



## *MICE CM37*

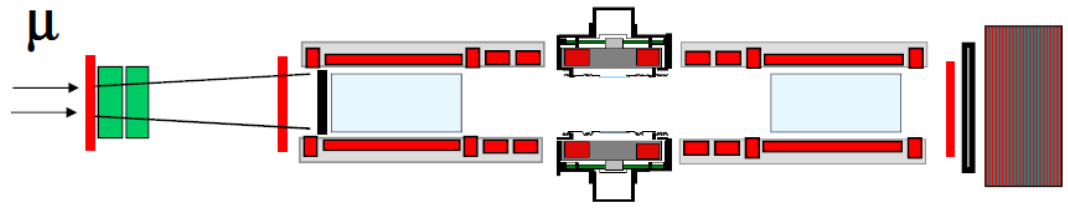
### *Step IV Operations: logistics*

- *An open question?*
- *Absorber changing*
- *Other stuff*

*Andy Nichols/Steve Watson STFC, 8/11/13*

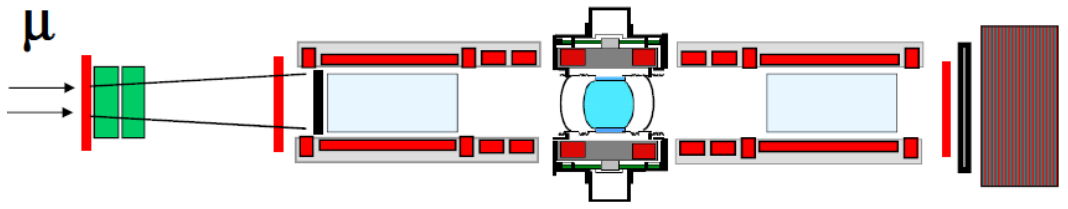


# STEP IV EXPERIMENTS (2015-2016)



**STEP IV**

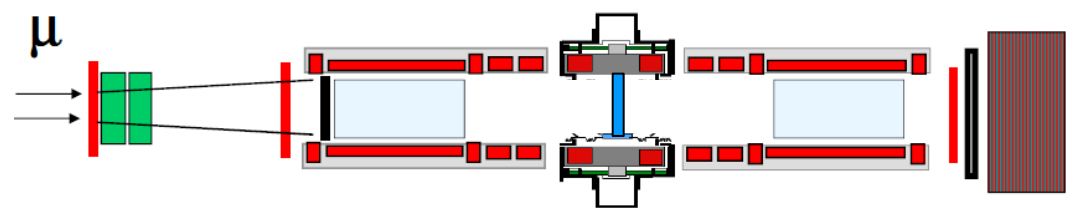
No absorber  
Alignment  
Optics studies



**STEP IV**

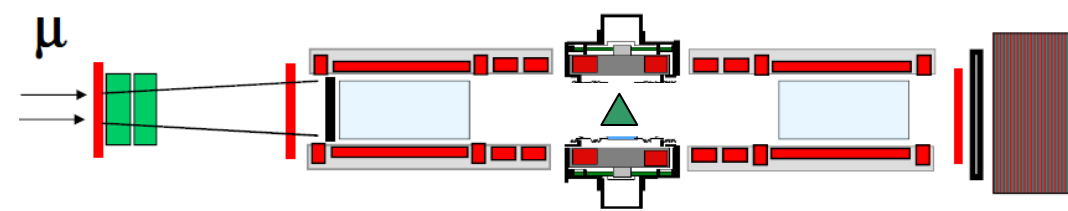
Liq H<sub>2</sub> absorber  
(full/empty)

