



Çekirdek ve Parçacık Fiziği ile Robotiğin Buluşması

Oktay DOĞANGÜN

YEFİST 2023

İçerik

- İZÜ NAR
- Nükleer Fizik Çalışmaları
- Nükleer Elektronik Çalışmaları
- Robotik Çalışmaları

İstanbul Zaim Üniversitesi



İstanbul Zaim Üniversitesi



İZÜNAR Laboratuvarı

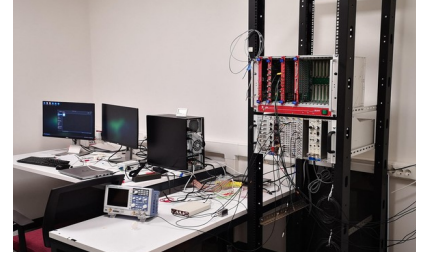
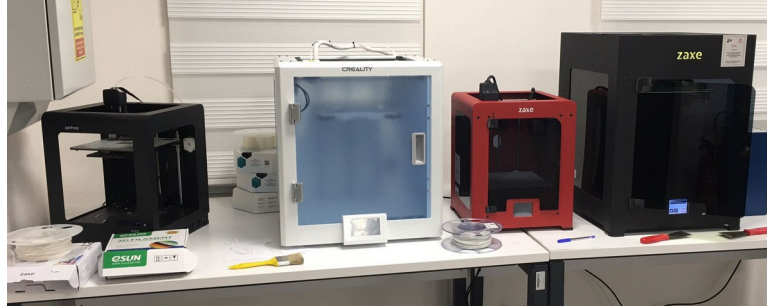
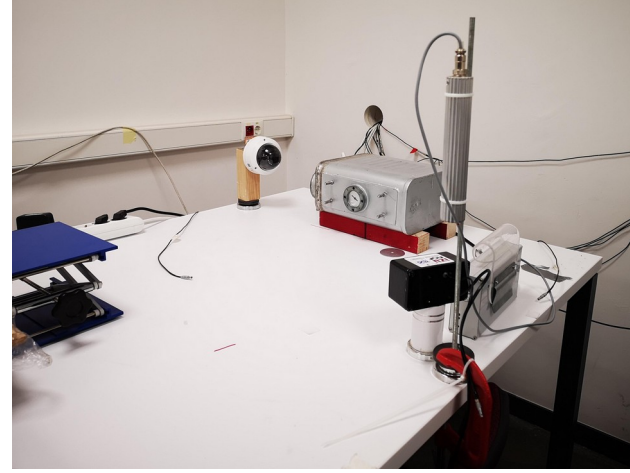


14.10.23

YEFIST 2023 - 0. Doğangün

5

İZÜNAR Laboratuvarı



Ekibimiz

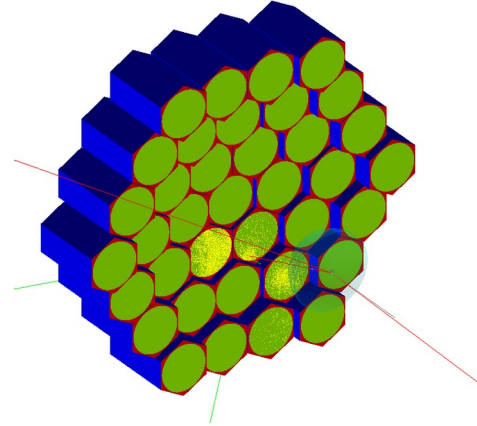
- Çekirdek:
 - Nizamettin ERDURAN, İZÜ
 - Oktay DOĞANGÜN, İZÜ
 - Ferhat Özok, MSGSÜ
 - Taylan Yetkin, YTÜ
 - A. Tarık ZENGİN, İTÜ
 - Emre İren, MSGSÜ
 - Onur Buğra KOLCU, İSÜ
 - Gökhan ERDEMİR, Tennessee/ABD
- Lisansüstü
 - Erdal ALİMOVSKİ, İZÜ Doktora
 - Asiye DEMİRTAŞ Medeniyet Doktora
- Lisans Öğrencilerimiz ve Stajyerlerimiz
 - Şeyma Hacifettahoğlu, İZÜ YAM 3. sınıf
 - İlayga Avan, İZÜ EEM 4. sınıf
 - Ömer Kaan KESKİNER, İZÜ EEM 2. sınıf
 - Onur KARAKAŞ, MSGSÜ Fizik 3. sınıf
 - Ahmet KARANFİL, BIM 2. sınıf
 - Esmâ YAHYA, YAM 3. sınıf
 - Seba BIERNIE, YAM 3. sınıf
 - Aleyna Nur ÖZTÜRK, İÜ Ast. 2. sınıf

Ekibimiz



Çekirdek ve Parçacık Fiziği

- Simülasyon Çalışmaları
 - Dedektör simülasyonları (GEANT4)
 - Veri Analizi (ROOT)

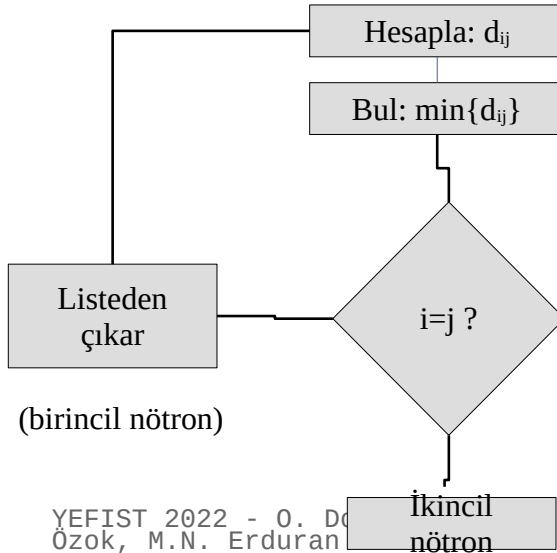


Jet Algoritması Tabanlı Kümeleştirme Algoritması

Soyut uzaklık:

