# Impact of Dichroic Filters on the FD1-XA PDE: Experimental Study

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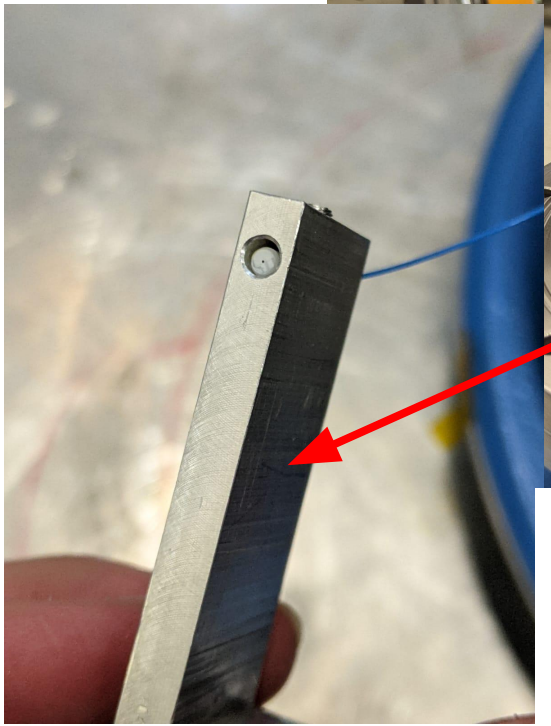
# Goals of the 2024 (ongoing) data taking campaign

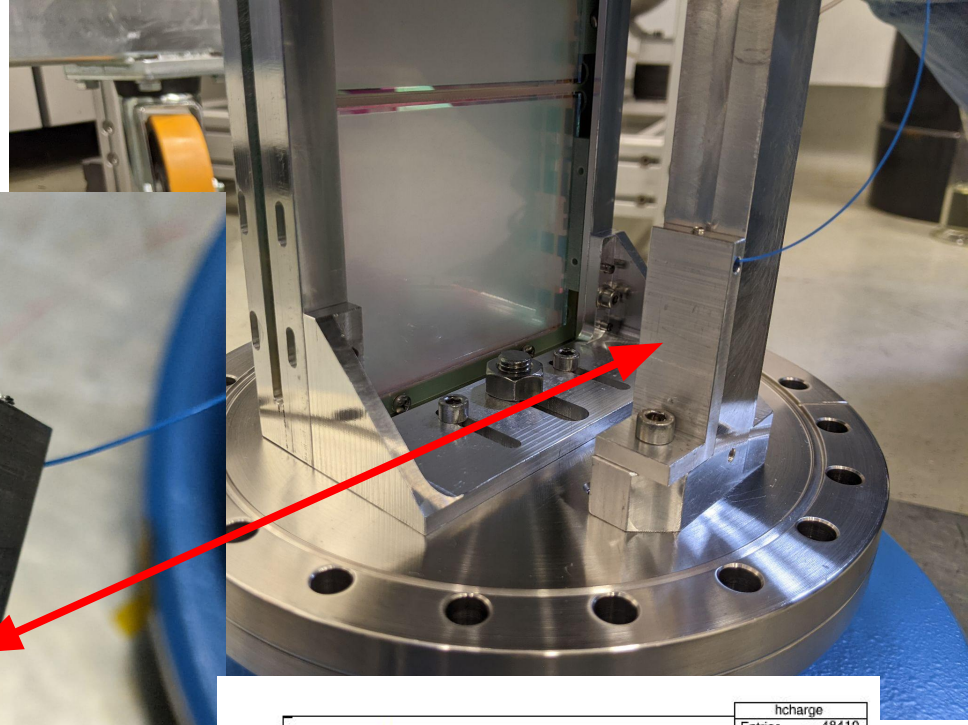
- Improve our setup facility with OF (to trigger synchronously the s.p.e. with the LED light pulse)
- Confirm/disprove the results achieved in 2023 (claimed a raw PDE of ~5% for the improved XA-FD1 configuration)
- Assess the impact of the DF on the XA-FD1 PDE.
- Study aging and multiple cooling down effects of
  - LG
  - ZAOT DF
  - pTP coating
- Monitor the setup and the XA stability over multiple days (as done in past campaigns).

