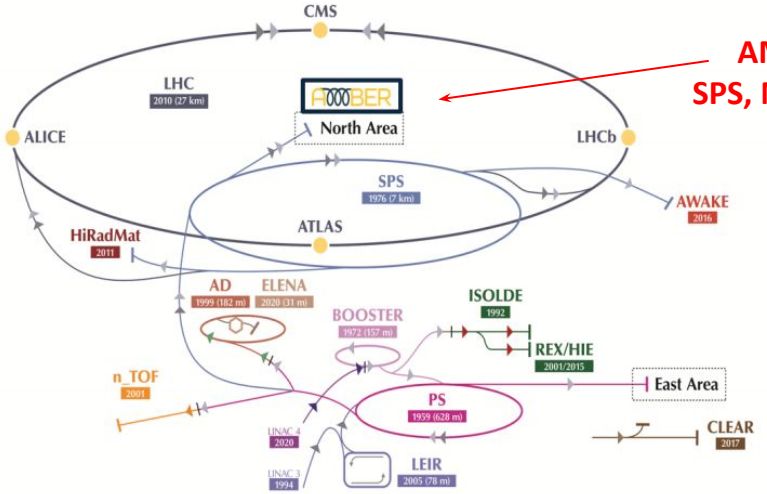
Large area micromegas detector for AMBER: lateral module test

Chiara Alice

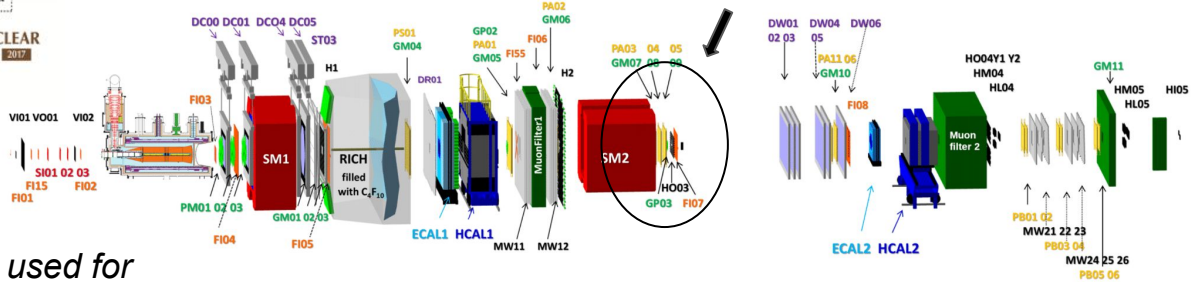
on behalf of AMBER-micromegas group
University of Torino
INFN Torino
CERN

AMBER experiment at CERN



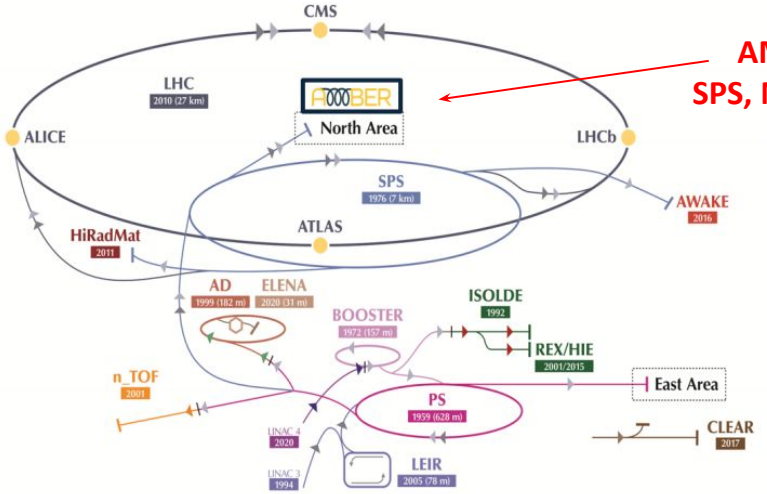
AMBER experiment:
SPS, North area, EHN2 hall

AMBER (NA66) *is a fixed target experiment at the M2 beam-line in the North Area of CERN. It is located in the same experimental hall (EHN2) in which COMPASS experiment was.*



The former COMPASS spectrometer is being used for the first phase of AMBER and will undergo several upgrades for the mid- and long-term program.

