QPS and nQPS Hardware Commissioning 2009 - a (still preliminary) approach

on behalf of the (extended) QPS team

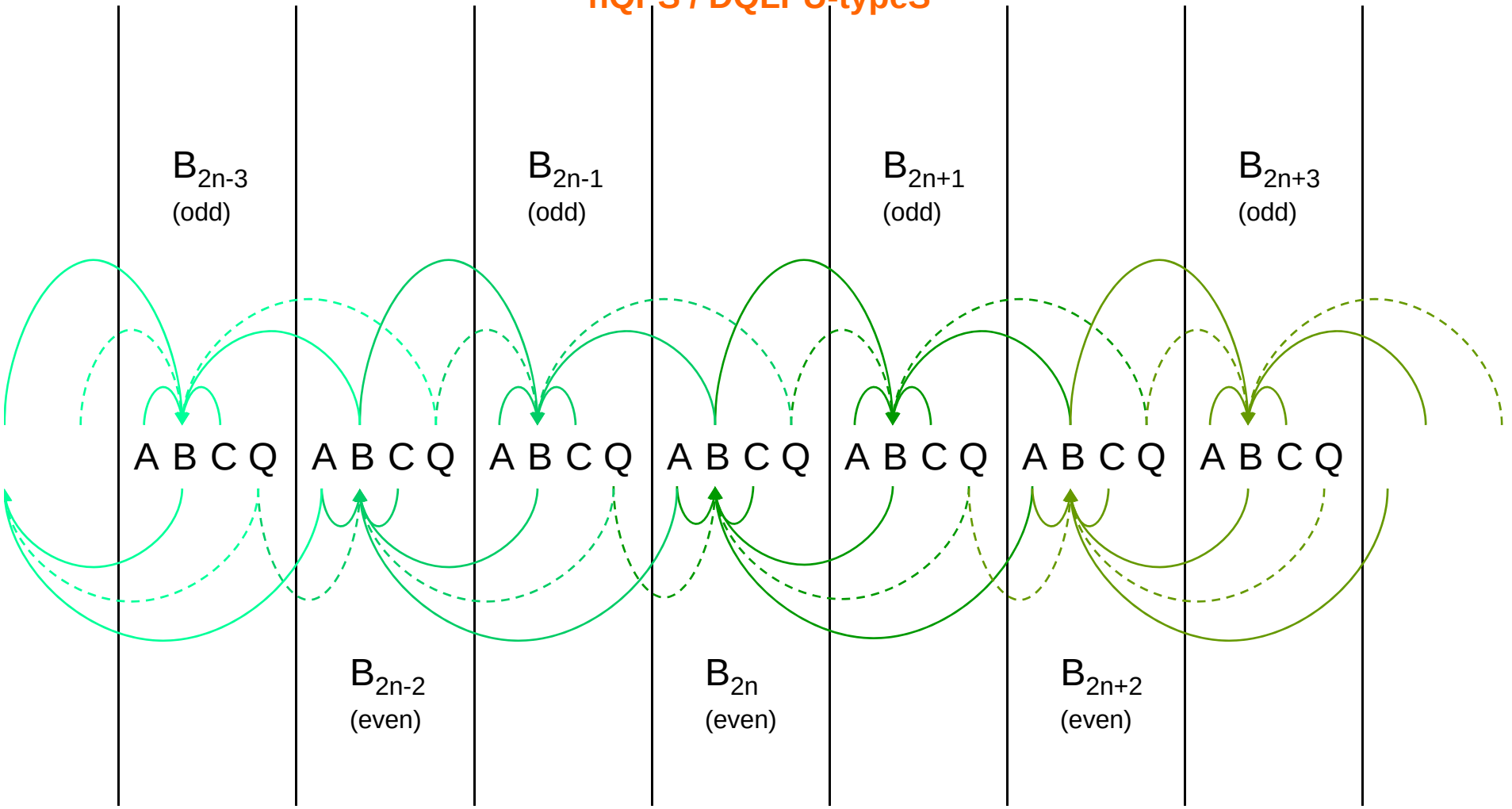
Concerns:

- **The present QPS (as you know it from the 2008 commissioning campaign)**
- **The few modifications applied to a minor part of the present detection systems**
- **The new QPS 'layer' of electronics for enhanced Busbar Protection and Aperture-Symmetric Quench Detection**
- **The present Energy Extraction systems (13 kA & 600A)**

- with associated upgrades of infrastructure (mainly UPS), controls and new Data Acquisition for Magnet Splice Monitoring and Busbar Splice Monitoring.

