CTF3 Collaboration Meeting 23. – 25. 11. 2004

Magnets for CTF3

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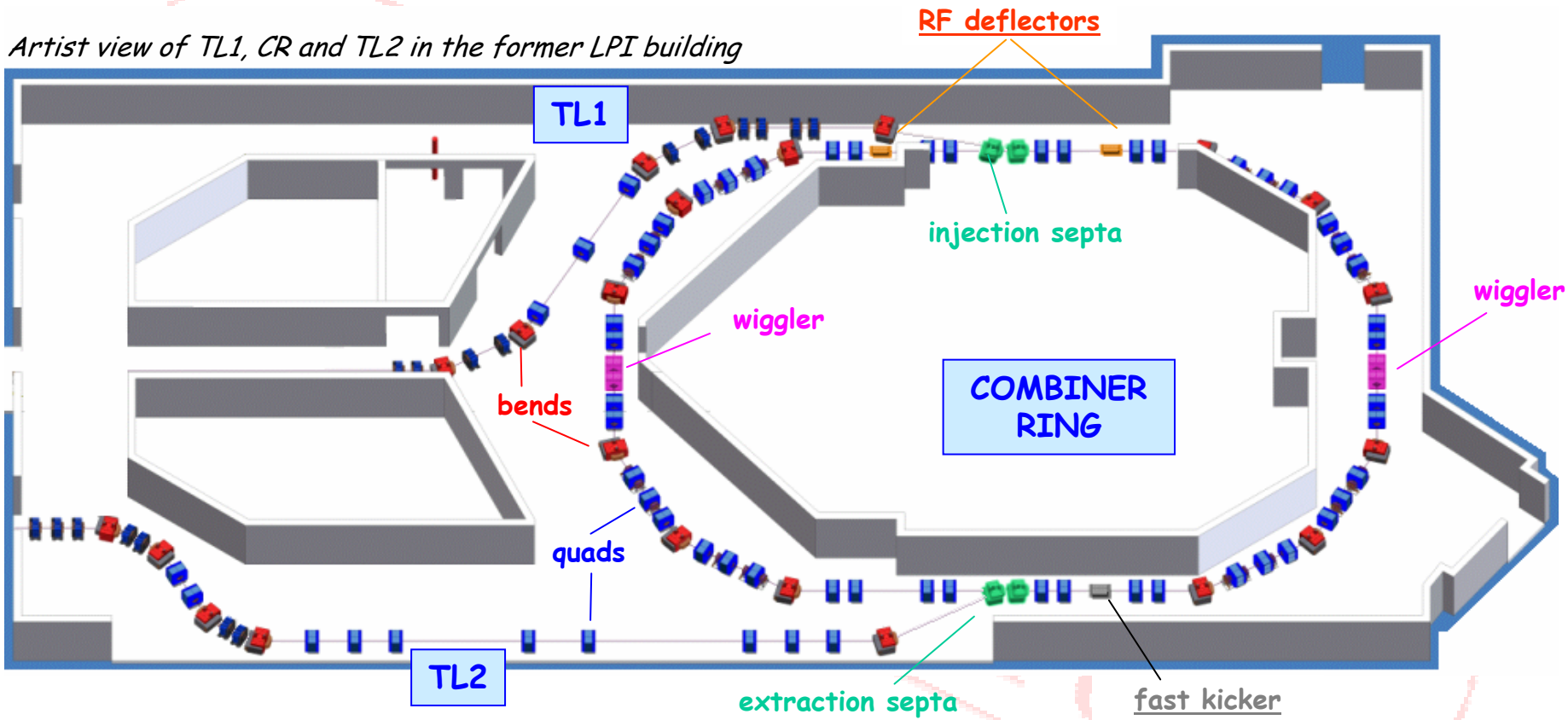
CERN

Magnets for CTF3

- Slim Quadrupoles QG for TL1, CR and TL2
- Corrector Magnets for TL1, CR and TL2
- Recuperated Quadrupoles from LURE for CR
- Sextupoles XC for CR
- Bending Magnets BF for TL2
- Quadrupoles for TBL and TB test stand

