

Algıç Dizinlerinde Çoklu Nötron Saçılımlarını Ayrıştırmak İçin Jet Algoritmalarına Dayalı Bir Yöntem Geliştirilmesi



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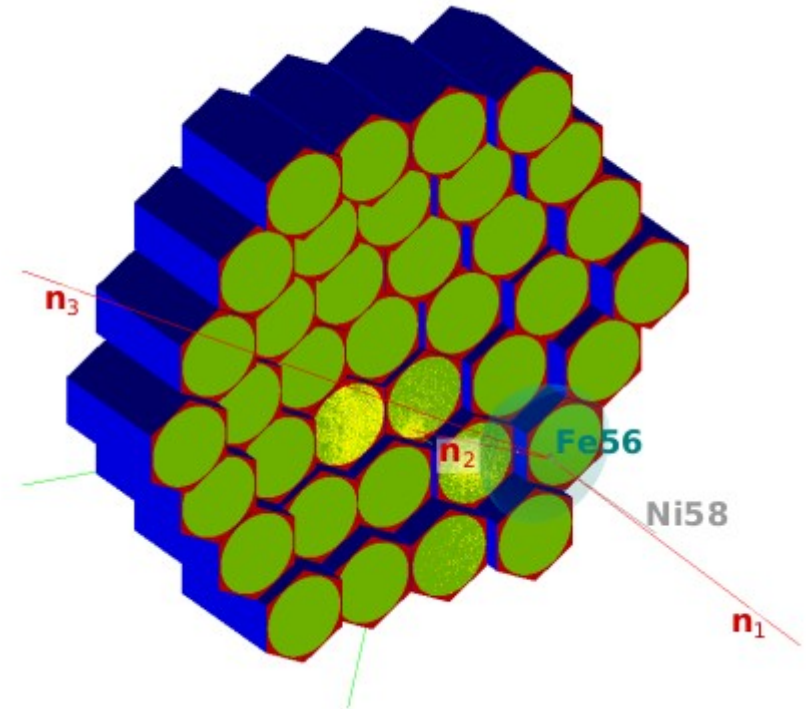
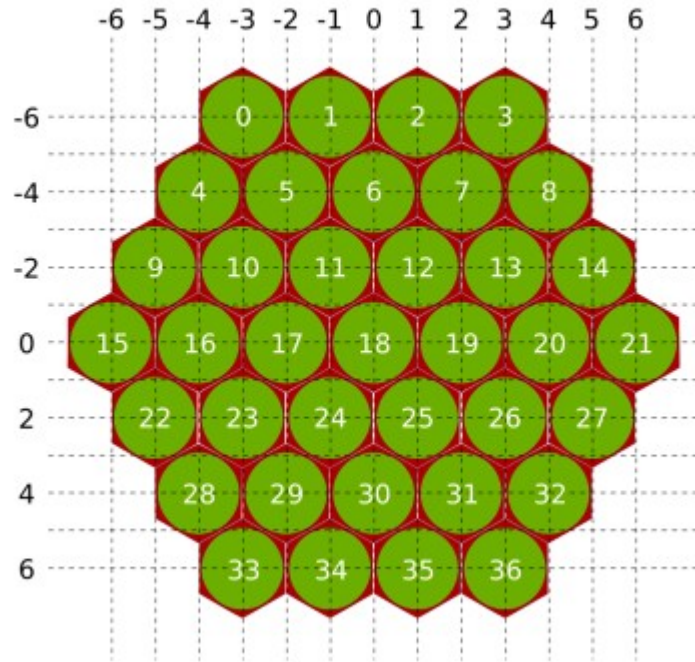
Motivasyon

- Algıç dizinlerinde çoklu saçılmaları ayrıştırma gerekliliği
- Var olan yöntemlerin eksikleri:
 - Birincil nötronları saçılardan ayırma başarımı
 - Saçılanların hangi birincil nötrondan geldiğini ayırt etme zorluğu

Neutron Detector Array (NEDA)