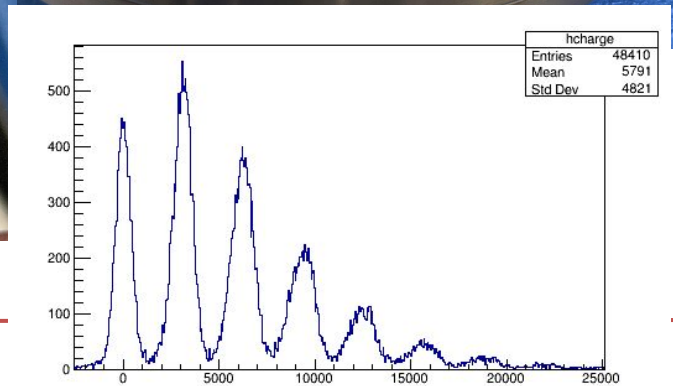
# XA-SC - MiB test setup upgrade

- added **optical fiber**
  - mounted next to the source rail
  - we can now **trigger on sphes** instead of searching for them in alpha pretrigger

- new **second stage** (warm) electronics **with transformer bypassable**
  - 3% undershoot
  - **now under study**

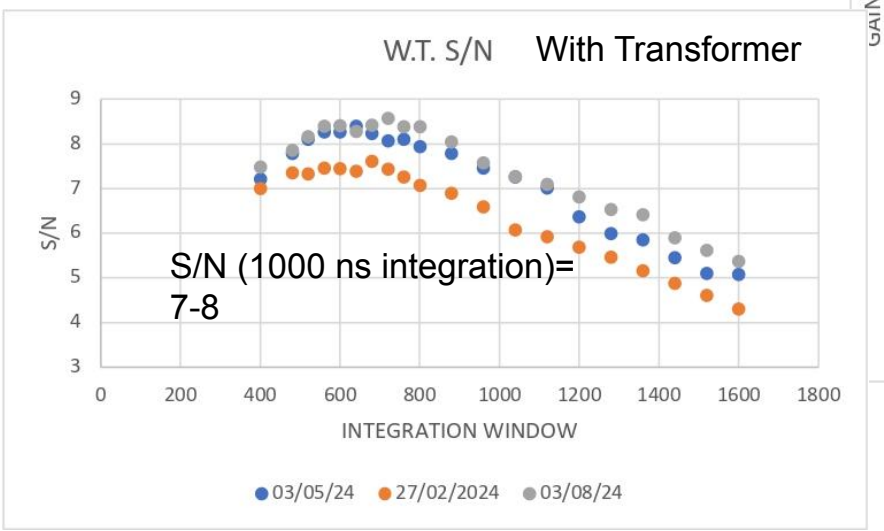


