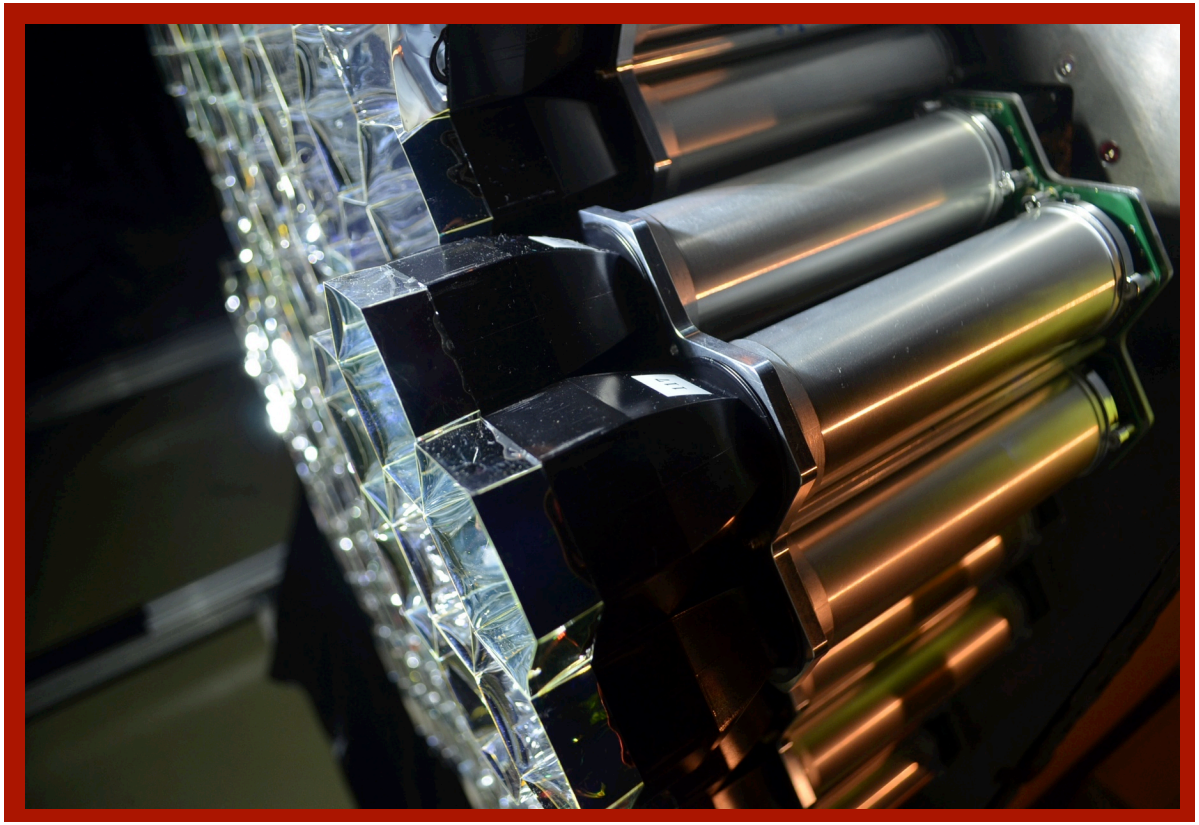


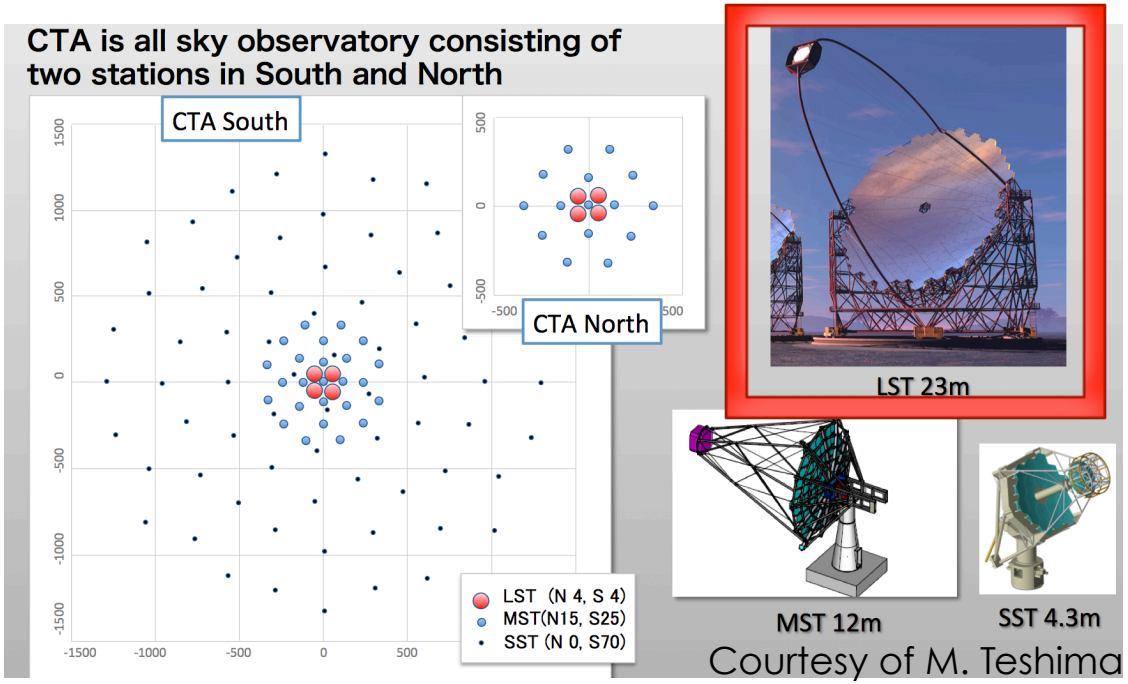
Courtesy of D. Nakajima

First results of the camera prototype for the Large Size Telescopes of the CTA

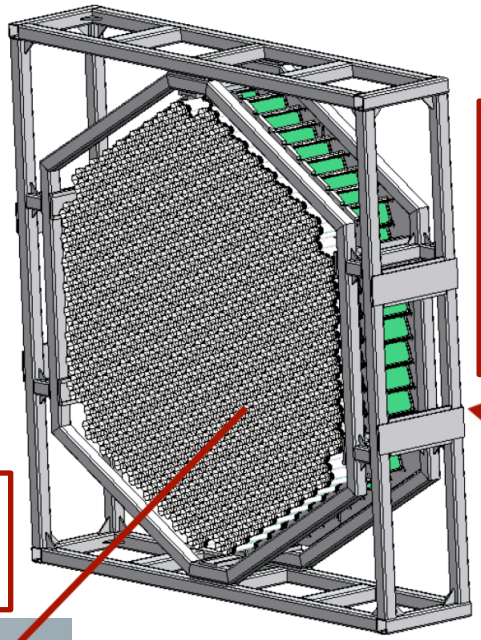
D. Hadasch (ICRR)
on behalf of the LST collaboration

Overview

