IWM-EC 2018

International Workshop on Multi facets of Eos and Clustering

Isospin influence on the Intermediate Mass Fragments dynamical emission at low energy

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Heavy-ion induced reactions with stable and radioactive beams are ideal to explore the nuclear matter under different stress conditions.

Low energy regime E < 15 MeV/A is dominated by Compound Nucleus formation and de-excitations in competition with binary processes (DIC, Quasi-elastic)

In this energy domain different reaction mechanisms are responsible of the Intermediate Mass Fragments $Z \geq 3$ production:

- Fusion-Fission processes

- Damped deep inelastic collision followed by Projectile –Like break-up,

$^{78}Kr + ^{40}Ca \rightarrow ^{118}Ba^{*}$

@E/A=10 MeV/A

$^{86}Kr + ^{48}Ca \rightarrow ^{134}Ba^{*}$

ISODEC EXPERIMENT

S. Pirrone et al., Journal of Physics: Conf. Series 515 (2014) 012018
G. Politi et al., JPS Conf. Proc. Vol. 6 (2015) 030082
B. G. Il Nuovo Cimento C39 (2016) 275

$^{124}Sn + ^{64}Ni$

$^{112}Sn + ^{58}Ni$

@E/A=35 MeV/A

Reverse Experiment

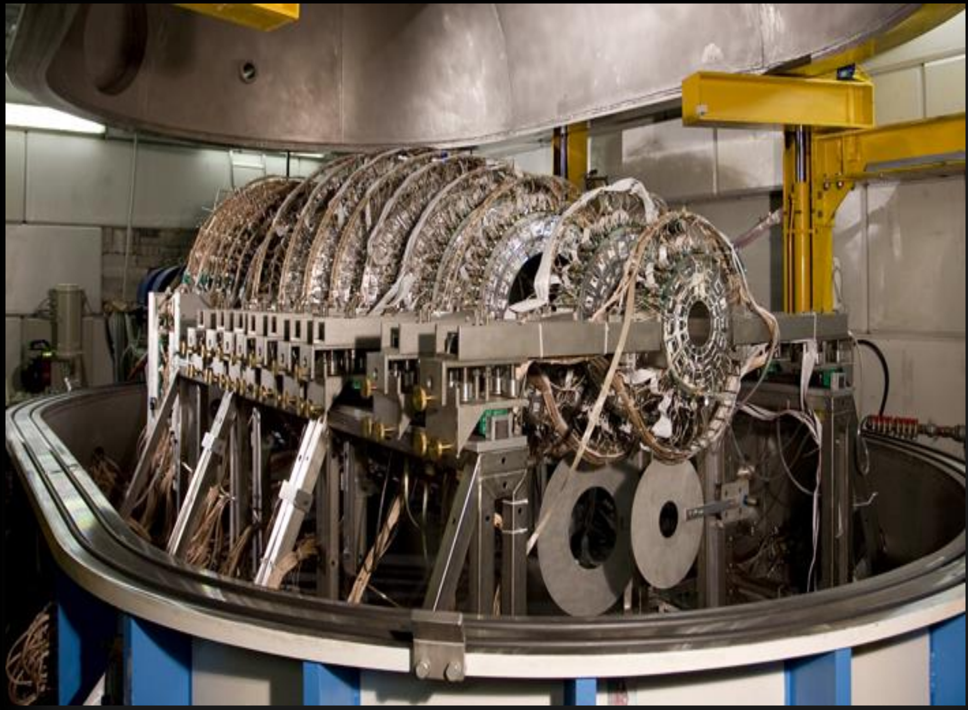
see E. De Filippo 's Talk

$^{124}Xe + ^{64}Zn$

$^{124}Xe + ^{64}Ni$

@E/A=35 MeV/A

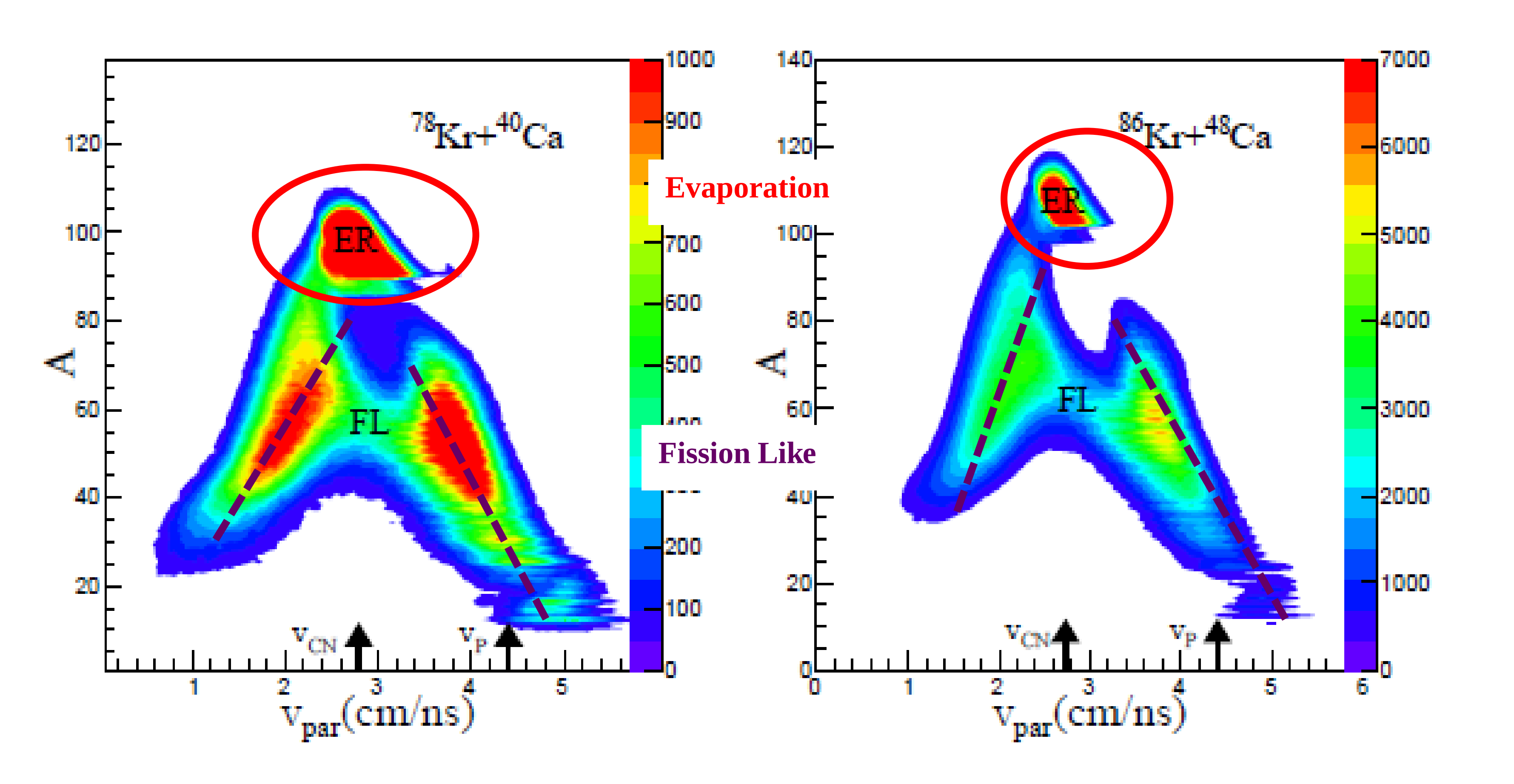
InKiIsSy Experiment



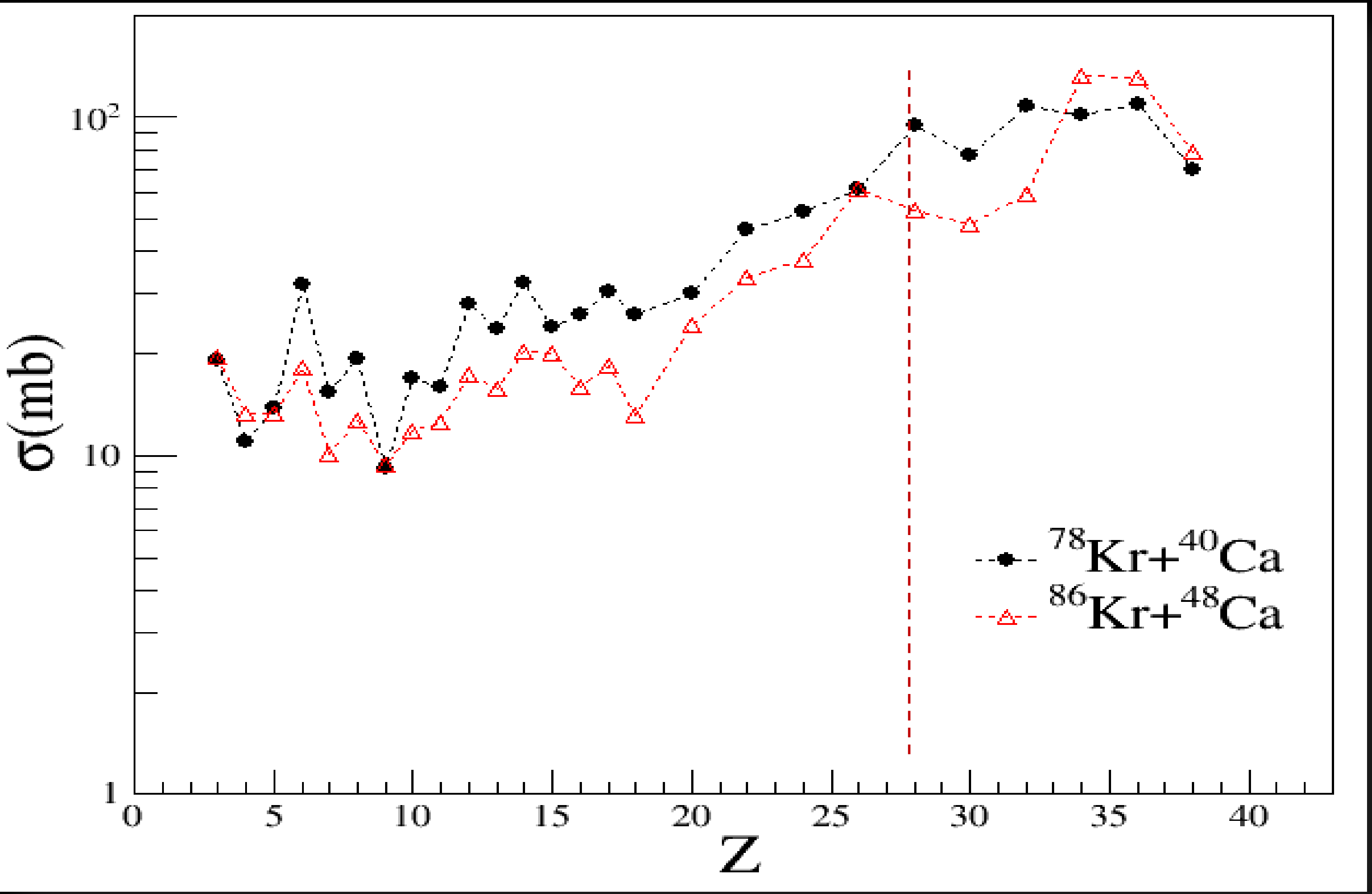
CHIMERA at INFN-LNS

A. Pagano et al., NPA681 (2001)331

Information from Complete Events
Correlation between fragment mass and parallel velocity



