Update on CDR issues;
Organization of technical work towards CDR

1. CDR vs TDR
2. CDR schedule
3. Highest priority work: Feasibility (:=Critical) Items
4. Organization of Technical Work
   Creation (2008) of CTC
   → Working groups, examples
5. Tools:
   - EDMS documentation, CLIC PBS
   - workshops/reviews
   - R&D summary sheets, Feasibility Benchmarks

Our definition of a CDR ?

- Proof that all components of a facility and their interplay are conceptually understood
- Quantify expected overall performance and related component requirements
- Scientific case for the accelerator
- Detection Concepts/Efficiency/background figures for Physics Detector
- Evolution path to TDR
- Proof of feasibility issues and cost estimate

What needs to be added for the TDR ?

→ Readiness to receive funding for building a facility, this implies

- Technical design of all components which are critical for schedule
- Technical feasibility of all components; working prototypes for all critical technologies
- Detailed site consideration
- Detailed construction Schedule
- Detailed material cost and manpower resource estimates and risk analysis

Basics of CDR (unchanged from last ACE)

- 3 TeV option for CLIC as baseline for the optimization of the parameters.
- Construction staging starting from the lowest demanded energy (let us say 500 GeV) as indicated by LHC results up to the full 3 TeV machine.
- Parameter changes and optimization for the “500 GeV” machine plus additional consequences for later energy upgrades in a separate chapter
- 4 volumes
- Volume 3:
  - Detailed description of the CLIC machine most critical subjects
  - Description of the physics and beam dynamics of all machine components following the order in the CLIC PBS.
  - Technology chapters grouped together by disciplines.

Present layout of CDR

Vol1: Executive Summary: target 20 pages, value estimate

Vol2: Physics at CLIC

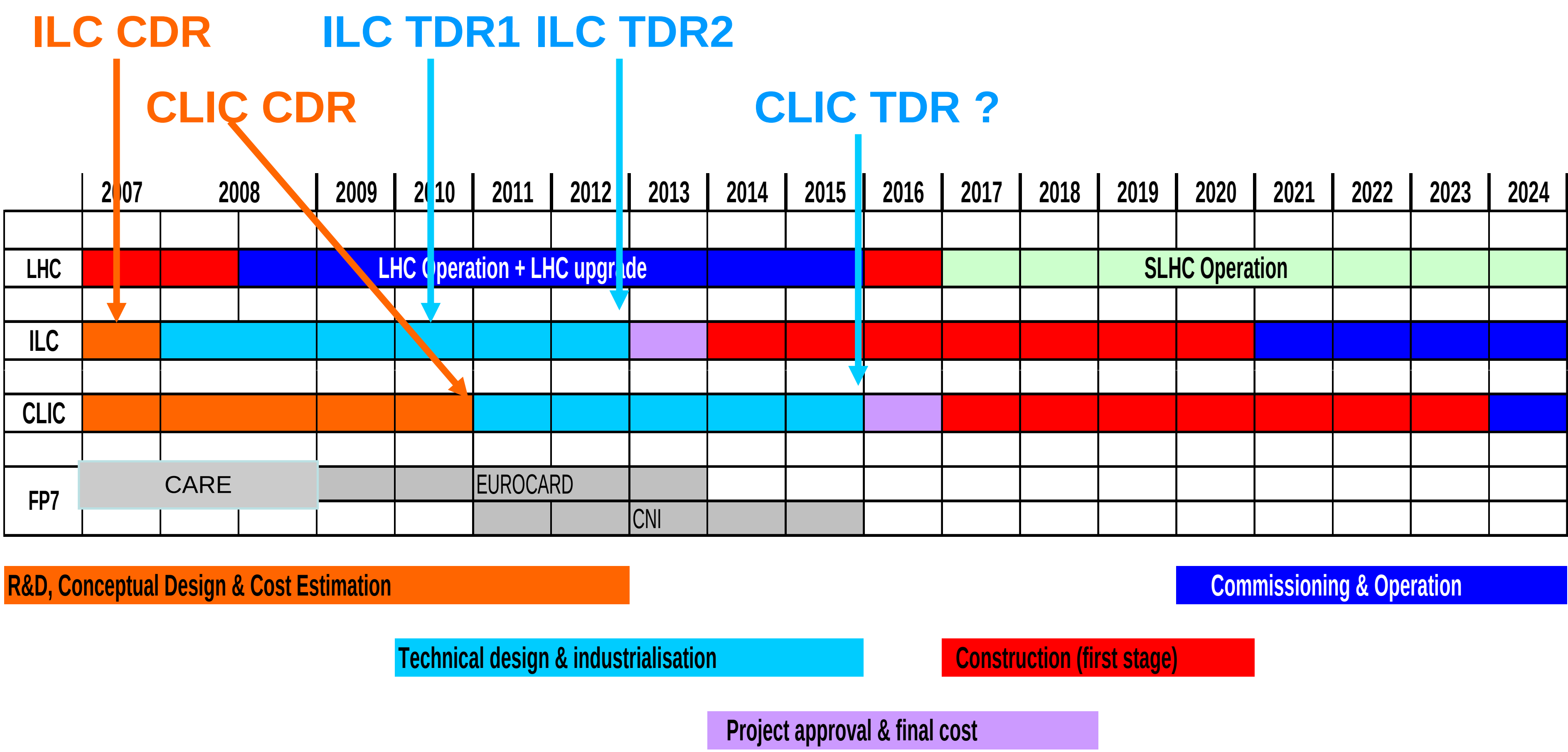
write-up progress will depend on LHC results; presently we use the report from 2004

Vol3: The CLIC accelerator and site facilities

Vol4: The CLIC physics detectors

→ https://edms.cern.ch/file/1001132/CLIC_CDR-LAYOUT_08.xlsx

CLIC in HEP context
Complementary to LHC
Collaborative competition with ILC



CDR schedule

-Due to the LHC technical accident several resources, which were scheduled to start working on CLIC, are still working on the LHC.

