

GEM Detectors: planning update

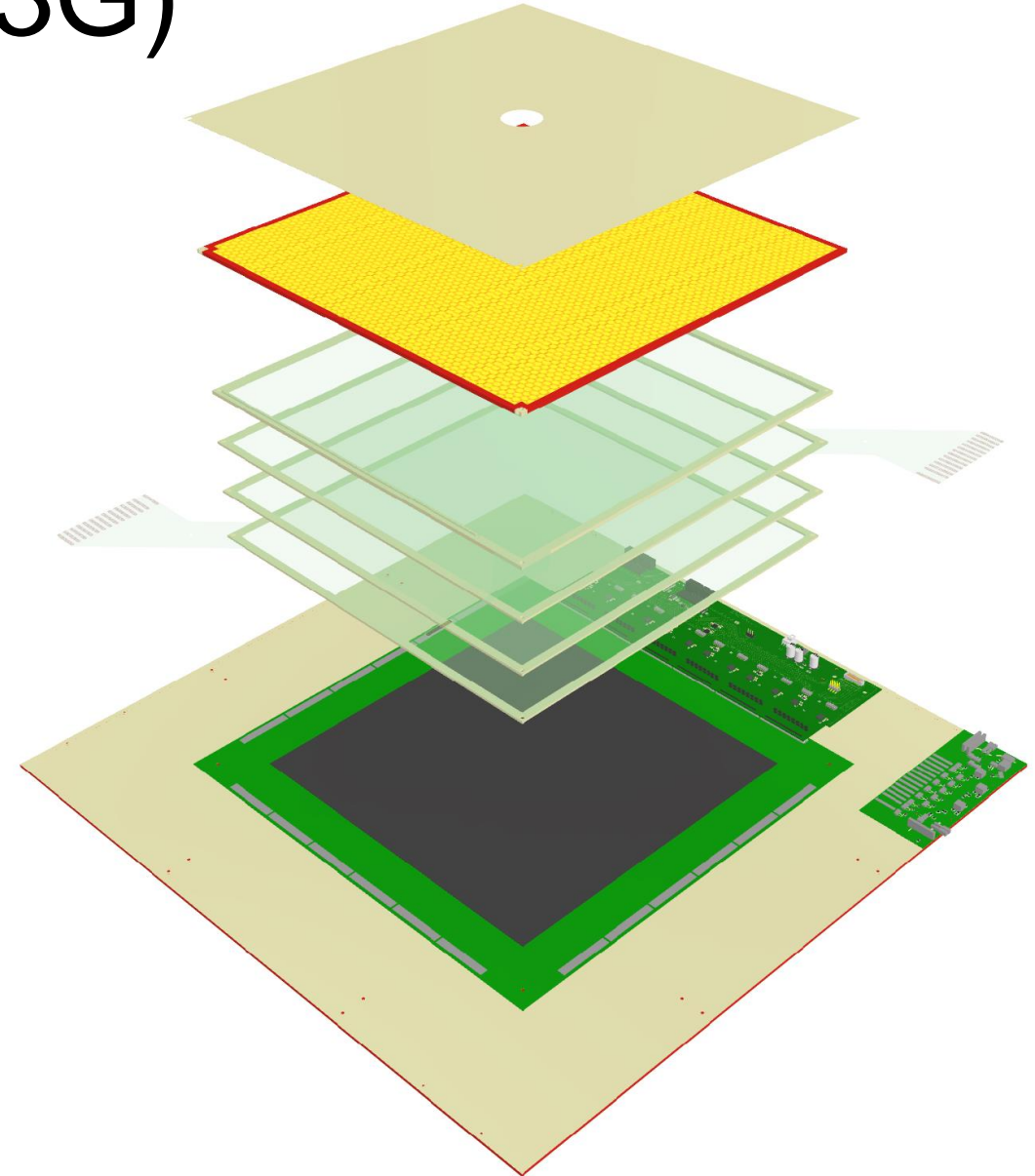
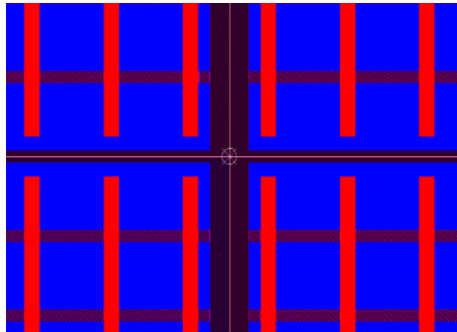
Dmitri Schaab

