



Test Beam July report

RPC weekly meeting

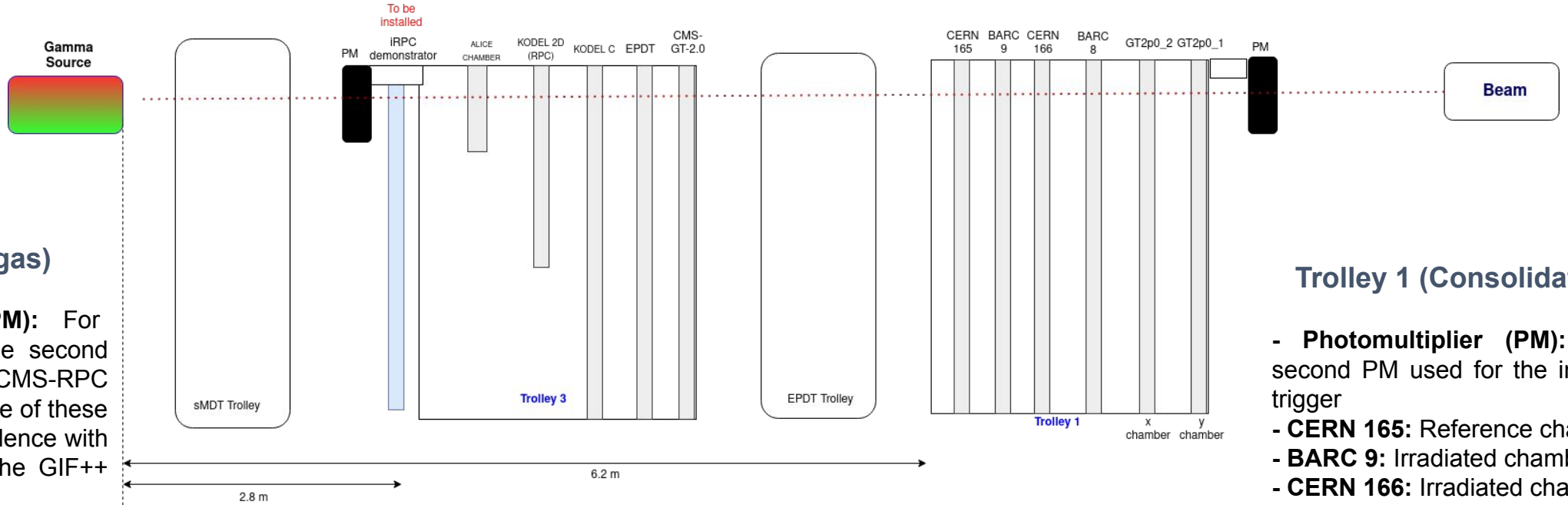
Nikolaos Zaganidis, Mapse Barroso

29/Jul/2021

Trolleys organization

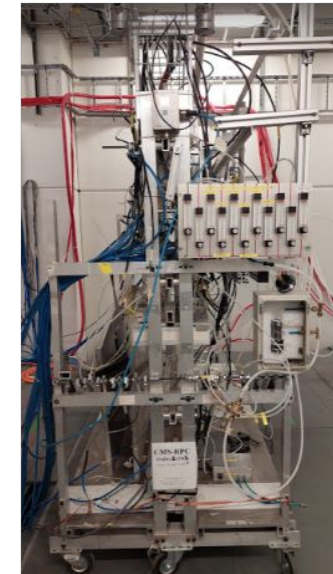
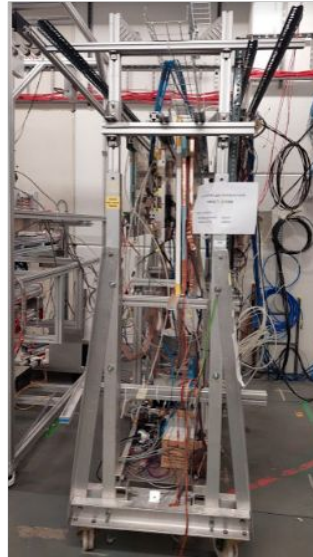
Trolley 3 (Ecogas)

- **Photomultiplier (PM):** For triggering purposes, the second PM is housed in the CMS-RPC trolley1. The coincidence of these two PMs go to a coincidence with the PMs installed by the GIF++ team.
- **iRPC demonstrator:** New RPC demonstrator for CMS-Phase II. This one should go for the test beam in september)
- **ALICE chamber**
- **Kodel C:** CMS-RPC chamber
- **Kodel 2D:** 2D strip chamber to the tracking system. The other chambers for tracking are housed in CMS-RPC Trolley
- **EPDT**
- **CMS-GT-2-0:** A CMS chamber for the ecogas program



Trolley 1 (Consolidation)

- **Photomultiplier (PM):** The second PM used for the internal trigger
- **CERN 165:** Reference chamber
- **BARC 9:** Irradiated chamber
- **CERN 166:** Irradiated chamber
- **BARC 8:** Reference chamber
- **gt2p0_2:** Horizontal tracking chamber
- **gt2p0_1:** Vertical tracking chamber



GIF++: readout

DCS:

- WebDCS (webdcs.cern.ch): raw data available
- currents monitored, PT correction enabled

DAQ:

- each channel read through TDCs (conventional setup) [600 ns time window]
- readout of PMT signals (to improve the time resolution measurement)
- DAQ rate < 200 events / spill

Trigger

Rate up to 5000 triggers / spill reduced by using a veto logic to 200 / spill to follow the DAQ rate

Most of the runs : 10 x 10 cm²

During the last day of the TB we took some runs with only the External triggers 40 x 35 cm²
(to be used with the tracking algorithm)

Analysis of the data

Direct analysis on raw TDC data, which provides:

- fired strips and their timestamps (contain muons/gammas/noise)

Analyzer has been written in Python which calculates *per HVpoint*:

- beam window determination within the 600 ns acquisition
- background noise/gamma rate (outside the beam window)
- clusterization of muons and gammas
- muon efficiency
- time resolution

Combination of results per run:

- efficiency vs. HV $\rightarrow$ sigmoid fit and determination of WP
- relevant parameters vs. HV: current, charge, cluster size, cluster multiplicity

Timing analysis:

Row Definition of muon time window:

- fit the beam peak with a Gaussian
- the time window is defined 2×3 sigma around the center (total 6 sigma width)

$\rightarrow$ *the muon time window is used for efficiency calculation, muon clusterization*

- No tracking (Salvador results with Tracking)
- No background correction $E_{\text{fake}} = 0$ (same as Salvador)

-

Runs and data

- Important links
 - Runs summary:
https://docs.google.com/spreadsheets/d/1-OdfUYhWqk-_h6sAfU1SR4Nu86CwmA_3/edit#gid=1353073507
 - Table with data:
https://docs.google.com/spreadsheets/d/1-OdfUYhWqk-_h6sAfU1SR4Nu86CwmA_3/edit#gid=2070985568
 - Google Drive with all informations (plots, tables, runs):
<https://drive.google.com/drive/u/0/folders/1DUSkwG5shKumSoLgteOpMmvPBJqC1Vv6>

Runs summary

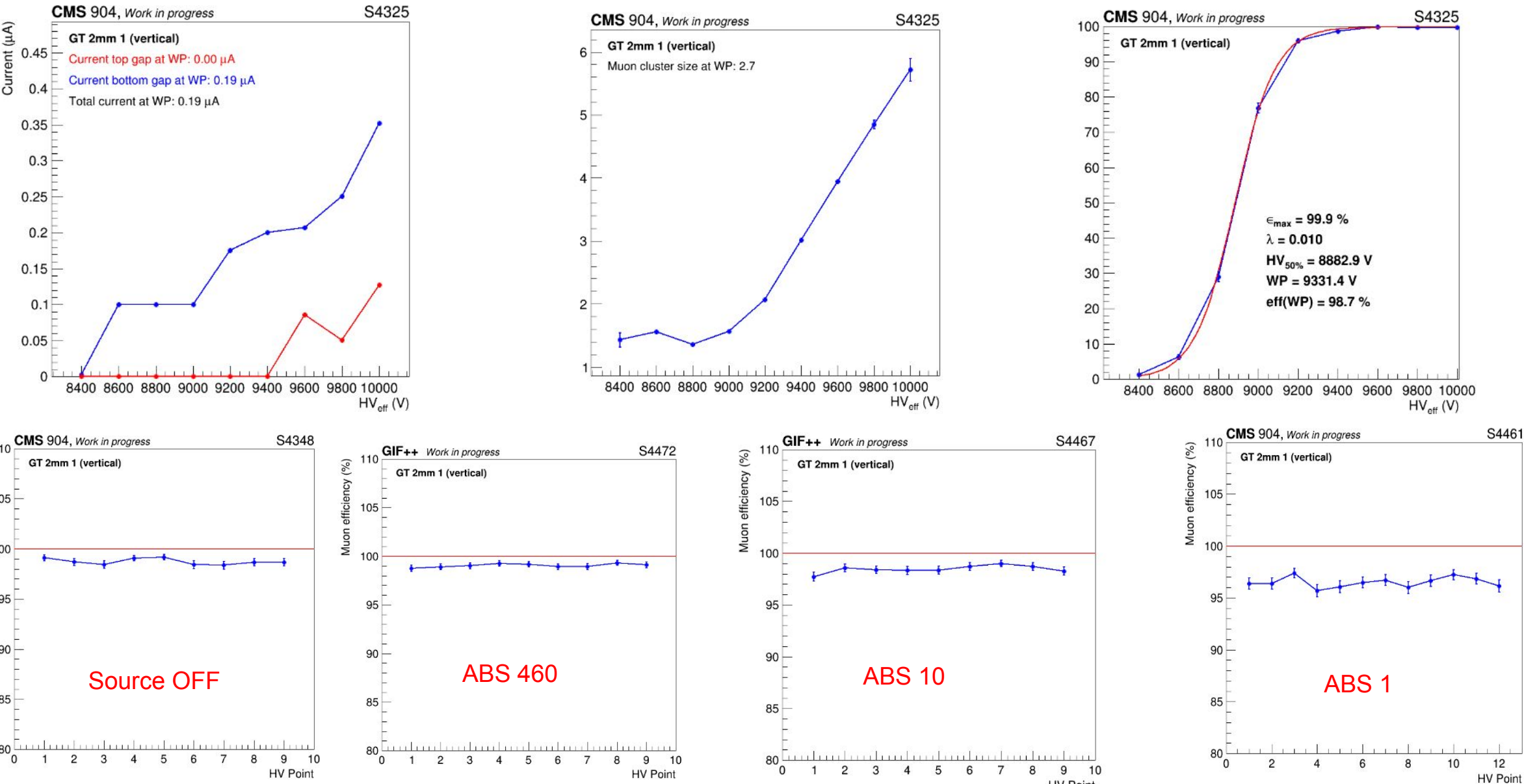
Standard gas

Run number	Scan type	ABS filter	Beam
4360	Efficiency	2,2	ON
4361	Efficiency	4,6	ON
4400	Efficiency	46	ON
4405	Efficiency	10	ON
4407	Efficiency	100	ON
4408	Efficiency	22	ON
4409	Efficiency	6,9	ON
4410	Efficiency	33	ON
4411	Efficiency	69	ON
4414	Efficiency	Source OFF	ON
4416	Efficiency	220	ON
4417	Efficiency	460	ON
4426	Rate	33	OFF
4427	Rate	100	OFF
4428	Rate	220	OFF
4429	Rate	2,2	OFF
4430	Rate	4,6	OFF
4431	Rate	6,9	OFF
4432	Rate	10	OFF
4316	Rate	22	OFF
4317	Rate	46	OFF

