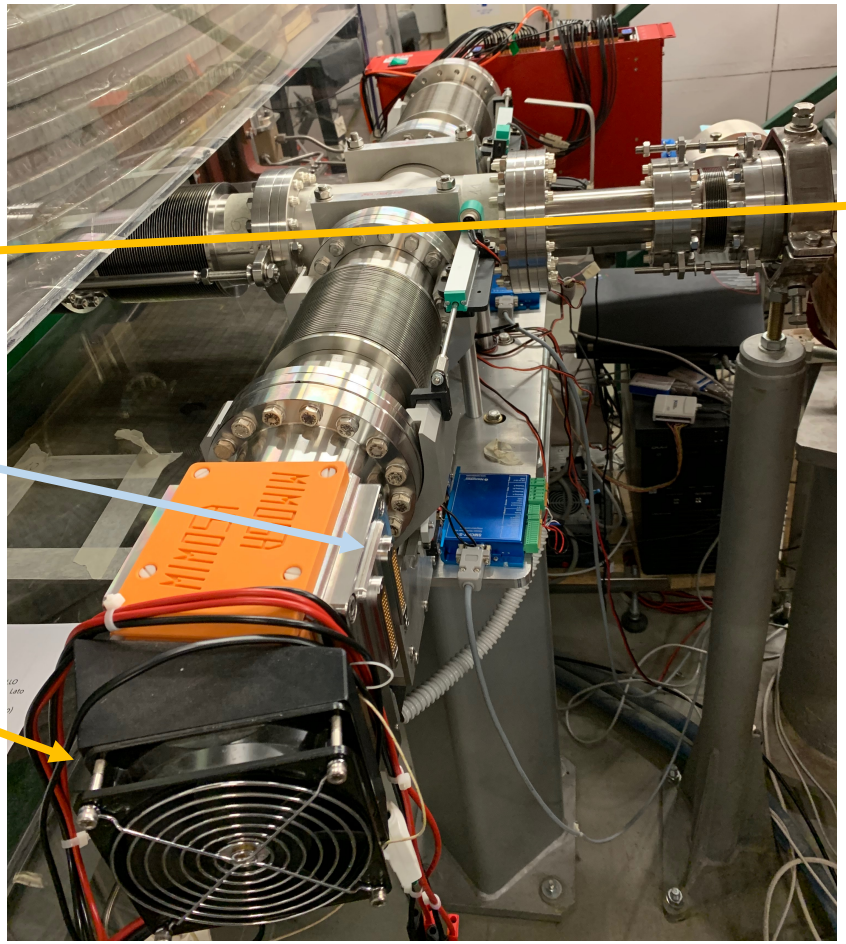
Pixel tracker update

1. Vertex: results from PADME
2. “Distributed” test lab during pandemic
3. Inner Tracker (IT) status
4. Conclusions

Vertex: results from PADME



PADME beam line

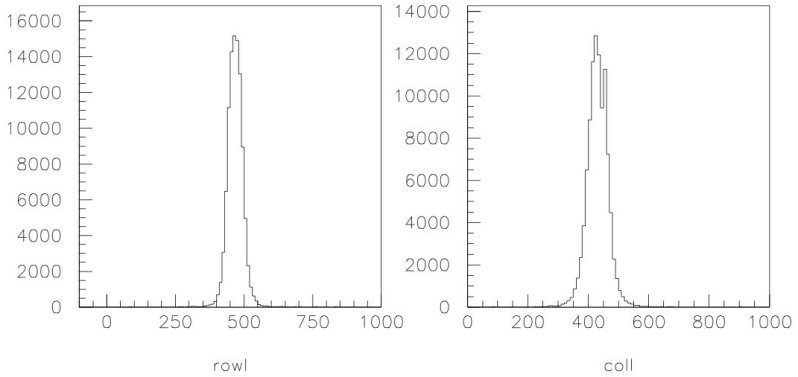
M28 signal connector

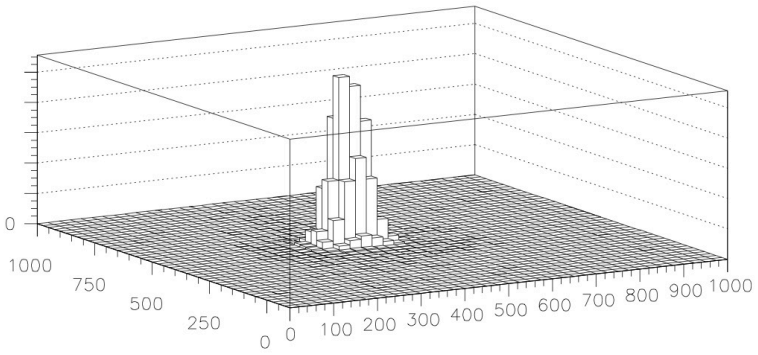
