

# Overview of MD9546 – Quench Test

Procedure and machine protection aspects

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Many thanks to all colleagues from every section for their essential support!

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# Main goal of the MD

- Induce high losses at IR7 TCP with increasing power load (target: **1MW for 10s**) to quench DS magnets using collimation debris
- Aim: Infer power load at TCP where DS magnets quench under HL-LHC operational conditions
- 2022 collimation Quench Attempts (QA) with B2 collected important data:
  - Magnet coil power deposition was within the middle of the expected HL-LHC range and tolerated
  - Upper end of expected power deposition range in HL-LHC not reached
- Objective: build on the experience from previous quench tests to achieve higher loss rates and power deposition
- Strengthen insights into operational quench limits to guide HL-LHC collimation system upgrades

# Filling scheme

25ns\_339b\_0\_0\_0\_MD9546\_B1QuenchTest

**on Schemes**

ALL

2352b\_2340\_2004\_2133\_108bpi\_24inj

Refresh list

Scheme Name: 25ns\_339b\_0\_0\_0\_MD9546\_B1QuenchTest

Scheme group: MD 2024

Creation date: 2024-10-11 11:26:54.679

Description: B1 only (12b witness B2) for quench test

Collisions IP1/5: 0

Collisions IP2: 0

Collisions IP8: 0

Over injection:

Pilot B1: 6001

Pilot B2: 10001

**BUNCH PATTERN SELECTION**

pattern filters

trains  bunches  bunch spacing  apply

25ns250Gp4Batches36Bu

25ns250Gp3Batches36Bu

25ns250Gp2Batches36Bu

25ns1Batch36Bu

50ns2200+225Gp3Ba36Bu

50ns2200Gp2Bat36Bu

50ns4175Gp2Bat36Bu

50ns200Gp4Batches36Bu

nbr of trains: 2

max bunches/train: 36

train spacing: 250

nbr of bunches: 72

Bunch spacing: 25

Display Buckets list

\*36b

Refresh patterns

Bunches position in 2.5ns buckets

INJECTION BEAM1				
RF Buc...	NbrBnches	BnchSpac...	NbrTrains	I level
1	12	25	1	NOM
2001	1	0	1	INTR
4001	1	0	1	INTR
6001	1	0	1	INTR
9201	108	25	3	NOM
10721	72	25	2	NOM
14301	36	25	1	NOM
18301	36	25	1	NOM
23001	36	25	1	NOM
27001	108	25	3	NOM
28561	72	25	2	NOM

INJECTION BEAM2				
RF Buc...	NbrBnches	BnchSpac...	NbrTrains	I level
121	12	25	1	NOM

**ADD INJECTIONS**

PROTON NOMINAL  is slip stacking

BEAM 1  BEAM 2

27001 add single at bucket(enter or click)