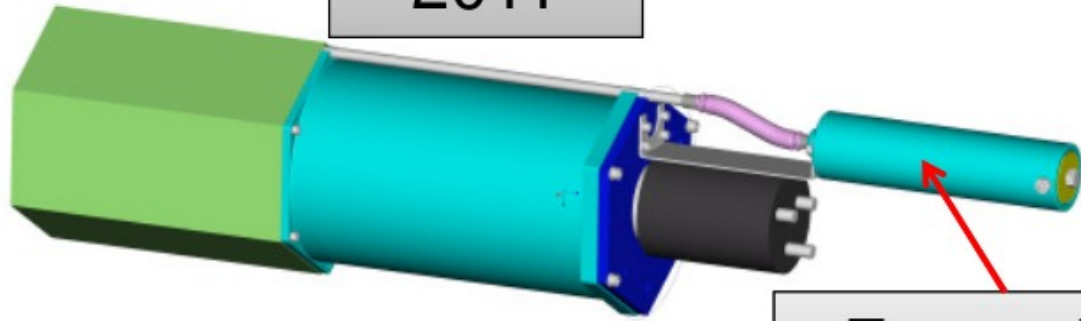
Neutron Detector Array (NEDA)



Neutron Detector Array (NEDA)

Self production

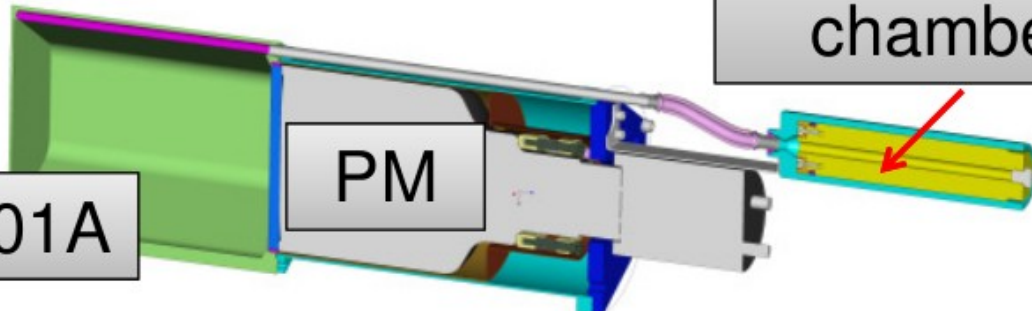
Al alloy
2011



Expansion
chamber

PM

BC501A



First three
prototype cells
(Feb. 2014)

