



Update-II on CSC Spatial Resolution and RechHit Efficiency study with GIF++ 2016-2018 data

[Vladimir Palichik \(Dubna-JINR\)](#),

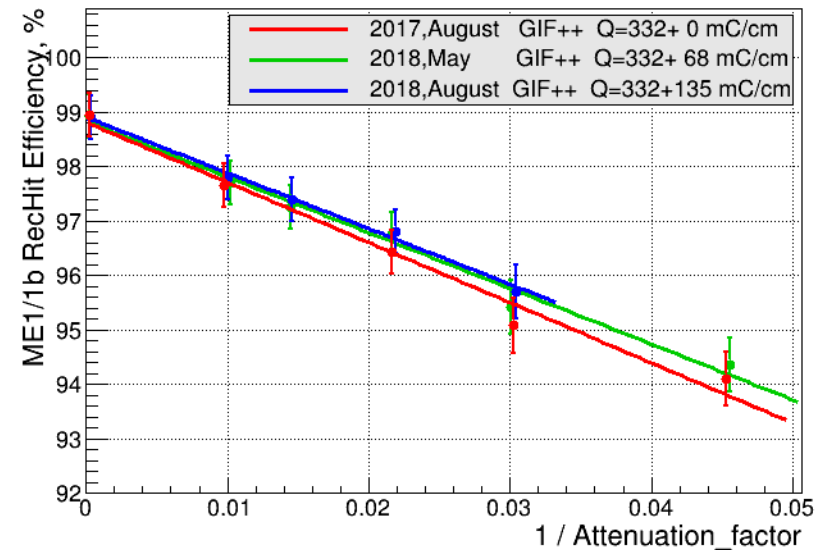
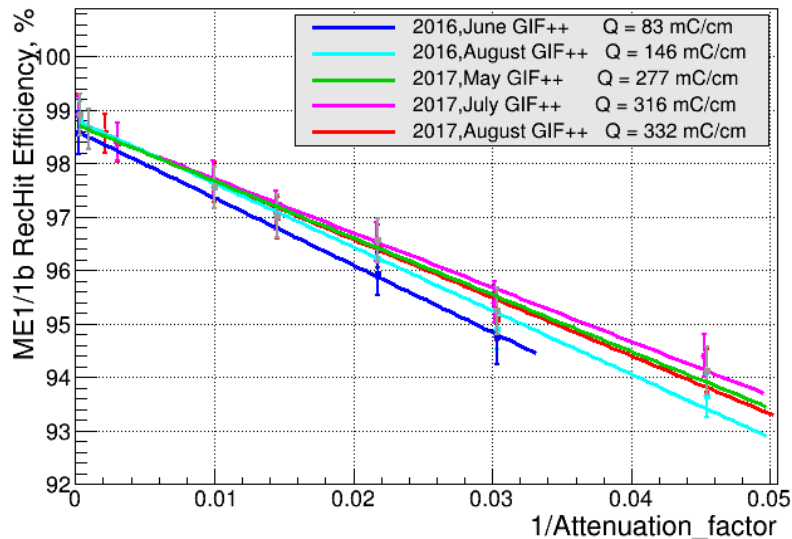
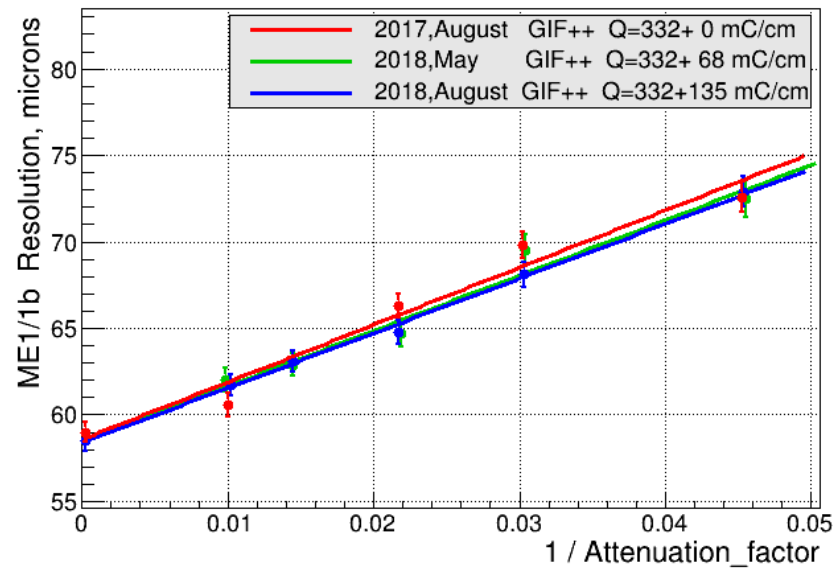
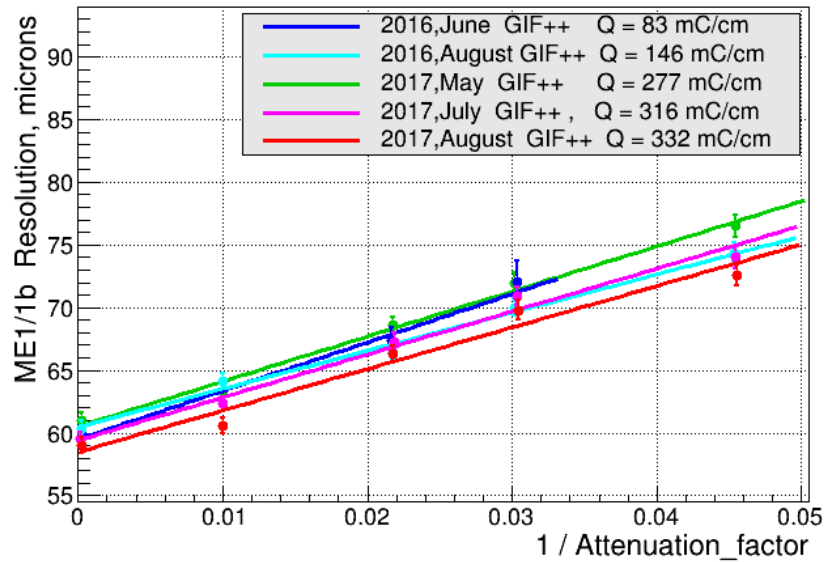
Victor Pereygin (Dubna-JINR)

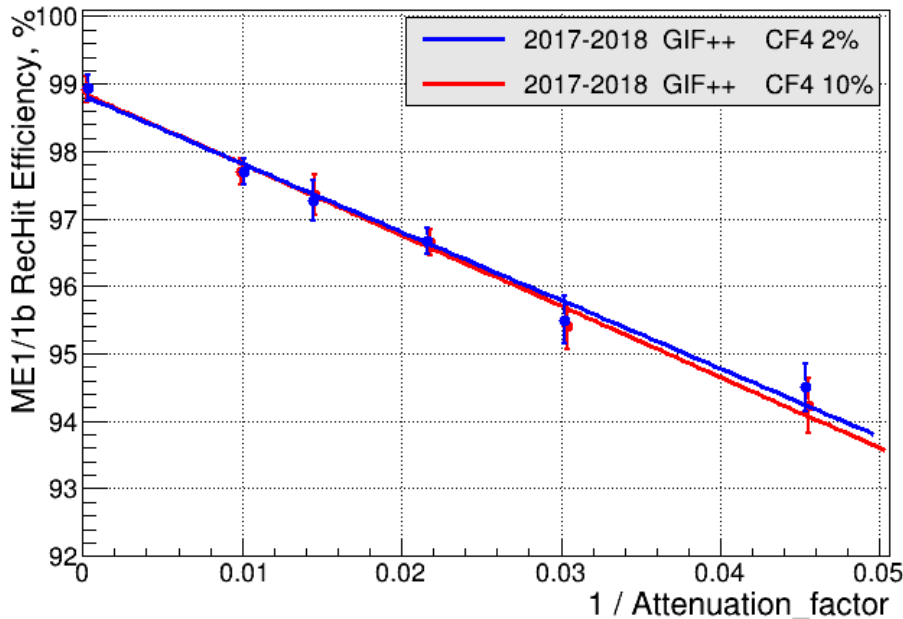
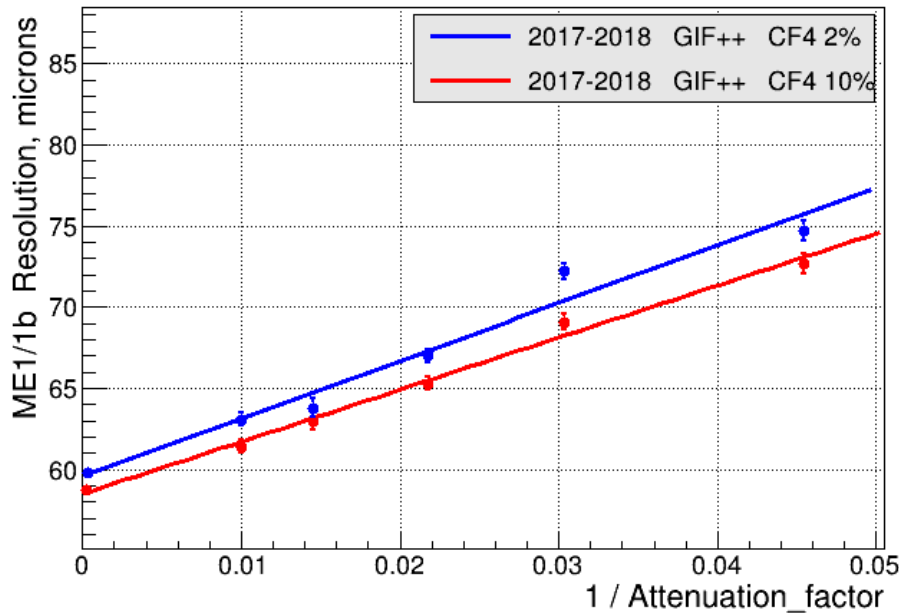
Katerina Kuznetsova (St. Petersburg-PNPI)