add single inj at min spac

add single inj at bkt spac

add multi at buckets

**SCHEME INFORMATION**

Set pilot positions and head-on numbers

Display head-on collisions

Display bucket list

PROTON - Train spacing: 200 ns

Bunches position in 2.5ns buckets

3x1b - Testing

As a 1x180b QA 1

3x36b - Testing

As a 1x180b QA 2

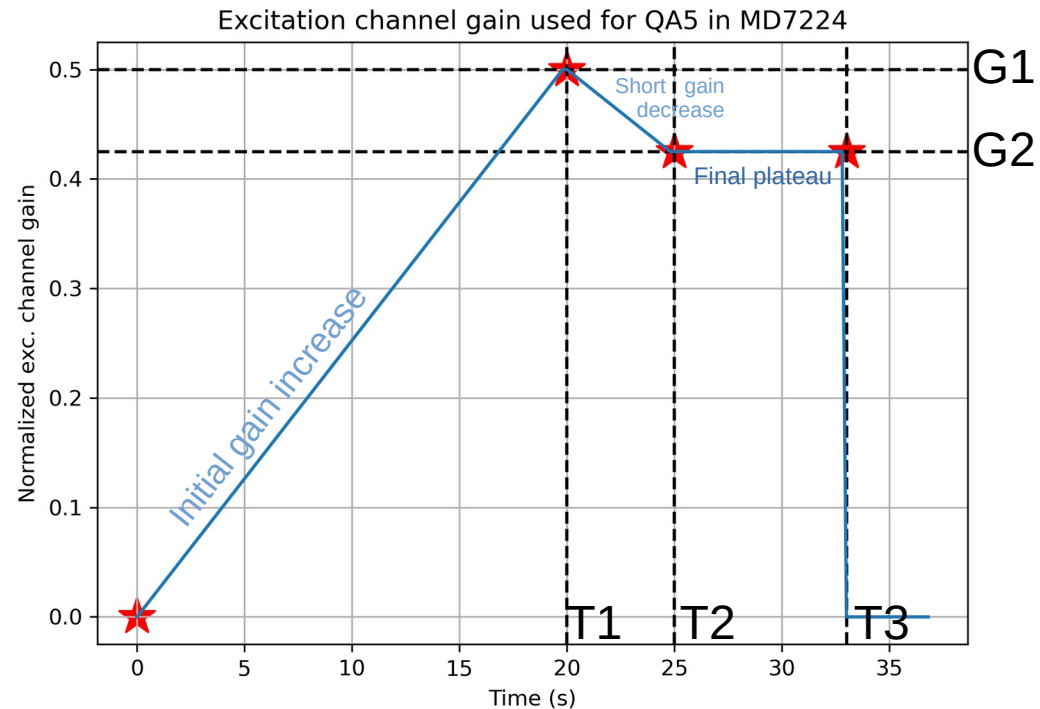
# Scheduled actions for the MD

- **Preparation:**
  - Configuration of BLM settings and ADT preparation
  - Initial checks and testings of ADT excitation settings and tools at flat bottom
- **3 fills scheduled for a total of 6 quench attempts**
  - Fill 1: nominal collimator settings
  - Fill 2&3: relaxed collimator settings
- **Actions during a fill:**
  - Ramp up to 6.8TeV to Flat Top with nominal ramp&squeeze beam process
  - Test and validation of ADT gain profiles with test trains available in fill
  - Perform quench attempts using dedicated batches
    - loss level of 1MW to be reached slowly (0-1MW in ~20s)
    - 1MW to be maintained for ~10s
    - Proceed until quench is achieved or target losses are achieved

Family	Region	Nominal [ $\sigma$ ]	Relaxed [ $\sigma$ ]
TCP	IR7	5	5
TCSG/TCSPM	IR7	6.5	8.5
TCLA	IR7	10	10
TCP	IR3	15	15
TCSG	IR3	18	18
TCLA	IR3	20	20
TCDQ	IR6	7.3	7.3
TCSP	IR6	7.3	7.3
TCT	IR2	37	37
TCT	IR1/IR5/IR8	18	18

# ADT configuration and Expert Script

- ADT to be used in Expert Mode with custom gain function
- Expert Script, also used on MD7224, assembled and revised by D. Valuch
  
- Initial gain function to use: Quench Attempt 5 of MD7224
  
- Parameters to be modified during QAs:
  - G1, T1 – initial gain increase
  - G2, T2 – gain decrease to control losses
  - T3 – length of final plateau

