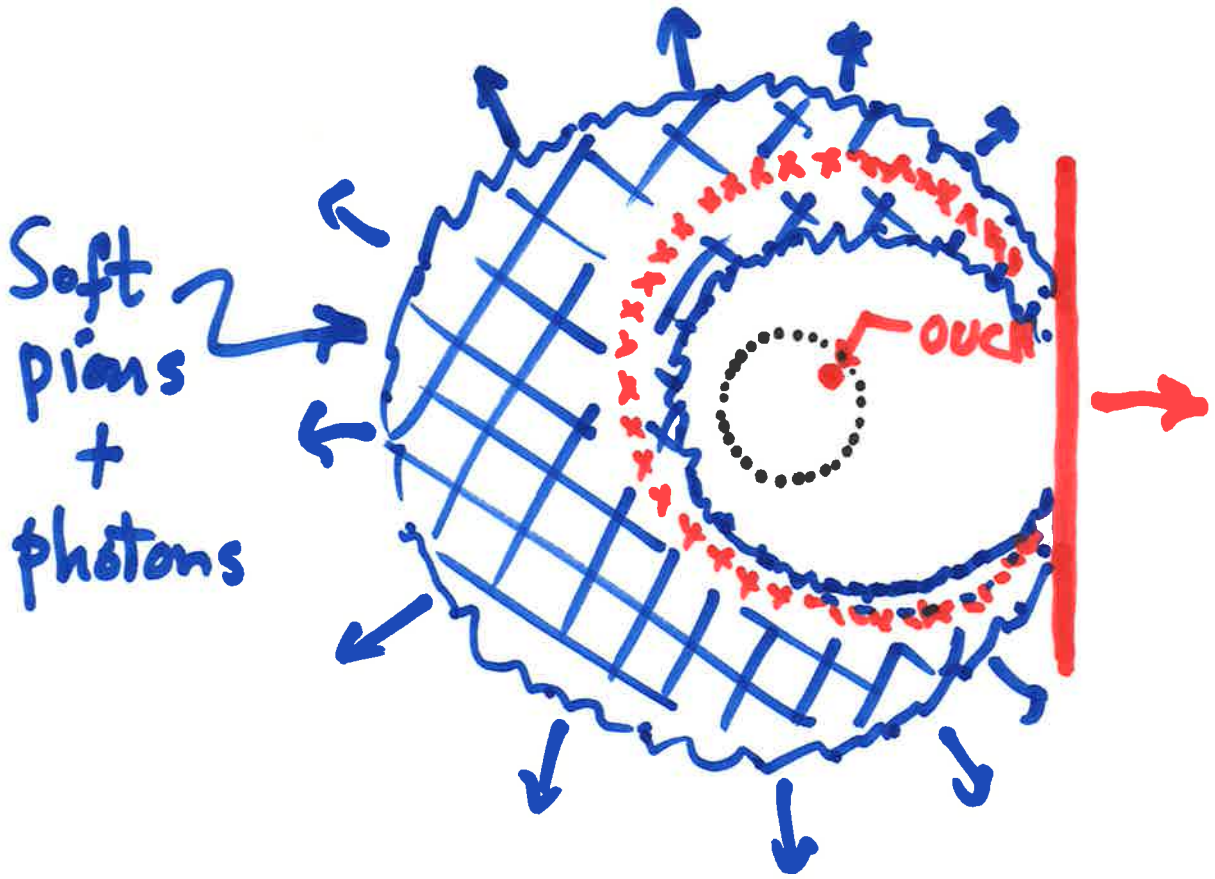
QCD at the LHC

bj
April 2015

- HEAVY IONS (Pb)
- FIXED TARGET (C, N, Al, Fe)

THE DECAY OF "NOTHING"



Huygen's principle tells the story

- Pulse thickness is ~ nuclear diameter
- The pulse is noisy
- How much energy is emitted?
- What is the multiplicity of emitted quanta?

EM Radiation:

$$\text{Energy} = \int d^3r \left(\frac{E^2}{2}\right) \sim \begin{cases} \frac{Z^2\alpha}{R_{\text{Nucleus}}} & \text{(coherent)} \\ \frac{Z\alpha}{R_{\text{Quark}}} & \text{(incoherent)} \end{cases}$$

$$\text{Momentum} \sim \begin{cases} \frac{1}{R_{\text{Nucleus}}} & \text{coherent} \\ \frac{1}{R_{\text{Quark}}} & \text{incoherent} \end{cases}$$

Pion Radiation in Chiral Limit ($m_\pi = 0$)

$$\text{Energy} \overset{?}{\sim} \begin{cases} \Delta\left(F_\pi^4 \cdot \frac{4}{3}\pi R_{Nuc}^3\right) \sim (\Delta F_\pi)\, A & \text{(coherent)} \\ \sim m_q A & \text{incoherent ("ouches")} \end{cases}$$

$\Delta F_\pi \equiv$ change in vev due to presence of nuclear matter ("bag model")

Real life:

How does $m_\pi \neq 0$ affect the answer?

