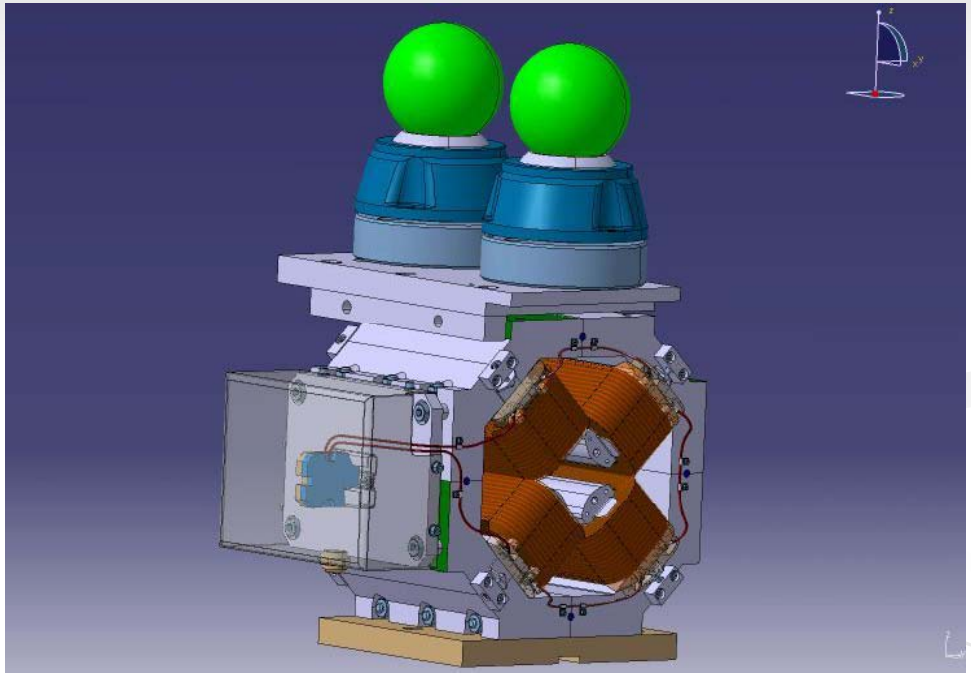
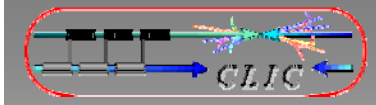
CTF3 Collaboration Meeting 27. – 28.1. 2009



