WP 1: Fluctuations & Vibrations

Task 1.1: Thermal Fluctuations

Task 1.1.1: Reference Data

Task 1.1.1.1: Flow Separation
Experimental Investigation

Institute for Neutron Physics and Reactor Technology

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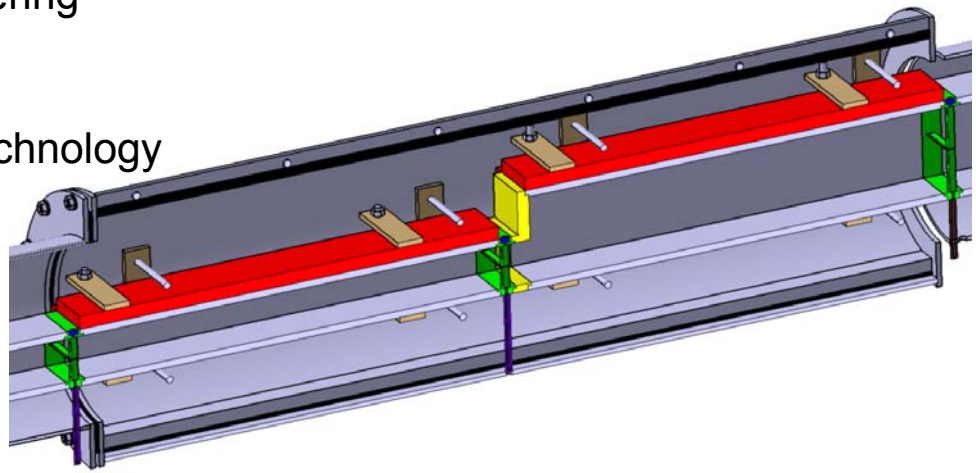


Outline

- Recapitulation
- Work done in the last 6 months
- Outlook and further work

Recapitualtion

- Delay of KASOLA (not in operation)
- Intrumentation and its calibration procedure in KASOLA very unpractical (safety constrains, TÜV)

➔ **Look for alternatives**

Recapitualtion

- Delay of KASOLA (not in operation)
- Intrumentation and its calibration procedure in KASOLA very unpractical (safety constrains, TÜV)

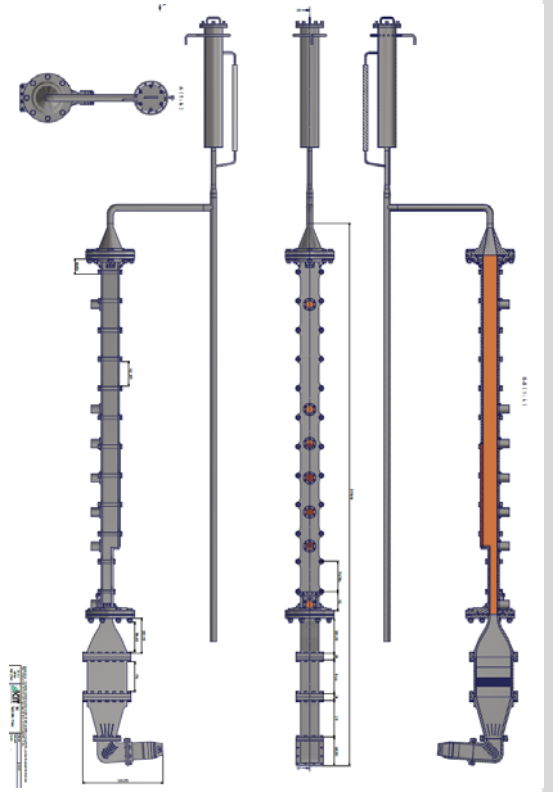
➔ **Look for alternatives**

- Integration of a BFS into the DITEFA (GaInSn) facility and development of a calibration procedure in a user friendlier environment