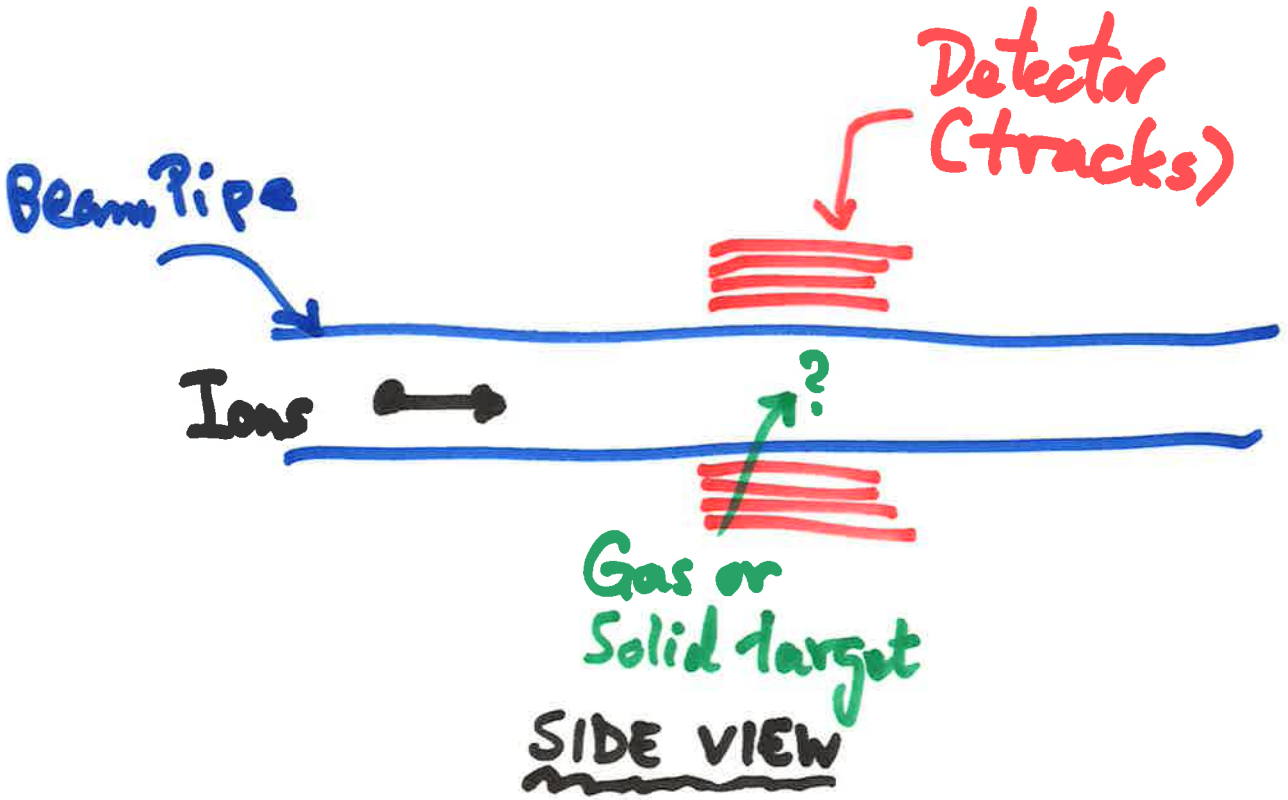
"Coherent" piece is suppressed?

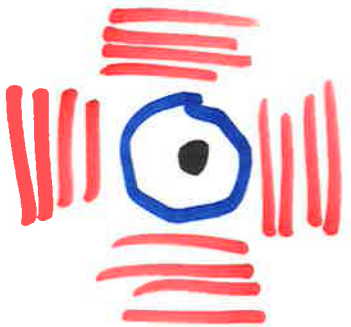
"Ouch" piece is robust?

Best answer:

Do the experiment & find out.

The experiment:





- For every bunch crossing ($\Delta t = 200$ nsec), count tracks.
- Location: Beam abort channel? Halo of circulating beam?

VACUUM ENGINEERING

WHAT DOES ONE LEARN ??

- Nothing of importance ?
- Something about chiral QCD vacuum
- Link with cosmic-ray 200 events ?

TOOLS :

Multiplicity dist
Momentum spectra

DCC ??
HBT ??

????