Cooling fan

Vertex: results from PADME

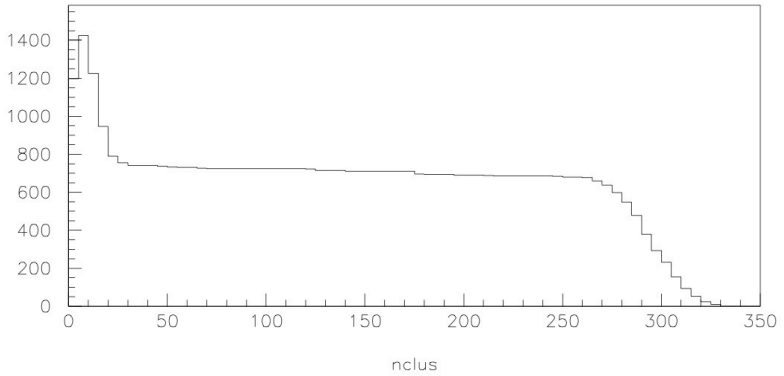
Main goal of the measure: check maximum multiplicity allowed by Ultimate/M28
Collected about 1.5 Milion event without DAQ problems

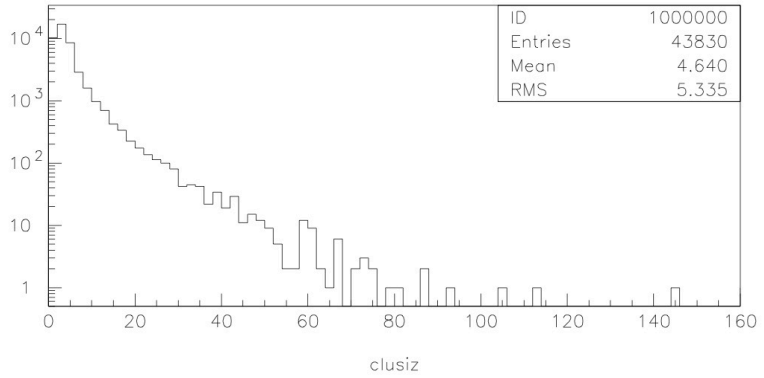
Beam profile (positrons @ about 500 MeV)



