

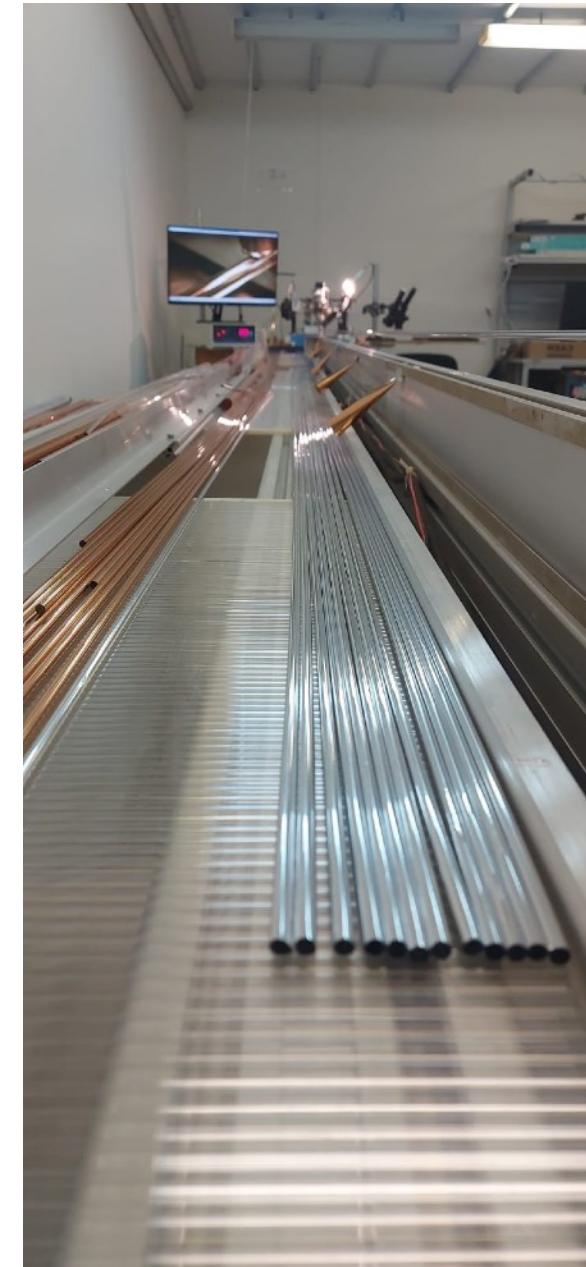
# Статус работ по ST-barrel и планы на 2024

29.02.2024

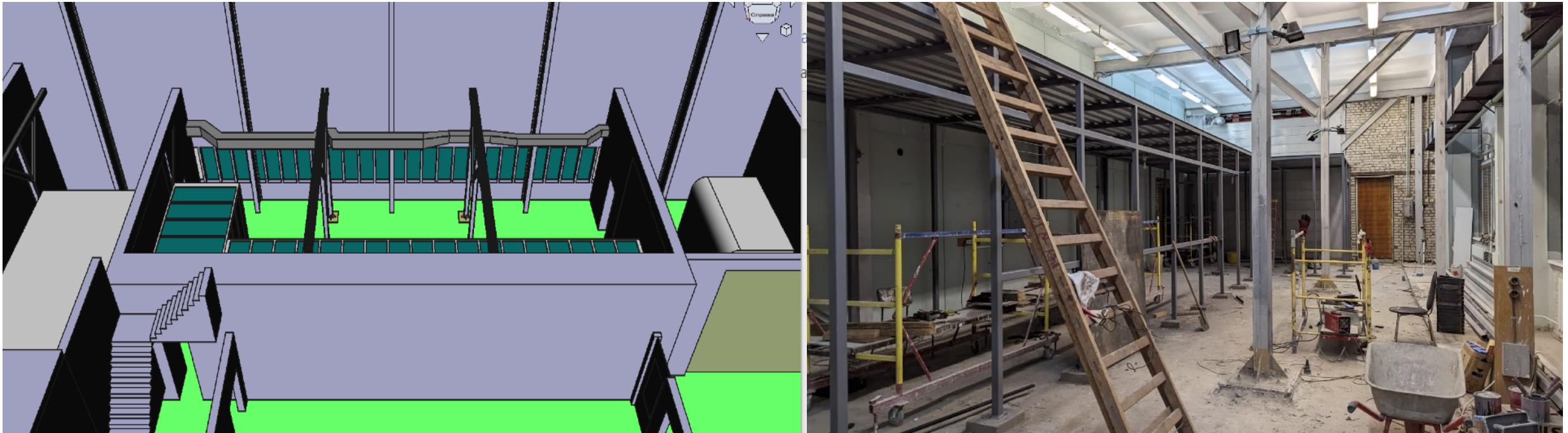
Т.Еник

# STRAW production line

- Производительность- 1м/мин
- Длина- 5.5м
- Диаметр-от 10
- Толщины пленки-36 мкм
- Пленка доступна в РФ
- Толщина напыления 50-100нм
- Напыление производится в РФ
- Изготовлено ~20km straw
- Установленно ~8000 straw
- После 10 лет эксплуатации неработающих- 3 straw
- Число сотрудников-10FTE



# NEW STRAW production line and assembling place



- Площадь ~200 кв.м., чистое помещение~100кв.м
- Длина производственной линии~12м
- Срок сдачи –начало 3 квартала 2024 года
- Пуско-наладочные работы-начало 4 квартала 2024 года
- Закуплены необходимые материалы и оборудование
- Планируемый объем ~60км straw

# Testbeam Schedule 2023

[ ] North Area Schedule v0.5.0; Beamlines H6, H8; Status 2023-03-13 18:30 (UTC)

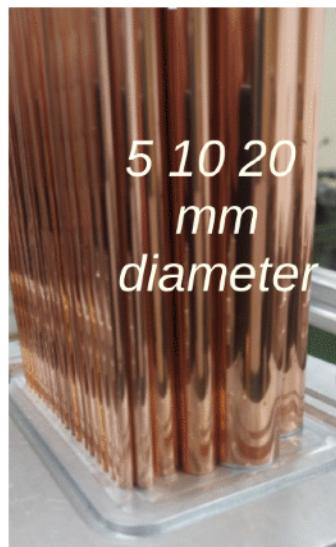
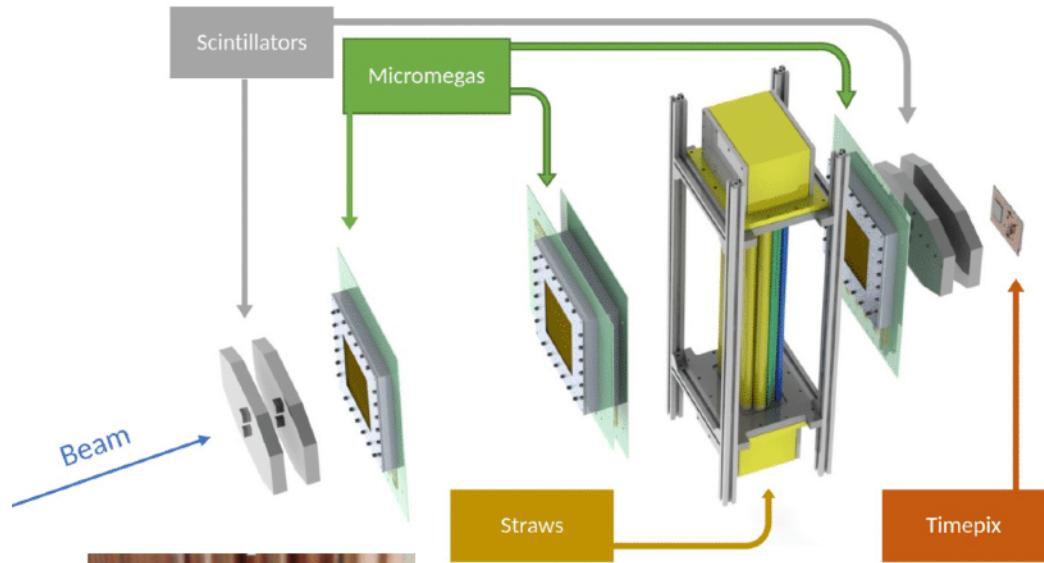
April		May		June		July		August		September		October																		
CW 14	CW 15	CW 16	CW 17	CW 18	CW 19	CW 20	CW 21	CW 22	CW 23	CW 24	CW 25	CW 26	CW 27	CW 28	CW 29	CW 30	CW 31	CW 32	CW 33	CW 34	CW 35	CW 36	CW 37	CW 38	CW 39	CW 40	CW 41	CW 42	CW 43	
Week 13	Week 14	Week 15	Week 16	Week 17	Week 18	Week 19	Week 20	Week 21	Week 22	Week 23	Week 24	Week 25	Week 26	Week 27	Week 28	Week 29	Week 30	Week 31	Week 32	Week 33	Week 34	Week 35	Week 36	Week 37	Week 38	Week 39	Week 40	Week 41	Week 42	Week 43