TBL Quadrupoles

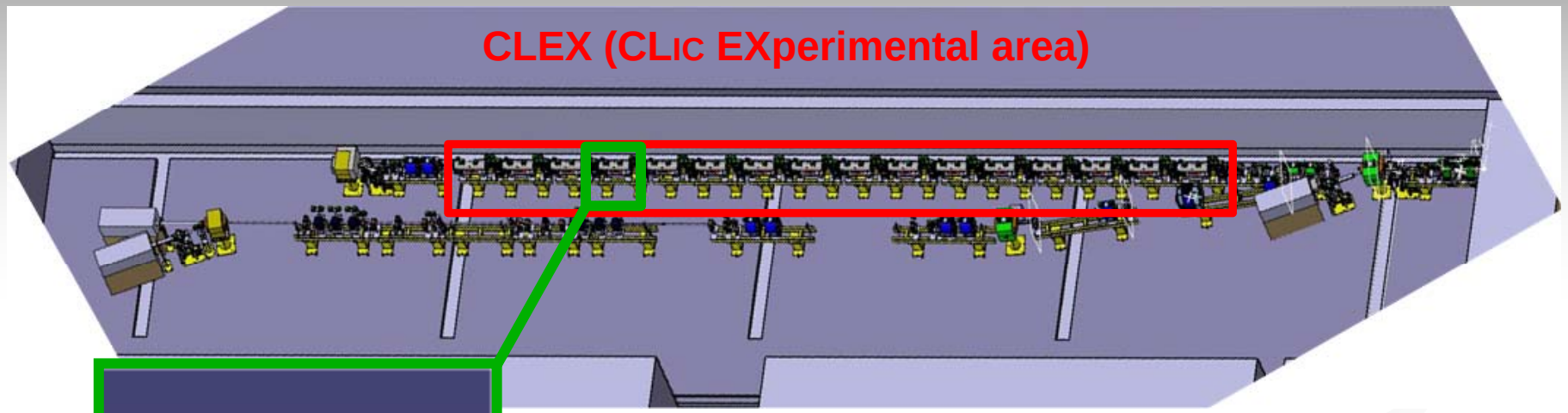
Antony Newborough CERN TE/MSC/MNC

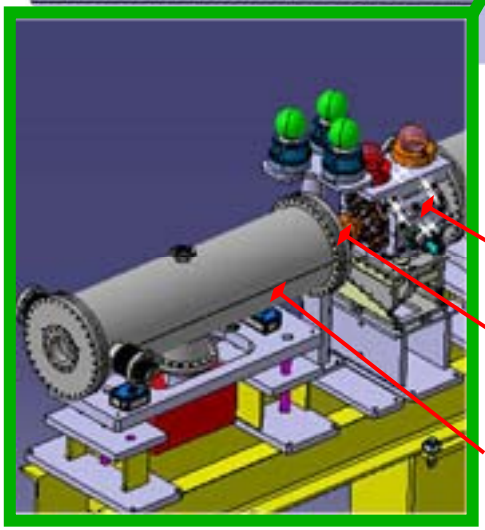


Outline

- What are the TBL Quadrupoles?
- Design and Specification
- Production
  - 16 Series magnets (BINP)
  - Proto-type magnet (CERN)
- Schedule

What are the TBL Quadrupoles?





- Single TBL Cell

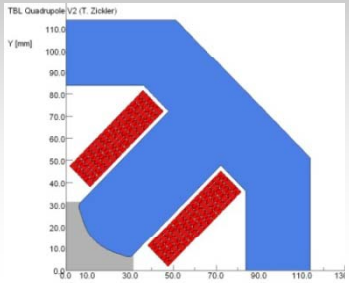
Quadrupole magnets for the 16 TBL (Test Beam Line) cells for the focusing of the beam during deceleration and power extraction.

Design and Specification

Main parameters:

BASIC		
Number of magnets		16 + 4 spare coils
Aperture radius	mm	19
Nominal gradient (at 8 A)	T/m	7.14
FIELD QUALITY		
Good field region	mm	$r \leq 15$
Gradient homogeneity $\Delta\int Gdl / \int Gdl$ at G_{nom}		$\leq \pm 2\times10^{-4}$ at $x,y \leq 15$ mm
EXCITATION		
Nominal current	A	8
Nominal voltage	V	8.5
Dissipated power at I_{rms}	W	68
Magnet resistance (at 20°C)	Ω	1
Magnet inductance	mH	140
DIMENSIONS AND WEIGHT		
Yoke length	mm	170
Yoke width	mm	236
Yoke height	mm	236
Yoke weight	kg	39
Overall length	mm	215

Project started – September 2007

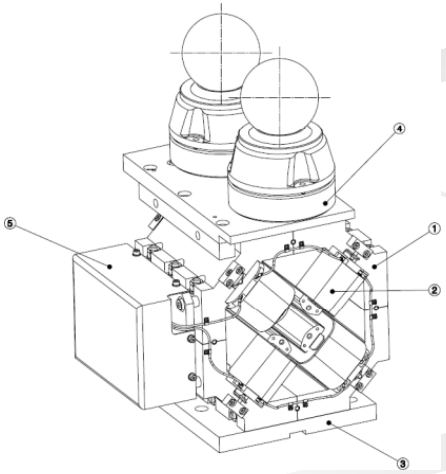


Magnetic Design:
Th. Zickler
– Finalised June 08.

