

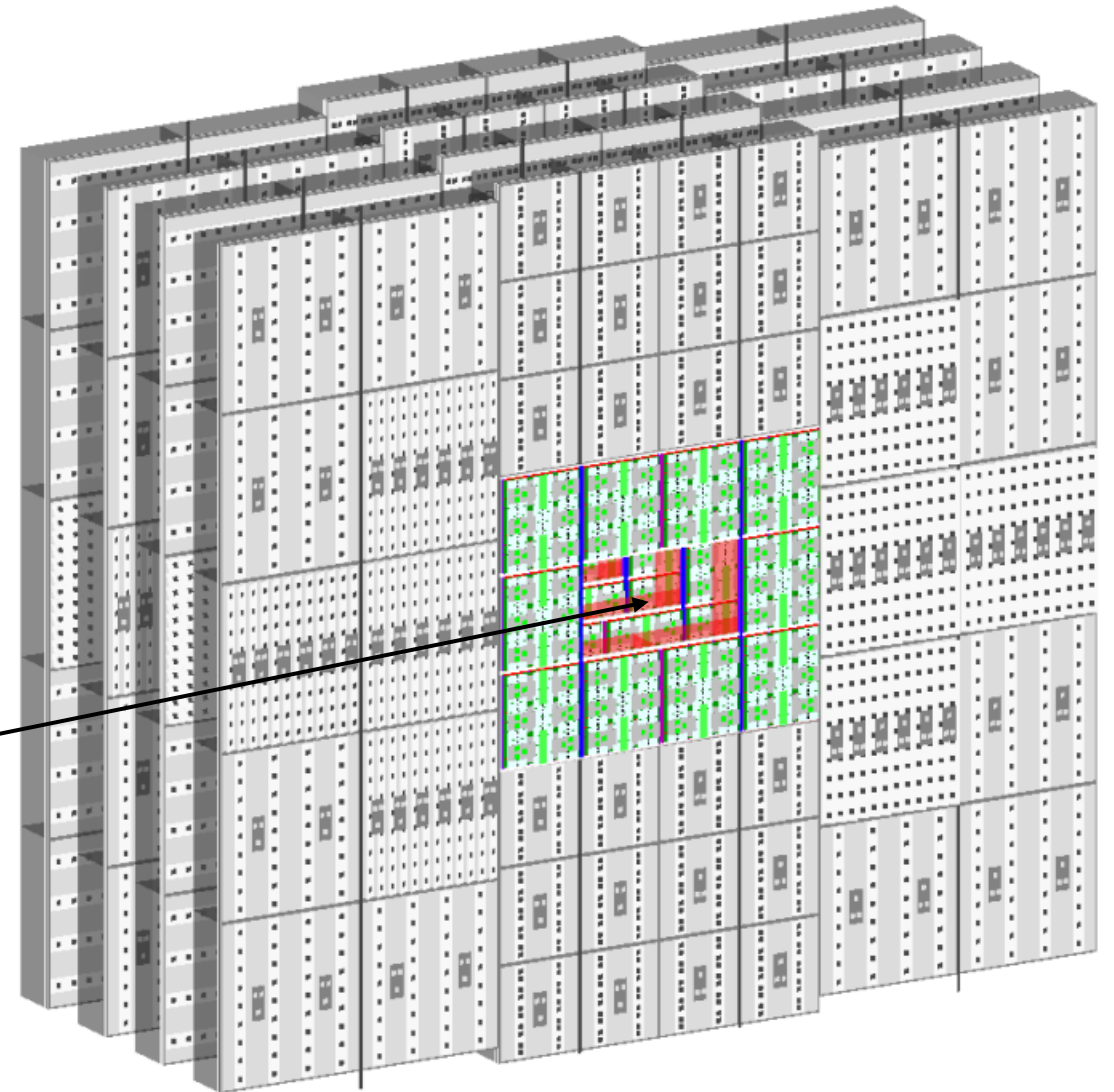
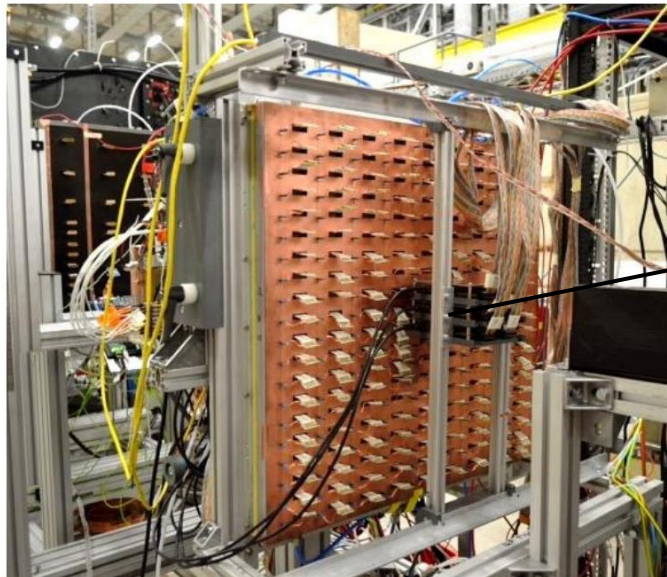
Studii de optimizare a ferestrei de intrare a detectorului de radiație de tranziție pentru experimentul CBM

