Registration of image Modalities for analyses of tissue samples using 3D image modelling

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INTRODUCTION

- Fusion of **image modalities** (**MALDI imaging & histological staining** methods)
  - **high variability** of image data (coloration, image sharpness, possible deformations etc.)
  - development of a **software approach** for a **robust data fusion**
- 3D representation of an **entire organ** with **different imaging** methods
  - **increased** and the **corresponding organ segments information content** than a single tissue section
  - protein distribution in the **entire organ**
  - **clinical questions** in organ samples and tissues
  - show the **context** between the **substances**

METHODS

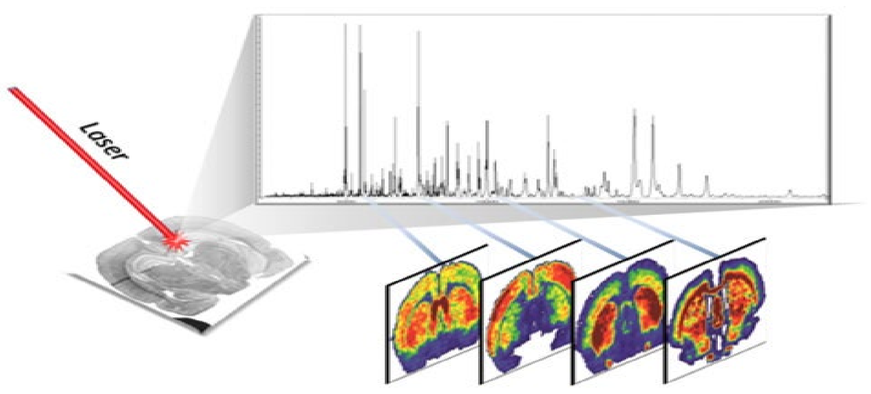

Figure 1: Illustration of MALDI imaging workflow

- Coating with **matrix** for MALDI MSI measurement
- **Ionization** by laser beam
- Scanning of sample and accumulation of **mass spectrometric data**
- Calculation of **MALDI imaging spectra**
- Peak convolution and **quantification** of signal intensity

WORKFLOW

- Histological **tissue sections** of **entire mice heart**
- **Successive** sections form one **data set**
- **MALDI MSI** data and data from **hematoxylin-eosin** staining, **Gomori** staining and **immunohistochemical double staining and immunofluorescence** were fused to a 3D reconstruction of a mice heart **(Figure 2)**