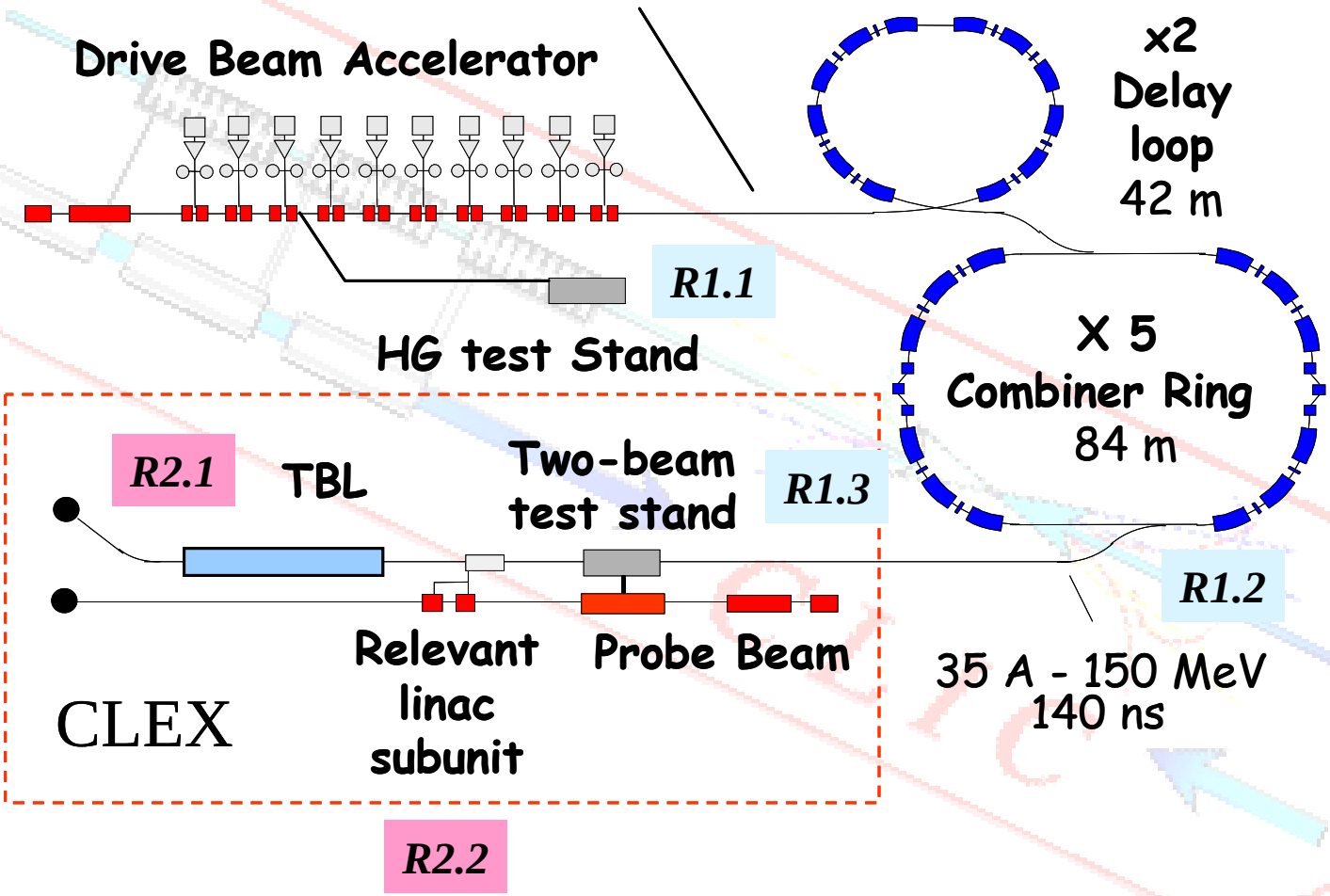
CTF3 Layout

Artist view of TL1, CR and TL2 in the former LPI building



CTF3 Layout

3.5 A - 2100 b of 2.33 nC 150 MeV - 1.4 μs



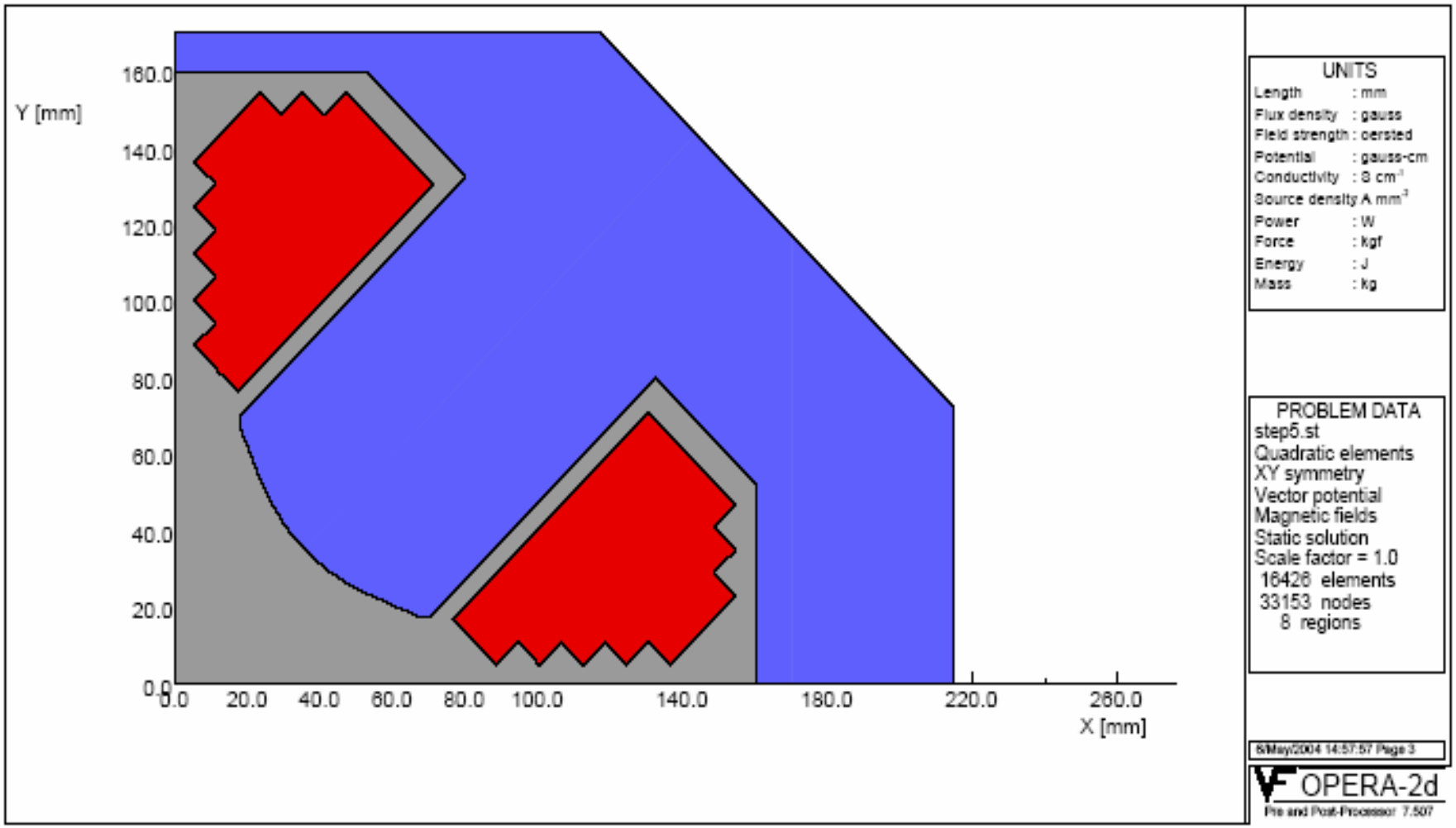
QG Slim Quadrupole Magnets

- 11 QG Quadruples (+1 set of spare coils) needed for the combiner ring (2) and the TL1 (4), TL2 (4) transfer lines
- Required for shut-down 2005/06
- New design made by B. Langenbeck respecting the restricted space near the injection and extraction areas of the combiner ring (figure-of-eight type)
- Manufacturing by BINP/Novosibirsk
- Magnetic design, specification and drawings finished
- Contract signed in October 2004
- Material procurement has started
- Delivery foreseen end of 2005