Seminar TRD-2D
18.01.2022

D. Bartoș, G. Caragheorgheopol, D. Dorobanțu, V. Duța,
M. Petriș, M. Petrovici, V. Aprodu, L. Prodan, A. Radu

Structura prezentării

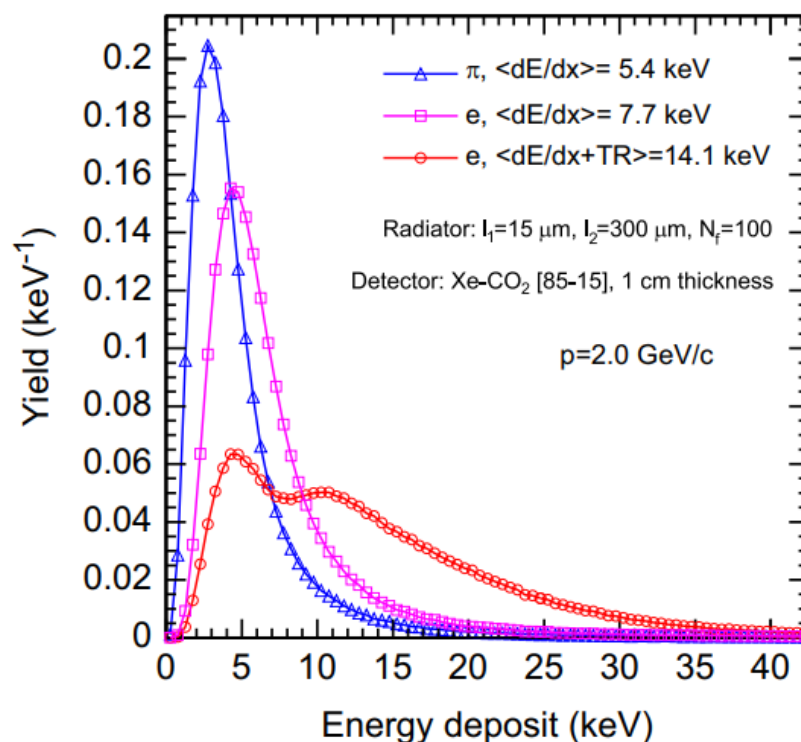
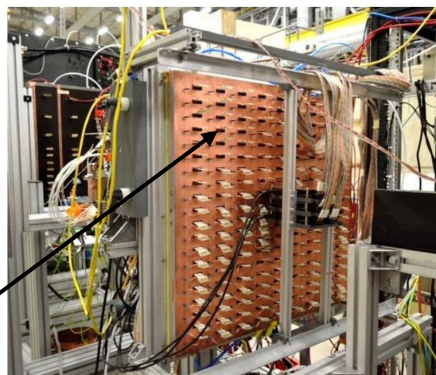
1. TRD la experimentul CBM
2. Probele analizate
3. Ansamblul experimental
4. Rezultate experimentale
5. Discuții
6. Concluzii



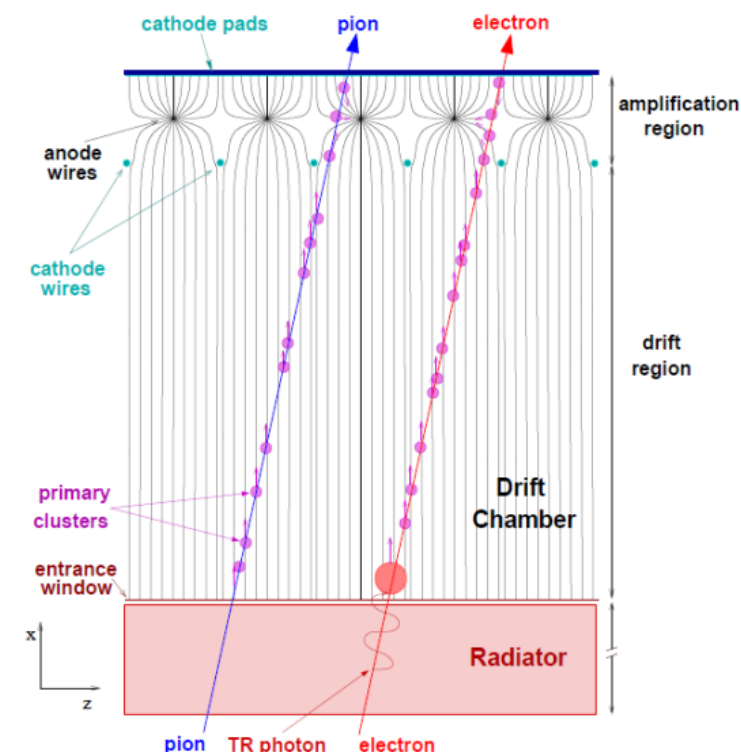
TRD la experimentul CBM

3

- 4 straturi;
- Identificarea electronilor cu $p > 1 \text{ GeV}/c$ ($\gamma > 1000$);
- Un factor de rejecție al pionilor mai bun 20 (CBM-TRD TDR) la o eficacitate de detecție a electronilor dată de $\approx 90\%$;
- Identificarea particulelor încărcate;
- Detector de tracking între STS și TOF;



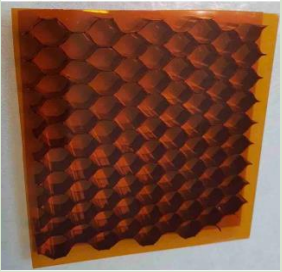
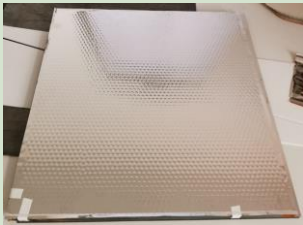
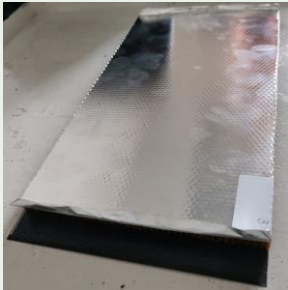
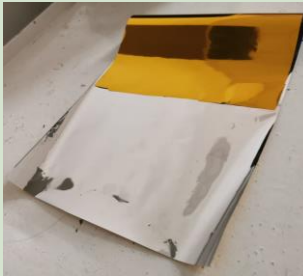
A. Andronic et al., *Transition radiation detectors*.
NIM Physics Research A (2012)



The CBM collaboration. *Technical Design Report for the CBM Transition Radiation Detector (TRD)*

