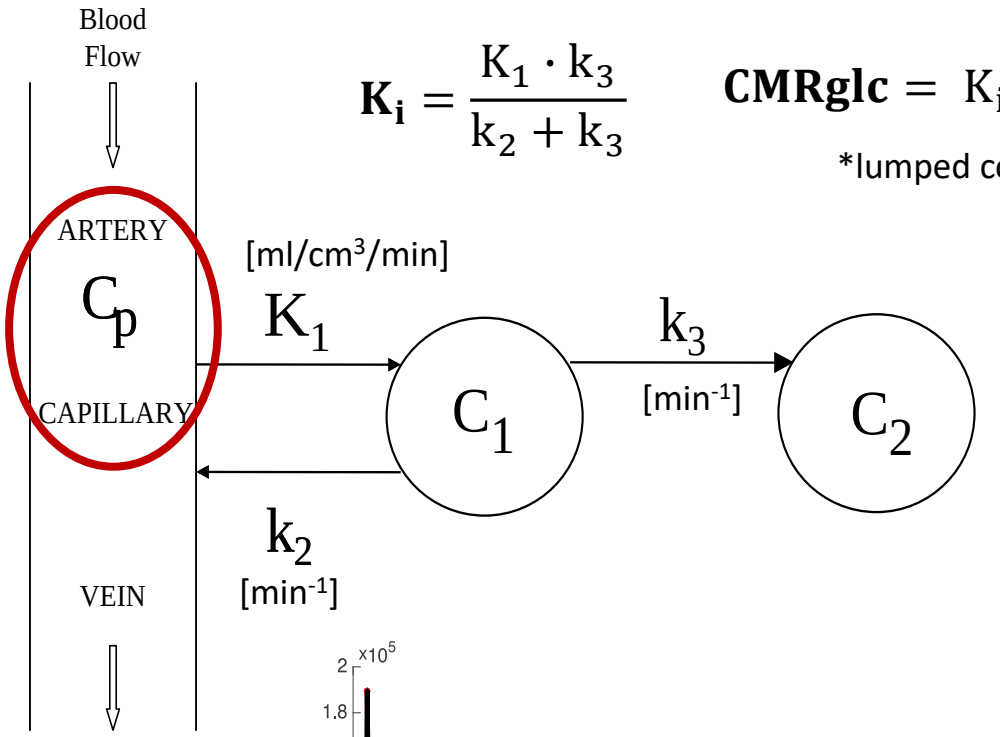
$$\mathbf{CMRglc} = K_i \cdot LC^*$$

*lumped constant

Two-tissue three-constant compartment model (2T-3K CM)

(*Sokoloff et al. J Neurochem 1977*)

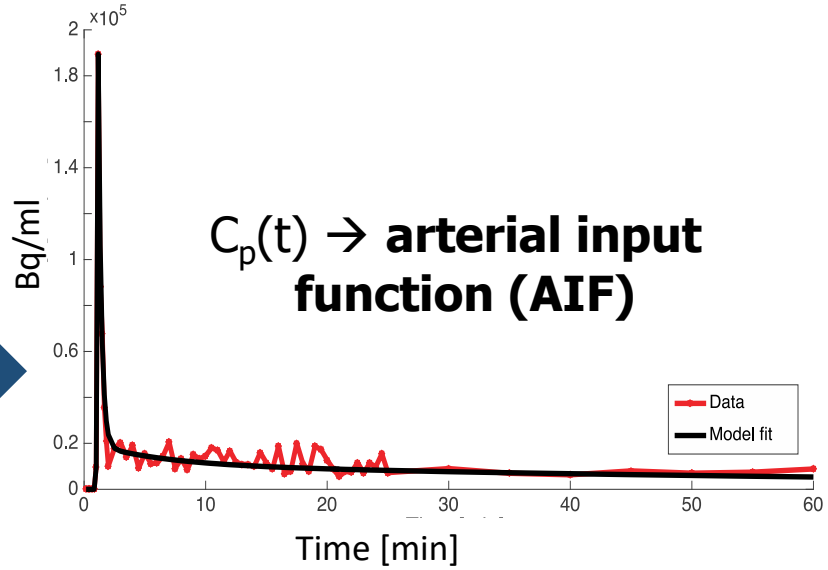
Quantification - Compartment Model



$$K_i = \frac{K_1 \cdot k_3}{k_2 + k_3}$$

$$CMRglc = K_i \cdot LC^*$$

*lumped constant



$C_p(t)$ → **arterial input function (AIF)**

Two-tissue three-constant compartment model (2T-3K CM)

