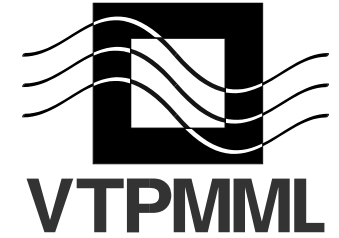




UNIVERSITY OF LATVIA

Laboratory for Mathematical Modelling of Environmental and Technological Processes



Mihails Ščepanskis

Neutron Imaging of Liquid Metals Potential of Latvian Contribution





Outline

- **Visualization of liquid metals: WHY IT IS IMPORTANT?**
- **BENEFITS of neutron imaging**
- **Neutron EXPERIMENTS**
- **Selected RESULTS**
- **Future plans**

LIQUID METALS: why it is important?

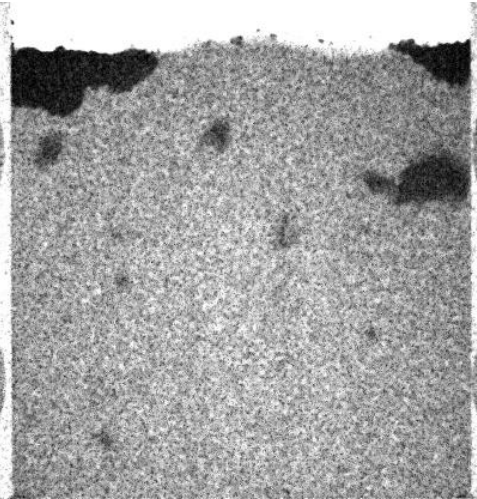
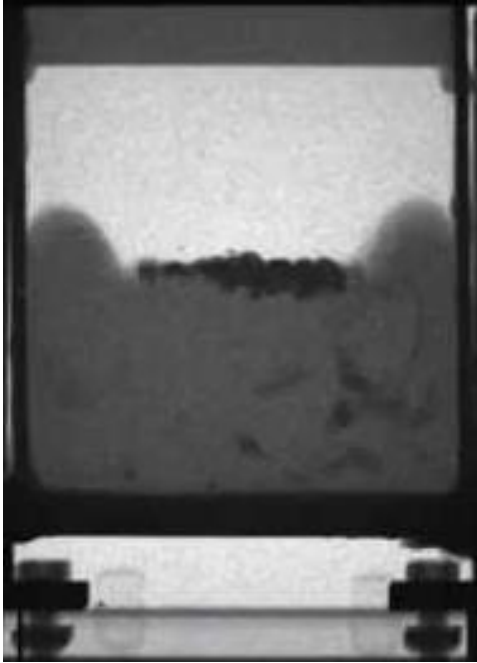


→ **METALLURGY**

→ **CRYSTAL GROWTH**

→ **ENERGETICS**

- Optimization of processes for better energy efficiency
 - New materials (MMC, ODS, ...)
 - Extremely pure casts, fine crystals
-
- Cooling in high energy nuclear reactors
 - Heat transfer for solar power concentrators
 - Energy source in space



Benefits of NEUTRON IMAGING:

- **Dynamic**
- **Non-invasive**
- **High penetration** (several centimeters, X-rays – only few millimeters)
- **High temporal and spatial resolution**

Neutron EXPERIMENTS

Swiss spallation source – the first and currently the biggest
continues spallation source



Collaboration between PSI and University of Latvia:

- MEGAPAI project: 1MW liquid metal spallation target
- Several research contracts
- Student practice at PSI
- Neutron experiments for liquid metals 2014 & 2015



Three whales:



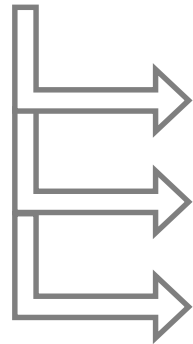
Model liquid metal



Contrast inclusions



Scaled down set-up

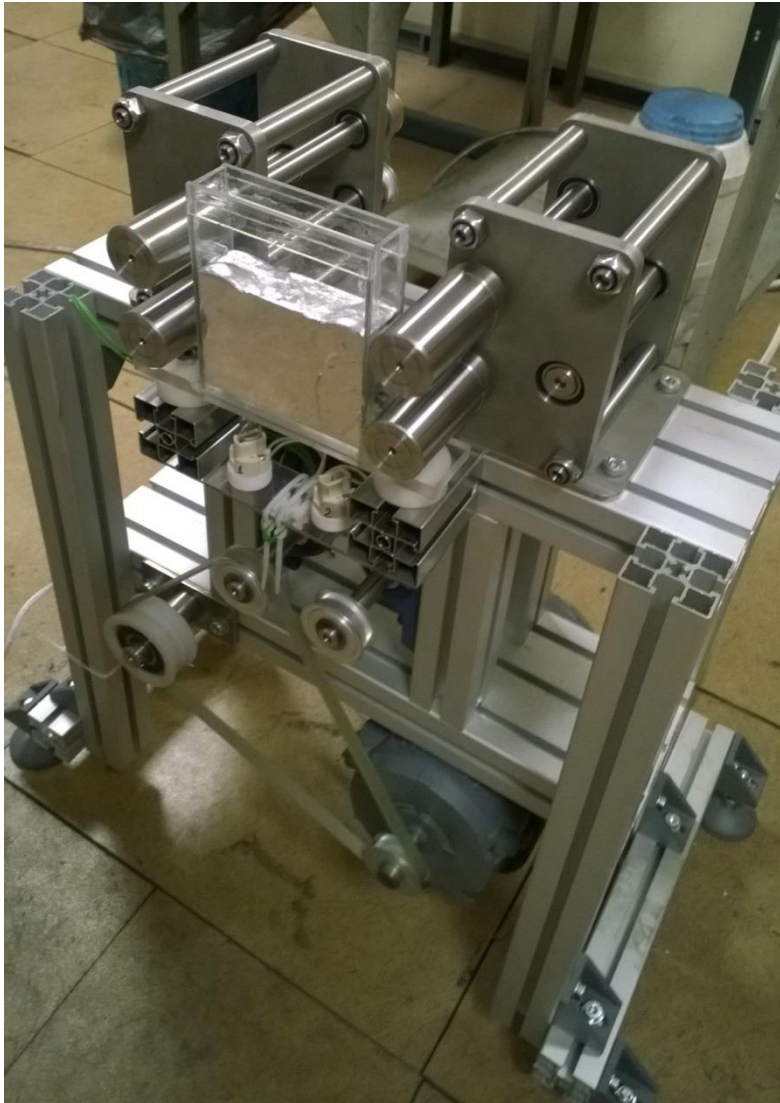