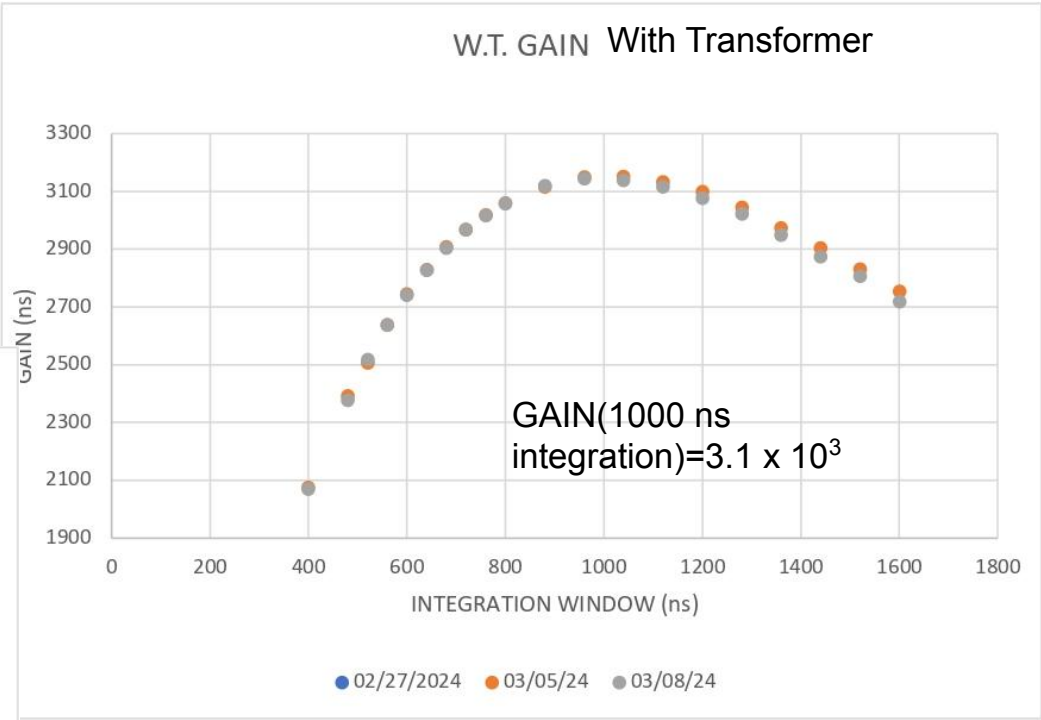




# XA-SC - MiB setup upgrade

- electronics gain is stable throughout the measurement campaign
- **consistent within 2-3 % with the value adopted in 2022-2023 (spe search in the pretrigger)**



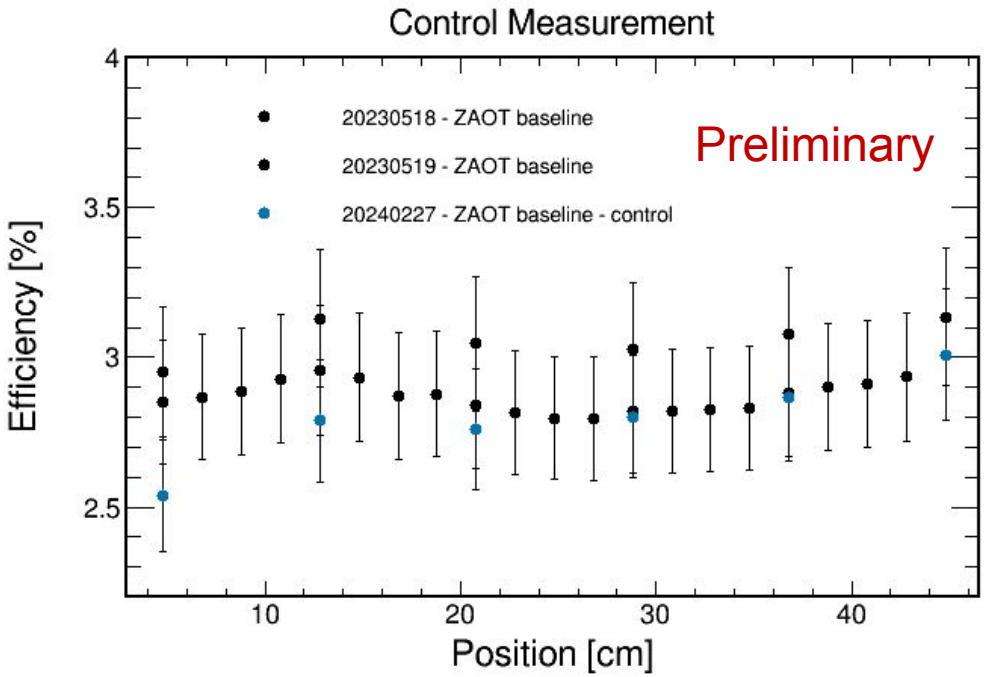
# XA-SC - control measurement

All results presented here are ZAOT Baseline:

- ZAOT DF,
- WLS no cut,
- no Viquity lined blocks btw. SiPMS

All Results are

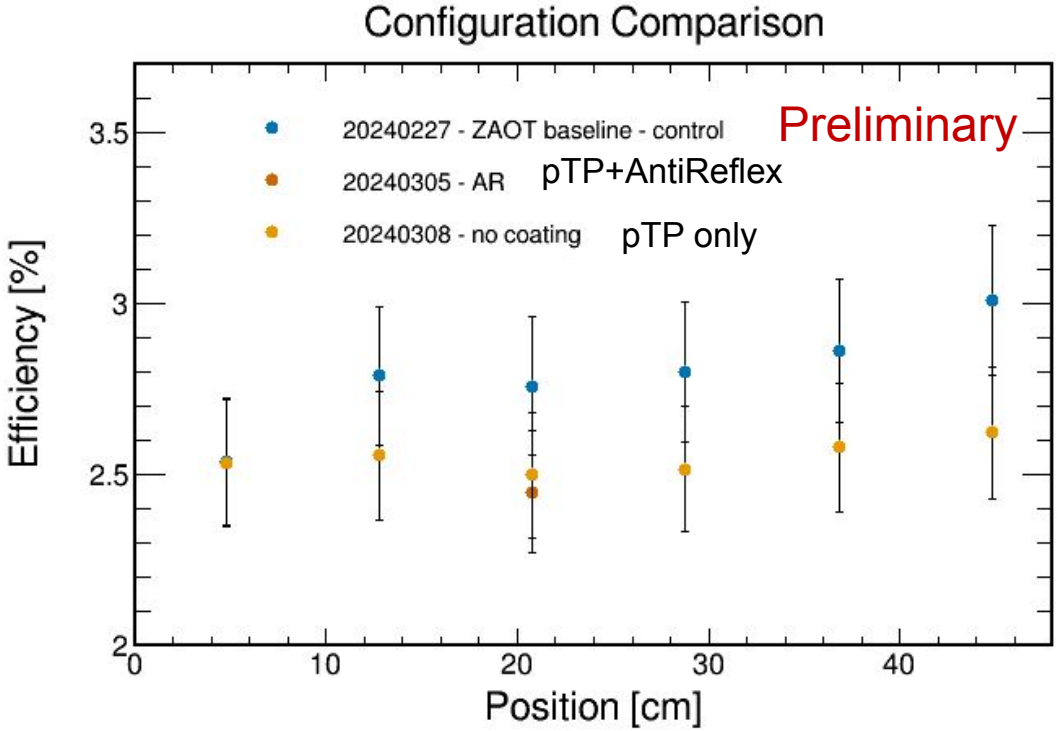
- Preliminary
- **xt** and **LAr purity uncorrected**



# XA-SC - measurements without Dichroic Filters

Available two set of ZAOT glass substrates (adopted for FD2 M0 & M1 DF)

1. with/w.o. antireflection (AR) coating (substitutes DF) +pTP on other side
2. pTP only and no AR coating