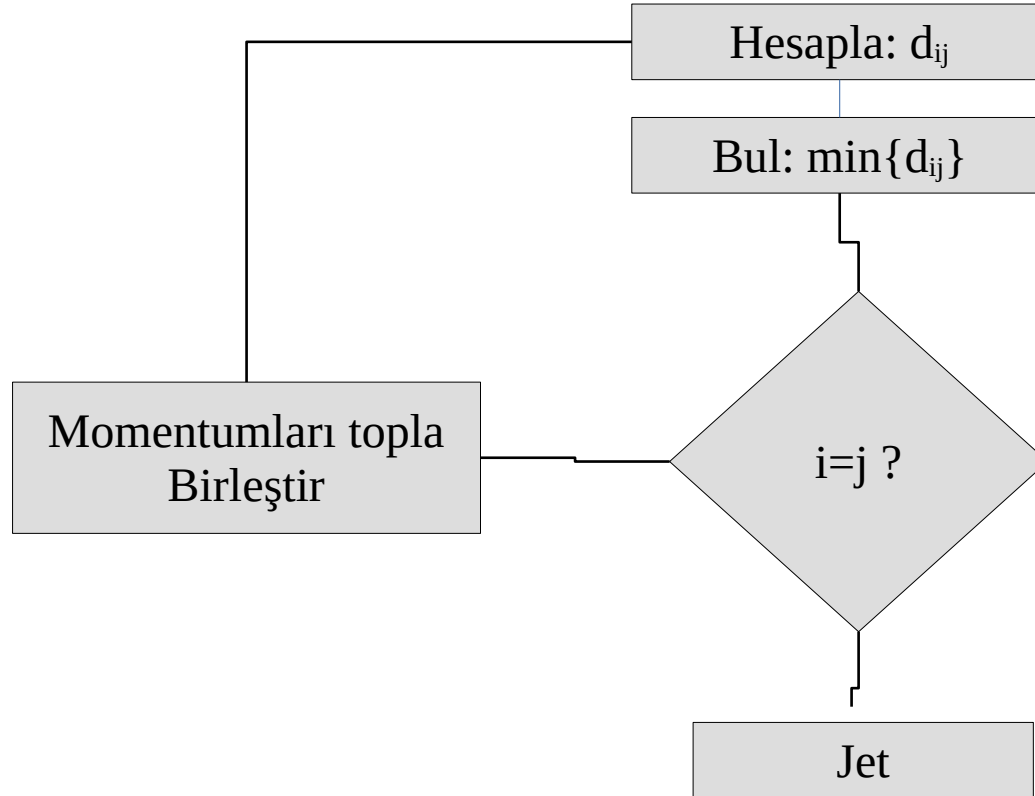
Genelleştirilmiş Jet Algoritması

Soyut uzaklık:

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

$$R_{ij} = \sqrt{(\phi_i - \phi_j)^2 + (\eta_i - \eta_j)^2}$$

Genelleştirilmiş Jet Algoritması



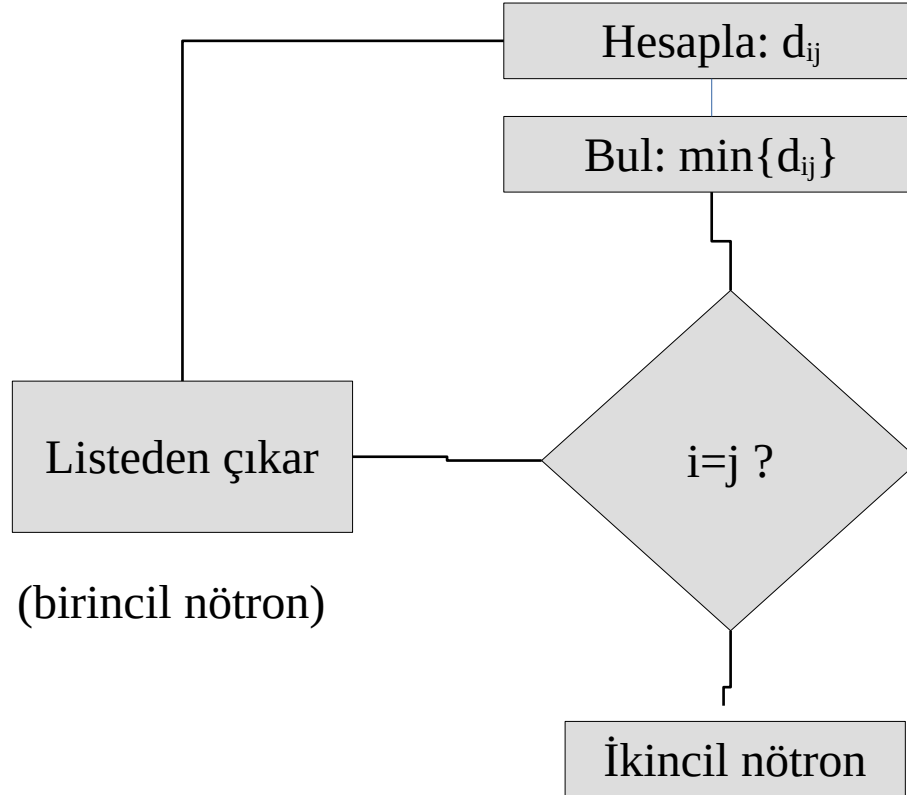
Önerilen Kümeleştirme Algoritması

Soyut uzaklık:

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

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

Algoritma

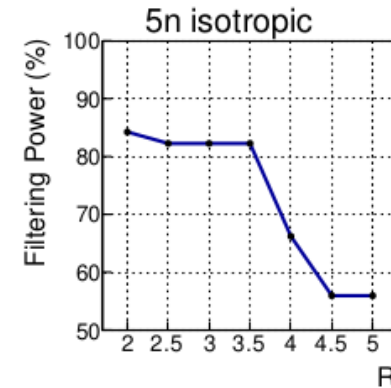
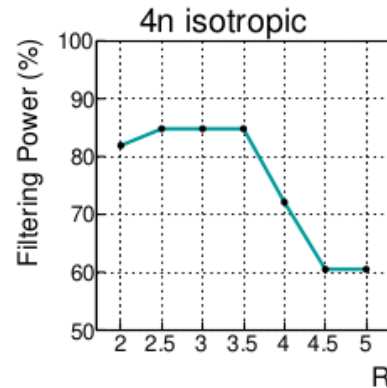
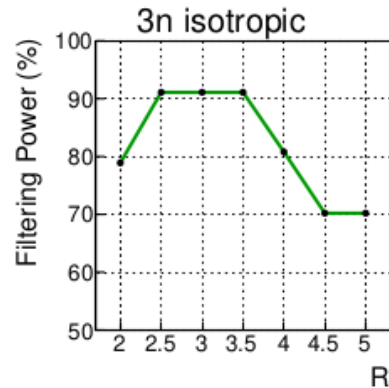
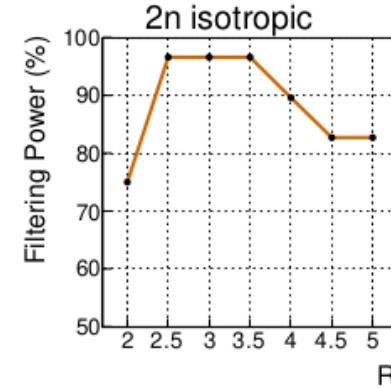
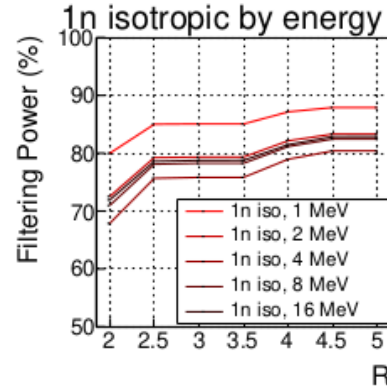
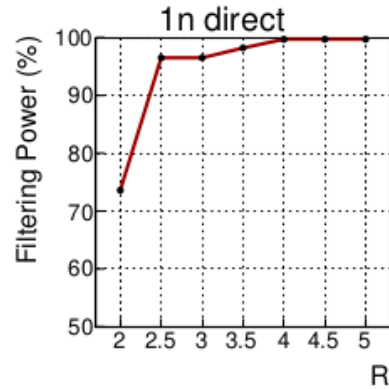


Algoritmanın Ayırıştırma Gücü

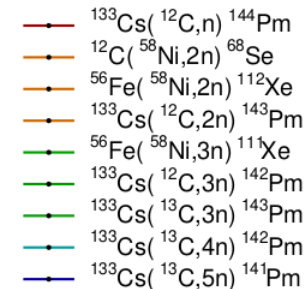
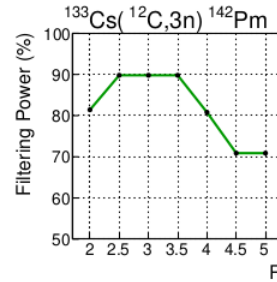
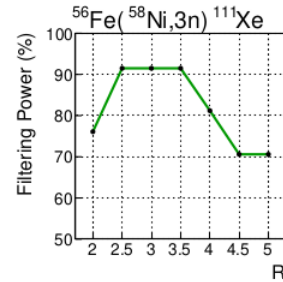
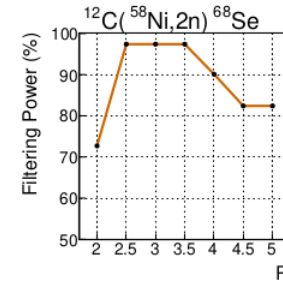
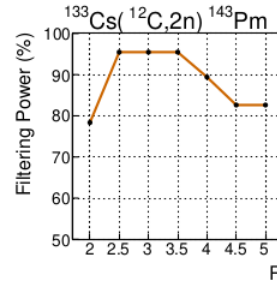
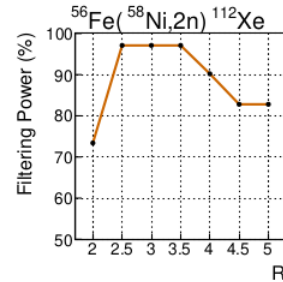
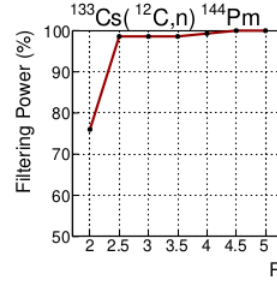
Ne kadar ayırıştırabiliyoruz?

