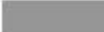
















Legend

	System
	Si
	BCB
	InP
	InGaAsP
	InGaAs
	MaN440_resist
	MaN415_resist
	Ti
	Pt
	Silver
	SiO
	HPR504_resist
	HSQ_resist
	Gold
	AZ4533_resist

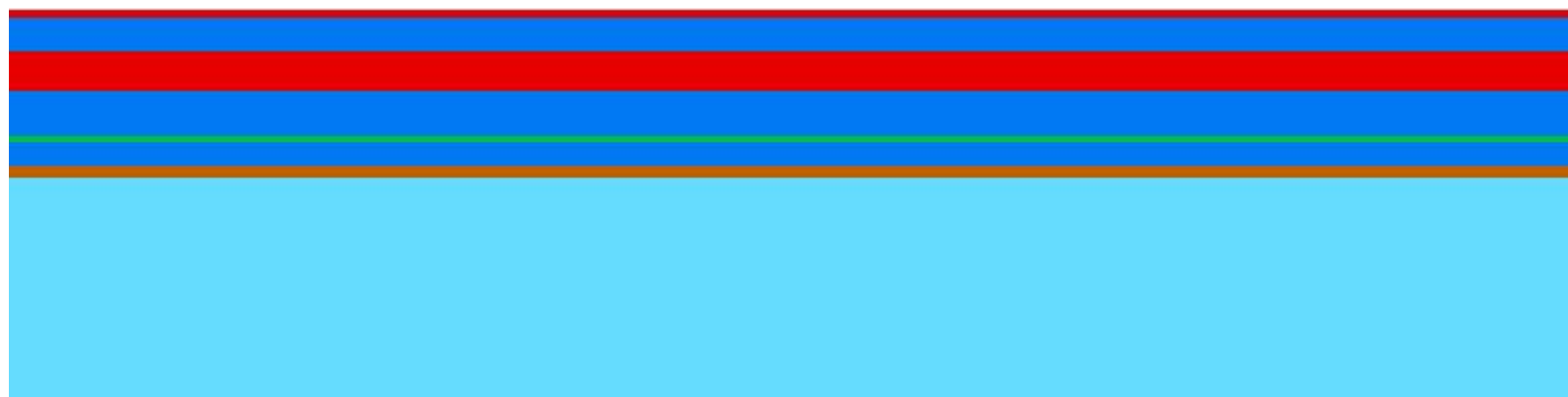
Metallo-dielectric laser

Initial layer stack



This is the initial layer stack after BCB bonding

Sample preparation



Dry clean - Stripper (B7.2), 5m?
Backside protection - Manual, paint S1805
Soft bake S1805 - Oven (B9.1)
Wet clean - Manual (B1.3), 2m
Rinse - Manual, UPW
Etch protection layer - Manual (B1.1)
Remove resist - Manual, acetone, 10m
IPA rinse - Manual, isopropanol
Dry clean - Stripper (B7.1), 5m
Wet clean - Manual (B1.3), 2m
Rinse - Manual, UPW, 10m