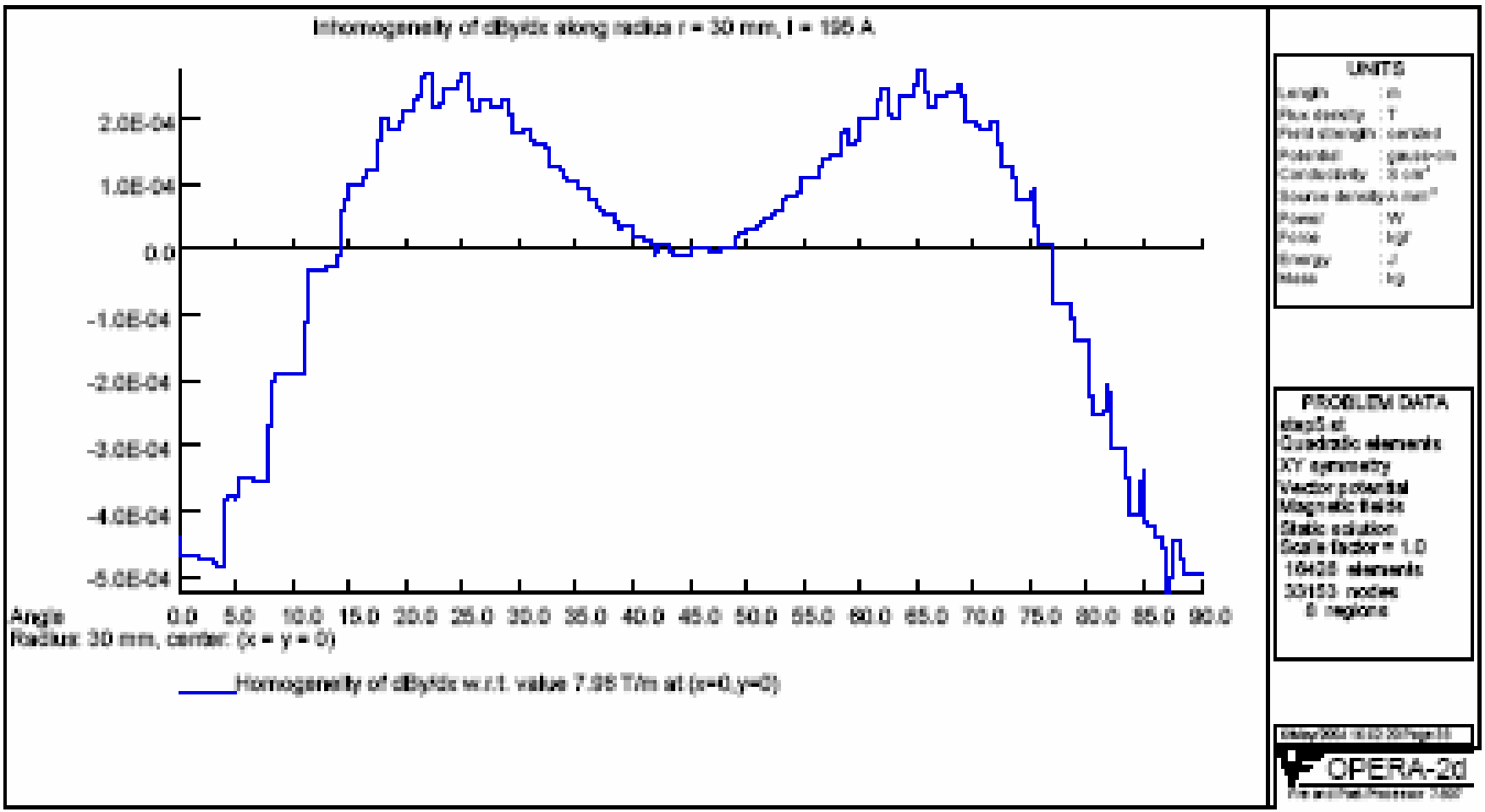
QG Main Parameters

Nominal field gradient	8 T/m
Nominal current	195 A
Yoke length	253 mm
Bore diameter	100 mm
Integrated field $\int B \cdot dl$	2.4 Tm/m
Resistance	< 85 mΩ
Inductance	~ 17 mH
Dissipated power	3 kW
Total weight	250 kg

