Status GEM Detectors
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COMPASS/AMBER Technical Board
08.02.2022
COMPASS GEM-3G (CG3G)

• Size of active area: 30.7 × 30.7 cm²
• Strips divided in center to reduce occupancy
• Triple GEM, foils sectorized on top (13 sectors)
• No spacer grids
• Gas in/out on drift plate, internal distribution

• Stabilized voltage divider: 3 +1 cards
• 6 × 4 front-end cards, 4 supply cards (bus cards)
Status of detector parts (drift foils + GEMs + R/O-foils)

- CERN Batch 1: shipped 20.10.2020
  - 6 GEM foils (2μm Cu) ⇒ 1 bad (high current), 5 good
  - 3 drift foils (2μm Cu) ⇒ 3 good
  - 2+1 R/O foils ⇒ 3 good
- CERN Batch 2:
  - 10 GEM foils (2μm Cu), shipped 30.8.2021 ⇒ 1 bad (high current), 7 good, 2 not yet tested
  - 2 drift foils (2μm Cu), shipped 30.8.2021 ⇒ 2 good
  - 2+1 R/O foils, shipped 27.10.2021 ⇒ 2 good, 1 bad (known)
- CERN Batch 3: ordered ⇒ to be finished by end of February
  - 7 GEM foils (minor design improvements)
  - 1 drift foil
  - 1 R/O foil

- **GEMs:** 12 good + 2 unknown + 7 ordered ⇒ ≥6 detectors
- **Drift:** 5 good + 1 ordered ⇒ 6 detectors
- **R/O:** 5 good + 1 ordered ⇒ 6 detectors
Status of Production

- **Honeycomb plates** (Piekenbrink)
  - Batch 1a: 2 drift plates, 2 R/O plates (potted, bent) ⇒ re-treated, flattened
  - Batch 1b: 2 R/O plates (GFK frame) ⇒ good
  - Batch 2: 2 R/O plates, 2 drift plates, ⇒ good
  - Batch 3: ordered 2 sets of R/O and drift plates

- **GEM frames** (local workshop):
  - full frame sets for 3 detectors available (drift, transfer, induction)
  - 10 parts for 2.5 transfer frames available
  - spare material for segmented frames available
  - ordered material for 10 drift frames + 20 transfer/induction frames

  ➢ **Currently**: Material for 5 detectors total (incl. backup material)
  ➢ **Mid March** (supply bottlenecks): Material for ≥8 detectors total

- **QA improved**: intersegment test automated (J. Paschek)
- **Production database** set up for COMPASS (taken over from ALICE / P. Glässel)
Database for Production

- Stock keeping integrated
- QA steps/files included
- Trackable construction chain
Status of Stabilized Voltage Divider (SVD)

- Single channel stabilized voltage divider (test):
  - 3 PCBs in use, one as Passive Voltage Divider (PVD)
  - Calibration done ⇒ voltage measurement working
  - Next Step: Test with detector ⇒ measure gain stability (B. Roth/Bachelor)
  - 5 more PCBs ordered ⇒ to be assembled

- Detector scale stabilized voltage divider
  - updated version with minor fixes ready to be ordered, once needed
  - HV cable between SVD boards ⇒ flex PCB (prototypes available)

- Passive voltage divider (PVD)
  - New PCBs in use, a few spare PCBs available

- Measurements / simulations with SVD/PVD ongoing
  - results expected by end of February (C. Honisch, B. Roth)

- See also: Talk on SVD by C. Honisch - RD51-Meeting 07.02.2022
# Status of detector production

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**Assembly steps:**
- QA: quality assurance
- G1, G2, G3: GEM i framed
- RO: R/O PCB glued
- D: drift foil glued
- S1, S2, S3: stack i glued
- DET: detector assembled
- GAS: gas pipes + tight
- HV: HV board assembled

**Stations to be replaced for 2022:** GM05, GM08 (GM04?)

**Installation:** April/May 2022
Front-end and readout electronics

- **Front-end cards (APV):**
  - APVs available for all detectors
  - 56 cards ready and tested (24 per det., 2 at TUM)
  - Components and PCBs for 100 cards available, some delay in assembly

- **Supply cards (bus cards):**
  - 2 produced and being tested (at TUM) / 6 PCBs in production \(\Rightarrow\) PCB + stencil + components available
  - bugfix for new PCBs: capacitor too high \(\Rightarrow\) add cut-outs
  - mating test with connectors to APV FE needs to be done \(\Rightarrow\) then ready to be assembled.

- **ADC cards:**
  - 2 produced, 1 working (at TUM), tested with IFTDC
  - 3rd assembled (solder process optimized) \(\Rightarrow\) to be tested by I. Konorov
  - after successful test: assemble more PCBs / PCBs + components still to be provided
  - components for 10-15 cards available, 2 per det. needed, delay in assembly (Covid)
  - full system test with APV to be performed at CERN (DAQ lab)
  - 9 IFTDC cards produced
  - ADC firmware ported to Artix FPGA (S. Huber) / Slow control implemented in config_server (V. Frolov)
AMBER PRM readout requirements

Starting point: 30x30 cm² with divided strips and active central sector / self-triggering VMM

- Readout of all 4 sides (1 detector)
- 768 channels per side (1 detector)
- 2 detectors per station in 6 stations

Requirements

- number of channels per projection: 2x768 = 1536
- number of projections per station: 4
- number of stations: 6
- number of bits per hit: 38 raw from VMM / 48 with additional time stamp
- in progress: amount of information produced by one projection for nominal PRM beam
  (conditions in streamed mode ⇒ noisy hits + induced by charged particles)