



Module Production planning



About 16.000 modules (including spares) have to be produced over a period of time less than 2 years.

There are in total 26 different types of modules in various combination of:

- 14 types of sensors masks
- 24 types of pitch adapters
- 3 types of hybrid layouts (but assembled differently with 4 or 6 APV chips, connector orientation up or down)
- 19 types of frames (e.g. different mechanical assembly jigs)

Very complex nesting of parts.



Front End Hybrids



Good progress in the last 2 months.

Side Orders

- 300 TOB Hybrids kapton substrate processed. Good quality.
Delivery of the first 100 assembled TOB Hybrids before Xmas.
TOB mod prod could start in Jan.
- Order of 300 TIB and 300 TEC Hybrid substrates early Dec.
TEC/TIB mod prod could start in Mar.

Mass production

Start the administrative procedure for Hybrid Tender in Dec.

Sign the Hybrid contract 4 months later.

Delivery could start 2-3 months later → June-July '03.

Throughput ~ 2000 hybrids/month

Intermediate Orders

Try to place additional orders for ~ 2500 hybrids to continue without interruption the module production after the first 800 modules.



Startup of the production



Unexpected problems with side order PA (see Catherine talk).
Company is very actively investigating the problem.

In order to allow a transition toward the massive production (~1000 modules /month) we envisaged an initial period of about 3 months dedicated to the construction of 800 modules (of 4 different types):

300 TOB SS - 200 TIB SS - 150 TEC R6 + 150 TEC R4

- Based on the 60 modules already built and before starting the production, WGs should review (next TK week in Jan.) in detail the procedures.
- The rump up will be slow and we have to be very focused on QC at each step
Procedures and specifications has to be strictly followed and enforced by L2.
- Definition of checklists to be compiled during module production (gantry/bonding/module test) will help to follow the procedures and keep track of possible defects or problems that might occur during these operations.



Start-up



- The initial pre-production has to be carry out in a controlled way.
 - produce 50-100 modules
 - stop and check the quality
 - apply corrections if needed
 - produce 50-100 more modules
 - . . .
- During this initial stage it might be useful to define one reference and expert person per subsystem to overview the quality in order make sure that the modules produced in the different labs have an acceptable quality.



Start up - module qualification



- The first produced final modules (TOB,TIB,TEC) with final hybrids have to undergo qualification tests to validate the latest hybrid choices (and its assembly) and to provide green light for the mass production.

- Irradiation tests
- Cooling efficiency measurements
- Mechanical measurement (cooling on/off)
- Long term test
- Thermal cycles
- Some destructive tests (on irradiated modules)

Identify groups that can carry out in a short time scale these measurements.
Specify these tests (already performed in the past).



Start-up



After the initial production of 800 modules, we envisage the pre-series construction of all the other module types.

This is quickly needed also for testing DS TOB Rod, DS TIB Layer, TID Disk, fully equipped TEC petal.



Module Production Plan



	2002				2003				2004				2005			
Module production																
Sensors																
Frames																
Kapton Circuits																
Pitch Adapters																
FE Hybrids																

TOB Module Production Flow

Type	SS4	SS6	DSp-u	DSp-d	DSs-u	DSs-d		Mod/mon	Accum.	Days /month	Mod/day
ott-02											
nov-02											
dic-02											
gen-03	40							40	40	13,3	3
feb-03	60							60	100	10,0	6
mar-03	100							100	200	11,1	9
apr-03	100							100	300	11,1	9
mag-03	50	50	25	25				150	450	12,5	12
giu-03	100				25	25		150	600	12,5	12
lug-03	150							150	750	12,5	12
ago-03	150	150						300	1050	16,7	18
set-03	100	200						300	1350	16,7	18
ott-03	100	200						300	1650	16,7	18
nov-03	100	200						300	1950	16,7	18
dic-03	100	200						300	2250	16,7	18
gen-04	100	200						300	2550	16,7	18
feb-04	100	200						300	2850	16,7	18
mar-04	100	200						300	3150	16,7	18
apr-04		200	50	50				300	3450	16,7	18
mag-04			75	75	75	75		300	3750	16,7	18
giu-04			75	75	75	75		300	4050	16,7	18
lug-04			75	75	75	75		300	4350	16,7	18
ago-04			75	75	75	75		300	4650	16,7	18
set-04			75	75	75	75		300	4950	16,7	18
ott-04			75	75	75	75		300	5250	16,7	18
nov-04			50	50	100	100		300	5550	16,7	18
dic-04											
Total	1450	1800	575	575	575	575		5550			
needed	1368	1680	540	540	540	540		5208			
%spare	5,7	6,7	6,1	6,1	6,1	6,1		6,2			
No. spare	82	120	35	35	35	35		342			

