Into the galaxy of

Winding curing and collaring

Workshop on Field Quality Steering of the Dipole Production

20/03/2003

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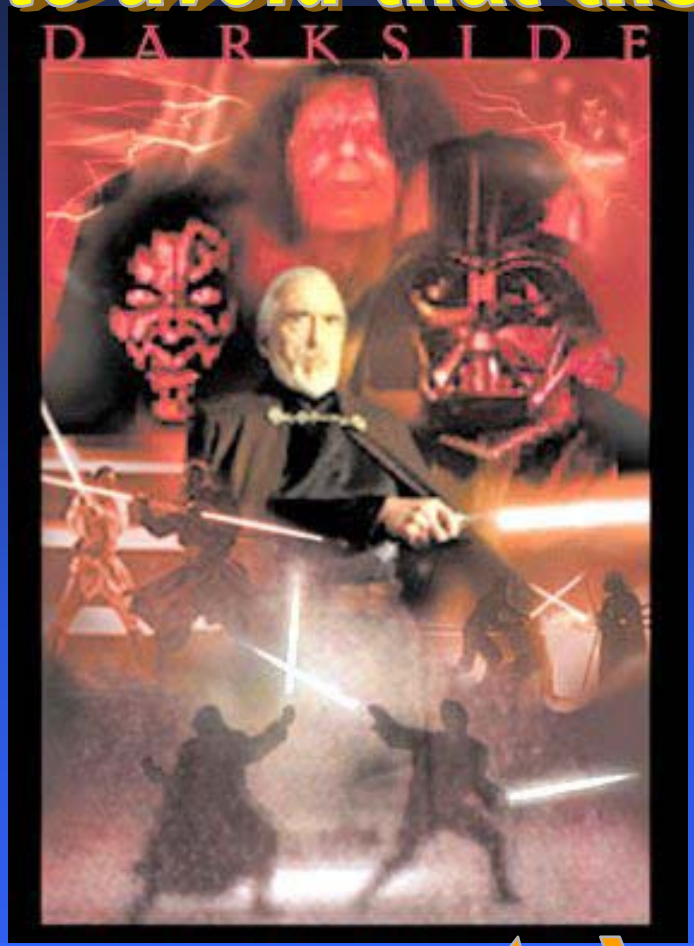
AT-MAS/MD

I hope that it will be interesting enough

to avoid that the

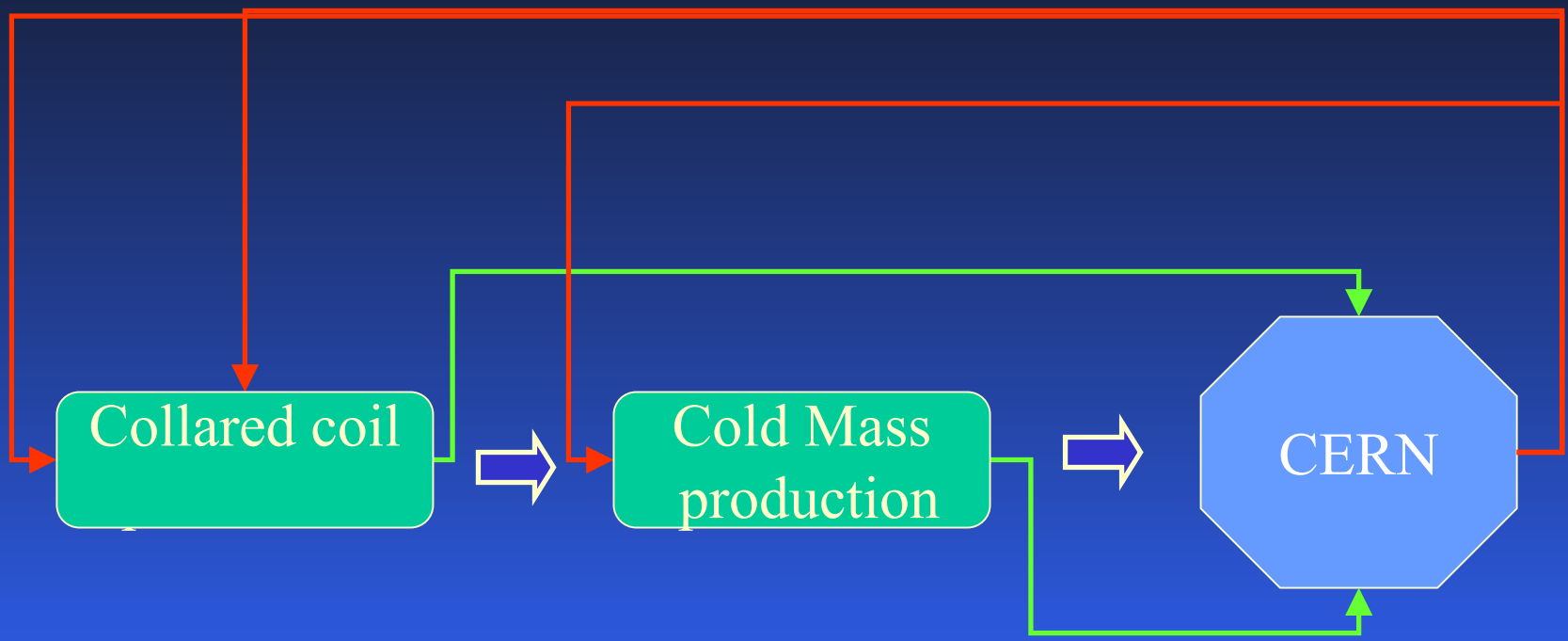


of the room catches you

Summary

- The process and the components
- The tooling
- Production back log estimation
- The handles and the estimated cost and delay