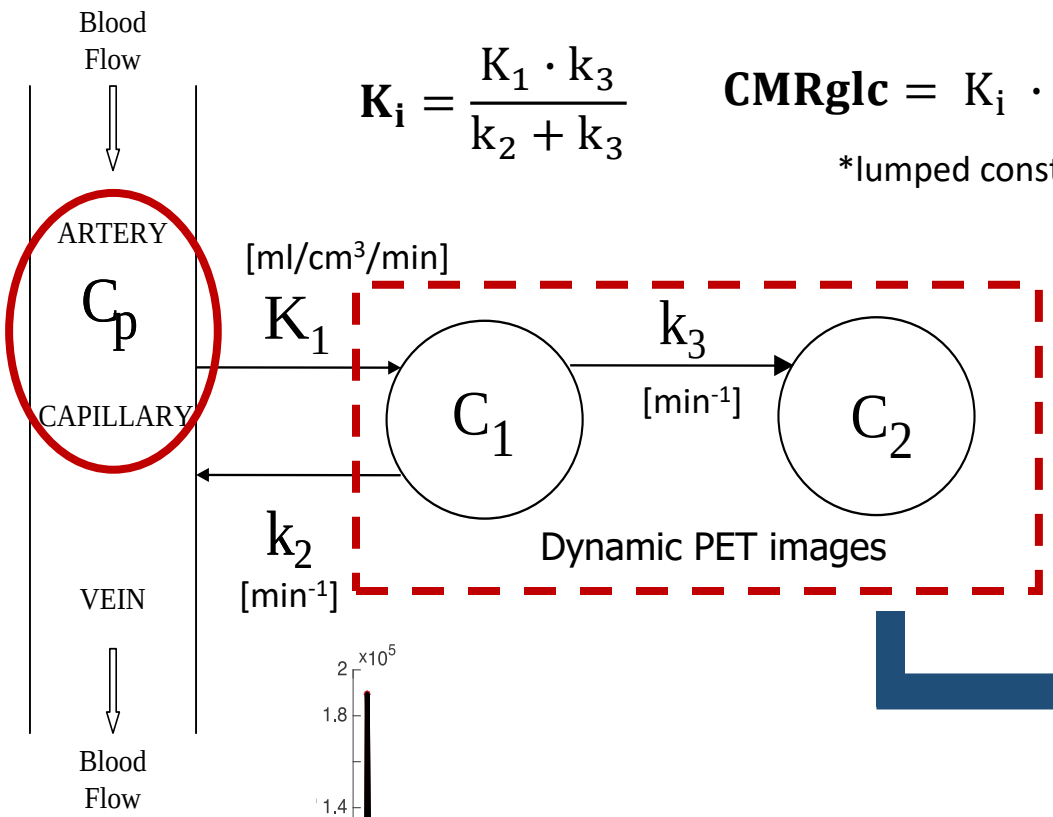
(*Sokoloff et al. J Neurochem 1977*)

