Status Report
AGATA Commissioning WG

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T.Habermann, I.Kojouharov, W.Korten, N.Kurz,
E.Merchan, C.Michelagnoli, J.Nyberg, S.Pietri,
D.Ralet, M.Reese, H.Schaffner, M.Schlarb,
O.Stezowski, H.J.Wollersheim

AGATA Commissioning

Integration and system commissioning

To ensure that the integration of AGATA with the PRESPEC/FRS systems is successful, while in parallel assuring the conditions of run meet specfication in rate capabilities.

Performance commissioning

Experimentally characterize the performance of AGATA in the GSI/FRS environment, and ensure that the detector response is compatible with the expected behaviour (from simulations).

List of Done & To-be-done tasks

Task (from Commissioning Proposal)	Description	Status	Results	Related presentation in this AW
Technical commissioning	Integration of all subsystems (FRS-LYCCA-AGATA)	Performed	Yes	S. Pietri
Different Target/Beam Combinations	Background, Trigger rates and thresholds	Performed	Yes	D. Ralet
Effect of Lead-shielding	Run with / without lead shiedling	Performed	Yes	G. Guastalla
Time calibration of the prompt gamma-ray peak	Target at two different positions	Performed	Ongoing	
Acquire sufficient amount of data-files under different conditions	Debug analysis codes Go4_Prespec and Narval/Femul	Performed	Ongoing	S.Pietri / E. Merchan
“Easy” Doppler-Correction of projectile X-rays	For developing and testing DC alogrithm in the analysis codes	Performed	Yes	Michael Reese
^{50}Ti Doppler correction from knockout gamma-rays	For developing and testing DC alogrithm in the analysis codes under more realistic conditions	Performed	Ongoing	M. Reese et al.
Performance Commissioning & PSA	Knockout with 86Kr-Beam		To be done (Sept. 1-3)	
Performance Commissioning & PSA	Coulex With 86Kr-Beam		To be done (Sept. 1-3)	

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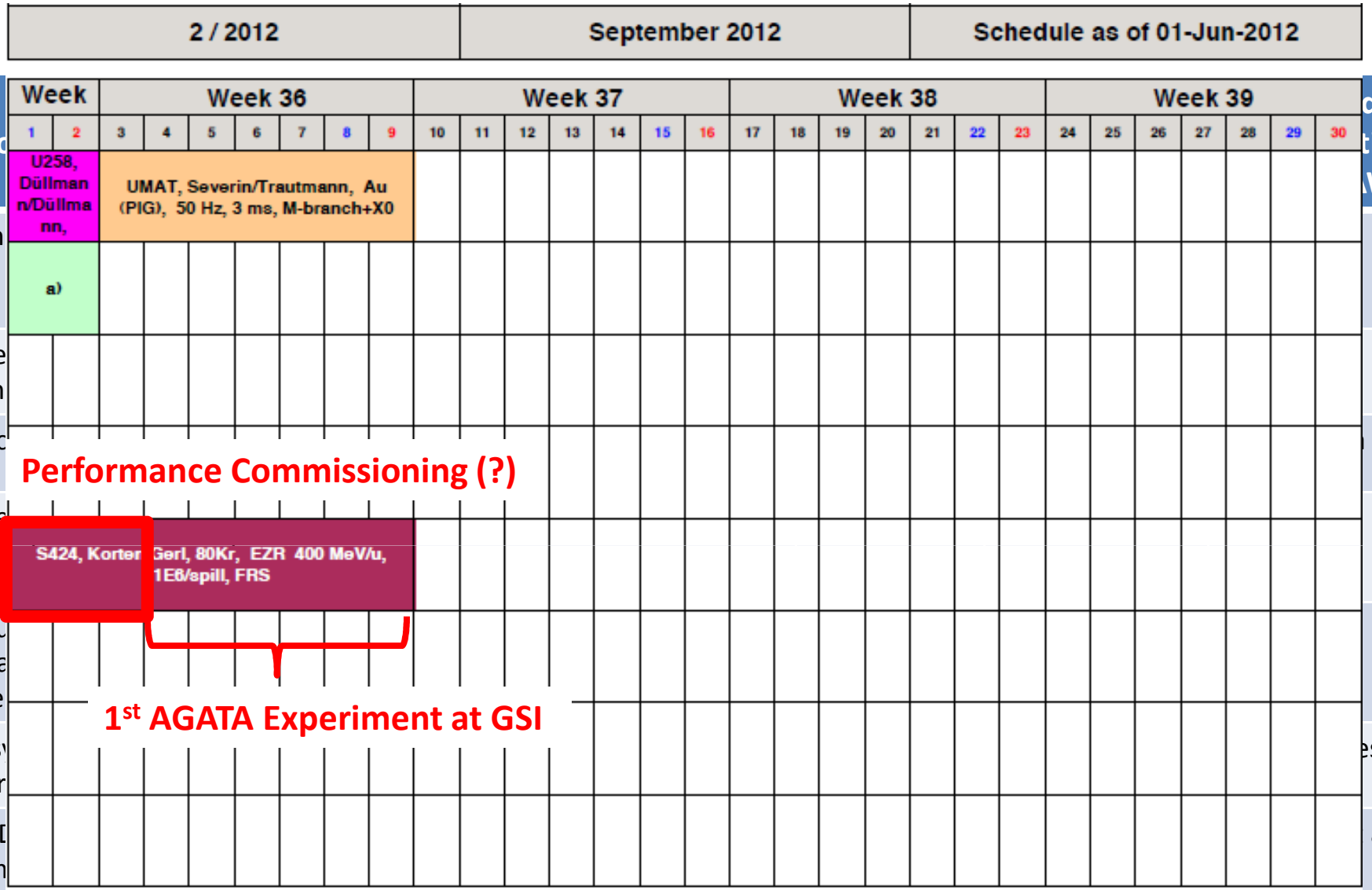

rays	more realistic conditions	
Performance Commissioning & PSA	Knockout with 86Kr-Beam	To be done (Sept. 1-3)
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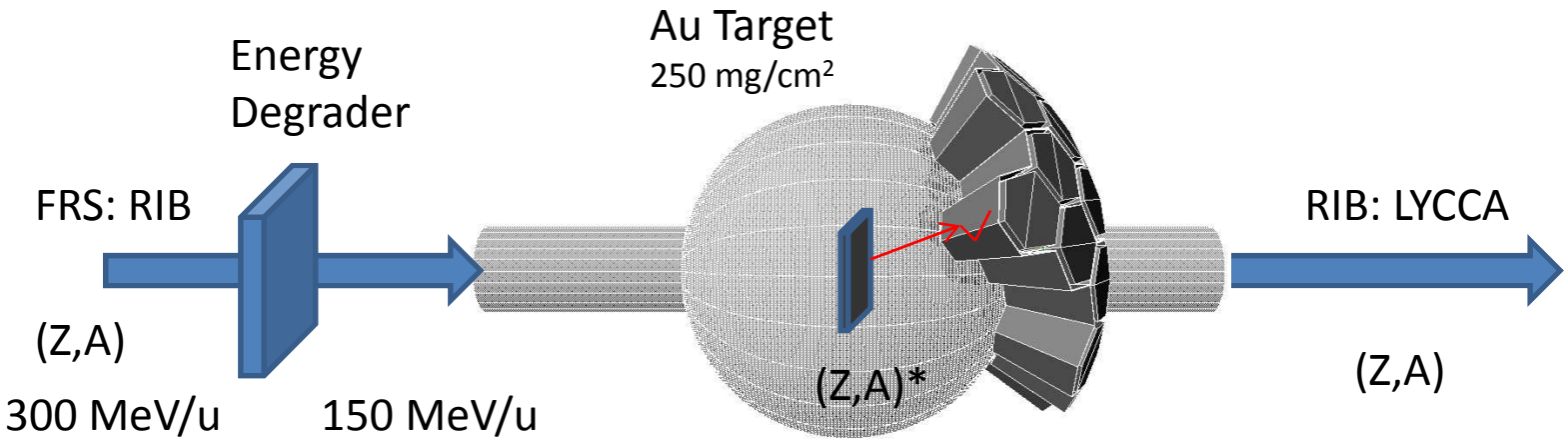
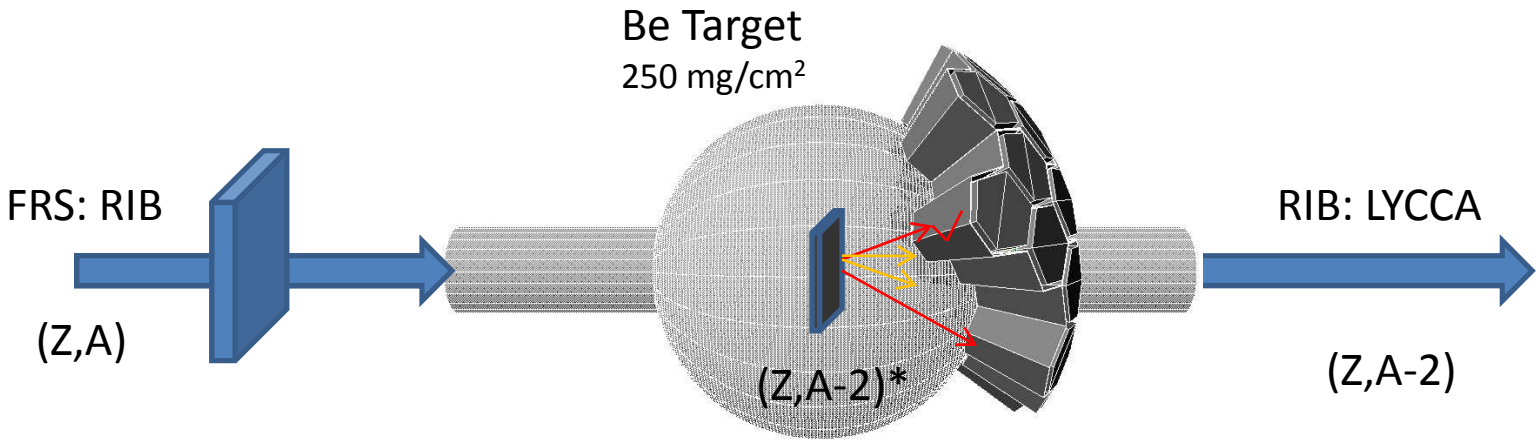
Performance Commissioning: ^{86}Kr

- Relativistic Coulomb Excitation

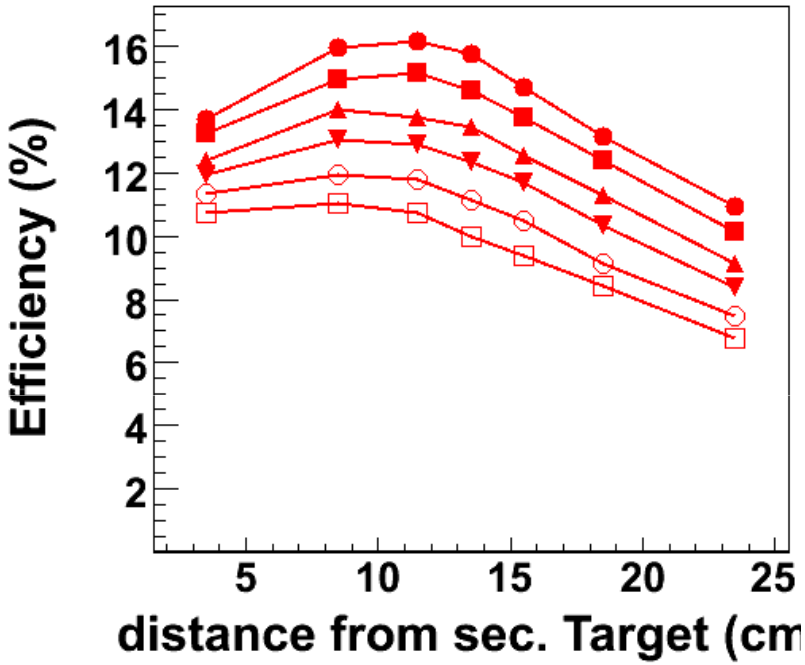


- Secondary fragmentation or particle knockout

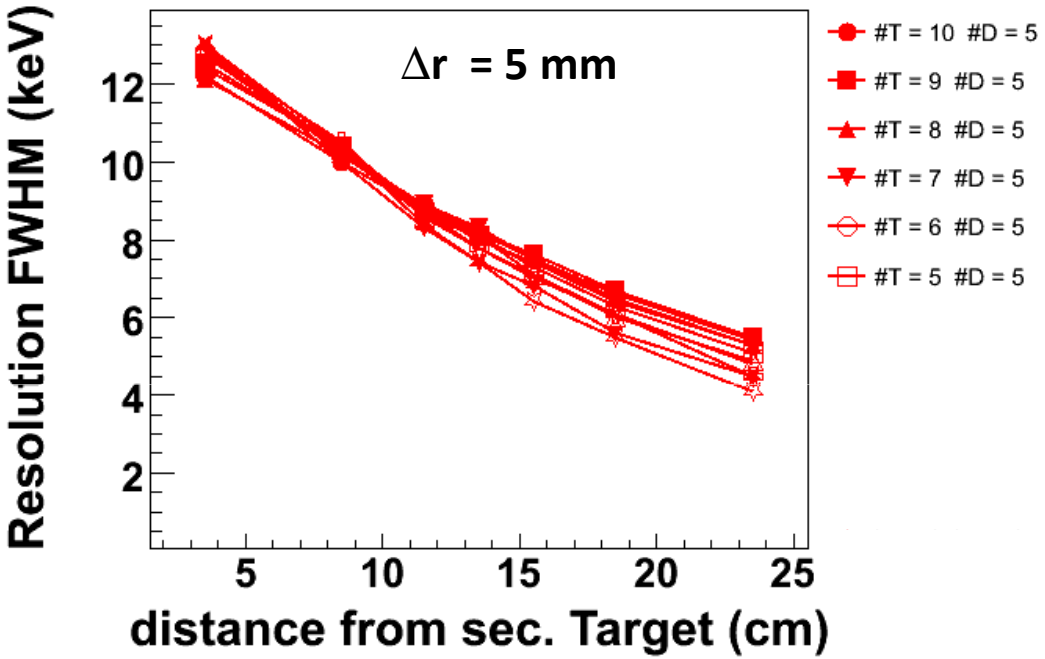


AGATA S2' @ GSI: efficiency vs. # triple (double) clusters

EFFICIENCY



RESOLUTION



- "Reference physics case": $E_{\gamma,o}$ = 1 MeV, recoil nucleus at β = 0.43 (E = 100 MeV/u), Mγ = 1

(GEANT4 AGATA code from NIMA 621 (2010) 331-343, E.Farnea et al.)