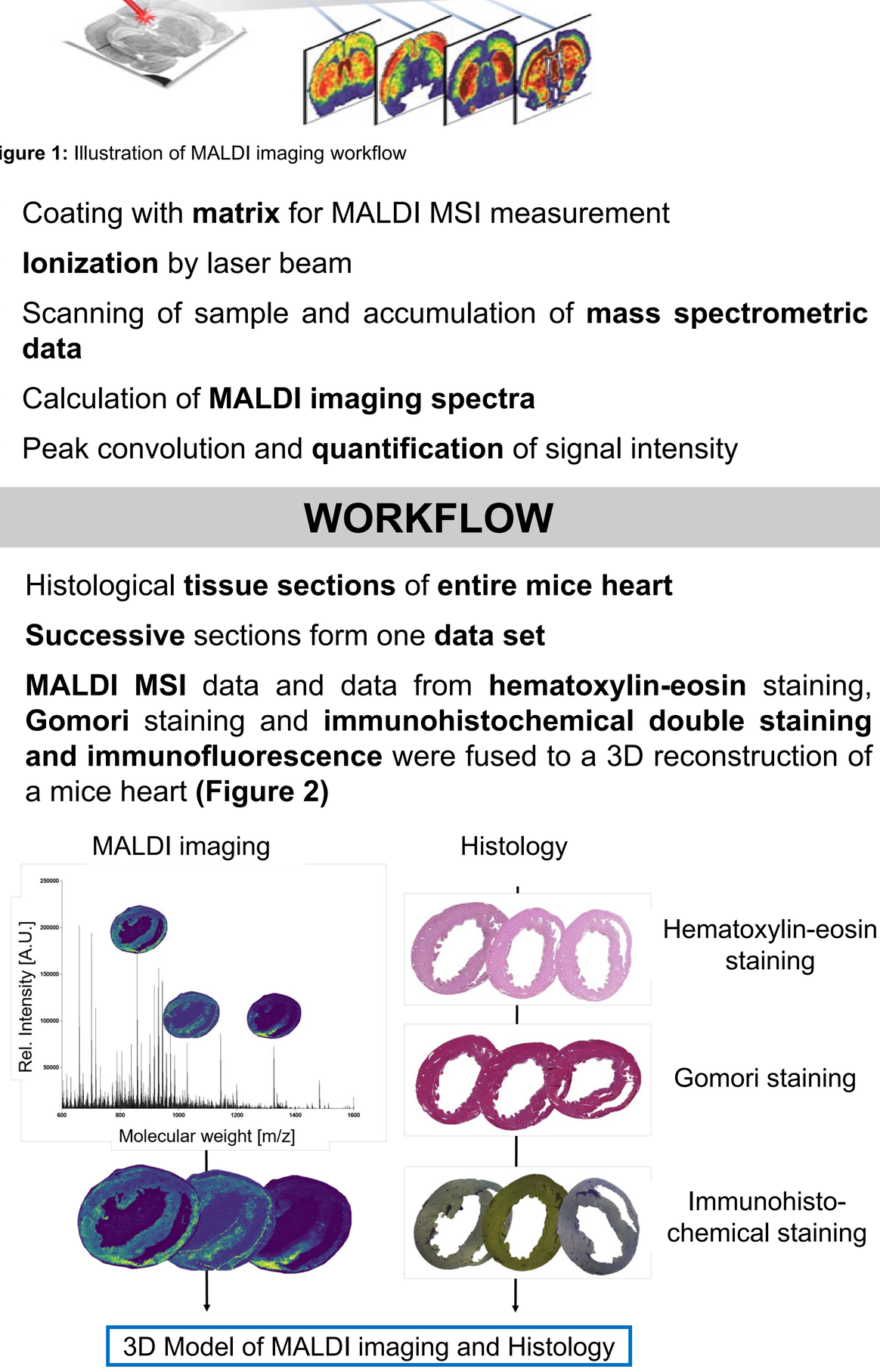

Figure 2: Overview of the 3D model by fusion of image modalities

RESULT

- **Stacking** of the single sections to get an **reconstruct** of the mice heart Arbitrary cutting from any angle of the organ **reconstruction is possible**
- **Zooming** into the model also available
- **Fusion** of hematoxylin eosin (HE) stained and MALDI imaging data **(Figure 3)**
- The **narrow planes of the corresponding image data** can be blended out and blended in again