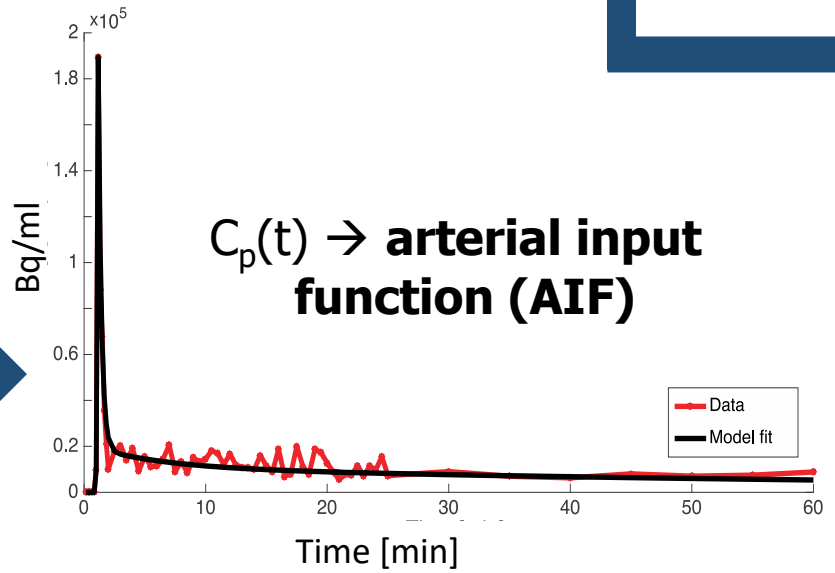
Quantification - Compartment Model

$$K_i = \frac{K_1 \cdot k_3}{k_2 + k_3}$$

$$CMRglc = K_i \cdot LC^*$$

*lumped constant

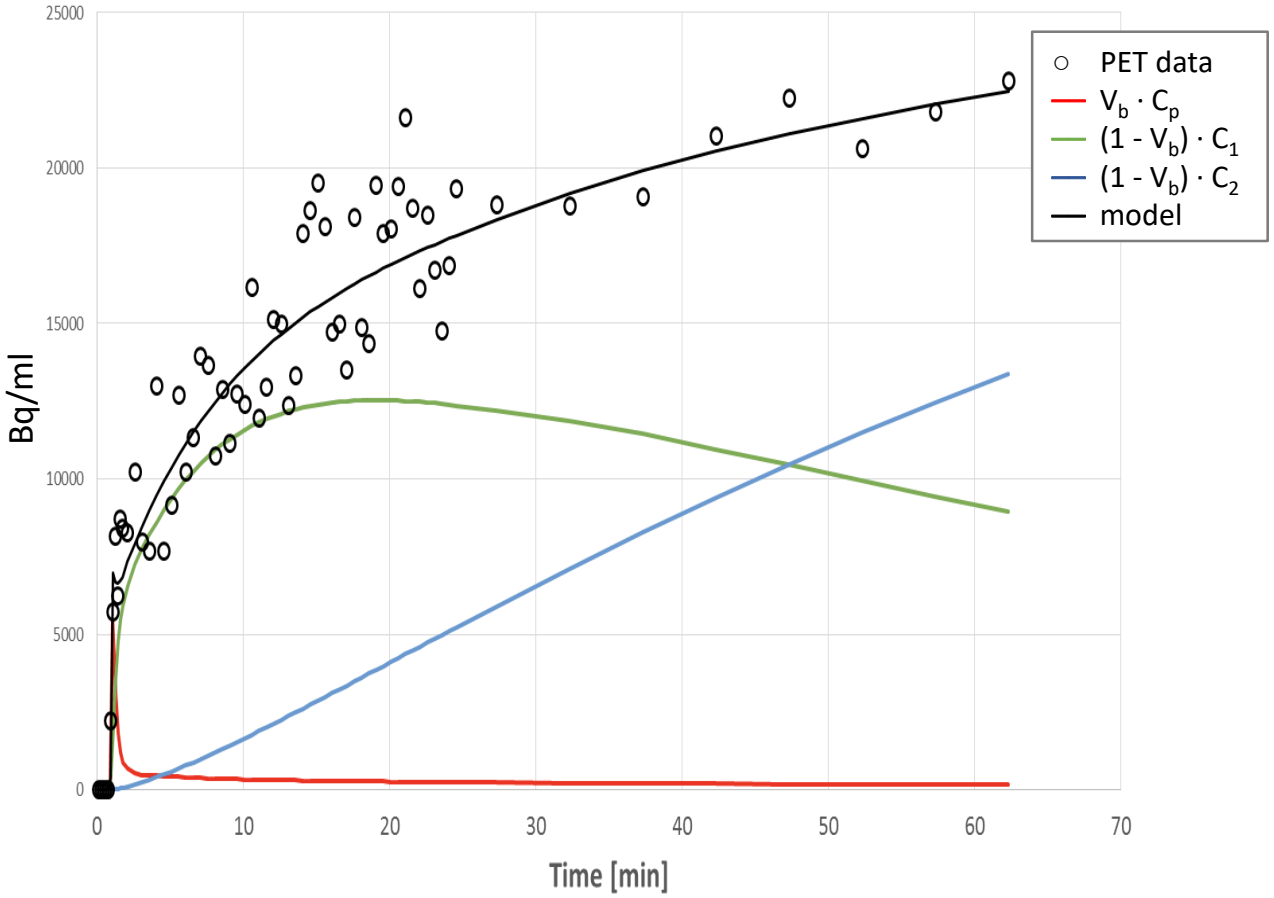




$C_p(t)$ → **arterial input function (AIF)**

Two-tissue three-constant compartment model (2T-3K CM)

(*Sokoloff et al. J Neurochem 1977*)