[ DRAFT ] North Area Schedule v0.5.0; Beamlines H2, H4; Status 2023-03-13 18:30 (UTC)

Calendar Months /		April		May		June		July		August		September		October																
Weeks (Mon-Mon)	CW 16	CW 17	CW 18	CW 19	CW 20	CW 21	CW 22	CW 23	CW 24	CW 25	CW 26	CW 27	CW 28	CW 29	CW 30	CW 31	CW 32	CW 33	CW 34	CW 35	CW 36	CW 37	CW 38	CW 39	CW 40	CW 41	CW 42	CW 43		
Weeks (Wed-Wed)	Week 16	Week 17	Week 18	Week 19	Week 20	Week 21	Week 22	Week 23	Week 24	Week 25	Week 26	Week 27	Week 28	Week 29	Week 30	Week 31	Week 32	Week 33	Week 34	Week 35	Week 36	Week 37	Week 38	Week 39	Week 40	Week 41	Week 42	Week 43		
H2	PPE152	H2	Regular	Regular		CALICE SCW AHCAL 16d	PLACE HOLDER 7d	RADICAL	MUONE ECAL 10d	EP FTS 4d	ATLAS ZDC 7d																			
	PPE172	H2	Regular	Regular		CMS HF 7d																								
H4	PPE154	H4	Regular	Regular		RDS1		LHCb ECAL 14d																						
	PPE174	H4	Regular	Parasitic		STRAW TRACKER RD 16d		RDS1																						
	PPE154	H4	Regular	Regular		GIF++ 16d		MINICACTUS 7d		STRAW TRACKER RD 14d		FASER NU 7d	RDS1	PLACE HOLDER 7d	PLACE HOLDER 14d															
	PPE174	H4	Regular	Parasitic				GIF++ 14d																						

STRAW TRACKER R&D

# The setup:



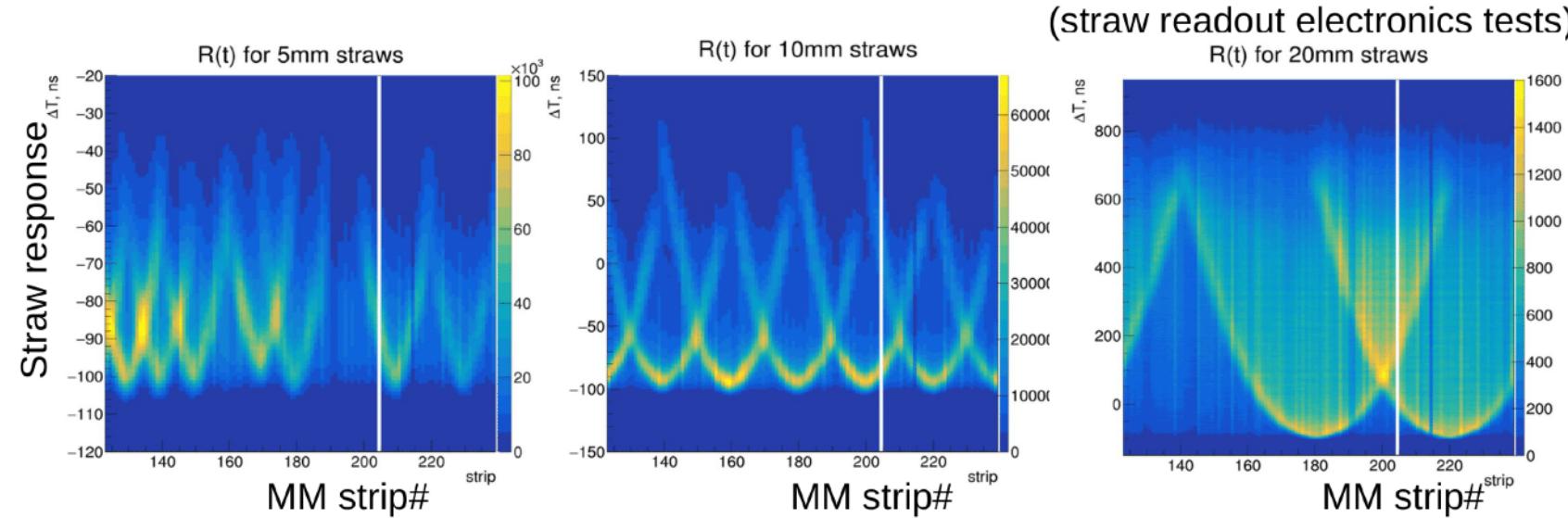
## Reference tracking:

- MM detectors (250 um) + Tiger readout (Torino University)
- Timepix4 – 50um x 50um (many thanks to LHCb VELO colleagues Martin van Beuzekom and Kevin Heijhoff for helping us to get the data!)

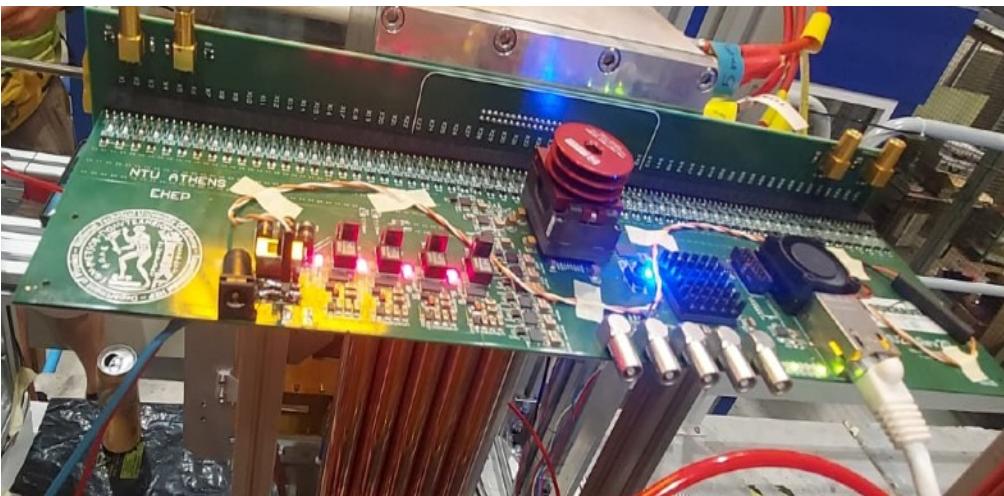
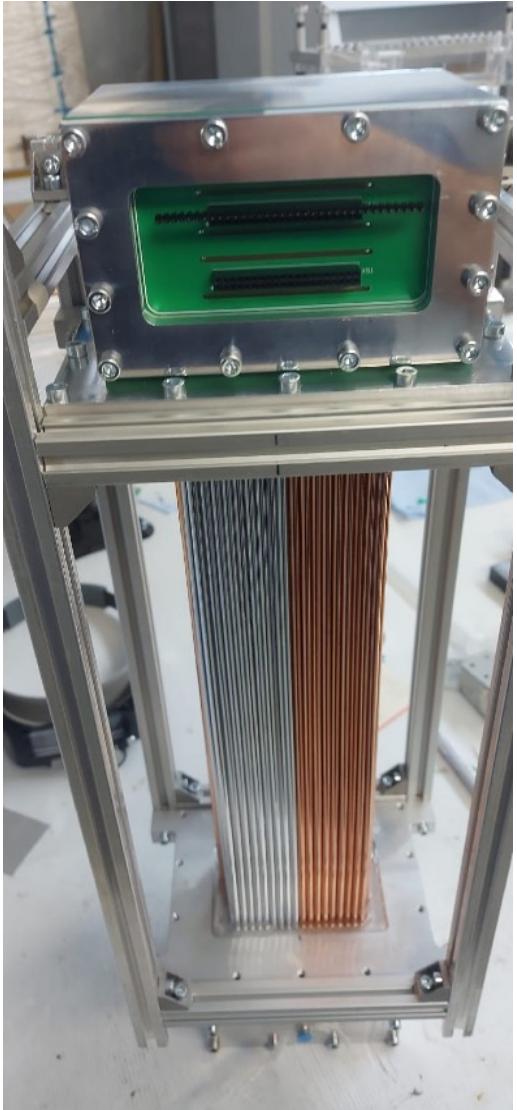
## Under test: a combined straw tracker prototype with the Tiger readout

Good data taking with MM+straw and success in integrating the Timepix4

And as usual many thanks to the RD51 team!