Performance Commissioning: ^{86}Kr

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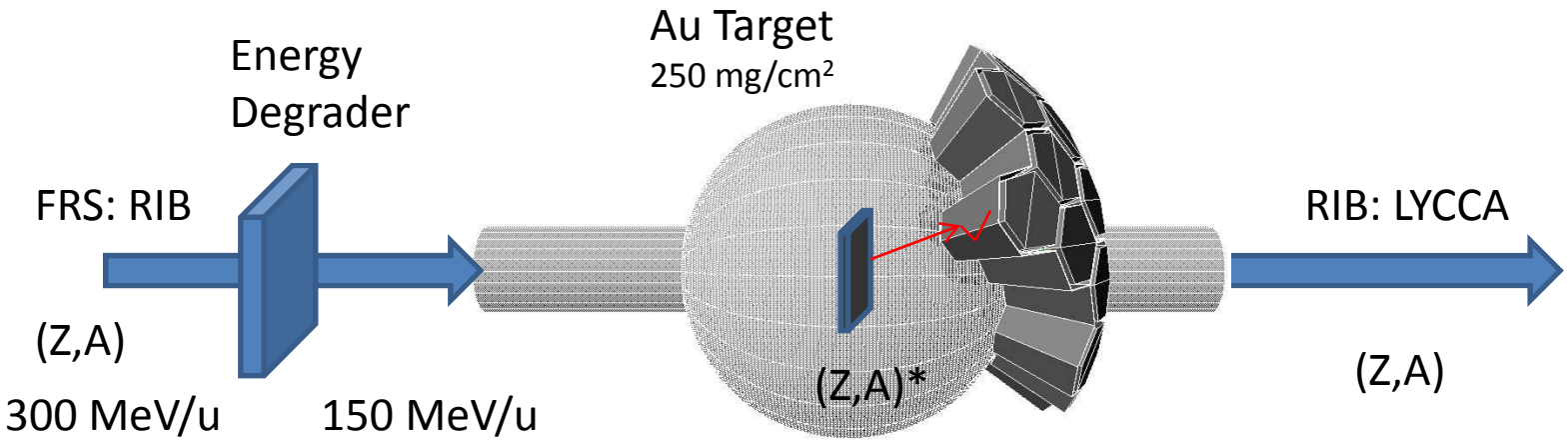

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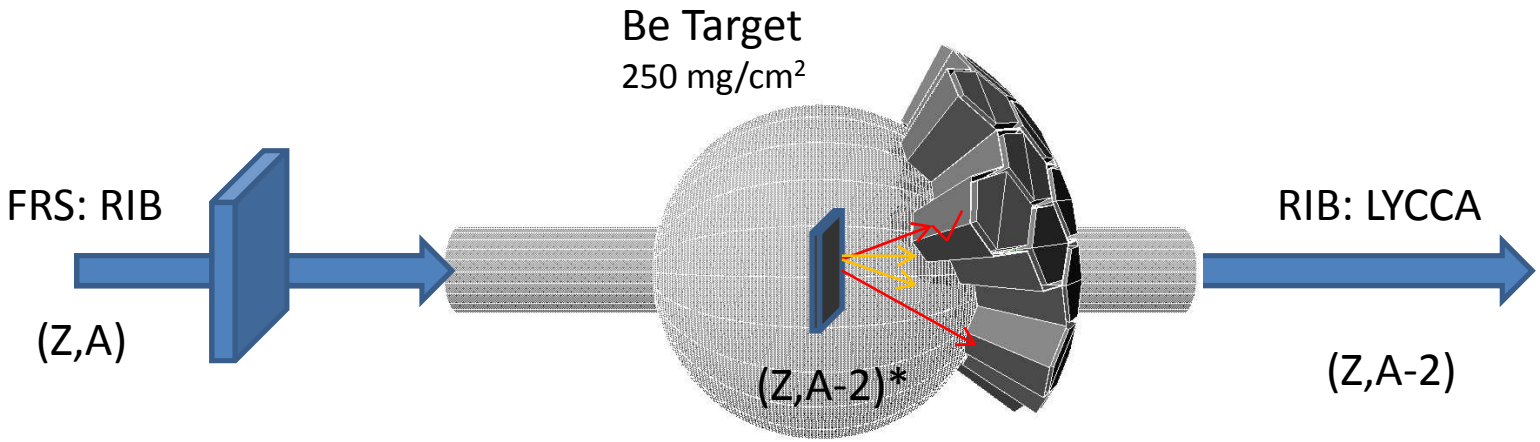

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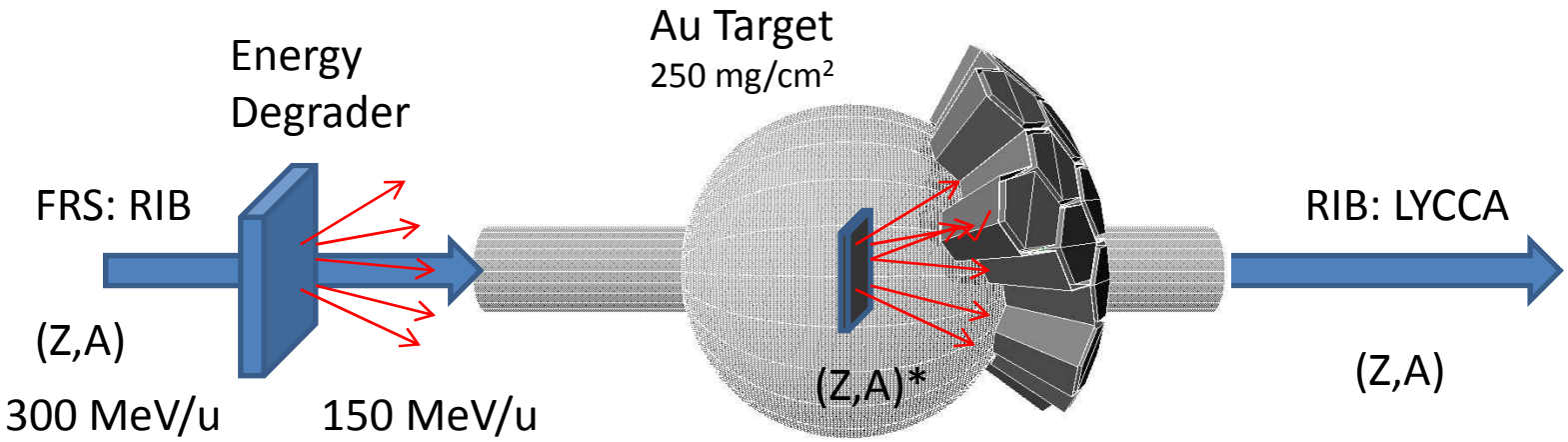

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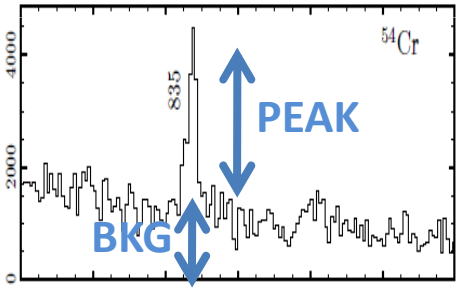
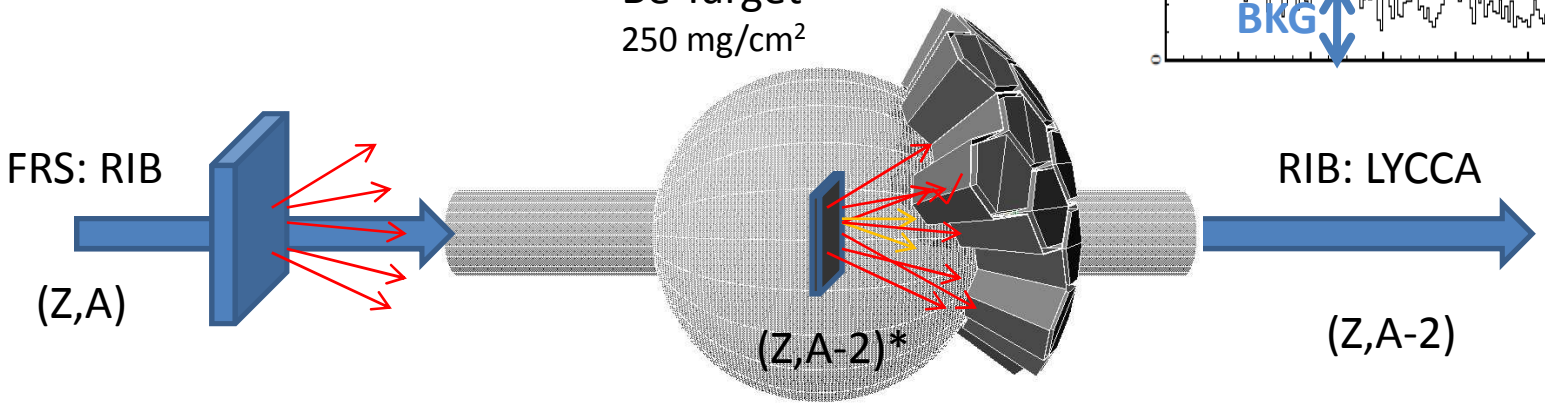
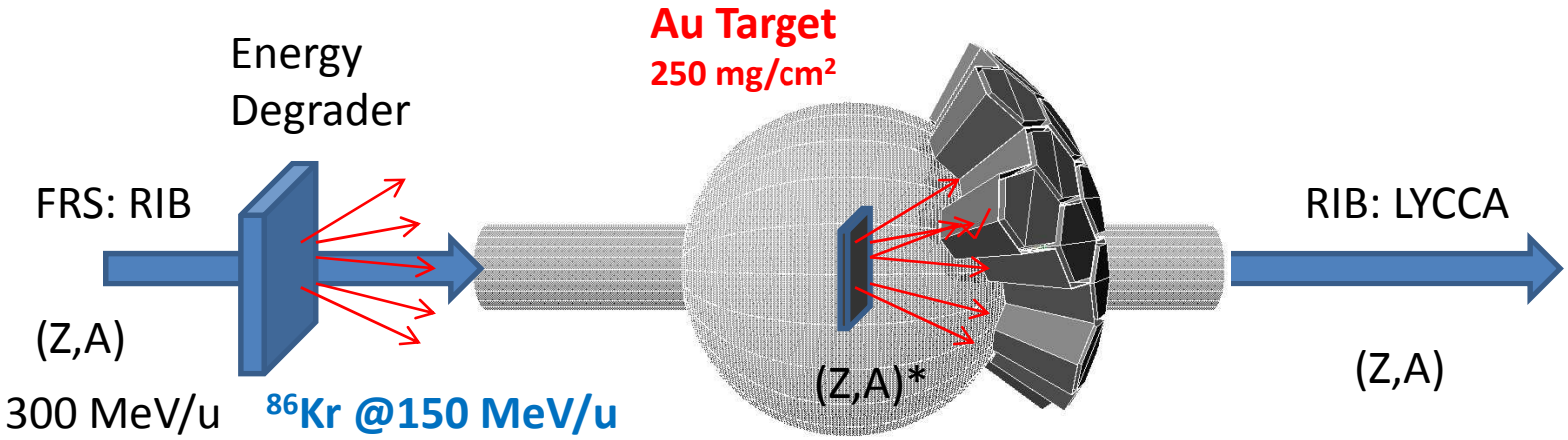