COMPASS/AMBER Technical Board meeting

19.04.2022

COMPASS GEM-3G (CG3G)

- Size of active area: $30.7 \times 30.7 \text{ cm}^2$
- 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



- voltage divider: 3 +1 cards
- 6×4 front-end cards, 4 supply cards (bus cards)

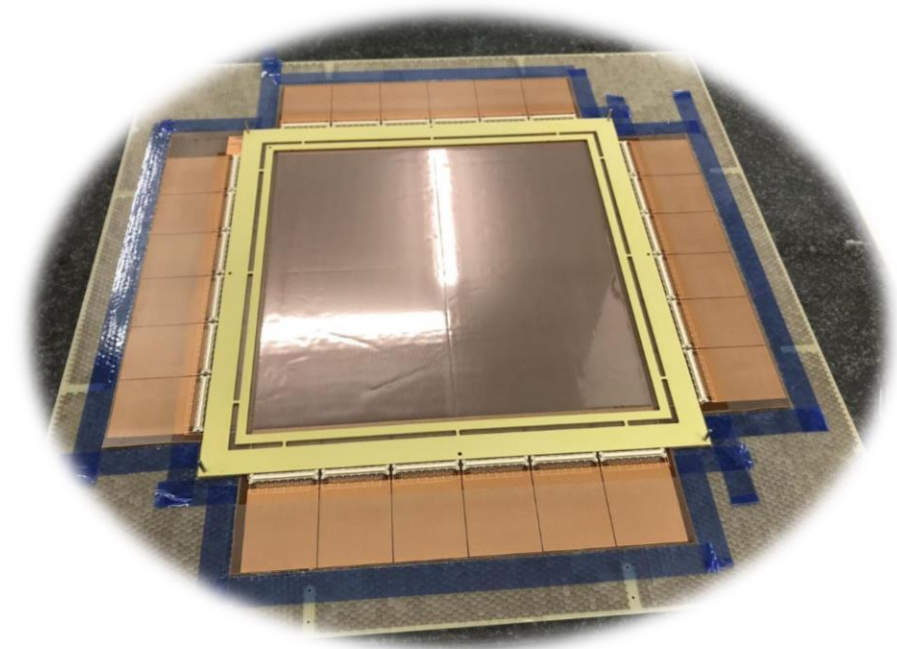
Status of detector parts (drift foils + GEMs + R/O-foils)

- **CERN Batch 1:** shipped 20.10.2020
- **CERN Batch 2:** shipped 30.8.2021
- **CERN Batch 3:** delivered 13.04.2022 (**delayed delivery > 1 month**)
 - detector production delayed ~ 1-2 weeks

} details: see backup

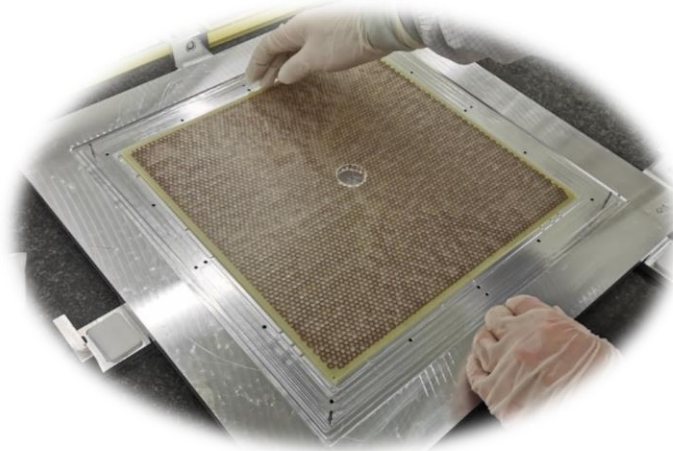
- **Total**

- **GEMs:** 15 good + 7 not tested ⇒ **≥6 detectors**
- **Drift:** 6 good ⇒ **6 detectors**
- **R/O:** 4 good + 1 repaired + 1 not tested ⇒ **6 detectors**



