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Possible Uppsala contributions to PANDA at HADES

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Recent results from UU theory group

Radiative decays $B^*(J = 3/2) \to B\gamma$

We can fit c_M to data and make predictions

Decay	$c/(c_M e)$	BR [%]	$\lvert c_M \rvert$ [GeV^{-1}]
$\Delta \to N\gamma$	$2/\sqrt{3}$	0.60±0.05	2.00±0.03
$\Sigma^{*+} \to \Sigma^+\gamma$	$-2/\sqrt{3}$	0.70±0.17	1.89±0.08
$\Sigma^{*-} \to \Sigma^-\gamma$	0	< 0.024	—
$\Sigma^{*0} \to \Sigma^0\gamma$	$1/\sqrt{3}$	**0.18±0.01**	—
$\Sigma^{*0} \to \Lambda\gamma$	-1	1.25±0.13	1.89±0.05
$\Xi^{*0} \to \Xi^0\gamma$	$-2/\sqrt{3}$	**4.0±0.3**	—
$\Xi^{*-} \to \Xi^-\gamma$	0	< 4	—

$\Sigma^{*-} \to \Sigma^-\gamma$, $\Xi^{*0} \to \Xi^0\gamma$ vanishes due to U-spin symmetry

(predictions in boldface)

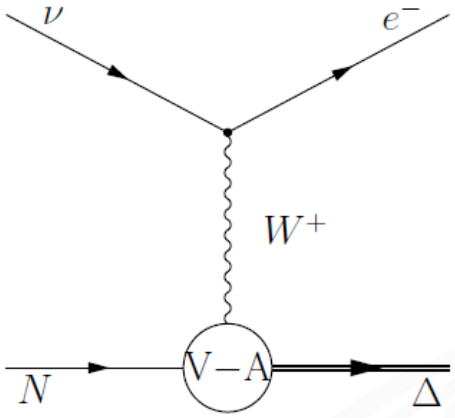
M. Holmberg, SL, arXiv:1802.05168 [hep-ph], to appear in EPJ A

Talk by Måns Holmberg, PANDA CM, June 2018

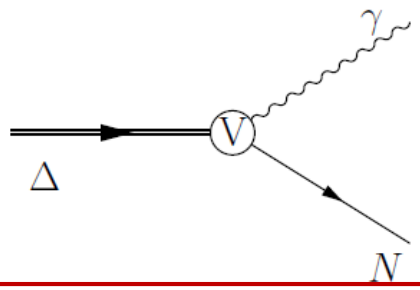
Recent results from the UU theory group

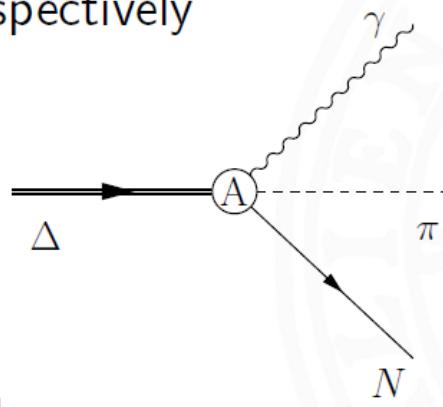
Axial-vector transition form factors

- Interesting for scattering neutrino-nucleon to electron-Delta
- Low energies: want to know deviation from LO result $\rightsquigarrow$ LEC c_E



- Vector and axial-vector transition form factors contribute also to $\Delta \to N\gamma$ and $\Delta \to N\pi\gamma$, respectively





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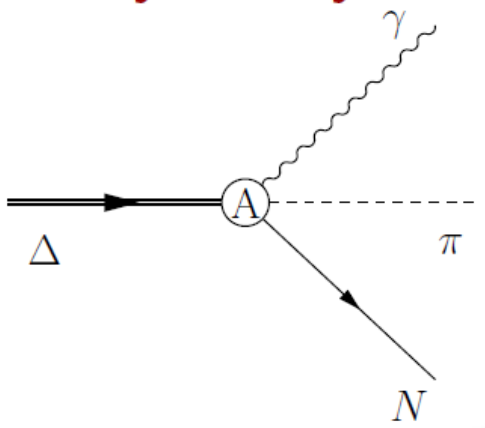
Recent results from the UU theory group