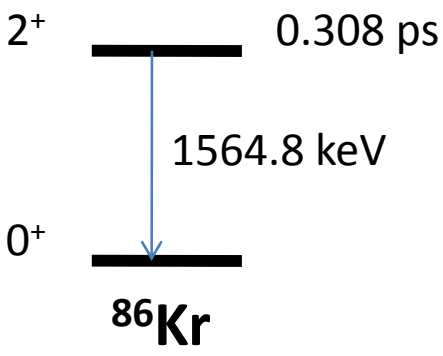


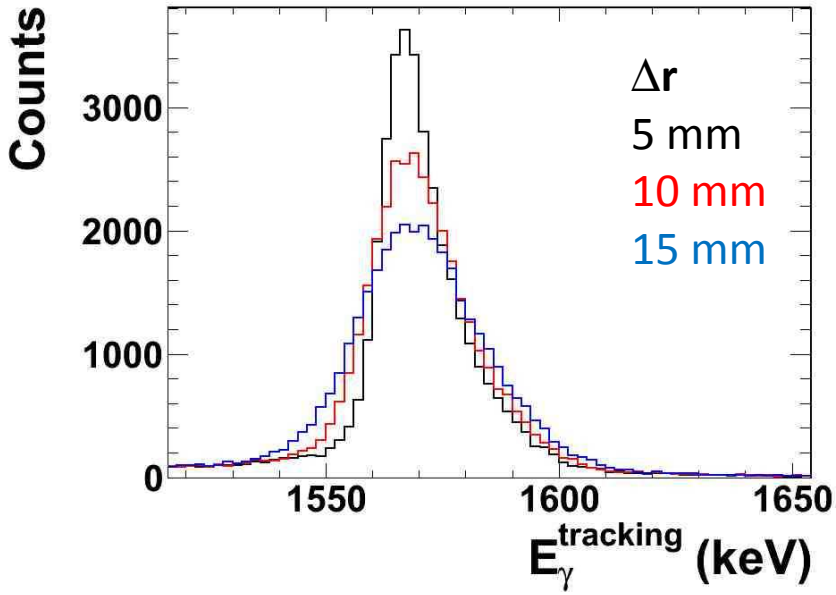
Performance Commissioning: ^{86}Kr

- Relativistic **Coulomb Excitation**



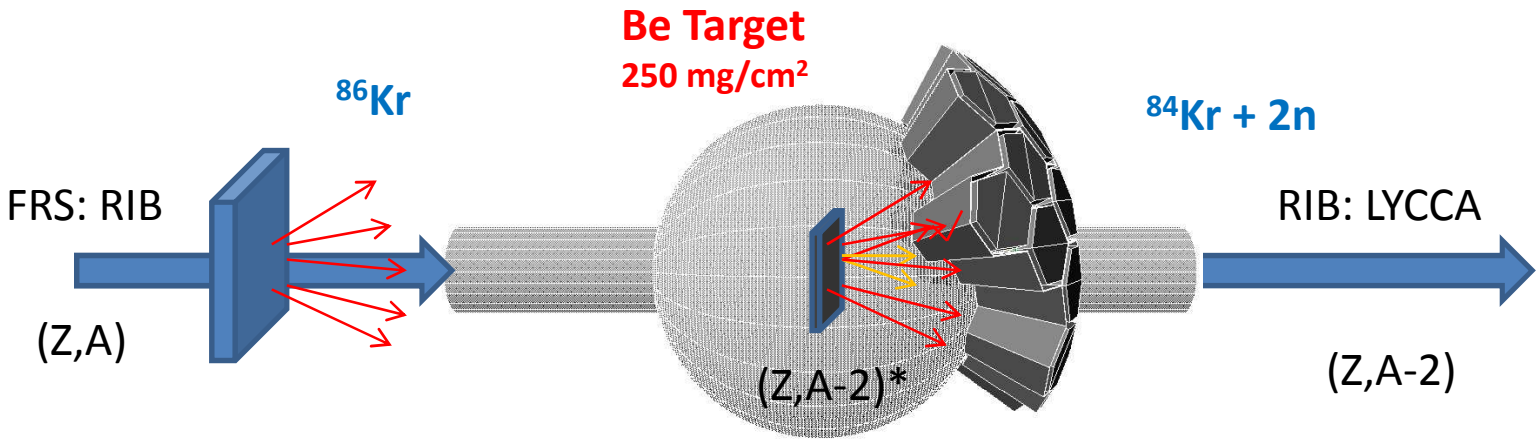
PSA Optimisation

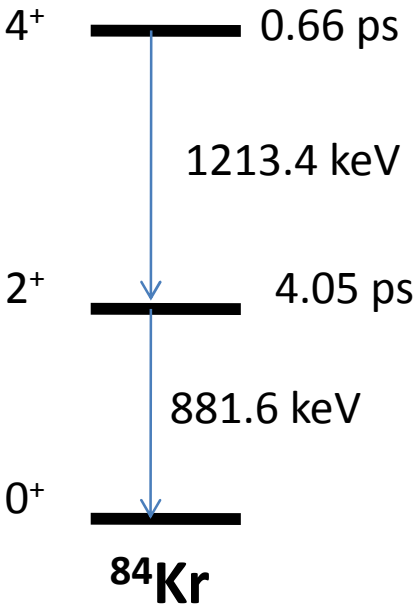


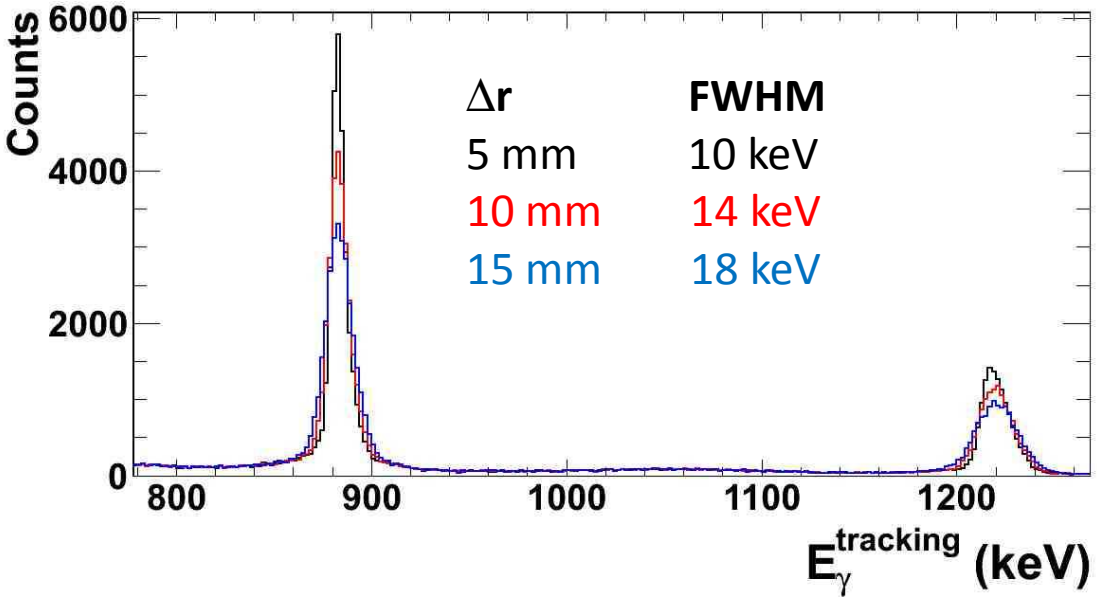


Performance Commissioning: ^{86}Kr

- **Secondary fragmentation** or particle knockout







Summary

• The **technical commissioning** of AGATA at GSI has been successfully carried out (see the following talks).

• Some aspects like the time-calibration of the prompt gamma-peak, and the debug of the online software using the data taken are still in progress.

• We expect to carry out the **performance commissioning** in the **first week of September** (?) and it would be convenient to have some time to analyse the data and optimise the system settings before the first experiment starts.

• It seems that primary **^{86}Kr beam** could be available (for performance commissioning), which is appropriate for the two bechmark tests on Coulex and particle knockout.

• Using primary beam for the commissioning (defocussed at S4) has the advantage that the FRS does not need to be calibrated.

• On the other hand, a **LYCCA calibration** is mandatory mainly for the knockout case.

Backup slides

List of Done & To do tasks

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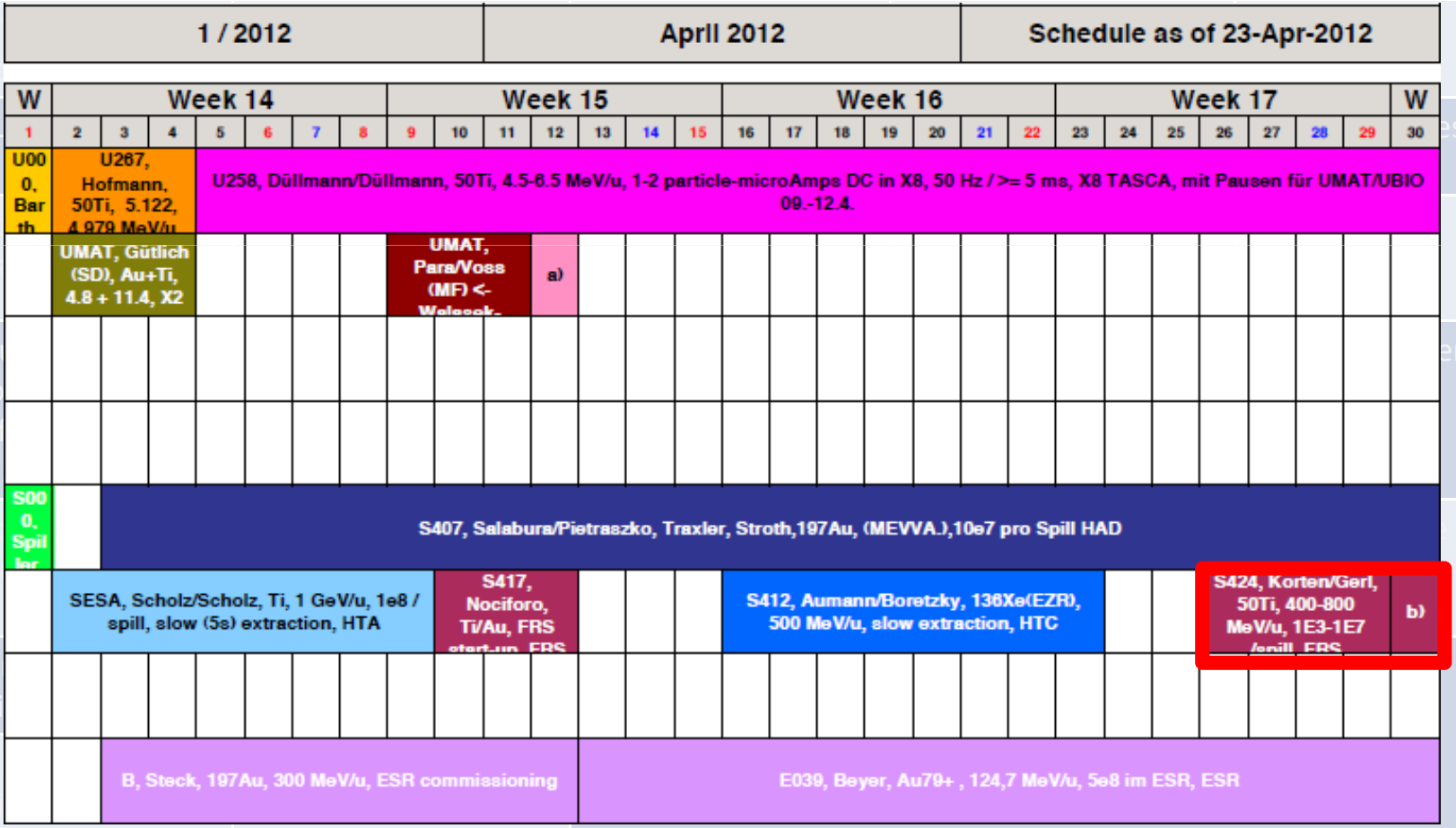

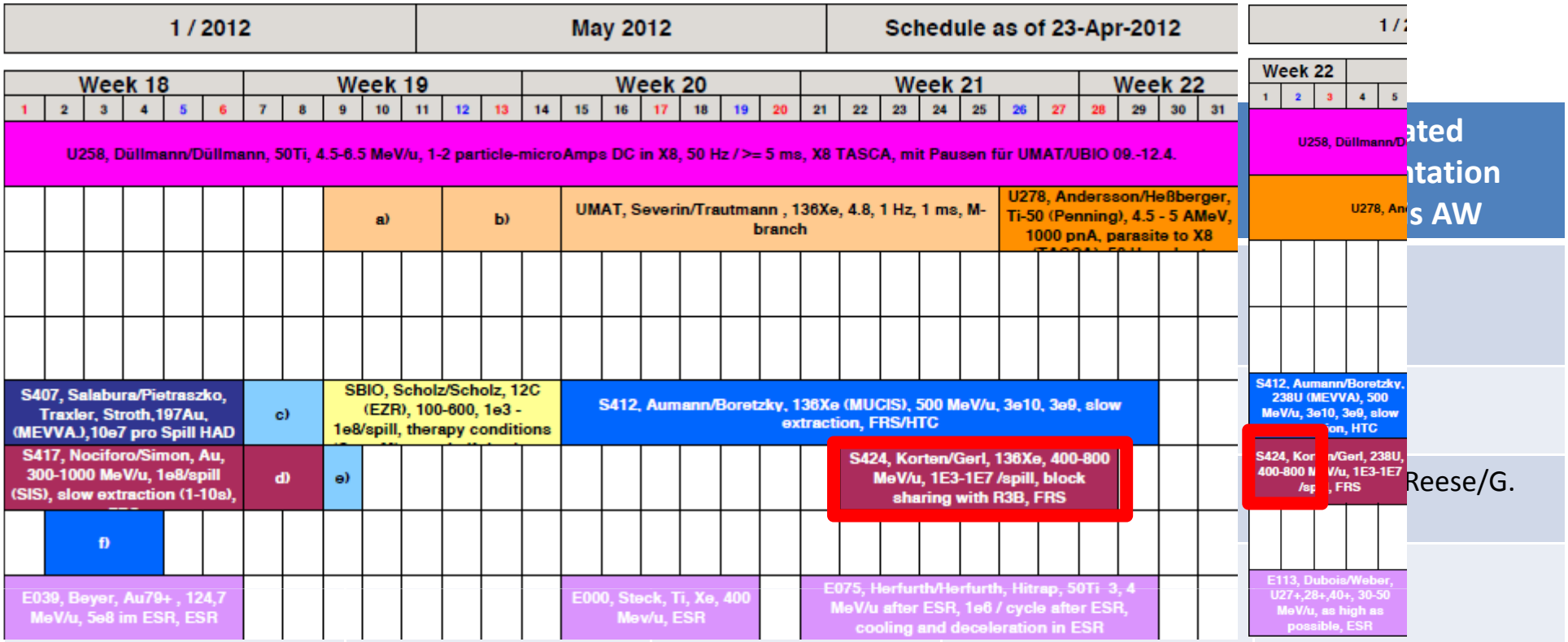

Acquire sufficient amount of data-files under different conditions	Debug analysis codes Go4_Prespec and Narval/Femul	Performed	Ongoing	S.Pietri / E. Merchan
“Easy” Doppler-Correction of projectile X-rays	For developing and testing DC alogrithm in the analysis codes	Performed	Yes.	Michael Reese
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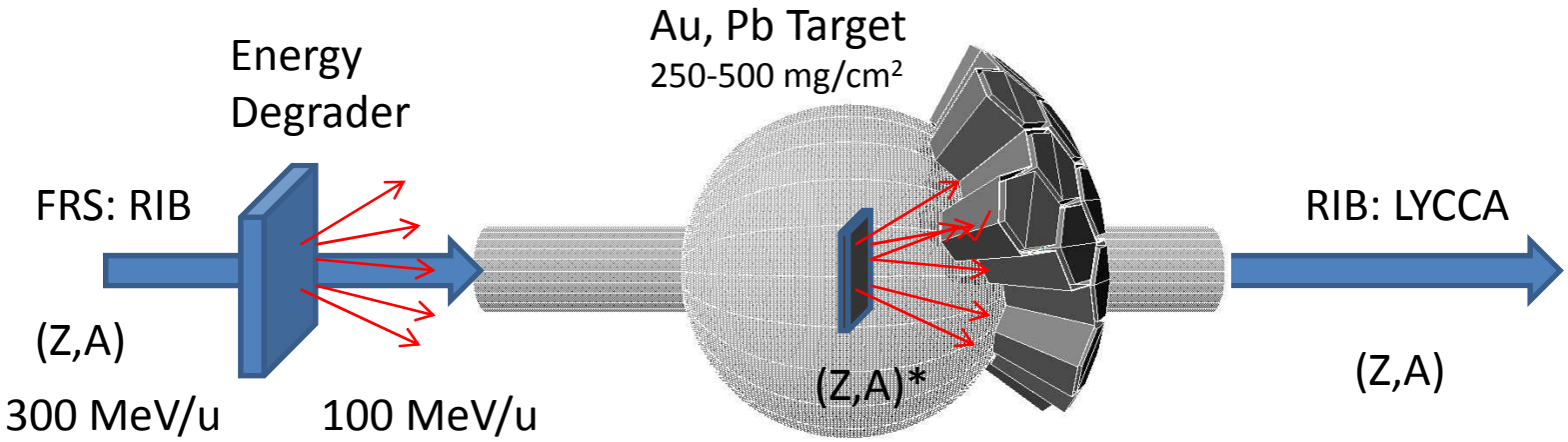
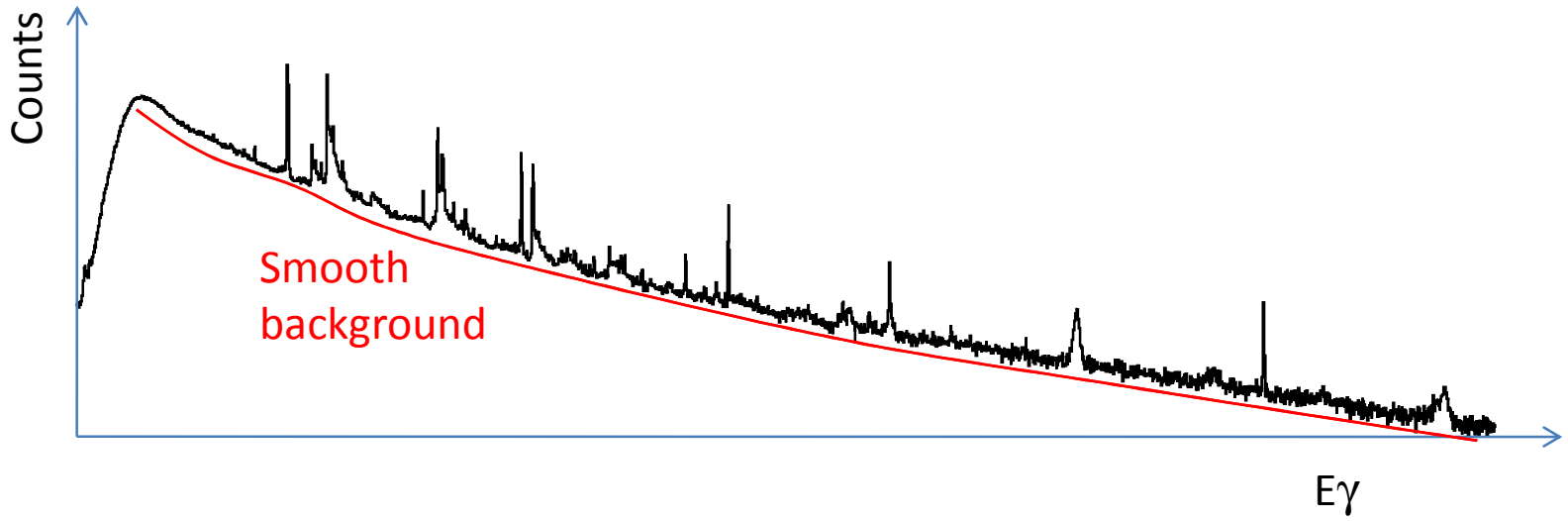
Two common techniques @ FRS