GIF_CSC_Working_Meeting_Nov.06-2018



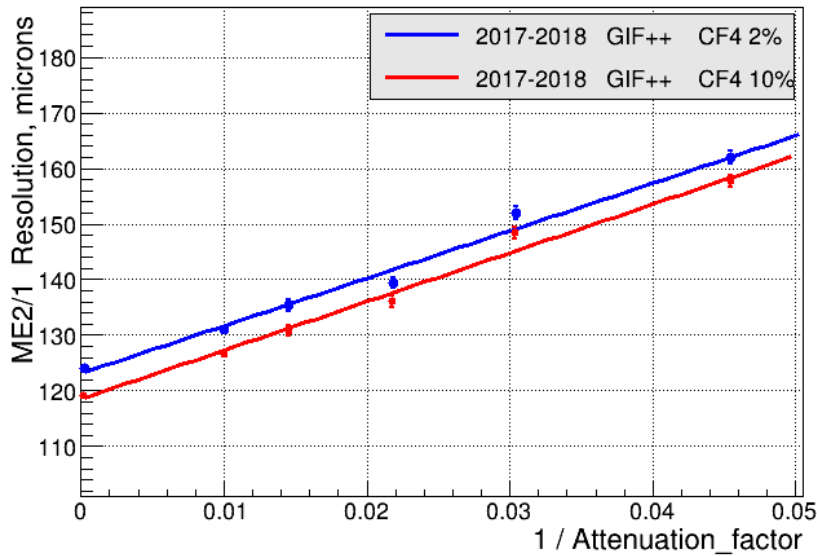
ME1/1b Spatial resolution and efficiency 2016-2018 with 10% CF4 gas mixture





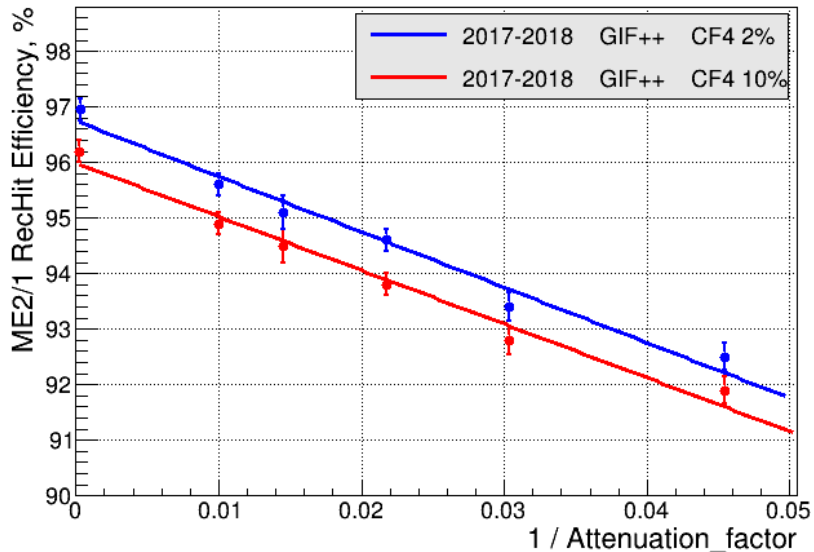
ME1/1b spatial resolution and RecHit efficiency – averaged values of 2017-2018 data for 2% and 10% CF4 gas mixture.

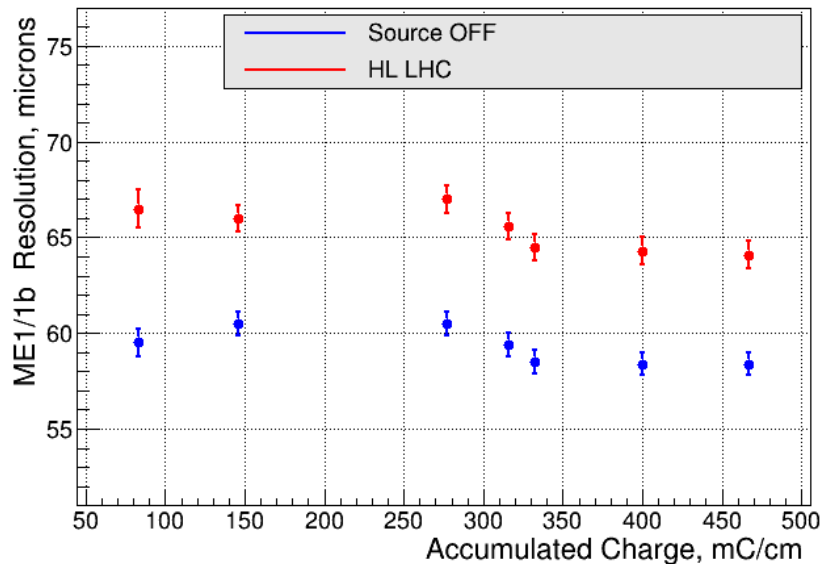
With 10% CF4 the Resolution is better by $\sim 3 \mu\text{m}$ while the Efficiency looks identical.



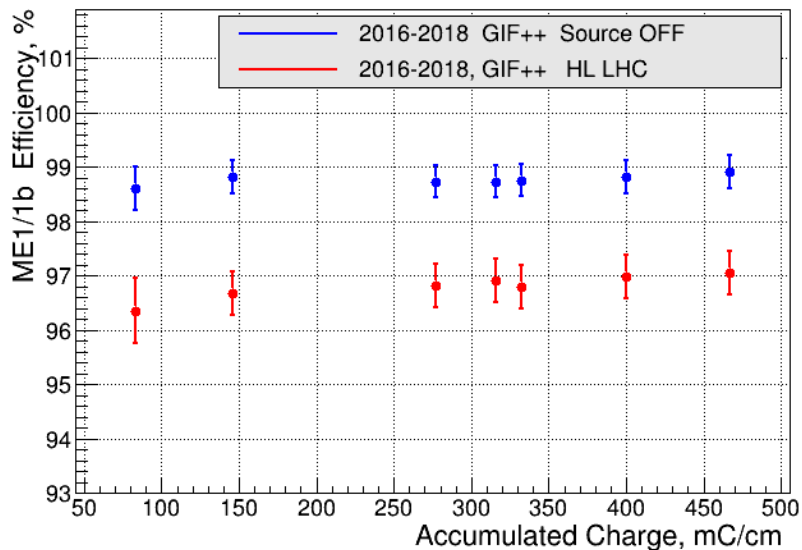
ME2/1 spatial resolution and RecHit efficiency – averaged values of 2017-2018 data for 2% and 10% CF4 gas mixture.

With 10% CF4 the Resolution is better by ~4 μm while the Efficiency looks 0.8% better for 2%.





