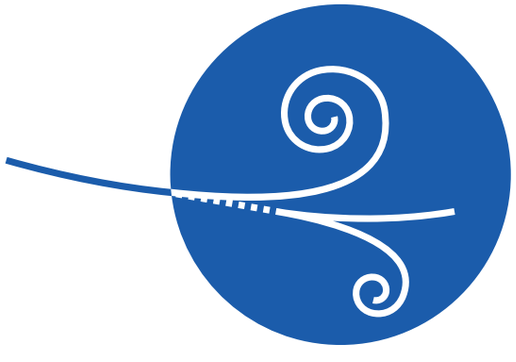


III. Physikalisches
Institut A

RWTH AACHEN UNIVERSITY

Experimental Techniques in Particle Physics (WS 2020/2021)

Exercises

Prof. Alexander Schmidt

10.11.2020

Exercises

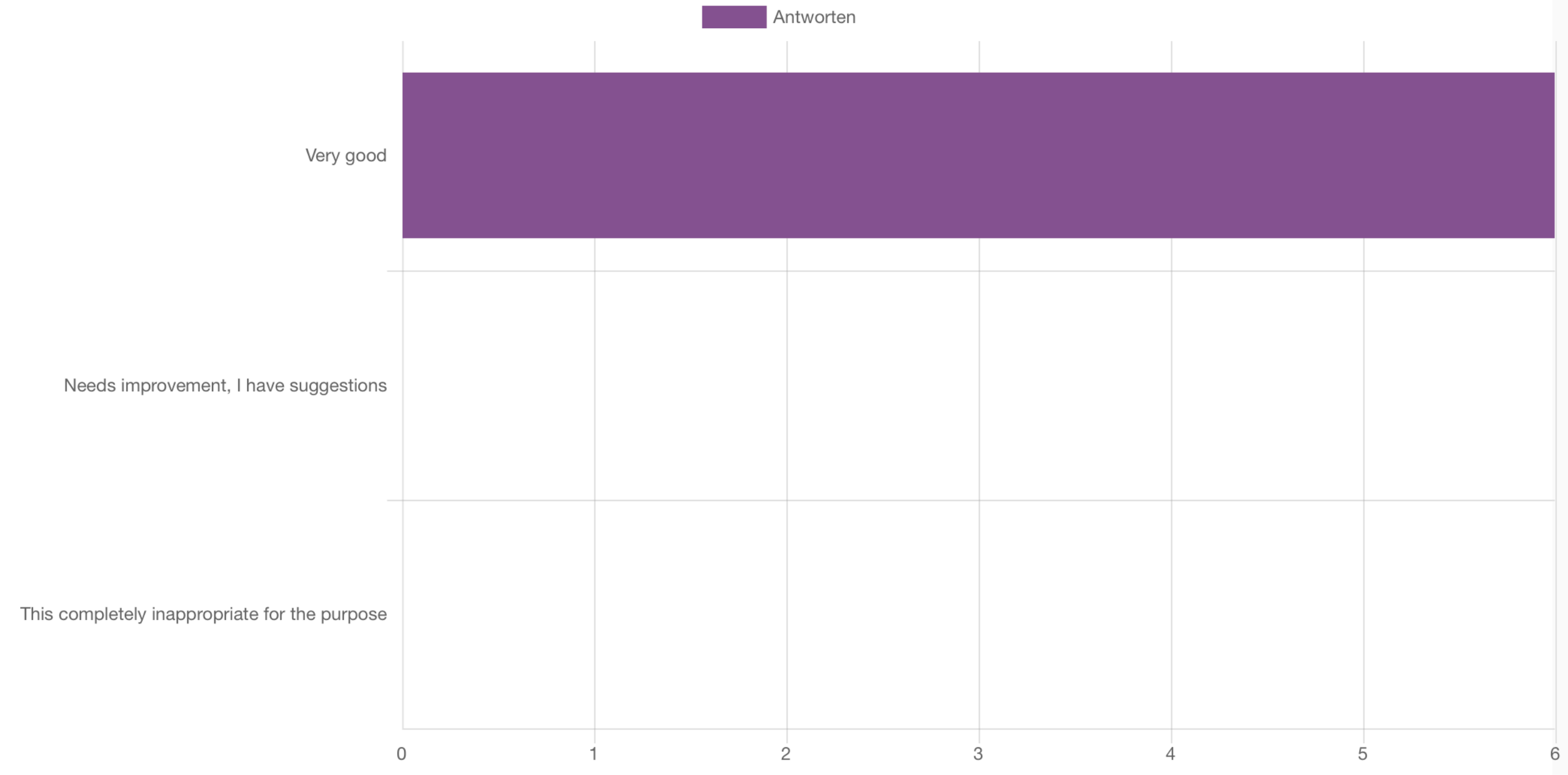
during last time, some questions were raised… some clarifications below:

