

# The Art of Superconducting Magnets



**Arnaud Devred**  
**ITER IO**

Chris Quigg Symposium, Fermilab  
15 December 2009

# **The Art of Superconducting Magnets**

## **(A Fantasy Freely Adapted From Yasmina Reza)**



**Arnaud Devred and Yann Siliac**

Chris Quigg Symposium, Fermilab  
15 December 2009

# Prologue

iter china eu india japan korea russia usa

- My friend Chris has bought a painting.
- It is a canvas of about one meter sixty by one meter twenty, painted in white.
- The background is white and if one squints, one can see a fine white transverse lining.
- Chris has been my friend for almost twenty years.
- He has succeeded in life, he is a particle physicist and he loves Art.

# Stanza I

iter china eu india japan korea russia usa

- That Chris would buy such a painting is beyond my grasp and provoked in me an ill-defined anxiety.
- Coming out of his place, I had to gulp three glasses of Grgich Chardonnay that Liz offered me –by the way, she said Grgich or Puligny-Montrachet, but what do I know?—for I cannot at all fathom why Chris, who is a friend, would buy such a painting.
- He paid twenty thousand dollars for it! Chris is well off but he is not a millionaire. Well off, but no more. Who buys a twenty thousand dollar painting?

# Stanza I (Cont.)

iter

china eu india japan korea russia usa

# Stanza I (Cont.)

iter

china eu india japan korea russia usa



# Stanza I (Cont.)

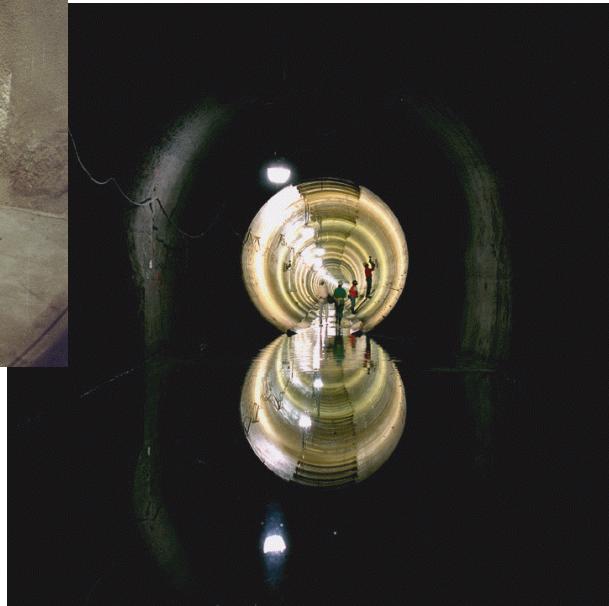
iter

china eu india japan korea russia usa

# Stanza I (Cont.)

iter

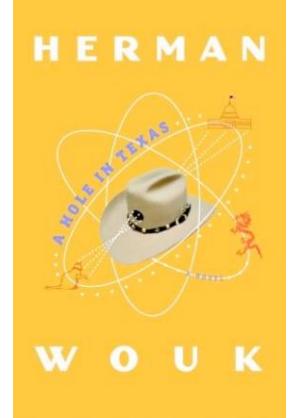
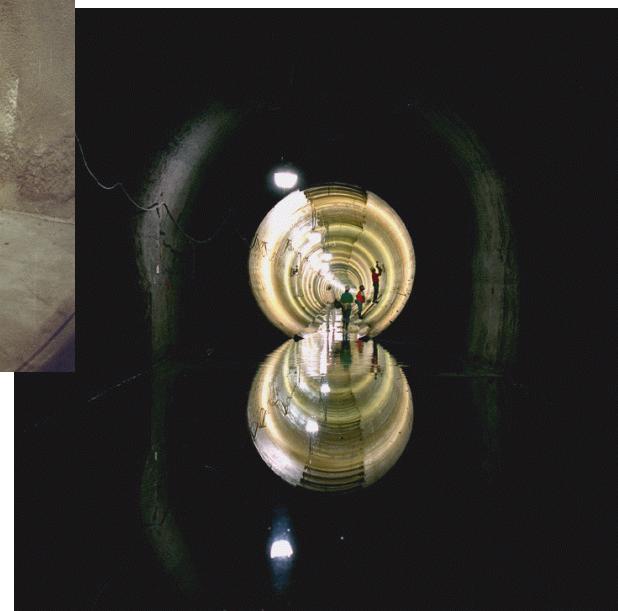
china eu india japan korea russia usa



# Stanza I (Cont.)

iter

china eu india japan korea russia usa



# Stanza II

- Can you figure out a canvas about one meter sixty by one meter twenty... white background... entirely white...
- And in its diagonal, fine white transverse lines... Can you imagine? And perhaps a single white horizontal line... in addition... near the bottom...
- I try to see these lines... because, let us assume they were grey or the opposite... you know, there are nuances in white... white can be more or less white...

# Stanza II (Cont.)

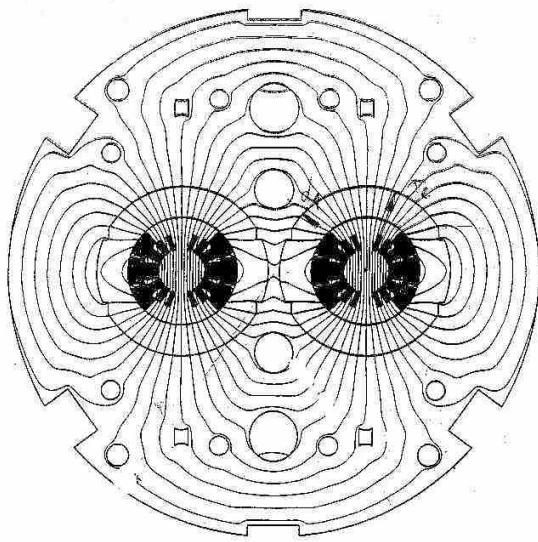
iter

china eu india japan korea russia usa

# Stanza II (Cont.)

iter

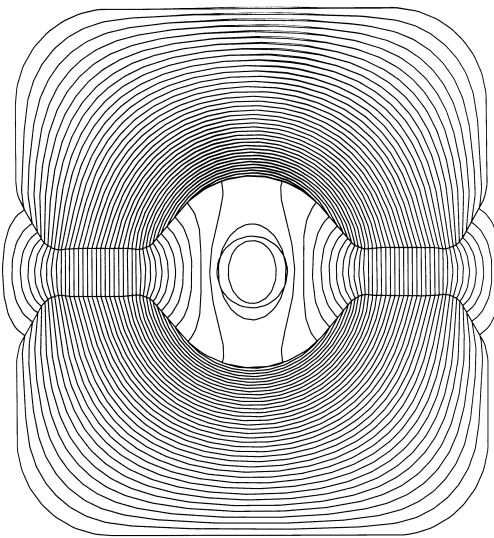
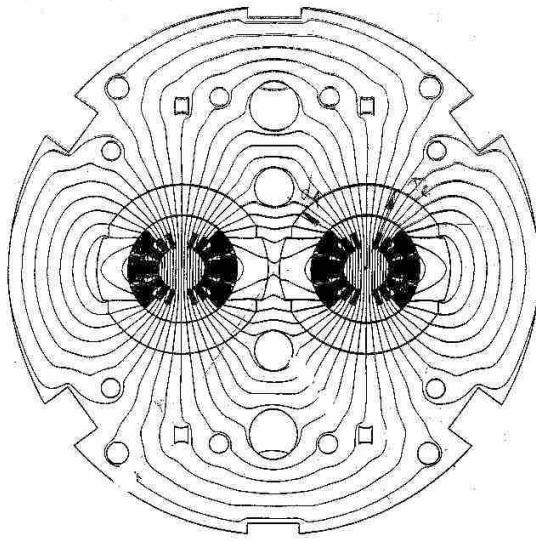
china eu india japan korea russia usa



# Stanza II (Cont.)

iter

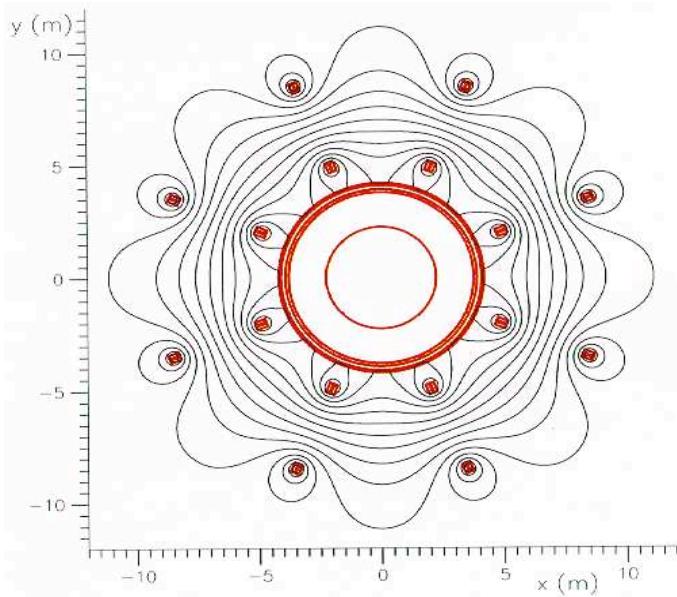
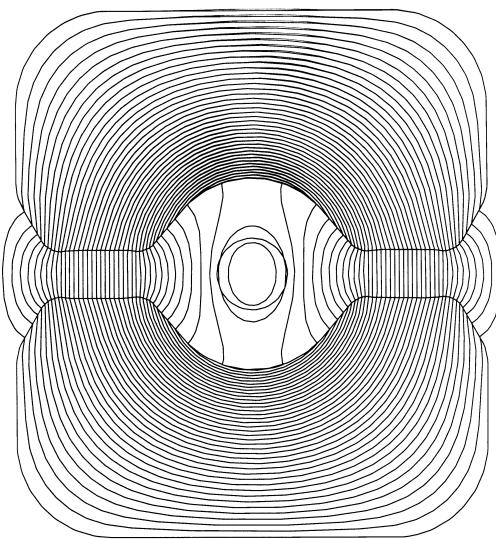
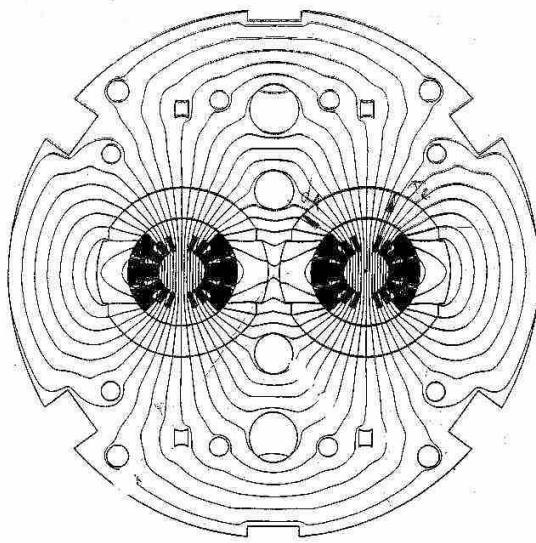
china eu india japan korea russia usa



# Stanza II (Cont.)

iter

china eu india japan korea russia usa



# Stanza III

iter china eu india japan korea russia usa

- Of course, one cannot hate the invisible... one cannot hate nothingness...

