ILC RTML
Dumps and Collimators

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Contributors

SLAC

- Dieter Walz – responsible for almost every SLAC dump/collimator
- Lew Keller – EGS/FLUKA/TURTLE….
- Eric Doyle- ILC ME responsible for 1999 NLC Lehman Dumps& Collimators costs
- TWM*: HEP Experimentalist: Bookkeeper; interface to Area Groups; author of RDR text on Dumps & collimators

RAL: MEs responsible for ISIS Target

- Chris Densham*
- Brian Smith – Civil layouts and RAL updates of commercial costs
- Otto Caretta

KEK:

- Suichi Ban*

*** = RDR Regional coordinators**

RDR Bottom Line on Dumps & Collimators for RTML

This technical system's cost is dominated by:

- **The 3-loop radioactive water processing systems**
- **The CFS infrastructure, shielding, etc.**

Technical maturity & performance acceptability of the dumps are assured based on

- **Many similar dumps in use at SLAC**

Technical maturity & performance acceptability of the collimators are assured based on fact that

- **All RTML fixed collimators are peripherally cooled mechanical devices**
- **All RTML adjustable collimators are uncooled mechanical devices**

Cost uncertainty is dominated by

- **Lack of a self-consistent CFS/Mechanical design and fact that CFS costs will likely dominate mechanical costs**
- **Cost of additional safety systems not yet considered**
  - Facility for dump replacement
  - Vessel failure mitigation

Component Types

Parts list corresponding to RDR

- **Dumps (6 RTML/26)**
- **Fixed aperture collimation devices (52 RTML/85)**
  - Does not include collimators NOW being added by Sergei Seletskiy for RTML Dump lines
- **Variable aperture collimation devices (36 RTML/85)**
- **MPS and PPS stoppers (6 RTML/25)**

Basic Device Technology assigned based on incident power, beam energy and particle type

- **18MW-600kW: Pressurized water dump (0 RTML)**
- **600kW-40kW: Metal balls in water bath (6 RTML)**
- **40kW-25W Peripheral cooled solid metal (88 RTML)**
- **25W – 0W Un-cooled metal (6 RTML)**

Dumps Specified for RTML

Post_BC1_electron	Dump:TuneUp:Charged:5GeV:225kW	Sigx>=1300um; Sigy>=9um, rastered, 3cm radius
Post_BC2_electron	Dump:TuneUp:Charged:15GeV:225kW	Sigx>=495um; Sigy>=10.1um, rastered, 3cm radius
DRX-electron	Dump:TuneUp:Charged:5GeV:225kW	Sigx>=300um; Sigy>=10um rastered, 3cm radius
Post_BC1_positron	Dump:TuneUp:Charged:5GeV:225kW	Sigx>=1300um; Sigy>=9um, rastered, 3cm radius
Post_BC2_positron	Dump:TuneUp:Charged:15GeV:225kW	Sigx>=495um; Sigy>=10.1um, rastered, 3cm radius
DRX-positron	Dump:TuneUp:Charged:5GeV:225kW	Sigx>=300um; Sigy>=10um, rastered, 3cm radius

N_e	E_GeV	N_b	f	Perf OH	Peak Power	DF:10 sec	Eng OH	Cooling Power	DF:1year	Avg Power	Unit
2.00E+10	1.50E+01	2820	5	0.333333	**225600**	1	1	225600	5%	11280	W
2.00E+10	5.00E+00	2820	5	1	**225600**	1	1	225600	5%	11280	W

Fixed Aperture Pre-Linac Collimators (52)

Short Description: Fixed, circular 1cm diameter aperture, 20RL thick, 220 W maximum, water cooled, 10 degree taper, Cu coated if not made of Cu; local shielding required (?)

