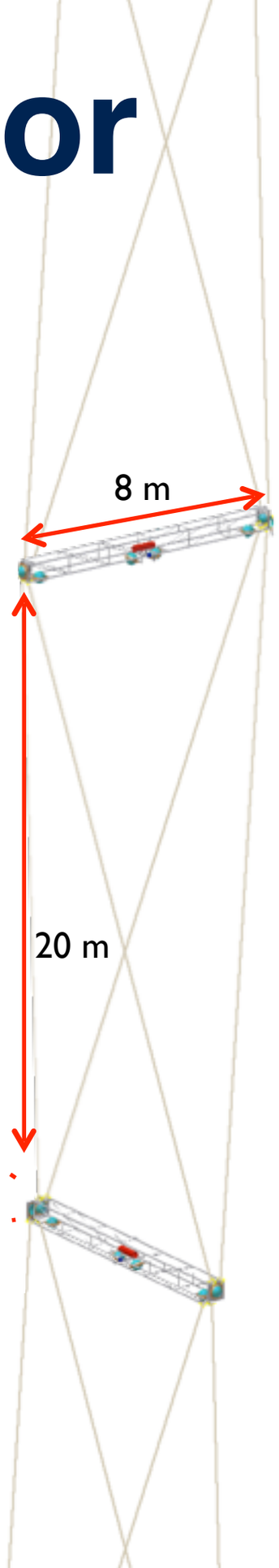
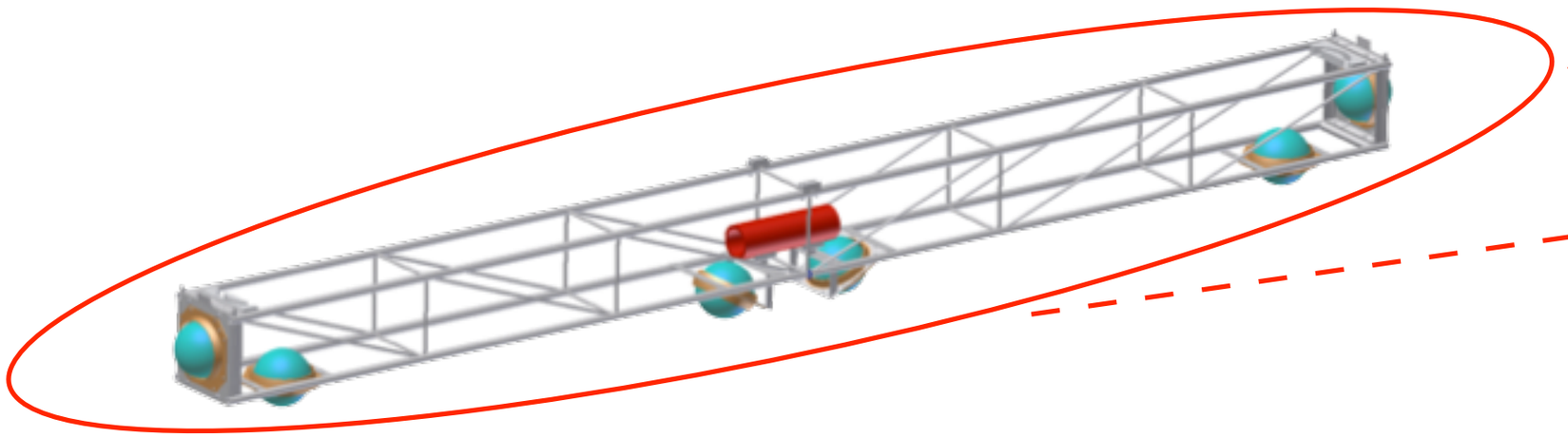
# The Trigger and Data Acquisition System for the KM3NeT-Italy neutrino telescope

Matteo Manzali
INFN - Università degli Studi di Ferrara

# The KM3NeT-Italy detector

- KM3NeT-Italy is an INFN project to build the inner core of the multi-km3 size KM3NeT neutrino telescope
- The detector site is placed in Italy in the Ionian Sea, 100 KM off Sicily coast and at 3500 m of depth
- It foresees ~700 optical modules (OMs) arranged in structures called **floors** containing 6 OMs each one
- Floors are vertically linked together in groups of 14 called **towers** of about 500 m high



