

SCRF Infrastructure at CERN?

Electron Accelerator R&D for the Energy Frontier

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DESY -MPY-

Overall Framework

- GDE Discussions
 - Effort needed
 - To make ILC-gradients more reproducible
 - Any step in Europe should be integrated in the larger R&D framework
 - Step toward a integrated systems test
 - At least the size of one RF unit, which determines the number of cavities to at least 30
 - Knowledge transfer to industry
 - Large contribution of the XFEL
 - But: the XFEL will not have the time to explore all the parameter space (see below)
- FP7 preparation
 - Come to some conclusions here

Primary goal: Production of ILC prototype modules (4th generation) in Europe

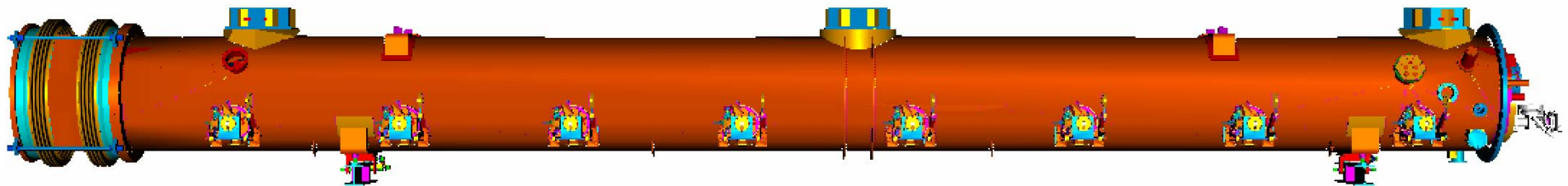
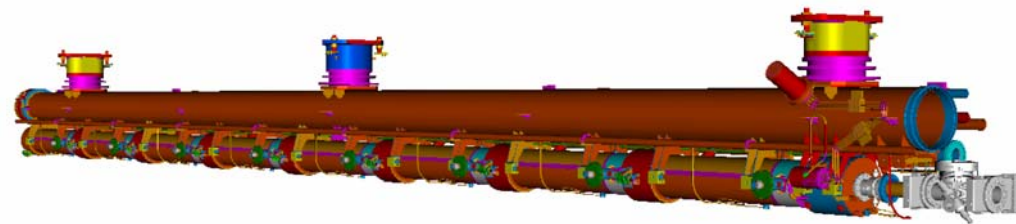
- Scope

- Should include building all parts

- Cavities
- Couplers
- Magnet
- BPM
- Cryostat vessel

- Must include a next generation cavity preparation facility

- Improve processes
- Avoid bottlenecks



Cavity Preparation Infrastructures Today

- Some infrastructure is available in Europe (not only DESY)
- Most setups are still R&D size
 - Often single-cell cavities
 - Small through-put
- Single-line of processing
 - No redundancy
- Have come to age
 - Materials
 - Overall layout needs significant re-work with today's knowledge
 - Electropolishing as the baseline process
 - required number of high pressure water rinses

Next Generation Cavity Preparation Infrastructure I

- Main Features
 - Improved electropolishing
 - Focus to avoid sulphurus contamination
 - Redundancy
 - Improve Final cleaning
 - Flexibility needed here e.g. alcohol rinses
 - High pressure rinse (HPR)
 - Online particle count integrated in drain water line
 - Redundancy
 - Cleaning of parts
 - Automation needed: screws used as example
 - Improved/novel methods of QA/QC