Deposition of SiO hardmask



Deposition of hardbaked HPR504 photoresist



Deposition of HSQ negative resist



Spin resist - (B8.2), 80nm
Hard bake 1 - (B9.6), 2m
Hard bake 2 - (B9.7), 2m

Deposition of gold



Evaporation of gold - (B12.3), EDWARDS, 7.5nm

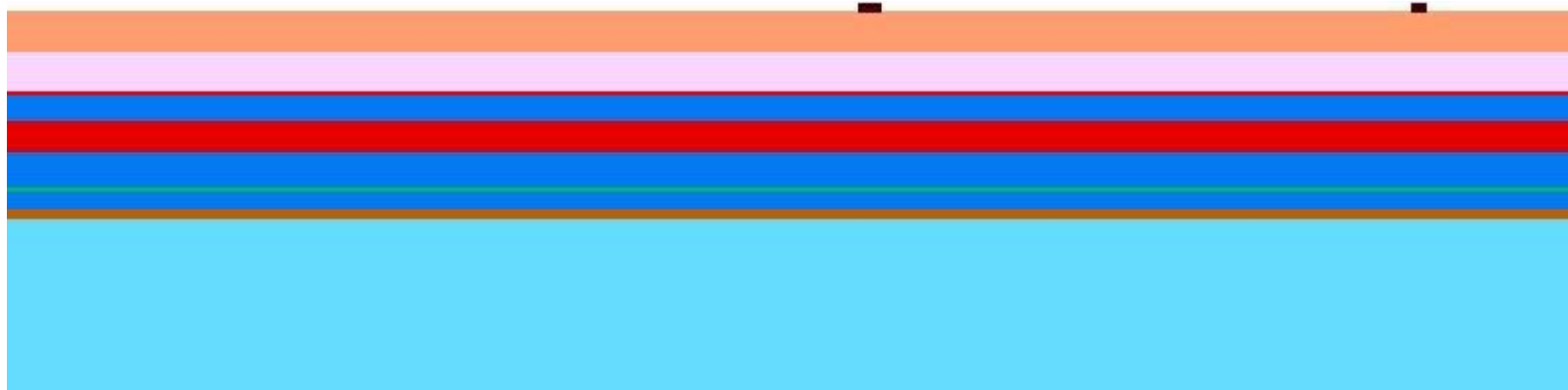
E-Beam lithography to define pillar



Remove gold

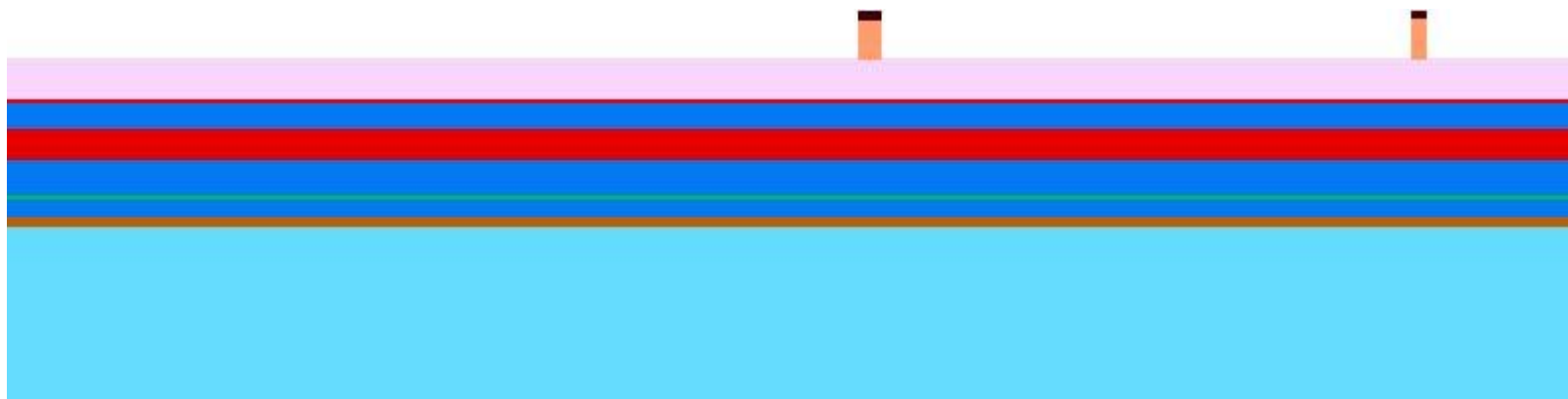


Develop HSQ



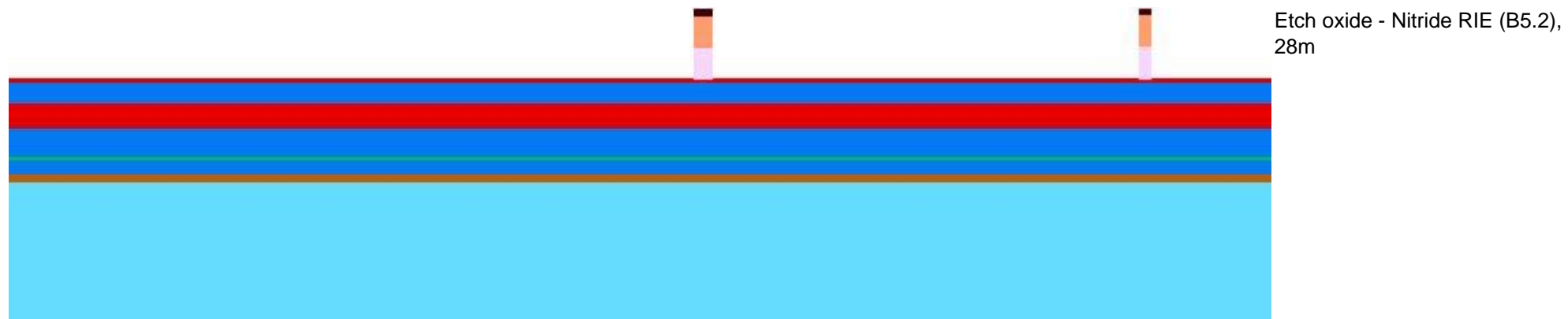
Develop HSQ - (B4.1), 2m
Rinse - Manual, UPW

Etch polymer (RIE)

