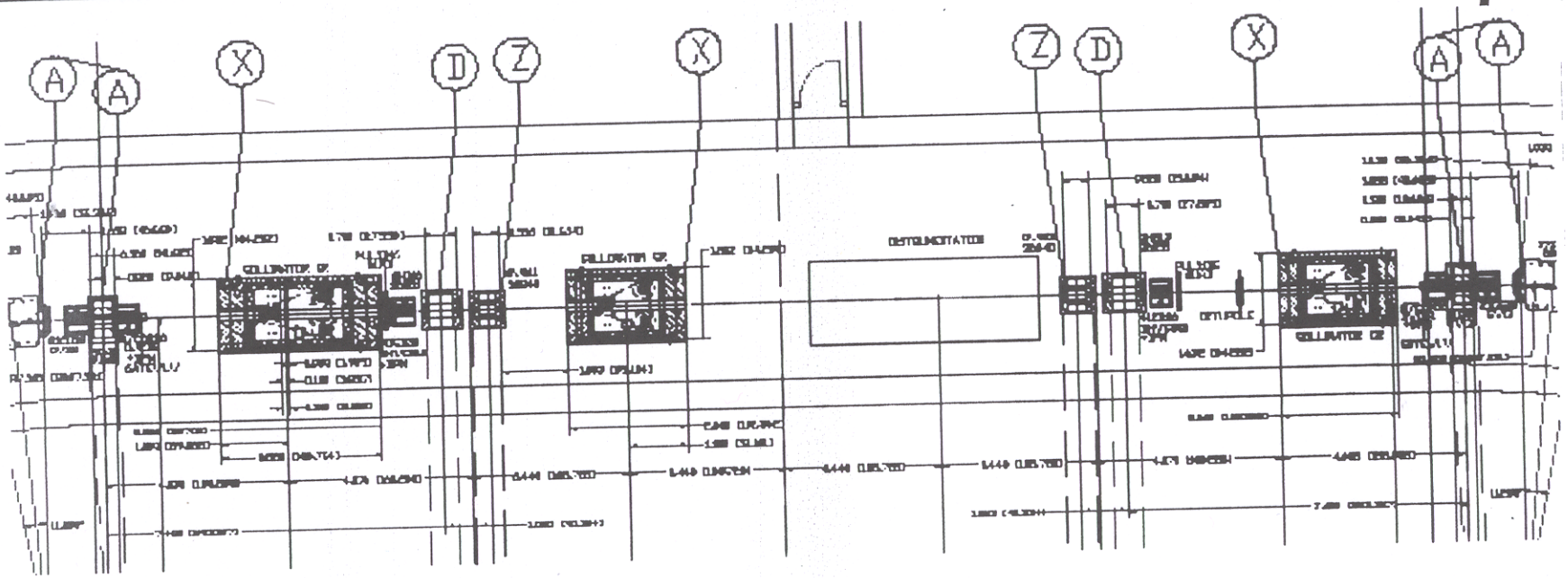
INSTRUMENTATION NEEDS FOR COLLIMATORS AND SCRAPERS

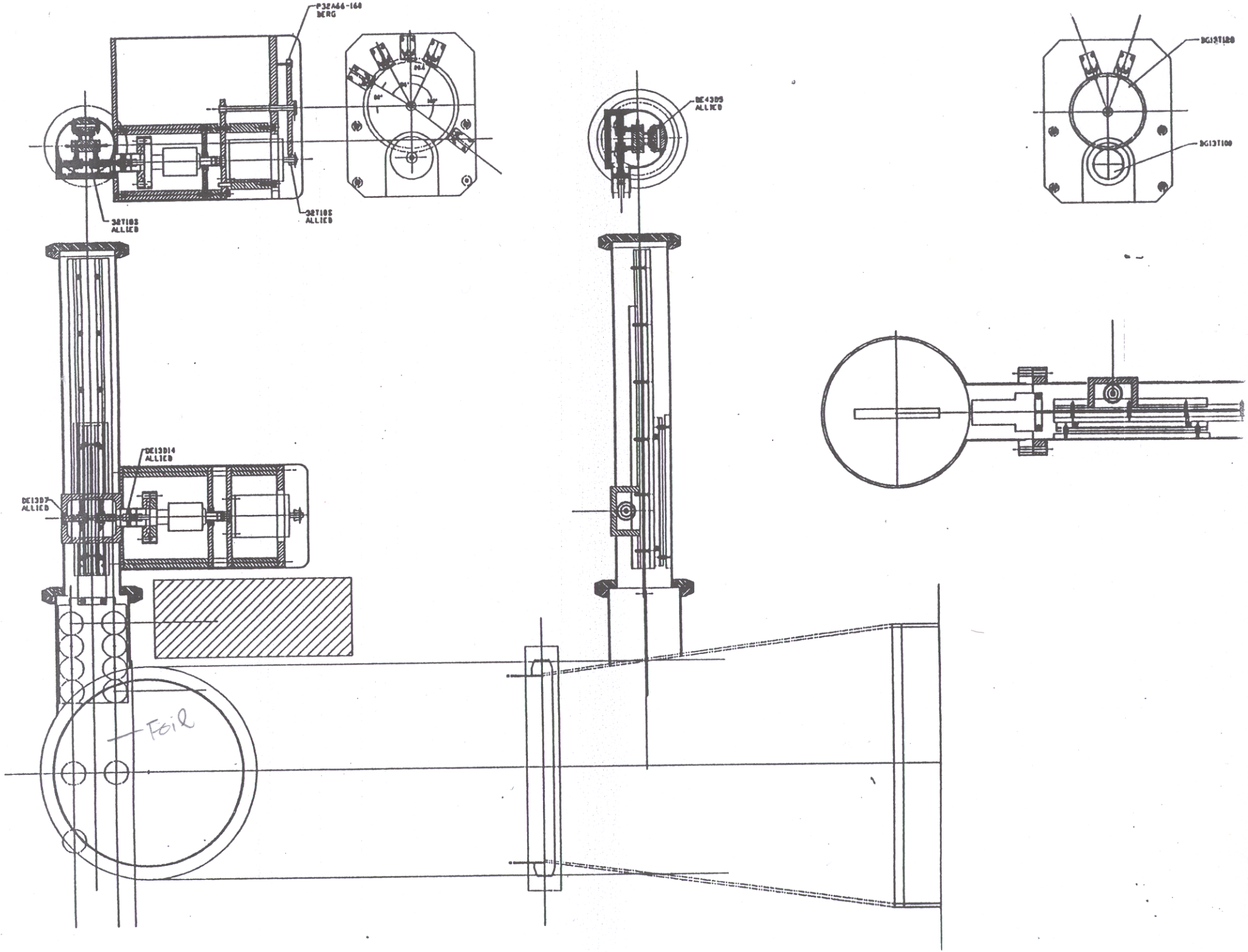
- INLET AND OUTLET THERMO-COUPLES FOR DETERMINING WATER TEMPERATURE. ONE THERMO-COUPLE PAIR PER ABSORBER, AND FOUR FOR SCRAPER IN PRIMARY RING COLLIMATOR. (13 PAIRS).
- FLOW METERS AT THE INLET OF EACH ABSORBER AND SCRAPER (13)
- WATER PRESSURE SENSOR AT THE INLET OF EACH ABSORBER AND SCRAPER (13)
- POSITION DETERMINATION FOR THE FOUR SCRAPERS, AND THE CHARGE EXCHANGE FOILS. THE TIME RESPONSE OF THE CONTROL LOOP NEEDS TO BE OF THE ORDER OF THE RING CYCLE TIME.
- SECONDARY RADIATION MONITORING IN THE VICINITY OF THE PRIMARY RING COLLIMATOR. THIS INSTRUMENT IS NOT CLEARLY DEFINED YET.