# Stanza III (Cont.)

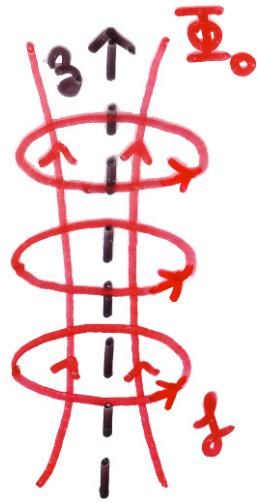
iter

china eu india japan korea russia usa

# Stanza III (Cont.)

iter

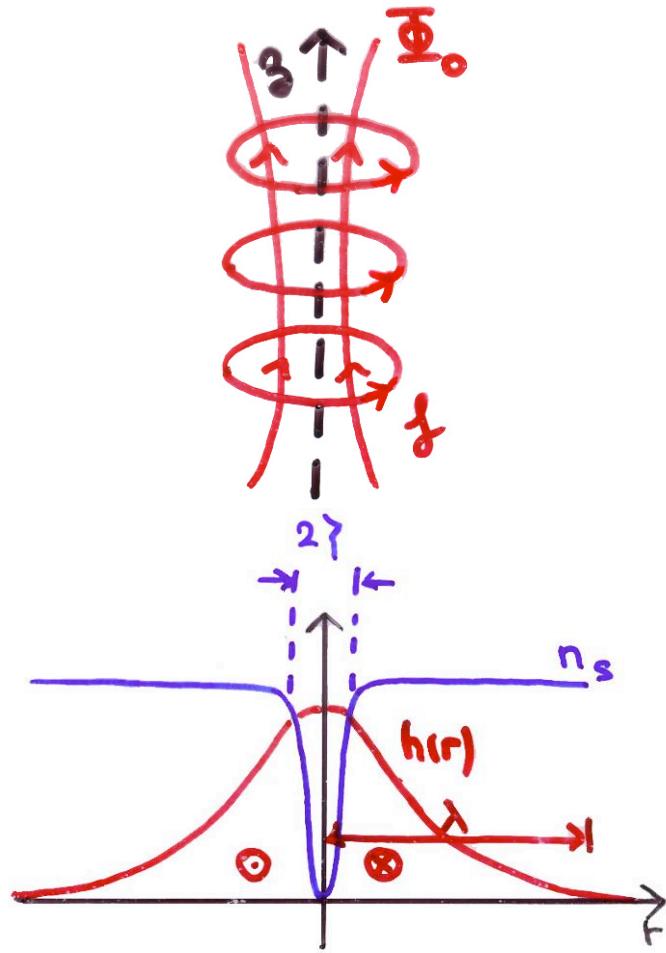
china eu india japan korea russia usa



# Stanza III (Cont.)

iter

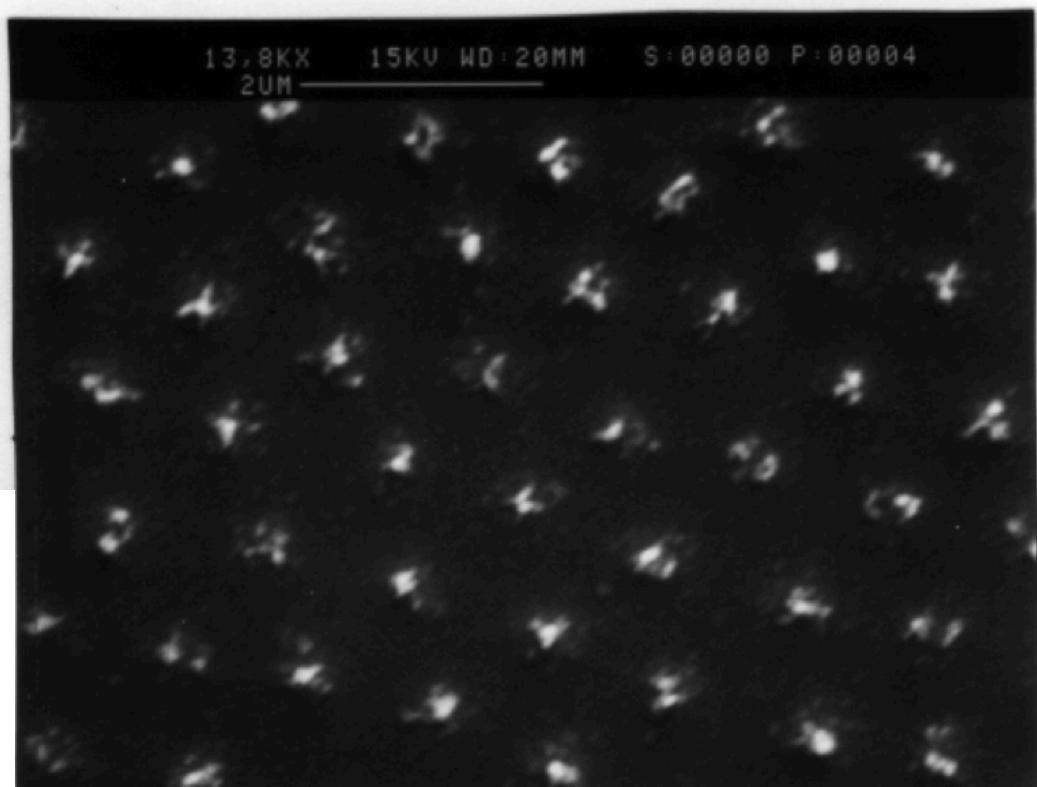
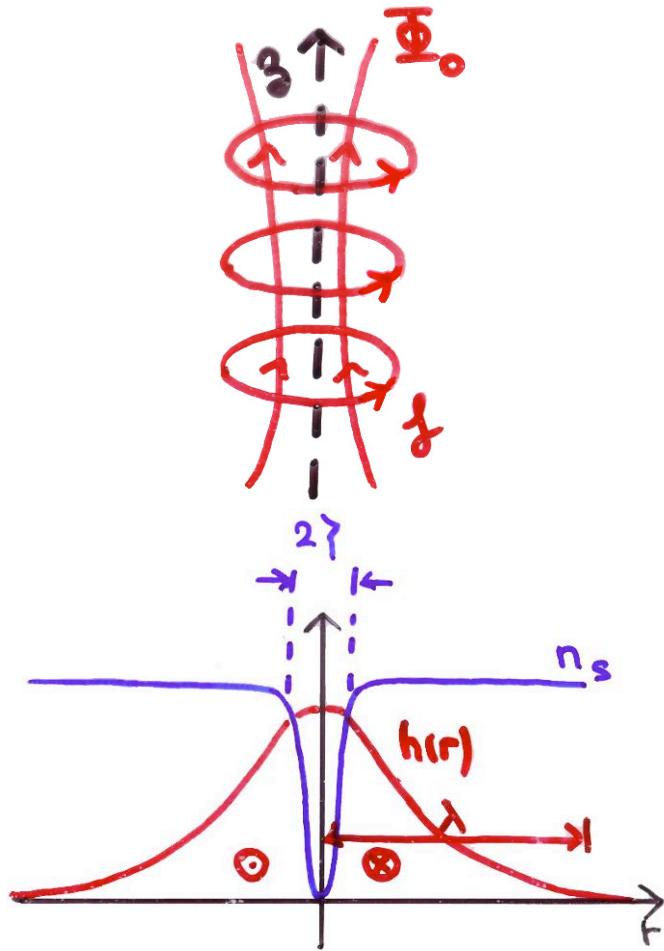
china eu india japan korea russia usa



# Stanza III (Cont.)

iter

china eu india japan korea russia usa



# Stanza IV

iter

china eu india japan korea russia usa

- Chris says it's a formidable work, that there is the power of a mind behind.
- He says it's not purely random, it is a work that inscribes itself within a larger frame.

# Stanza IV (Cont.)

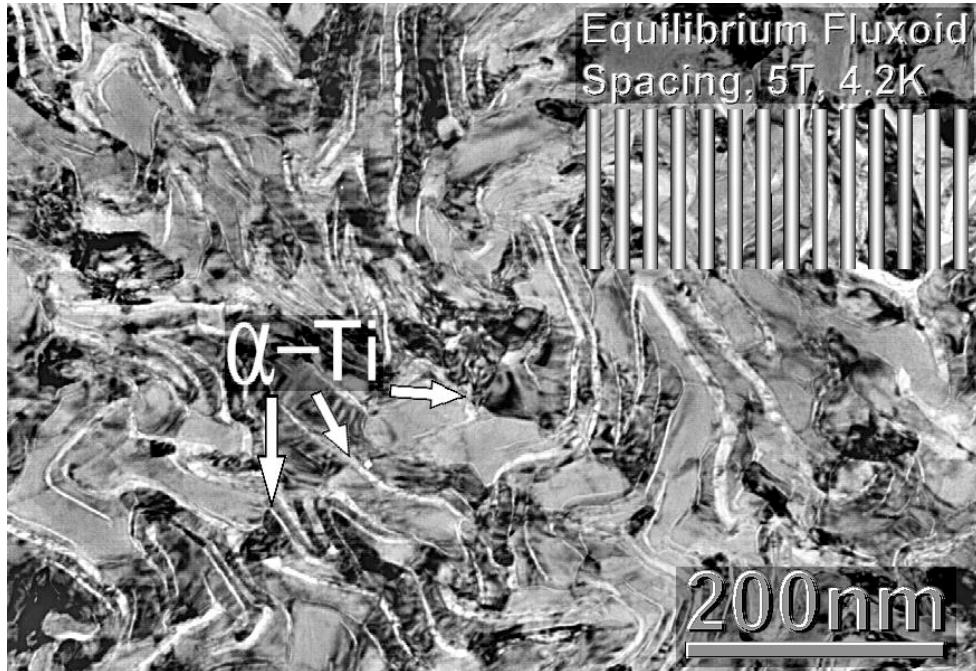
iter

china eu india japan korea russia usa

# Stanza IV (Cont.)

iter

china eu india japan korea russia usa



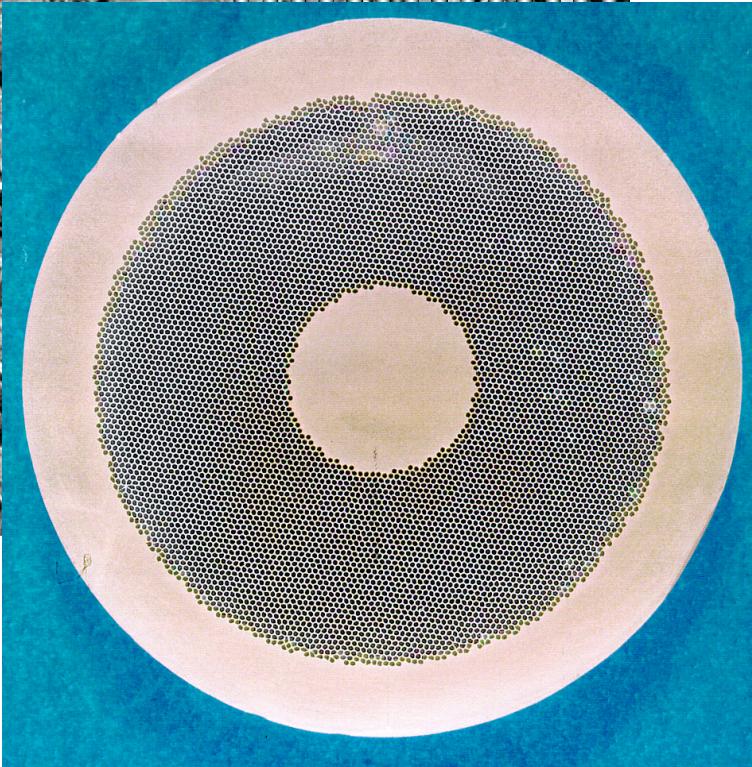
# Stanza IV (Cont.)

iter

china eu india japan korea russia usa



Equilibrium Fluxoid  
Spacing, 5T, 4.2K



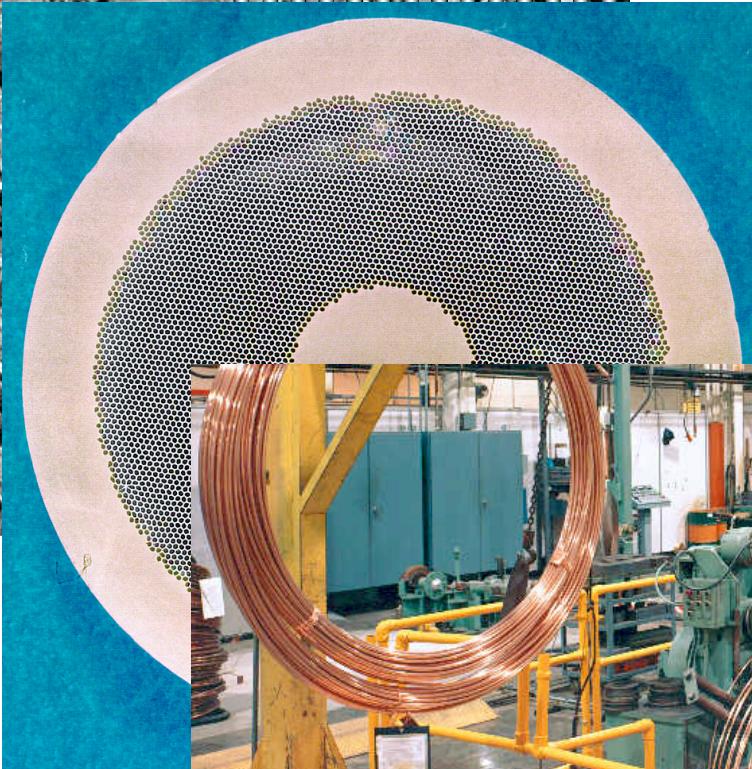
# Stanza IV (Cont.)

iter

china eu india japan korea russia usa



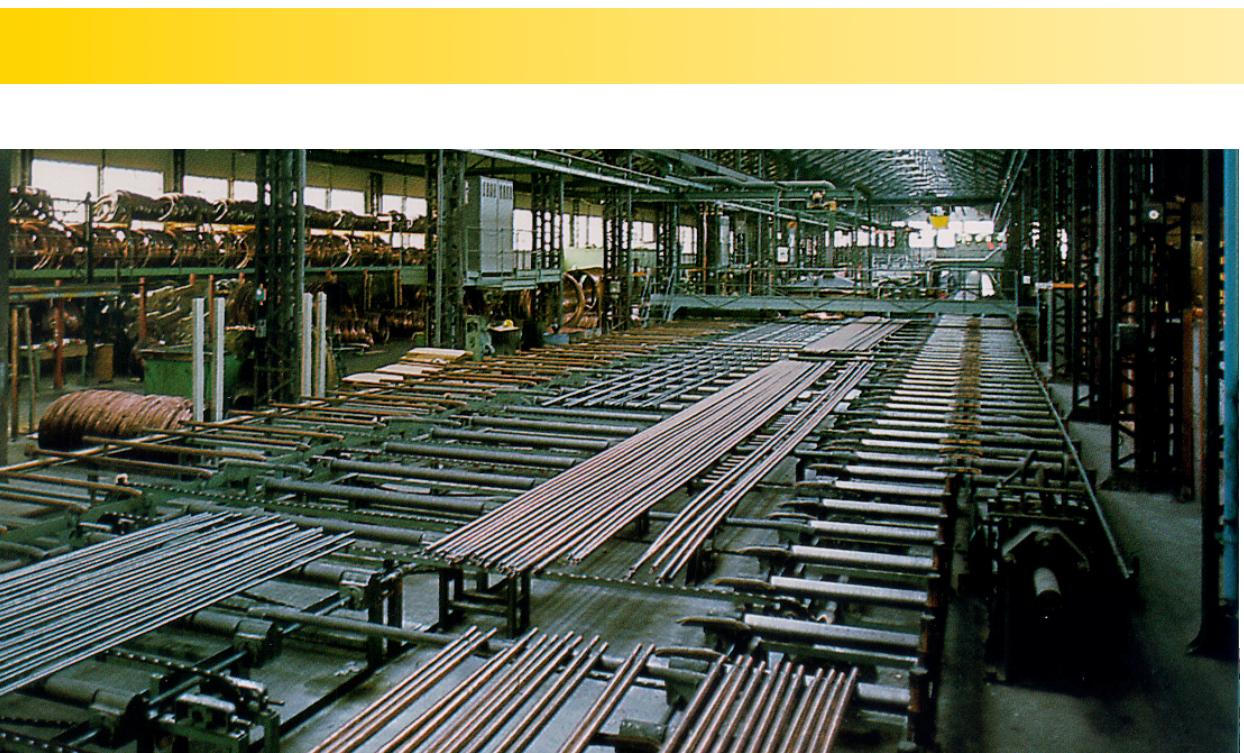
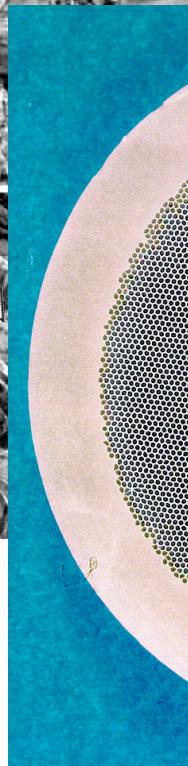
Equilibrium Fluxoid  
Spacing, 5T, 4.2K