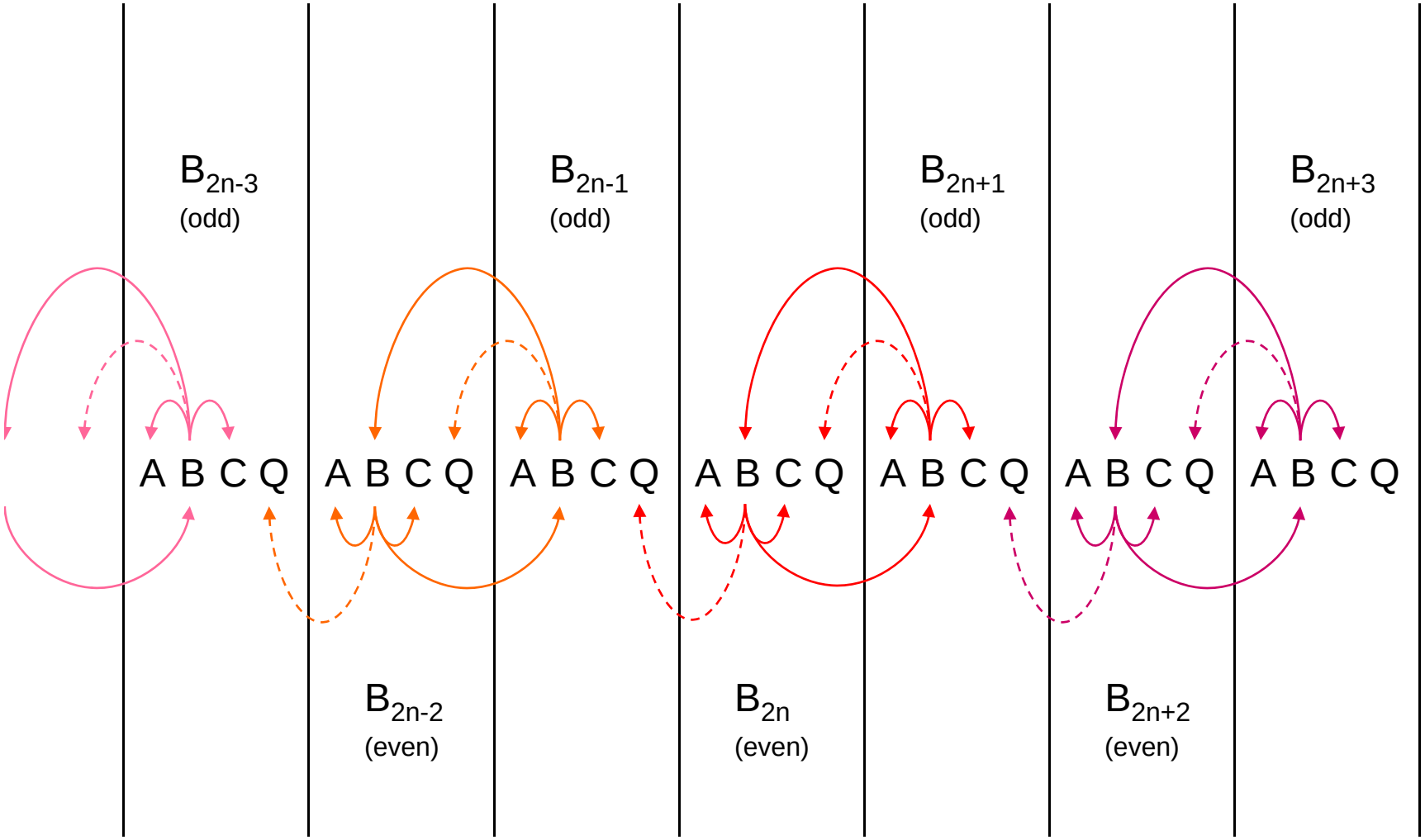
QPS Hardware Commissioning 2009

The new layer of circuit protection electronics