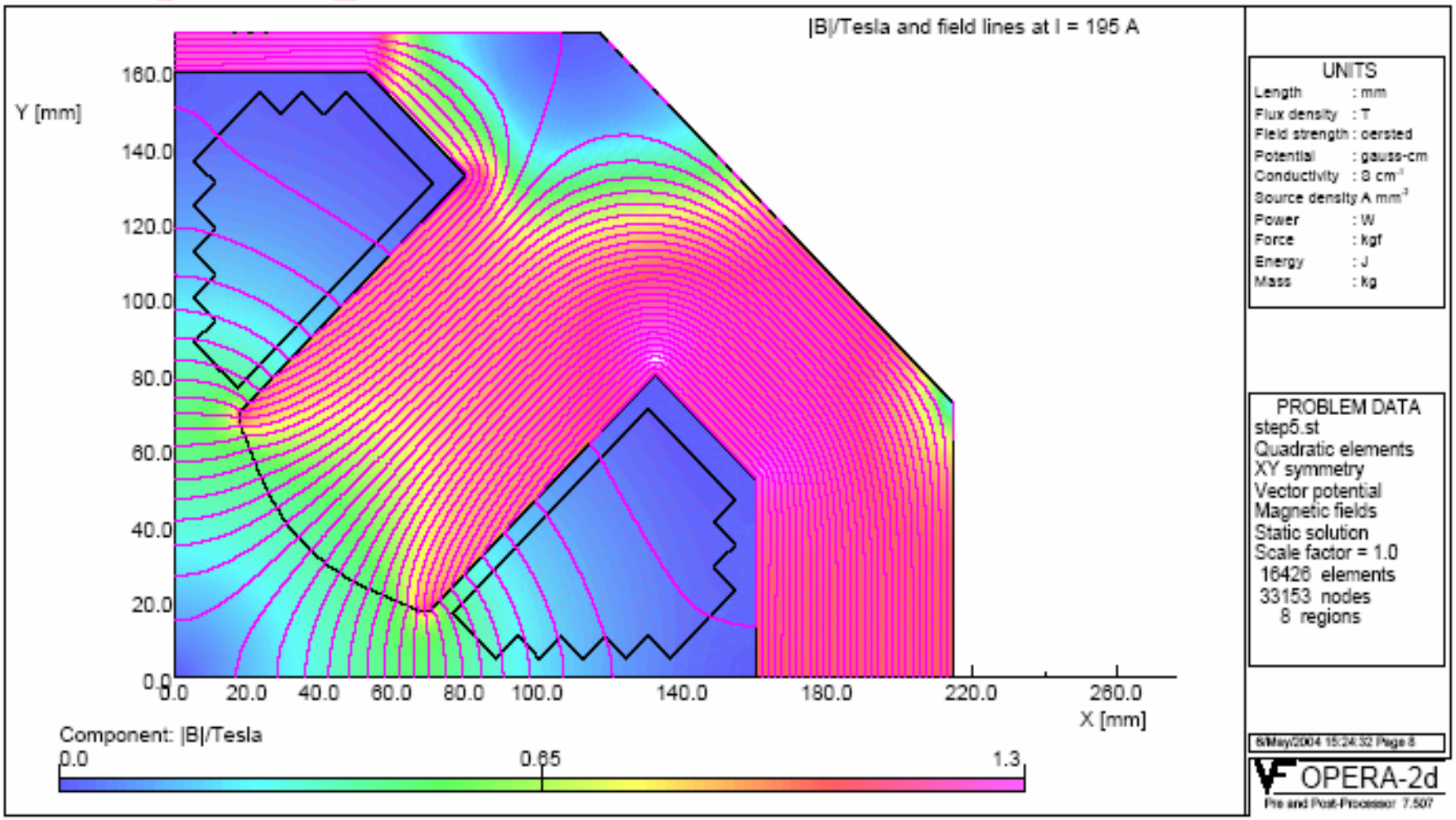
QG Magnetic Design



QG Gradient Homogeneity



QG Flux Lines and Field Density Distribution



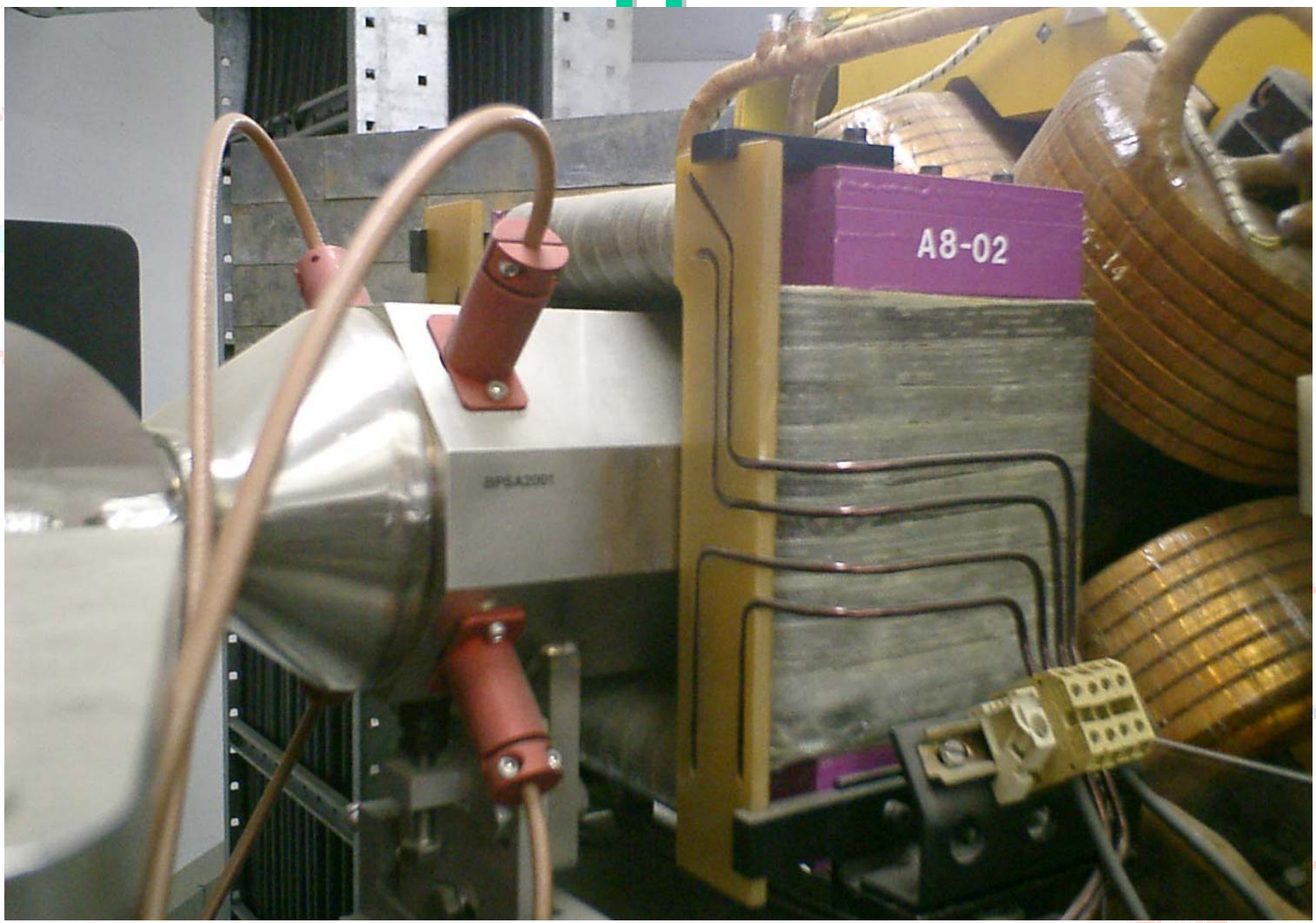
H/V Corrector Magnets

- 33 Horizontal/vertical corrector magnets including supports needed for the combiner ring (20) and the TL1 (5), TL2 (5) transfer lines
- Required for shut-down 2005/06
- Design based on Delay Loop correctors provided by Frascati
- Spanish contribution via CIEMAT
- Manufacture already in preparation by ANTEC, Spain