Transverse collimation
B Superperiod layout

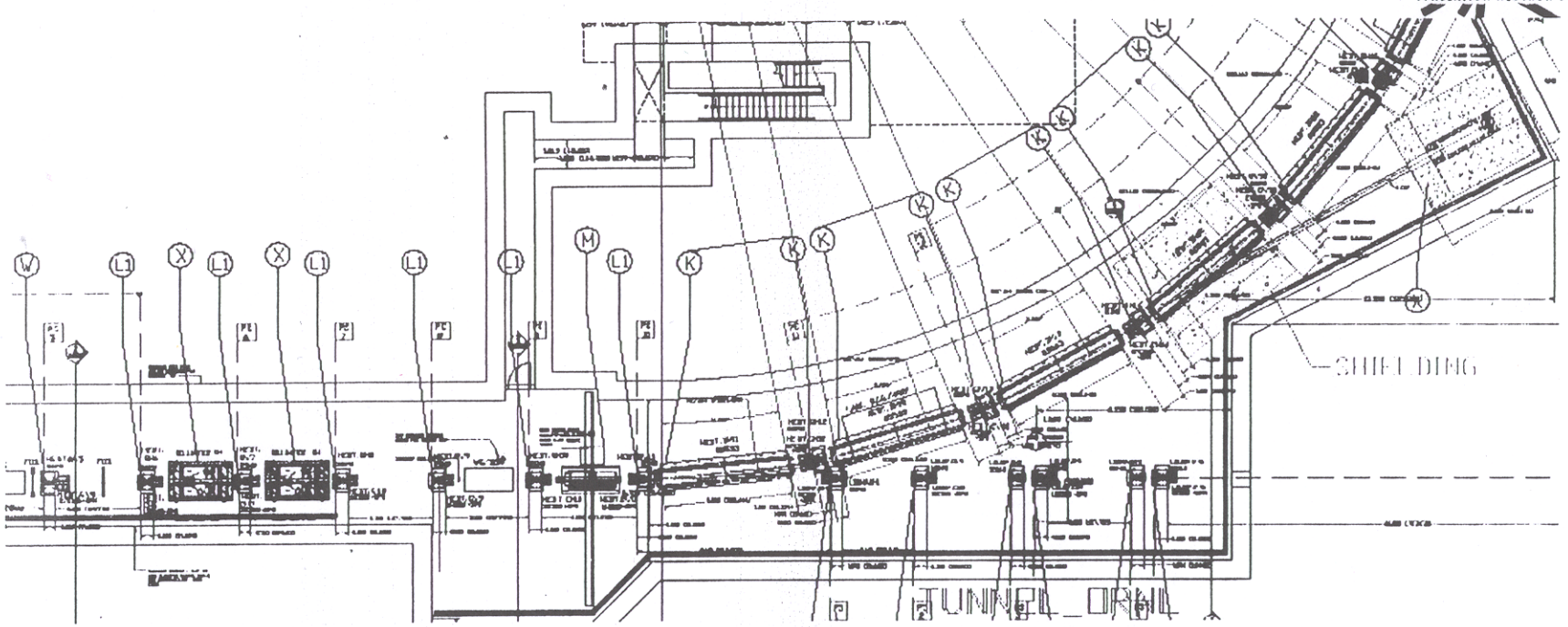
Aperture が 温度最高の部分



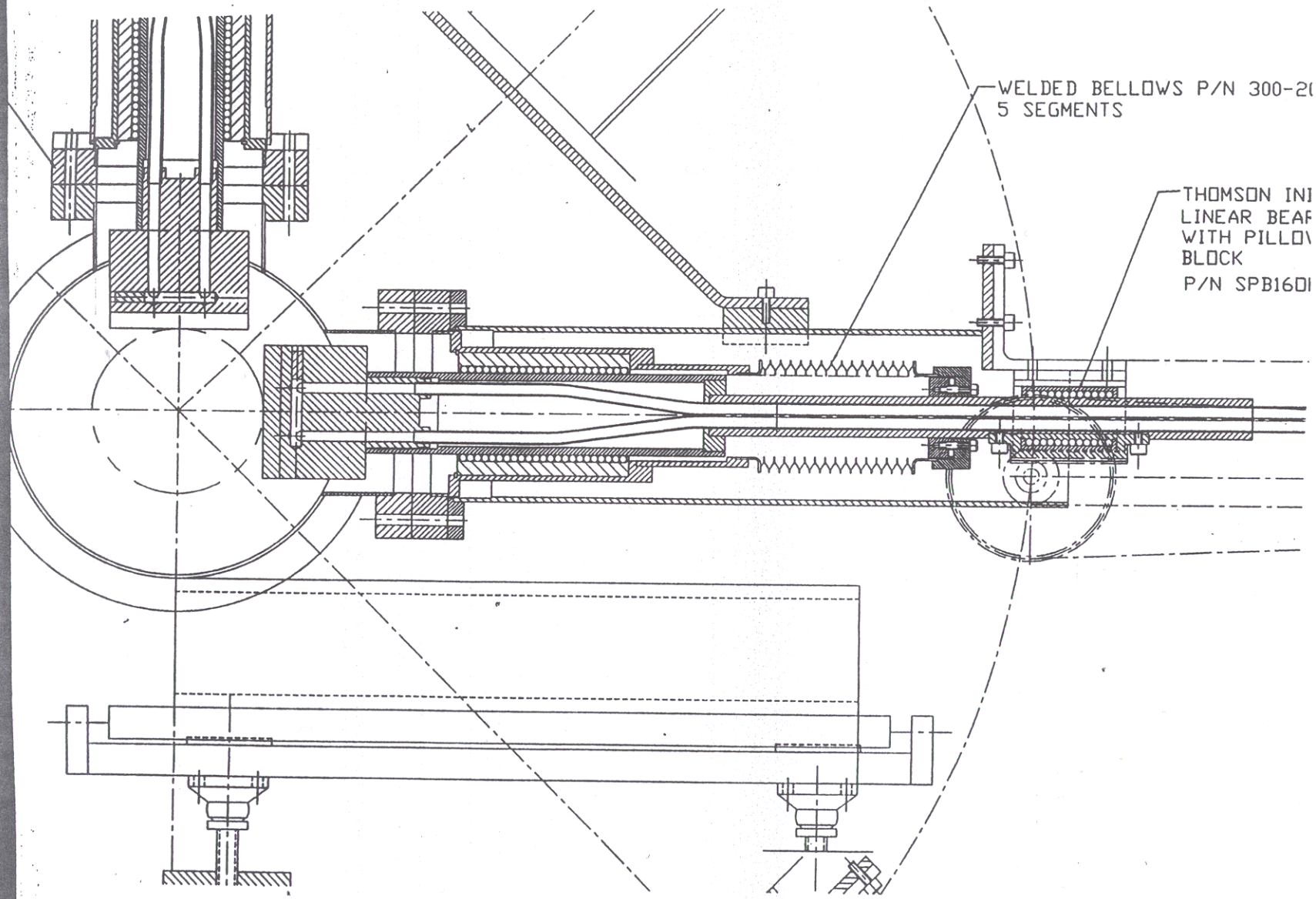
- Four adjustable collimators (scrapers)
- Two self shielding collimators (absorbers)
- Two special absorbers at both sides of the scraper
- (Limited) flexibility to move collimators if necessary


P32A66-160
BERG
