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TRACI

- **Development in AIDA framework together with interested partners.**

- Nikhef & CERN lead development with engineering support of the Cracow University of Technology.
- New partners have joined to boost development
 - INFN Milano (It)
 - Oxford University (UK)
 - Sheffield University (UK)
 - Liverpool University (UK)
- Co-funding from clients
 - Atlas, CMS, LHCb, KeK



- **Development goal:**

- A small transportable unit for general CO₂ R&D.
- User friendly (no expert needed)
- Simple to use and cheap to produce.
- Broad operational range
 - From room temperature 20°C to -30°C
 - Several hundred watts cooling power

- **Possible commercial spin-off**

- CERN-Nikhef shared patent
- Ongoing market survey



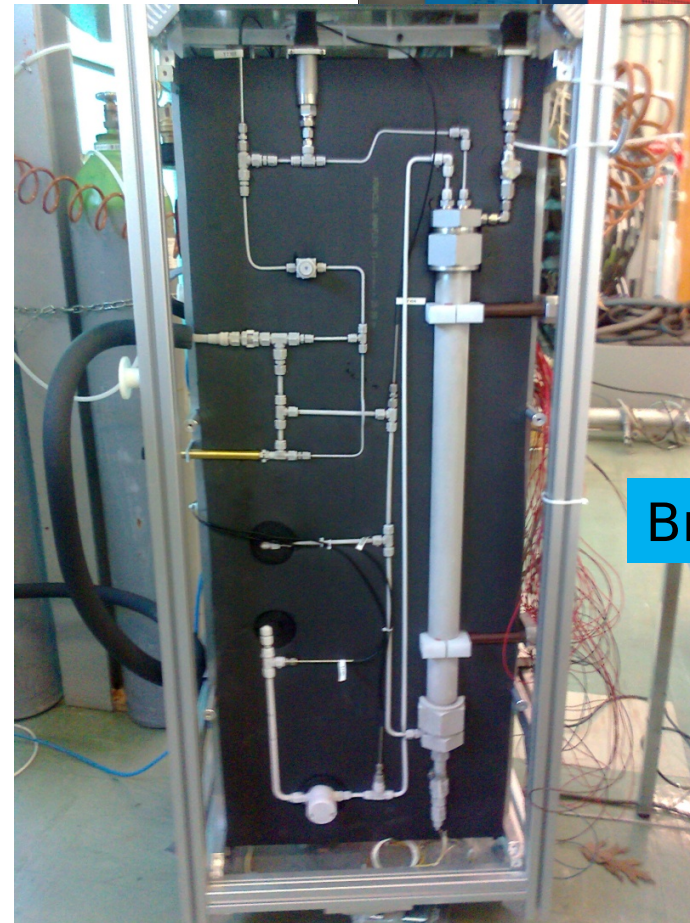
TRACI-1a
(LHCb)



TRACI-2
(Uni GVA, CMS, KeK)



TRACI-1b
(Atlas)



Brrrrrrr!

- **Portable** laboratory cooling unit
- Cooling power 100 to 250 W
- Temperature range -40 to +20 C
- **Turn key**
- Very simple to operate "**fridge like**"

- Several prototypes have been built
 - Traci-1 (3x)
 - Atlas SR1, for IBL stave R&D
 - LHCb-Velo for Micro channel R&D
 - Traci-2 (2x)
 - University of Geneva, for IBL stave production tests
 - CMS-Pixel, for sensor R&D
 - Traci-2a (1x)
 - KEK, A modified Traci-2 with a different pump for ILC-TPC R&D
 - Traci-3 (1x)
 - AIDA cooler will be one of these
 - Development prototype, improved control system based on PLC
 - Improvements will be made towards serial production
 - Development together with new partners, Liverpool, Oxford, Sheffield and Milano
 - Focus on improved pumping concept

Traci challenge: How to find a reliable pump?

- CO2 is a problematic fluid to pump
 - Very low viscosity (15% of water)
 - Limited or no lubrication
 - Low pumping efficiency
 - High system pressure
- Currently using Gather gear pumps
 - Long duration use of current Tracis show short and variable life times
 - company not willing to help solving the problems
- Exploring different new pump options
 - HNP pump (2 types)
 - 3m pump
 - Lewa pump (LHCb style)
- LHCb pump with excellent track record too big for small systems.
 - Being installed in KEK system, but performance degradation at colder temperature: less cooling power