$$d_{ij} = \begin{cases} t_i & \text{if } i = j \\ \min(t_i, t_j) \frac{R_{ij}^2}{R^2} & \text{if } i \neq j \end{cases}$$

$$R_{ij} = \sqrt{(X_i - X_j)^2 + (Y_i - Y_j)^2}$$



Jet Algoritması Tabanlı Kümeleştirme Algoritması

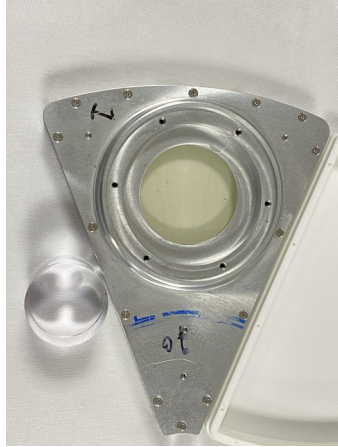
Nikel-58 demetinin Demir-56 hedefine çarpışması

Geometry	Granularity	Ω [sr]	ϵ_{1n} [%]	ϵ_{2n} [%]	ϵ_{3n} [%]
Present Work	61	$\sim 1.42\pi$	58.84	29.46	4.58
NEDA+NW [2]	50+50	$\sim 1.62\pi$	28.70	6.37	1.66
NEDA+NW-ring [2]	51+45	$\sim 1.60\pi$	31.30	7.62	1.89
NW [2]	50	$\sim 1.00\pi$	26.00	3.93	0.55

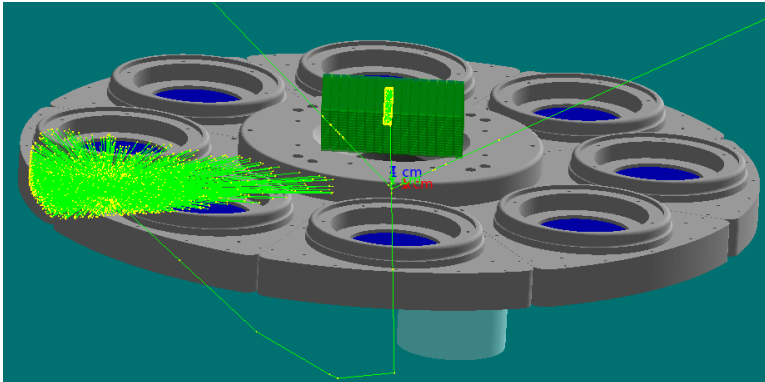
Kaliforniyum-252 bozunumu

Geometry	Gran.	Ω [sr]	ϵ_{1n} [%]	ϵ_{2n} [%]	ϵ_{3n} [%]
Present Work	61	$\sim 1.42\pi$	67.08	18.86	2.72
NEDA+NW [2]	50+50	$\sim 1.62\pi$	13.55	1.371	0.125
NEDA+NW+ring [2]	51+45	$\sim 1.60\pi$	14.68	1.743	0.182
NW [2]	50	$\sim 1.00\pi$	8.81	0.50	0.021

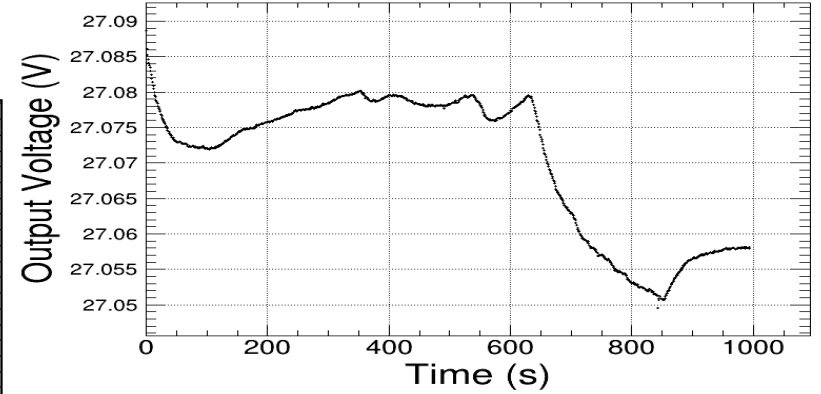
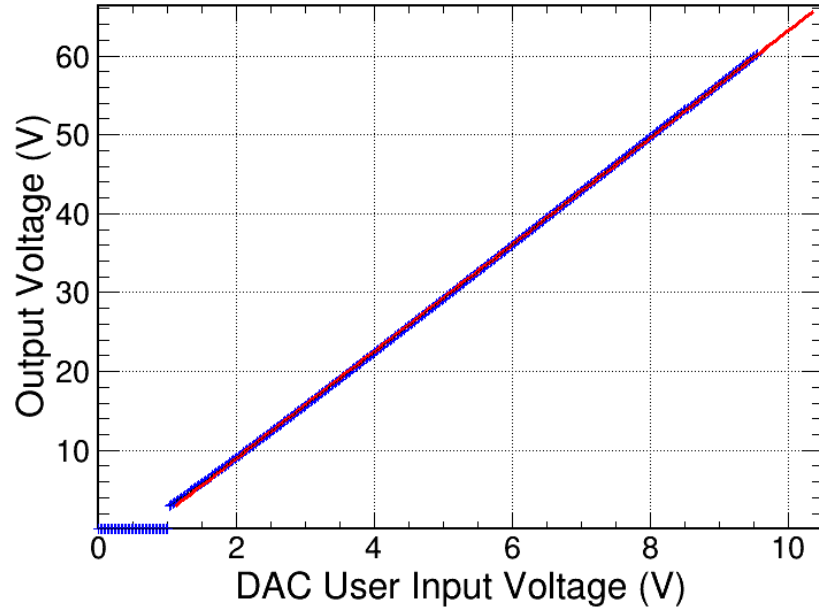
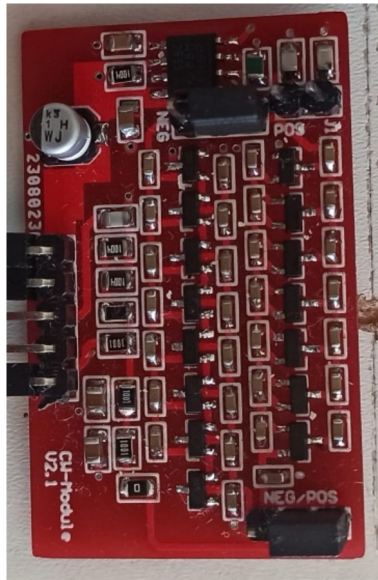
Üniversite Sanayi İşbirliği