Corrector Main Parameters

Nominal field	9.8×10^{-3} T
Nominal current	± 10 A
Yoke length	100 mm
Horizontal aperture	128 mm
Vertical aperture	128 mm
Integrated field $\int B \cdot dl$	0.003 Tm
Resistance per plane	310 mΩ
Inductance per plane	84 mH
Dissipated power	31 W

Correctors for CR and TL



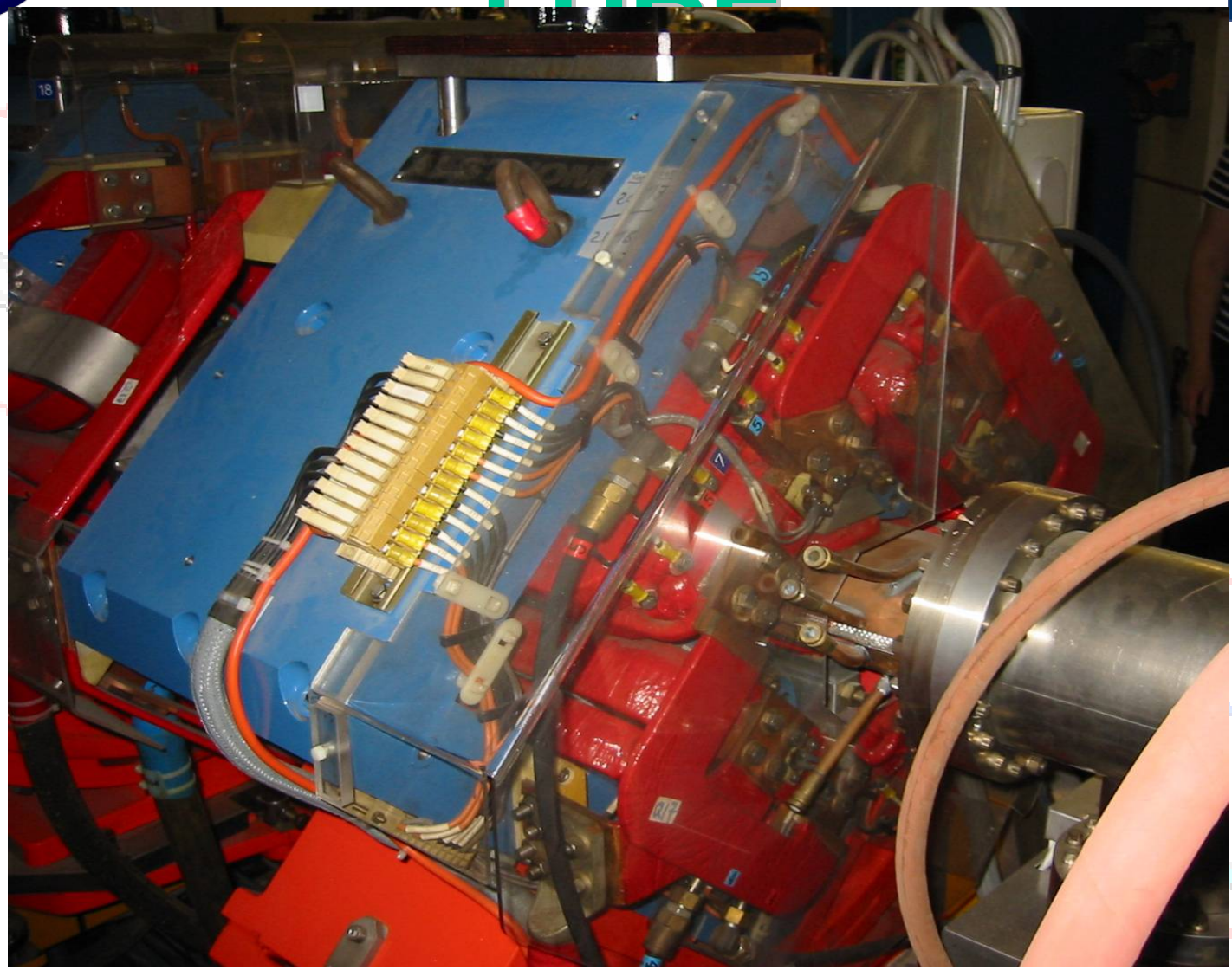
LURE Quadrupoles for CR

- 32 Quadrupoles became available after the closing of the SUPER ACO ring at LURE/Orsay in 2003
- Required for shut-down 2005/06
- Letter of intention from the DG has been signed
- Dismantling and shipment not before August 2005 depending on the green light of the French authorities
- Refurbishment and modification at CERN required (compensation coils, correction coils, sextupole coils)
- Magnets are for free, but CERN shall cover all expenses incurring from dismantling, packing and transport

LURE Quads Main Parameters

Solid non-laminated yoke for DC operation	
Nominal field gradient	8 T/m
Nominal current	450 A
Yoke length	320 mm
Bore diameter	120 mm
Integrated field $\int B \cdot dl$	3.2 Tm/m
Resistance	54 mΩ
Dissipated power	10.8 kW
Total weight	670 kg