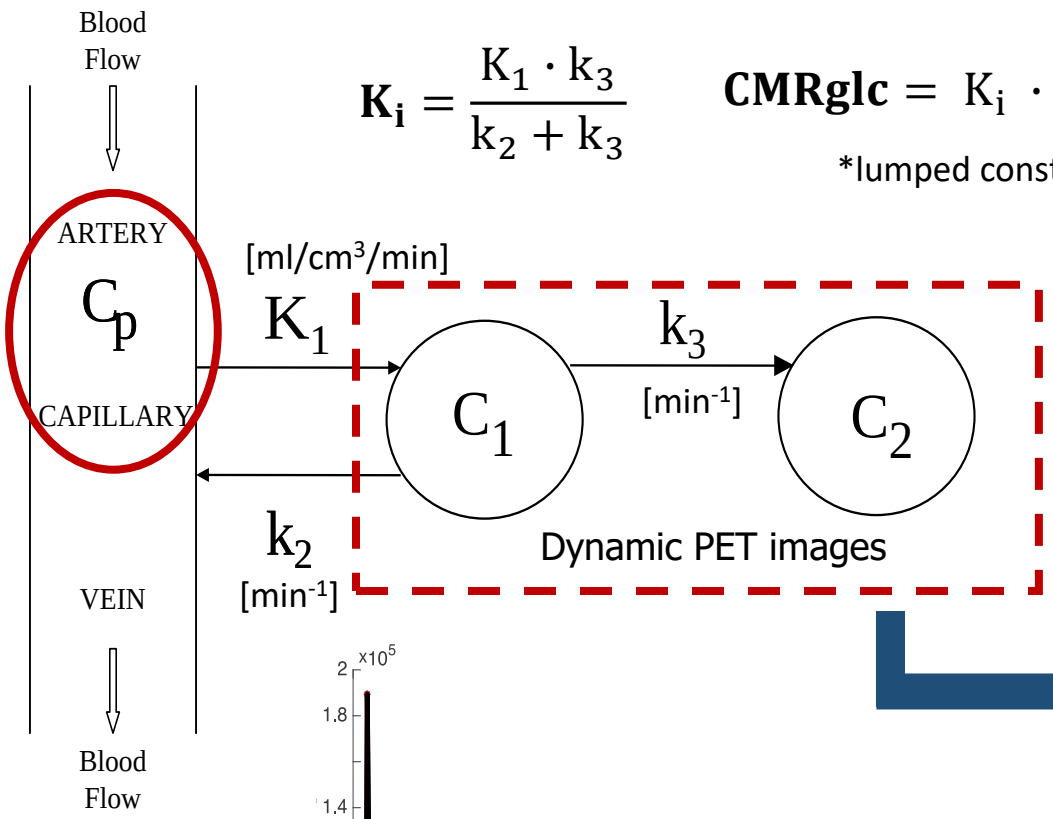


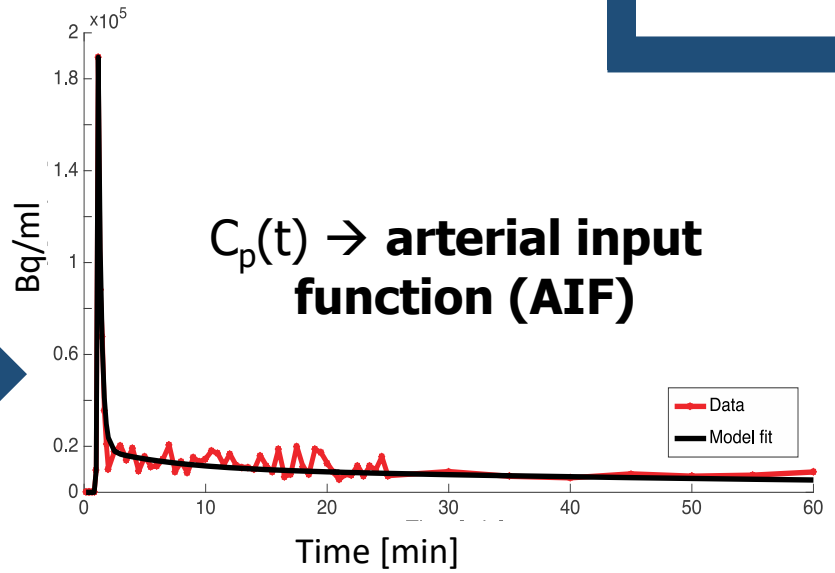
Quantification - Compartment Model

$$K_i = \frac{K_1 \cdot k_3}{k_2 + k_3}$$

$$CMRglc = K_i \cdot LC^*$$

*lumped constant



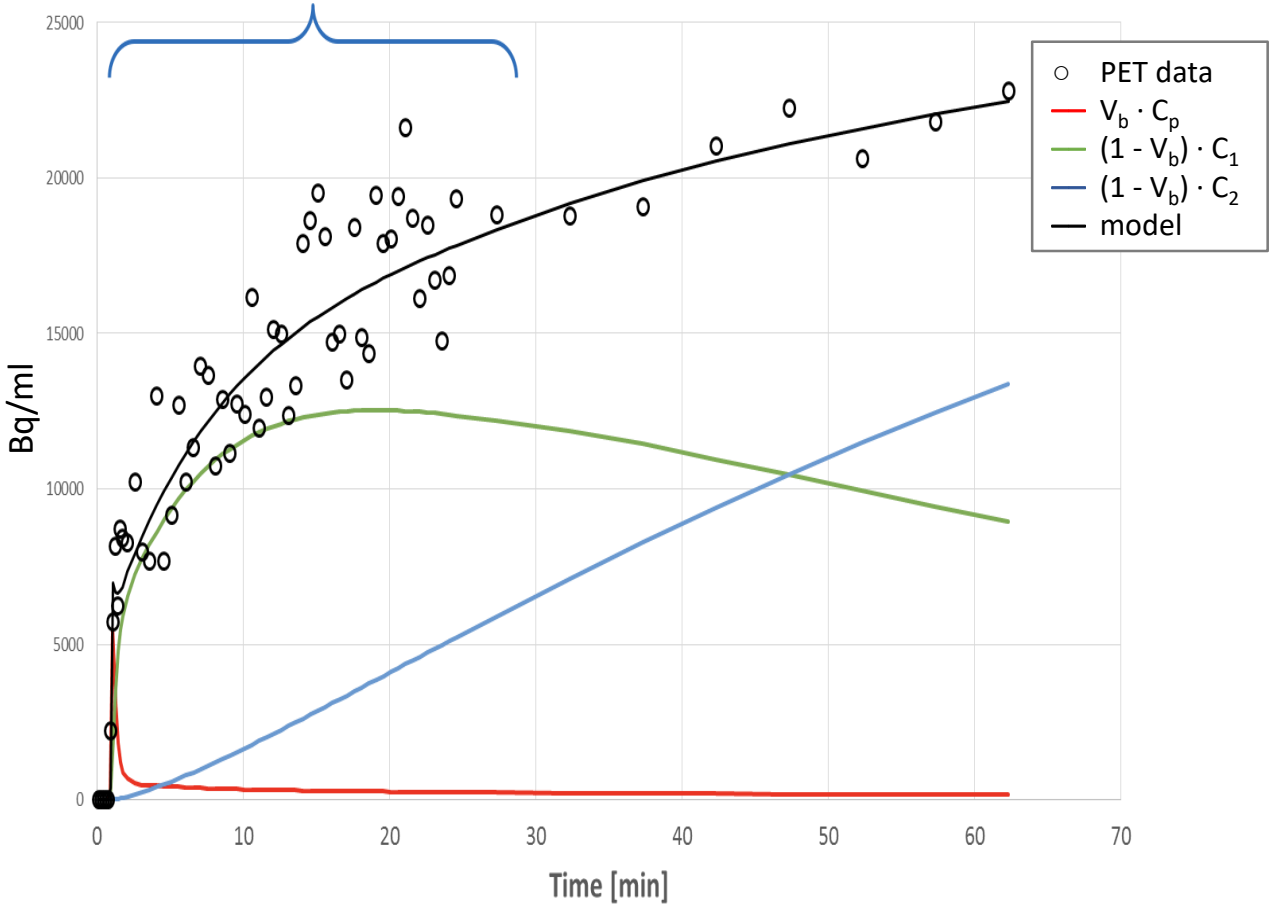


$C_p(t)$ → **arterial input function (AIF)**

Two-tissue three-constant compartment model (2T-3K CM)

(*Sokoloff et al. J Neurochem 1977*)