Charge Distributions



- → Fragments production globally favored for n-poor
- →Strong even-odd effect , staggering, more pronounced for the n-poor system
- →Charge distribution asymmetric with respect to $Z_{CN}/2=28$→ process not fully relaxed in mass

The main result of the ISODEC experiment

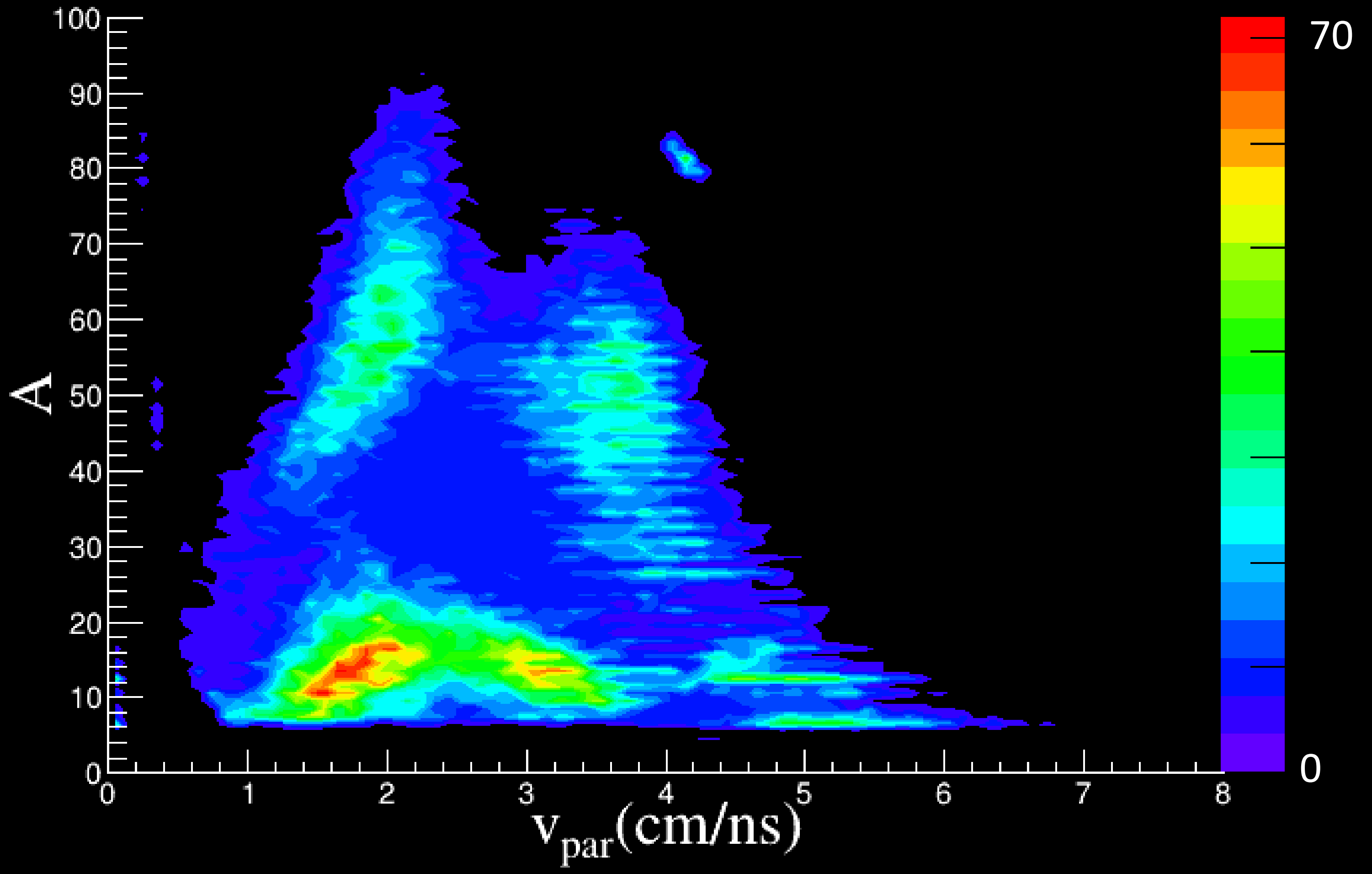
	σ_{ER} (mb)	σ_{FL} (mb)	σ_{fus} (mb)	σ_{reac}^{qp} (mb)
^{78}Kr+^{40}Ca	455±70	850±120	1305±190	2390±250
^{86}Kr+^{48}Ca	400±60	530±85	930±145	2520±260

S. Pirrone et al., Phys. Rev. C, submitted

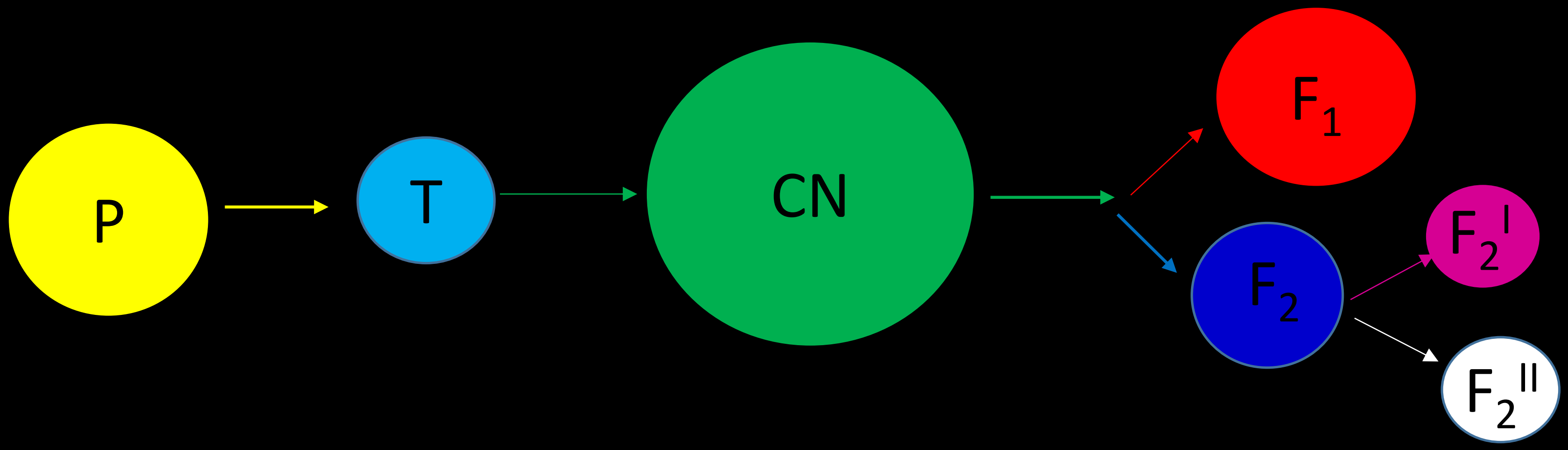
Fission-Like processes Cross section is more pronounced for the ^{78}Kr+^{40}Ca system respect to ^{86}Kr+^{48}Ca , while the fusion-evaporation are comparable for the two systems

In general the neutron enrichment seems to discourage globally the formation of the compound nucleus, in particular the fusion-fission procceses

Correlation between fragment mass and parallel velocity of reaction products in events with 3 IMF detected and well identified



