

## Canadian Contributions to SVX-IIb

- Run IIa contributions
  - SVX positioning feet
  - Inchworm supports
- The IIb silicon detector
- IIb silicon ladder alignment pins
  - The scheme
  - Prototyping the proposed solution
  - Canadian prototype pin positioning jig
- Room for further involvement

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## The Canadian hardware contributions to IIa

- Provided pieces of IIa silicon support mechanics
  - General theme was SVX-II barrel alignment
  - Ensuring parallelism (to beam) for SVT
    1. Micro-adjustable screws align three barrels
    2. Inchworms align tracker axis with beam
- Also participated in
  - Assembly and testing of SVX barrels
  - Survey of barrel positions
  - Installation of tracker in B0

## Experience with IIa Inchworms

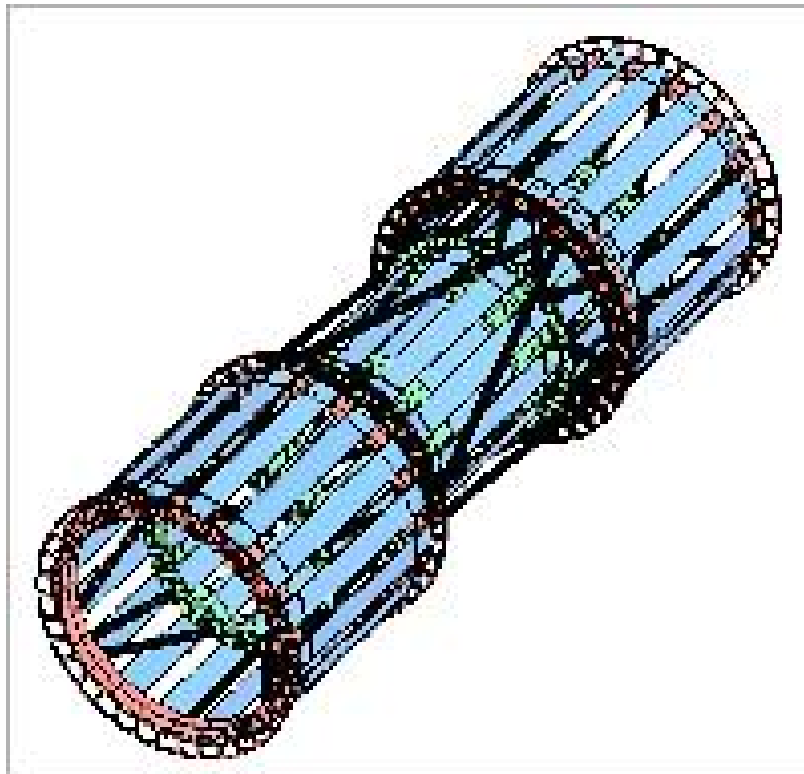
- IIa silicon tracker was heavier than expected
  - Original inchworms designed to lift 65 kg
  - Re-designed during construction to lift 100 kg
    - \* Silicon system ended up weighing 120 kg
    - \* Motors are at their limit (supporting 40+ kg)
- Partly explains short-comings of current system
  - Working to protect against sparking observed
  - Mechanical replacement for IIb (Simon's talk)

## RASNIK Position Monitoring

- UCLA group introduced RASNIK system to CDF
  - A video camera based alignment monitoring
  - RASNIK  $\equiv$  Relative Alignment System  
invented by NIKhef
  - Mounted in various places on silicon system
    - \* Including on the inchworm brackets
  - Now orphaned, picked up by Pierre for **IIb**
- Extend to monitor calorimeter alignment
- Adapt to **IIb** silicon support structure (Ian's talk)

