

Industrialization of Electropolishing (EP)

D.Proch, DESY

- EP is the preferred cleaning method for superconducting Nb resonators (besides Buffered Chemical Polishing, BCP)
- There are experimental type EP installations in several laboratories
- **Worldwide there was only one industrial EP facility at Japan (Nomura plating)**
- EP activities in CARE:
 - Optimize EP parameters (DESY, Saclay, INFN Legnaro)
 - Transfer EP technology to industry
 - Develop quality assurance methods (QA) for EP

Electro-chemistry of EP

- Oxidation



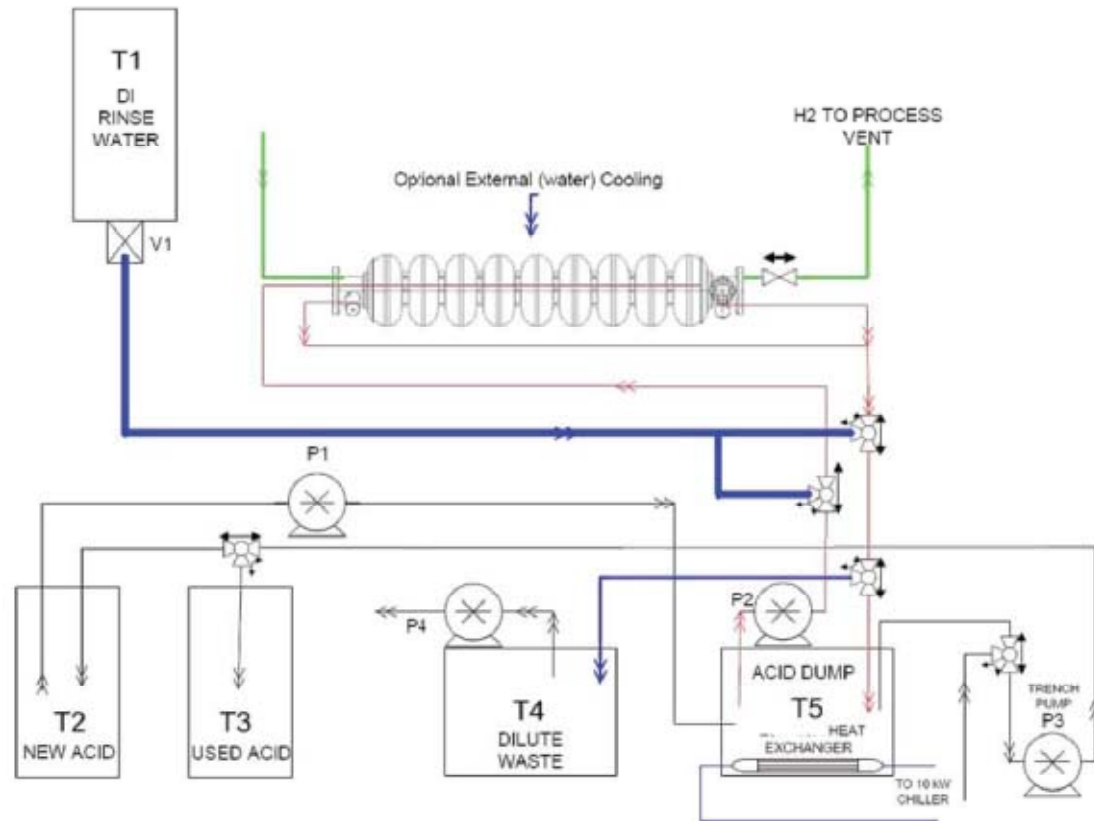
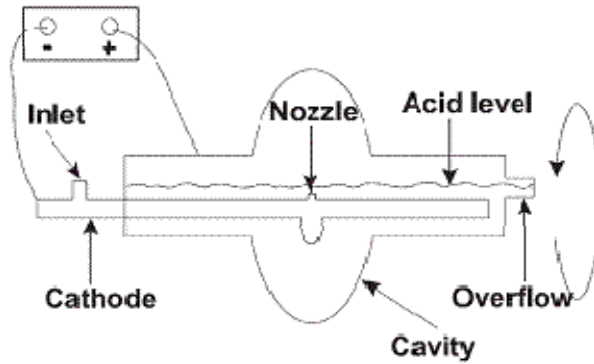
- Reduction