# Stanza IV (Cont.)

iter

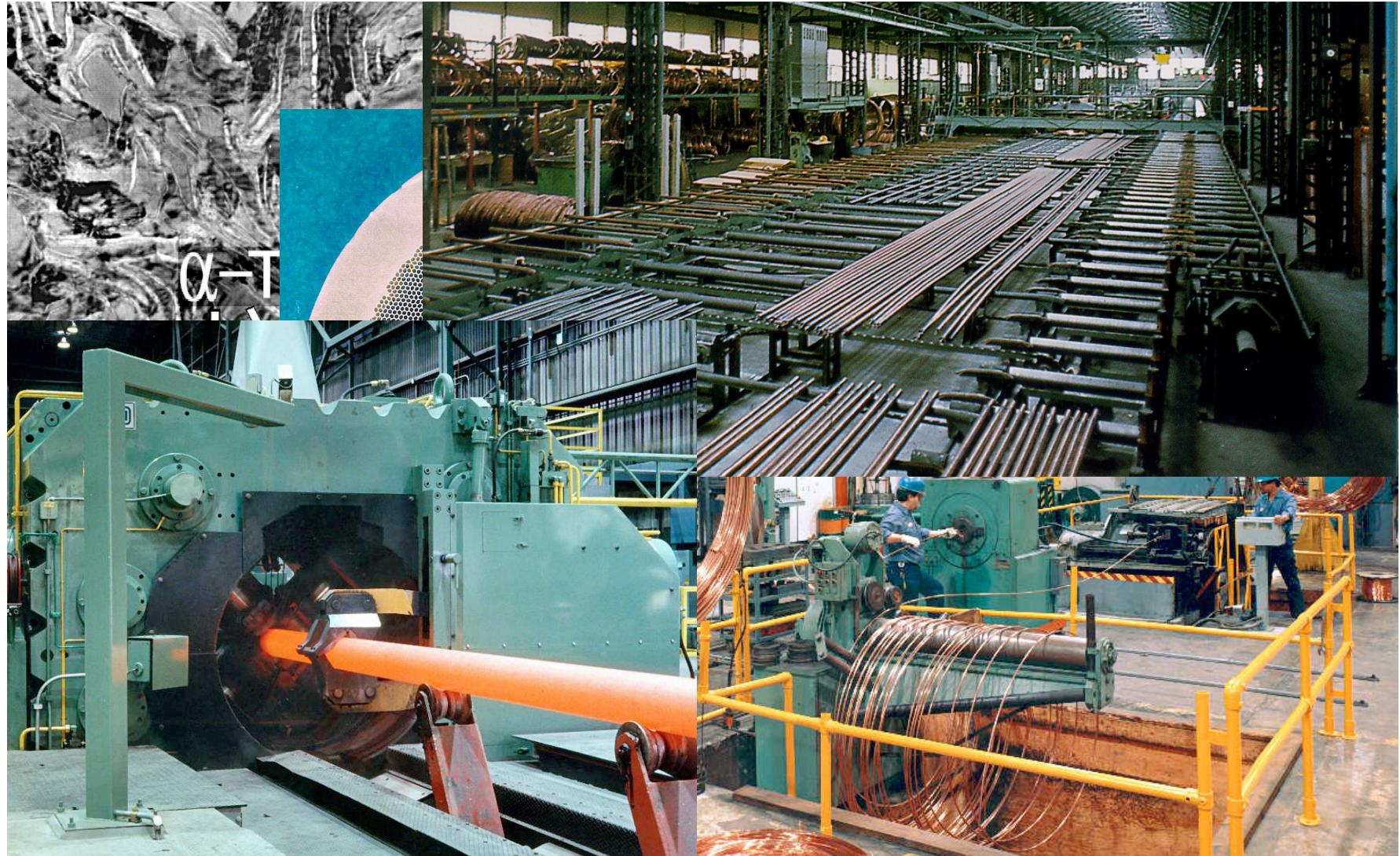
china eu india japan korea russia usa



# Stanza IV (Cont.)

iter

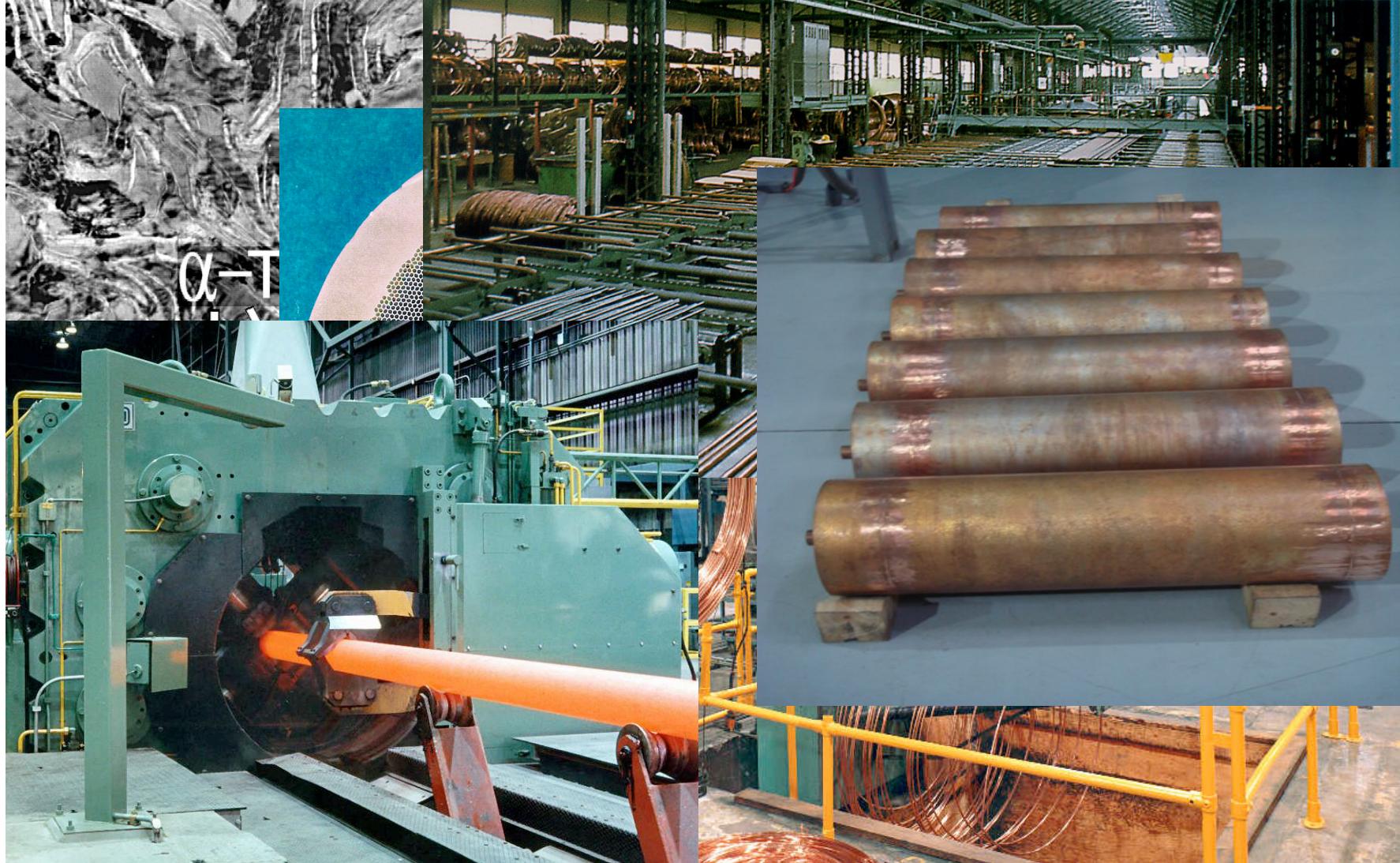
china eu india japan korea russia usa



# Stanza IV (Cont.)

iter

china eu india japan korea russia usa



# Stanza IV (Cont.)

iter

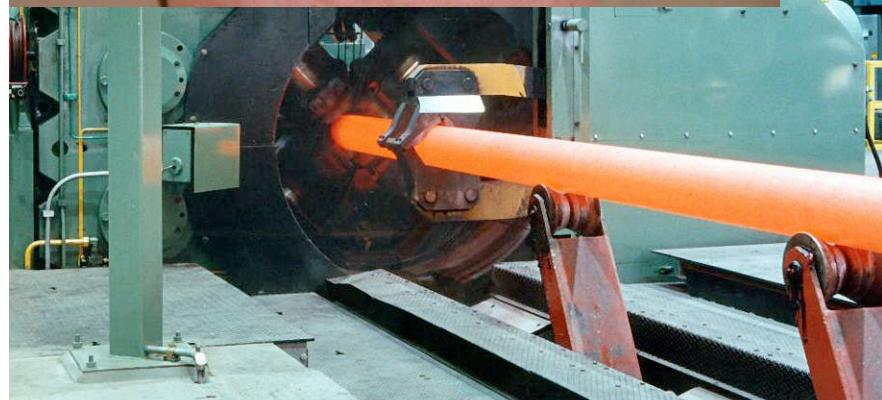
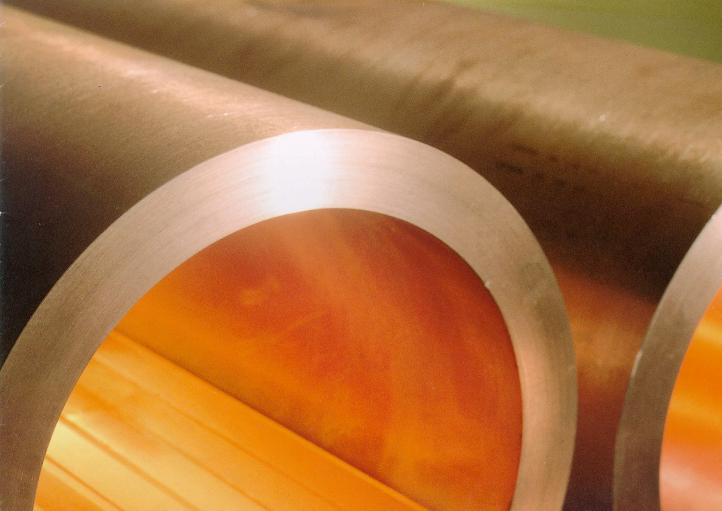
china eu india japan korea russia usa



# Stanza IV (Cont.)

iter

china eu india japan korea russia usa



# Stanza IV (Cont.)

iter

china eu india japan korea russia usa



# Stanza V

iter

china eu india japan korea russia usa

- Chris says the painting is not white. He says, objectively, it is not white.
- There is a white background, but there are all kinds of grey brush strokes... There is even some red.
- He says it's very pale.
- If it was entirely white, Chris would not like it.
- He says, some see it only white. It is because they are limited. It is because they are of the pre-conceived opinion that it is white.

# Stanza V (Cont.)

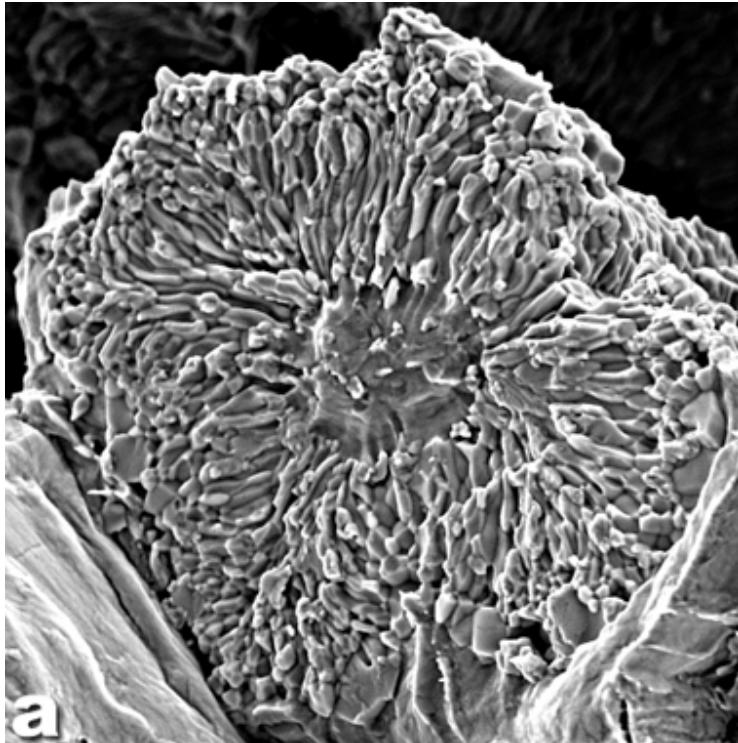
iter

china eu india japan korea russia usa

# Stanza V (Cont.)

iter

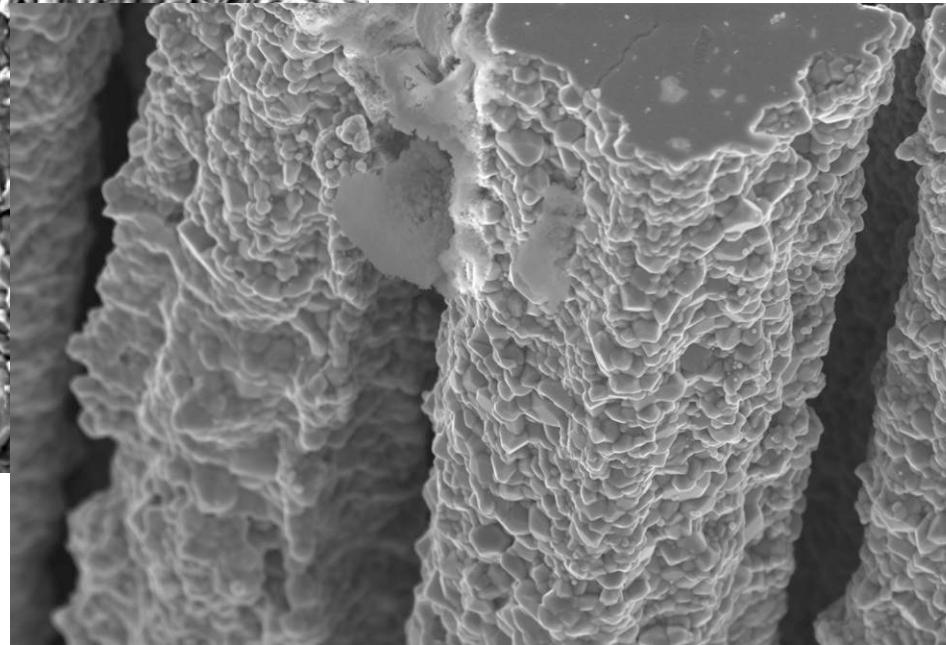
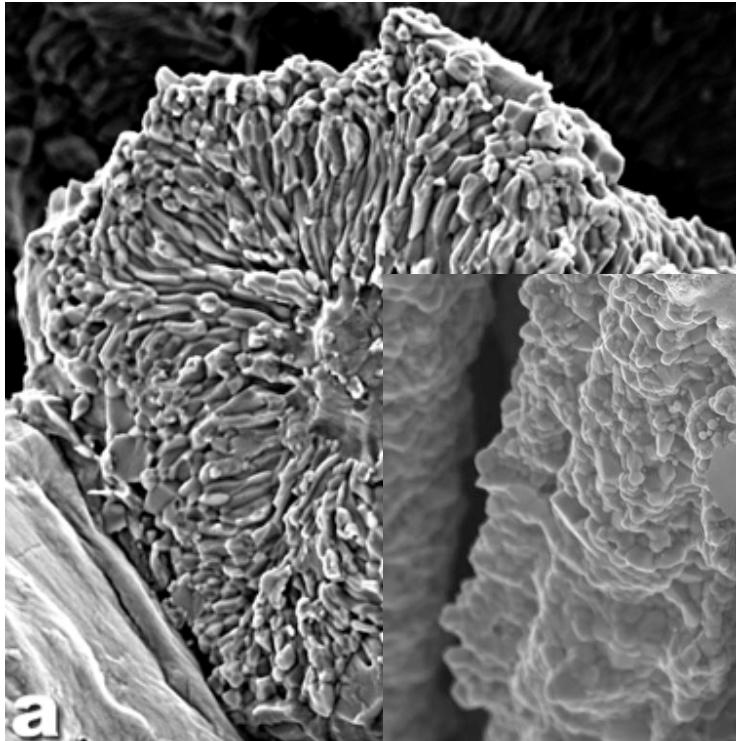
china eu india japan korea russia usa



