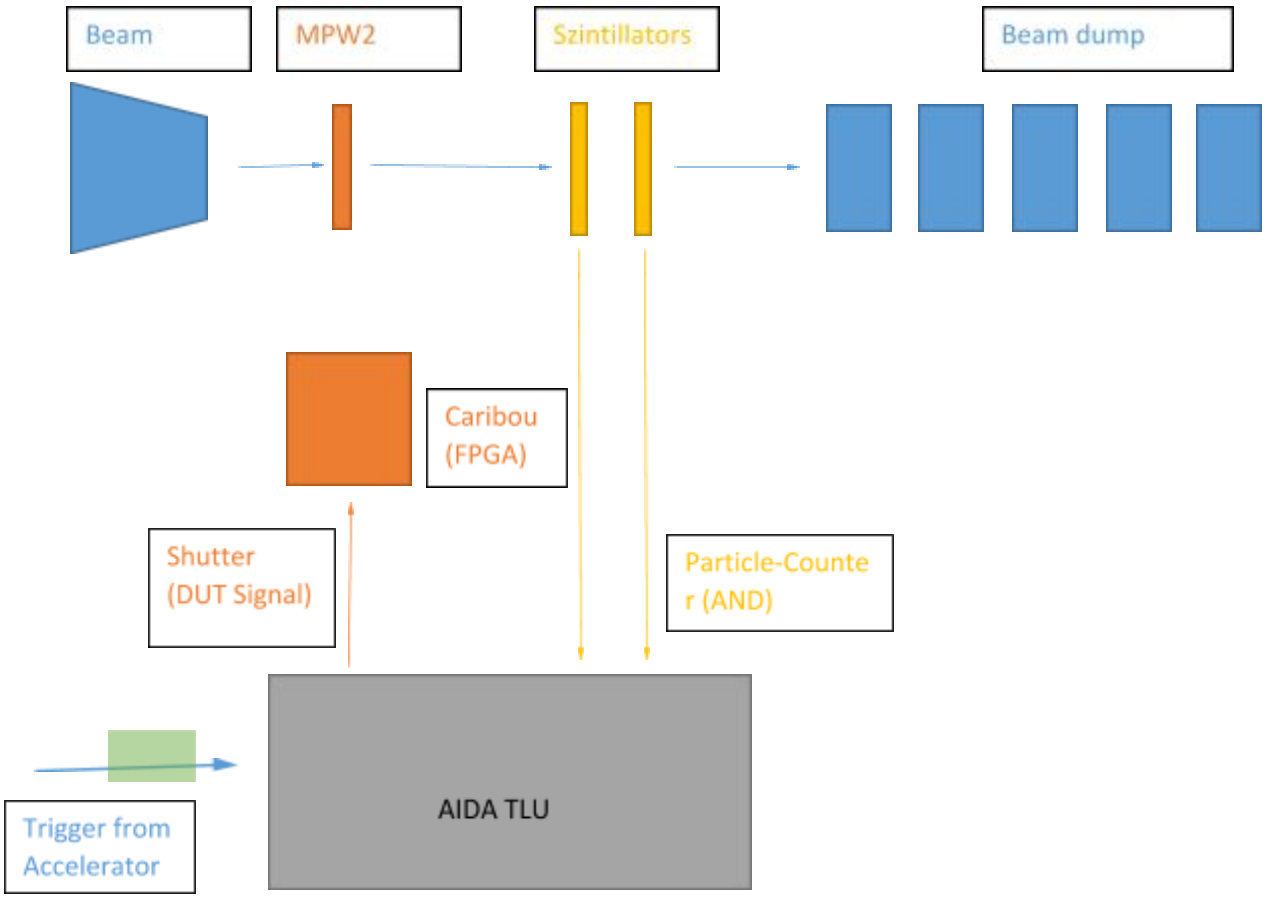
Setup for first MPW2 Beamtest
Step 1 MPW2

What do we want to Measure?

We want to measure the rate of the beam with two different options: 2 Scintillators as reference counter and our MPW2-chip as DUT. Goal is to compare these measurements *relative* to each other. -> Geometric Factor, cannot be eliminated. We only measure the integrated number of particles over one spill. (~5s) This allows timing via software and thus no sophisticated Trigger Logic is needed.



Hardware

- Beam from MedAustron
    - Beam Specs (Noch berechnen, welche rate wir brauchen)
    - 5s long spills with 5s pause in between
    - Spot size:
- MPW2 chipboard, CaR-Board and FPGA board.

    - FPGA connected to CaR with 30cm? FMC cable (radiation!) → maybe w/o FMC cable
- 2 Plastic Scintillators
    - AND-Logic in TLU
    - 5x5 cm
- Beam dump
    - Water Canisters (all available, at least 2 stacks) → how many do we need?
- AIDA TLU
    - Version 1e
    - Used for Scintillators (RaMon)
- Shaper, Decoupling, … Something to protect TLU

Trigger Signal and TLU

We use a 3.3V TTL signal asserted by the accelerator when particles leave the Linac and enter the circular collider. This signal is high for 650 us and arrives roughly 4us (Just high for 1us -> No clue if correct, but still works) before the spill. Thus, we get one trigger to start readout roughly every 10s.
We want to catch this Signal with a trigger input of the TLU, thus we want to modify it first:

- The AIDA TLU accepts +/-5V maximal, with a discriminator Level of +/- 1.3V. However, we are not sure what kind of disturbances can occur on this signal, thus we want to decouple the TLU from trigger. (Either with a TTL to NIM converter plus shaper, or an optocoupler or sth. similar)
- The TLU triggers unfortunately only on negative edges -> Thus we need to invert the signal, since the negative edge is arriving too late. The is done with the VME Module.

We use the Shutter mode from the TLU for reading out the MPW2: The TLU creates a 5-5,5s long shutter signal (LVDS), which we connect via a DUT output (HDMI) to the FPGA via the FMC connector (Helmuts FMC-breakout board) (Self-made cable as adapter needed) → CI: which signal levels? - CMOS

The scintillators are also connected on 2 Trigger inputs of the TLU and used as a counter. Although connected to a trigger input, they are NOT used as trigger signals, just as a second (reference) counter.

Readout

EUDAQ

We want to use EUDAQ to record and store data. RaMon is already working with EUDAQ.
The MPW2 as well. → CI: Is this really true? How much SW development is required?-EUDAQ works
A run consists of multiple (~20-100 Spills). The MPW2 will write a new header in the data with the current CPU time (precision = seconds). RaMon will be modified to write a CPU timestamp in the ROOT Tree. –Since we only need a precision of 1-2s in order to match timestamps of spills, this will be good enough.

- At INIT state, voltages are set (Whole bitstream for MPW2 and Scintillators/TLU)
- At CONFIGURE state, SlowControl commands are forwarded (TLU gets config)
- At START state, MPW2 starts to accept the shutter signal and RaMon starts to record triggers. To be checked, if RaMon is recording hits, when TLU is VETOing trigger-inputs due to a missing open shutter signal. If yes, timing is trivial. If not, we need to think of timing (delay and shutter window)

RaMon (Scintillators)

To be checked how it is working – probably needs some re-programming, since it's not a simple monitor anymore.

Monitor-functionality MUST remain possible, for debugging.

MPW2

During a run, MPW2 is simply asking if the Shutter signal is high (in a software-loop) and reads out the number of triggers in the memory of the FPGA, once the shutter signal is low.