# The TriDAS software

- The TriDAS software has been developed to acquire and filter the data stream coming from the KM3NeT-Italy detector

- Few TriDAS highlights:

    - C++ and Boost libraries

    - ~15000 lines of code

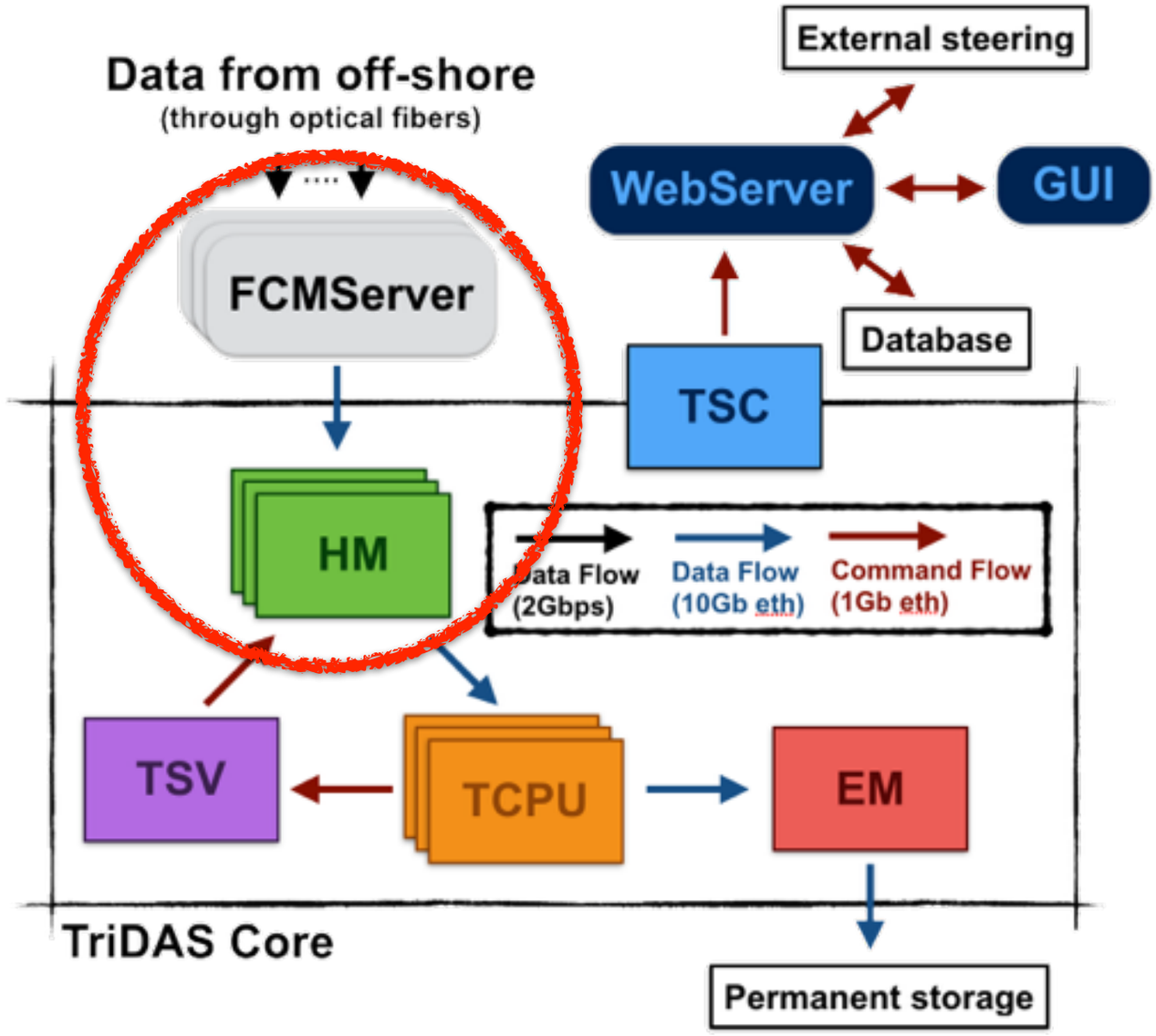
    - source code available on BitBucket (https://goo.gl/XRUu5A)

