Mad Dump

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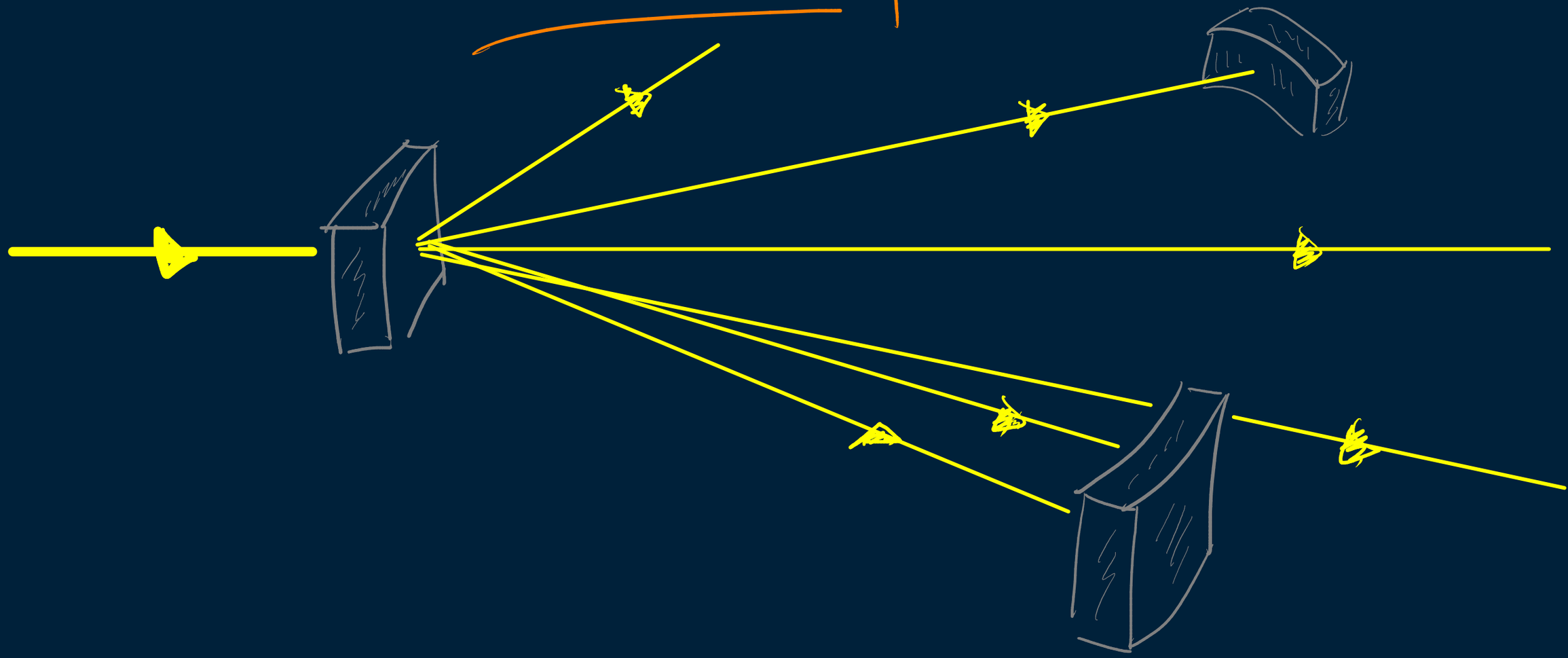
Outline

1) Motivations
2) Beam-dump experiments
3) The example
4) Algorithm
5) Results & Analysis