38T105
ALLIED
38T105
ALLIED
DE4305
ALLIED
DG13T100
DG13T100
DE13D14
ALLIED
DE13D7
ALLIED
Foil

HEBT Line layout



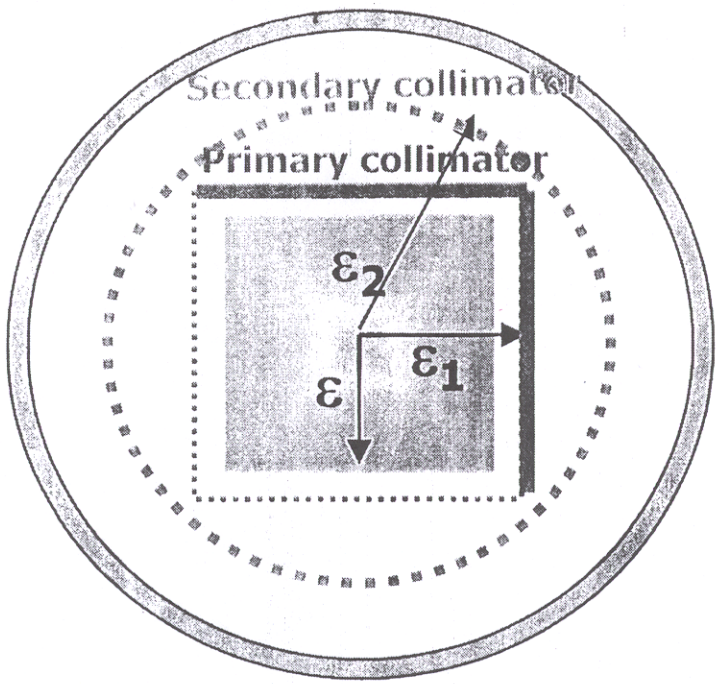
- Beam emittance 0.5; Line acceptance 2.0 (at the cavity); Collimator acceptance 1.9 $\pi\mu m$
- Scraper aperture adjustable. Shave tails off the linac beam
- Longitudinal collimator outside the beam line