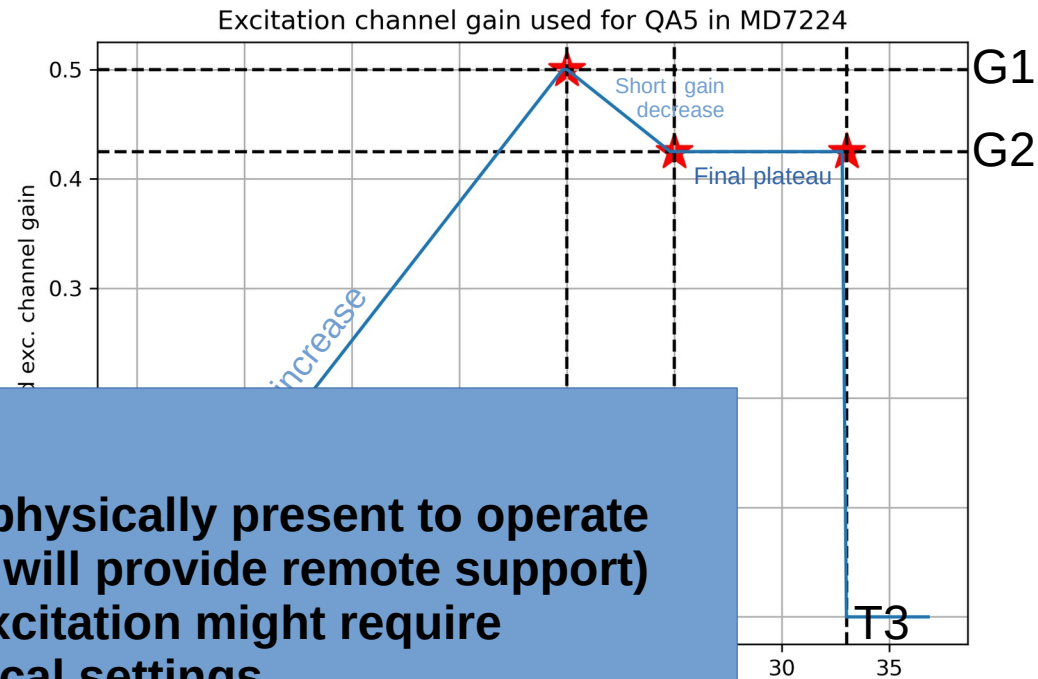


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  - G2, T2 –
  - T3 – length

## Critical elements:

- Need for an RF expert to be physically present to operate ADT expert script (D. Valuch will provide remote support)
- Gain window for QA batch excitation might require modification of machine critical settings

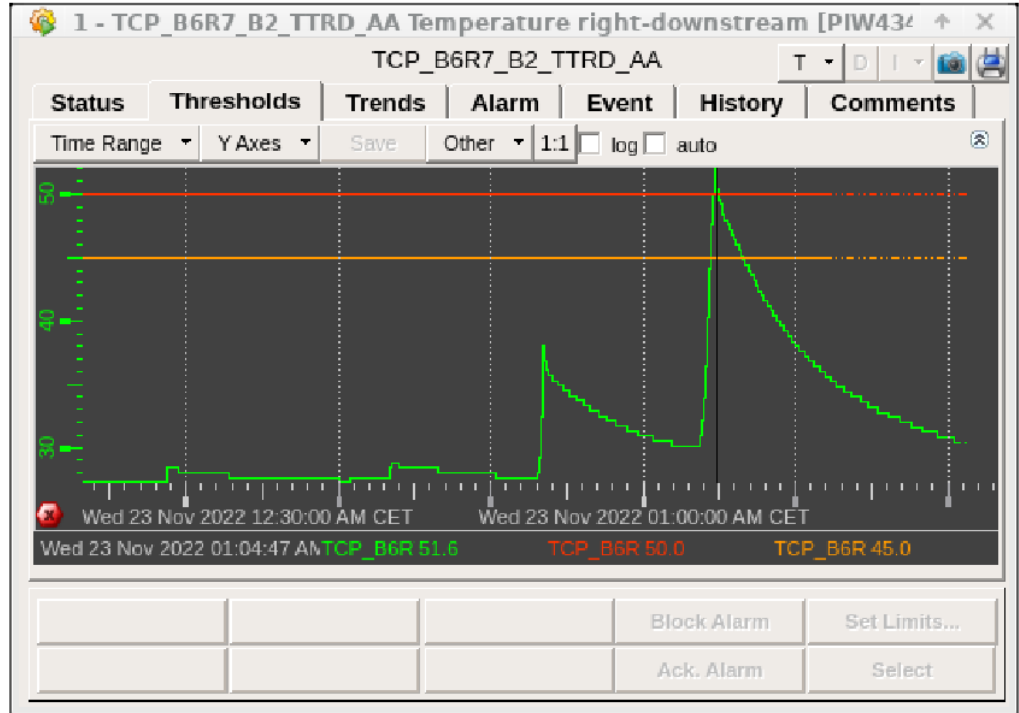


# BLM Threshold configuration

- Proposal for BLM thresholds presented yesterday at BLMTWG, details to be discussed on Friday
- Thresholds constructed from lossmaps with relaxed collimator settings:
  - B1H: 2024-05-02 18:04:32
  - B1V: 2024-05-02 18:09:58
- Target plane: B1V – final decision taken after review of IR6 losses
- Development of necessary BLM families and settings ongoing
- **Important aspect** – to avoid cross-talks with B2, and hit dumps on fast losses, as happened in previous MD quench attempt, it is necessary to **mask the following B2 BLMs:**
  - BLMTI.06L7.B2I10\_TCLA.A6L7.B2
  - BLMTI.06L7.B2W10\_TCLA.B6L7.B2