- Important:

- HF is a very toxic acid!!!
- Hydrogen gas is produced

Principle arrangement of EP

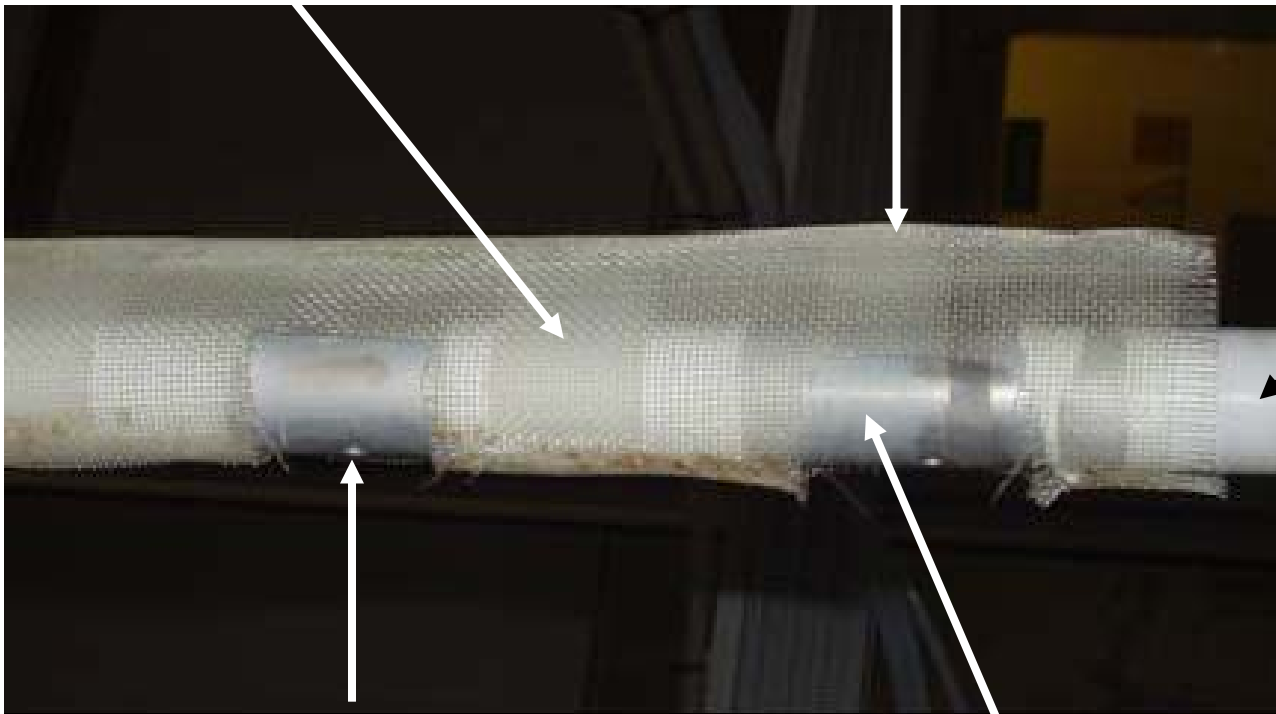


New EP electrode at DESY EP