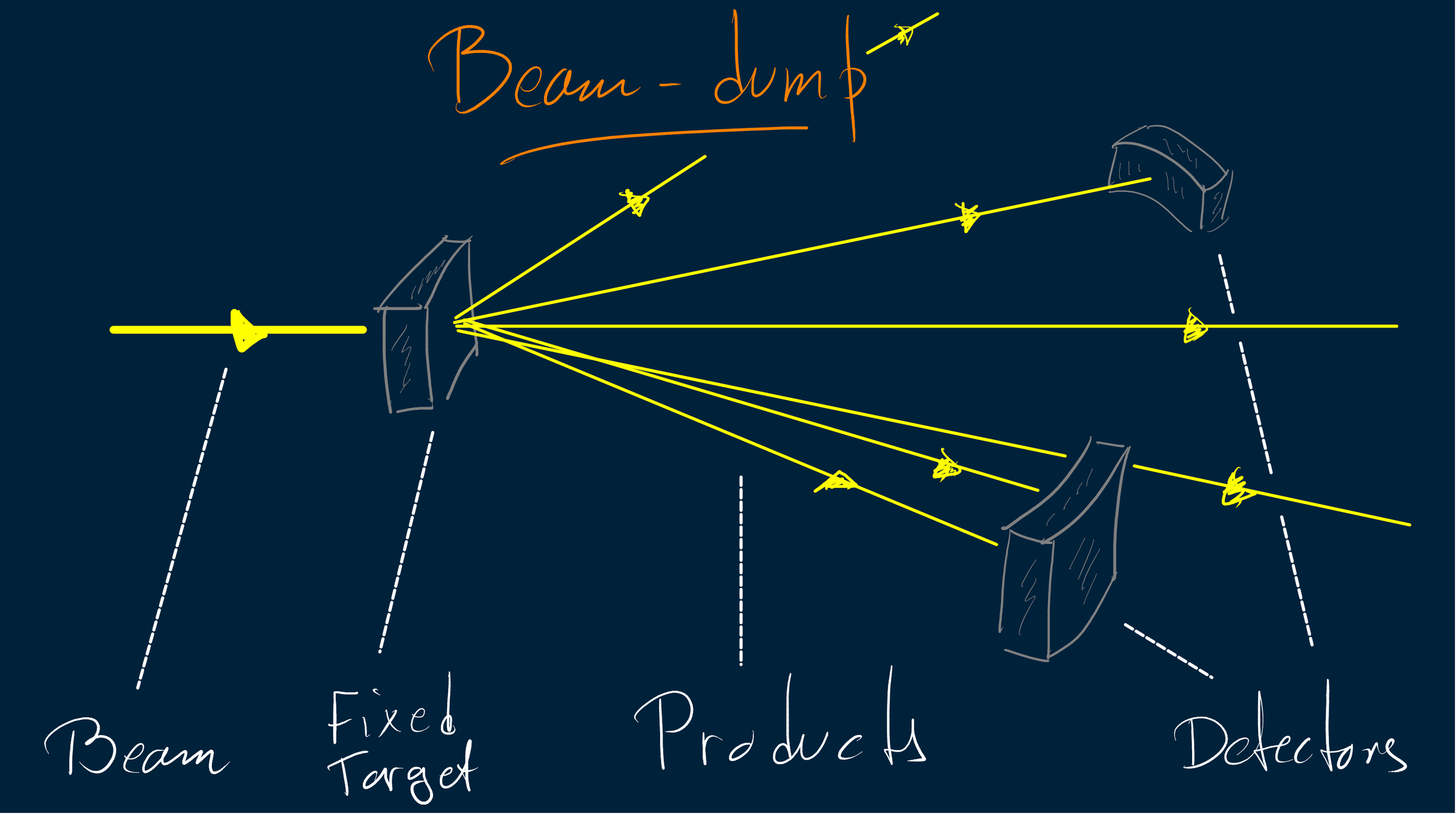
Motivations

- Released in '18 ⇒ still unexplored
- Focused on beam-dump experiments

Beam - dump



Beam - dump



Beam - dump

2) Complicated targets (Al, Na, ...)