- The original publication date of July 2010 had to be delayed and the first “90% draft for volume 3; ready in summer 2009” has been canceled.
- The new target publication date is December 2010.

- The present technical work (including this meeting) consist in establishing a realistic work-plan to see what results can be obtained by end 2010.

List of CLIC items

- Effort started in April 2008 with an overview of CLIC subjects by D.Schulte and H.Braun

- Successive discussions in the CSC, CTC, etc produced as working document an excel spread-sheet called “List of critical items”.
This file is (almost) kept up-to-date in EDMS:
https://edms.cern.ch/file/918791/8/list-open-points_all_CLIC_ver20022009_V8.xlsx

This file contains a classification of the subjects by
“critical = feasibility item”, “performance item”, “ cost item”.

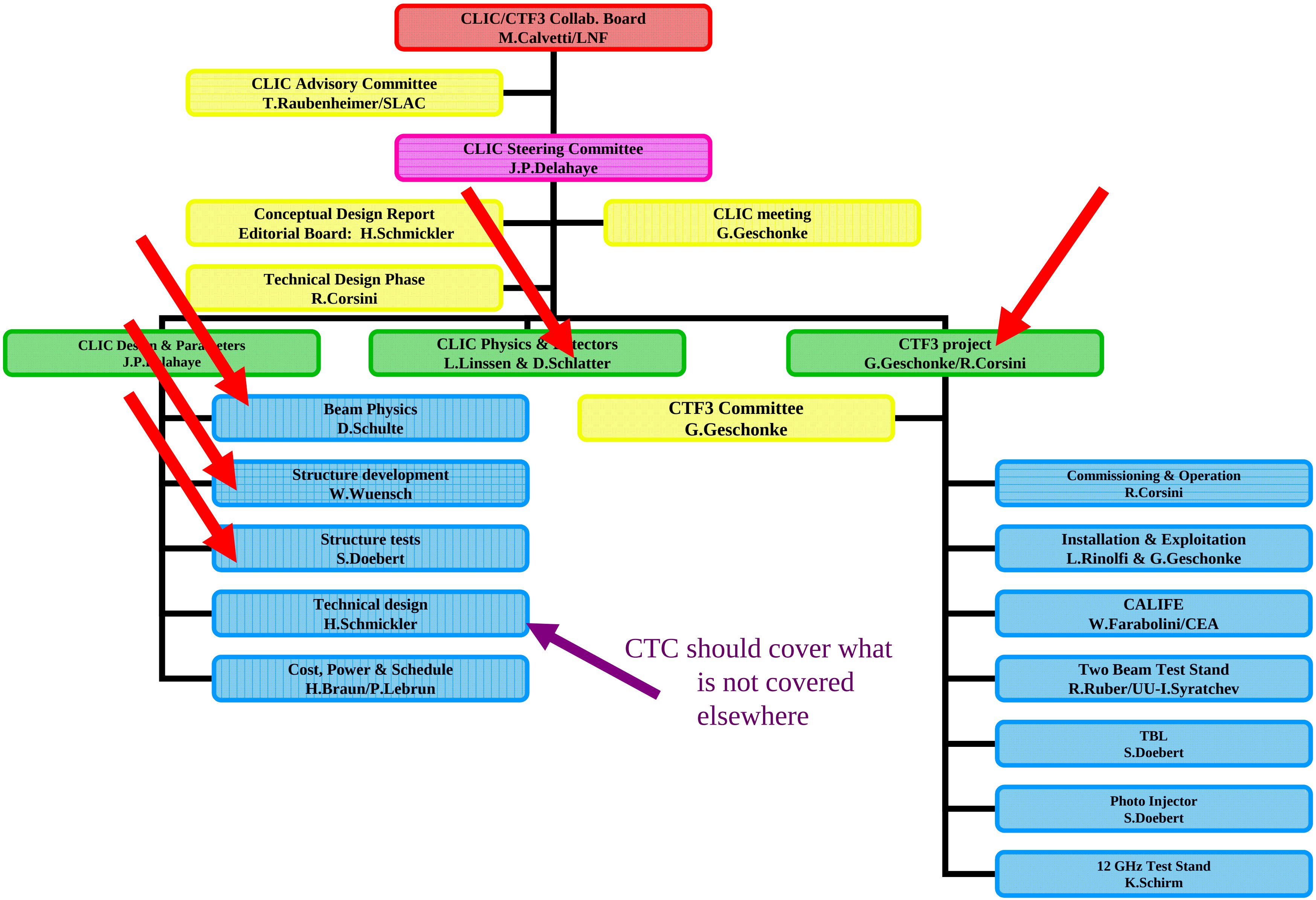
Daniel’s talk has shown all details and has explained the selection of the:

- list of critical items (next slide), which summarizes the high priority working fields of the CLIC study.

