



A Fixed Target Experiment at the LHC: a precision version of RHIC ?

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Challenges for precision physics at the LHC
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Brainstorming with F. Fleuret (LLR), S.J. Brodsky (SLAC), A.L. Linden Levy (LLNL), ...

Part I

A fixed-target experiment using the LHC beam(s): generalities

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Liq. H ₂	0.07	1	21	210
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- **NA51** used 1.2m-long liquid H_2 & D_2 targets, this would give here

$$\mathcal{L}_{\text{H}_2/\text{D}_2} \simeq 20 \text{ fb}^{-1} \text{y}^{-1}$$

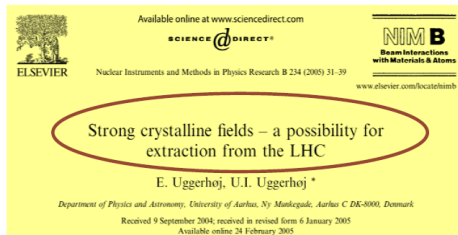
Beam extraction: one possibility

• Beam extraction @ LHC

... there are extremely promising possibilities to extract 7 TeV protons from the circulating beam by means of a bent crystal.

... The idea is to put a bent, single crystal of either Si or Ge (W would perform slightly better but needs substantial improvements in crystal quality) at a distance of $\simeq 7\sigma$ to the beam where it can intercept and deflect part of the beam halo by an angle similar to the one the foreseen dump kicking system will apply to the circulating beam.

... ions with the same momentum per charge as protons are deflected in a crystal with similar efficiencies



If the crystal is positioned at the kicking section, the whole dump system can be used for slow extraction of parts of the beam halo, the particles that are anyway lost subsequently at collimators.

Part II

Two illustrative aspects:
AFTER as a quarkonium and dilepton (DY) factory

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- Yet, the physics case is still there !

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(with branching and per unit of rapidity)		
Liq. H ² (1m)	0.6 10 ⁹	10 ⁶
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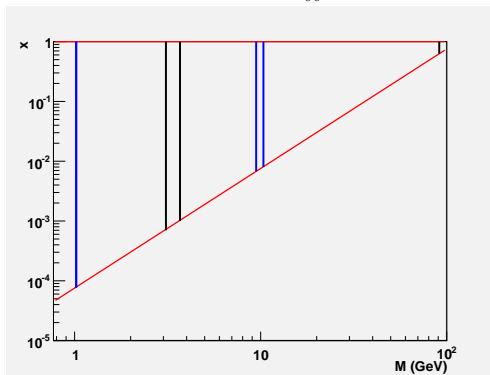
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- **AIM/HOPE**: Extract $g(x, Q^2)$ with Q^2 as low as 10 GeV^2 from $x = 10^{-3}$ up to \simeq one

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→ Region in x probed by dilepton production as function of $M_{\ell\ell}$



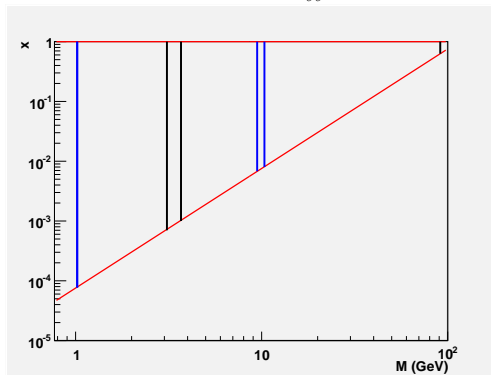
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⇒ Region in x probed by dilepton production as function of $M_{\ell\ell}$

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→ Above $b\bar{b}$: $x \in [9 \times 10^{-3}, 1]$



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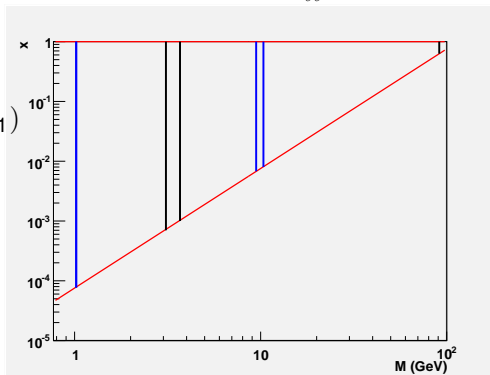
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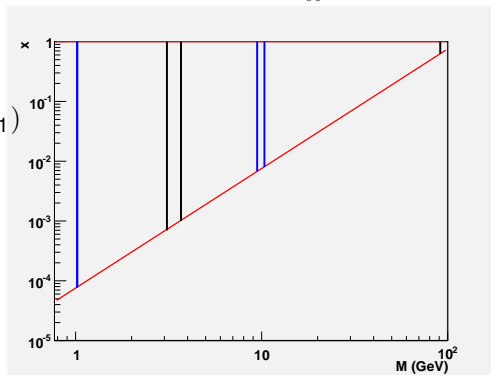
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→ sea-quark asymmetries
via p and d studies

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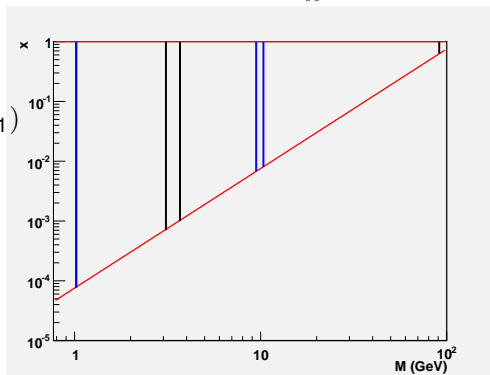
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⇒ To do: to look at the rates to see how competitive this will be

Part III

One funnier example:
AFTER as photon-proton collider

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One exotic illustration of the potentialities:

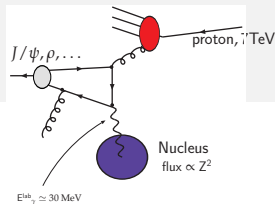
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Inelastic photoproduction of J/ψ via UPC*

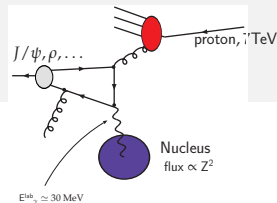


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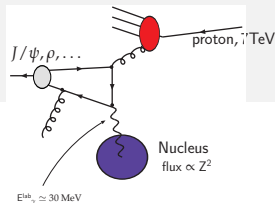
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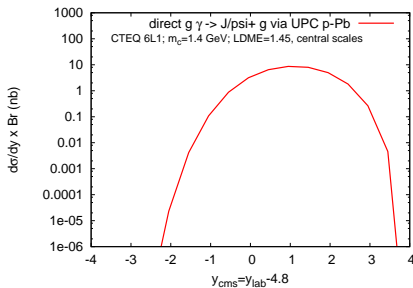
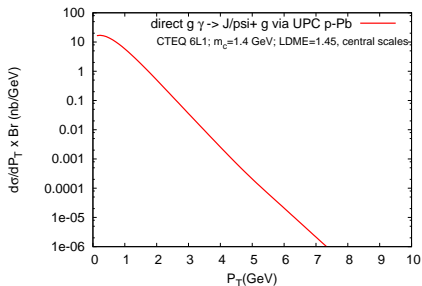
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Disclaimer: these numbers suppose a dedicated trigger and are preliminary

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