- the Tuesday exercises after the lecture are **voluntary**
- the hands-on tutorials will not be part of the exam
- the **content of the lecture will be** part of the exam
- the Tuesday exercises supplement the lecture and are supposed to strengthen your knowledge, show the applications, improve the understanding, give you some new problem-solving skills
- doing the Tuesday exercises could possibly improve your success in the exam, as the content of the lecture is repeated

- the Wednesday and Thursday courses (GEANT and FPGA) **are obligatory between 14:30 and 16:00**, a list of attendance is kept. Attendance is prerequisite for admission to the exam.
- the content of FPGA and GEANT courses will be part of the exam

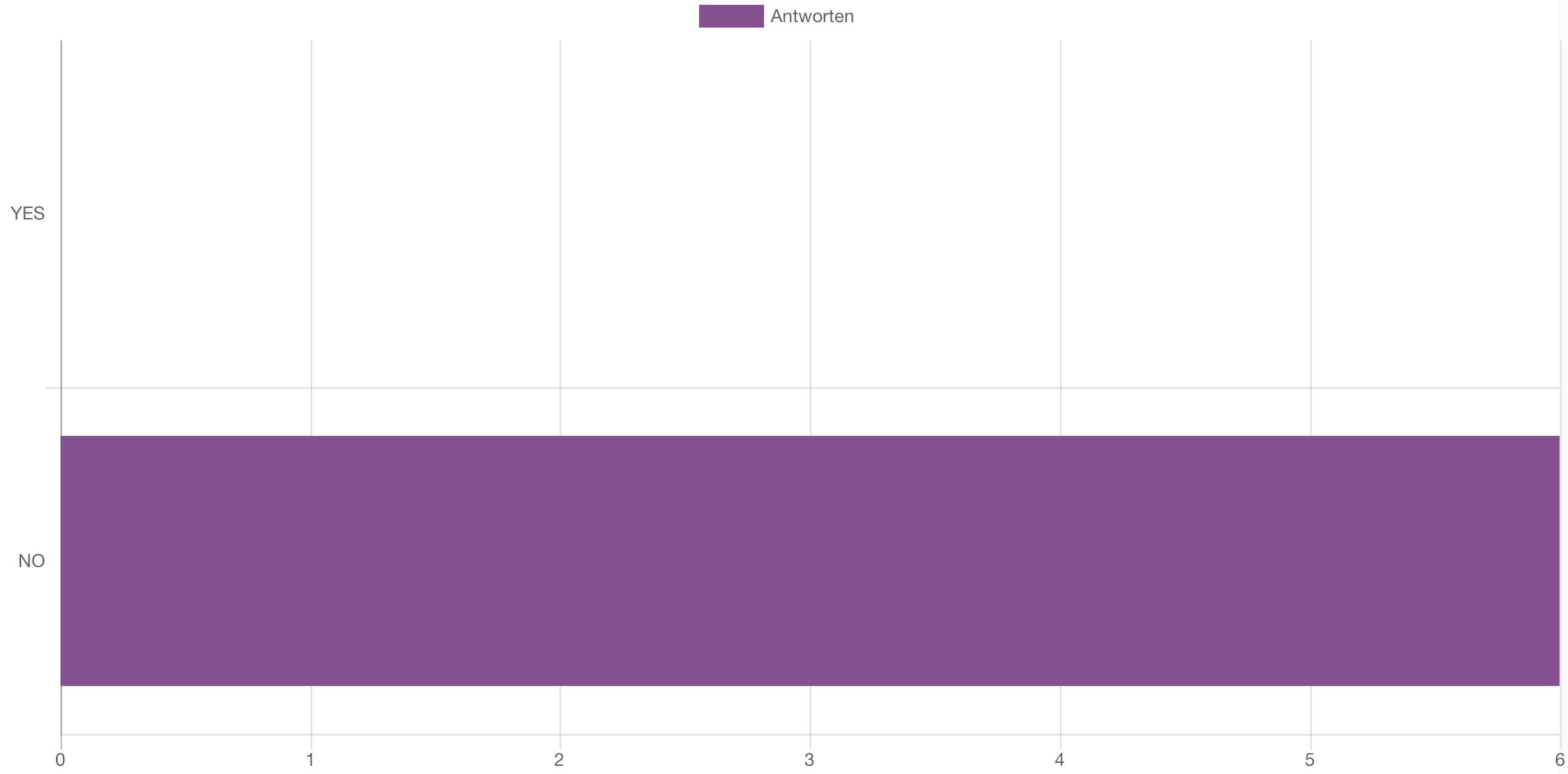
Questionnaire

How do you like the breakout room concept for exercises



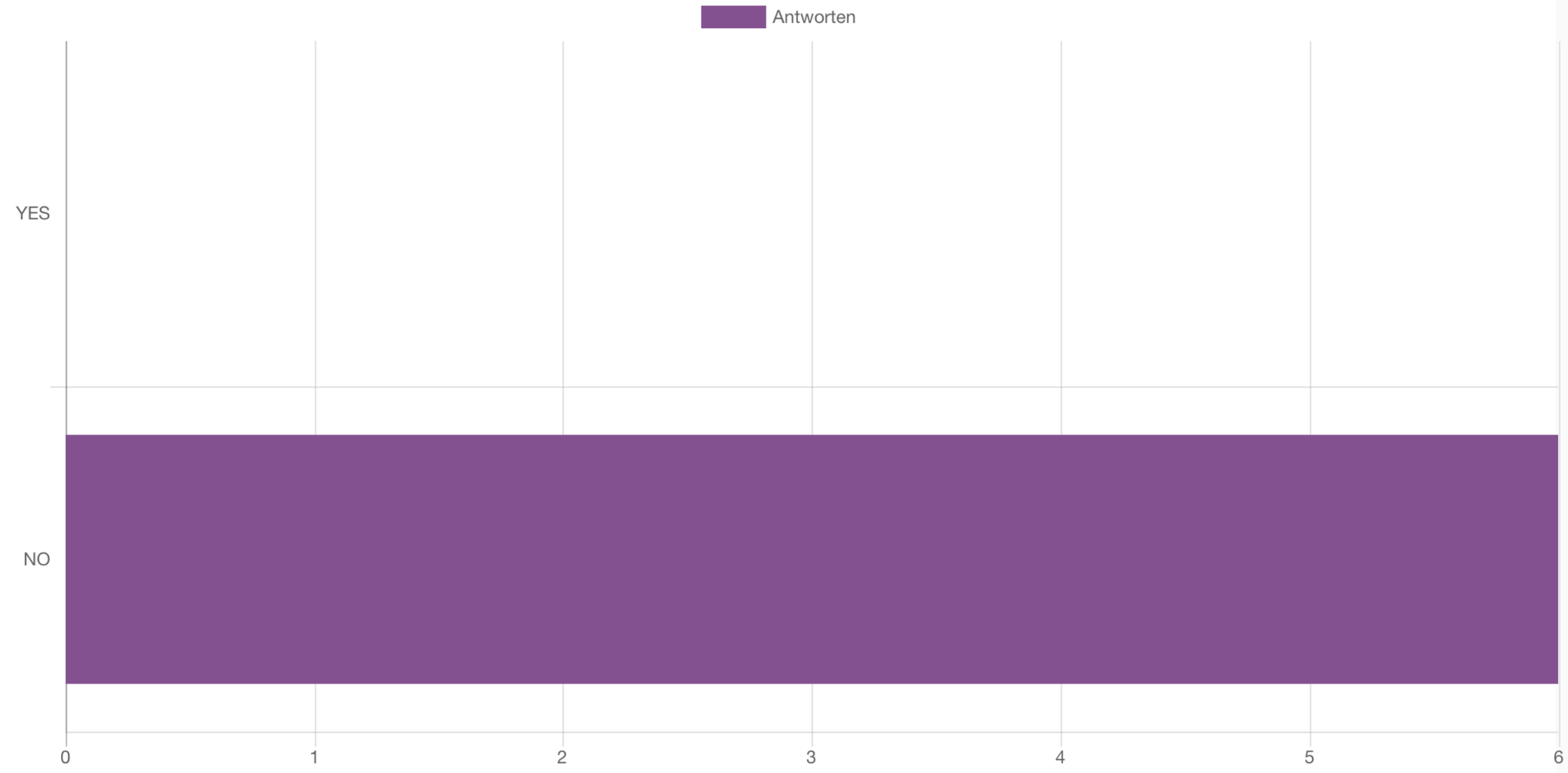
Questionnaire

Would you rather prefer to have one big discussion room instead of small ones?