$$\text{Filtering Power} = \frac{N_{\text{valid}} - N_{\text{cluster}}}{N_{\text{valid}}} \times 100 \%$$

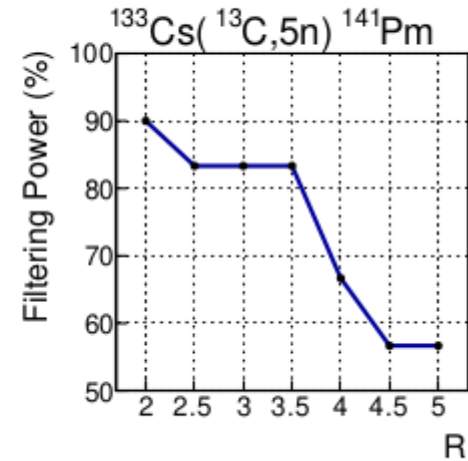
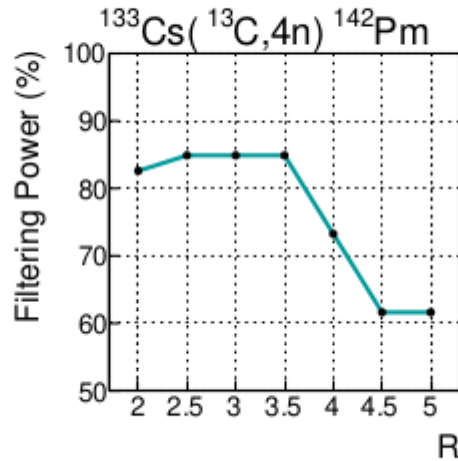
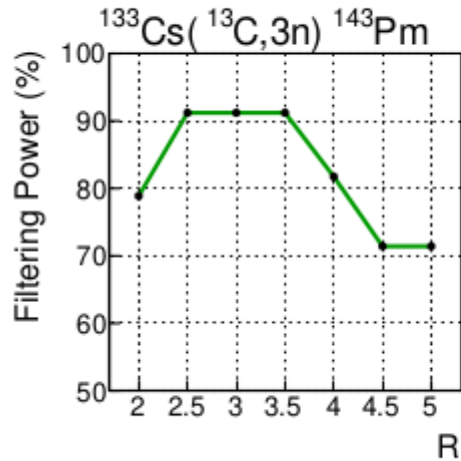
Izotropik Olayların Ayırıştırma Gücü



Nötron Buharlaştırma Tepkimeleri



Nötron Buharlaştırma Tepkimeleri



Ayrıştırma Gücü

Multiplicity	Neutron Source	Filtering Power [%]	
		Proposed ($R = 3$)	Previous Work [10]
1n	direct +Z	96.5	96.0
	isotropic	79.6	80.0
	$^{12}\text{C} + ^{133}\text{Cs}$	98.6	98.6
2n	isotropic	96.6	82.8
	$^{58}\text{Ni} + ^{12}\text{C}$	97.4	84.6
	$^{58}\text{Ni} + ^{56}\text{Fe}$	97.1	85.4
	$^{12}\text{C} + ^{133}\text{Cs}$	95.5	86.7
3n	isotropic	91.1	62.6
	$^{58}\text{Ni} + ^{56}\text{Fe}$	91.5	61.7
	$^{12}\text{C} + ^{133}\text{Cs}$	89.8	62.4
	$^{13}\text{C} + ^{133}\text{Cs}$	91.2	63.2
4n	isotropic	84.4	32.2
	$^{13}\text{C} + ^{133}\text{Cs}$	84.9	35.2
5n	isotropic	82.3	14.0
	$^{13}\text{C} + ^{133}\text{Cs}$	83.3	–

Nötron Algılama Verimliliği

$$\epsilon_{mn} = \frac{N_{\geq m}}{N_{\text{emitted}}}$$

Başka Yöntemlerle Karşılaştırılması

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	$\approx 1.62\pi$	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