Clarification

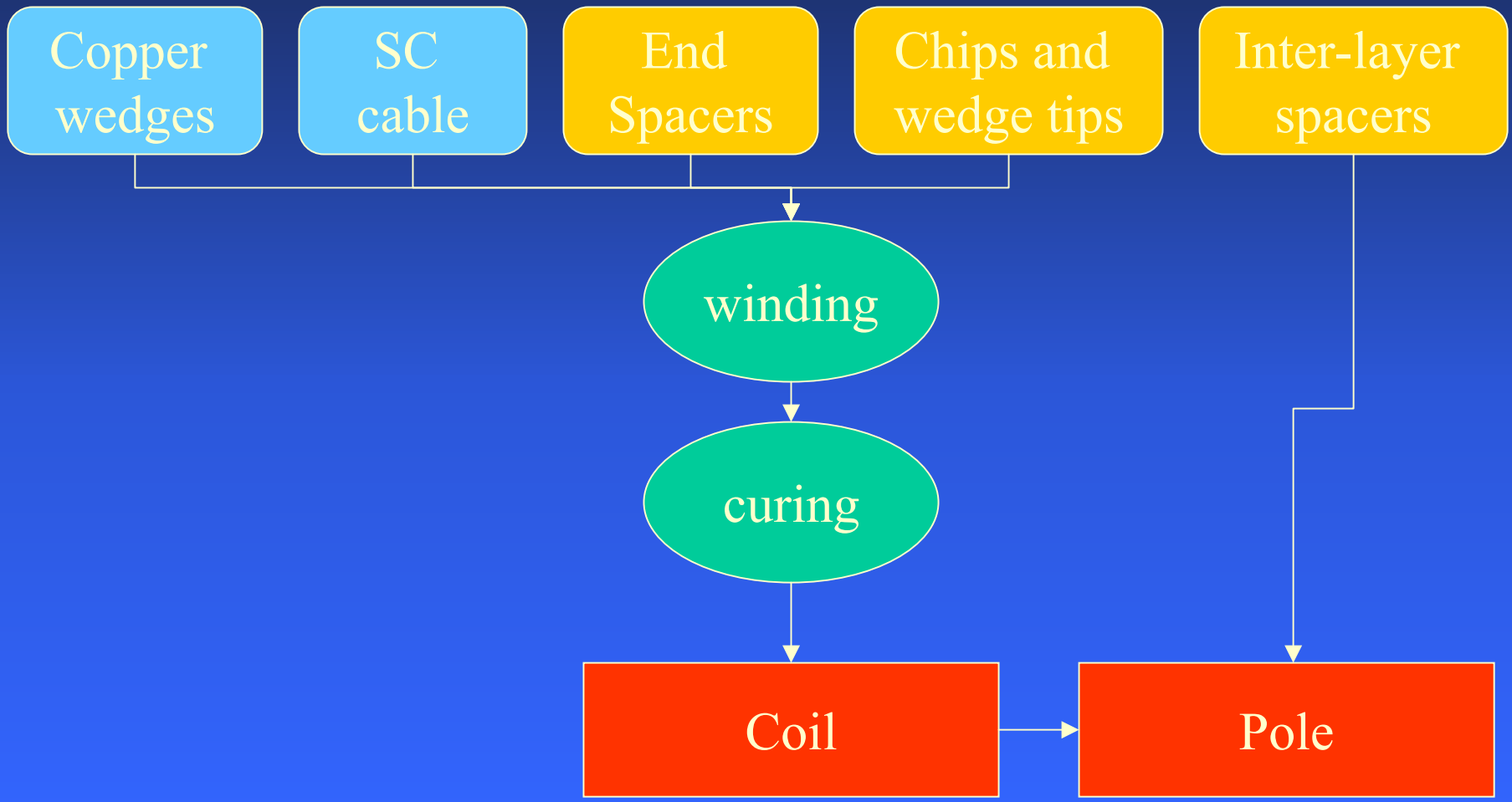


Back log

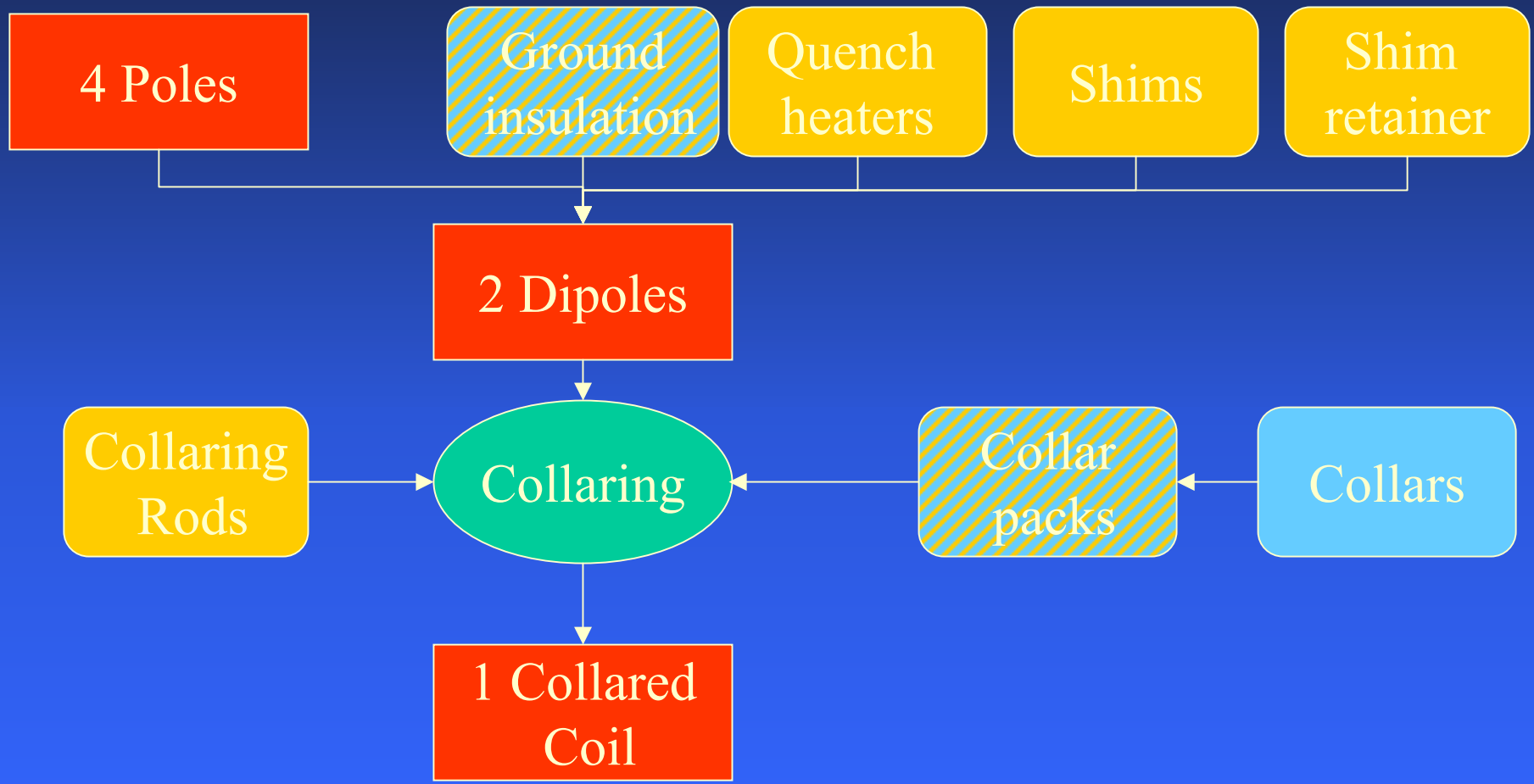
From the measurement that triggers feed back to the moment when the corrected dipole gets to the same kind of measurements