200W assumes 0.1% Halo DC:

N_e	E_GeV	N_b	f	Peak Power	DF:10 sec	Eng OH	Eng Power	DF:1year	Avg Power	Unit
2.00E+07	5.00E+00	2820	5	226	1	1	**226**	100%	226	W

Device	Eng_Name
30cm cylinder peripheral cooled	Coll:Cu:20RL:1.0cmBore:220W:H2O-cooled

Device Length (cm)	Absorber Length (cm)	Absorber Length (RL)	Absorber Material	Power (W)	Nominal Aperture (mm)
	28.6	20	Cu	220	10

RTML Pre-linac collimation spoilers (36)

Short Description: Either H or V adjustable;0.6RL Ti, in a tapered +/-3cm of Be, all Cu coated, 10 degree taper, 5 Watt cooling; non-adjustable support; no mover; ion chamber

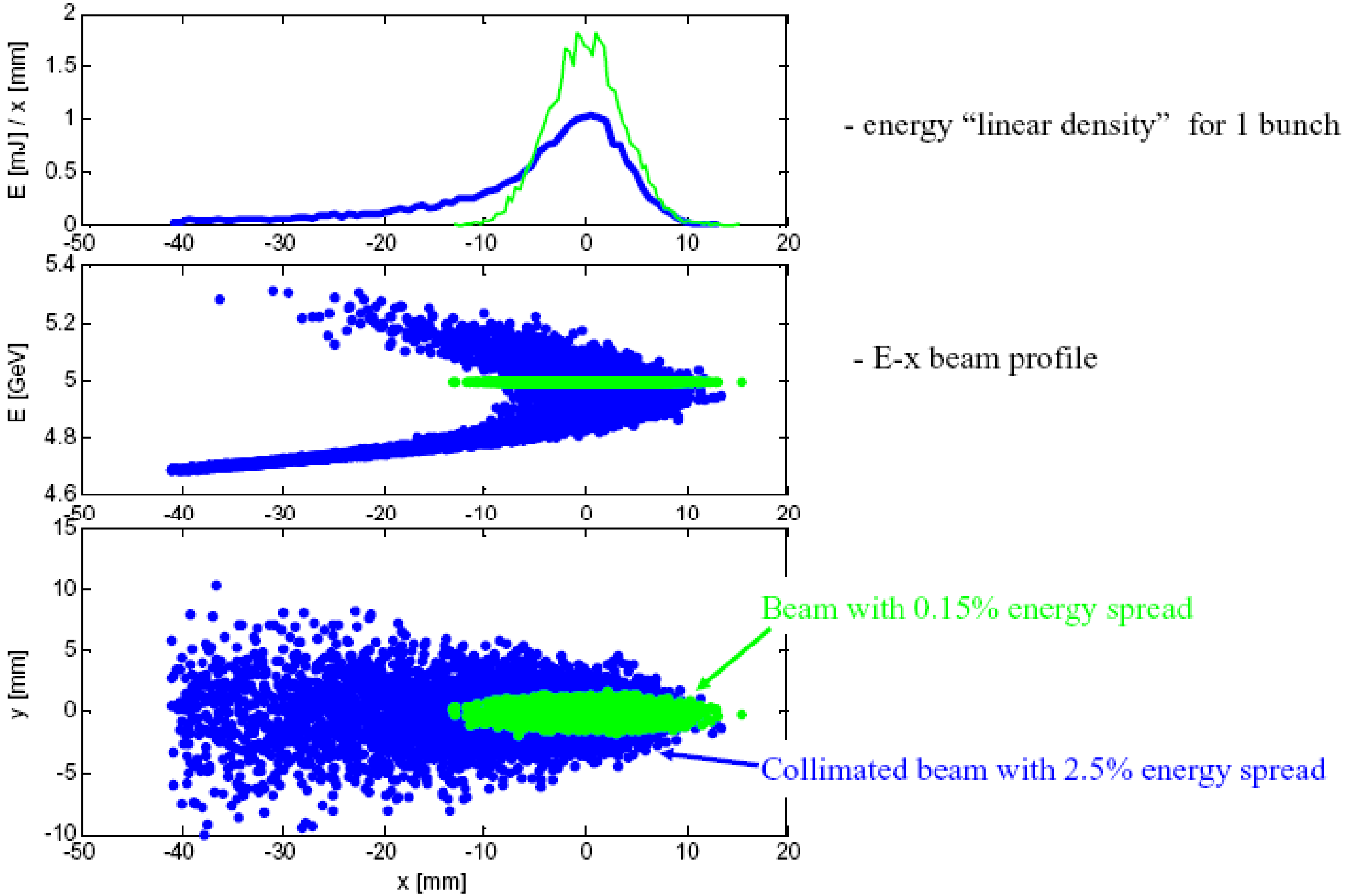
Absorber Length (cm)	Absorber Length (RL)	Absorber Material	Power (W)	Nominal Aperture	Min Gap (mm)	Max Gap (mm)
2.1	0.6	Ti				