Feasibility Items

SYSTEMS		Critical parameters
Structures	**Main Beam Acceleration Structures:** Demonstrate nominal CLIC structures with damping features at the design gradient, with design pulse length and breakdown rate .	100 MV/m 240 ns < 3·10-7 BR/(pulse*m) RF to Beam efficiency > 30%?
	RF Power production structures: Demonstrate nominal PETS with damping features at the design power, with design pulse length, breakdown rate and on/off capability	136 MW, 240 ns < 10-7 BR/(pulse*m)? Beam to RF efficiency >? On/Off < 20 ms
Two Beam	**Two Beam Acceleration (TBA):** Demonstrate RF power production and Beam acceleration with both beams in at least one Two Beam Module equipped with all equipments	Two Beam Acceleration with simultaneous & nominal parameters as quoted above for individual components
Drive Beam	**Drive Beam Production** - Beam generation and combination - phase and energy matching - Potential feedbacks	100 Amp peak current 12GHz bunch repetition frequency 0.2 degrees phase stability at 12 GHz 7.5 10^{-4} intensity stability
	RF power generation by Drive Beam - Rf power extration - Beam stability	90% extraction efficiency Large momentum spread
Beam Physics	**Generation and Preservation of Low Emittances** Damping Rings, RTML and Main Linacs	Emittances(nm): H= 600, V=5 Absolute blow-up(nm): H=160, V=15
Stabili zation	**Main Linac and BDS Stabilization**	Main Linac : 1 nm vert. above 1 Hz; BDS: 0.15 to 1 nm above 4 Hz depending on final doublet girder implementation
Operation and reliability	**Operation and Machine Protection** Staging of commissioning and construction MTBF, MTTR Machine protection with high beam power	drive beam power of 72 MW @ 2.4 GeV main beam power of 13 MW @ 1.5 TeV
Detector	**Beam-Beam Background** Detector design and shielding compatible with breakdown generated by beam beam effects during collisions at high energy	3.8 10^{8} coherent pairs

CLIC Chart 09



Mandate CLIC Technical Committee (CTC)

- **General objective:**
  Towards a Project Oriented and Cost Conscious CLIC Design in preparation for the Conceptual Design Report to be edited in 2010.

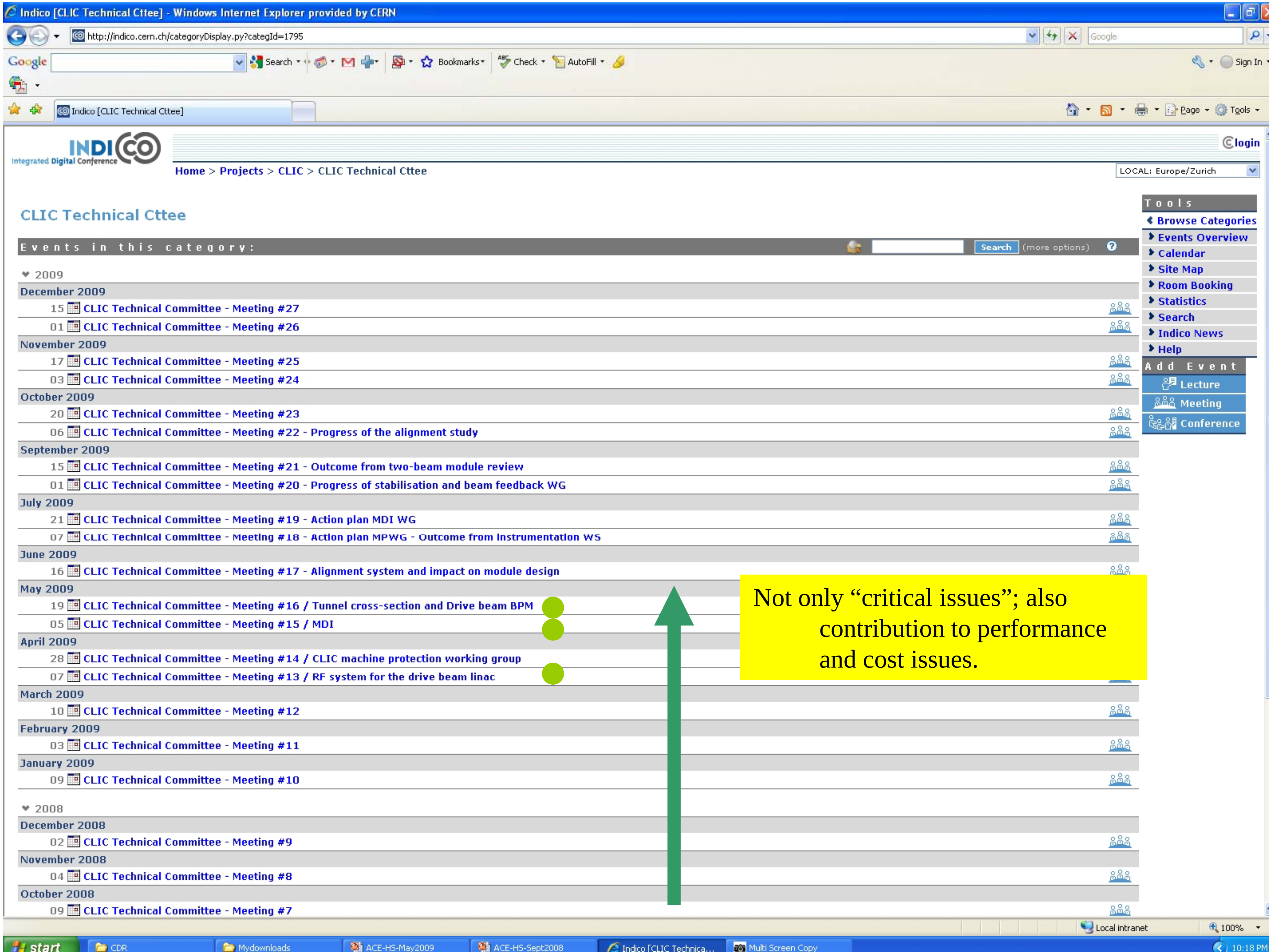
- **Specific responsibility:**
  Set-up and keep updated:
  - an overall nomenclature of the components of the whole project,
  - a complete and coherent CLIC Work Breakdown Structure with components specifications derived from the present design by the Parameters WG
  - The related documentation structure integrating a description of all technical components