Break-up of the slow-fission-fragment



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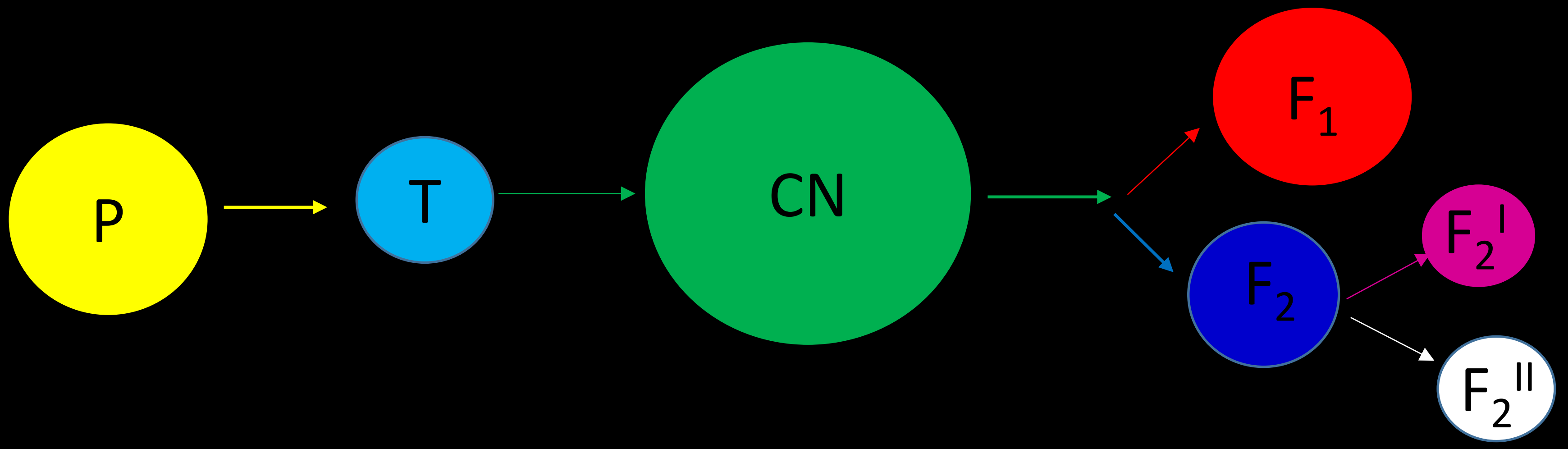
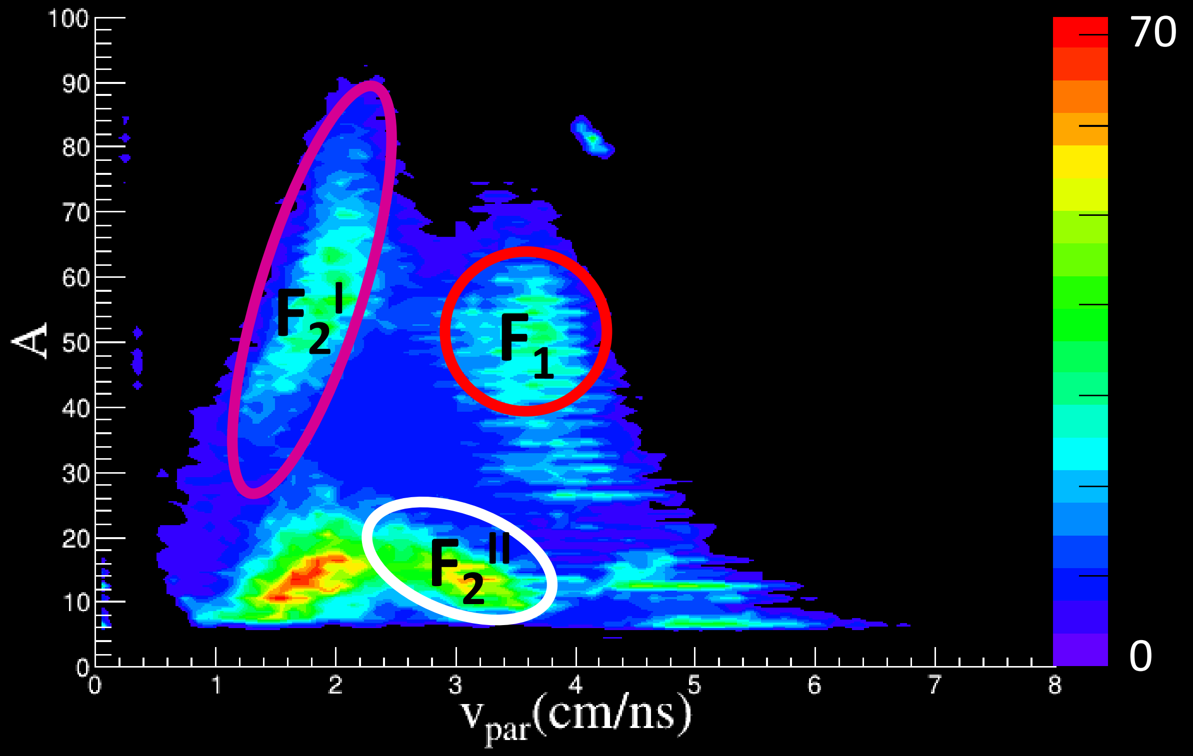
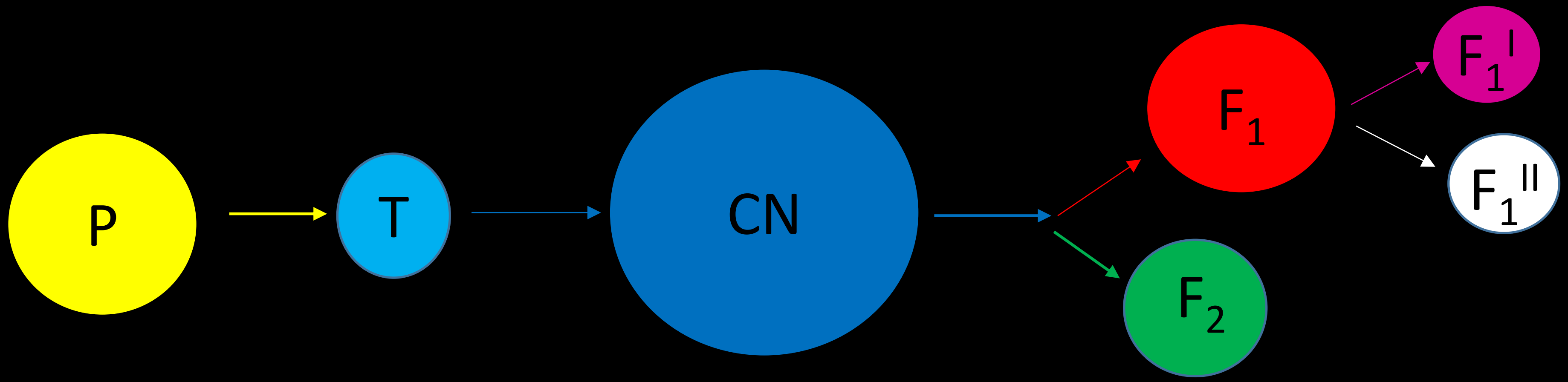




Break-up of the fast-fission-fragment



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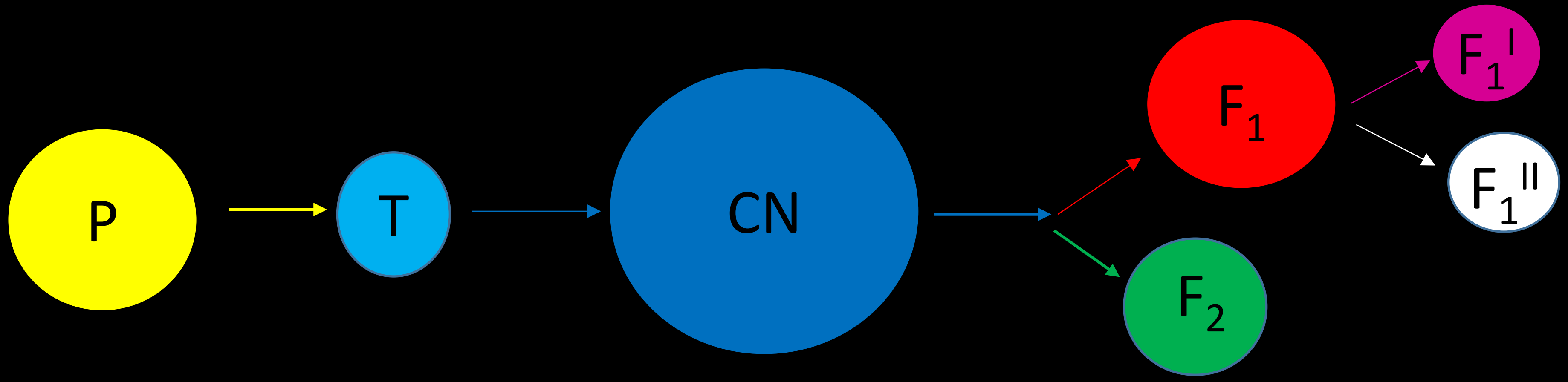