- Camera for the Large Size Telescope (LST) of the Cherenkov Telescope Array (CTA)
- **Prototype camera (Mini Camera)**
  - **Purpose**
  - **Setup**
  - **Results**

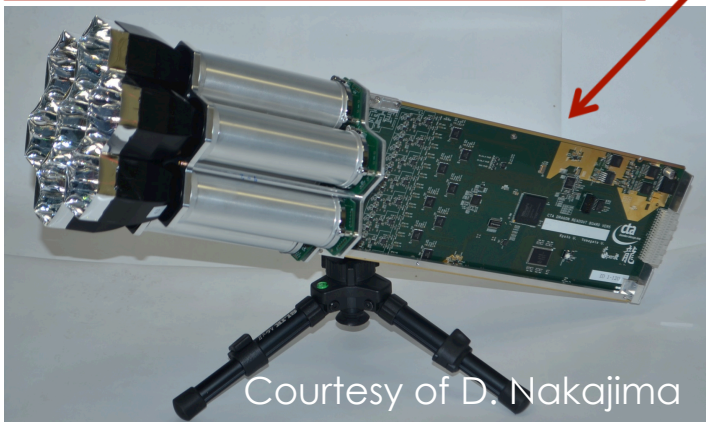


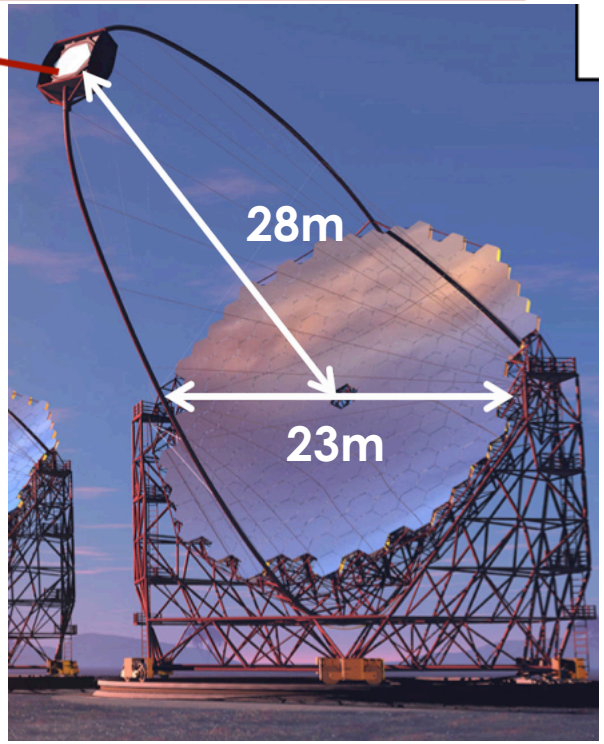
Focus on LST - Camera



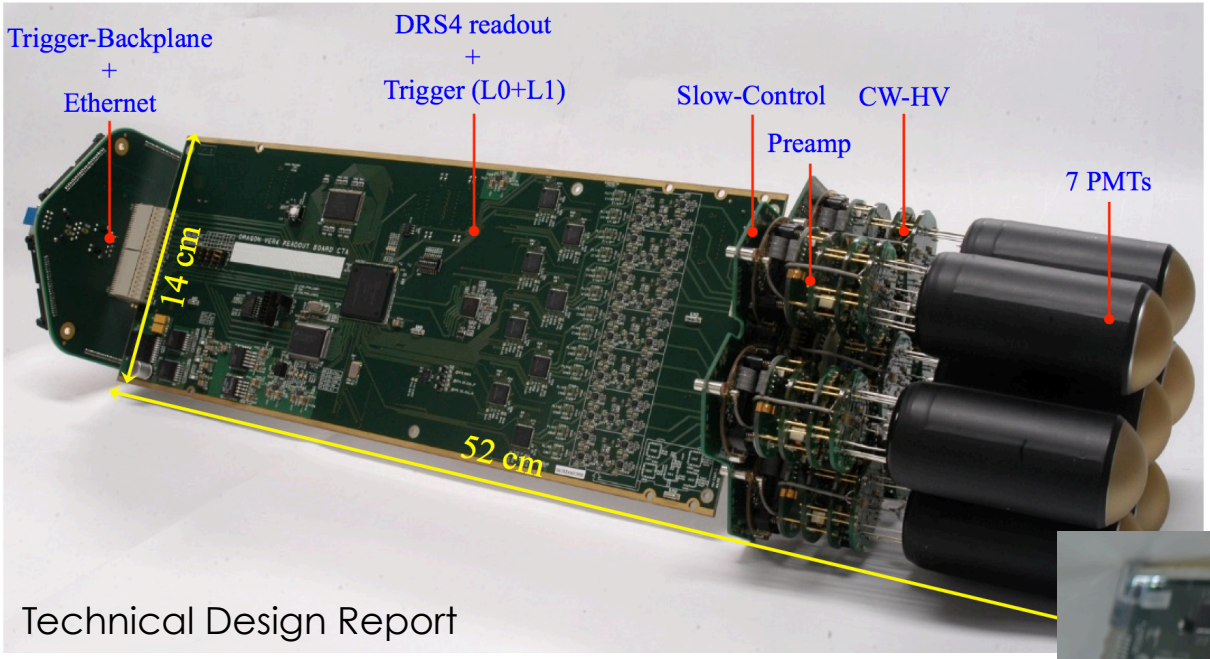
- 2.2m diameter
- 265 modules à 7 pixels
  →1855 pixels