  Review the ensemble of technical equipments in the present CLIC design in terms of:
  - Specifications
  - Technical feasibility
  - Fabrication and prospective in industrialization
  - Integration (machine/tunnel)
  - Interface with the detectors
  - Installation
  - Schedule (including fabrication & installation)
  - Cost (investment and exploitation)

New CLIC EDMS documentation

-preserved existing CLIC documentation and organization of CLIC documentation
- has CLIC PBS added
- uses CLIC PBS for new additional project information:
parameter specs, functional specs, engineering specs…

https://edms.cern.ch/nav/CERN-0000060014



Indico [CLIC Technical Cttee] - Windows Internet Explorer provided by CERN

http://indico.cern.ch/categoryDisplay.py?categId=1795

Home > Projects > CLIC > CLIC Technical Cttee

CLIC Technical Cttee

Events in this category:

2009

December 2009
- 15 CLIC Technical Committee - Meeting #27
- 01 CLIC Technical Committee - Meeting #26

November 2009
- 17 CLIC Technical Committee - Meeting #25
- 03 CLIC Technical Committee - Meeting #24

October 2009
- 20 CLIC Technical Committee - Meeting #23
- 06 CLIC Technical Committee - Meeting #22 - Progress of the alignment study

September 2009
- 15 CLIC Technical Committee - Meeting #21 - Outcome from two-beam module review
- 01 CLIC Technical Committee - Meeting #20 - Progress of stabilisation and beam feedback WG

July 2009
- 21 CLIC Technical Committee - Meeting #19 - Action plan MDI WG
- 07 CLIC Technical Committee - Meeting #18 - Action plan MPWG - Outcome from instrumentation WS

June 2009
- 16 CLIC Technical Committee - Meeting #17 - Alignment system and impact on module design

May 2009
- 19 CLIC Technical Committee - Meeting #16 / Tunnel cross-section and Drive beam BPM
- 05 CLIC Technical Committee - Meeting #15 / MDI

April 2009
- 28 CLIC Technical Committee - Meeting #14 / CLIC machine protection working group
- 07 CLIC Technical Committee - Meeting #13 / RF system for the drive beam linac

March 2009
- 10 CLIC Technical Committee - Meeting #12

February 2009
- 03 CLIC Technical Committee - Meeting #11

January 2009
- 09 CLIC Technical Committee - Meeting #10

2008

December 2008
- 02 CLIC Technical Committee - Meeting #9

November 2008
- 04 CLIC Technical Committee - Meeting #8

October 2008
- 09 CLIC Technical Committee - Meeting #7

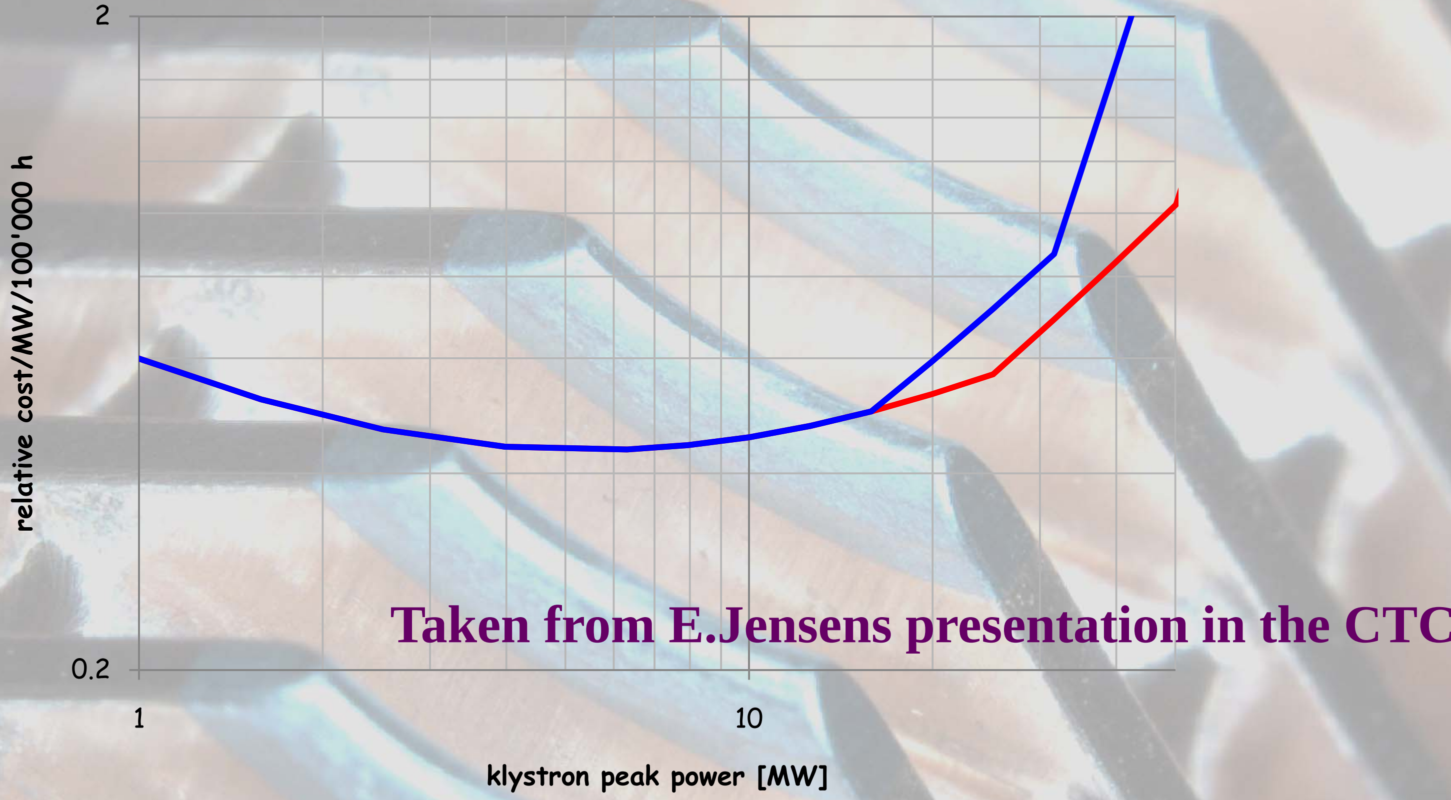
Tools: Browse Categories, Events Overview, Calendar, Site Map, Room Booking, Statistics, Search, Indico News, Help