PE spacer holding the
TEFLON Nitrogen overlay tube

PTFE net covering
the electrodes

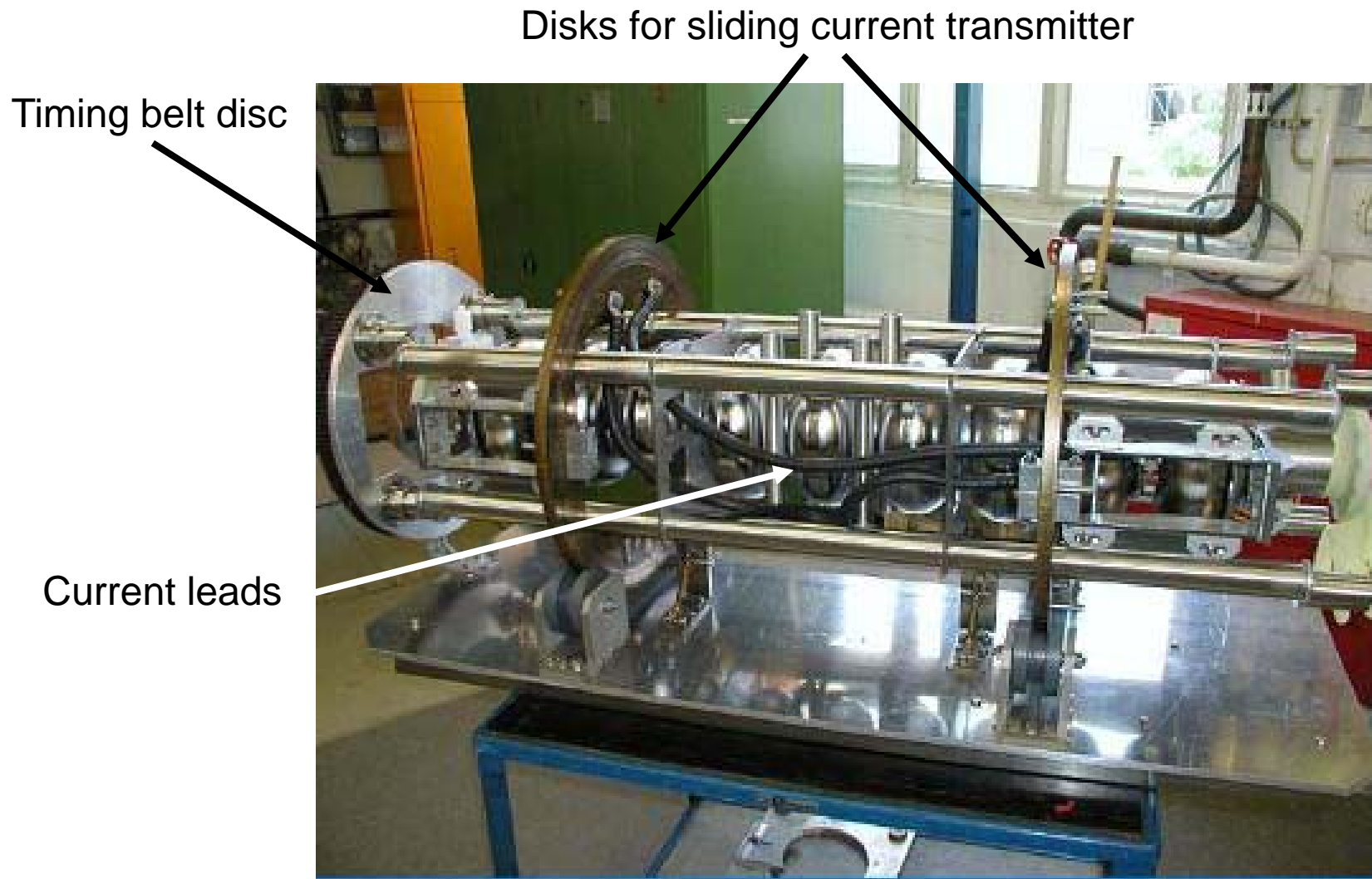
Teflon insulator
covering the
electrode in the
beam tube area