We can't state any degradation of ME1/1 performance vs Charge up to 467 mC/cm



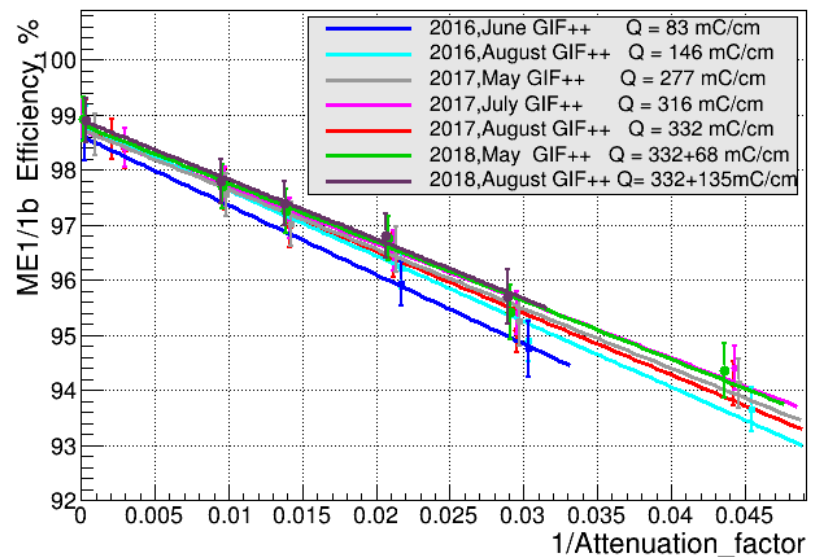
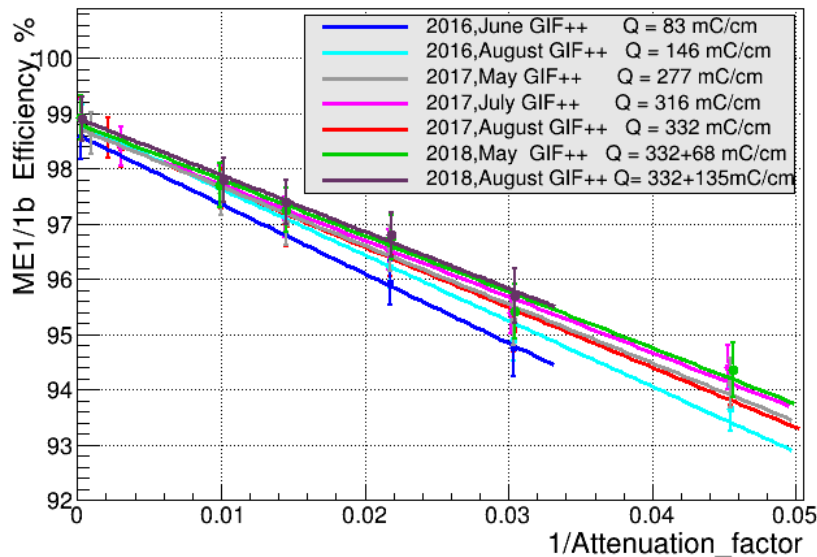
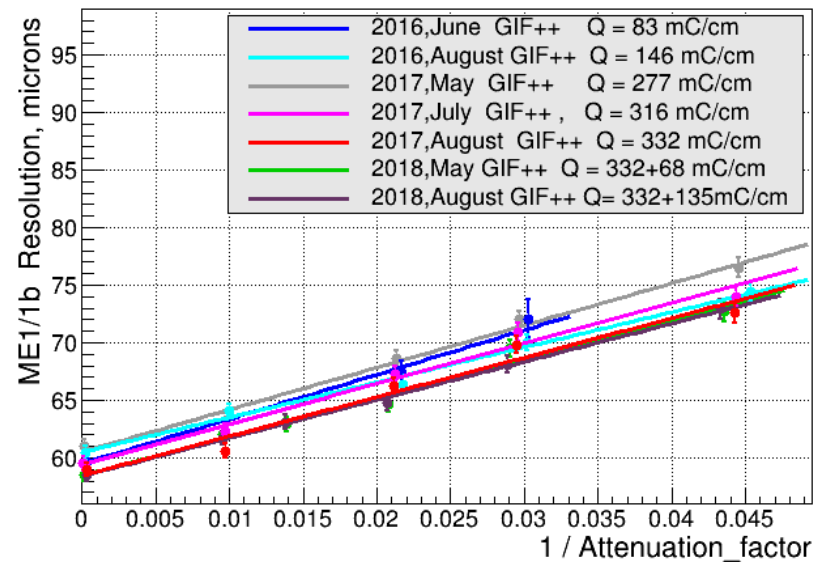
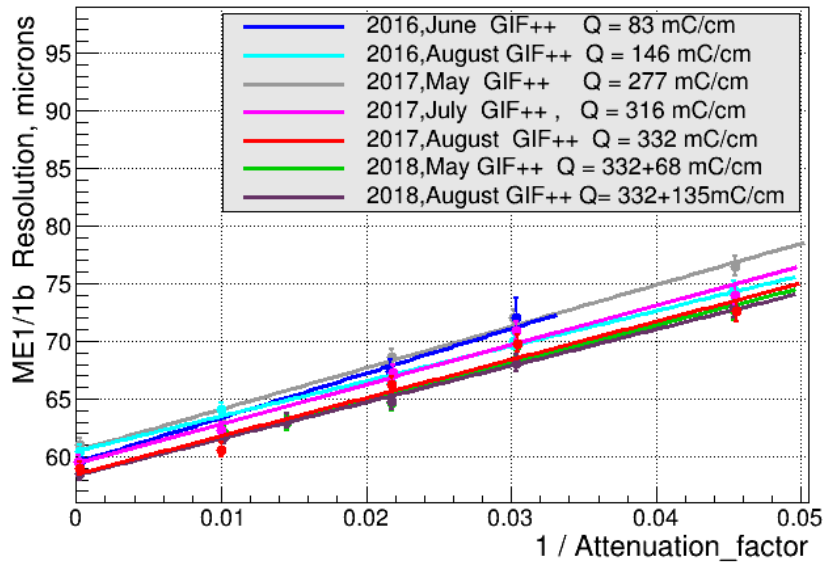


correction to the Cs-137 half-life -> att.factor increase



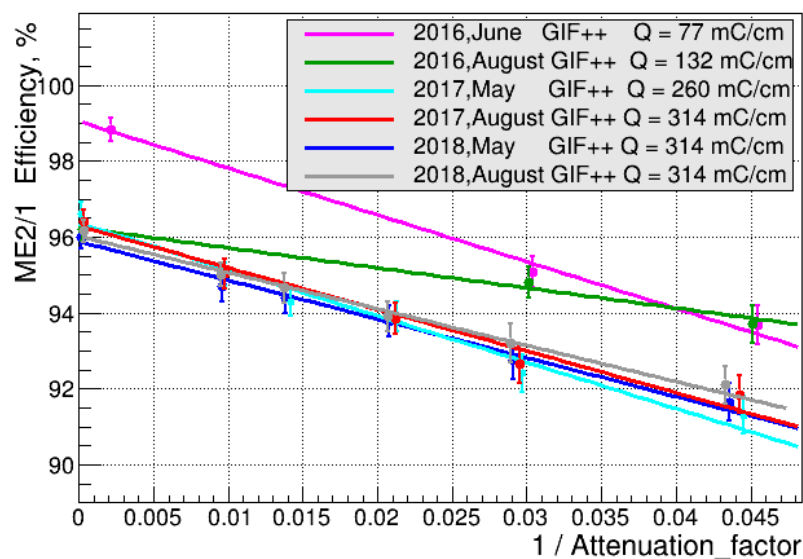
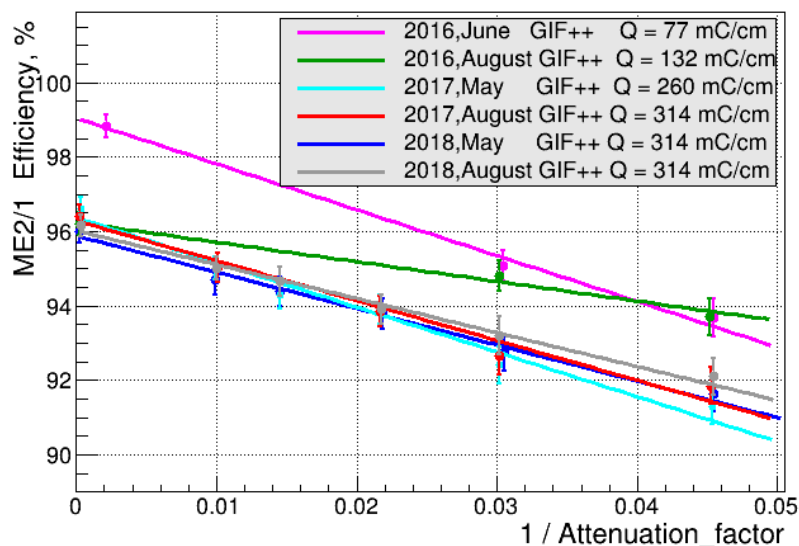
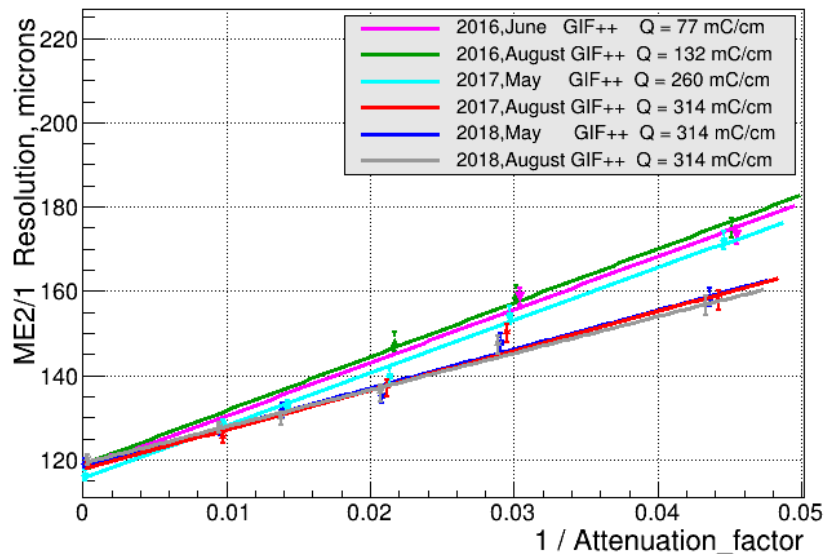
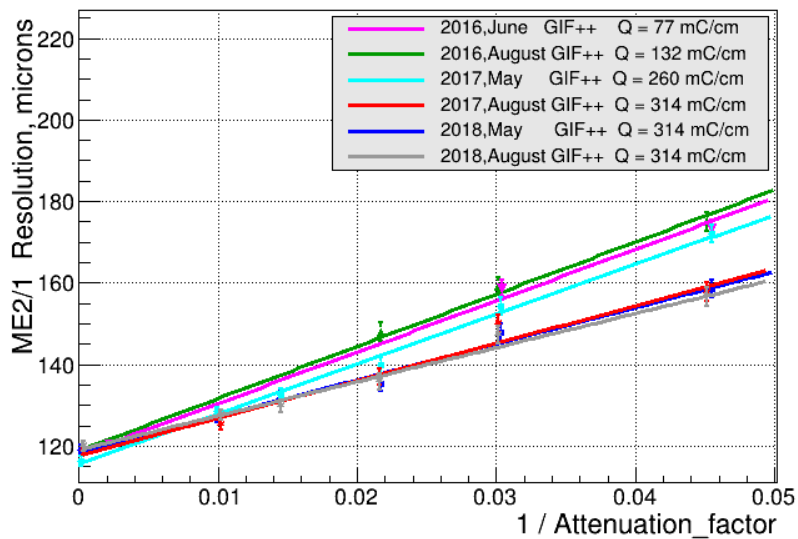
$$N(t)/N_0 = 2^{-t/(T_{1/2})} = 2^{-t/30}$$