Technical Specification:
A. Newborough - April 2008


TECHNICAL SPECIFICATION

Test Beam Line (TBL) Quadrupole for the CERN CLIC Test Facility

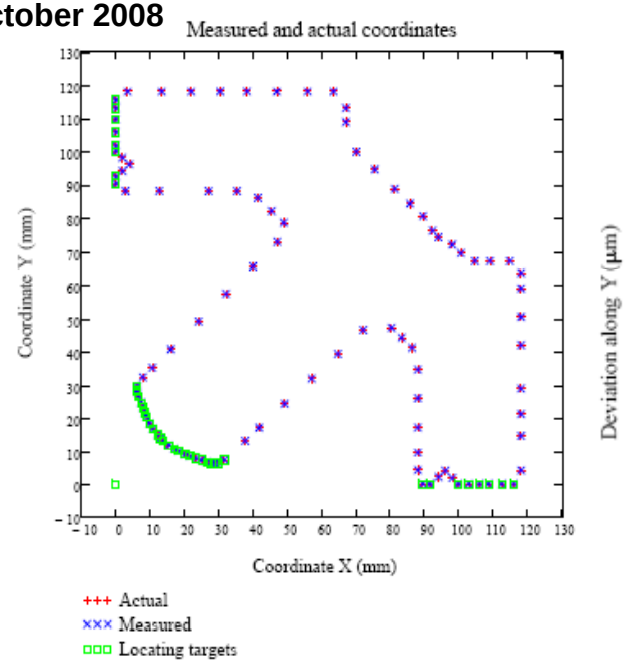


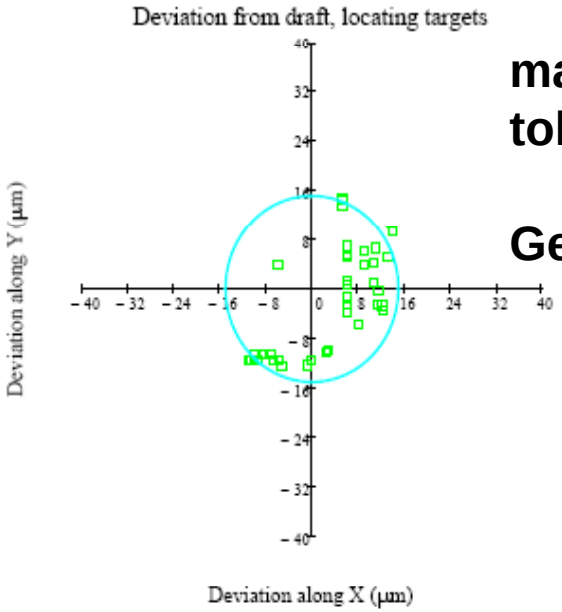
Engineering Drawings:
T. Sahner and D. Steyaert
- April 2008

BINP collaboration confirmed May 08, design finalised July 2008.

Production - 16 Series magnets (BINP)

October 2008





mating surfaces & pole tolerances +/- 15 µm

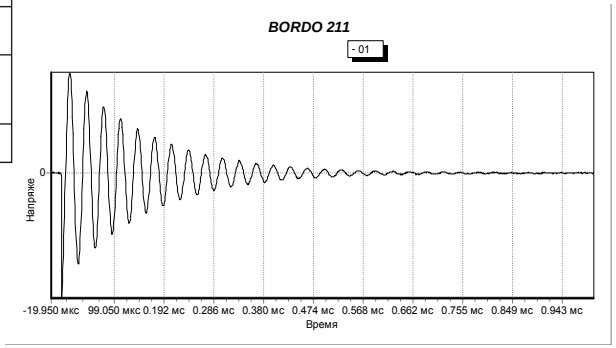
General tolerance +/- 30 µm

Production - 16 Series magnets (BINP)

October 2008

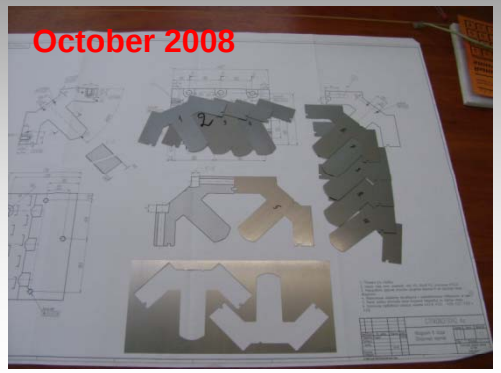
5.3 INSPECTION OF COIL № 17

No	PARAMETER	MEASURED	REFERENCE
1	Checking of the dimensions of the coil before impregnation	Ok	Ok
2	Checking of the dimensions of the coil after impregnation	Ok	Ok
3	Visual checking for quality of insulation of conductors in the coil	Ok	Ok
4	Electrical resistance of the coil at ambient temperature	270 mOhm for 16 °C	x mOhm for y °C
5	Electrical resistance for 20° C	274 mOhm	z mOhm
6	Leakage current between the coil terminations and bath at 1 kV	0	<100 µA
7	Electrical resistance between the coil terminations and bath at 1 kV (DC) after 8 hours	Ok	>100 MOm
8	Turn-to-turn isolation (10V per turn)	Ok	Ok

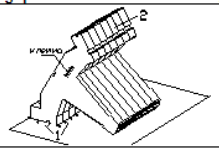
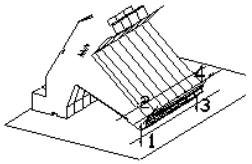
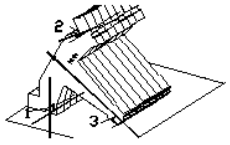