# Stanza V (Cont.)

iter

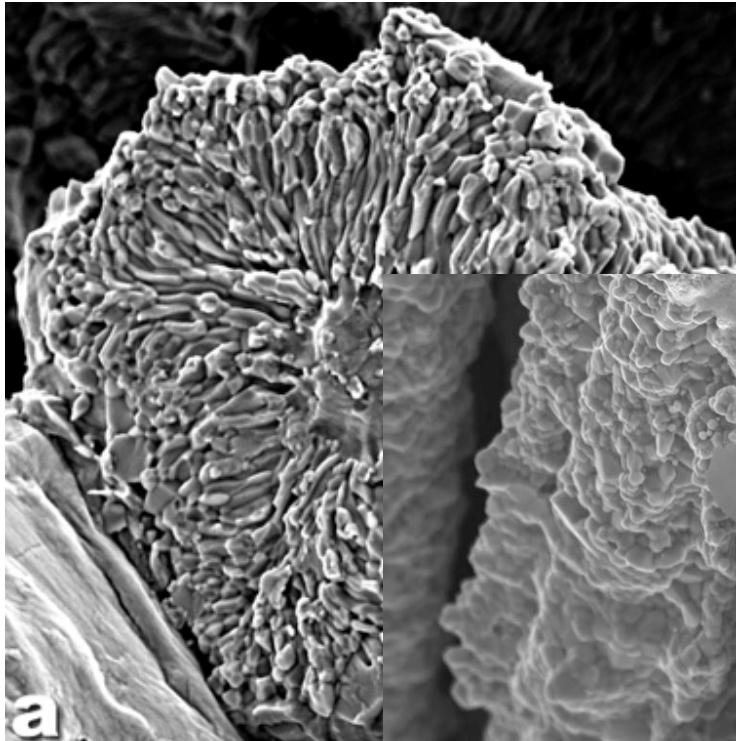
china eu india japan korea russia usa



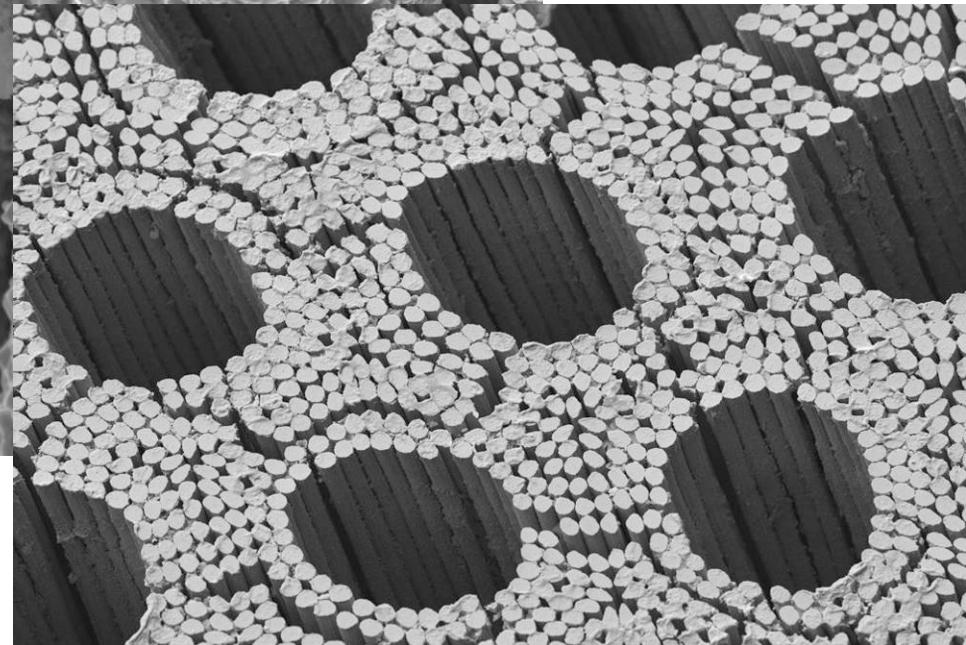
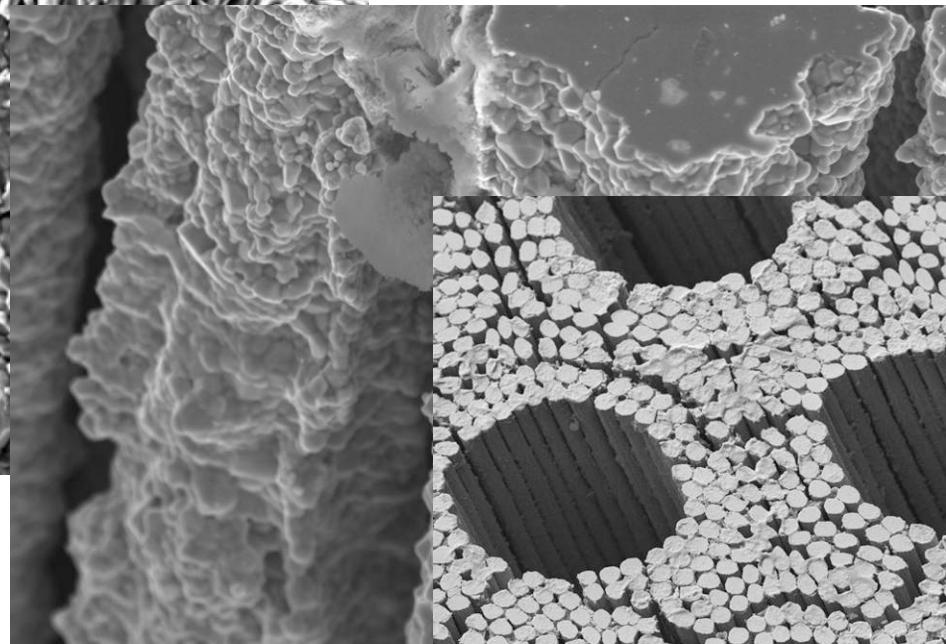
# Stanza V (Cont.)

iter

china eu india japan korea russia usa



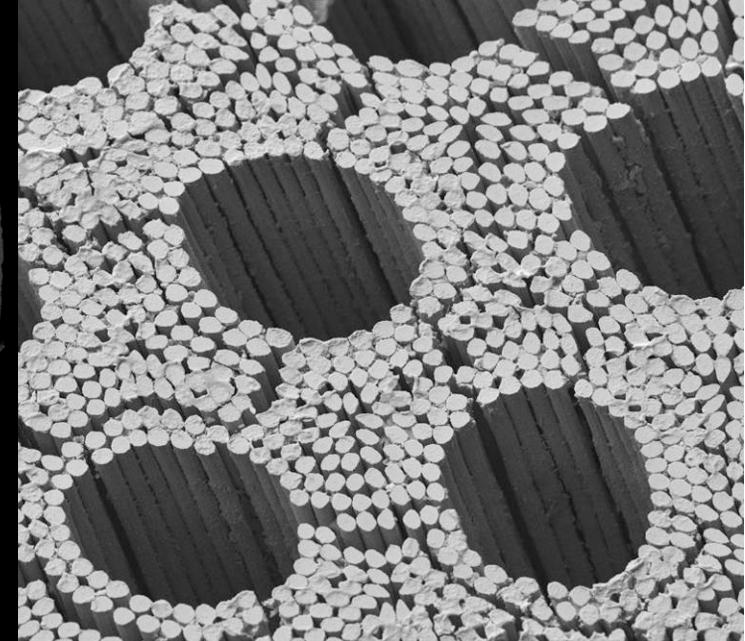
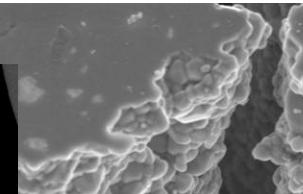
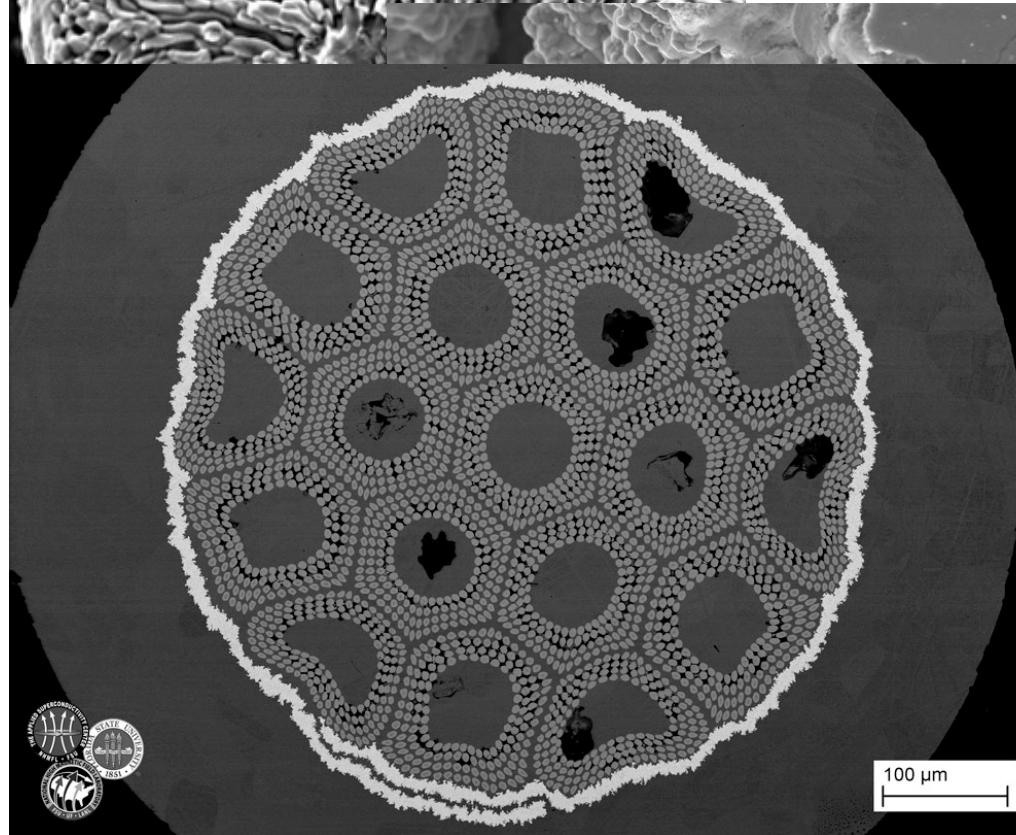
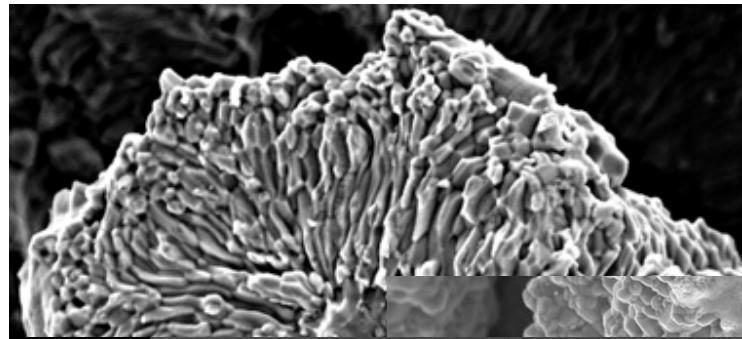
a



# Stanza V (Cont.)

iter

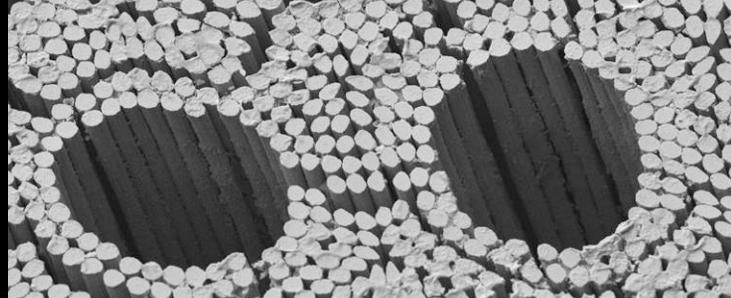
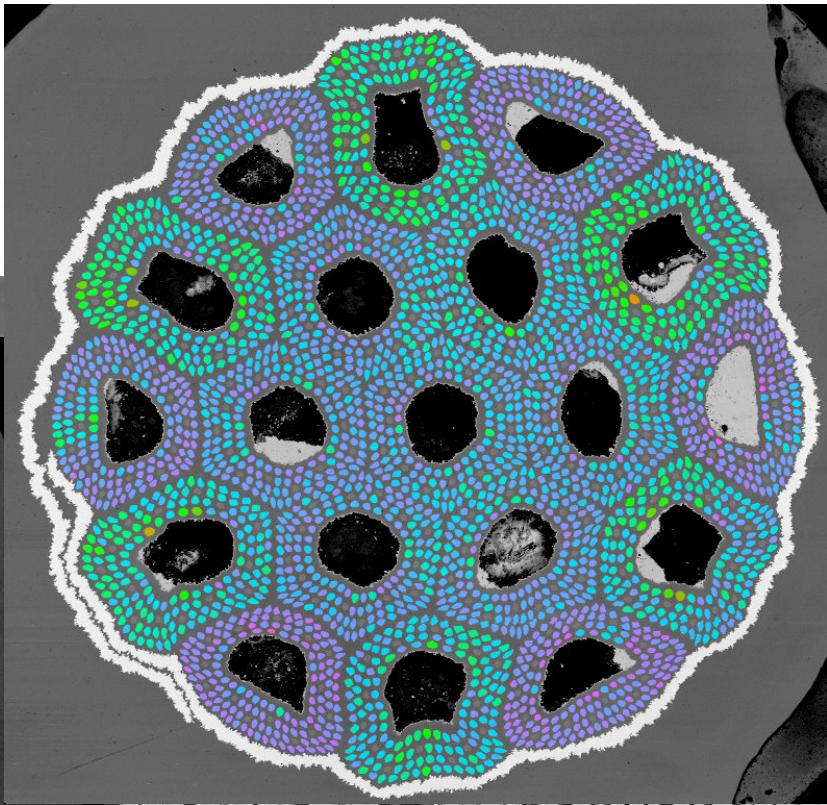
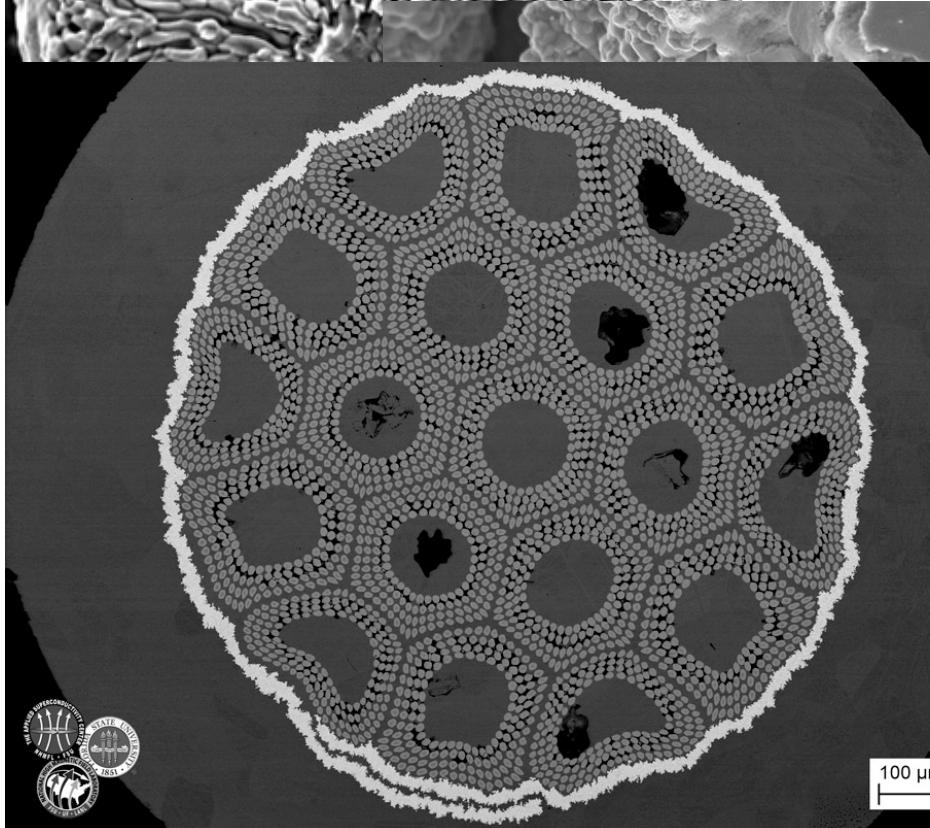
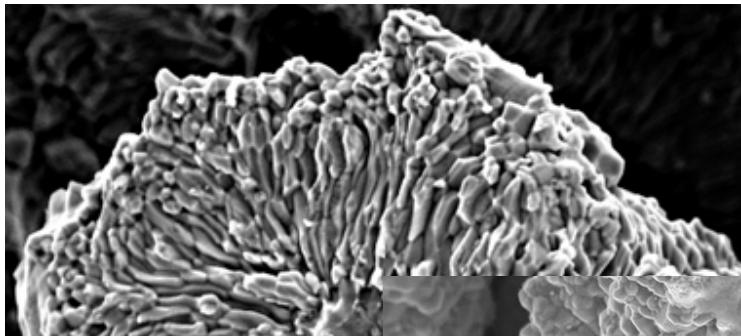
china eu india japan korea russia usa