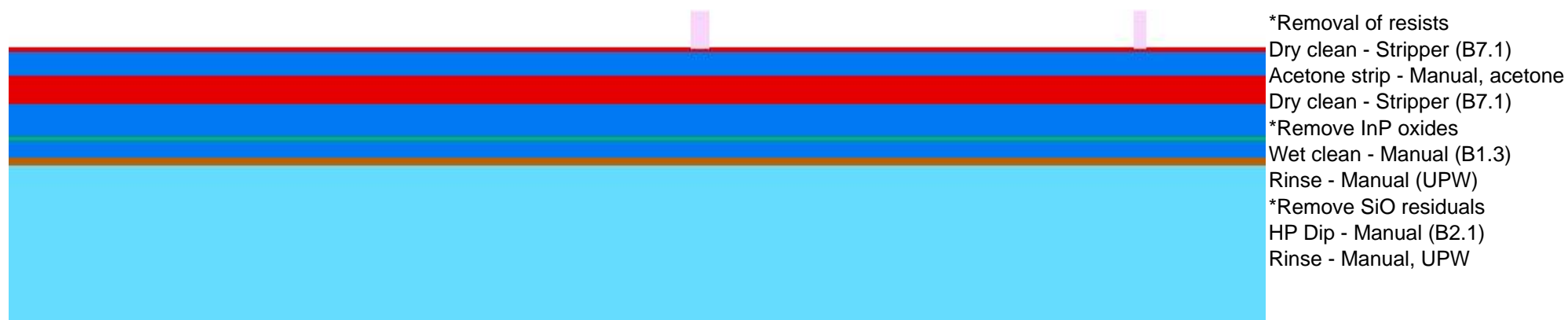


Etch polymer - Polymer RIE
(B5.3), 7m

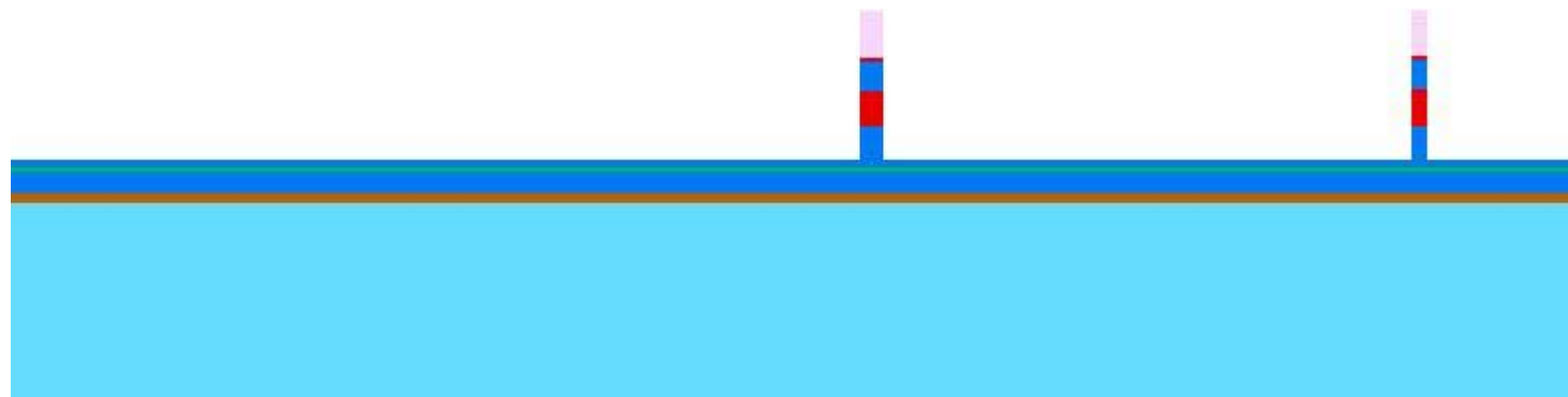
Etch oxide (RIE)