CERN
CMA

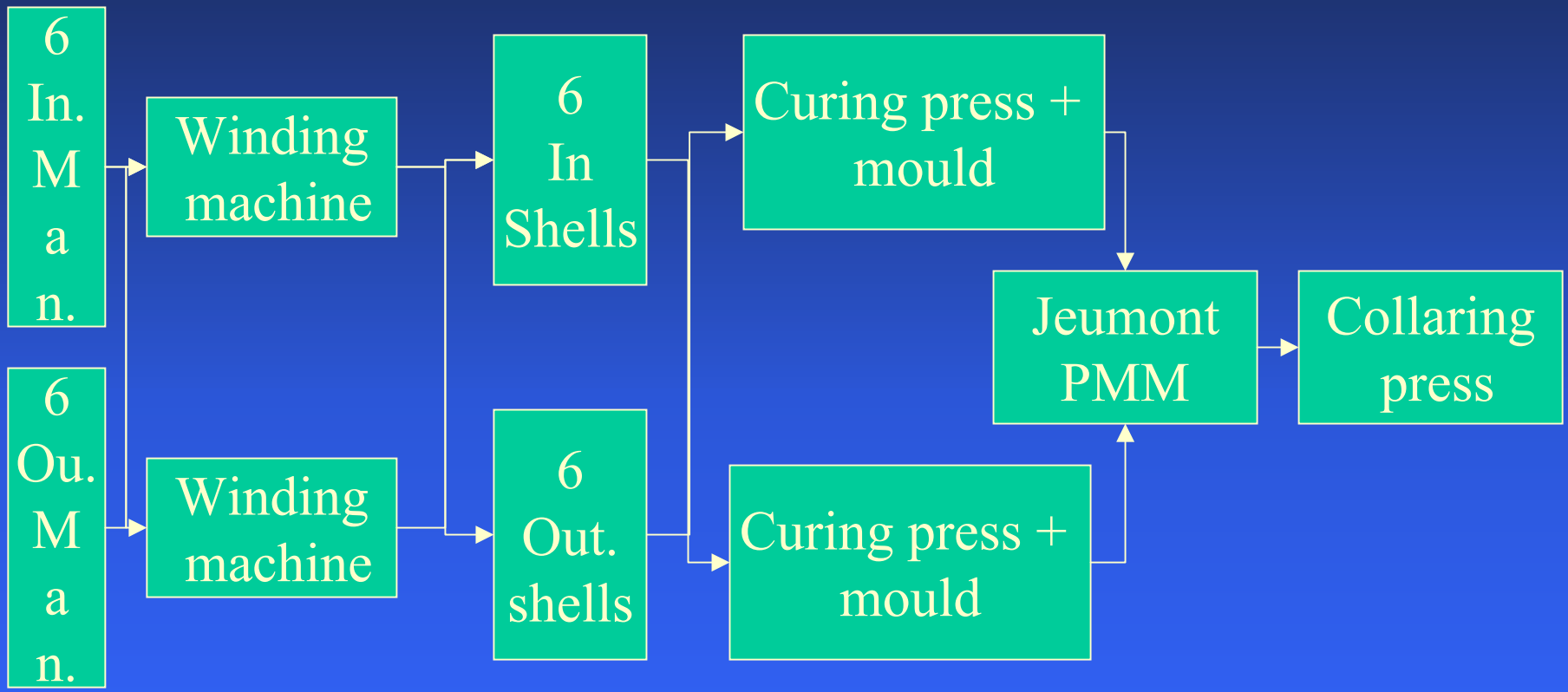
The components I from SC Cable to Poles



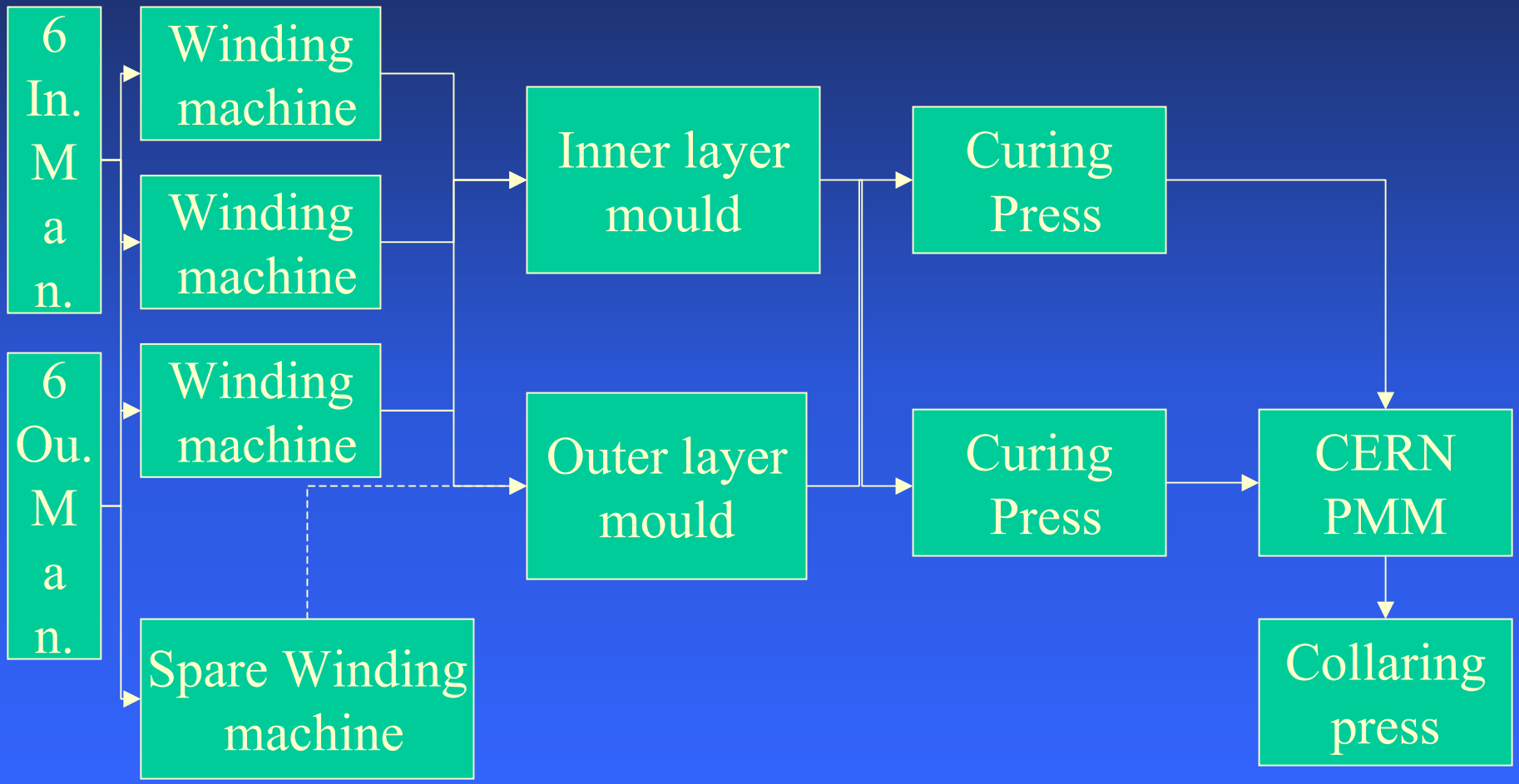
The components II
From Poles to Collared Coil



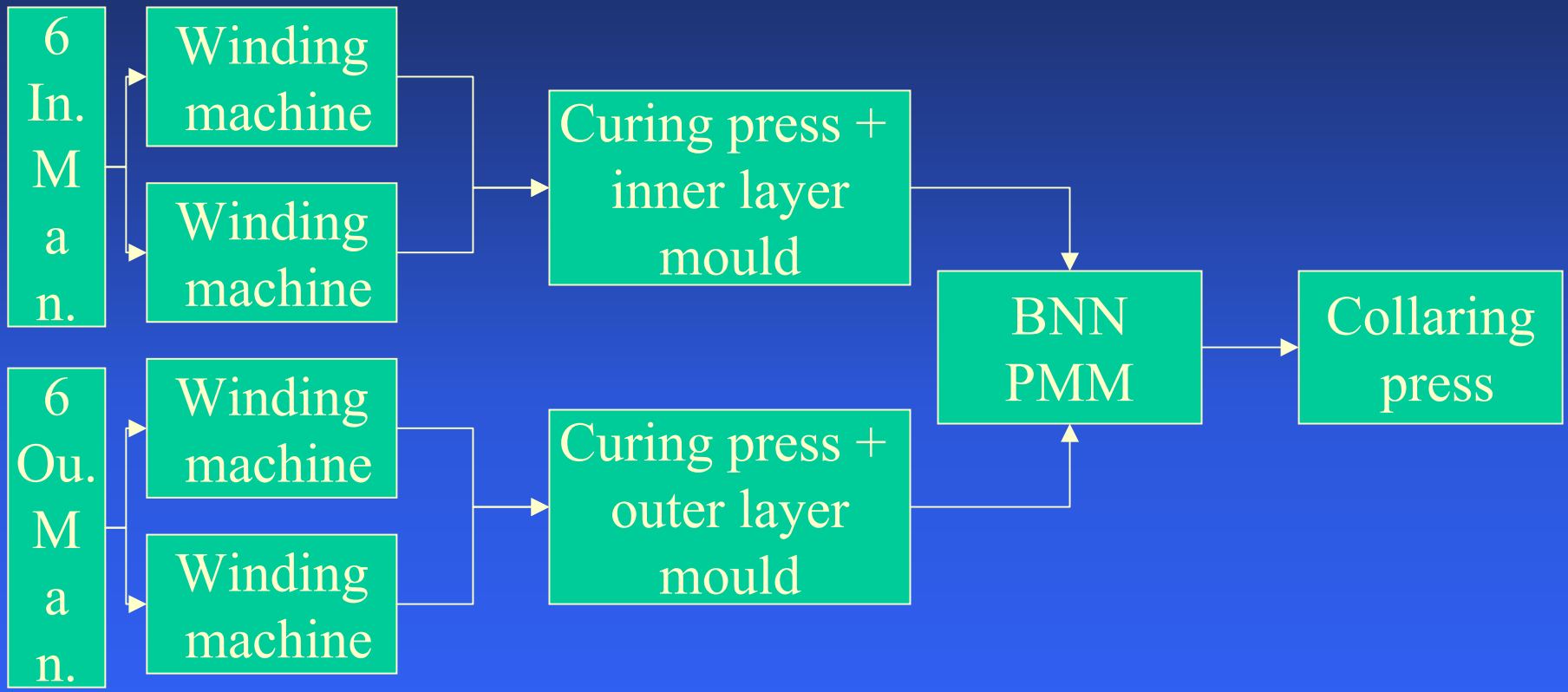
Jeumont /Alstom Tooling



Ansaldo Tooling



BNN Tooling


6 In. Man.
Winding machine
Winding machine
6 Ou. Man.
Winding machine
Winding machine
Curing press + inner layer mould
Curing press + outer layer mould
BNN PMM
Collaring press

