Jefferson Lab
Thomas Jefferson National Accelerator Facility
Exploring the Nature of Matter

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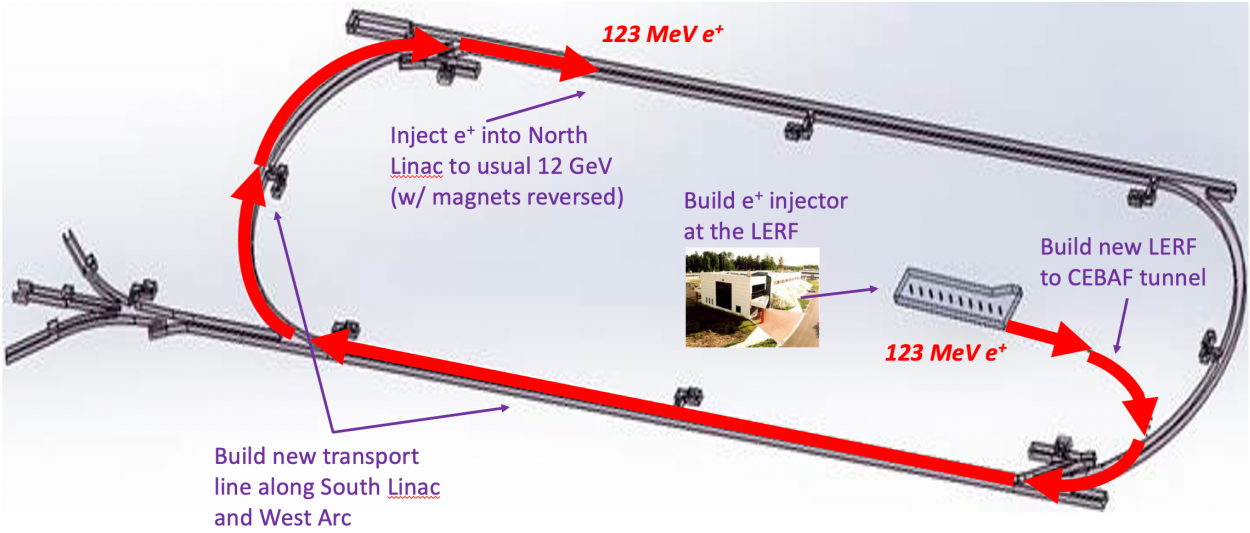
Dear Jefferson Lab Program Advisory Committee,

Due to the success of the PEPPo experiment, a great deal of excitement has been building in the Jefferson Lab community about the possibility of polarized 12GeV positrons at CEBAF. As a new injector will be required for a future Jefferson Lab energy upgrade, a positron source is now envisioned by laboratory management as a step towards that future upgrade.

To make best use of equipment and buildings that have already been built, it has been decided that the positron source will be built in the LERF building, previously known as the FEL. As this building already exists and is separate from the main machine, it will allow development of the positron source in parallel to nominal running and maintenance of the CEBAF accelerator.

Once the positron source has been developed, civil construction will be required to connect the beam from this new source into the main machine as indicated in the image below. Once inside the main machine, the 123 MeV positron beam will be transported to the current injection point in the north linac allowing the usual 12 GeV acceleration but now with magnet polarities reversed.



Since the positron beam will be a secondary beam, it will not have the same properties of the here-to-fore standard CEBAF electron beam. To try to avoid confusion about what will be possible with a first generation CEBAF positron source, we have created the following table which shows the current electron beam along with expected positron beam parameters. These parameters have been presented to the Jefferson Lab user community at a recent positron workshop in Charlottesville as well as at recent APS April and APS GHP meetings.

Since the positron beam will be injected into the north linac at the same point as the current injector, energy range and duty factor remain exactly the same as indicated in blue; but many other parameters change. Most notably, the maximum currents will be over two orders of magnitude lower than we can achieve with electrons. Also, the maximum current for positron will depend on whether or not polarized beam is needed, initially with >1 uA available for unpolarized positrons and >50 nA expected for ~60% polarized positrons. The larger emittance beams, especially at lowest passes, may make running multiple halls simultaneously with the positron source more challenging (TBD), thus we will investigate experiments as they are approved to determine if there are cost-effective ways to complete them in the multi-hall setup.

Machine Parameter	Electrons	Positrons
Hall Multiplicity	4	1 or more
Max. Energy (ABC/D)	11/12 GeV	11/12 GeV
Beam Repetition	249.5/499 MHz	249.5/499/1497 MHz
Duty Factor	100% cw	100% cw
Unpolarized Intensity	170 μA**	> 1 μA
Polarized Intensity	170 μA**	> 50 nA
Beam Polarization	> 85%	> 60%

** Total beam power at Jefferson Lab is limited to 1.1 MW with a max. of 0.9 MW to individual high power dumps.

Accelerator beamline magnet reversal between e+ and e- optics should be assumed to be possible if required for a given experiment. Without bipolar switches, changes between polarities will require significant amounts of time and labor and will likely take of order a week. This should be considered in overhead accounting for PAC days.

It is our hope that the committee finds this short summary of the likely parameters of the future Jefferson Lab positron beam is helpful. It has been noted that in addition to experiments in the main machine, it will be possible to do low energy positron experiments in the LERF itself with energies up to ~123 MeV and members of the user community have expressed interest in that as well. As those would be independent of CEBAF running, they could help drive positron source development in the years leading up to Ce^{+}BAF.

Most Sincerely,
Joe Grames, Douglas Higinbotham, Eric Voutier, Xiaochao Zheng
for the Positron Working Group