Probe analizate

4

Nr.	Probă	Caracteristici	Nr.	Probă	Caracteristici	Nr.	Probă	Caracteristici
1		75 μm Kapton+9 mm honeycomb +75 μm Kapton	4		20 μm Kapton aluminizat+3 mm Rohacell + 6 mm honeycomb+3 mm Rohacell+20 μm Kapton aluminizat; Densitatea: 32 kg/m^3	7		20 μm folie Kapton aluminizat+9 mm honeycomb +20 μm folie Kapton aluminizat
2		20 μm Kapton aluminizat+3 mm Rohacell+9 mm honeycomb+3 mm Rohacell+20 μm Kapton aluminizat; Densitatea: 48 kg/m^3 (TRD2012)	5		10 μm folie aluminiu+9 mm honeycomb +0,25 mm folie carbon	8		170 μm folie carbon aluminizat+9 mm honeycomb +170 μm folie carbon aluminizat
3		20 μm Kapton aluminizat+3 mm Rohacell + 6 mm honeycomb+3 mm Rohacell+20 μm Kapton aluminizat; Densitatea: 48 kg/m^3	6		0,25 mm folie carbon aluminizat+9 mm honeycomb +0,25 mm folie carbon aluminizat	9		Folie Kapton aluminizat 20 μm

Principiul fizic al metodei experimentale

Legea Beer-Lambert

$$I(x) = I_0 e^{-\mu x}$$

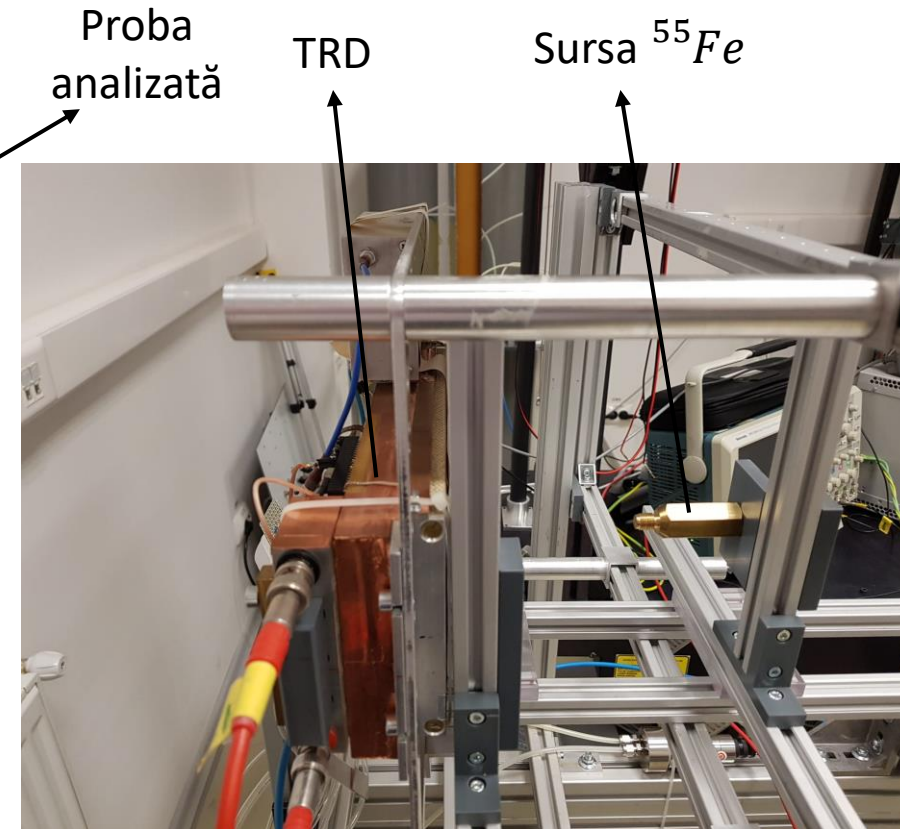
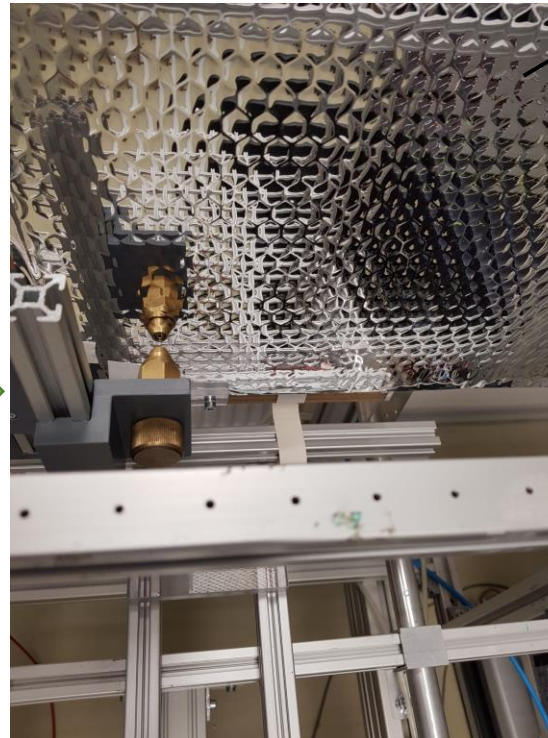
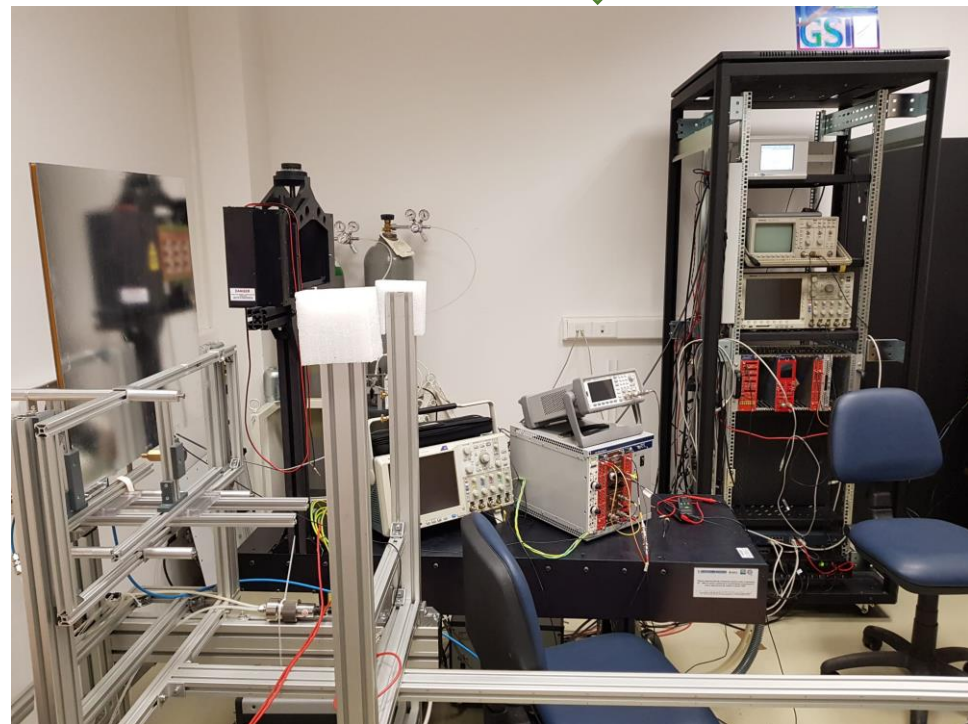
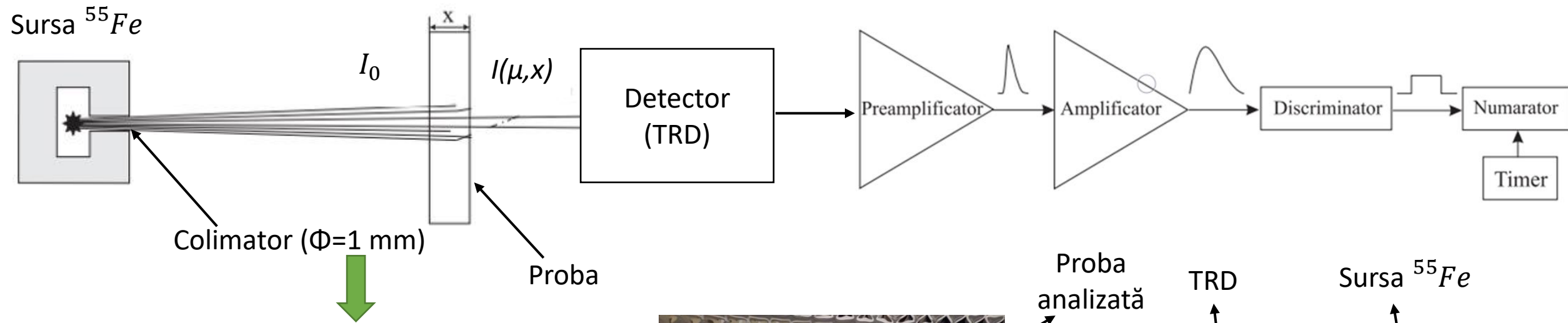
- $I(x)$ = intensitatea fascicului de fotoni care au străbatut grosimea de material x fără să interacționeze;
- $I_0 = I(x = 0)$ $\Rightarrow$ intensitatea inițială a fascicului de fotoni;
- μ = coeficientul liniar de atenuare;
- x = grosimea materialului.