## Highlights of the IIb Silicon Tracker Design

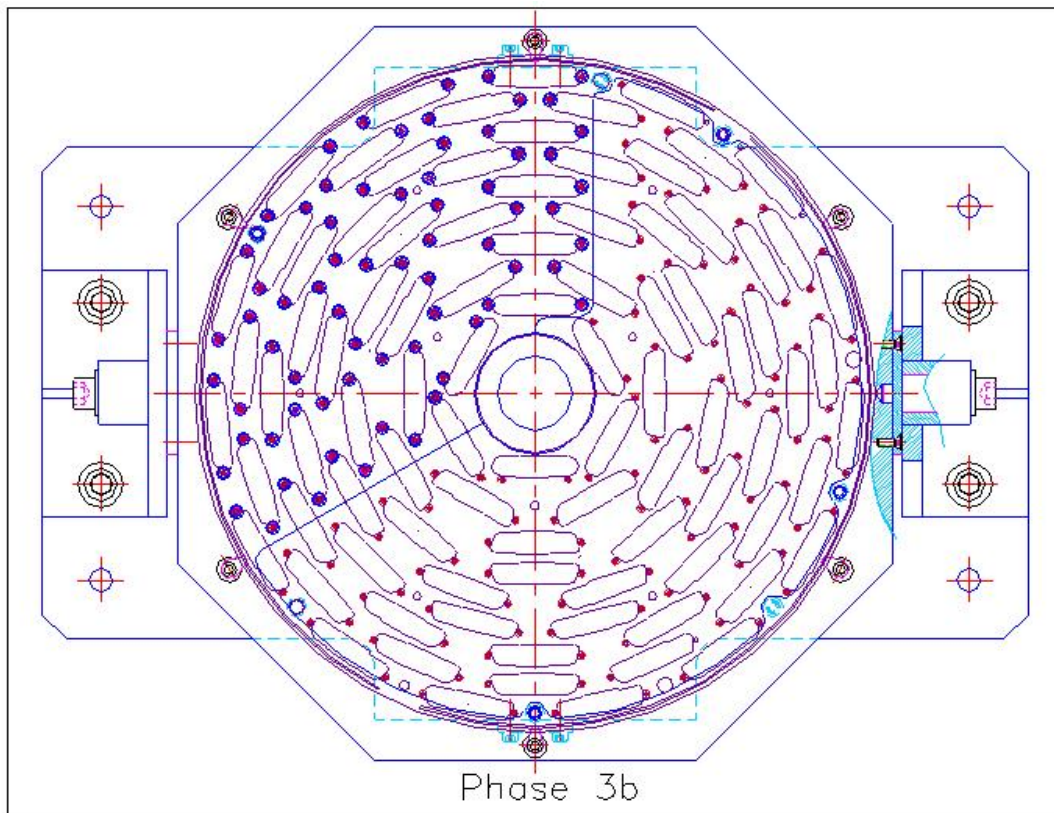
- Plan to retain as much of IIa tracker as possible
  - This means ISL + support frame
  - Must replace L00 and first layers of SVX
    - \* In practice replace L00 + SVX-IIa



- Have IIb inner silicon ready to install
  - By summer 2005  $\Rightarrow$  6 month shutdown

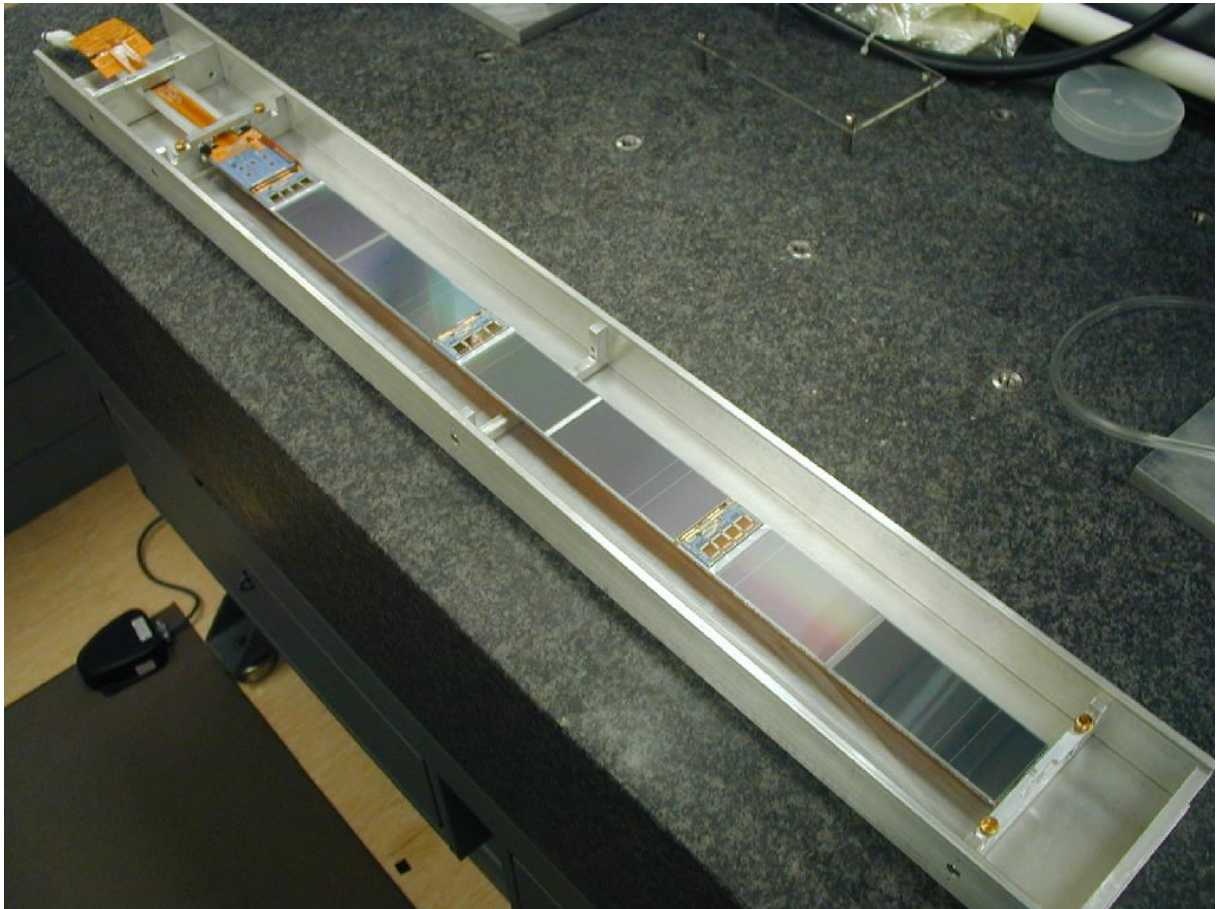
## Lessons Learned from IIa construction