Ecomix-2

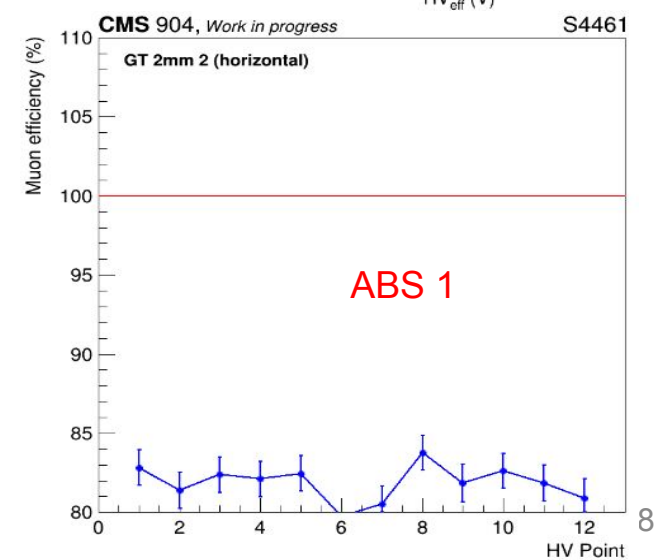
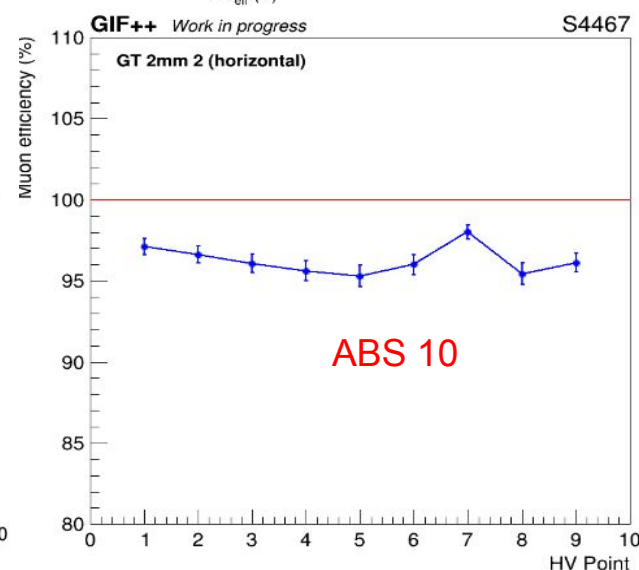
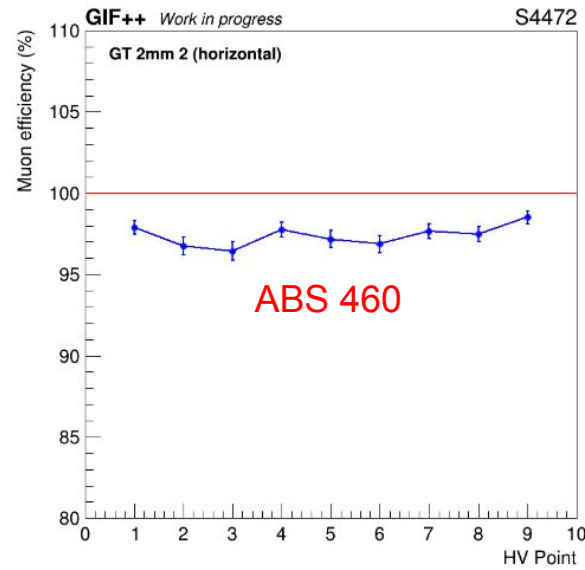
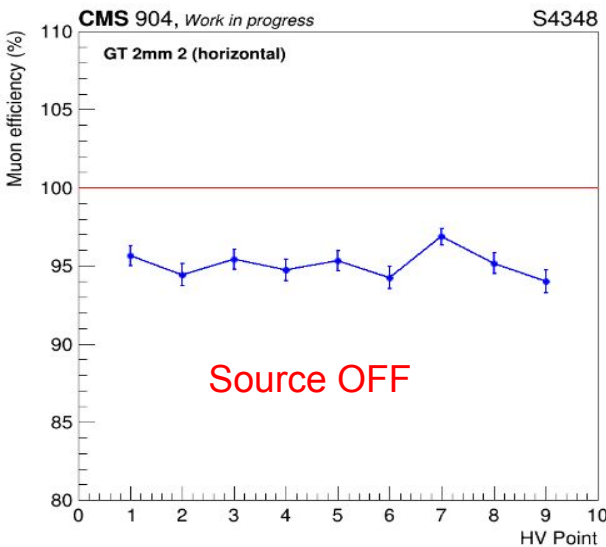
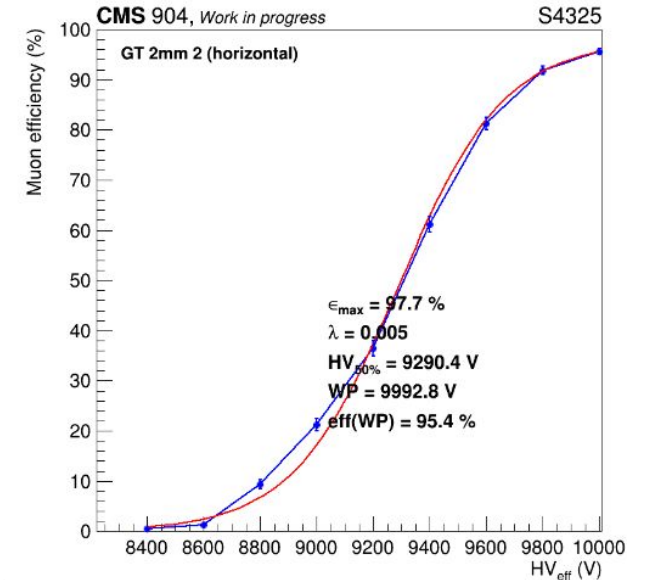
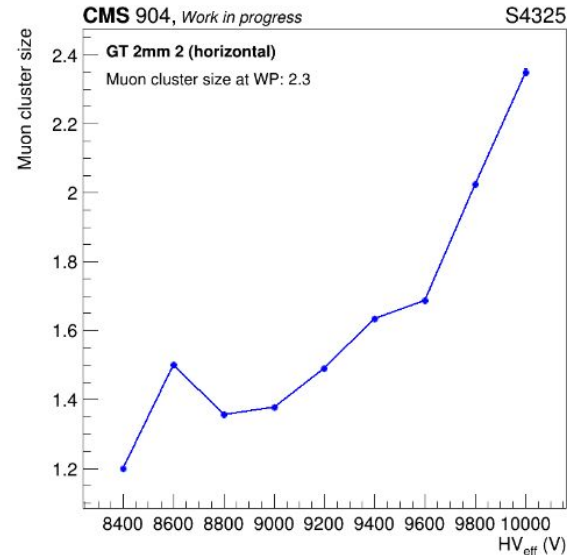
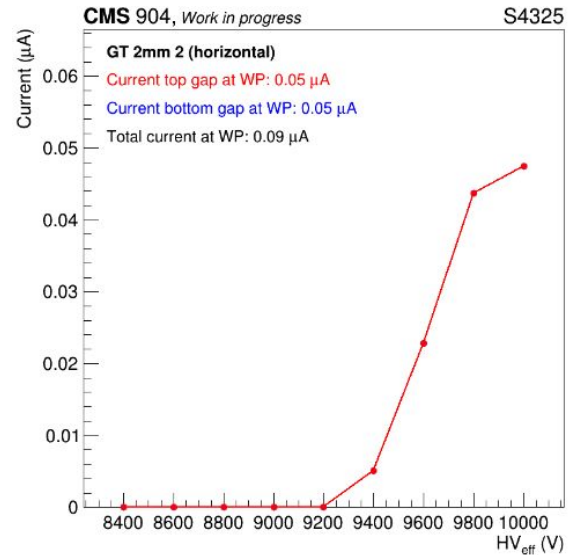
Run number	Scan type	ABS filter
4453	Efficiency	100 ups, 46 down
4454	Efficiency	33 ups, 46 down
4455	Efficiency	OFF
4456	Efficiency	69 ups, 33 down
4457	Efficiency	46 ups, 22 down
4465	Efficiency	46 ups, 46 down
4466	Rate	46 ups, 46 down
4467	Efficiency	10 ups, 6.9 down
4471	Efficiency	220 ups, 46 down
4472	Efficiency	460 ups, 22 down
4473	Rate	460 ups, 22 down
4474	Rate	10 ups, 22 down
4475	Rate	22 ups, 22 down
4476	Rate	33 ups, 22 down
4477	Rate	69 ups, 22 down
4478	Rate	100 ups, 22 down
4479	Rate	220 ups, 22 down
4480	Efficiency	22 ups, 4.6 down

GT2p0_1 tracking chamber (vertical): Tracking not used in this analysis



GT2p0_2 tracking chamber (horizontal): Tracking not used in this analysis

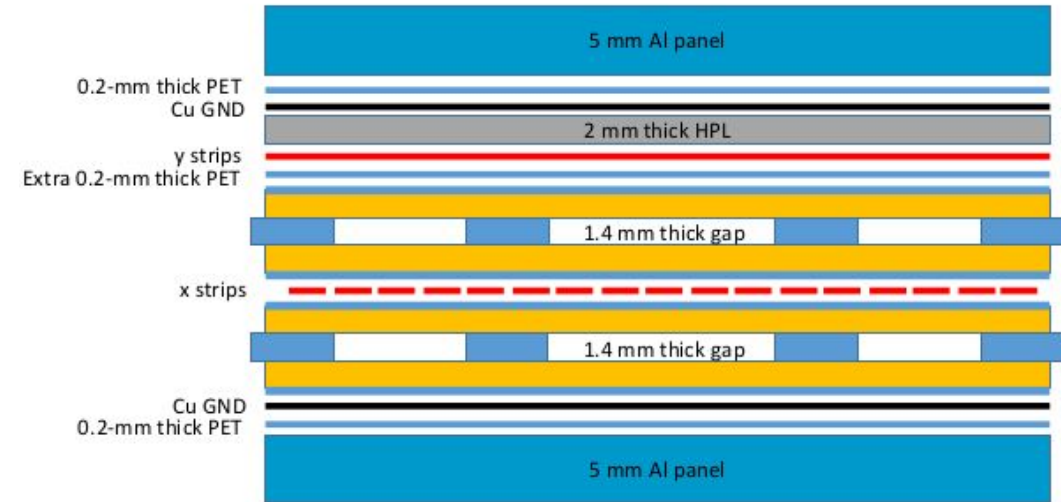
- Working on single gap mode.



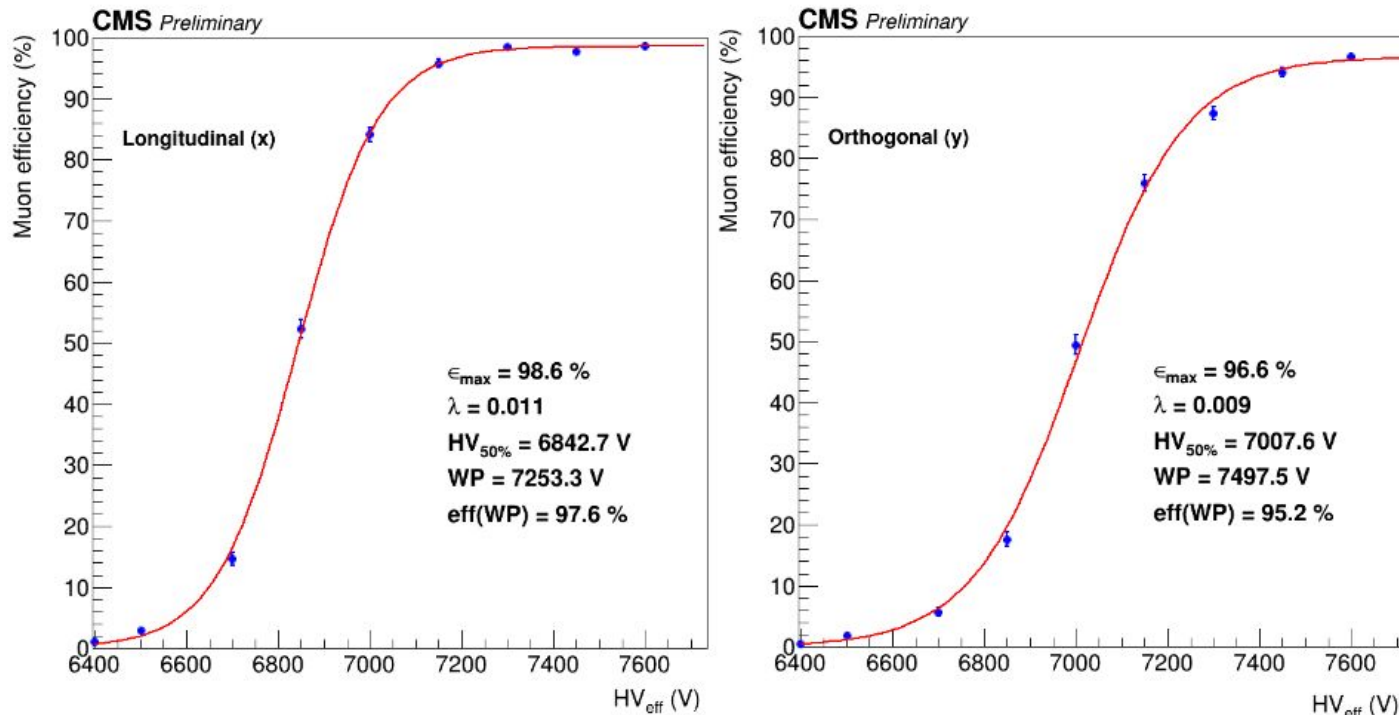
Kodel 2D: Only standard gas mixture (40 % RH)