WELDED BELLOWS P/N 300-2(
5 SEGMENTS
THOMSON INI
LINEAR BEAF
WITH PILLOV
BLOCK
P/N SPB160I

Correlated and Anti-correlated Collimation Schemes

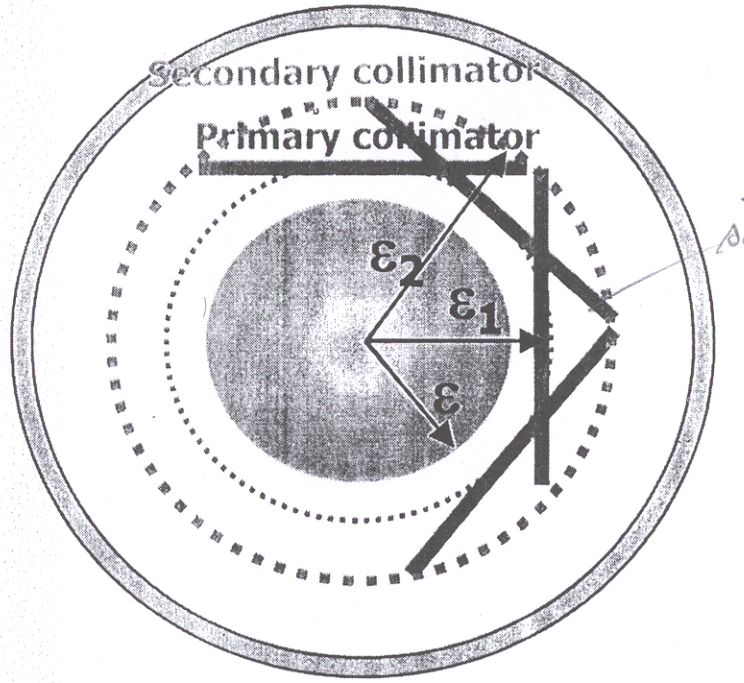
SNS SPALLATION NEUTRON SOURCE

Correlated painting



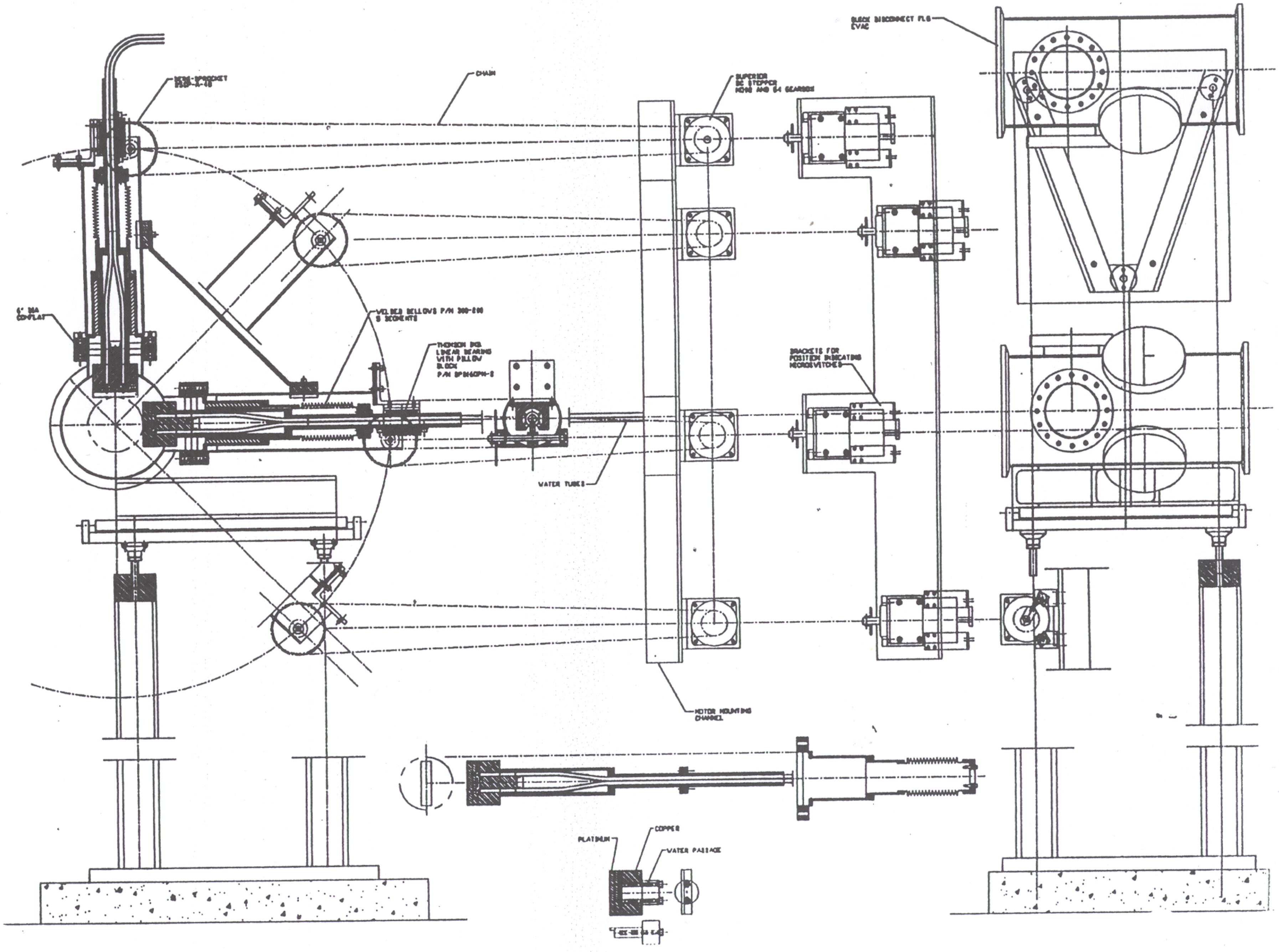
$\varepsilon_1 > \varepsilon = 120$; $\varepsilon_2 > 2\varepsilon_1$

