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# Summary of HiTAT Workshop at CERN

SMP Technical Meeting – 2023.04.18

Jean-Francois Croteau

# High Temperature superconductors for Accelerator Technology (HiTAT) Workshop

- March 9-10, 2023 at CERN
- 1<sup>st</sup> workshop dedicated to HTS superconductors for particle accelerators
- [Indico link](#)

# Overview of the HiTAT Schedule

HTS tapes

HTS cables

Other materials

Tape/cable  
characterization

09:00	Welcome 307-018 - Kjeil Johnson Auditorium, CERN	Dr Amalia Baitarino et al.	09:00 - 09:10
10	REBCO tape at SuperPower: state of the art and prospects 307-018 - Kjeil Johnson Auditorium, CERN	Yifei Zhang	09:10 - 09:30
	REBCO tape at Faraday Factory Japan: state of the art and prospects 307-018 - Kjeil Johnson Auditorium, CERN	Alexandre Molodtsov	09:30 - 09:50
	REBCO tape at SuNAM: state of the art and prospects 307-018 - Kjeil Johnson Auditorium, CERN	Hunju Lee	09:50 - 10:10
	REBCO tape at Fujikura: state of the art and prospects (Video) 307-018 - Kjeil Johnson Auditorium, CERN	SATORU HANYU	10:10 - 10:30
	REBCO tape at Theva: state of the art and prospects 307-018 - Kjeil Johnson Auditorium, CERN	Werner Prussel	10:30 - 10:50
11:00	Coffee Break 307-018 - Kjeil Johnson Auditorium, CERN		10:50 - 11:10
12	REBCO tape at Shanghai Superconductors: state of the art and prospects 307-018 - Kjeil Johnson Auditorium, CERN	Yue Zhao	11:10 - 11:30
	Technologies for REBCO Conductors: Rutherford-type cabling and MEMS array quench detection 307-018 - Kjeil Johnson Auditorium, CERN	Makoto Takayasu	11:30 - 11:45
	Progress on REBCO Star Wires 307-018 - Kjeil Johnson Auditorium, CERN	Venkar Solvmanickam	11:45 - 12:05
12	The KIT/CERN REBCO Laboratory 307-018 - Kjeil Johnson Auditorium, CERN	Bernhard Holzapfel	12:05 - 12:25
	Iron Based Superconductors: status and prospects 307-018 - Kjeil Johnson Auditorium, CERN	Dongliang Wang et al.	12:25 - 12:45
13:00	Lunch Break: Sandwich lunch served in room 307-010 307-018 - Kjeil Johnson Auditorium, CERN		12:45 - 14:00
14	Scaling law of the anisotropic magnetic field dependence of the critical current of REBCO coated conductors Giovanni Succi		14:00 - 14:10
	Electrical properties of REBCO tapes and scaling law 307-018 - Kjeil Johnson Auditorium, CERN	Carmine Senatore	14:20 - 14:40
15	REBCO Cables at CERN 307-018 - Kjeil Johnson Auditorium, CERN	Dr Christian Barth	14:40 - 15:00
	HTS Cable for IFAST CCT 307-018 - Kjeil Johnson Auditorium, CERN	Thibault LECREVISSE	15:00 - 15:20
	AC loss in round cables from helically arranged HTS tapes 307-018 - Kjeil Johnson Auditorium, CERN	Fedor Gömöry	15:20 - 15:40
16:00	Roebel cables for Eucard-2 307-018 - Kjeil Johnson Auditorium, CERN	Dr Anna Karo	15:40 - 16:00
	Coffee Break 307-018 - Kjeil Johnson Auditorium, CERN		16:00 - 16:20
16	High field test facilities for HTS 307-018 - Kjeil Johnson Auditorium, CERN	Francois Debay	16:20 - 16:40
	Magnetization: measurements of multifilament REBCO tapes 307-018 - Kjeil Johnson Auditorium, CERN	Prof. Dr Anomiyi	16:40 - 17:00
17	Current Distribution and the "Critical" Current in REBCO Tapes and Coils 307-018 - Kjeil Johnson Auditorium, CERN	Yifeng Yang	17:00 - 17:20
	Overview of mechanical characterization an properties of REBCO tapes 307-018 - Kjeil Johnson Auditorium, CERN	Herman Ton Kate	17:20 - 17:40