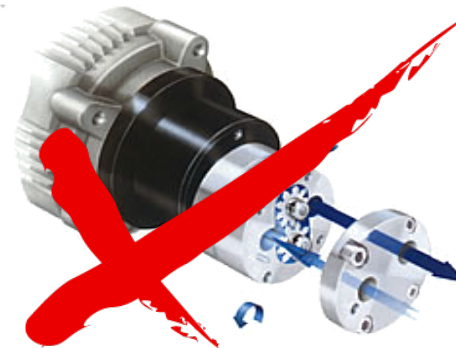
Small HNP pump



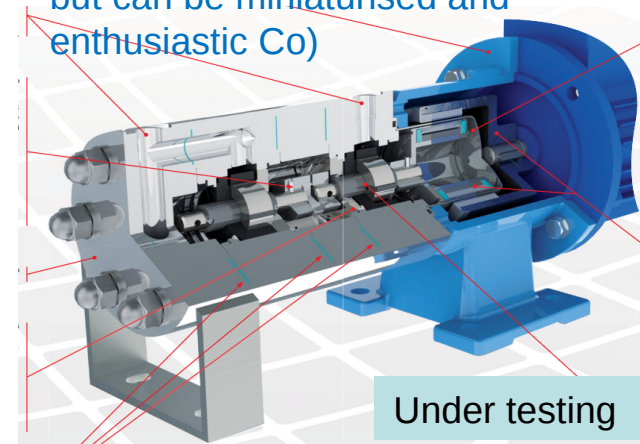
Purchased for testing



Larger HNP pump:
More than enough capacity
On loan for test (expensive)
Can buy if wanted