# Stanza V (Cont.)

iter

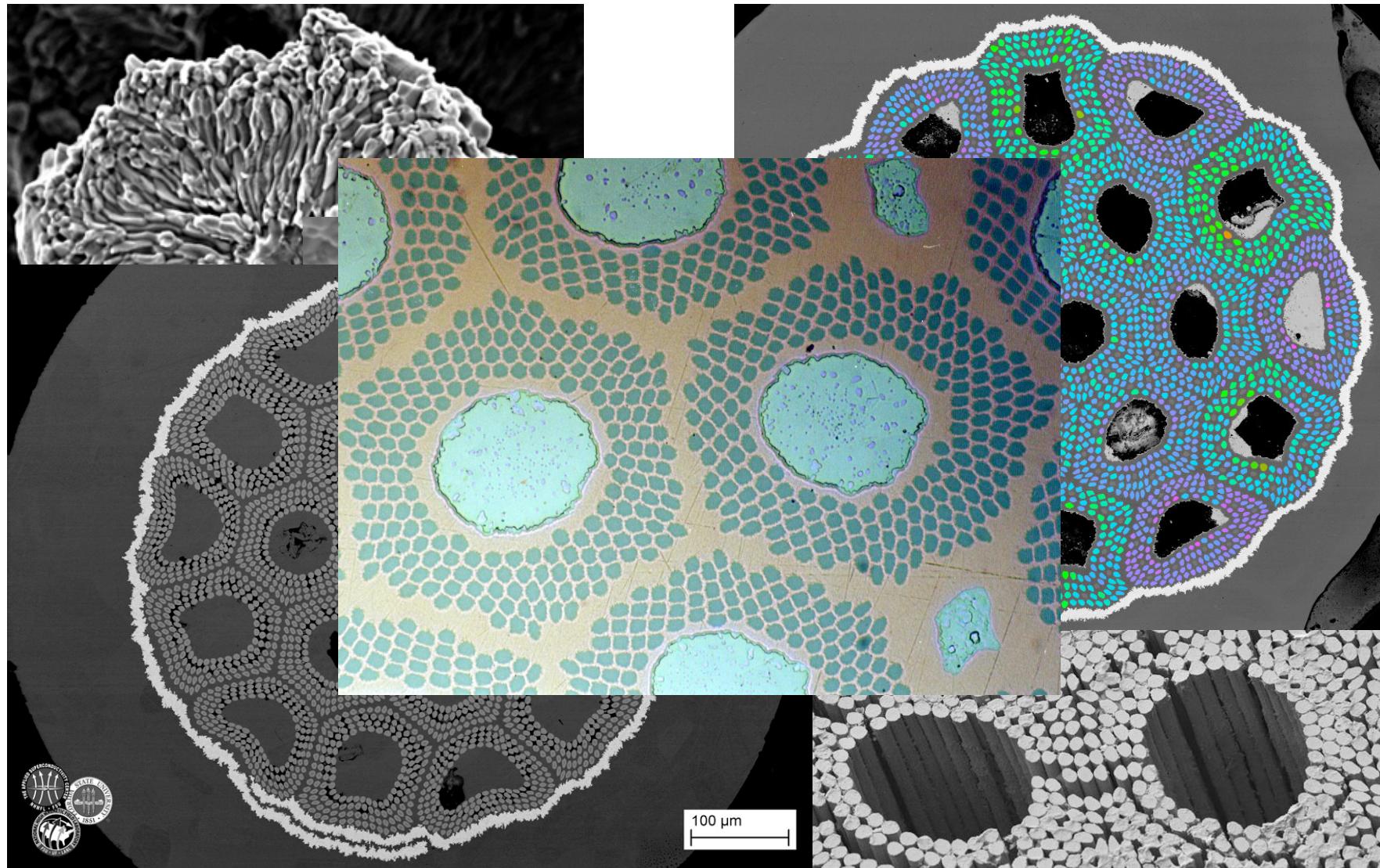
china eu india japan korea russia usa



# Stanza V (Cont.)

iter

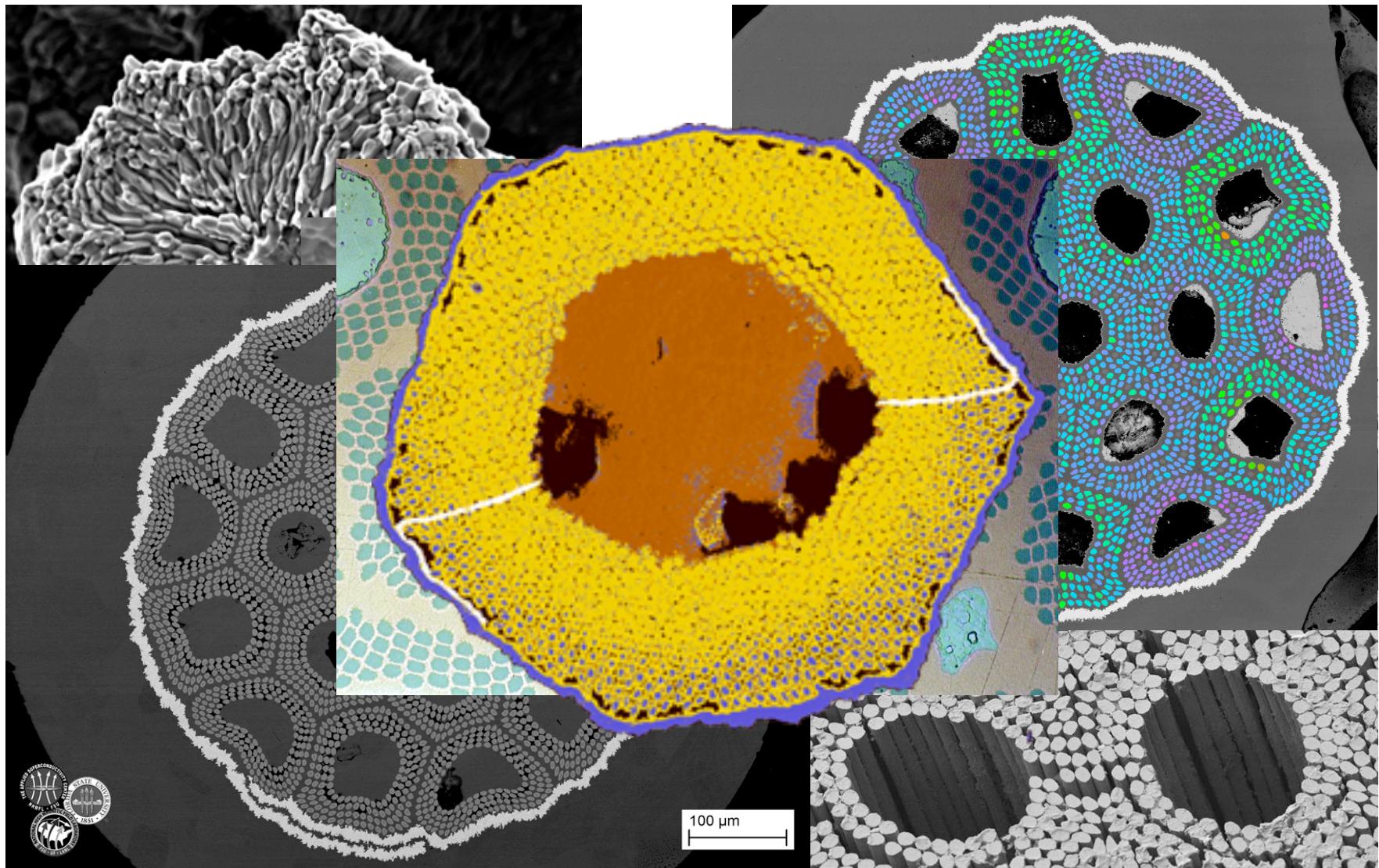
china eu india japan korea russia usa



# Stanza V (Cont.)

iter

china eu india japan korea russia usa



# Stanza VI

iter

china eu india japan korea russia usa

- Chris says he has no free time, so he has to go to the essential.
- Like in the painting, where form and color, these two scoriae have been advantageously eliminated.

# Stanza VI (Cont.)

iter

china eu india japan korea russia usa

# Stanza VI (Cont.)

iter

china eu india japan korea russia usa



# Stanza VI (Cont.)

iter

china eu india japan korea russia usa



# Stanza VII

iter china eu india japan korea russia usa

- The artist –the physicist?– is like an untouchable entity.
- The artist –the physicist?– is like a divinity.
- Otherwise who would spend twenty thousand –or billions– of dollars on a vulgar mortal?

