

Plan for HPRF test

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Required item

to promote HPRF test with/without beam

- Approve safety requirement
- Radiation shielding plan
- Design diagnostic system
- Beam requirement & Run plan

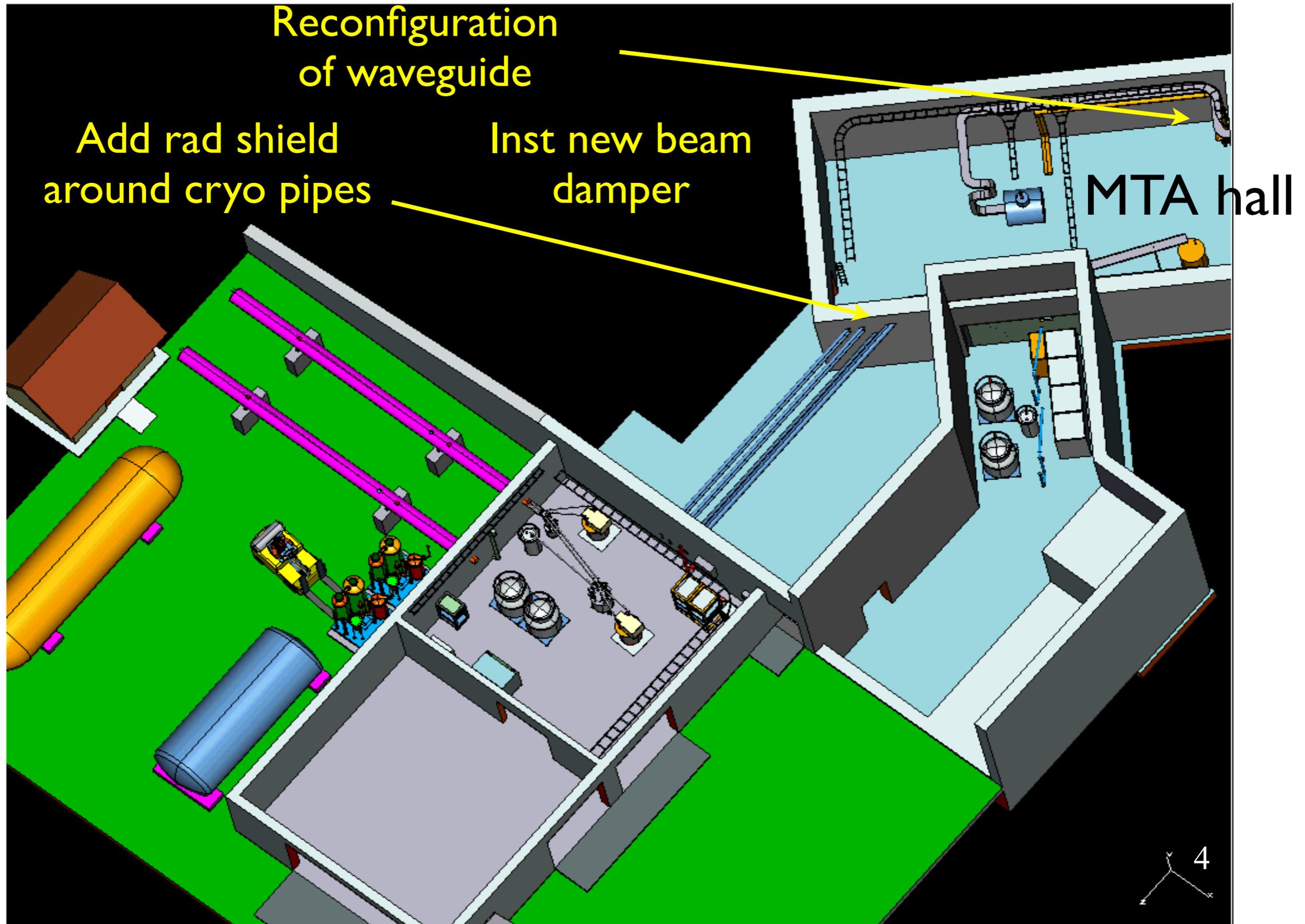
Safety requirement

(Radiation & H₂ safety)