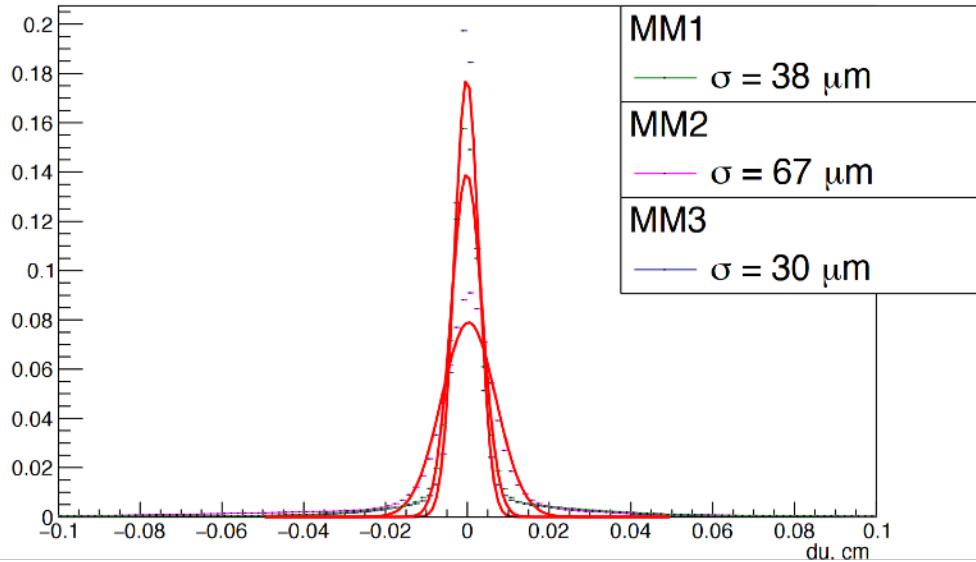


# Текущая активность. TIGER vs VMM3



# Reference tracking and timing

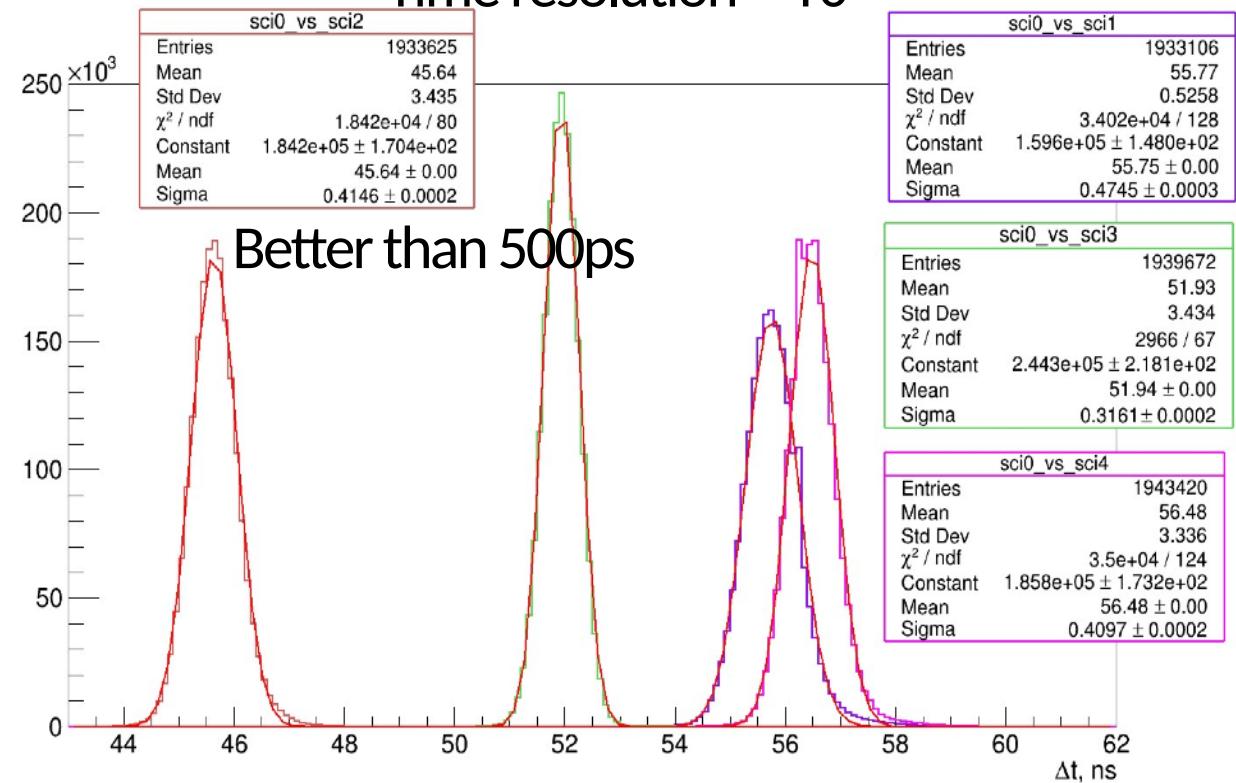
## Reference tracking -- residuals



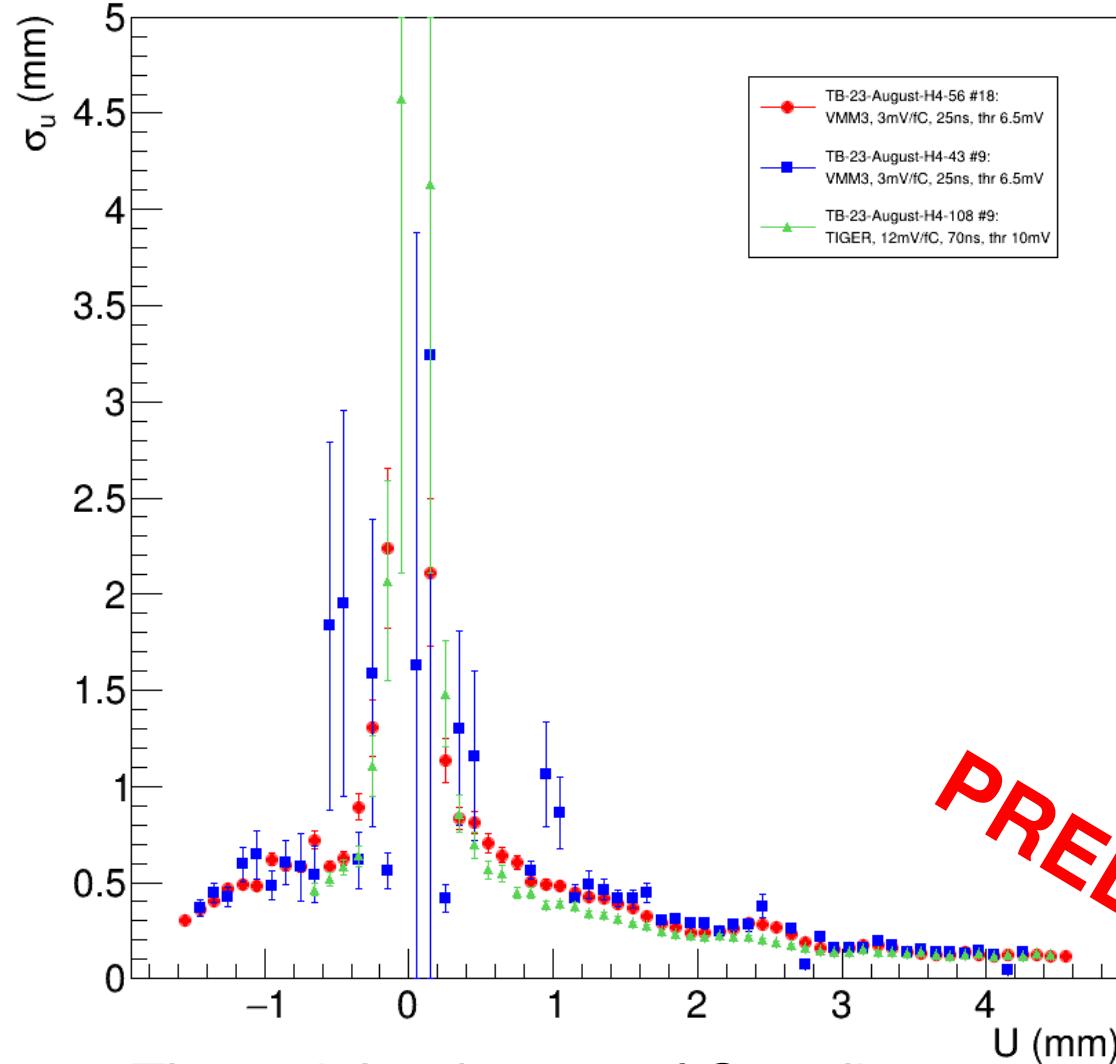
Work ongoing:

- accounting for the reference system uncertainty in the TB analysis
- improvement of the reference tracking resolution

