The infrastructure for figures in INSPIRE

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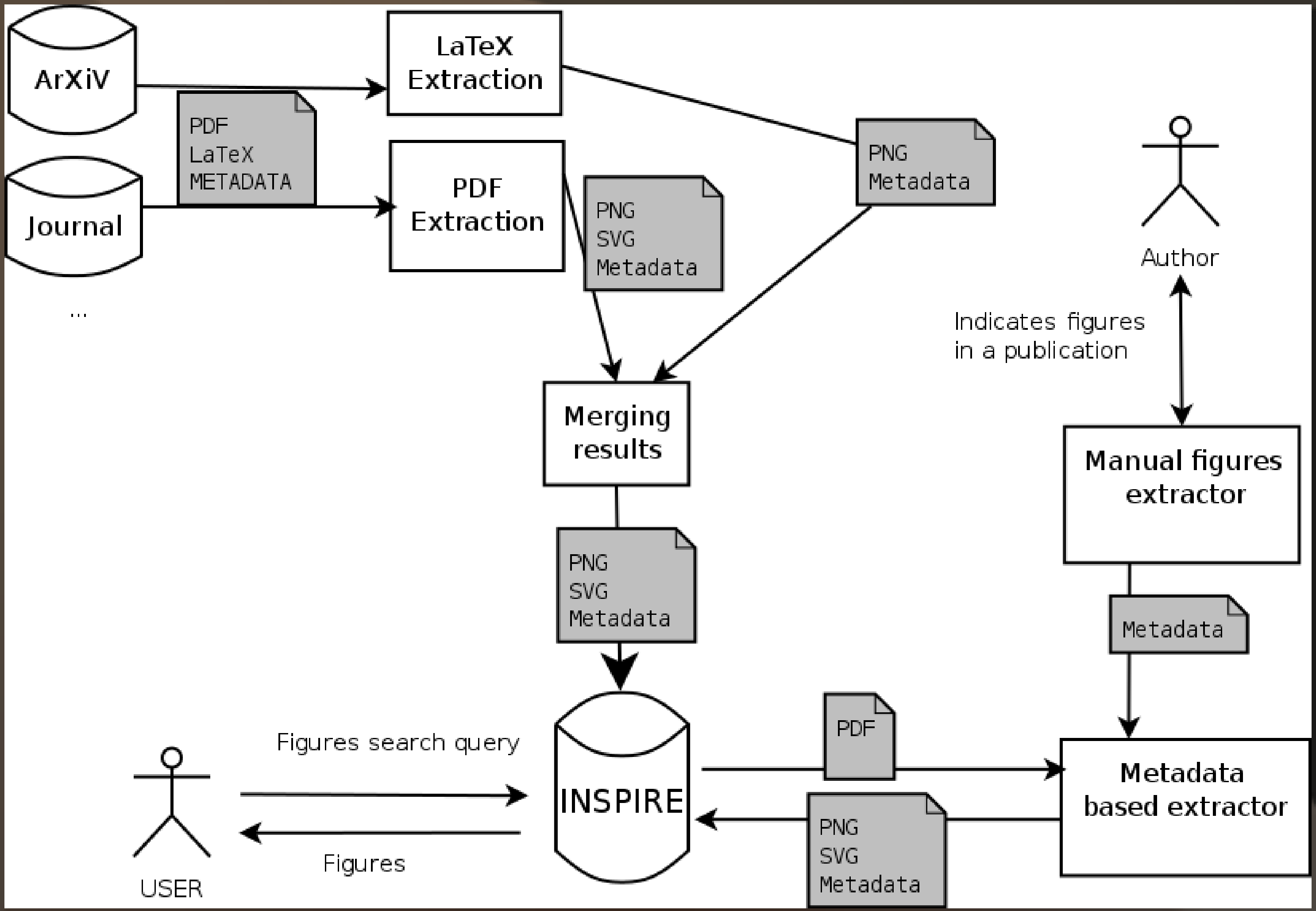
Usage of graphics in scholarly communication

