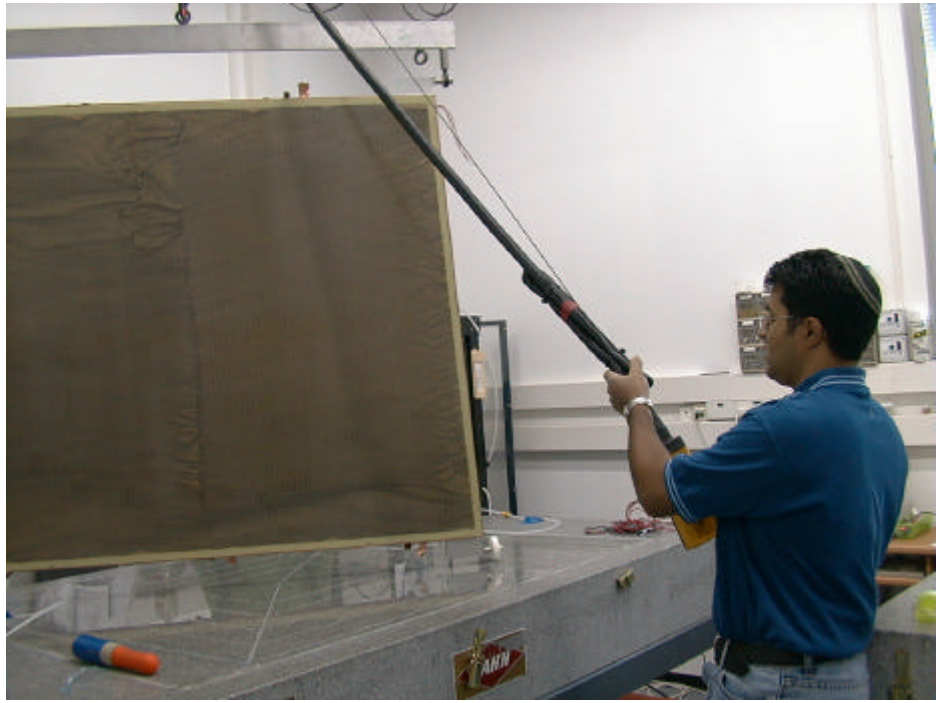
TGC Construction plan

- TGCs are assembled into dublets and triplets

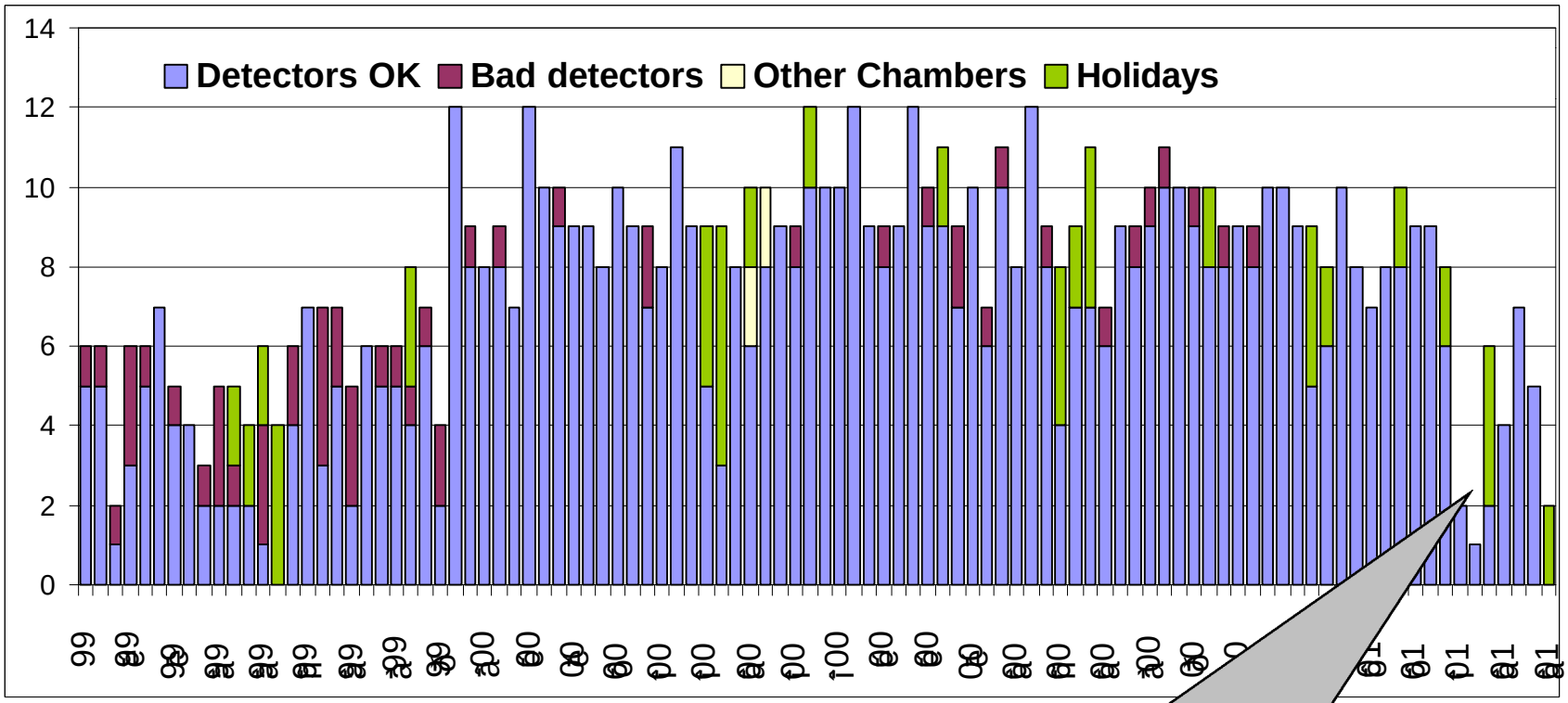
Country	China	Japan	Israel	Total
Place	Shandong Univ.	KEK	Weizmann Inst.	