Add Event: Lecture, Meeting, Conference

Not only "critical issues"; also contribution to performance and cost issues.

Cost for 100,000 operating hours and MW

- Even if this model may be wrong, there will be a cost per MW and per operating hour: With the above model, this becomes:



- Blue: present state of the art
- Red: assuming a major investment into the development of a dedicated 30 MW tube

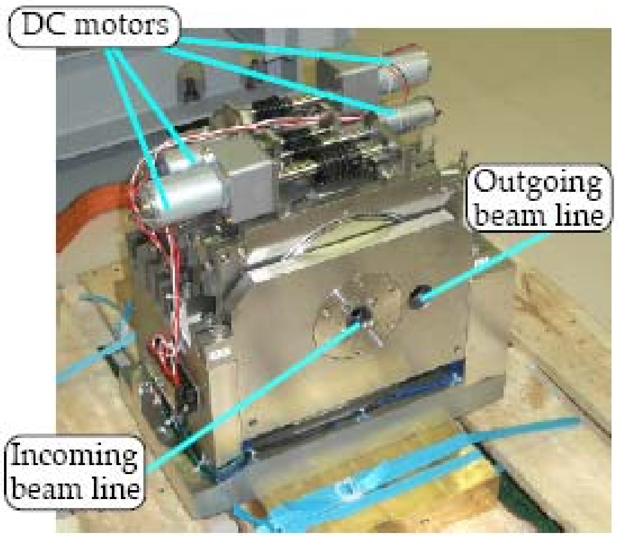
CLIC FF doublet parameters

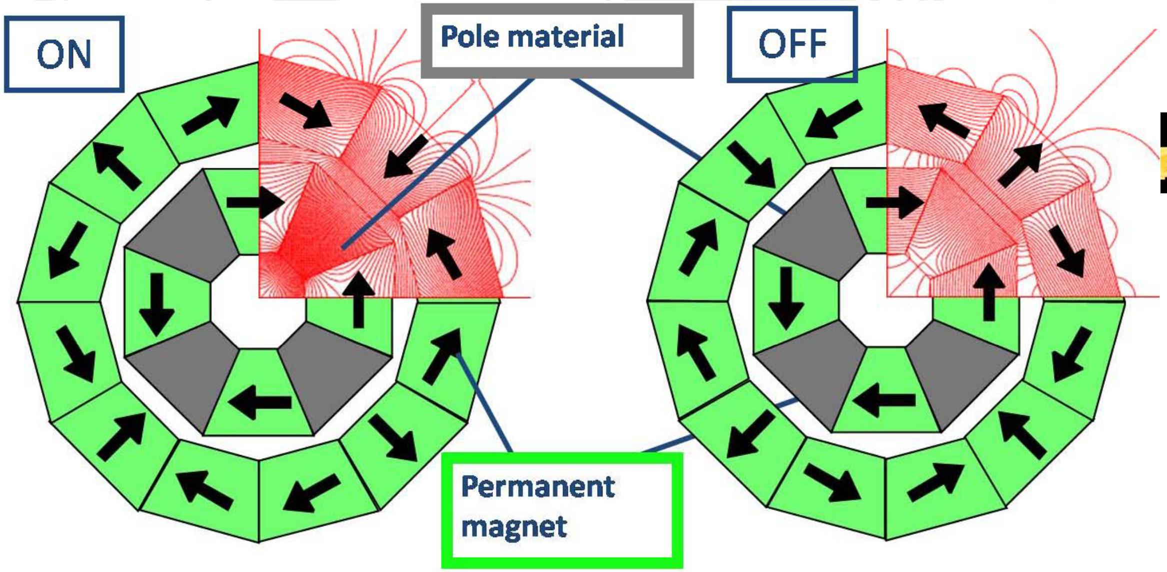
QF1 QD0		
L*	3.5	m
Gradient	200 - 575	T/m
Length	3.26 - 2.73	m
Aperture (radius)	4.69 - 3.83	mm
Outer radius	< 35 - < 43	mm
Octupolar error	106	T/m3
Dodec. error	1016	T/m5
Peak field	0.94 - 2.20	T
Field stability	10^-4	
Energy spread	± 1	%