- Describe experiments
- Summarise large amounts of data
- Illustrate relations between results
- Present ideas in a schematic manner

Usage of Plots in Inspire



Extracting data from PDF

PDF:

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  - Fonts
  - External objects
- Meta-description

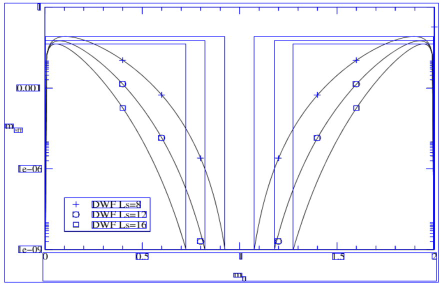

FIG. 1. Effective quark mass induced by domain-walls for the free field configuration. L_s is the number of lattice sites in the fifth direction.

In the presence of a realistic gauge potential, the effective quark mass result from the finite wall separation may depend on how it is defined. Different definitions shall yield results consistent up to a factor of order unity. One approach is to exploit the explicit quark mass dependence in chiral Ward identities such as the Gell-Mann-Oakes-Renner (GMOR) relation as done in Ref. [7]. Here we explore the effective mass in an alternative way. In continuum field theory, the Atiyah-Singer theorem [8] states that the Dirac operator has a zero eigenvalue in the presence of an external background with topological charge $|Q| = 1$. The explicit form of the solution was found by 't Hooft in 1976 [9]. On the lattice, however, the notion of topological charge is ill defined: any gauge configuration can be continuously deformed into a null gauge field. Moreover, the discretization of an instanton field can introduce finite lattice-spacing effects lifting any exact zero eigenvalue. Therefore, a test of the Atiyah-Singer theorem on lattice is usually complicated with various lattice artifacts.

There exists, however, a definition of lattice topology and fermion zero mode which largely avoids this complication. In the overlap formalism, the Dirac operator is constructed from the overlap of two many-fermion ground states [3]. According to their recipe, one starts from a four-dimensional Wilson-Dirac operator with a negative Wilson mass m_0 and calculates its eigenvalues. For m_0 small and positive, the number of positive eigenvalues is equal to that of negative ones. When m_0 increases, a level might cross from positive to negative or vice versa. When this happens, the gauge field is regarded to have a net topological charge $|Q| = 1$. Then the overlap determinant is exactly zero by construction. This definition of lattice topology and zero mode do depend on, for instance, the Wilson parameters r and m_0. However, the zero eigenvalue is exact, independent of the lattice spacing a and volume V.

Intermediate steps of the algorithm

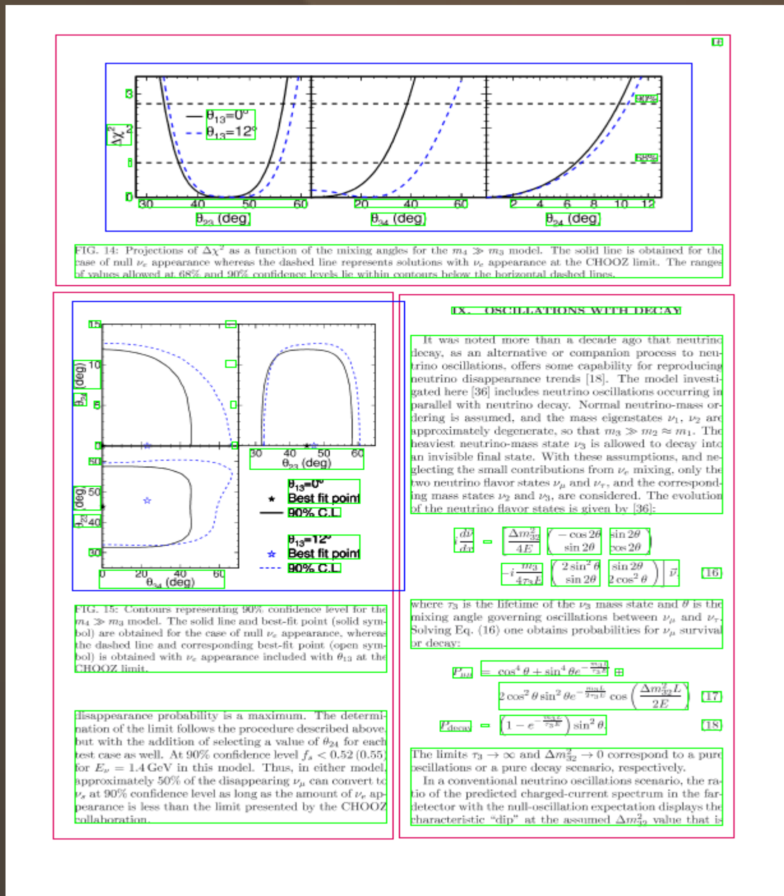
FIG. 14: Projections of $\Delta\chi^2$ as a function of the mixing angles for the $m_4 \gg m_3$ model. The solid line is obtained for the case of null ν_e appearance whereas the dashed line represents solutions with ν_e appearance at the CHOOZ limit. The ranges of values allowed at 68% and 90% confidence levels lie within contours below the horizontal dashed lines.