Eng_Name

Coll:Ti:0.6RL:2Jaw:Uncooled

Note: 5W corresponds to dE/dx of halo; Power of halo is 226W

Beam Spot on RTML Dump from S. Seletskiy (9 October 2007)



Sergei & Dieter on Collimators

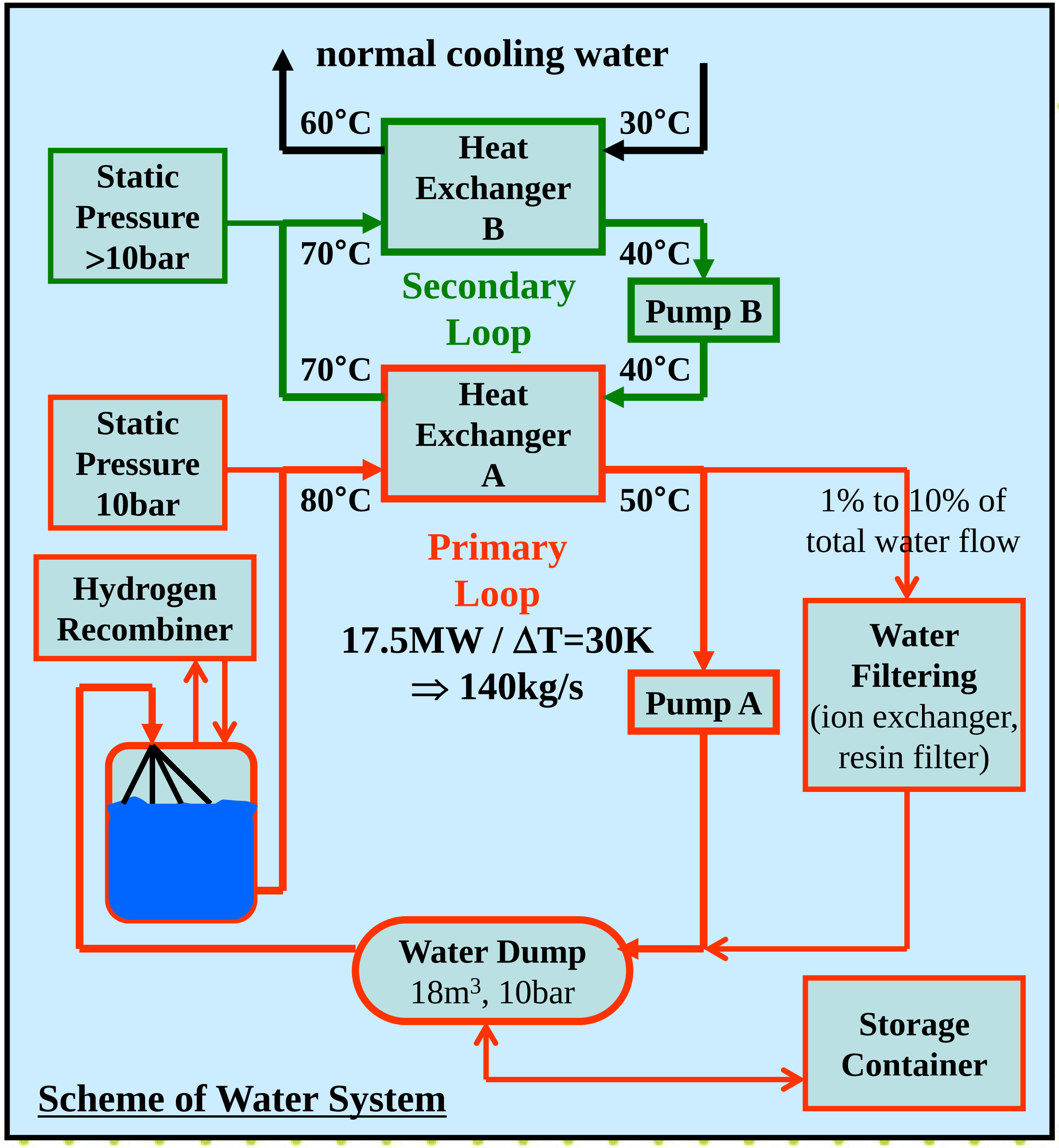
Sergei

- **two fixed aperture collimators in the dump line, one takes 9.5kW/train the other one takes 3kW/train of the beam power**

Walz

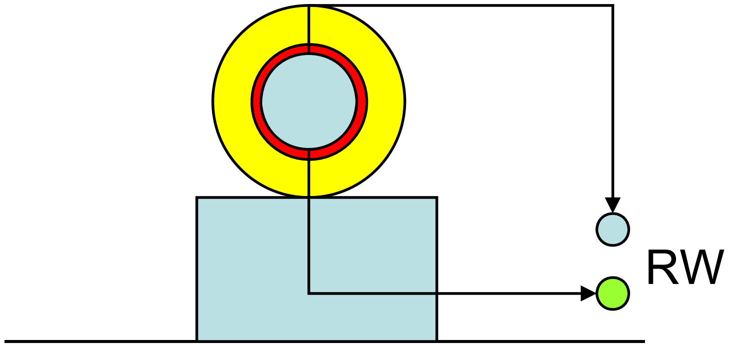
- **Dump Window**
  - the largest diameter aluminum window I proposed and eventually had built is 1.5 m. If you wouldn't mind supplying me with the pertinent input beam parameters such as max beam current, transverse sigma values, tails and halo I will analyze these and propose a window (diameter, thickness, alloy etc.).
- **Protection collimator questions:**
  - is one bunch train, i.e. 9.5kW and 3kW,the most power they would ever be exposed to?
  - how "dark" a shadow do we need to cast,i.e.does it need to be an umbra or is a penumbra good enough (the latter being good enough for just protecting one or several components further downbeam from destruction by an errant primary beam)?
  - what are the current and energy values,also the transverse sigma values of the beam(s) targeting on these collimators?

