Physics Specification of IVCC Power Supply for RWM Control and Other Tasks – Criteria Based on Physics Needs

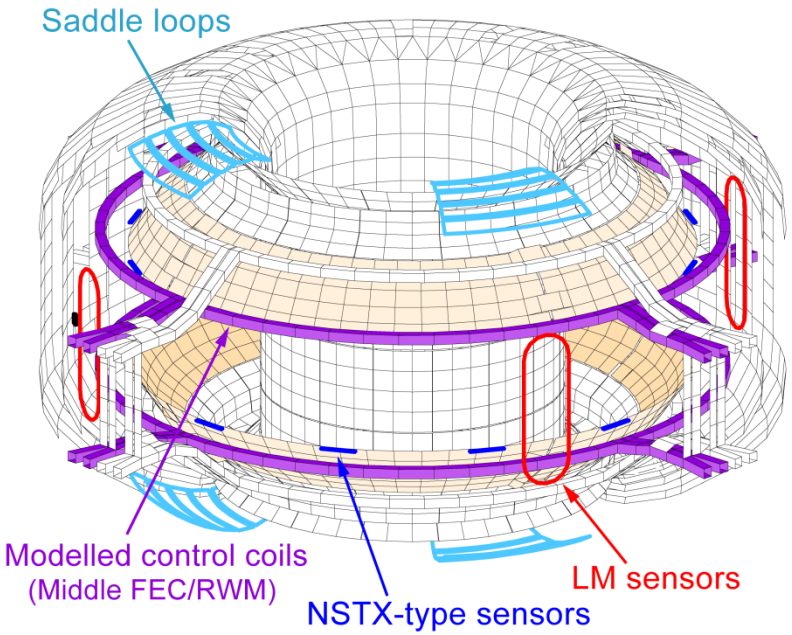
- Number of independent current channels
  - Decided that 4 channels were minimum for initial system, bi-polar
- Bandwidth
  - ~ 1 kHz range (cost is not a key driver 1 kHz ~ 5 kHz range)
- Voltage
  - ~ 1 kV range
- Duration
  - Continuous operation (important capability / important for cost)
- Current
  - To be determined: this appears to be the variable to determine cost
  - Best would be to provide current up to maximum coil rating if budget allows

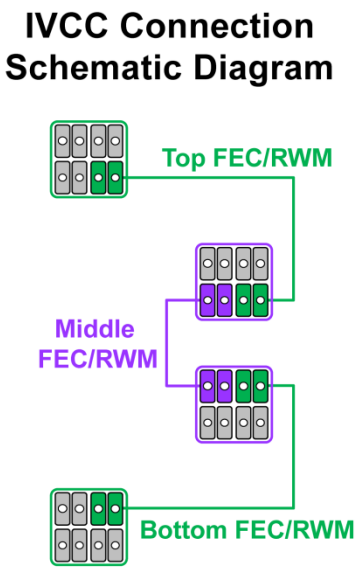
KSTAR SPA should support multiple physics tasks

Physics / control role	IVCC circuit / Power supplies used	Approx. freq	Approx. current (kA/t)
RWM active control	Middle (RWM PS)	1 - few kHz	~ 1 – 3
Active MHD spectroscopy	Middle (RWM PS)	~ 20 - 80 Hz	~ 0.8 – 1.0
“Fast” error field correction	Middle (RWM PS)	~ 200 Hz	~ 0.5
“Slow” error field correction	Bottom/Middle/Top (RWM PS, RMP PS)	~ DC	~ 0.5
NTV rotation profile alteration/control	Bottom/Middle/Top (RWM PS, RMP PS)	~ DC up to 1 kHz	~ up to 5
ELM mitigation/triggering /physics	Bot/Top (slow); Mid (fast) (RMP PS, RWM PS)	DC ~ 50 Hz (1–few kHz triggering)	~ 2.0 – 3.5 (triggering unknown)