Cleaning by stripping, rinsing and wet etching

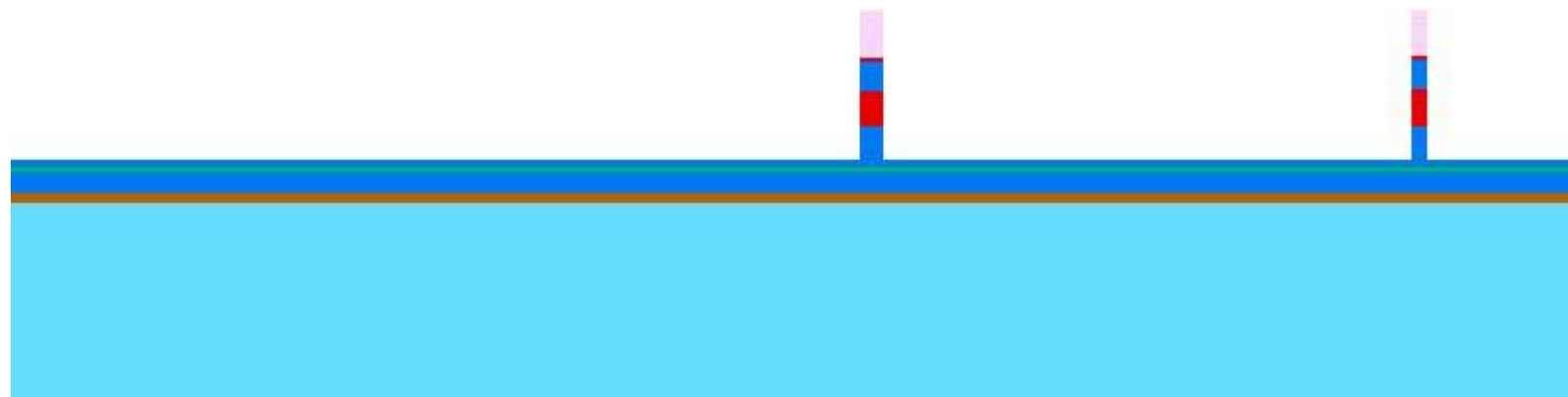


Etching of pillar by ICP



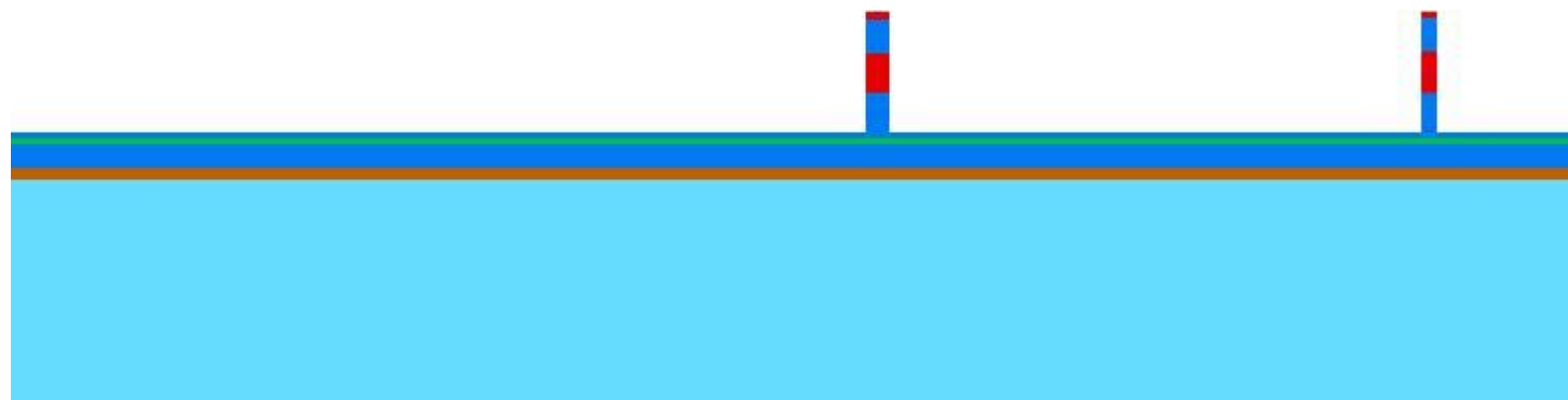
ICP etch - ICP RIE (B5.1a/b),
cycles: 1m/12s

Removal of sidewall damage (x4)



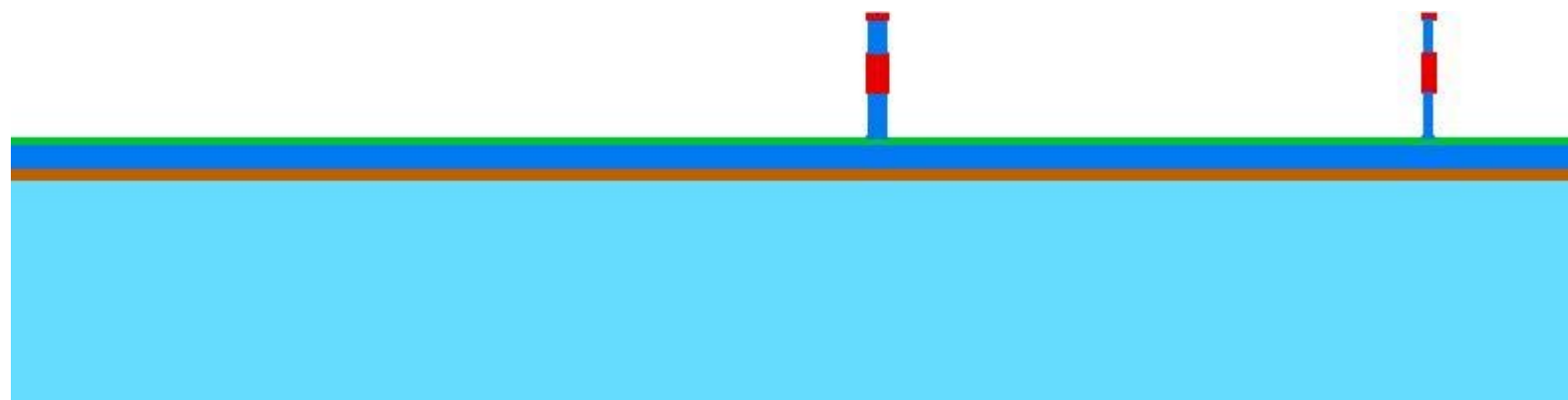
Dry clean - Stripper (B7.1)
Wet etch - Manual (B2.1)
Rinse - Manual, UPW
Wet etch - Manual (B1.3)
Rinse - Manual, UPW

Remove hardmask



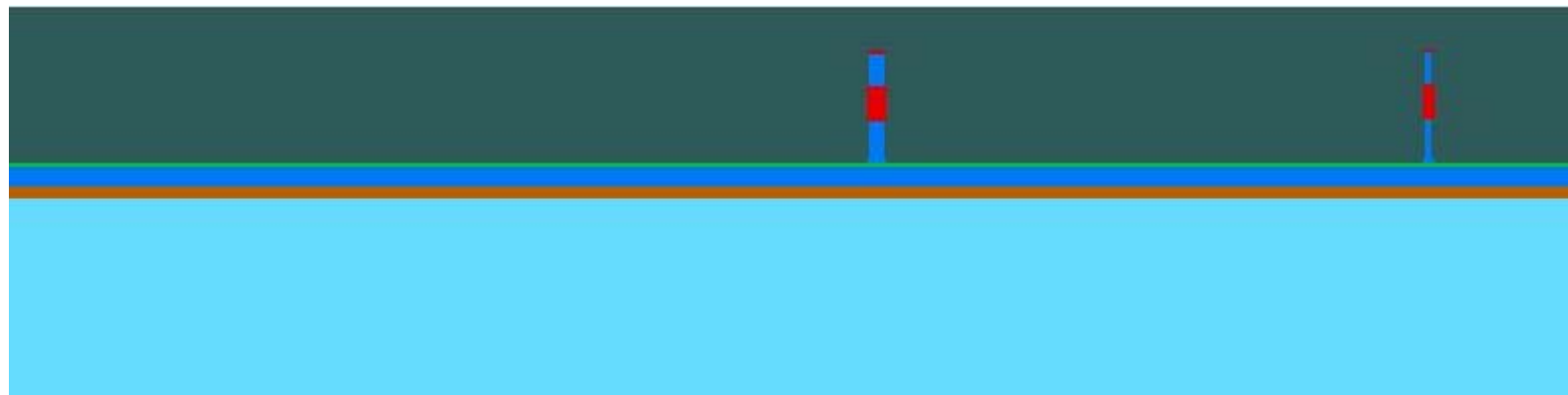
Wet etch - Manual (B2.2)
Rinse - Manual, UPW