- Learned several lessons from IIa construction
  - Abandon purely projective wedges
    - \* (multiplies jigs, fixtures, hybrids, spares)



- Use copper readout
  - \* Optical readout not reliable enough
  - \* Save mass (cables/power for optical drivers)

- Build two barrels instead of three
  - \* Staves incorporate 3 readout units
  - \*  $\approx 65$  cm long



- Add cooling (a la L00) for radiation tolerance
- Make bulkheads out of Carbon fibre

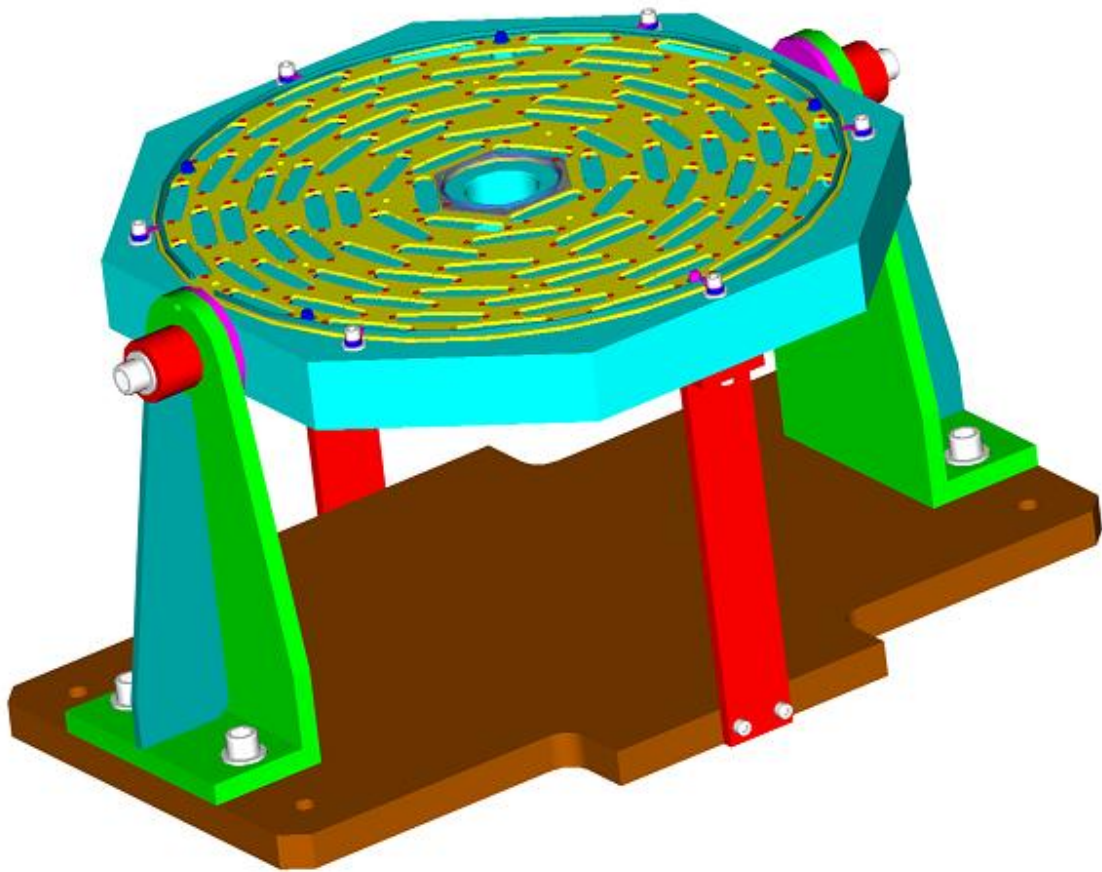
## Canadian Contributions to Ilb Tracker