Anti-correlated painting

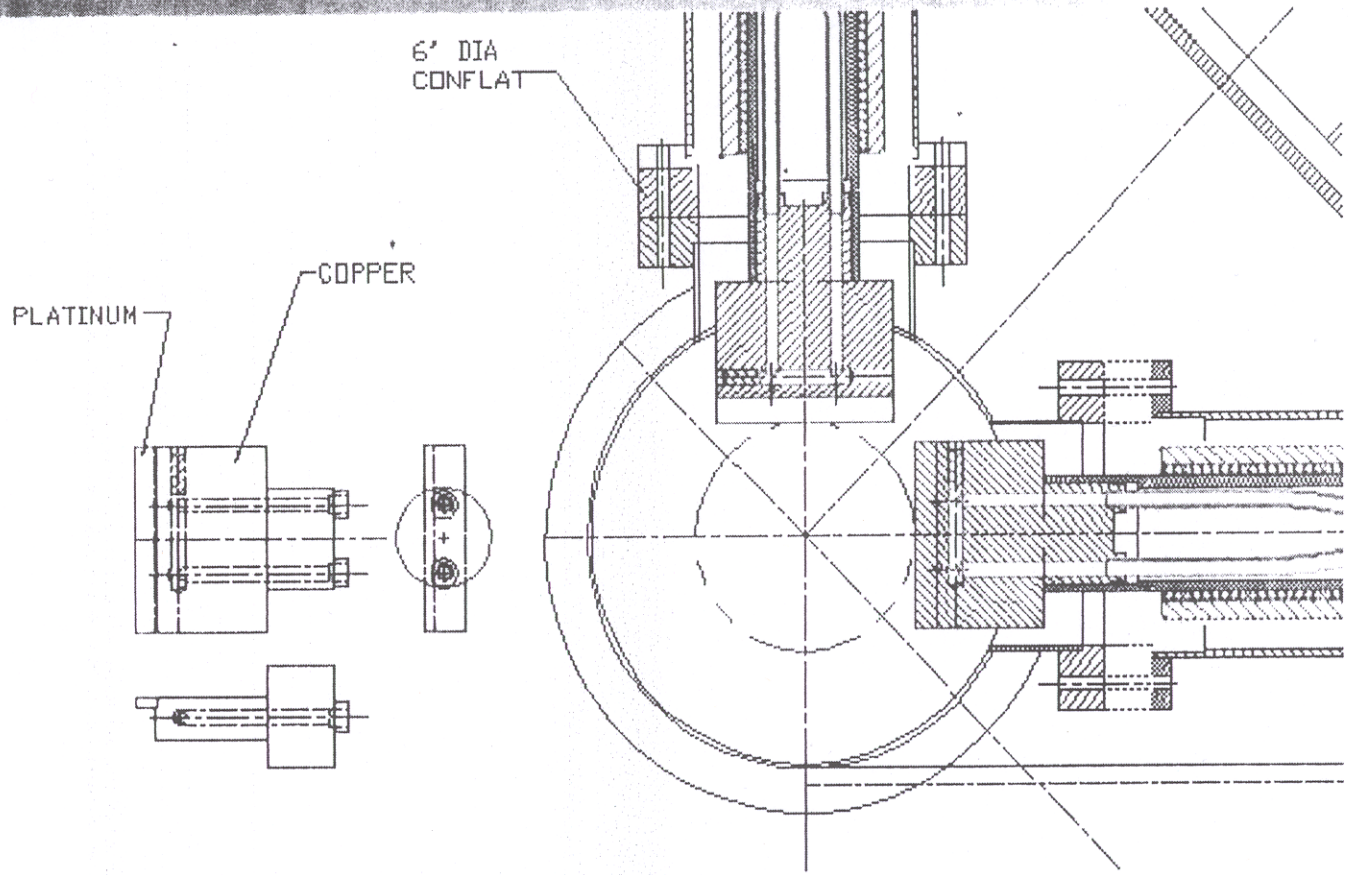


$\varepsilon_1 > \varepsilon = 160$; $\varepsilon_2 > \varepsilon_1$

$\varepsilon_1 = 140$; $\varepsilon_1 = 180$; $\varepsilon_2 = 300$

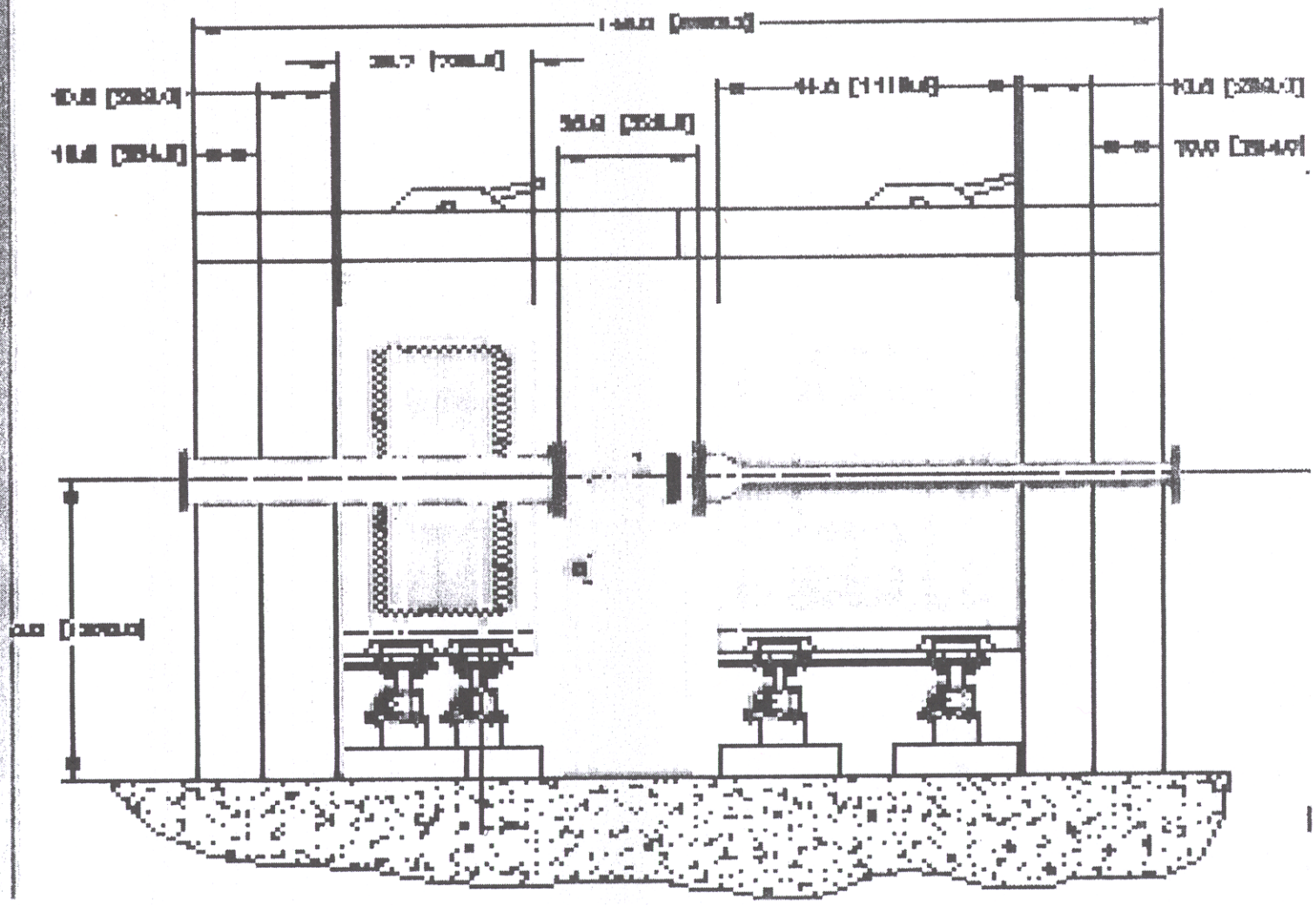

CHAIN
QUICK DISCONNECT FLG
EVAC
WATER TUBES
BRACKETS FOR
POSITION INDICATING
MICROSWITCHES
LINEAR BEARING
