Quadrupole Shielded-Pickup Data

Comparison of Signals from 10- and 20-Bunch e+ Trains

-- Trapping ! --

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Electron Cloud Meeting

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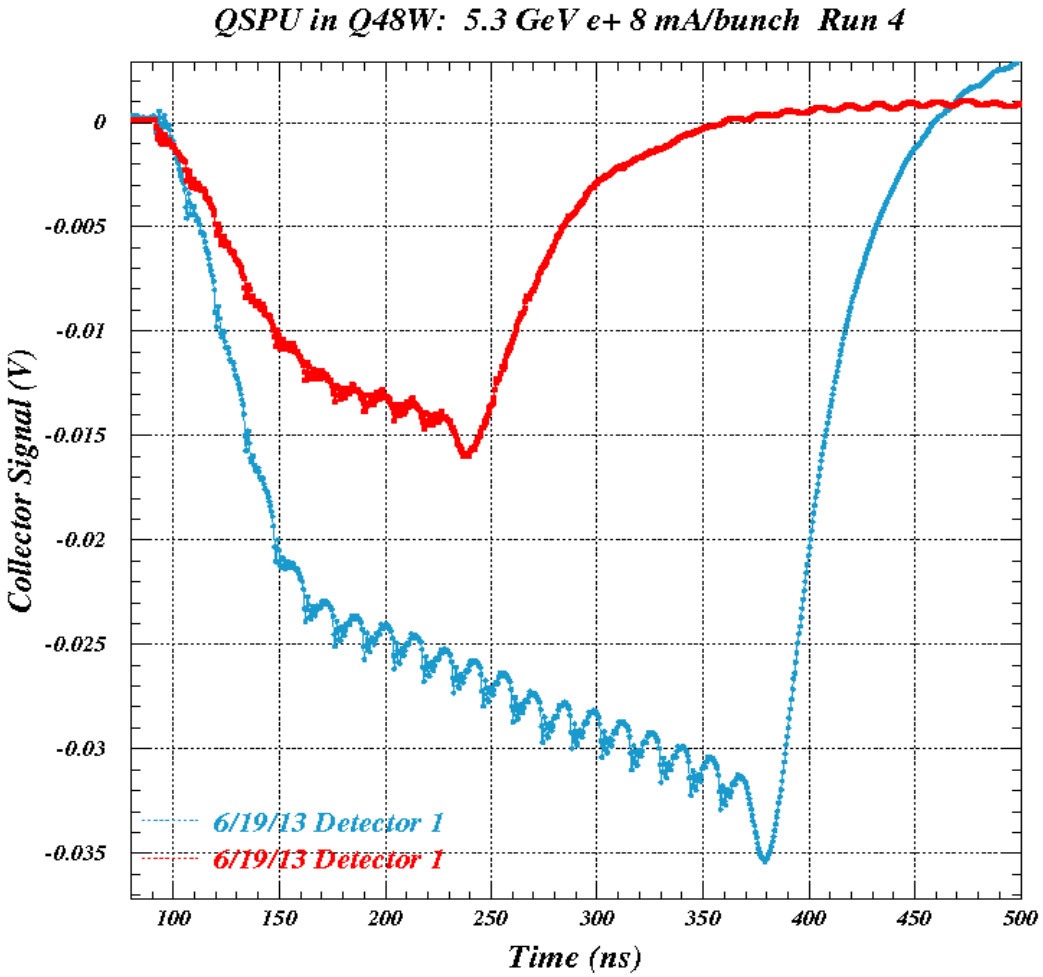
Recent June QSPU Measurements of 10- and 20-Bunch e+ Trains