# Collimator temperature thresholds

- **No change** to collimator temperature thresholds
- Active monitoring of coll. temperature during QA to avoid dumps



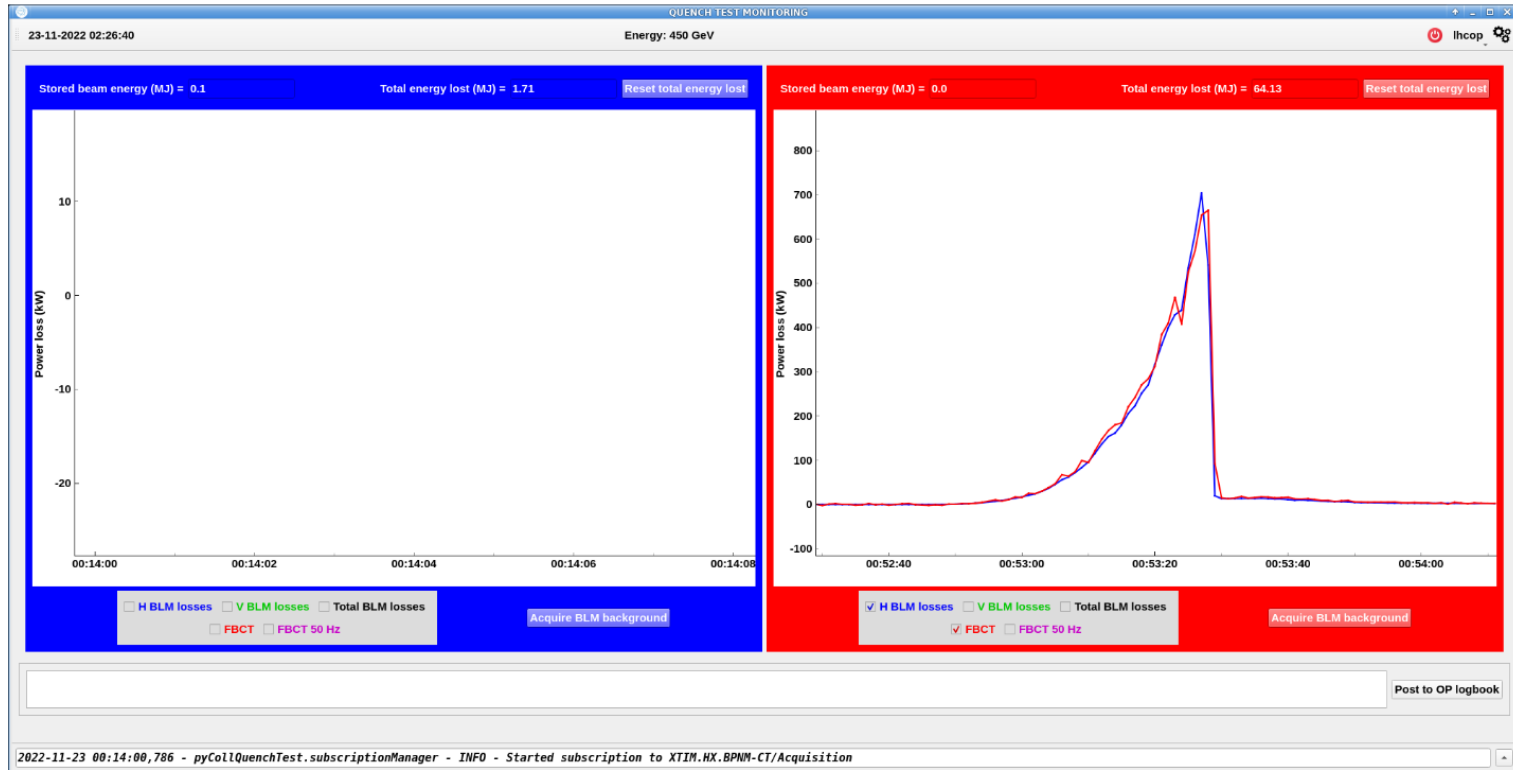


# QPS settings

- **Important to ensure full performance of QPS logging system in case of quench!**
- Need of QPS team available to:
  - Perform a full reset of QPS system before start of MD
  - Have piquet available in case of unforeseen issues during MD

# Other tools to be used

- Real-time view of power loss on TCPs with dedicated application



**Thank you!**