Acid injection hole
on top of the cavity equator

Al cathode

Details of the EP mechanical frame



Cathode feed trough at the beam pipe flange

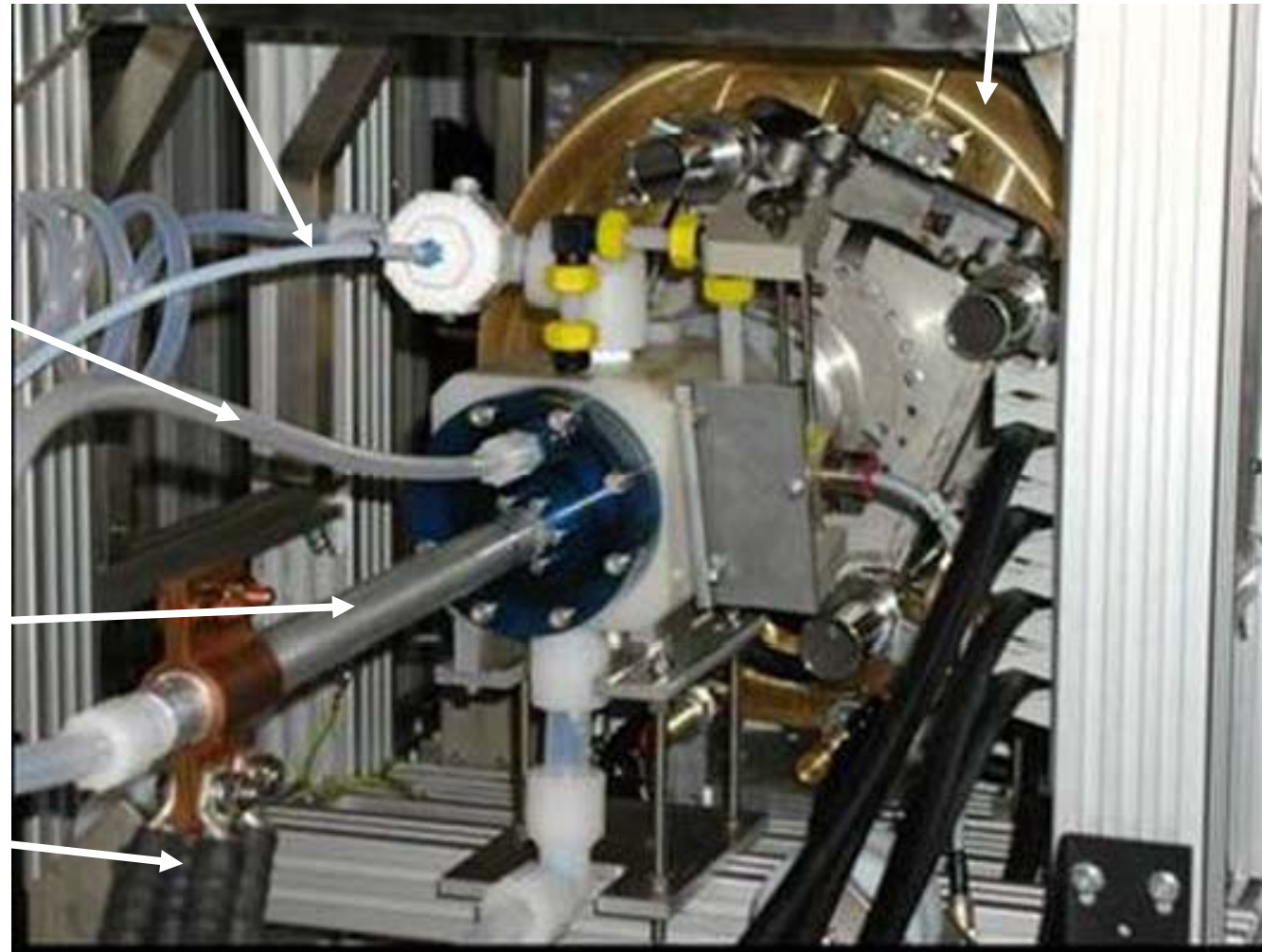
Gas outlet towards exhaust cleaner
(nitrogen, hydrogen and evaporated HF)