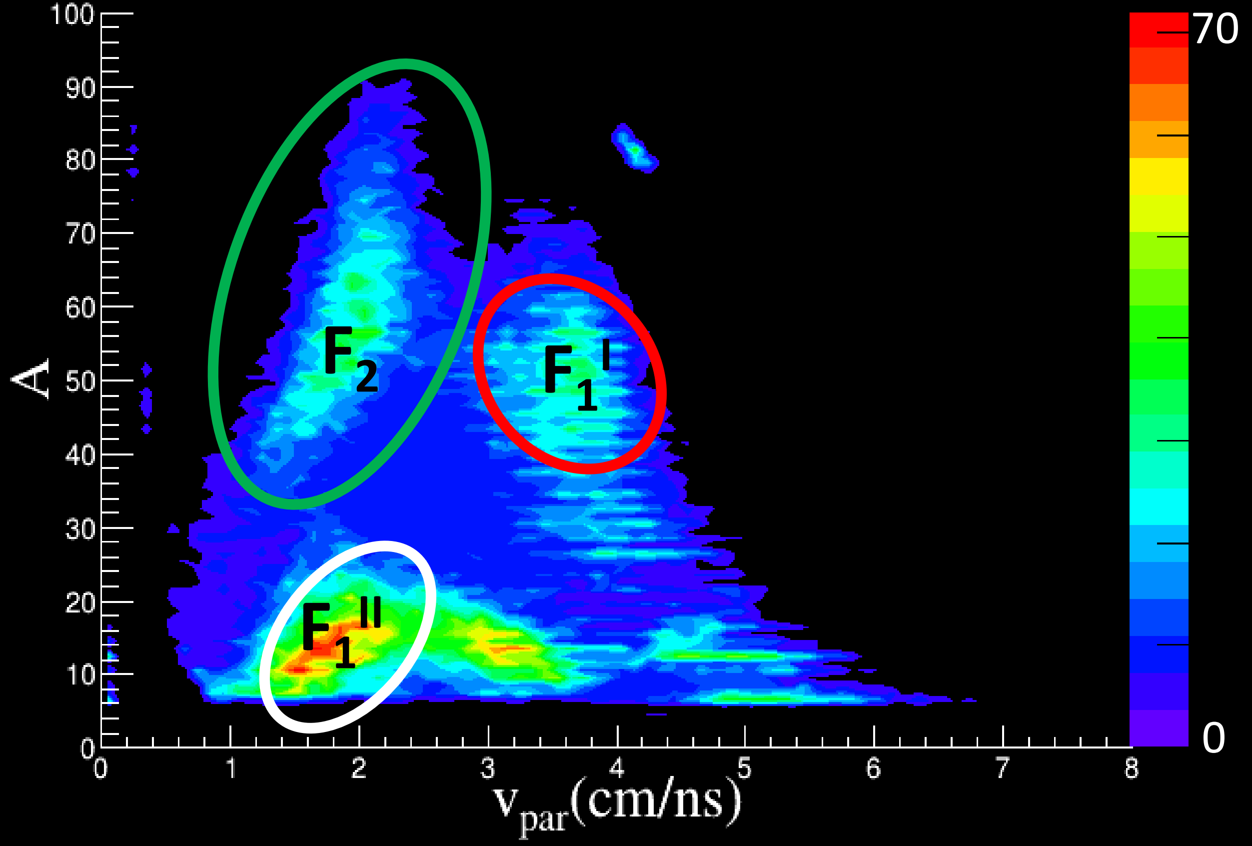

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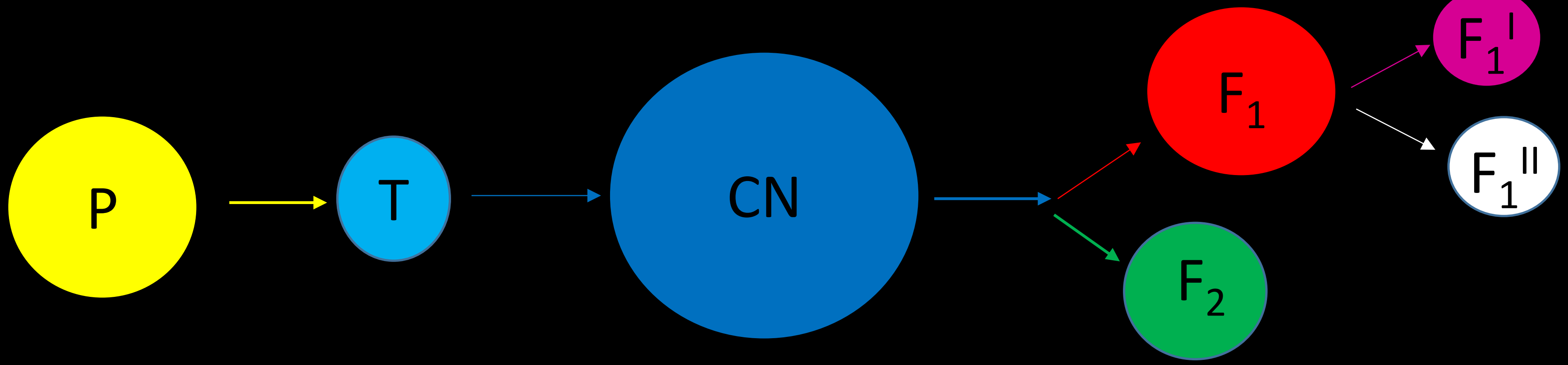
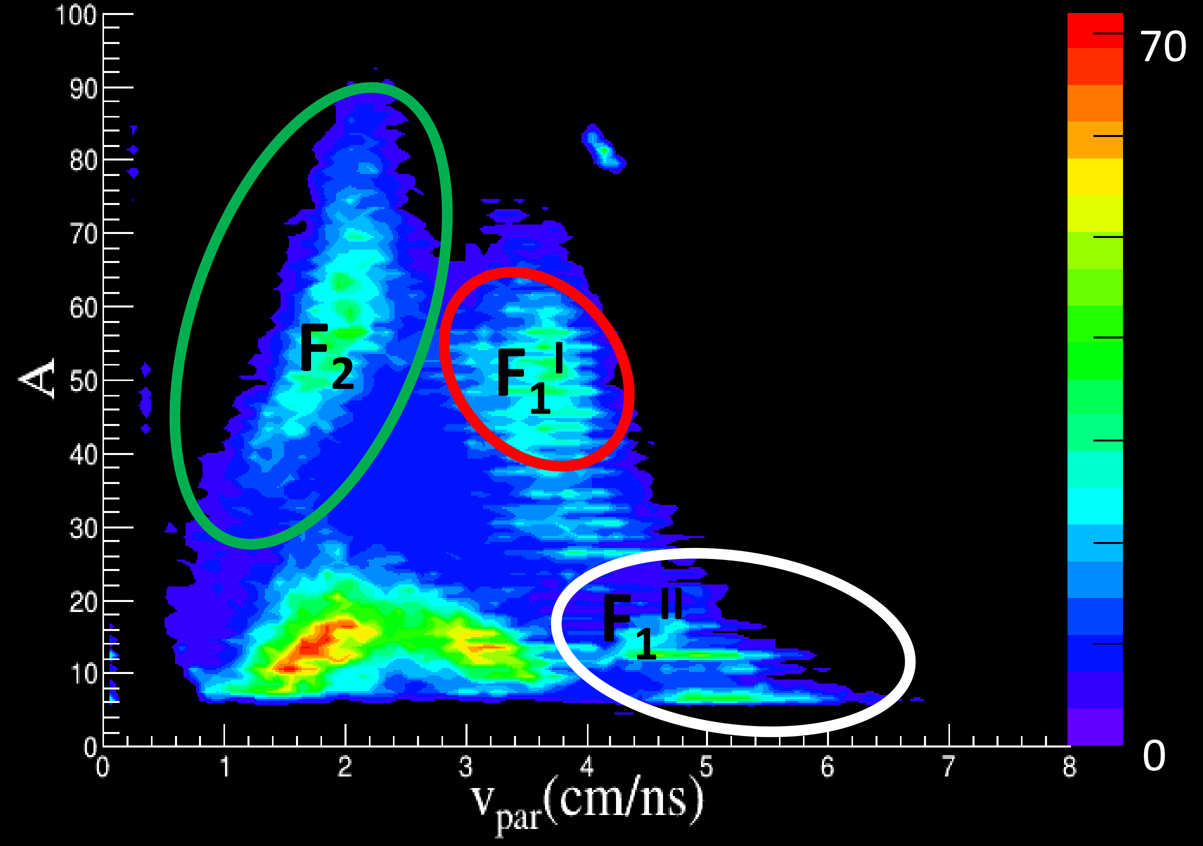
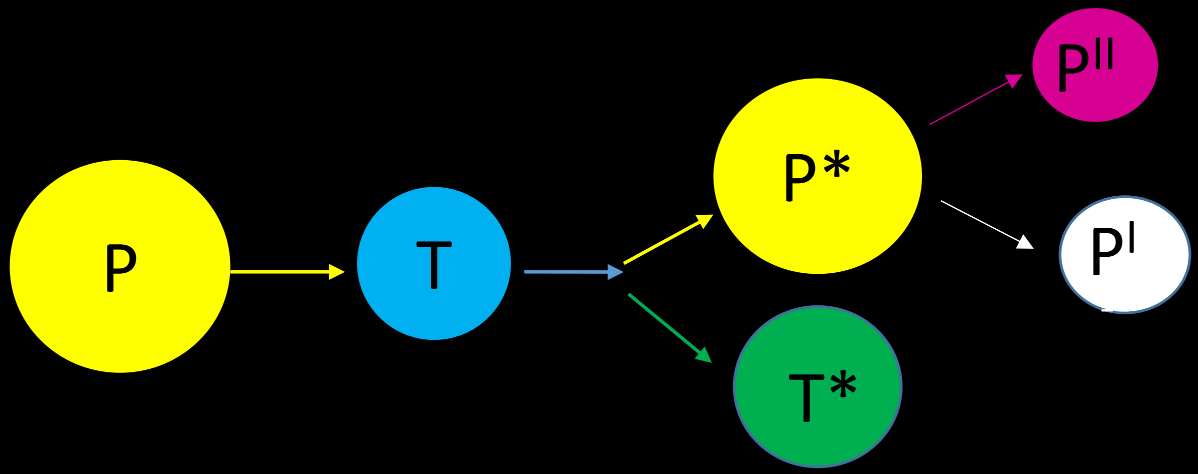




Break-up of the Projectile-Like-Fragment



The third fragment is a part of TLF

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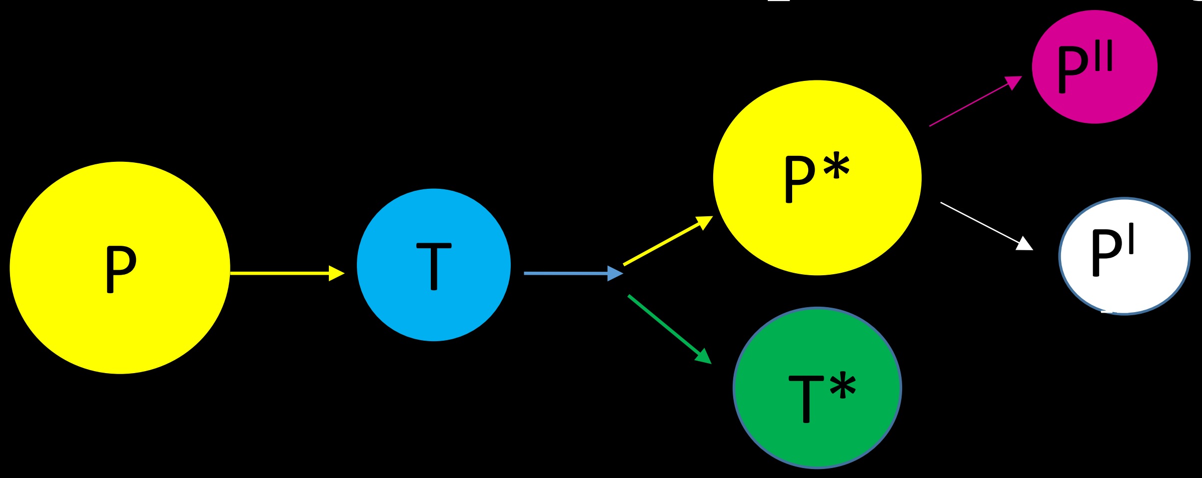

