

GEM aging studies and future plan/milestones @ Korea

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CMS GEM Workshop 24

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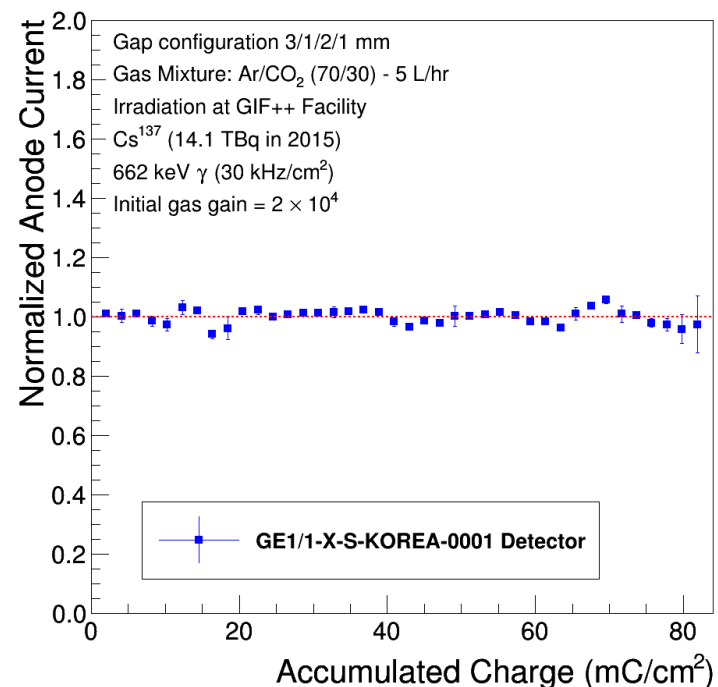
- Goal: aging test of double-segmented Mecaro foils at Korea
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1 Goal – Aging test of double-segmented GEM foils @ Korea

- Aging test of double-segmented Mecaro foil is planned to be performed at UoS, Korea for ME0.
 - With Ag target x-ray source like 904.

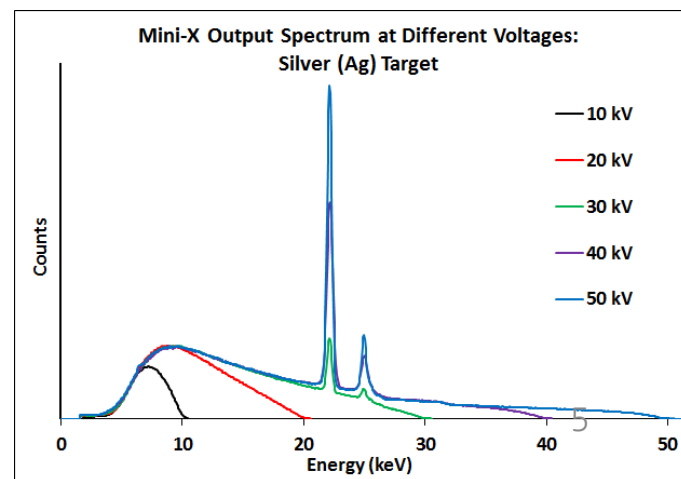
2 Motivation

- ME0 requirement
 - No gain loss due to classical aging after 850 mC/cm^2 of integrated charge.
- So far, 82 mC/cm^2 has been collected by using GIF++.
 - No gain drop
 - Single-segmented Mecaro foils
- However charge collection @ GIF++ was not fast enough.
 - Many interruptions; weekly access, bunker extension, low dose radiation period, ETC
 - Low cross section
 - 6-6.5 years needed to reach 850 mC/cm^2



2 Motivation

- New aging setup @ 904 with Ag target x-ray source
 - Higher cross section due to low energy photon
 - Higher duty factor
 - ⇒ Faster charge collection. $0.4 \text{ mC/cm}^2 \text{ day}$ (GIF++) vs $4.6 \text{ mC/cm}^2 \text{ day}$ (new setup)
 - ⇒ Charge collection @ GIF++ has been stop!
- Impossible to allocate Cu box to aging test any more
 - Need to find another place to perform the aging test
 - UoS, Korea is candidate