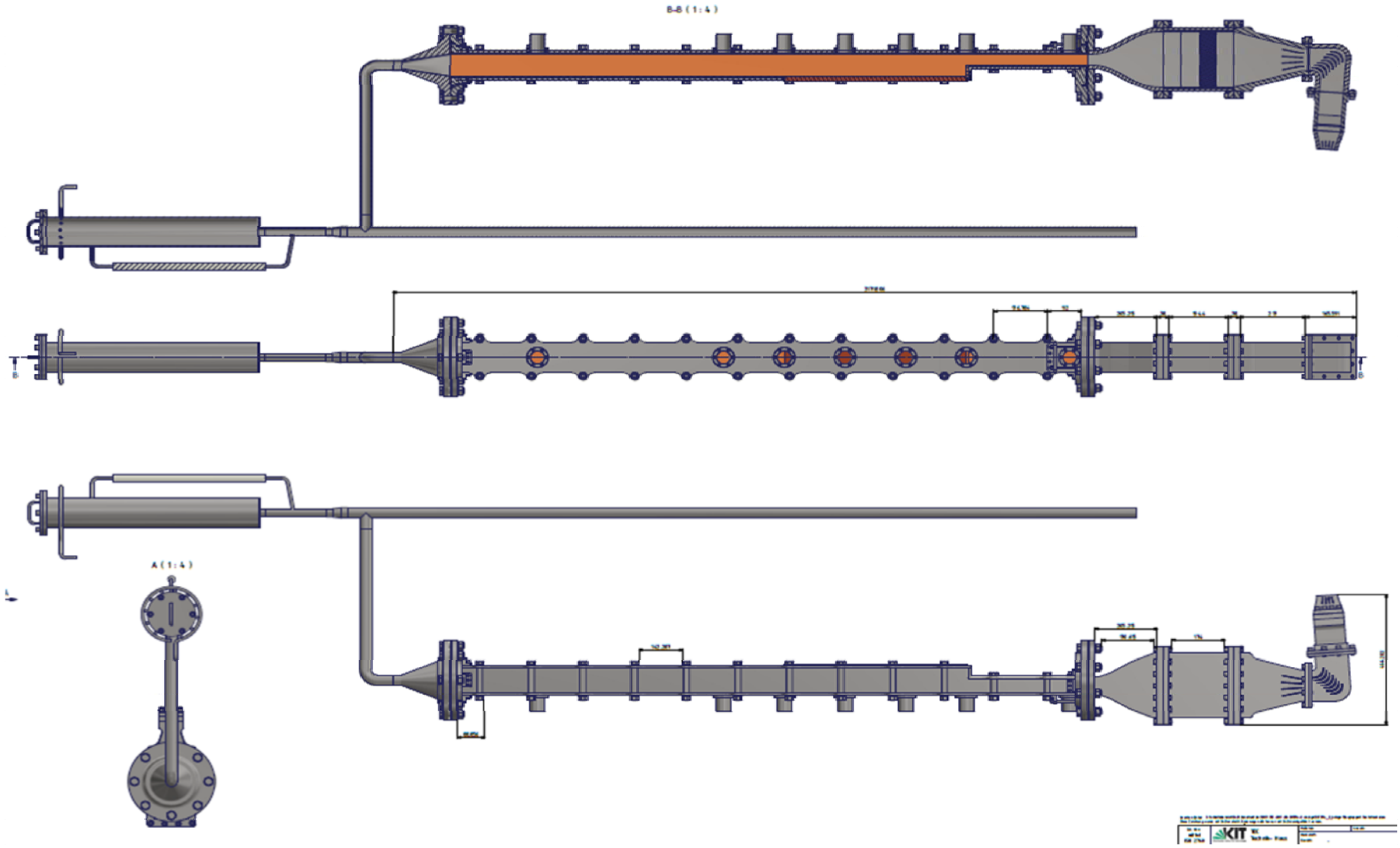
➔ **Wind tunnel concept**

Recapitualtion

- Project stages – current status
  - Concept ✓
  - Basic engineering ✓
  - Detail engineering ✓
  - **Manufacturing: both facility & probe**
  - Commissioning
  - Measurement campaign
  - Data analysis
  - Report of results



Recapitualtion



Work done in the last 6 month

- Developments of the drawings
- Identification of the manufacturing techniques
- Development of statistical analysis procedures
- Beginning of the manufacturing of the double-wall test section + flow conditioning section
- Development of a calibration strategy for the measurement probe
- Development of the measurement chain (measurement probe + signal amplifier) for velocity- and temperature measurments

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- Developments of the drawings **(skip)**
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Work done in the last 6 month

Beginning of the manufacturing of the double-walled test section + flow conditioning section