Tracking not used in this analysis

- This is a x and y chamber (70 cm x 40 cm))with 1.4 mm double gap.
- This is a double gap chamber divided into orthogonal plan strips.
- 32 channels for x and 32 channels for y
- Strip pitches: 10 mm for x and 20 mm for y.
- Purpose in testbeam: For tracking studies (work ongoing)



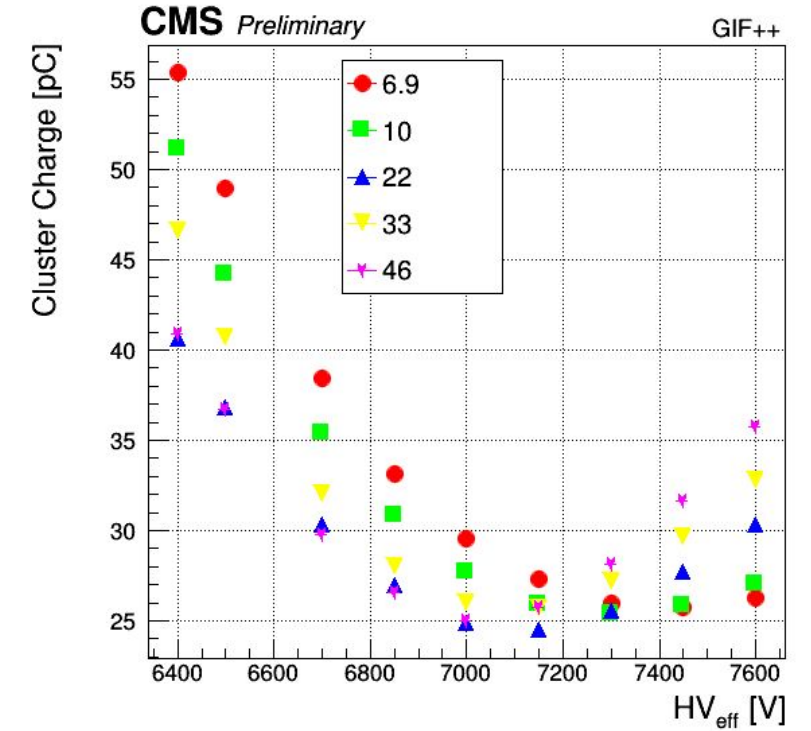
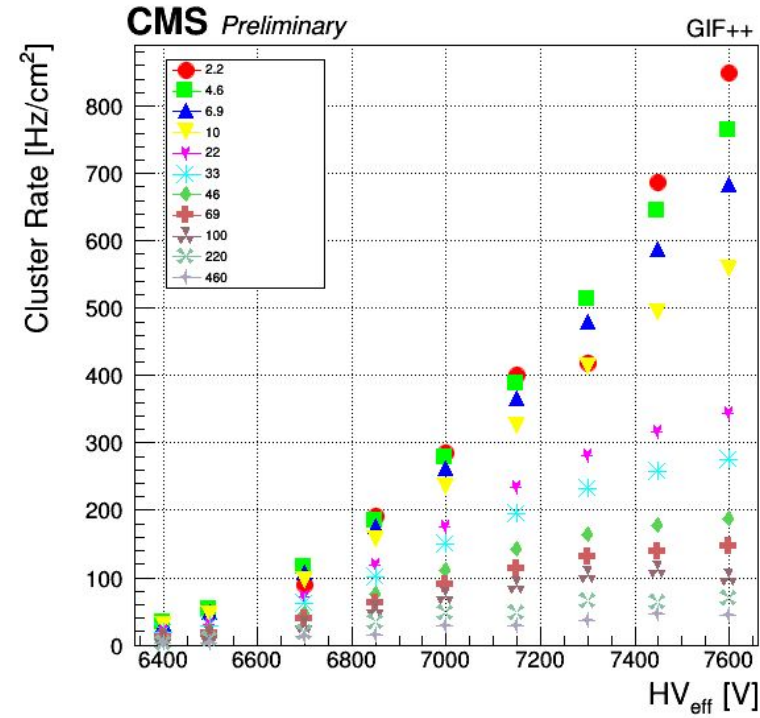
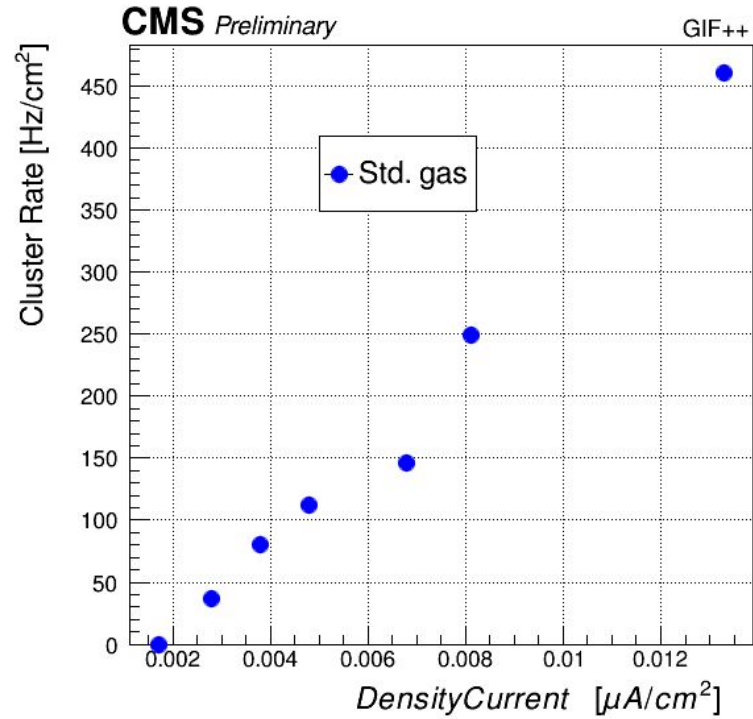
Reference scans



Kodel C - Standard gas (40 % RH) - runs summary

Standard Gas										
ABS upstream	ABS downstream	Rate (Hz/cm²)	Cluster rate (Hz/cm²)	Working point (V)	Efficiency	Cluster size @ WP (V)	Itop @ WP (V)	Ibot @ WP (V)	Itotal @ WP (V)	Current Density @ WP (uA/cm²)
2.2	46000	1869.1	1335.07	7956.4	97.6	1.4	144.68	103.74	248.42	0.03549
4.6	46000	1061.5	707.67	7745.4	96.4	1.5	94.94	68.45	163.39	0.02334
6.9	46000	968.2	691.57	7630.7	87.9	1.4	76.47	55.22	131.69	0.01881
10	46000	690.4	460.27	7478.1	89.8	1.5	53.84	39.32	93.16	0.01331
22	46000	399.3	249.56	7368.2	94.7	1.6	32.43	24.61	57.04	0.00815
33	46000	335.5	197.35	7350.6	95	1.7	26.99	20.77	47.76	0.00682
46	46000	247.6	145.65	7298.5	97.5	1.7	18.78	14.72	33.5	0.00479
69	46000	202.6	112.56	7270.5	97.9	1.8	15.02	11.84	26.86	0.00384
100	46000	144.5	80.28	7249.7	97.1	1.8	10.93	8.6	19.53	0.00279
220	46000	80.6	36.64	7235	98.8	2.2	6.73	4.98	11.71	0.001673
Source OFF	Source OFF	2.2	1	7203.8	98.7	2.2	1.98	0.34	2.32	0.000331

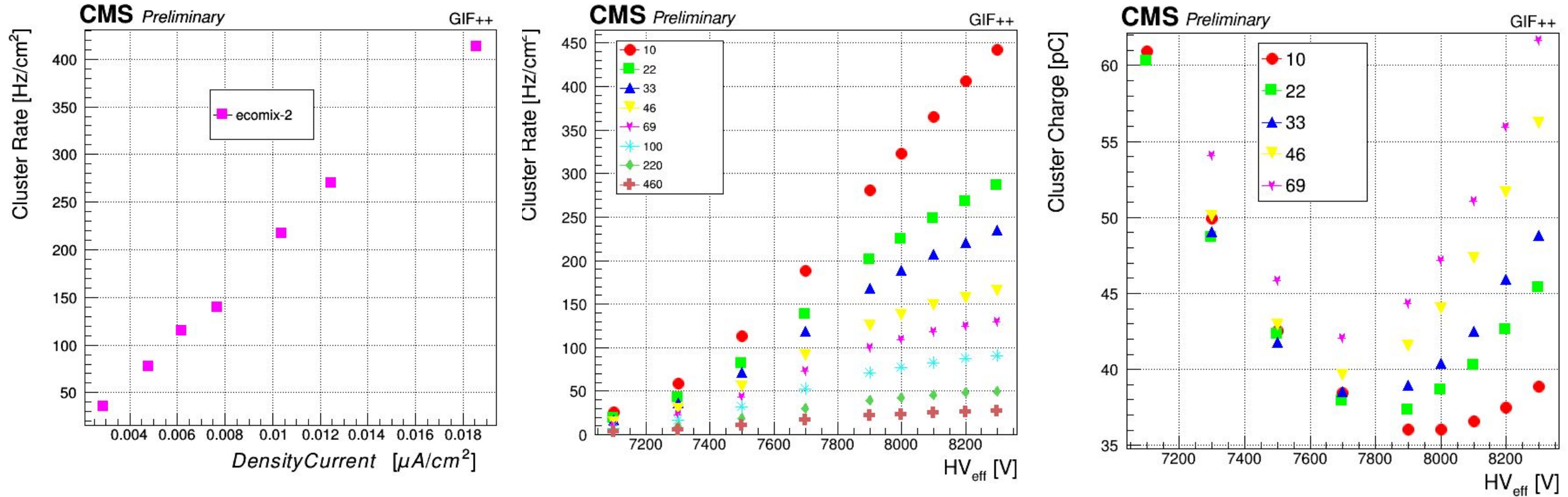
Kodel C: Standard gas mixture (40 % RH)- Rate scans