- Relativistic Coulomb Excitation





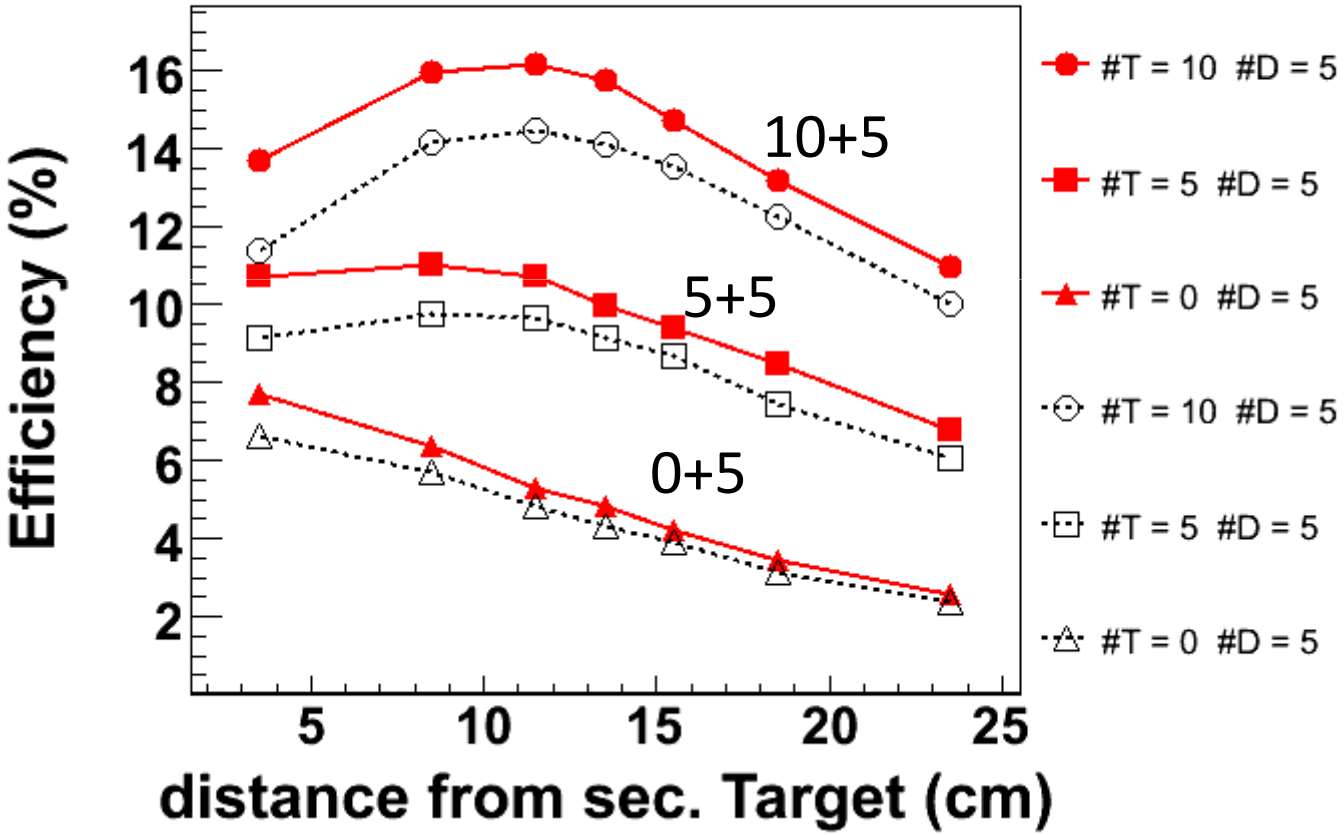
Effect of the lead absorber

No shielding

2mm Pb shielding

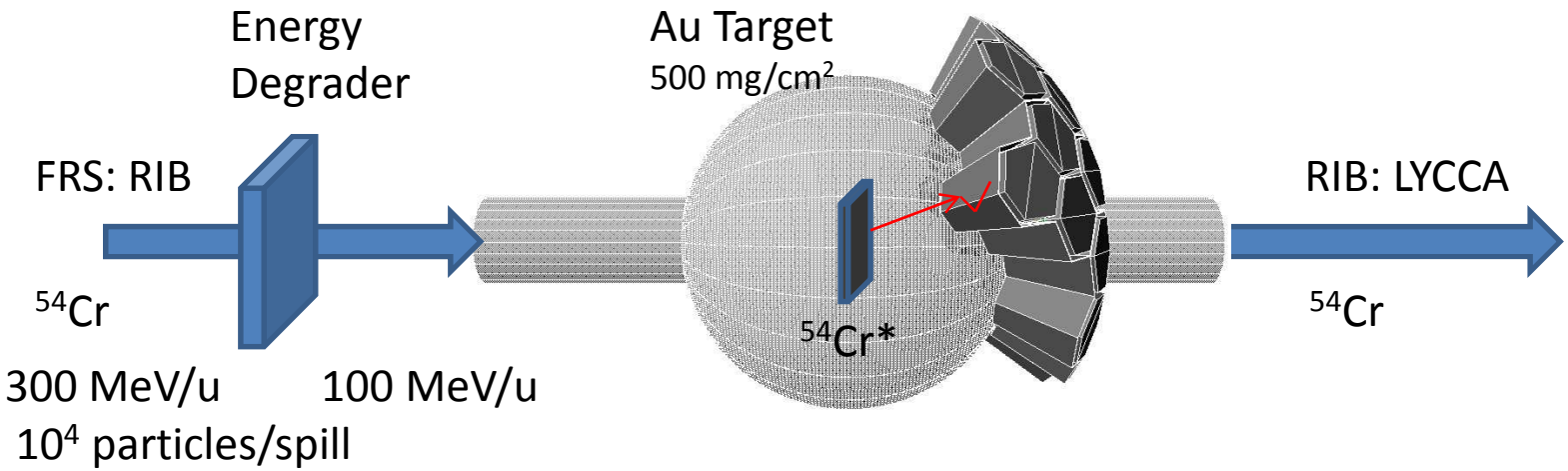
Really needed? how thick?

Test it !

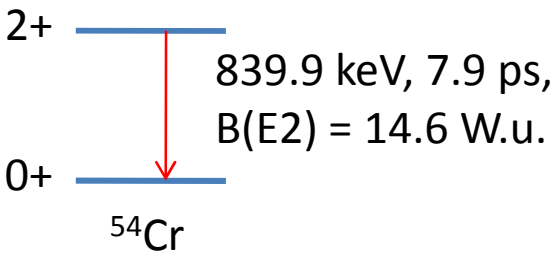


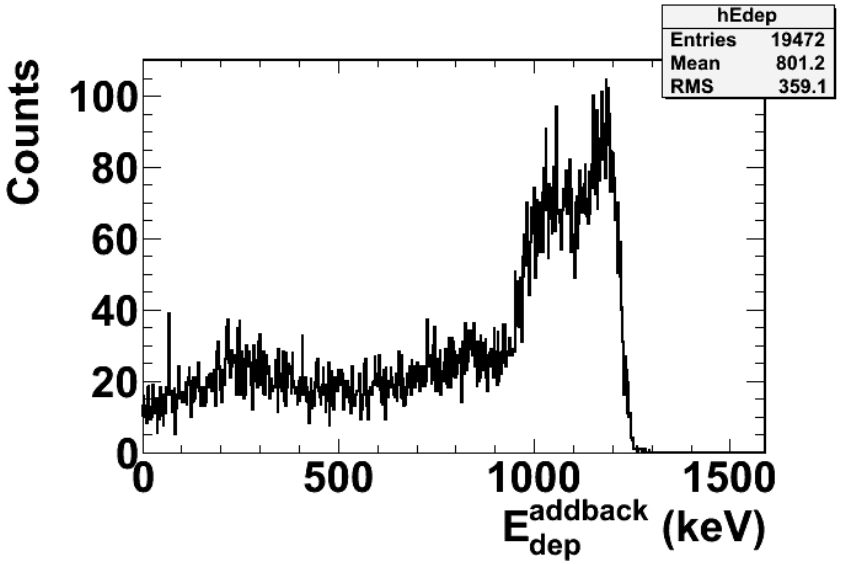
Coulex benchmark case

- Relativistic Coulomb Excitation (just an example)



$p\gamma\text{-rate@AGATA} = I_{54} x N_{at} x \sigma_{Coulex} x \varepsilon\gamma$





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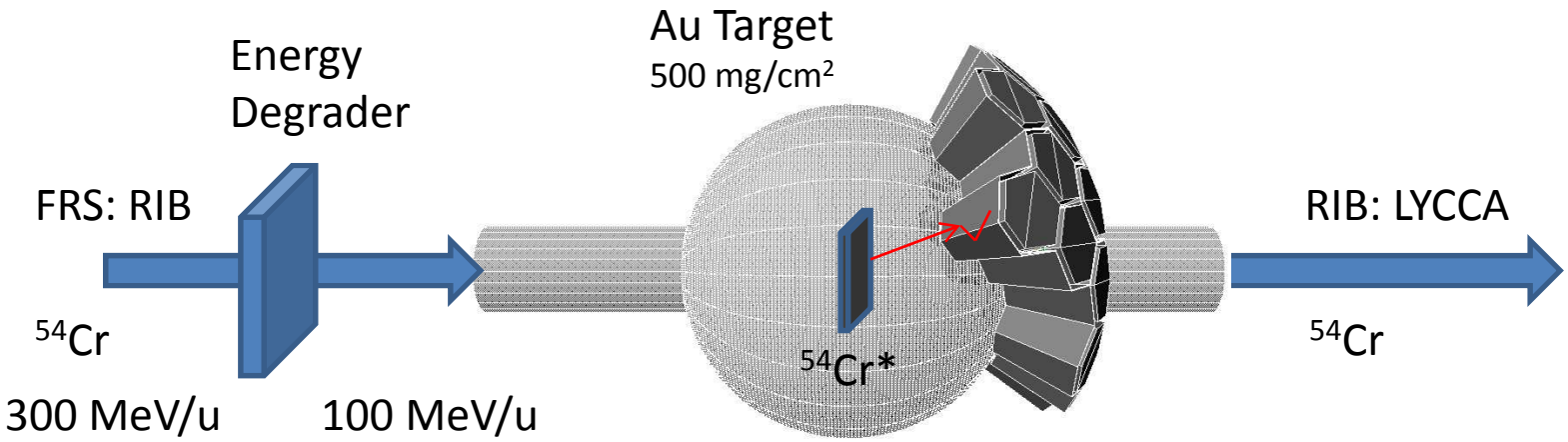

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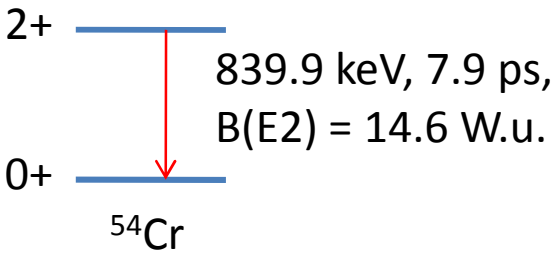