- **68 - coils produced 16 magnets + spare**
- **1st set completed end of October 08**
- **Series Completed November 08**

Production - 16 Series magnets (BINP)



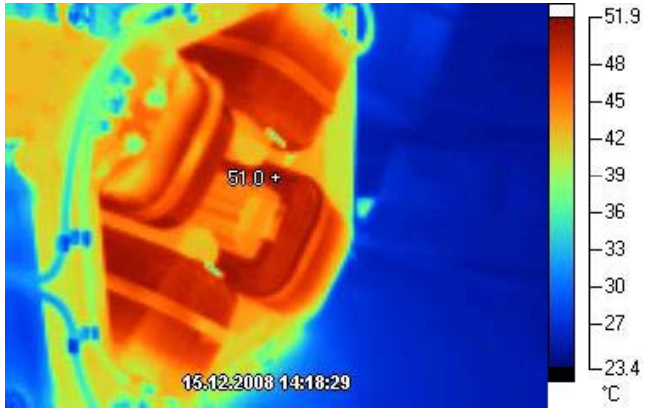
November2008

6	The gap between surfaces of segment and base plate (2 measures). Nominal : 0.02 mm.		
		1	0.02 mm
		2	0.02 mm
7	The gap between shims and base plate (4 measures). Nominal : 6.25 ± 0.02 mm.		
		1	6.26 mm
		2	6.25 mm
		3	6.25 mm
		4	6.26 mm
8	Non-perpendicularity of surfaces of the segment (3 measures). Nominal: 0.2 mm		
		1	0.2 mm
		2	0.2 mm
		3	0.1 mm

- **64 - quadrants**
- **1st set completed end of November 08**
- **Series Completed December 08**

Production - 16 Series magnets (BINP)

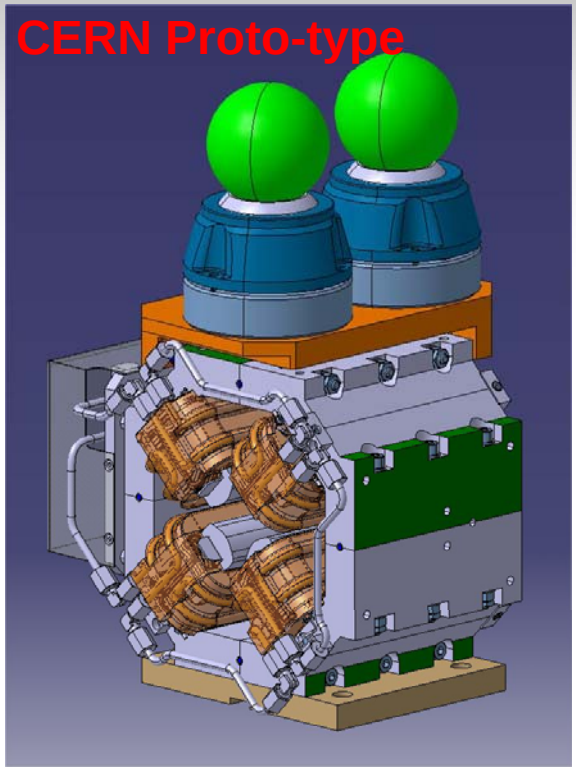
December 2008



- **Pre-series assembly Dec 08**
  - **Power test Dec 08**
  - **Basic magnetic measurement Jan 08, full measurement Feb 08 (1-2 weeks delay)**
- **Series completed end of Jan 08**

Production - Proto-type magnet (CERN)