nQPS / DQLPU-typeS



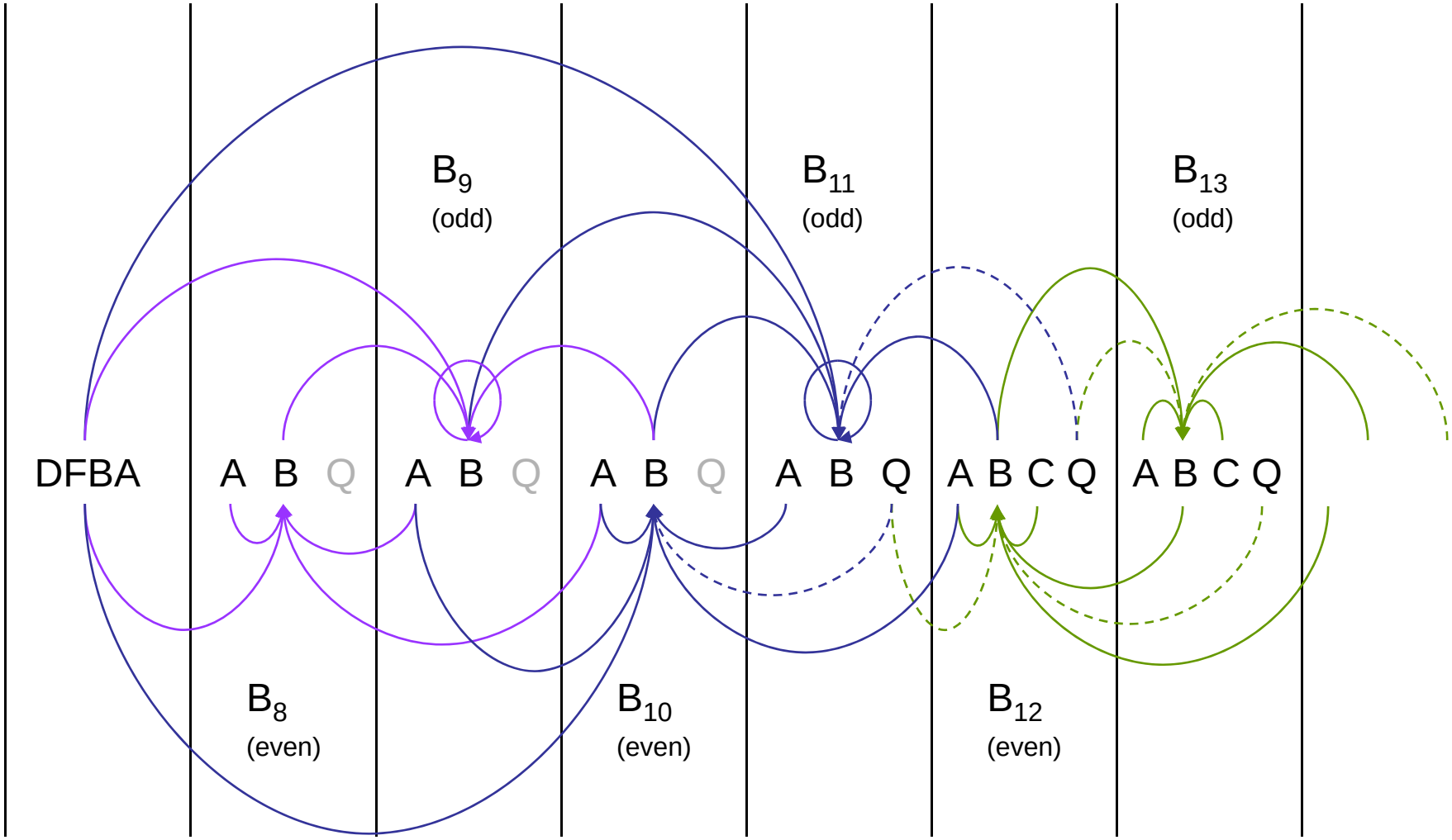
Arc magnets: sensing wires (all repetitive cells)

