

Status Report

AGATA Commissioning WG

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R.Gernhäuser, N.Goel, M.Gorska, G.Guastalla,
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 specification 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 shielding	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 algorithm in the analysis codes	Performed	Yes	Michael Reese
⁵⁰ Ti Doppler correction from knockout gamma-rays	For developing and testing DC algorithm 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			

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2 / 2012	September 2012	Schedule as of 01-Jun-2012
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	Week	Week 36								Week 37								Week 38								Week 39							
	1	2	3	4	5	6	7	8	9	10	11	12	13	14	15	16	17	18	19	20	21	22	23	24	25	26	27	28	29	30			
(from	U258, Düllmann/Düllmann,	UMAT, Severin/Trautmann, Au (PIG), 50 Hz, 3 ms, M-branch+X0																															
Tech	a)																																
Diffe																																	
Com																																	
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50Ti																																	
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Performance Commissioning (?)

S424, Korter Gerl, 80Kr, EZR 400 MeV/u, 1EB/spill, FRS

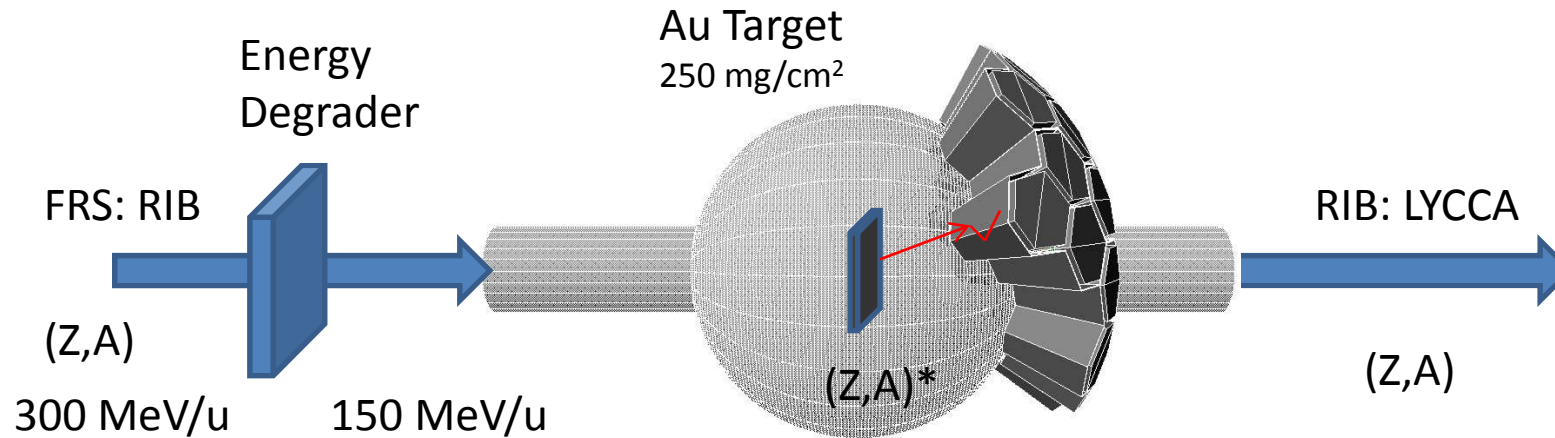
1st AGATA Experiment at GSI

more realistic conditions

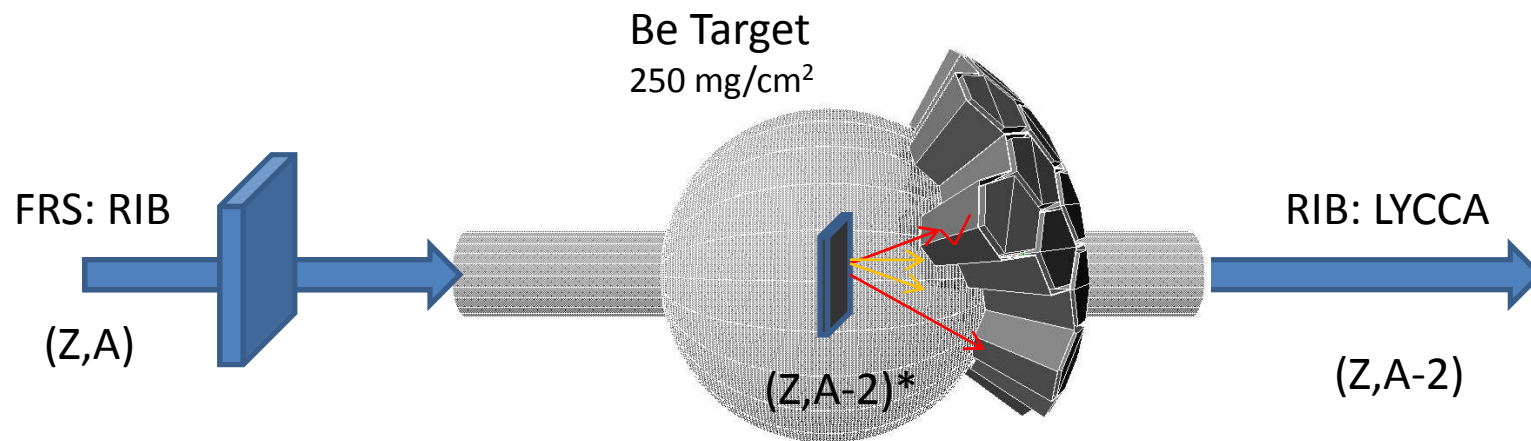
Performance Commissioning & PSA	Knockout with 86Kr-Beam	To be done (Sept. 1-3)
Performance Commissioning & PSA	Coulex With 86Kr-Beam	To be done (Sept. 1-3)

Performance Commissioning: ^{86}Kr

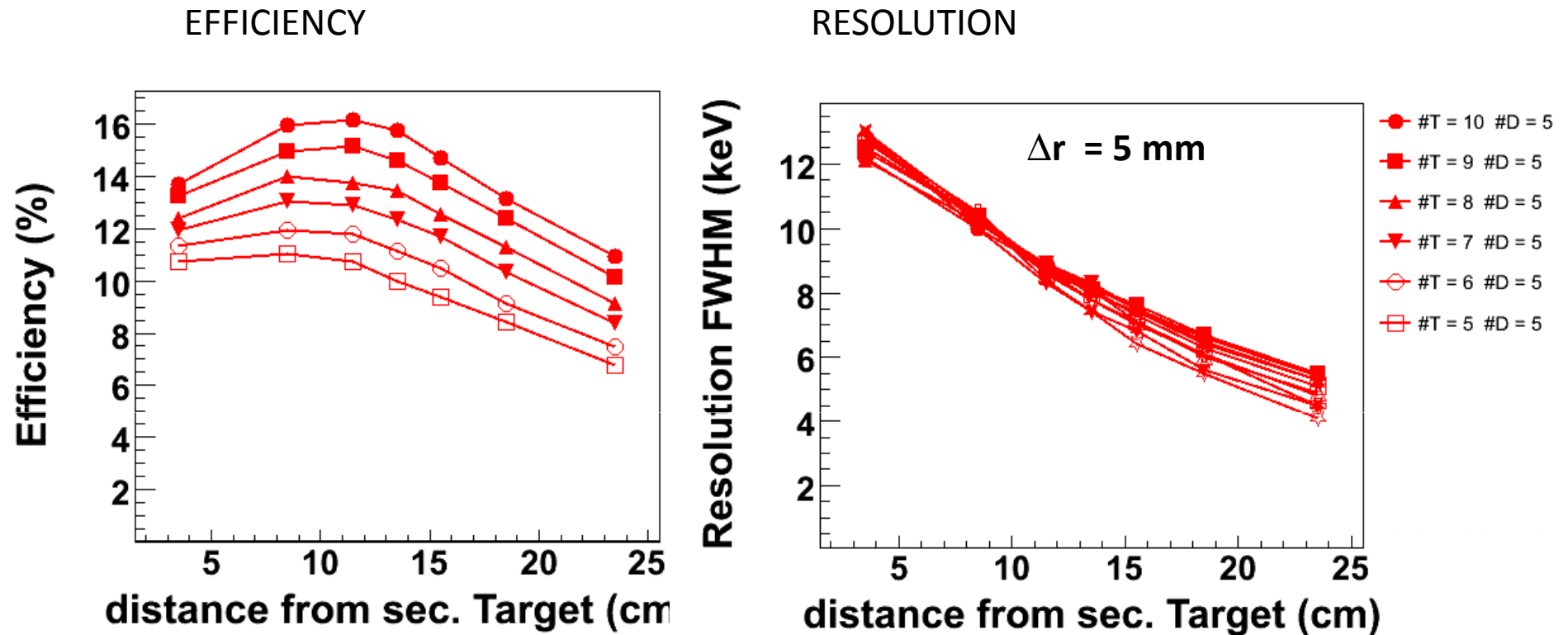
- Relativistic Coulomb Excitation



- Secondary fragmentation or particle knockout



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

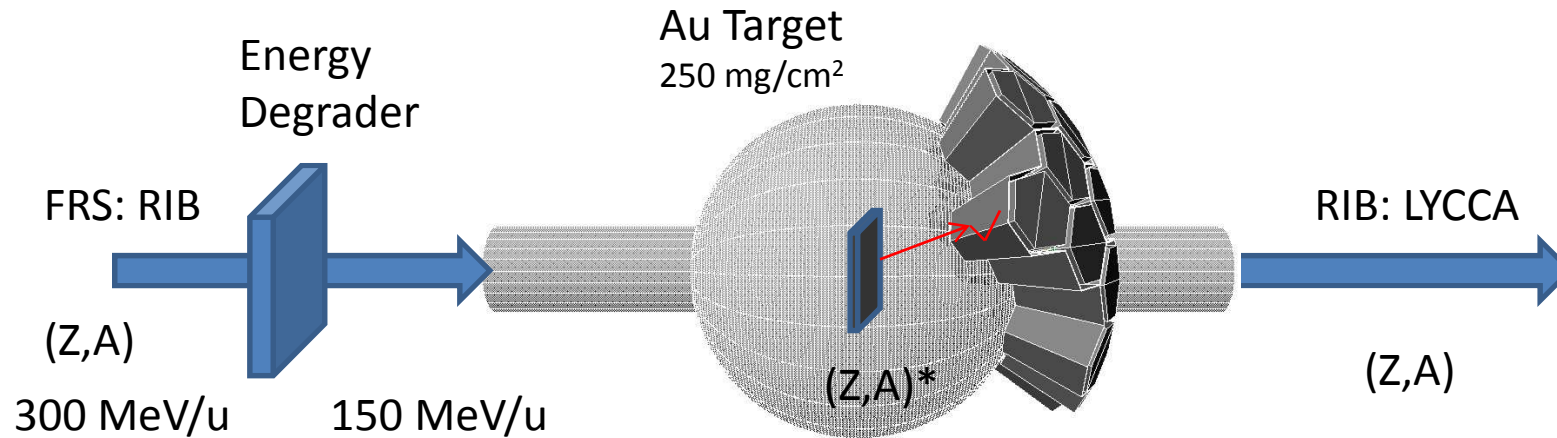


- “Reference physics case”: $E_{\gamma_0} = 1$ MeV, recoil nucleus at $\beta = 0.43$ ($E = 100$ MeV/u), $M\gamma = 1$

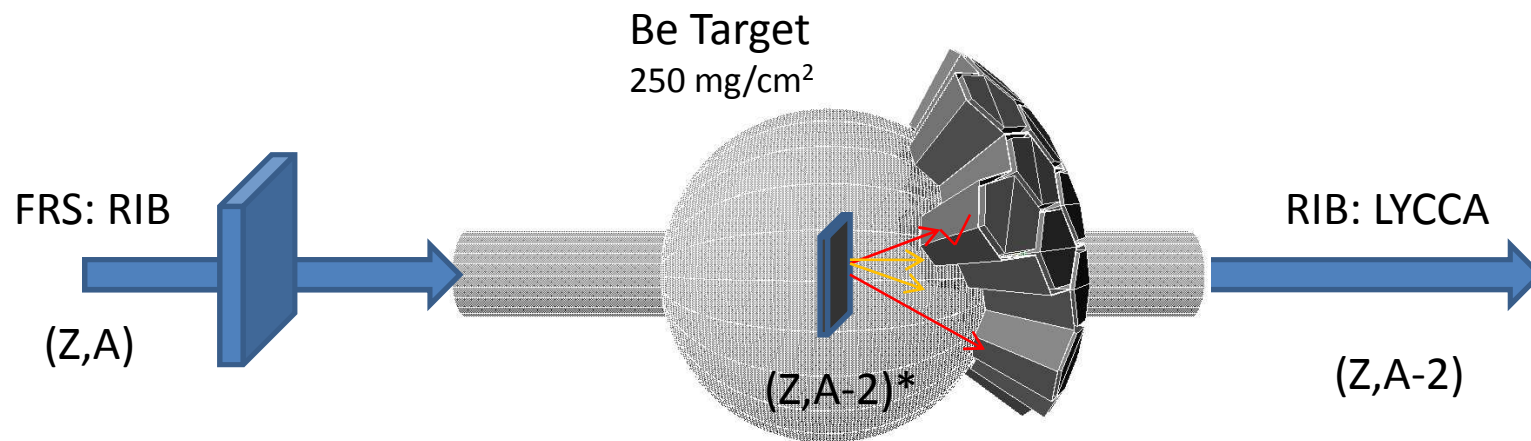
(GEANT4 AGATA code from NIMA 621 (2010) 331-343, E.Farnea et al.)