    - INFN Jenkins used for Continuous Integration (https://goo.gl/e0UFQT)

# TriDAS components

- Each FCMServer:
  - performs data readout-out through dedicated ASIC
  - sends data to a specific HitManager

- Each Hit Manager (HM):
  - receives data from a specific portion of detector called “Sector”
  - slices the data stream into “Time Slices” (TS) of fixed time duration
  - creates the so called “SectorTimeSlices” (STSs)

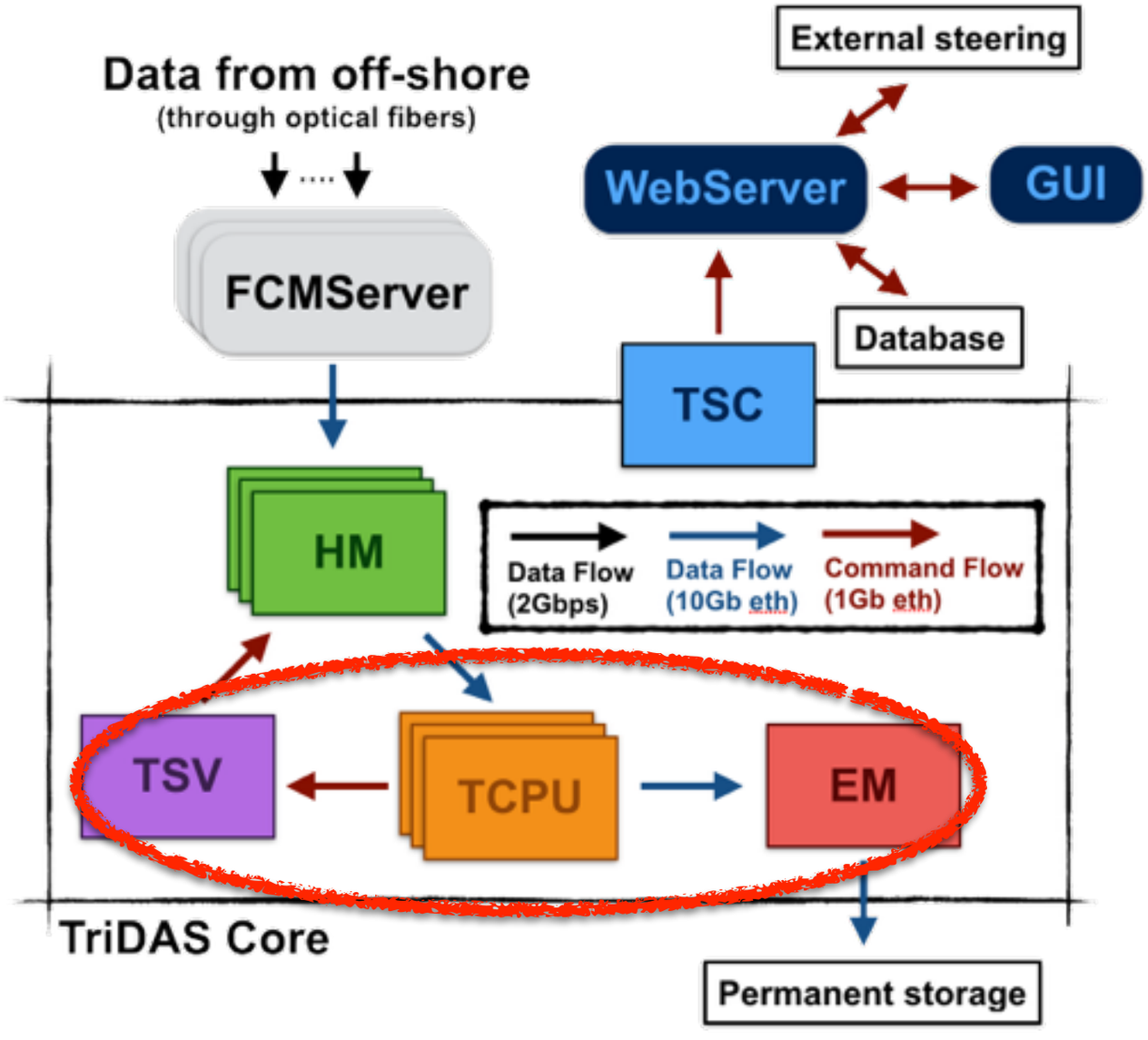


# TriDAS components

- Each Trigger CPU (TCPU):
  - receives the STSs from HMs creating a TelescopeTimeSlice (TTS)
  - applies the triggers to the TTS
  - sends the triggered events to the Event Manager