| | t (year) | t/30 | $2^{t/30}$ | N(t)/No | δ% | Shift in Att. factor value | | | |
|-----------|----------|-------|------------|---------|-----|----------------------------|------------|---------|--------|
| | | | | | | 22*→ | 1/22* → | 33*→ | 1/33*→ |
| June-2016 | 0 | 0 | 1 | 1 | 0 | | 0.0454 | | 0.0303 |
| July-2017 | 1.08 | 0.036 | 1.025 | 0.975 | 2.5 | 22.55* | 0.0443 | 33.825* | 0.0296 |
| Aug.-2017 | 1.17 | 0.039 | 1.027 | 0.973 | 2.7 | 22.59* | 0.0442 | 33.891* | 0.0295 |
| May-2018 | 1.92 | 0.064 | 1.045 | 0.957 | 4.3 | 22.95* | 0.0436 | 34.419* | 0.0291 |
| Aug-2018 | 2.17 | 0.072 | 1.051 | 0.951 | 4.9 | 23.08* | 0.0433 | 34.617* | 0.0289 |





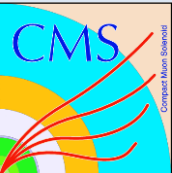
ME2/1: Old pictures → new pictures with correction to the Cs-137 half-life



To do:

- Process another one Aug.-2016 data set,
- Add data TB-3 Oct.2018,
- Improve pictures for approval.

Back up



TB-2 Filter scan Test40 Runs list with 2% CF4



TB-2 Aug.-2018 Runs Test40, HV0, Dual readout **2%CF4** 06.08.2018, Nev=40000

1. **Source=OFF** M#6249, Pgif=961 mbar

emugif2.cern.ch:/raid/data/current/csc_00000001_EmuRUI01_STEP_40_000_180806_114140.UTC.raw

2. **Att.=100*** M#6252, Pgif=960.5 mbar

emugif2.cern.ch:/raid/data/current/csc_00000001_EmuRUI01_STEP_40_000_180806_124511.UTC.raw

3. **Att.=69*** M#6253 Pgif=960.4 mbar

emugif2.cern.ch:/raid/data/current/csc_00000001_EmuRUI01_STEP_40_000_180806_125621.UTC.raw

4. **Att.=46*** M#6255 Pgif=960.4 mbar

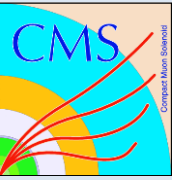
emugif2.cern.ch:/raid/data/current/csc_00000001_EmuRUI01_STEP_40_000_180806_131740.UTC.raw

5. **Att.=33*** M#6257 Pgif=960.4 mbar

emugif2.cern.ch:/raid/data/current/csc_00000001_EmuRUI01_STEP_40_000_180806_133710.UTC.raw

6. **Att.=22*** M#6259 Pgif=960.2mbar

emugif2.cern.ch:/raid/data/current/csc_00000001_EmuRUI01_STEP_40_000_180806_135714.UTC.raw



TB-2 Filter scan Test40 Runs list with 10% CF4



TB-2 Aug.-2018 Runs 10%CF4 Test40p, HV0, Dual readout 25.08.2018, Nev=40000

1. Source=OFF M#6665, Pgif=961 mbar

emugif2.cern.ch:/raid/data/current/csc_00000001_EmuRUI01_STEP_40p_000_180825_180701.UTC.raw

2. Att.=100* M#6671, Pgif=962 mbar

emugif2.cern.ch:/raid/data/current/csc_00000001_EmuRUI01_STEP_40p_000_180825_192327.UTC.raw

3. Att.=69* M#6664 Pgif=961 mbar

emugif2.cern.ch:/raid/data/current/csc_00000001_EmuRUI01_STEP_40p_000_180825_175657.UTC.raw

4. Att.=46* M#6673 Pgif=962 mbar

emugif2.cern.ch:/raid/data/current/csc_00000001_EmuRUI01_STEP_40p_000_180825_194744.UTC.raw

5. Att.=33* M#6660 Pgif=961 mbar

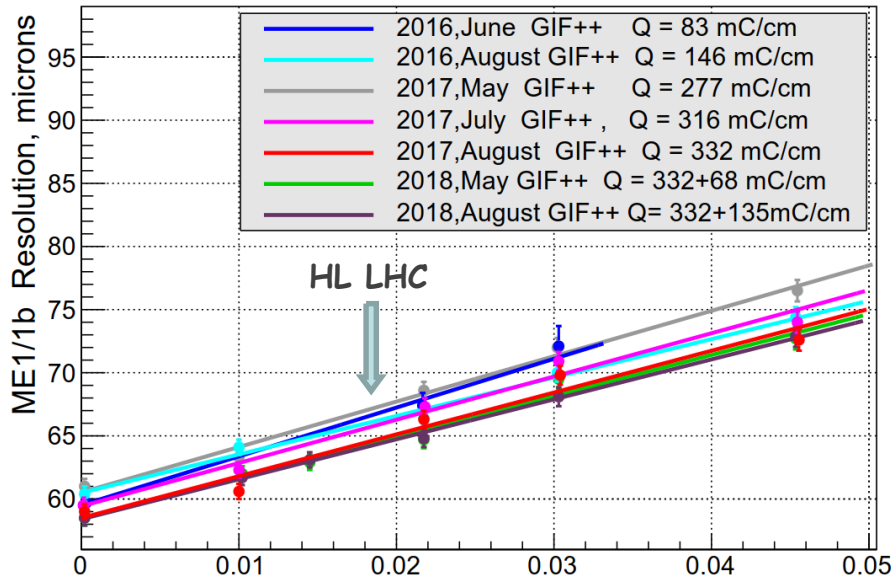
emugif2.cern.ch:/raid/data/current/csc_00000001_EmuRUI01_STEP_40p_000_180825_171101.UTC.raw