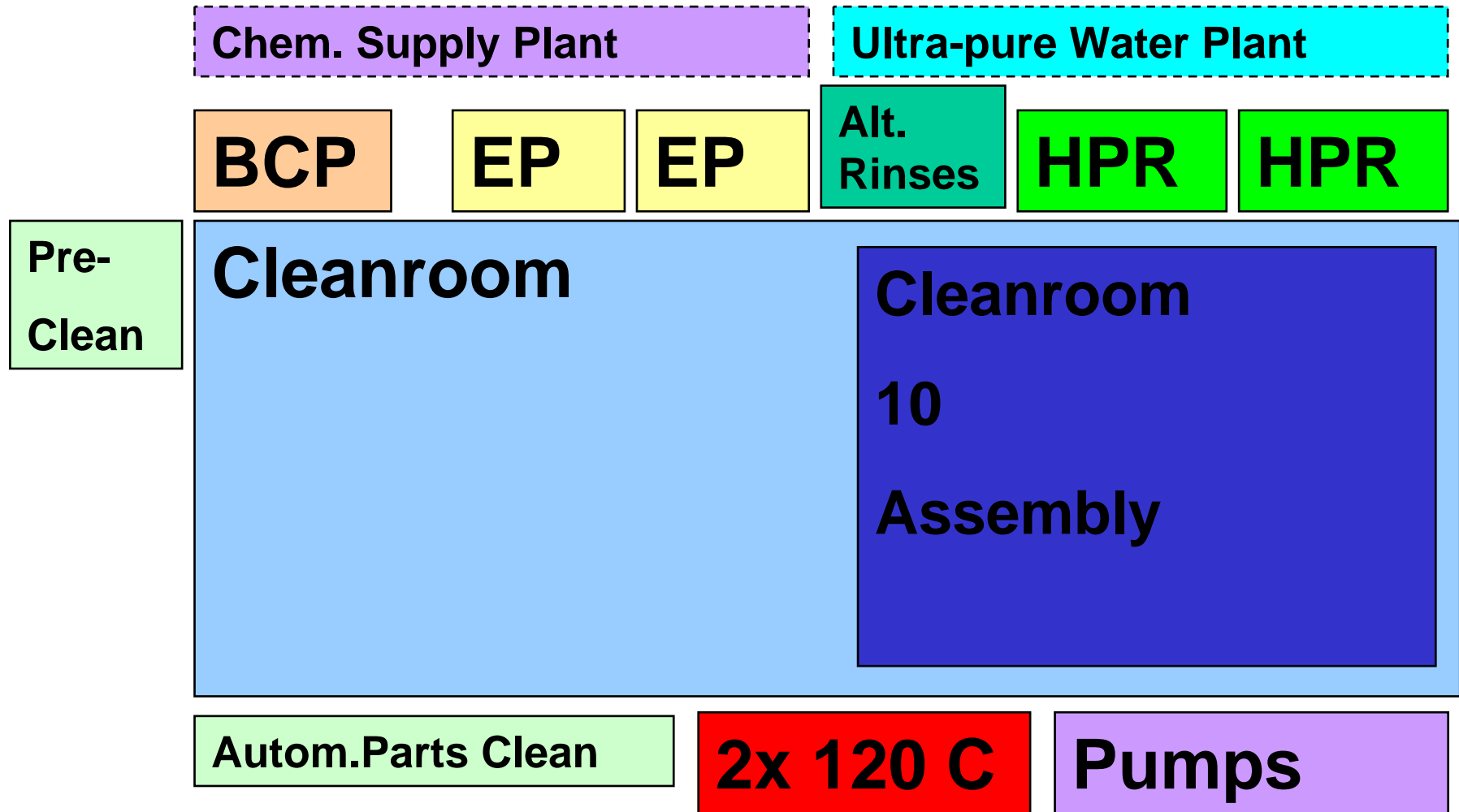
Next Generation Cavity Preparation Infrastructure II

- Modular setup
 - Institutes get responsibility for part of the process (HPR design, EP design etc.)
- Redundant setup
 - 2 x EP,
 - 2 x HPR,
 - 2-3 120 °C bakeout stations
- Other infrastructure
 - Etching needed (e.g. outside cleaning)
 - designated 800°C furnace
 - Sufficient pump stations, etc.
- Opional
 - Dry-ice cleaning
 - Needs feasibility demonstration

Layout of Preparation Facility

Tuning

Oven



Implementation of a Facility

- Location Alternatives:
 - Makes sense to site this at existing TTF infrastructure here at DESY.
 - Additional manpower would be a pre-requisite
 - CERN
 - Available (needs check):
 - 2K cryogenic-infrastructure
 - Vertical Teststands
 - Module Teststands (How many?)
 - Single-cell preparation infrastructure?
 - Surface science department in-house
 - Manpower ?
 - Needed
 - Infrastructure for multi-cells with redundancy
 - RF Power
- Manpower
 - Qualified manpower is a critical issue on all levels (engineers, technicians)
 - How 'free' could this expertise be in 2008+?
 - How much additional manpower could be made available?

Sketch of possible programme:

- Component design in framework of world-wide effort
 - Some design work might be finished by 2007 e.g. cryostat vessel
 - but this should not stop people stop from thinking about sub-components like magnet and cold BPM
- Details...

– Goals **ILC Cryomodule Design**

- 4th generation module
 - Quadrupole in the center
 - Shorter cavity spacing
 - Module assembly capability
 - Module testing capabilities
 - Prototyping of cryostat vessel in European industry
- Implementation:
- Finish design work as collaboration of FNAL, INFN, DESY,..
 - ILC design finished in 2007?
 - Assembly of modules
 - Need a cleanroom for string
 - » Could use refurbished CERN cleanroom in SM18
 - » could be at TTF?
 - Test facility without beam
 - Could refurbish CERN infrastructure in SM18
 - Could be extension to XFEL module test hall, then use single module test stand for ILC
 - If Beam test is needed somewhere (e.g. HOM damping), could be just a probe beam.