Performance Commissioning: ^{86}Kr

- Relativistic Coulomb Excitation

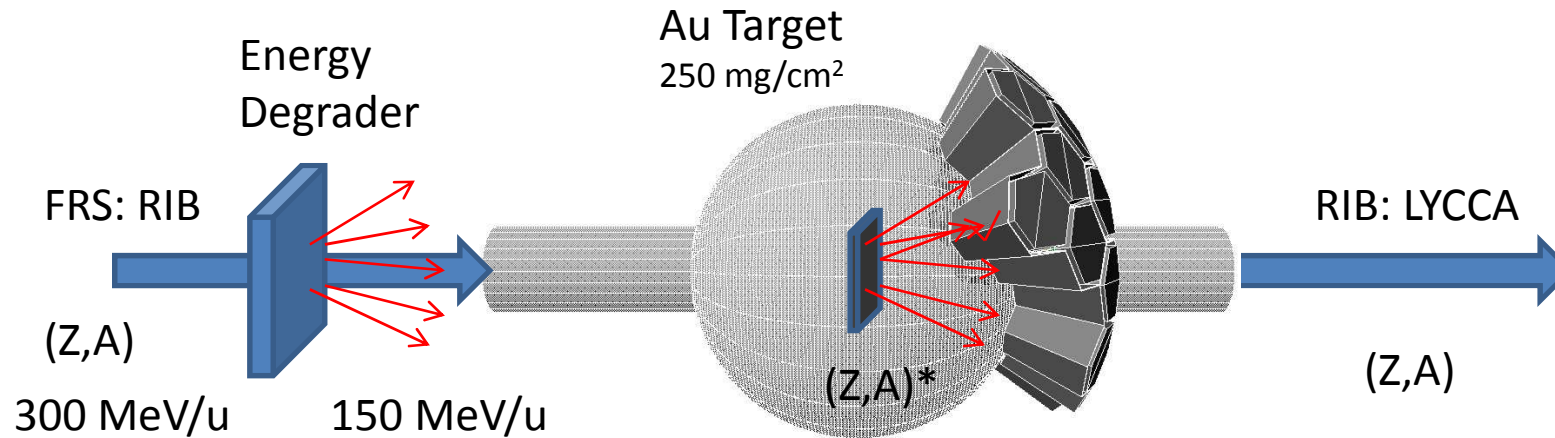


- Secondary fragmentation or particle knockout

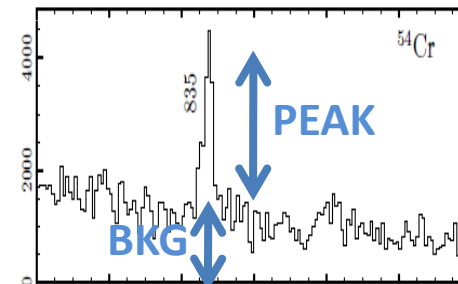
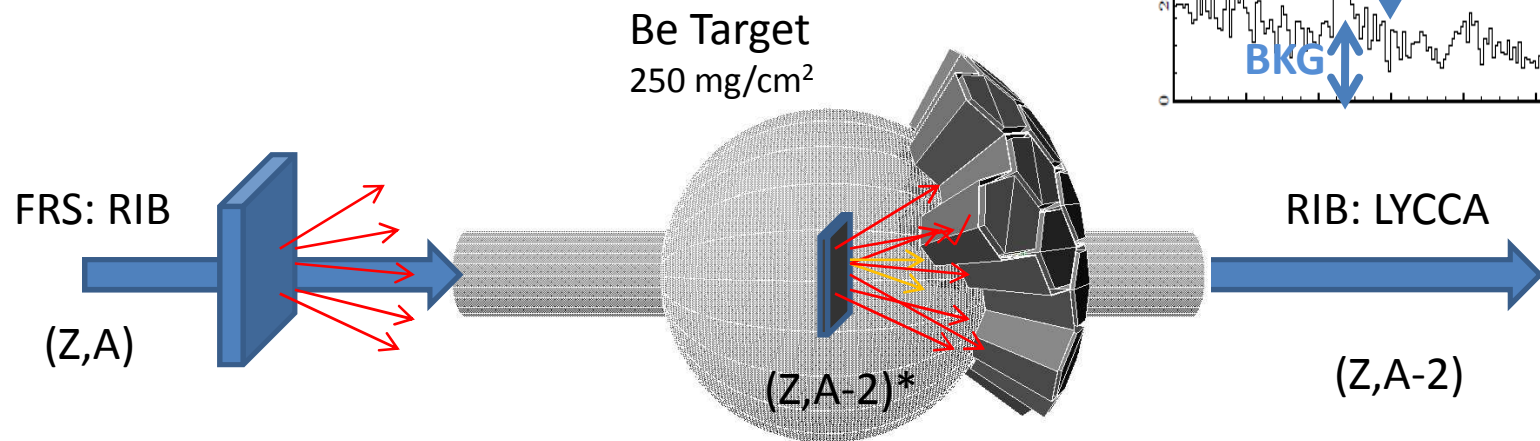


Performance Commissioning: ^{86}Kr

- Relativistic Coulomb Excitation

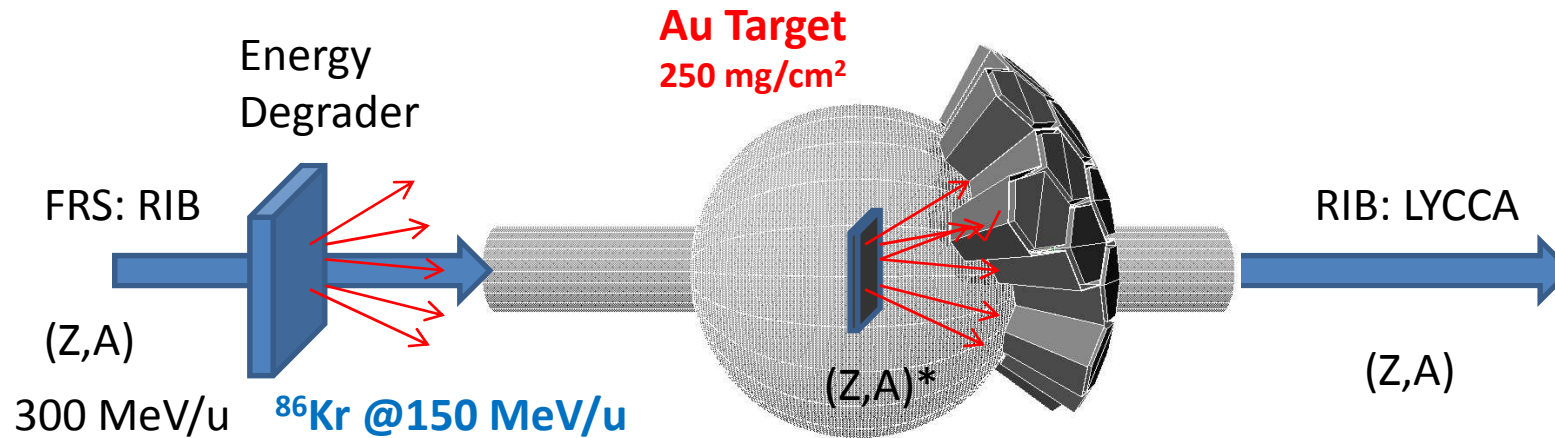


- Secondary fragmentation or particle knockout

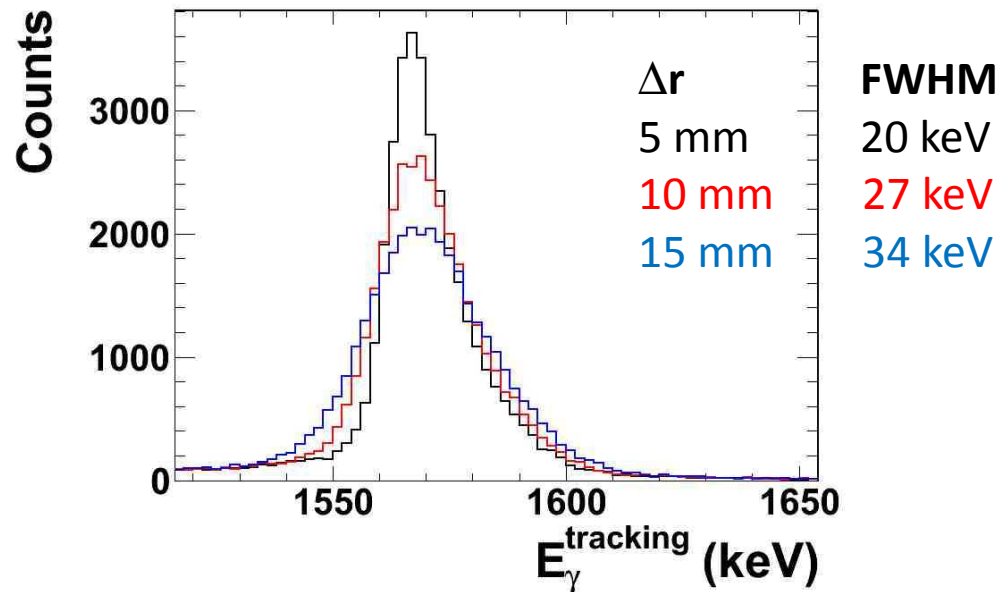
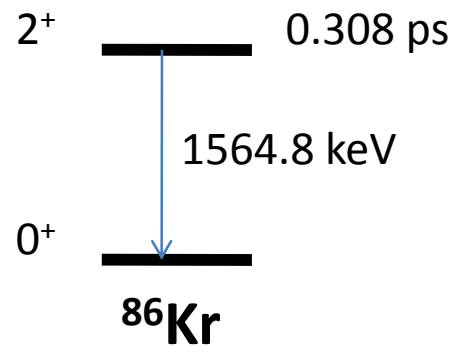


Performance Commissioning: ^{86}Kr

- Relativistic **Coulomb Excitation**

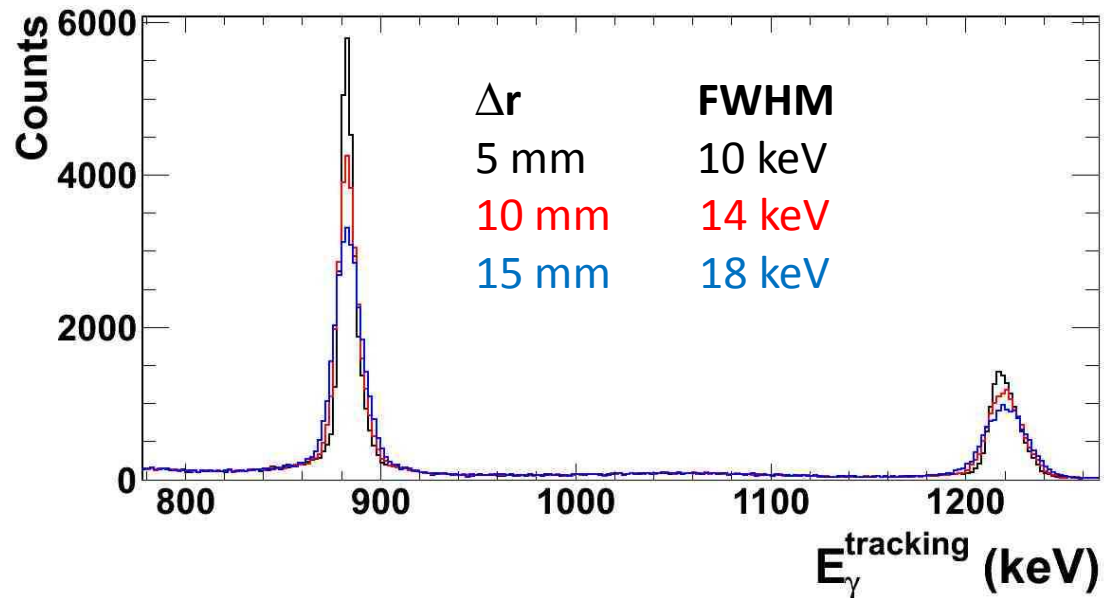
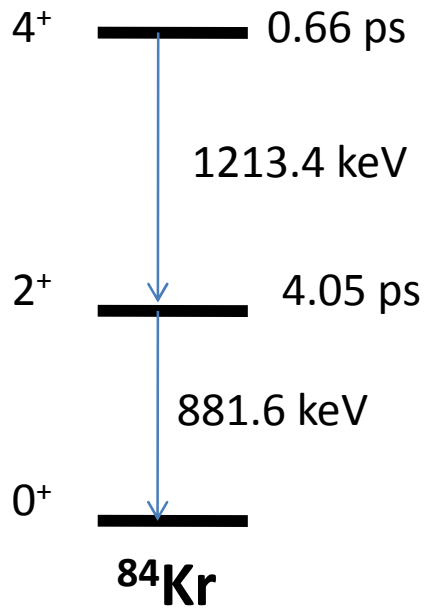
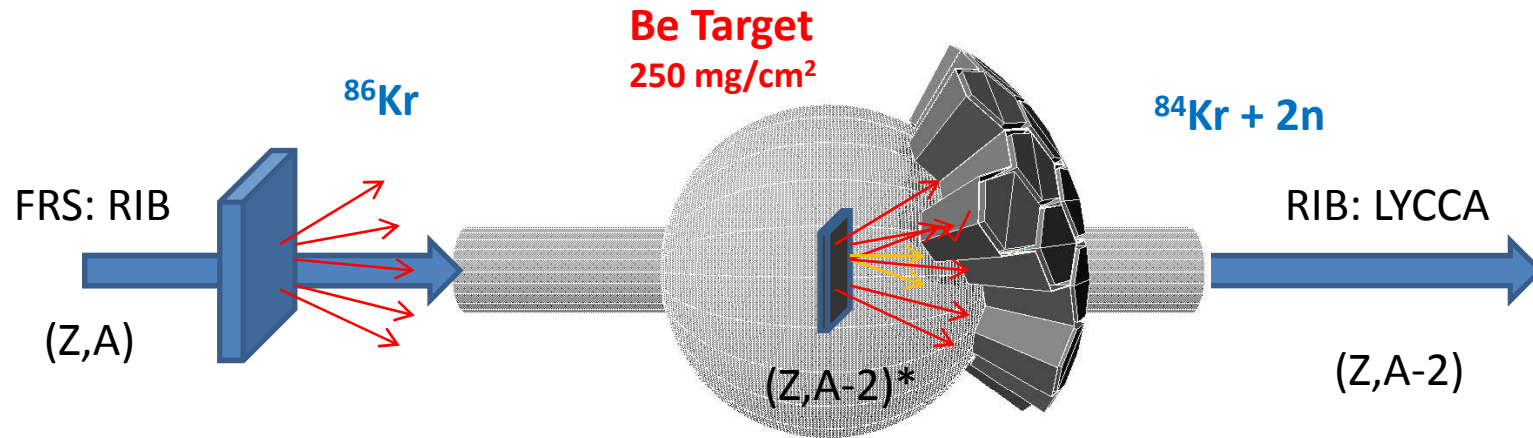