TIB TID Module Production Flow

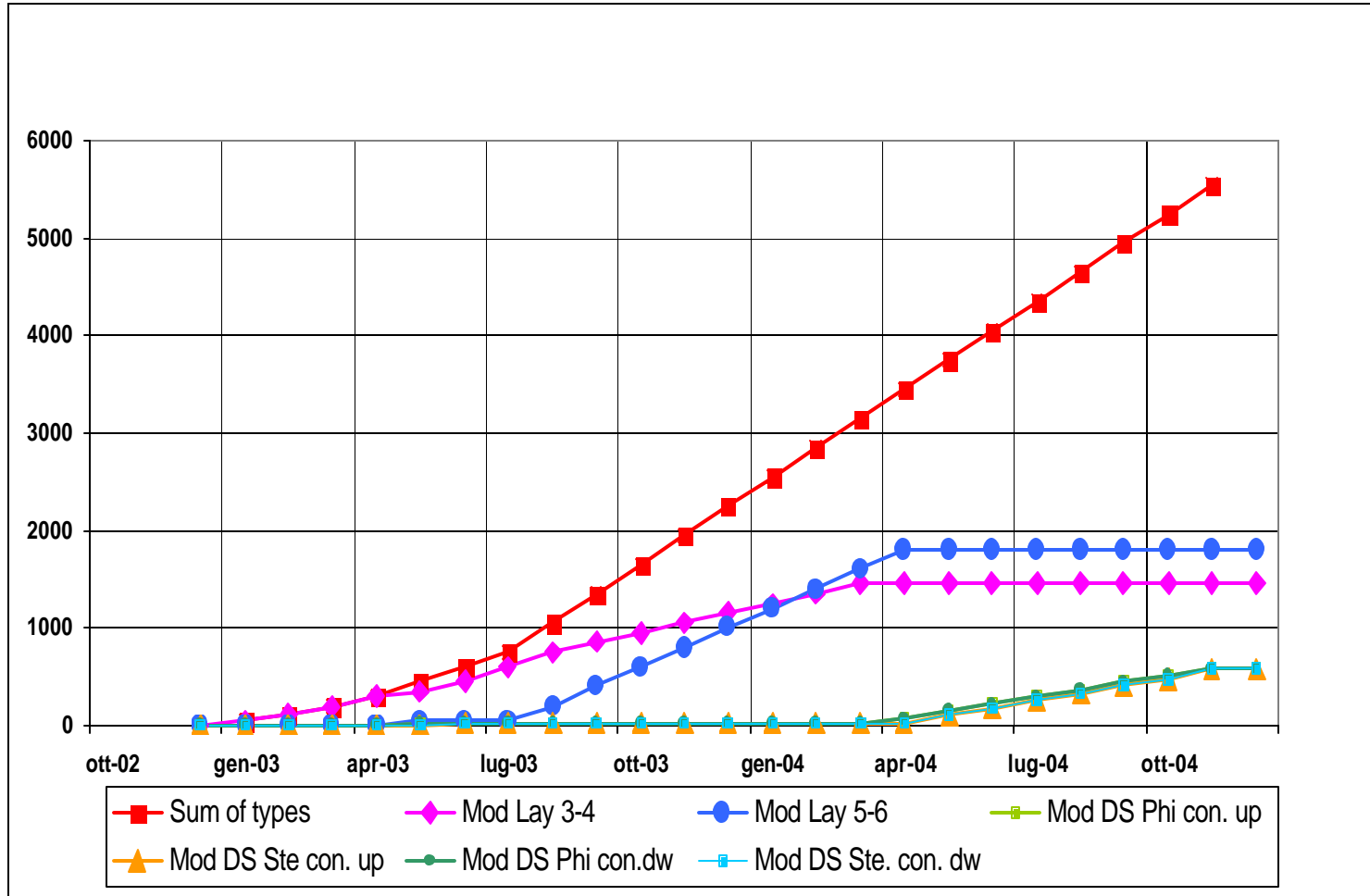
Type	LSS	LDSp	LDSsl	LDSsr	D1p	D1sf	D1sb	D2p	D2sf	D2sb	D3p	Mod/ month
Oct-02												
Nov-02												
Dec-02												
Jan-03												
Feb-03												
Mar-03	40											40
Apr-03	80											80
May-03	80											80
Jun-03	100	20	20									140
Jul-03	100			20	10	5	5					140
Aug-03					20	10	10	10	5	5	20	80
Sep-03	140	20						20	10	10	30	230
Oct-03	140	80	40	40								300
Nov-03	100	100	50	50								300
Dec-03	100	100	30	30								260
Jan-04	100	100	30	30								260
Feb-04	100	100	50	50								300
Mar-04	100	100	50	50								300
Apr-04	100	100	50	50								300
May-04	20	100	90	90								300
Jun-04					30	15	15	30	15	15	50	170
Jul-04					40	20	20	40	20	20	70	230
Aug-04					50	25	25	50	25	25	90	290
Sep-04												
Oct-04												
Nov-04												
Dec-04												
Total	1300	820	410	410	150	75	75	150	75	75	260	3800
needed	1188	768	384	384	144	72	72	144	72	72	240	3540
% spare	8.6	6.3	6.3	6.3	4.0	4.0	4.0	4.0	4.0	4.0	7.7	6.8
No.spare	112	52	26	26	6	3	3	6	3	3	20	260