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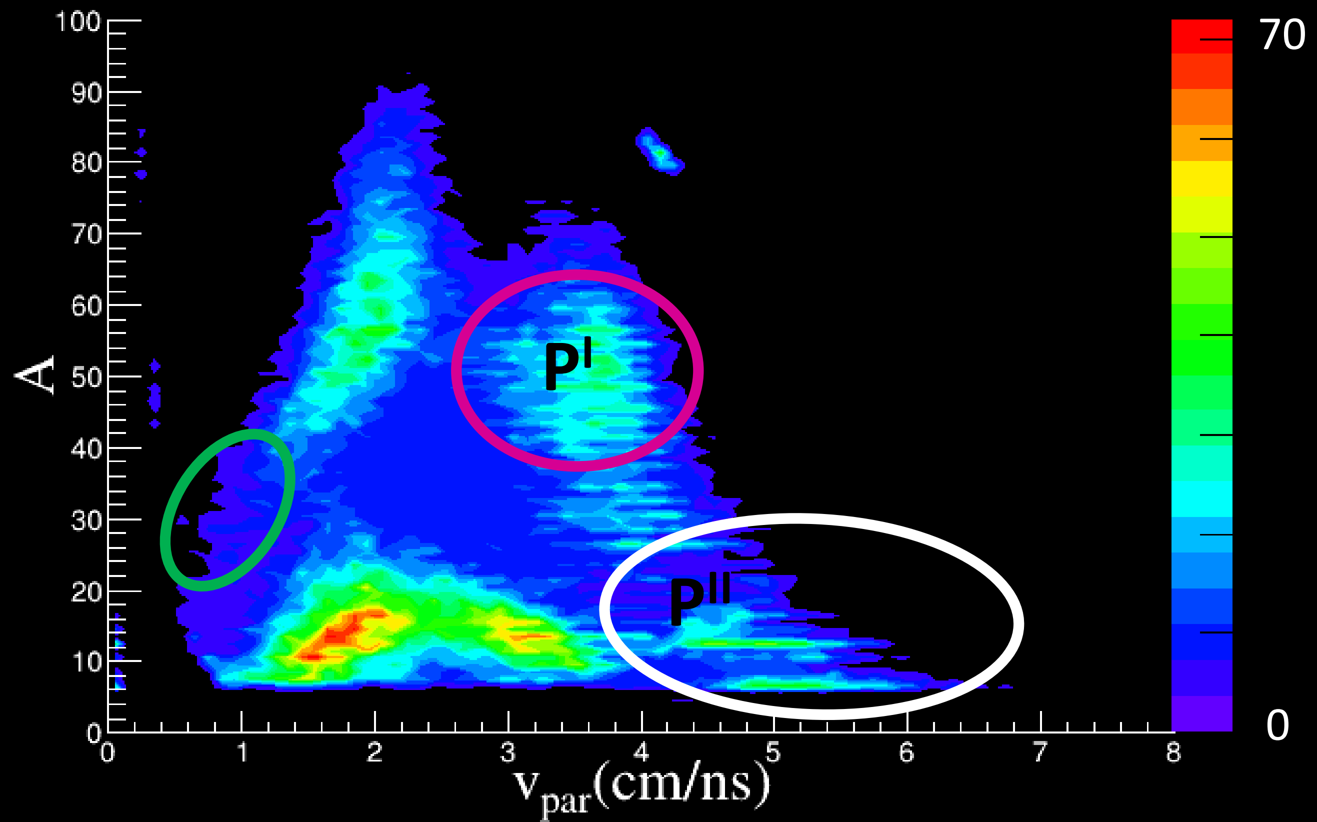
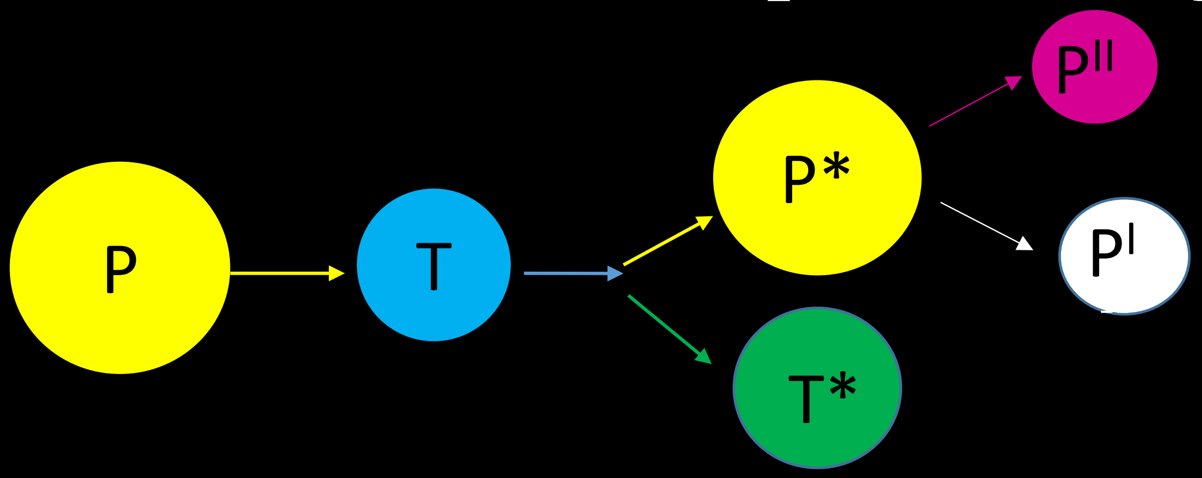


Break-up of the Projectile-Like-Fragment



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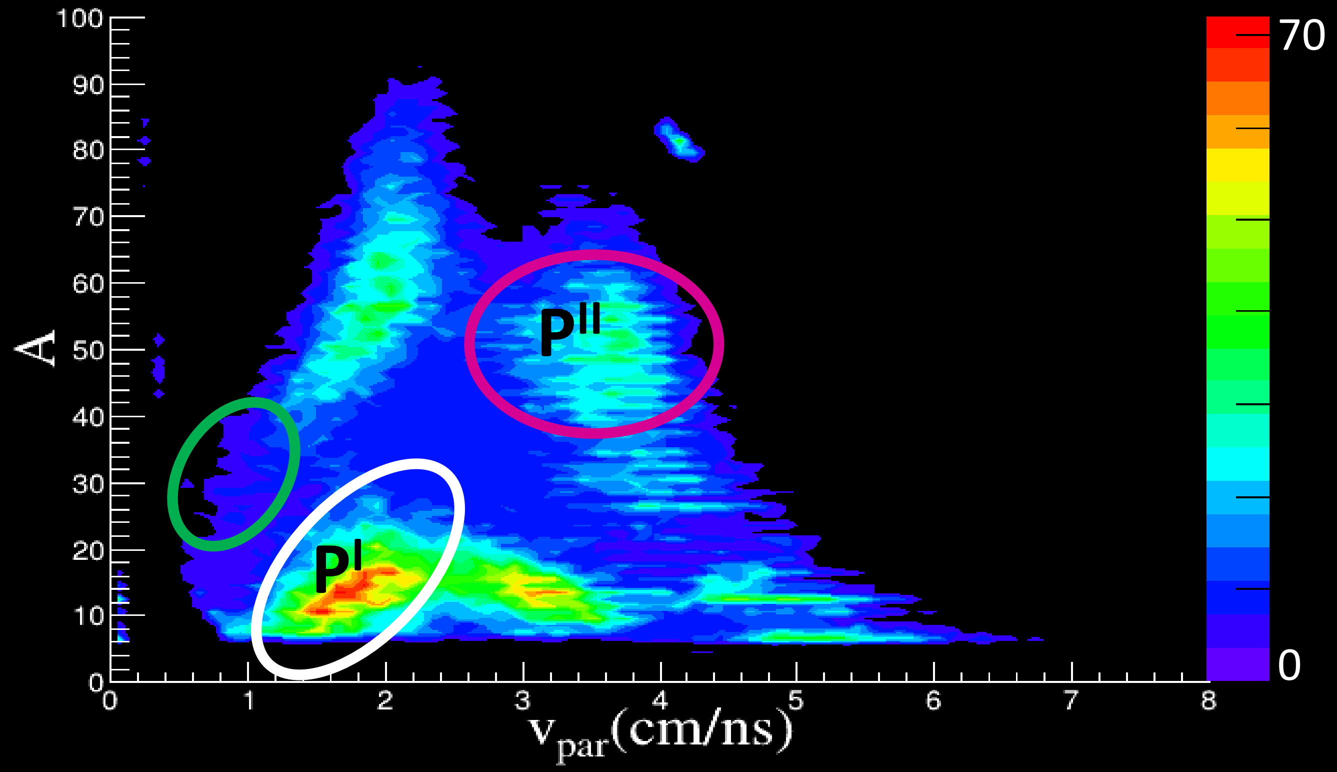
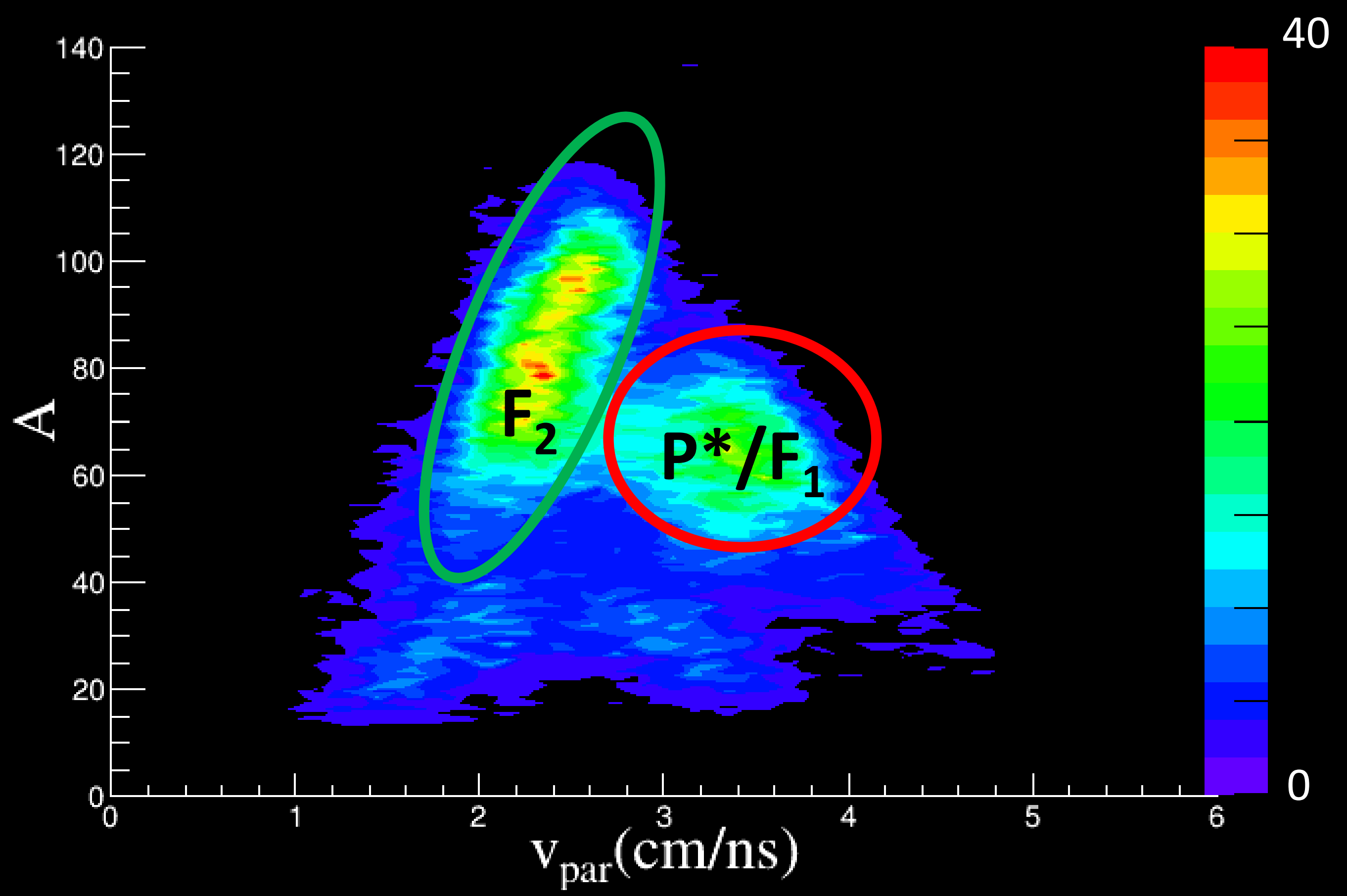