Back Log Estimation

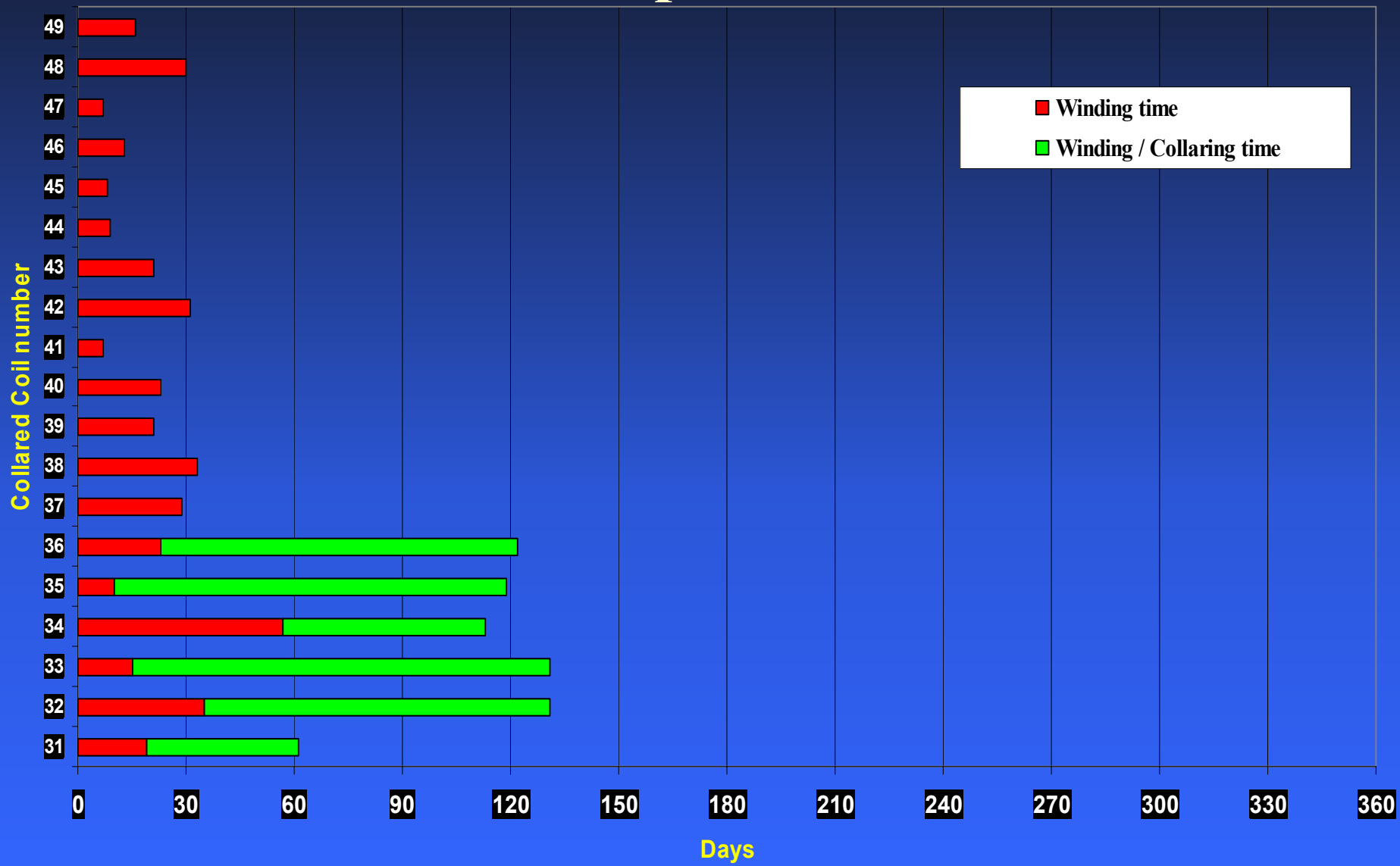
Total Back Log

(number of collared coil)

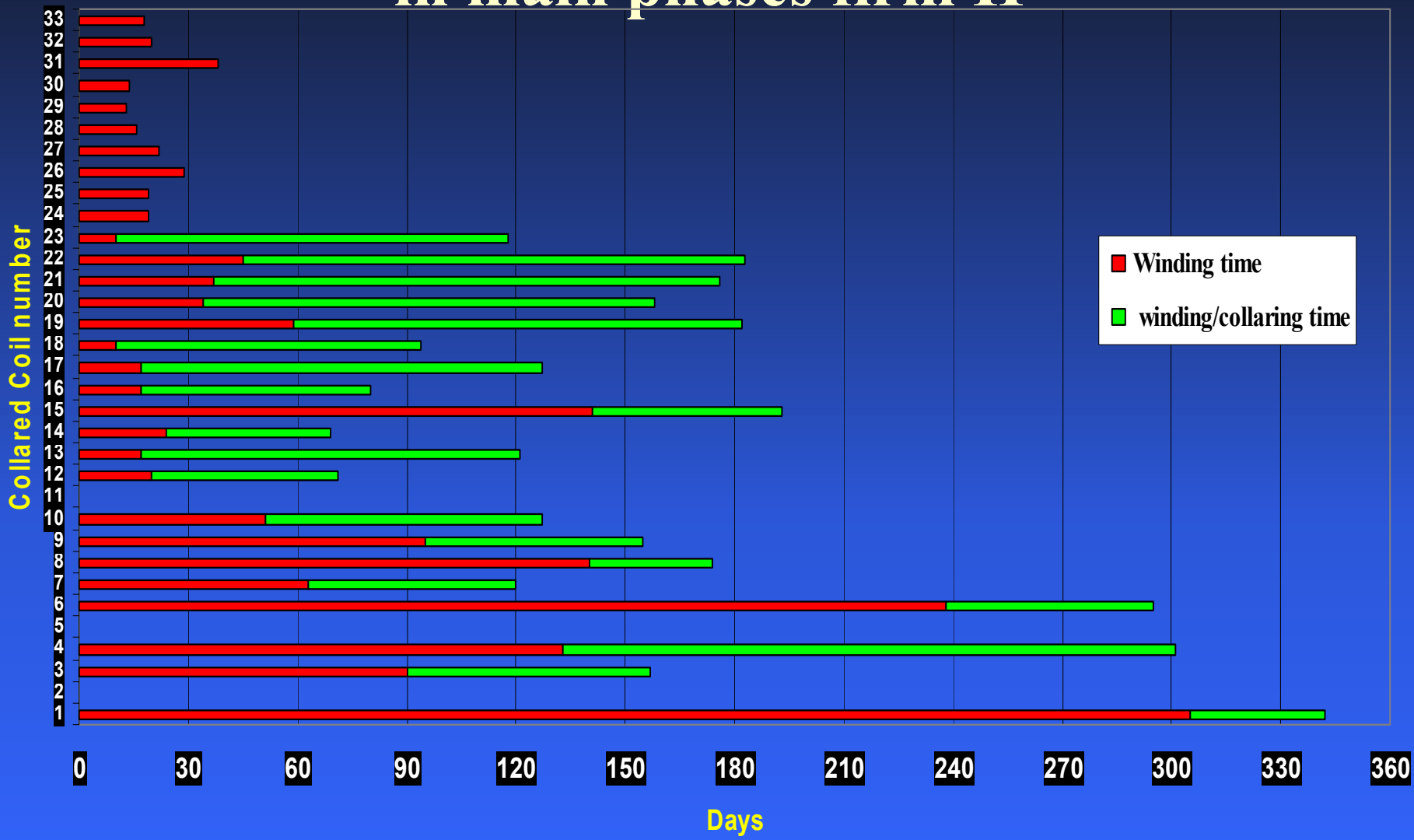
Production back log (Tprod X Rprod)