High-quality cavity production and preparation including full-power test

- Cavity design
 - Goals:
 - Compact with shortened beam tubes
 - Cavity shape options
 - Standard
 - Low-Loss
 - Implementation
 - ILC LL
 - complete design available done at SLAC, DESY and others
 - Initial tests will be available
- Material options
 - Goals:
 - Large-grain or single-crystal
 - Standard material
 - Implementation
 - Built 30 ILC-cavities and test

High quality cavity production ctd.

- Cavity preparation
 - Goals
 - Improve preparation process
 - Improve EP (is a must...)
 - Etching needed (e.g. outside cleaning)
 - Improve Final cleaning
 - High pressure rinse (HPR)
 - » Online particle count integrated in drain water line
 - Dry-ice cleaning?
 - » Needs feasibility demonstration
 - Cleaning of parts
 - » Automation needed: screws used as example
 - Improved/novel methods of QA/QC
 - Implementation
 - Setup of new infrastructure
 - » DESY: Independent of TTF
 - » CERN: partial refurbishment might be an option
 - Modular setup
 - » Institutes get responsibility for part of the process (HPR design, EP design etc.)
 - Redundant setup
 - » 2 x EP,
 - » 2 x HPR,
 - » 2-3 120 °C bakeout stations
 - designated 800°C furnace
 - Sufficient pump stations, etc.

High quality cavity program ctd.

- Cavity testing capabilities
 - Goals :
 - Low-power and high-power individual cavity tests
 - Implementation
 - DESY: Extension of XFEL infrastructure or use TTF
 - CERN: Make SM18 1.3GHz compatible
 - Minor work cryostats
 - Improve pumps for 2K ?
 - RF system esp. for Pulsed operation
 - » obtain MBK from America

Cavity Auxiliaries

– TTF-III coupler

- Goals
 - Lower cost
 - Even faster processing
- Implementation
 - Continue work at LAL Orsay
 - Full synergy with XFEL

– Compact Tuner design

- Goals
 - Develop compact tuner
 - Including fast tuning (e.g Piezo)
- Implementation
 - Blade tuner at INFN
 - Compact lateral tuner at Saclay ? – needs confirmation

ILC magnet design

– Goals

- Full design to ILC specs
- Follow discussions on ILC issues

– Implementation

- Continue work with CIEMAT
- Acquire magnets in America?

ILC BPM design

– Goals

- More compact re-entrant
- Eventually integrated (closely attached) to quadrupole

– Implementation

- Basic layout XFEL-like ?
 - XFEL Resolution insufficient for ILC
 - Continue CEA work
 - Need compact design

Time scales:

– >2008

- Time scale would have this infrastructure running parallel to XFEL cryomodule production, which could provide ‘mass production’ feedback for foreseen ILC program.
- some of the design work will be done until end 2007 by ILC worldwide
- setting up of preparation infrastructure is most time-consuming
 - if parts of TTF infrastructure can be used the cavity preparation can be started earlier
 - at CERN the adaptation of the infrastructure needs to be cross-checked but should be rather straight-forward

Money Scales

(Warning: My Guess!)

- potential amount 30 MEUR (greenfield site)
 - Collaborations will probably still require to support 50% of the activities.
 - Budget would be allocated for
 - New cryostat vessels
 - Up to 3 modules
 - new cavities (>30)
 - auxiliaries
 - new infrastructure
 - RF
 - Cryogenics
 - » Plant
 - » Cryostats +low-power RF
 - Cleanroom (min.2 HDs)
 - » Assembly tooling
 - Chemistry
 - » EP (2 benches)
 - » Etching
 - Furnace min.800°C
 - » Extras
 - manpower (new people)
- | | |
|---|----------|
| } | 6 MEUR |
| | 2 MEUR |
| | 5 MEUR |
| | 5 MEUR |
| | 4 MEUR |
| | 1 MEUR |
| | 3,5 MEUR |
| | 1 MEUR |
| | 5 MEUR |

For Discussion...

- I see two possibilities for such a facility
 - CERN refurbishment
 - Some construction work needed
 - DESY would need new construction and significant manpower
 - Cavity testing might start earlier by using existing facilities
- A participation by collaborating institutes are hardware (e.g. EP system) and/or people
 - Possible integration of industry
- Other cavity shapes (e.g. for protons) could be integrated in case treatment modules are supplied
 - Use of water and chemical plant is straightforward

Conclusion

- Such a facility is needed
- CERN is a clear option as some (costly) part of the infrastructure is there
 - Not to be forgotten: Some Know-how as well!
 - DESY can be an alternative
- Evaluation is needed on who can provide what