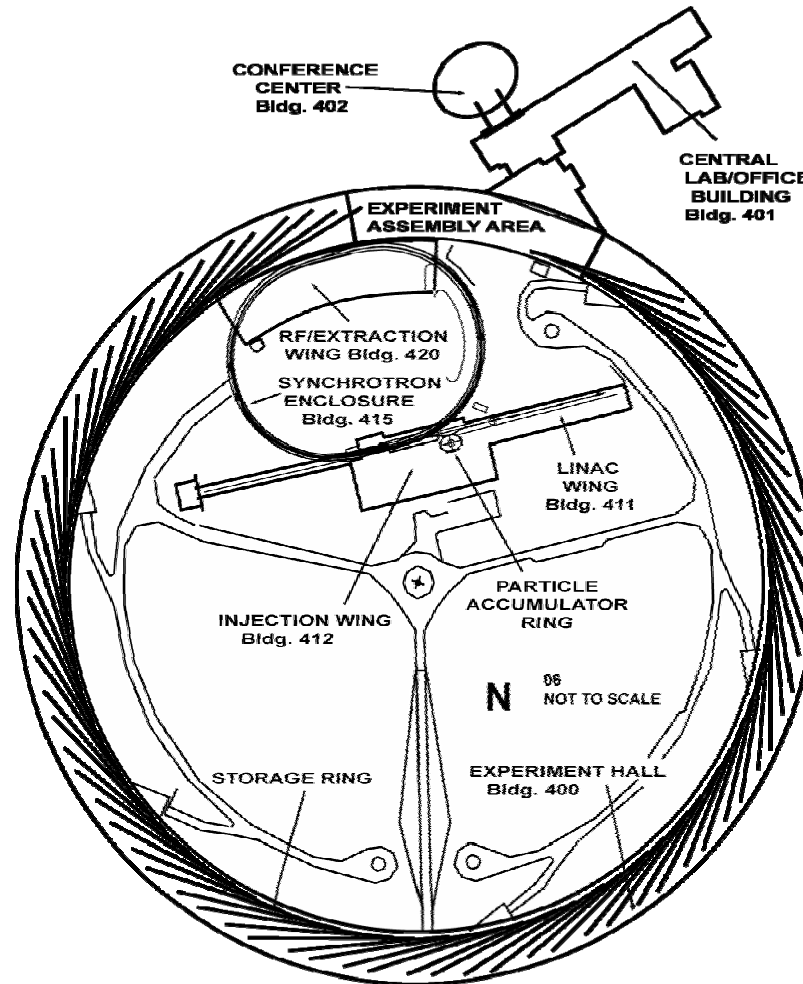


# *APS Particle Accumulator Ring Upgrades in Support of Improvement in Bunch Purity and Operational Reliability*

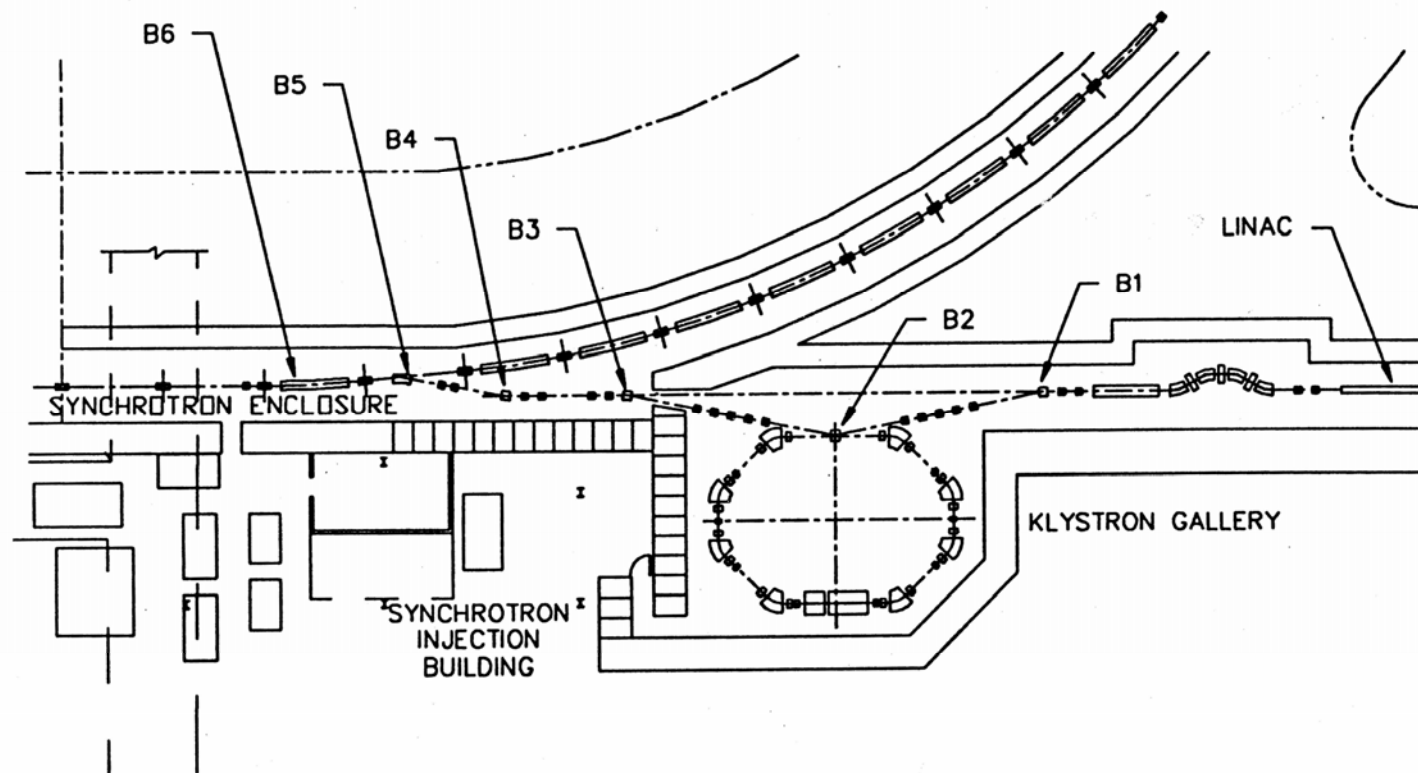
*A.E. Grelick, E. Cherbak, N.P. DiMonte, T.L. Smith, and C.Y. Yao*