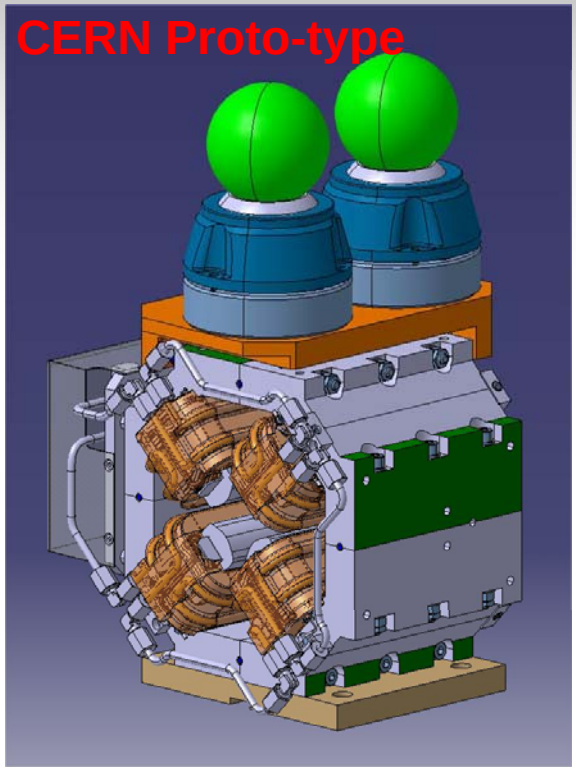
Coil with Indirect Cooling

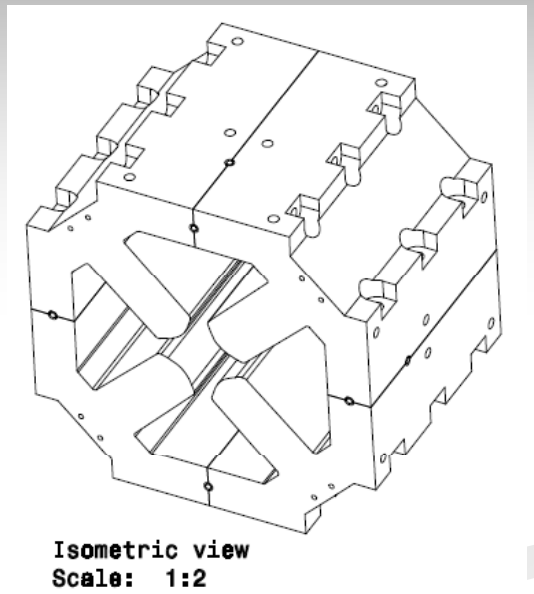


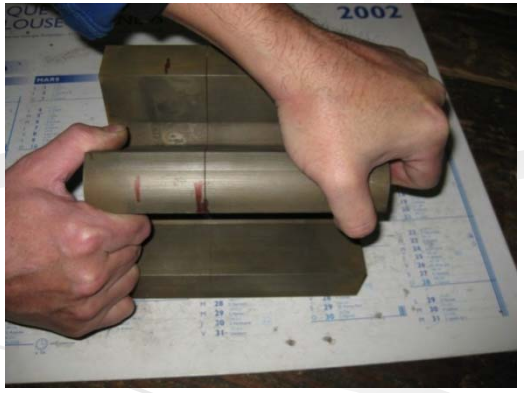
- 1 option for drive beam quads for CLIC
  - Air cooling unrealistic
  - Direct water cooling not reliable enough
  - Charged resins being Investigated for improved heat transfer

Production - Proto-type magnet (CERN)

Yoke – Electrical Discharge Machining (EDM)







- 1st attempt March 08
- Bonding problems with the steel
- Stopped until new steel delivery

Schedule

- **Assembly of 16 magnets finished – end of January**

- **Magnetic Measurement**
  - **Rotating coil – End of January**
  - **Hall probe array – Mid February**

- **Shipping**
  - **To leave BINP – mid February**
  - **Delivery to CERN – February - March**

- **Acceptance Tests – 1 Week**

(Electrical Test, thermal measurements and installation of interlocks)

- **Magnetic Measurement – 1 to 2 weeks (one magnet)**

- **Installation – March/April**

Other Work


CALIFES correctors


TL2 & CLEX correctors
014


TL2 vertical dipoles


TL2 & TL2'


TL2 & CALIFES

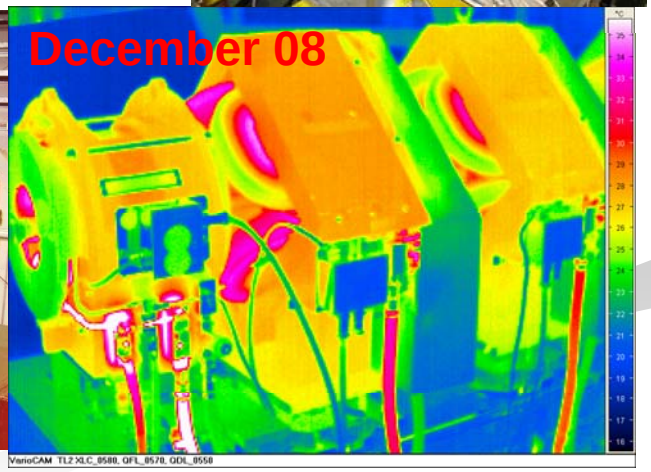

CALIFES, TBTS & TBL


TL2' & TBL


CALIFES & CTF2


CALIFES


July 08


December 08