

# ADVANCED PHOTON SOURCE

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## Top-up Stored Beam Monitor

- Purpose is to detect presence of stored beam.
- Injection with beamline shutters open disallowed unless stored beam is detected.
- Design philosophy emphasis on simplicity, ease of use and validation.
- Six-month validation procedure consists of verifying push-button response on front of chassis, together with simple beam check to verify bit status change with beam in the range  $3 \text{ mA} < I_{\text{beam}} < 30 \text{ mA}$ .
- All readbacks, including bit statuses, are monitored and logged via EPICS. Calibration is thus a continuous process, active whenever stored beam is present. Data is reviewed prior to each operating period by system manager.
- Readbacks will be continuously cross-checked against storage ring DCCT for consistency.

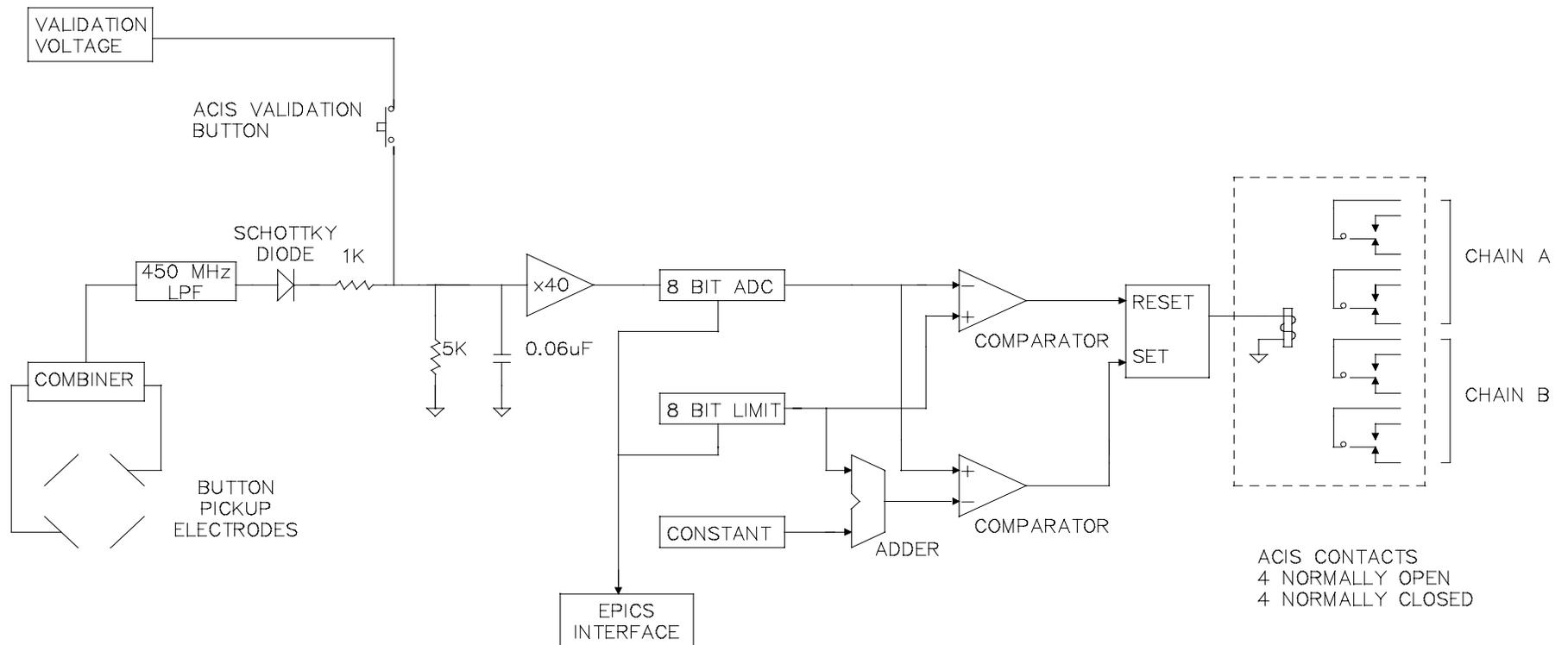
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## Top-up Stored Beam Monitor Hardware Design