+ tuning range of FF: several %

- Present (old) design: based on permanent magnets
  recall of problems: physical size of PM magnet elements, temperature coefficient, radiation damage, tuning possibility, mechanical stability

Double Ring Structure –Adjustable PMQ-





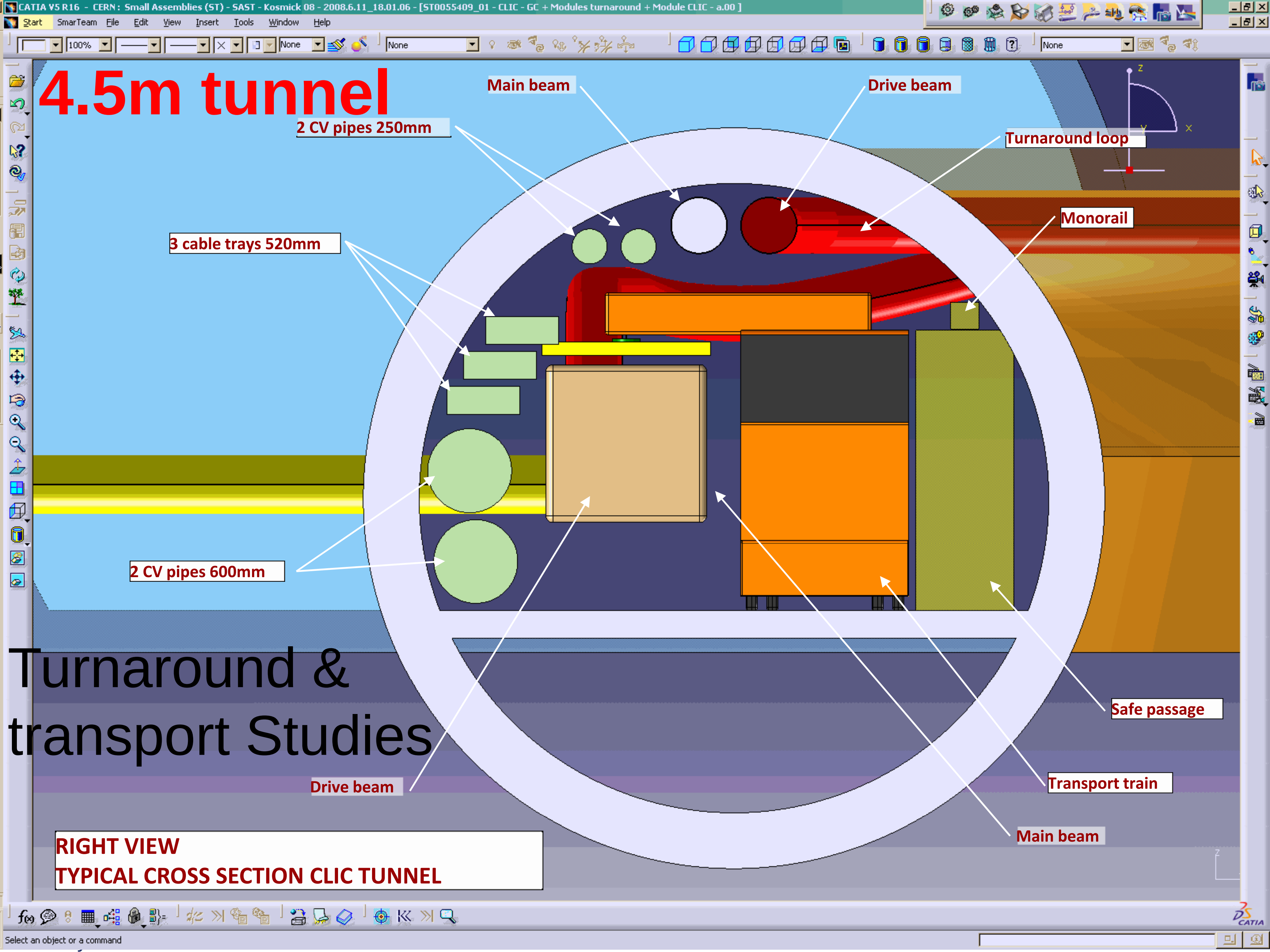
•High gradient → heat load during adjustment

The double ring structure

PMQ is split into inner ring and outer ring. Only the outer ring is rotated 90° around the beam axis to vary the focal strength.