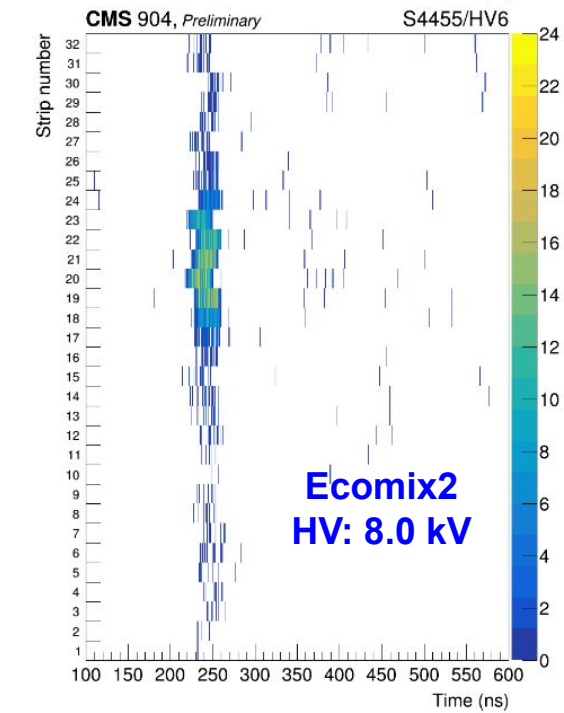
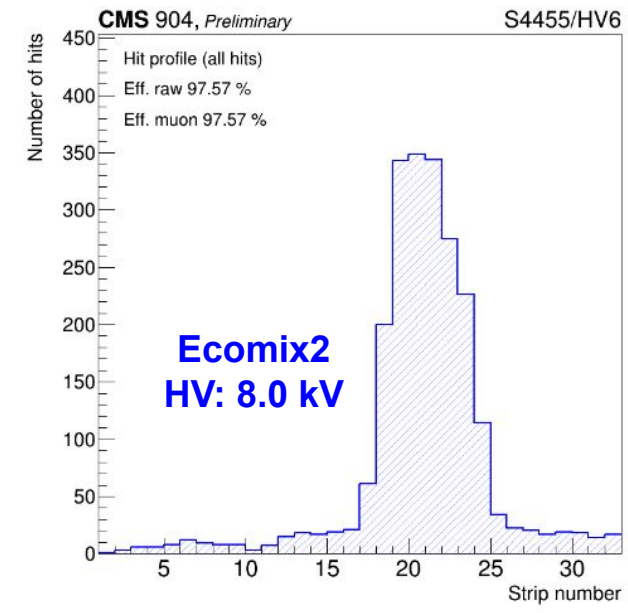
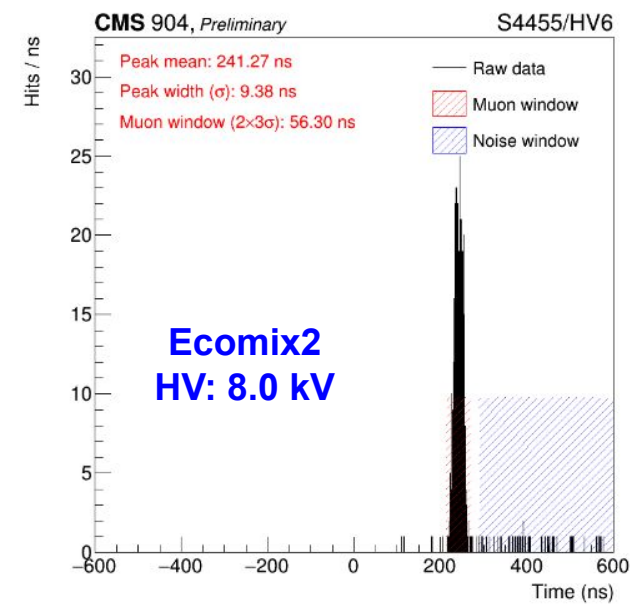
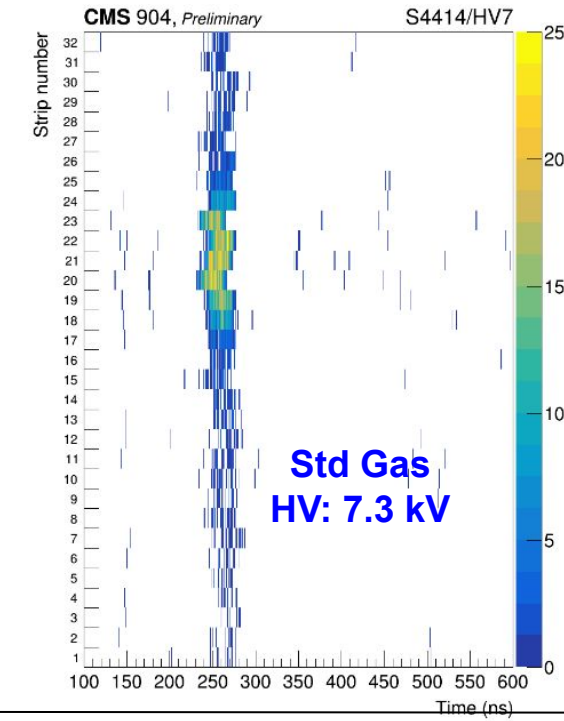
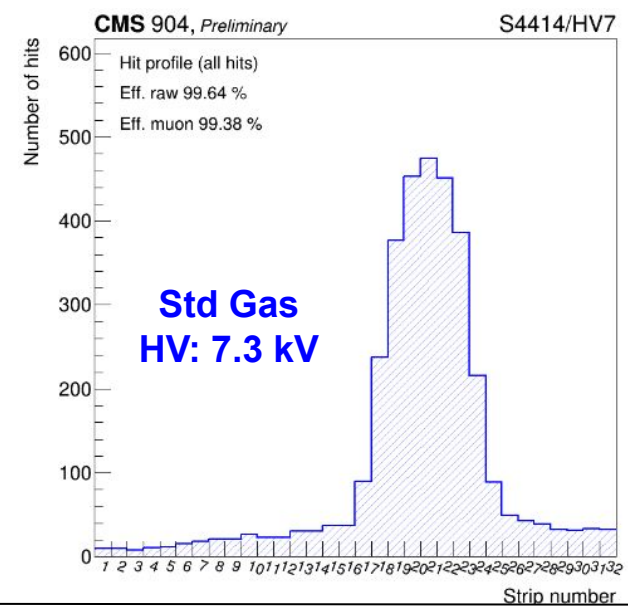
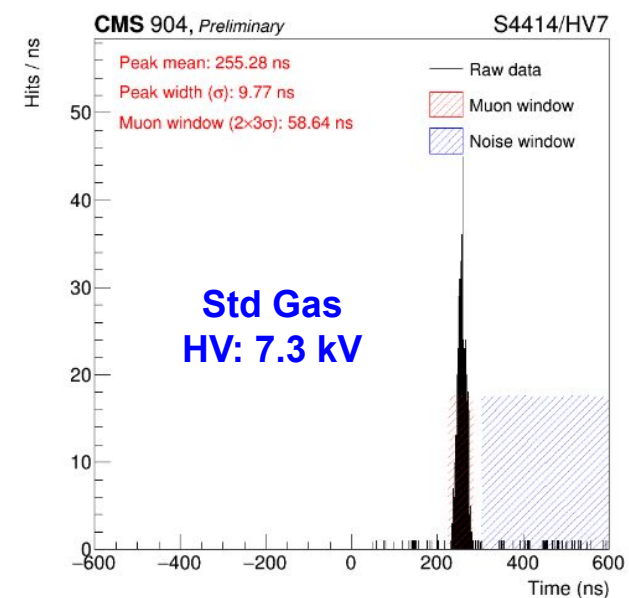
Kodel C - Ecomix2 (60 % HFO, 35 % CO2, 4 % iC4H10, 1 % SF6) (40 % RH) - summary

ECOGAS2 (60 % HFO, 35 % CO2, 4 % iC4H10, 1 % SF6)										
ABS upstream	ABS downstream	Rate (Hz/cm ²)	Cluster rate (Hz/cm ²)	Working point (V)	Efficiency	Cluster size @ WP (V)	Itop @ WP (V)	Ibot @ WP (V)	Itotal @ WP (V)	Current Density @ WP (uA/cm ²)
10	22	618.5	412.33	8363.9	88.8	1.5	75.55	54.36	129.91	0.01856
22	22	430.8	269.25	8267.5	92.6	1.6	50.12	37.12	87.24	0.01246
33	22	368.1	216.53	8228	92.9	1.7	41.5	31.15	72.65	0.01038
46	46	250.1	138.94	8175.1	94.5	1.8	30.4	23.58	53.98	0.00771
69	22	206.3	114.61	8131.9	95.1	1.8	24.3	19.31	43.61	0.00623
100	22	153	76.50	8114.2	95.9	2	18.58	15.18	33.76	0.004823
220	22	69.8	34.90	8056.2	96.5	2	11.17	9.54	20.71	0.002959
460	22	39.7	19.85	8044.9	96.7	2	7.48	6.22	13.7	0.001957
Source OFF	Source OFF	no scan	no scan	8018.8	97.6	2	3.23	0.81	4.04	0.000577