Component stock back log

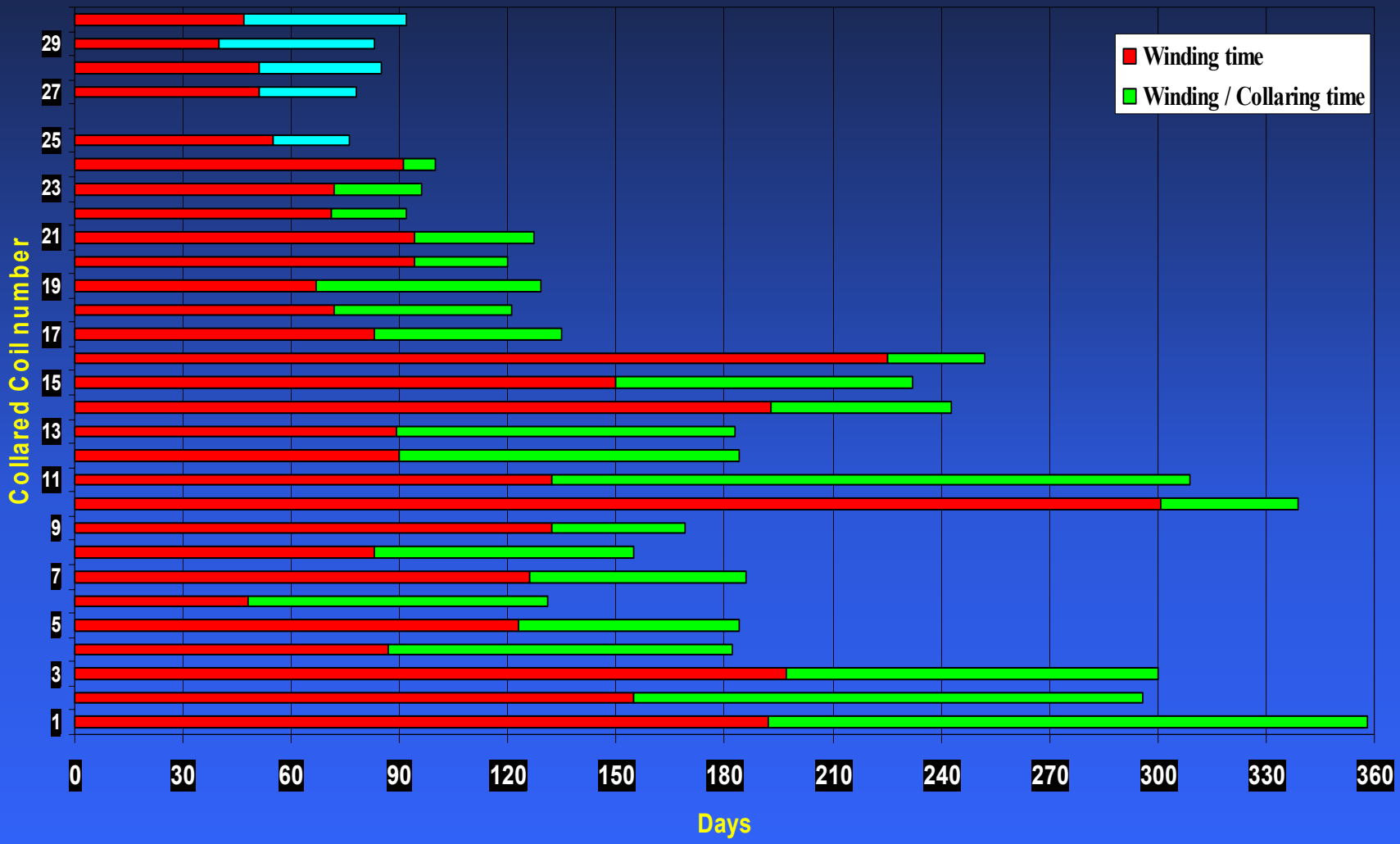
Collared Coil Production time divided in main phases firm I