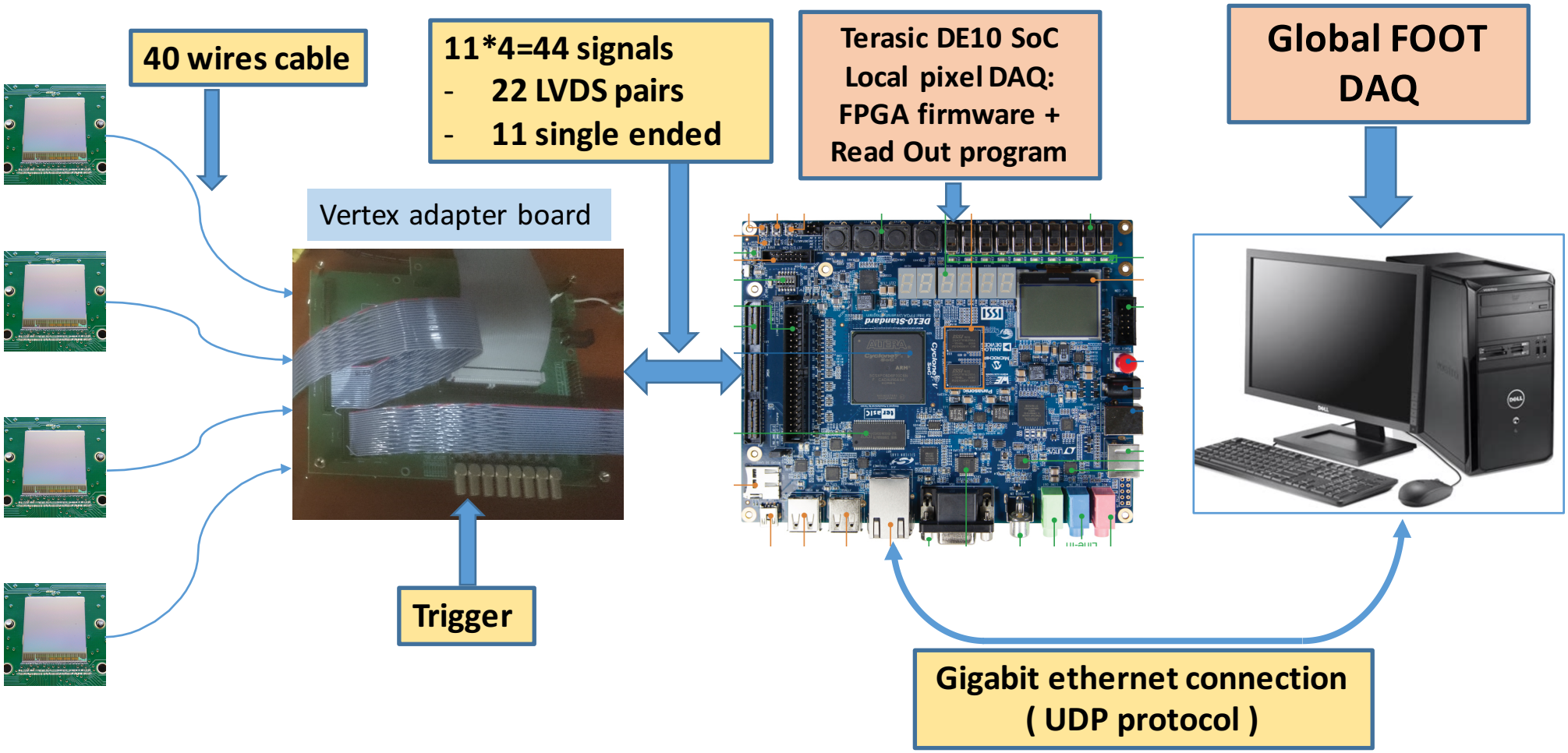


Cluster multiplicity and size

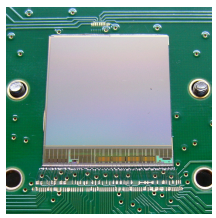




"Distributed" test lab during pandemic: Readout Architecture



"Distributed" test lab during pandemic: Readout Architecture



Two serial out DO0, DO1 (160MHz)

JTAG

SoC FPGA firmware

DP RAM DO0

DP RAM DO1

SoC Arm A9 CPU Local pixel DAQ program

Send UDP packets on Gigabit ethernet

Intermediate PC

Trigger

Architecture **ALREADY** running on PADME.
PADME trigger rate requirement at **50 Hz!!!!!!!!**

Data logger listening on sockets, one for each readout board and writing data on files.

"Distributed" test lab during pandemic: Readout Architecture

```
> source daqSoC_v4_control_script
************************************************************
************************************************************
*****              HELP                  *****
************************************************************
 Command to execute list:
      start       Start program daqSoC_v4
      end         End   program daqSoC_v4
      kill        Kill program daqSoC_v4
      enableTRHW    ENABLE   the external hardware trigger
      disableTRHW   DISABLE  the external hardware trigger
      startClient   Start data receiving processes
      stopClient    Stop data  receiving processes
      showProc      Show relevant processes on server and client
      remoteHelp    daqSoC_v4 remote help on server
command:
IP number server:  192.168.1.11
IP number client:  192.168.1.50
num events:       5000000
Start command:    /home/root/bin/daqSoC_v4 -NumEventsToRead 5000000 -JtagInit
default -triggerSW daq -StepTriggerMonitor 100 > /home/root/daqSoC_v4.log
2>daqSoC_v4_err.log &
Last Event:
************************************************************
```

- Intermediate PC available @LNF and connected to the Vertex hardware
- 10 Gigabit links available
- PC accessible to Bologna and Strasbourg people (Mauro, Silvia, Christian) to test DAQ remotely

- New set of script available on the intermediate PC
- Scripts to be used to control the daq program on the Terasic board remotely.
- Scripts used by the general DAQ to control both Vertex and Inner Tracker data acquisition program (1+8 Gbit links)