# Stanza VII (Cont.)

iter

china eu india japan korea russia usa

# Stanza VII (Cont.)

iter

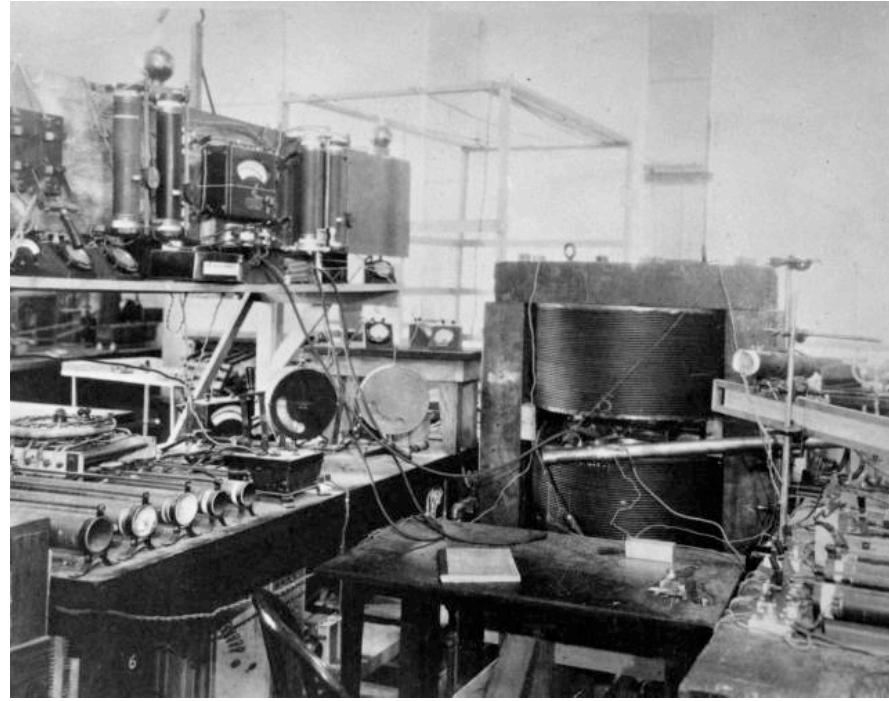
china eu india japan korea russia usa



# Stanza VII (Cont.)

iter

china eu india japan korea russia usa



# Stanza VII (Cont.)

iter

china eu india japan korea russia usa

# Stanza VII (Cont.)

iter

china eu india japan korea russia usa



# Stanza VII (Cont.)

iter china eu india japan korea russia usa



# Stanza VII (Cont.)

iter

china eu india japan korea russia usa

# Stanza VII (Cont.)

iter

china eu india japan korea russia usa



# Stanza VII (Cont.)

iter

china eu india japan korea russia usa

# Stanza VII (Cont.)

iter

china eu india japan korea russia usa



# Stanza VII (Cont.)

iter

china eu india japan korea russia usa



# Stanza VII (Cont.)

iter

china eu india japan korea russia usa

# Stanza VII (Cont.)

iter

china eu india japan korea russia usa



# Stanza VII (Cont.)

iter

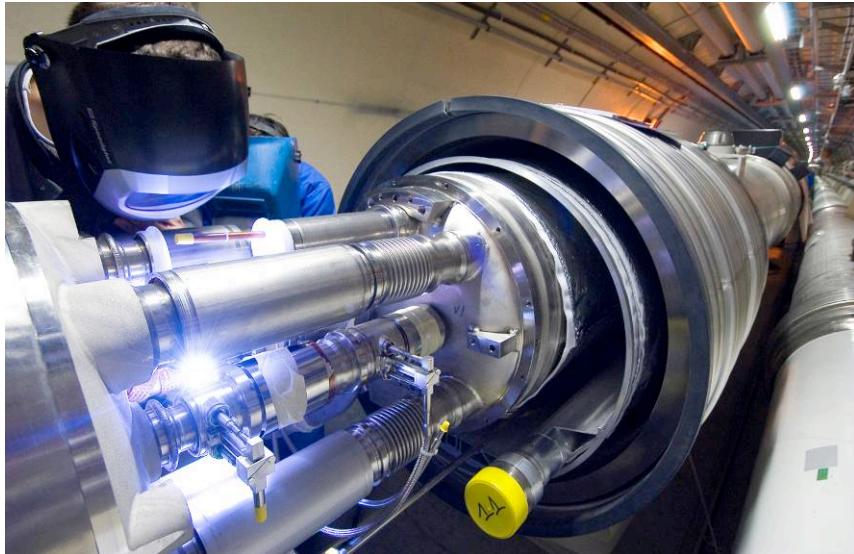
china eu india japan korea russia usa



# Stanza VII (Cont.)

iter

china eu india japan korea russia usa



# Stanza VII (Cont.)

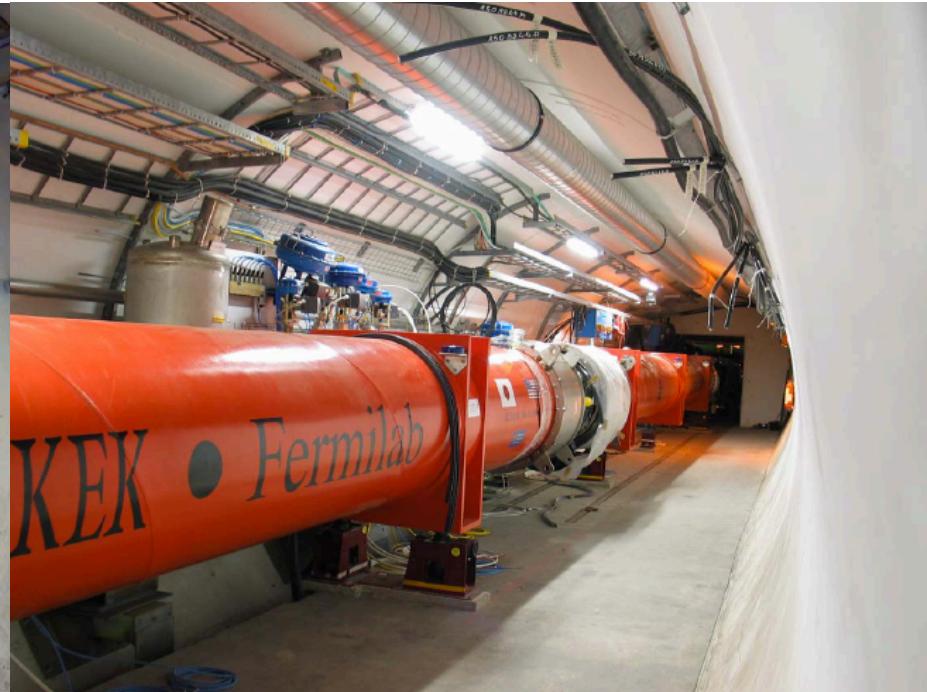
iter

china eu india japan korea russia usa

# Stanza VII (Cont.)

iter

china eu india japan korea russia usa



# Stanza VII (Cont.)

iter

china eu india japan korea russia usa

# Stanza VII (Cont.)

iter

china eu india japan korea russia usa



# Stanza VII (Cont.)

iter china eu india japan korea russia usa



# Stanza VII (Cont.)

iter

china eu india japan korea russia usa



# Stanza VII (Cont.)

iter

china eu india japan korea russia usa

# Stanza VII (Cont.)

iter

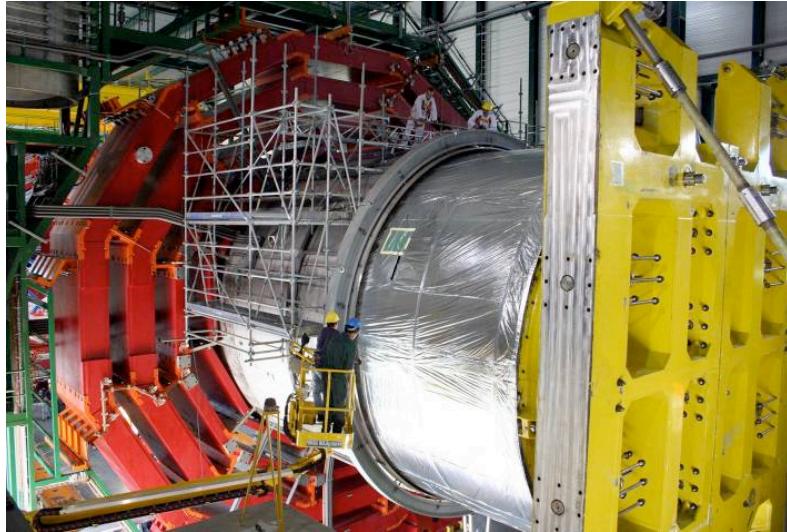
china eu india japan korea russia usa



# Stanza VII (Cont.)

iter

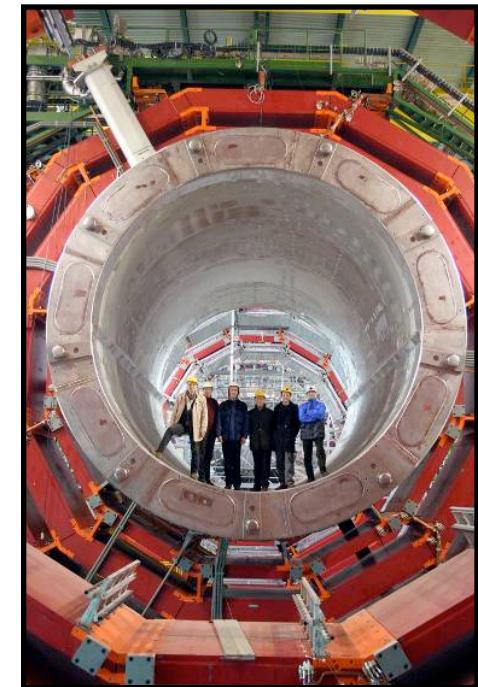
china eu india japan korea russia usa



# Stanza VII (Cont.)

iter

china eu india japan korea russia usa



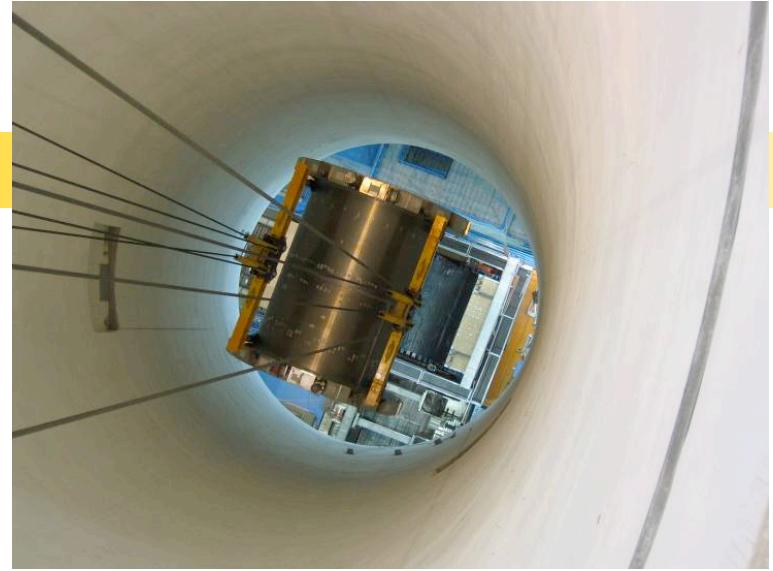
# Stanza VII (Cont.)

iter

china eu india japan korea russia usa

# Stanza VII (Cont.)

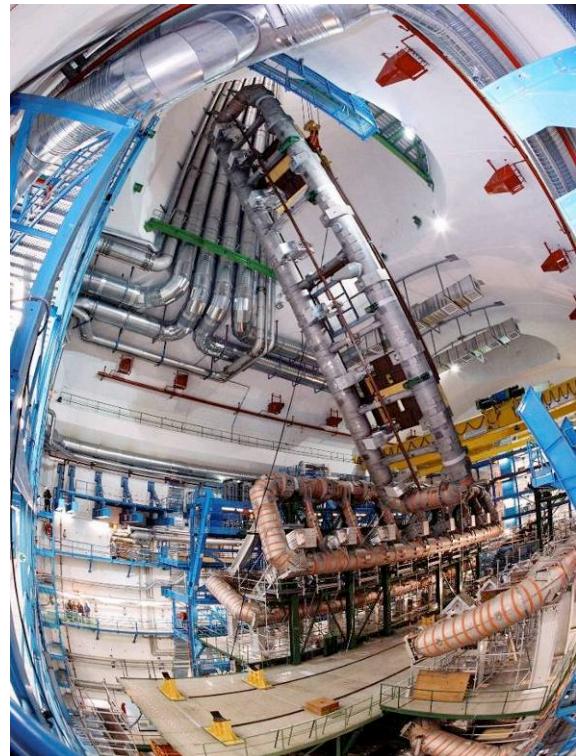
iter china eu india japan korea russia usa



# Stanza VII (Cont.)

iter

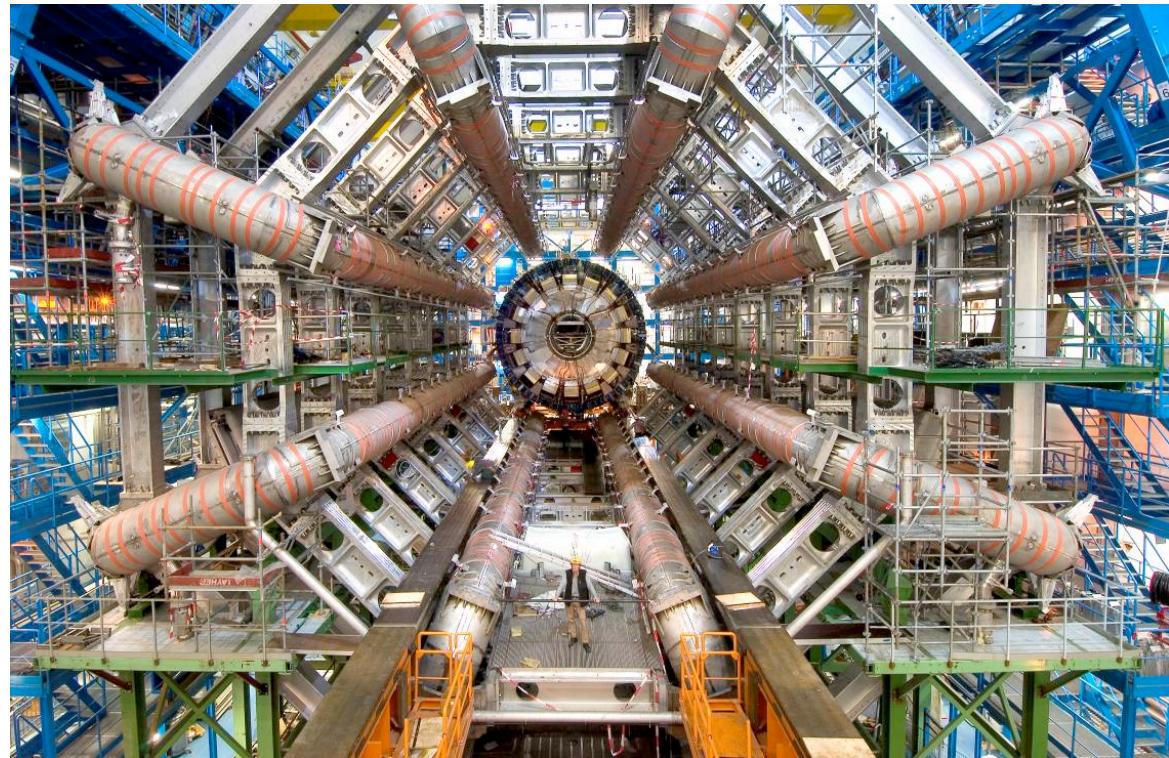
china eu india japan korea russia usa



# Stanza VII (Cont.)

iter

china eu india japan korea russia usa



# Stanza VII (Cont.)

iter

china eu india japan korea russia usa

# Stanza VII (Cont.)

iter

china eu india japan korea russia usa



# Stanza VIII

iter

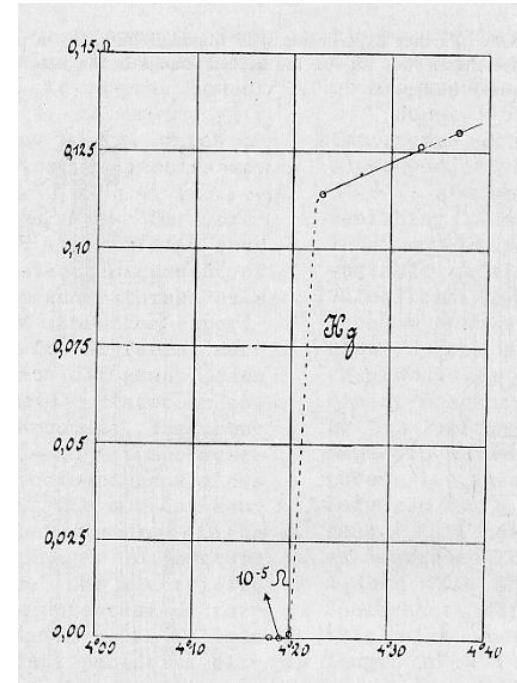
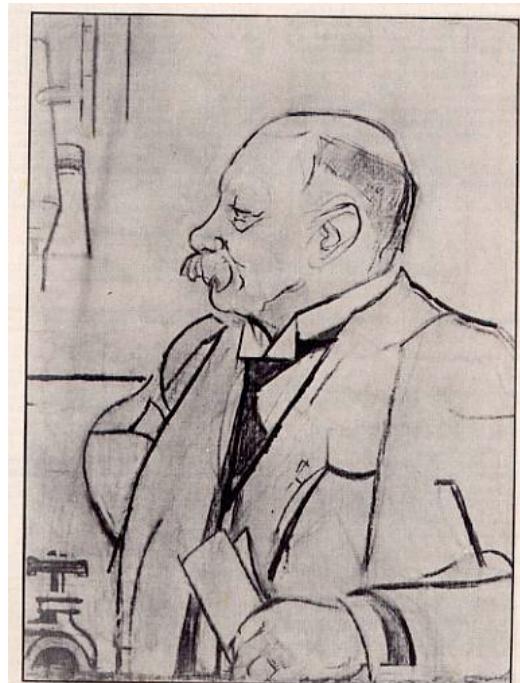
china eu india japan korea russia usa

- I don't believe in the values that underline today's Art...  
the Art of Novelty... the Art of surprise.
- Surprise is a dead thing, stillborn as soon as it is  
conceived.

# Stanza VIII

iter china eu india japan korea russia usa

- I don't believe in the values that underline today's Art...  
the Art of Novelty... the Art of surprise.
- Surprise is a dead thing, stillborn as soon as it is  
conceived.



# Stanza IX

iter china eu india japan korea russia usa

- “Modernism,” as if modern was the best acknowledgement.
- As if, when talking about a thing, one couldn’t speak more highly, more definitely of it than by saying: modern.