Unreliable uptake

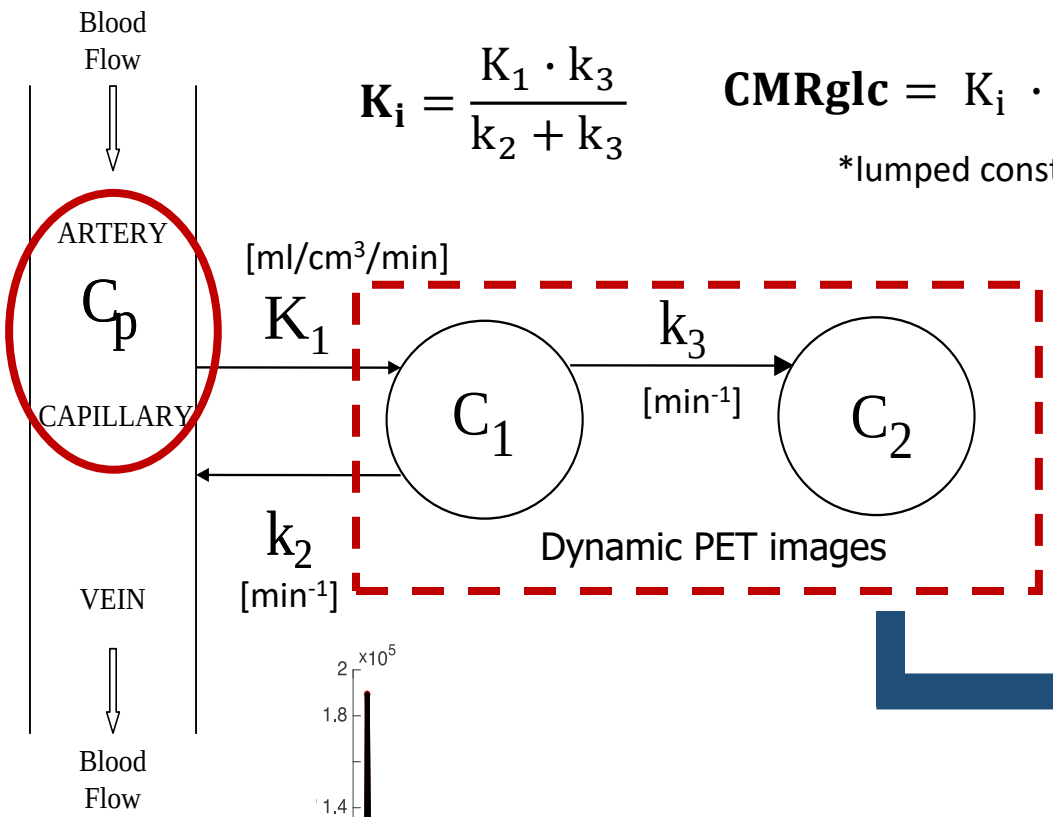


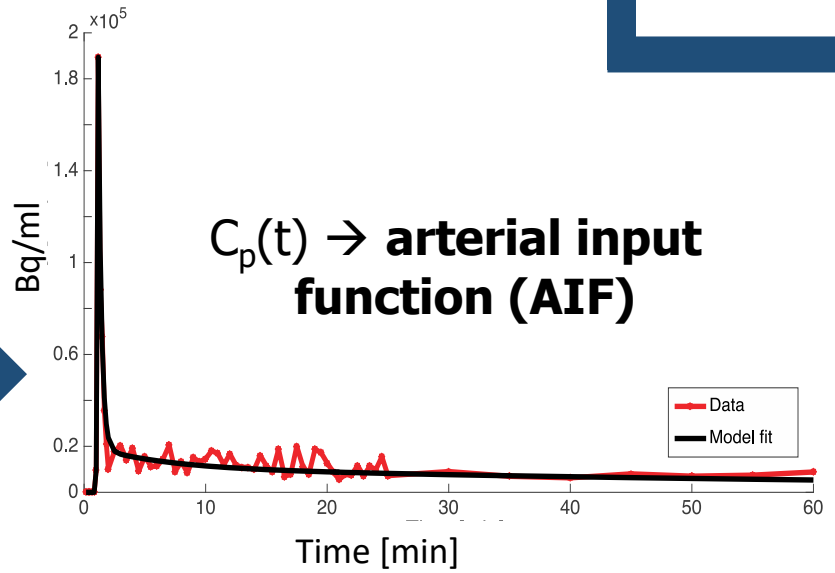
Quantification - Compartment Model

$$K_i = \frac{K_1 \cdot k_3}{k_2 + k_3}$$

$$CMRglc = K_i \cdot LC^*$$

*lumped constant

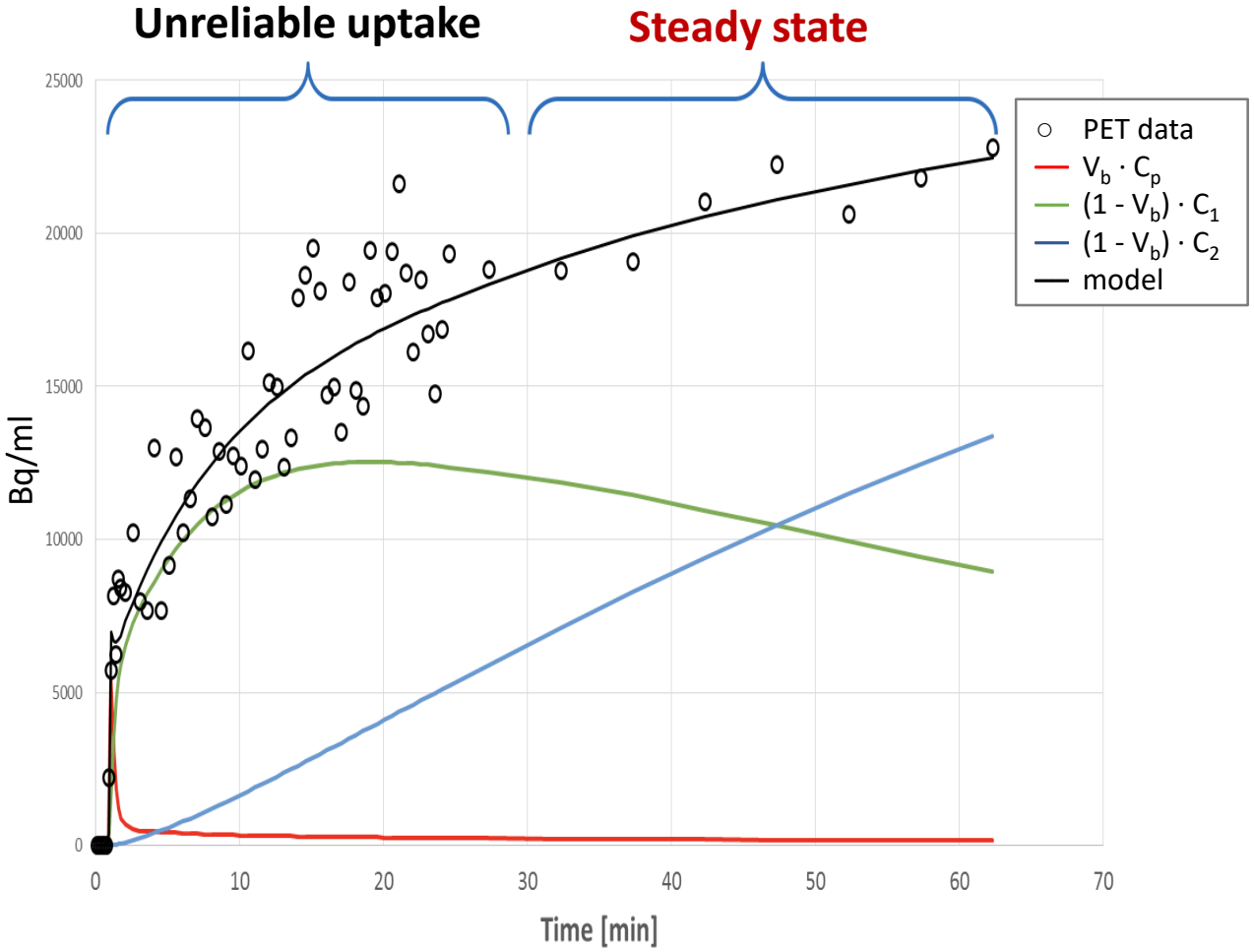




$C_p(t)$ → **arterial input function (AIF)**

Two-tissue three-constant compartment model (2T-3K CM)

(*Sokoloff et al. J Neurochem 1977*)



Quantification – simplifications

COMPARTMENTAL MODELS
→ 2TCM