Inner Tracker (IT) status

Memorandum of Understanding between the Laboratori Nazionali di Frascati of the Istituto Nazionale di Fisica Nucleare (INFN-LNF) and the Institut Pluridisciplinaire Hubert Curien (IPHC) regarding the assembly of the FOOT inner tracker

1. Purpose

The purpose of this Memorandum is to document the understanding between the Laboratori Nazionali di Frascati (LNF) of the INFN, hereby represented by its Director, Dr. Fabio BOSSI, and the Institut Pluridisciplinaire Hubert Curien of Strasbourg (IPHC), hereby represented by its Director, Dr. Rémi BARILLON regarding the assembly work for the internal tracker of the FOOT experiment over the 2020-2021 timeframe.

2. Scientific and technical context

The FOOT experiment of INFN is run by a collaboration of different INFN sites and other institutes, including IPHC. The scientific goals of the experiment concern the measurement of nuclear fragmentation cross sections to be used in applied physics contexts such as medical physics and space radioprotection.

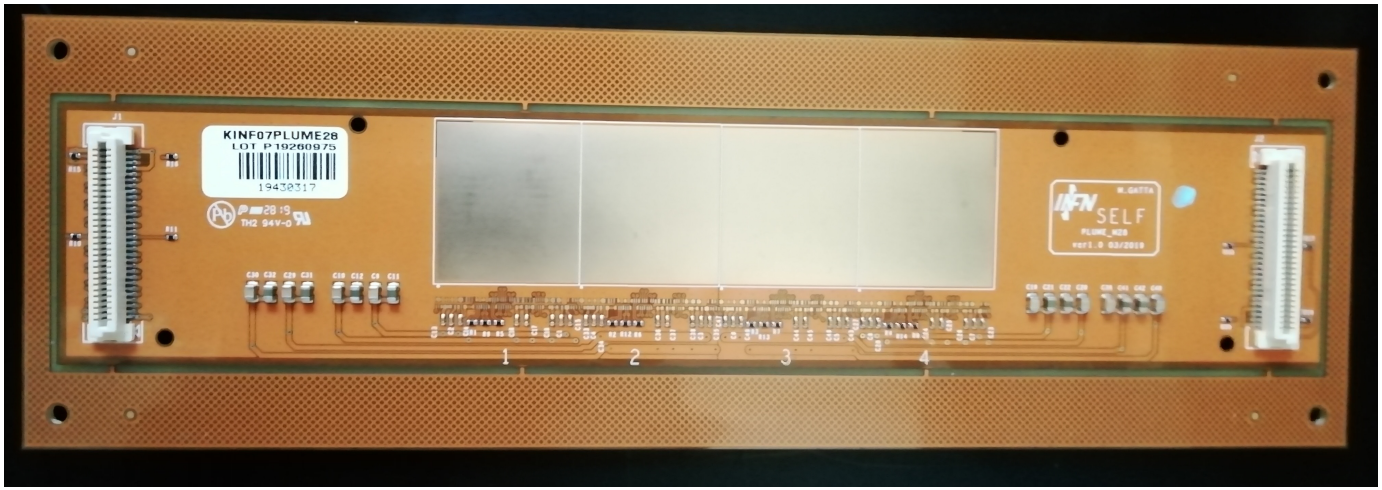
The apparatus currently under construction by the FOOT collaboration is a multi-detector, which includes a high precision inner tracker (ITR) made of 4 so-called detection *ladders*. Such ladders are built from the assembly of three main parts: CMOS pixel sensors, flex print cables and a spacer made of carbon-based foam.