Kodel C: Ecomix-2 (40 % RH)-- Rate scans

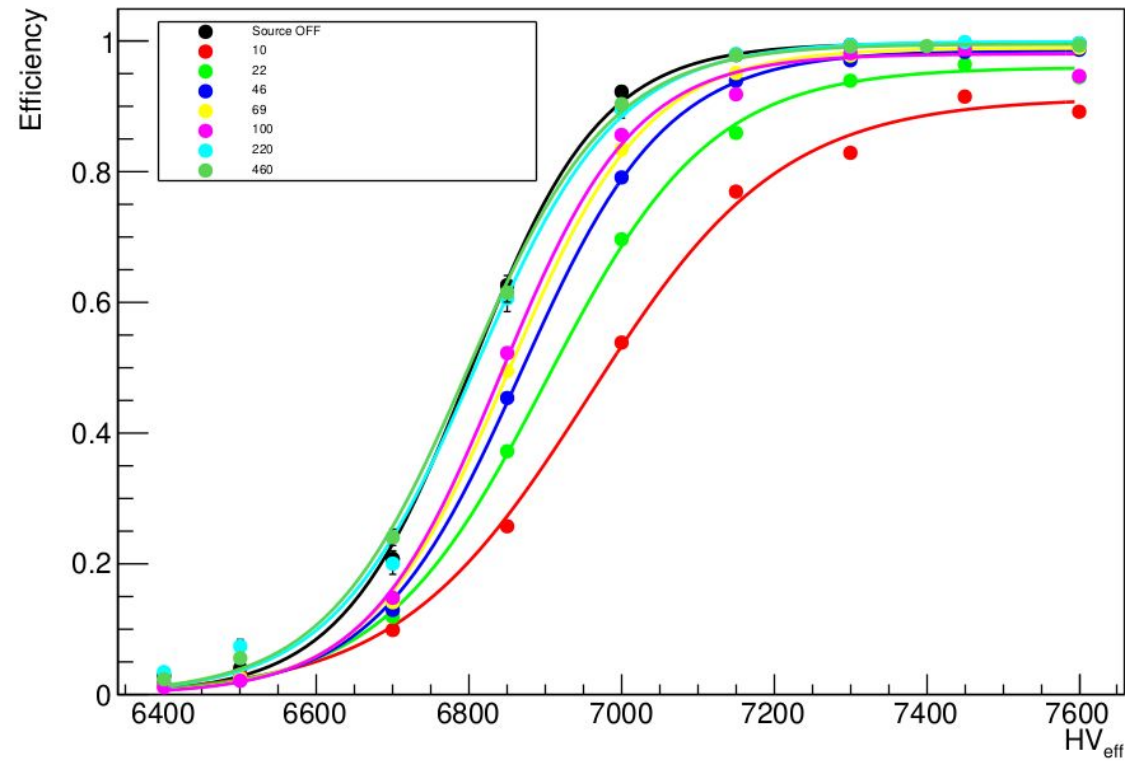


Kodel C: Efficiency scan Source OFF: Standard gas x ecogas

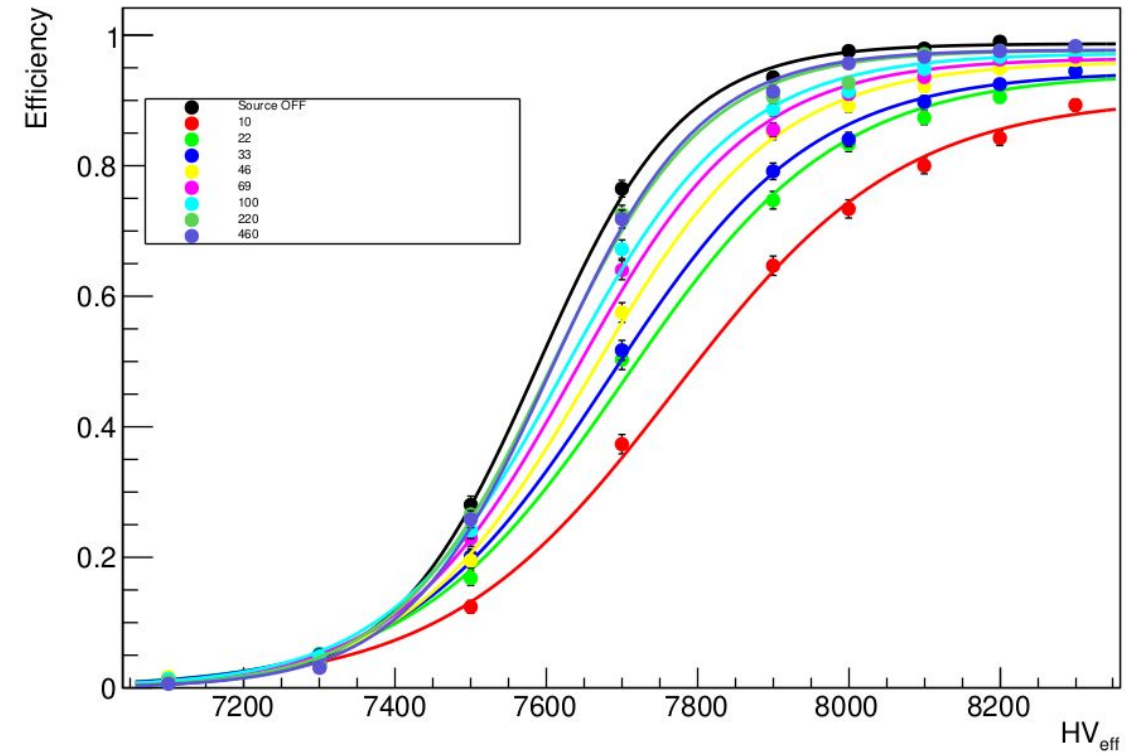


Kodel C: Efficiencies

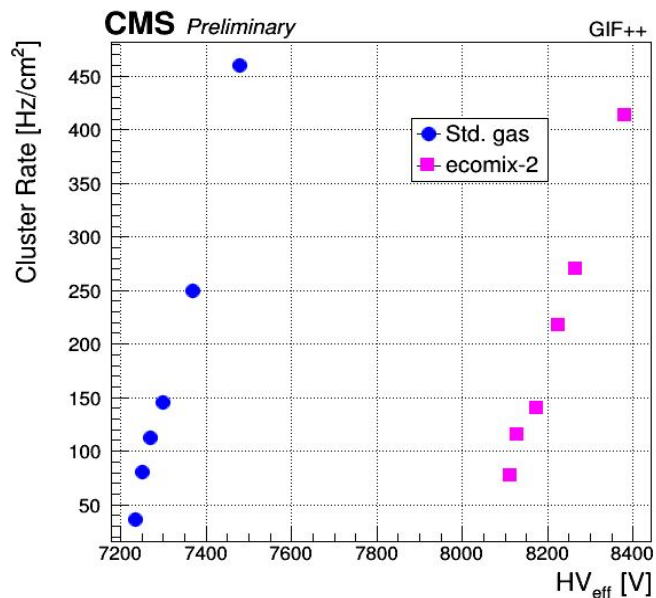
Standard gas mixture



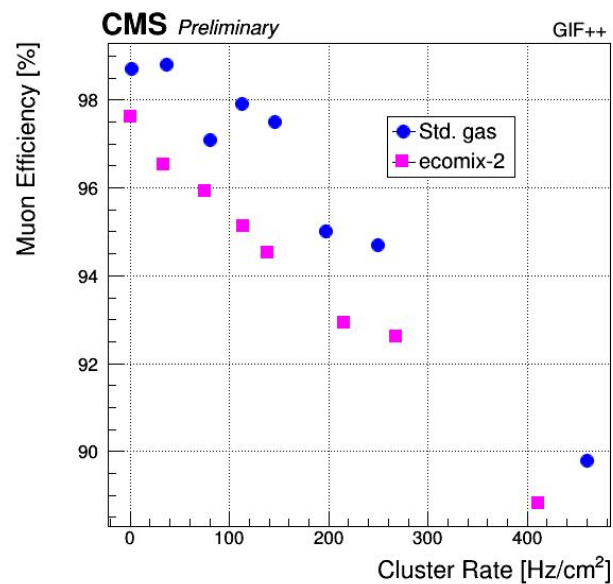
Ecomix-2



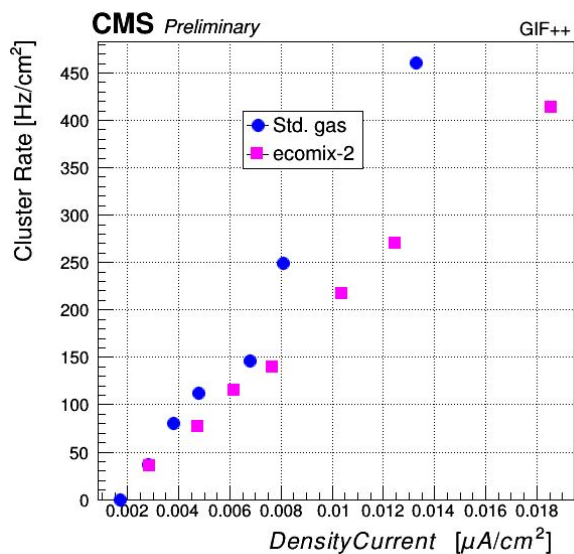
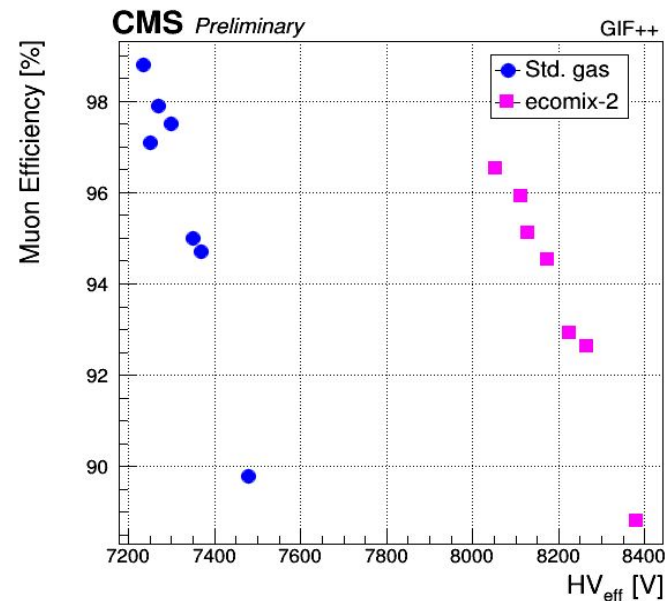
Kodel C: Standard gas x ecogas



Average Working point shift: ~ 870 V



Average difference: ~ -2 %



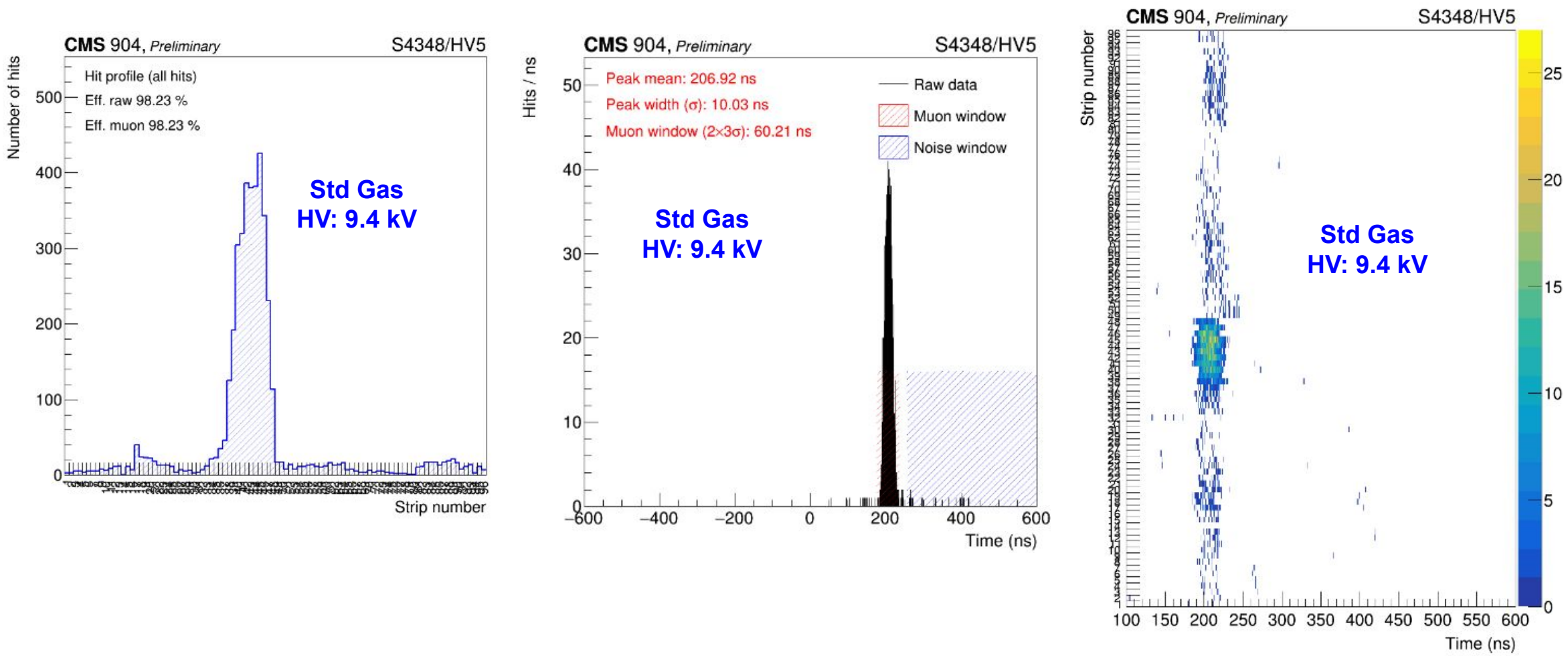
Both
quantities
at WP

CMS-GT-2-0: Standard gas scans summary

Standard Gas									
ABS upstream	ABS downstream	Rate (Hz/cm ²)	Cluster Rate (Hz/cm ²)	Working point (V)	Efficiency	Cluster size @ WP (V)	I _{top} @ WP (V)	I _{bot} @ WP (V)	I _{total} @ WP (V)
6,9	46000	1707,8	776,27	10226,2	86,7	2,2	154,99	OFF	154,99
10	46000	1520	690,91	9664,8	91,1	2,2	79,99	101,08	181,07
22	46000	856,6	356,92	9566	98,2	2,4	54,43	78,17	132,6
46	46000	660,9	264,36	9801,4	87,9	2,5	54,12	OFF	54,12
69	46000	no scan	no scan	9704,5	86,5	2,4	44,33	OFF	44,33
100	46000	98	46,67	9418	95,7	2,1	27,25	84,6	111,85
220	46000	76,7	28,82	9559,3	97,3	3,4	27,87	50,31	78,18
Source OFF	Source OFF	14,1	5,42	9323,1	97,8	2,6	8,96	22,48	31,44

