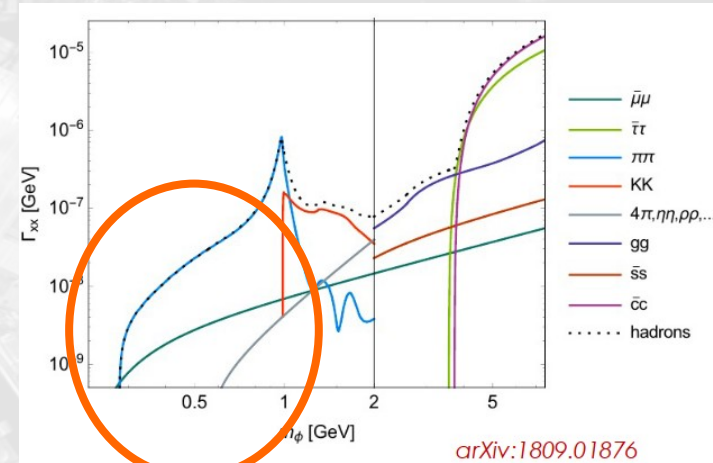


# New physics in CMS data analysis

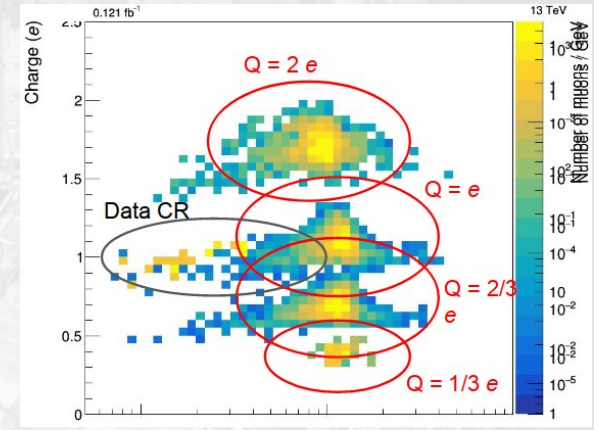
- search for new physics decay  $H \rightarrow ss$ 
  - uncovered for  $m(s) < 2\text{GeV}$  !
  - search in the decay of  $s$  to 2 kaons, pions or muons
  - study signal and background, devise selection, and assess uncertainties and sensitivity
- extension or
  - dark photon jet reconstruction with neural networks

master thesis

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- search for new particles with charge  $\neq 1e$ 
  - challenge at very low charge: how to collect the data, how to reconstruct the feeble interactions
  - option 1 [MA]: study alternative trigger
  - option 2 [MA] (technical): straight track reco with missing hits
  - [BA] study of charge and mass estimators from ionization loss and particle speed measurement

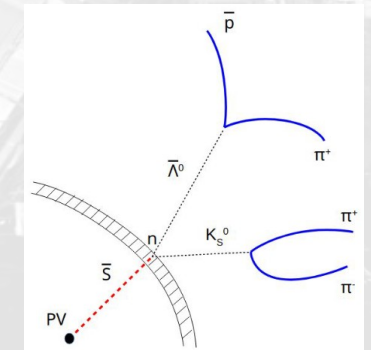


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- standard model dark matter: search for a 6-quark composite particle
  - advanced topic

master thesis



# CERN detector instrumentation

- **the CMS tracker upgrade:** understand and develop the detector of tomorrow's discoveries
  - module characterization during production
    - study the performance of modules for quality assurance
    - link results to fundamental properties of silicon detectors
  - beam test studies
    - study the behaviour of modules in a muon beam
    - reproduce [BA] or produce novel results [MA] using state-of-the-art experimental data
- **the milliQan detector:** build and characterize a simple real-life detector
  - build a working detector from decommissioned milliQan scintillators and PMTs
    - including readout and powering
  - take data and analyse
    - verify the cosmic muon rate with expected flux
    - characterize a radioactive source

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