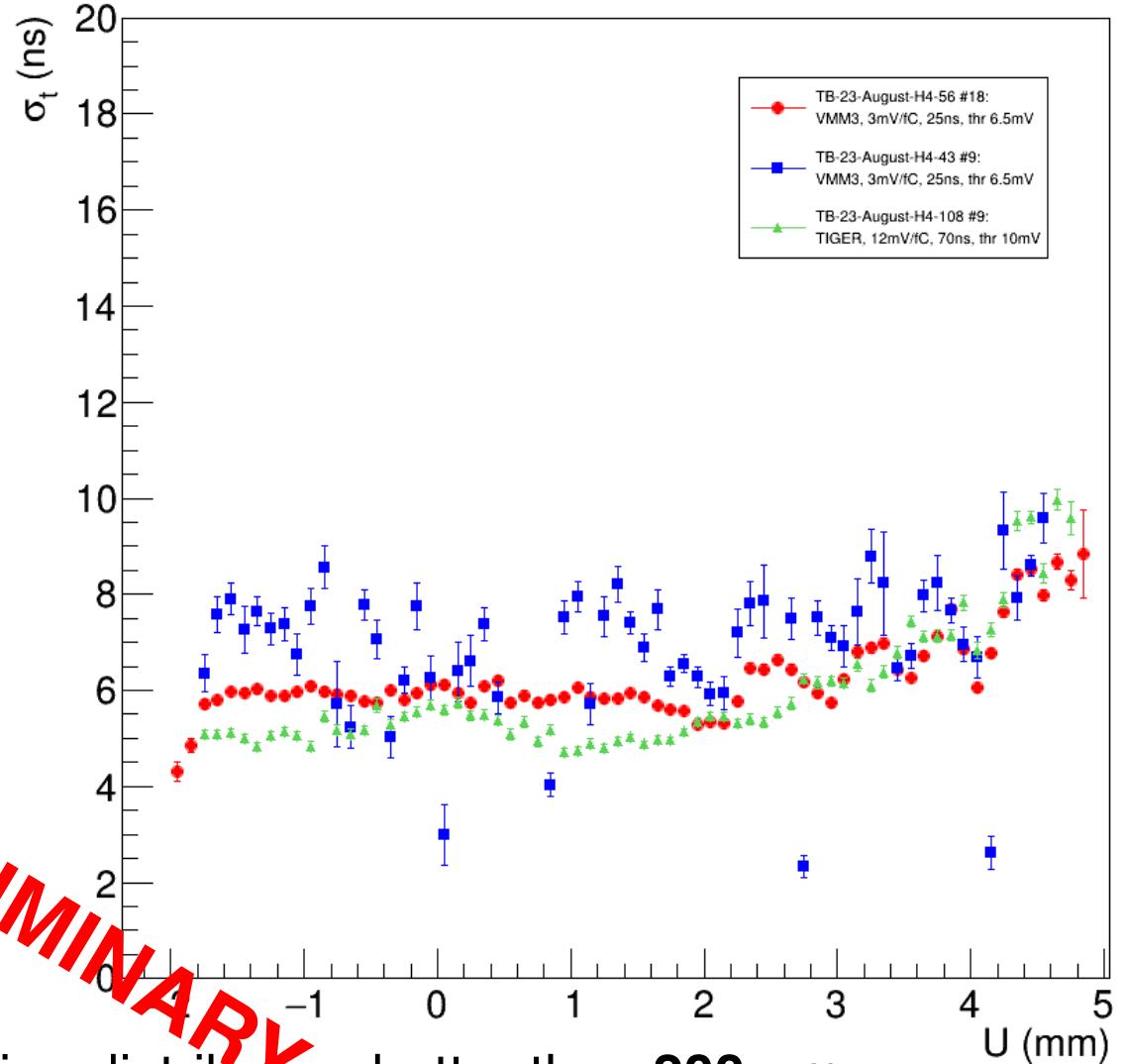
## Time resolution -- T0



# 10mm Straw Resolution



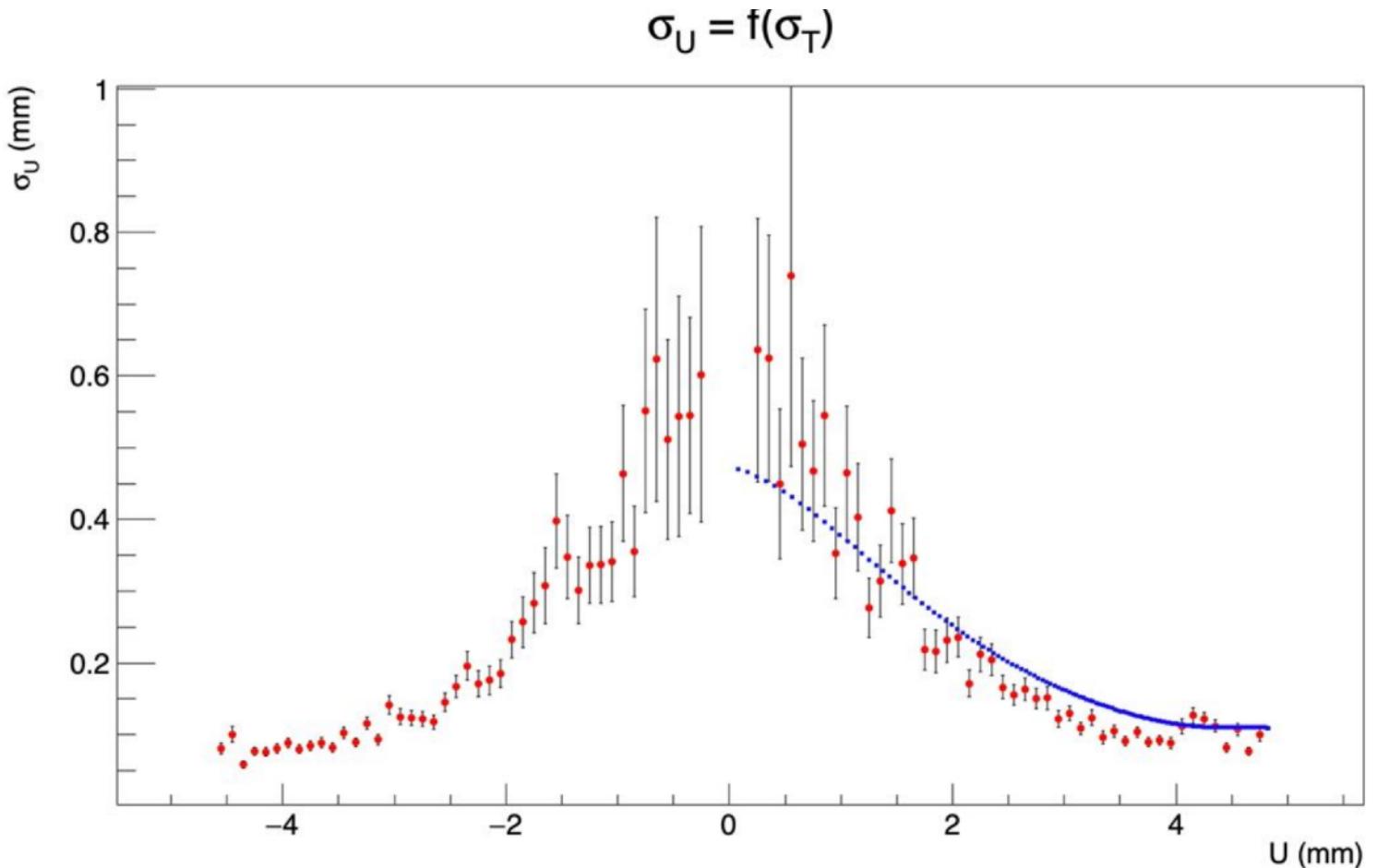
The weighted mean of Coordinate resolution distribution better than **200  $\mu$ m**  
The best time ‘resolution’ is about **4-5 ns**



Analysis ongoing

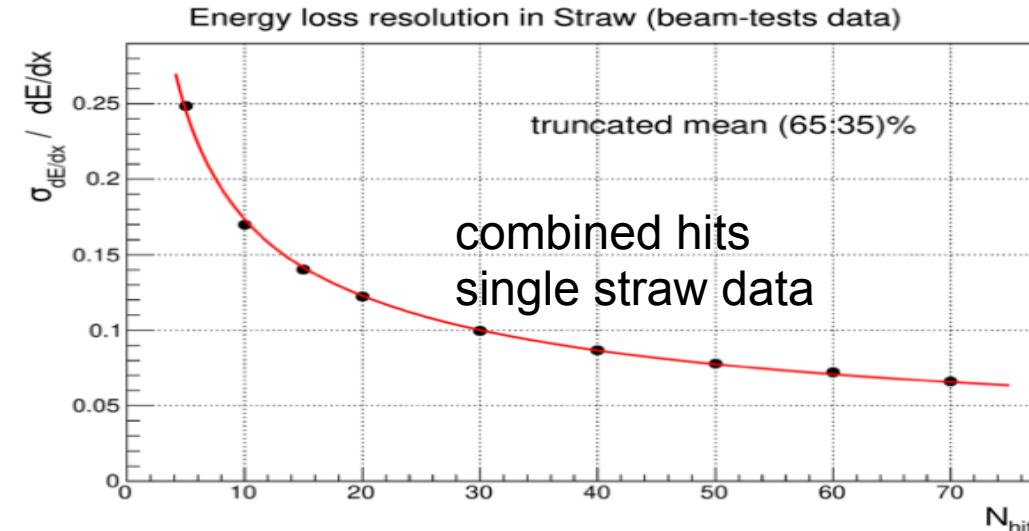
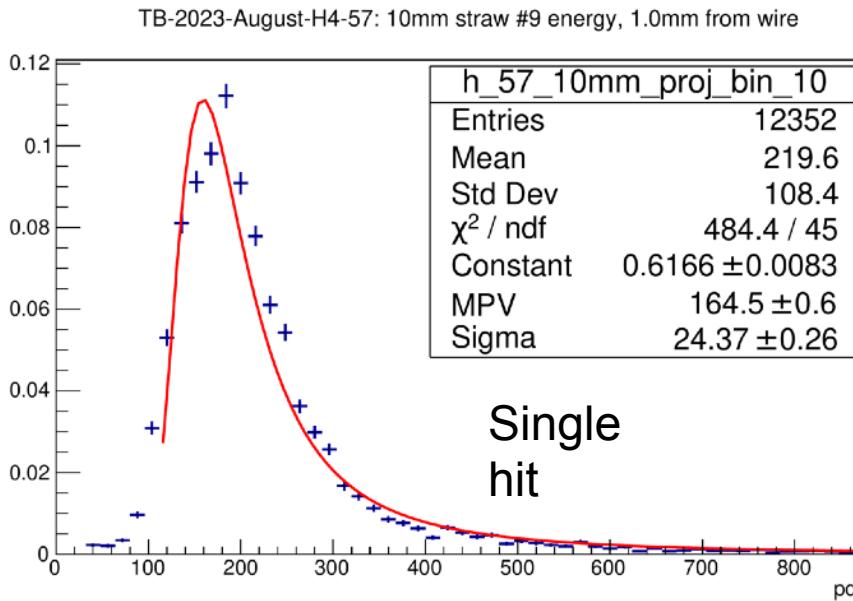
# Validation with NA62 data