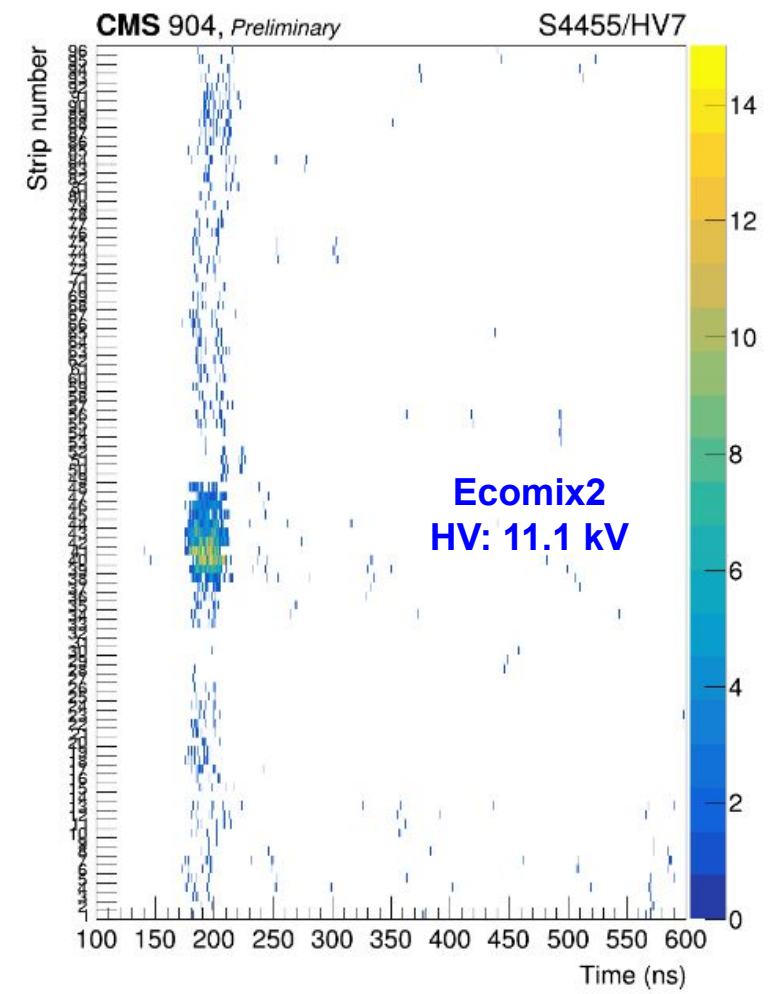
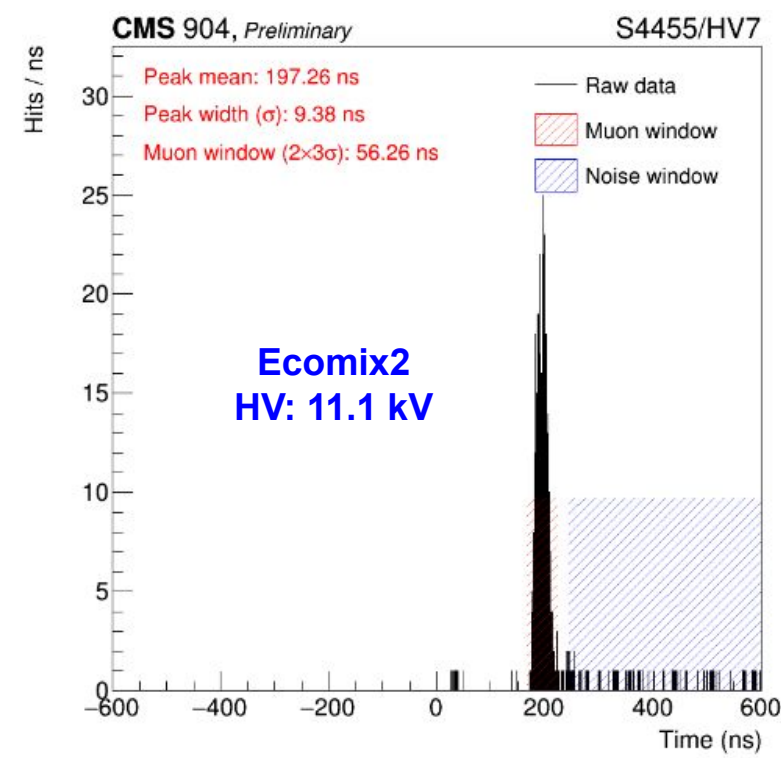
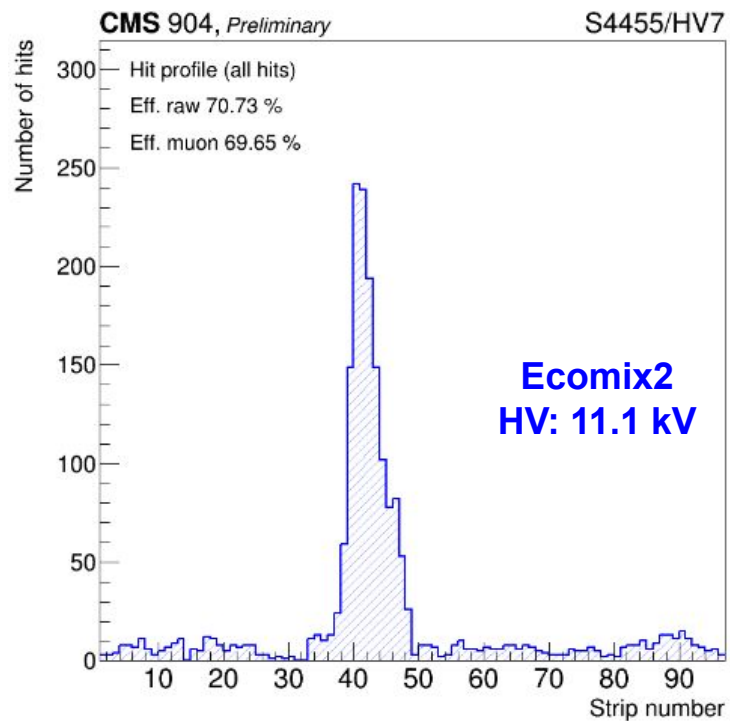
- At the beginning we were able to work with the chamber in double gap mode. However, after irradiating the chamber to take the data BOT gap starts to trip for ABS smaller than 100 .
- The efficiency found for the single gap configuration drops considerably.
- After switching to ecogas the chamber was kept single gap for all runs.
- The runs for ecogas weren't good.

CMS-GT-2-0: Source OFF - Standard gas



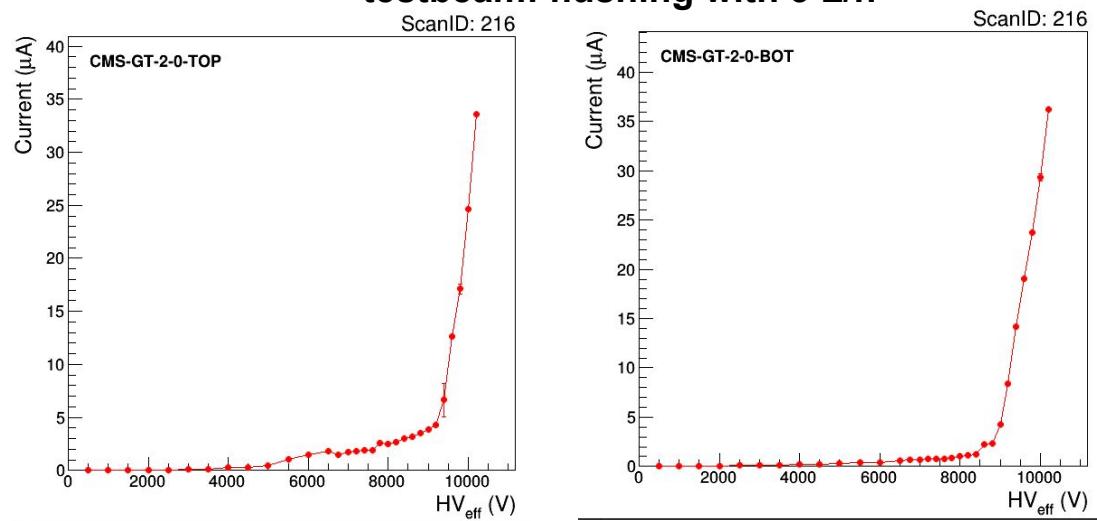
CMS-GT-2-0: Source OFF - ecomix-2

single gap

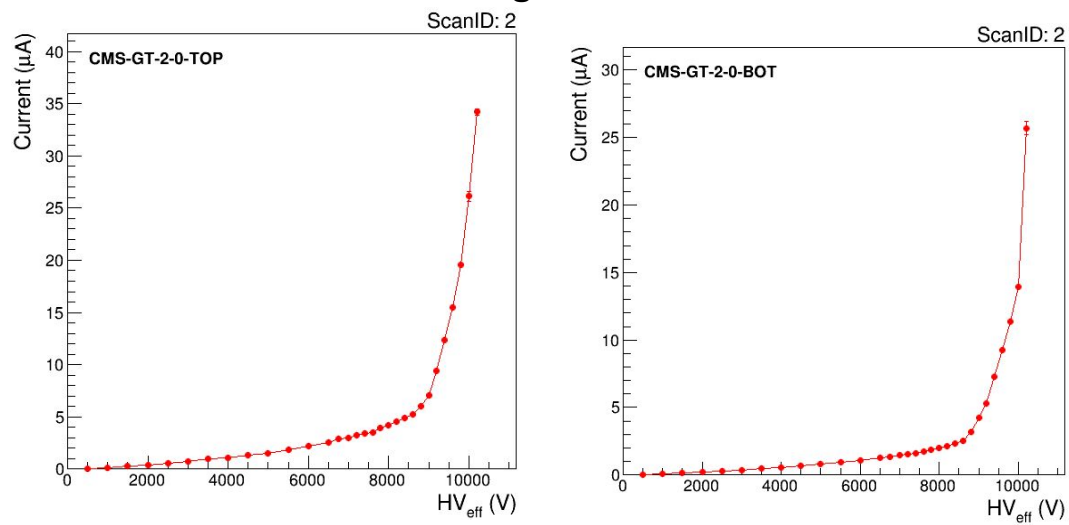


CMS-GT-2-0: Gaps current history

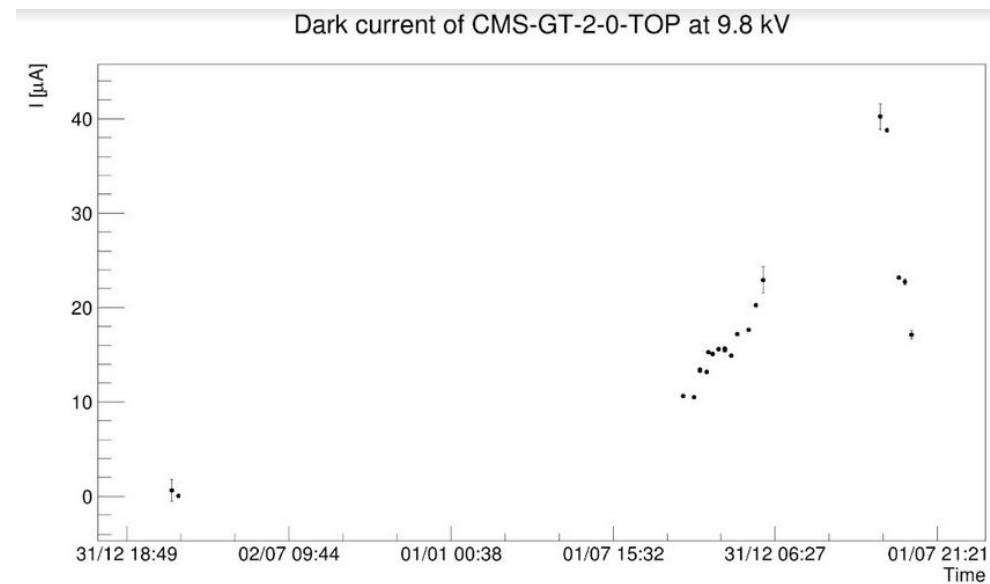
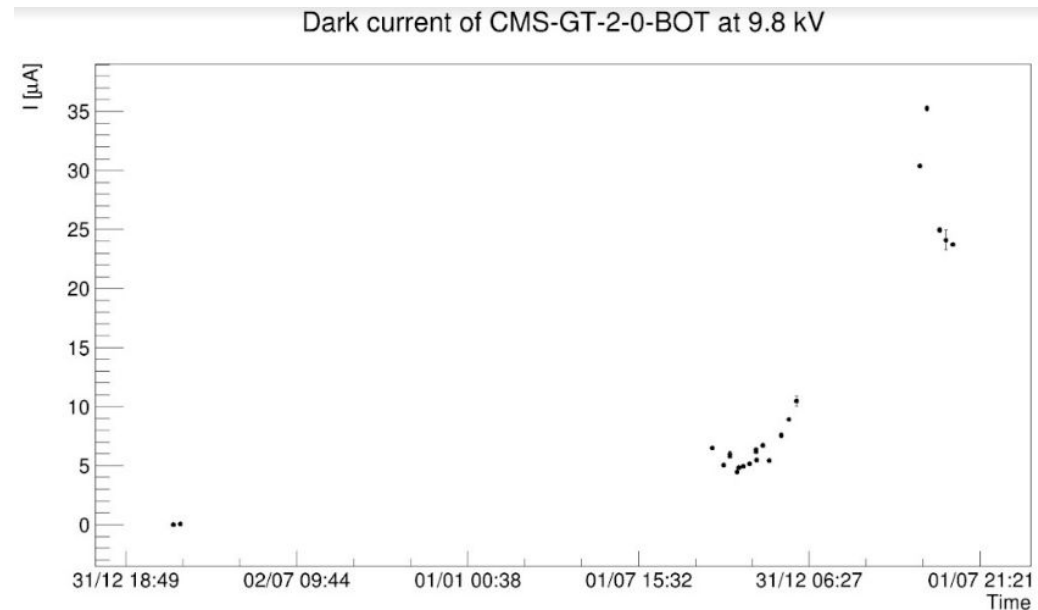
**HV Scans taken before
testbeam: flushing with 3 L/h**



