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Plasma-based experiments at the SPARC_LAB test facility

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Plasma-based acceleration has already proved the ability to reach ultra-high accelerating gradients. A significant improvement in the efficiency of particle-driven plasma wakefield acceleration has been demonstrated so far accelerating a witness bunch in the wake of a higher charge driver bunch [1]. Both the transformer ratio and the energy transfer from the driver to the witness beam can be increased by resonantly exciting the plasma with a properly pre-shaped drive electron beam. At present the step towards the realization of a plasma-based accelerator still requires some effort to guarantee high brightness beams, stability and reliability. The transport and focusing of electron beams over cm-scale distances is also worth being investigated and at this regard plasma-based focusing devices will be presented [2].

[1] M. Litos et al., *Nature* 515, 92-95 (2014).

[2] R. Pompili et al., *Appl. Phys. Lett.* 110, 104101 (2017).

Primary author: CHIADRONI, Enrica (LNF)

Co-authors: MAROCCHINO, Alberto (LNF); CIANCHI, Alessandro (ROMA2); Prof. MOSTACCI, Andrea (Sapienza); Dr ROSSI, Andrea Renato (MI); BIAGIONI, Angelo (LNF); GIRIBONO, Anna (ROMA1); VACCAREZZA, Cristina (LNF); DI GIOVENALE, Domenico (LNF); BRENTAGANI, Emanuele (Laboratori Nazionali di Frascati, INFN); VILLA, Fabio (LNF); BISESTO, Fabrizio Giuseppe (LNF); FILIPPI, Francesco (ROMA1); DI PIRRO, Giampiero (LNF); CASTORINA, Giovanni (L); SCIFO, Jessica (LNF); BELLAVEGLIA, Marco (LNF); MARONGIU, Marco (R); ANANIA, Maria Pia (LNF); FERRARIO, Massimo (LNF); CROIA, Michele (LNF); ROMEO, Stefano (LNF); SHPAKOV, Vladimir (LNF)

Presenter: CHIADRONI, Enrica (LNF)

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