$$\frac{I_0 - I(x)}{I_0} = 1 - e^{-\mu x}$$

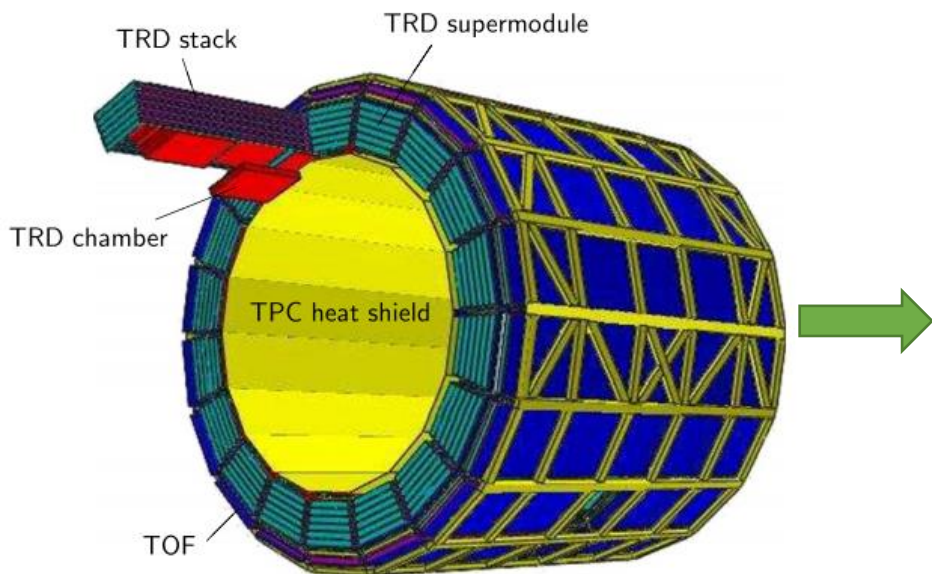
Probabilitatea ca un foton să interacționeze în grosimea x