- The Event Manager (EM):
  - stores triggered events to a permanent storage

- The TriDAS SuperVisor (TSV):
  - supervises the data exchange between HMs and TCPUs
  - assigns every TS to a specific TCPU

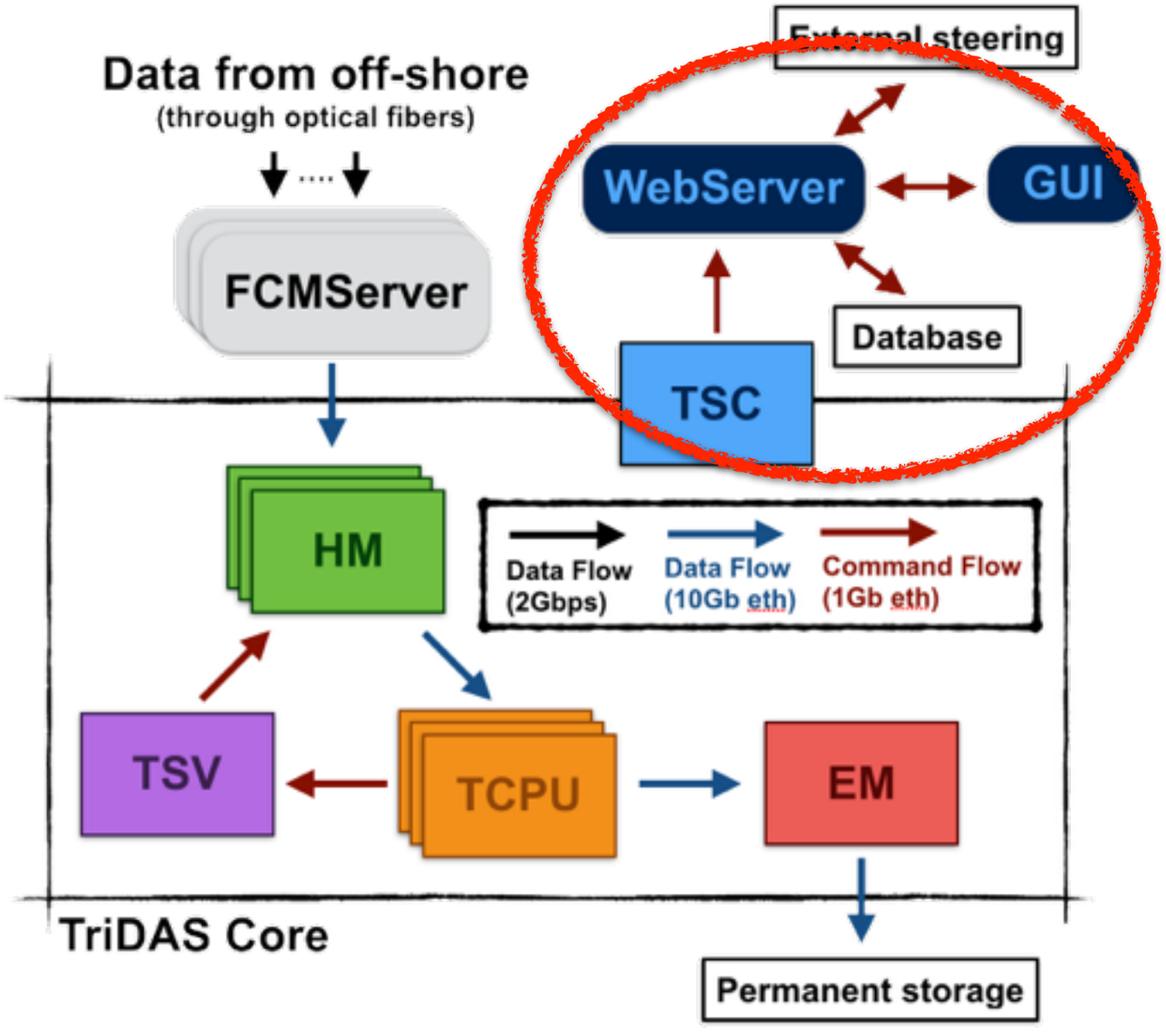