Work done in the last 6 month

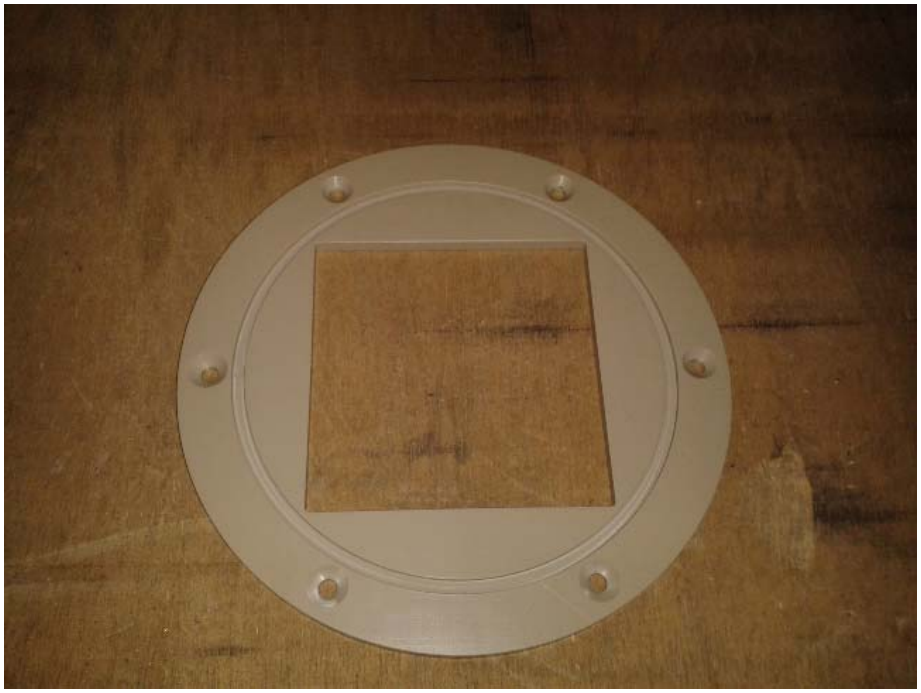
Outer metal wall

Inner plastic wall

Work done in the last 6 month

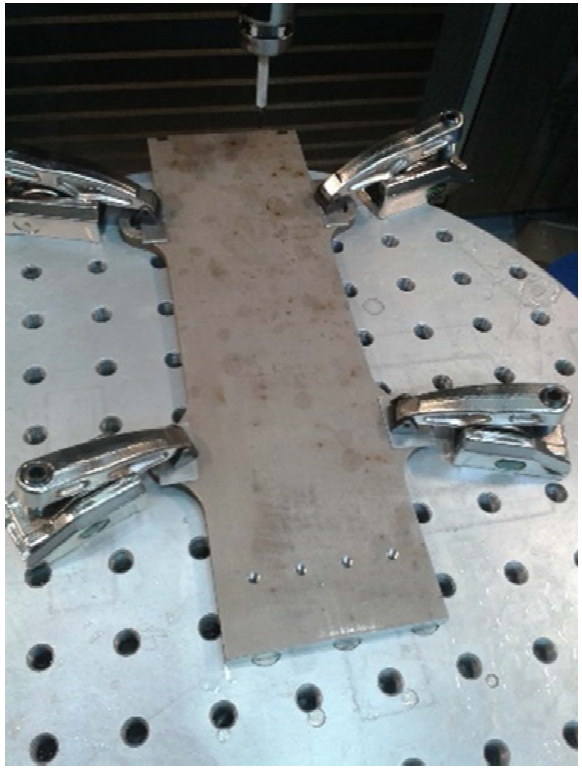
Beginning of the manufacturing of the double-walled test section + flow conditioning section

Inlet section (rectangular)



Outlet section (quadratic)

Work done in the last 6 month



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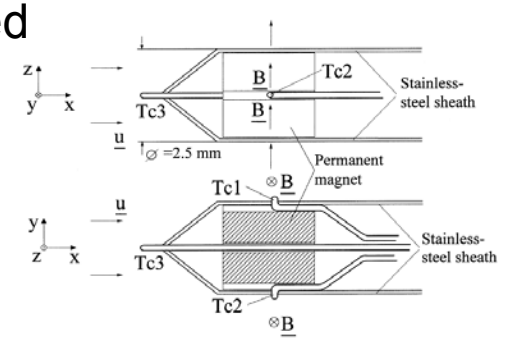
Work done in the last 6 month