Ansamblul experimental utilizând TRD

6

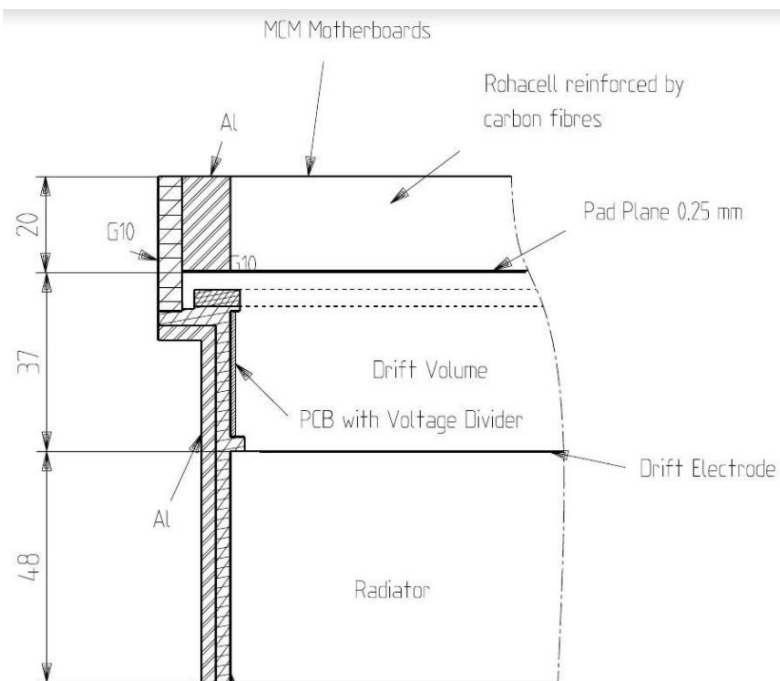


ALICE-TRD



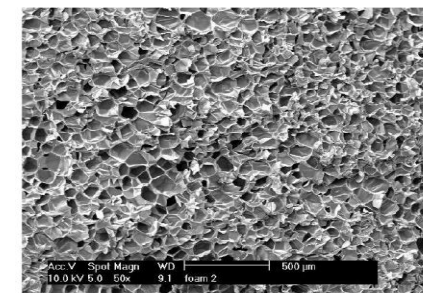
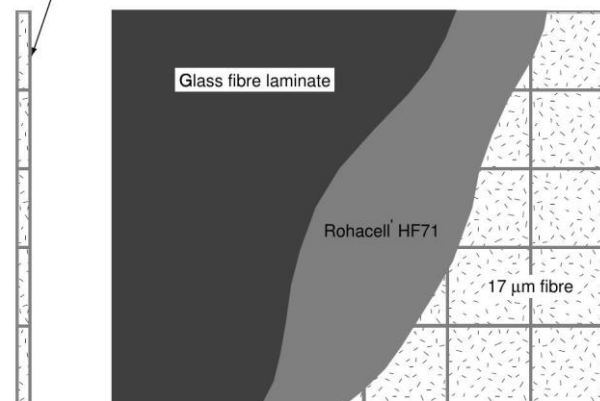
A. Andronic et al., *Transition radiation detectors*.
NIM Physics Research A (2012)

540 TRD-uri aranjate in 18 supermodule →
fiecare avand 30 de module organizate cate 5 si
avand 6 straturi

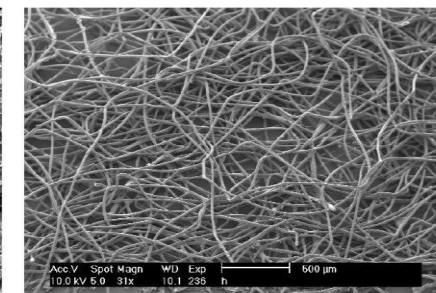


- 6 straturi;
- Identificarea electronilor cu $p > 1 \text{ GeV}/c$ ($\gamma > 1000$);
- Un factor de rejecție al pionilor mai bun 100 (ALICE-TRD TDR) la o eficacitate de detecție a electronilor dată de $\approx 90\%$;
- Amestecul de gaz este format din Xe(85%) si CO₂(15%);
- Trigger pentru particulele incarcate cu impuls mare.

Rohacell HF71
(glass fibre-enforced)



Rohacell HF71



polypropylene fiber

ALICE-Technical Design Report of the
Transition Radiation Detector, 2001

ALICE-TRD in DFH

ALICE-TRD chamber construction

Frame assembly on the gluing table
in 100000 particles/ft³ room



Multiwire electrodes winding
using winding machine



Pad plane assembling on the vacuum table
in 100000 particles/ft³ room



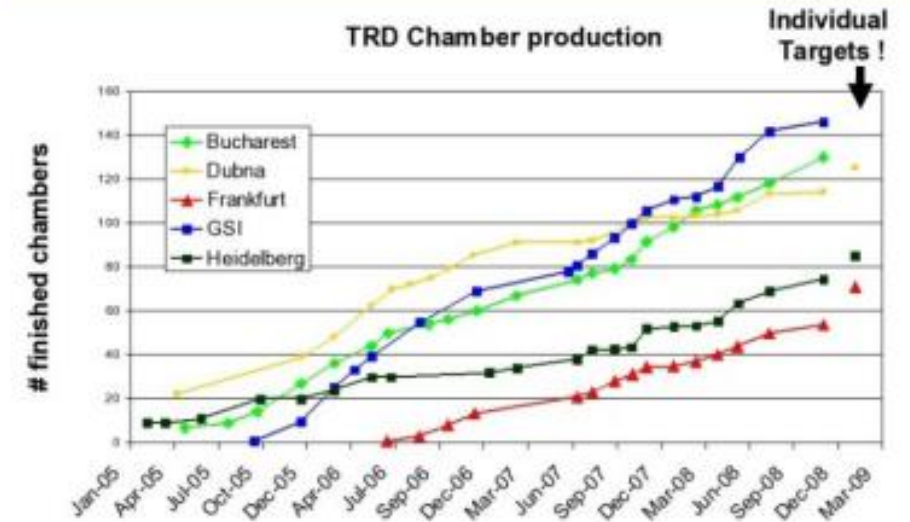
Soldering of the electrical connections of the
multiwire electrodes in 10000 particles/ft³ room