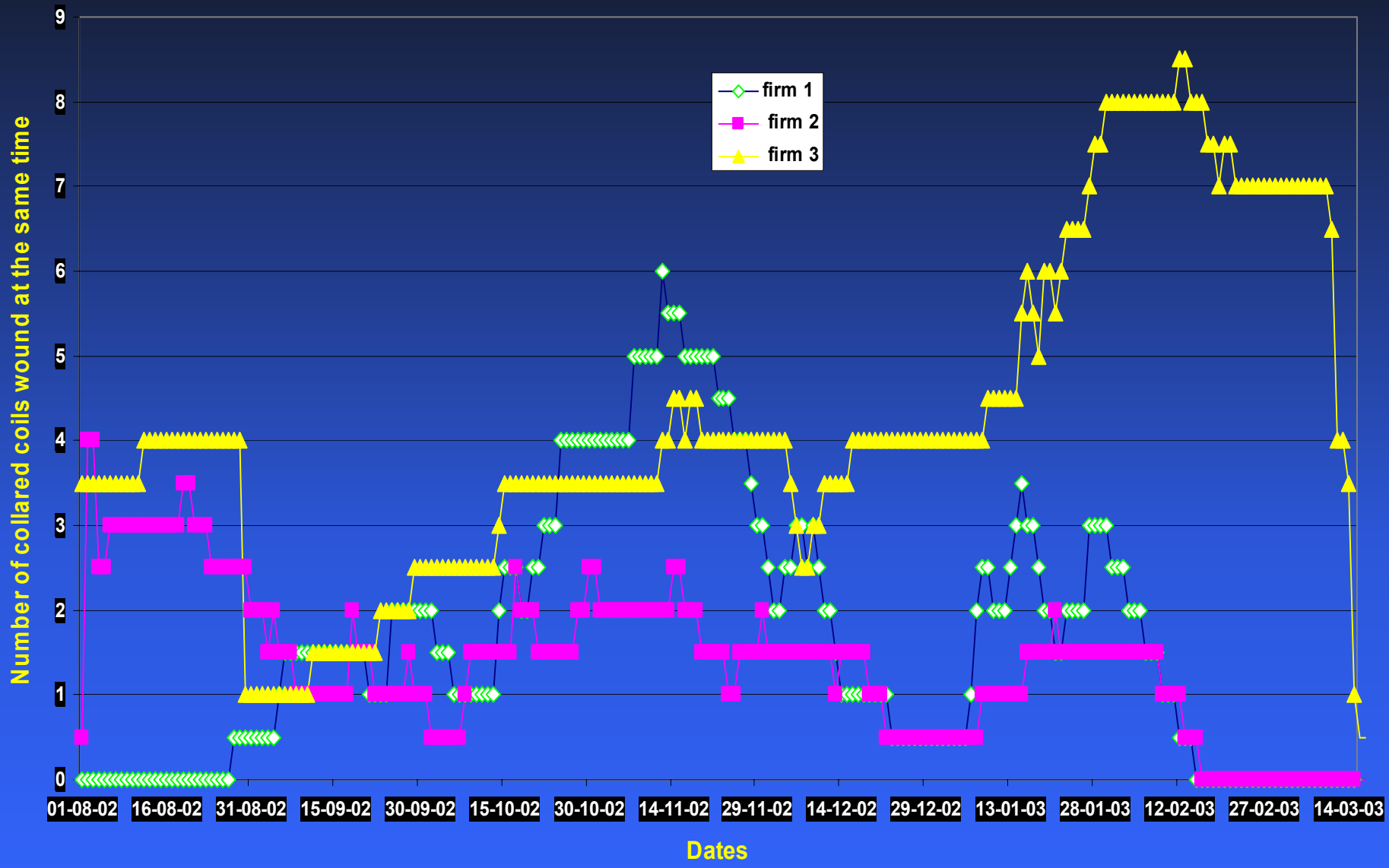
Collared Coil Production time divided in main phases firm II



Collared Coil Production time divided in main phases firm III



Number of collared coil in parallel production



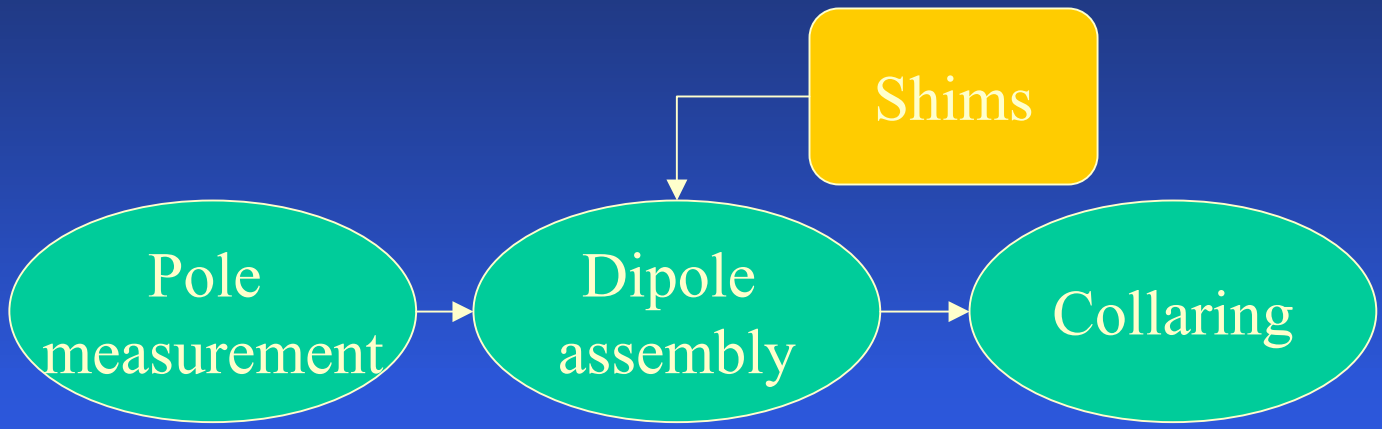
Production back log estimation

Firm	1 collared coils week/CMAs			3 collared coils week/CMAs		
	Winding back log	Assembly back log	Tot back log	Winding back log	Assembly back log	Tot back log
F I	5	7	12	12	18	30
F II	9	6	15	10	20	30
F III	13	5	18	17	9	28
Total	27	18	45	39	47	88

The handles and their estimated cost and delay

Polar shims

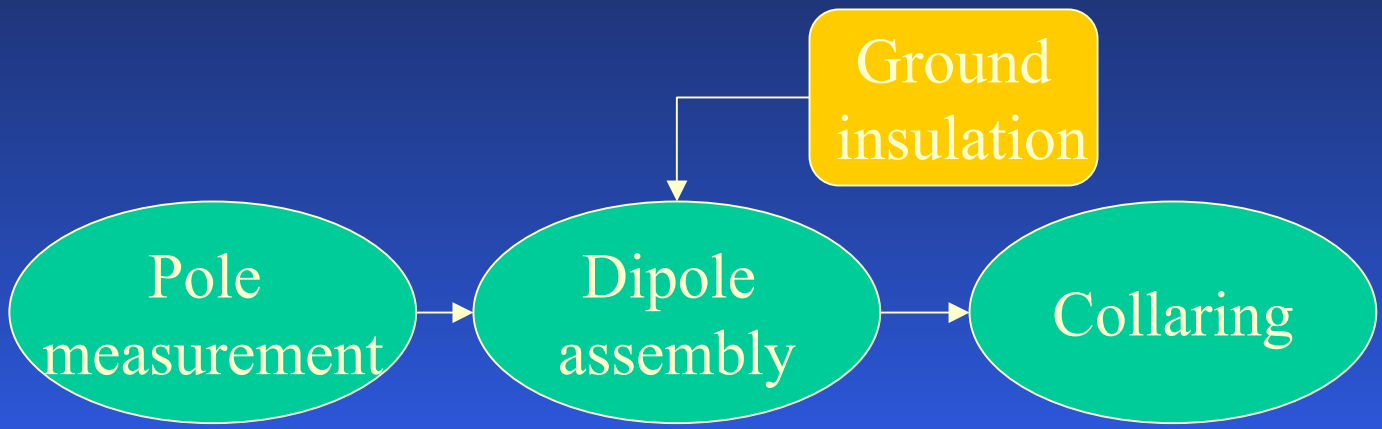
- Delay of intervention: approx. 1 week to 4 weeks of production (shim procurement time)