Multiple scattering  
Energy loss  
→ Cooling



**STEP IV**

Solid absorber(s)  
LiH  
Plastic  
C, Al, Cu



**STEP IV**

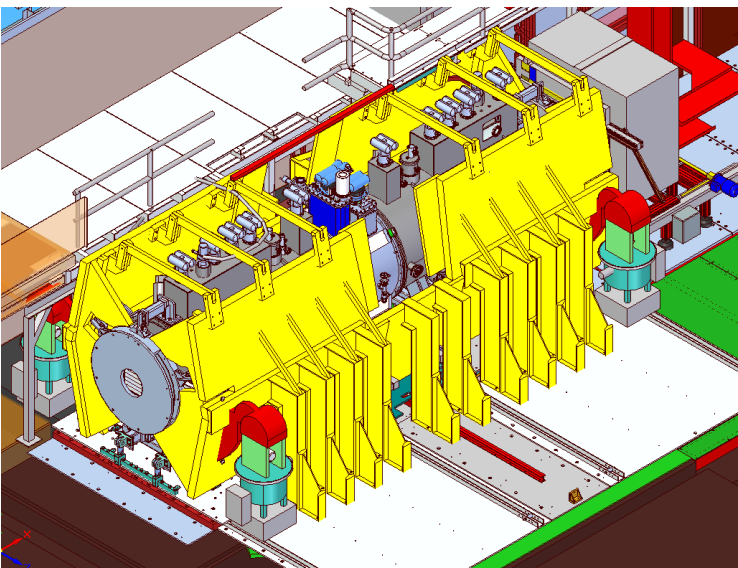
LiH Wedge absorber  
Emittance exchange

# An open question?

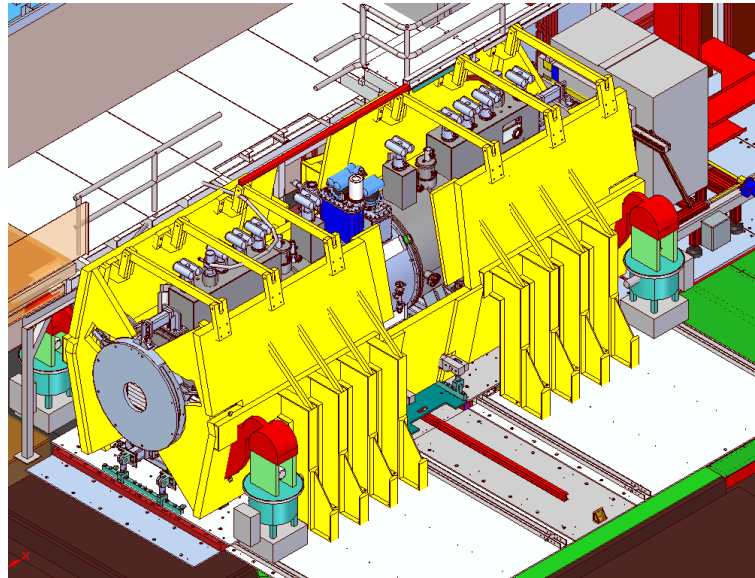


- *Commissioning of the liquid hydrogen system will take around six-eight weeks*
- *It obviously needs to start with the liquid absorber in place*
- *The Technical Board had agreed that the first MICE Step IV run would be with an 'empty' absorber, but with a fully assembled LH2 delivery system so the beam only sees the windows*
- *This way we can use the run up to Feb 2015 in commissioning the LH2 and integrating it with the PRY*
- *I believe this is what's in Alan's big plan*
- *If we have to run completely empty channel first, then dismantle the PRY and fit the absorber, we'll need more time – probably more than six-eight weeks*
- *Both options are equally technically viable of course, but there is a schedule consideration.....*