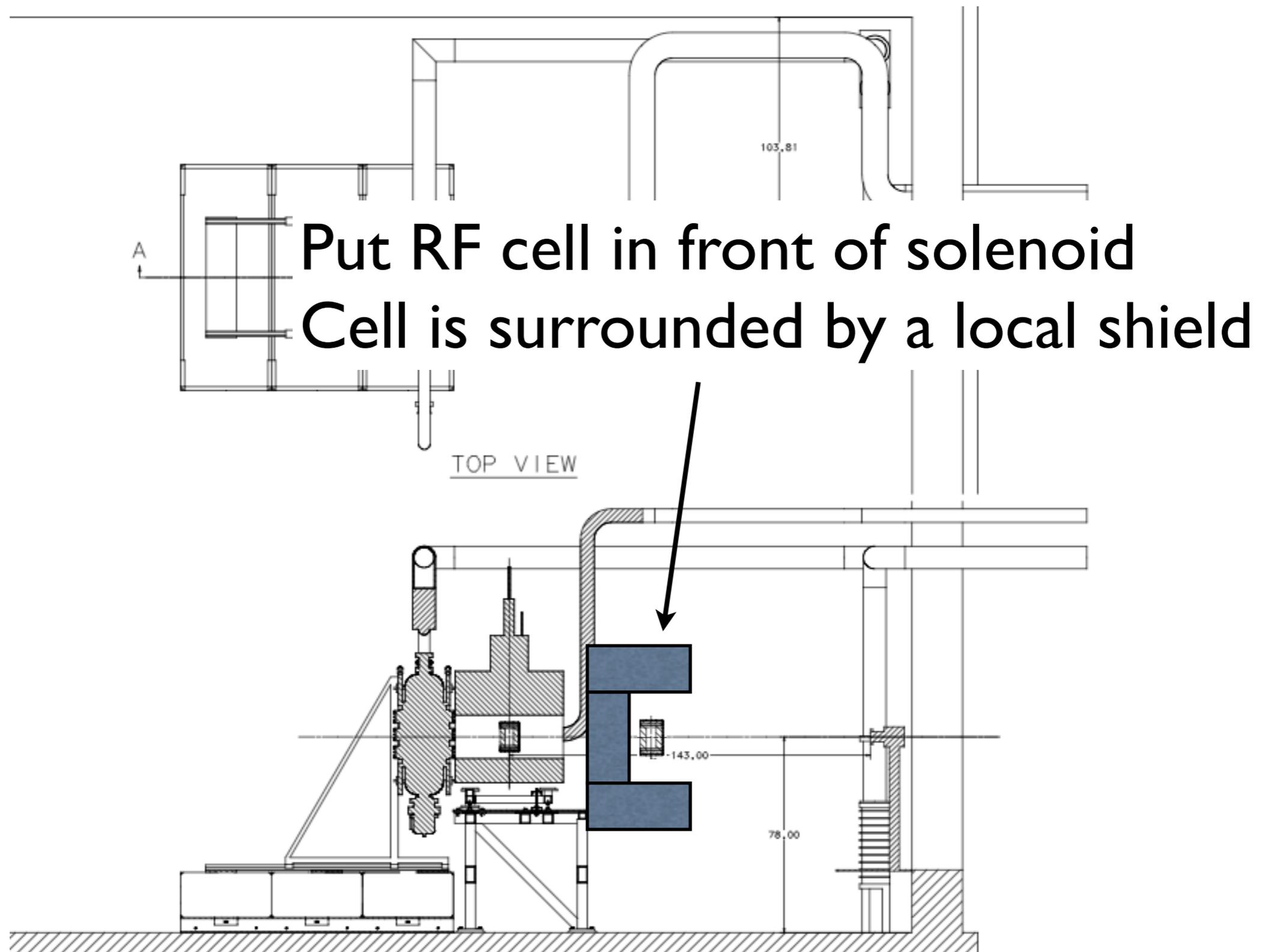
- Need radiation assessment
 - Submit to RSO & SSO
 - Require for each arrangement
- 15-ft rule for hydrogen safety
 - No ignition source within 15 feet