Meeting, 27 – 29 Mar

Mariana Petris for Hadron Physics Department (HPD) team.
Lessons learned from building and testing 24% of ALICETRDs and 50% of
ALICE-OROCs. 2021

TRD Chamber Production



03.11.2008

TRD ROC Status

Christian J. Schmidt

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130 camere (24%) din totalul de 540 camere
pentru ALICE-TRD

O noua structura bazata pe experienta ALICE-TRD

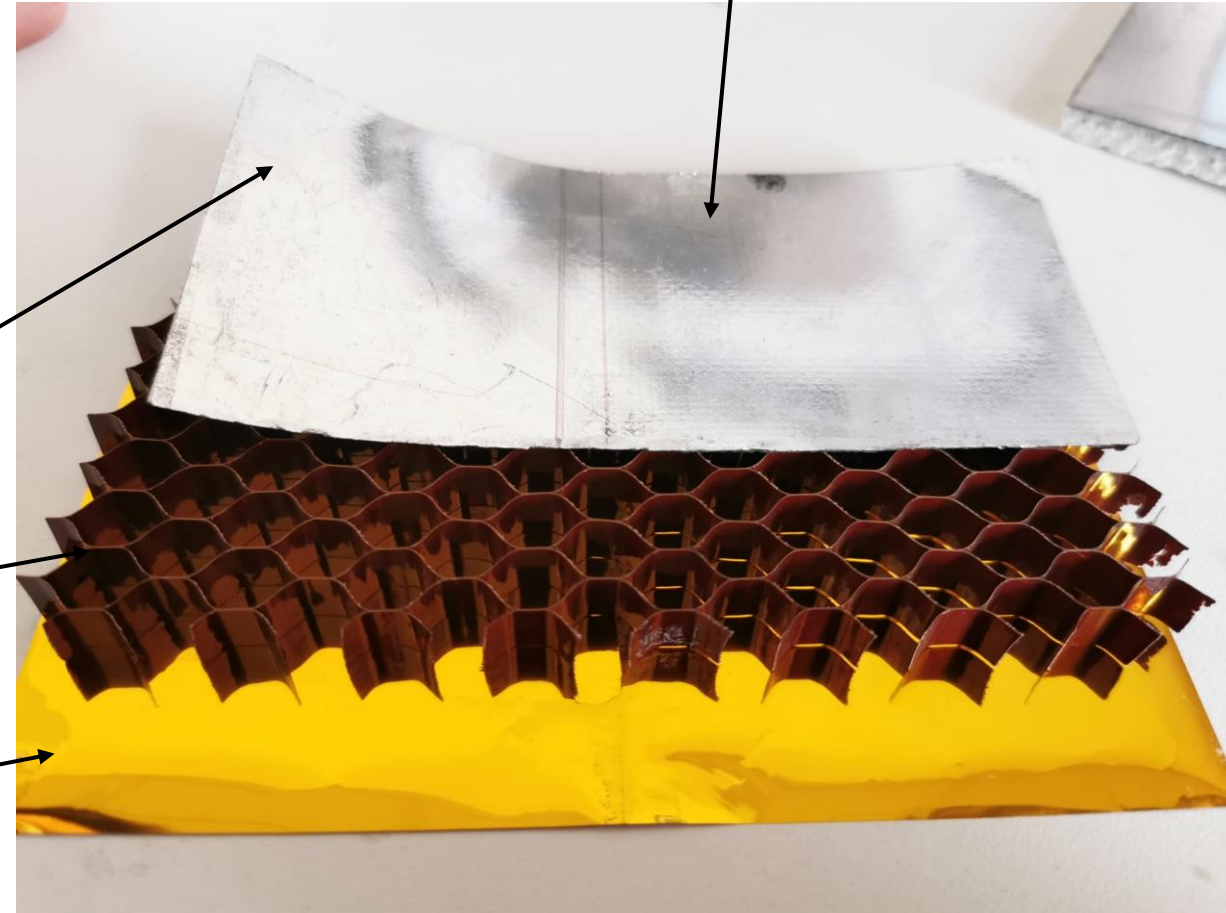


Folie Carbon
Aluminizata

Rohacell HF71 (8 mm)



Folie Carbon
Aluminizata (160 μm)



