Mercury Delivery System Issues

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Targetry Teleconference

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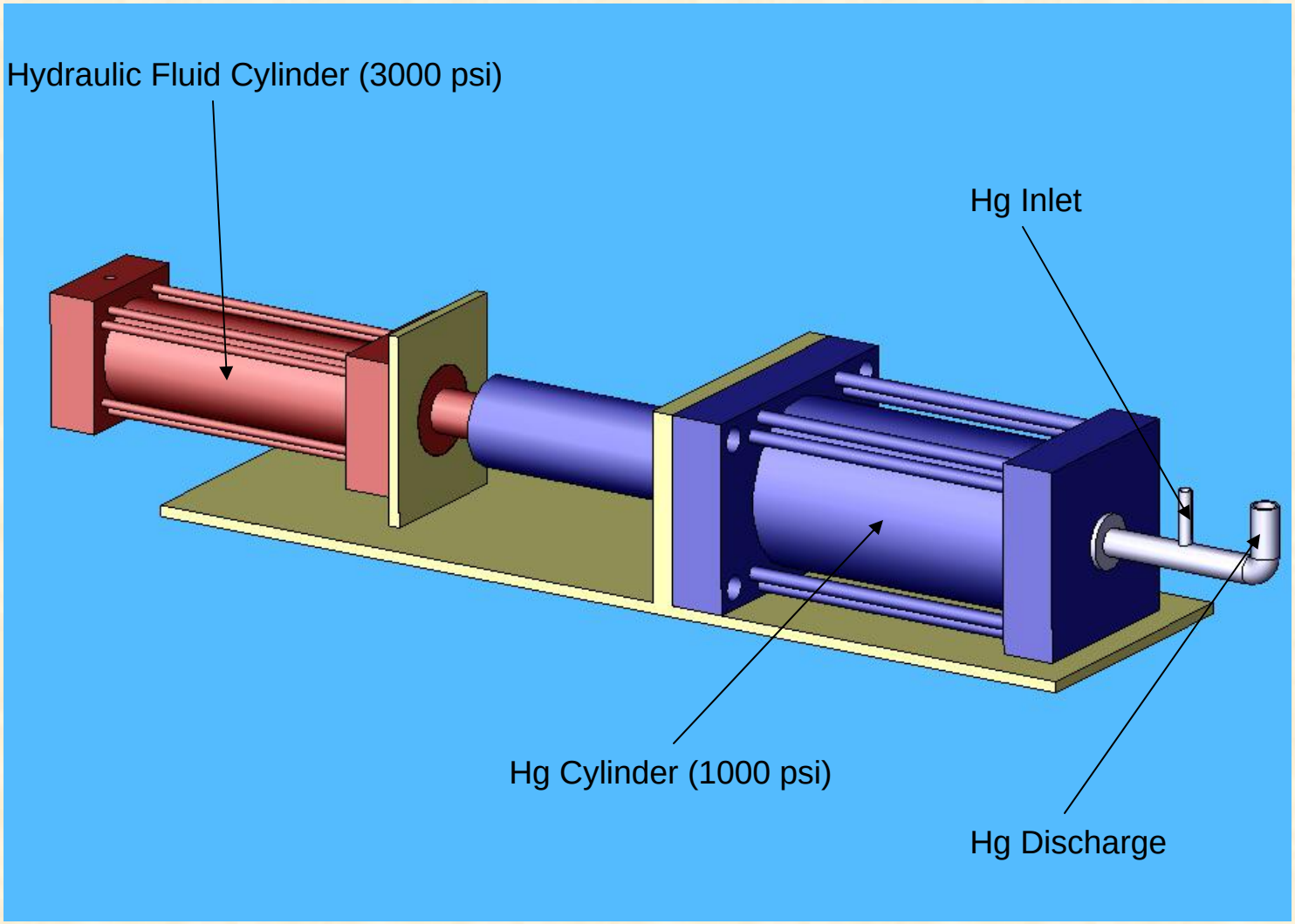
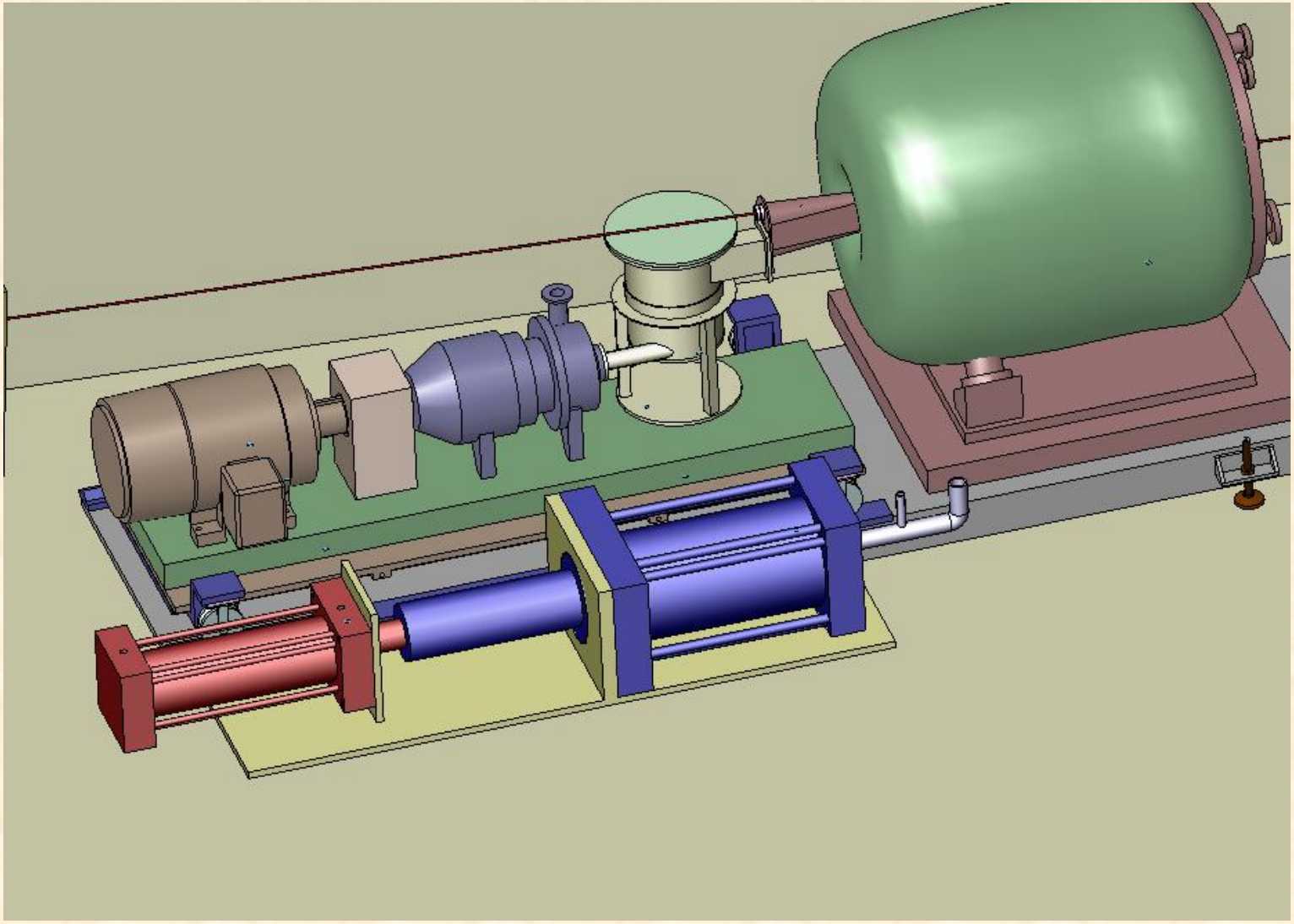
Pump Heat Issues