Wet etch of InP (by HCl?) to: (i) reach quaternary, (ii) create undercut



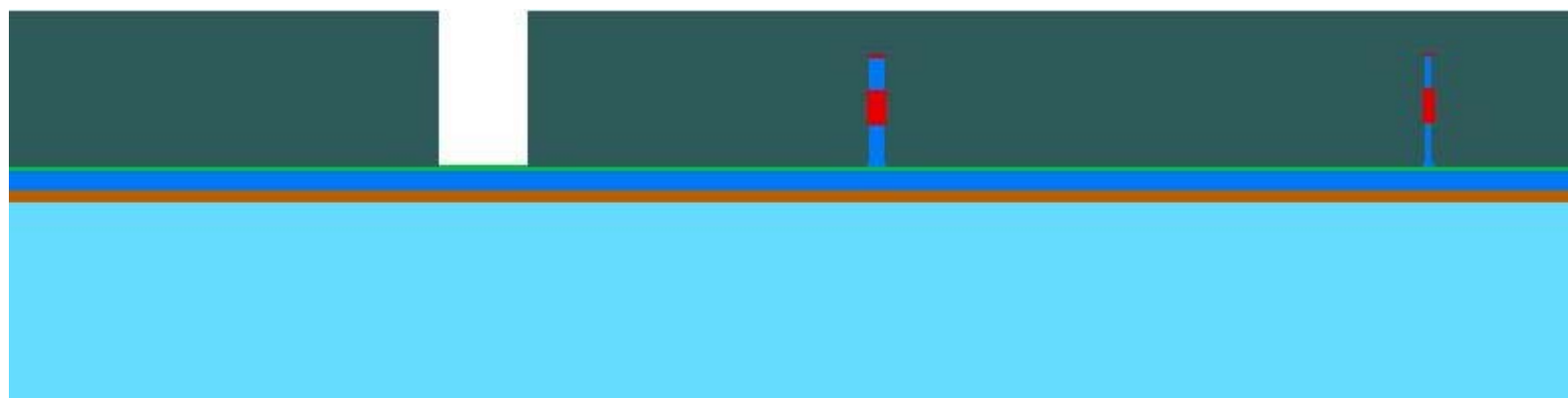
Wet etch - Selective and isotropic,
HCl?
*Cleaning steps proposed:
Rinse - Manual, UPW

Deposition of MaN440 resist for P-contact definition



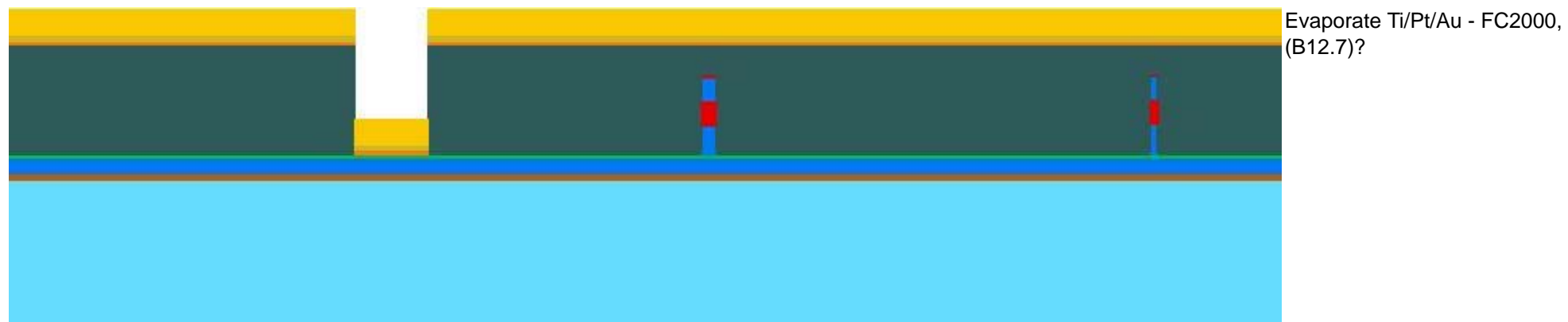
Spin resist - (B8.3), thickness:
pillar height + 400nm?
Softbake - (B9.8), 5m