- Beam parameters
- Geometry of exp hall
- Equipments
- Run plan

Reconfiguration for radiation safety



Or, local radiation shielding



Permanent shield vs local shield

- May be cheap (and quick?) for local shielding
- May need to change shield configuration each time when we update cavity/run plan for local shielding
- Rad assessment is required for each shield configuration
- Need to approve 15-ft rule for local shielding
- Not be available to test with a magnet for local shielding

Permanent shield plan seems better

Diagnostic system

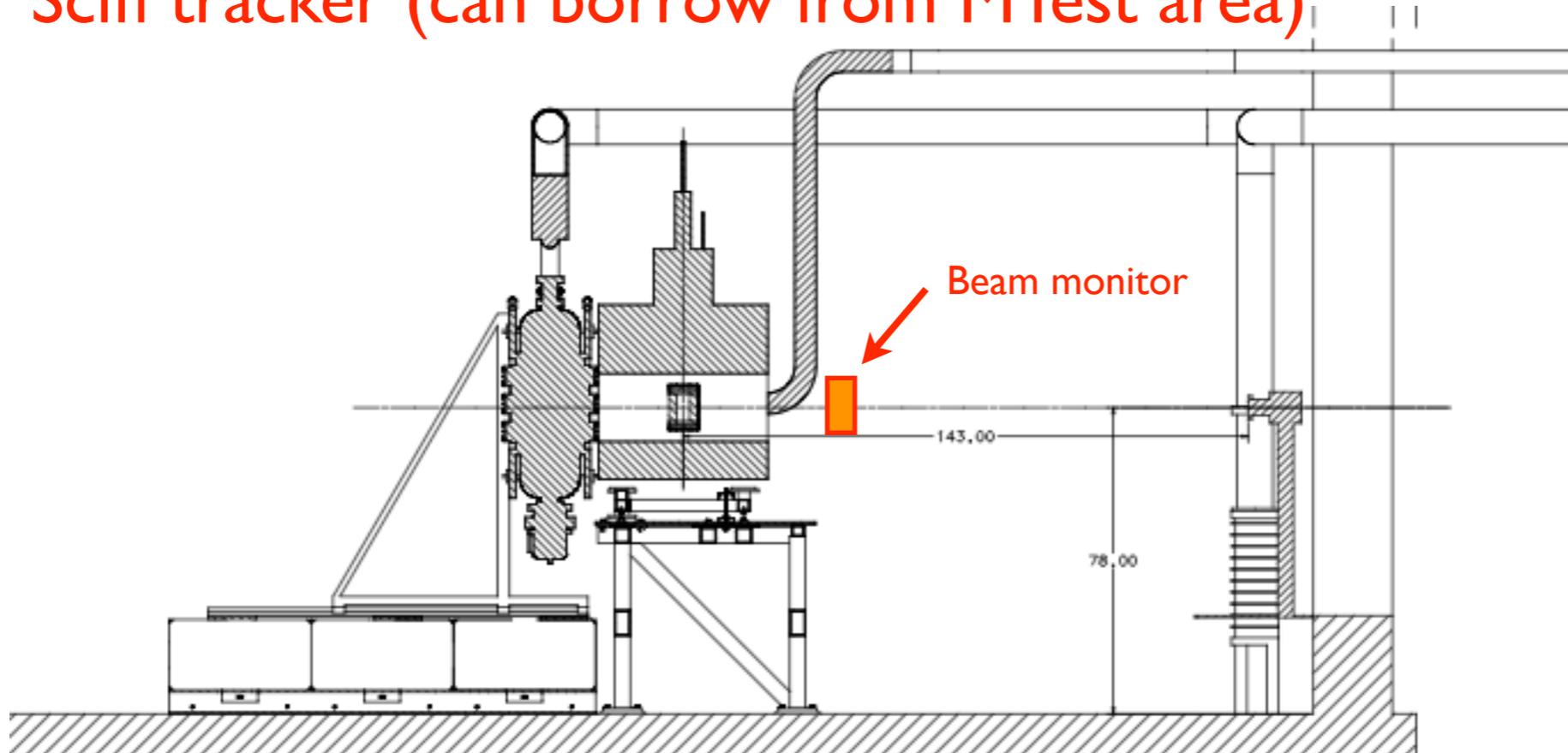
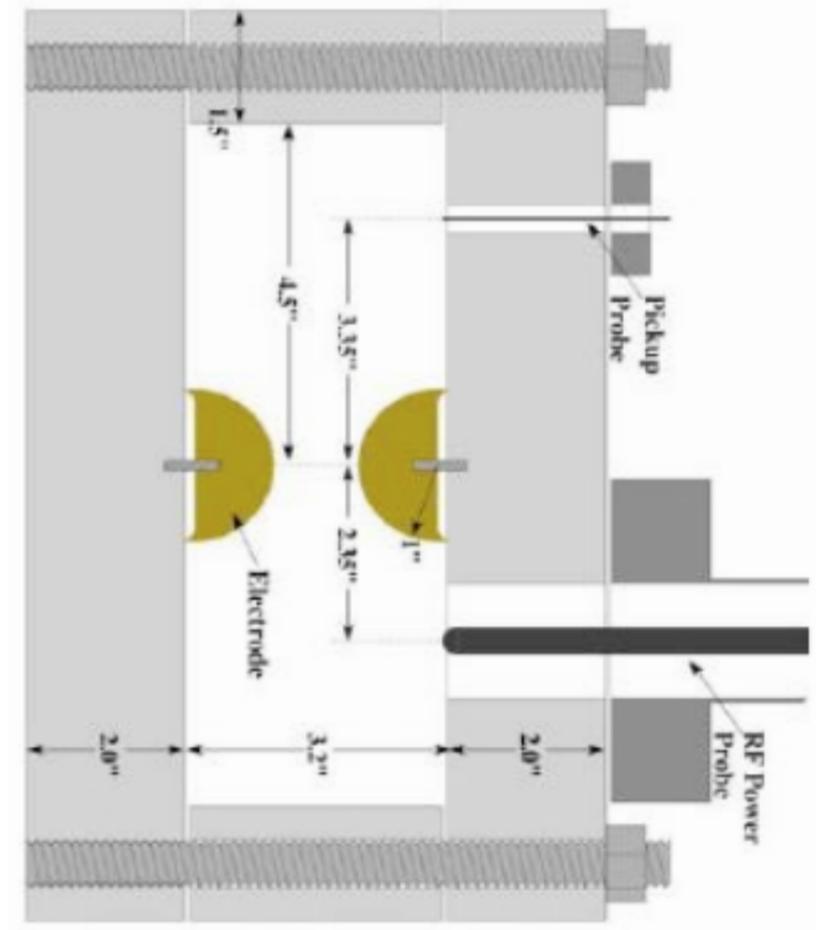
Goal in HPRF test

- Development of HPRF for Muon Collider
- Study gas/metallic breakdown mechanisms
- Improve RF structure for practical application