3 Procedures

- Produce double-segmented GE2/1 M7 foils at Mecaro (5 foils)
 - Budget for the 5 foils is secured
 - Prior to masks production, KCMS needs CMS official letter to confirm that foil design is finalized.
 - Once the letter arrive, mask and foil production will start. Mecaro allocates priority to CMS test production.
 - ⇒ So, the 5 foils production can be done in 2019
- Deliver foils to 904 to build chamber
 - Budget for ROB, frames, ETC is secured
 - Perform QC chain up to 5. Gain measurement needs special care to resolve the gain issue (the reason of wrong geometry is understood, Fri.)
- Deliver to UoS
 - Check chamber is damaged or not during shipping (gain measurement)
 - Start charge collection

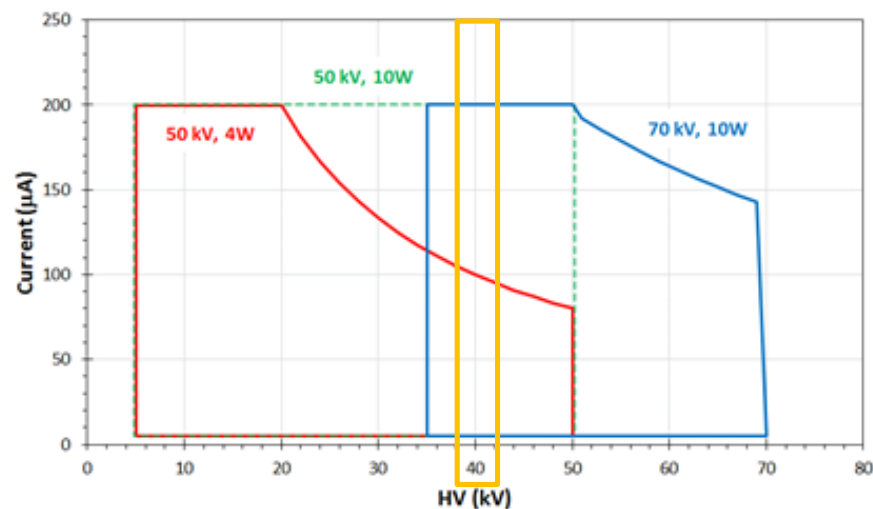
4 Items at UoS

- Shield box
 - 1.6 mm Fe+2 mm Pb+1.6 mm Fe
 - 2603 mm (w) x 1808 mm (L) x 2400 mm (H)
- Small clean room (10000 class)
 - Impossible to assembly chamber in here because of lack of tools
- Gas system (stainless), meteo-station (raspberry pi+ BME280 environmental sensor; resolution 0.1 °C, 0.008 % RH, 0.18 Pa), Keithley 4987 picoammeter
- Person-power
 - 2 Ph.D
 - 5 Ph.D students (1 fully trained student)



5 Purchasing x-ray gun

- 10 W gun instead of 4 W
 - If unexpected delay occurs, 10 W gun can accelerate charge collection to compensate it.
- Internal regulation of UoS to use x-ray gun is ready
- Report to KINS (Korea Institute of Nuclear Safety) is almost ready (next week)
 - Draft is ready but tweak is ongoing
 - Professional agency is helping us
- Once permission of KINS is obtained, purchasing procedure will start
 - 6 weeks to build the gun
 - The gun will be available in early 2020



6 Concerns

- Schedule
 - The test will be started in early 2020. Then 1-1.5 year is available until PRR.
 - 11 months was needed for 904 case.
 - 10 W source will compensate any unexpected delay.
- Large fluctuation of environmental variables
 - Annual temperature change is larger than 50 °C in Seoul
 - In fall, many typhoons induce pressure down.
 - RH reaches 90% in summer. Reason of higher dark current (10 cm*10 cm experience)
 - Room is air conditioned. However I'm not sure the air conditioner can cover the fluctuation.
 - I'm not sure the PT correction can cover large fluctuation.

7 Summary

- No aging effect is observed up to 82 mC/cm^2 for chamber with single-segmented Mecaro foils so far.
 - ME0 requirement: 850 mC/cm^2
- Aging test will be performed with double-segmented Mecaro foils in Korea
 - New aging technique like 904 will be used.
 - Double-segmented GE2/1 M7 foils will be used for the test.
- Procedures to fulfill radiation safety and purchasing x-ray gun is ongoing.
 - Report to KINS will be available in very soon.
- Large environmental fluctuation is concern.