QPS Hardware Commissioning 2009
The new layer of circuit protection electronics
nQPS / DQLPU-typeS



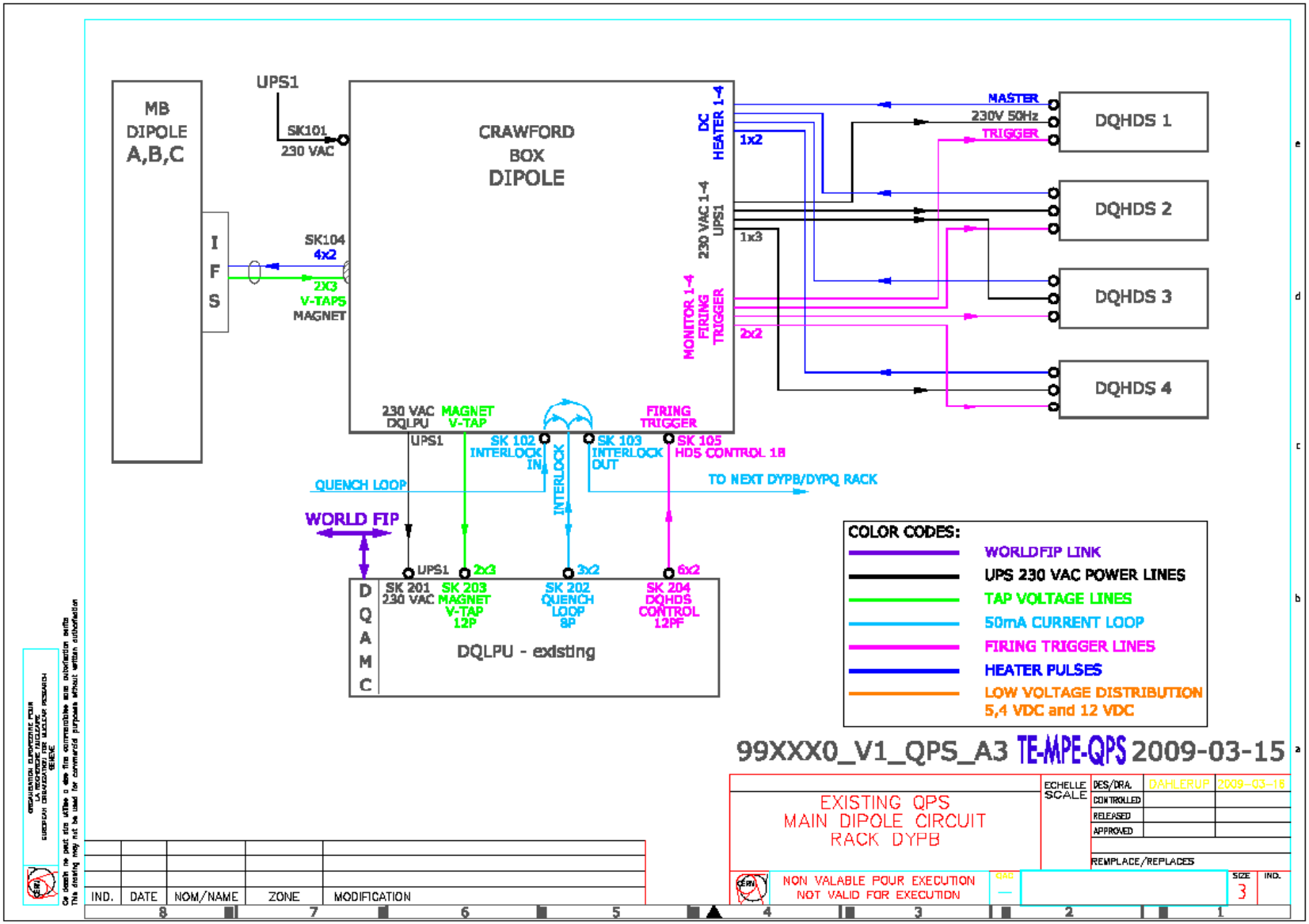
Arc magnets: firing lines (all repetitive cells)