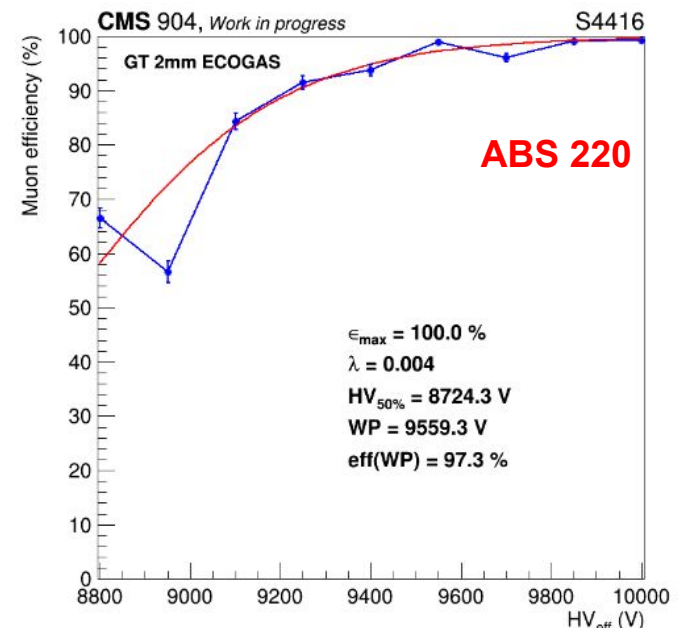
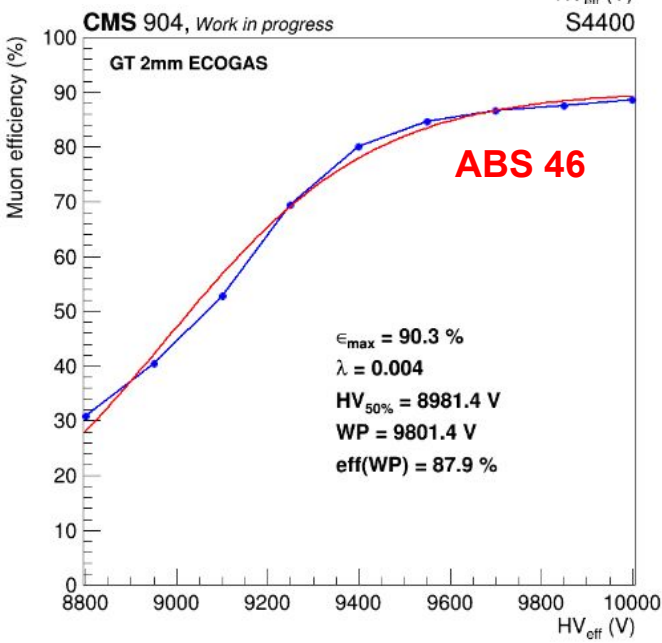
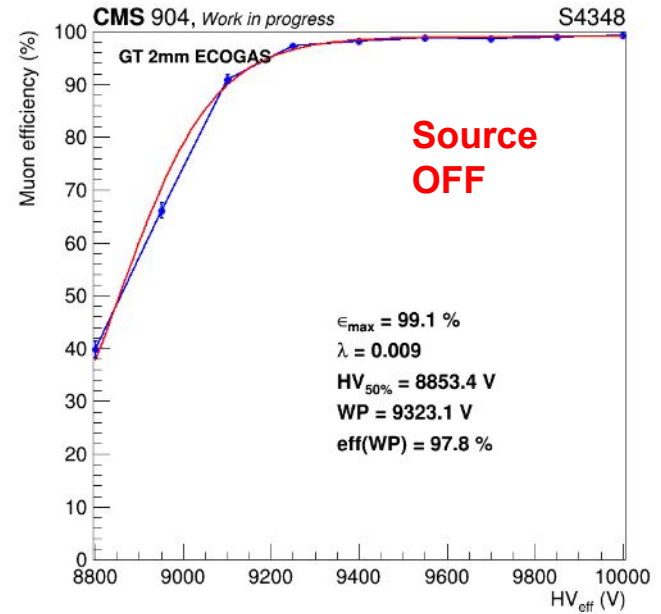
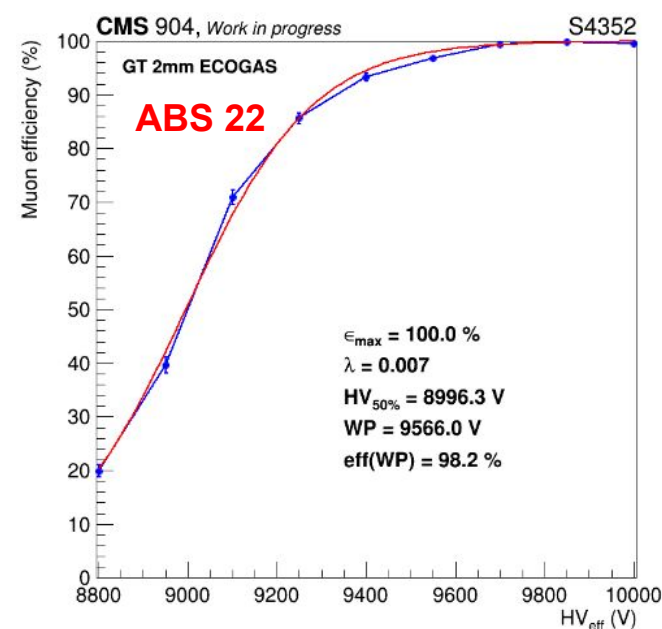
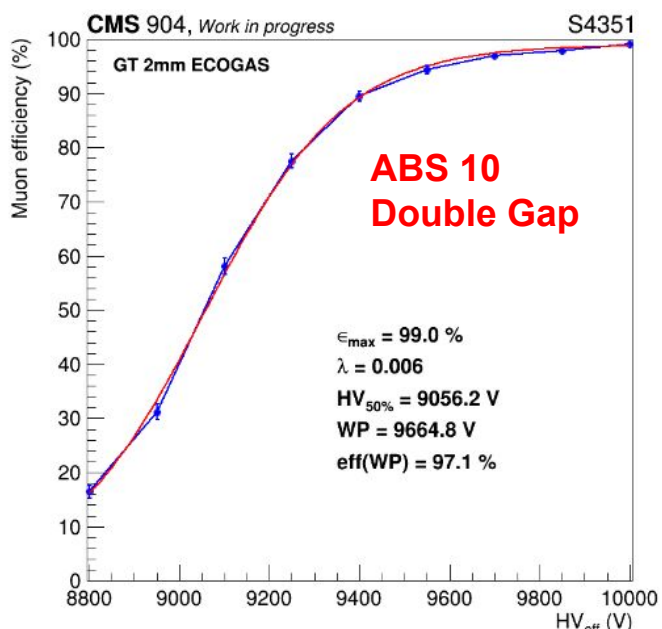
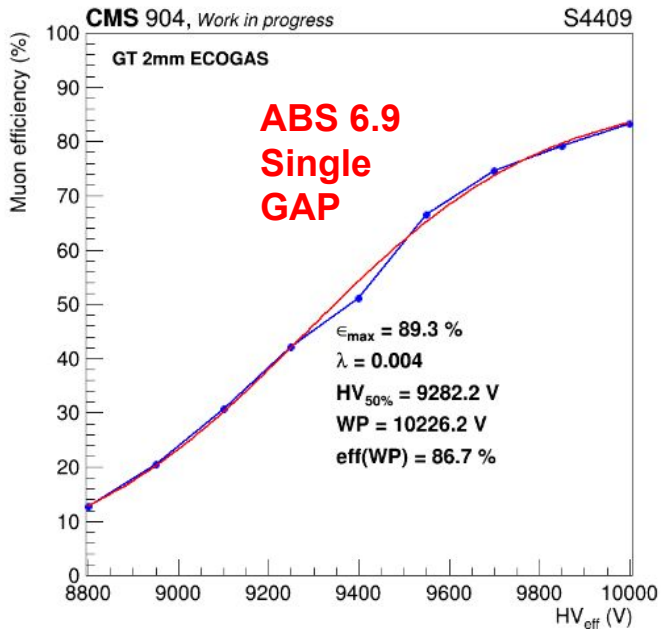
**HV Scans taken after testbeam:
Flushing with 6 L/h**