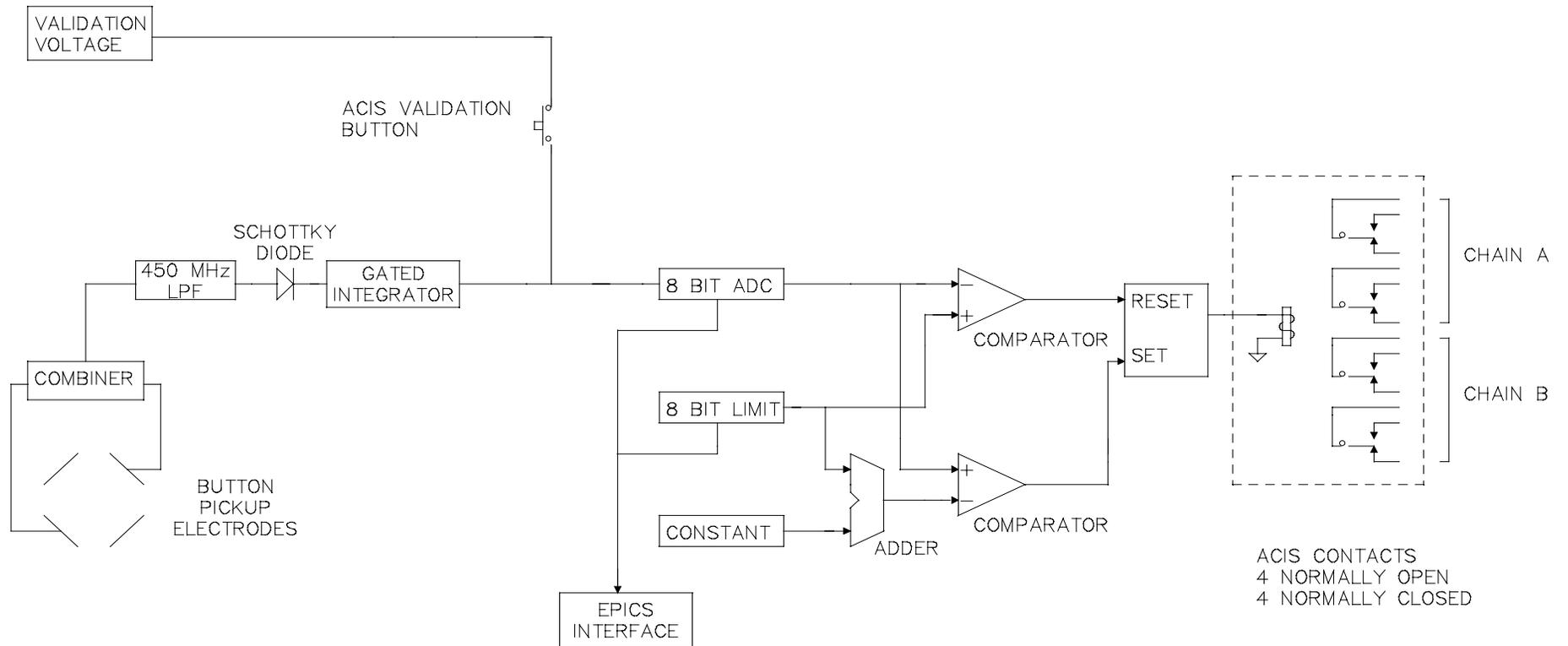
- **Beam transducer is a set of four dedicated standard capacitive button pickup electrodes, identical in design to those for beam position monitor system. Diagonal button pairs are summed using rf hybrid combiners, then sent to separate detection electronics of differing designs, to provide redundancy.**
- **Fast front end uses broadband Schottky diode rf detector followed by passive low-pass filter or active integrator for the two designs.**
- **Once converted to a DC level, each detector incorporates an 8-bit digitizer followed by simple digital gate logic driving up to eight ACIS relay contacts.**
- **“Limiting current” trip threshold settable via on-board DIP switches, available as EPICS readback.**
- **Digital comparator includes small amount of hysteresis to avoid relay chatter.**