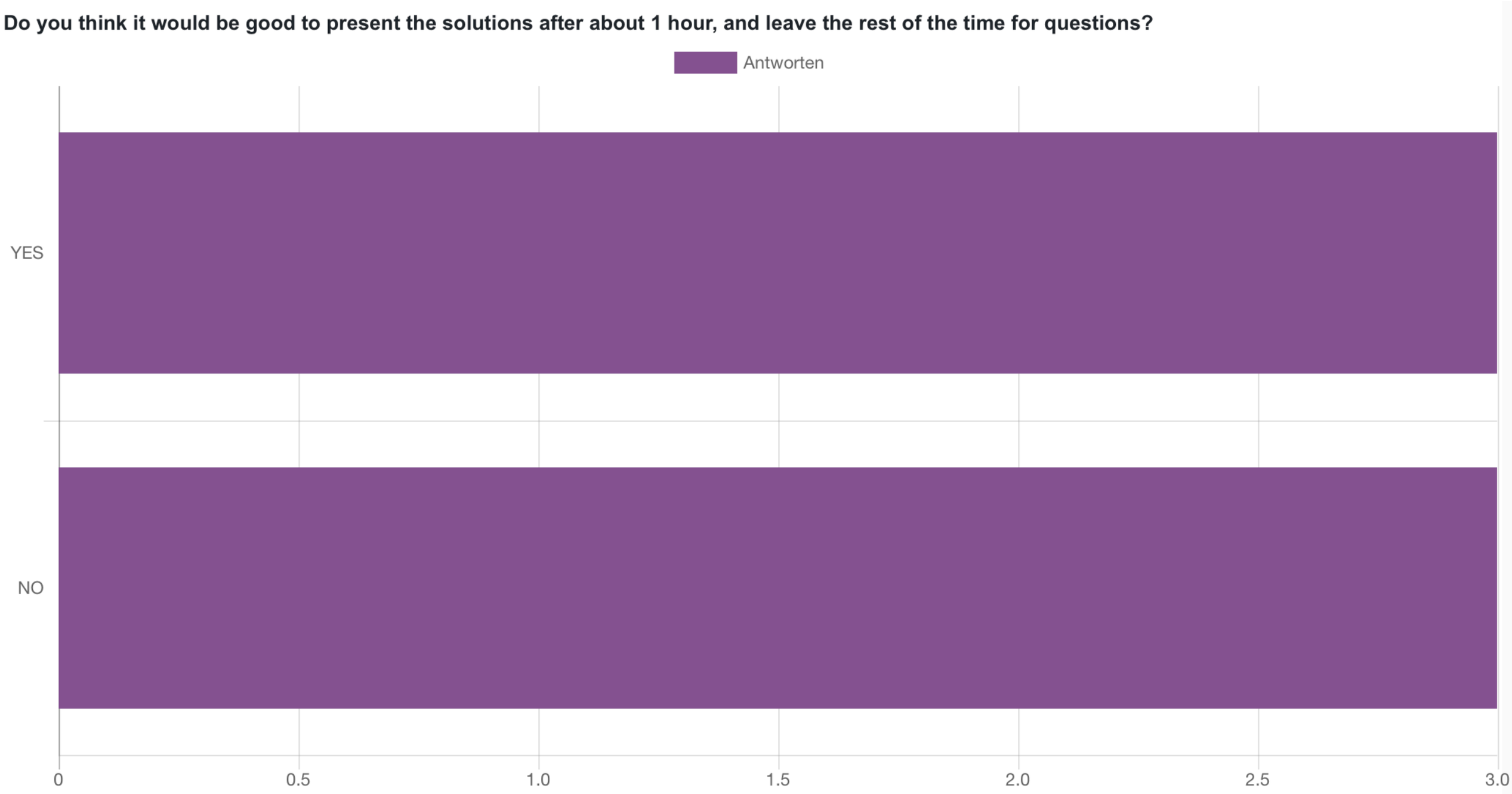


Questionnaire

Would you rather prefer to have 3 rooms with a supervisor present all the time?



Questionnaire



Questionnaire

Do you have any suggestions what to improve in the way the exercises are done?

About solutions: I'm not sure if solutions should be presented because it would spoil the task/take away the novelty of learning by doing. The self-learning time is great for that, in my opinion. Solutions in the moodle room would be very nice, though, so that I can compare only after I completed the task.

Having about 1h to work on something with a small group and optional help of supervisors is great.

After 1hour a dedicated (short) discussion of the problem/solution in the big room would be nice, since after you solved the main part of the exercises, you are often stuck with minor details. (Like sacling the Y-axis for a TRatioPlot...).