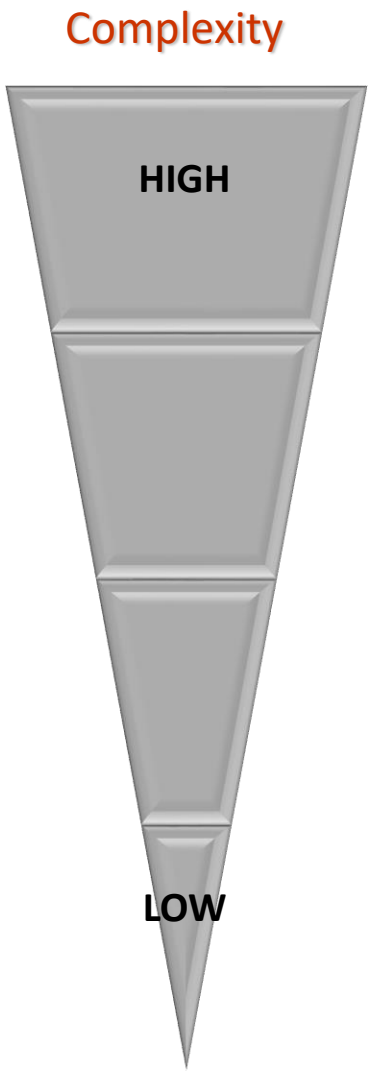
INPUT/OUTPUT MODELS
→ spectral analysis

GRAPHICAL METHODS
→ Patlak's plot

SEMI-QUANTITATIVE METHODS
→ SUV, SUVR

(*Bertoldo, Rizzo, Veronese, Clin Transl Imaging, 2014*)

Quantification – simplifications



COMPARTMENTAL MODELS
→ 2TCM

INPUT/OUTPUT MODELS
→ spectral analysis

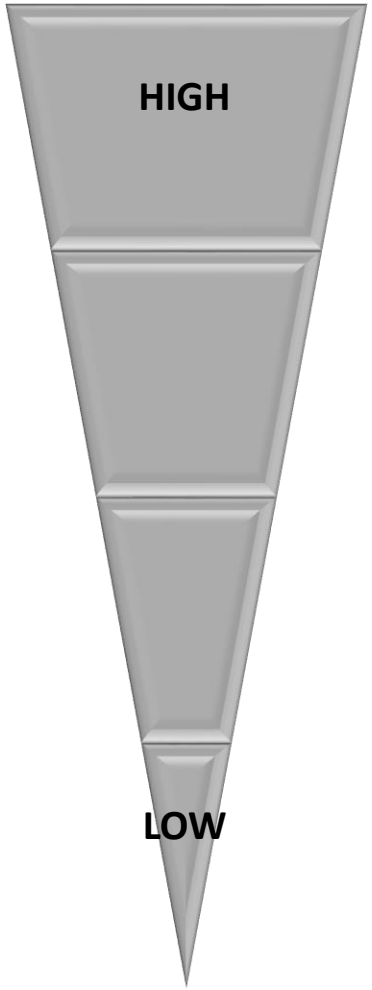
GRAPHICAL METHODS
→ Patlak's plot

SEMI-QUANTITATIVE METHODS
→ SUV, SUVR

(*Bertoldo, Rizzo, Veronese, Clin Transl Imaging, 2014*)