# doublets	192	384	576	**1,152**
# triplets	-	96	336	**432**
Total ch.	384	1,056	2,160	**3,600**
TGC/Week	~5	~10	~10	**~25**

Production at Weizmann (1)



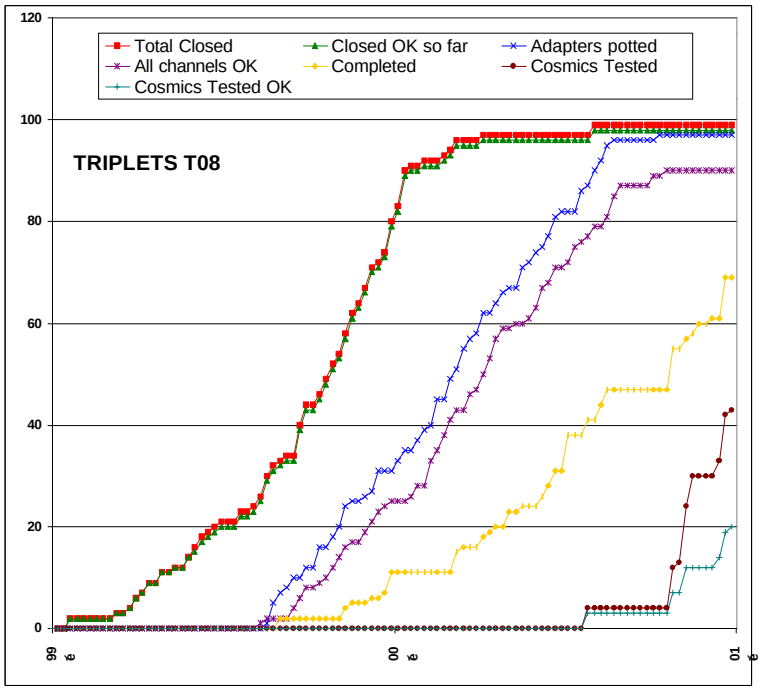
Winding & Assembling of TGCs

Production at Weizmann (2)