# APS Machine Plan View



## PAR Plan View



## *PAR Cavities from Inside Ring*



## *Current Key PAR Parameters*

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<b>Parameter</b>	<b>Fundamental</b>	<b>Harmonic</b>
Frequency	9.775 MHz	117.3 MHz
Power	2000 W	2200 W
Gap Voltage	32.8 kV	30.5 kV





## *Critical Harmonic Turn-on Process*

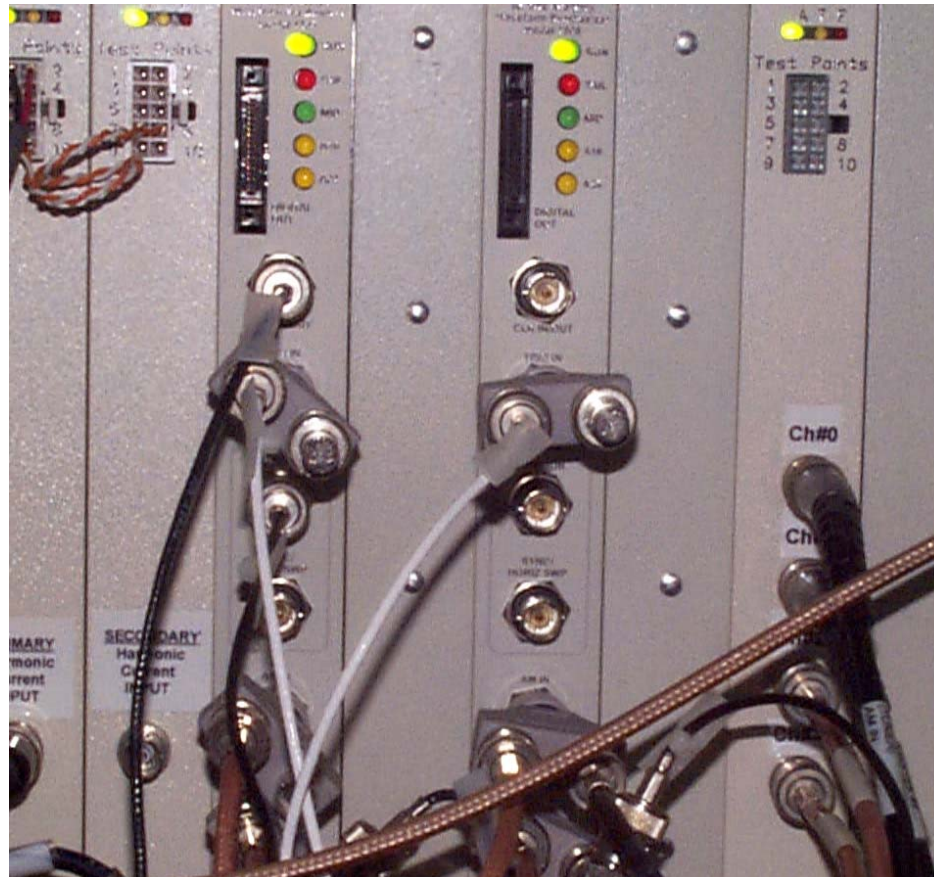
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- Compressed bunch is formed as soon as cavity is tuned
- Original timing called for simultaneous RF and tuner turn-on
- Unavoidable transient on initial loop closing
- Hardware limitations have worsened initial RF turn-on transients