- SSB: Aselsan+İZÜNAR
 - GEANT4 simülasyonu
 - Sintilasyon dedektörleri
 - Nükleer elektronik, veri alımı (NIM, VME modülleri)
 - Veri Analizi (ROOT)

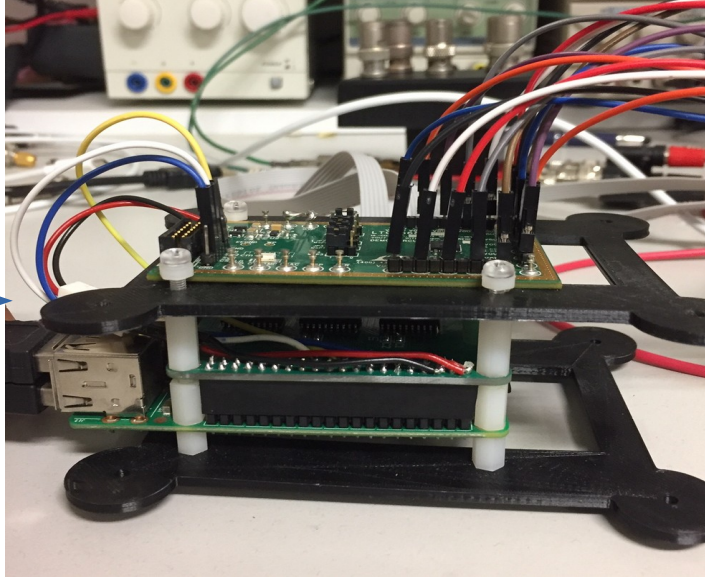


SiPM Besleme Modülü II (Cockcroft-Walton Multiplier)