FIG. 15: Contours representing 90% confidence level for the $m_4 \gg m_3$ model. The solid line and best-fit point (solid symbol) are obtained for the case of null ν_e appearance, whereas the dashed line and corresponding best-fit point (open symbol) is obtained with ν_e appearance included with θ_{13} at the CHOOZ limit.

disappearance probability is a maximum. The determination of the limit follows the procedure described above, but with the addition of selecting a value of θ_{24} for each test case as well. At 90% confidence level $f_s < 0.52$ (0.55) for $E_\nu = 1.4$ GeV in this model. Thus, in either model, approximately 50% of the disappearing ν_μ can convert to ν_s at 90% confidence level as long as the amount of ν_e appearance is less than the limit presented by the CHOOZ collaboration.

IX. OSCILLATIONS WITH DECAY

It was noted more than a decade ago that neutrino decay, as an alternative or companion process to neutrino oscillations, offers some capability for reproducing neutrino disappearance trends [18]. The model investigated here [36] includes neutrino oscillations occurring in parallel with neutrino decay. Normal neutrino-mass ordering is assumed, and the mass eigenstates ν_1, ν_2 are approximately degenerate, so that $m_3 \gg m_2 \approx m_1$. The heaviest neutrino-mass state ν_3 is allowed to decay into an invisible final state. With these assumptions, and neglecting the small contributions from ν_e mixing, only the two neutrino flavor states ν_μ and ν_τ, and the corresponding mass states ν_2 and ν_3, are considered. The evolution of the neutrino flavor states is given by [36]:

$$\frac{d\vec{\nu}}{dx} = \frac{\Delta m^2_{32}}{4E}\begin{pmatrix} -\cos 2\theta & \sin 2\theta \\ \sin 2\theta & \cos 2\theta \end{pmatrix} - i\frac{m_3}{4\tau_3 E}\begin{pmatrix} 2\sin^2\theta & \sin 2\theta \\ \sin 2\theta & 2\cos^2\theta \end{pmatrix}\vec{\nu} \quad (16)$$

where τ_3 is the lifetime of the ν_3 mass state and θ is the mixing angle governing oscillations between ν_μ and ν_τ. Solving Eq. (16) one obtains probabilities for ν_μ survival or decay:

$$P_{\mu\mu} = \cos^4\theta + \sin^4\theta e^{-\frac{m_3 L}{\tau_3 E}} + 2\cos^2\theta\sin^2\theta e^{-\frac{m_3 L}{2\tau_3 E}}\cos\left(\frac{\Delta m^2_{32} L}{2E}\right) \quad (17)$$

$$P_{decay} = \left(1 - e^{-\frac{m_3 L}{\tau_3 E}}\right)\sin^2\theta \quad (18)$$

The limits $\tau_3 \to \infty$ and $\Delta m^2_{32} \to 0$ correspond to a pure oscillations or a pure decay scenario, respectively.

