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**RF**

# ICD1 vs ICD2

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**Change from pulsed to cw changes things significantly for the RF systems**

- **Cooling issues are radically different**
- **Vector modulators have new challenges**
  - **Not part of present planning but might be of use (reduce amplifier count)**
  - **Development being done for HINS**

# Brief (and incomplete) Status

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## LLRF (ICD2)

- Phase and amplitude control: 1° and 1%
- Conceptual design in place
  - Some components have been tested
  - 2 cryomodules per LLRF station
- M&S for 2 GeV linac is ~\$2.4M
  - Labor will add to this

# Brief (and incomplete) Status cont'd

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## HPRF

- **Linac**
  - 1 cavity per amplifier
  - Spoke cavities would get a mix of solid state amps and tetrodes
  - 2 GeV linac gets IOT's
- **RCS**
  - 16 fundamental cavities; 10 2<sup>nd</sup> harmonic
  - Have a prototype fundamental cavity for RCS
    - Based on SSC LE booster
    - Can be tested in MI enclosure
      - Could also test 2<sup>nd</sup> harmonic cavities there, too
    - Challenge is to provide enough cooling for the required fields
- **Estimates**
  - **Linac:** \$94M + 45 p-y
  - **RCS:**
    - fundamental: ~\$31M + ~50 p-y
    - 2<sup>nd</sup> harmonic: ~\$18M + ~25 p-y

# Open Questions

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- How much detuning (microphonics) will have to be accommodated?
  - Need data from cavities, e.g. spokes cavities
- Are rf parameters (other than freq) for RCS constant during the ramp?
  - Need input from Accelerator Physics folks
- Spoke resonators or DTLs?
- Single or multiple cavity per power amplifier?
- Cost reduction for Ferrite Vector Modulators?

# Open Questions (cont'd)

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- **Because we're not talking about starting construction "tomorrow"**
  - **What will be the "best" electronics packaging in 2015?**
  - **Are there new technologies emerging that we should be exploring?**
- **Build or buy LLRF hardware and software?**
  - **What mix to use?**
- **RCS beam loading issues**

# Potential Collaborators

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	LLRF	HPRF
<b>LBNL</b>	<ul style="list-style-type: none"><li>• Timing reference system</li><li>• systems modeling,</li><li>• firmware development,</li><li>• Evolution of Real Time Simulator (RTS) into digital hardware</li></ul>	
<b>ANL</b>	<ul style="list-style-type: none"><li>• Combine studies for SPX with NML-ProjX</li></ul>	<ul style="list-style-type: none"><li>• Modeling for RCS</li><li>• 2<sup>nd</sup> harmonic system for RCS</li></ul>
<b>JLab</b>	<ul style="list-style-type: none"><li>• RTS (potential)</li></ul>	

**FNAL also collaborating with KEK and DESY**