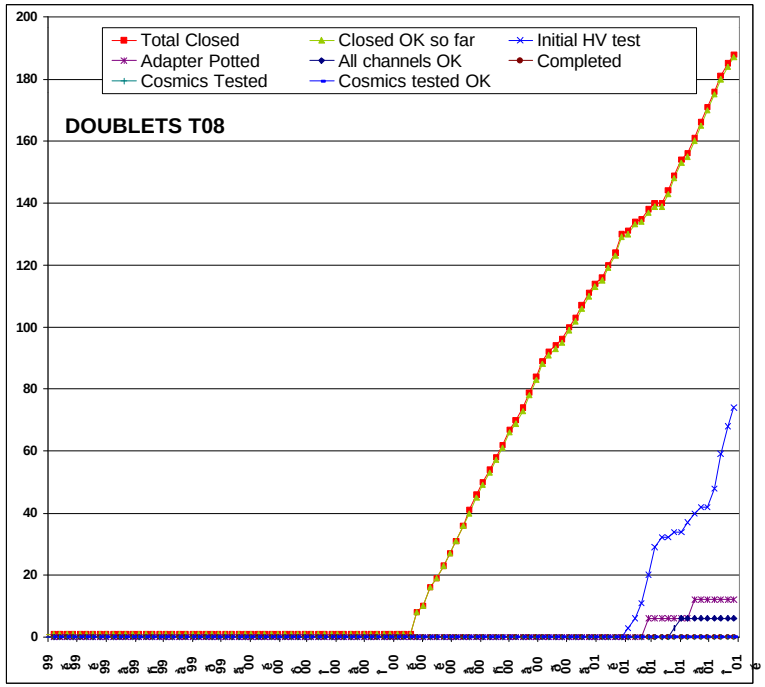
Setting for new chambers

Production at Weizmann (3)



…. Triplets

…. Doublets



Production at KEK (1)

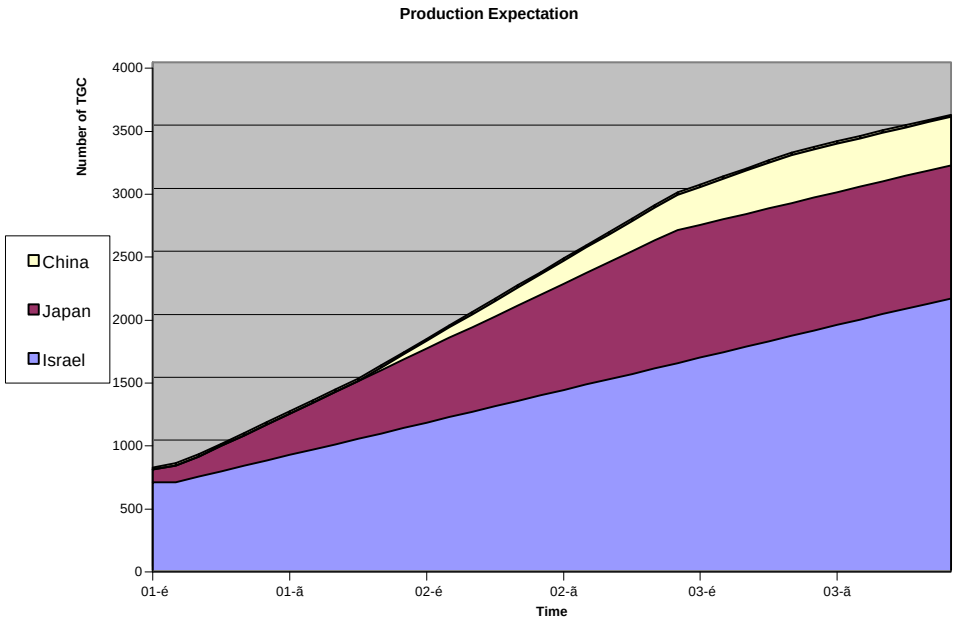
- Production facility almost completed in August 2000.
- Pilot-production of TGC-T7 started in September 2000.
- Satisfactory results at KEK test beam in December 2000.
- Number of workers have been increased 6->12
- 93 TGC-T7 chambers have been built; ~ 25 Triplets closed
- Assembly of the CO_2-channel around the periphery of the Triplets will start soon.
- Full production rate (~10 TGCs/week) August 2001