WITH PILLOW
BLOCK
MOTOR MOUNTING
CHANNEL
PLATINUM
COPPER
WATER PASSAGE

Design Review
Primary Scraper Design & Thermal Analysis

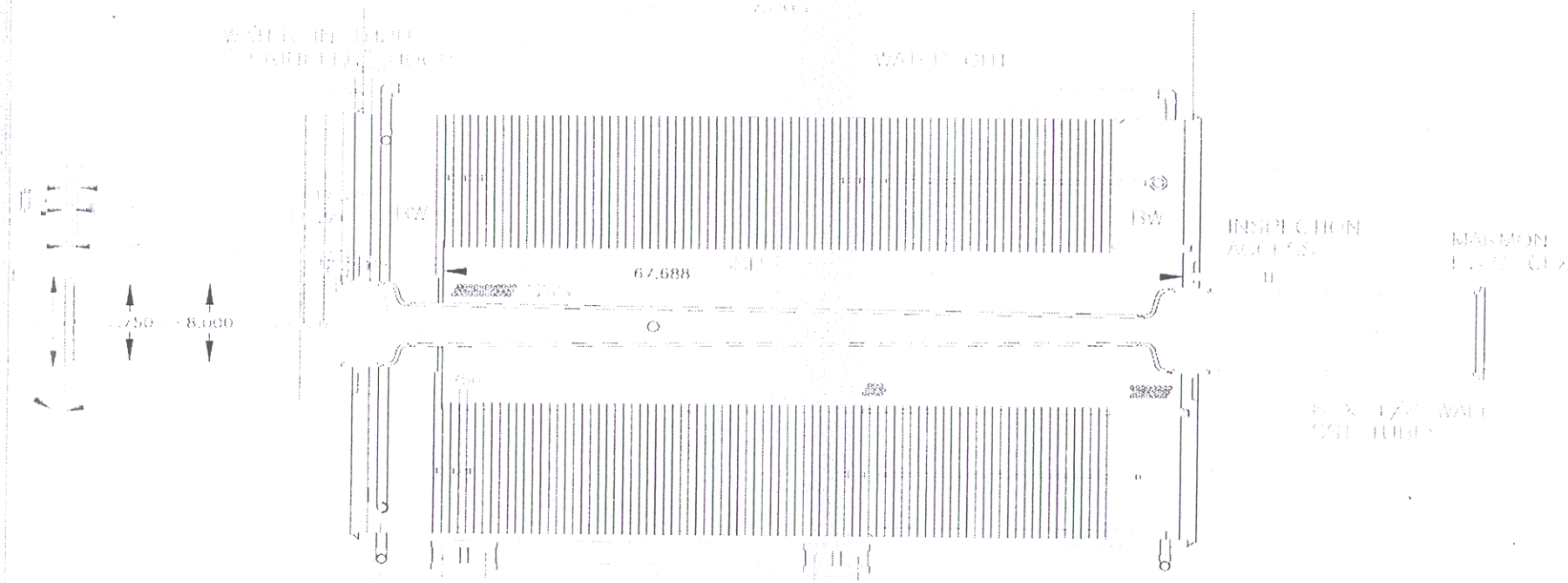


- Steady-state operation = 60 pulses/sec
- Energy deposition 60 ~ 100 Watts
- Coolant calculations based on above number
- Critical Evaluation: full beam/scraper interaction