AMBER experiment at CERN



AMBER experiment:
SPS, North area, EHN2 hall

Test area downstream SM2

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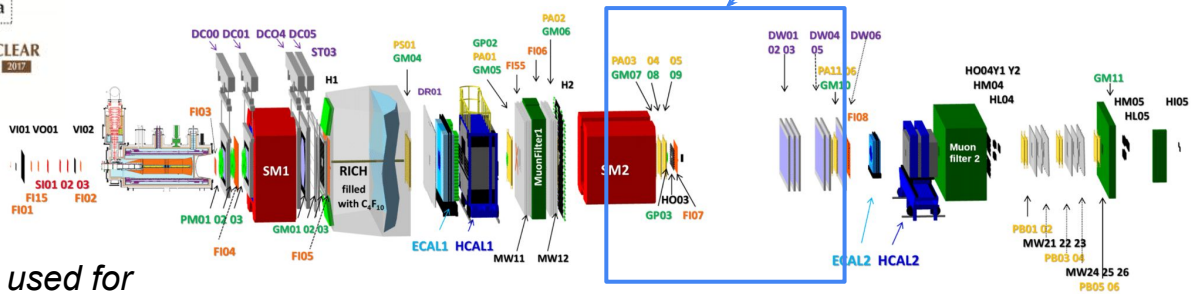

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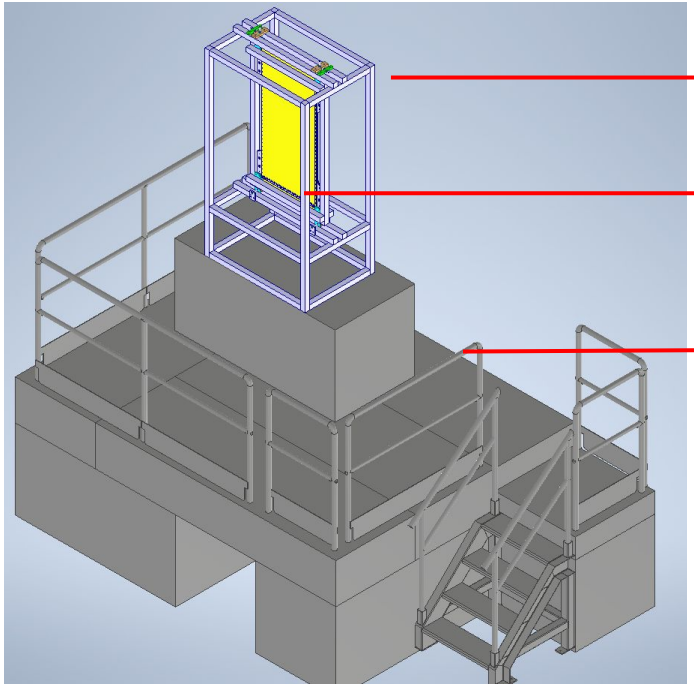
Test setup @AMBER