TEC Module Production Flow

Type	R1p	R1s	R2p	R2s	R3	R4	R5p	R5s	R6	R7	Mod/ month	
Oct-02												
Nov-02												
Dec-02												
Jan-03												
Feb-03												
Mar-03							40			40	80	
Apr-03							50			50	100	
May-03			10	10			60			60	140	
Jun-03			10	10	20			20	20		100	
Jul-03	10	10	10	10	20			20	20		120	
Aug-03					40		50				150	
Sep-03			20	20	40		50	30	30	50	320	
Oct-03	10	10	20	20	40		50	40	40	50	360	
Nov-03	10	10	20	20	40		50	50	50	50	390	
Dec-03	10	10	20	20	40		50	50	50	50	390	
Jan-04	10	10	20	20	40		50	50	50	50	390	
Feb-04	10	10	20	20	40		50	50	50	50	390	
Mar-04	10	10	20	20	40		50	50	50	60	400	
Apr-04	10	10	20	20	40		50	50	50	60	400	
May-04	10	10	20	20	40		50	50	50	60	400	
Jun-04	10	10	20	20	40		50	50	50	60	400	
Jul-04	10	10	20	20	40		50	50	50	60	400	
Aug-04	10	10	20	20	40		60	40	40	60	390	
Sep-04	10	10	20	20	40		60	40	40	60	390	
Oct-04	20	10	20	10	40		60	40	40	60	390	
Nov-04	20	10	20		40		60	40	40	60	380	
Dec-04	25		15				70	40	40	90	370	
Total	195	150	345	300	680		1060	760	760	1080	1520	6850
needed	184	144	328	288	640		1008	720	720	1026	1440	6498
%spare	5.6	4.0	4.9	4.0	5.9		4.9	5.3	5.3	5.0	5.3	5.1
No. spare	11	6	17	12	40		52	40	40	54	80	352



TOB all types of modules





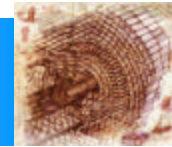
Parts delivery flow for Mod. TOB SS L 3&4