Status of local production (support structures + QA)

- **Honeycomb plates** (Piekenbrink)
 - material for 6 detectors available
 - 2 sets of (retreated) spare material available



details: see backup

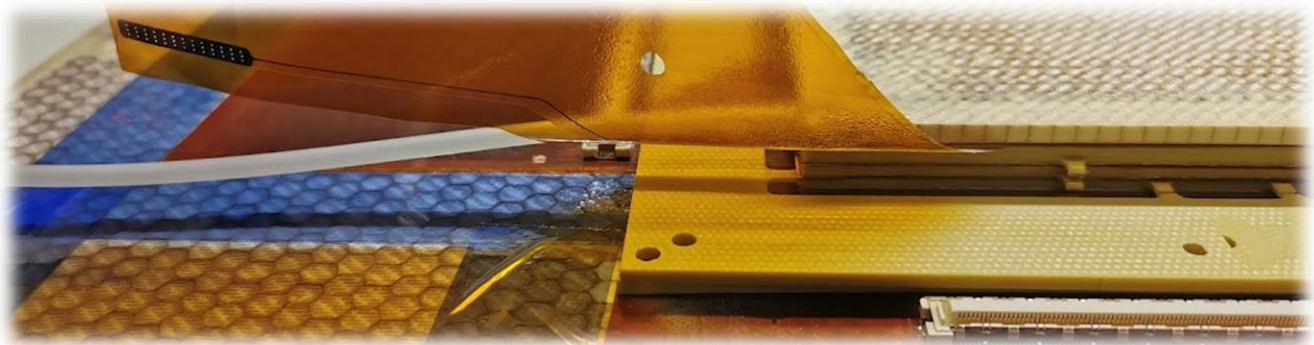
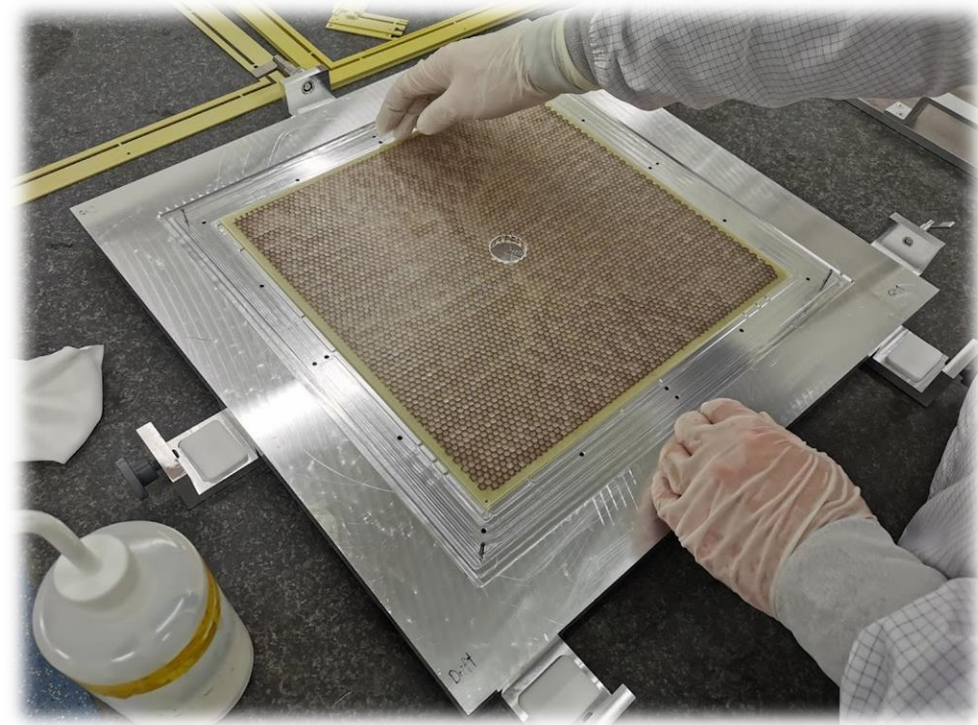