Production at KEK (2)

Winding

Assembly

Production schedule

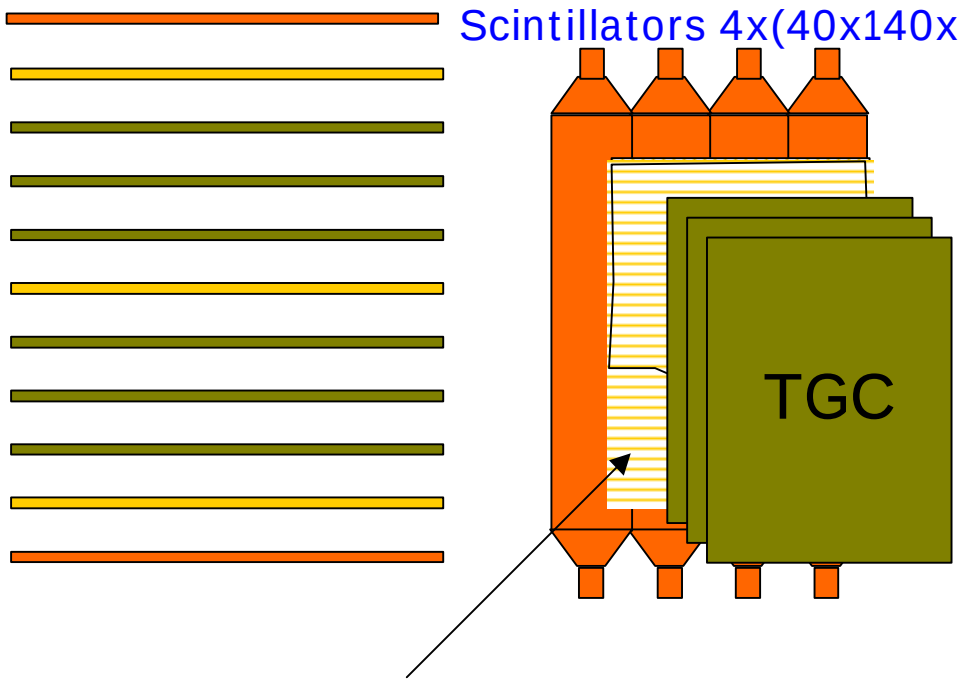


- **Israel:** - Currently **700** produced, (reached 500 ch/yr)
  - Expect : 1,200 - July 2002
  - 1,700 - July 2003
  - **2,160 - May 2004**

- **China:** - Expect: to start production March 2002 (assuming 250/yr)
  - Expect: **384 - end 2003**

- **Japan:** - Started March 2001, **(~100** completed)
  - Expect : 200 - August 2001
  - 700 - August 2002
  - **1.056 - mid 2003**