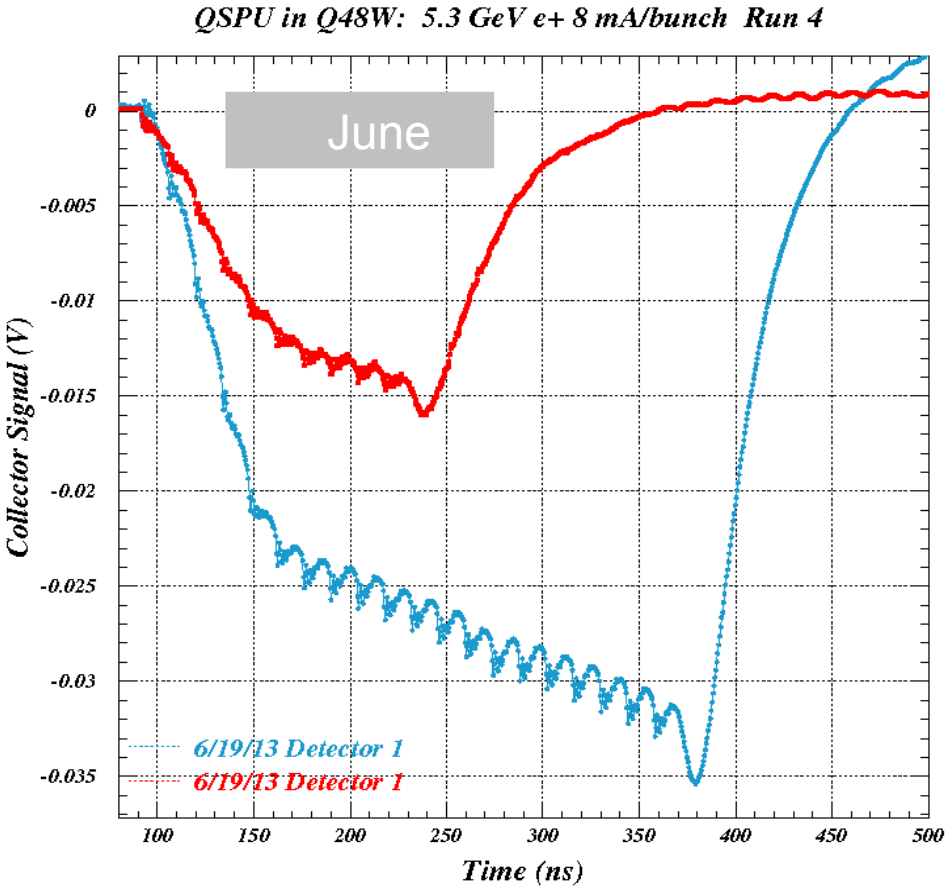
The cloud buildup process exhibits a distinct change in behavior after six bunches.

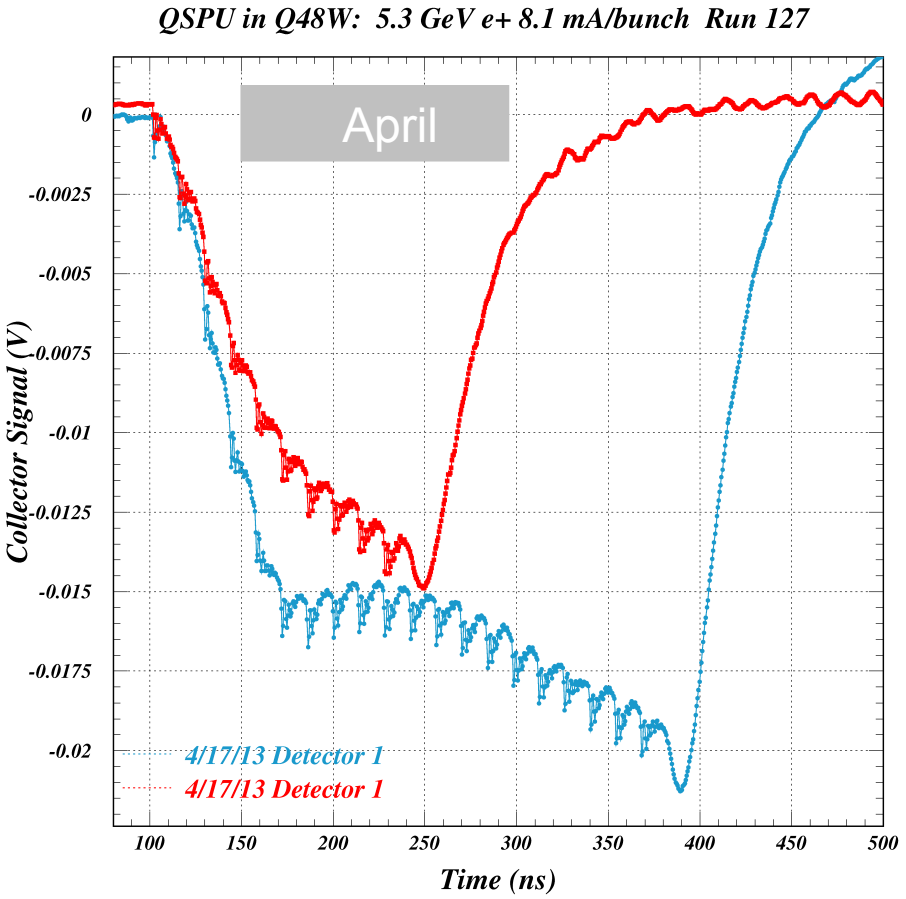
How do the first six bunches know that the last ten bunches are coming ?