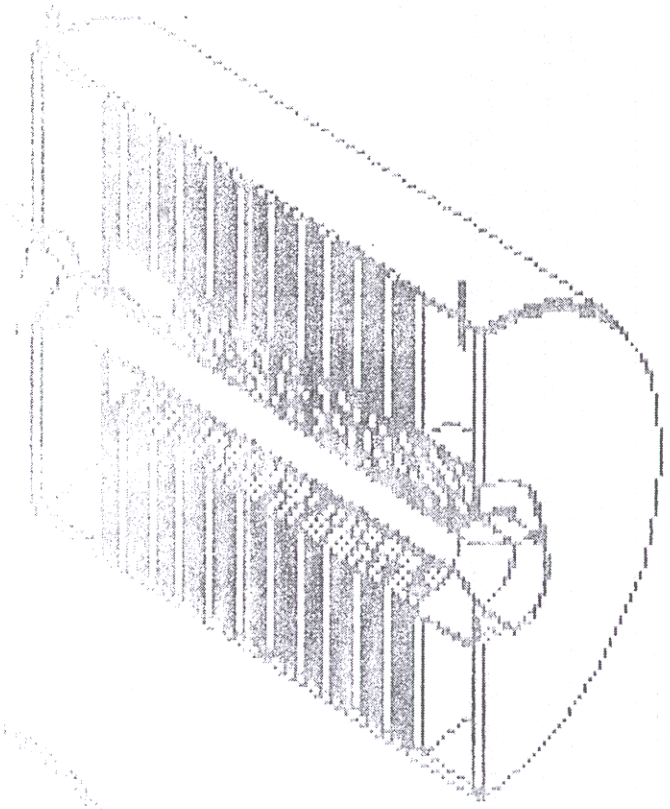
Design Review
Primary RING Collimator System Concept

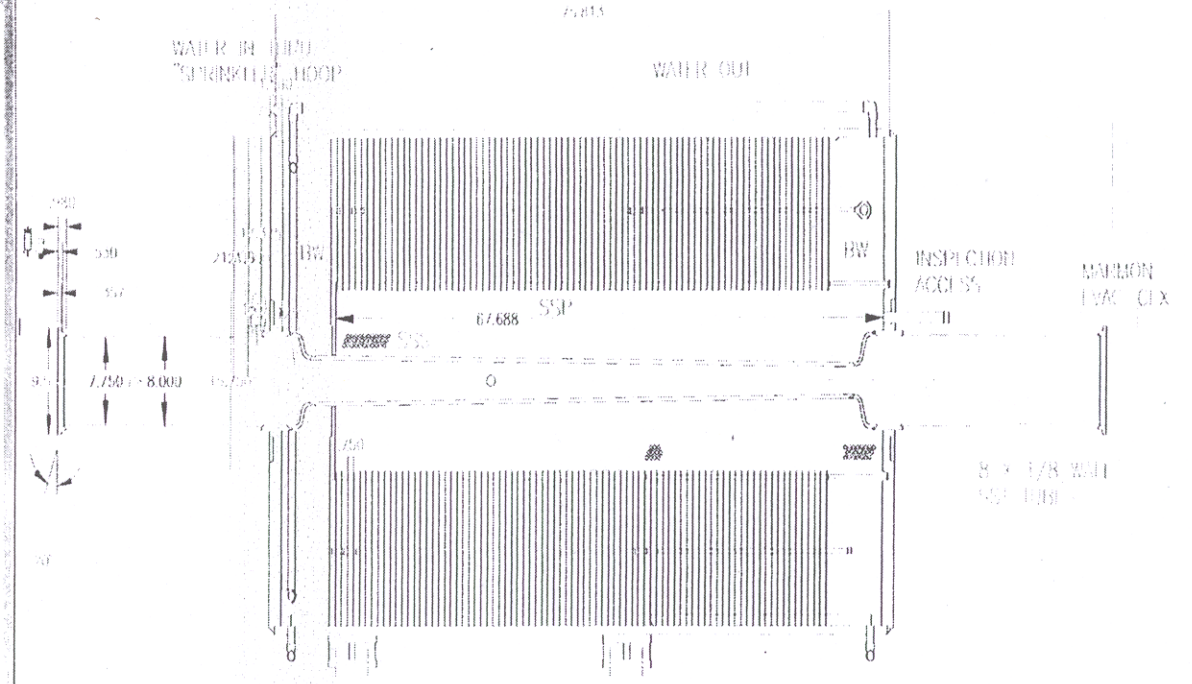


Design Review
Absorber Design & Interfaces



Design Review
Collimator System Concept - Absorber





DESIGN PHILOSOPHY

- DESIGN PHILOSOPHY TO STOP HALO PARTICLES AND RESULTING SECONDARY PARTICLES (n^0, γ, π, e^-, p^+, etc.). RESULTS IN A SELF-SHIELDED ABSORBER CONFIGURATION.