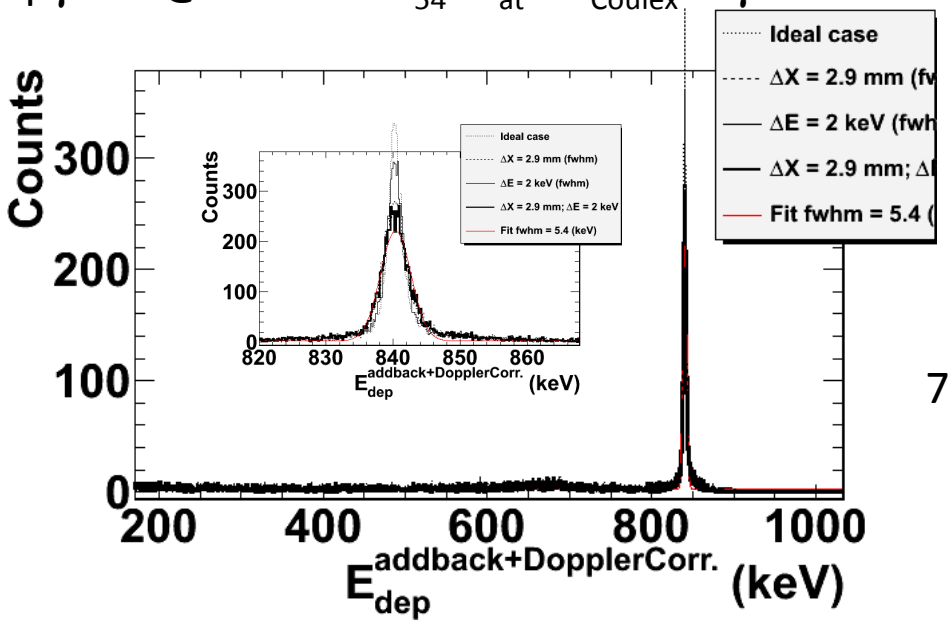

716 C/hour

Coulex benchmark case

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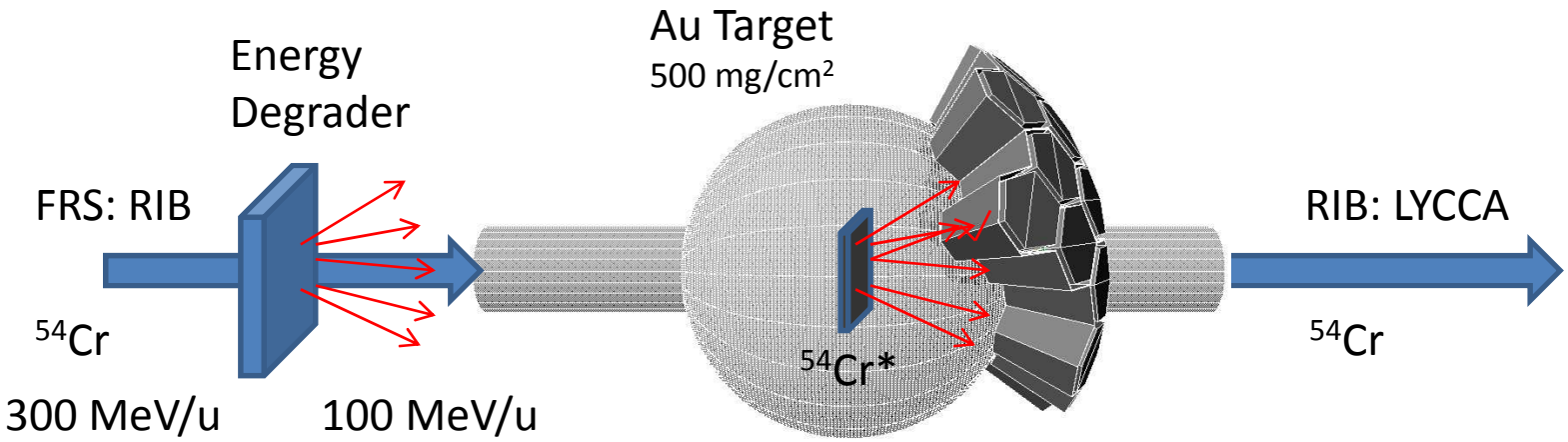

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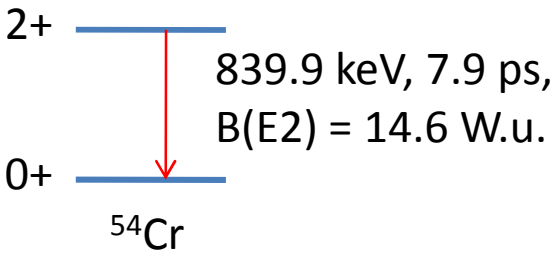

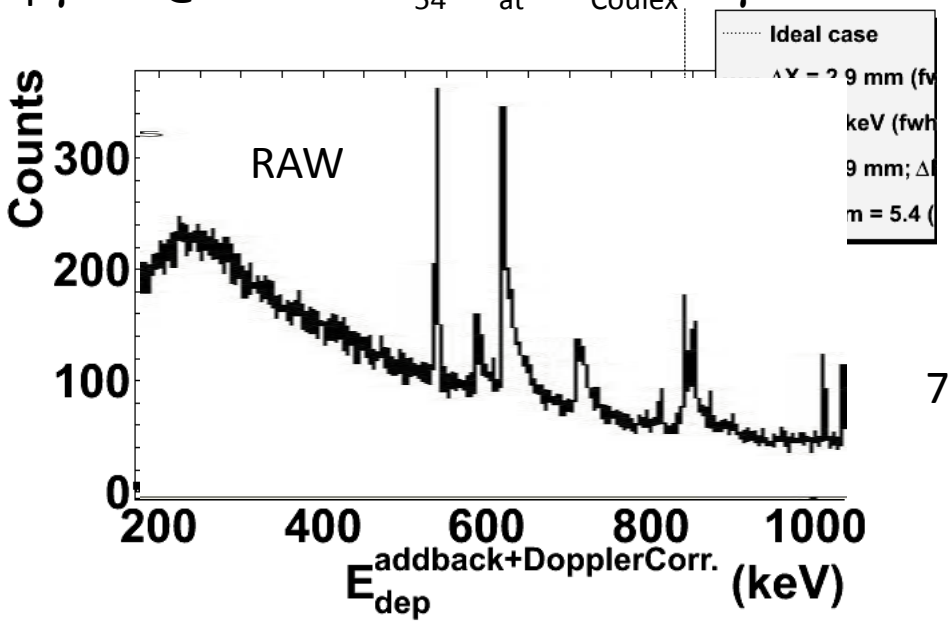

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Coulex benchmark case

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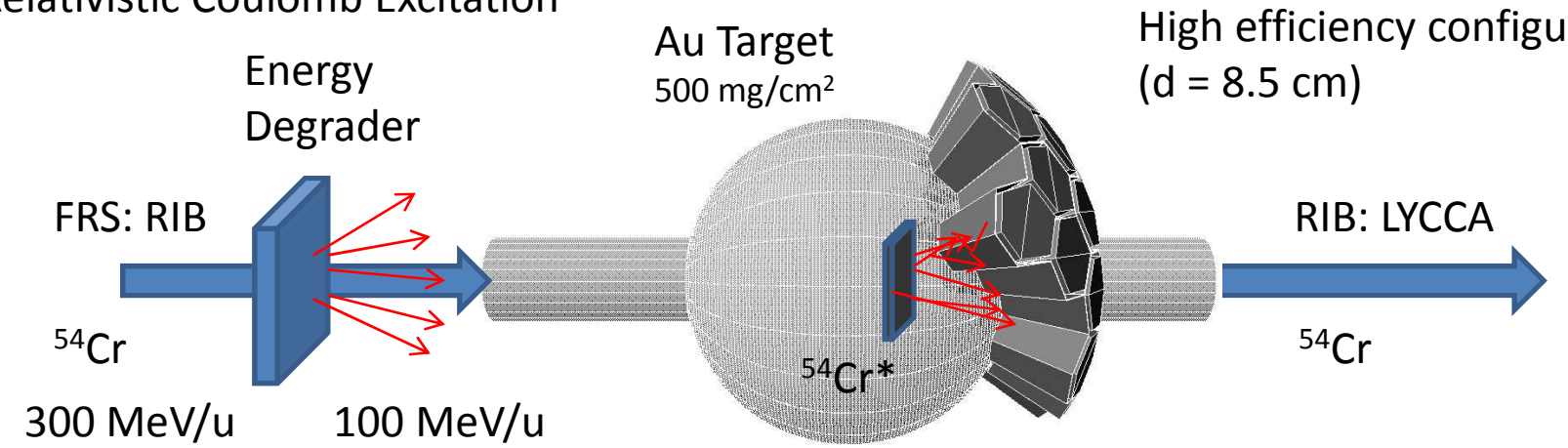

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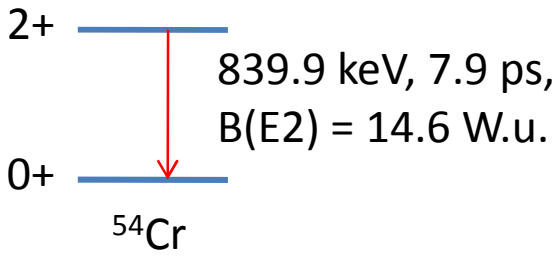

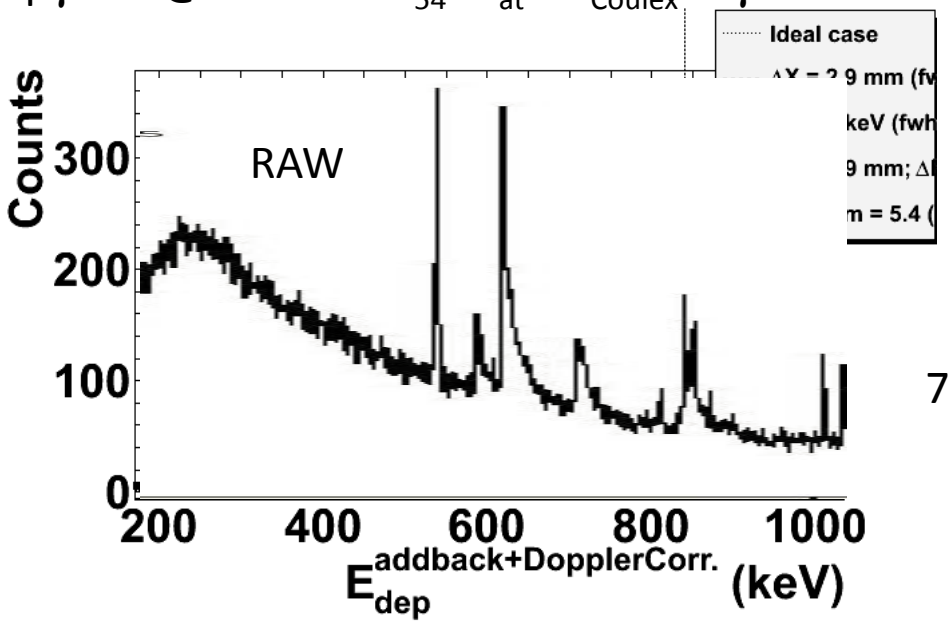

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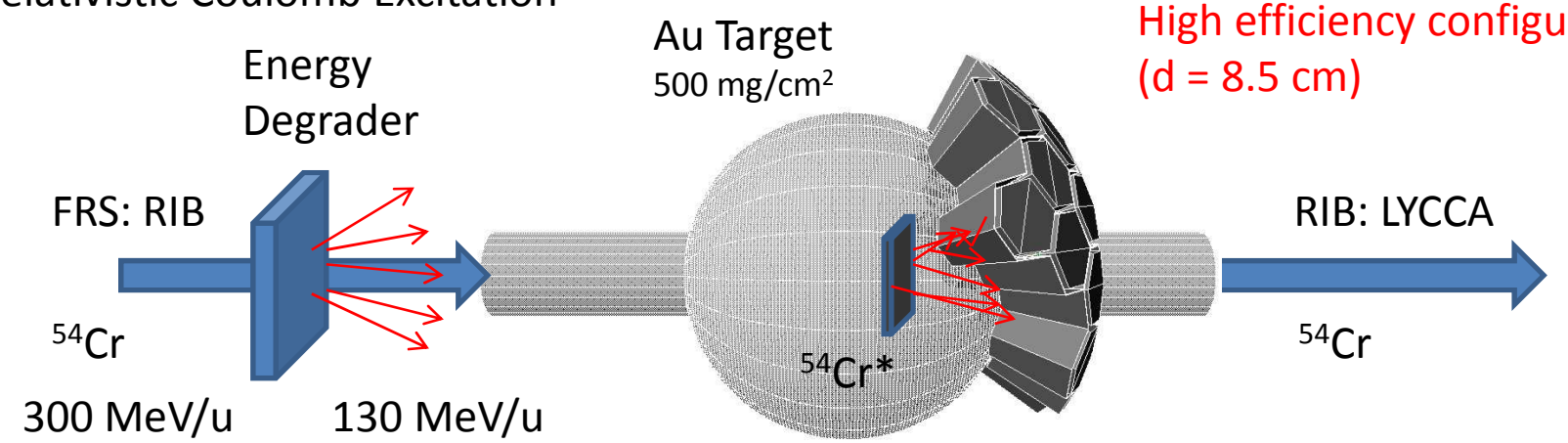

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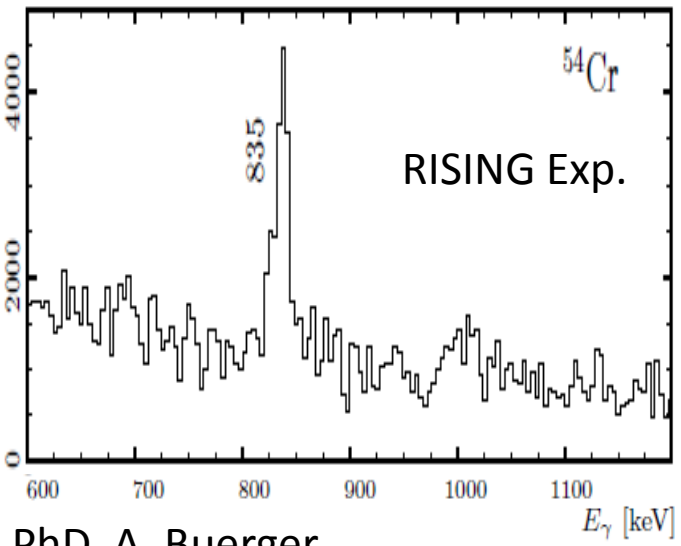
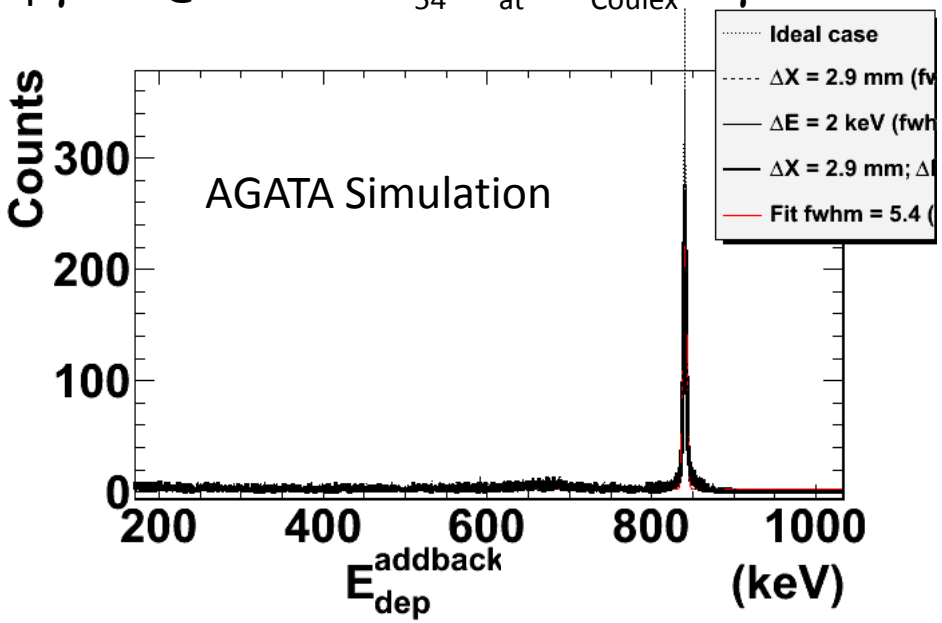