Quadrupoles from LHDF



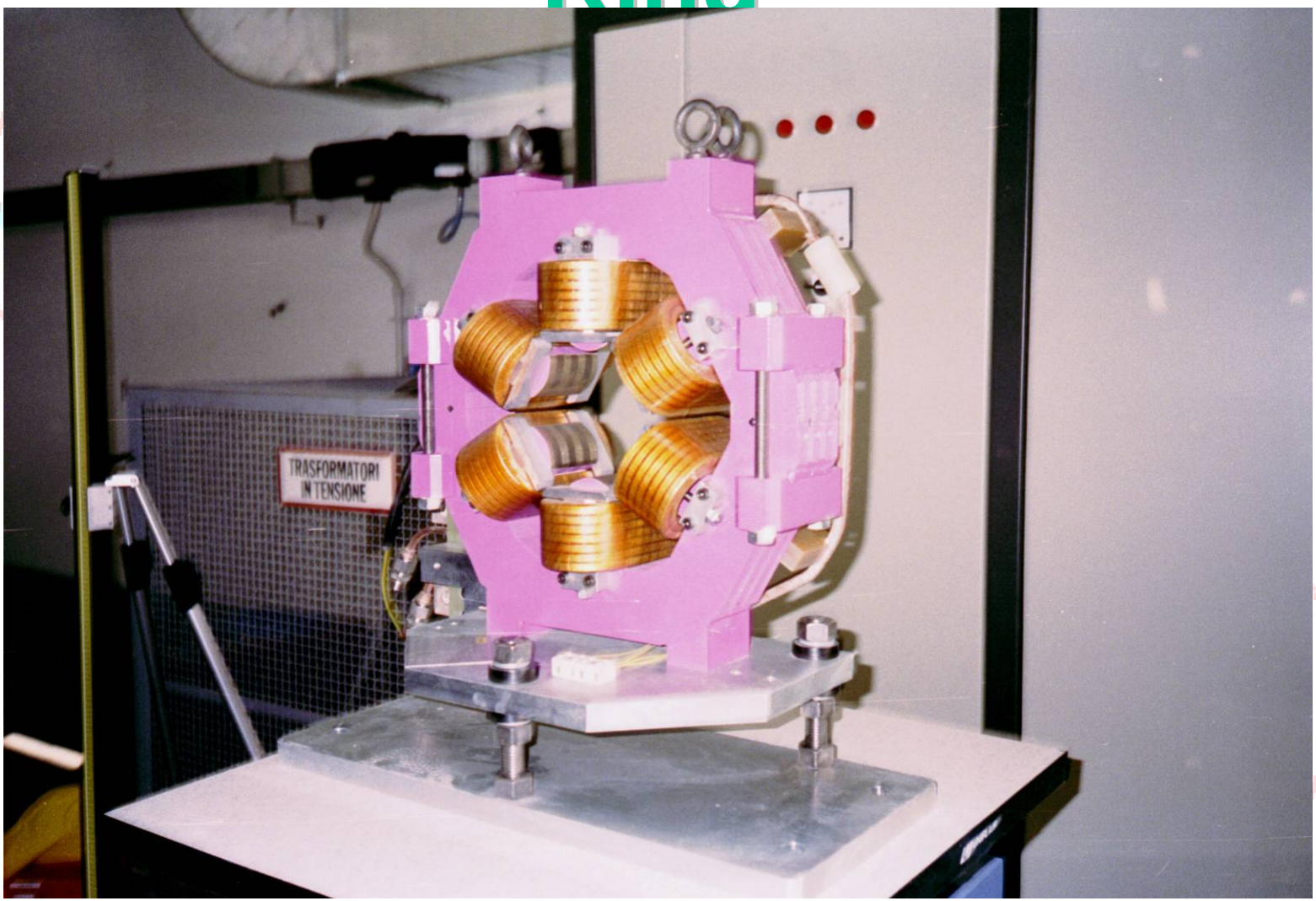
XC Sextupole Magnets

- 26 XC Sextupole magnets (+2 set of spare coils) needed for the combiner ring
- Required for shut-down 2005/06
- Modified design based on Delay Loop sextupoles provided by Frascati
- Manufacturing by BINP/Novosibirsk
- Contract signed in October 2004
- Material procurement has started
- Delivery foreseen by end of 2005
- Specification finished, drawings in preparation

XC Main Parameters

Nominal sextupole gradient	180 T/m^2
Nominal current	280 A
Yoke length	100 mm
Bore diameter	108 mm
Resistance	< 16 mΩ
Inductance	~ 0.93 mH
Dissipated power	1.4 kW
Total weight	60 kg