→ PSA Optimisation



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 benchmark 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

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 Combinations	1 / 2012	April 2012	Schedule as of 23-Apr-2012																													
Effect of L	W	Week 14	Week 15	Week 16	Week 17	W																										
Time call prompt g	1	2	3	4	5	6	7	8	9	10	11	12	13	14	15	16	17	18	19	20	21	22	23	24	25	26	27	28	29	30	Case/G.	
Acquire s amount c under dif condition	U000, Barth	U267, Hofmann, 50Ti, 5.122, 4.979 MeV/u	U258, Düllmann/Düllmann, 50Ti, 4.5-6.5 MeV/u, 1-2 particle-microAmps DC in X8, 50 Hz / >= 5 ms, X8 TASCA, mit Pausen für UMAT/UBIO 09.-12.4.																													
"Easy" De Correctio X-rays		UMAT, Gütllich (SD), Au+Ti, 4.8 + 11.4, X2							UMAT, Para/Voes (MF) < Walecek.	a)																						
Performa Commiss	S000, Spilker	S407, Salabura/Pietraszko, Traxler, Stroth, 197Au, (MEVVA.), 10e7 pro Spill HAD																														
Performa Commiss		SESA, Scholz/Scholz, Ti, 1 GeV/u, 1e8 / spill, slow (5s) extraction, HTA								S417, Nociforo, Ti/Au, FRS start-up FRS				S412, Aumann/Boretzky, 136Xe(EZR), 500 MeV/u, slow extraction, HTC								S424, Korten/Gerl, 50Ti, 400-800 MeV/u, 1E3-1E7 Jenill FRS				b)						
Performa Commiss		B, Steck, 197Au, 300 MeV/u, ESR commissioning											E039, Beyer, Au79+ , 124,7 MeV/u, 5e8 im ESR, ESR																			

Week 18						Week 19						Week 20						Week 21						Week 22													
1	2	3	4	5	6	7	8	9	10	11	12	13	14	15	16	17	18	19	20	21	22	23	24	25	26	27	28	29	30	31	1	2	3	4	5		
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										a)		b)		UMAT, Severin/Trautmann, 136Xe, 4.8, 1 Hz, 1 ms, M-branch										U278, Andersson/Heßberger, Ti-50 (Penning), 4.5 - 5 AMeV, 1000 pA, parasite to X8 TASCAs, 50 Hz													
S407, Salapura/Pietraszko, Traxler, Stroth, 197Au, (MEVVA), 10e7 pro Spill HAD						c)						SBIO, Scholz/Scholz, 12C (EZR), 100-600, 1e3 - 1e8/spill, therapy conditions						S412, Aumann/Boretzky, 136Xe (MUCIS), 500 MeV/u, 3e10, 3e9, slow extraction, FRS/HTC										S412, Aumann/Boretzky, 238U (MEVVA), 500 MeV/u, 3e10, 3e9, slow extraction, FRS/HTC									
S417, Nociforo/Simon, Au, 300-1000 MeV/u, 1e8/spill (SIS), slow extraction (1-10e),						d)						e)						S424, Kortzen/Gerl, 136Xe, 400-800 MeV/u, 1E3-1E7 /spill, block sharing with R3B, FRS										S424, Kortzen/Gerl, 238U, 400-800 MeV/u, 1E3-1E7 /spill, FRS									
f)																																					
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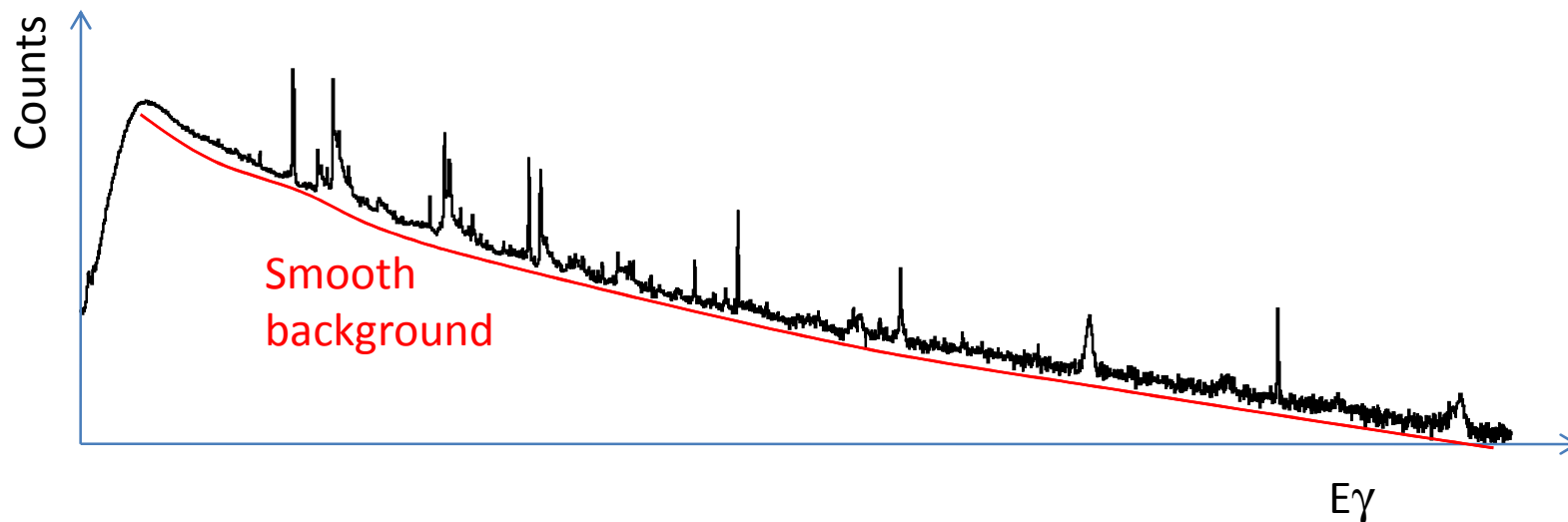
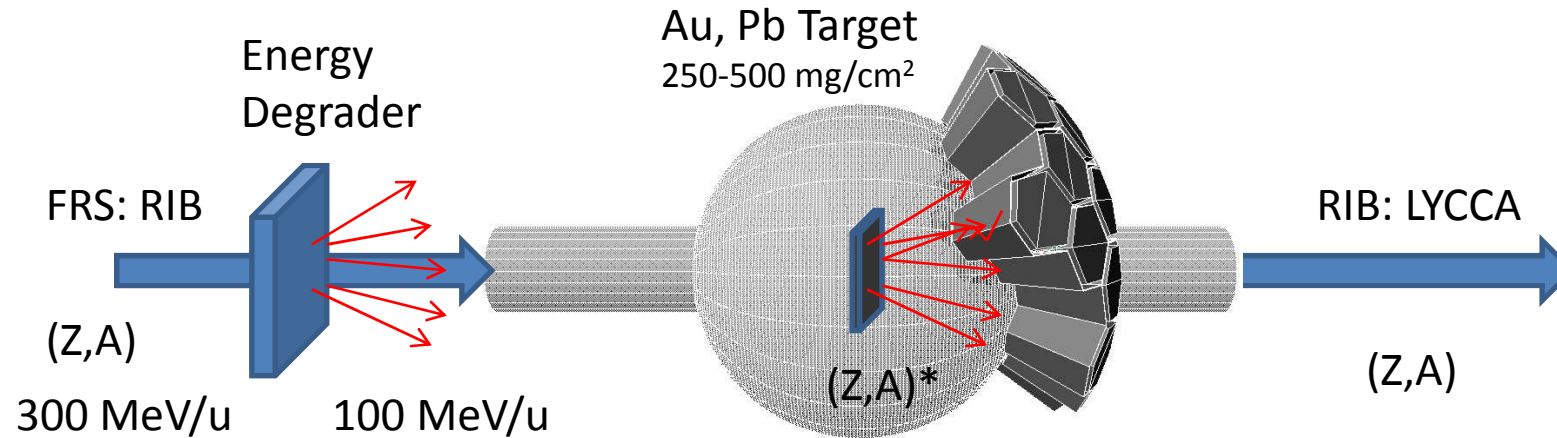
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Reese/G.

Acquire sufficient amount of data-files under different conditions	Debug analysis codes Go4_Prespec and Narval/Femul	Performed	Ongoing	S.Pietri / E. Merchan
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Performance Commissioning & PSA	Coulex With 86Kr-Beam			