Correlation between mass and parallel velocity of the reconstructed source of each combination of two fragments in events with 3 IMFs detected.



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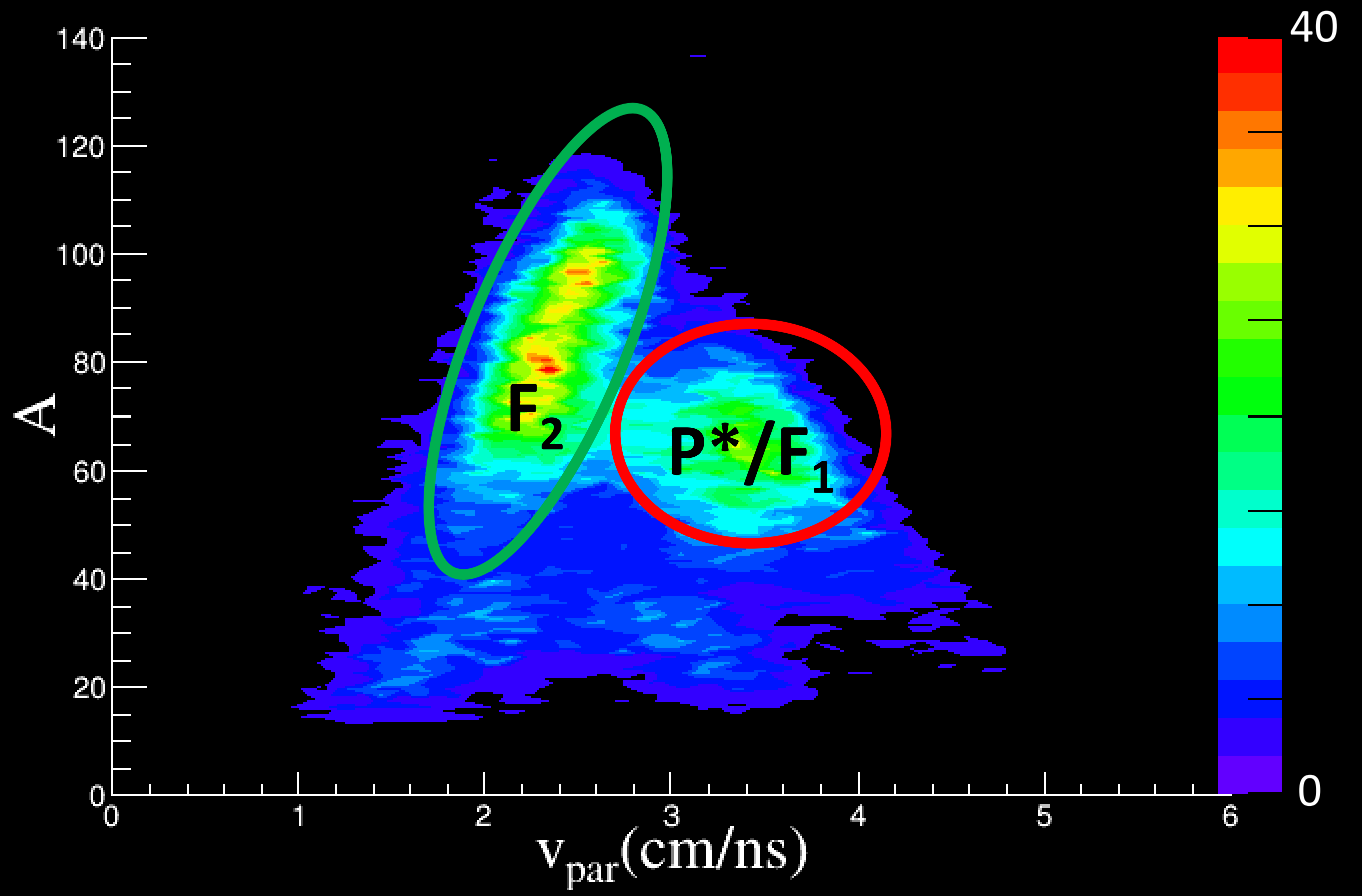
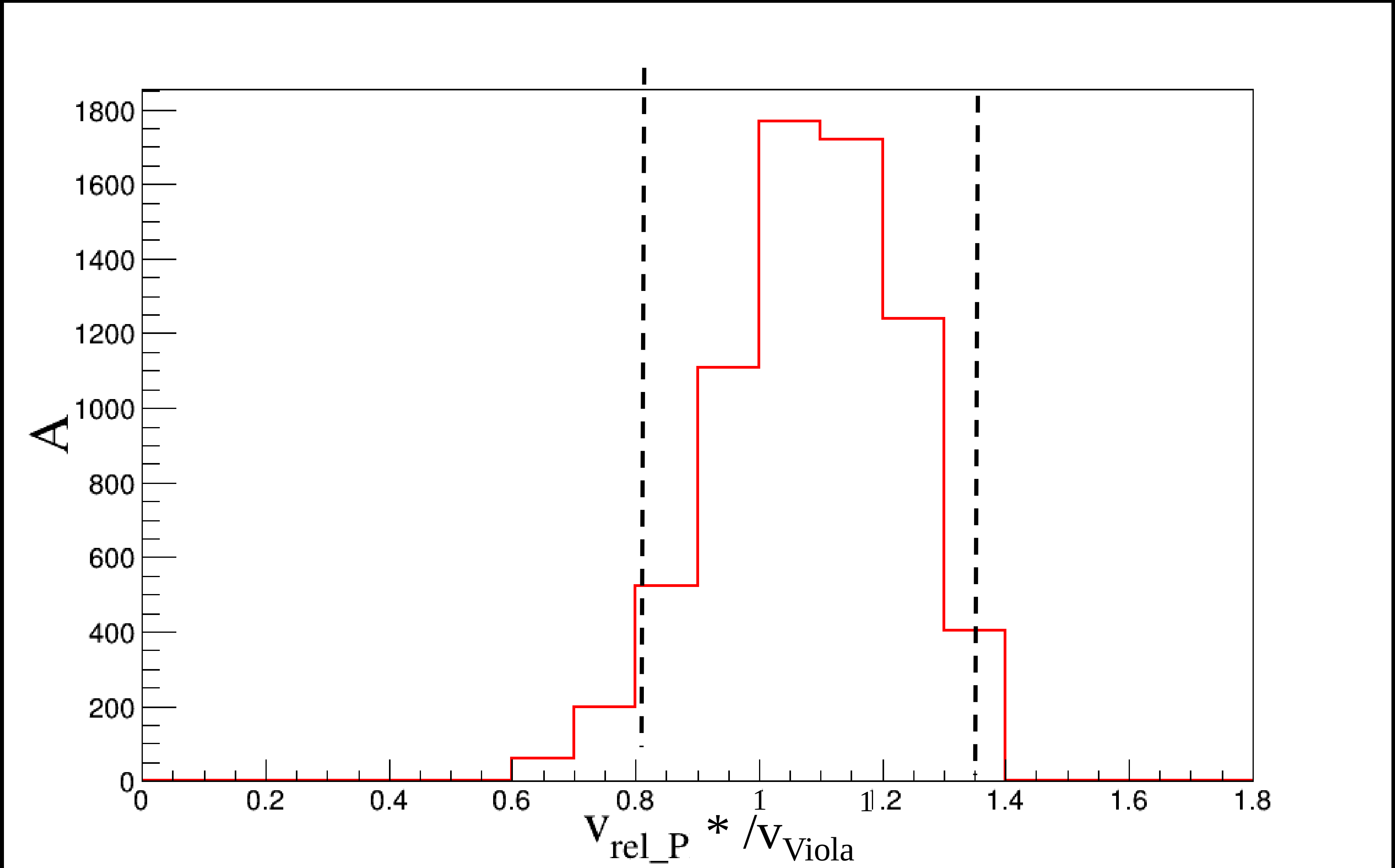
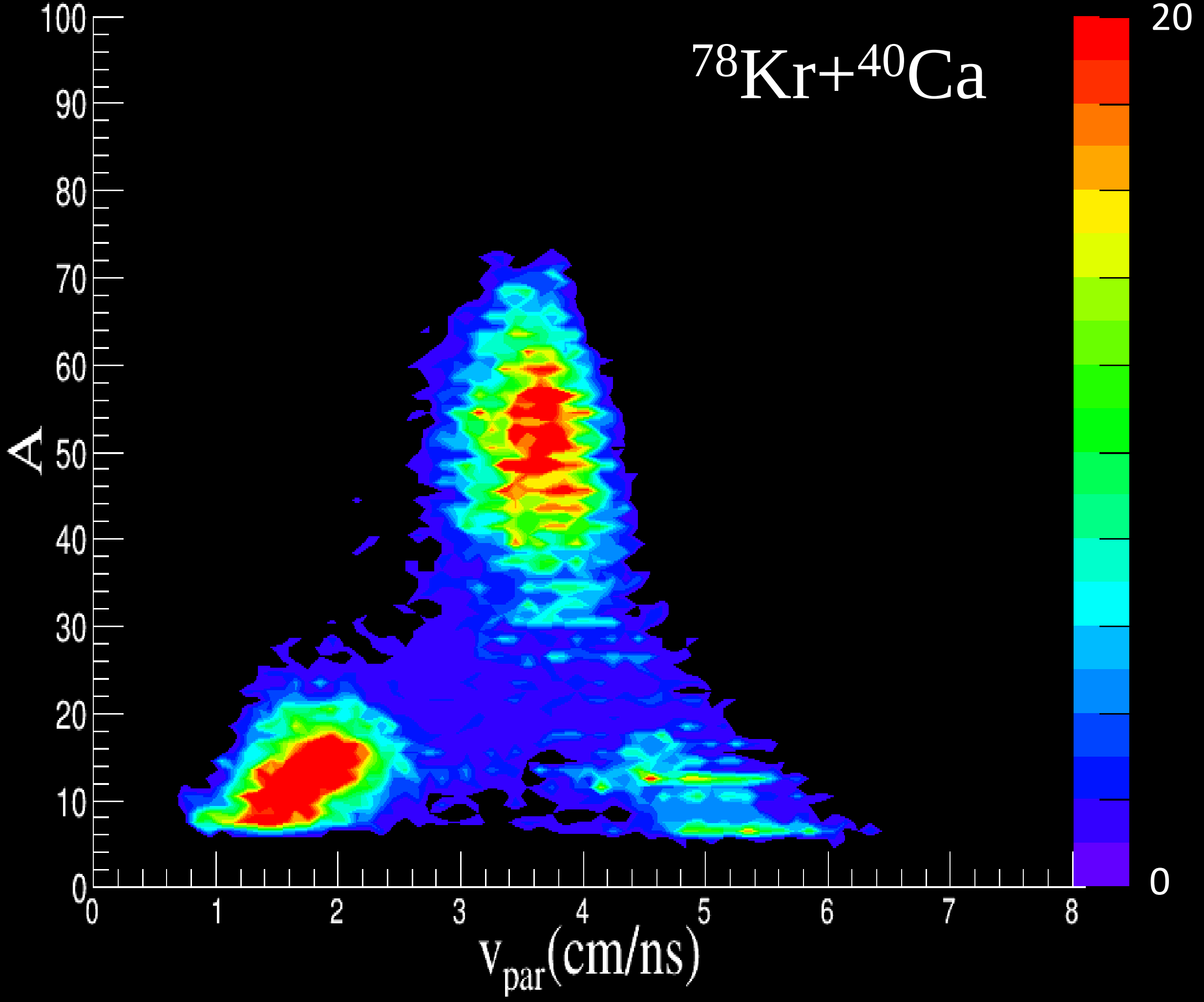