QPS Hardware Commissioning 2009
The new layer of circuit protection electronics
nQPS / DQLPU-typeS

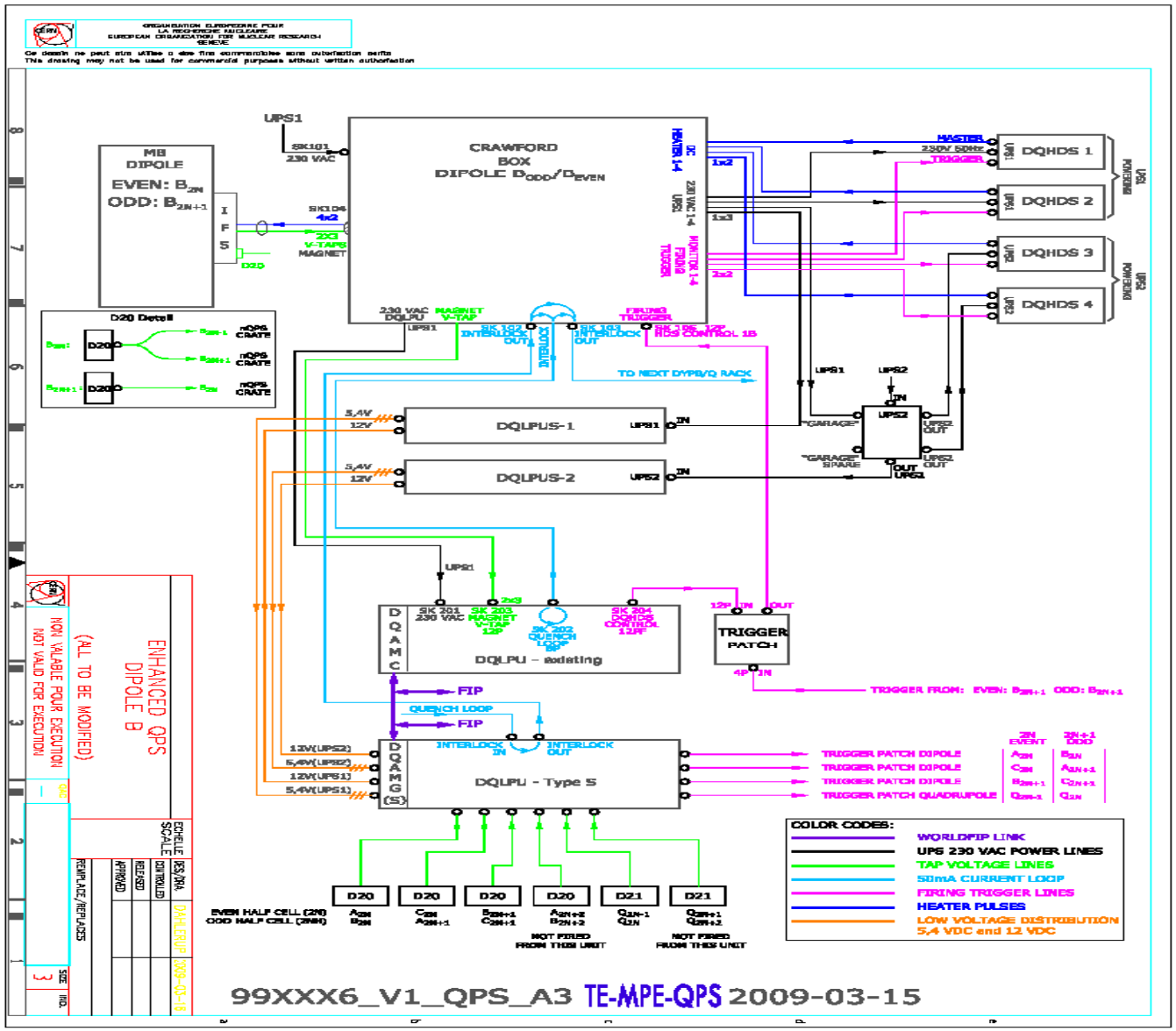


Arc magnets: sensing wires (cells 8 to 12 - for : R2, R4, R6, R8, L2, L4, L6, L8)