- Moral equivalent of barrel alignment screws
  - Alignment pins glued into C-fibre bulkheads
  - Ladder ends placed with  $15\ \mu\text{m}$  precision
    - \* Results in  $100\ \mu\text{rad}$  parallelism for SVT
  - Cannot machine C-fibre with this accuracy
    - \* Solve by gluing alignment pins into C-fibre
    - \* Use gluing jig with the required precision
- Design finalised in fall 2002
  - Prototype parts machined in Chicago
  - Second set of parts machined in Carleton STC



## Pin Placement Jig

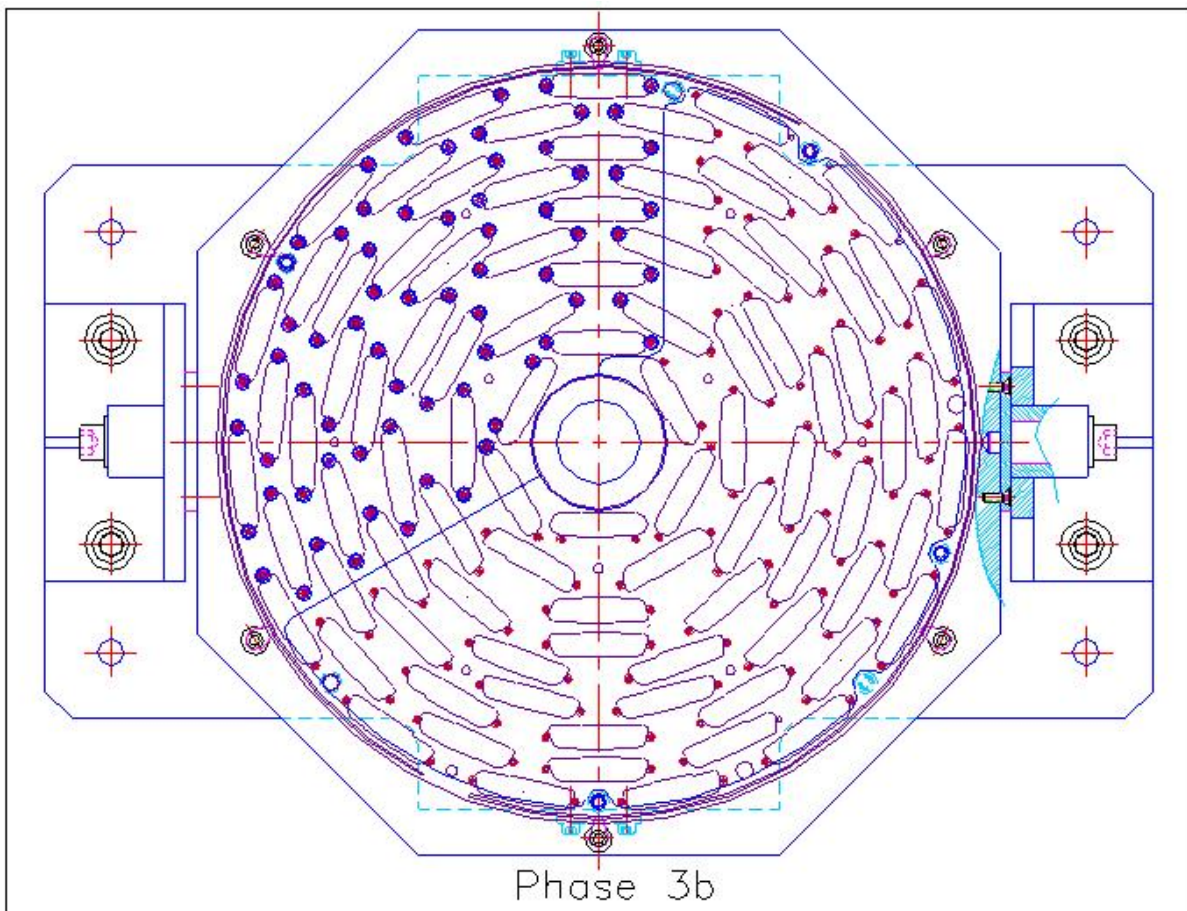
- Can't place  $\approx 200$  pins all at once
  - Develop a system that looks like



