

# Communication device for the Bergen proton CT Project

FPGA solution for communication between IPbus and a power control unit using a custom USART

> BO22EB-08

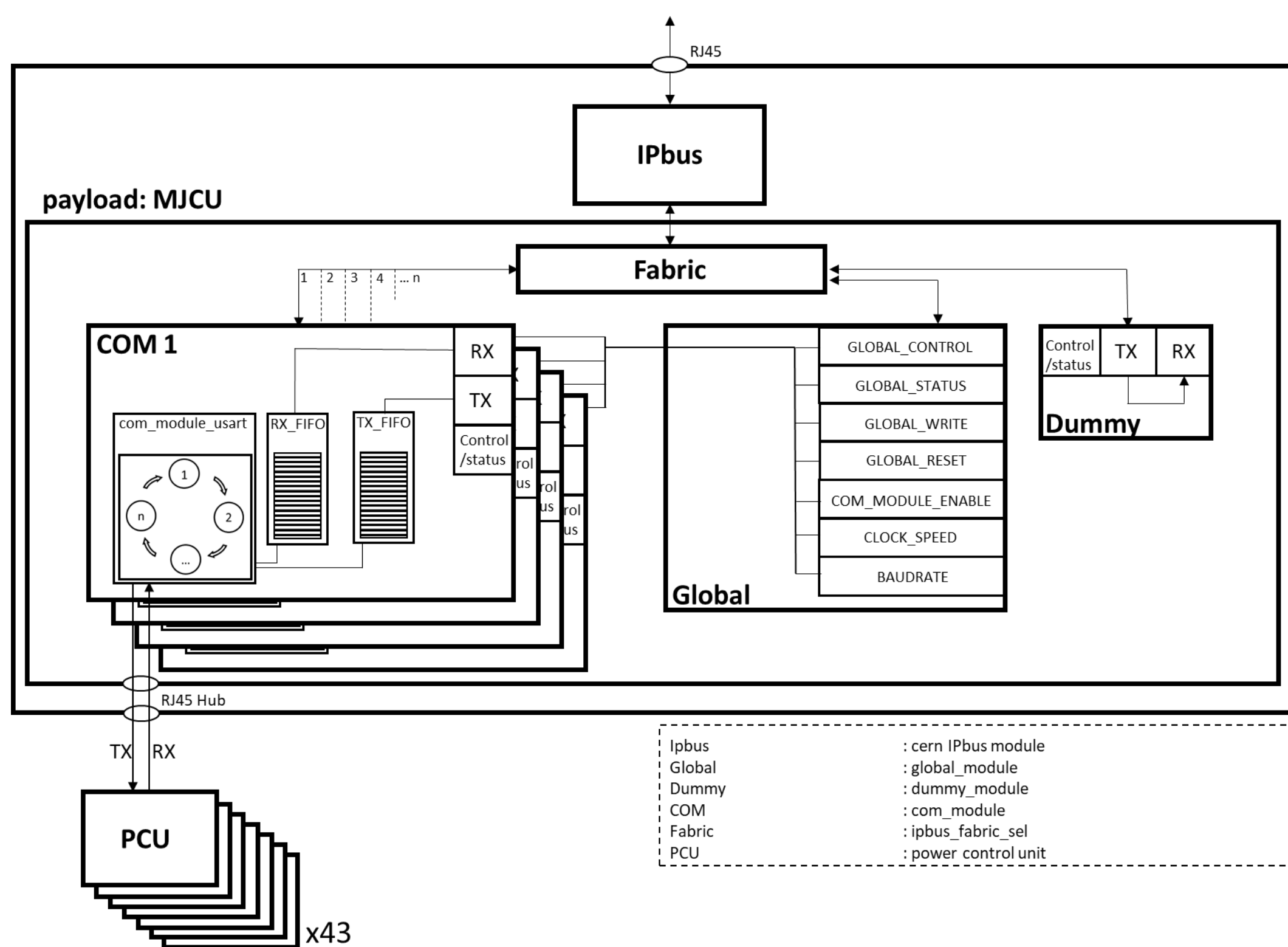
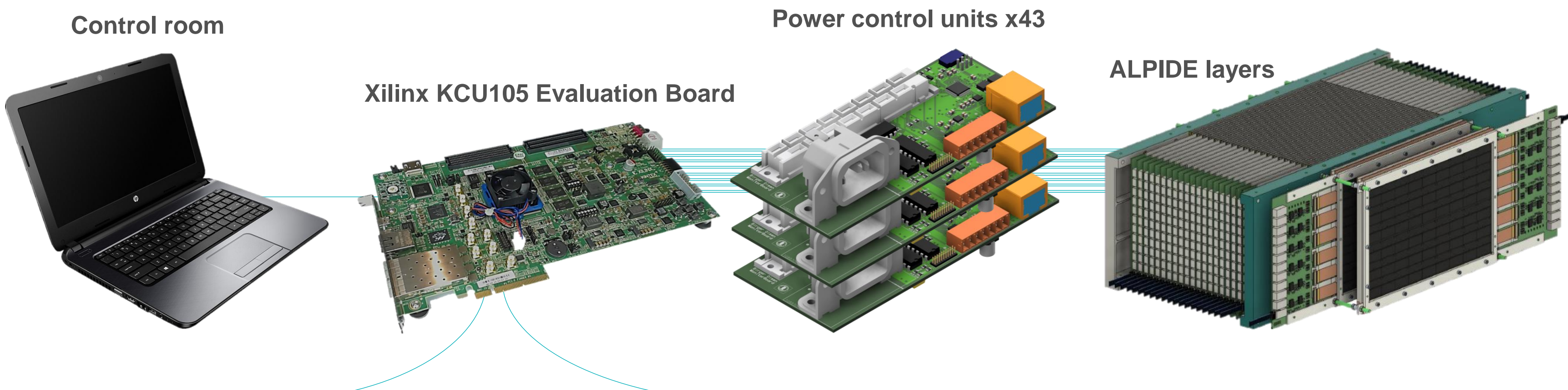
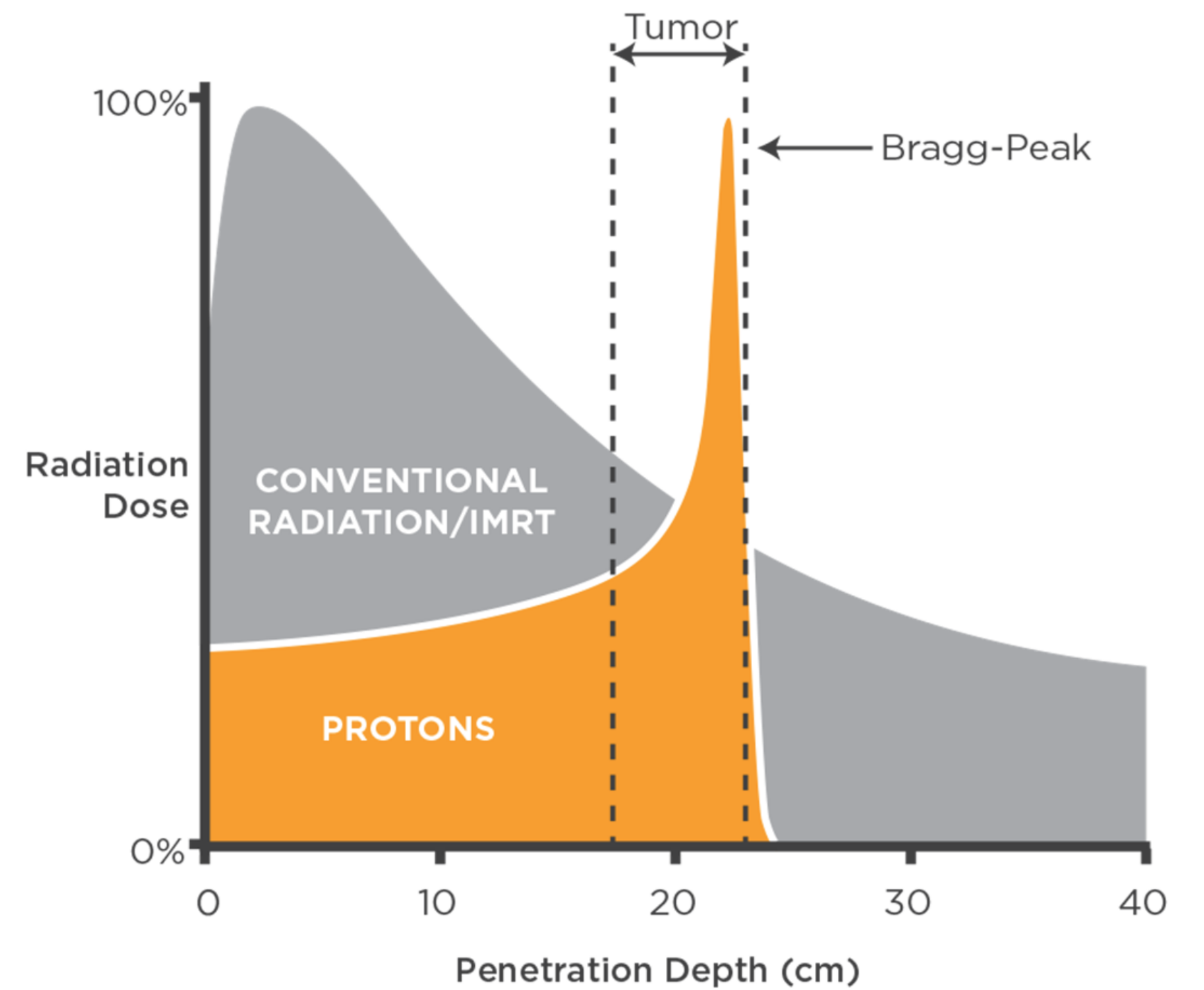
Bachelor thesis by Martin Eggen and Jakob Hauser

Proton Computed Tomography (pCT) is a rising technology in the field of medical tomography. Coming to Bergen in 2024 according to Haukeland. Proton treatment has the distinct advantage of a more focused energy dispersion.

The proton CT project in Bergen is a project aiming on designing a CT-scanner prototype using protons instead of photons. The current solution is using multiple layers of Monolithic Active Pixel chips, called ALPIDE, to create a three-dimensional image scan. The ALPIDEs were developed at CERN for the inner Tracking System in a large ion collider experiment (ALICE).

## Assignment

The prime objective was to make a stable communication link between a computer inside a control room (using IPbus by CERN) and 43 external devices (using a custom USART protocol). Designed to be as stable and reliable as possible. Prioritizing stability over efficiency. Everything that is designed is required to be tested, verified, and version controlled.



## The MJCU

MJCU is an acronym for Martin and Jakob's Communication Unit. The Figure on the left shows a simplified block diagram of how the modules are connected to each other, to IPbus and to the power control units (PCU). The modules in this design are com\_module, global\_module and dummy\_module.

## Testing

The testing was performed using both virtual testbenches in QuestaSim, and physical transmitting tests.

On the right two pictures of successful write/read operations are displayed.