Besleme Modülü I Kontrol Yazılımı

16x



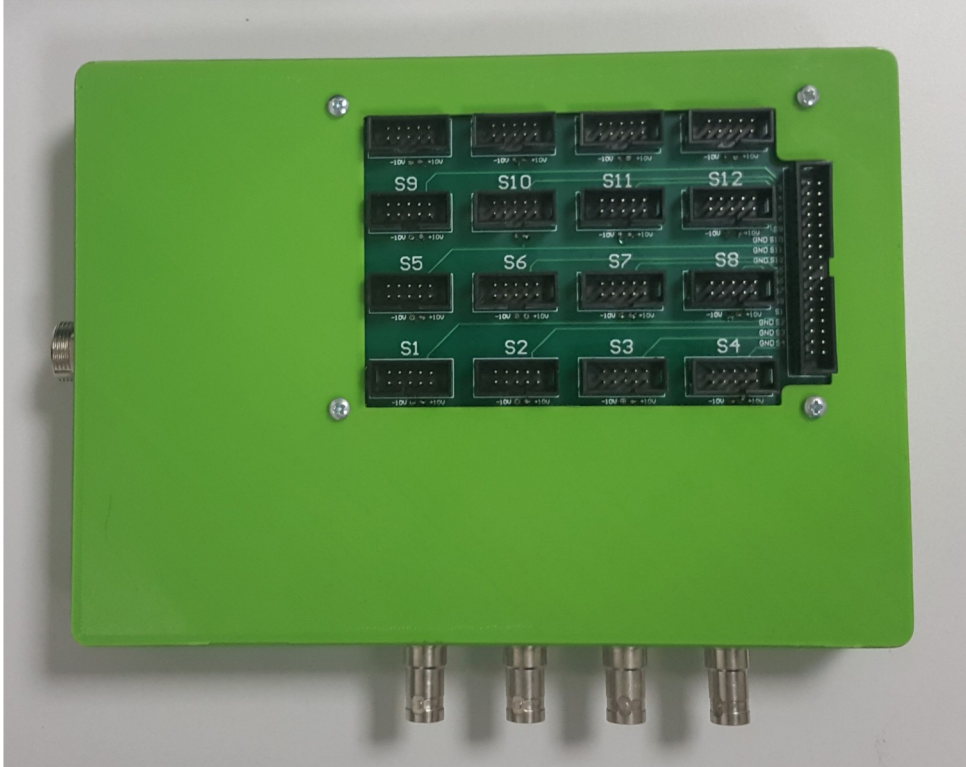
HV Controller

File About Quit

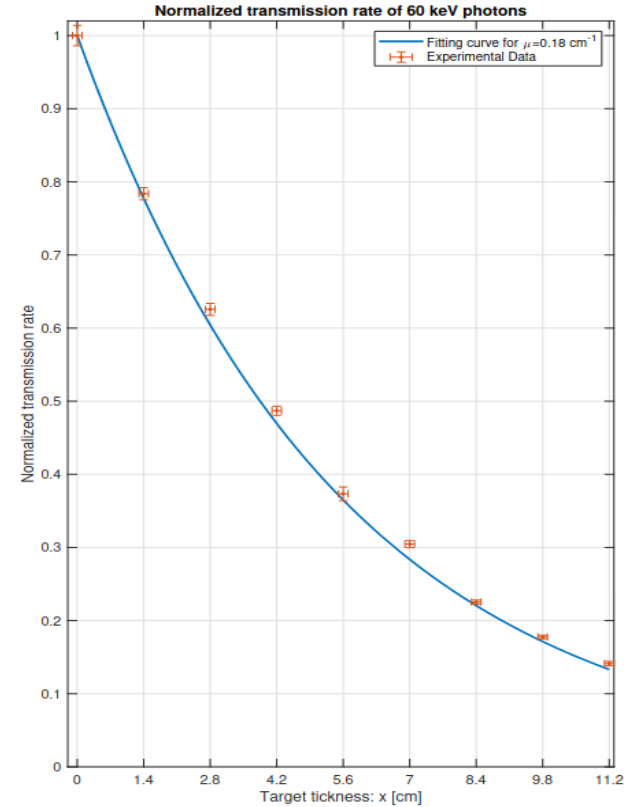
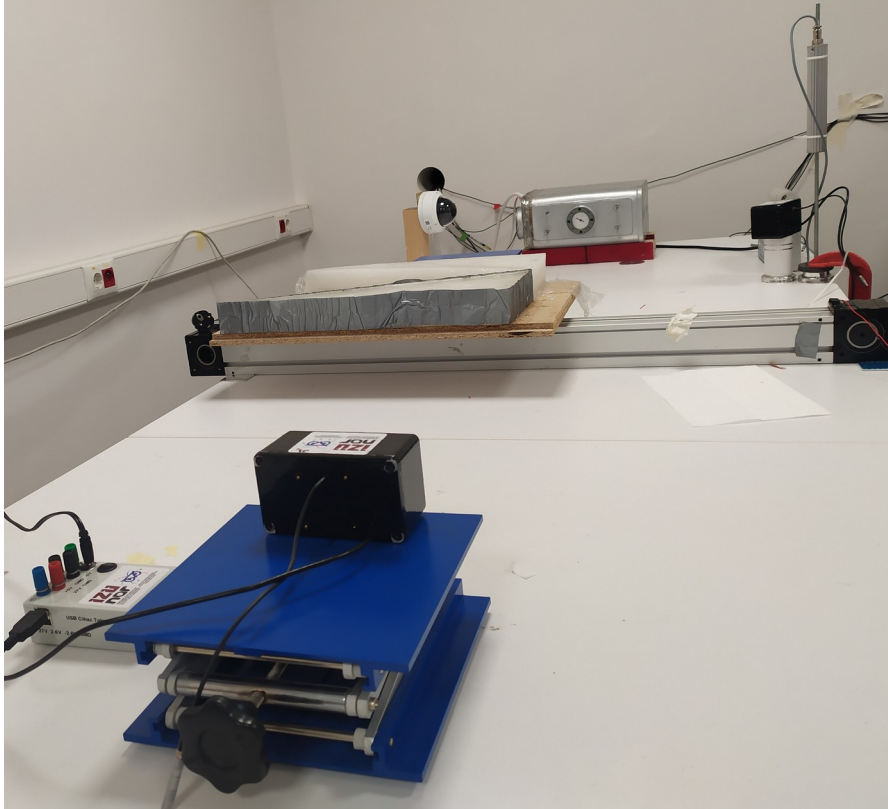
Connect Power Up All Power Down All Power Down & Exit

Channel 0		Channel 1		Channel 2		Channel 3	
Value (V)	Output (V)	Value (V)	Output (V)	Value (V)	Output (V)	Value (V)	Output (V)
0.00	0.0	0.00	1.0	0.00	2.0	0.00	3.0
Write & Update		Write & Update		Write & Update		Write & Update	
Power Down Detector		Power Down Detector		Power Down Detector		Power Down Detector	
Channel 4		Channel 5		Channel 6		Channel 7	
Value (V)	Output (V)	Value (V)	Output (V)	Value (V)	Output (V)	Value (V)	Output (V)
0.00	4.0	0.00	5.0	0.00	6.0	0.00	7.0
Write & Update		Write & Update		Write & Update		Write & Update	
Power Down Detector		Power Down Detector		Power Down Detector		Power Down Detector	
Channel 8		Channel 9		Channel 10		Channel 11	
Value (V)	Output (V)	Value (V)	Output (V)	Value (V)	Output (V)	Value (V)	Output (V)
0.00	8.0	0.00	9.0	0.00	10.0	0.00	11.0
Write & Update		Write & Update		Write & Update		Write & Update	
Power Down Detector		Power Down Detector		Power Down Detector		Power Down Detector	
Channel 12		Channel 13		Channel 14		Channel 15	
Value (V)	Output (V)	Value (V)	Output (V)	Value (V)	Output (V)	Value (V)	Output (V)
0.00	12.0	0.00	13.0	0.00	14.0	0.00	15.0
Write & Update		Write & Update		Write & Update		Write & Update	
Power Down Detector		Power Down Detector		Power Down Detector		Power Down Detector	