Two common techniques @ FRS

- Relativistic Coulomb Excitation



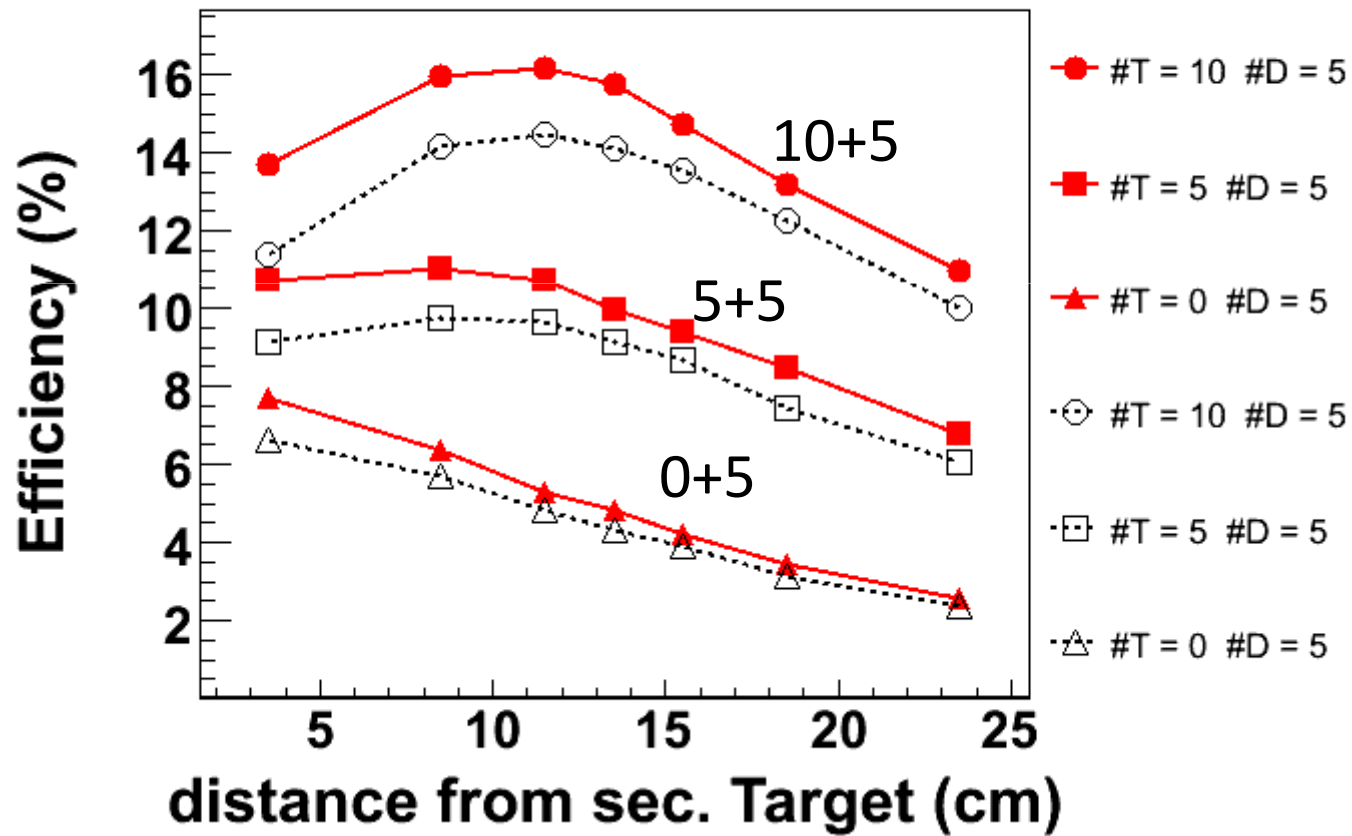
Effect of the lead absorber

—●— No shielding

····○···· 2mm Pb shielding

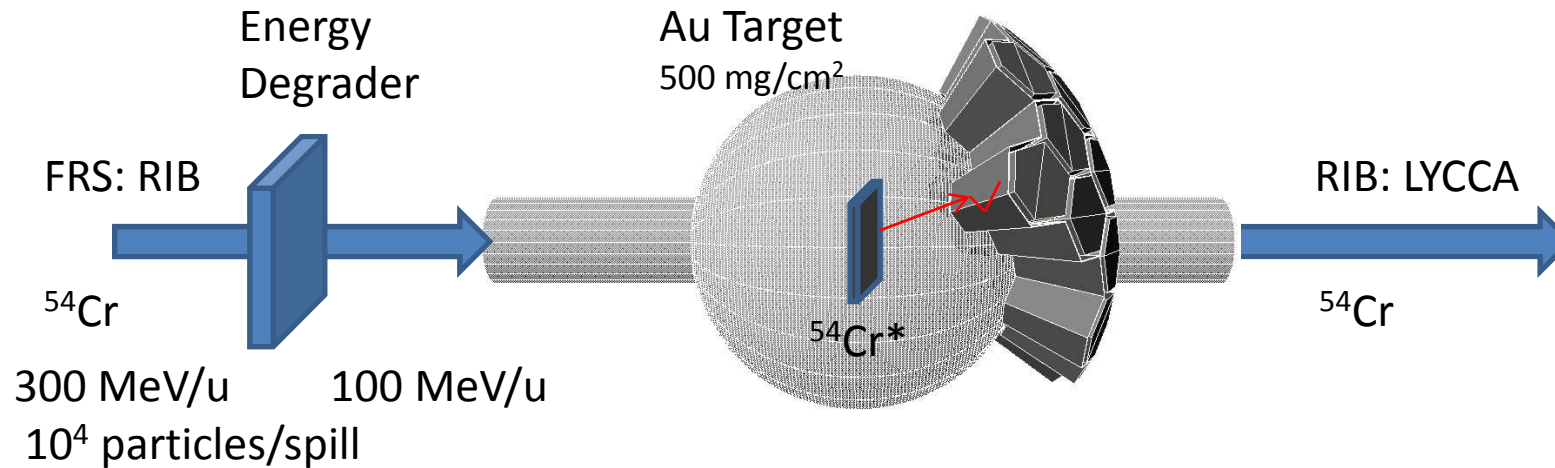
Really needed? how thick?

→ Test it!

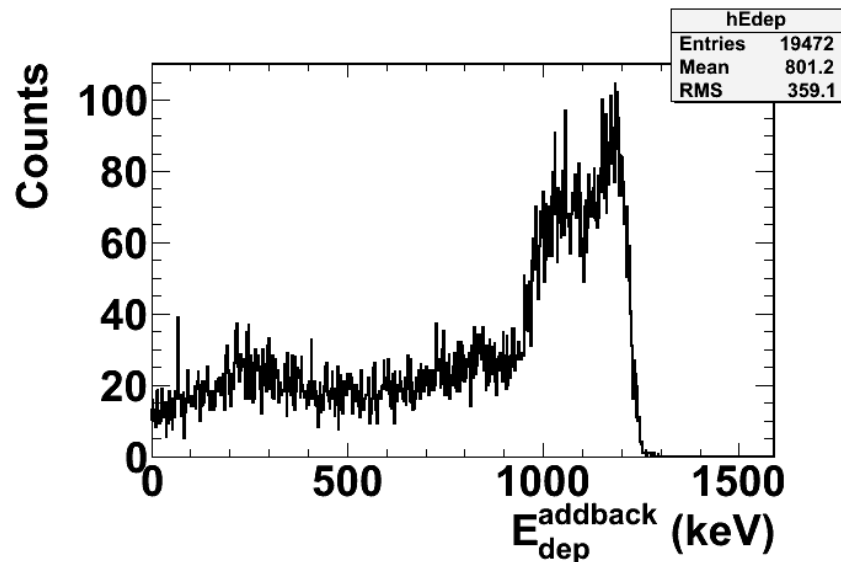
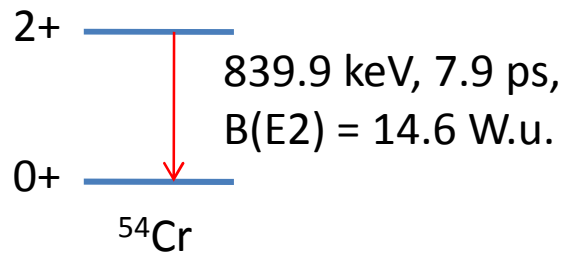


Coulex benchmark case

- Relativistic Coulomb Excitation (just an example)

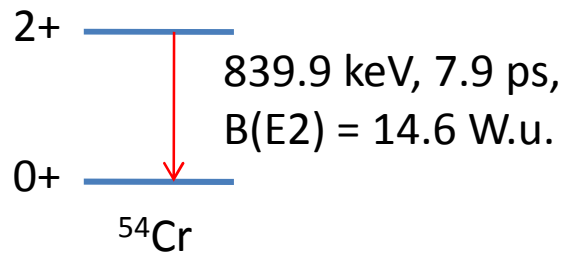
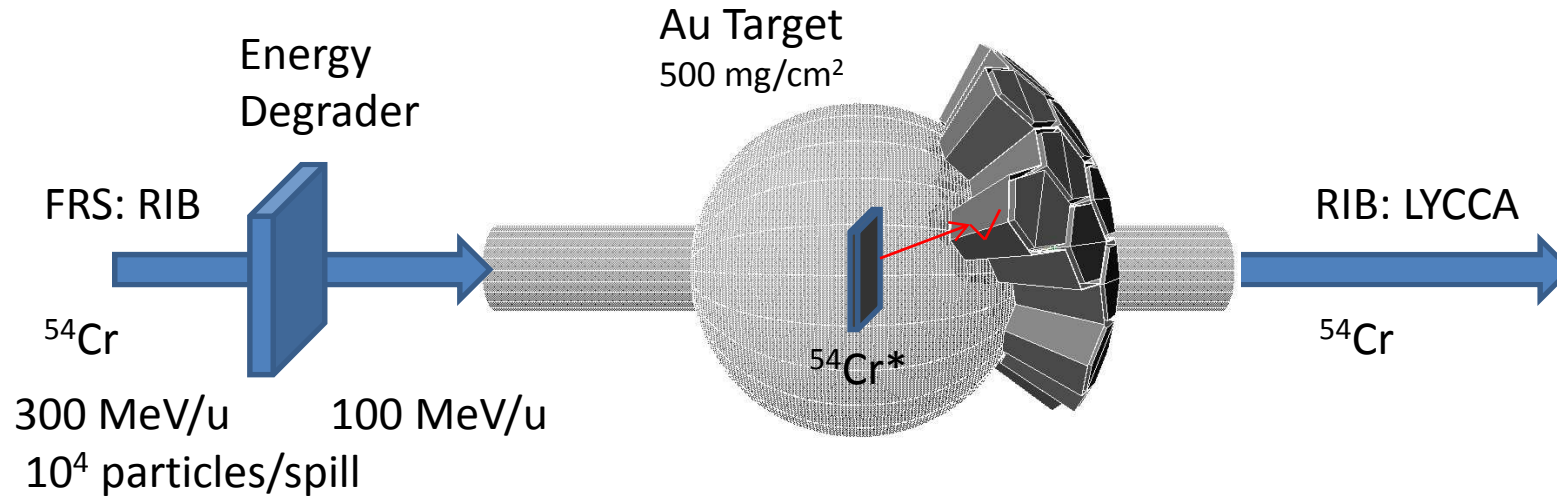


$$p\gamma\text{-rate@AGATA} = I_{54} \times N_{\text{at}} \times \sigma_{\text{Coulex}} \times \epsilon_{\gamma}$$

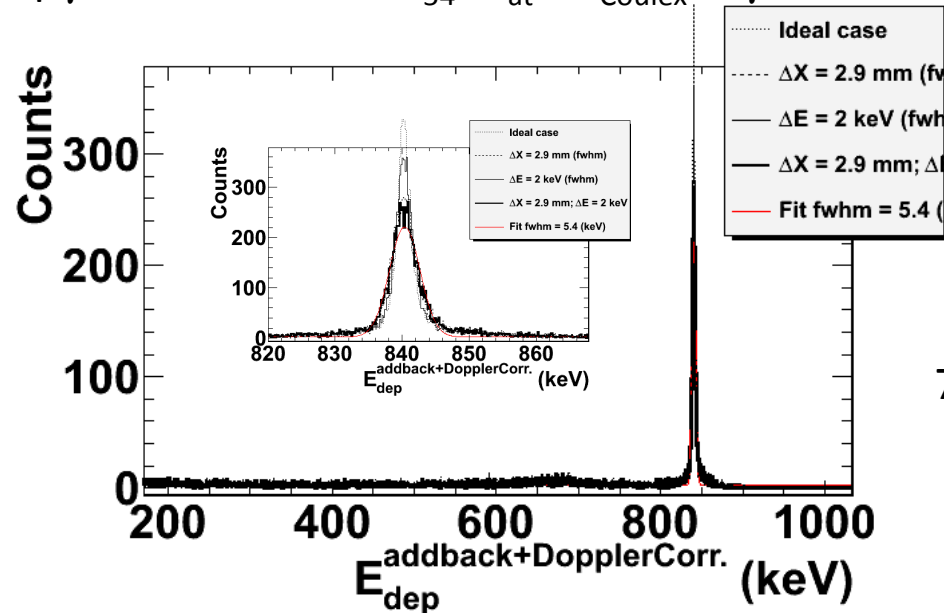


Coulex benchmark case

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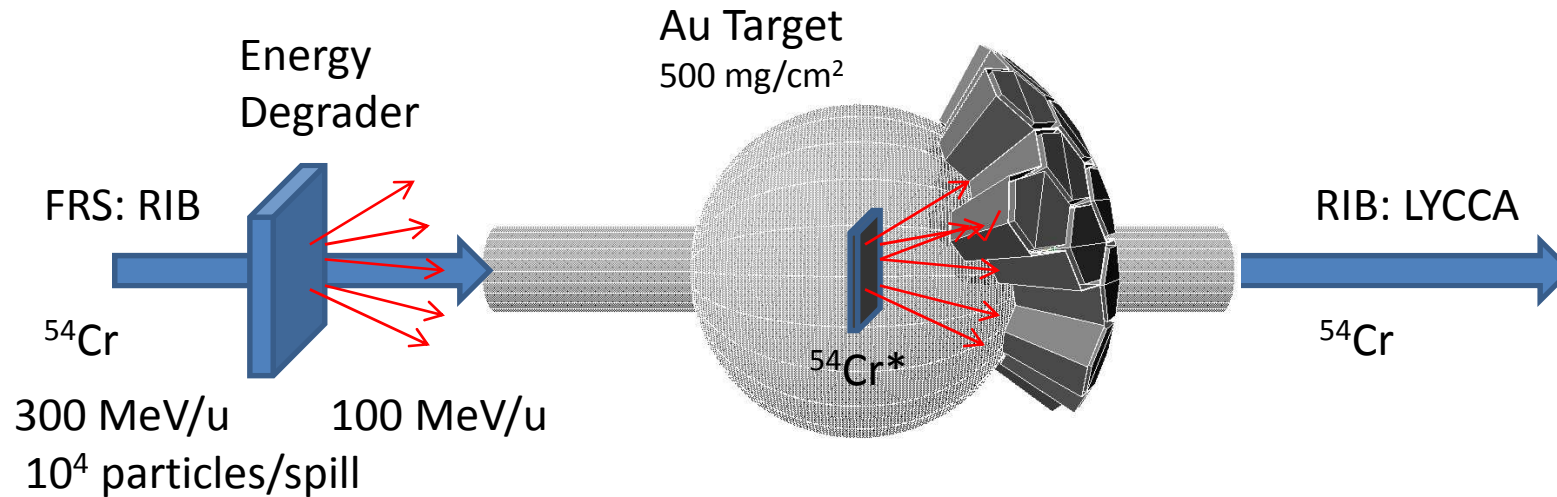