6. Att.=22* M#6676 Pgif=962 mbar

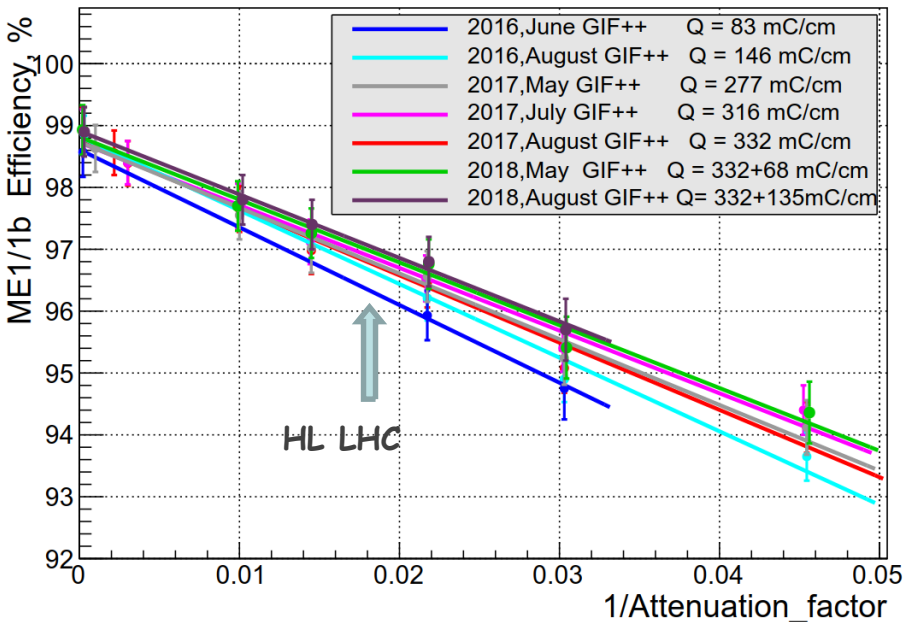
emugif2.cern.ch:/raid/data/current/csc_00000001_EmuRUI01_STEP_40p_000_180825_203730.UTC.raw

7. Att.=15* M#6677 Pgif=962 mbar

emugif2.cern.ch:/raid/data/current/csc_00000001_EmuRUI01_STEP_40p_000_180825_204726.UTC.raw



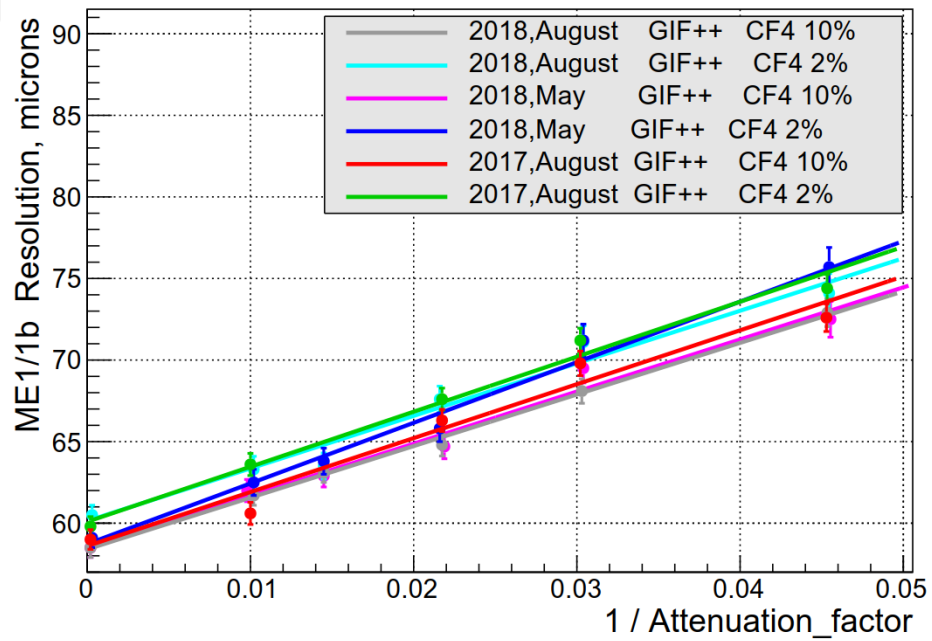
ME1/1b spatial resolution:
We can't state but it looks like there is a slight tendency for resolution improvement with charge increase.



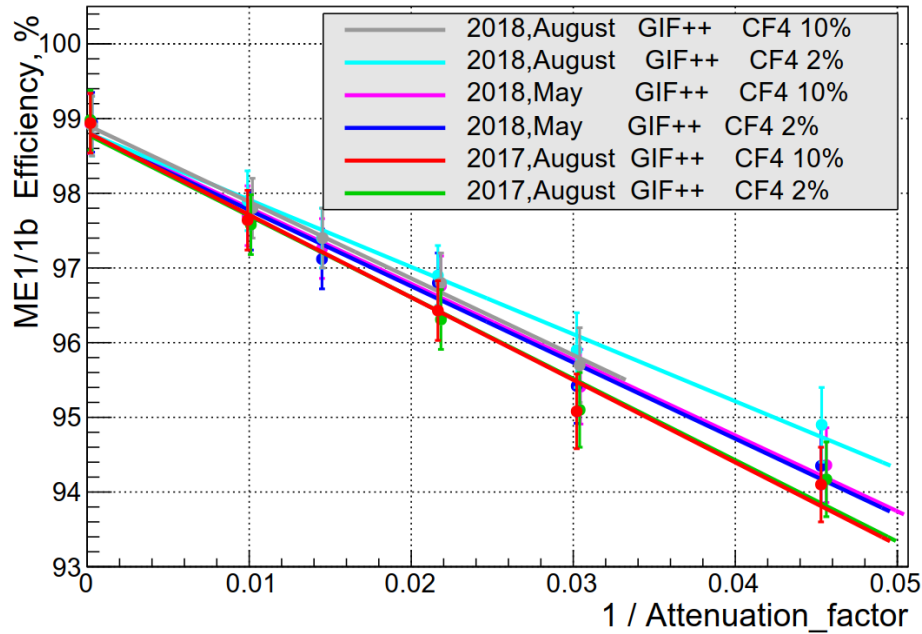
ME1/1b RecHit efficiency:
Looks stable with charge increase inside uncertainties.



ME1/1b Spatial resolution and efficiency 2017-2018 with 2% & 10% CF4 gas mixture



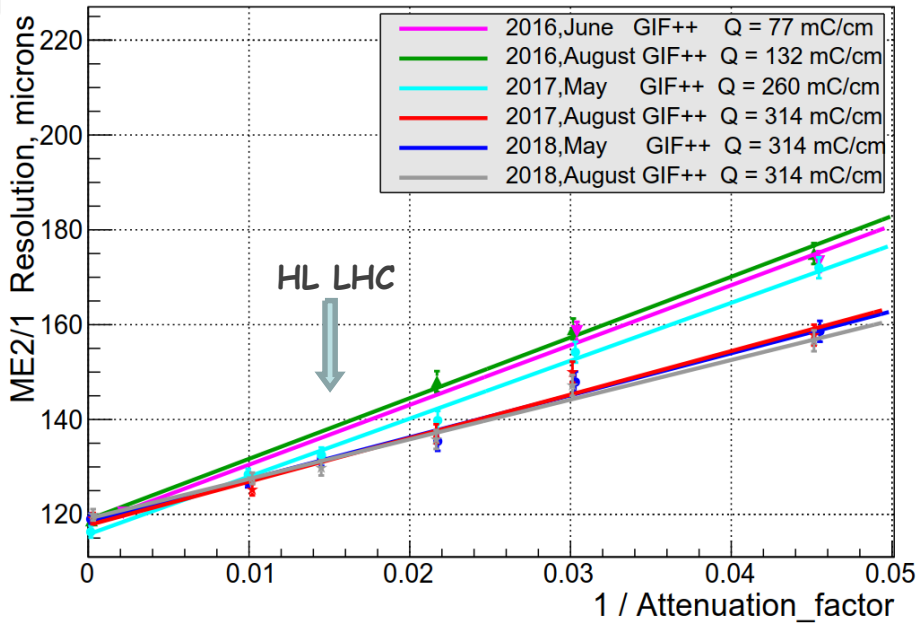
ME1/1b spatial resolution:
With 10% CF4 gas mixture shows better resolution by $\sim 2 \mu\text{m}$.