As well, if there is a solution presented and room for questions, you can be sure not to miss out on anything and either you stay or can leave satisfied.

Thanks for your feedback !

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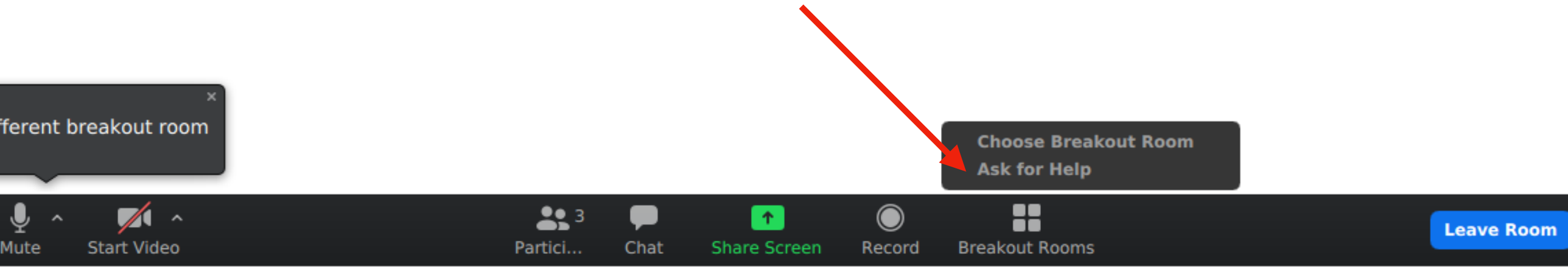
My proposal to this: We present the solutions after approx 1 hour in a separate room **and record them.** Then you can watch it later, if you want to solve it by yourself first.

N.B.: there is usually not one solution only, maybe yours is better…

breakout room: ask for help



Exercise for today:

- implement the Bethe Bloch equation
  - as first step implement a Bethe-Bloch calculator that accepts the parameters as input (mass, energy of incoming particle,…)

- calculate the mean energy loss of a muon (and/or electron) with an initial kinetic energy of 1 GeV passing through a 300μm slice of silicon (and/or a block of lead)