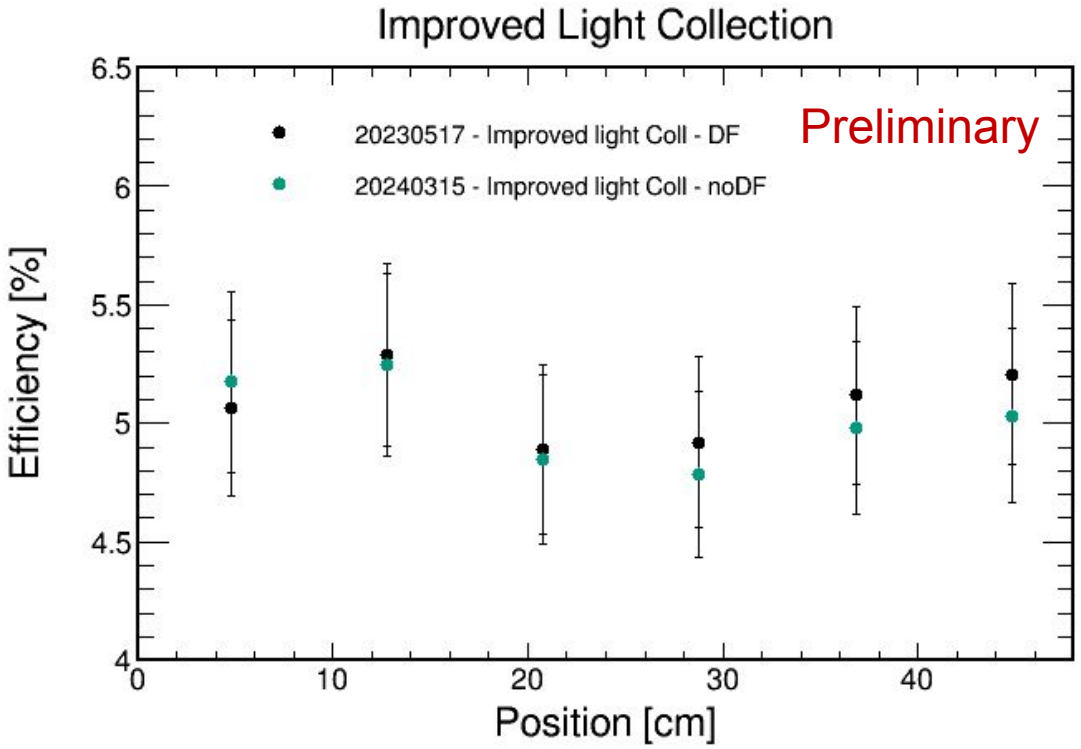


# XA-SC - meas w/o DF, improved light collection

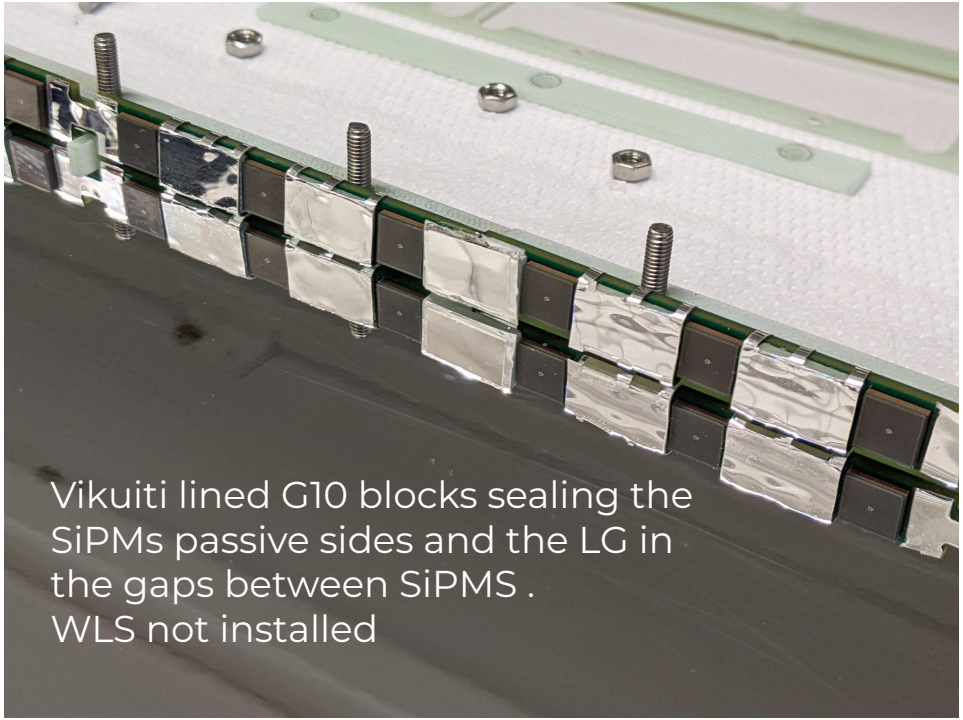
Lightguide (LG) from the pDUNE-HD batch.