Development of a calibration strategy for the measurement probe

- Problems
  - i. The velocity signal has to be temperature-compensated: temperature gradient between the electrodes/thermocouples and across the probe
  - ii. All available experience and correction procedures have been developed for sodium and years ago... retired technicians an poor know-how documentation (super scientific one, though...)
  - iii. The existing experience with these probes with GaInSn is restricted to isothermal cases
  - iv. Material properties of GaInSn are rare and scattered



Work done in the last 6 month

Karlsruhe Institute of Technology

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- What to do? To adapt/modify the existing correction and calibration procedures...

Work done in the last 6 month

Development of a calibration strategy for the measurement probe

- What to do? To adapt/modify the existing correction and calibration procedures ...
  - i. to our experimental boundary conditions and needs
  - ii. making use of the advantages of the „user friendly“ environment
    - a. ↓ T + ↓ safety
    - b. material choice
    - c. proper electrical insulation of certain probe´s components
    - d. proper positioning of the electrodes
    - e. taking a look to the math and the underlying physics!

$$\Phi(\underline{r}_1) - \Phi(\underline{r}_2) = \underbrace{-\int_V \mathrm{d}V\, \sigma \nabla G \cdot (\underline{u} \times \underline{B})}_{(1)} \underbrace{- (\Psi(\underline{r}_1) - \Psi(\underline{r}_2))}_{(2)}$$
$$\underbrace{+ \sum_i \int_{F_\mathrm{i}} \mathrm{d}F_\mathrm{i}\, \sigma \underline{n}_\mathrm{i} \cdot \nabla G \Psi}_{(3)} + \underbrace{\int_{F_\mathrm{o}} \mathrm{d}F_\mathrm{o}\, G \underline{n}_\mathrm{o} \cdot \underline{j}_\mathrm{o}}_{(4)},$$

Work done in the last 6 month

- Confection of the drawings + manufacturing techniques to be used: skip
- Development of statistical analysis procedures: skip
- Beginning of the manufacturing of the double-walled test section + flow conditioning section
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Work done in the last 6 month

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- Identification of the manufacturing techniques **(skip)**
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Work done in the last 6 month

Development of the measurement chain (measurement probe + signal amplifier) for velocity- and temperature measurments

- Problems
  i. The velocity signal is in the nanovolt range
  ii. Extreme sensible signal to external noise: even the lab´s light plays a role
  iii. Manufacturing of the probe has to be „doable“, reproducible (7 probes), fast and cheap
  iv. High temporal and spatial resolution requirements: turbulent heat fluxes!
- What to do? Less science, more „art“

Work done in the last 6 month

Development of the measurement chain (measurement probe + signal amplifier) for velocity- and temperature measurments

- What to do? Less science, more „art“
  - i. Avoid reinventing the wheel: cooperating and refinding „lost“ know how

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LTT
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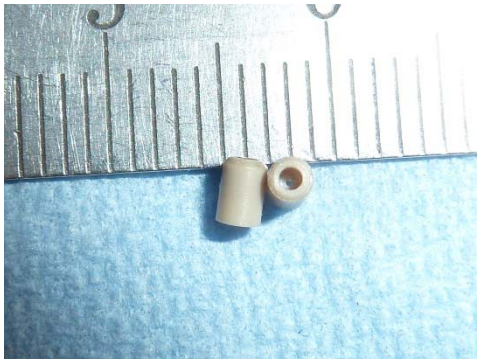
KIT
Karlsruher Institut für Technologie

  - ii. Improving the wheel: Mr. Joachim Konrad (KIT-workshop) managed to manufacture a 2 [mm] permanent magnet probe, beating the state of art



Outlook and future work

- Delay of ~ 6 months to the original DITEFA-schedule because of limted man-power at KIT workshops + modified calibration/correction procedure needed (unexpected to that extent)
- Manufacturing is running according to schedule ~ 10.18
- Commisioning ~ 11-12.18
- Preliminary results ~ 12.18-01.19
- Final results ~ 04-05.19