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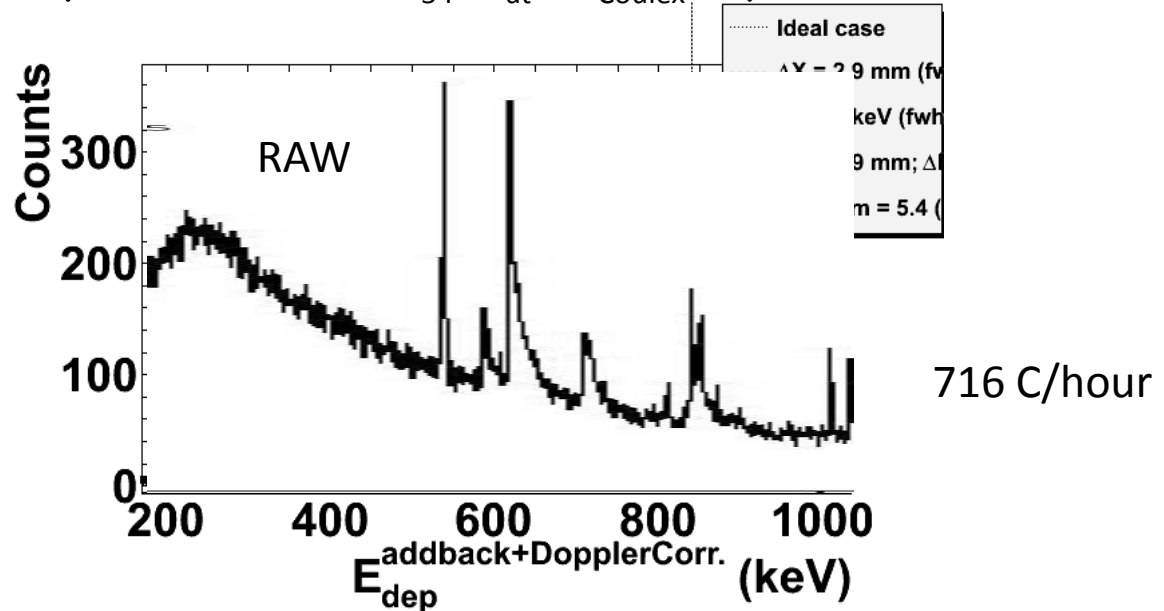
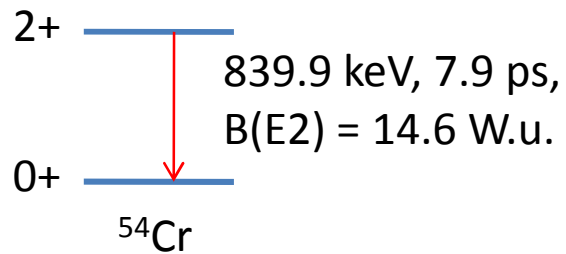


Coulex benchmark case

- Relativistic Coulomb Excitation

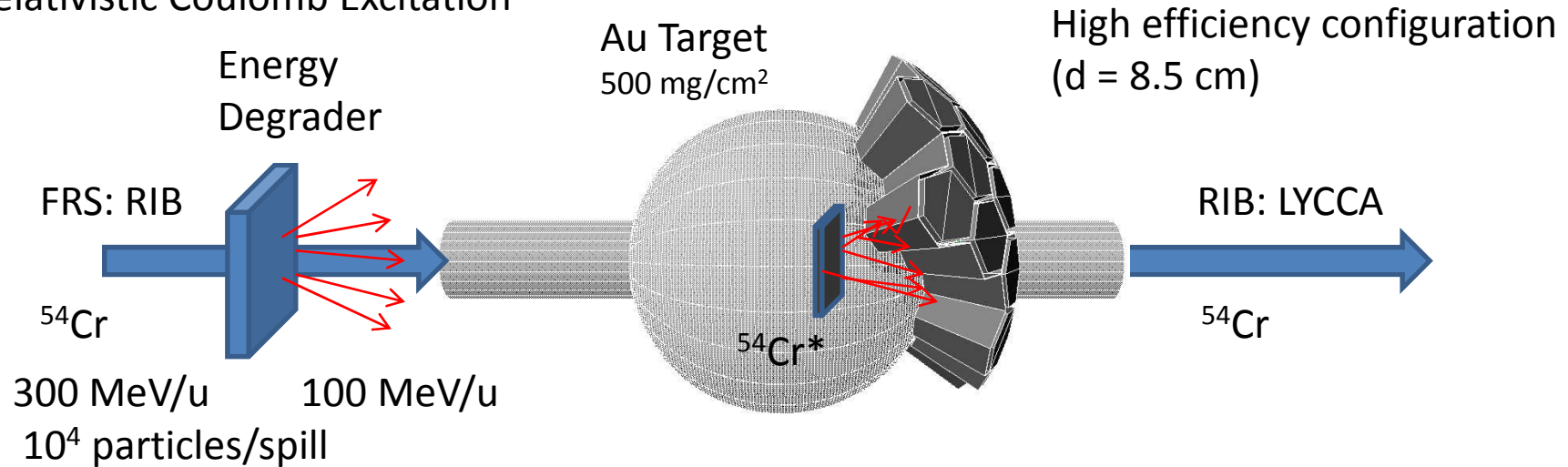


$$p\gamma\text{-rate@AGATA} = I_{^{54}\text{Cr}} \times N_{\text{at}} \times \sigma_{\text{Coulex}} \times \epsilon_{\gamma}$$

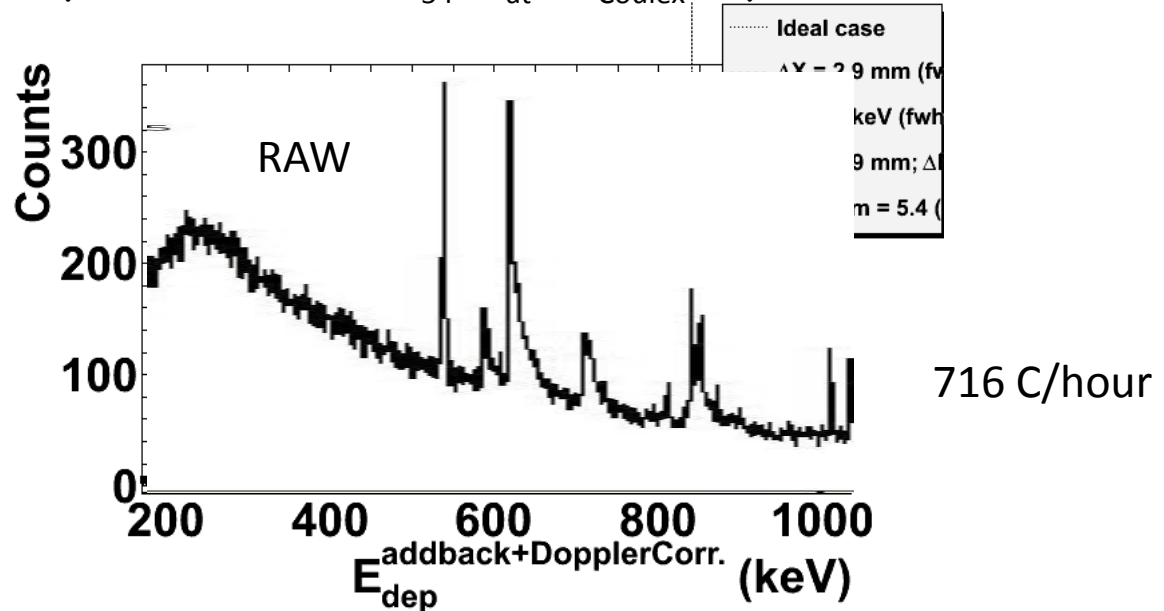
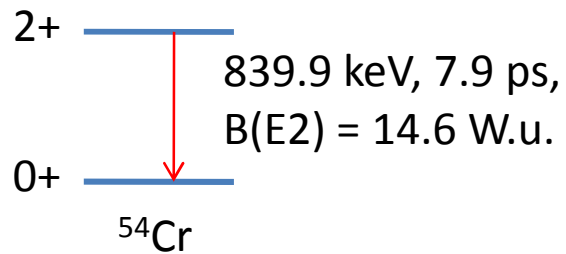


Coulex benchmark case

- Relativistic Coulomb Excitation

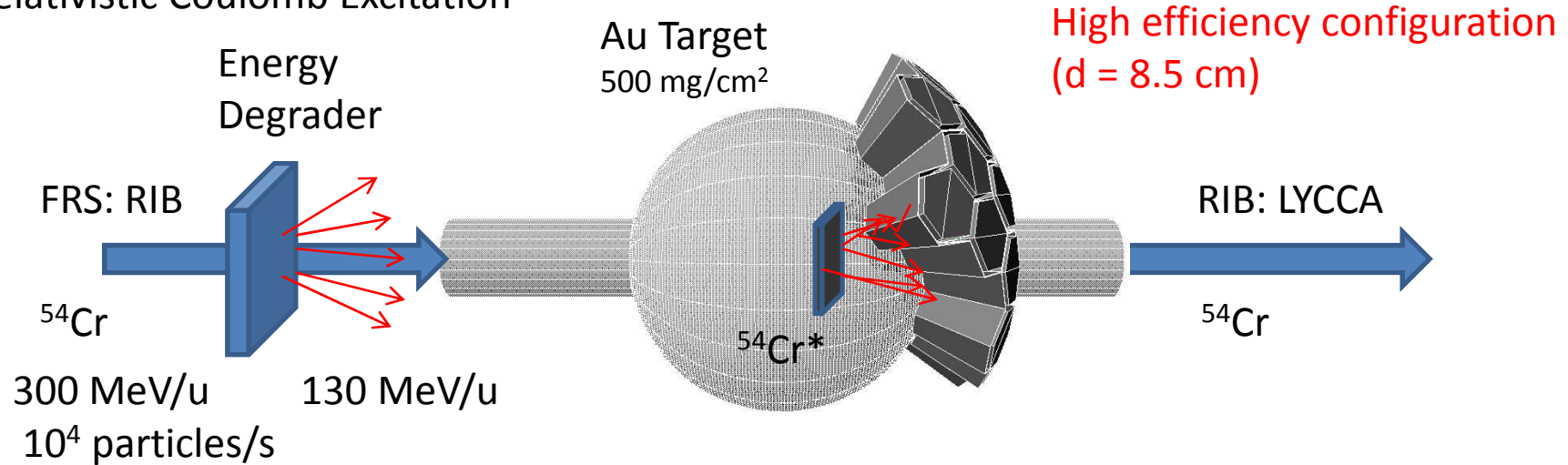


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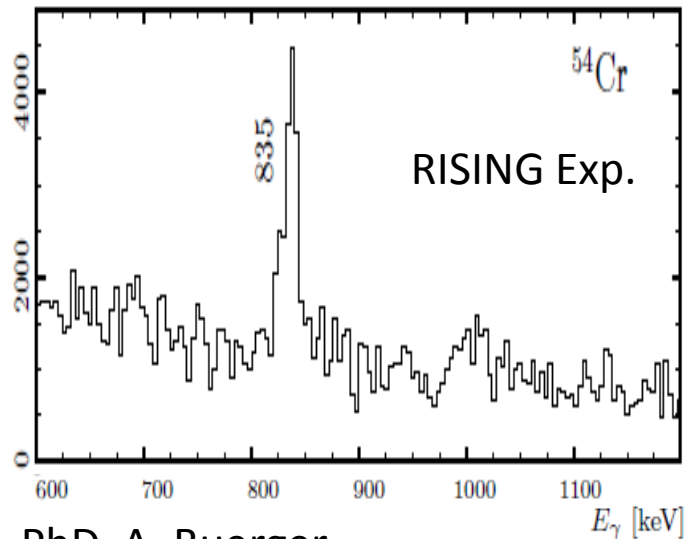


Coulex benchmark case

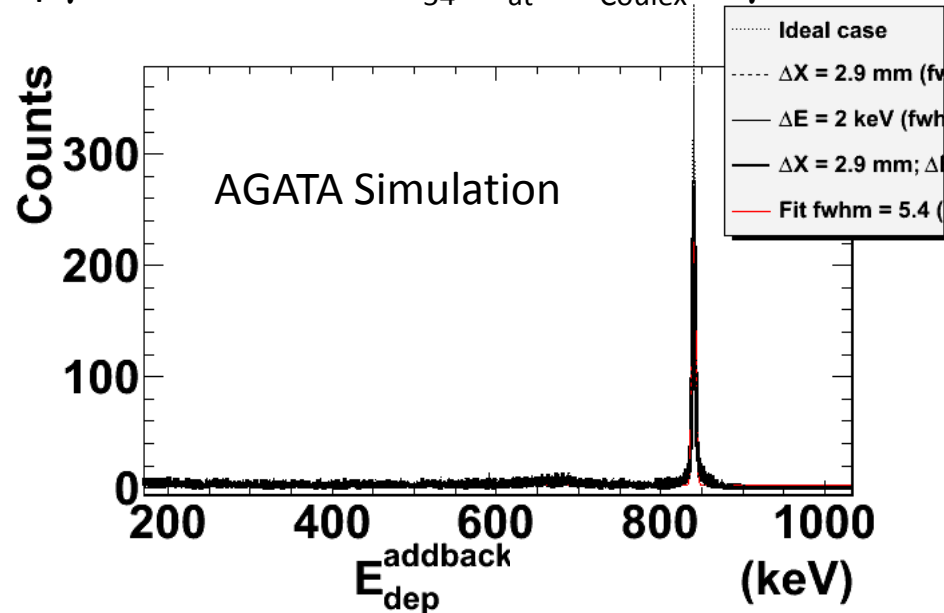
- Relativistic Coulomb Excitation



$$p\gamma\text{-rate@AGATA} = I_{^{54}\text{Cr}} \times N_{\text{at}} \times \sigma_{\text{Coulex}} \times \epsilon_{\gamma}$$



PhD A. Buerger



Beam candidates (from nndc database)