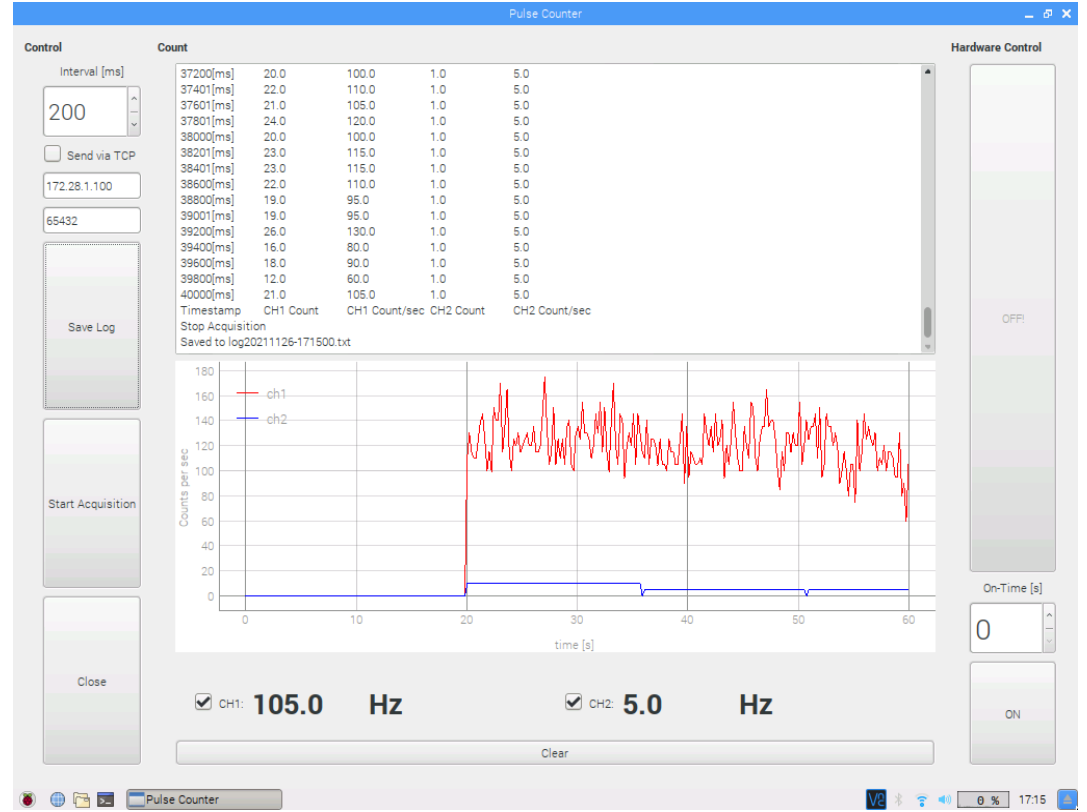
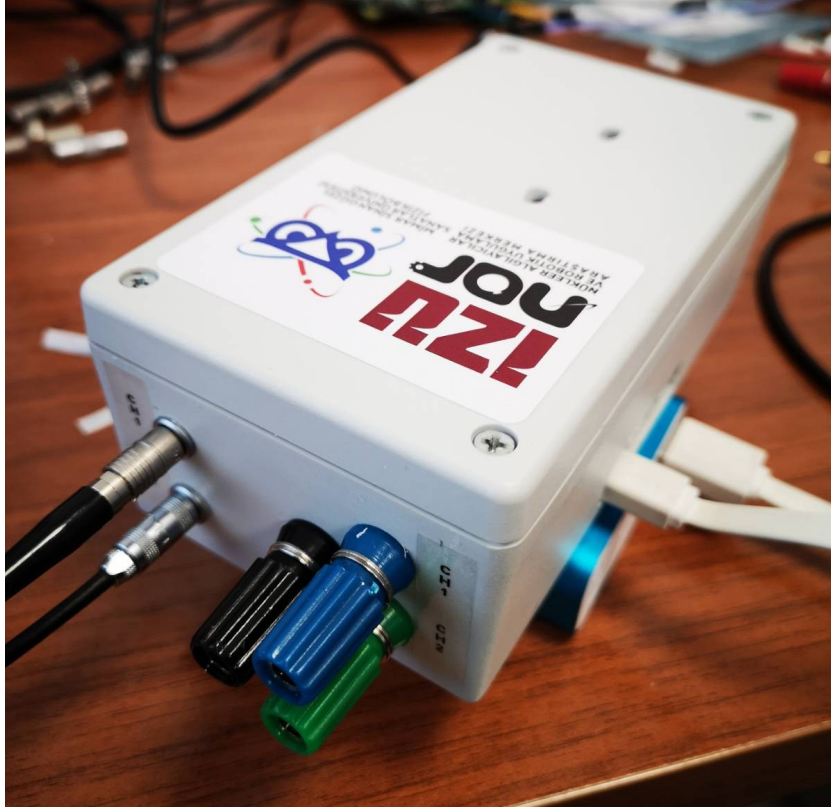
Dedektör Güç ve Sinyal Toplama Modülü



X-ışınları ile Hızlı Değişen Kalınlıkların Belirlenmesi

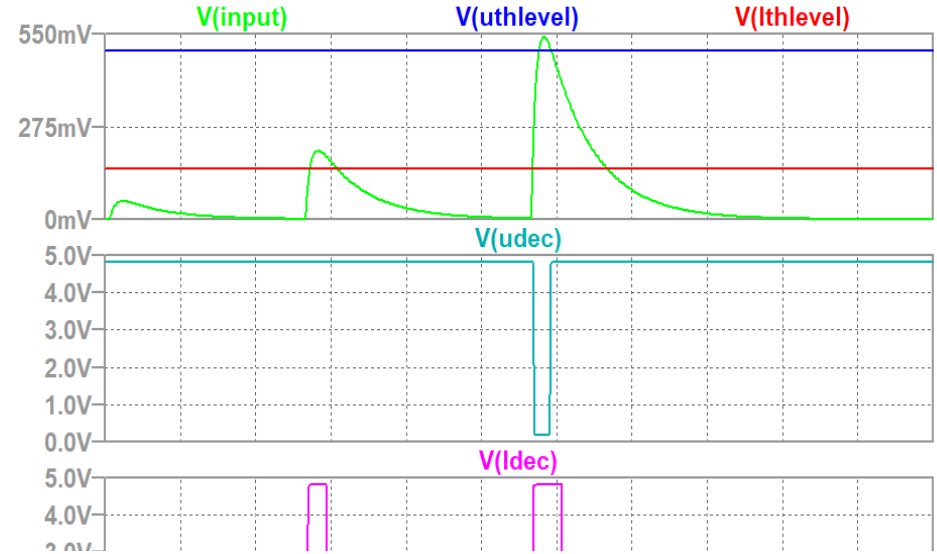
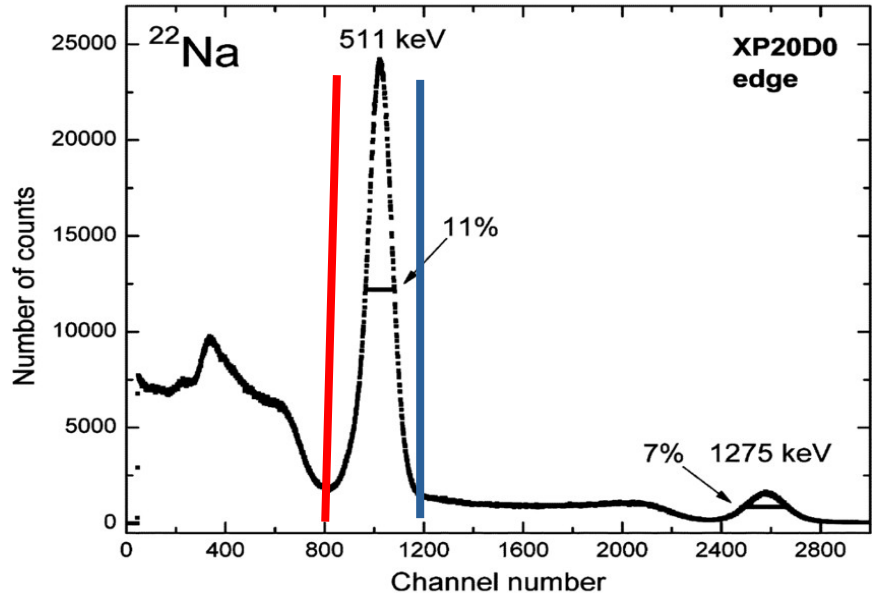