- good agreement between two independent analysis methods
- results similar to the resolution obtained with straw prototype and VMM3/TIGER



# Charge measurements – work in progress

## MIP with VMM3 (not calibrated response)



**Simulation studies (Geant4) are ongoing for MIP and other particles @subGeV**

## Measurements @subGeV are scheduled at PS T9

[DRAFT] Schedule Runs 0.7.0 :: Status 2024-02-27 08:23 (UTC)																																		
Calendar Months / Weeks (Mon-Mon)			March		April		May		June				July				August				September				October									
Weeks (Wed-Wed)			CW 12	CW 13	CW 14	CW 15	CW 16	CW 17	CW 18	CW 19	CW 20	CW 21	CW 22	CW 23	CW 24	CW 25	CW 26	CW 27	CW 28	CW 29	CW 30	CW 31	CW 32	CW 33	CW 34	CW 35	CW 36	CW 37	CW 38	CW 39	CW 40	CW 41	CW 42	CW 43
T8	T8	Regular	IRRAD CHARM DRAFT 20d																								CHIMERA DRAFT 14d							
T8	T8	Regular	SHIP DRAFT 19d	CMS BRIL DRAFT 7d	LHCb ECAL DRAFT 7d	PAN DRAFT 14d	FE44 FERD DRAFT 7d	STRAW TRACKER RD DRAFT 7d	VLAST DRAFT 14d	E+BOOST DRAFT 18d	CALICE SCW AHCAL DRAFT 14d	SHIP DRAFT /d	MPGDCA DRAFT /d	CMS BRIL DRAFT 7d	STCF ECAL & PID DRAFT 14d	NP06 ENUBET DRAFT 14d	EIC ePIC DRAFT 7d	SHIP DRAFT /d	HIKE SAC DRAFT 7d	NANOCA DRAFT 7d	STRAW TRACKER RD DRAFT 7d	WCTE DRAFT 19d	WCTE DRAFT 21d	WCTE DRAFT 7d	WCTE DRAFT 7d	WCTE DRAFT 7d	WCTE DRAFT 7d	WCTE DRAFT 7d	WCTE DRAFT 7d	WCTE DRAFT 7d	WCTE DRAFT 7d			
T9	T9	No Beam	TS1																								WCTE DRAFT 7d	WCTE DRAFT 7d	WCTE DRAFT 7d	WCTE DRAFT 7d				

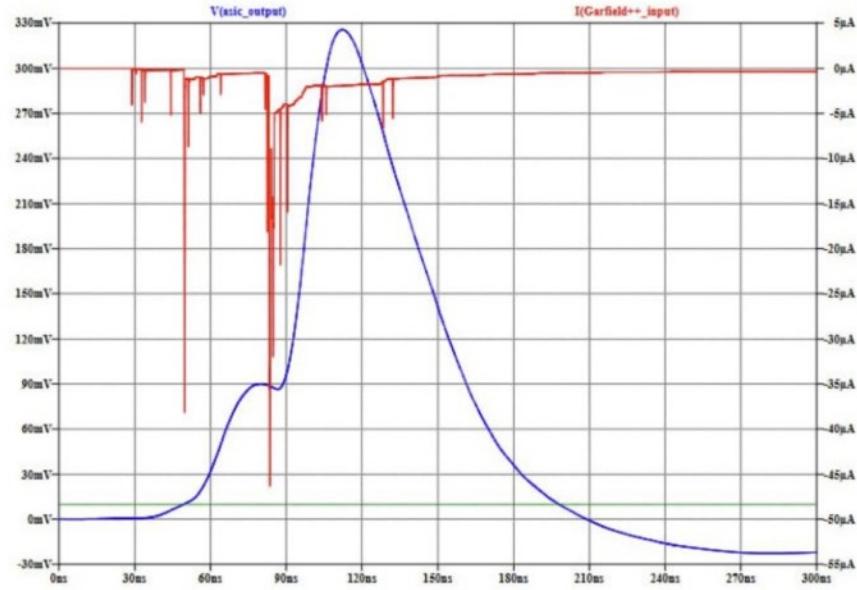
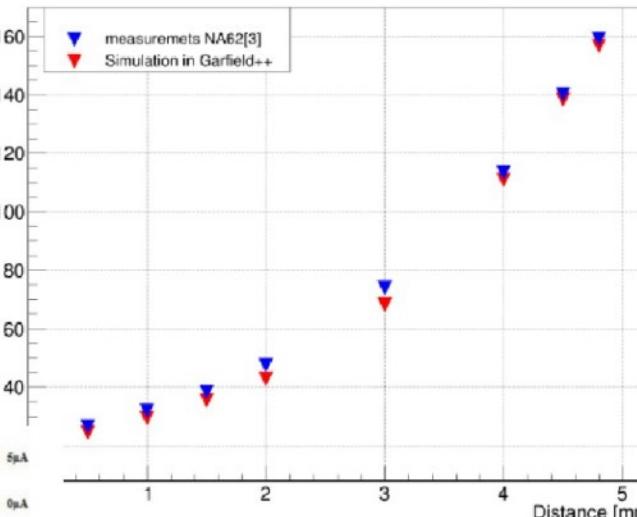
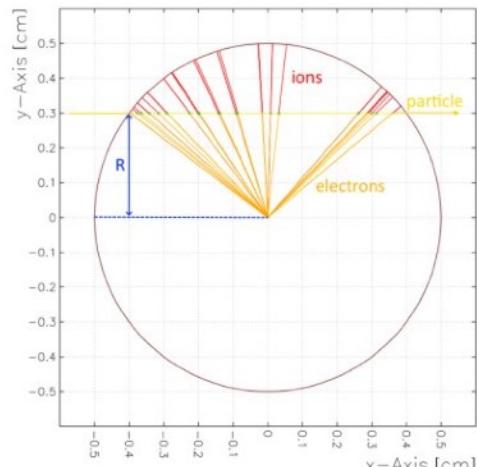
# MC simulation and comparison to the data