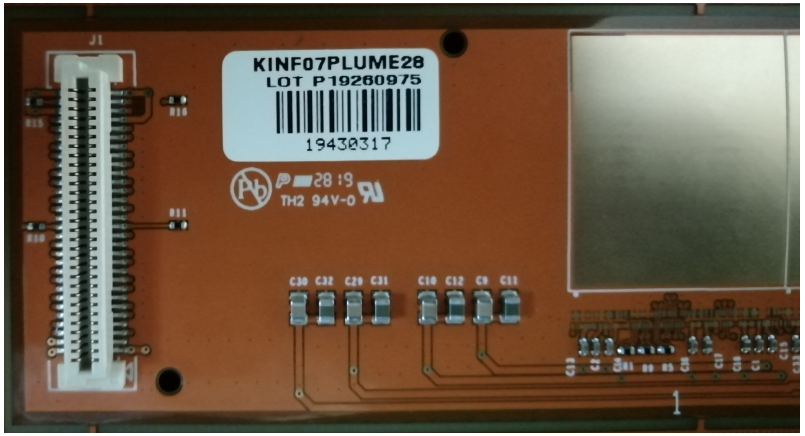
october 30, 2020 Final signature of MoU

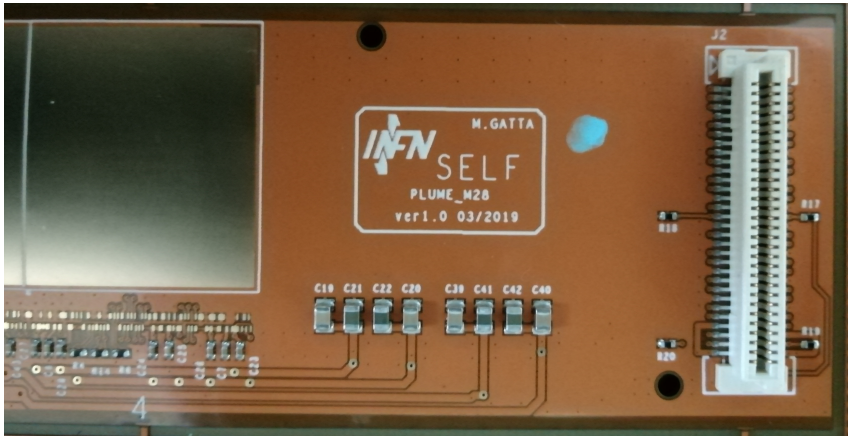
december 4, 2020 Inner Tracker assembly order issued