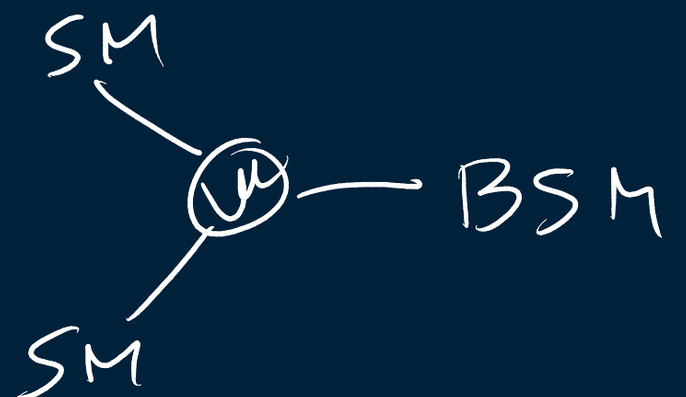
2) Detector geometry (cylinder, square, ...)

2) Probe many kinds of physics

Beam-dump

Production

→ Prompt:

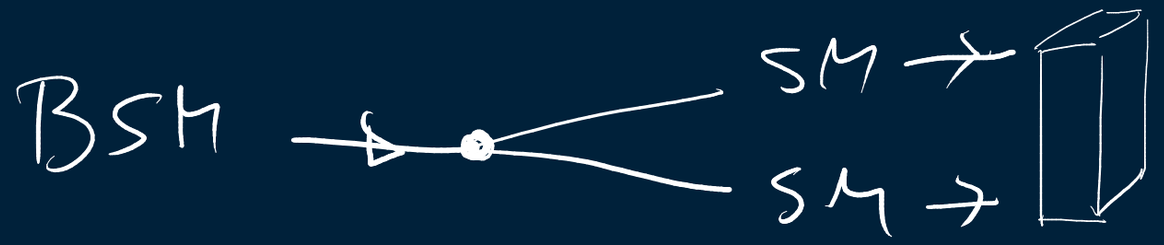


→ Meson decay

Beam-dump

Detection

- Detector interaction
  - BSM → BSM ⚡ p^+, e^-, n
- On-flight decay



Mad Dump

2) Can simulate both types of production and detection

2) Outputs the number of events (or almost)

The Model

- Secluded $U(1)$ dark photon

$$\mathcal{L} = \frac{1}{2} m_{Z_D}^2 Z_D^2 + e\epsilon J_{EM}^{\mu} Z_D^{\mu}$$

- Z_D^{μ} = dark photon field;
- ϵ = kinetic mixing parameter;