Sextupole for Combiner Ring



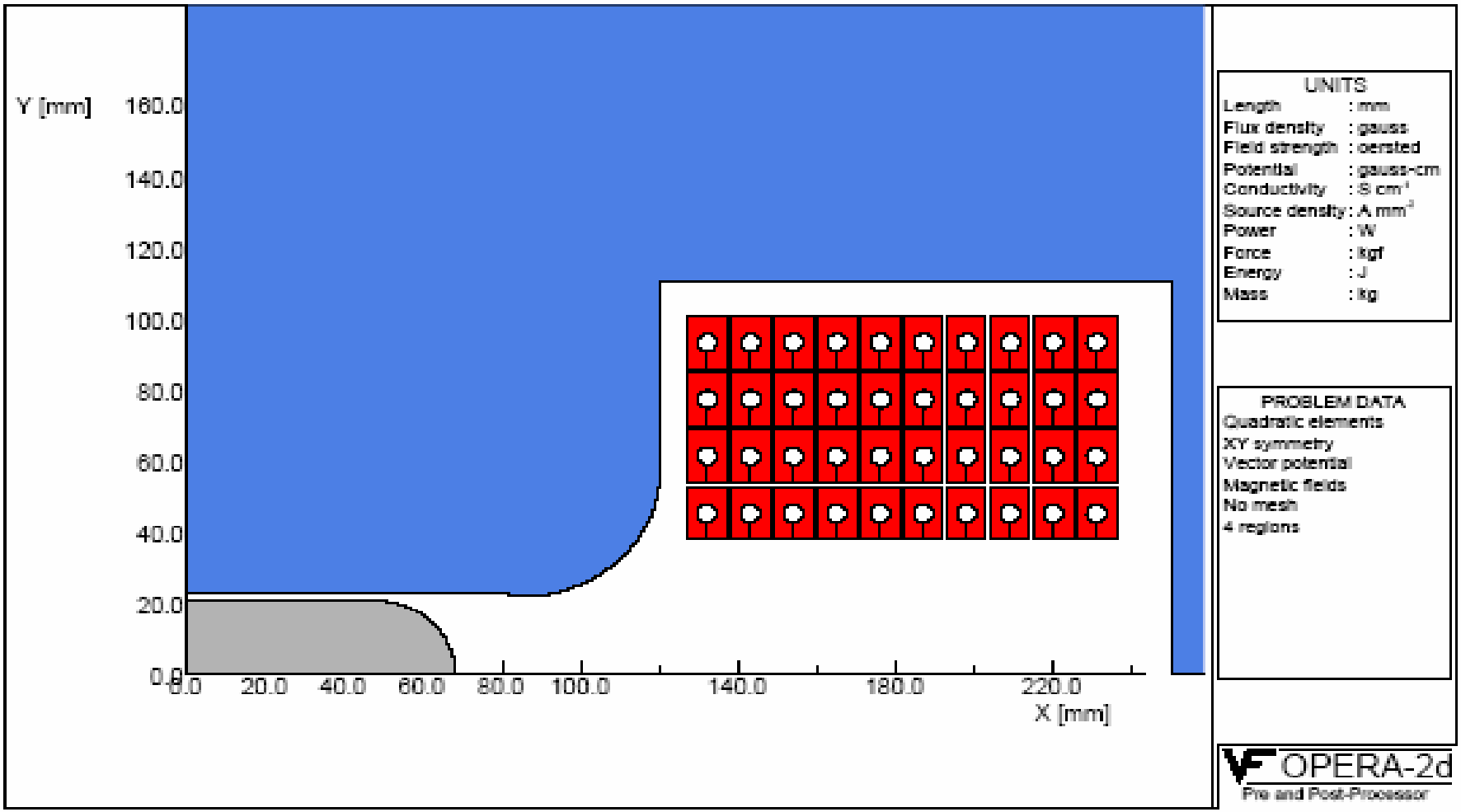
BF Bending Magnets

- 6 BF bending magnets needed for the TL2 transfer line (5 + 1 spare)
- Required for shut-down 2006/07
- Design based on the EPA bending magnets (zero gradient)
- Probably Swedish contribution via Uppsala University (waiting for approval)
- Contract to be signed foreseen in April 2005
- Magnetic design and Specification already finished by B. Langenbeck
- Specification drawings to be prepared until March 2005

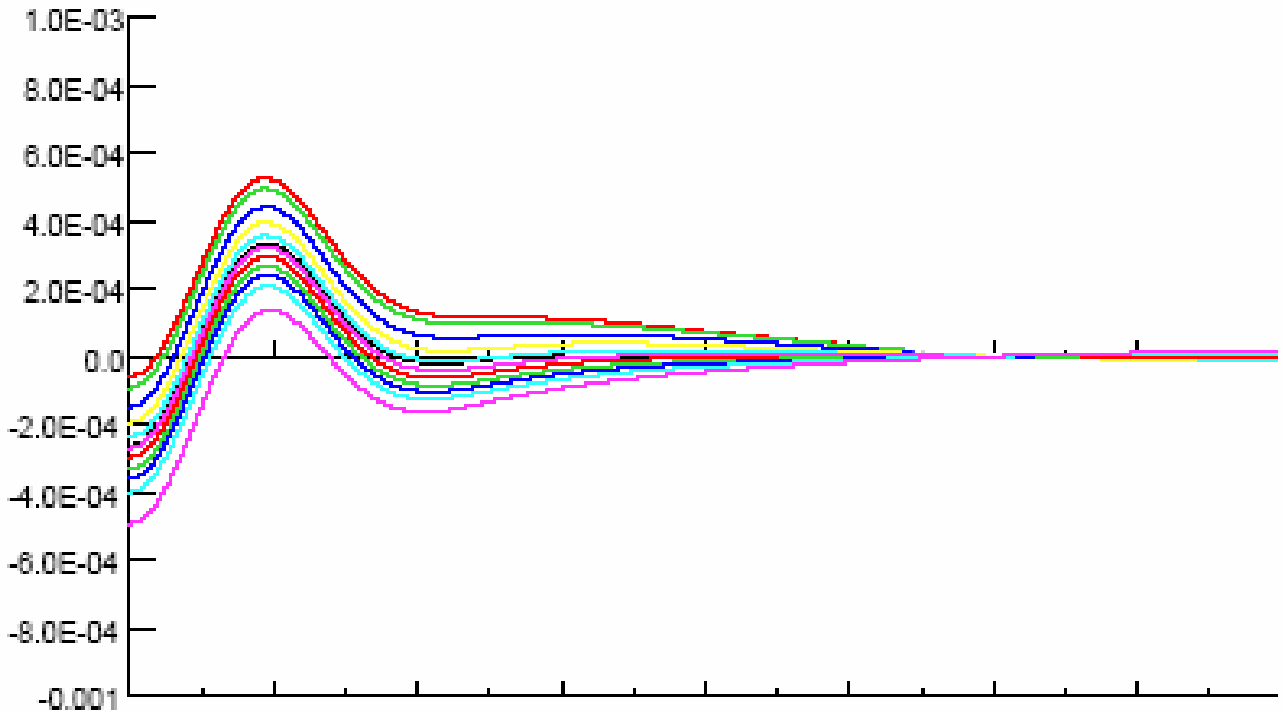
BF Main Parameters

Nominal field	1.3 T
Nominal current	570 A
Yoke length	465 mm
Gap height	45 mm
Integrated field $\int B \cdot dl$	0.611 Tm
Maximum bend angle	35°
Resistance	< 30 mΩ
Inductance	~ 25 mH
Dissipated power	9.3 kW
Total weight	1200 kg