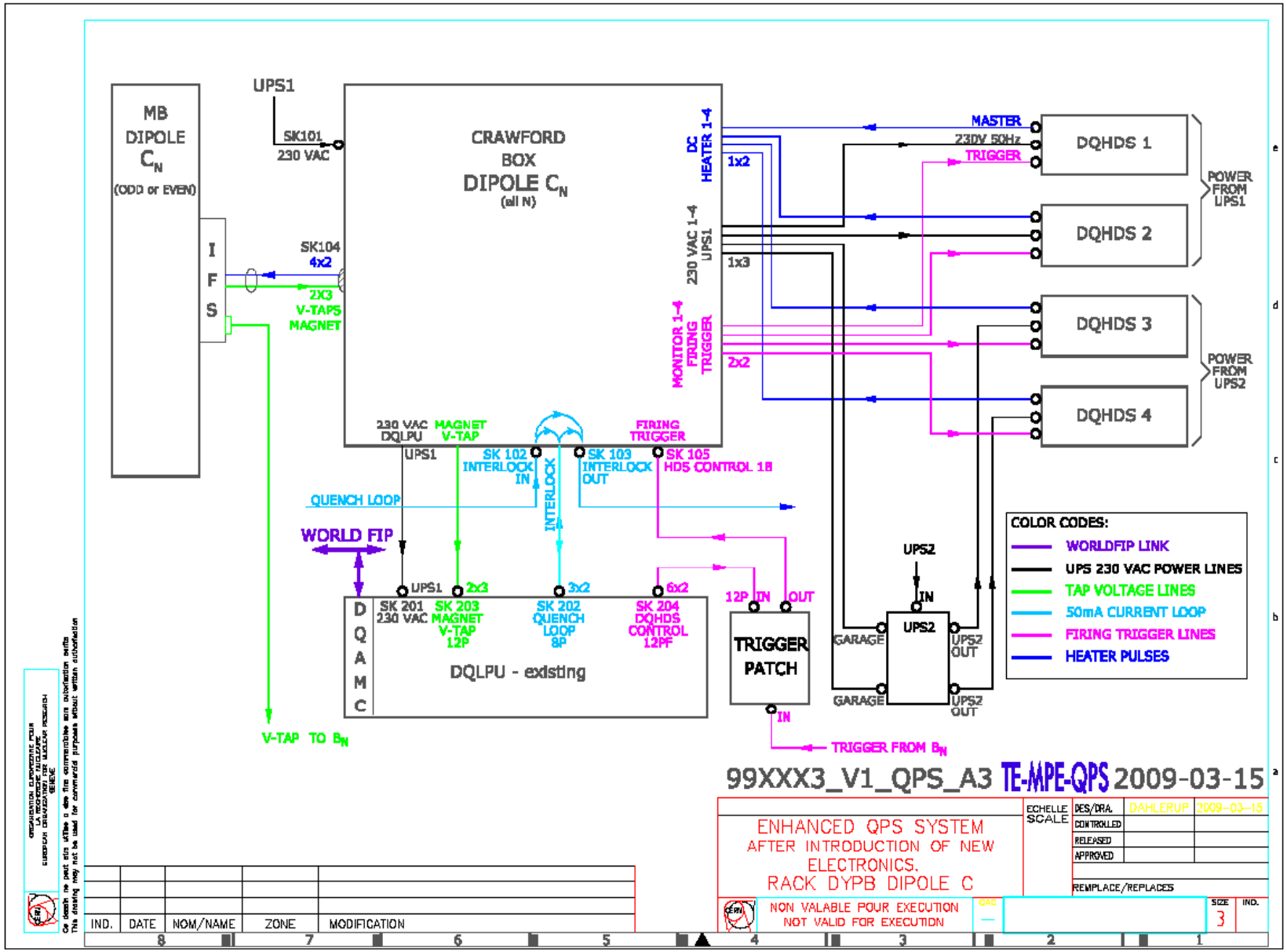
QPS Hardware Commissioning 2009 - the present local protection system



QPS Hardware Commissioning 2009 The new layer of circuit protection electronics nQPS / DQLPU-typeS –placed under Dipole 'B'



QPS Hardware Commissioning 2009 The new layer of circuit protection electronics nQPS / DQLPU-typeS – placed under Dipole C2N



QPS Hardware Commissioning 2009
The new layer of circuit protection electronics

To be commissioned.....