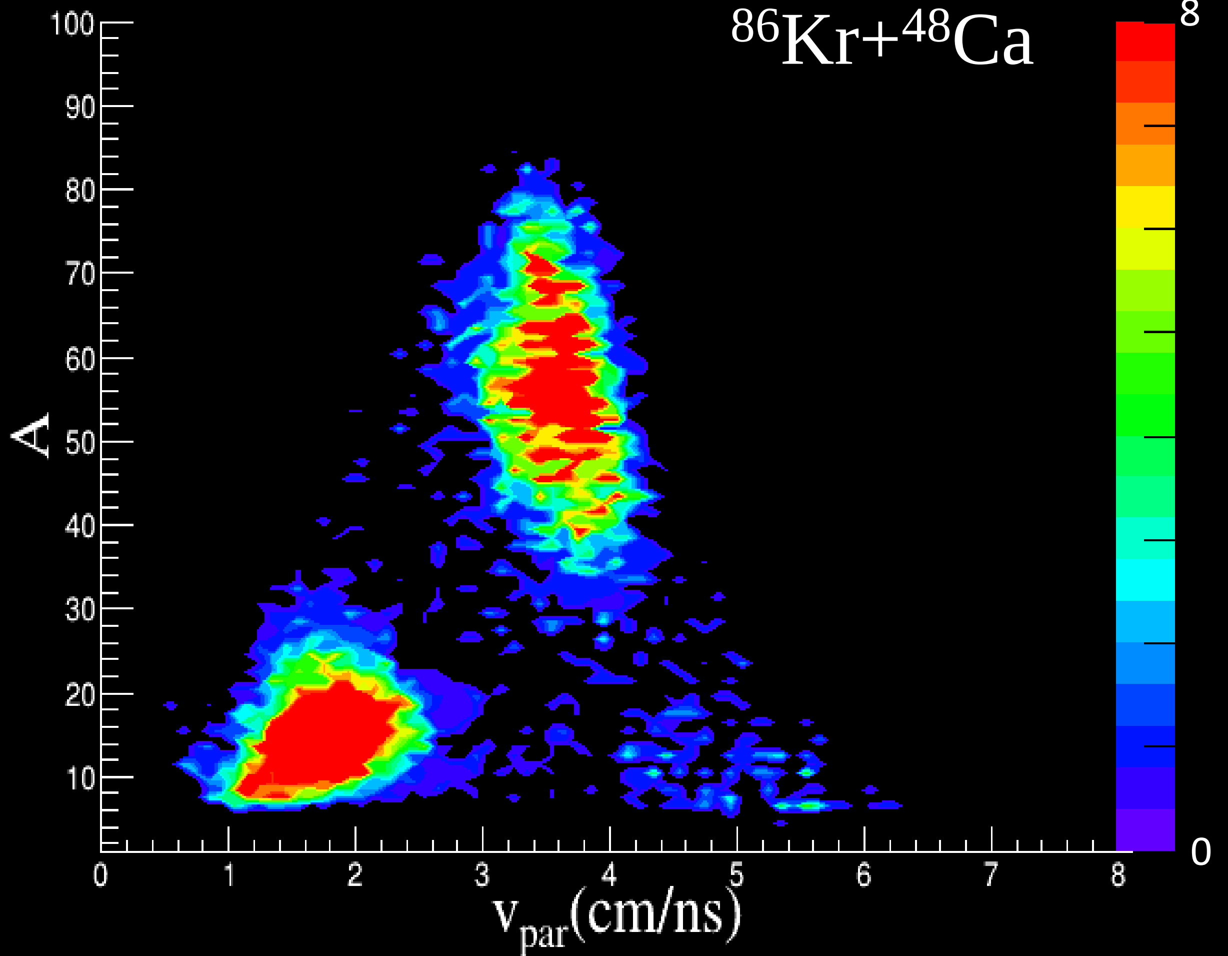
We required that the reconstructed source of two fragments is P*/F1 and that the third doesn’t belong to the slow branch of fission from CN → P*

Cut on the ratio between the relative velocity between two fragments reconstructing the P*/F1 and the Viola velocity