In a conventional neutrino oscillations scenario, the ratio of the predicted charged-current spectrum in the far-detector with the null-oscillation expectation displays the characteristic "dip" at the assumed Δm^2_{32} value that is

- Regions of graphics (blue)
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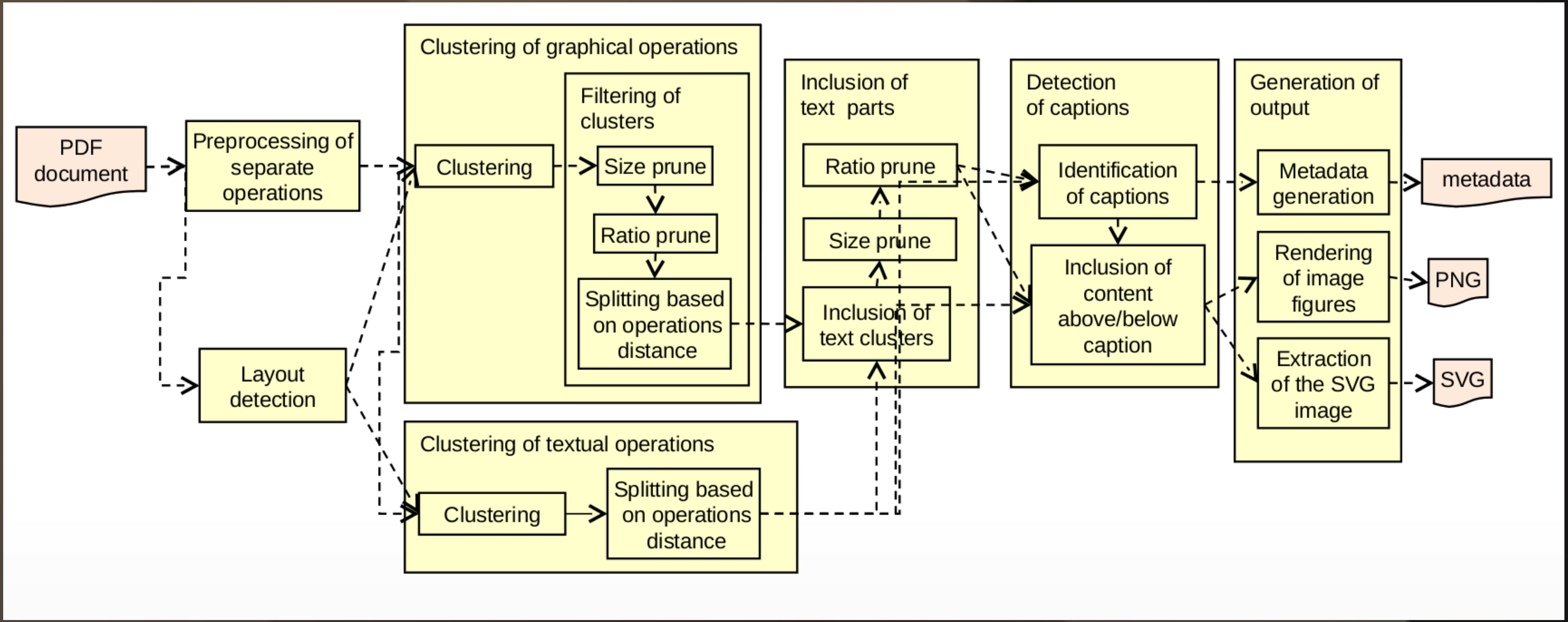
- Regions of text (green)
  - Clustered text operations
- Elements of page layout (red)