disc for sliding
current transmitter

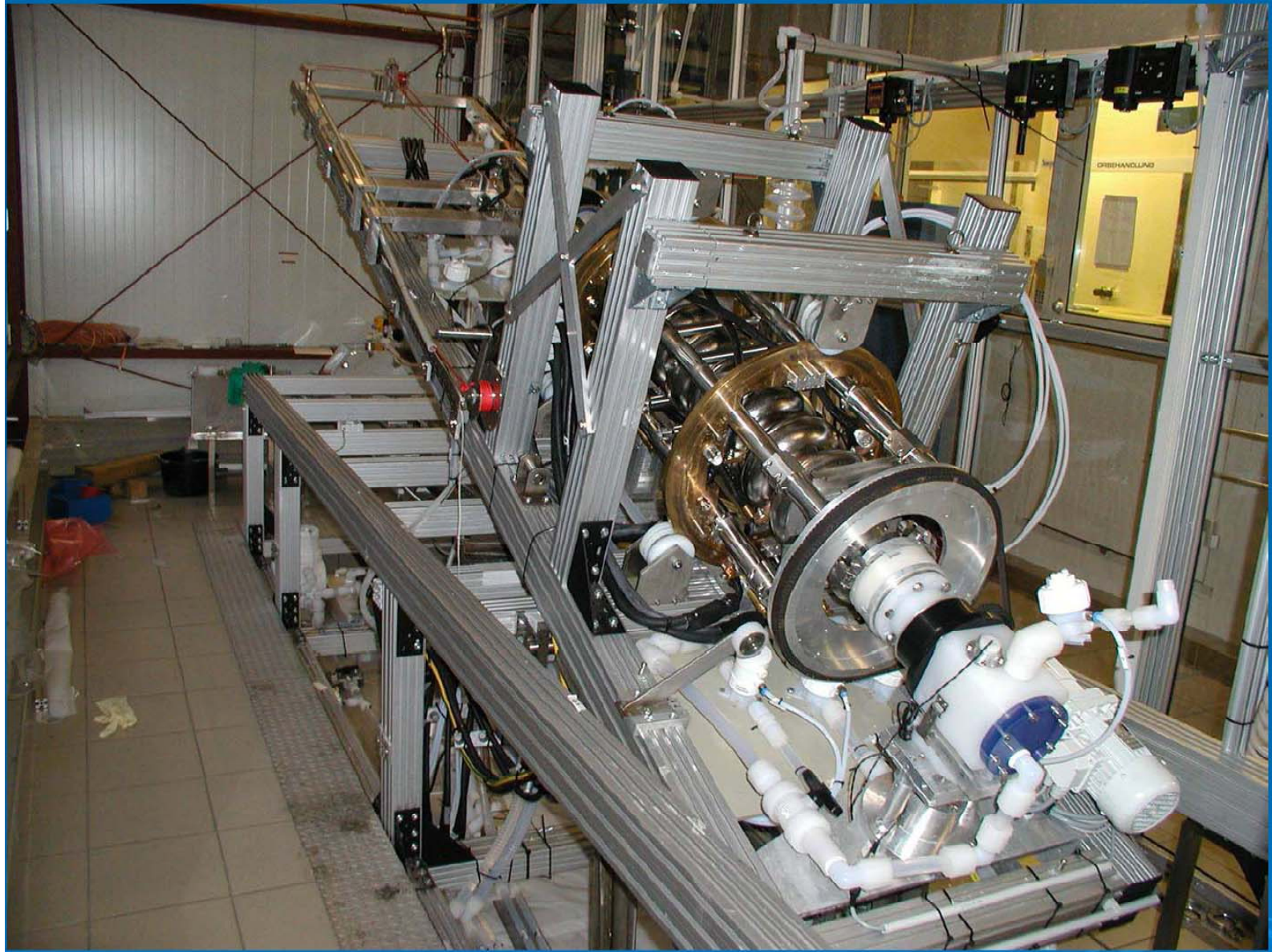
Nitrogen overlay
inlet pipe

alumina electrode

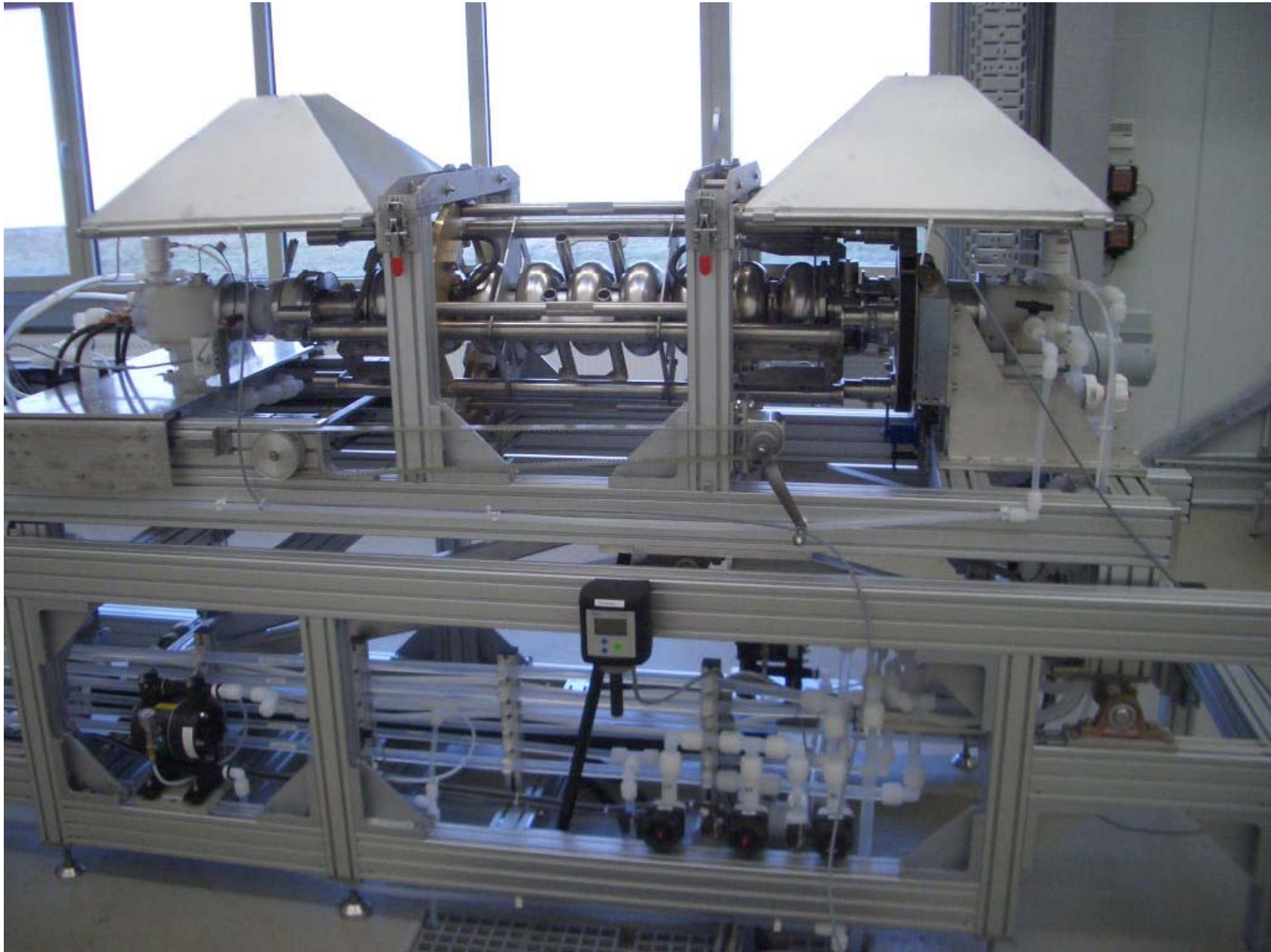
current leads



EP installation at DESY



EP Installation at Henkel,1



EP installation at Henkel,2



EP installation at ACCEL



Rough EP at ACCEL (courtesy of M. Pekeler)

Best candidates for EP electrolyte quality assurance (Henkel Study)

- **Titration**
- **ICP-OES** (inductively coupled plasma-optical emission spectroscopy)
- **IC** (ionic-chromatography)
- **TOC** (total organic carbon)
- **NMR** (nuclear magnetic resonance)
- **FTIR-ATR-probe** (Fourier transformation infrared spectroscopy –attenuated total reflection)

Overview QA methods for EP electrolyte (Henkel study)

Method	Applicability
Titration	total acidity
ICP-OES	all elements (Nb, Fe,..)
IC + distillation	Ions (So ₄ , F ⁻ , FSO ₃ H)
TOC	organic impurities
NMR	organic impurities
FTIR-ATR-probe	total overview of components defined by the ATR data base

Summary EP industrialization,1

- The goal of this task was to explore and optimize the important operating parameters of the DESY EP system and to transfer this technology to industry.
- At DESY 176 EP treatments of 9-cell cavities have been carried out
- The EP technology has been successfully transferred to industry.
- Two companies (ACCEL and Henkel) have designed, built, installed and operated EP installations based on the experience with electropolishing at DESY.

Summary EP industrialization,2

- Up to now ACCEL and Henkel have treated 24 cavities in total
- In addition a QA strategy for the EP electrolyte has been worked out by Henkel company
- **Electropolishing infrastructure & expertise at two companies is available now in Europe for EP cleaning of TTF type multi-cell Nb resonators**

Hazard of HF

Repair of a leak in the heat exchanger