Present situation with FF magnet:

- Have to reconsider SC option, permanent magnet option (tuning range?), or normal conducting option or combination of these
- Needs for each option strong interaction with physics detector project
- Will have to review aperture requirements within beam dynamics WG
- Work will happen within next months in the newly formed (and reinforced) MDI working group
- MDI WG will have to produce urgently input to stabilization WG
- No experimental work before CDR; studies and simulations only

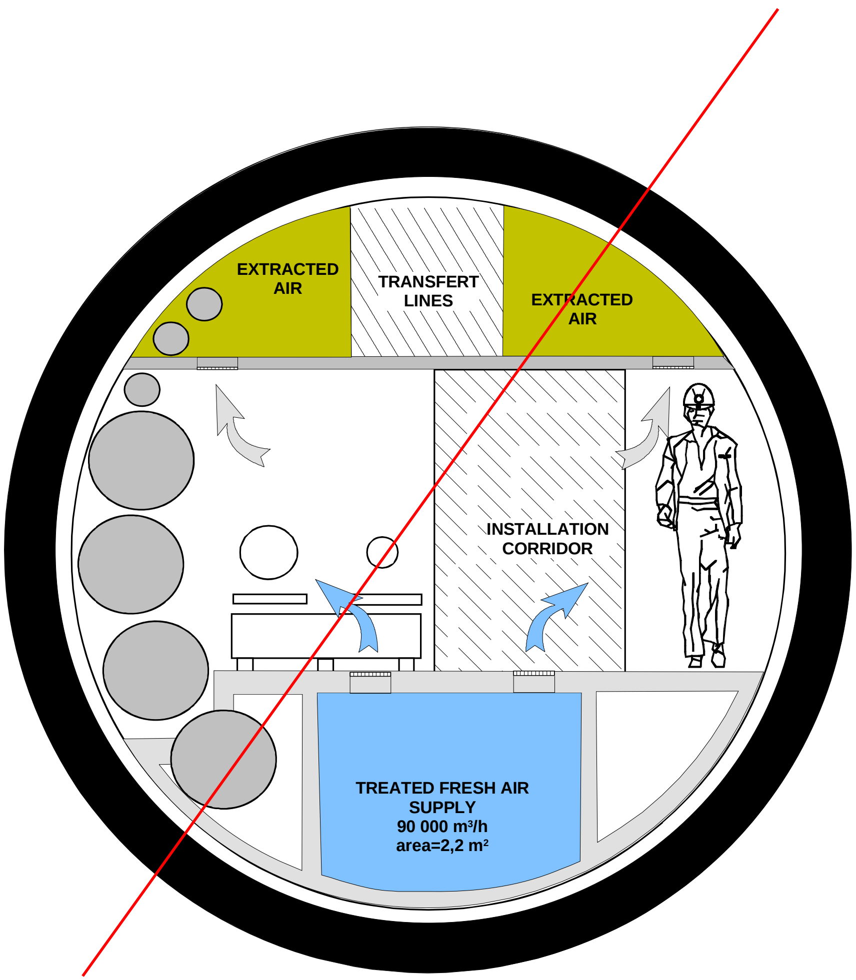

CATIA V5 R16 - CERN : Small Assemblies (ST) - SAST - Kosmick 08 - 2008.6.11_18.01.06 - [ST0055409_01 - CLIC - GC + Modules turnaround + Module CLIC - a.00]
Start SmarTeam File Edit View Insert Tools Window Help
4.5m tunnel
Main beam
Drive beam
2 CV pipes 250mm
Turnaround loop
Monorail
3 cable trays 520mm
2 CV pipes 600mm
Turnaround & transport Studies
Safe passage
Transport train
Drive beam
Main beam
RIGHT VIEW
TYPICAL CROSS SECTION CLIC TUNNEL
Select an object or a command

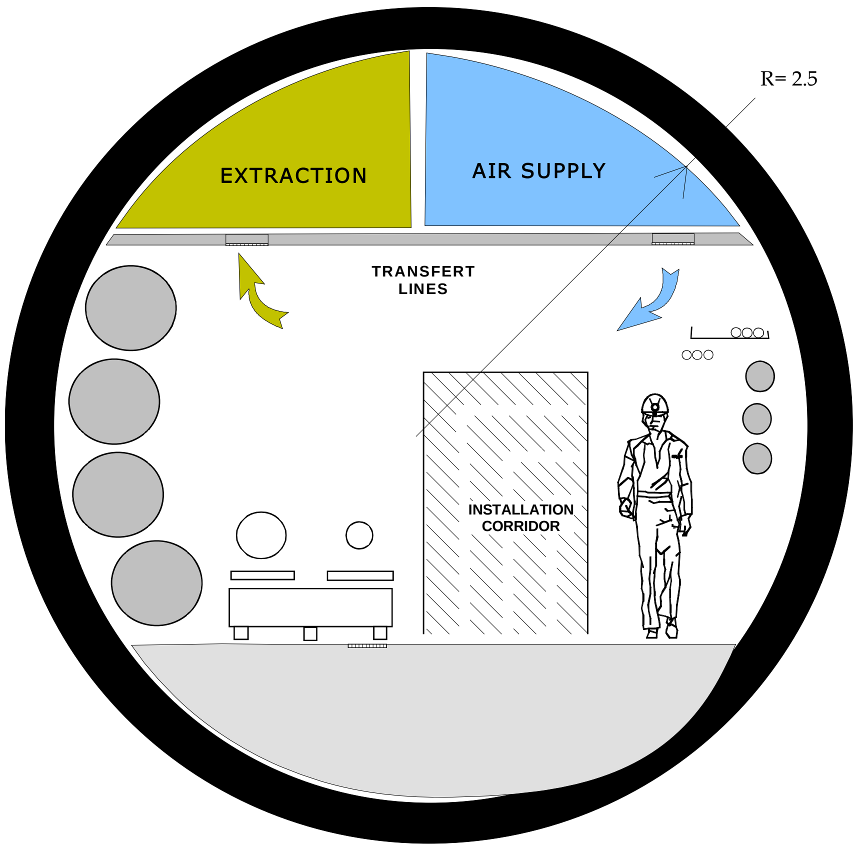
Ventilation Concepts

Advantages of transversal ventilation :