Inner Tracker (IT) status

The PlumeM28 first PCB prototypes

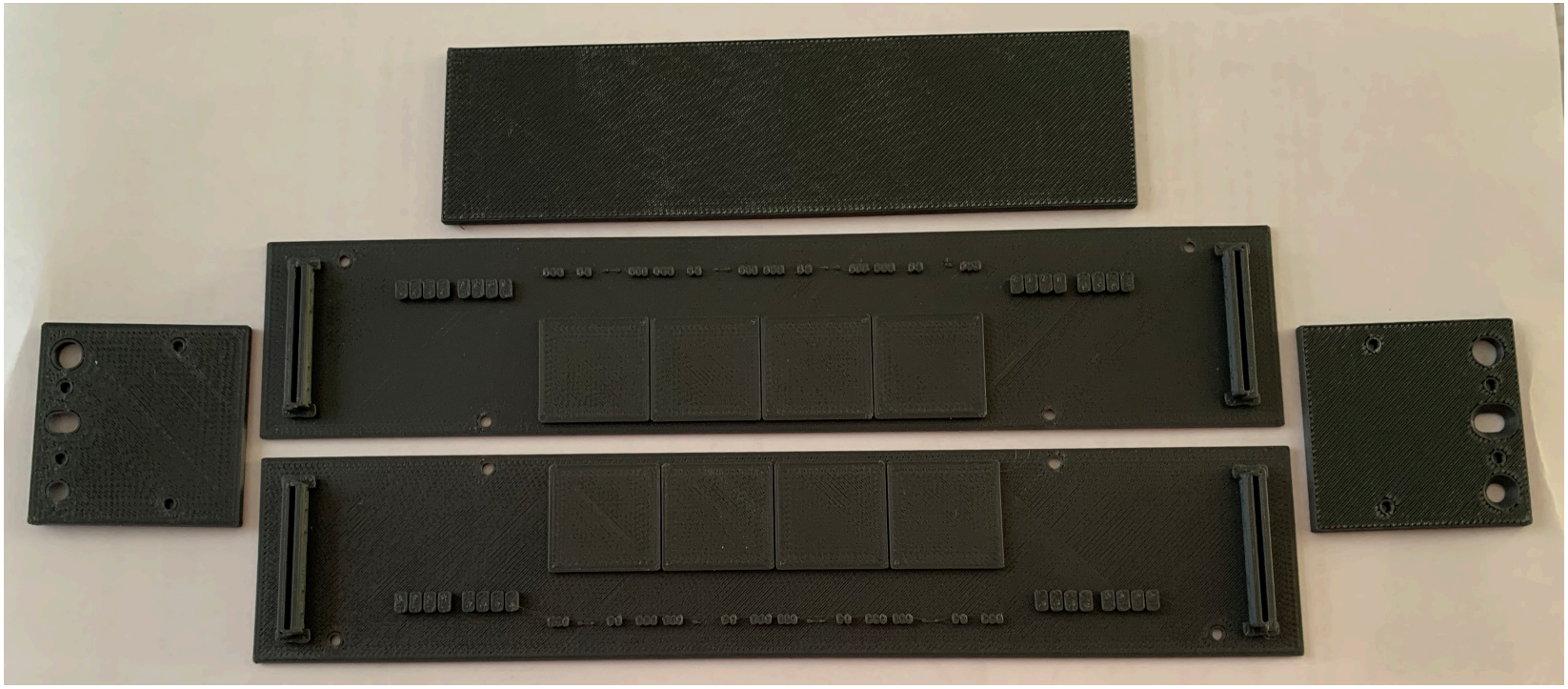






Inner Tracker (IT) status

3D pieces prototype for lab tests of assembly procedure

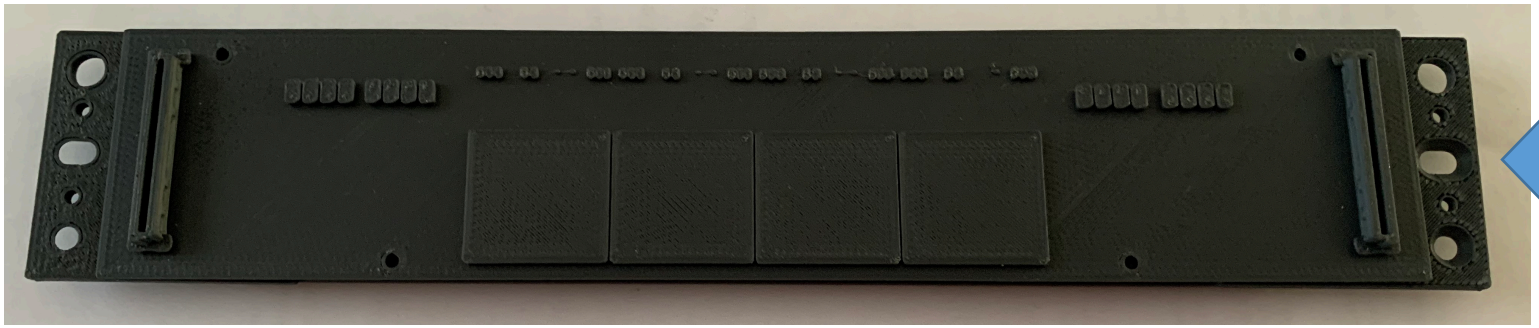


Inner Tracker (IT) status: Starsbourg activity

3D printed pieces

One module + 2 holders

One module + 2 holders + foam



One module + 2 holders + foam + second module = one ladder

Inner Tracker (IT) status

Status in Strasbourg

- Glue tests done. TWO type of glue that work very well identified
- Assembly procedure writing is quite finished. Ideas are clear to proceed
- Positioning jigs are designed (3D printed prototypes available)
- Chips positioning program is almost finished

Schedule STRONGLY dependent from PANDEMIC situation

Inner Tracker status (11-06-2020)

• Adapter_PlumeM28	Prototypes ready and tested TESTED
• CableAdapter_PlumeM28	Prototypes ready and tested TESTED
• Connections cable and connectors	Available
• Read out firmware (Vertex firmware)	Available
• Read out boards (DE10-nano)	Available
• Slow control firmware	Under development
• Mechanical support structure	Prototype ready
• Intermediate PC (10 Gigabit ports)	Available
• PlumeM28 assembly components	Delivered to G&A december 2°, 2019
• 2° version of PlumeM28 PCB	in production (deliver beginning of july)
• Assembly of PlumeM28	STUCK UP

Conclusions

FOOT tracker mechanical setup:
- Waiting bid conclusion

Pixel vertex detector:
- Tested at GSI
- Debugged and solved readout bugs at the BTF july 2019 test
- Deeply tested in PADME
- Slow control firmware under development

Magnet system:
- This week very likely will be nominated the bid technical commission

Inner Tracker:
- Plume ladder assembly started in Strasbourg
- Hard to fix a schedule considering the pandemic situation