HTS magnet  
programs

Resins,  
insulation &  
splices  
Modeling

09	Muon Colliders Magnet portfolio 307-018 - Kjeil Johnson Auditorium, CERN	Luca Bottura	09:00 - 09:20
	HTS Programme in the MSC group at CERN 307-018 - Kjeil Johnson Auditorium, CERN	Dr Amalia Baitarino	09:20 - 09:40
	HTS programme at PSI 307-018 - Kjeil Johnson Auditorium, CERN	Bernhard Auchmann	09:40 - 10:00
	REBCO I.FAST CCT & IRIS 10 T HTS dipole at INFN 307-018 - Kjeil Johnson Auditorium, CERN	Luca Rossi et al.	10:00 - 10:20
	The HDMS experience and next steps 307-018 - Kjeil Johnson Auditorium, CERN	Dr Magnus Dam	10:20 - 10:40
11:00	Coffee Break 307-018 - Kjeil Johnson Auditorium, CERN		10:40 - 11:00
11	Overview of the HTS program for the fusion programs (Video) 307-018 - Kjeil Johnson Auditorium, CERN	Rod Bateman	11:00 - 11:15
	Overview of Eucard-2 magnets tests: lessons learn 307-018 - Kjeil Johnson Auditorium, CERN	Franco Julo Mangiarotti	11:15 - 11:35
12	HTS Gatoroid: design and test results 307-018 - Kjeil Johnson Auditorium, CERN	Axel Hanzler	11:35 - 11:55
	HTS Magnet activity at Fermilab 307-018 - Kjeil Johnson Auditorium, CERN	Vadim Kashikhin	11:55 - 12:15
12:35	REBCO CORC for CCT magnets 307-018 - Kjeil Johnson Auditorium, CERN	Reed Toybor	12:15 - 12:35
	HTS magnets for JPARC (video) 307-018 - Kjeil Johnson Auditorium, CERN	Toru Ogitsu	12:35 - 12:55
13:00	Lunch Break: Sandwich lunch served in room 307-010 307-018 - Kjeil Johnson Auditorium, CERN		13:00 - 14:00
14	Overview of BSOCO 2212 magnets development 307-018 - Kjeil Johnson Auditorium, CERN	David Larbalestier	14:00 - 14:20
15	Impregnation of REBCO tapes and cables 307-018 - Kjeil Johnson Auditorium, CERN	Dr Anna Karo	14:20 - 14:40
	Electrical insulation for ready-to-wind superconductors 307-018 - Kjeil Johnson Auditorium, CERN	Davide Ugliceti	14:40 - 15:00
15	REBCO high current splices 307-018 - Kjeil Johnson Auditorium, CERN	Dr Tim Mulder	15:00 - 15:20
	Quench measurements and modelling of Frankenstein Eucard-2 Roebel pancake 307-018 - Kjeil Johnson Auditorium, CERN	Yifeng Yang	15:20 - 15:40
	Quench propagation in REBCO cables: towards better numerical tools to understand the mechanisms 307-018 - Kjeil Johnson Auditorium, CERN	Frederic Sirois	15:40 - 16:00
16	Quench protection techniques for HTS coils 307-018 - Kjeil Johnson Auditorium, CERN	Mariusz Wozniak	16:00 - 16:20
	Guided discussions and conclusion 307-018 - Kjeil Johnson Auditorium, CERN		16:30 - 17:00

# Summary (tape manufacturers)

1. REBCO price is expected to come down by about a factor of 2 for a 10 fold increase in production (similar price reduction rate as in the last years)
2. Most suppliers are scaling up production (all values are for 4 mm equivalent lengths):
  - SuperPower: 600 km/year (2023) to 1200 km/year (planning phase)
  - Faraday Factory Japan (previously SuperOx Japan): ~3000 km/year (2023) and 10 fold increase in the next 3 years
  - Theva: aiming for 80 to 100 mm wide tapes and ~7500 km/year (2025-2027)
  - Shanghai Superconductor: building new plants (Shanghai and Hefei) and aiming for ~1000 km/year/plant
  - SuNAM: no lengths mentioned, but aiming for 120 mm wide tapes
  - Fujikura: not discussed
3. Many suppliers are not interested in working with thin Hastelloy substrates as it results in higher production losses (50  $\mu\text{m}$  preferred over 30  $\mu\text{m}$ ).

# Summary (magnets)

1. The work done at CERN on an HTS gantry magnet was presented, where they mentioned some issues by showing post-mortem investigation of the coil and expected REBCO contamination that led to a failure (GaToroid magnet, 2023.03.10\_AM #07)
  2. Franco Julio Mangiarotti also presented a nice overview of test results for magnets (Feather and CEA's cos-theta) developed in the Eucard-2 project (2023.03.10\_AM #06)
- See Indico for more details

# Takeaways

1. Tape manufacturers are scaling up to reduce cost and meet the needs of **fusion customers**
2. All (or most) development for HEP should happen at labs and universities (KIT is setting up the equipment that Bruker was using and created a partnership with CERN for higher risk R&D on tape ideas, e.g. current flow diverters at long lengths), as **suppliers are interested in fusion (\$\$) and don't see a clear commercial future with HEP**
3. We, the HEP community, need to determine **what we want in terms of tape design and properties** and tell the suppliers **or make it work using tapes developed for fusion.**