Hızlı Sayaç Modülü (2 Kanal)



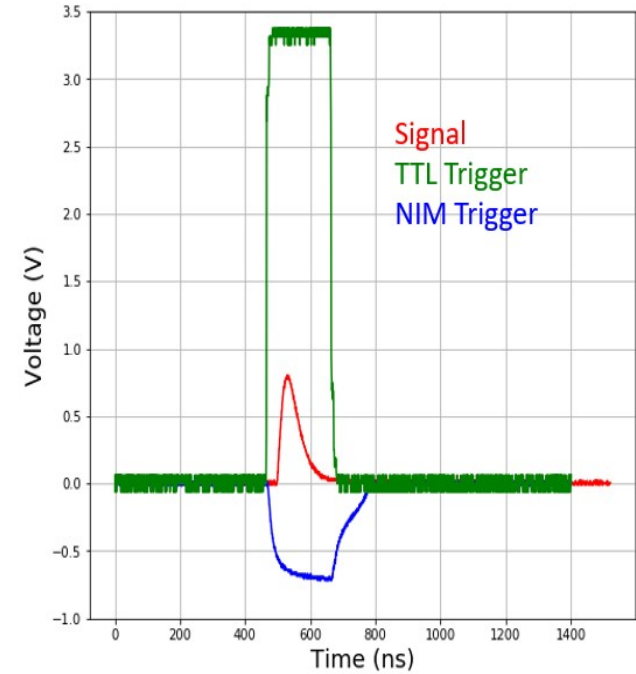
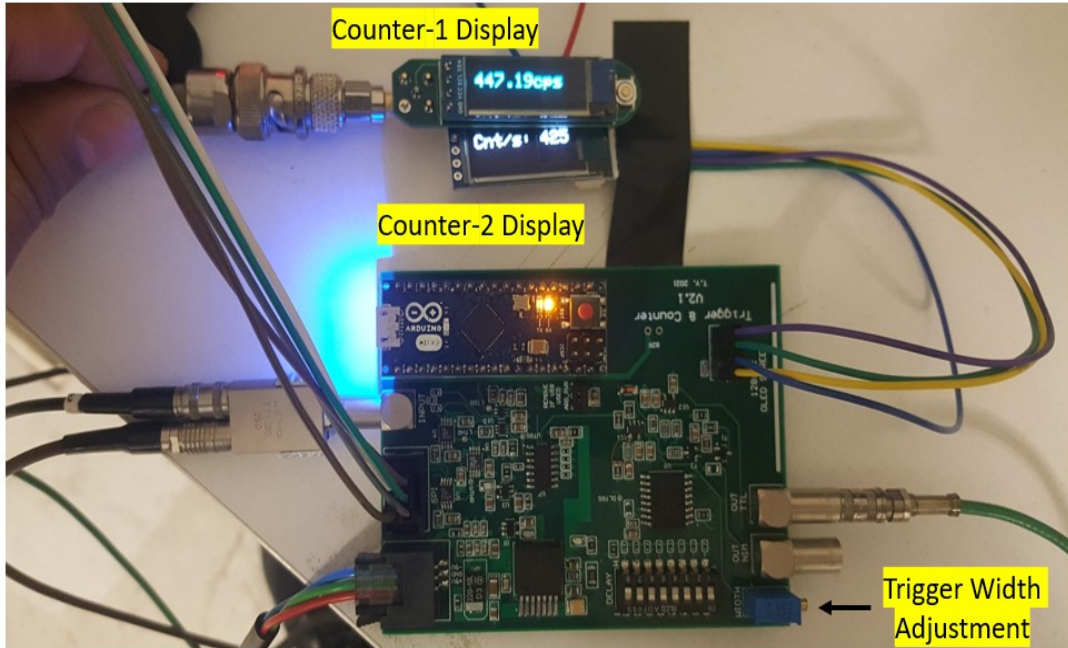
Tek Kanallı Tetikleme ve Hızlı Sayaç Modülü

DOI: [10.1109/TNS.2006.875999](https://doi.org/10.1109/TNS.2006.875999)