# TriDAS components

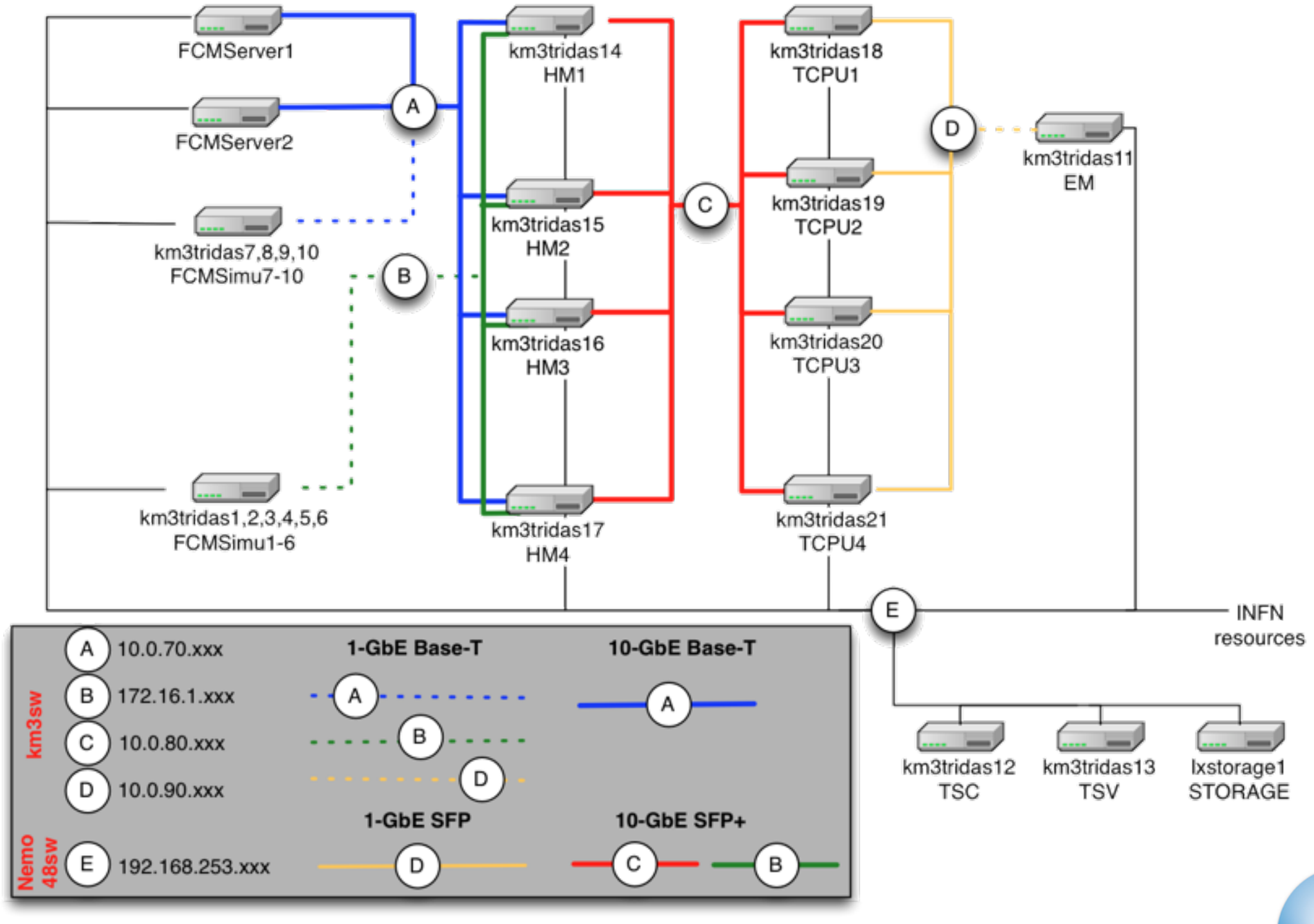
- The TriDAS Controller (TSC):
  - is the software interface to the entire TriDAS environment
  - allows to start, stop and check the status of each TriDAS process