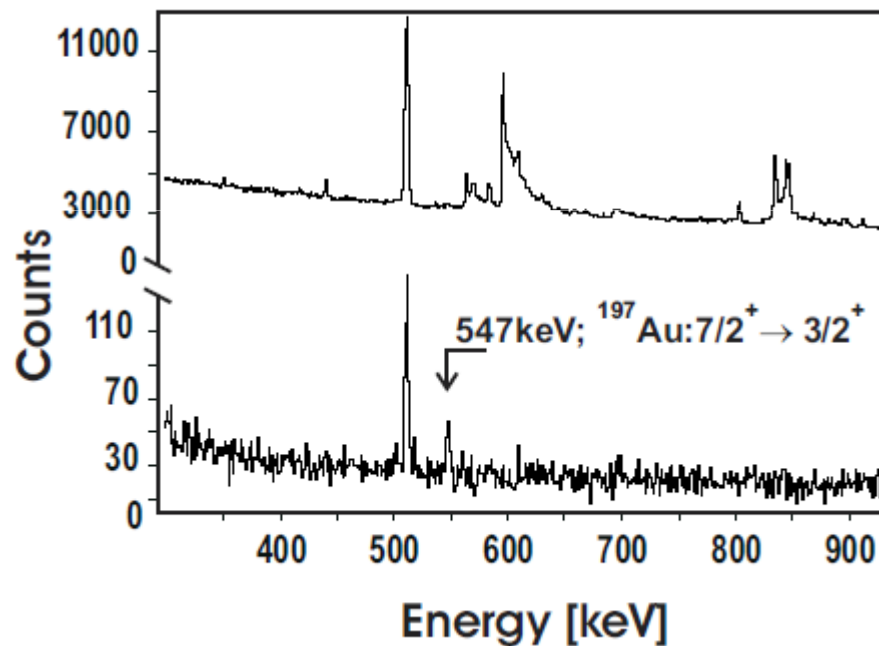
- Up to A<90 (to keep good A resolution in LYCCA)
- Eg in typical Coulex/Fragmentation energy range i.e. 400keV-1.5 MeV
- Large B(E2) in order to optimise beam-time
- Lifetime of the level above 4 ps (to decay after the target)
- Stable beam (to facilitate FRS start-up, etc)

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).



Vol. 36 (2005)

ACTA PHYSICA POLONICA B

No 4

STATUS OF THE RISING PROJECT AT RELATIVISTIC ENERGIES*

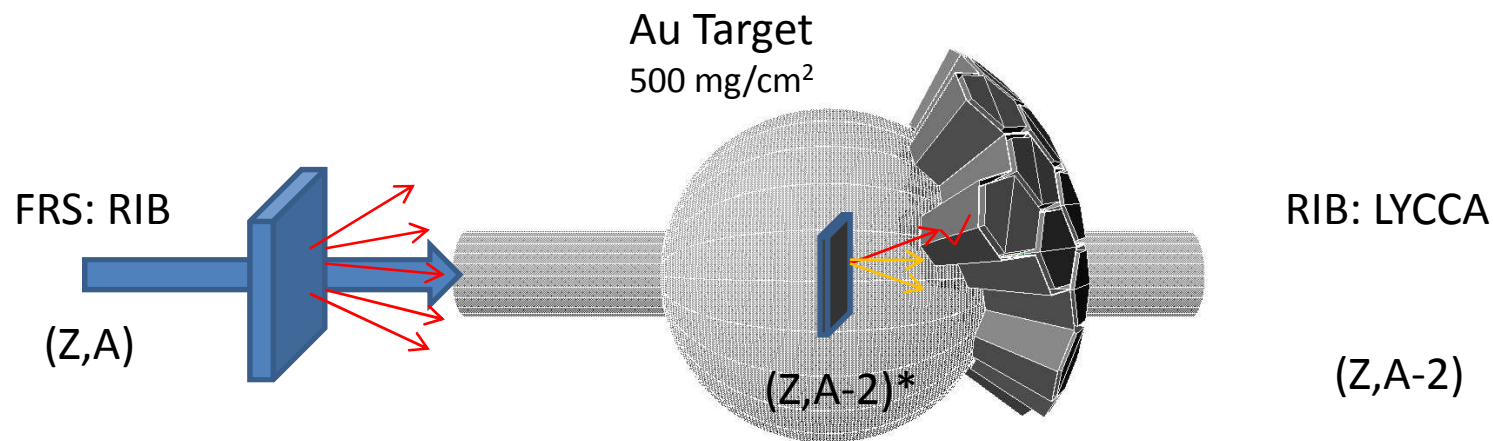
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G. BENZONI^d, A. BRACCO^d, A. BÜRGER^e, F. CAMERA^d, P. DOORNENBAL^a
C. FAHLANDER^f, H. GEISSEL^a, J. GERL^a, M. GÓRSKA^a, H. GRAWE^a
J. GRĘBOSZ^{a,b}, G. HAMMOND^c, M. HELLSTRÖM^a, H. HÜBEL^e, J. JOLIE^g
M. KMIECIK^b, I. KOJOUHAROV^a, N. KURZ^a, R. 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.

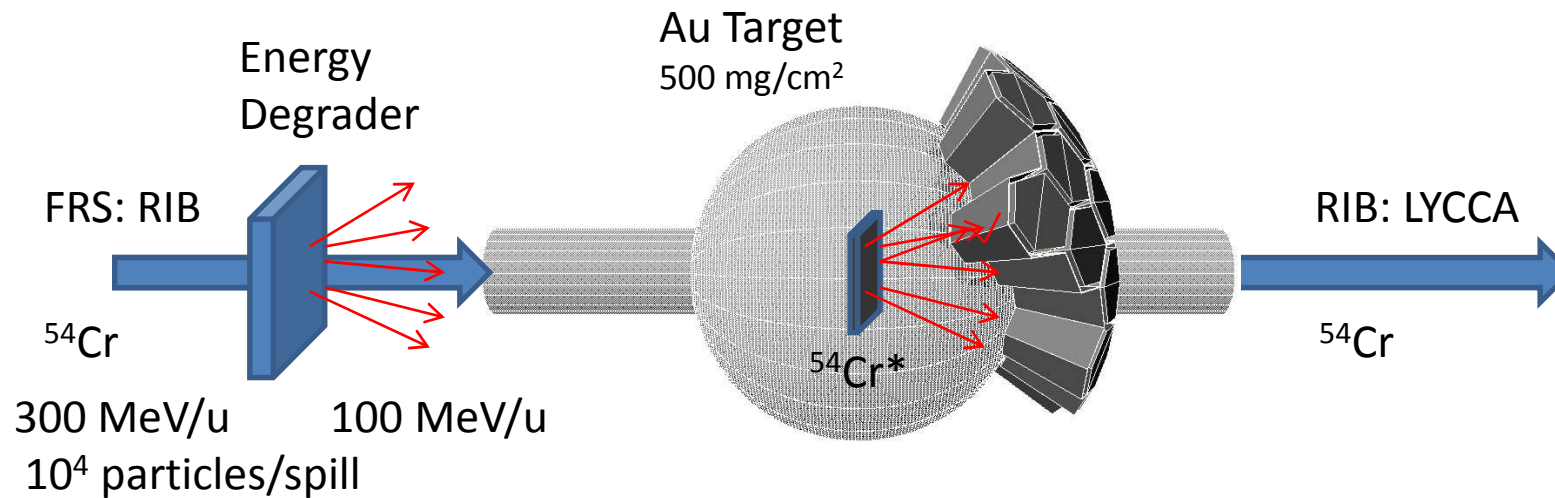
Concomitant aspects

- 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. $^{54}\text{Cr} \rightarrow ^{50,52}\text{Cr}, ^{50,52}\text{V}$, etc.

- Secondary fragmentation or **particle knockout**



Counting rates summary (example)



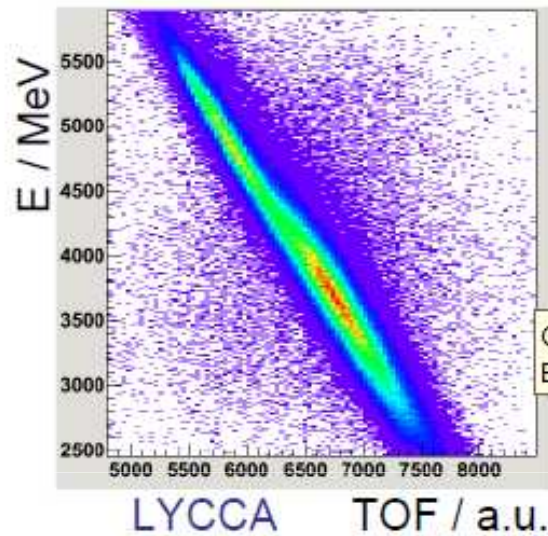
	CS (mb)	Yield (g/s)	Rate@23cm (C/h)	Rate@8cm (C/h)
$^{54}\text{Cr}, 845\text{keV}$	158	4.7	406	657
$^{197}\text{Au}, 547\text{keV}$	Exp.	Exp.	40	65
$^{52}\text{Cr}, 1434\text{keV}$	5	0.15	13	21

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

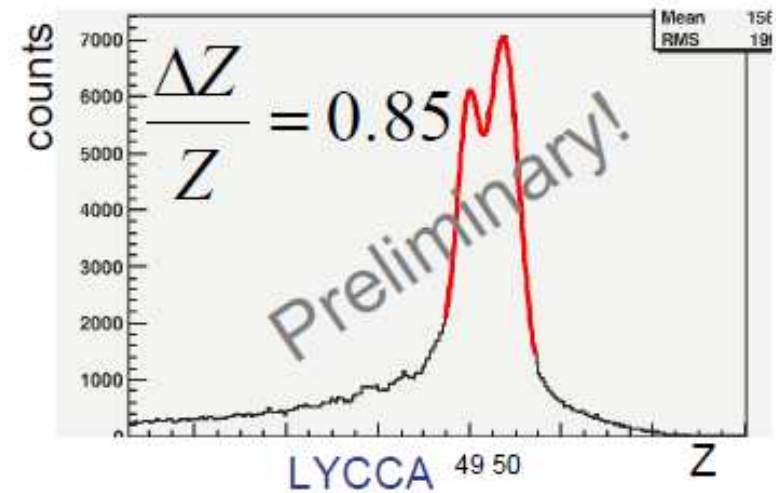
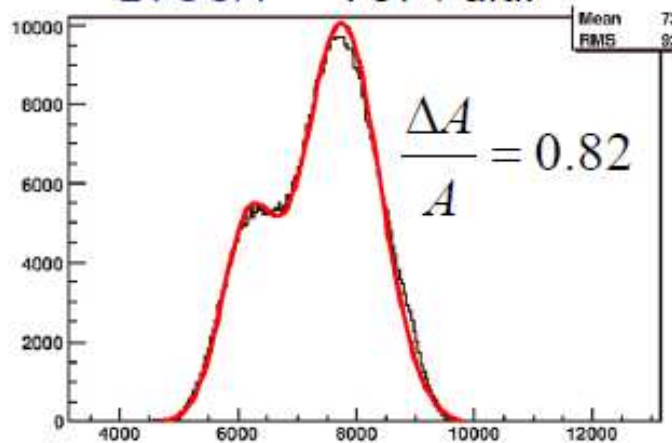
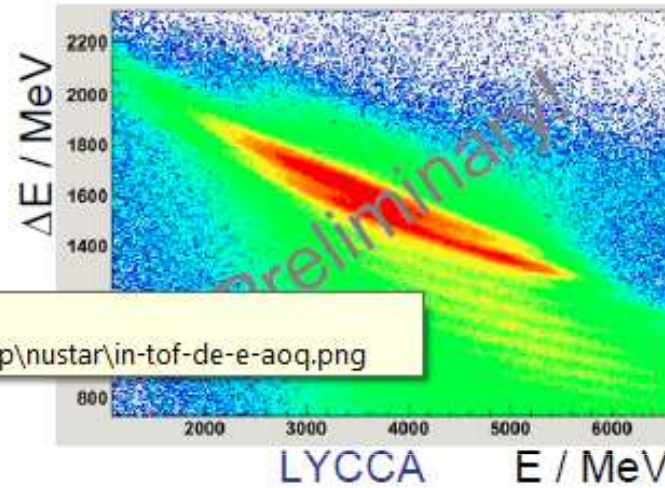
Beam time request

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

LYCCA A and Z ID around ^{100}Sn



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Einstellungen\Andy\Desktop\nustar\in-tof-de-e-aoq.png