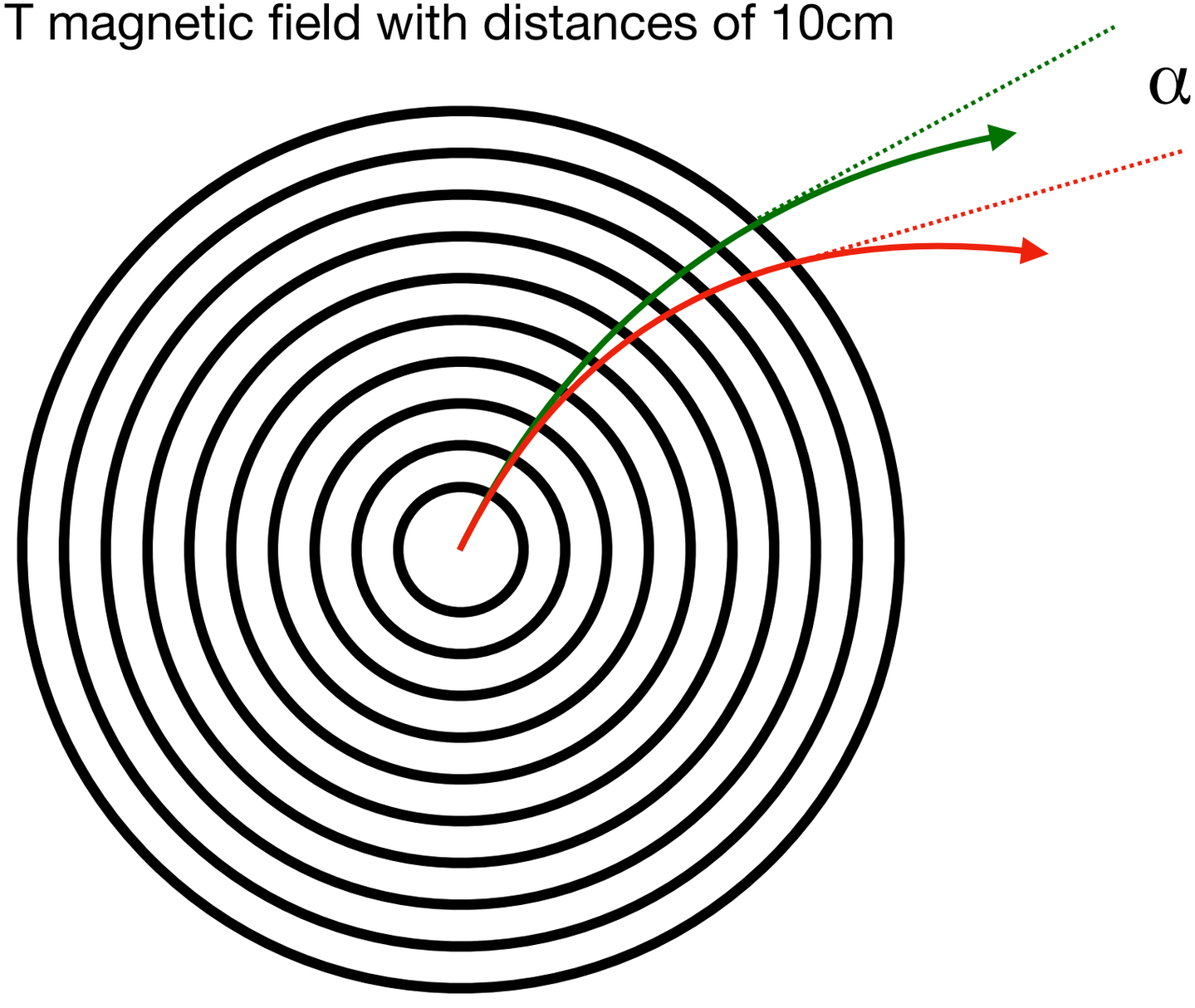
- ignore the high/low energy corrections

- in a second step, implement the landau fluctuations and make a histogram of the energy losses for several events

- note: to avoid floating point issues, you could use the “long double” data type

Exercise: extra

- this is a “bonus” exercise, in case you finish early
- consider a particle detector in 2D, consisting of 10 layers of silicon (300μm thickness) in a 4 T magnetic field with distances of 10cm



- the particles from the previous exercise now pass through this detector
- what is the angle α between the case with/without Bethe-Bloch energy loss?
- compare what happens if lead is used instead
- a skeleton for the extrapolation of the trajectory through the detector is provided