ISSCAST-2023

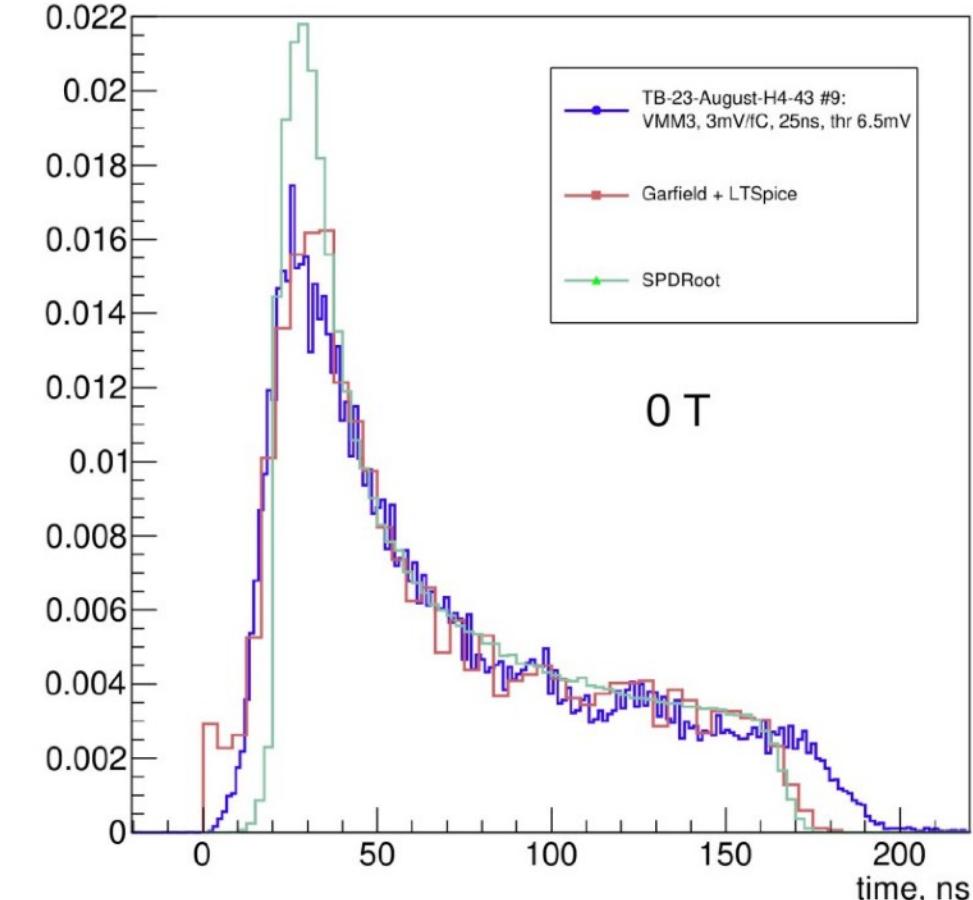
Journal of Physics: Conference Series

**GARFIELD + LTSpice**

2642 (2023) 012005 doi:10.1088/1



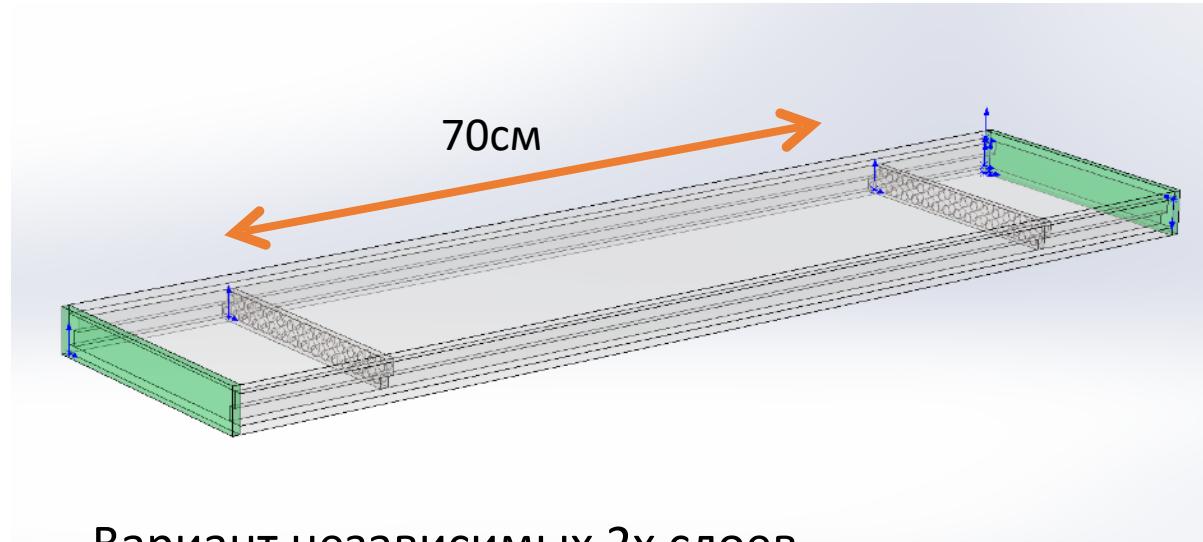
re 7. MPV from distance to wire.



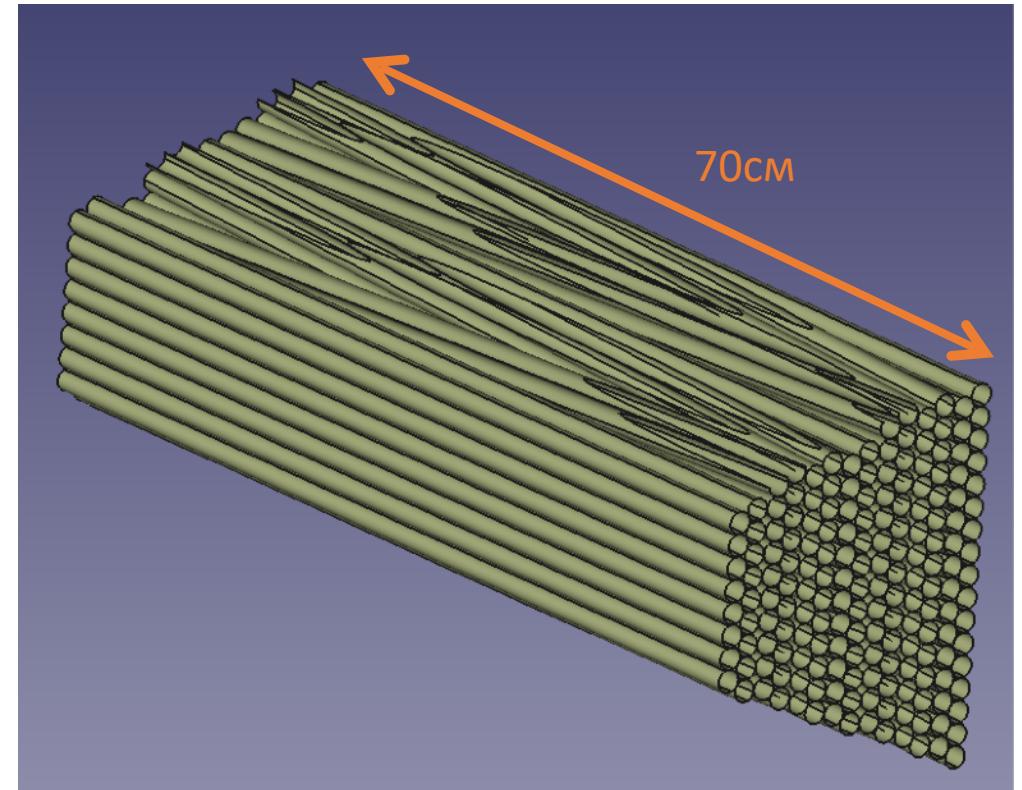
Work ongoing:

- better description of the straw impedance in LTSpice
- different electronics models
- better description on the charge

# Прототипирование

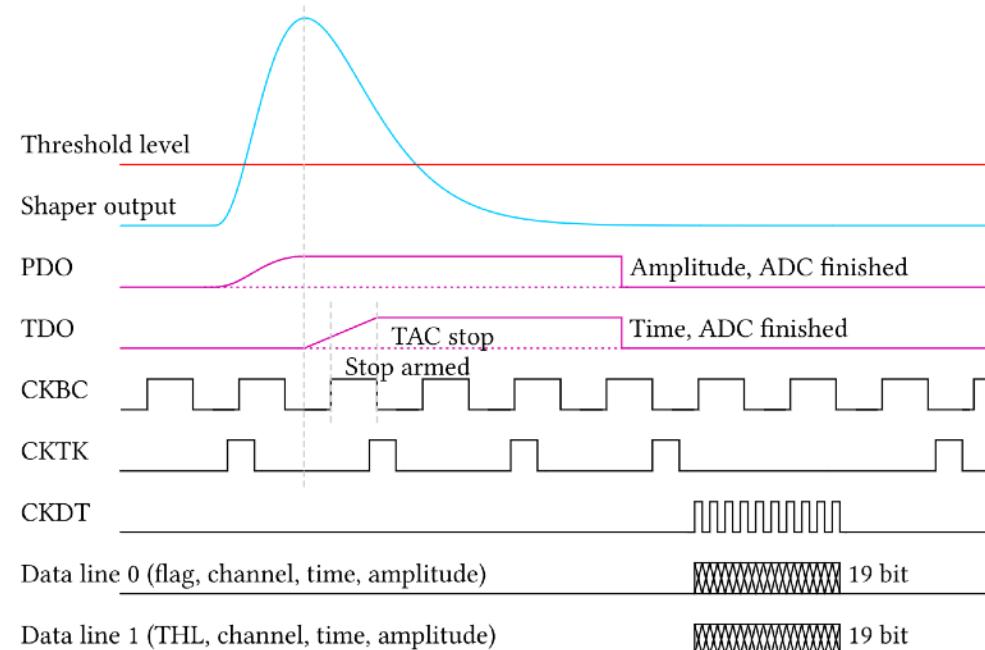
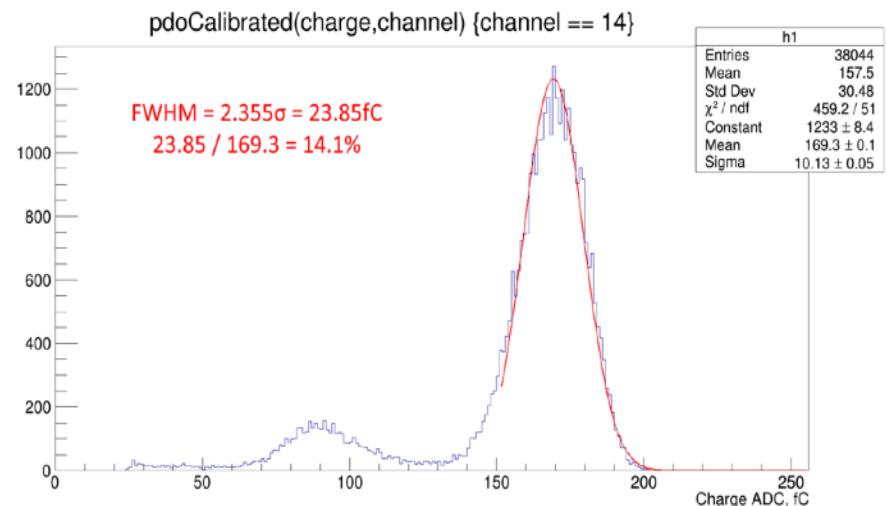
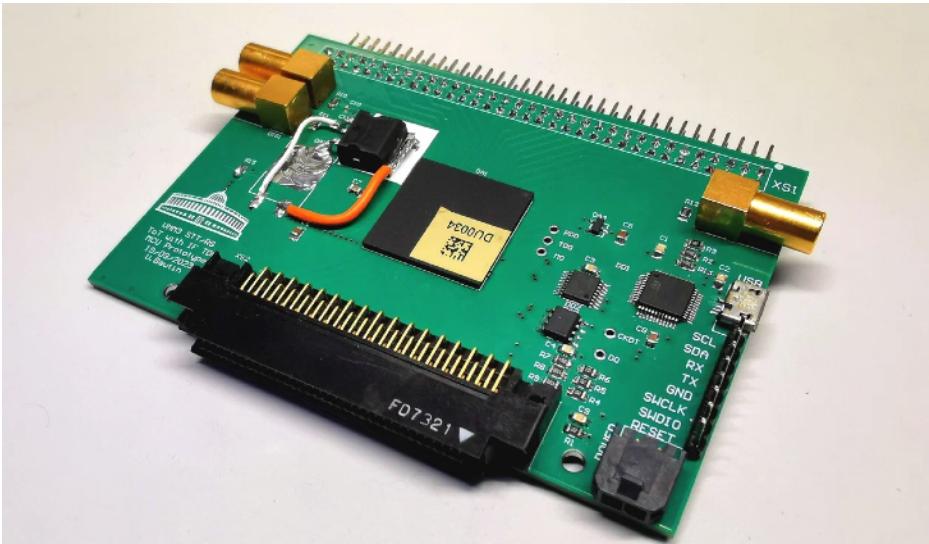