create a flow of particular interest

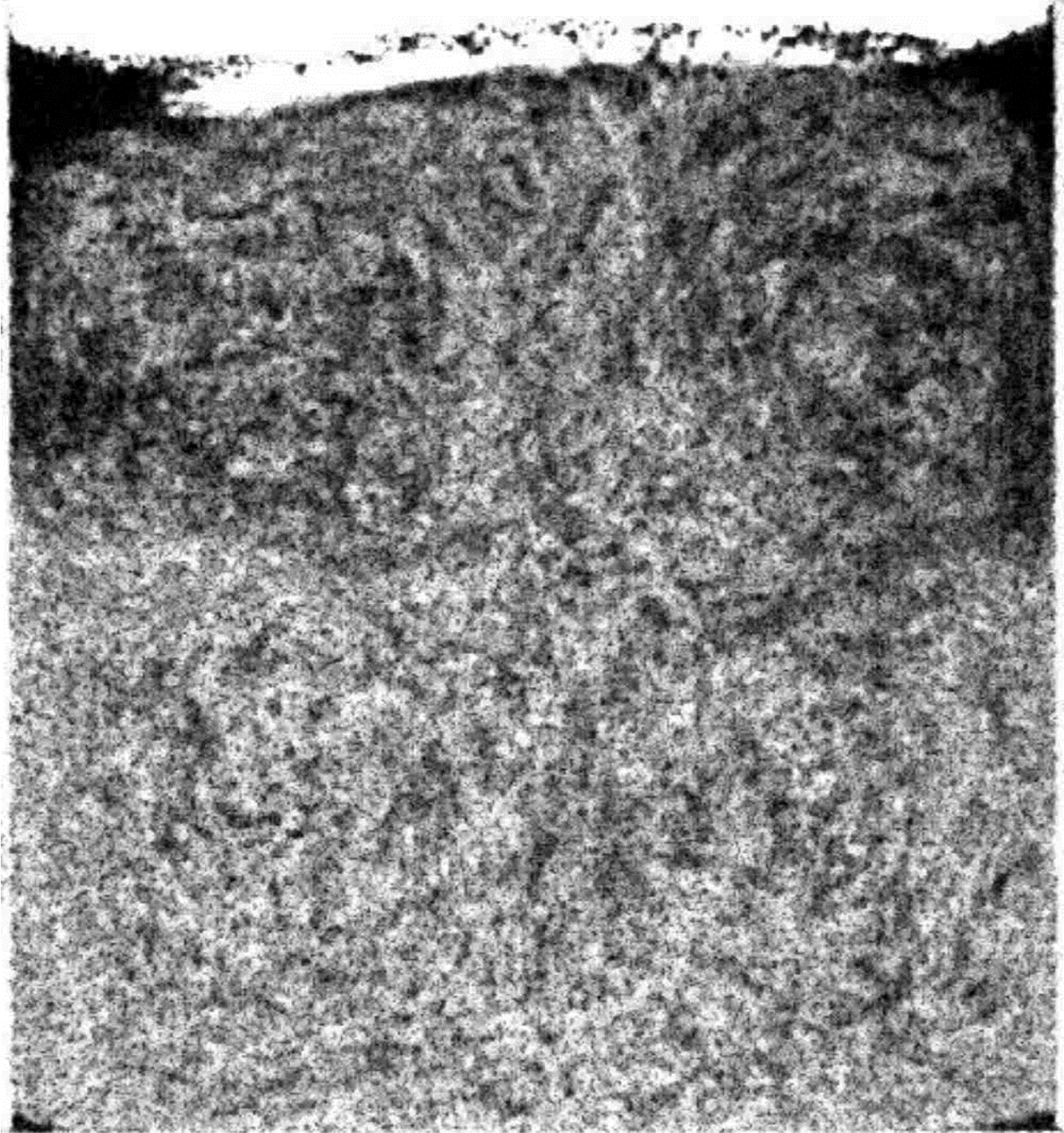
avoid materials of high attenuation in a beam way