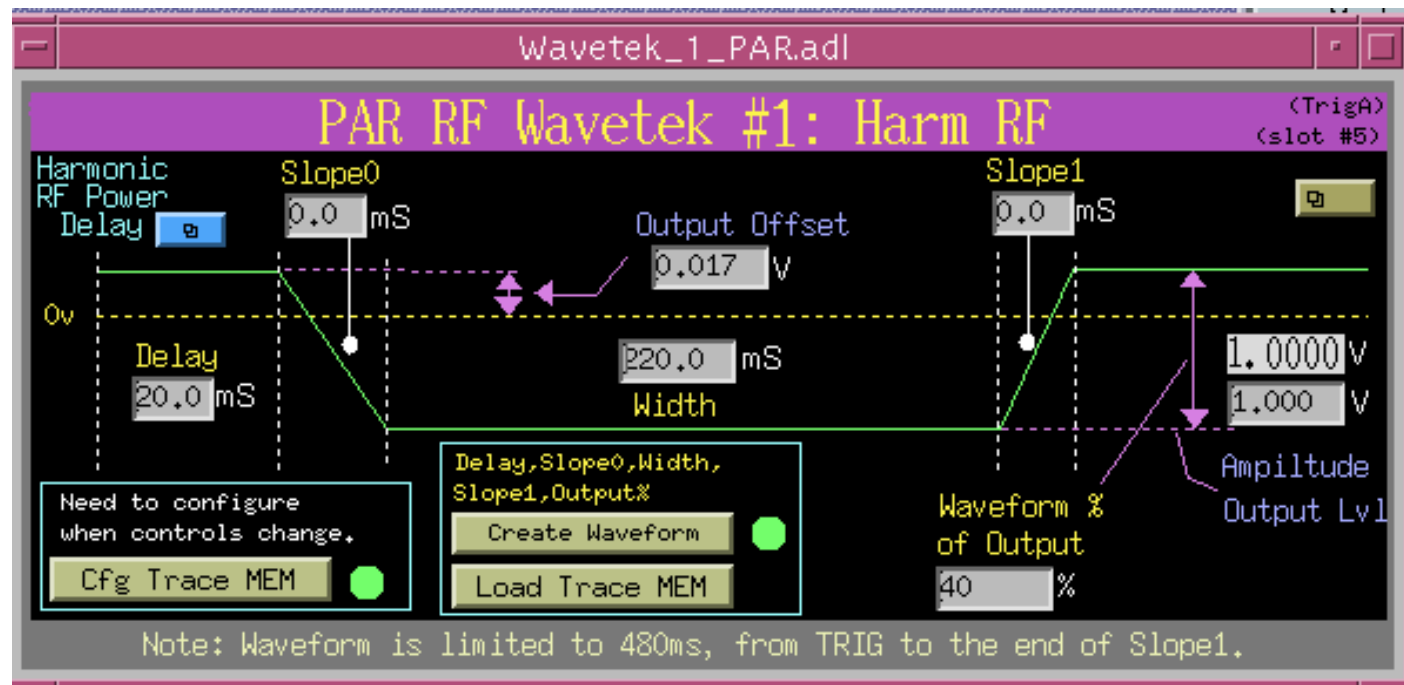




## Function Generators in VXI Mainframe



## PAR RF Function Generator







## *Timing Changes*

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- RF turn-on transients have very little effect on bunching if they occur at a different time from tuner turn-on
- RF turn-on either before or after tuner turn-on is beneficial, however after means all transient effects from RF turn-on are moved away from the critical bunch forming time and has been adopted





## *Dynamic and Thermal Improvement Goals*

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- Variable attenuator which is used in both Phase Detector and Modulator VXI modules has been identified as the probable culprit in the transient problem
- A modified Phase Detector VXI module which incorporates the Analog Devices AD8302 has been assembled and tested in the Harmonic PAR. However, with the modulator unchanged the transient is worse rather than better
- Phase Detector using AD8302 has superior amplitude rejection
- Test installation on Fundamental PAR is planned to evaluate thermal stability



## Modified Phase Detector – With AD8302





## *Harmonic Tuner Loop*

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- Stability and transient problems with closed loop operation
- Recent operation has been open loop with feed forward control
- A pulse to pulse software loop has been implemented on an experimental basis and is expected to improve thermal drift but has problems with very high beam current