Cosmic Ray Test Bench



Technion setup

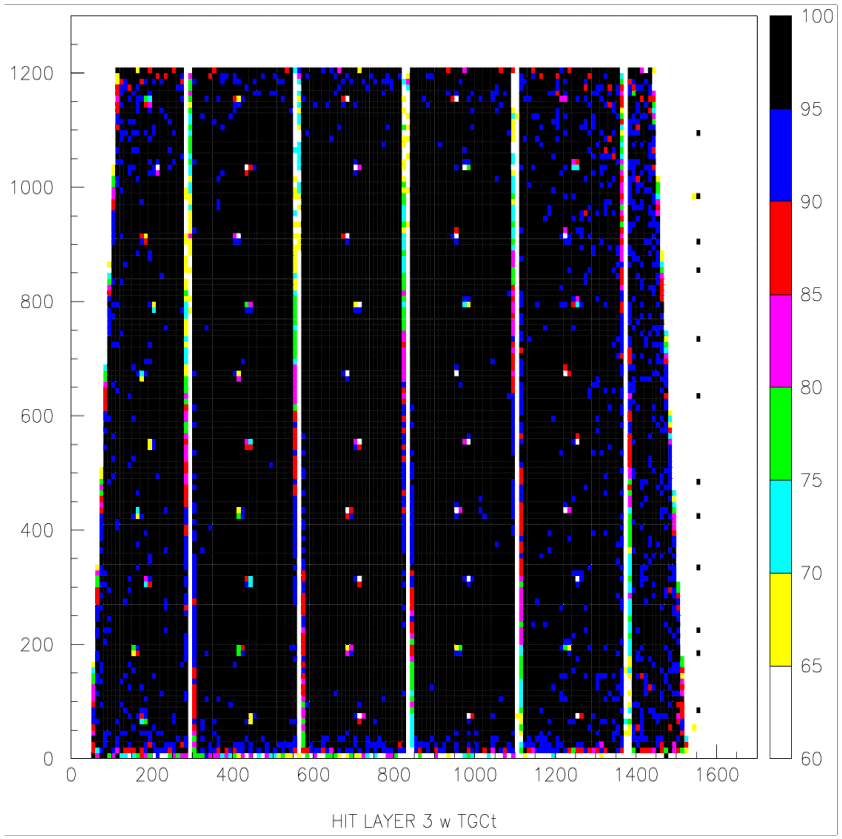
Quality Control Status

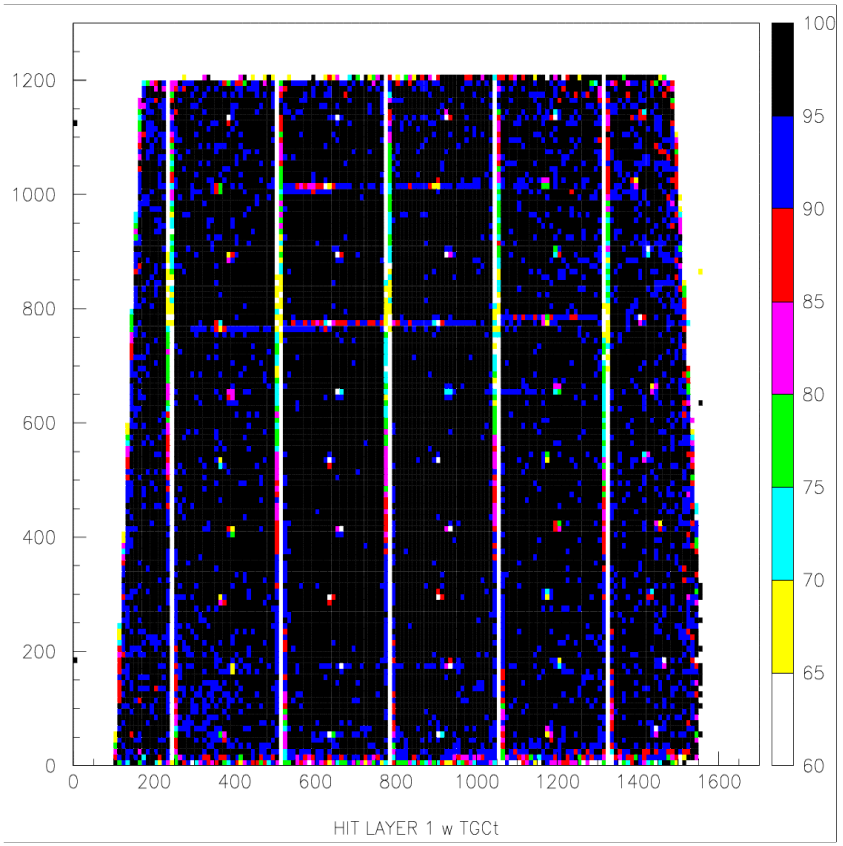
- **Technion**: Moved from prototype to production setup
- **Tel-Aviv:** Final construction
  - Readout modules designed, built, tested.
  - Software running.
- **Kobe**: To begin on August 2001