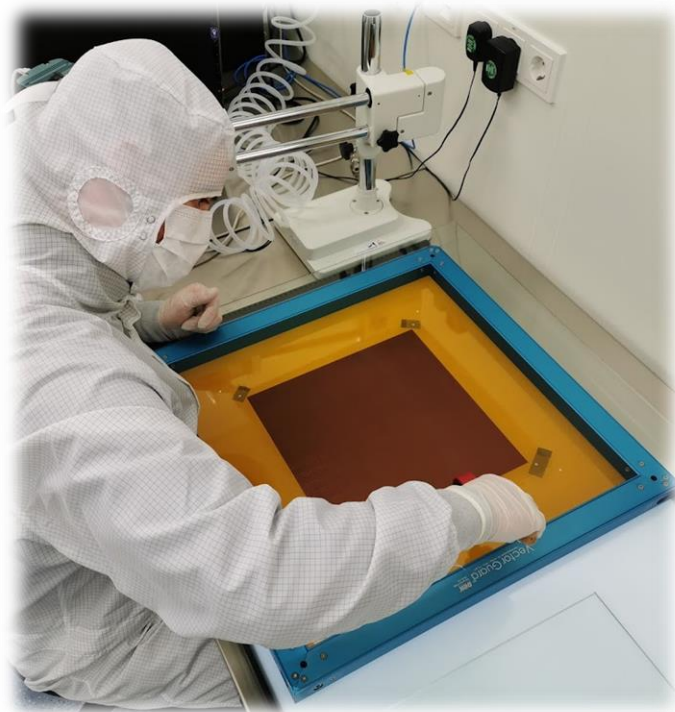
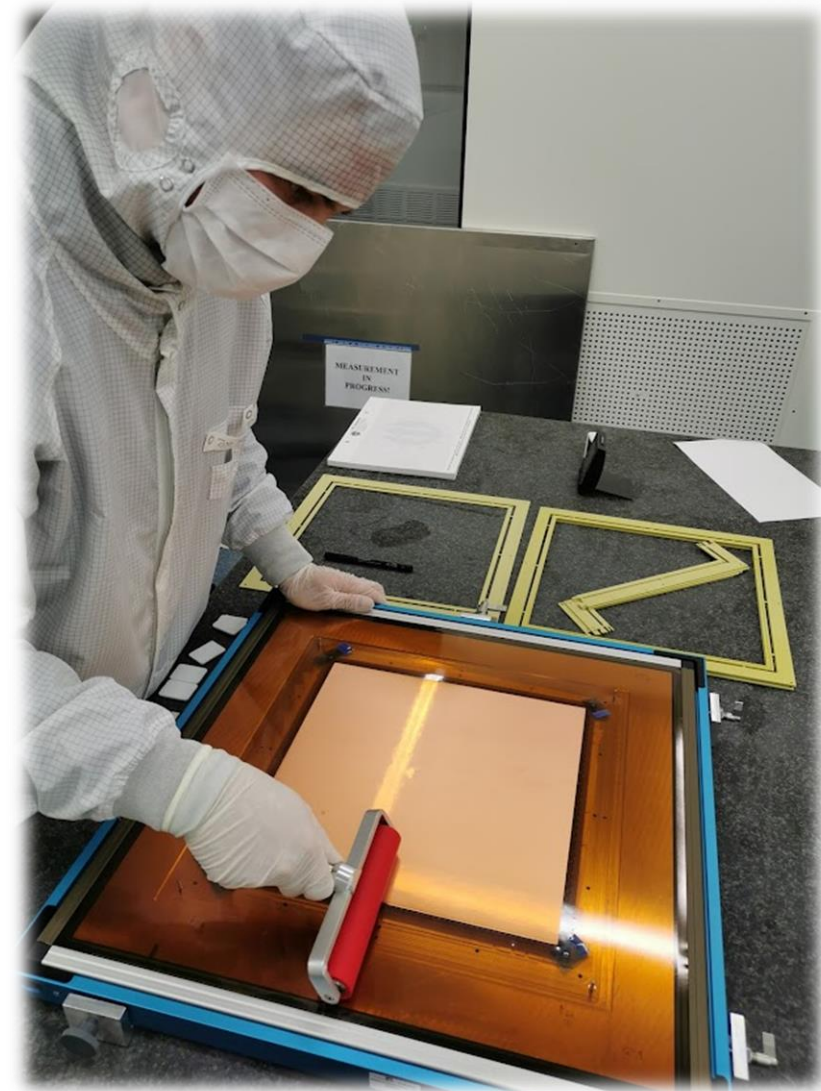
- **GEM frames** (local workshop):
 - Frames for ≥ 6 detectors total
 - partly backup material was used \rightarrow segmentation of some frames
 - available material for ≥ 8 detectors (total)