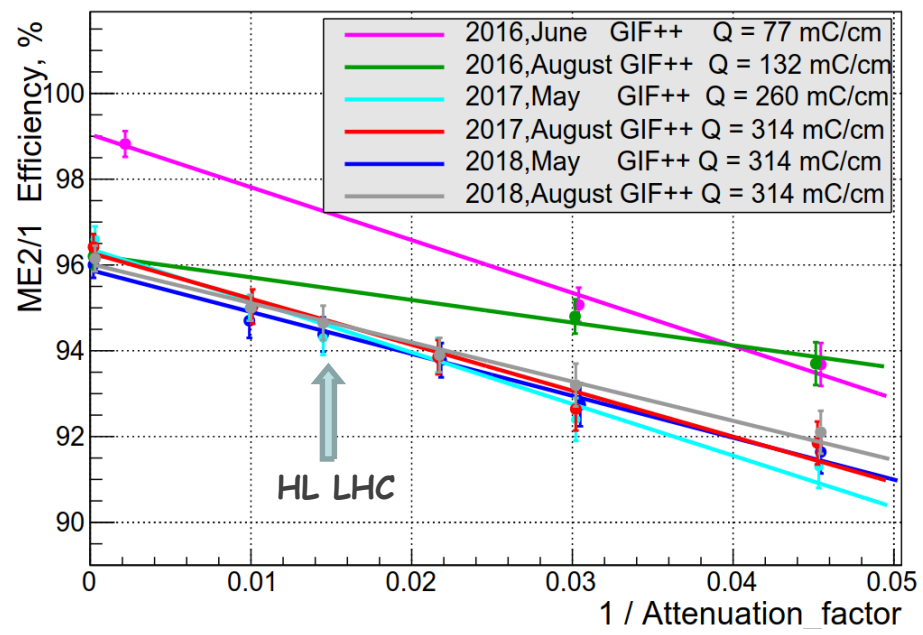
ME1/1b efficiency:
Looks stable with charge increase inside uncertainties.



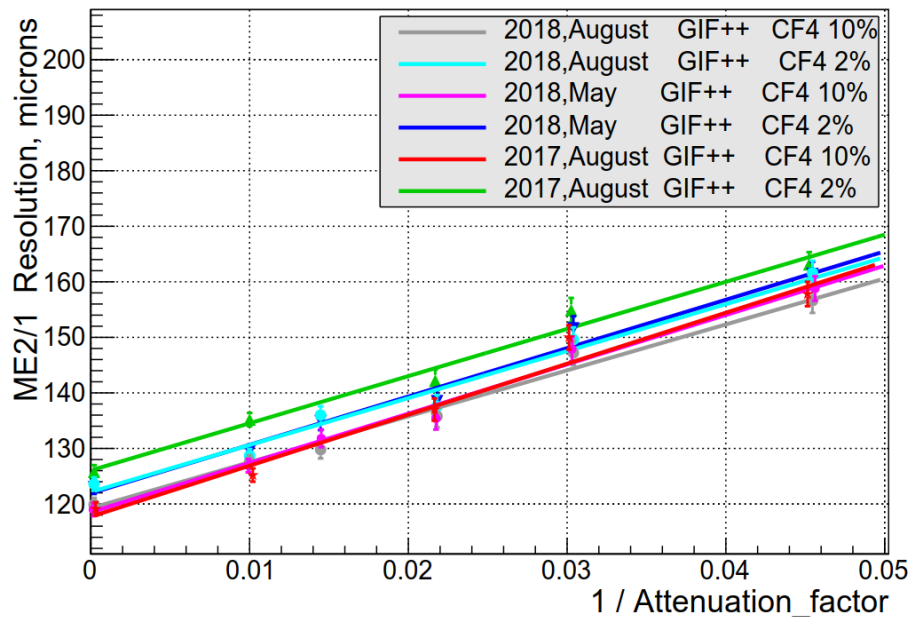
ME2/1 Spatial resolution and efficiency 2016-2018 with 10% CF4 gas mixture



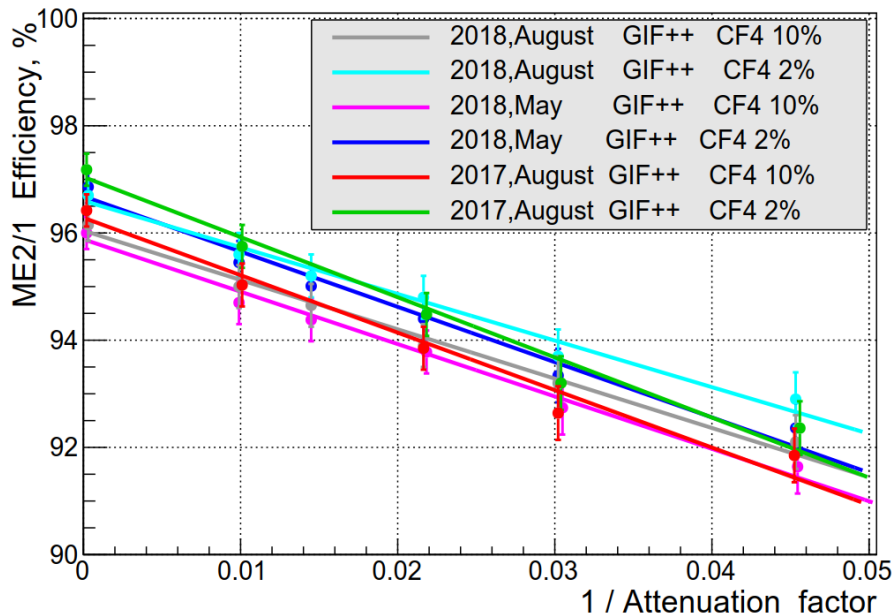
ME2/1 spatial resolution:
We really see a tendency for resolution improvement with charge increase.



ME2/1 efficiency:
We don't understand the difference in Efficiency 2016-2017 and the problem occurred in Aug.2016.



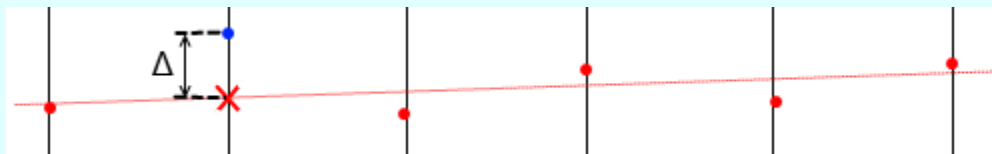
ME2/1 spatial resolution:
With 10% CF4 gas mixture shows better resolution by ~4-8 μm .



ME2/1 efficiency:
Looks better for 2% gas mixture but the difference is inside the uncertainties.

Spatial resolution calculation:

- Only 6 & 5-point segments are considered;
- For each layer with hit a straight line fit is applied excluding the current layer and the residual (Δ) between the measured strip coordinate and the predicted track coordinate from fit is used for resolution calculation.



- - hit used for fit
- - hit excluded from fit
- × - predicted track coordinate

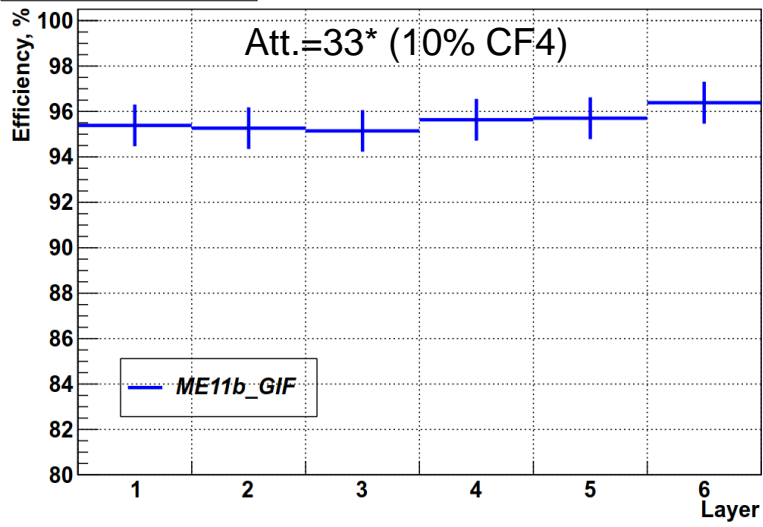
Efficiency per layer (from segments):

| | | | | | | |
|-------------|---|---|---|---|---|---|
| Numerator | 1 | 1 | 1 | 0 | 1 | 0 |
| Segment | x | x | x | o | x | o |
| Demoninator | 1 | 1 | 1 | 1 | 1 | 1 |