Optical lithography to define p-contact and develop of MaN440

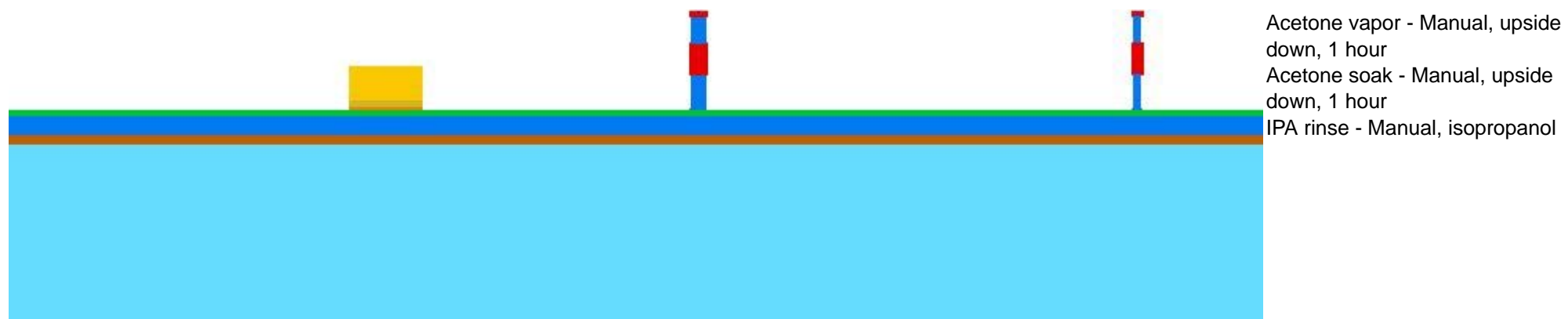


Optical lithography - MA6 (B10.1)?
Develop MaN440 - (B4.2)
Rinse - Manual, UPW

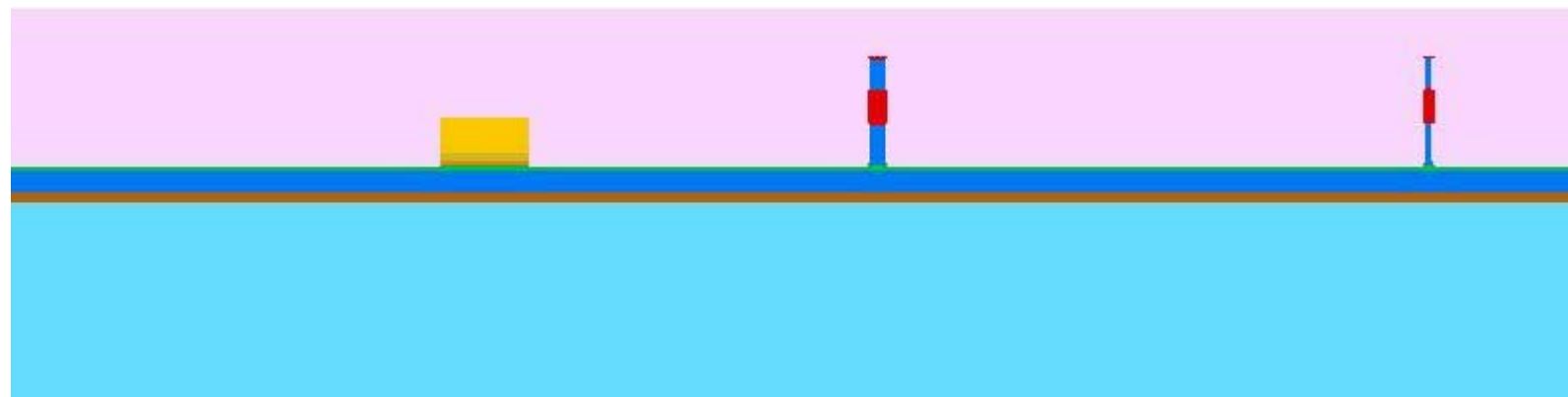
Deposition of Ti/Pt/Au)