	TOB SS4 (layers 3-4)							
	SS4	Si OB2	CF SS	KaSS	FRasSS	PA TOB 1.1	HyOB4u	HOB4uP11
ott-02	0		189					
nov-02	0	600	135	300		330		
dic-02	0	200		20	100		100	
gen-03	40	100			200		100	100
feb-03	60	100	810	145	20	300	100	100
mar-03	100	200			145		50	100
apr-03	100	200		500		850	100	50
mag-03	50	200		500	250		100	100
giu-03	100	200			200		100	150
lug-03	150	200			200		200	150
ago-03	150	200	351				200	150
set-03	100	200			200		200	150
ott-03	100	200			150		200	150
nov-03	100	200						150
dic-03	100	100						100
gen-04	100							
feb-04	100							
mar-04	100							
apr-04	0							
mag-04	0							
giu-04	0							
lug-04	0							
ago-04	0							
set-04	0							
ott-04	0							
nov-04	0							
dic-04	0							
Total	1450	2900	1485	1465	1465	1480	1450	1450
needed	1368	2736	1368	1368	1368	1368	1368	1368



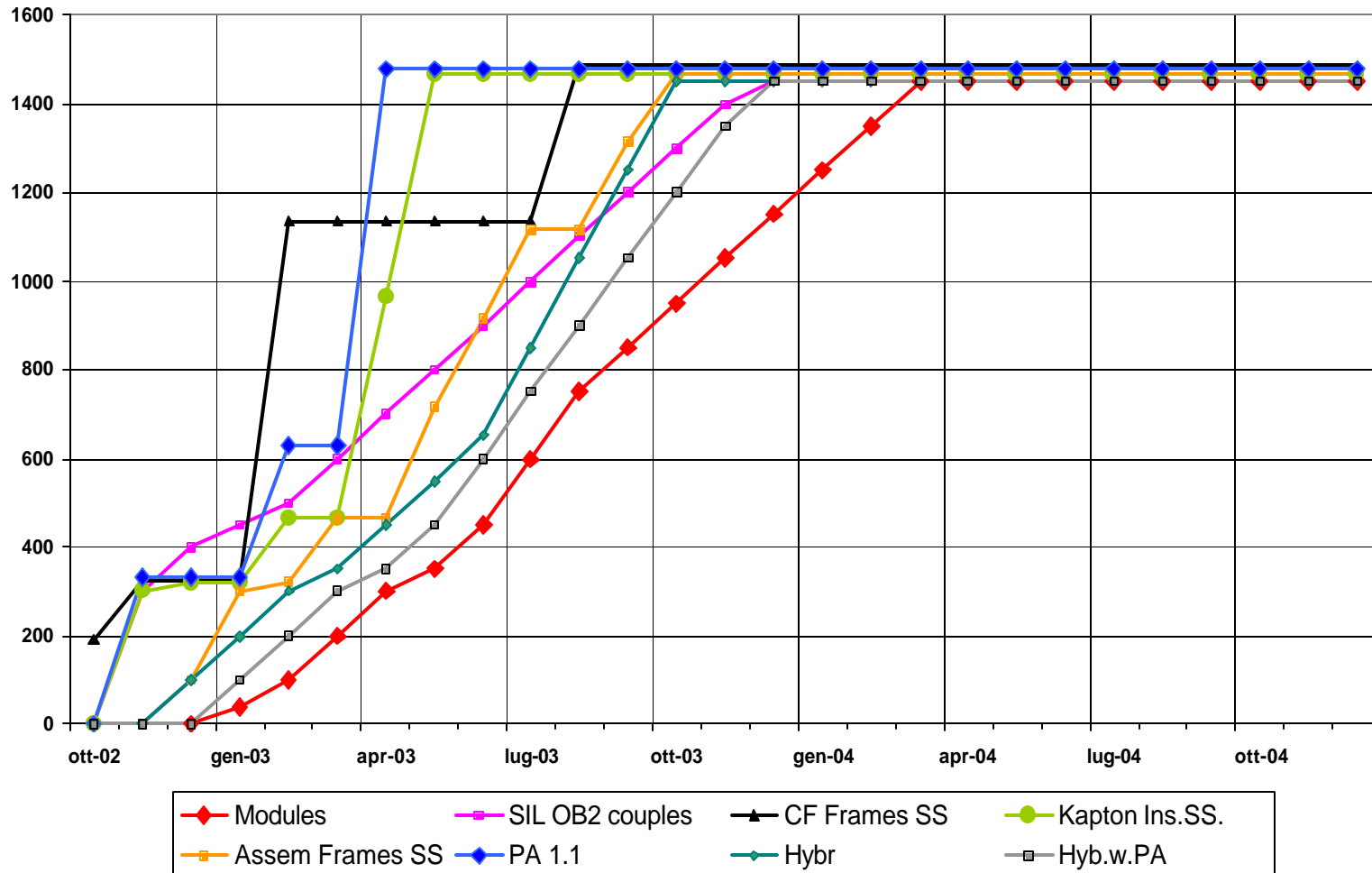
Example summary table for CF Frames



	TOB CF Frames			TIB TID CF Frames						