PhD A. Buerger



Beam candidates (from nndc database)

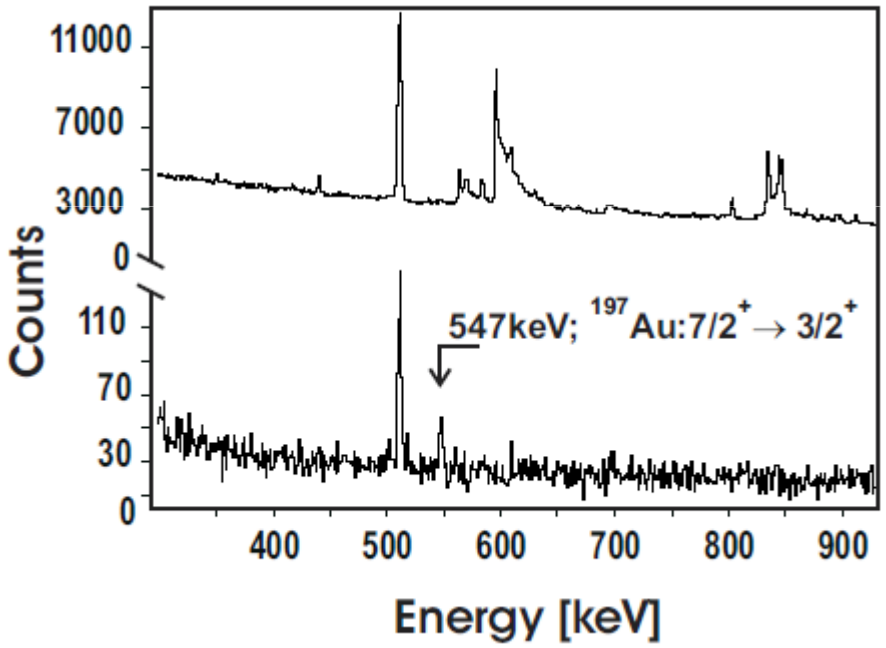
- Up to A<90 (to keep good A resolution in LYCCA)
- Eg in typical Coulex/Fragmentation energy range i.e. 400keV-1.5 MeV
- Large B(E2) in order to optimise beam-time
- Lifetime of the level above 4 ps (to decay after the target)
- Stable beam (to facilitate FRS start-up, etc)

A	Element	Z	N	Energy	T1/2 (ps)	B(E2) W.u.
44	CA	20	24	1157.0	2.61	11.3
48	TI	22	26	983.5	4.04	14.7
50	CR	24	26	783.30	8.87	19.8
54	CR	24	30	834.855	7.9	14.6
56	FE	26	30	846.776	6.07	16.8
58	FE	26	32	810.7	6.54	18.5
72	GE	32	40	834.011	3.35	17.8
72	GE	32	40	834.011	3.35	23.5
74	GE	32	42	595.850	12.41	33.0
76	GE	32	44	562.93	18.2	29
74	SE	34	40	634.74	7.08	42.0
76	SE	34	42	559.102	12.3	44
78	SE	34	44	613.727	9.79	33.5
80	SE	34	46	666.27	8.52	24.7
78	KR	36	42	455.033	21.6	67.9
80	KR	36	44	616.60	8.3	37.3
82	KR	36	46	776.520	4.45	21.3
84	KR	36	48	881.615	4.05	12.0

$\sigma \sim B(E2\uparrow) \times Z^2$

Concomitant aspects

• Simultaneous Coulomb excitation of the Au-target atoms → online inspection of the ARRAY performance (not Doppler shifted).



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STATUS OF THE RISING PROJECT AT RELATIVISTIC ENERGIES*

P. Bednarczyk[a,b], A. Banu[a], T. Beck[a], F. Becker[a], M.A. Bentley[c], G. Benzoni[d], A. Bracco[d], A. Bürger[e], F. Camera[d], P. Doornenbal[a], C. Fahlander[f], H. Geissel[a], J. Gerl[a], M. Górska[a], H. Grawe[a], J. Grębosz[a,b], G. Hammond[c], M. Hellström[a], H. Hübel[e], J. Jolie[g], M. Kmiecik[b], I. Kojouharov[a], N. Kurz[a], R. Lozeva[a], A. Maj[b], S. Mandal[a], W. Męczyński[b], B. Million[d], S. Muralithar[a], P. Reiter[g], D. Rudolph[f], N. Saito[a], T.R. Saito[a], H. Schaffner[a], J. Simpson[h], J. Styczeń[b], N. Warr[g], H. Weick[a], C. Wheldon[a], O. Wieland[d], M. Winkler[a] and H.J. Wollersheim[a]

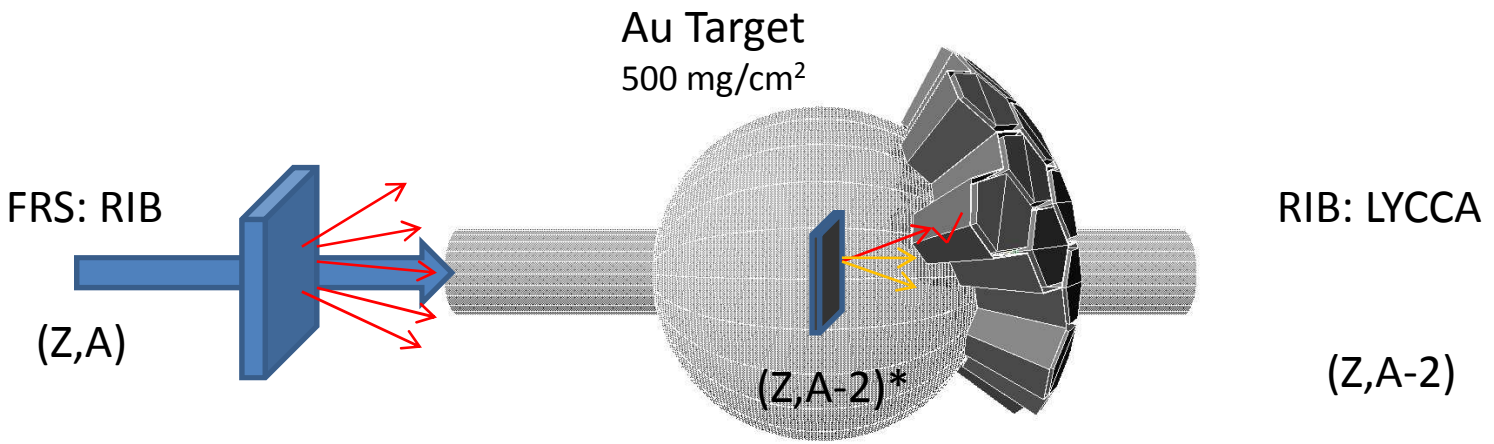
• Ensure (online, but after some hours due to the low yield) that particle-gamma coincidences are working properly.

• Allows to determine Peak/Total-ratio and background level for the RAW spectrum, although these parameters are actually relevant in the Doppler Corrected spectrum.

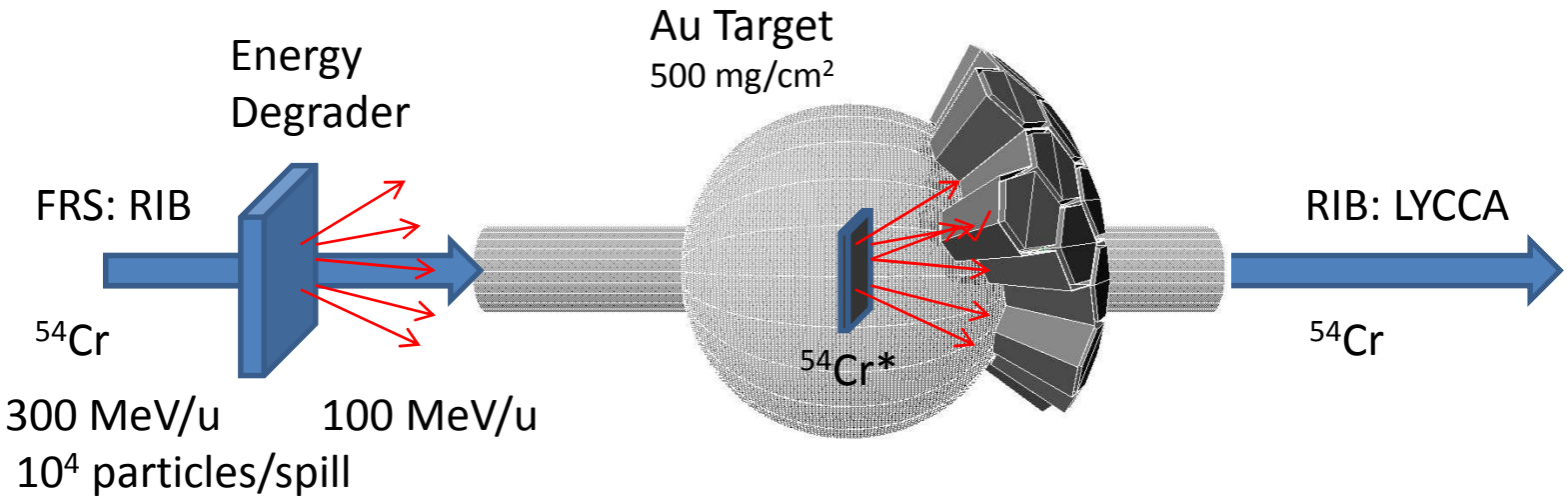
Concomitant aspects

• Simultaneous Coulomb excitation of the Au-target atoms → online inspection of the ARRAY performance (not Doppler shifted).
• Secondary fragmentation reactions in Au-target → same P/N-study for fragmentation reactions, e.g. ^{54}Cr→ ^{50,52}Cr, ^{50,52}V, etc.

• Secondary fragmentation or **particle knockout**



Counting rates summary (example)



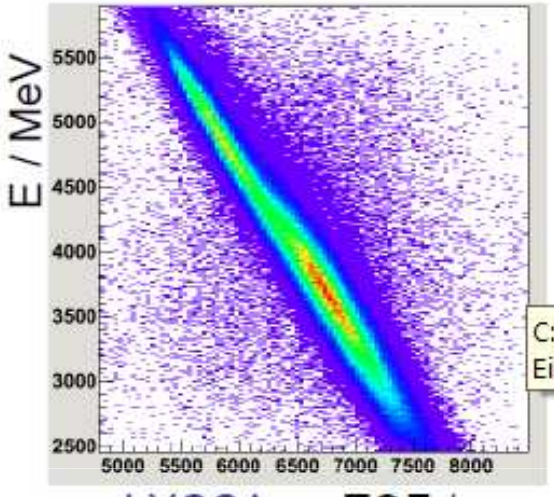
	CS (mb)	Yield (g/s)	Rate@23cm (C/h)	Rate@8cm (C/h)
54Cr, 845keV	158	4.7	406	657
197Au,547keV	Exp.	Exp.	40	65
52Cr,1434keV	5	0.15	13	21

Beam time request: about 1 week to collect enough statistics in every crystal, and have enough data to test PSA and tracking algorithms.

Beam time request

1. FRS Calibration (24 h, parasitic)
2. LYCCA Calibration (x h)
3. 54Cr Coulex @ high efficiency mode (10h)
4. 54Cr Coulex @ high resolution mode (10h)

LYCCA A and Z ID around ^{100}Sn



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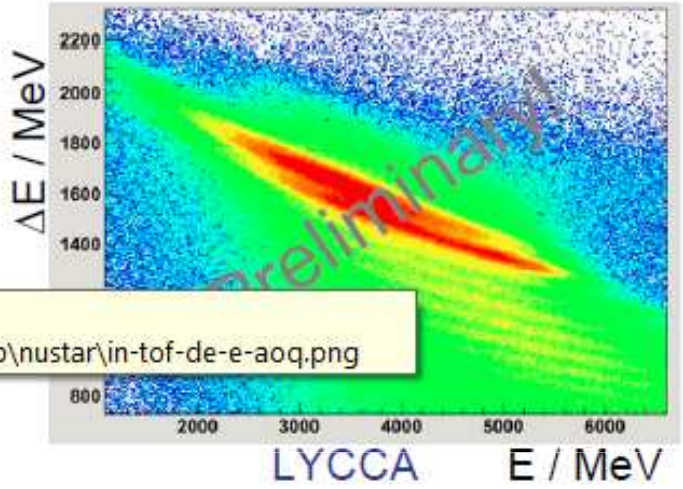
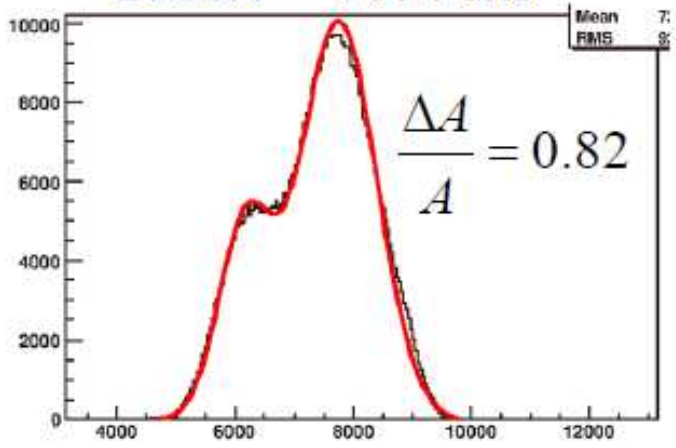
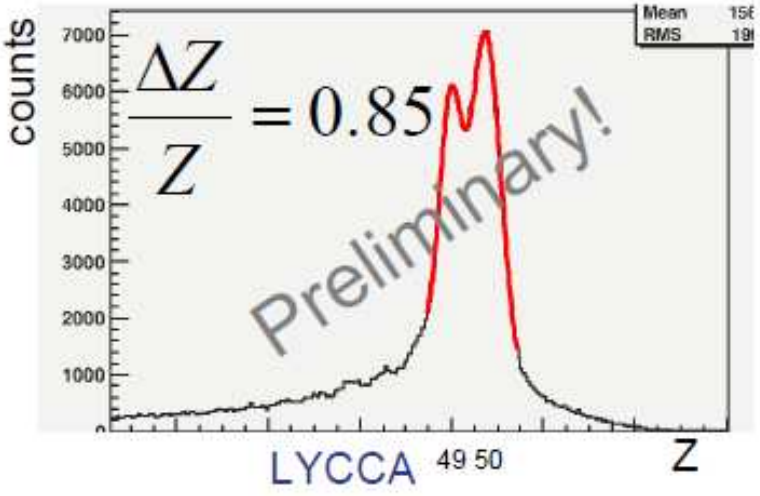