Improved light collection

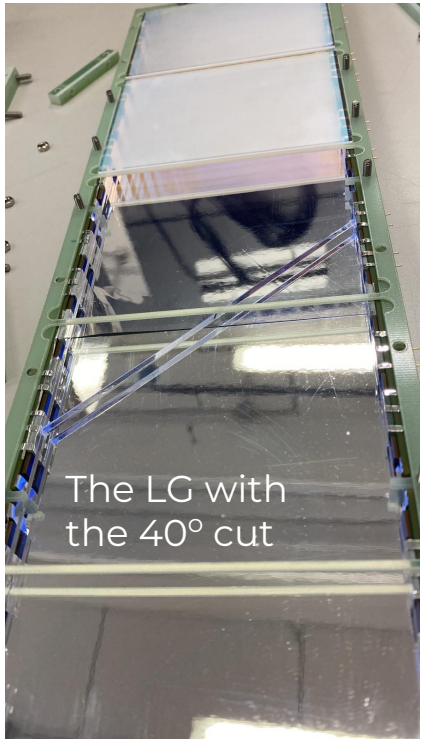
1. LG with 40° cut
2. LG & SiPMs sides optically sealed by Vikuiti lined blocks



# XA-SC - improved light collection configuration



Vikuiti lined G10 blocks sealing the SiPMs passive sides and the LG in the gaps between SiPMS .
WLS not installed

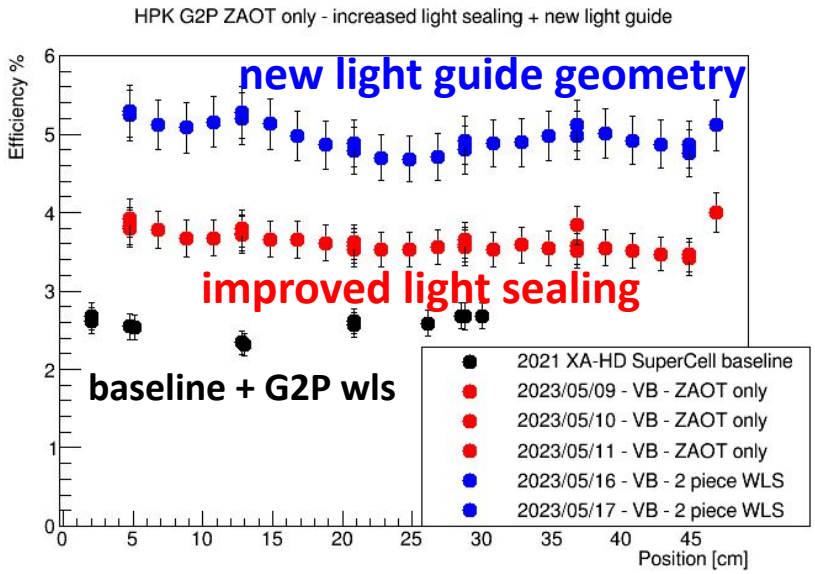


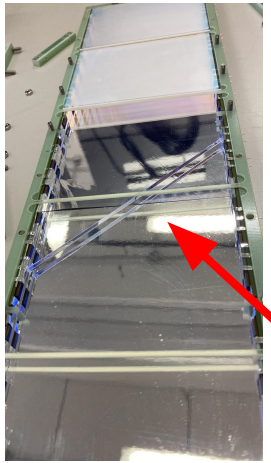
The LG with the 40° cut

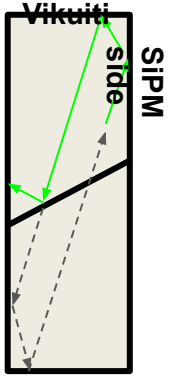
# FD1: Modified WLS-LG geometry (2023 results)

