

Progress on the Investigation of Electron Cloud Buildup in Longitudinal Magnetic Fields

- Comparisons of SPU measurements at 15W with solenoidal windings(Dec/2010) and Helmholtz coils (Nov/2012) -

Bonus: Quantum efficiency history in TiN-coated chamber from Sep/2010 to Nov/2012

Previous work: see Jared's talk at the EC meeting on 25 July 2012

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Solenoid windings vs Helmholtz coils







May 2010 – June 2011

Preliminary calibration 1000 cu / 25 A / 40 G

August 2012 – now

Preliminary calibration 1000 cu / 25 A / 150 G

Only the two coils on the right are powered

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Compare SPU signals 24Dec10 - 19Nov12





5.3 GeV electrons 8 mA/bunch

Compare signals for the same field values according to the preliminary calibration.

Scale the 2010 signals up by arbitrary factors as a visual aid.

The 2010 signals are all EARLIER than the 2012 signals for the same field value.

Since the timing is determined by the cyclotron period (see Jared's talk on 25 July 2012), this means the 2010 field values according to the preliminary calibration must be too low.

Notice that the 2010 16-G signal is timed similarly to the 2012 22-G signal.

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Compare SPU signals 24Dec10 - 19Nov12



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Conditioning Study of the TiN Chamber

Conditioning comparison: 5.3 GeV 4.7 mA/bunch e+ 15W TiN



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first



Compare SPU signals 24Dec10 - 19Nov12





Applying the factor 1.9 to the 2010 16-G signal produces a signal strikingly similar to the 22-G 2012 signal.

The field calculation for the welldefined geometry of the Helmholtz coils is presumably more reliable. (see Uniform Magnetic Fields and Doublewrapped Coil Systems, J.L. Kirschwink, Bioelectromagnetcs 13 (1992))

Does this remarkable comparison hold up for other field values? (next slide)

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Compare SPU signals 24Dec10 - 19Nov12



YES

The field ratio is 22 / 16 = 1.38 So the 2010 field value of 22 G is instead 22 x 1.38 = 30.4 G. Indeed the signal arrives slightly earlier than the 30-G 2012 signal.

The 2010 field value of 28 G is instead 28 x 1.38 = 38.6 G. Again the signal arrives slightly earlier than the 37-G 2012 signal, as expected.

Notice in particular how similar the signals are despite the dramatically different coil geometry. This raises confidence that even with the uneven solenoid windings the field was quite uniform.

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Solenoid windings vs Helmholtz coils





May 2010 – June 2011

New calibration 1000 cu / 25 A / 52.1 G



August 2012 – now

Calibration from improved calculation (JPS) 1000 cu / 25 A / 142 G

The simulation studies of last summer already convinced us that the field values were likely too low, since the modeled signals arrived later than observed. The level of error in the field calibration is consistent with the nonlinear failure of the model for differing field values. This convincing improvement in the field calibration will give more confidence in the modeled photoelectron energy distribution, which now must be re-tuned.

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