# Stanza IX

iter

china eu india japan korea russia usa

# Stanza IX

iter

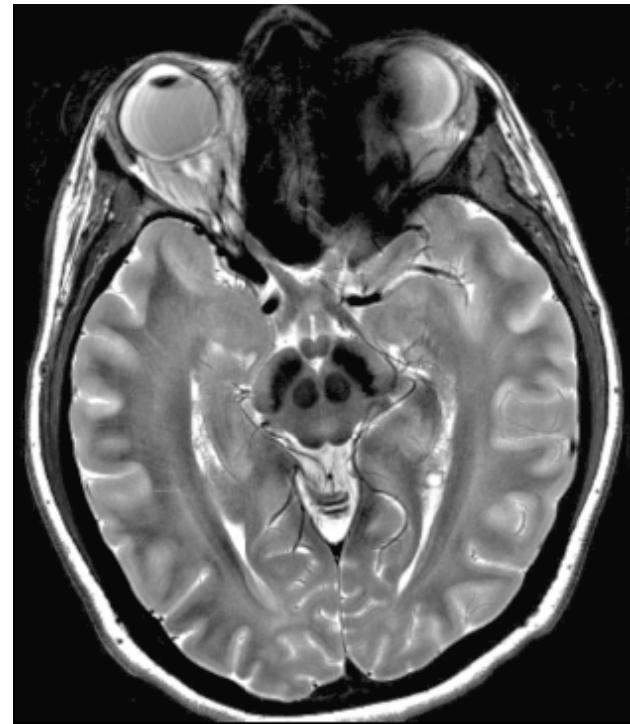
china eu india japan korea russia usa



# Stanza IX

iter

china eu india japan korea russia usa



# Stanza IX

iter

china eu india japan korea russia usa

# Stanza IX

iter

china eu india japan korea russia usa



# Stanza IX

iter

china eu india japan korea russia usa



# Stanza IX

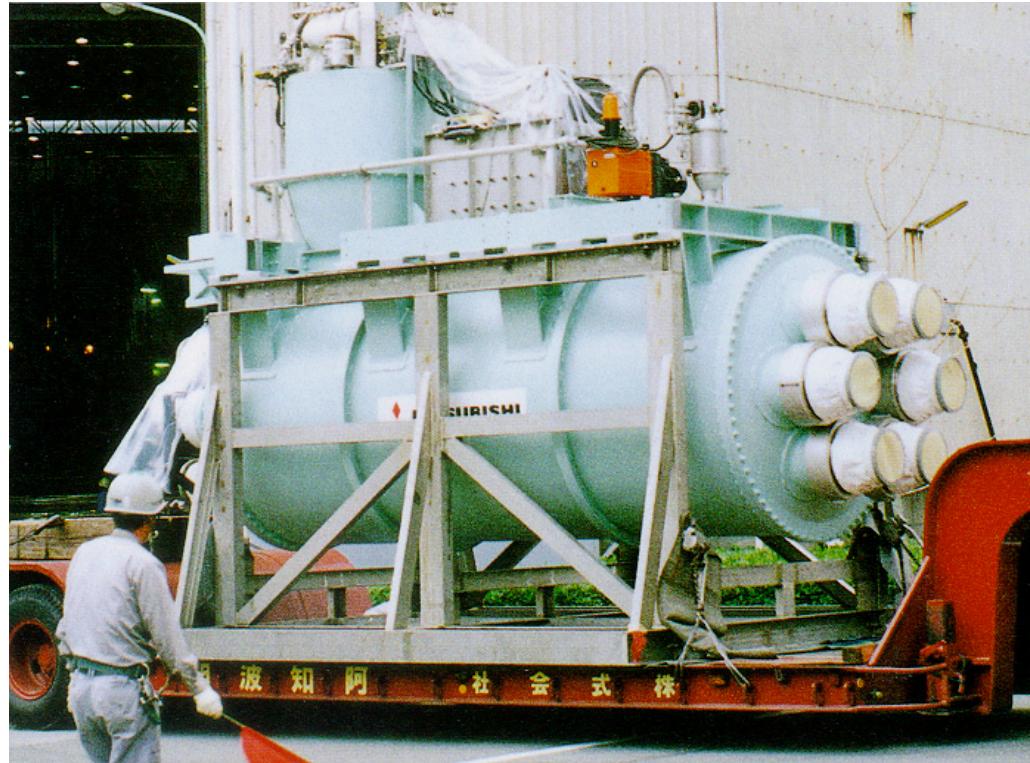
iter

china eu india japan korea russia usa

# Stanza IX

iter

china eu india japan korea russia usa



# Stanza IX

iter

china eu india japan korea russia usa



# Stanza X

iter

china eu india japan korea russia usa

- What does it mean to be a modern man?
- A modern man may be somebody who brings something to humanity.
- A modern man does not stop the history of painting at a Flemish view of Cavaillon or Carcassonne.
- A modern man may take part to the inner dynamics of evolution.

# Stanza X (Cont.)

iter

china eu india japan korea russia usa

# Stanza X (Cont.)

iter

china eu india japan korea russia usa



# Stanza X (Cont.)

iter

china eu india japan korea russia usa

# Stanza X (Cont.)

iter

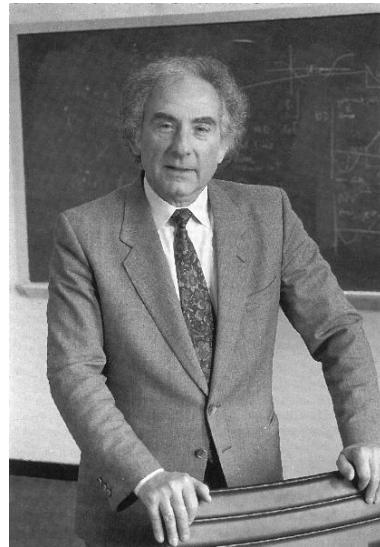
china eu india japan korea russia usa



# Stanza X (Cont.)

iter

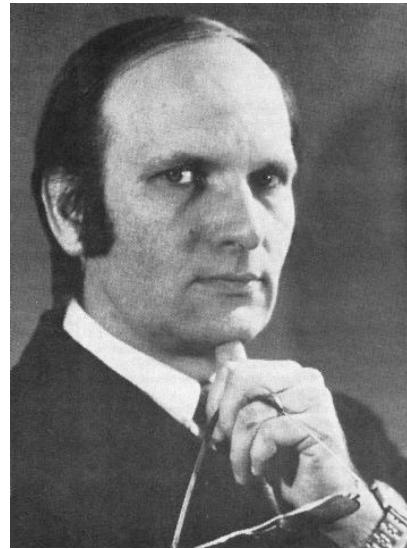
china eu india japan korea russia usa



# Stanza X (Cont.)

iter

china eu india japan korea russia usa



# Stanza X (Cont.)

iter

china eu india japan korea russia usa

# Stanza X (Cont.)

iter

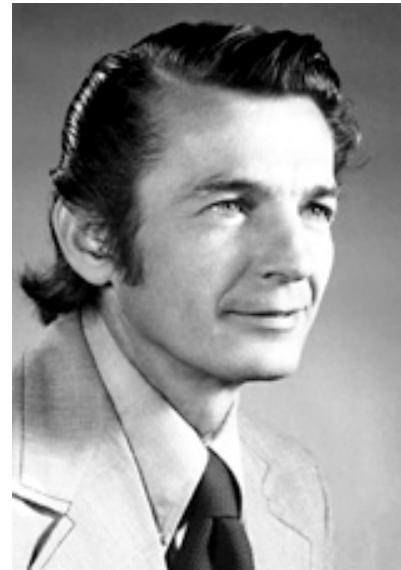
china eu india japan korea russia usa



# Stanza X (Cont.)

iter

china eu india japan korea russia usa



# Stanza X (Cont.)

iter

china eu india japan korea russia usa



# Stanza X (Cont.)

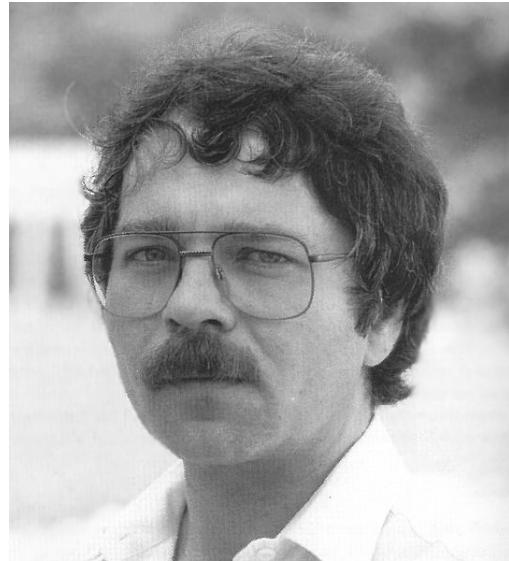
iter

china eu india japan korea russia usa

# Stanza X (Cont.)

iter

china eu india japan korea russia usa



# Stanza X (Cont.)

iter

china eu india japan korea russia usa



# Stanza X (Cont.)

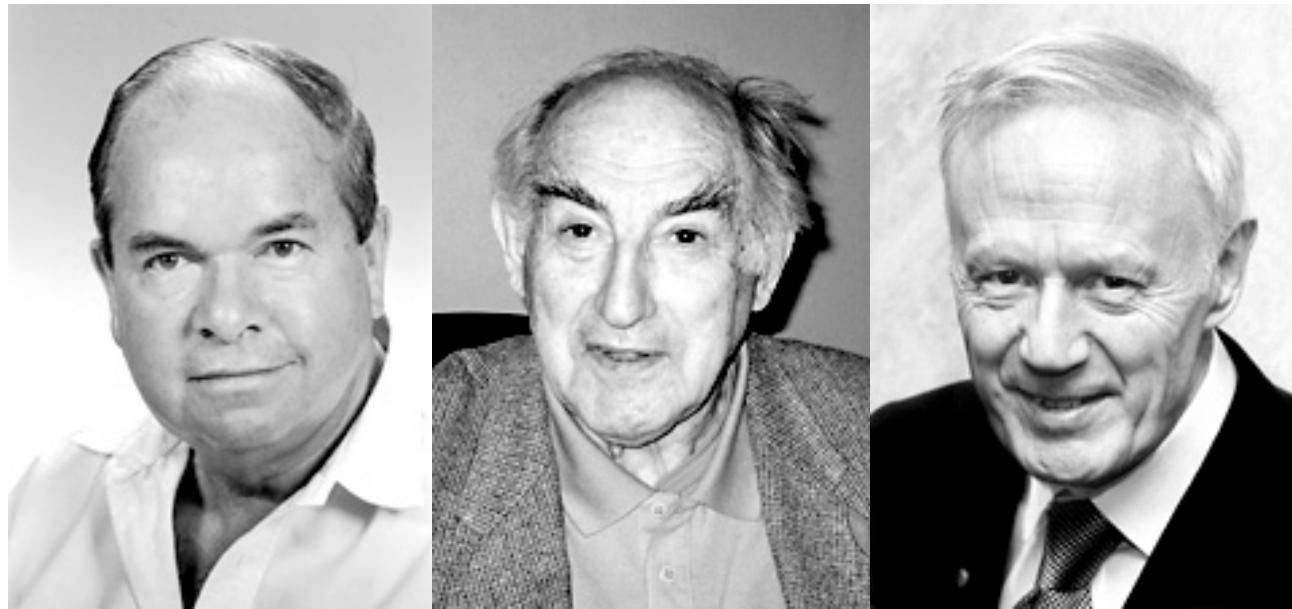
iter

china eu india japan korea russia usa

# Stanza X (Cont.)

iter

china eu india japan korea russia usa



# Stanza XI

iter

china eu india japan korea russia usa

- Shortly after the “incident,” I remember being at Chris’ place.
- We were standing in front of the painting, and Chris was holding a bucket of water into which I was dipping a piece of fabric.
- Chris had rolled up the sleeves of his Brooks Brothers’ shirt, and I was wearing a painter apron, too short for me.
- We were surrounded by all kinds of cleaning products, flasks or bottles of white spirit, Eau Ecarlate, rags and sponges.

# Stanza XI (Cont)

iter china eu india japan korea russia usa

- Once we succeeded in cleaning up the painting, thanks to a beef-fat based Swiss soap, I looked at it carefully and turned to Chris

Did you know that canvasses were washable?

No, answered Chris... No... Did you?

No, I didn't know either, I said very quickly, lying.

- On the spot, I almost said, of course, I knew it. But how could I jeopardize our trial run by such a disappointing confession? ... On the other hand, starting over by cheating?

- Cheating? Come on, let's not exaggerate... Since when have I become so virtuous?

# Stanza XI (Cont.)

iter

china eu india japan korea russia usa

# Stanza XI (Cont.)

iter

china eu india japan korea russia usa



# Stanza XI (Cont.)

iter

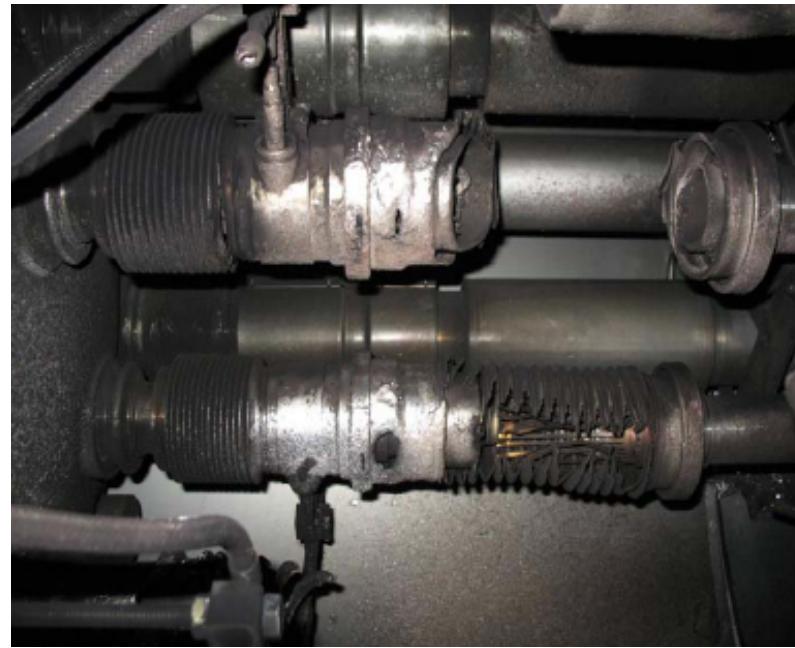
china eu india japan korea russia usa



# Stanza XI (Cont.)

iter

china eu india japan korea russia usa



# Stanza XI (Cont.)

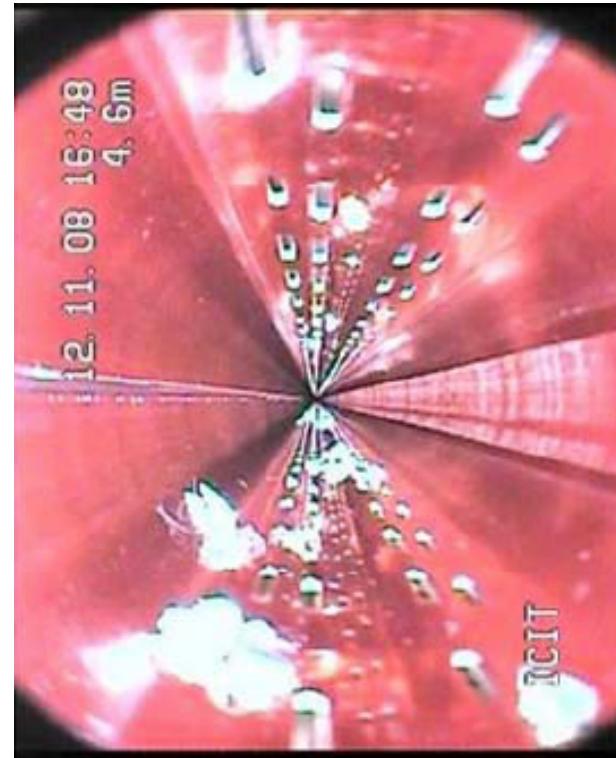
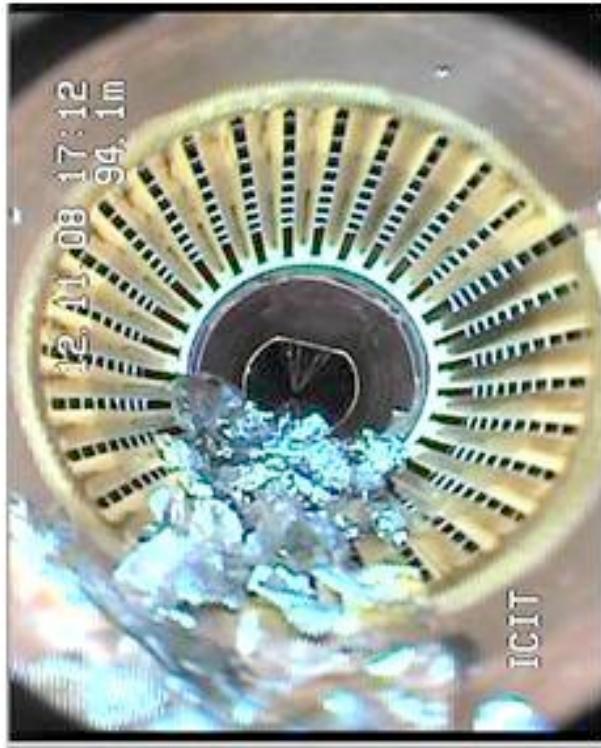
iter