Electronics

- Stabilized Voltage Divider (SVD)
 - **no** SVD for detectors CG3G_02 - CG3G_05 (gain stability measurement pending)
 - first 4 detectors will be equipped with Passive Voltage Divider (PVD)
- Passive voltage divider (PVD)
 - PCB boards available (in assembly)
 - thinner PCB boards (300 μ m) ordered for future PVDs
 - center segment voltage control \rightarrow to be implemented to config server
- DAQ (next week):
 - test config server (V. Frolov)
 - test of read out without detector connected (I. Konorov)
 - FE card from C. Honisch to be tested

Status of detector production



Status of detector production

	Support plates	Frames	Drift foil	GEM foils	Readout PCB	HV board	Assembly	Calibration	Installation
CG3G01	✓	✓	✓	✓	✓	SVD	✓	✓	Prototype
CG3G02	✓	✓	✓	✓	✓	PVD	✓	ongoing	
CG3G03	✓	✓	✓	✓	✓	PVD	PVD		
CG3G04	✓	✓	✓	✓	✓	PVD	GAS		
CG3G05	✓	✓	✓	✓	✓	PVD	R/O		

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: Start of May 2022

Status of detector production / installation

- All except one detector mechanically finished
- Equipment with PVDs + Calibration tests ongoing
- Two detectors prepared for CERN: **end of April**
 - will be brought to CERN: **1st week of May**
 - **test in DAQ Lab** (1st week of May?)
 - **installation** (2nd week of May?)
- Installing back (old) GM2
 - **1st week of May**
 - **DC5 → parking position**

Backup

Status of detector parts (drift foils + GEMs + R/O-foils)

- **CERN Batch 1:** shipped 20.10.2020
 - 6 GEM foils (2 μ m Cu) \Rightarrow 1 bad (high current), **5/6 good**
 - 3 drift foils (2 μ m Cu) \Rightarrow **3/3 good**
 - 2+1 R/O foils \Rightarrow 1 repaired (strip short), **3/3 good**
 - **CERN Batch 2:** shipped 30.8.2021
 - 10 GEM foils (2 μ m Cu), \Rightarrow 1 (bad \rightarrow recovered by HV cleaning), **10/10 good**
 - 2 drift foils (2 μ m Cu), shipped 30.8.2021 \Rightarrow **2/2 good**
 - 2+1 R/O foils, shipped 27.10.2021 \Rightarrow 1 bad (known), **2/3 good**
 - **CERN Batch 3:** delivered 13.04. (delay > 1 month)
 - 7 GEM foils (minor design improvements)
 - 1 drift foil
 - 1 R/O foil
- **GEMs:** 15 good + 7 not tested \Rightarrow **\geq 6 detectors**
- **Drift:** 6 good \Rightarrow **6 detectors**
- **R/O:** 4 good + 1 repaired + 1 not tested \Rightarrow **6 detectors**

Status of local production (support structures + QA)

- **Honeycomb plates** (Piekenbrink)
 - Batch 1a: 2 drift plates, 2 R/O plates (potted, bent) \Rightarrow re-treated, flattened } **2 detectors (avail./spare)**
 - Batch 1b: 2 R/O plates (GFK frame) \Rightarrow good } **4 detectors (available)**
 - Batch 2: 2 R/O plates, 2 drift plates, \Rightarrow good } **2 detectors (available)**
 - Batch 3: 2 sets of R/O and drift plates
- **GEM frames** (local workshop):
 - full frame sets for 3 detectors available (drift, transfer, induction) } **3 detectors (available)**
 - 10 parts for 2.5 transfer frames available } **~2 detectors (backup material)**
 - spare material for segmented frames available
 - delivered material for 10 drift frames + 20 transfer/induction frames } **≥ 6 detectors (available)**
- **Currently:**
 - Honeycomb plates for 8 detectors (incl. backup)
 - Frames for ≥ 6 detectors total (partly backup material used) / avail. 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