Slide from LYCCA Collaboration

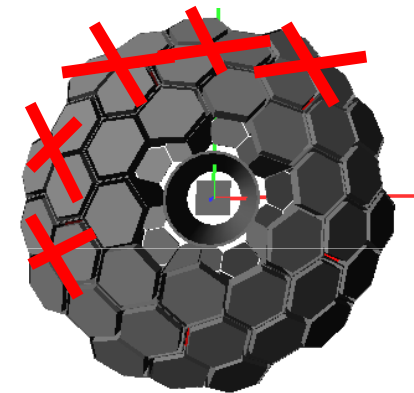
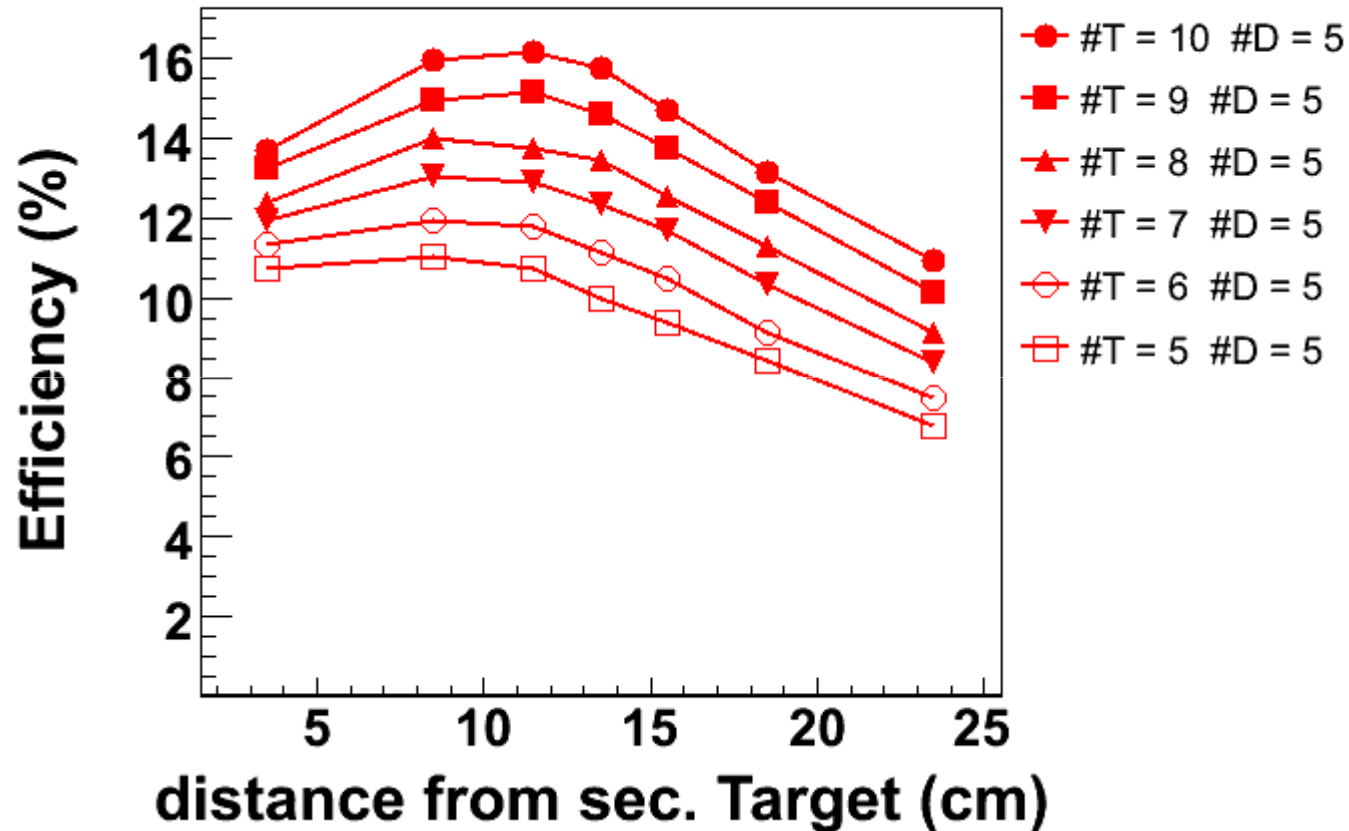
Beam candidates up to $A = 90$

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

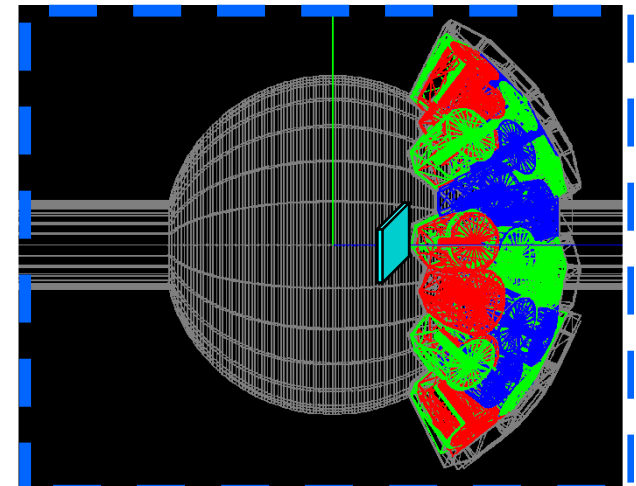
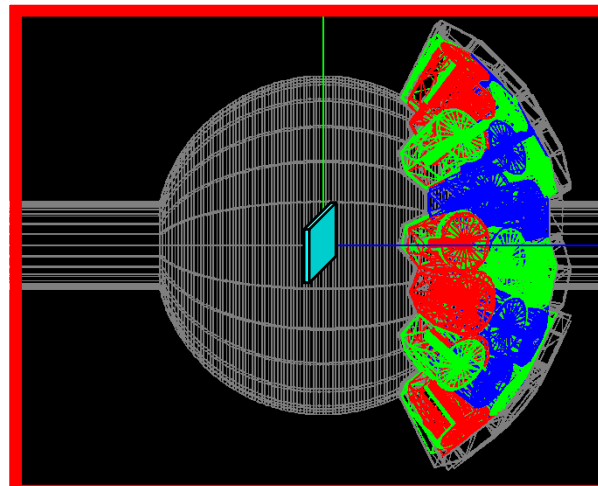
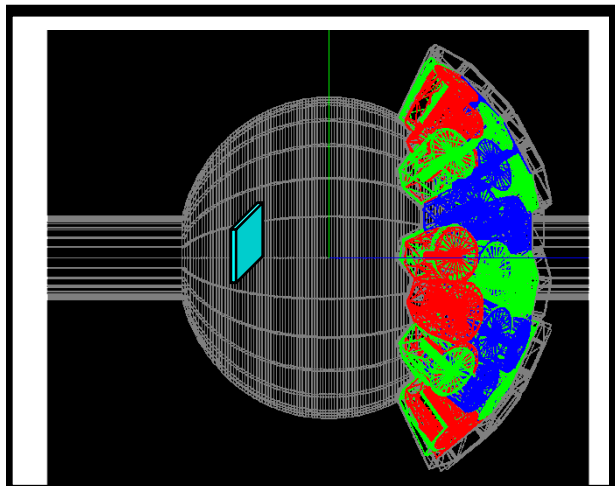
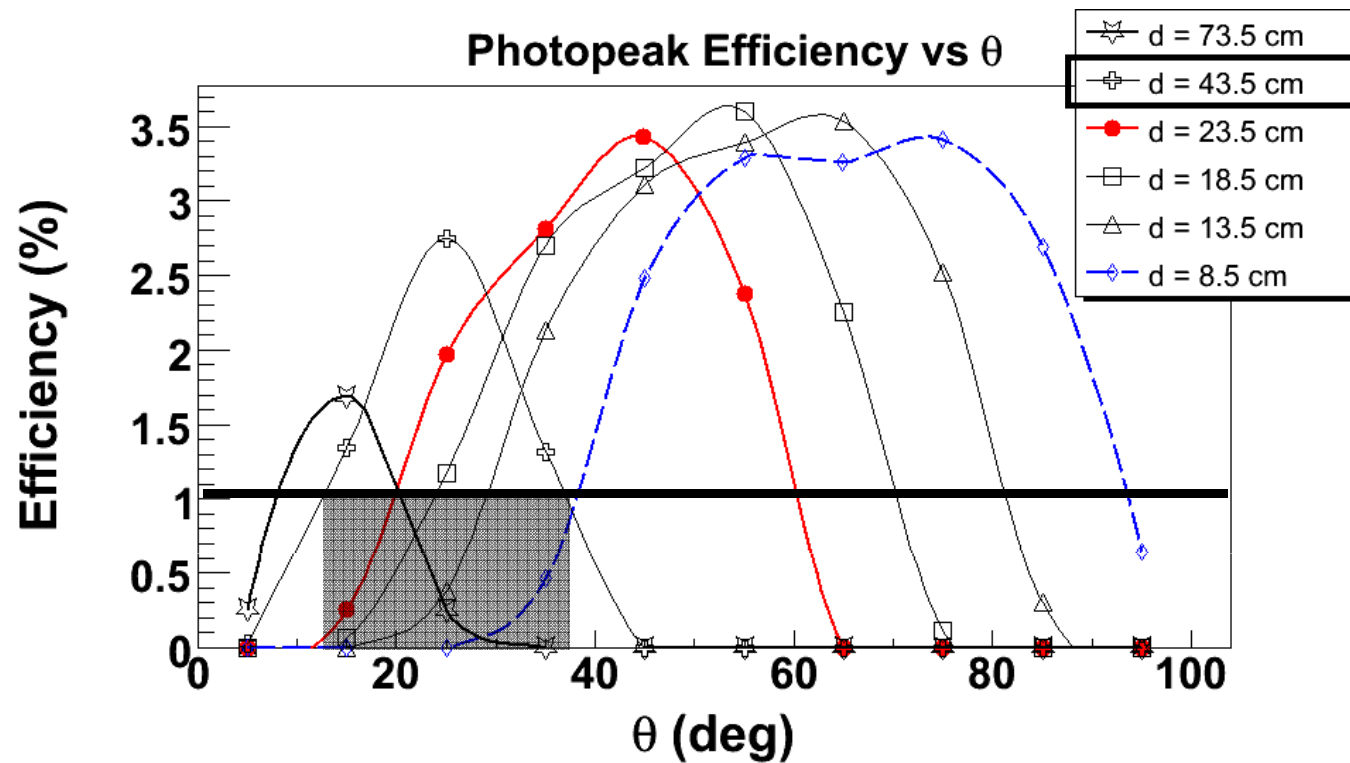
AGATA S2' @ GSI: efficiency vs. # triple (double) clusters

- “Reference physics case”: $E_{\gamma_0} = 1 \text{ MeV}$, recoil nucleus at $\beta = 0.43$ ($E = 100 \text{ MeV/u}$), $M\gamma = 1$

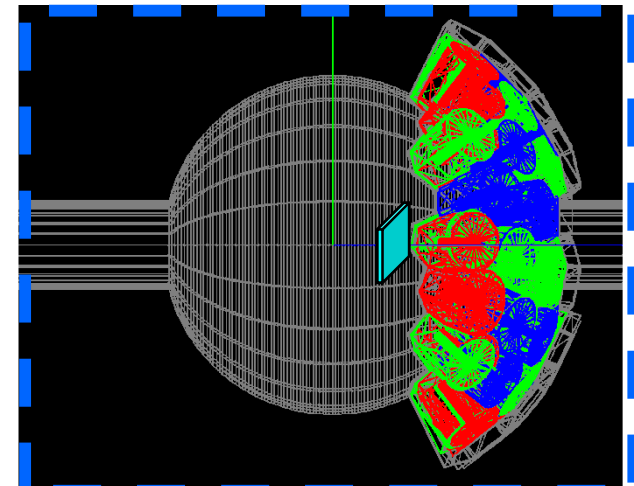
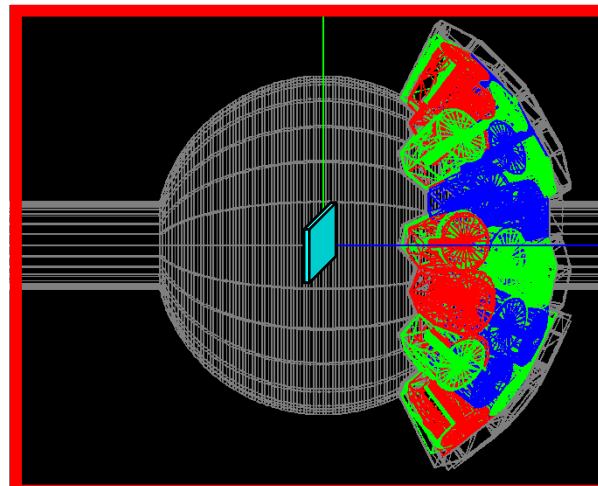
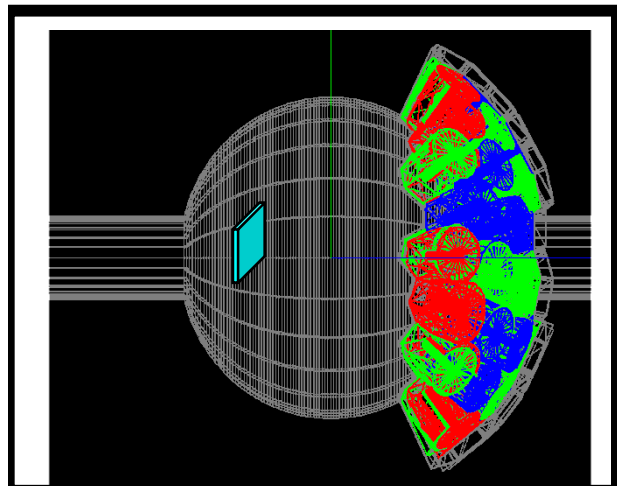
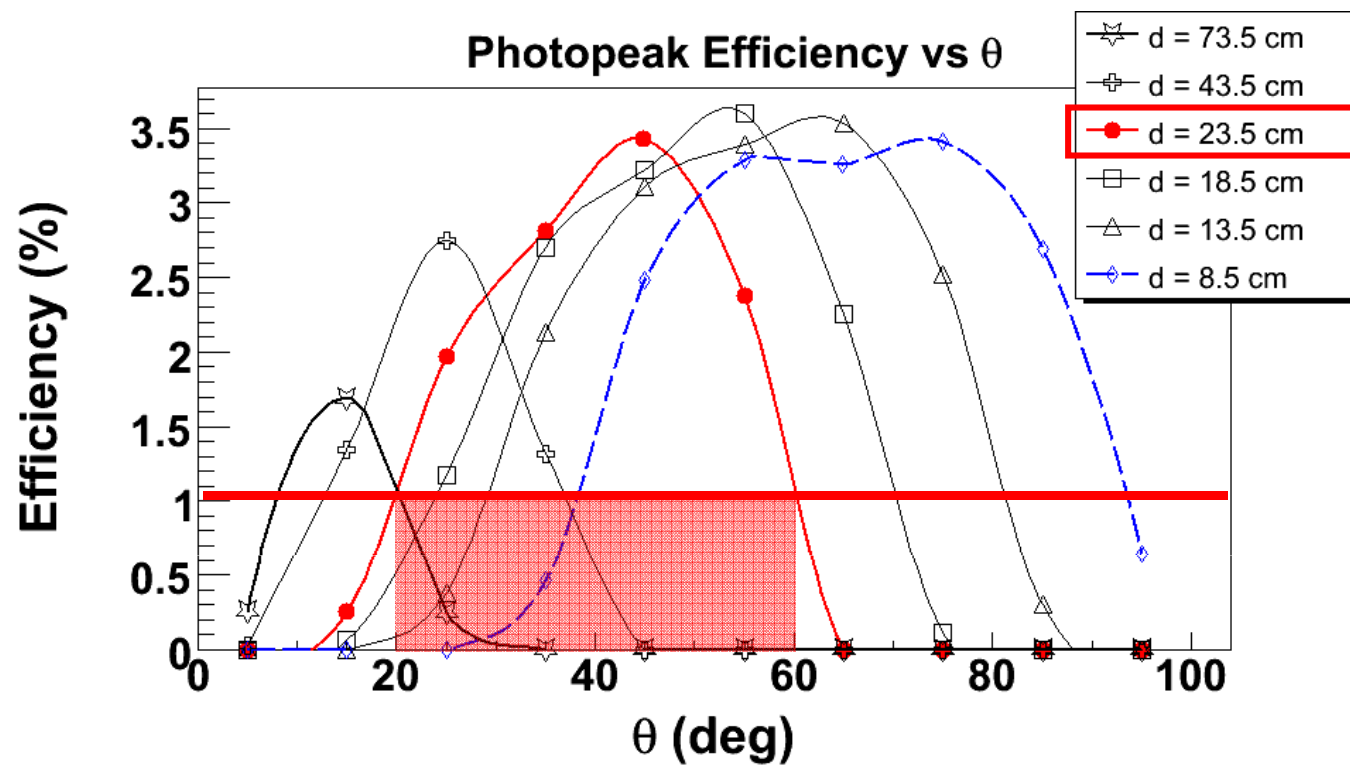
(GEANT4 AGATA code from NIMA 621 (2010) 331-343, E.Farnea et al.)