The Model

- Light $\Sigma_D \Rightarrow m_{\Sigma_D} \lesssim 1\ GeV$

$\Rightarrow$ Visible decays $\Sigma_D \to$

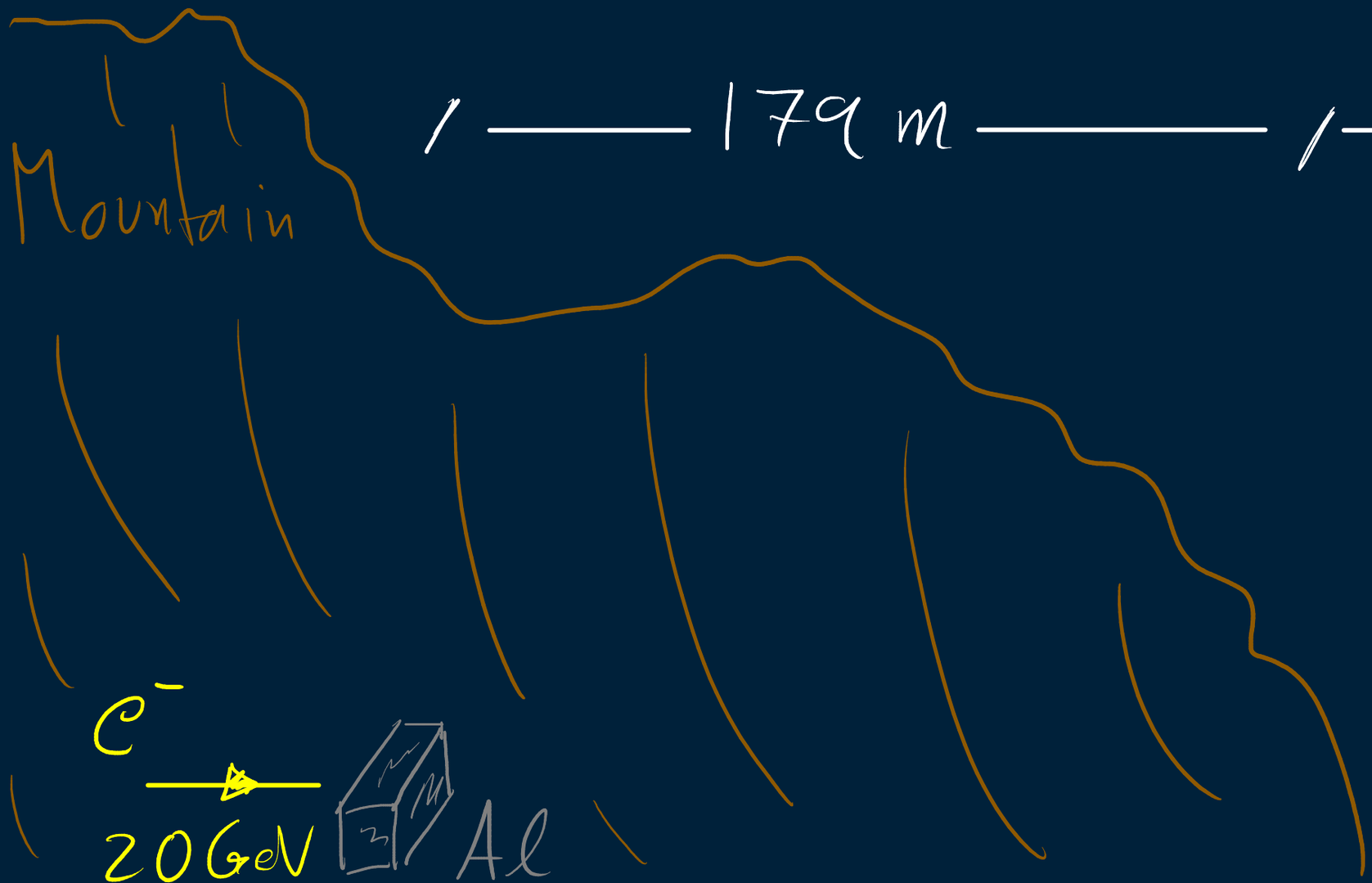
$\to l^- l^+$

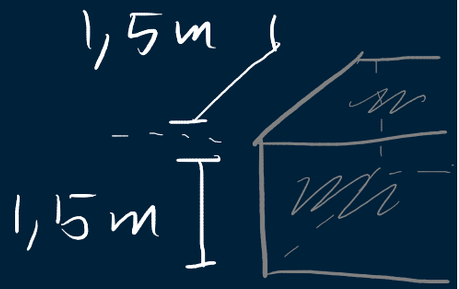
$\to \pi^+ \pi^-$

$\vdots$

$\Rightarrow \Gamma_{tot} \propto \epsilon^2$.

Beam - dump - E137





Beam-dump - E137

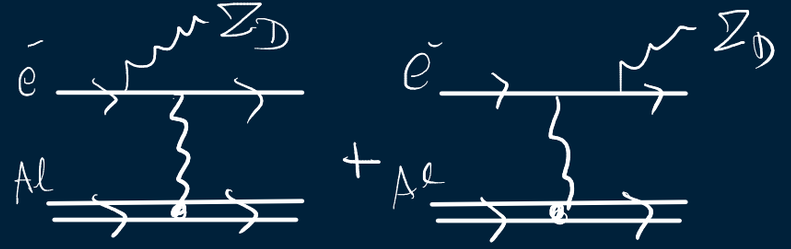
- Al target is thin (approx.)
- Detector is on-axis
- Mountain = Shielding