10 bar H2O Dump Plumbing



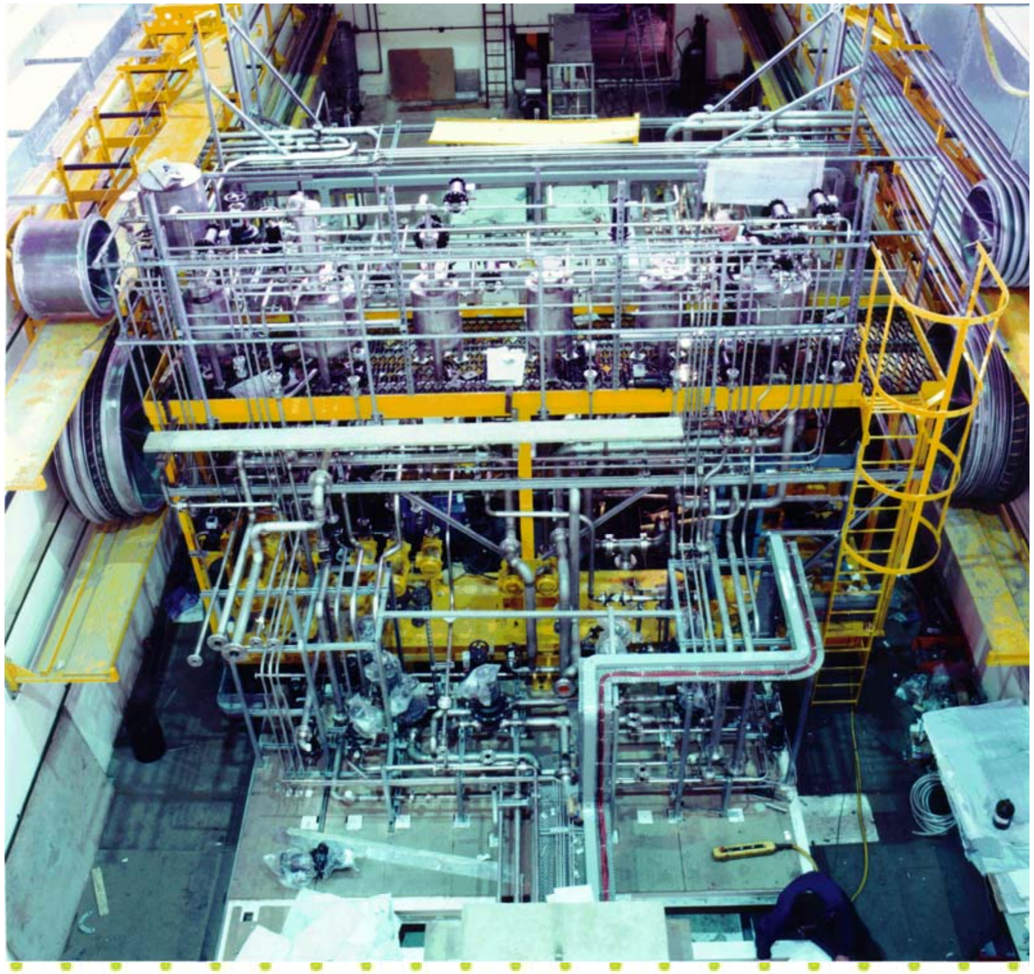
9 ~240kW Aluminum Ball Dumps

50cm Diameter x 2m long
Aluminum Ball Dump with Local