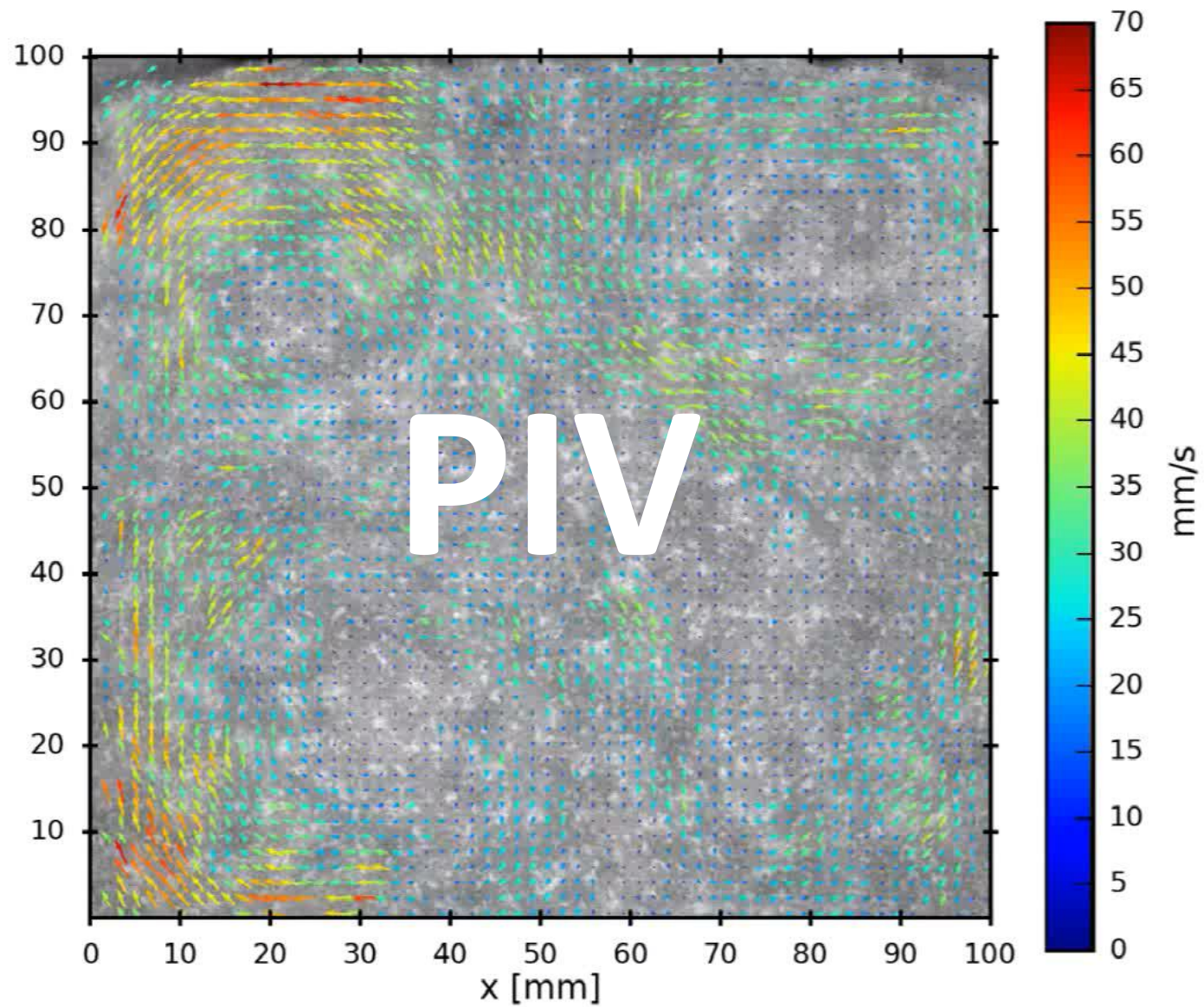
fulfill a quasi-2D structure of the flow to allow shadow imaging