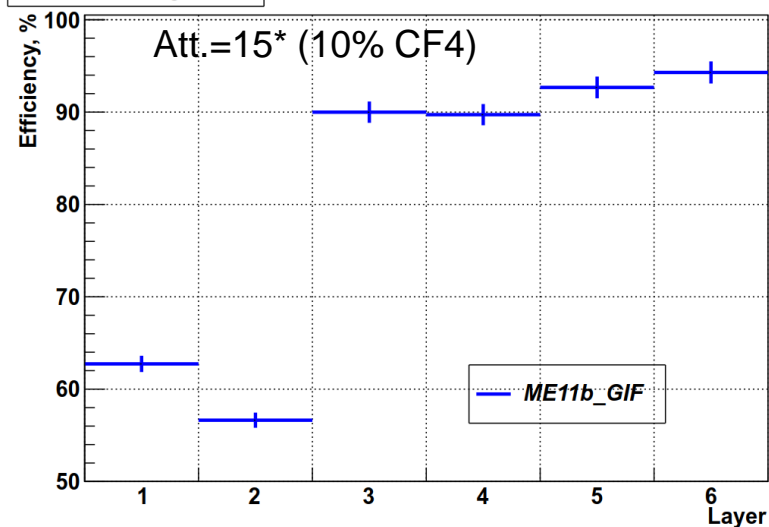
➔ Efficiency



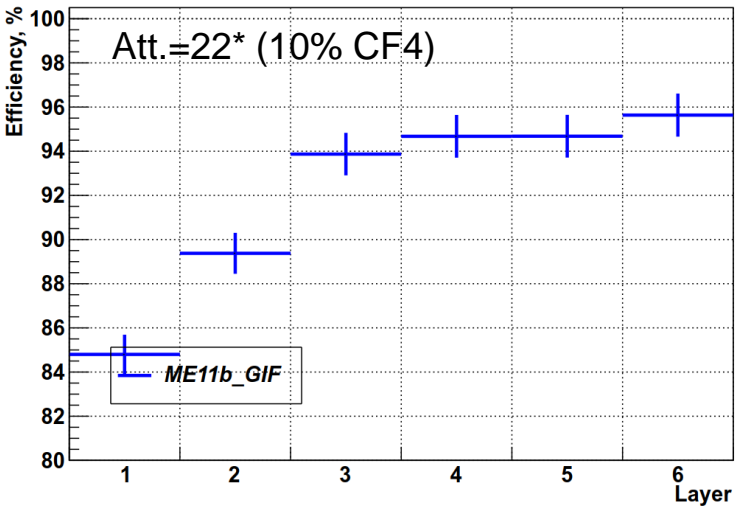
Efficiency 11b



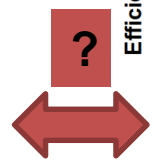
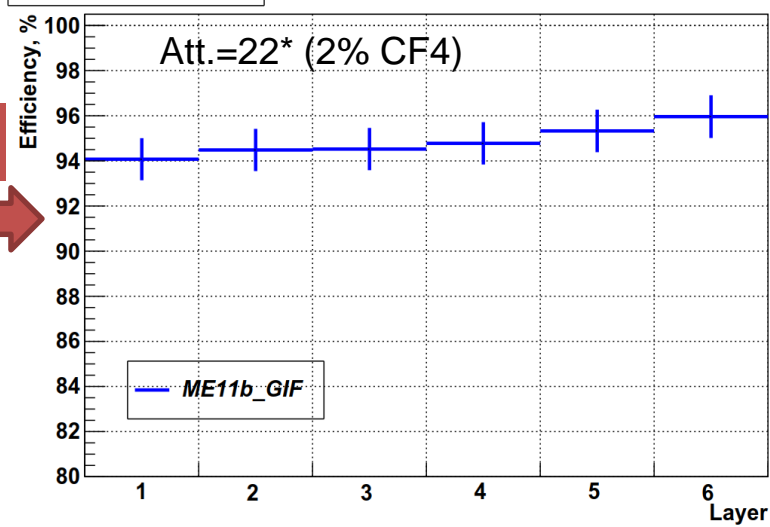
Efficiency 11b