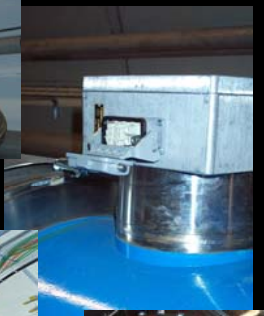
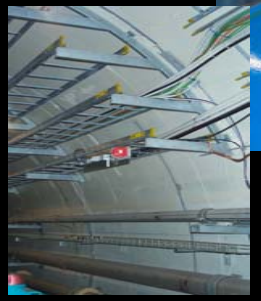











QPS and nQPS Hardware Commissioning - PROCEDURES and REQUIREMENTS I

ICT - IST - HwC

component level system level machine level

- **nQps:**

ICT: - Verification and Electrical Tests of installed signal cables (4400) prior to connection. On-going, using portable testers developed by QPS and ELQA, Outsourced to BE/OP and CMS (Russian) team. To be completed by early June.

- Electrical Noise Floor Measurements at zero current using two portable QPS crates with DQQDC detector board, linked to a Labview application. Outsourced to an IHEP team.

CONDITIONS: Cold sector, max. of noise sources operating.

Duration: 2 weeks first sector, 1 week following sectors.

Period: Mid-May to Mid-August. No overlaps.

Installation and connection of WorldFip, Patches, 'internal' cables and PowerPacks (DQLPUS) as early as available.

After installation of the DQLPU-typeS (with 1xDQAMG,5xDQQBS) IST can begin.

QPS and nQPS Hardware Commissioning - PROCEDURES and REQUIREMENTS 2

IST: - Communication tests with each facility –present and new QPS.

QPS & nQPS

At the same occasion test of updated Controls Software (QPSExpert and Synoptics/Supervision)

- Noise evaluation at 0A using nQPS (DQQBS, high precision, magnet total voltages and busbar segments)
- Interlock tests with DQQBS - heaters not charged
- Interlock tests with DQQDS (SymQ as soon as available and installed – heaters not charged
- With heaters charged: Discharge tests from SymQ, all main magnets
- (Usual) discharge test from present QPS units, with heaters charged
- UPS1&2 tests: Validation of reaction to absence of UPS1 or UPS2
- Verification of PM functionality
- Verification of Logging and Alarm features
- Verification of the new Splice Data Acquisition Software (data flow and data treatment - from MSM and the BSM

QPS and nQPS Hardware Commissioning - PROCEDURES and REQUIREMENTS 3

HwC: At I_{min} (350A) - also without presence of SymQ cards:

nQPS

- Signal verifications of all differential voltages from the five DQQBS boards (magnet and busbar voltages)
- Calibration of Inductance Compensation for each busbar segment of the sector
- Complete Mapping of all BusBar and Total Magnet voltages.
  0 – 2kA – 0, with 1-2 A/s, in steps of 200A, 21 plateau's

→ Generation of first Splice Resistance values

For powering to higher currents SymQ cards must be installed, the DQQDS Interlock and Discharge tests must have been performed and the MSM / BSM monitor(s) must be continuously running and displaying.

At I = 3 kA:

- Discharge request from FPA (also for EE).

QPS and nQPS Hardware Commissioning - PROCEDURES and REQUIREMENTS 4

IST +HwC: **Stand-alone magnets (IPQ's, IPD's) and inner triplet quads:**

Due to intervention by QPS on all units for UPS redundancy adaptations an extensive re-commissioning is required on all circuits:

- **Communication tests**
- **Interlock tests**
- **Measurement of heater resistances from HDS**
- **Discharge test at 0A**
- **UPS1/UPS2 failure tests**

- followed by standard HwC procedure as defined for that particular circuit, incl. voltage signal validation at Inom.

