P348
Search for Dark Photon

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H4 Beam Users Meeting

DESY (Hamburg); ETH (Zurich); IAP (Paris); Ins. for Nucl. Res. (Moscow); Joint Inst. for Nucl. Res. (Dubna); KAIST (Daejon); State Res. Centre of the Russian Federation (Protvino); Uni. Patras (Patras); UTFSM (Chile)

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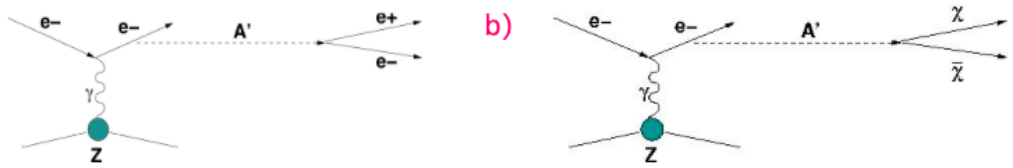
A' production and decay

Origin of Dark Matter- great puzzle for particle physics, astrophysics and cosmology. A' is the vector boson which mediates the interaction between our and Dark matter through mixing with ordinary photon (γ), $\gamma - A'$ mixing strength, ϵ and A' mass are free parameters to be measured.

a) b)



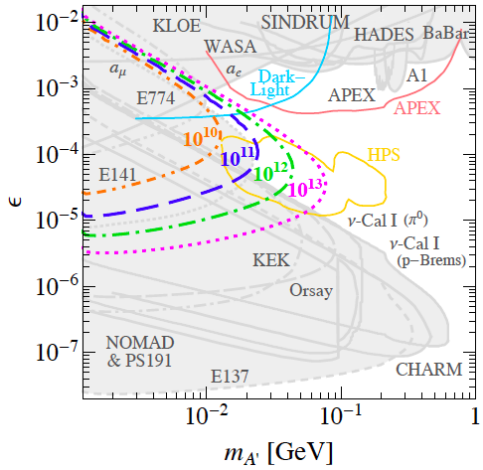
$eZ \rightarrow eZA'$ cross-section $\sigma_{A'} \sim \epsilon^2 (\frac{m_e}{M_{A'}})^2 \sigma_\gamma$,

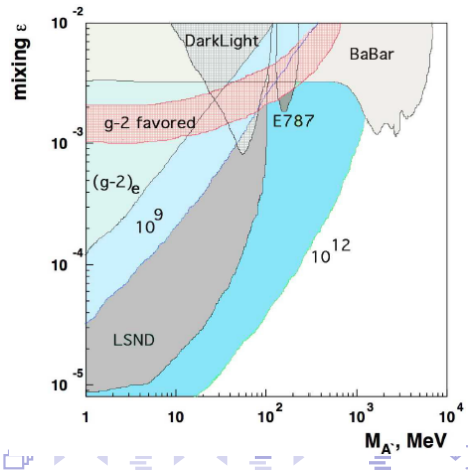
Bjorken'09, Andreas'12.

For long lived A', sensitivity $\sim \epsilon^4$, as is typical for beam dump experiments.