Instruments

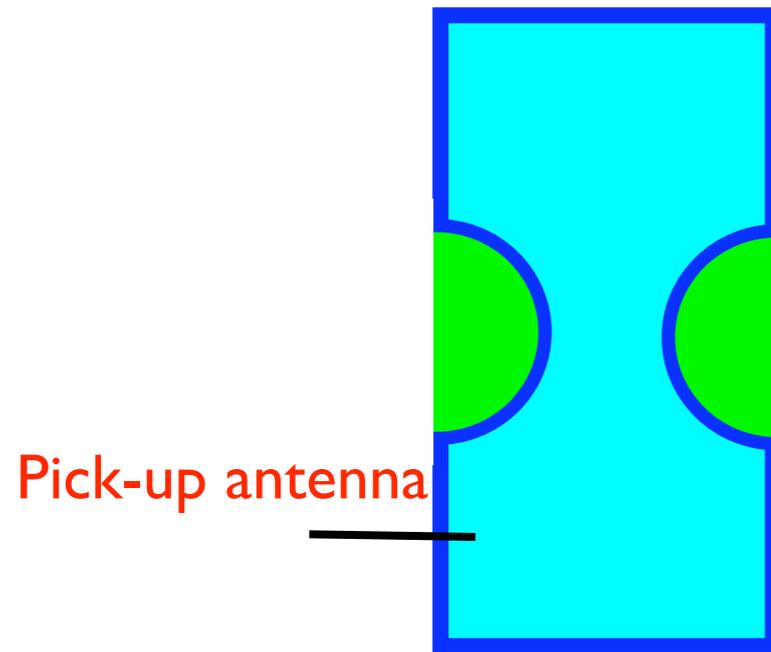
blue: existing, red: new

- Pick-up antenna
 - Need fast signal measurement to see microscopic structure of breakdown
- RF Power coupler (injection/reflection)
- Beam monitor system
 - Scifi tracker (can borrow from MTest area)