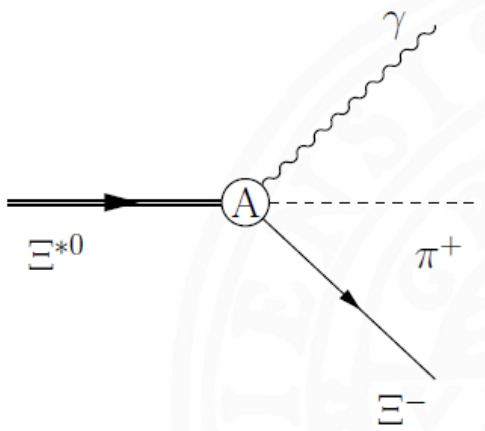
Axial-vector TFFs and three-body decays

Problems:

- Needs to be disentangled from bremsstrahlung
- Hard to measure for broad Delta



↪ Get some clue from radiate three-body decays of hyperons, e.g. cascades



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Recent results from the UU theory group

Three body decays $B^*(J = 3/2) \to B\gamma\pi$

Preliminary predictions (none of these are measured!)

Decay	BR	Decay	BR
$\Sigma^{*+} \to \Sigma^+ \pi^0 \gamma$	1.1×10^{-6}	$\Xi^{*-} \to \Xi^- \pi^0 \gamma$	7.9×10^{-6}
$\Sigma^{*+} \to \Sigma^0 \pi^+ \gamma$	3.6×10^{-5}	$\Xi^{*-} \to \Xi^0 \pi^- \gamma$	1.3×10^{-3}
$\Sigma^{*+} \to \Lambda \pi^+ \gamma$	—	$\Xi^{*0} \to \Xi^- \pi^+ \gamma$	1.1×10^{-3}
$\Sigma^{*-} \to \Sigma^- \pi^0 \gamma$	6.0×10^{-7}	$\Xi^{*0} \to \Xi^0 \pi^0 \gamma$	1.8×10^{-6}
$\Sigma^{*-} \to \Sigma^0 \pi^- \gamma$	4.3×10^{-5}	$\Delta^{++} \to p \pi^+ \gamma$	1.7×10^{-3}
$\Sigma^{*-} \to \Lambda \pi^- \gamma$	—	$\Delta^+ \to p \pi^0 \gamma$	6.6×10^{-5}
$\Sigma^{*0} \to \Sigma^+ \pi^- \gamma$	5.7×10^{-5}	$\Delta^+ \to n \pi^+ \gamma$	7.4×10^{-4}
$\Sigma^{*0} \to \Sigma^- \pi^+ \gamma$	3.2×10^{-5}	$\Delta^0 \to p \pi^- \gamma$	1.0×10^{-3}
$\Sigma^{*0} \to \Sigma^0 \pi^0 \gamma$	2.5×10^{-8}	$\Delta^0 \to n \pi^0 \gamma$	7.2×10^{-6}
$\Sigma^{*0} \to \Lambda \pi^0 \gamma$	3.5×10^{-6}	$\Delta^- \to n \pi^- \gamma$	2.3×10^{-3}

(Photon energy cut at 25 MeV)

Talk by Måns Holmberg, PANDA CM, June 2018

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The UU situation…

- Right now, no funding ☹
  - Will not be able to allocate any full-time work force within the next year.
- However, we are working on finding synergies with ongoing projects at UU:
  - Neural network on hyperon selection in BESIII
  - Track finding algorithms for PANDA
  - Vertex fitting
  - Kinematical fitting

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IT student project: ANN for hyperon selction with BESIII

Project plan

- selecting a Neural network interface
- selecting the observables and training the neural network

(Monte Carlo sample or training on background form experimental data ?)