Slide from LYCCA Collaboration

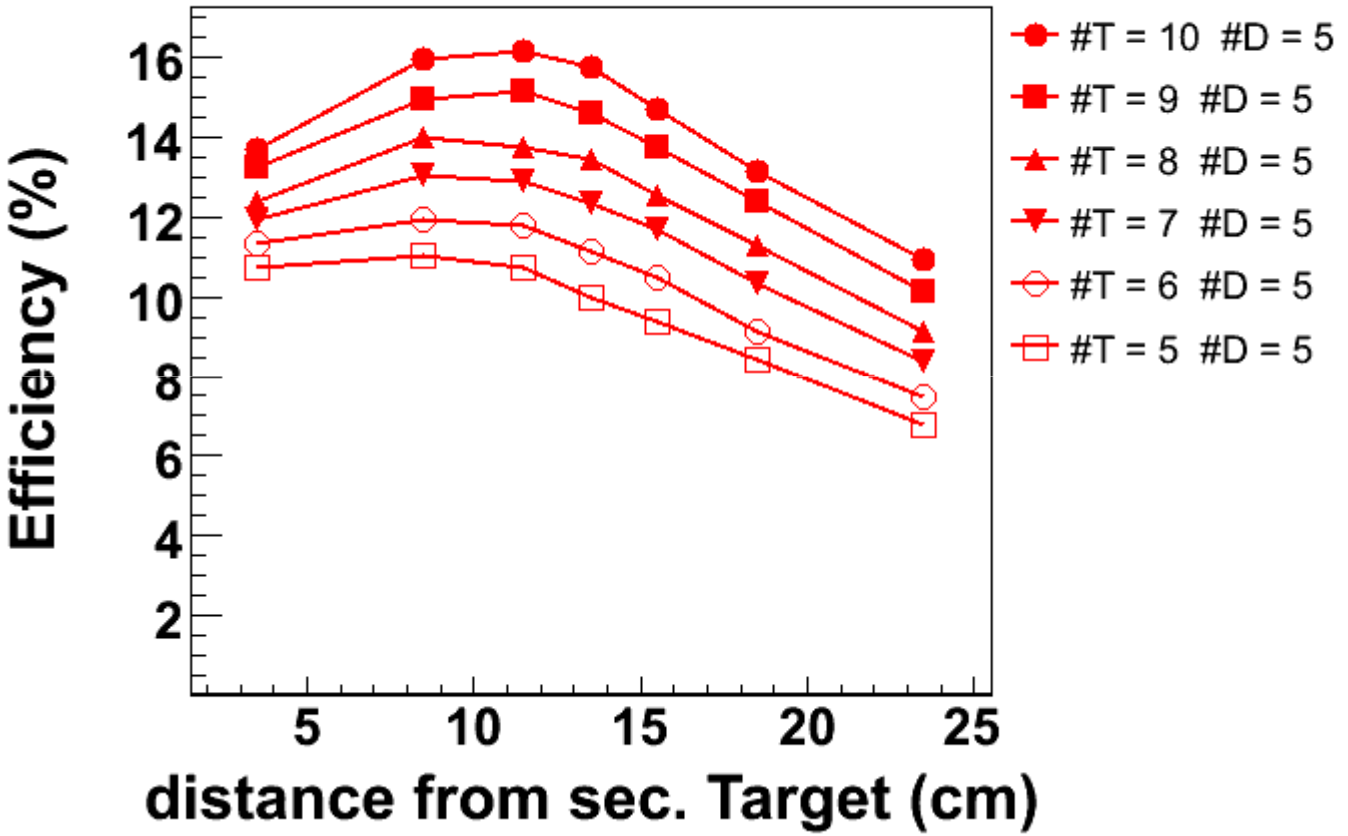
Beam candidates up to A = 90

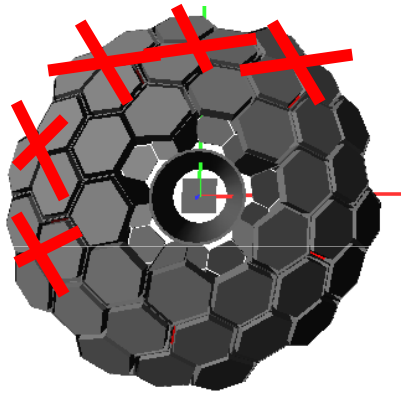
A	Element	Z	N	Energy	T1/2 (ps)	B(E2) W.u.
44	CA	20	24	1157.0	2.61	11.3
48	TI	22	26	983.5	4.04	14.7
50	CR	24	26	783.30	8.87	19.8
54	CR	24	30	834.855	7.9	14.6
56	FE	26	30	846.776	6.07	16.8
58	FE	26	32	810.7	6.54	18.5
62	NI	28	34	1172.91	1.45	12.1
64	ZN	30	34	991.56	1.94	20.0
66	ZN	30	36	1039.3	1.68	17.5
68	ZN	30	38	1077.37	1.57	15.1
70	ZN	30	40	884.46	3.7	16.5
70	GE	32	38	1039.5	1.30	20.9
72	GE	32	40	834.011	3.35	17.8
72	GE	32	40	834.011	3.35	23.5
74	GE	32	42	595.850	12.41	33.0
76	GE	32	44	562.93	18.2	29
74	SE	34	40	634.74	7.08	42.0
76	SE	34	42	559.102	12.3	44
78	SE	34	44	613.727	9.79	33.5
80	SE	34	46	666.27	8.52	24.7
78	KR	36	42	455.033	21.6	67.9
80	KR	36	44	616.60	8.3	37.3
82	KR	36	46	776.520	4.45	21.3
84	KR	36	48	881.615	4.05	12.0
84	SR	38	46	793.22	3.23	26
86	SR	38	48	1076.68	1.61	10.5

AGATA S2' @ GSI: efficiency vs. # triple (double) clusters

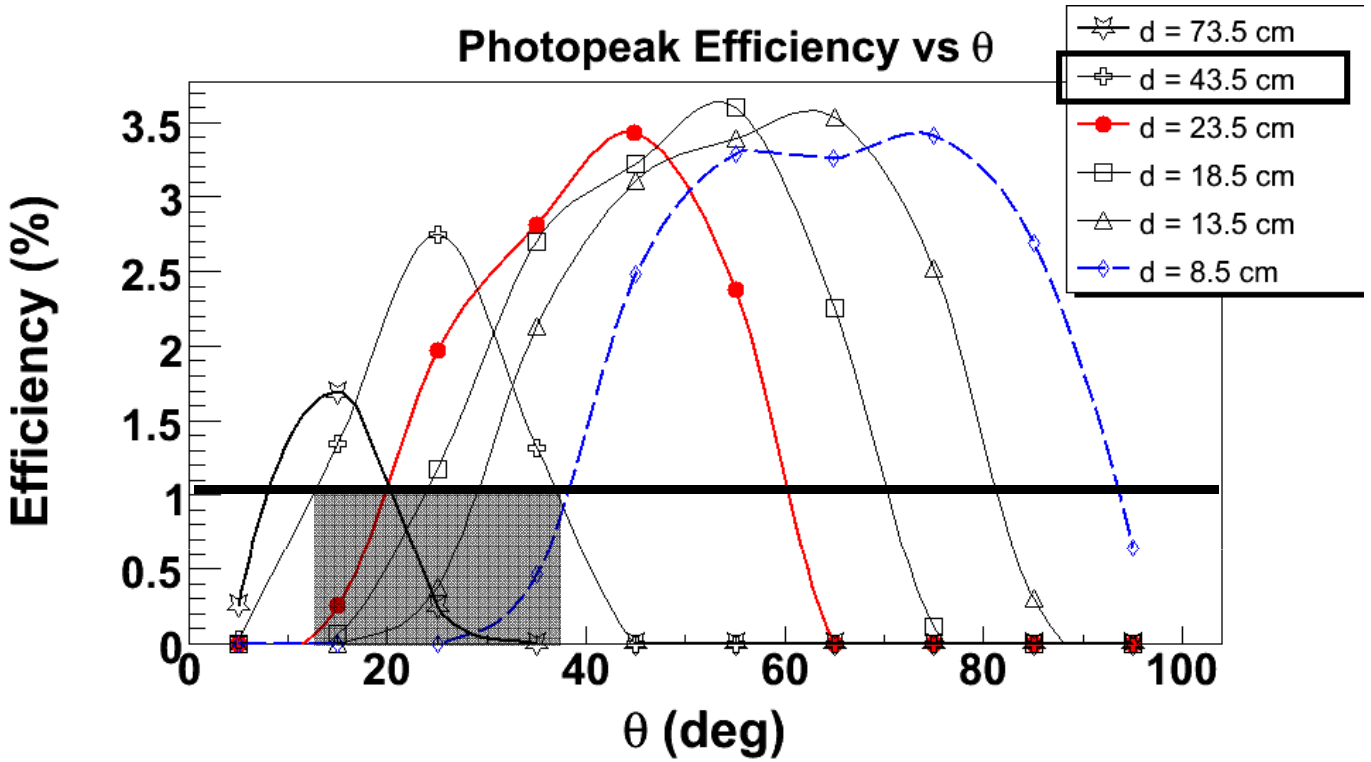
- "Reference physics case": $E_{\gamma,o}$ = 1 MeV, recoil nucleus at β = 0.43 (E = 100 MeV/u), Mγ = 1

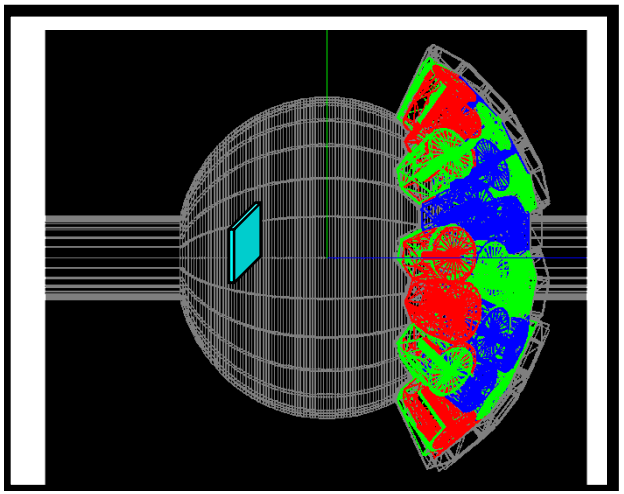
(GEANT4 AGATA code from NIMA 621 (2010) 331-343, E.Farnea et al.)