•Safety (see CLIC note from F.Corsanego EDMS 827669)

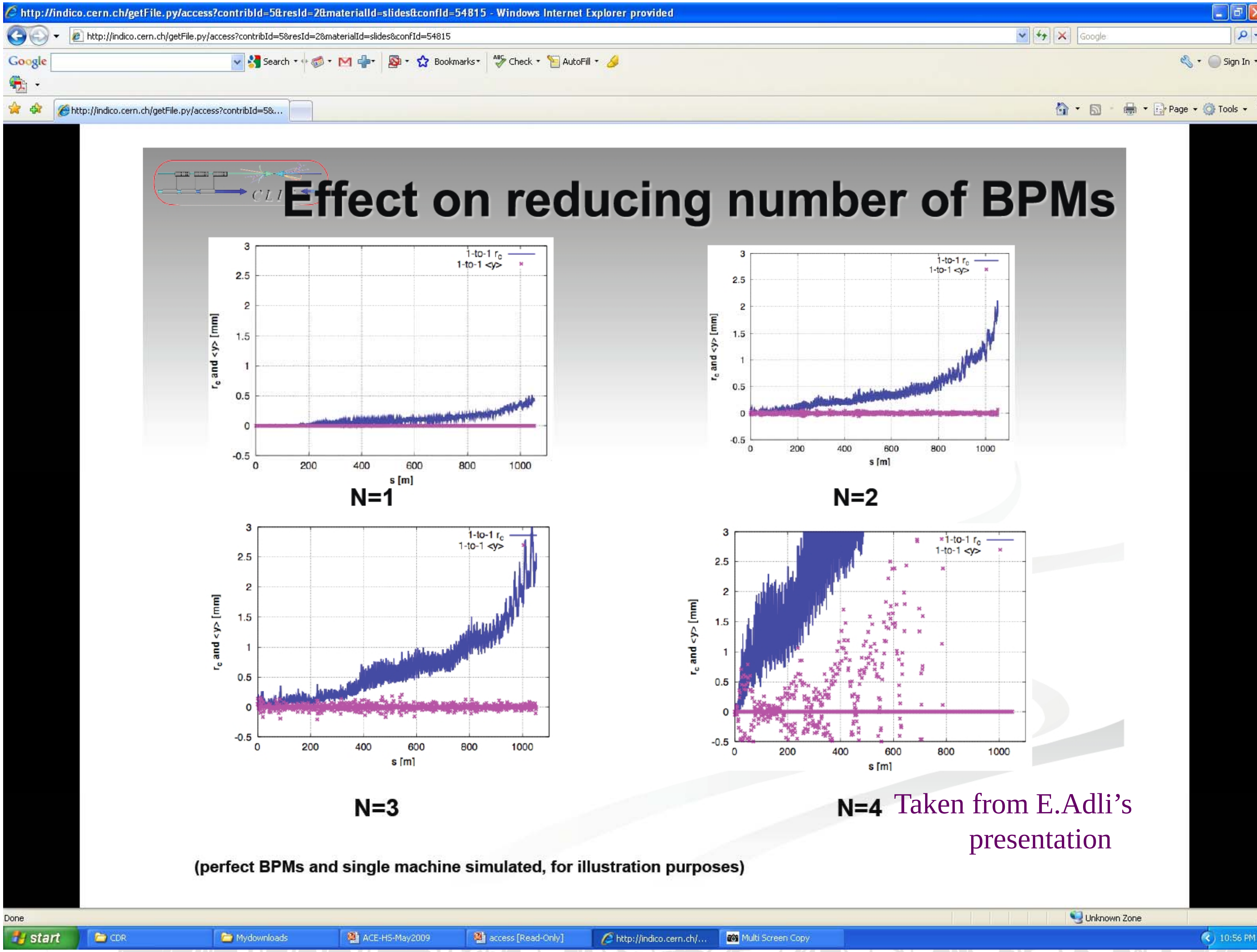
•Much better control of temperature & humidity gradient along the tunnel





DB BPMS

- Present specs:
  - about 40000 BPMs in all 48 decelerators
  - 2 um resolution
  - 20 um precision (and also 20 um quad alignment)
- Cost with present technologies: 15 ksfr/BPM
  → order of 600 MSfr for the DB BPMs
- 1) Launch cost reduction work in BI group and collaborators
  2) Rediscuss need for 40000 BPMs
  3) Complete Specs (Beam Types, Operating Temperature Range...)



Taken from E.Adli's presentation

Choice not obvious: tradeoff between number of BPMs and precision; availibility, cost versus precision, risk….

Workshops/Reviews

- April 2009: Workshop on Wire Position Sensors for Alignment Systems; Search for Collaborators

- June 2009 (next week): Beam Instrumentation workshop
Purpose: Review CLIC beam instrumentation requirements;
Identify together with BI group unsolved technology problems
Define and launch most important studies and prototyping

- September 2009: Two beam module Review
Purpose: Present all integration issues, discuss some of the old design choices, define new baseline for the CDR

Summary

- CTC was created in 2008
- CTC complements existing work in CTF3, Structures WGs, Beam dynamics WG and LCD Project in preparation of the CDR.
- Start of complementary QA documentation in EDMS
- This workshop has as aim to:
  - identify critical technology questions in the CLIC beam instrumentation.
  - Give input for the preparation of a work-plan
  - Conclude on collaborations