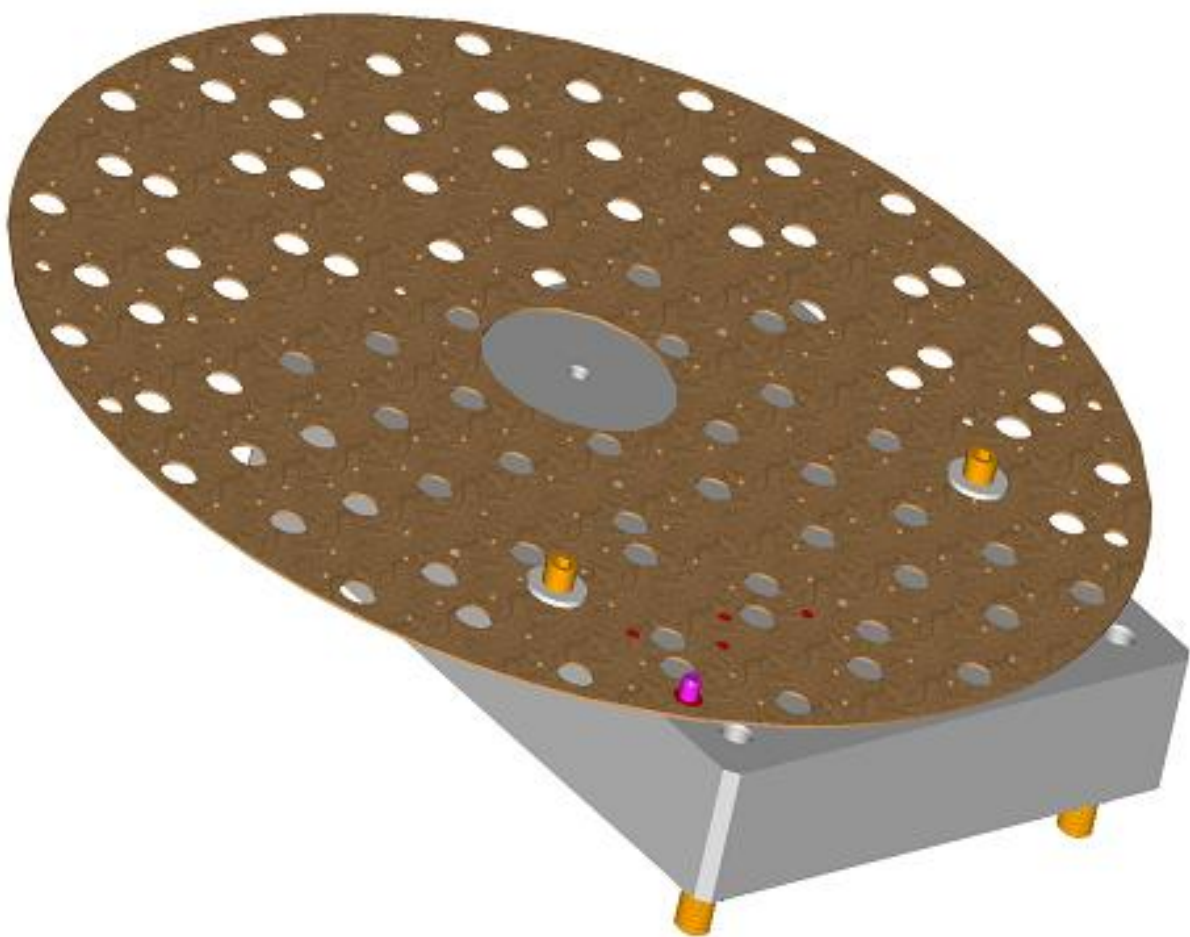
- Precision pins held by insertion screws
  - \* Can be disengaged once glue has set