Shielding



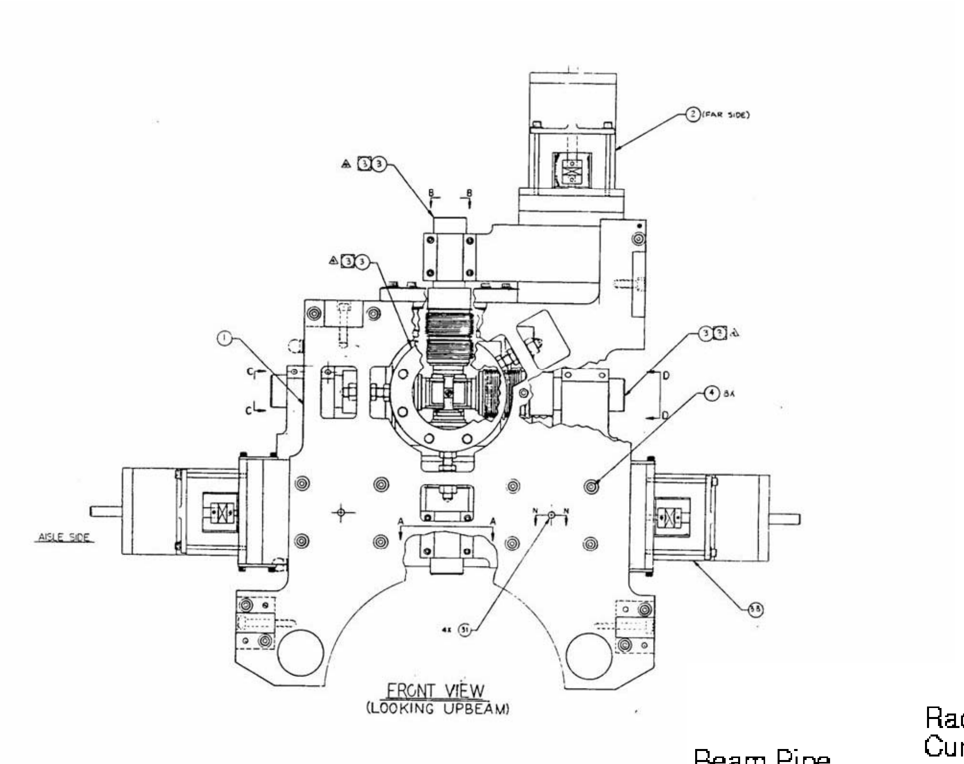
Cost Basis
vessel (Walz)
ISIS plumbing
ISIS controls & monitoring
Total $1M each