Вариант уменьшенной пирамиды



# Электронное R&D

Плата на VMM3(3a) на микроконтролле.



# FEE на попаме чипе

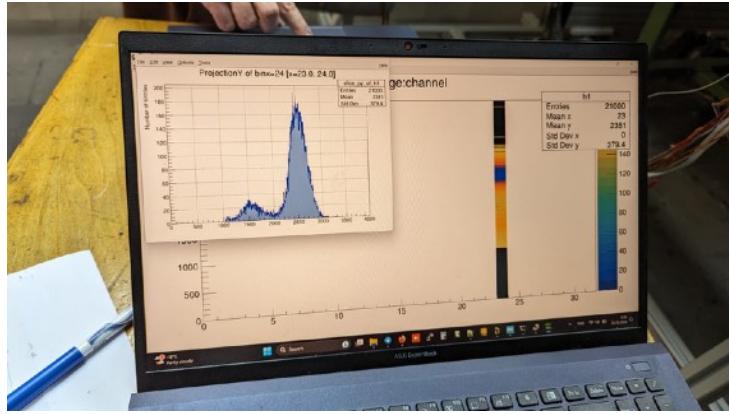
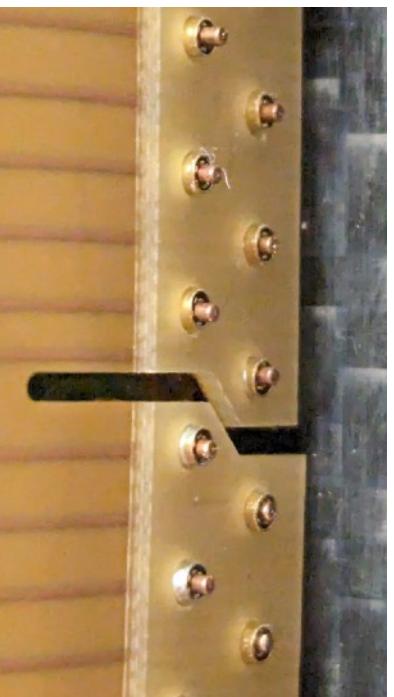
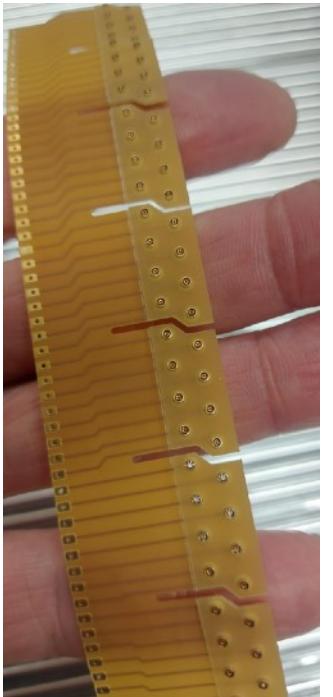


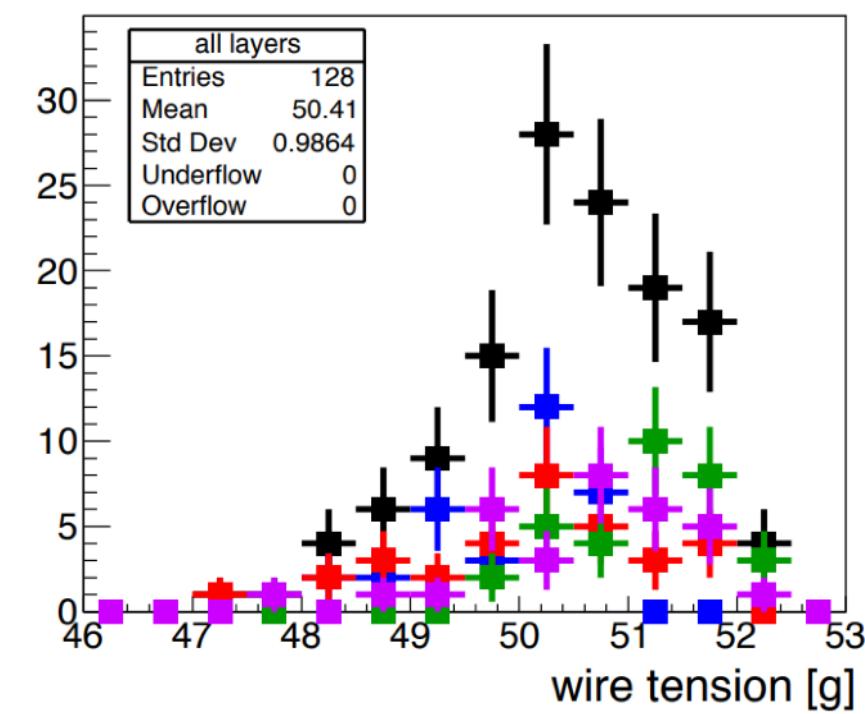
Table 1. ADC features on STM32G4 Series

Features	Values for STM32G4 Series
Number of ADCs	Up to 5
Resolution	12 bits (or 10, 8, 6 bits), 16 bits with oversampling
Number of input channels	Up to 42
ADC principle	Successive approximation register (SAR)
ADC clock frequency	Up to 60 MHz (up to 52 MHz in multiple-ADC operation case)
Sampling rate	Up to 4 Msps (up to 3.46 Msps in multiple-ADC operation case)
Sampling time	2.5 to 640.5 [ADC clock periods]
Supply voltage	$V_{DDA} = 1.62 \text{ V to } 3.6 \text{ V}$
Reference voltage	On dedicated $V_{REF+}$ pin <sup>(1)</sup> (internal or external), $V_{REF+} = 1.62 \text{ V to } V_{DDA}$ (see datasheet)
Triggers	From external pins or internal peripherals (timers)
Conversion modes	Single, continuous, scan-selected channels, discontinuous mode
Others	Offset calibration, analog watchdog, hardware oversampling, offset compensation, gain compensation, interleaved mode (two ADCs coupled), sampling time controlled by trigger edges, bulk mode sampling