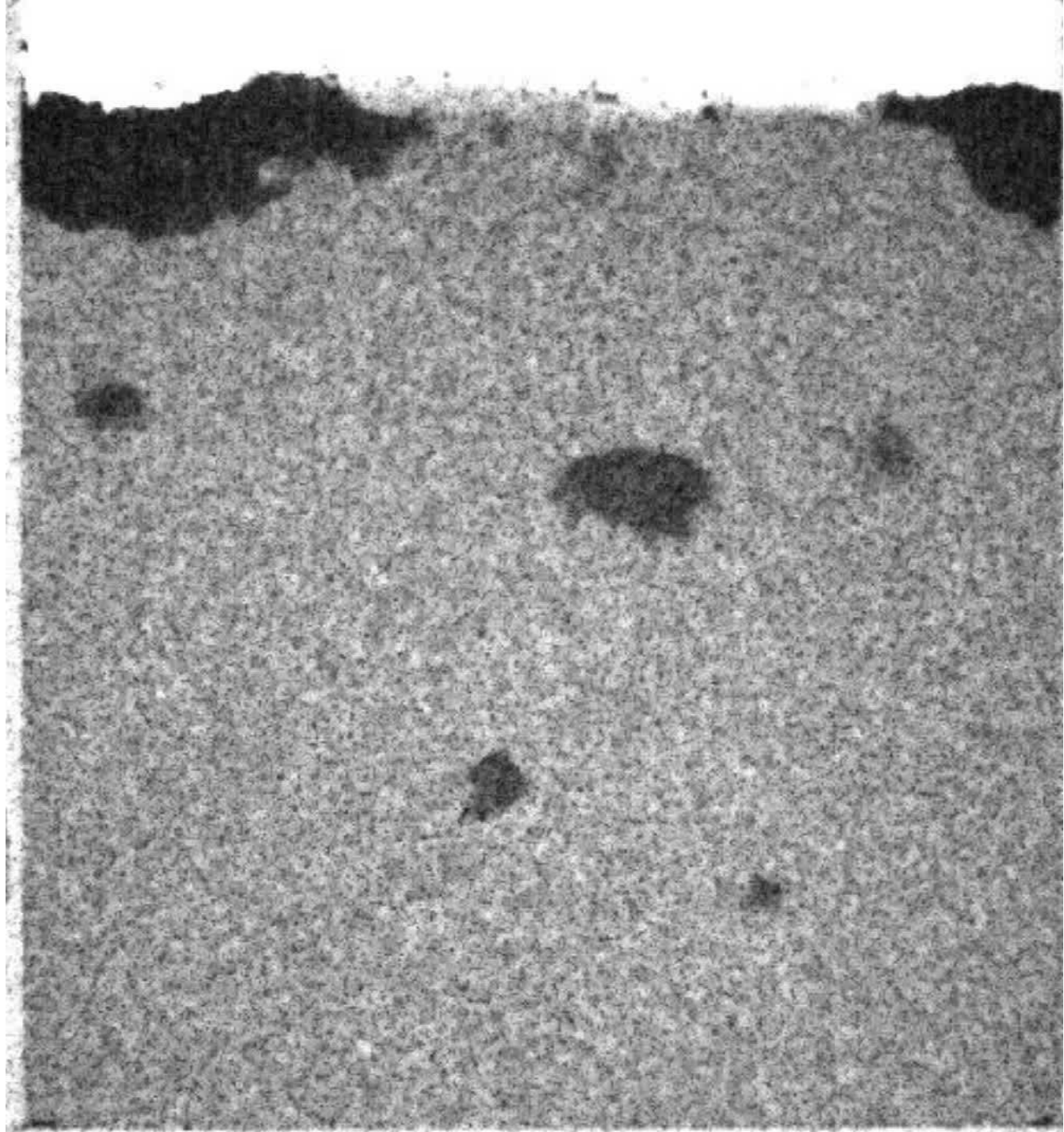
Neutron EXPERIMENTS

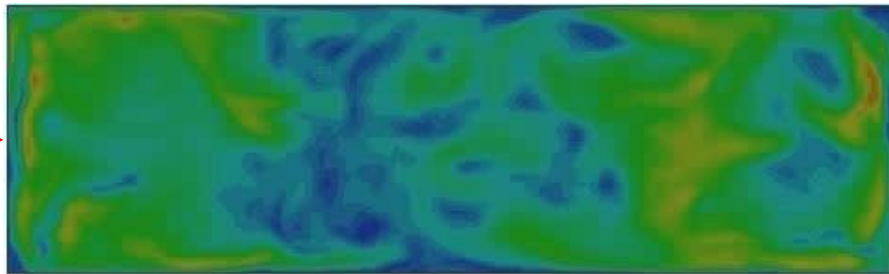


The set-up is designed and manufactured in Institute of Physics, University of Latvia