50kW 3-loop 2006 Rad Water Cooling for ISIS Neutron Spallation Targets

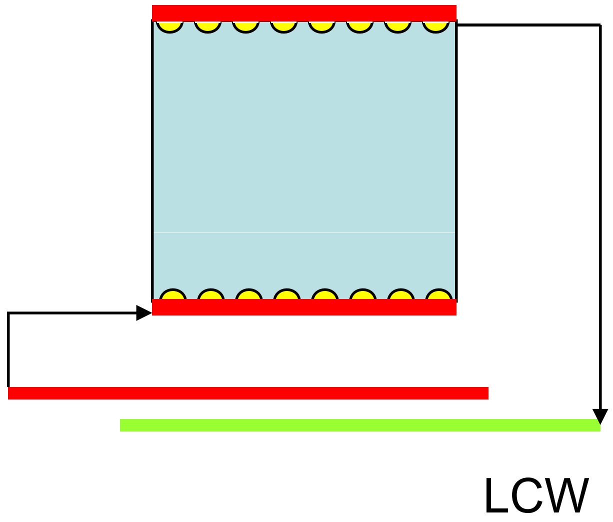


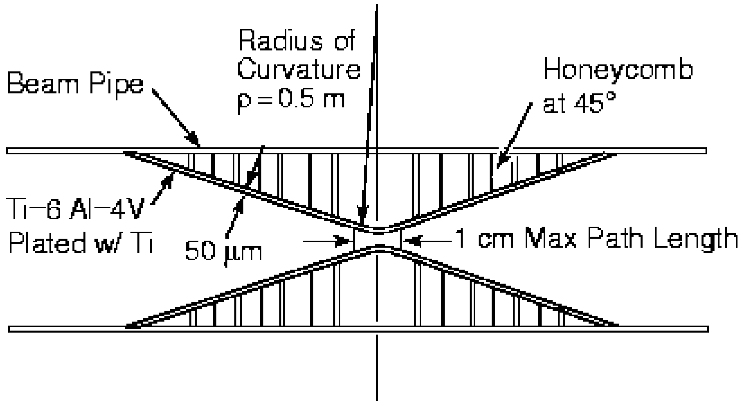
Collimator Cartoons

SLC Sector 30 4-Jaw collimator



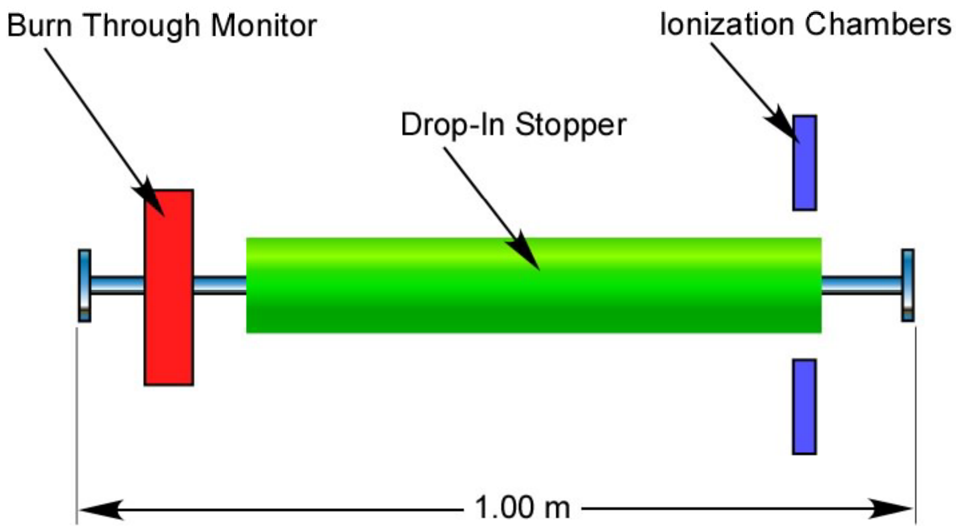
50cm Diameter x 50cm long Peripherally-cooled Solid Cu or Aluminum Dump (before local shielding added)



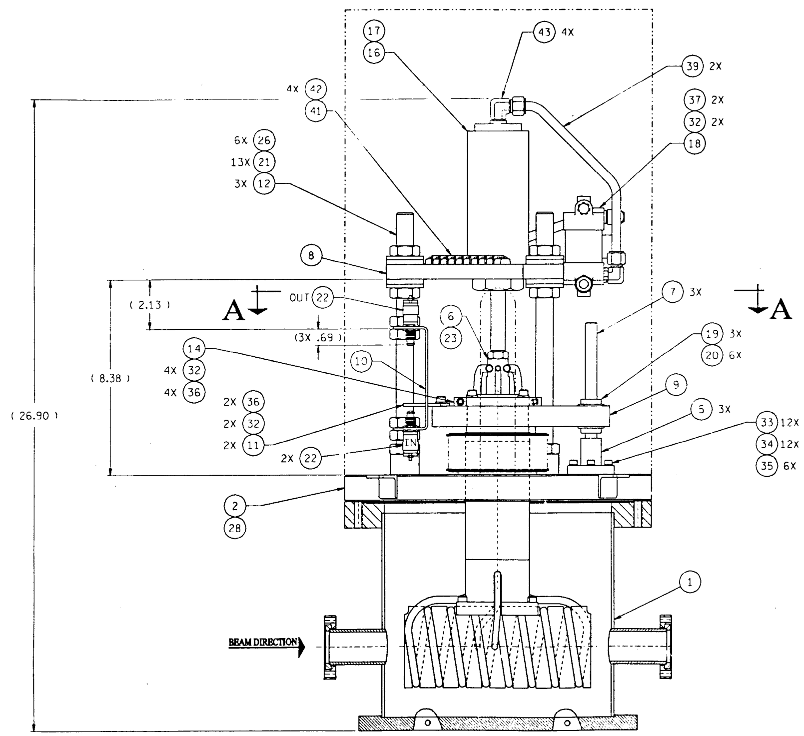


Tapered NLC Spoilers & Absorbers

Stopper Cartoons



JC Sheppard Stopper



PEP-II Stopper

Cost Methodology

Economy of scale factor for each device type

- **Learning curve not applied**
- **Minimum=60% for 72 H2O-cooled protection collimators**

ED&I baseline set to 25% and adjusted upward for difficult one-off devices

- **NOT estimated bottom's up**

Cost Uncertainty

ISIS 50KW water system seems 10x SLAC experience

Also concerned that CF&S related costs will dominate total D&C related costs

- **beam line plus civil housing drawings do not exist except for BDS**
- **tighter hand shake required**

Largest cost risks:

- **items falling through cracks**
  - installation/replacement model
- **implications from technical risk of difficult devices or regulatory issues that we have not begun to consider**

No real effort yet to estimate accurately ED&I, economies of scale or required site resources