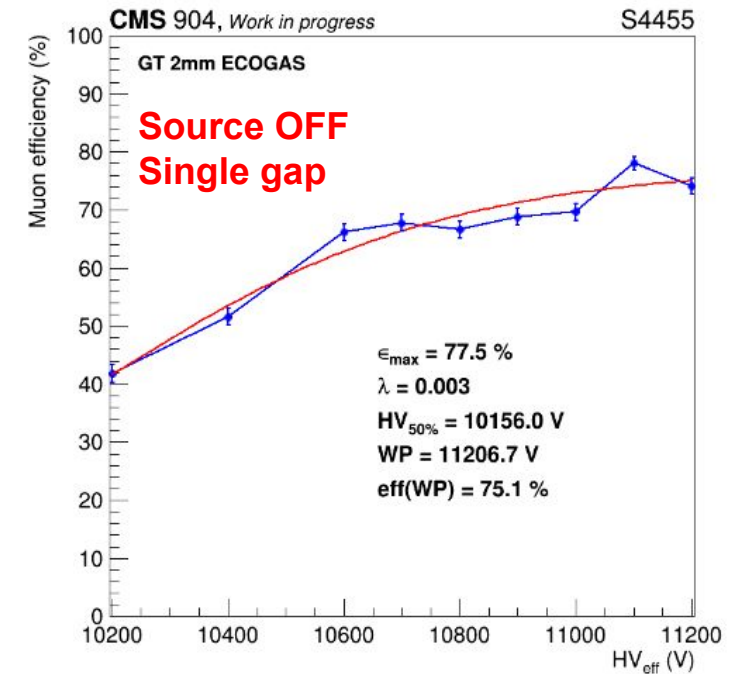
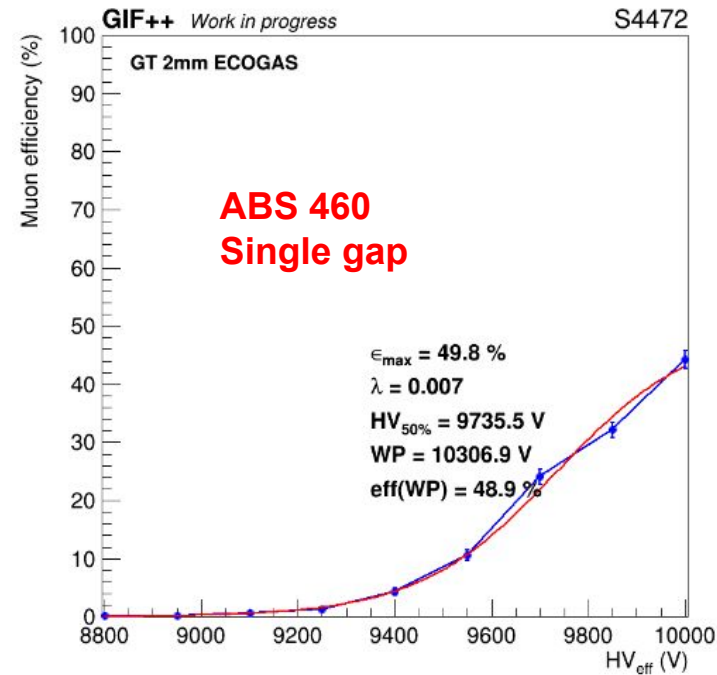
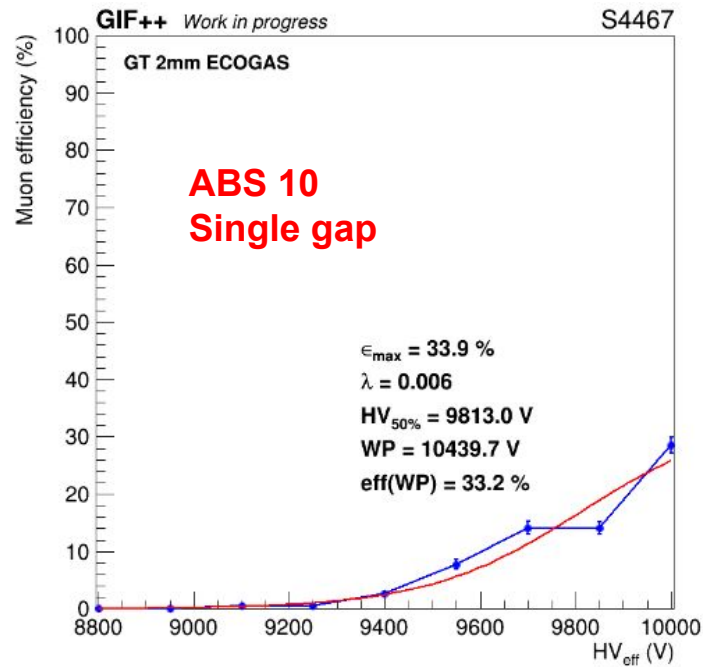
Current history with for CMS-GT



CMS-GT-2-0: Standard gas - Efficiency scans



CMS-GT-2-0: Ecomix 2: Bad efficiency scans

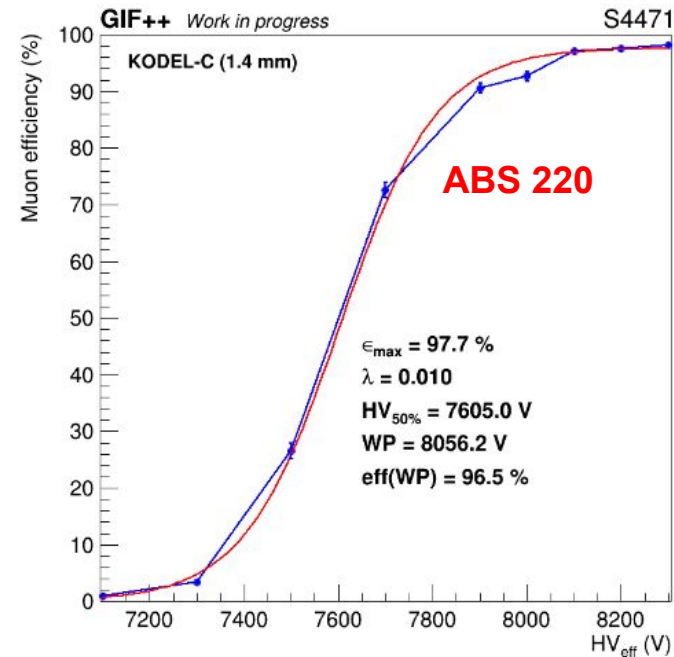
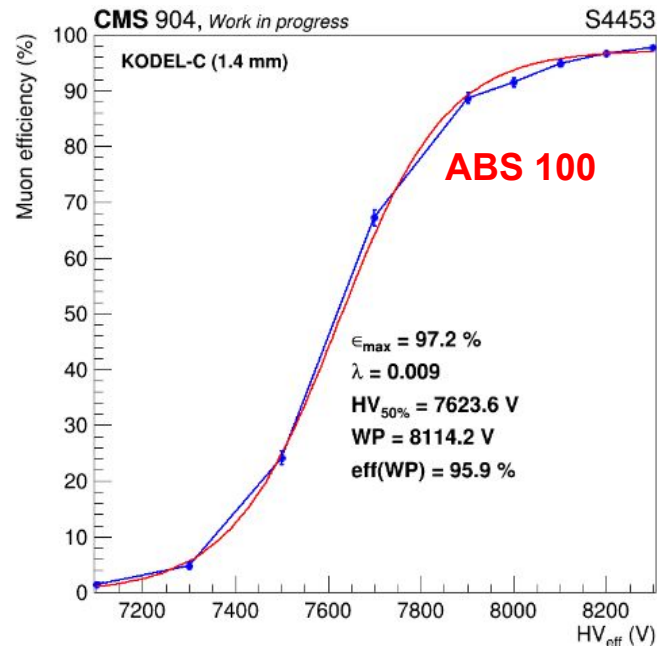
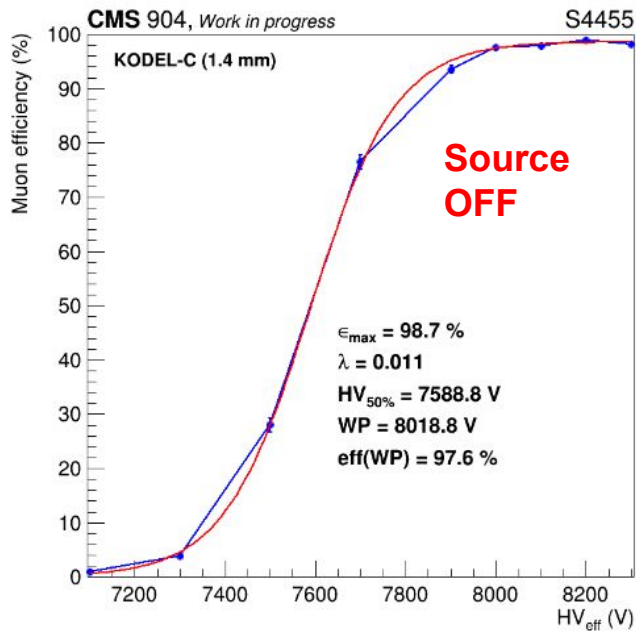
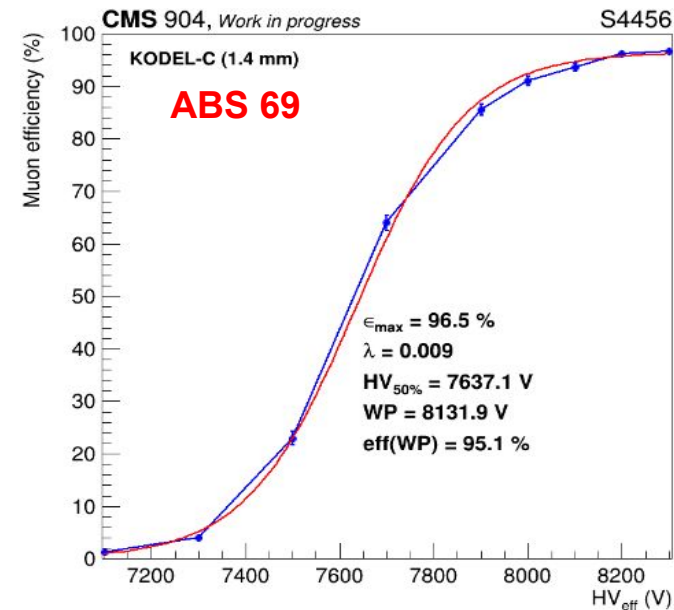
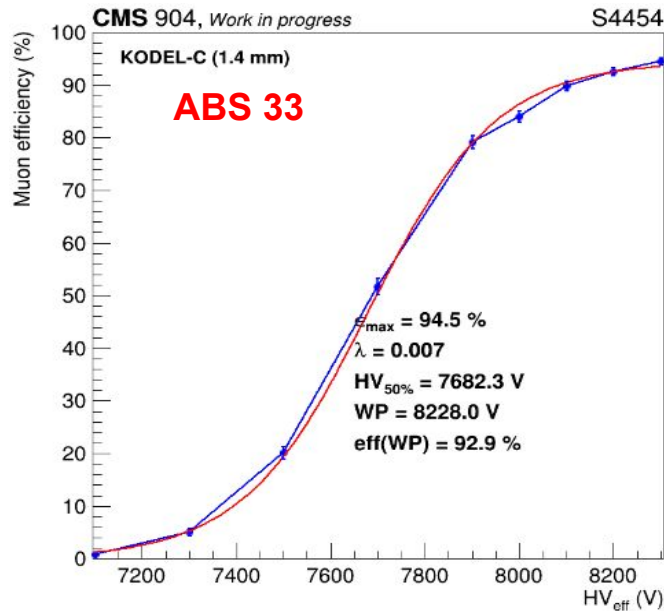
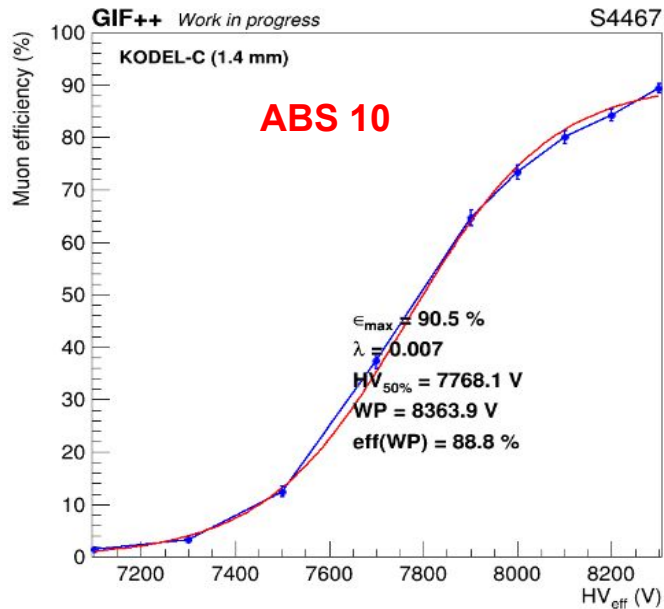


Conclusions/future works

- Investigation on the high currents in **CMS-GT-2-0**: We measure the currents with a resistor in return line to the mainframe -> No CURENT leaks found. We need to investigate if this could be related with a gas leak.
Chamber is now at 904 and if not possible to recover it we have to replace it with another 2 mm CMS chamber.
- Kodel C: Very good behavior with both gas mixtures. Now it is under std. gas and the chamber is off. If we move consolidation to 60 % RH ,the Kodel-C should remain OFF ??
- GT2p0_2: We have to investigate the issue on the gap that is tripping. Probably we need to replace the connector on chamber side
- Work on the twiki to include all relevant informations: System details, analysis recipes, plots, etc.
- Further analysis:
 - Implement the tracking algorithm in order to improve the efficiency calculation
 - Correction of the efficiencies with the fakes (Background)
 - subtraction of the ohmic component, etc

BACKUP

Kodel C: Ecomix-2- Efficiency scans



Kodel C: Standard gas mixture - Efficiency scans