HISKP Compass production database, category Compass

link color code	serial no	barcode	unnumbered
prefix color code:	parent part	daughter part	both
part color code:	QA defined		

link	category	part	batch	type	prefix	ordered	sent	unnumbered stock at institutes		numbered stock		
								Bonn	used	inventory	finished	used
X	Compass	Drift foil			CD3G-nn					5		1
X	Compass	Drift frame	1		D-frame			2				
X	Compass	Drift GEM			GM1-nn							1
X	Compass	Drift plate			DP-nn							1
X	Compass	GEM foil			CG3G-nnn					13		3
X	Compass	GEM stack			GMS-nn							1
X	Compass	honeycomb plate large	1		HCL			1				
X	Compass	honeycomb plate large	2		HCL			3				
X	Compass	honeycomb plate small	1		HCS			1				
X	Compass	honeycomb plate small	2		HCS			1				
X	Compass	intermediate frame	1		I-frame			4		2		
X	Compass	intermediate GEM			GM2-nn							1
X	Compass	R/O foil			CR3G-nn					5		1
X	Compass	R/O frame	1		R-frame			2				
X	Compass	R/O GEM			GM3-nn							1
X	Compass	R/O plate			RP-nn							1
X	Compass	readout chamber			G3Mnn					1		

Item G3M/G3M01 (batch 1) contains (only next level):

part	type	prefix	num	serialno	batch	date	status	link	comment
GEM stack	GMS	0	GMS-01	1	2022-01-28		X		
R/O plate	RP	0	RP-01		2022-01-28		Δ		

[define/modify contained parts](#)

Item GMS/GMS-01 (batch 1) contains (only next level):

part	type	prefix	num	serialno	batch	date	status	link	comment
Drift plate	DP	0	DP-01		2022-01-28		X		
Drift GEM	GM1	0	GM1-01	1	2022-01-28	0	X		
intermediate GEM	GM2	0	GM2-01	1	2022-01-28	0	X		
R/O GEM	GM3	0	GM3-01	1	2022-01-28	0	Δ		

[define/modify contained parts](#)

Item GM2/GM2-01 (batch 1) contains (only next level):

part	type	prefix	num	serialno	batch	date	status	link	comment
GEM foil	CG3G	0	CG3G-003	1	2022-01-28	2	X		

[define/modify contained parts](#)

step (link)	status	data field (hover cursor for explanations)	value	n	date	QA step/file comment	author	condition	true?
1	1	quick defect map	defectmap.txt show		2022-01-25 11:22:26	ok 0 0 0 2 defects	Karl	file txt	
2	2	HV cleaning	done	2	2022-01-26 13:21:07		Karl	eq done	
3	3	intersegment test						eq ok	
6	6	leakage current [pA] at 500 V	15		2022-01-26 13:32:27		Karl	<= 167	
7	7	spark map	do the spark map					file txt	
8	8	absolute humidity [ppmV]	2800		2022-01-26 13:32:27		Karl	<= 6000	
9	9	spark map upload	Upload datafile: Datei auswählen Keine Datei ausgewählt upload file after choosing file!			file comment: <input type="text"/>		file ok	
10	QA-B	I_leak histo data	06_CG3G_01_03_N2_framed_corrected.txt evaluate		2022-01-26 13:31:59	no comment	Karl	file txt	
15	QA-A	long term leakage current data	04_CG3G_01_03_N2_longterm_corrected.txt evaluate		2022-01-26 13:31:41	no comment	Karl	file txt	
20	20	frame glueing	ok	3	2022-01-26 13:33:12		Karl	eq ok	
25	25	quality	A		2022-01-26 13:32:36		Karl	le C	

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**: $2 \times 768 = 1536$
- 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 \Rightarrow noisy hits + induced by charged particles)