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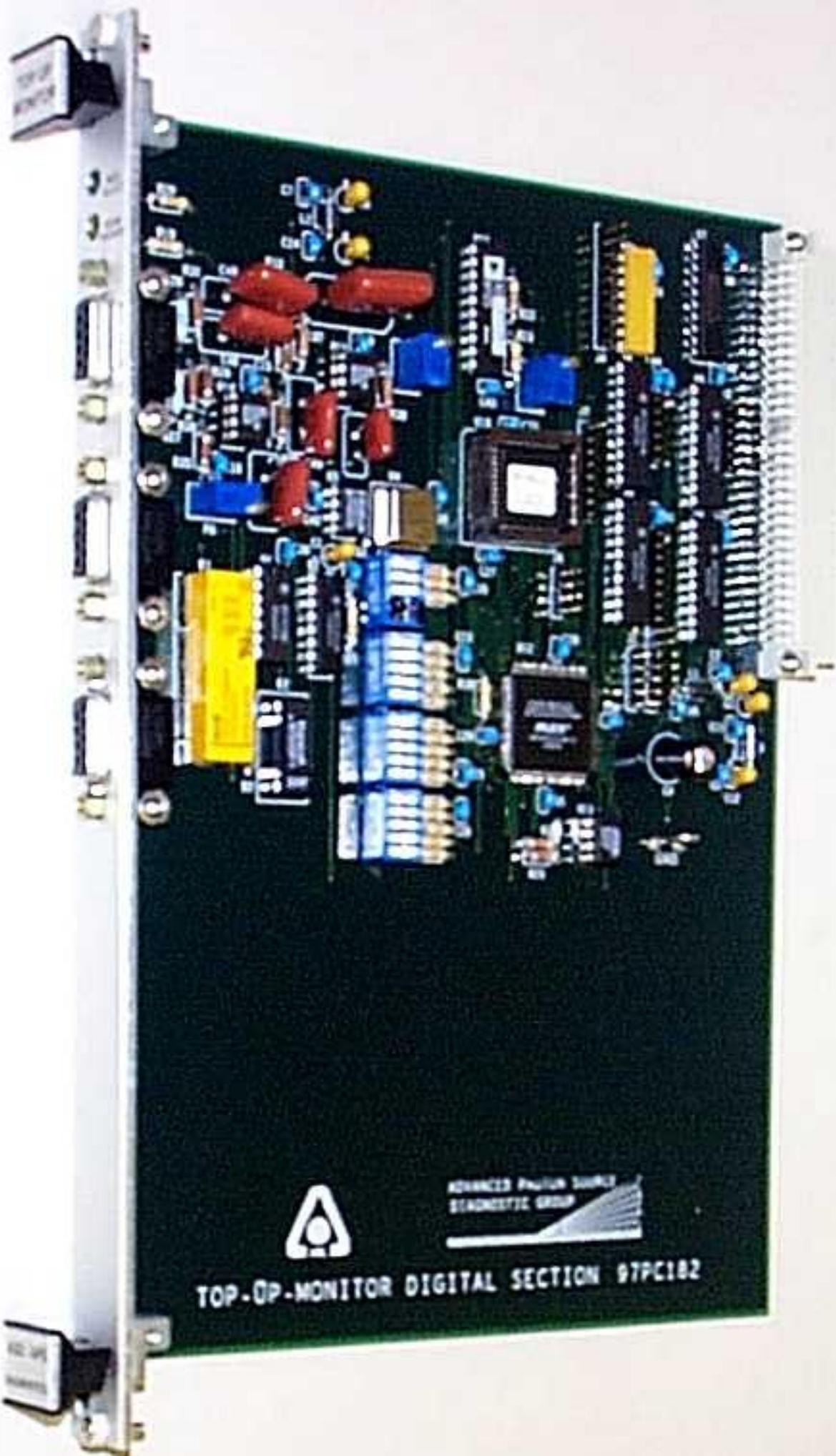