Do they know those ten trailing bunches were (or were not) there on the preceding turn(s) ?

Such a phenomenon has not been observed in SPU data or TR_RFA data with or without a dipole magnetic field.

Was the effect already present in the April measurements? Yes.

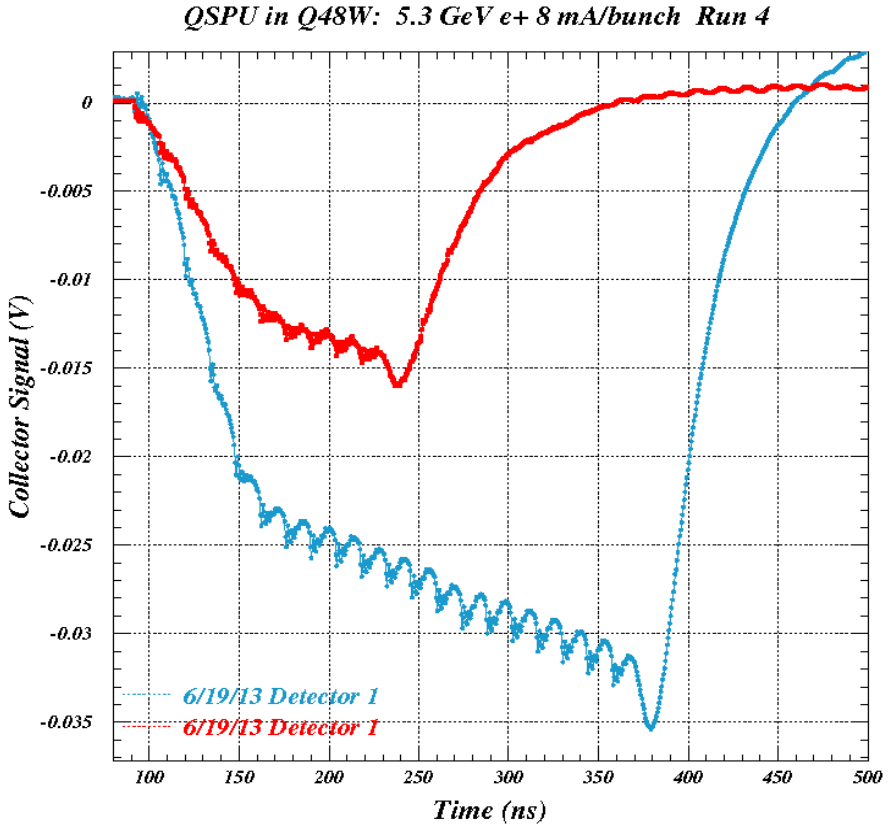


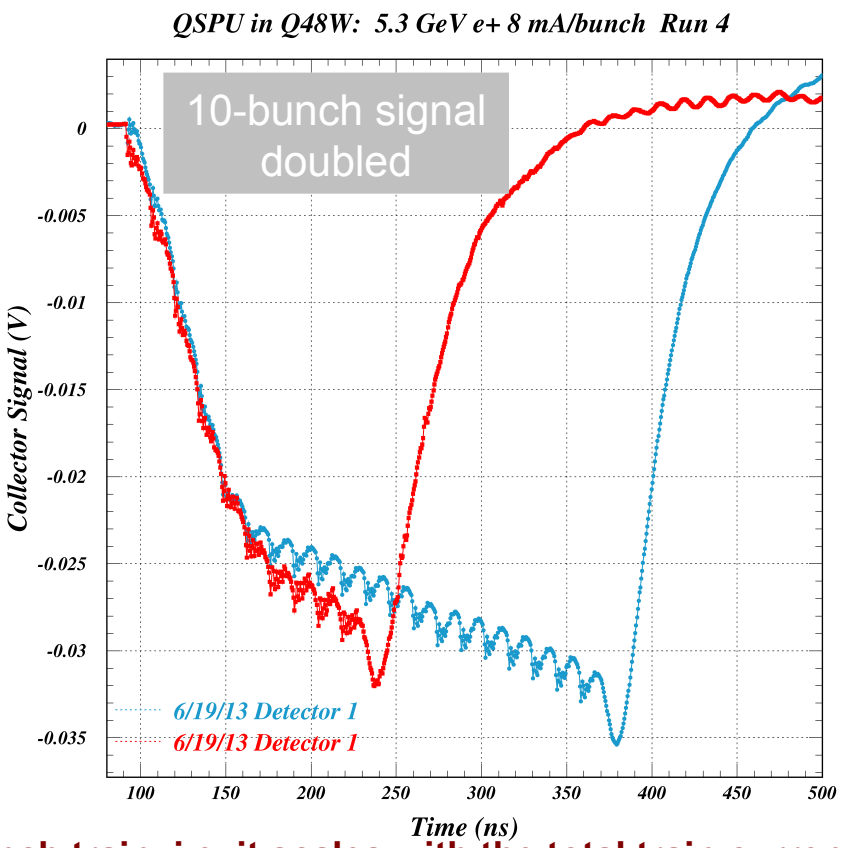


The same "memory effect" occurs in both the June and April data.

(Why is the 20-bunch signal so much larger in June?)