Electrod de drift

Honeycomb
9mm

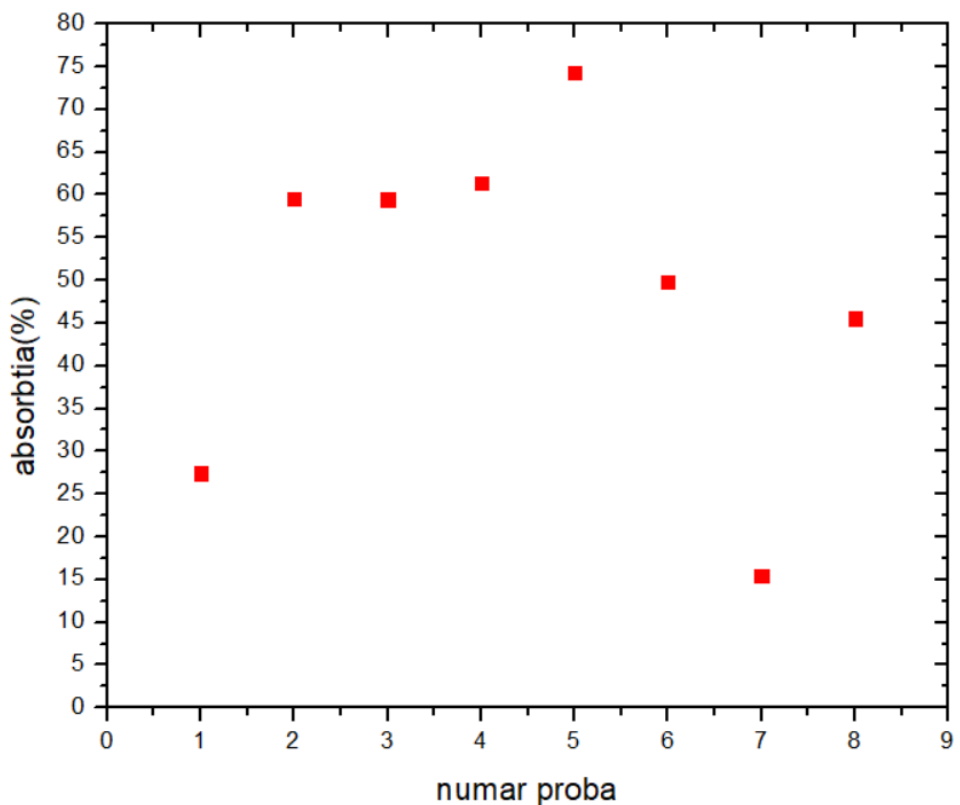
Folie Kapton
aluminizat 20 μm

Determinarea coeficientului de absorbție cu ajutorul TRD

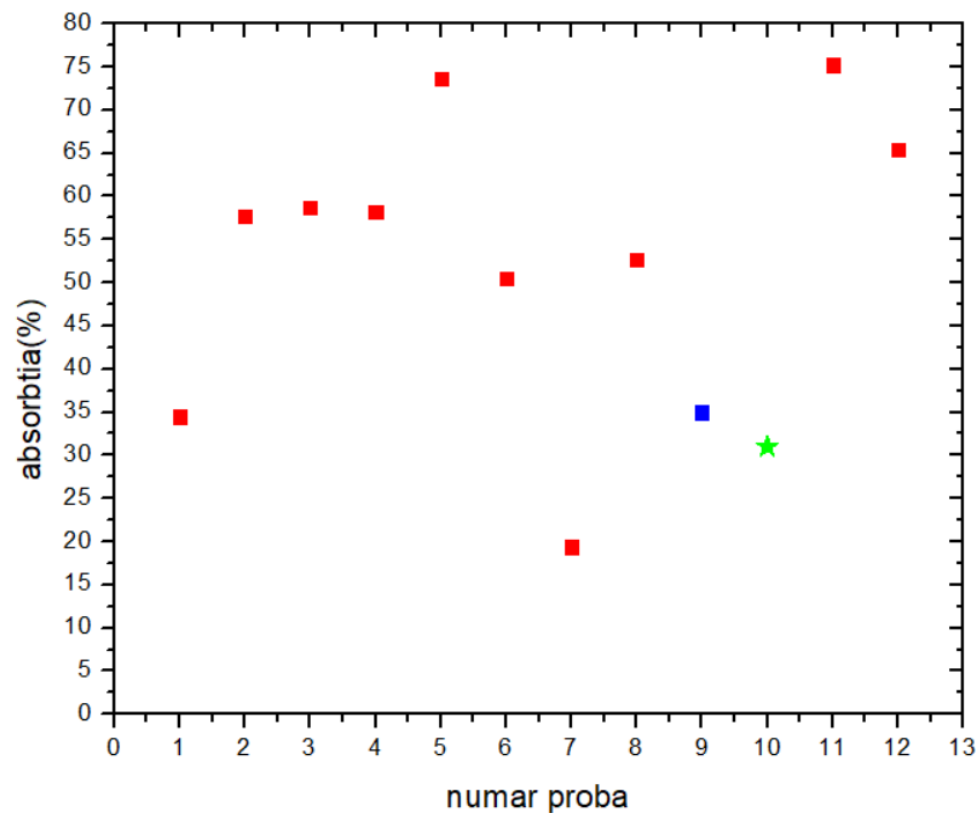
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Legenda