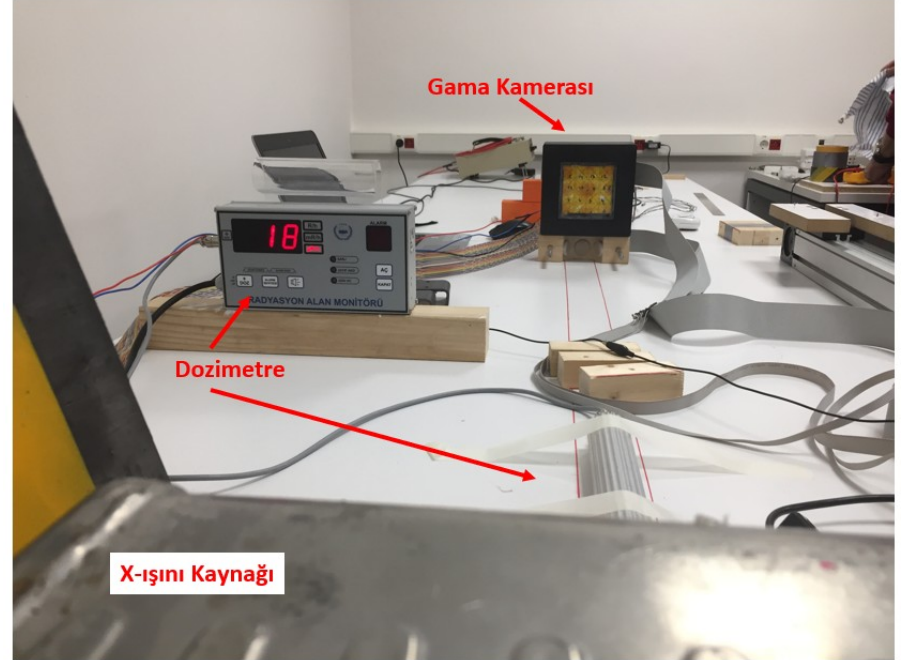
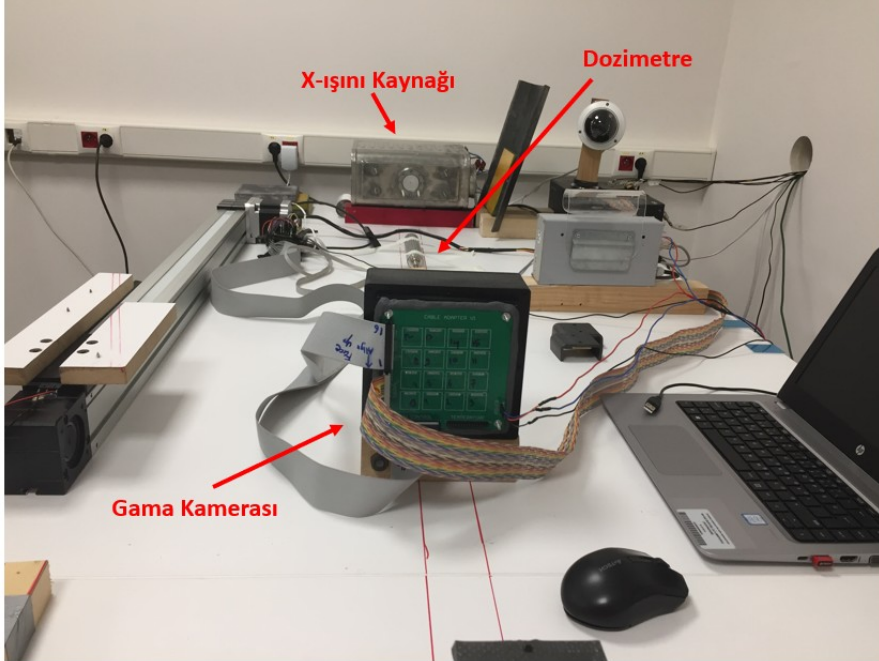


Tek Kanallı Tetikleme ve Hızlı Sayaç Modülü

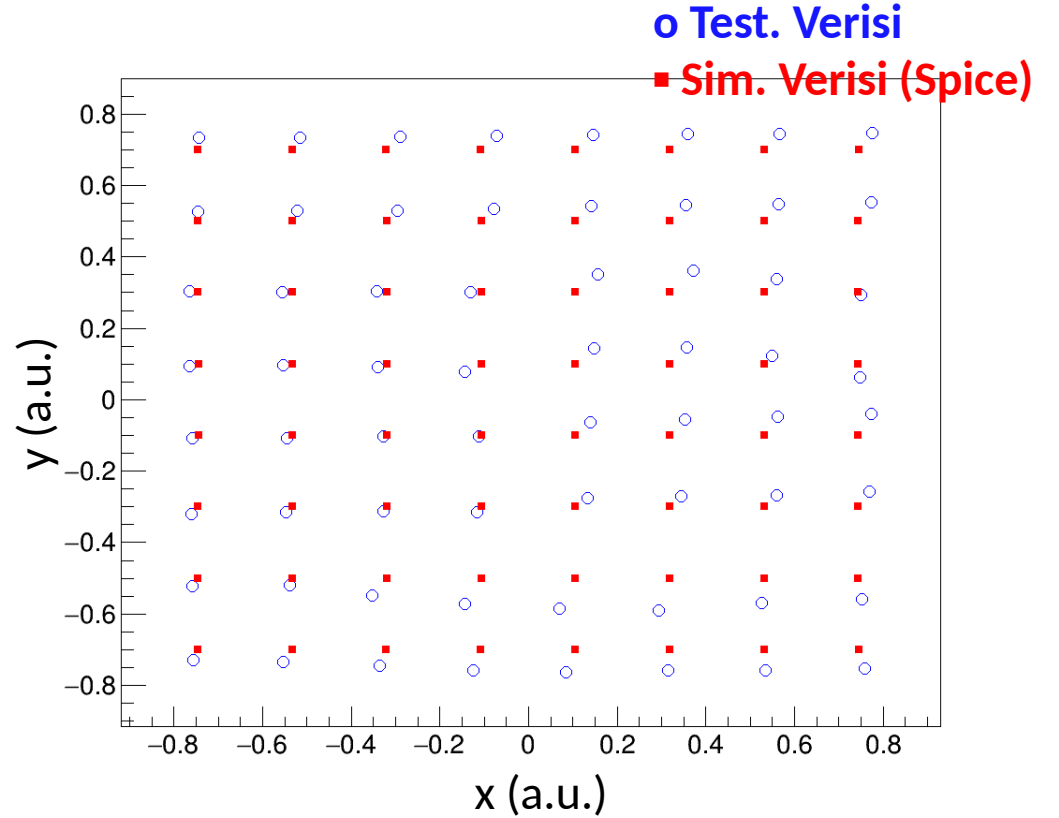
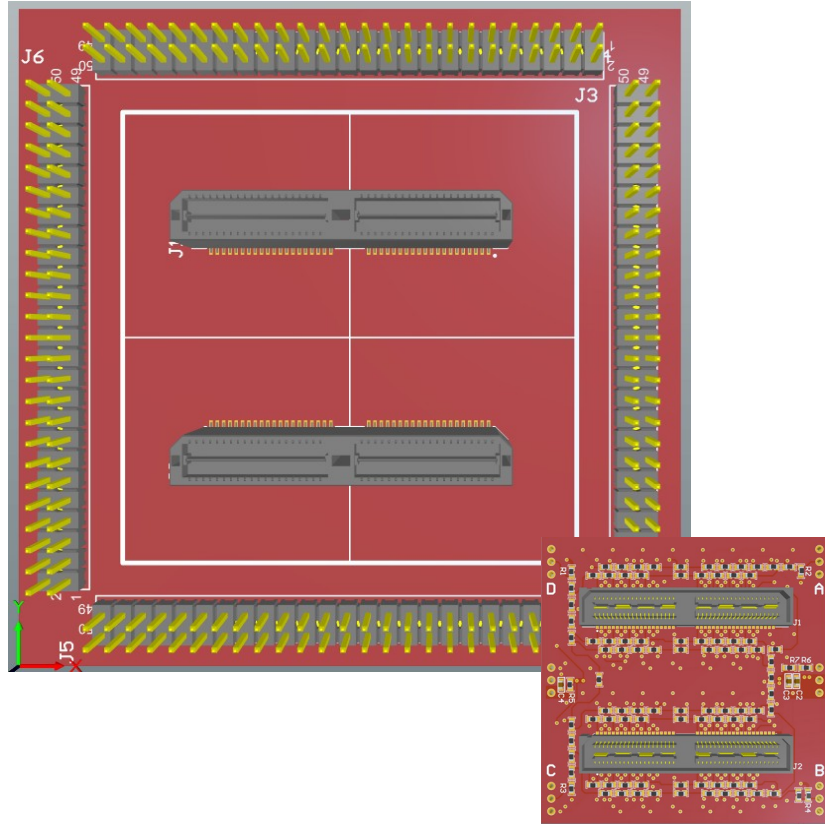
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Saçılma Dedektörü Güç ve Okuma Modülü