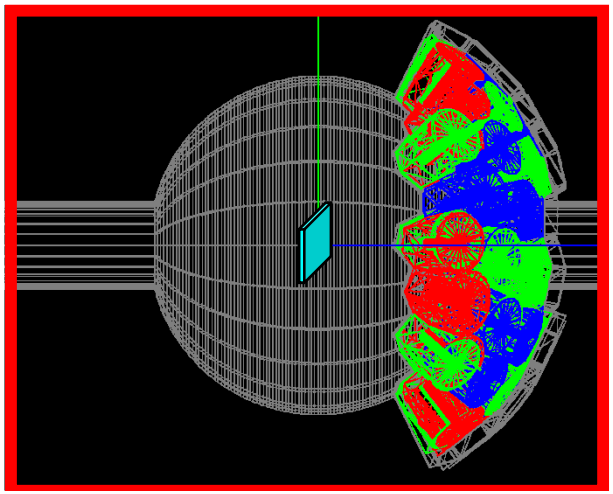


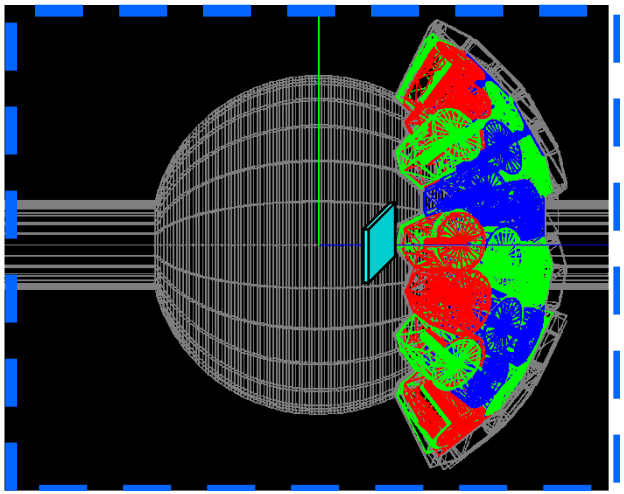


AGATA S2' @ GSI: angular dependence of the efficiency

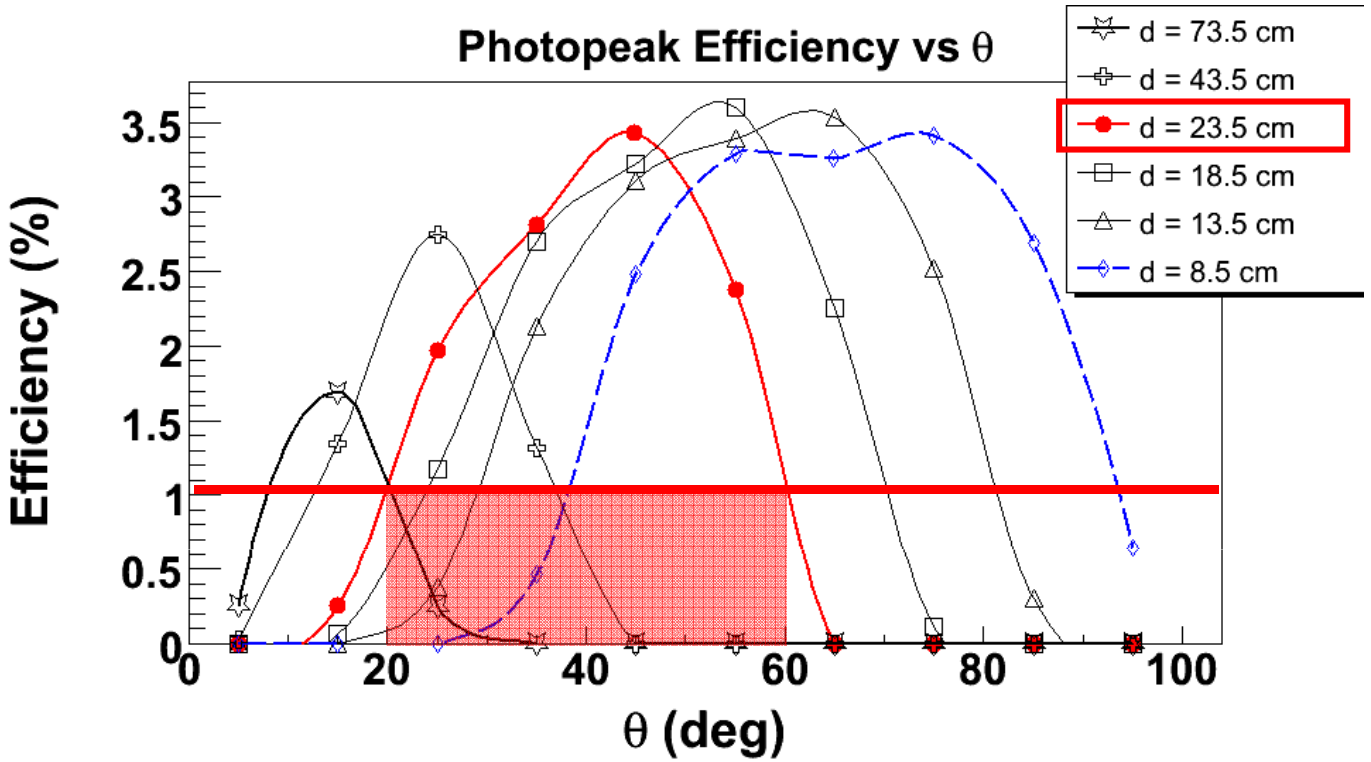


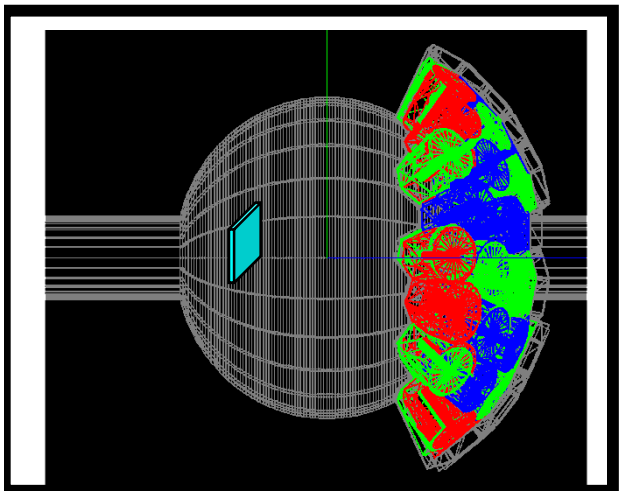


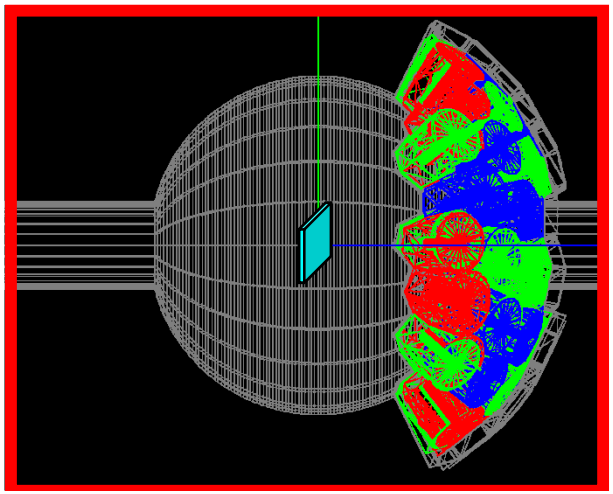


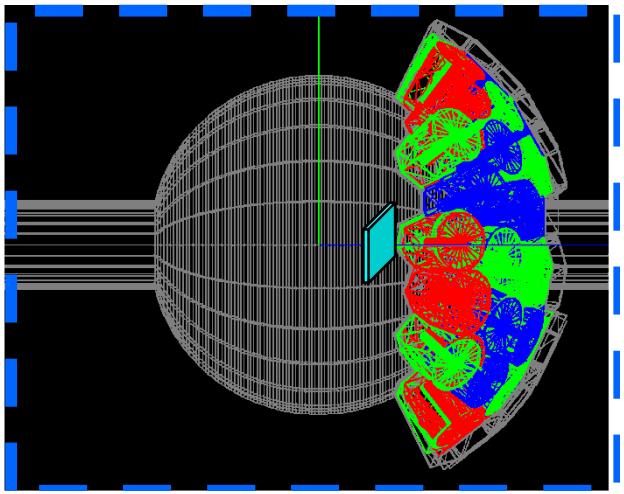


AGATA S2' @ GSI: angular dependence of the efficiency

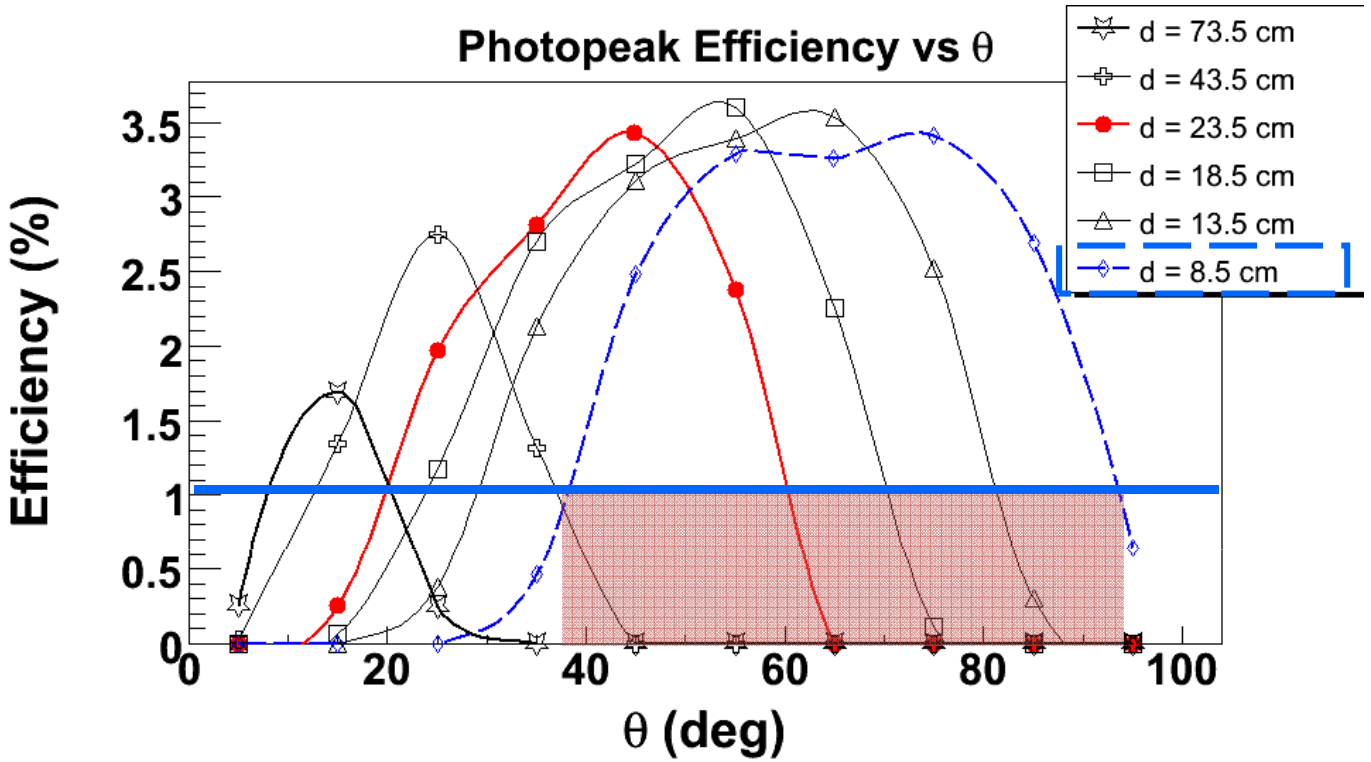


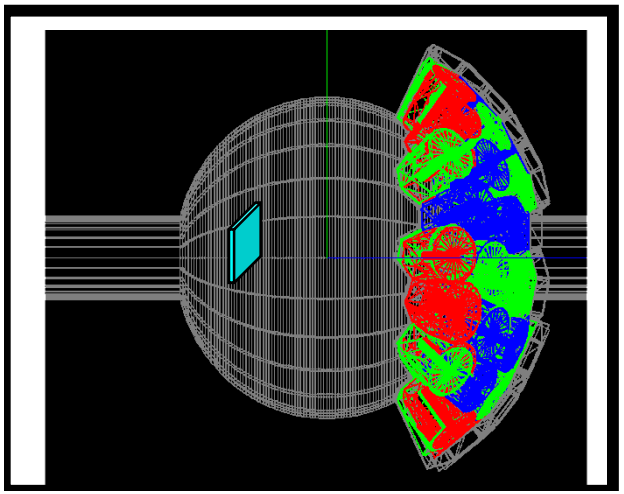


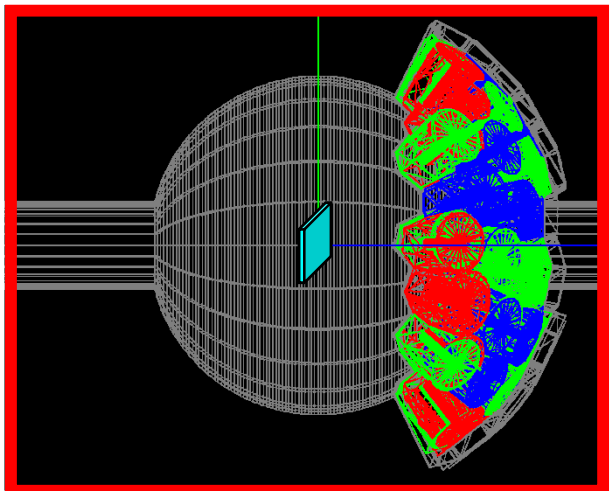


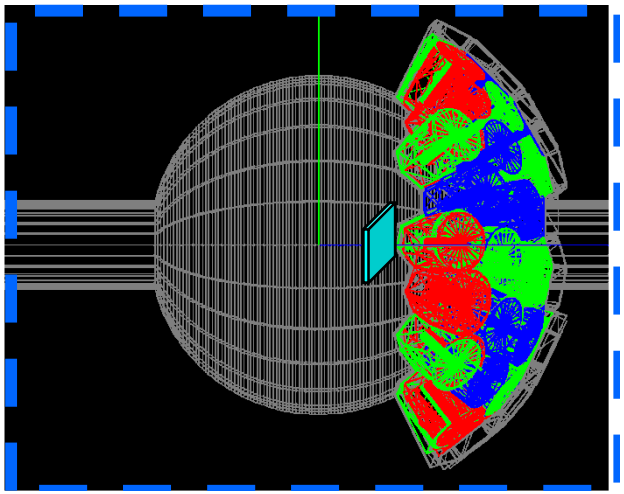


AGATA S2' @ GSI: angular dependence of the efficiency

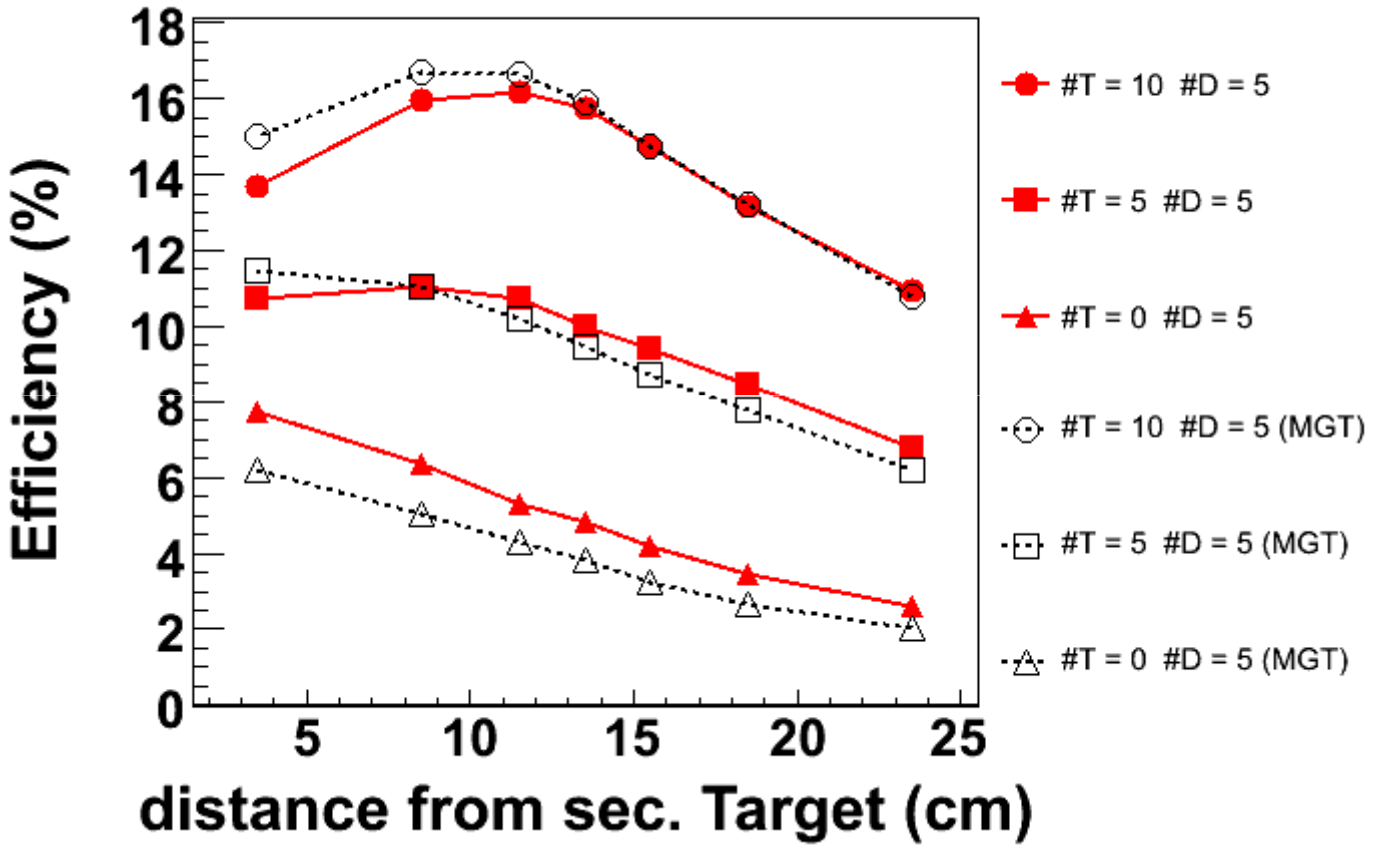








Efficiency comparison mc-add-back vs. mgt



Peak/Total values from mgt