Compare slopes for 10- and 20-bunch trains





The 6-bunch slope is a factor of two higher for the 20-bunch train, i.e. it scales with the total train current.

Proposed Interpretation

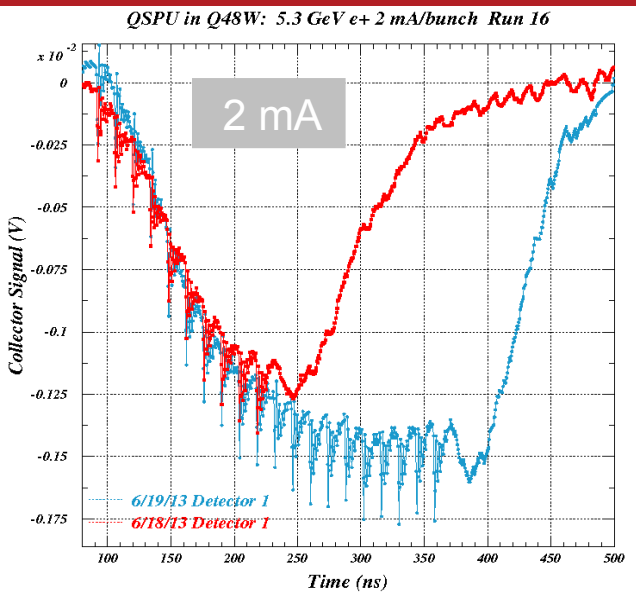
A reservoir of cloud electrons has collected (or remained) during the turn prior to the arrival of the train.

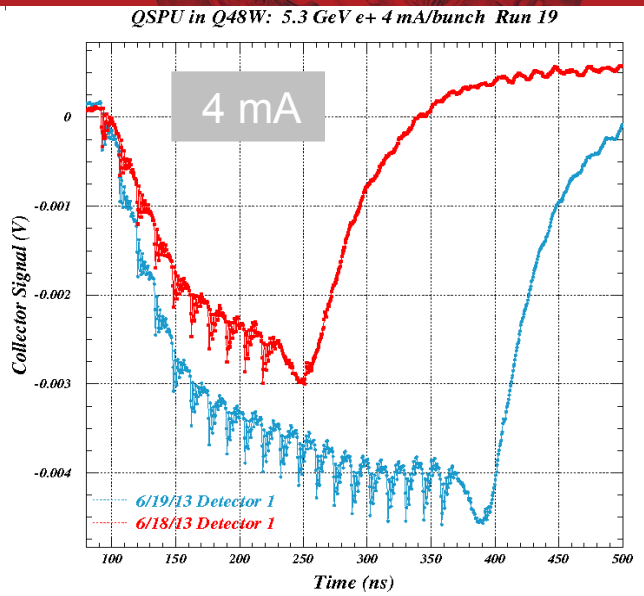
Each of the first six bunches sweeps out 1/6th of the reservoir.