Saçılma Dedektörü Güç ve Okuma Modülü



Robotik

- Üç kartezyen eksenli dedektör kalibrasyon düzeneği
- Kara
 - Kobuki TurtleBot
 - TurtleBot3
 - Omniwheel robotlar
 - 8 tekerlekli kurye robot
- Hava
 - Mini drone robot
 - Drone şarj istasyonu
- Karma
 - Amfibi robot



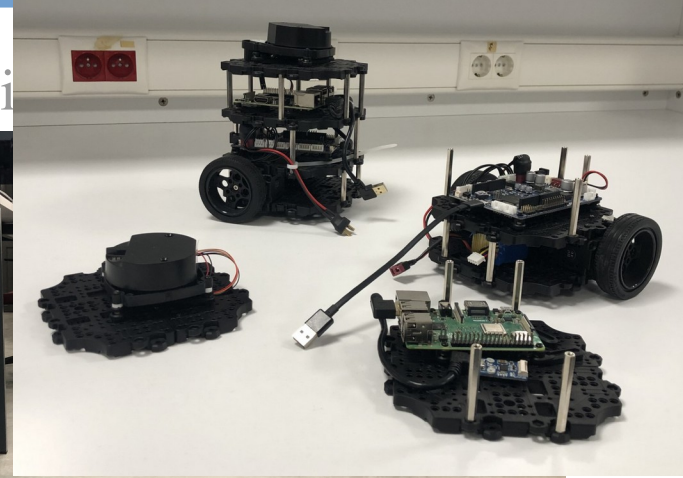
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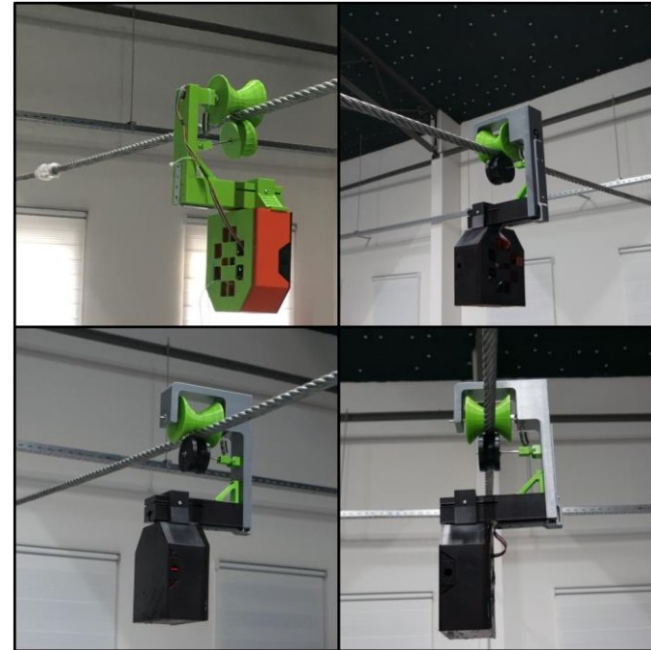
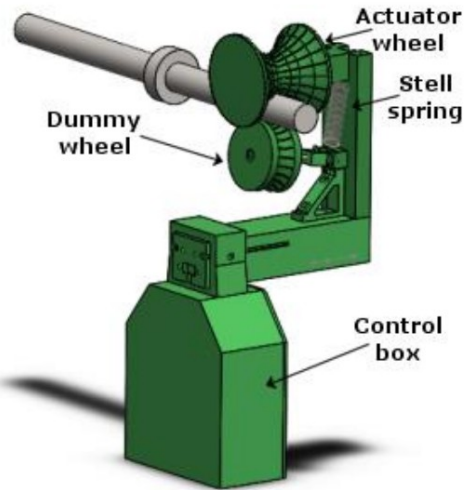


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Robotik



ROSETLineBot: One-Wheel-Drive Low-Cost Power Line Inspection Robot Design and Control
November 2019 Journal of Electrical Systems 15(4):626-634