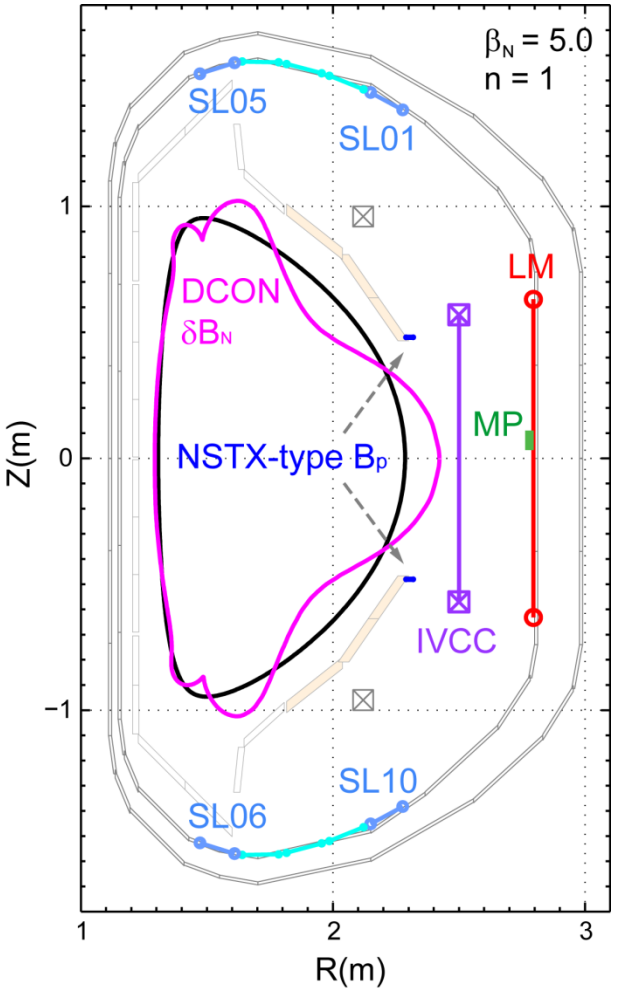
- Higher current needs of ELM and NTV could be supplemented by RMP PS and dedicated IVCC circuit in the near-term

Active n = 1 RWM control performance determined with 3D sensors





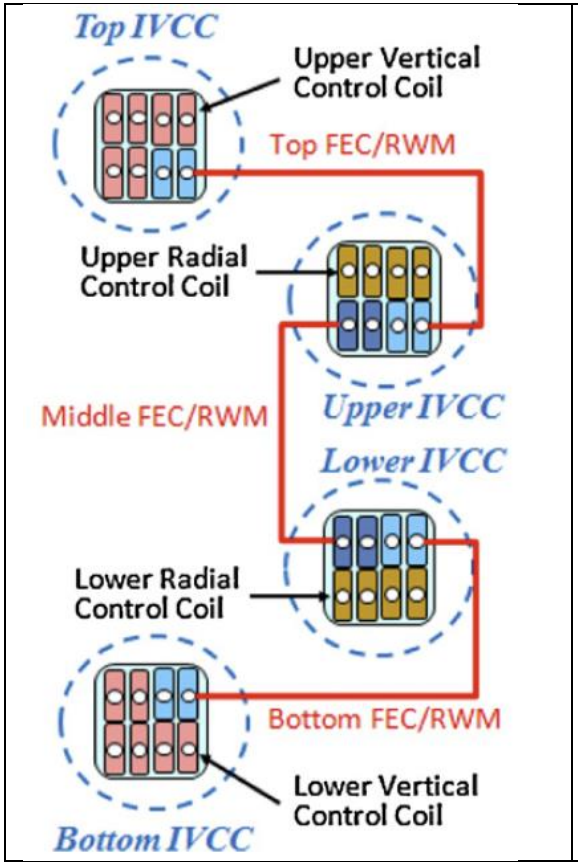
Sensor location and
n = 1 DCON eigenmode



- Study considered different sensors
  - Sensors presently available: (i) LM, (ii) SL, (iii) MP,
  - Possible new sensors: (iv) "NSTX-type B_P" sensors
  - RWM Control physics design paper:
    - Y.S. Park, et al., Phys. Plasmas **21** (2014) 012513

Extra slides

Possible IVCC circuit configurations discussed (Nov 2012 at NFRI)



Coil system	(present)	Options (turns)		
IVC	6	4	6	6
IRC	4	0	2	4
RMP	2	2	2	0
RWM (M)	0	2	2	2
RWM (T,B)	0	2	0	2
Total	12	10	12	14

Possible turn configurations discussed Nov 2012 at NFRI

- Other options possible – to be discussed/determined