- 1 module à 7 pixels

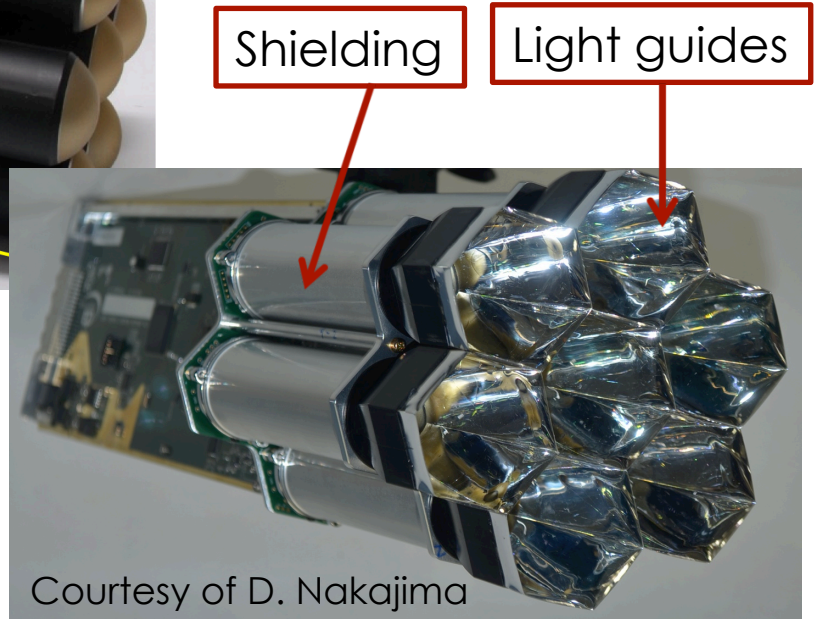




PMT module



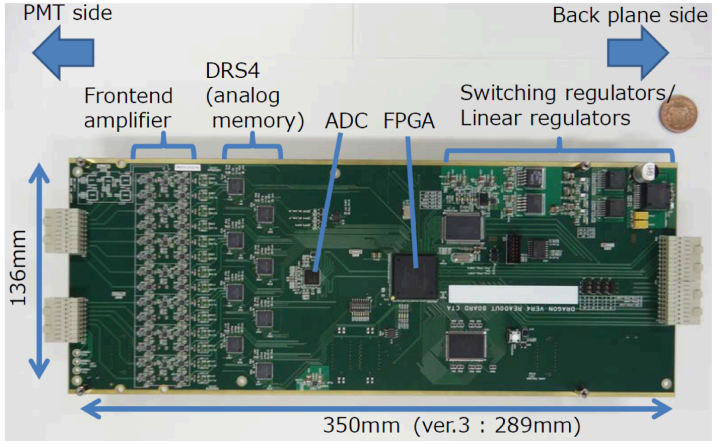
Technical Design Report



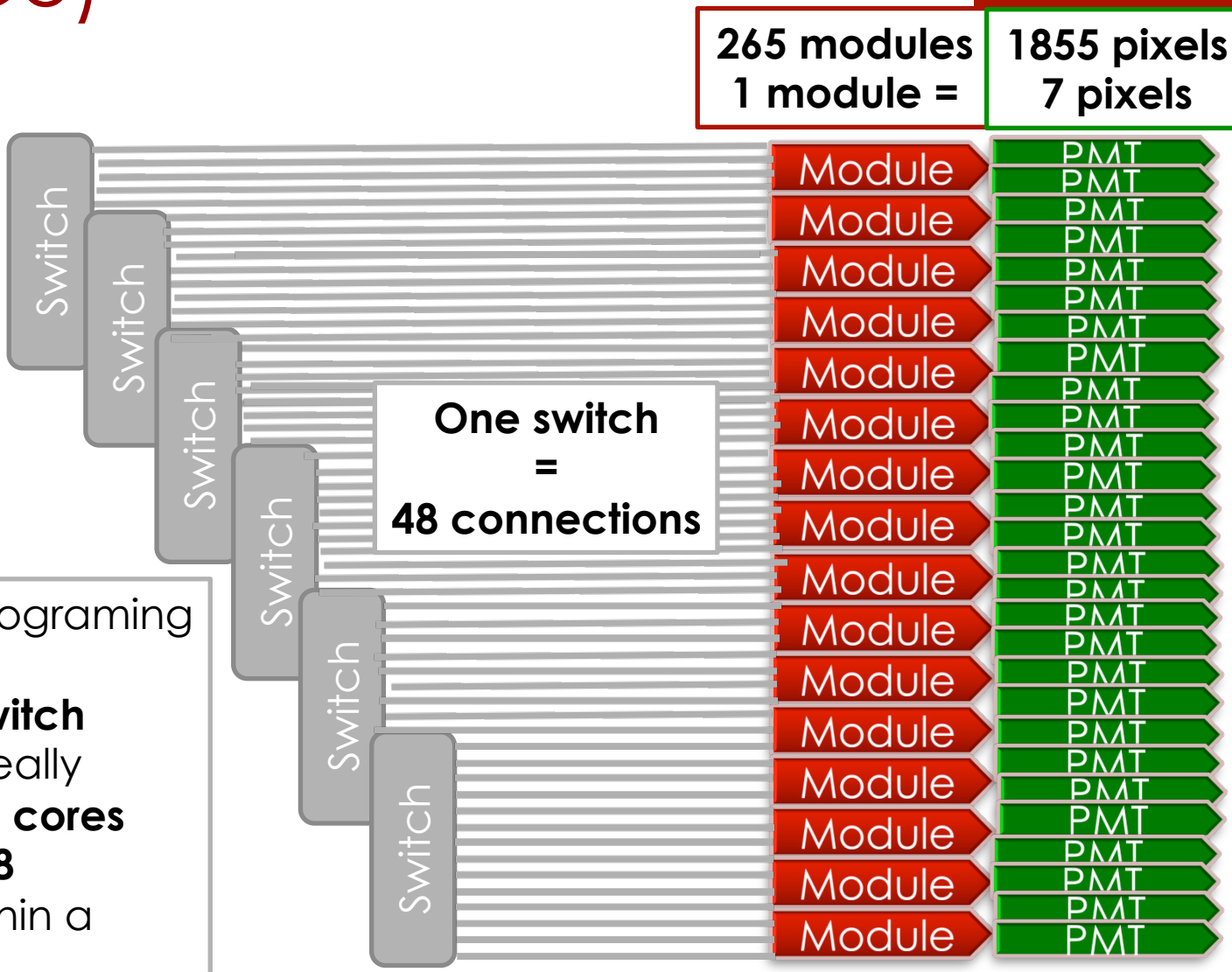
Courtesy of D. Nakajima

Module Control

- **Slow control of the modules** is done through an *FPGA* on the *DRS4* readout board
- **Control** and **Monitoring** of PMT modules
- **Settings** per pixel/ cluster/ all clusters:
  - High voltage, trigger threshold, sampling rate, readout window, DRS settings, trigger setting (L0 + L1)
  - **Monitor**: Temperatures, currents, voltages, rates
  - **Individual pixel rate control** (IPRC)