Formation of p-contact by lift-off

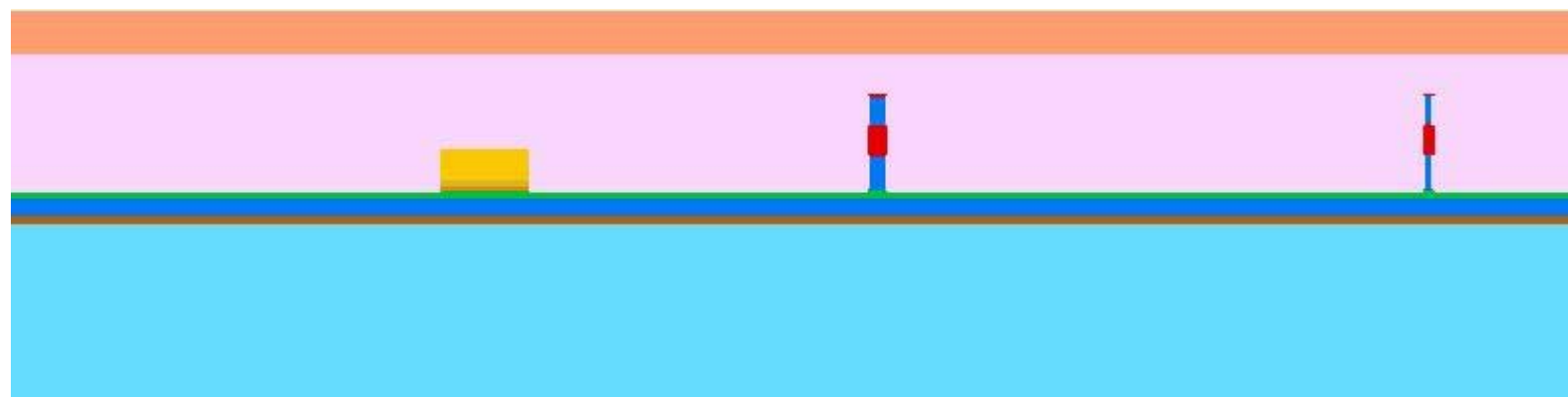


Deposition of SiO hardmask



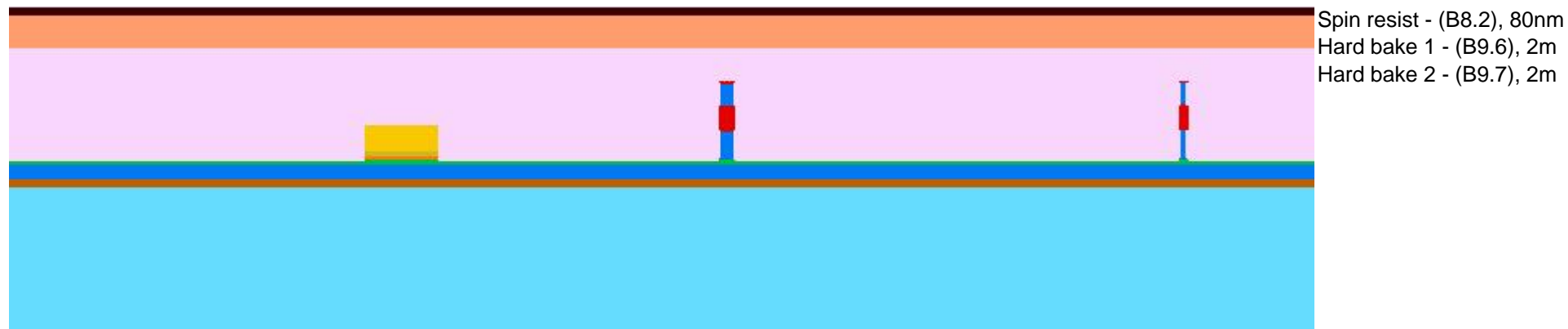
Oxide deposition - PECVD
Recipie?, thickness ~ 3*440nm?

Deposition of hardbaked HPR504 photoresist

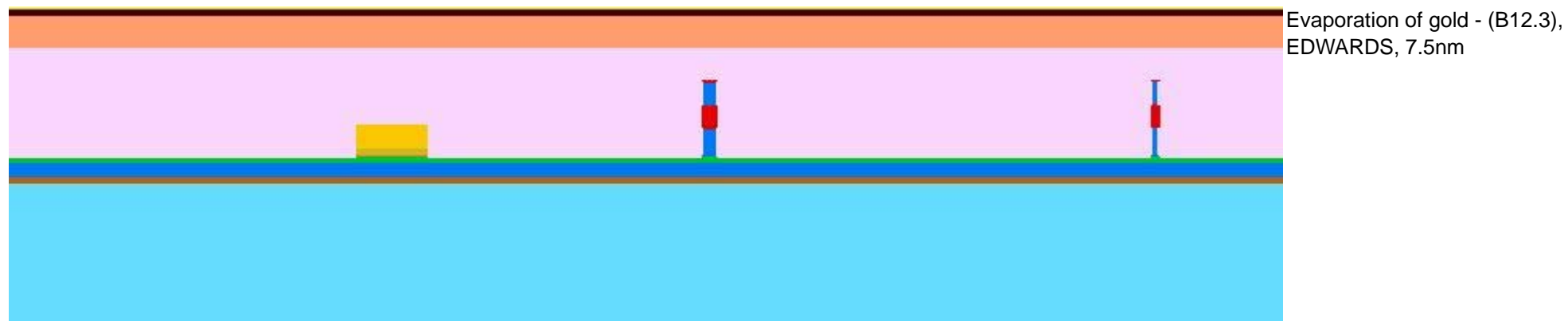


Spin resist - (B8.1), thickness ~
3*450nm
Hard bake 1 - (B9.3), 2m
Hard bake 2 - (B9.4), 2m
Hard bake 3 - (B9.5), 2m