Quality Control Results

- **Tested 50 triplet units.**
- **Rate ~90 Hz.**
- **Can run ~ 4 million triggers per day**
- **Of these ~ 45% useful**
  - **Require 2 hits per precision chamber**
  - **Require short time difference between scintillator planes**
  - **Need ~1 week per complete test**
- **Easy to detect bad chambers with <1/2 day running**
- **We now receive completely assembled chambers+ASDs**
- **Chamber shielding improved recently so we can reduce thresholds to ~60 mV. Some units to be re-tested.**
- **Some local inefficiencies in chambers.**

Efficiency plots





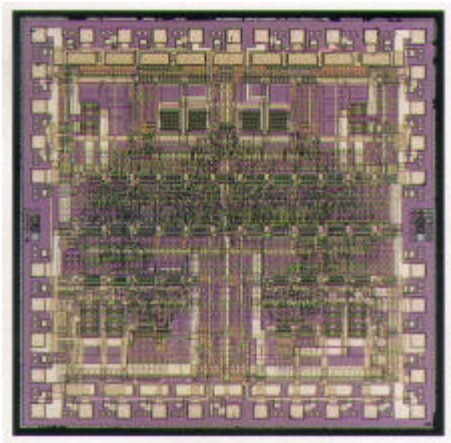
TGC Electronics (1)

- KEK, ICEPP Univ. of Tokyo, TMU, Shinshu Univ., Kyoto Univ. Kobe Univ.

- TGC Electronics system:
  - **ASD**
  - Patch Panel — LVL1 Review
  - Slave Board/High-Pt Board — “
  - Sector Logic — “
  - Readout — “

TGC Electronics (2)

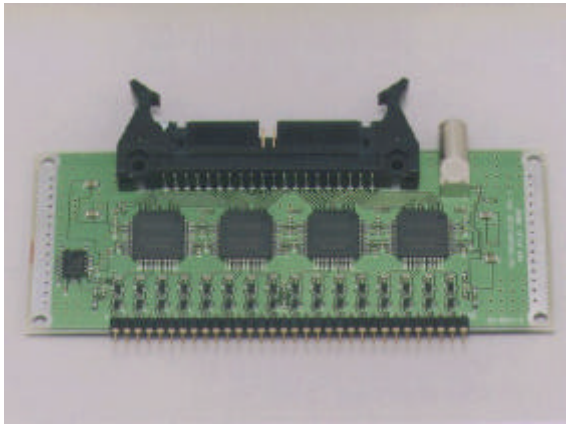
ASD Chips



- SONY bipolar semi-custom process
- LVDS output
- 4 ASD channels/chip
- PRR in 1998.12
- 100K chips produced in 1999.9

ASD Boards

- 4 chips/board
- 23.4K boards produced by 2000.3



TGC Electronics (3)

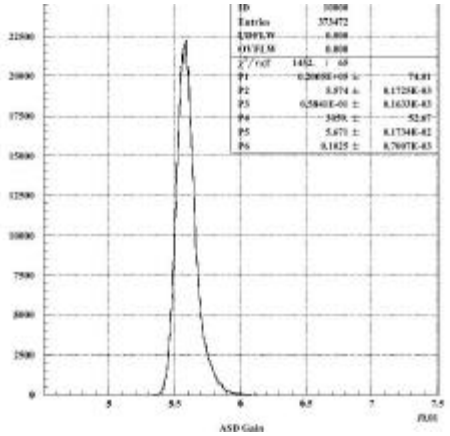
ASD Board inspection in China

Failure rate

58 / 23400 = **0.25 %**

- **Inferior ASDs: 45 (gain:15, no signal etc: 30)**
- **Poor soldering: 7**
- **Broken resistor: 3**
- **Broken input pins: 3**

ASD gain →



TGC Summary

- Production rate under control both in Israel and Japan (Site review for Chinese site in October)
- QC (Cosmic ray test started in Israel) & final testing rate is being achieved
- Testing station in Kobe to be operational in August
- Start testing detectors @ CERN in January 2002 (testing space is still not allocated).
- Starts assembly into big wheel May 2004 (Assembly hall is still not allocated).