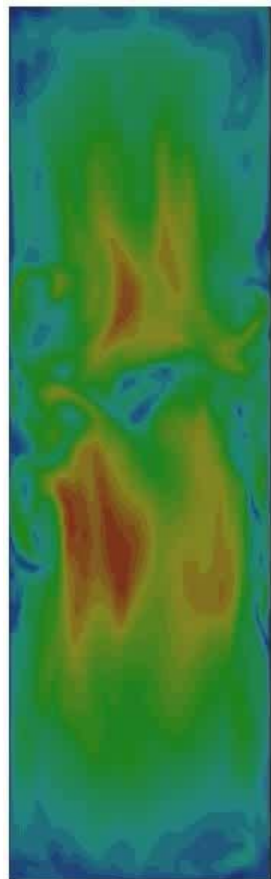




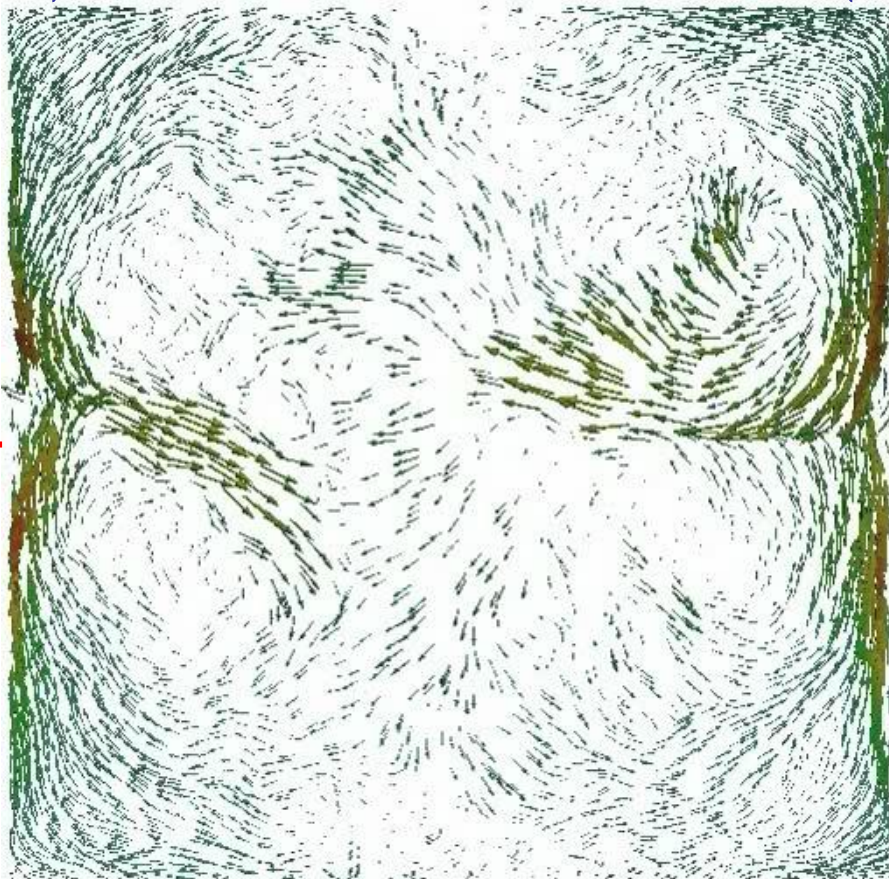
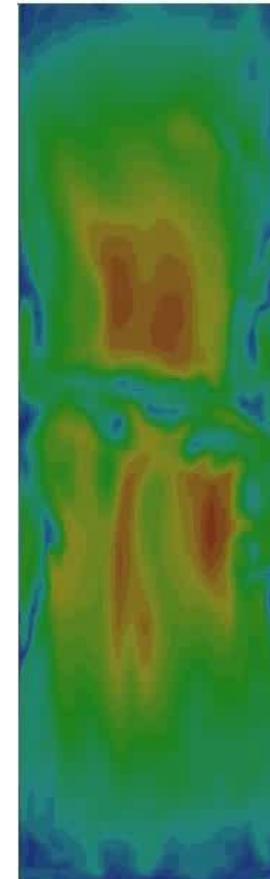
MIDDLE CUT

velocities

LEFT CUT



RIGHT CUT



LES, $\omega = 10$ rps



Further plans

- **2 proposal submitted for neutron beamtime at SINQ 2016**
- **HORIZON2020 FET-OPEN project NeutroMET submitted, University of Latvia is leading partner**
- **MID-TERM GOAL: establish an effective quantitative neutron imaging tool to unlock innovations in liquid metals**
- **LONG-TERM GOAL: breakthrough in metallurgy, new materials, new generation of energy efficiency equipment**

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NEUTRA - Imaging Beamline for Thermal Neutrons



Collimator zone

Slit system

SNG D2O tank