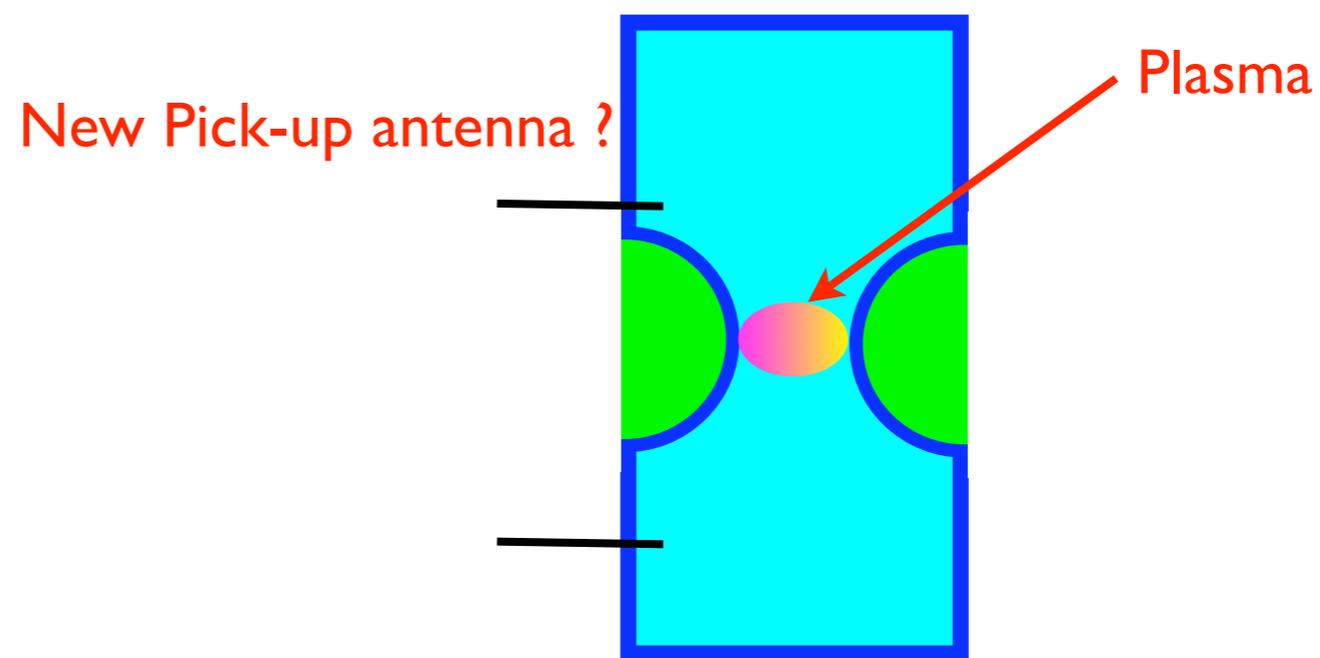


- Additional pick-up antenna

Cross-section of HPRF

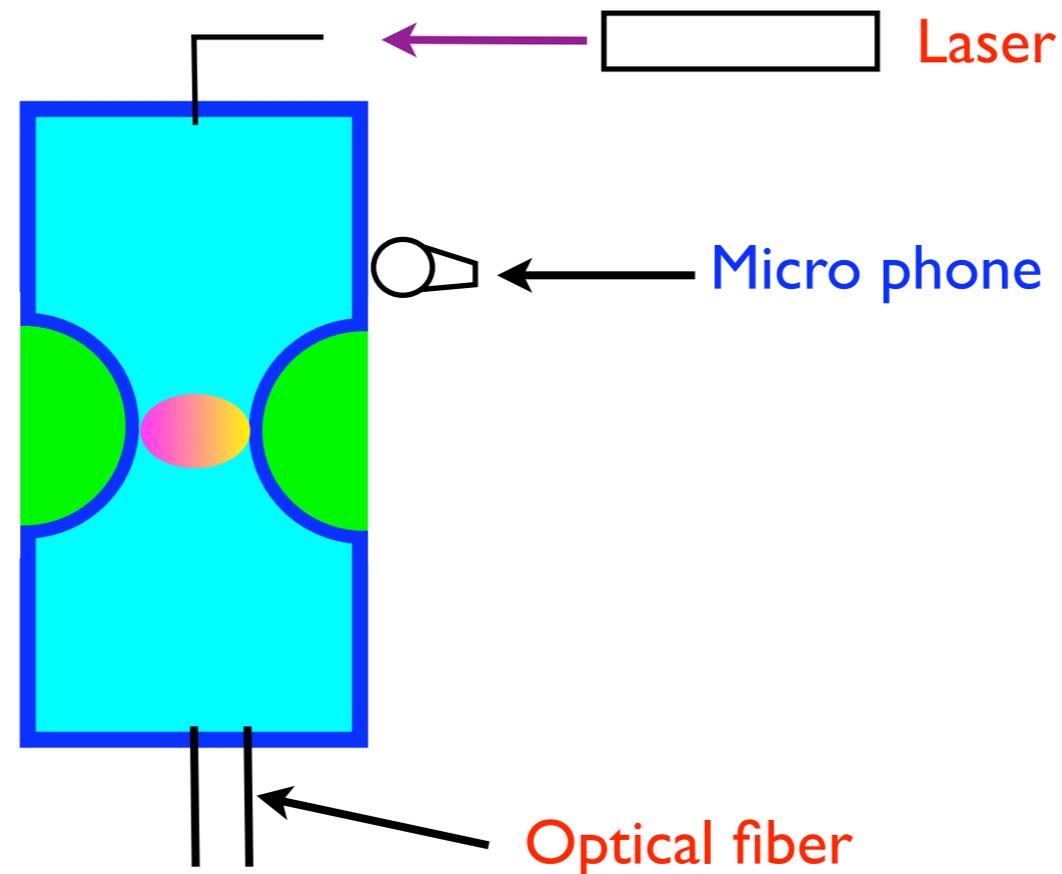


Cross-section of HPRF with plasma



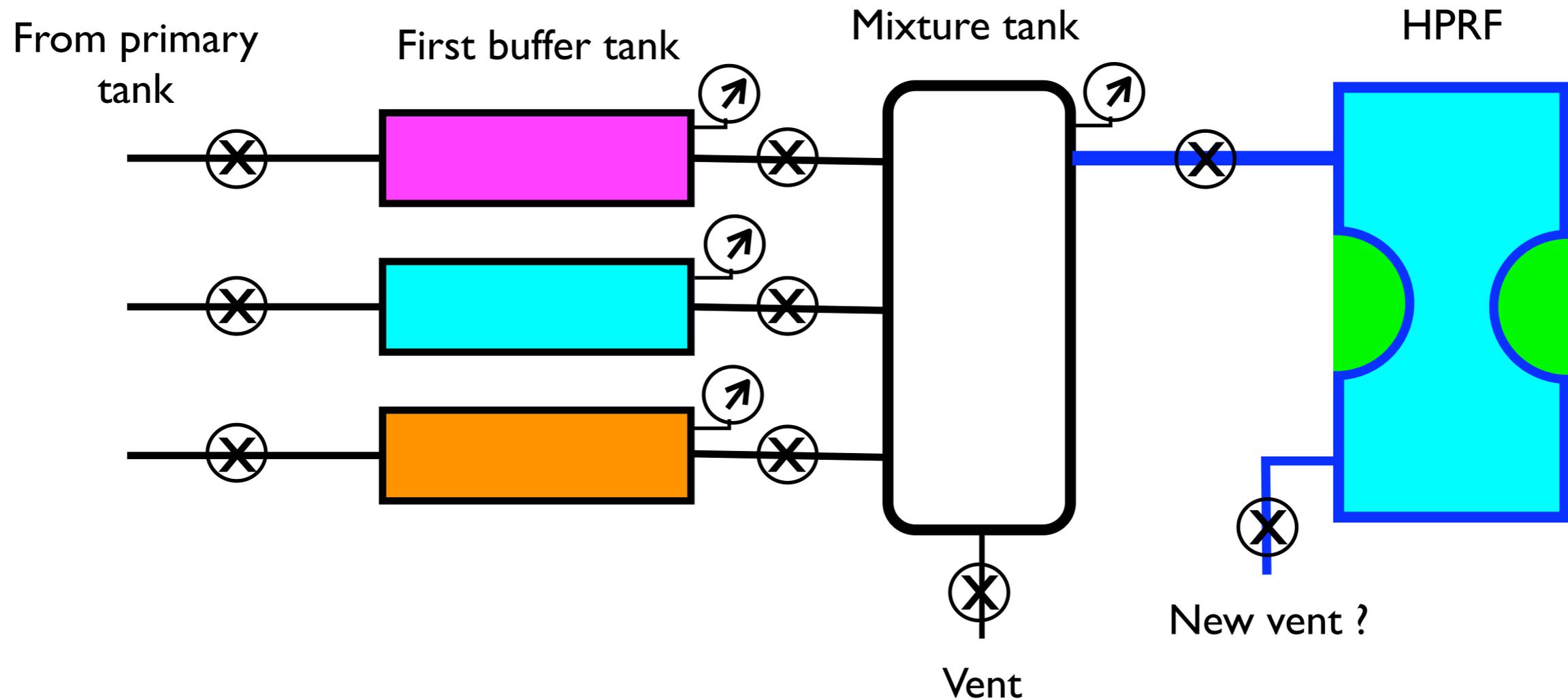
- A local field is observed by antenna
- Assume calibration is well-known
- Is calibration preserved with sufficient precision even with plasma?
- Does additional pick-up antenna help to estimate field?

● Optical & acoustic measurement



- Optical feedthru is available (use C fiber disk as sealing ferrule)
- Measure spectra inside RF cell
 - Ingredient of plasma (vapored metal? Hydrogen?)
 - Recombination rate (Hydrogen, H₂+dopant)
 - Thermometer (commercial product available)
- Interferometer to measure refractive index to study plasma
 - Depends on the plasma density, need more study

● Gas mixture system



- Required precision of pressure control 10^{-4}
- Dopant gas (ex. SF₆, N₂, etc) is heavier than H₂
→ Do we need a regulation system?

Run plan

- Beam intensity dependence
 - Minimum intensity = 10 bunches (~ 50 ns, $\sim 10^9$ p)
- Gas density & dopant dependence
- Magnetic field dependence
- New cavity