## Final Pin Placement Jig

- Full placement fixture will glue 1/3 of pins at once
  - Includes alignment screws + precision collar
  - Rotate bulkhead 120° to glue additional pins

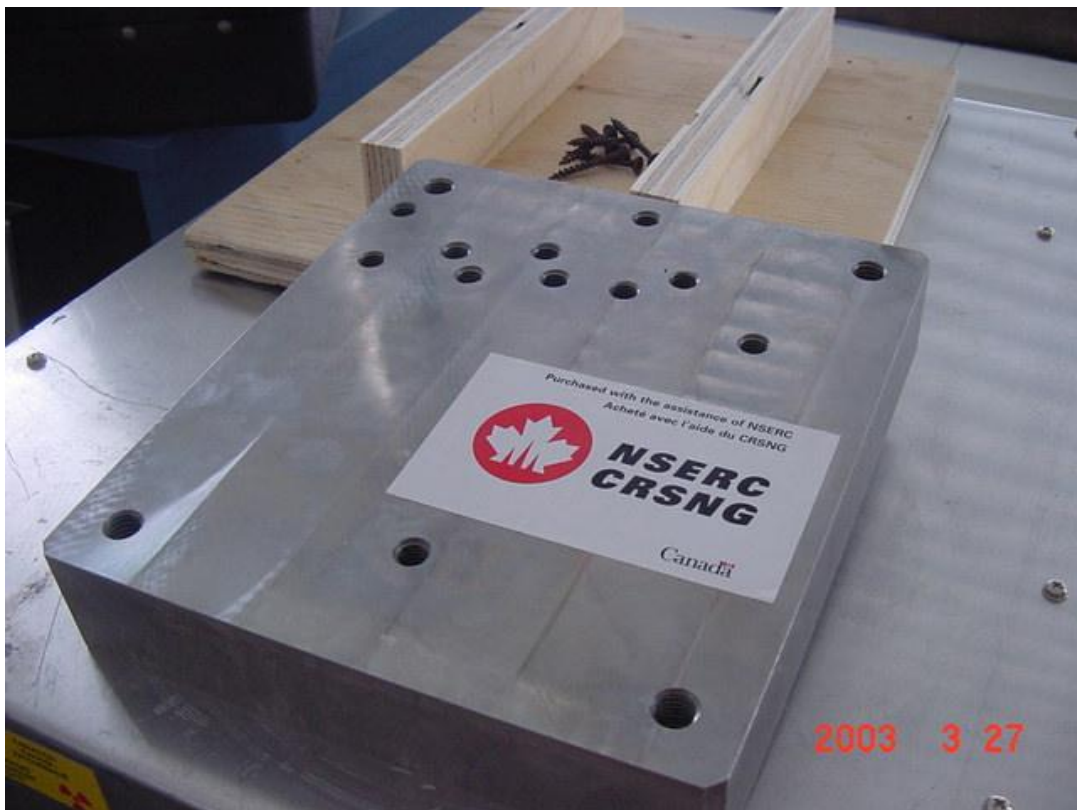


- Prototype plate that glues 2 slots at once
  - Includes placement pins
  - Prototype collar mechanism
  - Can do outer ( $|z| = 60$  cm) and
  - inner ( $|z| = 0$  cm) bulkhead



## Prototype Parts machined in Canada

- Have machined a prototype plate at Carleton University Science and Technology Centre
  - Delivered from machine shop at end of March



- Now at Fermilab being measured on
    - \* Ensure pin placement meets tolerances
    - \* Already have proof of principle (Chicago plate)
- Decide soon if full plate machined in Canada



