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Research with intense, pulsed ion beams at Berkeley Lab

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At Berkeley Lab, we currently operate two facilities for research with intense, pulse ion beams, NDCX-II (the neutralized drift compression experiment) and BELLA-i at the BELLA petawatt laser. In this talk we will report on the status of the two facilities and give examples of our research and re-search directions.
NDCX-II is an induction linear accelerator that produces pulses of 1 MeV Helium ions with peak currents of up to 2 A in a few ns long pulses (Figure 1) [1]. Beam spot sizes are in the range of 2 to 4 mm2. The total charge per pulse in the main peak and tail is up to 16 nC (1011 ions) for an beam energy of fluence of 16 mJ or ~0.5 J/cm2 at the given few mm2 spot size. This ion intensity level ena-bles studies of dose rate effects of radiation damage in materials and electronic devices and studies of phase-transitions in selected materials. We will report on studies of damage dose rate effects in tran-sistors and of flux effects on ion energy loss in materials.

BELLA-i is an initiative for high energy density science at the BELLA petawatt laser facility. We have now commenced experiments with solid targets at BELLA, using the long focal length beam-line that is optimized for electron acceleration [2]. Here, the Ti:sapphire laser delivers up to 40 J in 32 fs (1.2 PW) to target foils for peak intensities in the low 1019 W/cm2 range with a w0=57 micron beam spot and a repetition rate of up to 1 Hz. We will present results from a first ion acceleration campaign in the TNSA regime where spectra and angular distributions of accelerated ion pulses have been meas-ured from thin metal foils (sub-micron to a few micron thicknesses).

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References

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