Module Control program (ClusCo)



Multi thread programing written in C

1 thread per switch

→ **6 threads** ideally running on **6 cores**

→ Loop over **48 modules** within a thread

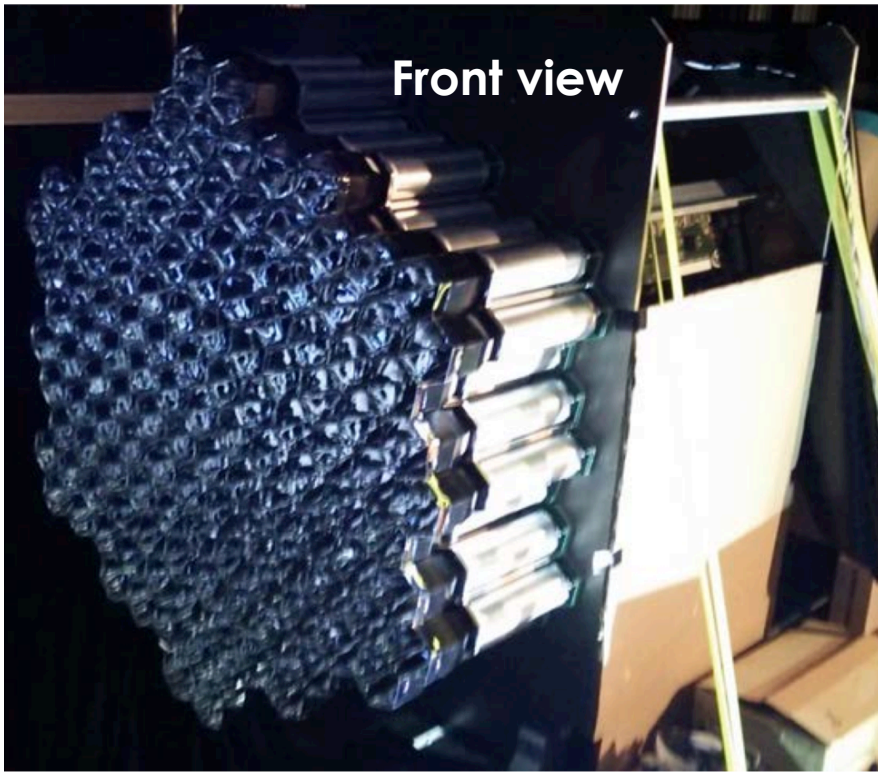
Aims and Use of Mini Camera system

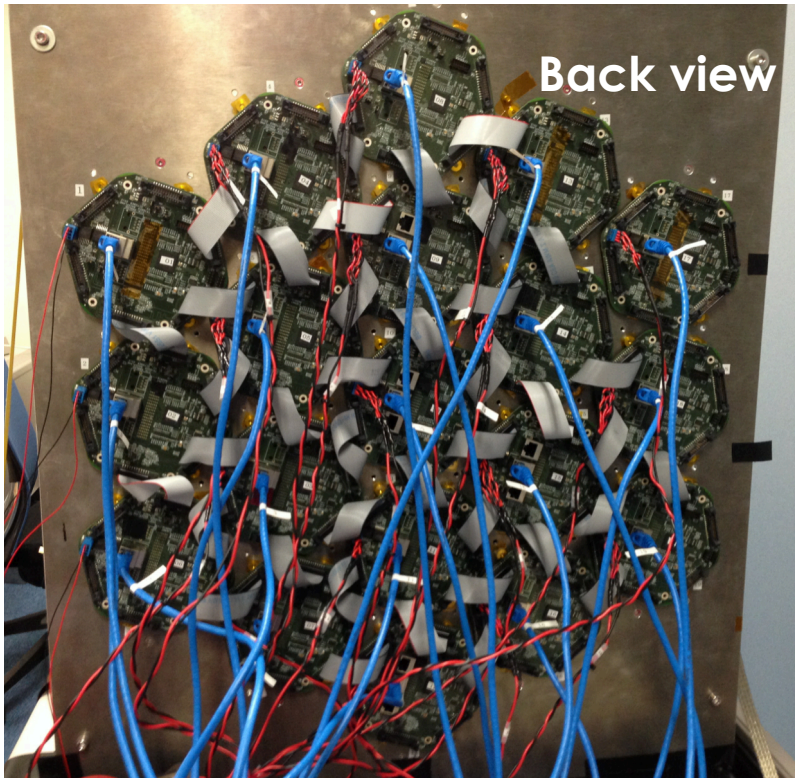
- Mini Camera consists of 19 modules
- Mini Camera test (Integration test)
  - Validations of multi-cluster assembly and functionality
  - Mechanics
  - Trigger, Communications, Control
  - DAQ, Power Consumption, etc.
- Module Characterization
  - Compile a database
  - Characterize basic parameters
  - Long term stability