	CF SS	CF DS	5L Plates	CFLSS	CFLDS	CFR1p	CFR1s	CFR2p	CFR2s	CFR3
	C. Vandervelde									
Oct-02	189	0	7	105	47	0	0	0	0	0
Nov-02	135	0	5	420	0	0	0	0	0	0
Dec-02	0	0		0	0	0	0	0	0	0
Jan-03	0	0		0	0	0	0	0	0	0
Feb-03	1674	108	66	525	245	35	35	35	70	70
Mar-03	0	0		0	0	0	0	0	0	0
Apr-03	0	0		0	0	0	0	0	0	0
May-03	0	0		0	0	0	0	0	0	0
Jun-03	0	0		0	0	0	0	0	0	0
Jul-03	0	0		0	0	0	0	0	0	0
Aug-03	1701	270	73	840	420	0	0	0	0	0
Sep-03	0	0		0	0	0	0	0	0	0
Oct-03	0	0		0	0	0	0	0	0	0
Nov-03	0	0		0	0	0	0	0	0	0
Dec-03	0	0		0	0	0	0	0	0	0
Jan-04	810	810	60	280	210	140	140	140	140	210
Feb-04	0	0		0	0	0	0	0	0	0
Mar-04	0	0		0	0	0	0	0	0	0
Apr-04	0	0		0	0	0	0	0	0	0
May-04	0	0		0	0	0	0	0	0	0
Jun-04	0	0		0	0	0	0	0	0	0
Jul-04	0	0		0	0	0	0	0	0	0
Aug-04	0	0		0	0	0	0	0	0	0
Sep-04	0	0		0	0	0	0	0	0	0
Oct-04	0	0		0	0	0	0	0	0	0
Nov-04	0	0		0	0	0	0	0	0	0
Dec-04	0	0		0	0	0	0	0	0	0
Total	4509	1188	211	2170	922	175	175	175	210	280
Needed	4128	1080		1956	768	144	144	144	144	240