- Cost of the intervention: max some thousands of CHF (1 set of shims about 1500 CHF, the cost will be equal to the number of set of shims not usable)

Mid plane insulation

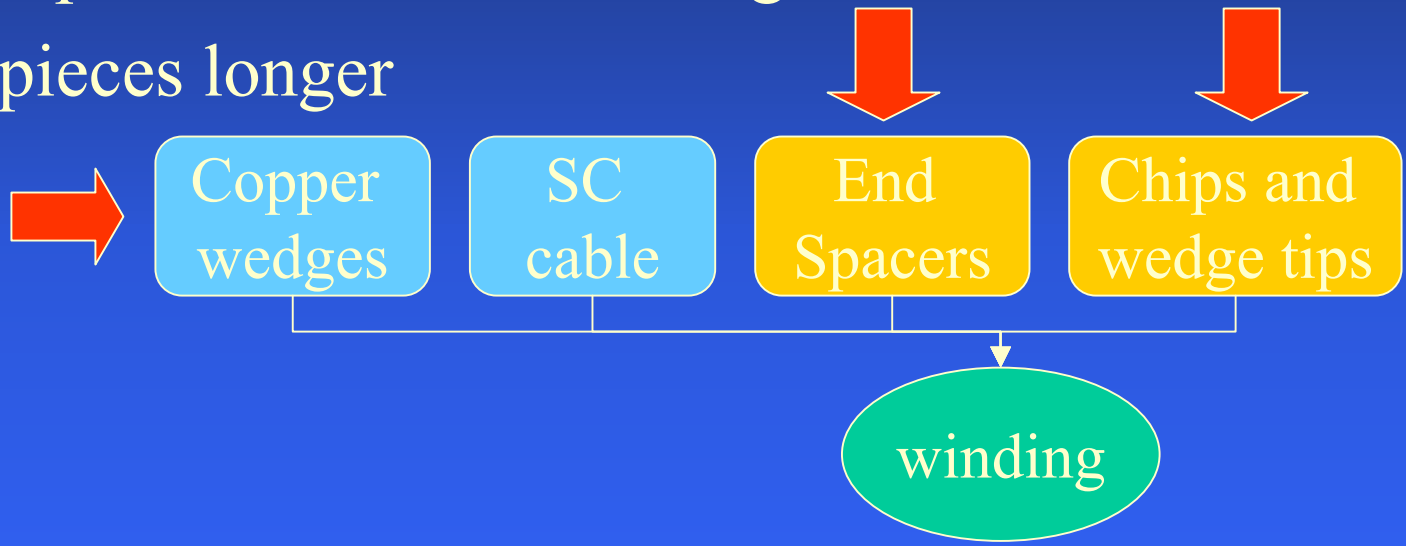
- Delay of intervention:
  - Change of ground insulation: 1.5-2 month of production (stock and intervention at the sub supplier)



- Cost of the intervention:average price to prepare ground insulation 9000 CHF/CC possible extra costs from 150 to1800 CHF/CC. Total extra cost: 200.000 CHF to 2.000.000 extra costs (i.e. 15 minutes more per layer is 300.000 CHF)

Copper wedges

- Delivery of modified copper wedges from the decision (14 working weeks)
- Modification of end spacer:
  - Machined pieces about 14 working weeks
  - Injected pieces longer



For costs see after

New component production

Copper wedges

10 days

Approval manufacturer's drawings

5 days

Drawings

T_0

New geometry

30 days

New tooling

20 days

Production

1 day

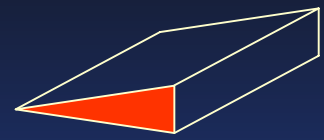
Acceptance

5 days

Expedition to CMA

Total time 70 Work. Days

Previous experience and cost estimation



- Decision 15/07/01
- Drawing cross section 15/08/01
- Delivery of end spacers for 2 CC and chips for 2 CC 15/11/01
- Delivery of new profile for 10 magnet each CMAs: 30/11/01
- Delivery of spacers 10 CC per CMAs 20/12/01
- Delivery of molded chips 01/02/02

- Cost I: 50 batches of copper wedges (500 magnets, i.e. cable delivered for 3/8) produced up to now. 7000 CHF/profile for tooling
- Cost II: at least only for end spacers 150.000 CHF (engineering + components)
- Cost III: quality problems

Correction of the magnetic length with nested laminations

- We can correct the magnetic length acting on the number of nested lamination
- 10 cm of extra nested lamination (Delta Bdl 7 units):
  - 10 cm more nested laminations: +660 CHF/CM
  - 10 cm less iron lamination: -150 CHF/CM
  - 10 cm net cost 1 magnet : +510 CHF/CM
- For 1 CMAs: about 200.000 CHF
- Other possible schemes:
  - Nested laminations transfer between CMAs
  - Use of special full non magnetic laminations

Change	Material delivery time back log	Production back log	Total
Polar shims	12 CC 36 CC	3 CC 12 CC	3 -12CC 12-48 CC
Mid plane insulation	24 CC 72 CC	3 CC 12 CC	27 CC 84 CC
Copper wedges	14 CC 140 CC	45 CC 88 CC	59 CC 230 CC
Laminations	12 CM 48 CM	24 CM 24 CM	36 CM 72 CM

Acknowledgements

- F. Bertinelli, C. Lanza, A .Schiappapietra, E. Todesco
- The whole MAS-MD and MAS-MA sections