Quantification – simplifications

Complexity



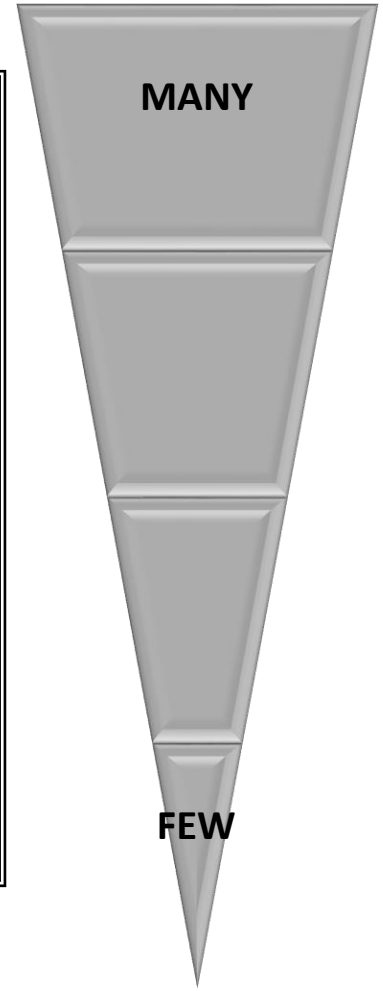
COMPARTMENTAL MODELS
→ 2TCM

INPUT/OUTPUT MODELS
→ spectral analysis

GRAPHICAL METHODS
→ Patlak's plot

SEMI-QUANTITATIVE METHODS
→ SUV, SUVR

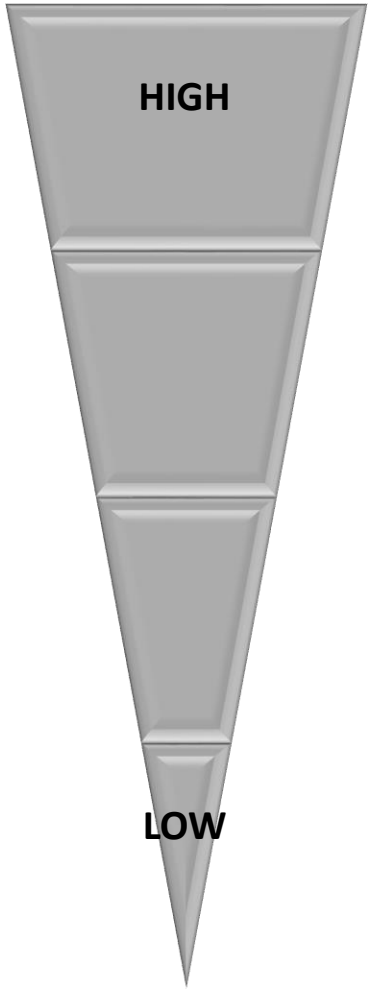
Physiological information



(*Bertoldo, Rizzo, Veronese, Clin Transl Imaging, 2014*)

Quantification – simplifications

Complexity



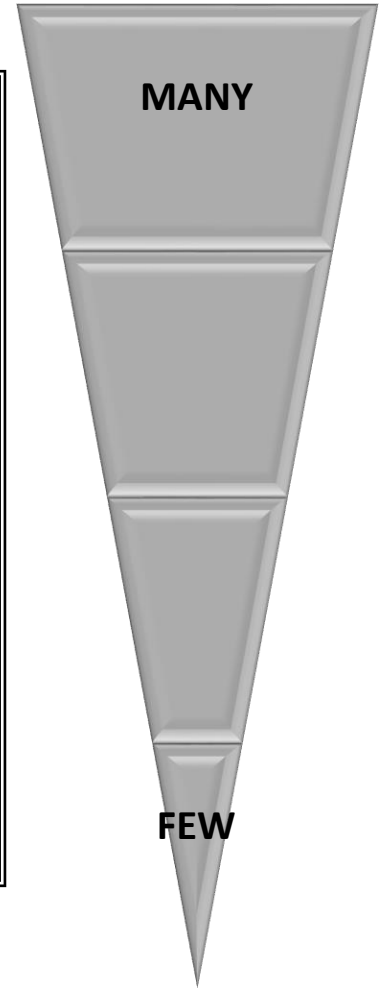
COMPARTMENTAL MODELS
→ 2TCM

INPUT/OUTPUT MODELS
→ spectral analysis

GRAPHICAL METHODS
→ Patlak's plot

SEMI-QUANTITATIVE METHODS
→ SUV, SUVR

Physiological information

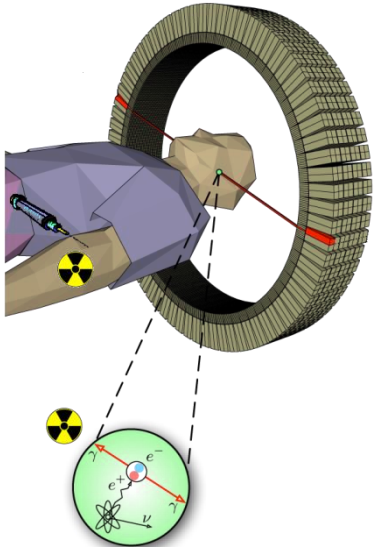


(*Bertoldo, Rizzo, Veronese, Clin Transl Imaging, 2014*)