Major improvement of the FD1 XA PDE cutting the WLS-LG in two parts by a 40° cut and improved LG light-sealing

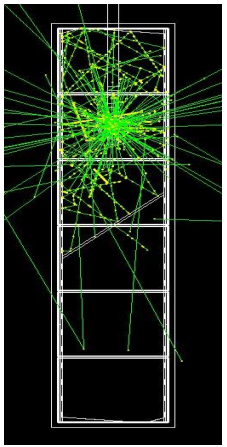
- optimization via optical sims
- measurements with MiB setup





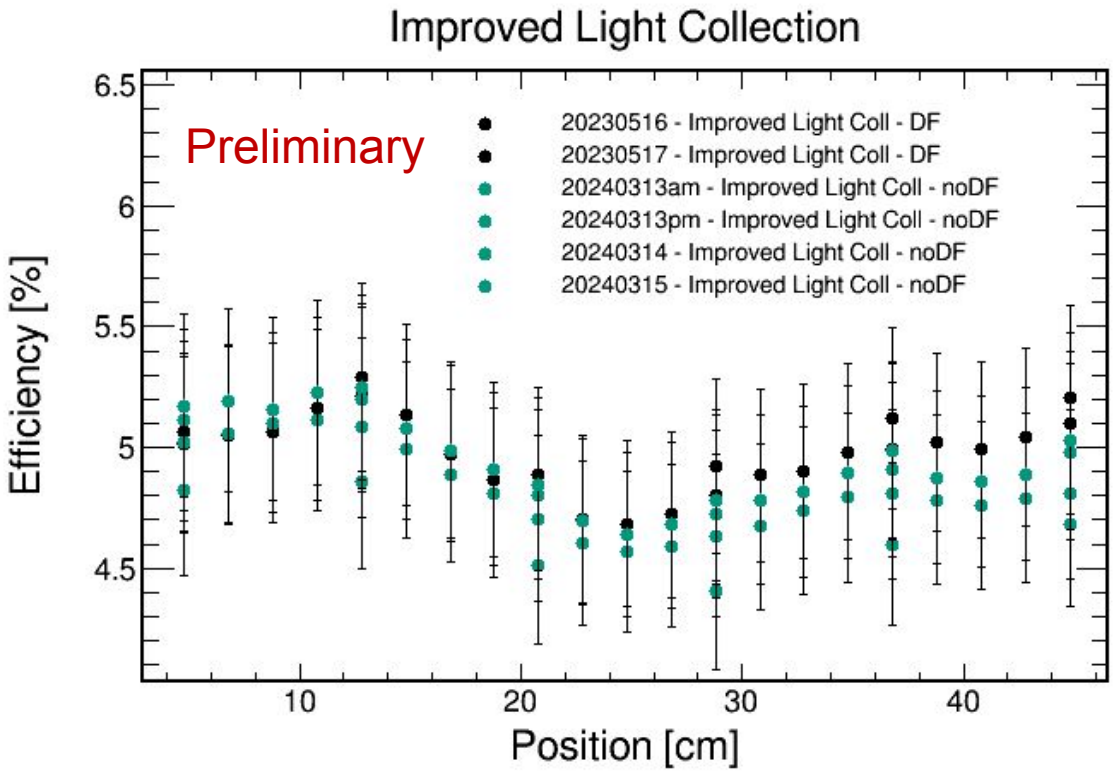

40° cut in the middle with Vikuiti applied



# XA-SC - integrated charge increase over time

- we usually observe an increase in integrated charge overnight
  - <=~10%
  - converges at a value
  - further study needed

- cause is not known
  - nitrogen impurities should have a lower impact



# Conclusions and next steps

- Control measurements are compatible with last years equivalent
- DFs in the baseline SC increase integrated charge ~10-20%
- DFs in the improved light collection design increase integrated charge ~5%

Next steps:

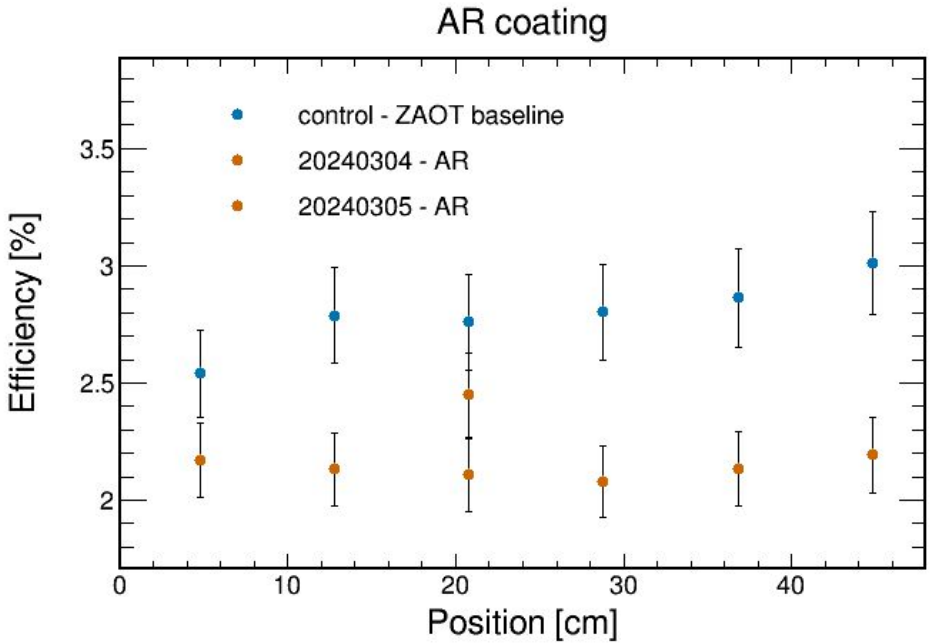
- study of the time dependence of the integrated charge
  - impurities other than nitrogen? (from added equipment?)
  - xt?
  - …other?

- New control measurement on the improved light collection design (ongoing today)

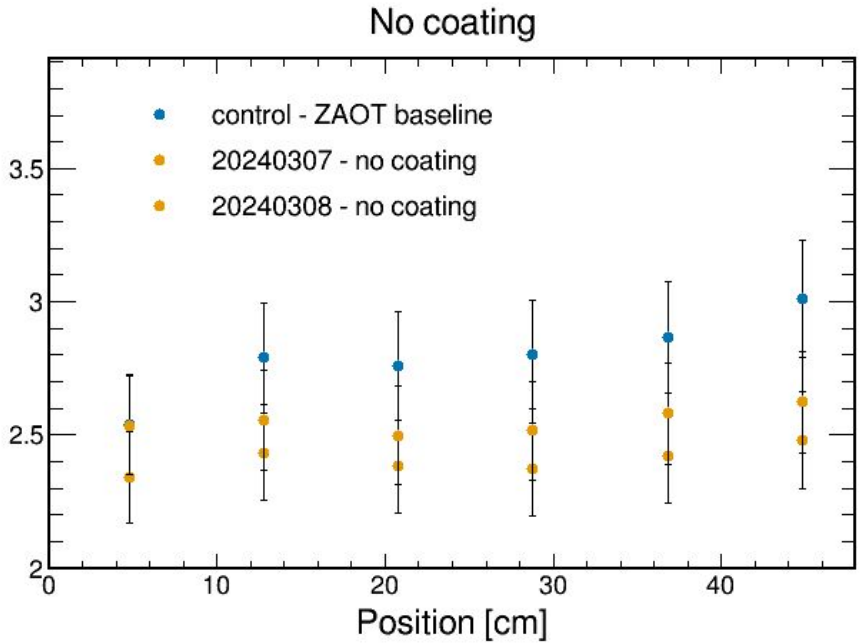
- new measurements will be decided based on the results from the current one
  - need further data on time dependence?
  - different configurations?

# Backup

# XA-SC - integrated charge increase over time




+10%




+5%