Parts for mod. Type TOB SS L3&4

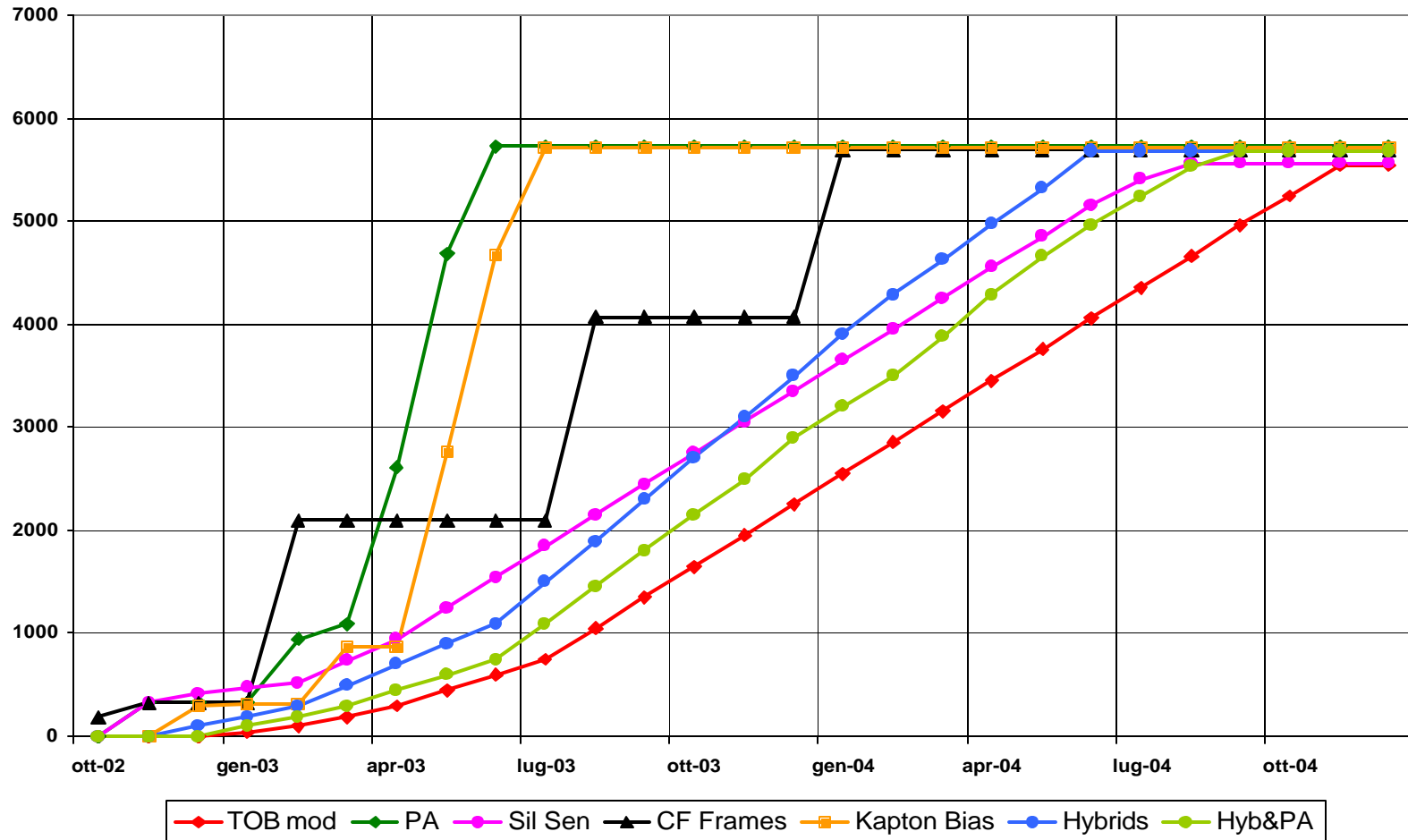
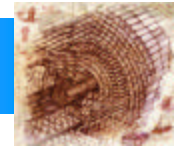