QPS and nQPS Hardware Commissioning - PROCEDURES and REQUIREMENTS 5

IST +HwC: 600A Corrector Circuits:

Shutdown modifications by QPS:

1. **Installation and connection of 16 Remote Reset Units for power cycling – LHC odd points (RR's, UJ's) -through Fip controllers**
2. **Updating of some Inductance Tables**

requiring:

- **Functional tests at 0A of the remote units**
- **Interlock testing on all circuits**
- **Powering with agreed and already used values of ramp rates and current acceleration.**

QPS and nQPS Hardware Commissioning - PROCEDURES and REQUIREMENTS 6

IST +HwC: Energy Extraction

13 kA:

- **No modification to any item was required**
- **No maintenance were needed , not even in S56 after training campaign**
- **Mounting of the missing arc detectors (21 out of 24) for counting the arcs in the extraction switch chambers was postponed due to lack of resources**

-consequently, the only required test is a discharge per system from 3 kA to verify the state of all signals from DQS and DQR.

600A:

-New embedded interface firmware for multiple closing pulse application

-17 systems were not commissioned (UJ33: 9, UA43: 1, RR53: 7)

Suggested procedure:

-Interlock test at 0A

-One discharge test / system above 50A

-No opening-time measurement where already made in 2007-2008

QPS Commissioning teams in CCC: 1 team leader + 2 operators per shift, a.m. and p.m. shifts.

Experienced people from last year's HwC campaign. Plus a Field Team of specialists.

WP	Task	Item	Description	Responsible	FTE %	Manpower	FTE %	Materials	Duration	Start	Milestones	End
QPS FUP 17	Hardware commissioning of new and present protection systems			Rudiger Schmidt	10%							
		17.1	Planning and Scheduling	Knud Dahlerup,	90%				8 wks.	cyo. wk. 32		cyo. wk. 39
				Fabio Formenti,	90%							
				Gert-Jan Coelingh								
		17.2	Front 1 A.M.									
			17.2.1 Team Leader	Robert Flora	100%				8 wks.	cyo. wk. 32		cyo. wk. 39
			17.2.2 Operators			Kevin Priestnall,	100%		8 wks.	cyo. wk. 32		cyo. wk. 39
						Adam Drozd	100%					
		17.3	Front 2 A.M.									
			17.3.1 Team Leader	Andrzej Skoczen	100%				8 wks.	cyo. wk. 32		cyo. wk. 39
			17.3.2 Operators			Arkadiusz Gorzawski,	100%		8 wks.	cyo. wk. 32		cyo. wk. 39
						Guy Deferne	100%					
		17.4	Front 1 P.M.									
			17.4.1 Team Leader	Zinur Charifoulline	100%				8 wks.	cyo. wk. 32		cyo. wk. 39
			17.4.2 Operators			Grzegorz Seweryn,	100%		8 wks.	cyo. wk. 32		cyo. wk. 39
						Regis Cerdin	100%					
		17.5	Front 2 P.M.									
			17.5.1 Team Leader	Edward Nowak	100%				8 wks.	cyo. wk. 32		cyo. wk. 39
			17.5.2 Operators			Mikhail Ovsienko,	100%		8 wks.	cyo. wk. 32		cyo. wk. 39
						Bhusan Baraskore	100%					
		17.6	Reserve manpower for commissioning			Sandor Feher,	100%		8 wks.	cyo. wk. 32		cyo. wk. 39
						Alan Honma	100%					
		17.7	Linkperson to operation	Alick Macpherson	40%				8 wks.	cyo. wk. 32		cyo. wk. 39
		17.8	Field team			Reiner Denz,	70%		8 wks.	cyo. wk. 32		cyo. wk. 39
						Joaquim Mourao,	70%					
						Vincenc Praklalse,	70%					
						Gert-Jan Coelingh,	70%					
						Noel Fournier,	70%					
						Hachieu Favre	70%					

Main objectives for the QPS commissioning team:

Make sure that the QPS, nQPS and EE equipment operates correctly and guarantees the expected circuit protection.

Give support for the HwC campaign in general.

Supply data for evaluating the performance of leads, busbars and magnets.