- The WebServer:
  - is the unique user entry point for the TSC

- The GUI:
  - is a web application
  - acts as a graphical control interface for the user



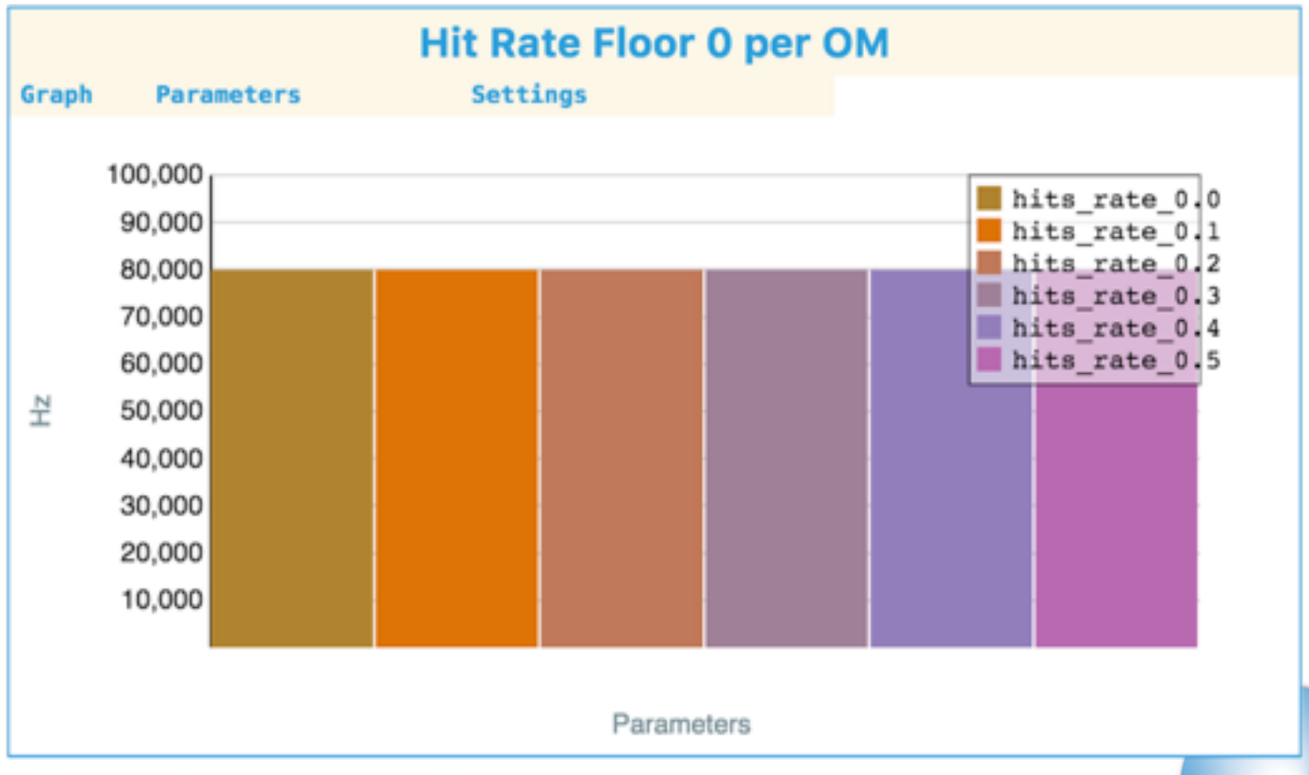
# Bologna Common Infrastructure



# Integration tests

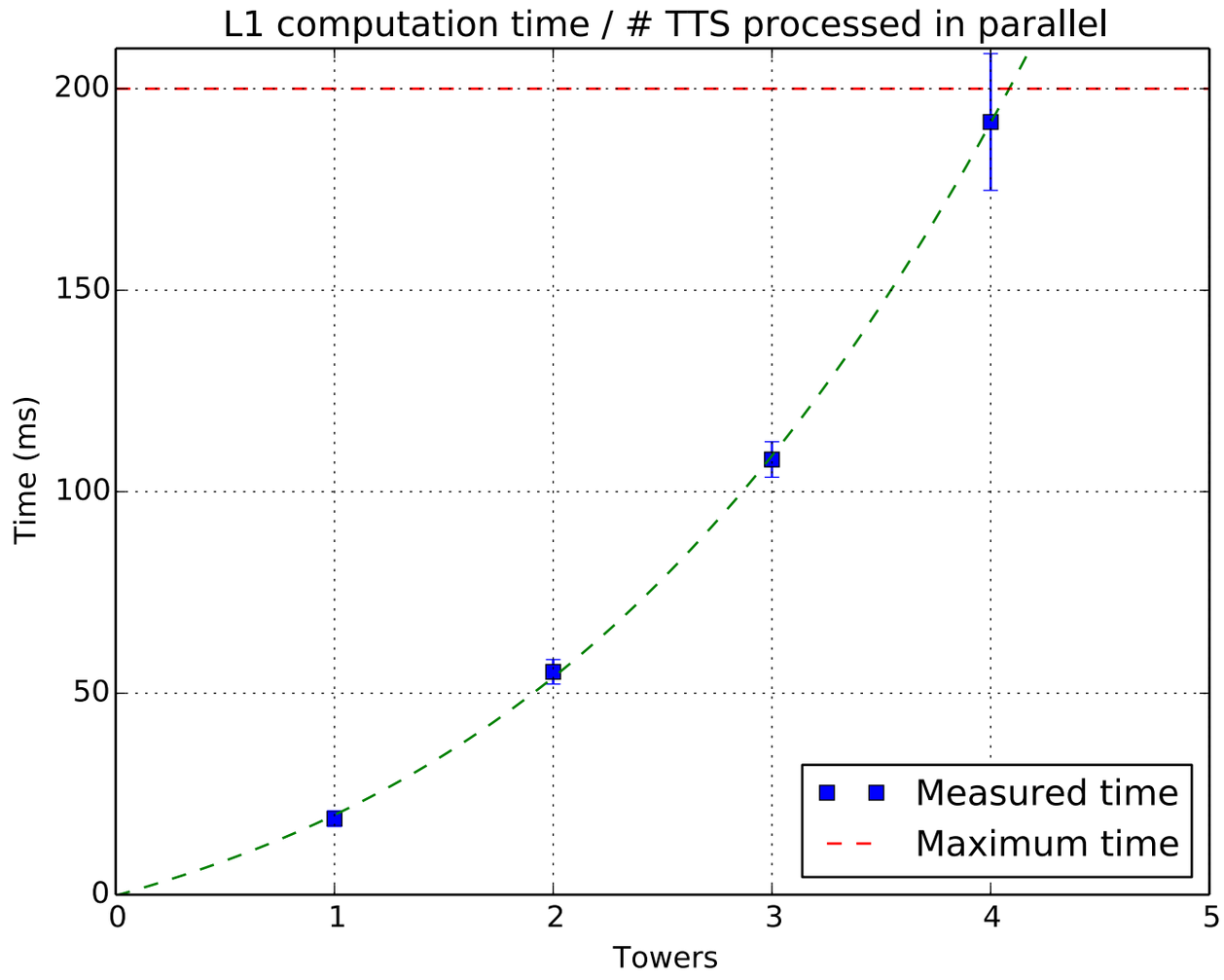
- Real electronics for 2 complete floors
- OM signal simulated with a waveform generator (up to 200 KHz per OM)
- Full software chain tested with success (HMs, TCPUs, EM, TSV, TSC, WebGUI)

- Crosschecked the rates of hits and L1 triggers identified by the TriDAS



# Scalability tests

- Simulated up to 4 towers
- ~100 KHz of hits rate per OM (only background noise)
- ΔTS 200 ms
- 80 TTS processed in parallel (4 TCPU servers)
- Values observed with 4 towers:
  - ~4.48 Gb/s of detector throughput
  - ~75 KHz of Simple Coincidences (L1 trigger)



# Conclusions

- The TriDAS has been developed to sustain the foreseen 8 towers detector
- The modular design of the TriDAS allows to scale the detector size simply increasing the CPU resources
- First integration tests successfully completed
- Scalability tests performed with limited CPU resources demonstrate that:
  - the system scales up to 4 towers
  - the end user is able to control it properly


Thank
You