Extraction of figures from PDF



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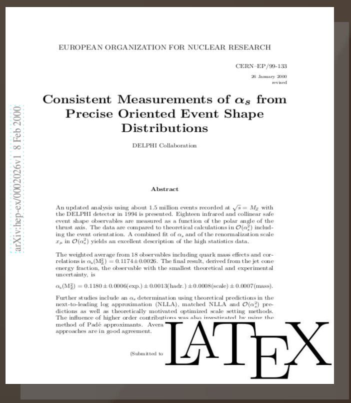
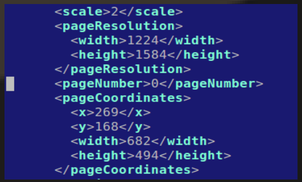
Automatic extraction of figures





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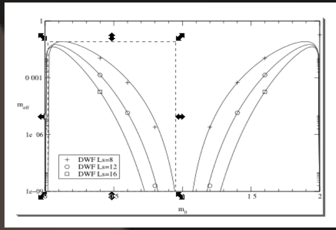

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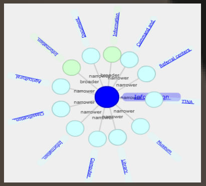

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Semantic description

Types of extracted meta-data

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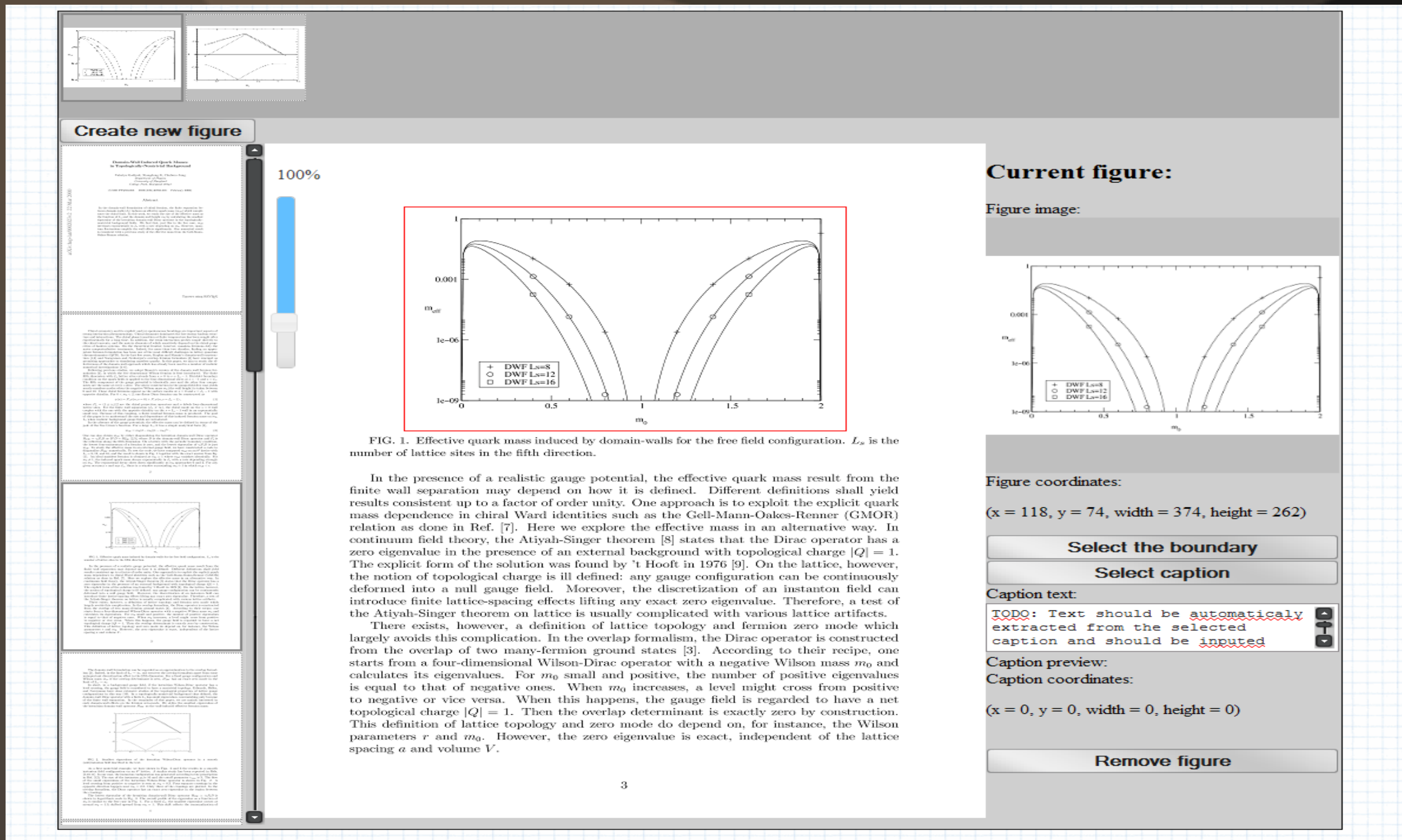