Courtesy of D. Nakajima

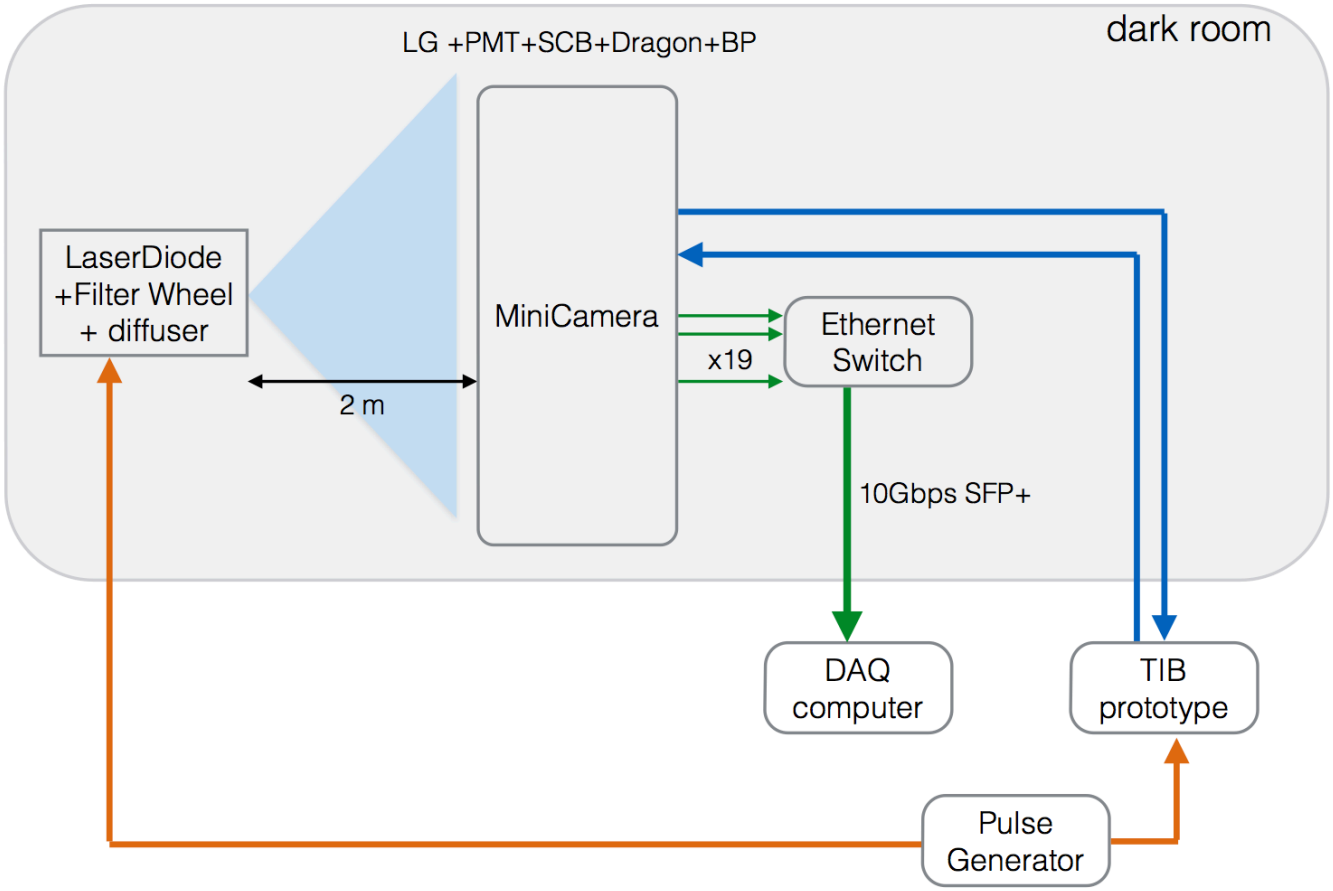
Mini Camera

- 19 Modules inserted in the mini-camera holder