- evaluating the method efficiency on a Monte Carlo data sample

(Or testing it on clean data sample)

- applying the method and extracting the signal of interest

Project supervised by Jacek Biernat, Uppsala

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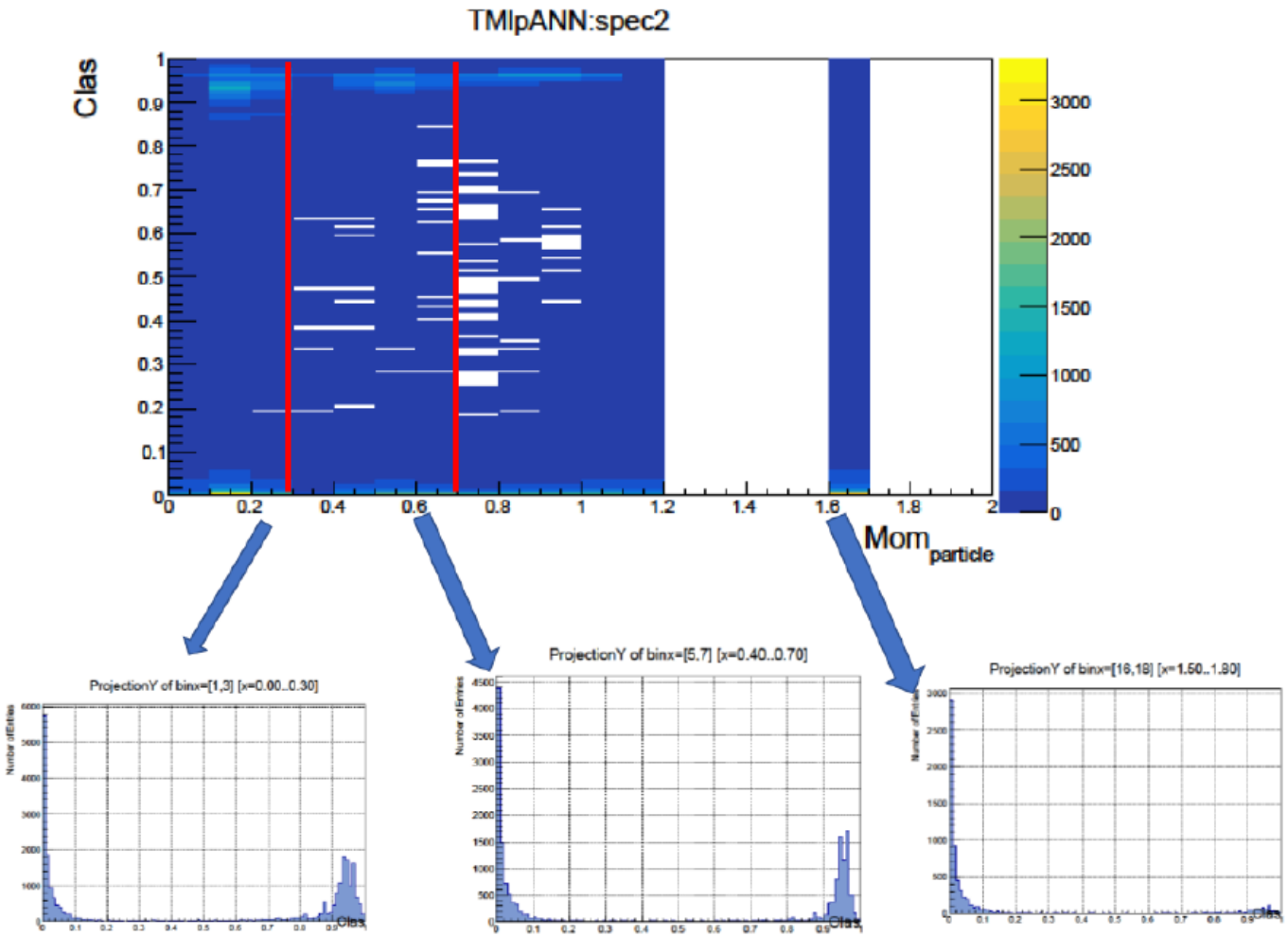
ANN for hyperon selection in PANDA: first test on FTS



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Track finding algorithms for PANDA

- Track finder based on the cellular automaton
- Machine learning algorithms

Any approach needs to be tested on real data –
PANDA@HADES the logical candidate!

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Questions

- Physics priorities in PANDA@HADES
- What is needed in terms of software / analysis method development?
- Synergies with UU activities?