Gian Mario Bilei, Mod. Production

CERN Dec. 4th 2002



All TOB module parts

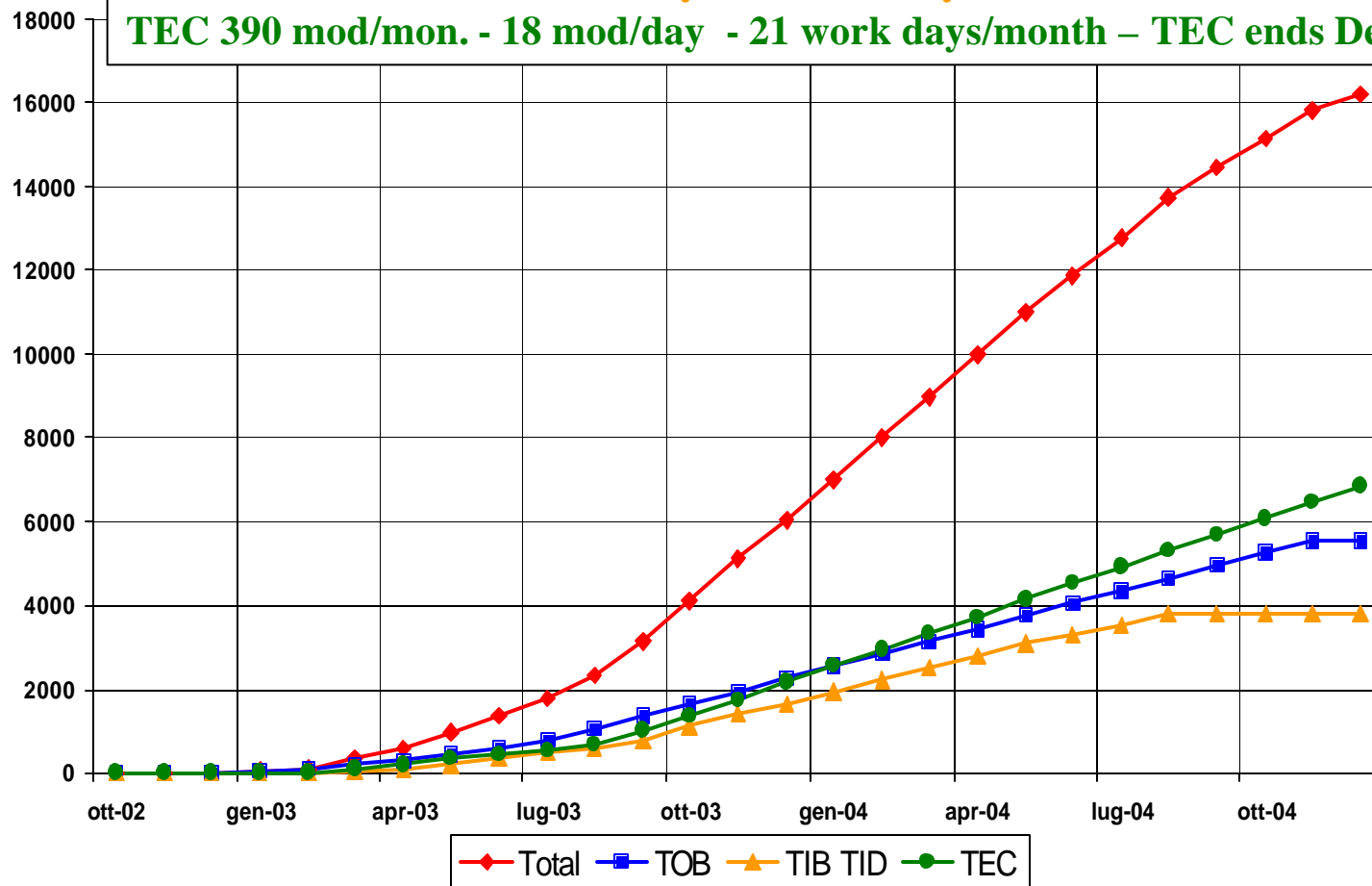




All modules production flow



TOB 300 mod/mon. - 18 mod/day - 17 work days/month – TOB ends Nov. 04
TIB 300 mod/mon. - 16 mod/day - 19 work days/month – TIB ends Aug. 04
TEC 390 mod/mon. - 18 mod/day - 21 work days/month – TEC ends Dec. 04





Conclusions



To cope with such large number of module types and their complex part flow, we have set up a framework that allow us to monitor each part of each type of module.

We should set up a simple procedure that allow us to monthly collect the information concerning the part procurement. I will circulate info and proposal.

This will help us to define our production benchmarks, to analyze the situation, set priorities in case of need in the attempt to maximize our efficiency.

According to this very preliminary plan, and keeping in mind the assumptions done for the Hybrids:

- TIB should terminate mod. prod. in Aug. '04
- TOB in Nov. '04
- TEC in Dec. '04

In 6 months from now more precise projections could be done.