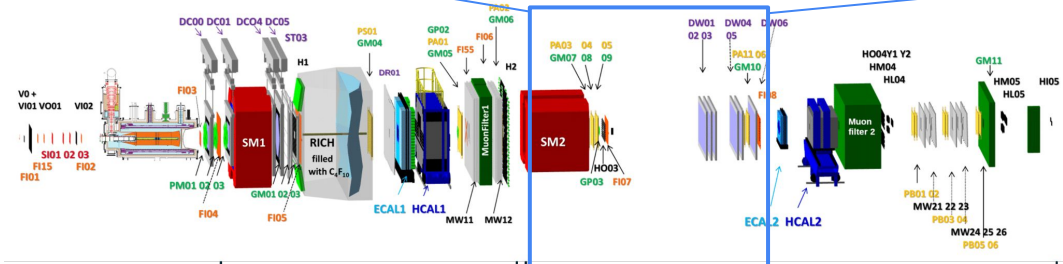


Detector holding structure made out of bosch profiles

Micromegas detector lateral module

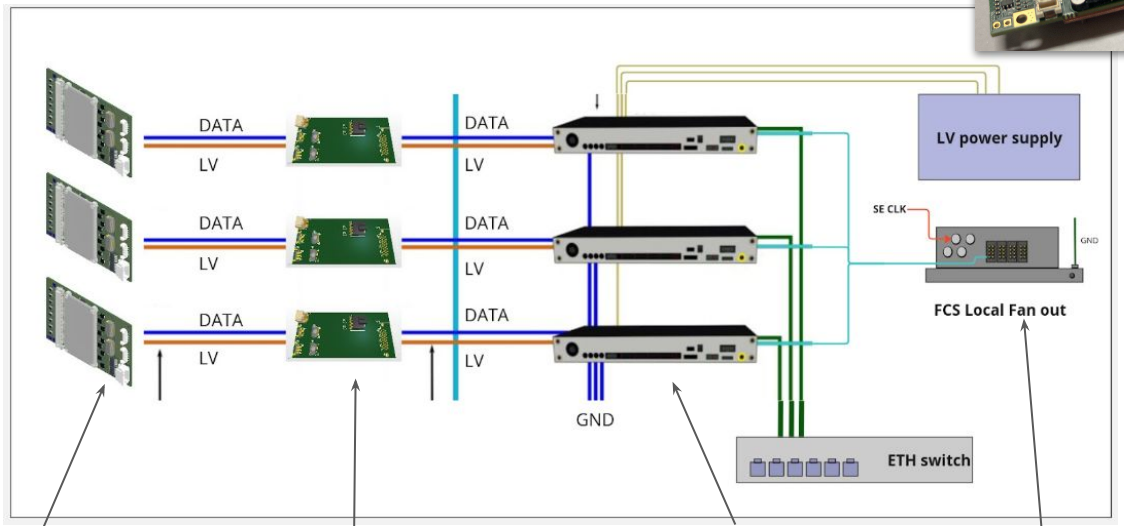
Concrete platform

Test area downstream SM2



Micromegas detector development: tests setup

AMBER TIGER-based readout chain:



AMBER-micromegas_FE
designed at INFN To

TIGER-based front-end board

Data and Low Voltage Patch Card - DLVPC
designed at JINR

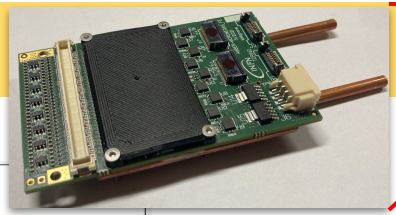
adapter for data and LV

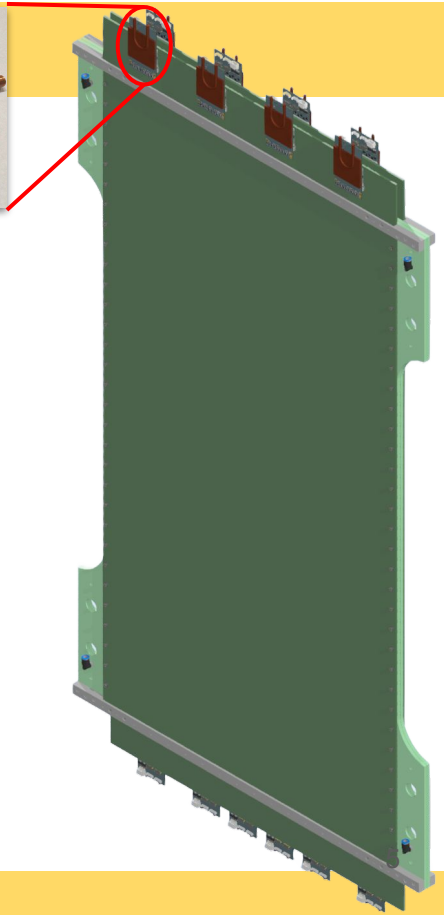
GEMROC modules
designed at INFN Fe

Configuration and control signal distribution
Data concentration

Local FAN OUT
designed at INFN Fe

Trigger and clock distribution





Backup slides

MM stackup

material	Density [g/cm^3]
Cu	8.96
Glass epoxy	1.98
Prepreg	1.47
Kapton	1.42
photoresist	1
DLC	3
Stainless steel	7.93

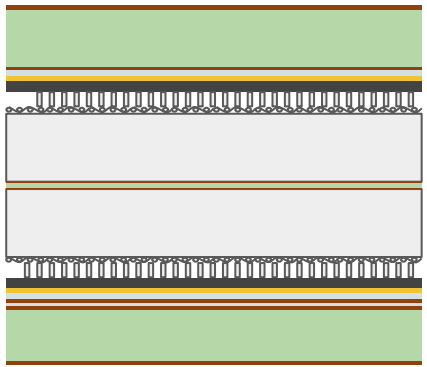
X shielding and connector layer : 35um copper
-3.2mm Glass epoxy
X strip layer : 35um Copper
-50um Prepreg
-50um Kapton
X DLC layer
-pillars 150um
X mesh: 45/18

Drift gap : 5mm

Drift mesh : 45/18

Drift gap: 5mm

U.V mesh: 45/18
-pillars 150um
U.V DLC layer
-50um Kapton
-50um Prepreg
U layer: 35um Copper
-28um Prepreg
V Layer: 17um copper
-3.2mm glass epoxy
U.V bottom shielding and connector layer: 35um copper



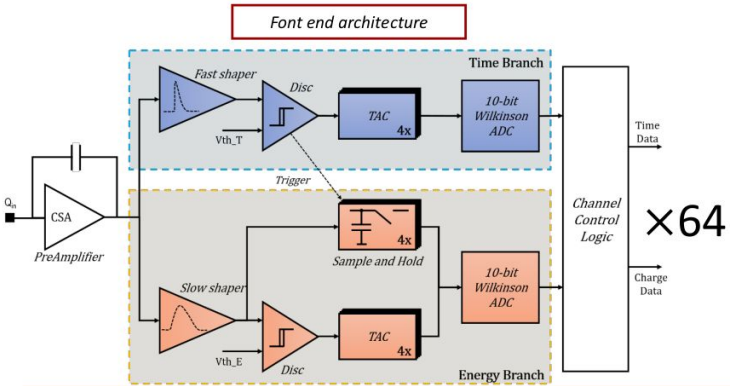
- Cu:
  SHIELDING x2: (0.0035*100*51.2)*2 cm3 = 17.92*2 cm3
  X strips: (0.0035*100*25.6)cm3 = 8.96 cm3
  U strips: (0.0035*100*32)cm3 = 11.2 cm3
  V strips: (0.0035*100*32)cm3 = 11.2 cm3
  Total copper = 602.112 g
- Glass epoxy:
  x2 (0.32*100*51.2)*2 cm3 =1638*2 cm3
  Total glass epoxy = 6486.5 g
- Prepreg:
  x2 (0.005*100*51.2)*2 cm3 = 25.6*2 cm3 ;
  x1 (0.0028*100*51.2)cm3 = 14.336 cm3
  Total Prepreg : 96.338 g
- Kapton:
  x2 (0.005*100*51.2)*2cm3 = 25.6*2 cm3
  Total Kapton: 72.704 g
- Photoresist (uniform layer approx):
  x2 (0.0150*100*51.2)*2 cm3= 65.536*2 cm3
  Total photoresist: 127,072 g
- DLC:
  x2 (0.01*100*51.2)*2 cm3 = 51.2*2 cm3
  Total DLC: 307.2 g
- Stainless Steel (uniform layer approx):
  x3 (0.0018*100*51.2)*3 cm3 = 9.216*3 cm3
  Total SS: 219.25 g