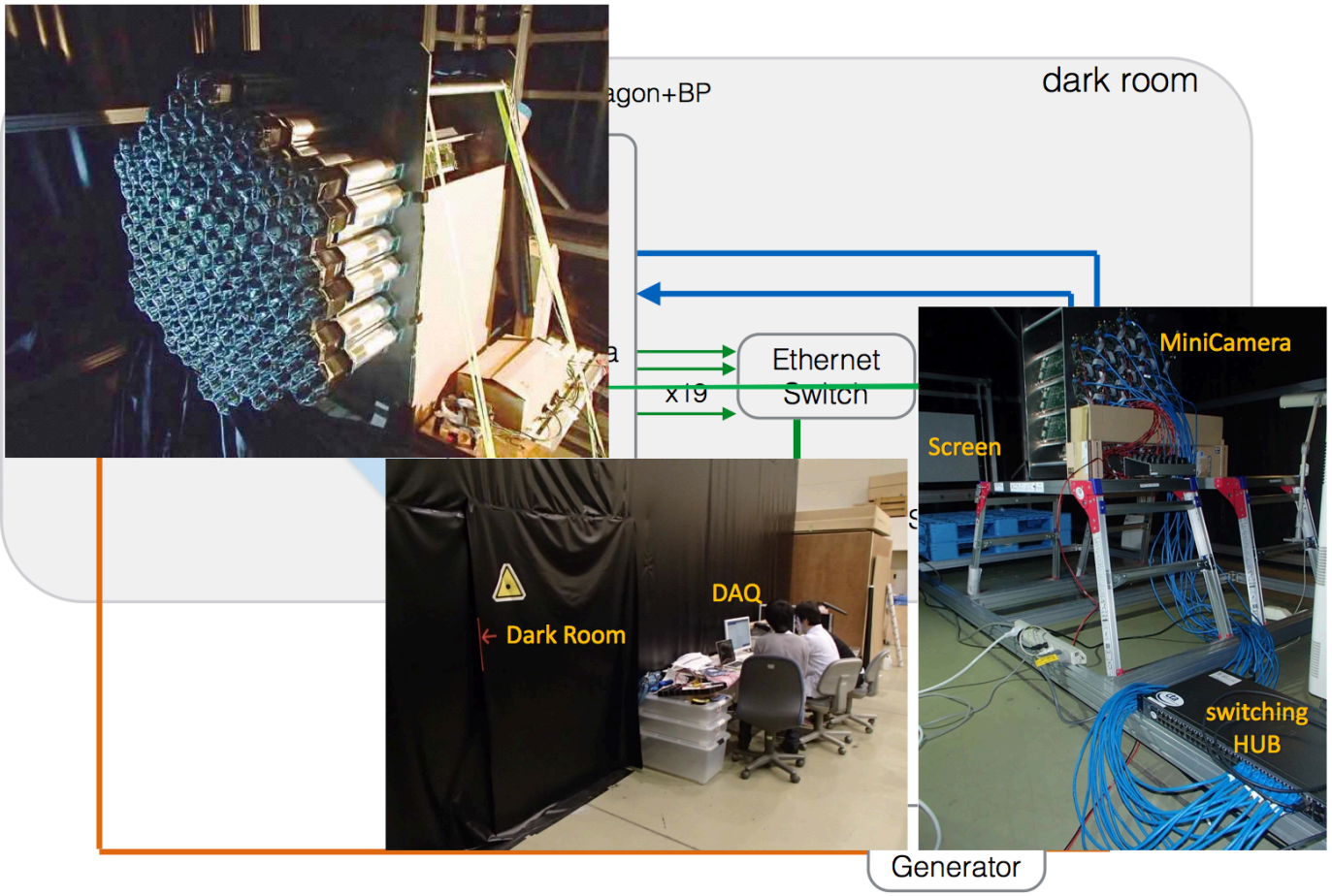




Mini Camera setup at ICRR (schematic view)



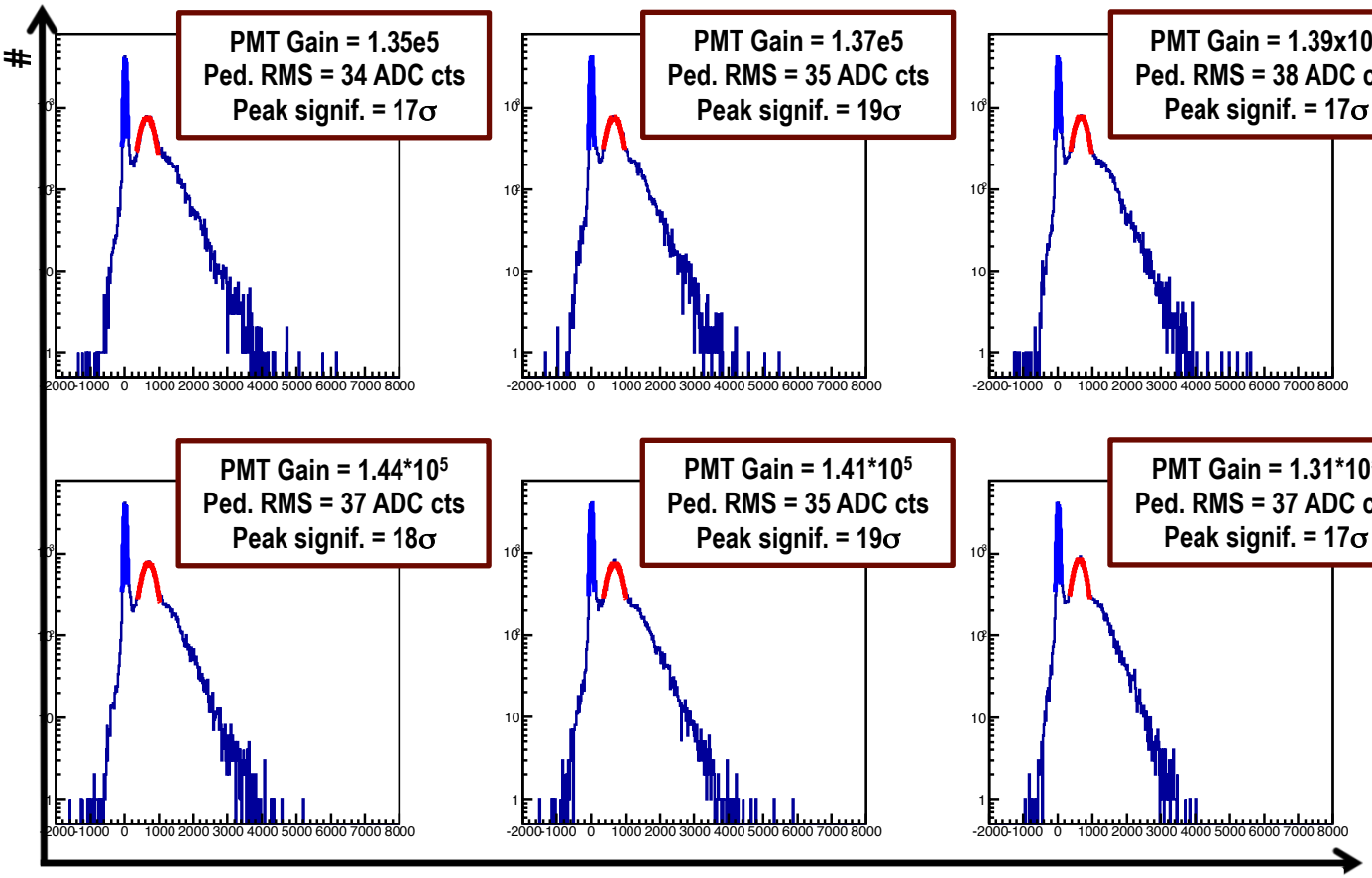
Mini Camera setup at ICRR (real view)