china eu india japan korea russia usa

# Stanza XI (Cont.)

iter

china eu india japan korea russia usa



# Stanza XI (Cont.)

iter

china eu india japan korea russia usa

# Stanza XI (Cont.)

iter

china eu india japan korea russia usa



# Stanza XI (Cont.)

iter

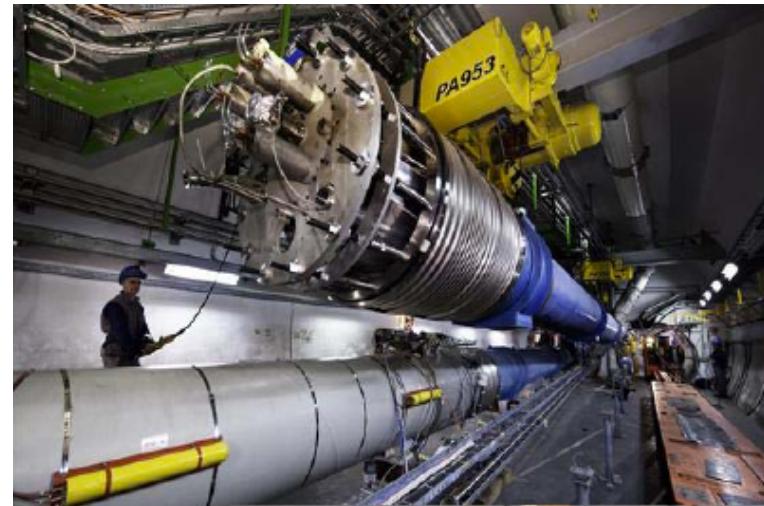
china eu india japan korea russia usa



# Stanza XI (Cont.)

iter

china eu india japan korea russia usa



# Stanza XI (Cont.)

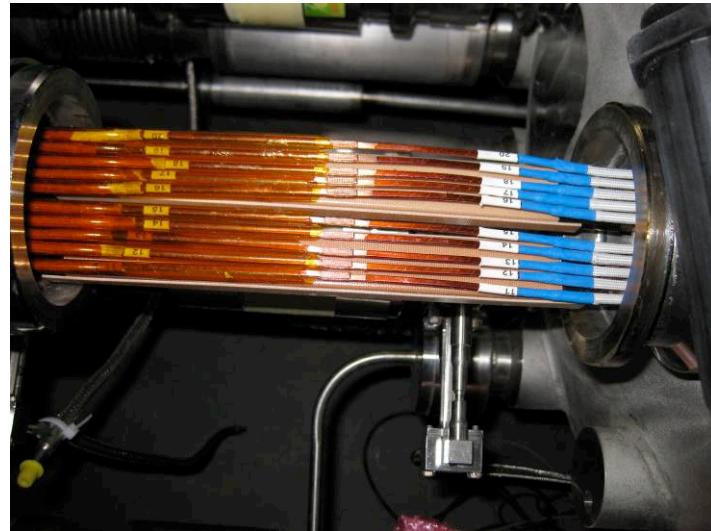
iter

china eu india japan korea russia usa

# Stanza XI (Cont.)

iter

china eu india japan korea russia usa



# Epilogue

iter china eu india japan korea russia usa

- I thought of Chris the other day. I thought of him and I changed my mind.
- The other day while driving in Vauvenargues by Cézanne's Sainte-Victoire, I thought of him and I told myself: there is genuine poetry in Chris' act.
- Letting oneself go for such an incoherent buy is a highly poetic act, isn't?

# Epilogue (Cont.)

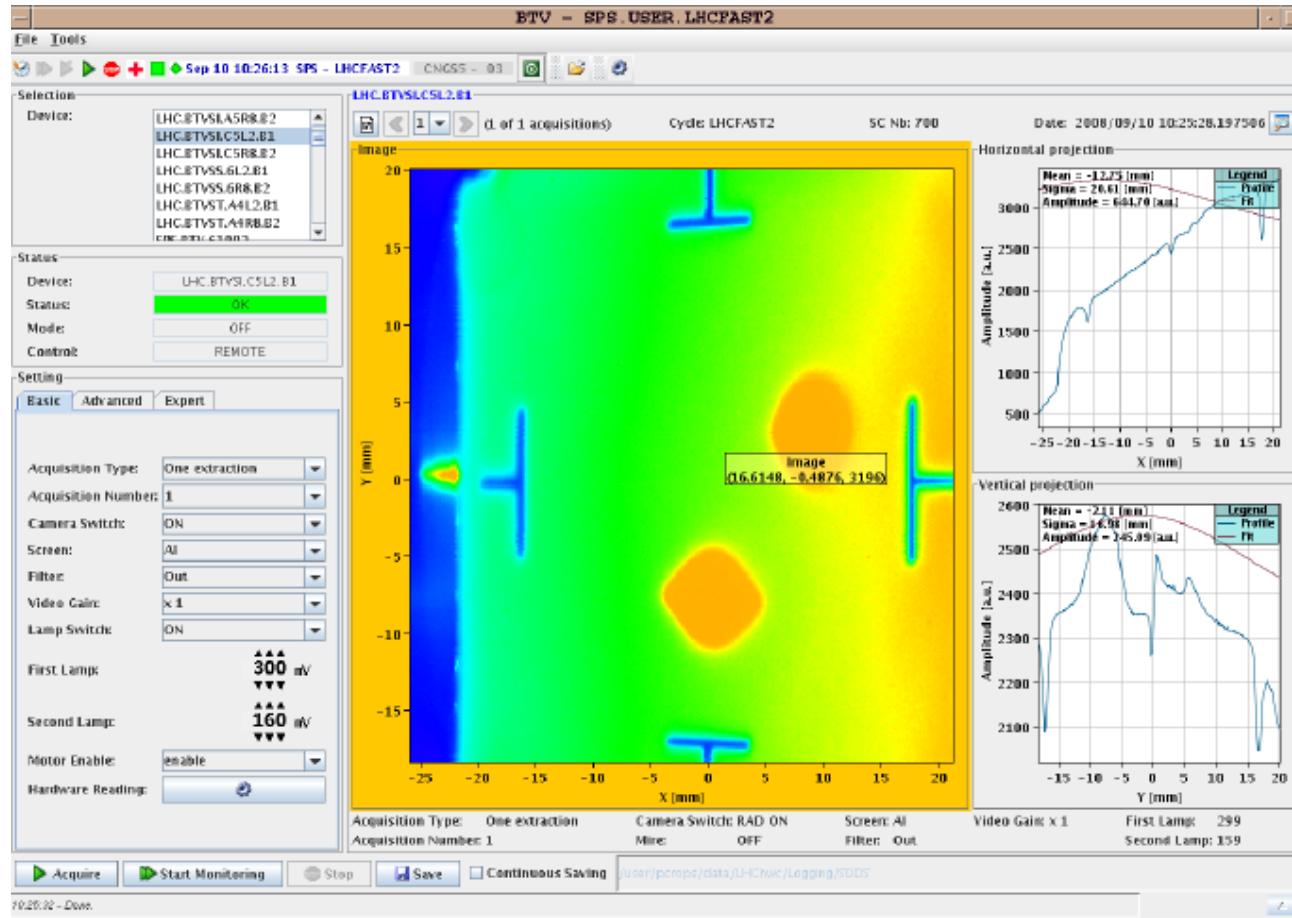
iter

china eu india japan korea russia usa

# Epilogue (Cont.)

iter

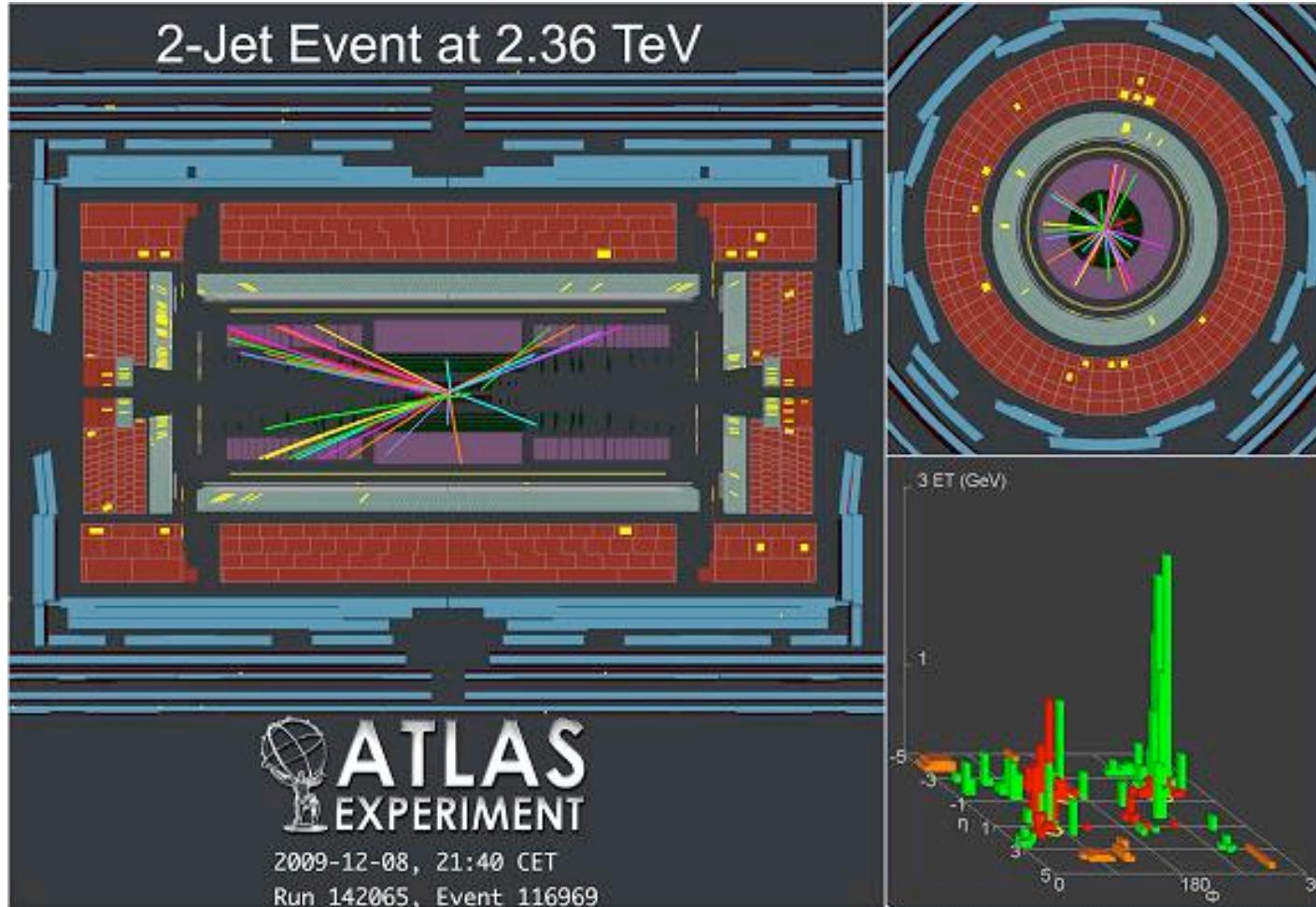
china eu india japan korea russia usa



# Epilogue (Cont.)

iter

china eu india japan korea russia usa



# Postface

iter

china eu india japan korea russia usa

- It's all my fault; Chris and I did not see each other much over the last few years.
- I have been away for too long.
- One should never leave one's friends without watching, one should always look after one's friends or they drift away.

# Postface (Cont.)

iter

china eu india japan korea russia usa

# Postface (Cont.)

iter china eu india japan korea russia usa



'It won't get boring" says Norbert Holtkamp.

# Postface (Cont.)

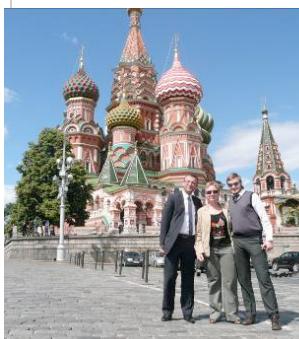
iter

china eu india japan korea russia usa



A.D. The Art of Supercond. Magnets Dec. 09 /33

'It won't get boring" says Norbert Holtkamp.



# Encore

iter

china eu india japan korea russia usa

- Under the white clouds, the snow is falling.
- One sees neither the white clouds nor the snow, neither the coldness nor the brightness of the ground.
- A lonely man, on skis, glides.
- The snow falls; it falls until the man disappears and recovers his opacity.
- It is a painting of about one meter sixty by one meter twenty.
- It features a man who crosses a space and disappears...

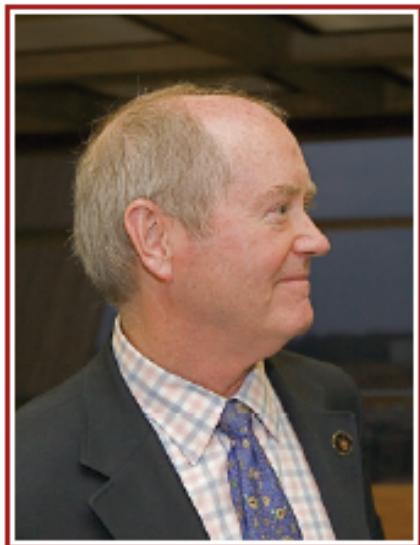


# Minute Particulars & Hidden Symmetries

CHRIS QUIGG SYMPOSIUM  
FERMILAB · DECEMBER 14-15, 2009

SPEAKERS INCLUDE

ROBERT CAHN  
ALEX CHAO  
SALLY DAWSON  
ARNAUD DEVRED  
SAMUEL DYSON  
PIERRE FAYET  
RICHARD FIELD  
FABIOLA GIANOTTI  
PAUL GRANNIS  
DEBORAH HARRIS  
JOHN DAVID JACKSON  
VERA LÜTH  
KATE METROPOLIS  
MARY HALL RENO  
JONATHAN ROSNER  
ELIZABETH SIMMONS  
SLAWEK TKACZYK  
SCOTT WILLENBROCK



THEORY.FNAL.GOV/MPHS

ORGANIZING COMMITTEE: BILL BARDEEN · MARCELA CARENA · PATRICIA MCBRIDE · OLIVIA VIZCARRA  
CONFERENCE OFFICE: CYNTHIA SAZAMA (SAZAMA@FNAL.GOV)  
SPONSORED BY FERMILAB AND FERMI RESEARCH ALLIANCE



# Minute Particulars & Hidden Symmetries

CHRIS QUIGG SYMPOSIUM  
FERMILAB · DECEMBER 14-15, 2009

SPEAKERS INCLUDE



ROBERT CAHN  
ALEX CHAO  
SALLY DAWSON  
ARNAUD DEVRED  
SAMUEL DYSON  
PIERRE FAYET  
RICHARD FIELD  
FABIOLA GIANOTTI  
PAUL GRANNIS  
DEBORAH HARRIS  
JOHN DAVID JACKSON  
VERA LÜTH  
KATE METROPOLIS  
MARY HALL RENO  
JONATHAN ROSNER  
ELIZABETH SIMMONS  
SLAWEK TKACZYK  
SCOTT WILLENBROCK

Happy birthday!

THEORY.FNAL.GOV/MPHS

ORGANIZING COMMITTEE: BILL BARDEEN · MARCELA CARENA · PATRICIA MCBRIDE · OLIVIA VIZCARRA  
CONFERENCE OFFICE: CYNTHIA SAZAMA (SAZAMA@FNAL.GOV)  
SPONSORED BY FERMILAB AND FERMI RESEARCH ALLIANCE



# Credits

iter

china eu india japan korea russia usa

- Matt Jewell, ITER IO
- Philippe Lebrun, CERN
- Peter Lee, FSU
- Lucio Rossi, CERN