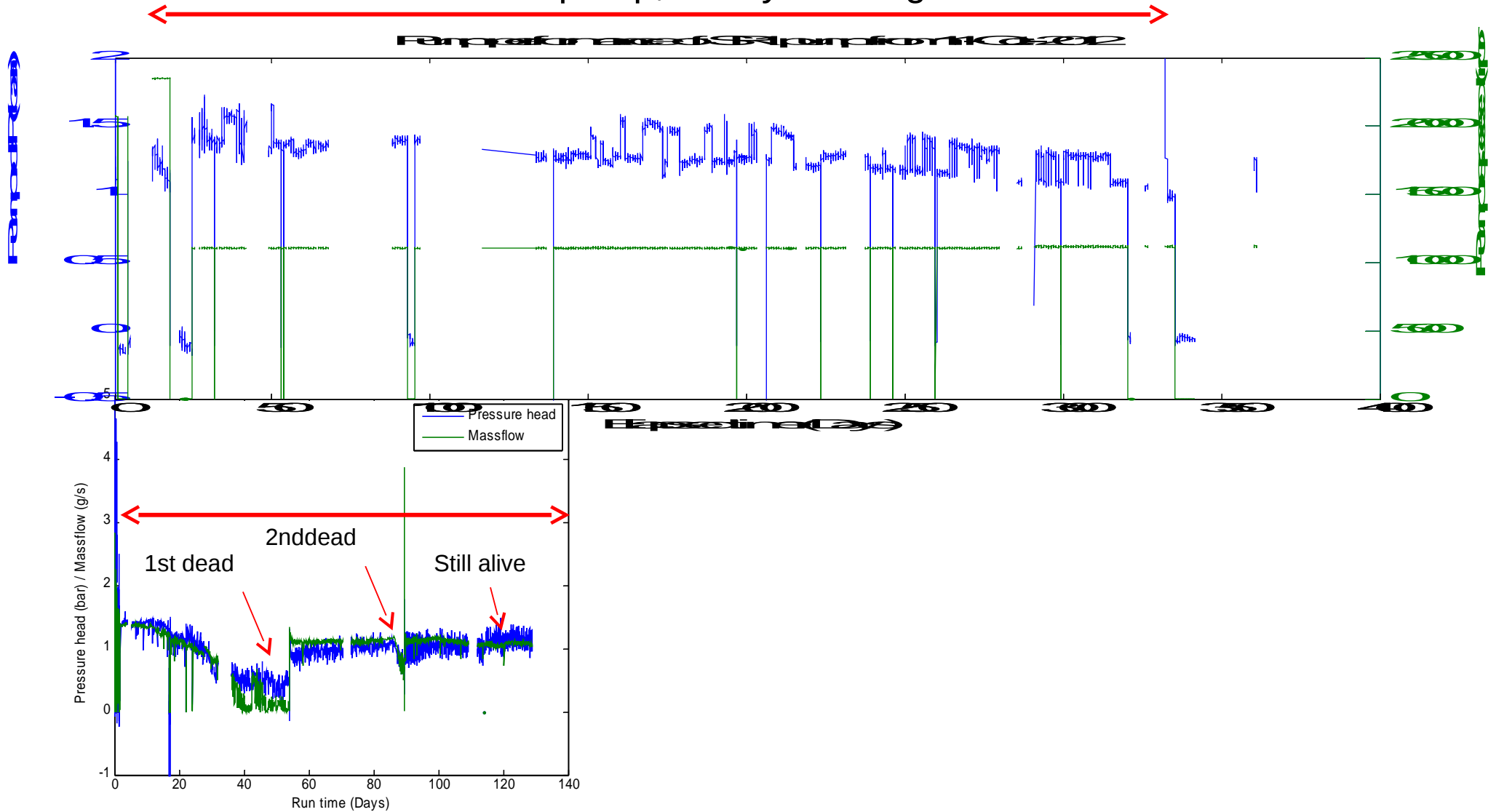


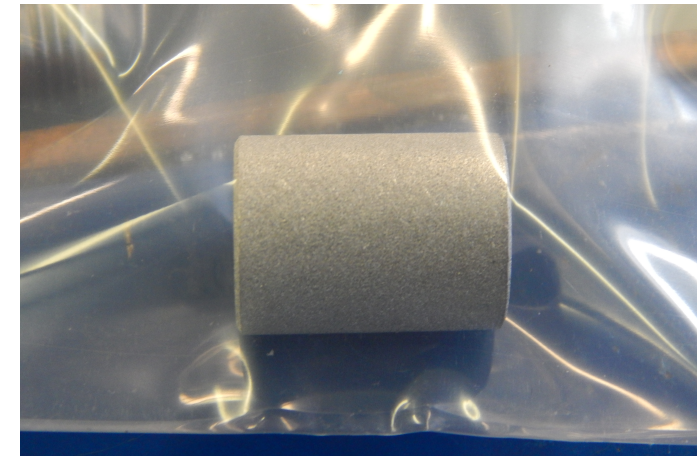
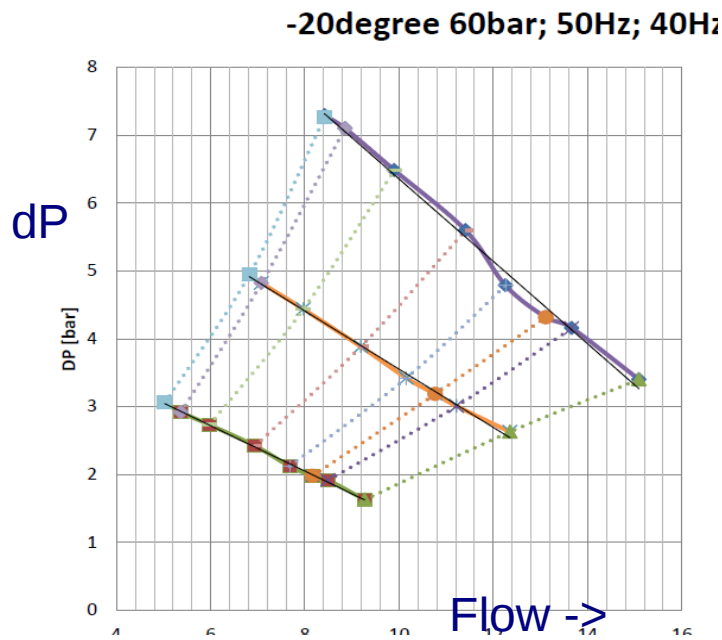
Mpump also under study
(Too big for a small Traci
but can be miniaturised and
enthusiastic Co)



Under testing

Atlas-SR1 1 pump, slowly wearing out

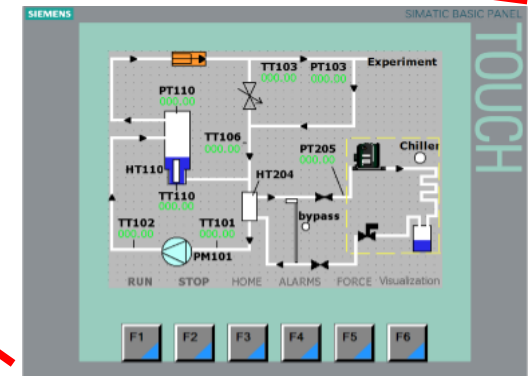




Pump test stand for endurance tests

Filters clean after ~350 hrs operation
 Ceramic high precision gears seem to last
 Pump characteristics are good, at max. speed (6000 rpm) it delivers enough.
 But do we want to run at max. always? ... the larger HNP pump will be more in its comfort zone
 AIDA cooler will initially be fitted with larger HNP pump, tested
 If necessary switch to some other pump eg small HNP

Old concept of Traci-1 with push buttons



Traci-3 design with PLC and touch screen operation

- Rack is completed at CERN with control electronics and chiller
- Nikhef will build cold box:
 - Foam insulated box with all pressureised piping, accumulator etc.
 - Drawings almost final from Milan
 - Most components at CERN; ship to Nikhef and order the rest soon
 - Initially with HNP larger pump
 - Hope to start assembly in May; ~6 weeks
- Integrate cold box with Traci at CERN
 - Commission at CERN (Summer student project?)
 - If unfortunately larger HNP pump is not OK, we have to change pumps
 - Ready for test beam in Oct.