Courtesy of D. Nakajima

Single Photo-Electron Response

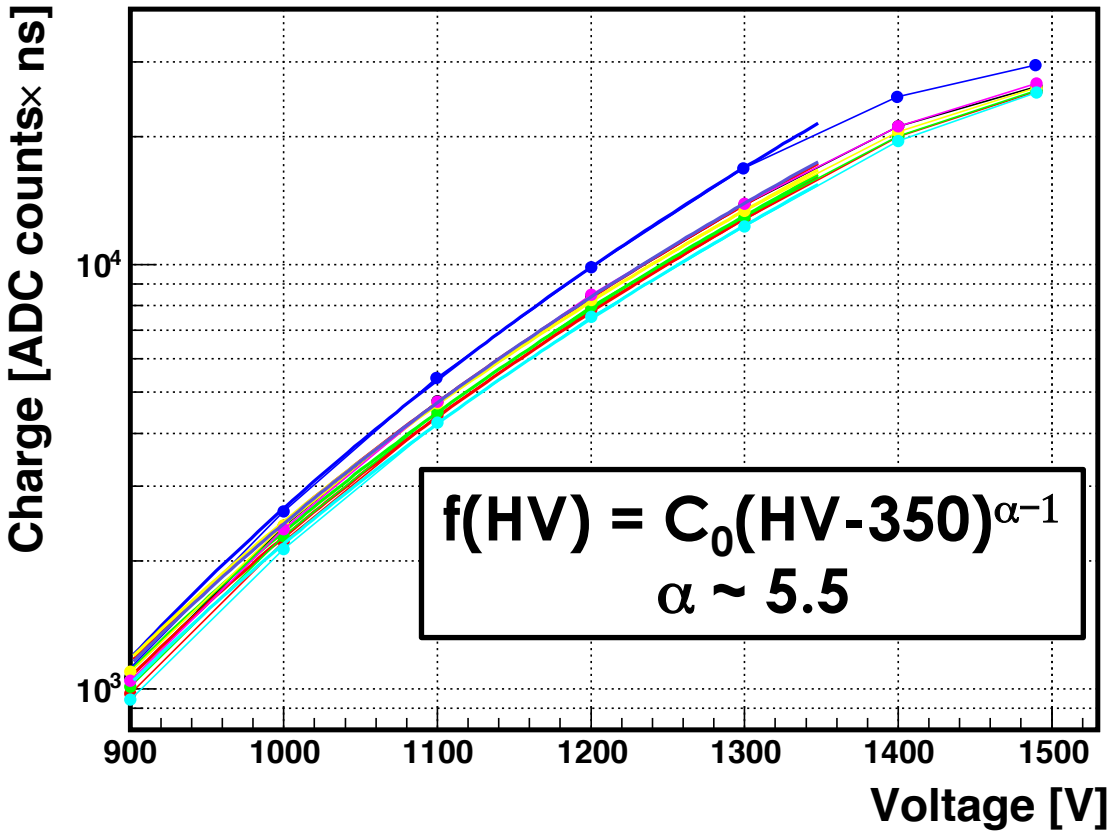
Clear resolution of a single photo-electron and pedestal



- Charge distributions of several pixels
- HV = 1400V (NOT nominal voltage)