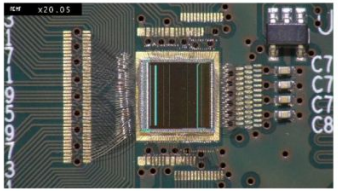
Total mass first estimation: 7.912 kg

Backup slides

TIGER ASIC

Torino Integrated Gem Electronics Readout





TIGER bonded on PCB

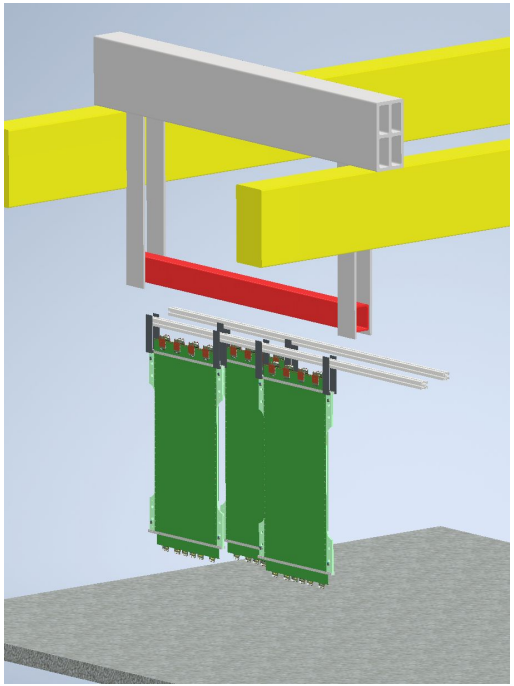
Front end board (FEB)

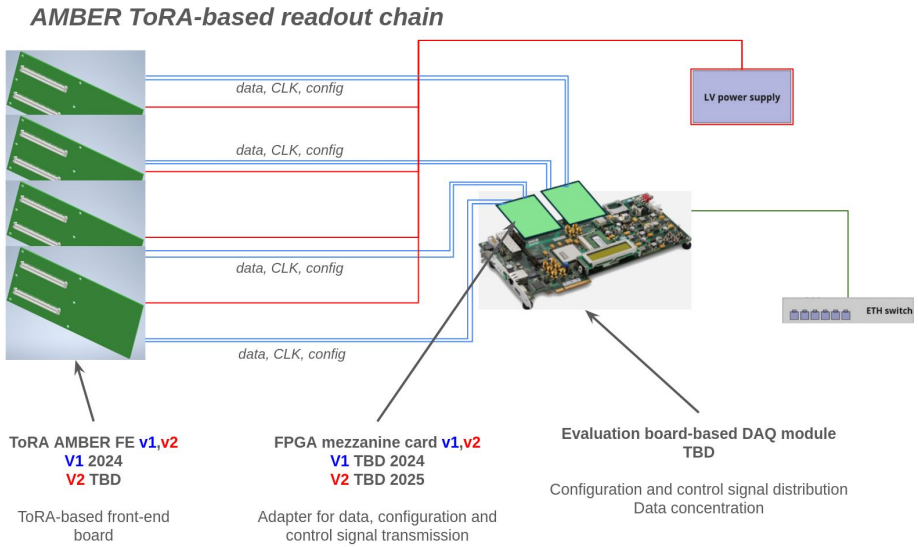
Chip features:

- 64 channels
- Power consumption < 12 mW/channel
- Sustained event rate 100 kHz
- Input dynamic range up to 50 fC
- Time resolution < 5 ns
- ENC < 2000 e^- rms with 100 pF input capacitance
- Analog read out providing charge and time measurement
- Digital logic protected from single event upset (SEU)
- Tunable internal test pulse generator
- 110 nm technology

Backup slides: DY test run

For Drell-Yan test run (2025) definitive suspension structure + FEE should be finalized:





DAQ still not defined, we are at the stage of stand-alone readout chain design. AMBER integration to be defined.