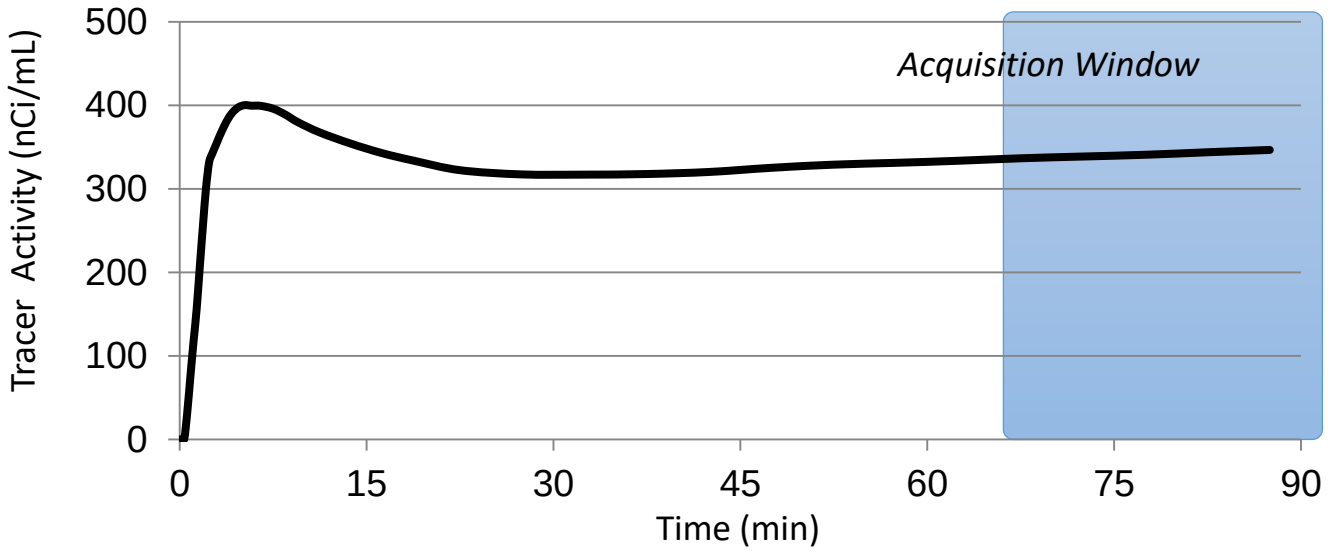
(Semi)quantification - SUV

Static PET imaging

PET study

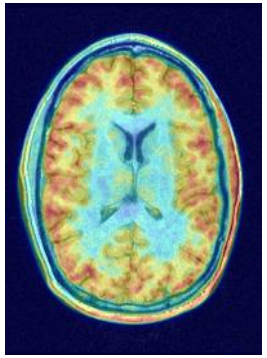


Evaluation of PET tracer activity



Acquired images

Standard uptake value (SUV)

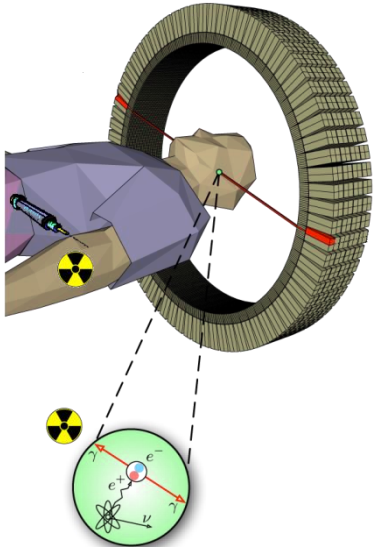


SINGLE-FRAME REPRESENTATION OF TRACER KINETICS

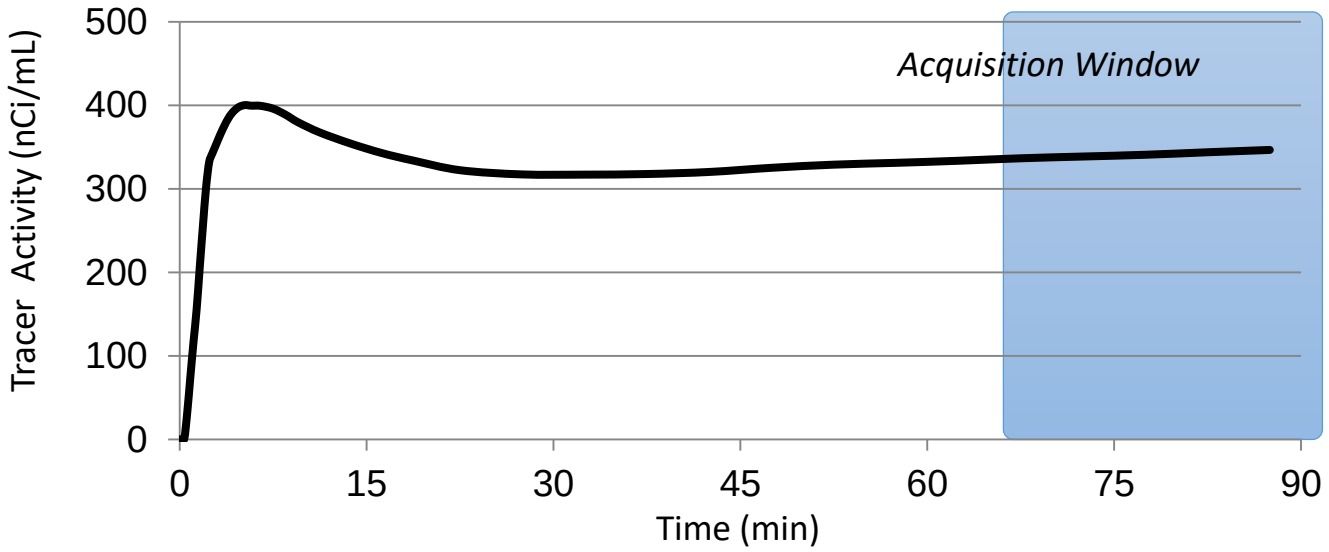
(Semi)quantification - SUV

Static PET imaging

PET study



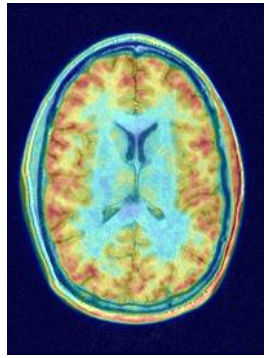
Evaluation of PET tracer activity



Acquired images

Standard uptake value (SUV)

$$K_i = \frac{K_1 \cdot k_3}{k_2 + k_3}$$



SINGLE-FRAME REPRESENTATION OF TRACER KINETICS

Acknowledgements

Prof. Alessandra Bertoldo, Ph.D.

Erica Silvestri, Ph.D.

Acknowledgements

Prof. Alessandra Bertoldo, Ph.D.

Erica Silvestri, Ph.D.

… and thank you for the attention!