1. In the LQFP128-pin packages, two  $V_{REF+}$  pins are available.



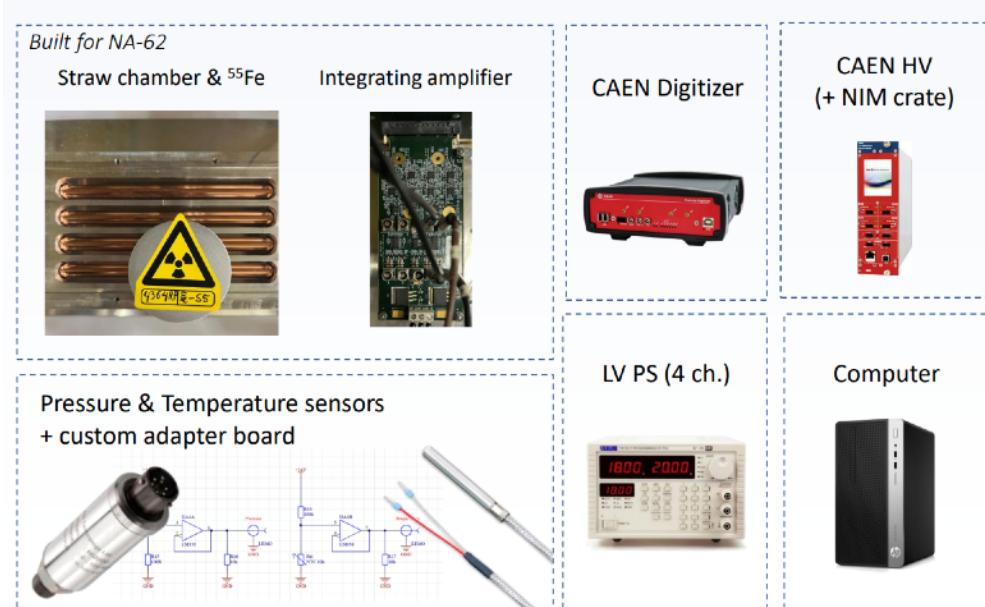
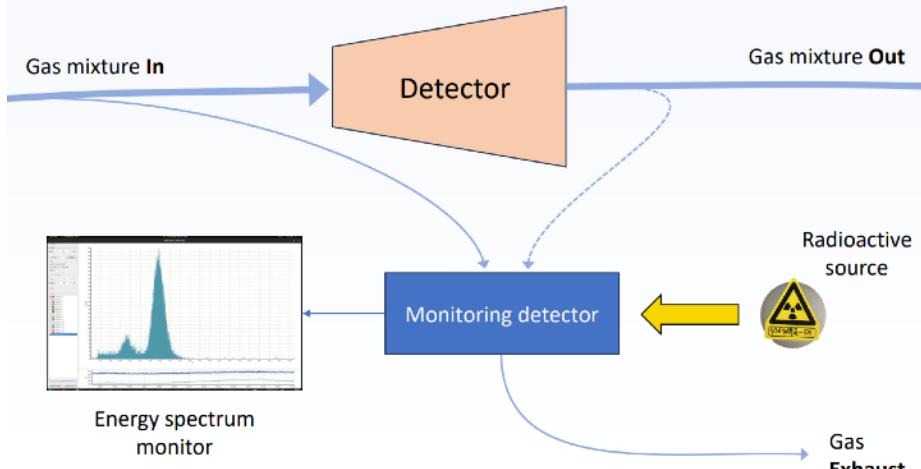
# Измеритель натяжения анодной нити



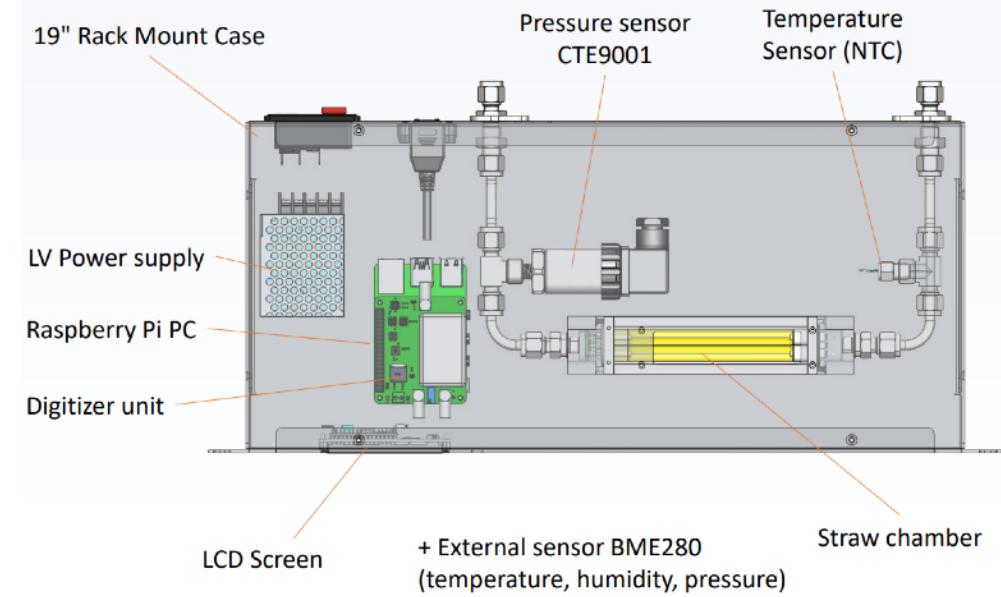
layer1	
Entries	32
Mean	49.91
Std Dev	0.7524
Underflow	0
Overflow	0
layer2	
Entries	32
Mean	50.05
Std Dev	1.093
Underflow	0
Overflow	0
layer3	
Entries	32
Mean	51.11
Std Dev	0.6361
Underflow	0
Overflow	0
layer4	
Entries	32
Mean	50.56
Std Dev	0.9172
Underflow	0
Overflow	0

# Gas Gain Monitor

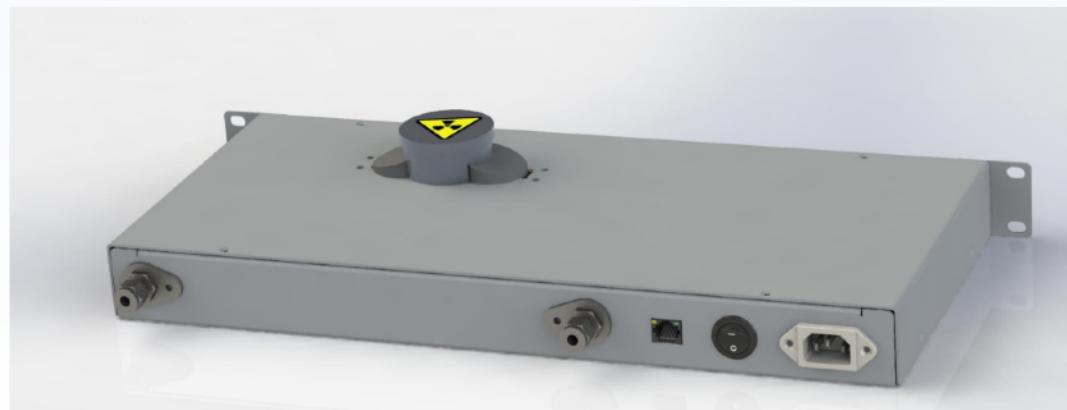
## Solution. Concept



## Implementation. 19" Rack unit



- Swagelok 6mm (In & Out)
- Ethernet (+ Wi-Fi antenna)
- 220V (C13)
- Socket for environment sensor (front panel)



# Сотрудничество

- ПИЯФ-анализ, data taking, моделирование, работа на пучках и т.д.
- ИЯФ(Казахстан)-моделирование, straw production, assembling
- Питерский политех – DAQ
- Томский политех-FFE
- Минск(Солин)-FFE
- Группа Каржавина(JINR) – aging и система газообеспечение
- Переговоры с индийскими коллегами
  - (a) IIT Guwahati Contact: Prof. Bipul Bhuyan ([bhuyan@iitg.ac.in](mailto:bhuyan@iitg.ac.in))
  - (b) Panjab University Contact: Prof. Vipin Bhatnagar ([vipin@fnal.gov](mailto:vipin@fnal.gov));
  - (c) NISER Bhubaneswar Contact: Prof. Sanjay Swain ([sanjay@niser.ac.in](mailto:sanjay@niser.ac.in)).

# Публикации за 2023г

## **Testbeam Measurements and Realistic Simulation for the SPD Straw Drift Tubes**

- November 2023
- [Physics of Atomic Nuclei](#) 86(5):832-837

## **Straw signal modeling using Garfield++ interface to LTSPICE**

- November 2023
- [Journal of Physics Conference Series](#) 2642(1):012005

## **Online Gas Gain Monitoring System**

- October 2023
- [Physics of Particles and Nuclei Letters](#) 20(5):1240-1242

- VMM3 ASIC as a potential front end electronics solution for future Straw Trackers, [NIM](#), Volume 1047, 2023,

# Планы 2024г

1. Создание 2x прототипов straw trackera
2. Восстановление стенда miniSPD
3. Пуско-наладка прототипов электроники
4. Участие в пучковых экспериментах на H4 SPS и PS с целью оптимизации FEE.
5. Проработка вариантов участия на пучках ускорителей в ПИЯФ(Гатчина) и ИЯФ(Алматы)
6. Проработка системы газообеспечения детектора