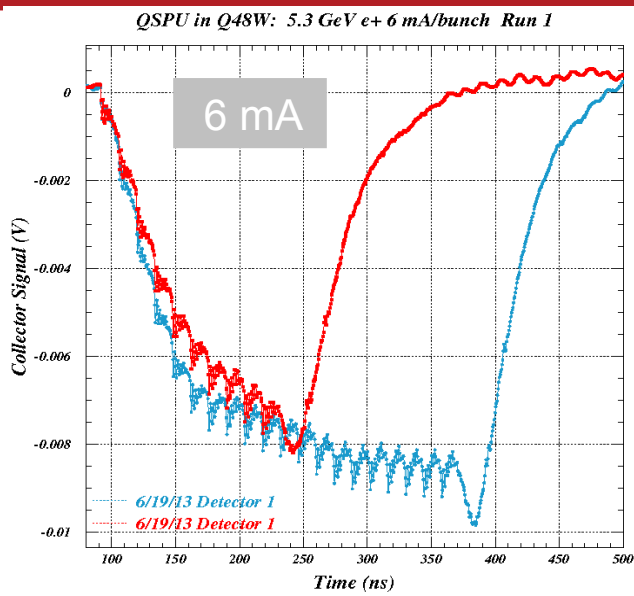
The number of electrons stored in the reservoir scales with train current.

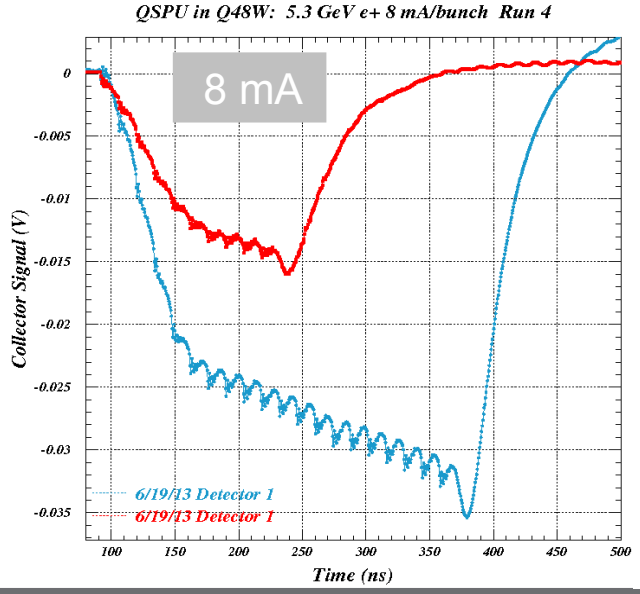
After the reservoir is empty, the cloud builds up using only newly produced electrons.

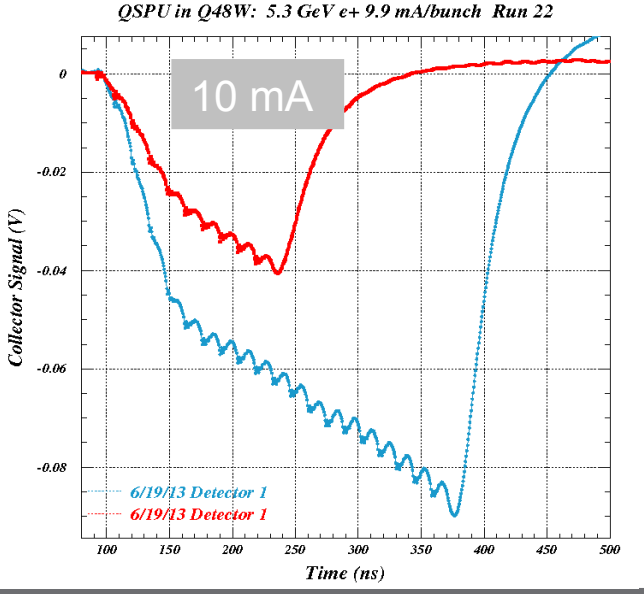
Dependence on Bunch Current











The 20-bunch signal increases from 2 mV to 80 mV when the bunch current increases from 2 mA to 10 mA/bunch. (SEY dominates.)

The transition occurs after the sixth bunch independent of bunch current.

Nonlinear (resonant?) behavior with bunch current (6 mA is "special").

Future Measurements and Modeling

Informative experiments

Why do six bunches suffice to clear the trapped electrons ?

Does each of the six bunches clear the same number of electrons?

- **Finer steps in bunch current (map out nonlinearity)**
- **Dependence on bunch spacing (still six bunches to clear?)**
- **Vary bunch current in the first six bunches**
- **Dependence on train length (< 6 ?)**
- **Beam energy (less light?). Electron beam.**
- **Can we vary the quadrupole field strength?**
- **Suggestions?**

Modeling

If six bunches suffice to clear all the trapped electrons,

it may suffice to model just two trains, i.e. 1 turn + 1 train.

- **Need to develop QSPU acceptance model**
- **Study dependence on bunch current, spacing, field strength**
- **How do the cloud and QSPU signal evolve from turn to turn?**