BF Magnetic Design



BF Field Homogeneity



X coord	68.0	65.60649	58.98996	49.69405	39.69862	29.69862	19.69862	9.698623
Y coord	0.0	9.607773	16.97257	20.37731	20.5	20.5	20.5	20.5
Distance	0.0	10.0	20.0	30.0	40.0	50.0	60.0	70.0

Homogeneity of BY w.r.t. value at x=y=0, from uppermost line (100 A) to the lowermost one (600 A) in steps of 50 A. A black line for 50 A is in between which is lower than the red line because for low fields permeability reduces, too

UNITS

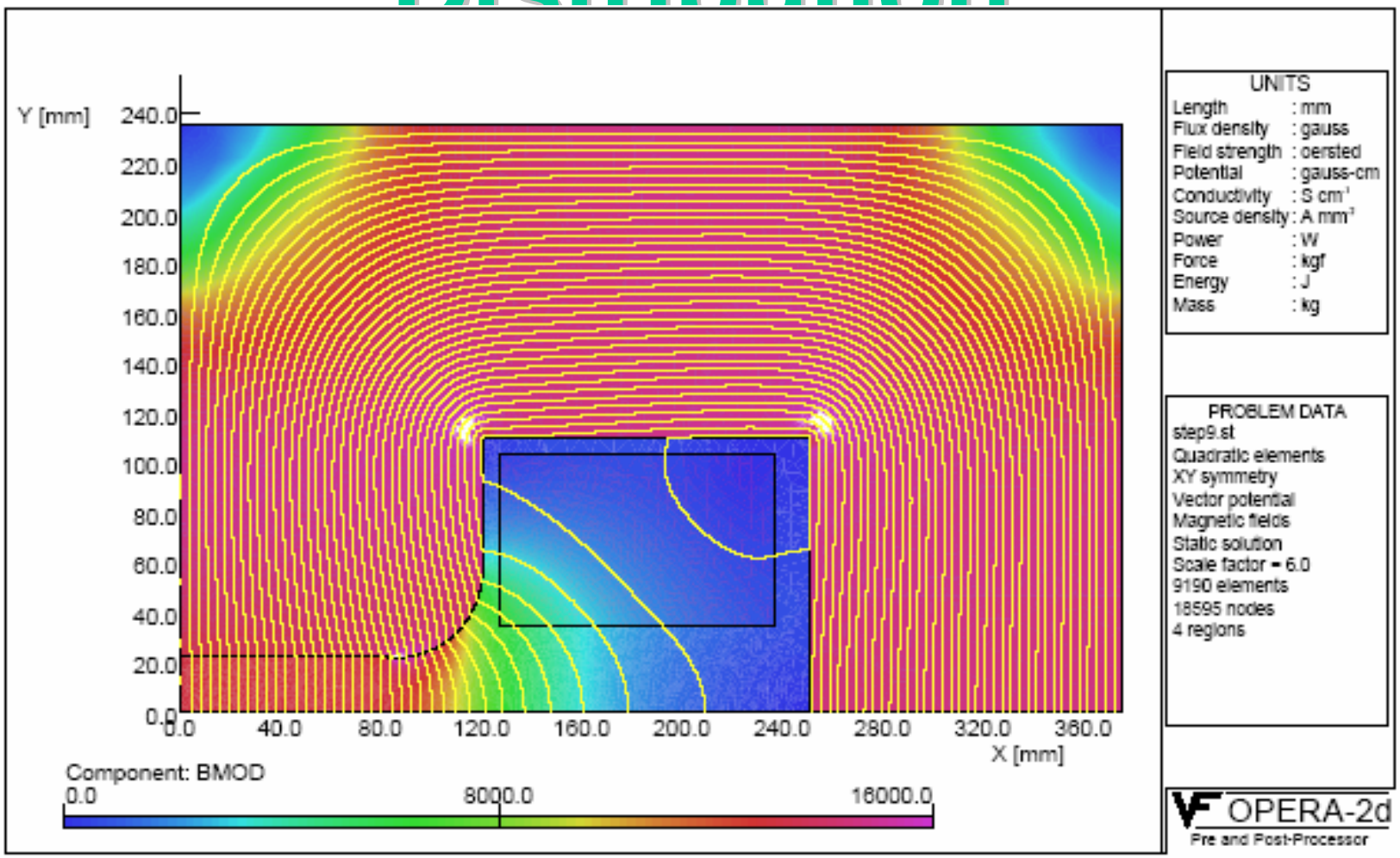
Length	: mm
Flux density	: gauss
Field strength	: oersted
Potential	: gauss-cm
Conductivity	: S cm^{-1}
Source density	: A mm^{-2}
Power	: W
Force	: kgf
Energy	: J
Mass	: kg

PROBLEM DATA

step9a.st
Quadratic elements
XY symmetry
Vector potential
Magnetic fields
Static solution
Scale factor = 6.0
9326 elements
18873 nodes
4 regions

OPERA-2d
Pre and Post-Processor

BF Flux Lines Distribution



Magnets for CLEX

- **Test beam line TBL**
  - 15 Quadrupoles including precision moving tables needed for TBL
  - Preliminary design in preparation
  - Spanish contribution ??? (waiting approval)

- **Two-beam test stand**
  - ? Quadrupoles needed
  - Work not yet started
  - Swedish contribution ???

Sextupole for LINAC

- Request from C. Biscari for a sextupole for the bunch lengthening chicane
- PS spare sextupoles 602:

Sextupole gradient	???
Inscribed diameter	243 mm
Magnet length	340 mm

Summary

- All magnets for TL1 and CR (11 new quadrupoles, 32 refurbished quadrupoles, 26 sextupoles and 33 correctors) are funded, contracts are placed and work has started
- Magnets for TL2 (11 dipoles): magnetic design finished, mechanical design in preparation
- Concerns & risks:
  - LURE quads not available before August 2005, but modification at CERN necessary (interference with PS consolidation project possible)
  - Technical engineer in charge of CFU in Russia left MEL group, replacement post not yet