Distanța mică (27 mm)
Iluminarea centrului structurii honeycomb

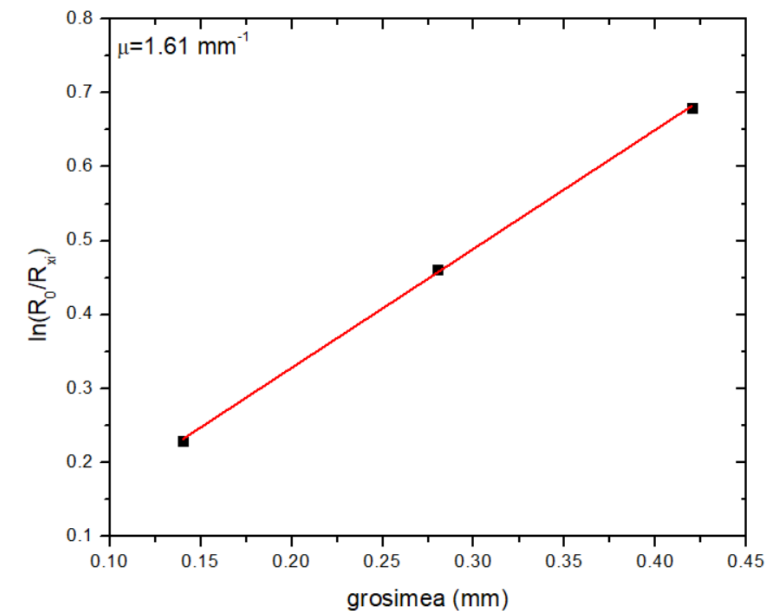
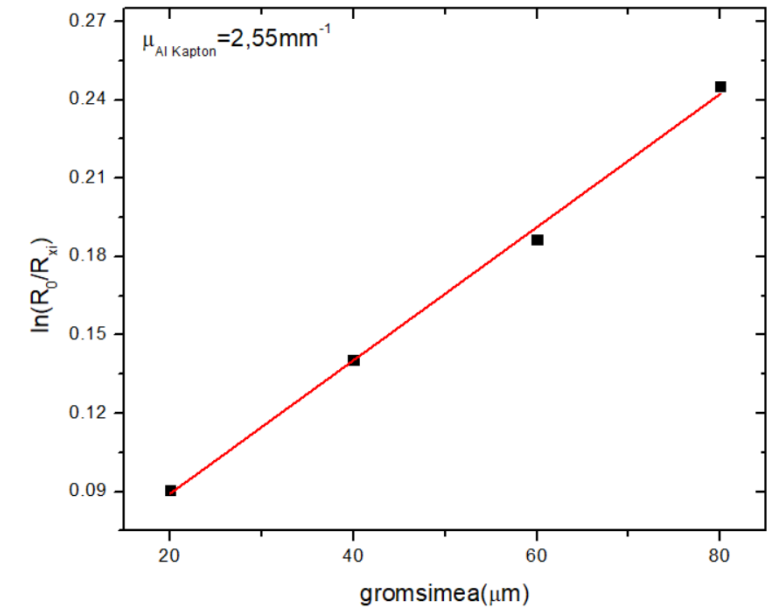
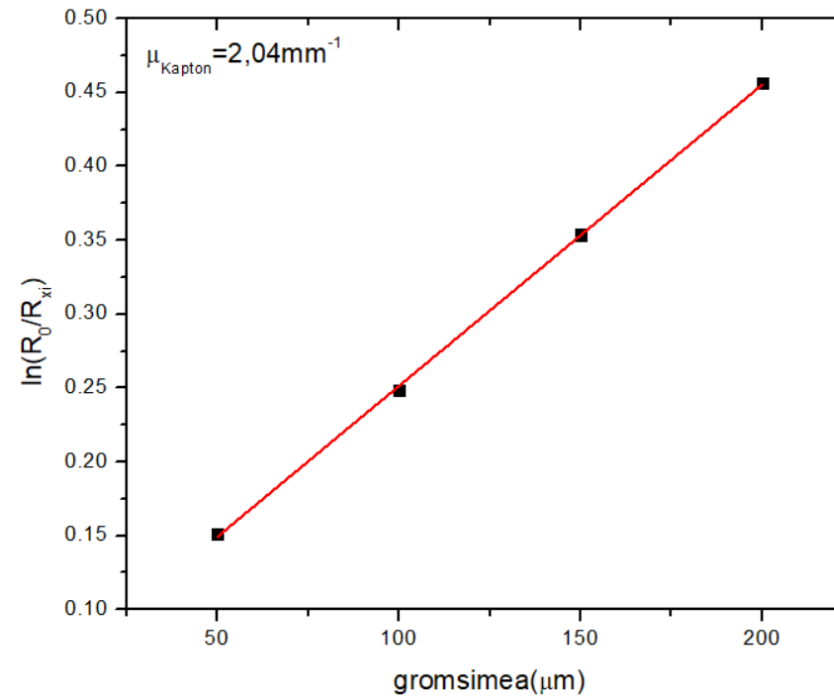
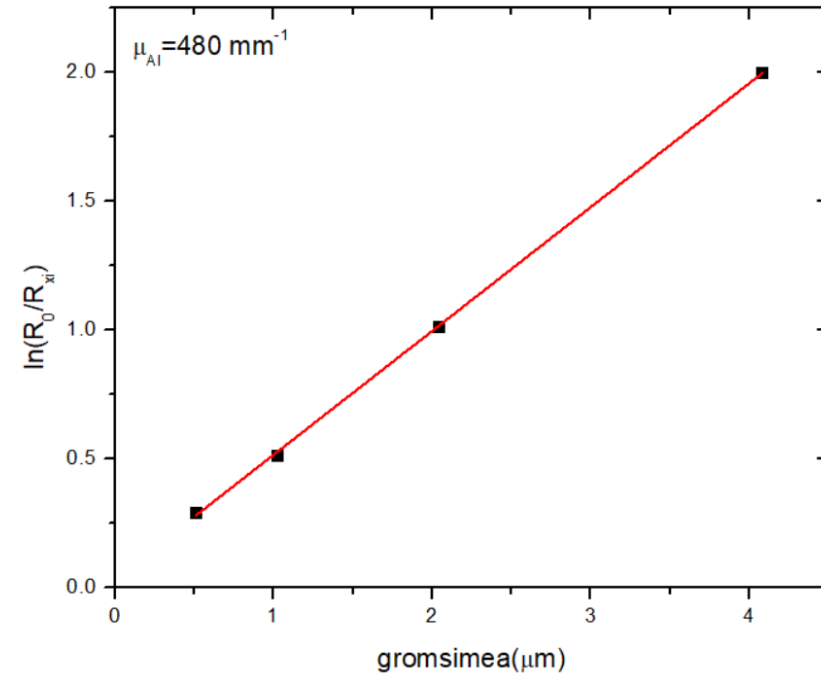


Distanța mare (16 cm)
Iluminarea uniformă



Nr.	Probă	Nr.	Probă
1		5	
2		6	
3		7	
4		8	
11		12	

Coeficientul liniar de atenuare



Reproductibilitatea rezultatelor

Studii realizate în 2021



Proba 2 (TRD2012)



Absorbția = 57.72%



Proba 3



Absorbția = 58.76%



Proba 4



Absorbția = 58.24 %

Studii realizate în 2012

Characteristic	S1	S2	S3
Rohacell thickness [mm]	2 x 3	2 x 3	2 x 3
Honeycomb thickness [mm]	9	6	6
$\Phi_{\text{honeycomb cell}}$	9.6	6.4	6.4
Honeycomb density [kg/m ³]	48	48	32
Al kapton thickness [μm]	2 x 20	2 x 20	2 x 20
Absorption [%]	56.23**	56.75	55.03

Vă mulțumesc pentru atenție!