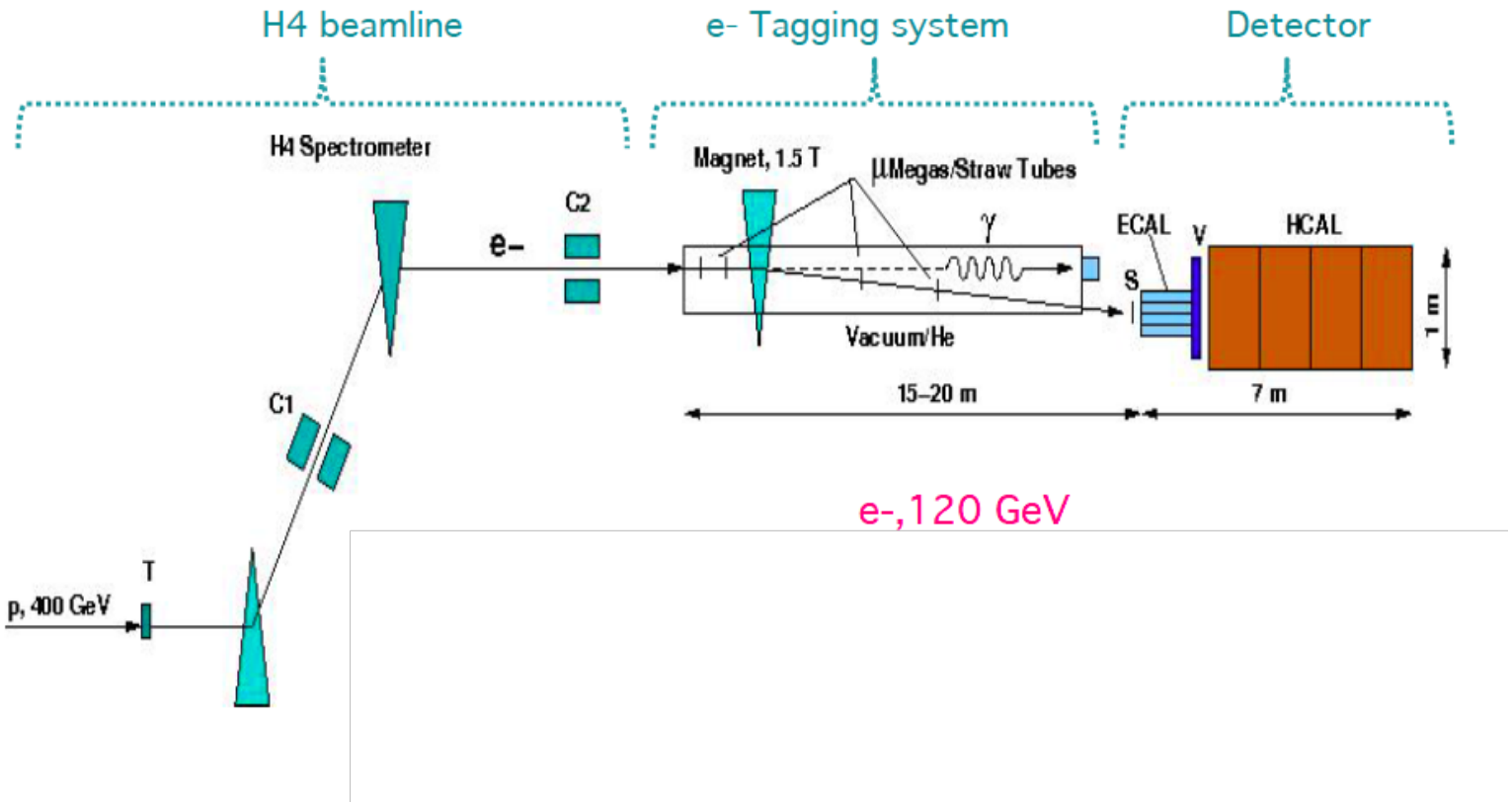
But for $10^{-5} < \epsilon < 10^{-3}$ and $M_{A'} \lesssim 100$MeV:

$\rightarrow$ very short lived A':
$10^{-14} < \tau_{A'} < 10^{-10}$ sec.
$\rightarrow$ very rare events:
$\sigma_{A'}/\sigma_\gamma < 10^{-13} - 10^{-9}$.
$\rightarrow$ A' energy boost to displace decay vertex: $\epsilon \sim 10^{-4}$, $M_{A'} \sim 100$ MeV, $E_{A'} \sim 100$GeV, $L_{decay} \sim 1$m.





Setup to search for $A' \rightarrow$ invisible decay in 2015



Signature: $= \mathrm{S} \times \mathrm{ECAL} \times \overline{V \times HCAL}$

single e-m shower in ECAL

$E_{ECAL} < E_0$

no activity in Veto and HCAL.

The main goals of the run 2015

→ Detector tests and calibration with e^-, pion, kaon and proton beams.

  → ECAL- 6×6 modules

  → HCAL-3×3 cells × 4 modules, 1 module = 3.5 ton.

→ Accumulation upto 10^9 electrons, pions, kaons, protons to test detector performance, in particular HCAL hermeticity.

→ Energy 10-50 GeV and 100 GeV.

→ Accumulate $> 10^9$ electrons at 120 GeV.

Delivery of HCAL at CERN

Support/Supplies Required

Preparation area/Clean room: →Already allocated. Plan to start assembly end of April.

Electronic Room: Space required to set up the readout electronics rack for the Micromegas Spectrometer close to the magnet and also some space for the electronics of the downstream detectors. Electronic channel tests to estimate noise need to be done before the test beam period in the experimental area.

Exceptional transport requests: crane for HCAL modules.

Spectrometer Magnet: MBPL magnet required - 2m, core diameter $\sim$ 170 mm, strength $\sim$ 1.5 T.

high electric power, cryogenics, experimental gases: no request for Cryogenics, Ar-Isobutane mixture (95-5%) for Micromegas detectors.

Mechanical Support: 15m vacuum beam pipes for the Micromegas spectrometer and synchrotron counters.

x/y tables: 4 ton for calibration of HCAL modules.

Requested Beam Parameters

Calibration:

- → e^-: 10, 30, 50, 120 GeV, a few $10^4 e^-$/spill.
- → π,p: 50, 100 GeV.
- → μ: 100 GeV.

Data:

π+K:

- → 40-50 GeV.
- → $10^5 - 10^6$/spill, accumulation up to 10^9 π or more.
- → a few cm^2 spot size.
- → low energy tail as small as possible.
- → K mesons selected with a Cerenkov counter.

protons:

- → 100-200 GeV,
- → $10^5 - 10^6$/spill, accumulated up to 10^9.
- → a few cm^2 spot size.
- → low energy tail as small as possible.

electrons: 120 GeV or lower energy:

- → intensity as maximum as possible per spill. $\sim 10^5 - 10^6$ expected.
- → accumulation $\sim 10^9 e^-$ or more.
- → no low energy tail- very important.
- → compact beam, a few cm^2 spot size at ECAL/ parallel beam.

Thank You !!!