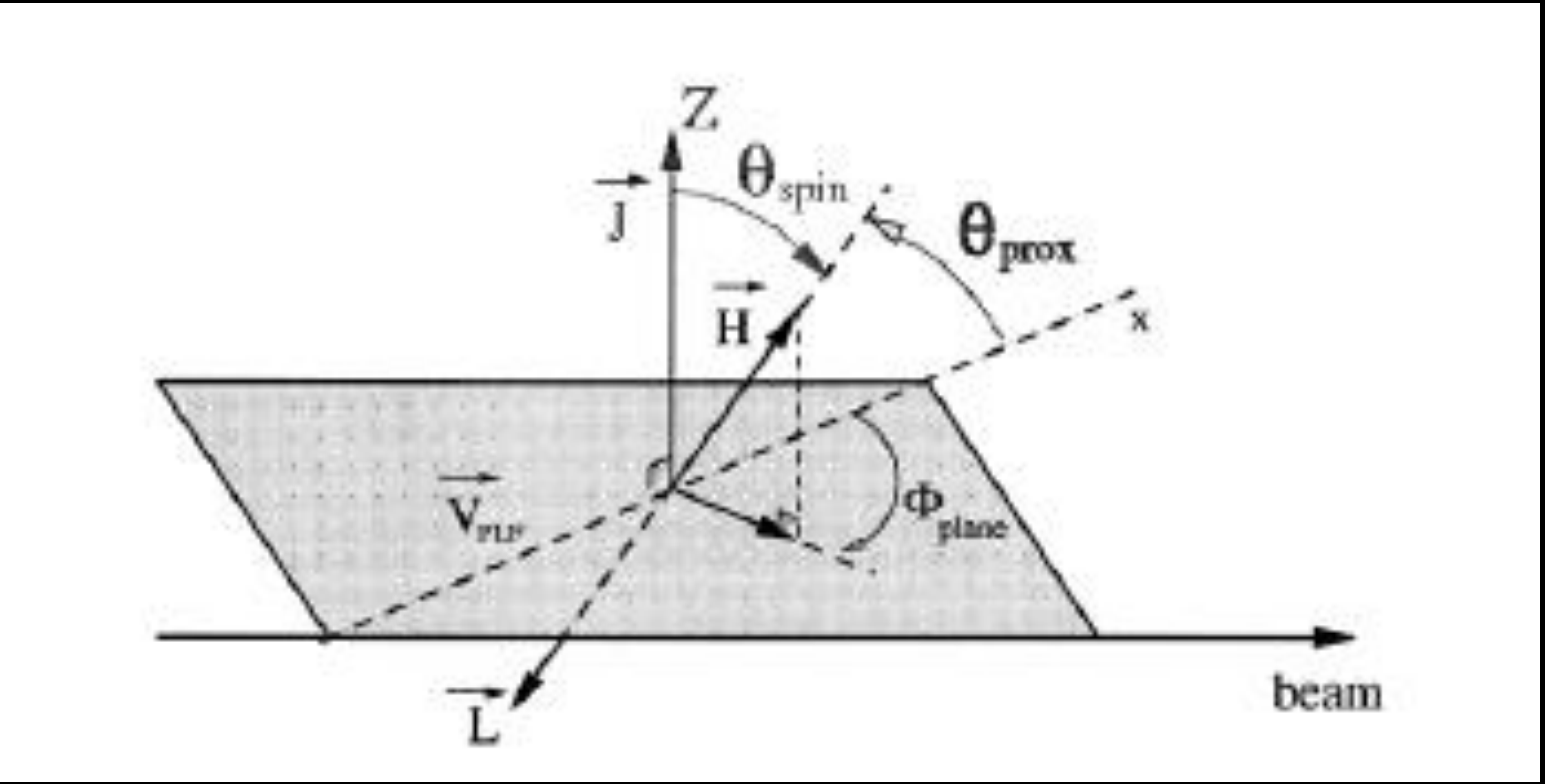


Mass versus the parallel velocity for the fragments produced in PLF Break-up

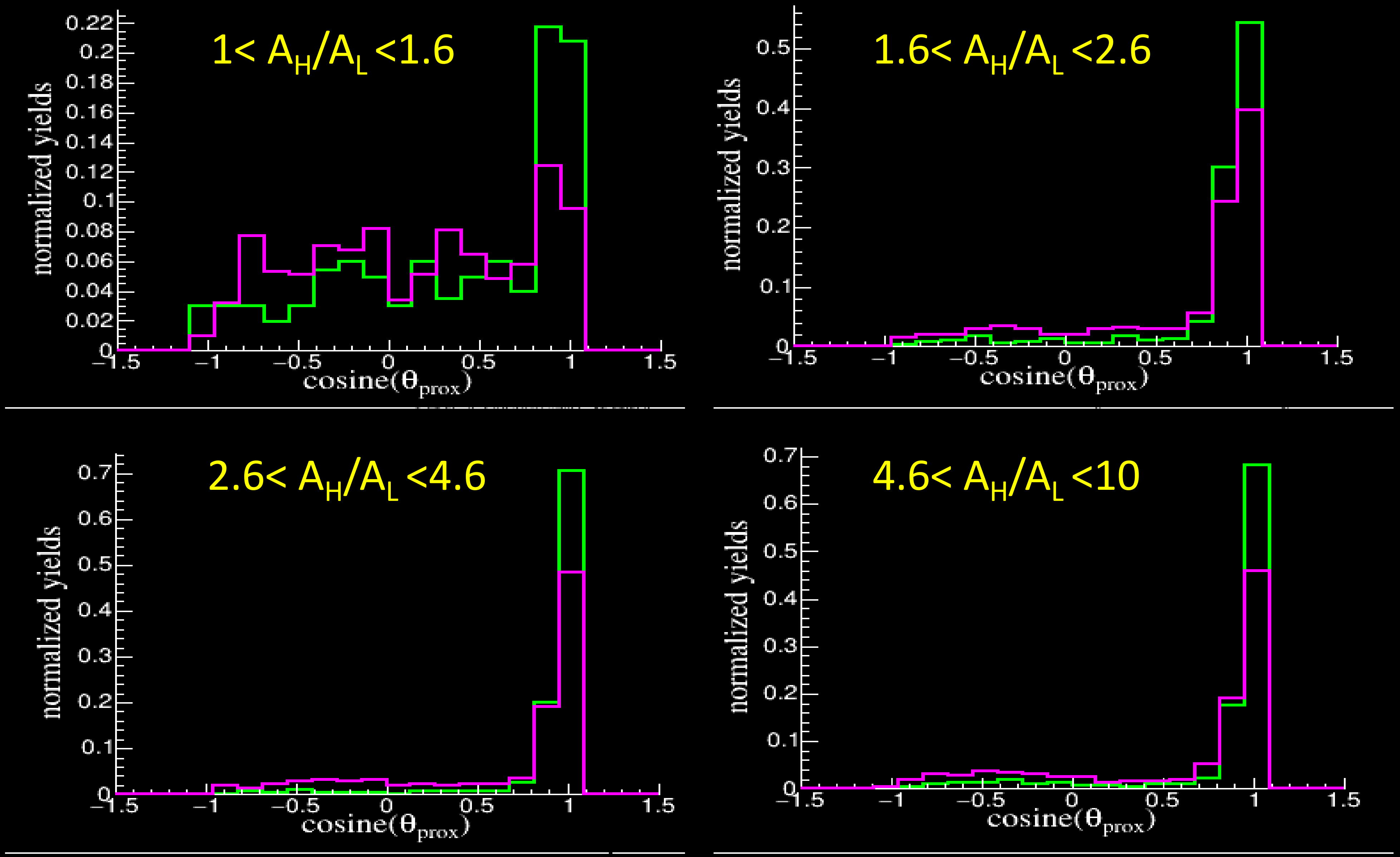


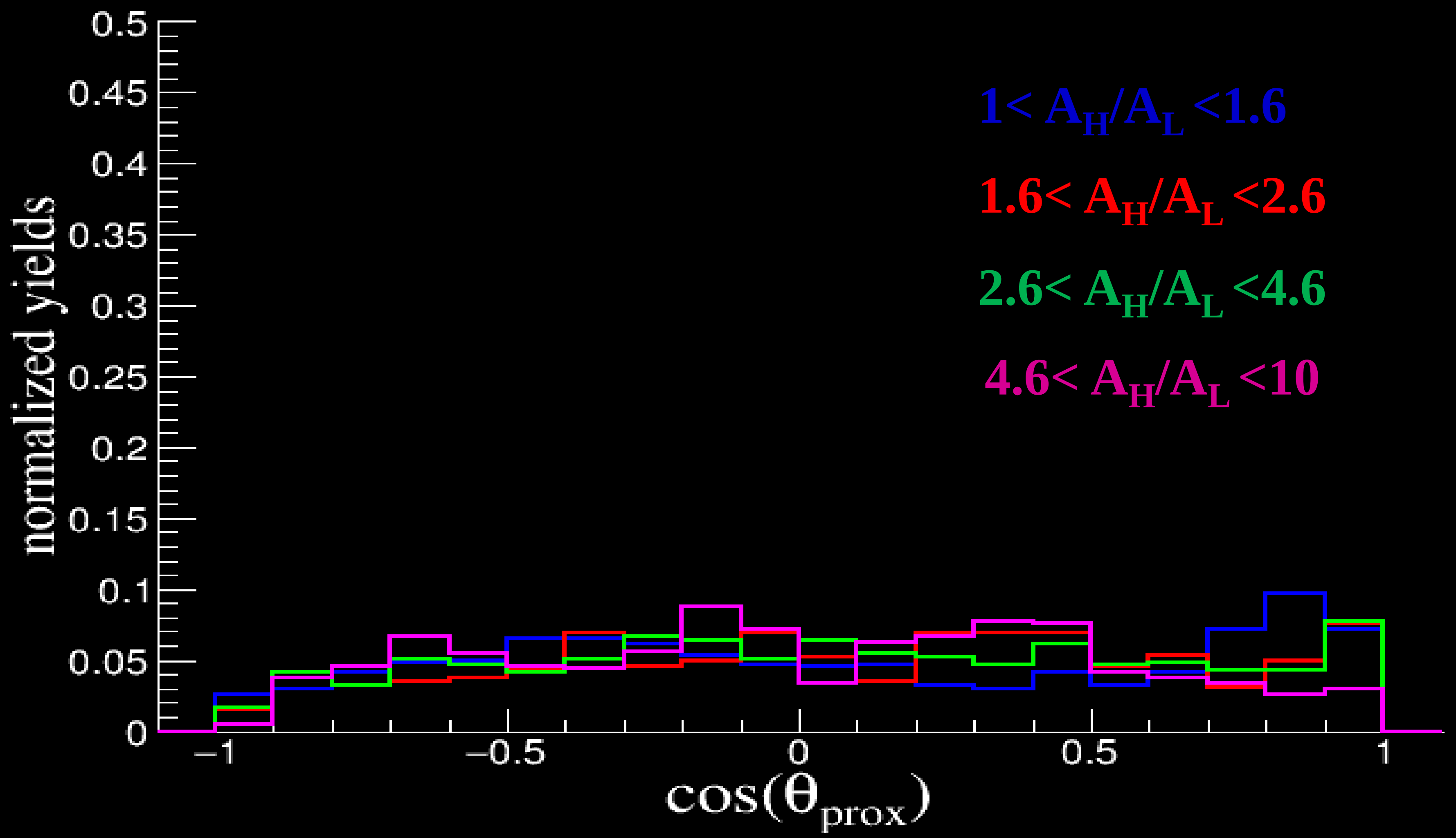


Cosine of ϑ proximity



$\cos(\vartheta_{prox})$ angular distribution for different asymmetry parameters, A_H/A_L, when the reconstructed PLF is in anticoincidence with the slow fission , for $^{78}Kr+^{40}Ca$ and $^{86}Kr+^{48}Ca$





$\mathrm{Cos}(\vartheta_{prox})$ angular distribution for the two studied systems, for different asymmetry parameter, when the reconstructed source is F1, indeed in coincidence with the slow fission fragment

Conclusions

The preliminary results of the analysis relative to the PLF break-up in the reactions $^{78}Kr+^{40}Ca$ and $^{86}Kr+^{48}Ca$ have been presented

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A preference for PLF aligned break-up, along the direction of the PLF-TLF separation axis with the light fragment emitted in the backward part, has been evidenced, suggesting dynamical-non equilibrium effects.

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The results seem to put in evidence that the dynamical effects are more pronounced for the reactions $^{86}Kr+^{48}Ca$, respect to $^{78}Kr+^{40}Ca$ one, for the different asymmetry parameters, in agreement with the results obtained at higher energy for the reactions $^{124,112}Sn + ^{64,58}Ni$ and $^{124}Xe + ^{64}Zn,^{58}Zn$

Outlook

We will do an attempt of a comparison between these damped reactions in the low energy and Fermi energy domain

A study of this process as function of dissipation classes will be done

NEWCHIM-ISODEC Collaboration

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