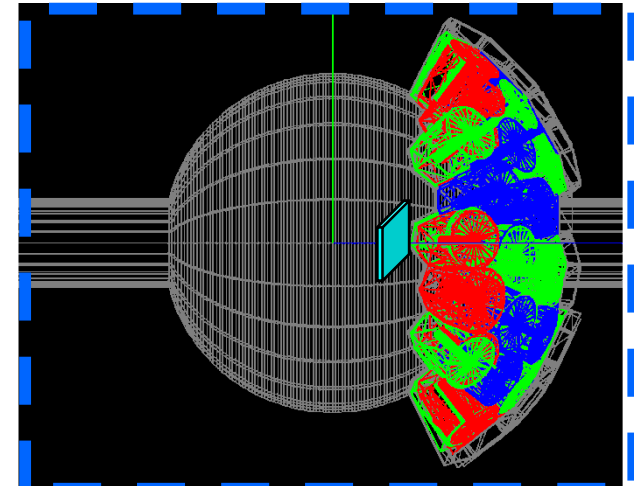
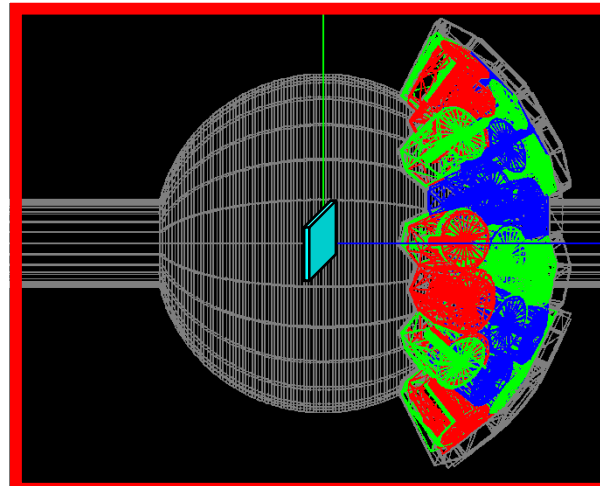
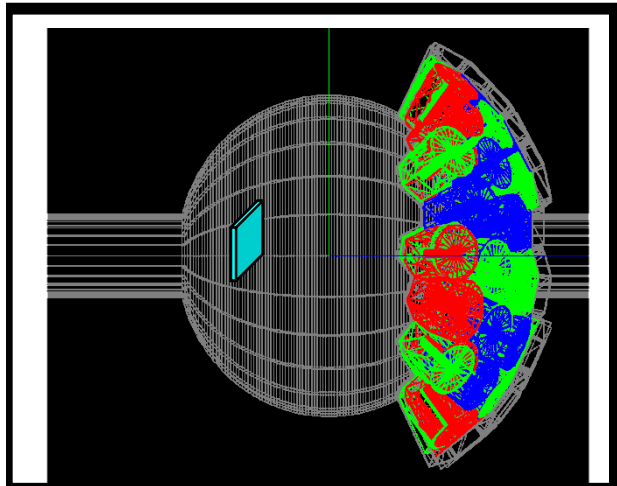
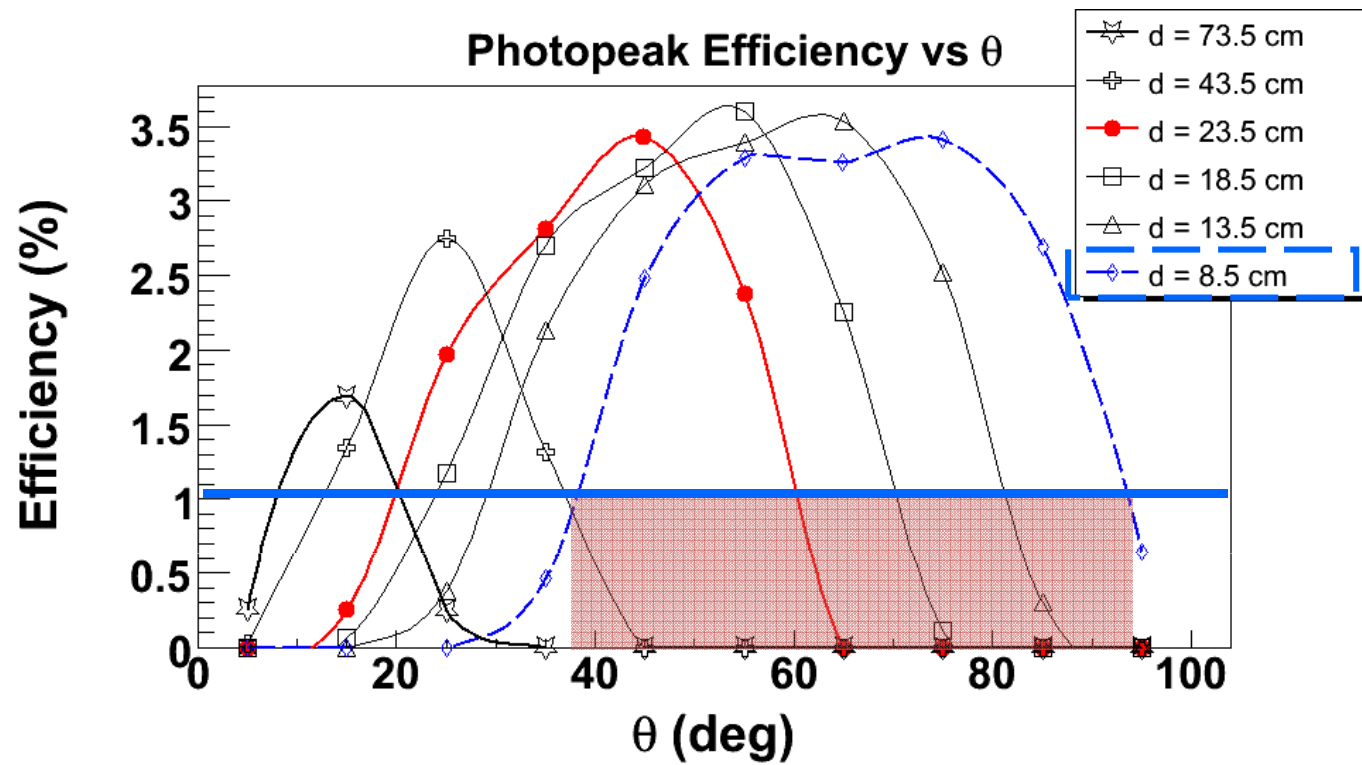
AGATA S2' @ GSI: angular dependence of the efficiency



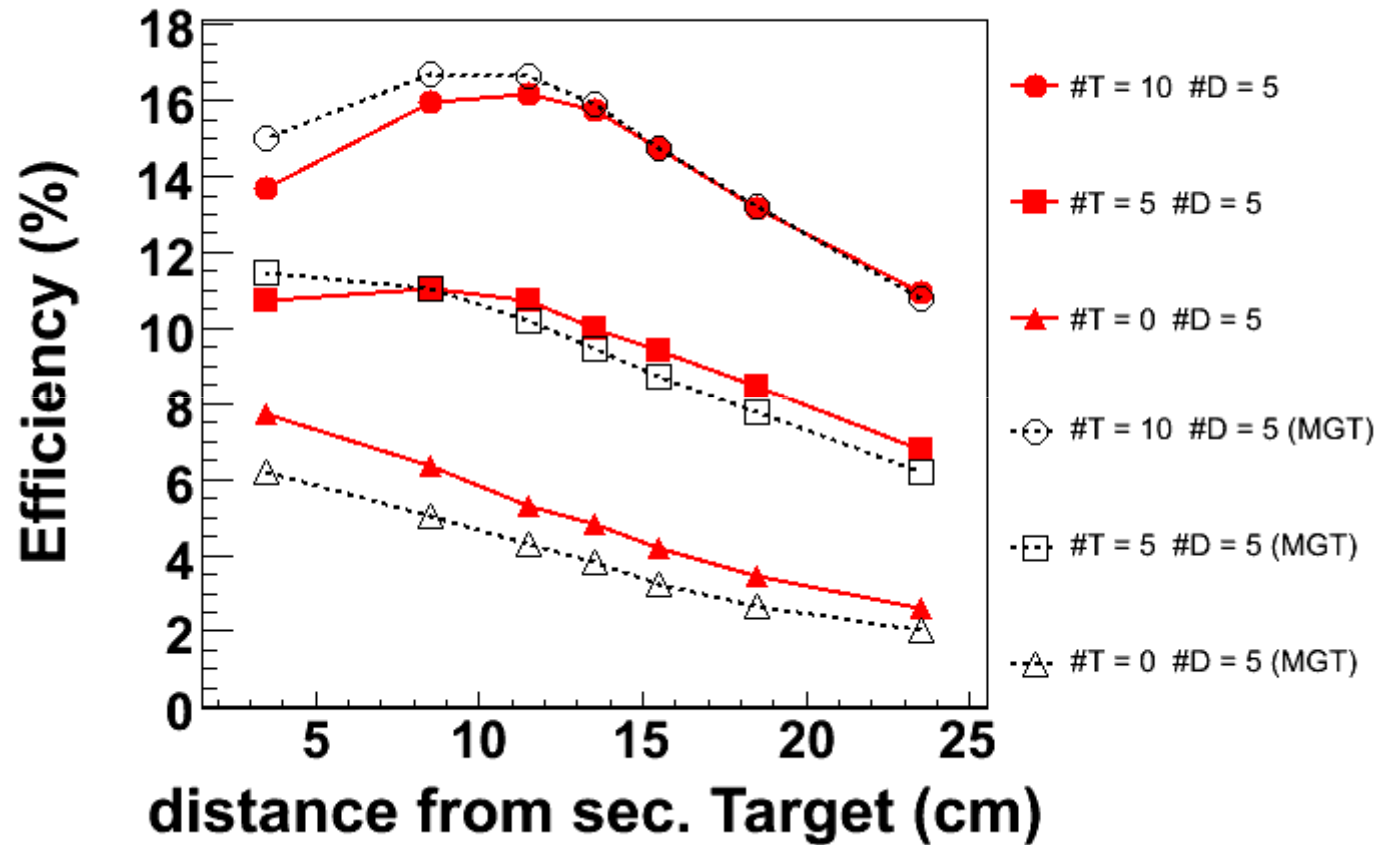
AGATA S2' @ GSI: angular dependence of the efficiency



AGATA S2' @ GSI: angular dependence of the efficiency



Efficiency comparison mc-add-back vs. mgt



Peak/Total values from mgt