Number of events

$$N \simeq \mathcal{L} \times \sigma_{prod} \times \text{Decay prob}$$

Number of events

$$N \simeq \mathcal{L} \times \sigma_{prod} \times Decay\ prob$$

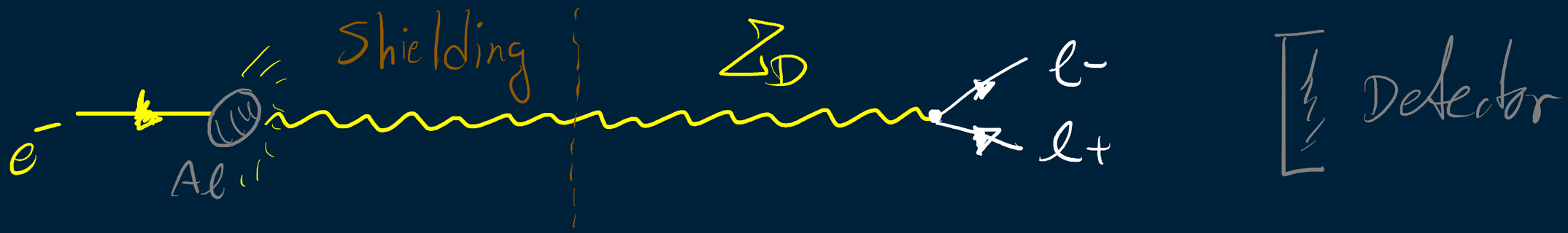


(Bremsstrahlung)

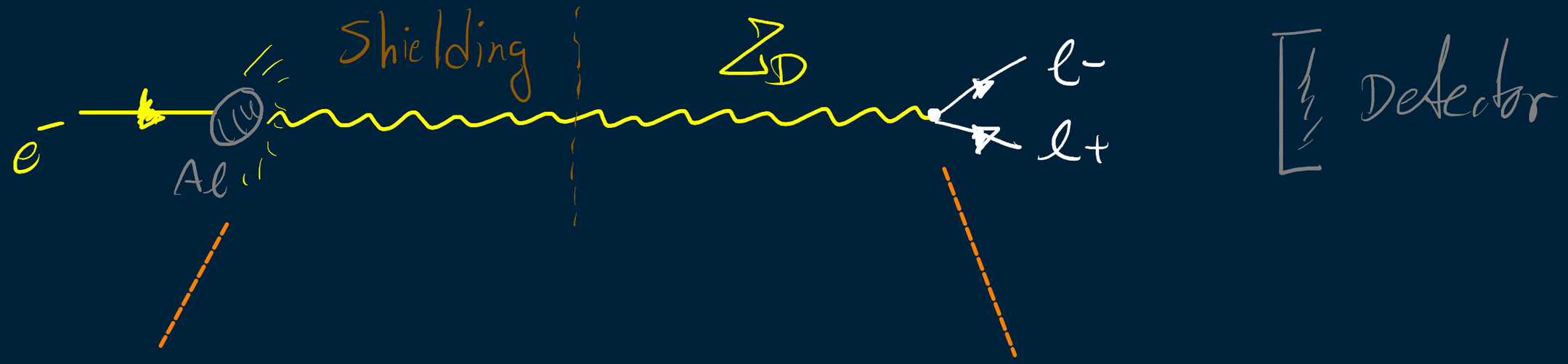
$$e^{-179\,m/\ell}\left[1 - e^{-20\,4m/\ell}\right] \times Br(visible)$$

$$\ell = c\,\gamma/\Gamma_{tot}$$

Algorithm



Algorithm



Collision

↓

MG

Decay

↓

MG

Algorithm

Collision → MG

Decay prob. → MD

Decay → MG

Event cuts & counting → MD

Let's see how
it works in practice
and live!

Conclusions

- Interesting tool
- Can save a lot of analysis time

Conclusions

2. The algorithm is still poor
2. Many bugs/errors to be fixed
2. Small community

2D A guide with all details :

MadDump : A guide written by a noob

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Thank you
for the
attention!