## Pin Insertion Screws

- Have also machined a series of
  - Pin placement/insertion screws

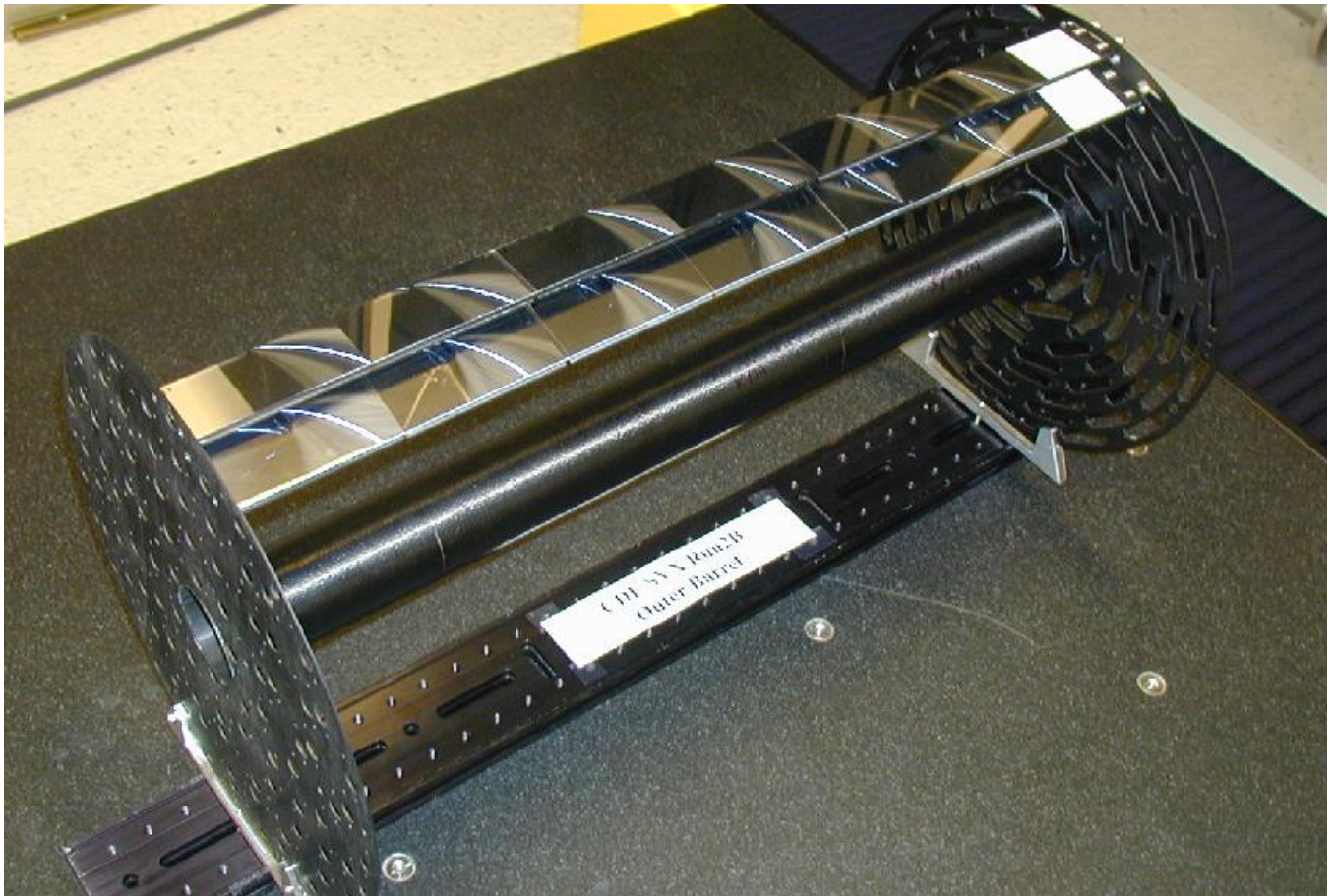




- These too are being tested at FNAL
  - Also plan to glue pins in a pair of bulkheads

## Progress on IIb Silicon

- Have built mechanical model of full barrel



- Improving flatness of C-fibre bulkheads
- Prototyping cooling connections
- Room for RASNIK light-sources?



- SVX4 chip now being produced



- In deep submicron technology (rad hard)
- Same readout protocol as current SVX3 chips
- Readout electronics significantly simplified



## Upgrade Approvals

- First conceived in 2001
  - Extensively reviewed through 2002
  - Full DOE approval in September, 2002
  - FY2003 construction funds released (1/4)
- Remainder of funding contingent on
  - Further evidence that we will get  $6 - 10 \text{ fb}^{-1}$
  - Next accelerator review this summer
- We (CDF-Canada) have funding to finish
  - Replacement inchworm mechanisms
  - Something like pin placement jig
- Scope for additional involvement
  - Both from perspective of FNAL/CDF
  - Funding of additional detector contributions
  - Prepare a proposal this fall