- IMPLIES A LAYERED STRUCTURE IN DIRECTION OF INCREASING "BLACKNESS" TO PROTONS IN DIRECTION OF BEAM. IN ADDITION, STRUCTURE SHOULD BE "BLACK" TO NEUTRONS AT EITHER END OF ABSORBER.

- PROTONS LOSE ENERGY GRADUALLY, PRODUCING BULK OF n^0, AND γ's INSIDE ABSORBER - MAXIMIZING THEIR LEAKAGE PATH LENGTH.

- "BLACK" OUTER EDGES FURTHER REDUCE n^0 LEAKAGE.

- ALL COLLIMATORS IN HEBT, RING, AND RTBT HAVE SAME BASIC STRUCTURE; WITH THE FOLLOWING EXCEPTIONS:
  - HEBT COLLIMATORS MUST BE INTEGRATED WITH CHARGE EXCHANGE FOILS AND MAGNETS,
  - RING COLLIMATORS HAVE FIXED APERTURES, MUST BE ABLE TO ACCEPT ONE PULSE WITHOUT DAMAGE IN CASE OF MALFUNCTION. SCRAPER INCLUDED IN FIRST UNIT, AND
  - RTBT COLLIMATORS HAVE FIXED APERTURE, MUST BE ABLE TO WITHSTAND SHARP HALO PULSE, AND TWO FULL POWER PULSES RESULTING FROM POTENTIAL "KICKER" FAILURE.

- COLLIMATOR ACTIVITIES APPEAR UNDER THE FOLLOWING WBS

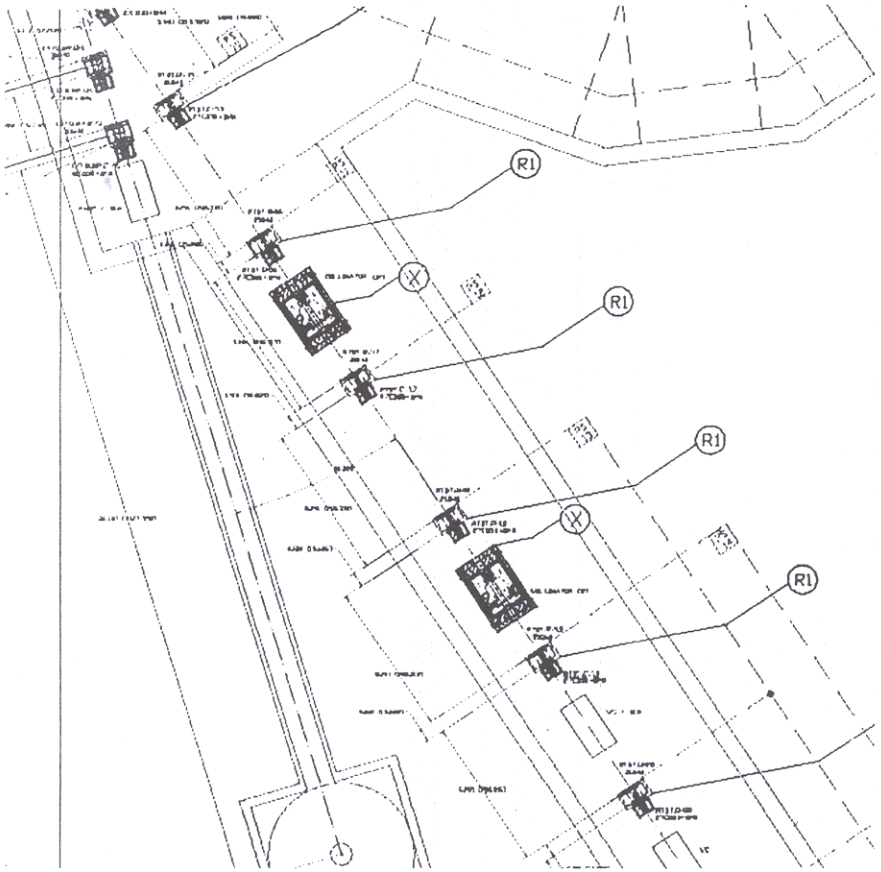
  - 1.5.1.5 HEBT CHARGE EXCHANGE FOIL AND COLLIMATOR
  - 1.5.8.1 RING COLLIMATOR
  - 1.5.8.2 MOVABLE SHIELD
  - 1.5.10.5 RTBT COLLIMATOR

PROBLEM REQUIREMENTS

- MAXIMIZE ATTENUATION OF PROTON HALO (10^{-4})
- MINIMIZE DOSE DUE TO SECONDARY RADIATION (NEUTRONS, GAMMAS)
- HEAT REMOVAL
- MAINTAIN STRESSES WITHIN ACCEPTABLE LIMITS
  - TRANSIENT THERMAL STRESSES
  - FATIGUE STRESS LIMITS
  - SHOCK ENHANCEMENT OF STRESSES (?)
- RADIATION DAMAGE
  - CHANGING MECHANICAL PROPERTIES
  - LIMITS ON COMPONENT LIFE
- ACTIVATION
  - AS LOW AS POSSIBLE
  - HANDS ON MAINTENANCE

RTBT Collimation

(D. Raparia)



- Protects the target in case of failure of the extraction kicker
- Two absorbers as for the ring, 90 degrees apart
- Collimation aperture 400π μm matches the extraction channel
- No losses during optimal operation
- Scrapes 10% of the beam when two kickers misfire
- Design to take the two pulses of full beam

HEBT Collimation. Stripping foil (H^-)

(D. Raparia)

- Two scrapers + two absorbers for betatron collimation
- One scraper + one absorber for momentum cleaning
- Large impact parameters assures large absorption efficiency