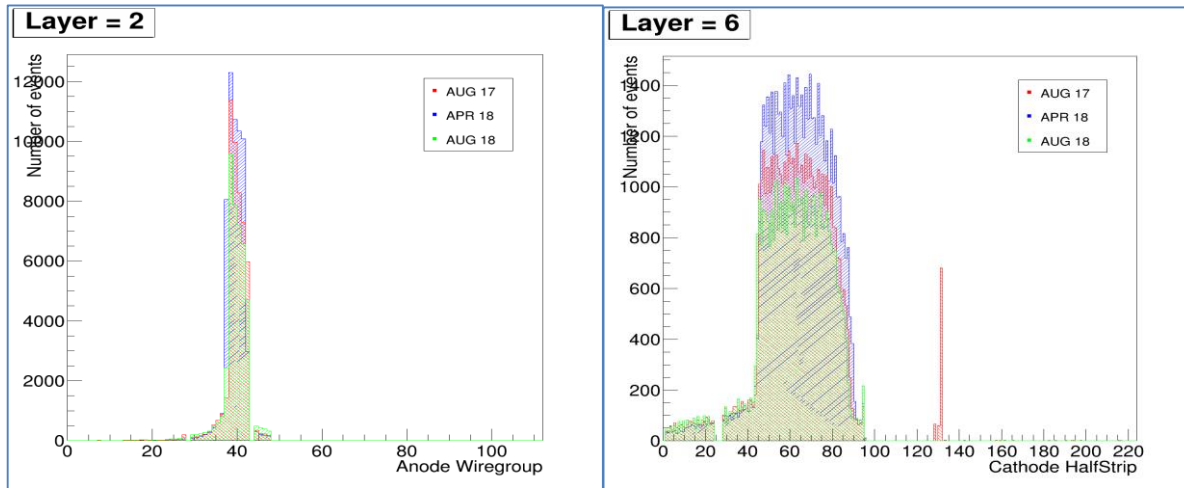


Efficiency 11b

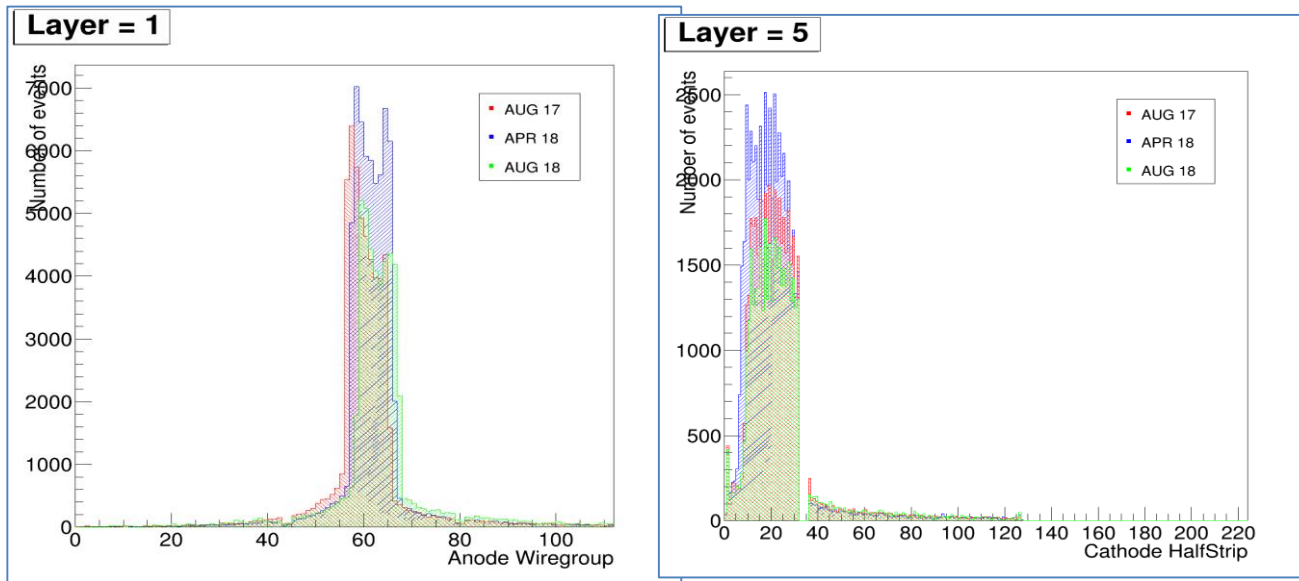


Efficiency 11b





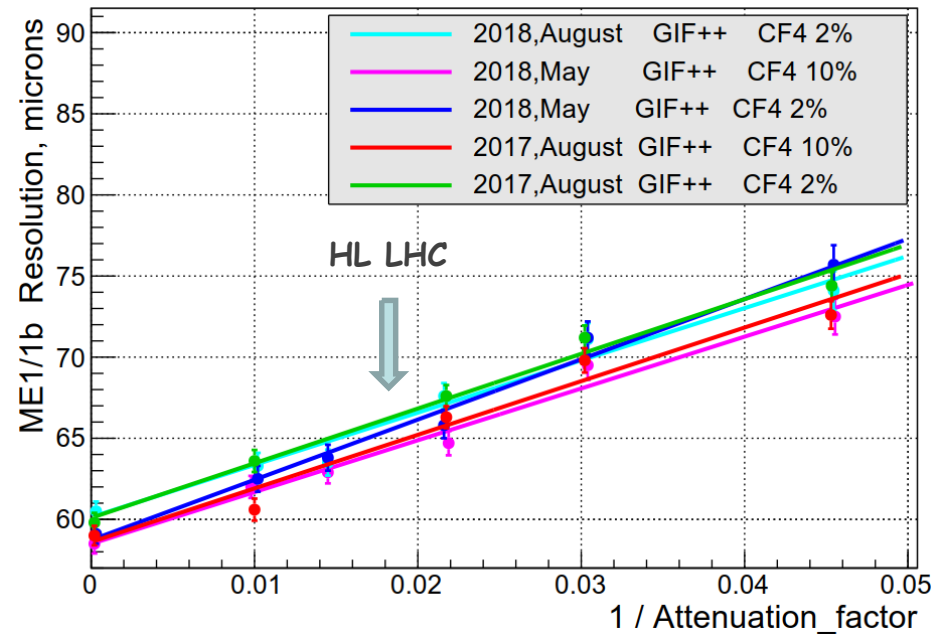
Scint. Position in ME1/1



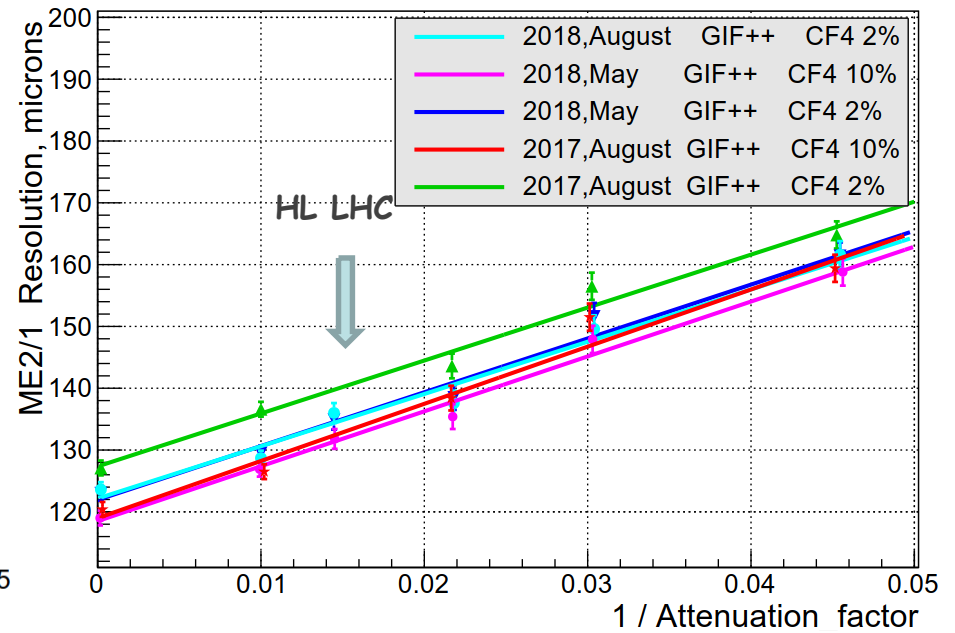
Scint. Position in ME2/1

CSC Spatial Resolution vs inversed Attenuation factor

ME1/1



ME2/1

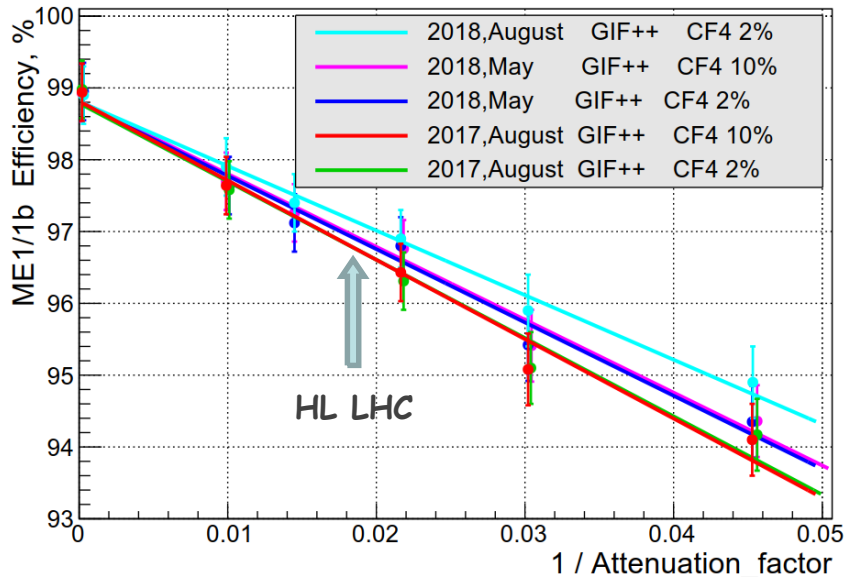


$$1/\sigma^2(\text{Station}) = 6/\sigma^2(\text{layer})$$

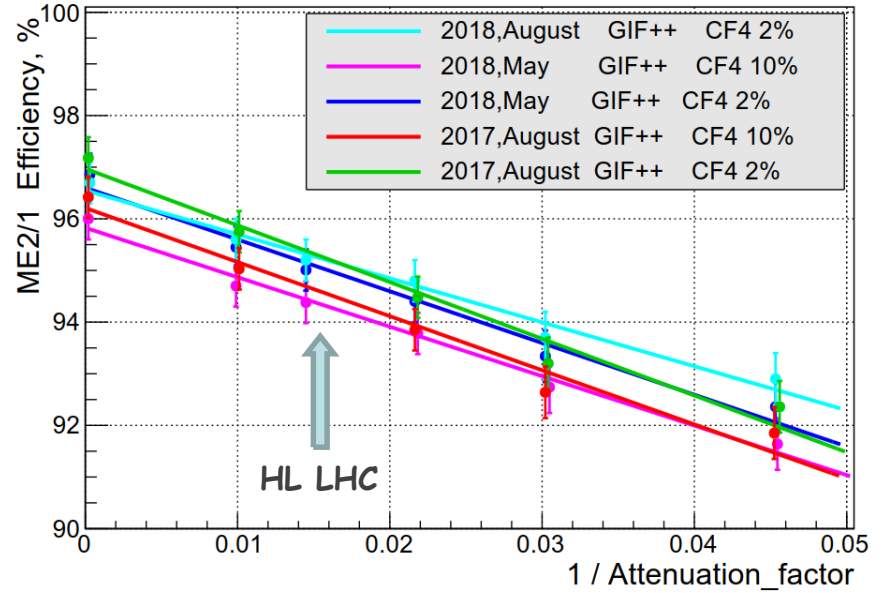
$$1/\sigma^2(\text{Station}) = 3/\sigma_1^2 + 3/\sigma_2^2$$

RecHit Efficiency vs inversed Attenuation factor

ME1/1



ME2/1

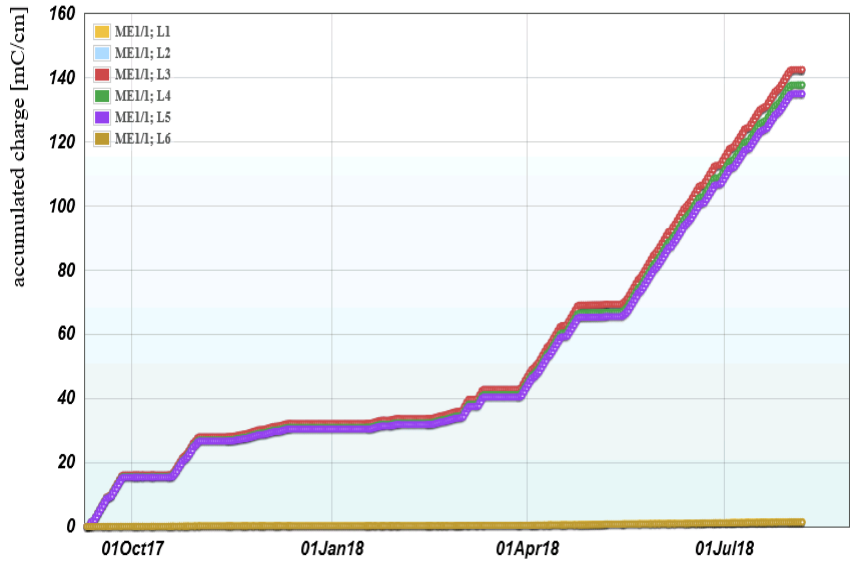




ME1/1_GIF accumulated charge with 10% and 2% CF4 gas mixture



ME11



| TB | date for Q estimate | Q(ME1/1) [mC/cm] | Q(ME2/1s1) [mC/cm] |
|---|---------------------|------------------|--------------------|
| June16 | 08.06.16 | 83 | 86 |
| Aug16 | 10.08.16 | 146 | 147 |
| May17 | 15.05.17 | 277 | 286 |
| Jul17 | 07.07.17 | 316 | 324 |
| Aug17 | 13.08.17 | 332 | 341 |
| Irradiation with Ar+CO2+CF4 (40%+58%+2%) | | | |
| May18 | TB1 | 400 | |
| Aug18 | TB2 | 467 | |