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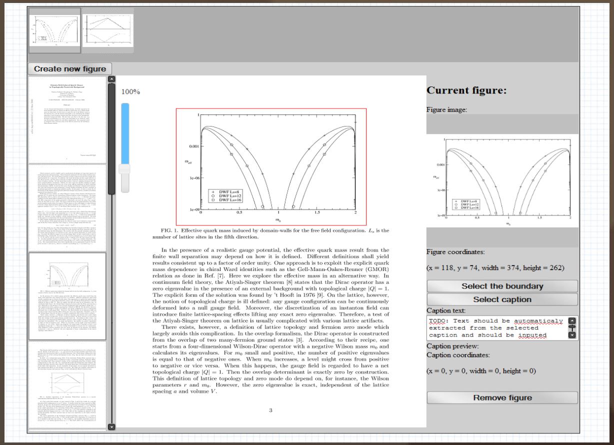

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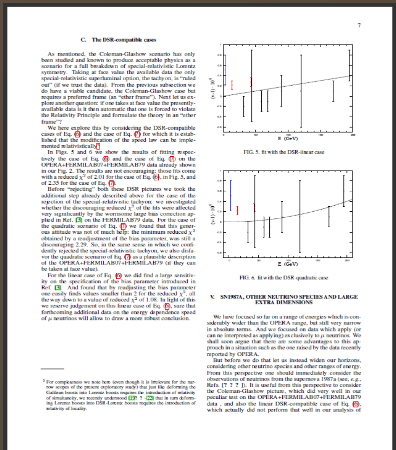
Figures from scientific publications



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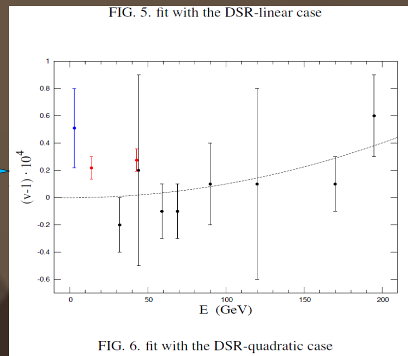

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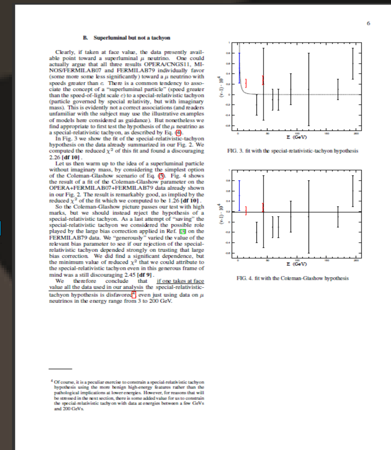

Figure 1

Describes the same data

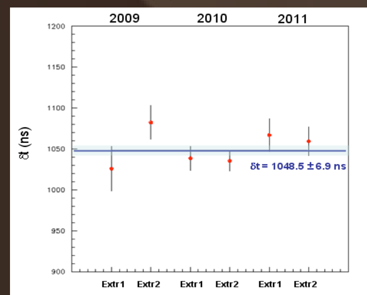

Figure 2 (extracted from different publication)

Questions ?