TOP UP MONITOR  
PASSIVE FRONT END

# ADVANCED PHOTON SOURCE



TOP UP MONITOR  
ACTIVE FRONT END



ADVANCED PHOTON SOURCE  
BIOMEDICAL GROUP

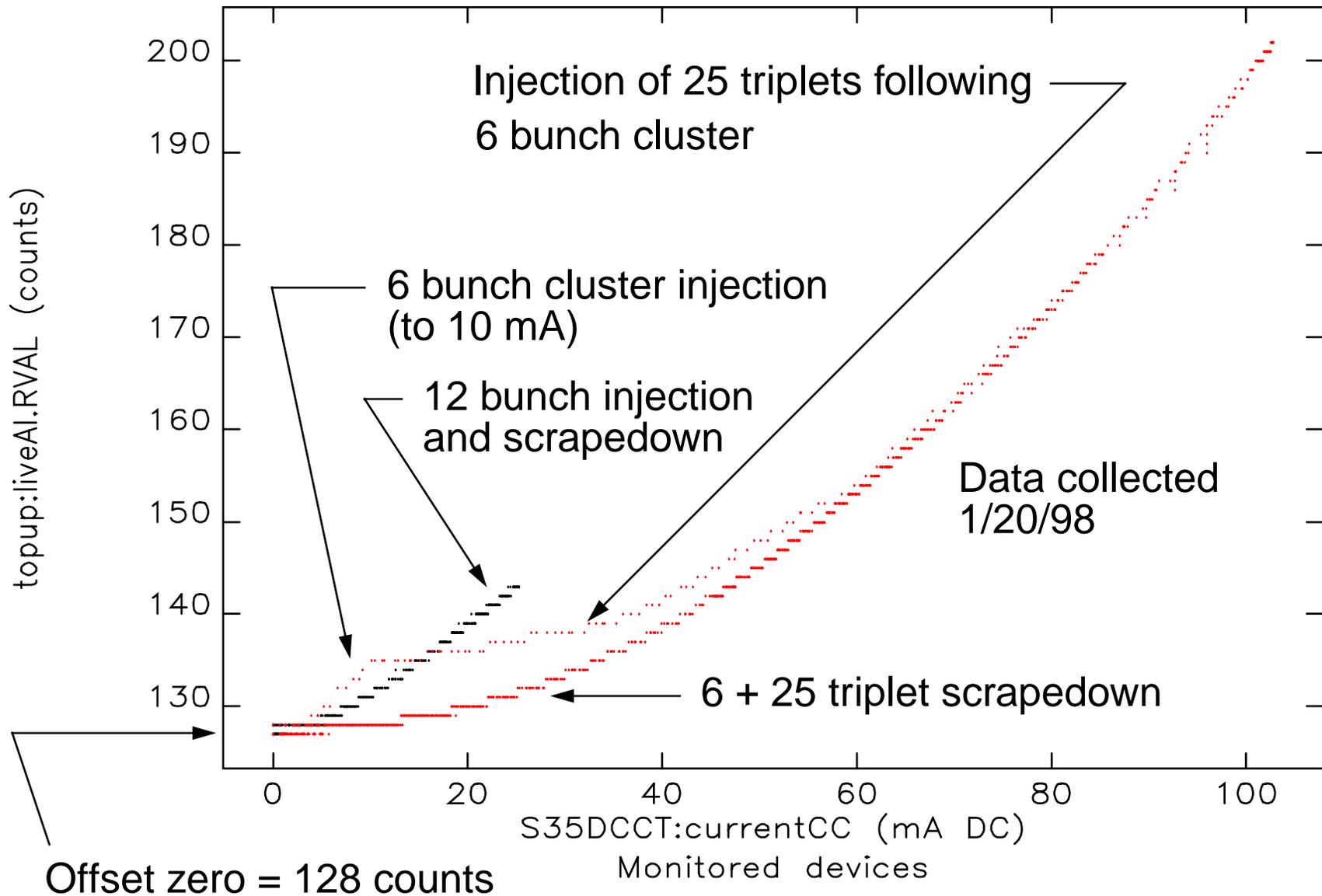
TOP-OP-MONITOR DIGITAL SECTION 97PC182

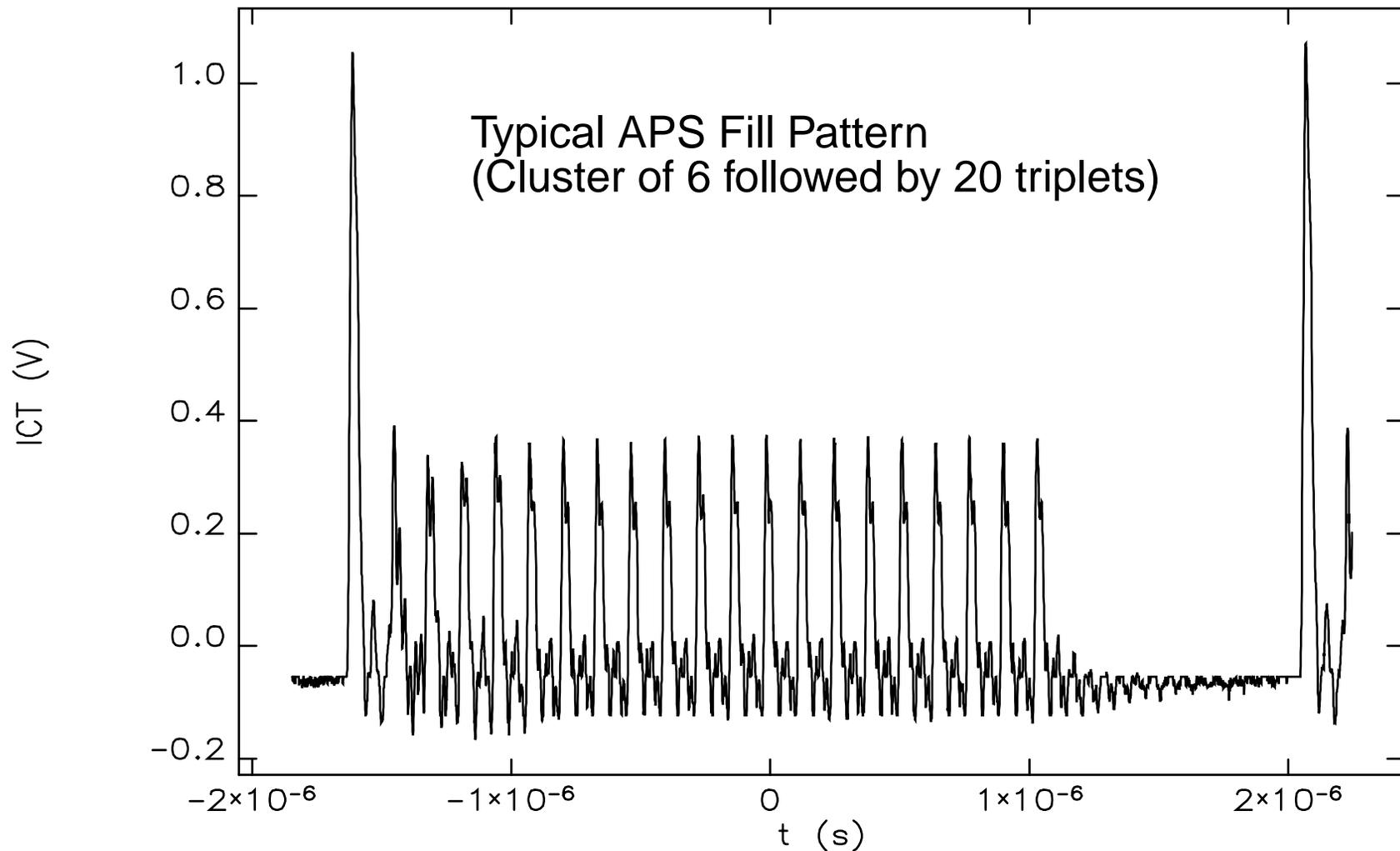
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## Top-up Stored Beam Monitor Prototype Calibration

- **Two fill patterns were used for the measurement:**
  - Standard multibunch pattern “6 + 25 triplets”
  - Twelve adjacent bunches (2.8 ns spacing)
- **Detector found to have high sensitivity to peak current**
  - In all cases, response is monotonic function of average current, for fixed fill pattern.
  - Cluster of 6 in standard fill pattern showed largest response during injection.
  - Twelve bunch response had next largest response.
  - Scrapedown of complete multibunch fill had weakest response.
  - > Peak current sensitivity effectively expands dynamic range in spite of 8-bit digitizer resolution limitation.
- **Single bunch sensitivity expected to be highest**
  - Measurement to be incorporated in formal calibration procedure for production units.
- **Signal observed to decrease for off-axis beam steering**
  - Theoretical and numerical simulations show second-order sensitivity to beam position with maximum at bore center.
  - > This assures that monitor will underestimate average beam current, erring conservatively.
- **Calibration of “trip limit” corresponds to 3 mA single bunch**
  - Assures bit transition at greater than 3 mA for all other bunch patterns, again providing an underestimate of average current.





Thu Feb 12 16:42:51 1998