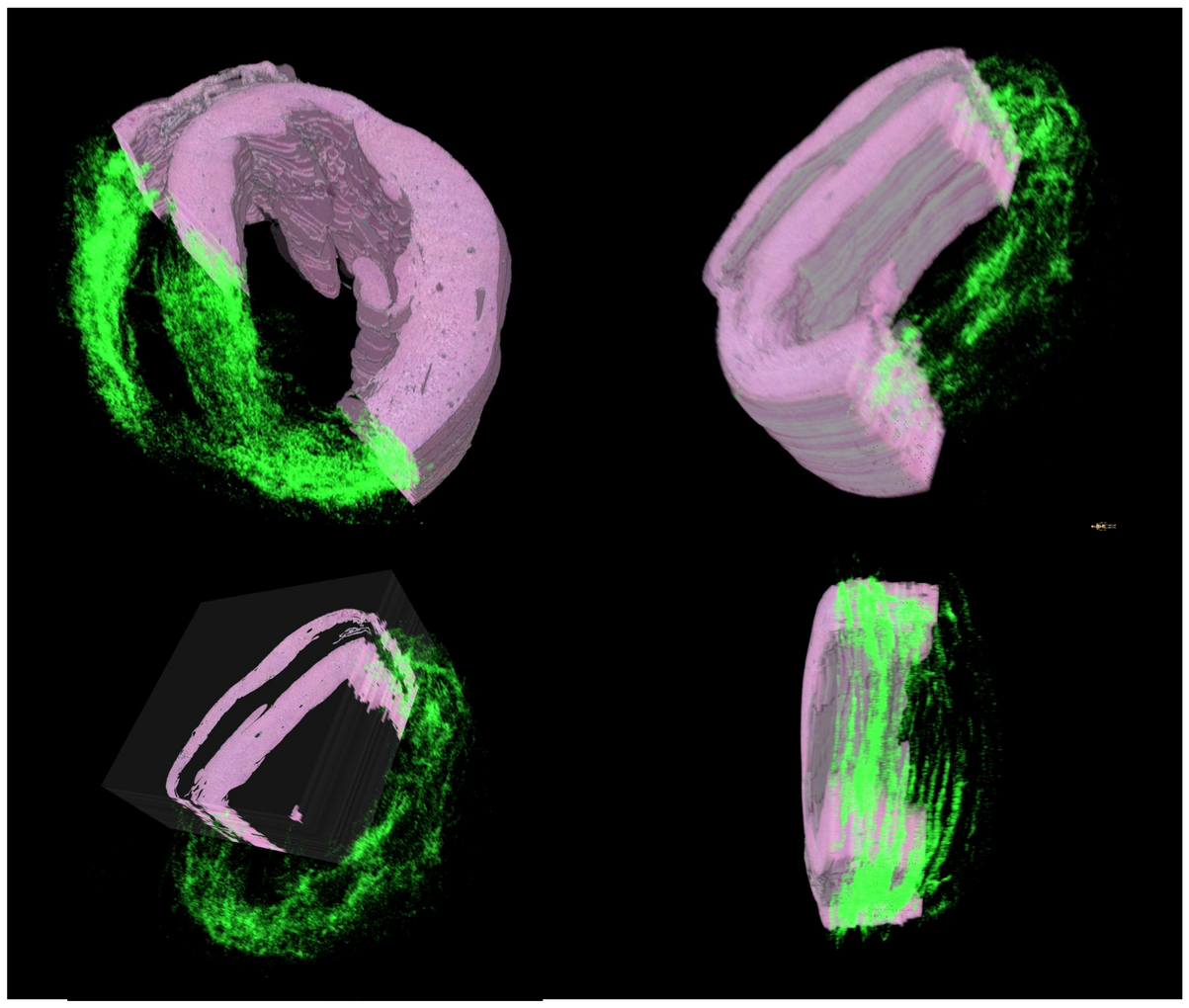

Figure 3: Illustration of merged hematoxylin eosin (HE) stained and MALDI imaging data of a entire mice heart. The dataset for MALDI images and for HE stained images can be hidden separately on and off. Also, the complete model can be cutting. The MALDI data illustrate the mass signal of 805.7)

- Tissue can be **zoomed precisely** to display the **axial**, **coronal** and **sagittal level (Figure 4)**
- **Superposition** of the selected **image modalities** are displayed for this area **(Figure 4A)**

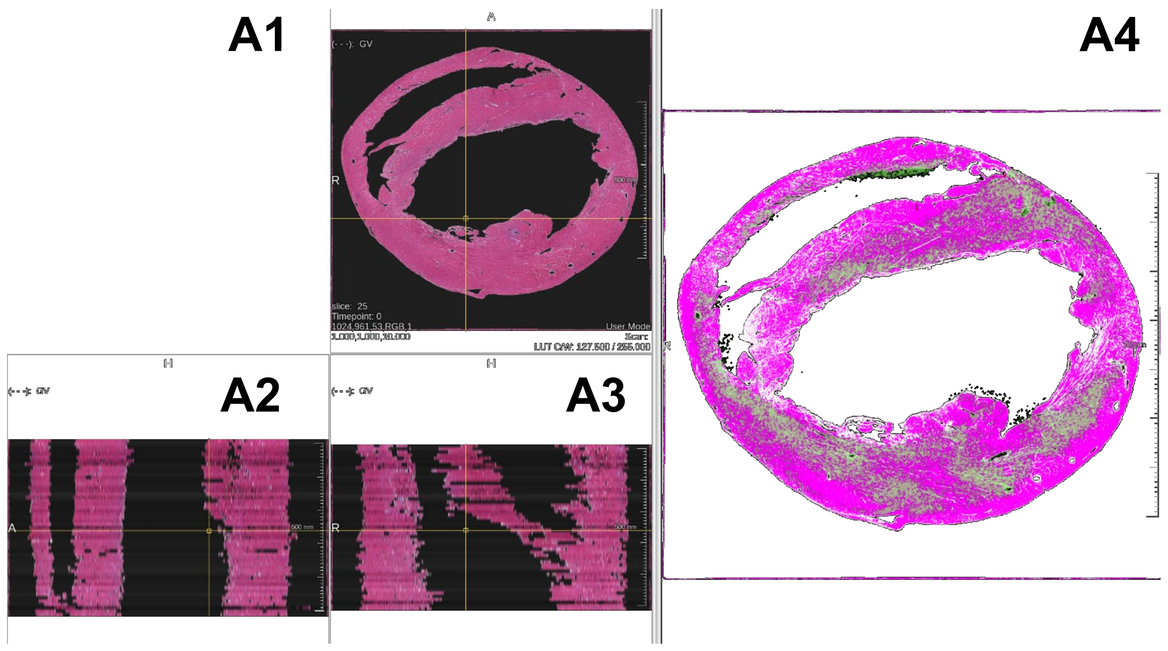

Figure 4: Split screen of the fusion Gomori and MSI data of a mice heart. A4 present the fusion of HE and MSI data. A1 Display one tissue section of the model in an axial level. A2 display the sagittal level and A3 display the coronal level

CONCLUSION

- There is a **successful fusion** of MALDI imaging and histological stained images and a reconstruction of the entire organ
- Different **variants to illustrate** the reconstruction, to get an **increased information content (Figure 3 and 4)**

Conflict of Interest – Disclosure: *Juliane Hermann* DOES NOT have a financial interest/arrangement or affiliation with one or more organizations that could be perceived as a real or apparent conflict of interest in the context of the subject of this presentation.