- **Per centrifugal pump vendor**
  - **Pump efficiency 23%**
  - **Heat energy into mercury is 40.5hp (30kw)**
    - **With Vol=12liter, ΔT=2.4°F/sec (1.3°C/sec)**
- **Possible solutions**
  - **Increase Hg volume (ΔT decreases linearly with Hg mass)**
  - **Add heat exchanger for system testing**
    - **Perhaps not needed during CERN tests**
  - **Investigate alternative Hg delivery systems**
    - **Experiment lends itself to non-continuous flow approach**

Mercury Syringe Concept



Syringe Layout



Syringe Performance Benefits

- **Piston-driven jet is unaffected by pressure drops in downstream piping**
  - **Nozzle/piping changes will not affect Hg delivery ability**
  - **Jet characteristics should be identical in both high field & no field conditions**
- **Piston will be nearly 100% efficient**
  - **No significant heat imparted to Hg by piston**

Other Benefits

- **No heat exchanger required**
- **Syringe design may be smaller than shown, depending on Hg volume required**
  - **25gpm -> 50 liter for 30sec, 25 liter for 15sec**
  - **Concept shown is for 30sec jet**
- **Lower power requirements**
  - **Initial vendor discussions estimate 20hp**
- **No added controls issue with this approach**
- **Initial estimate indicates syringe cost may be much less than pump system, esp. if non-stainless cylinders can be used**

Hg Delivery System Comparison

Attribute	*Pump*	*Syringe*	*Attribute*	*Pump*	*Syringe*
Continuous Flow	√		**Size**		√*
Hg Inventory	√*		**Power Requirements**		√
Piping Loss Effects		√	**No Heat Exchanger**		√
Jet Consistency In/Out of Field		√	**Controls Complexity**	--	--
Hg Temp Rise		√	**Cost**		√
Magnetic Field Effects		√			

* Depending on design

Basic Questions / Issues

- **Jet duration directly affects required Hg volume**
  - **Initial sizing based on 30 sec jet**
  - **15T field duration is only 1 sec**
- **Hydraulics in tunnel**
  - **What fluids are acceptable (flammability)?**

Recommendations

- **Change baseline Hg delivery system to hydraulic cylinder**
- **Set required jet duration to 10-15 sec**