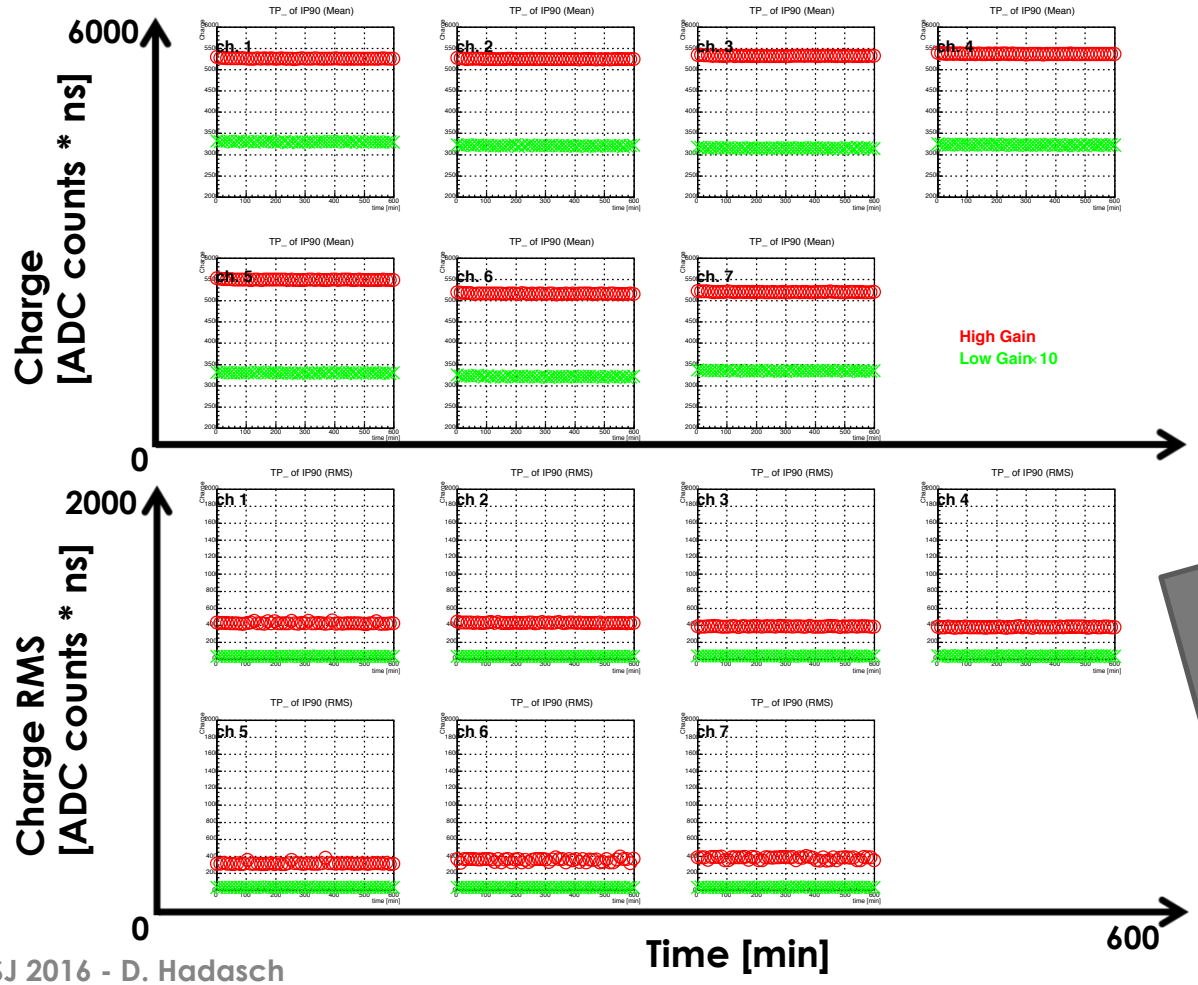
Gain vs. High Voltage

Gain is linear



- Long term monitoring for 10hrs with test pulse injection
- #dynodes = 8
- Voltage fixed between Cathode and first Dynode to 350V
- Charge saturates above 1400 V because of dynamic range of the high gain readout. We have Low gain, too (not shown here).

Long term monitoring of gains

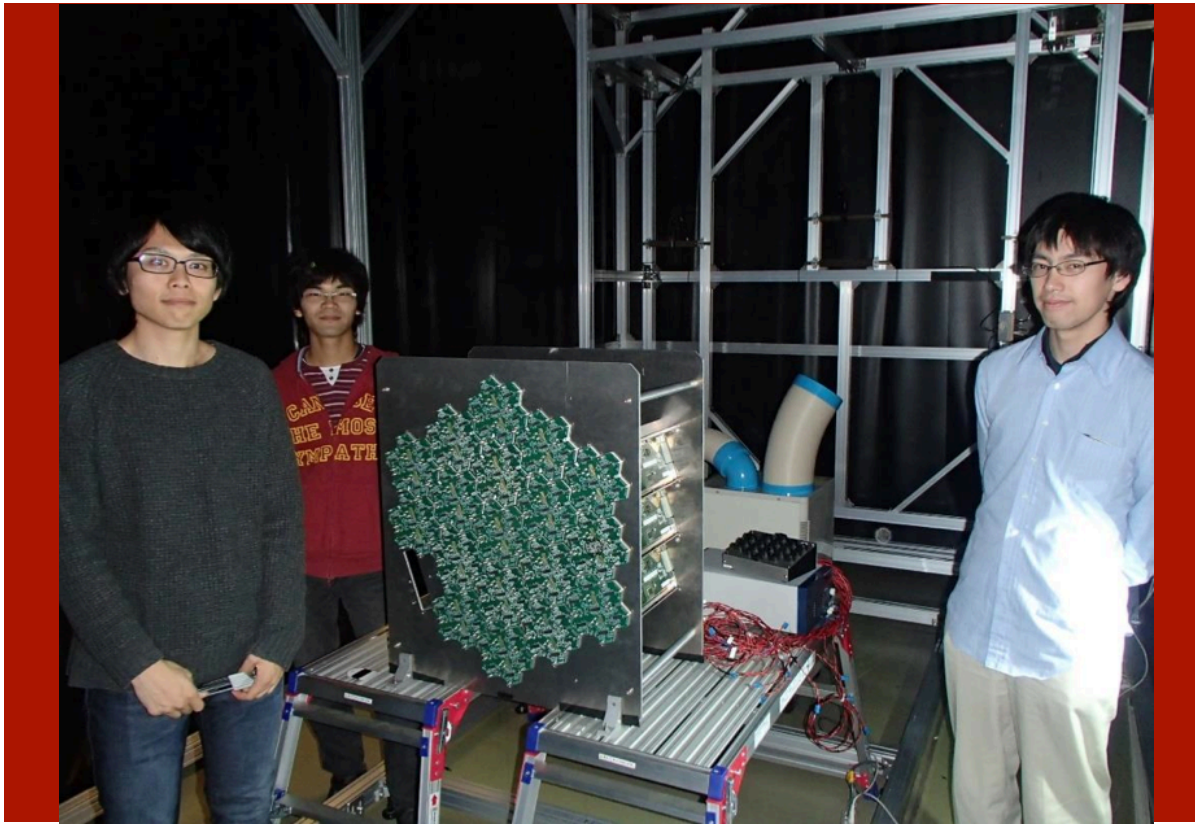


- Long term monitoring for 10hrs with test pulse injection

Charge & Charge RMS stable within 2% for high and low gain

Achievements

- **Mechanical validation** of the multi-module assembly: no problem on the mechanical structure
- **Power consumption** of a module is about 800 mA while the DAQ is running with the power of *PMT*s off
- **Basic functionalities** have been intensively and successfully tested
- **Development of ClusCo** (ClusterControl): 19 clusters can be controlled from ClusCo via multithread program
- **Trigger Propagation test** through L0L1 mezzanine, analog backplane and *TIB* prototype: No problem
- **Development of DAQ program**: C++ program with basic functionalities, such as the architecture of the program, data format, event reading, event writing, event building, data corruption checks and buffers.



Thank you

ありがとうございます