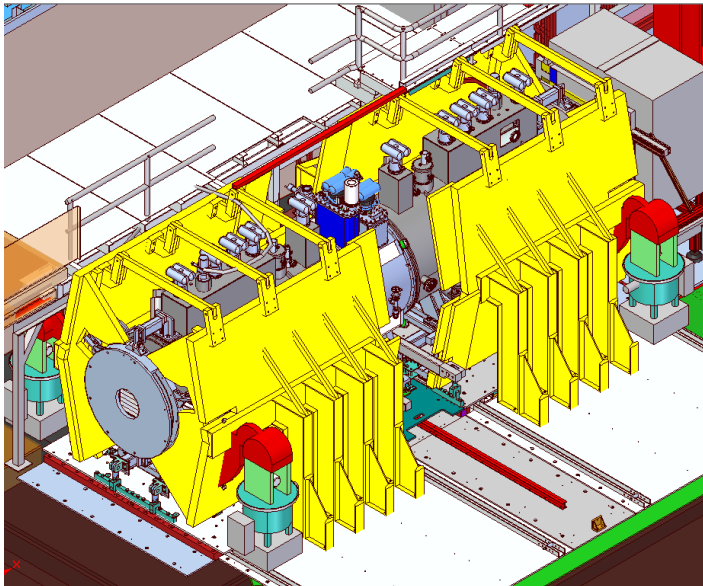




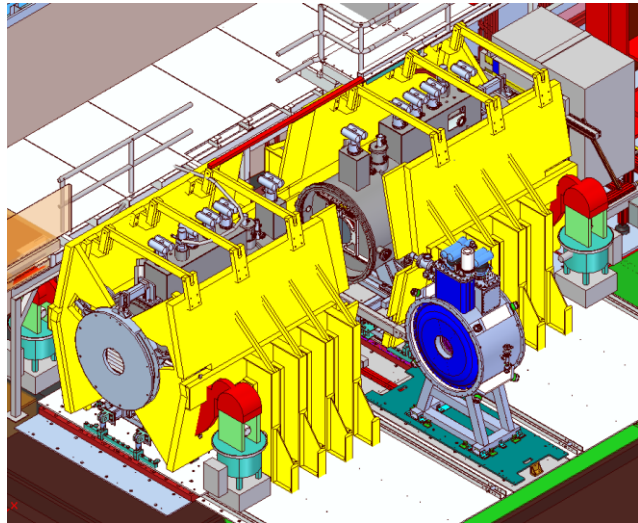
- Remove upper outer doublers & north middle-upper plate



- Remove middle legs



- Slide out north middle-lower plate



- Uncouple bellows between AFC & SSs [1 day]
- Remove AFC [0.5 day]
- Change Absorber [? day TBD]

[1 day] (for north side middle plates)



## Absorber changing in general

- *This discussion has punctuated my entire tenure as Project Manager!*
- *It's a little more difficult now that we have the PRY, but Jason and Steve Plate have a mechanical solution (presented yesterday). My only plea is that the installation schedule is conservative and allows float for:*
  - *Bellows that are inflexible*
  - *Bolts that get dropped*
  - *Joints that leak*
  - *Holes that do not line up*
- *Believe me, they will all happen to us!*
- *Steve W has come up with some time estimates that may or may not be in the schedule yet:*





## To decommission hydrogen absorber mid-Step

### IV:

- Boil off LH2 and warm up hydrogen turret/absorber with heater - 4 days
- Pump out hydrogen from entire system and blanket hydride bed with argon - 2 days
- Let up hydrogen insulating vacuum to nitrogen - 1 day
- Remove hydrogen transfer line, insulating vacuum line and pumping manifold - 2 days
- Remove FC end cap, disconnect internal pipework/sensors, remove absorber - 2 days
- System ready for installation of solid absorber

*Eleven days to de-commission the LH2 system*



## To commission hydrogen absorber mid-Step IV:

- Remove solid absorber
- ?
- Insert absorber into FC
- 1 day
- Make hydrogen pipework indium seals
- 3 days
- Install end cap and move FC into beamline
- 2 days
- Install hydrogen transfer line, insulating vacuum line and pumping manifold
- 2 days
- Pump hydrogen insulating vacuum (includes absorber MLI)
- 10 days
- Leak test hydrogen pipework with helium
- 2 days
- Cool absorber
- 10 days
- Charge hydride bed with hydrogen
- 1 day
- Liquefy hydrogen
- 3 days
- System ready for operation

*Thirty-two days, excluding interaction with the PRY  
Hoping this is done in the pre-Feb'15 run-up*



## My recommendation.....



- ....is that we explicitly define a rehearsal of the absorber changing routine as part of the pre-August '14 build.
- We have most of the stuff:
  - *The liquid absorber, but no windows*
  - *No solid absorber, but a dummy is easy to make*
  - *We have the solid absorber support gear*
  - *We have bellows, but the holes need re-drilling*
  - *We have something of a PRY mock-up, but more work needed*
- *If we did this, we could lay this discussion to rest and then make a good foundation for the Step IV run-plan*