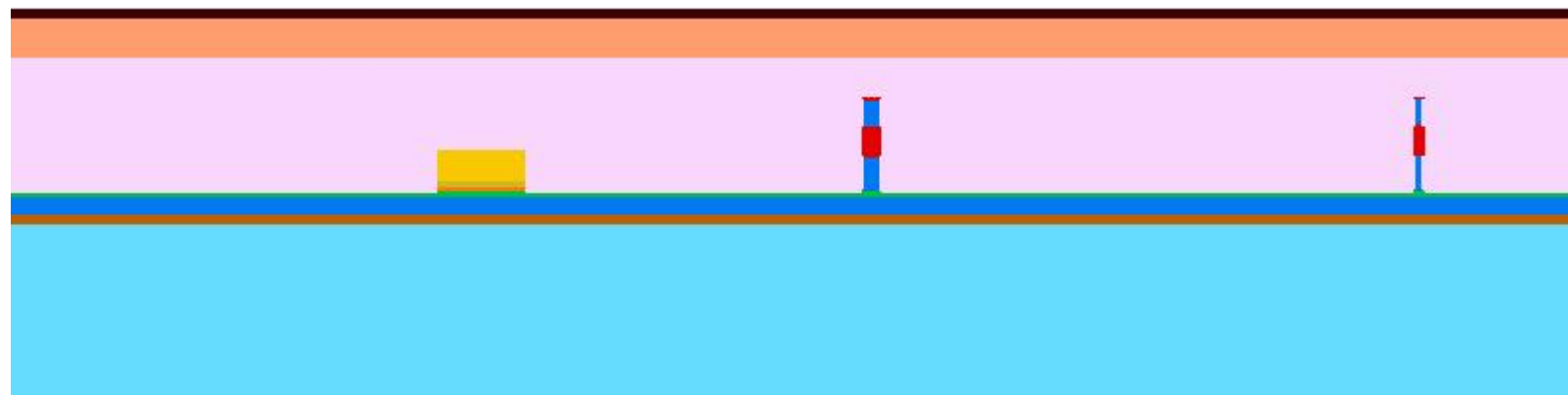
Deposition of HSQ negative resist



Deposition of gold

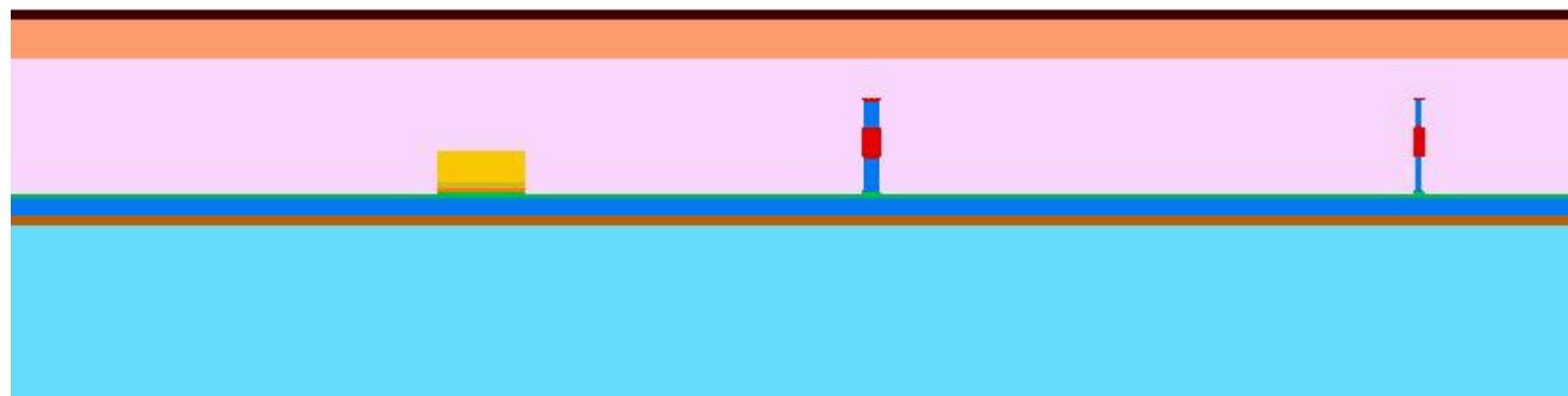


E-Beam lithography to define waveguide



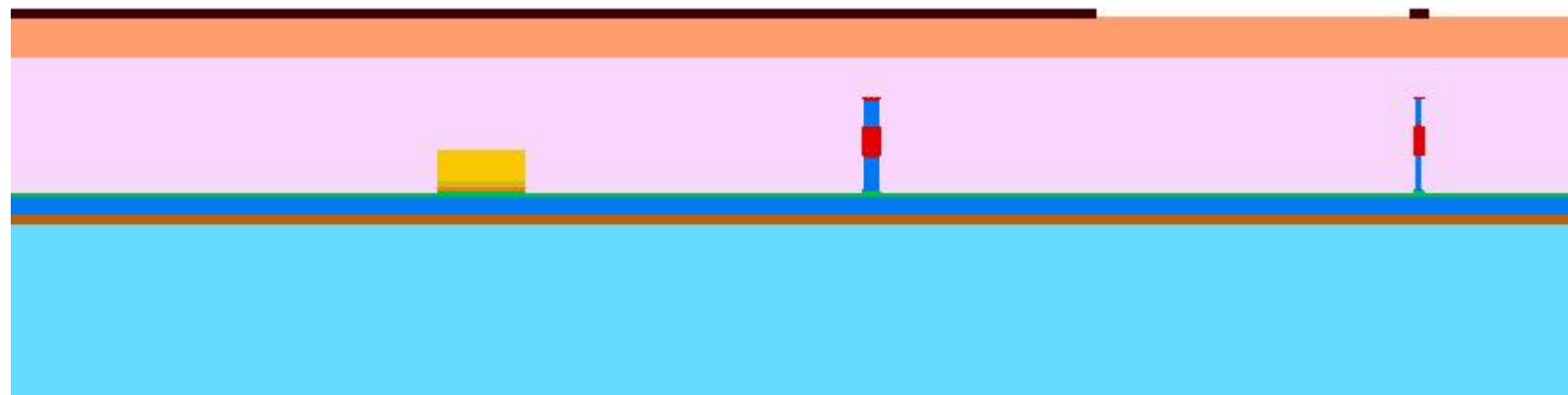
E-Beam lithography - Recipie?

Remove gold



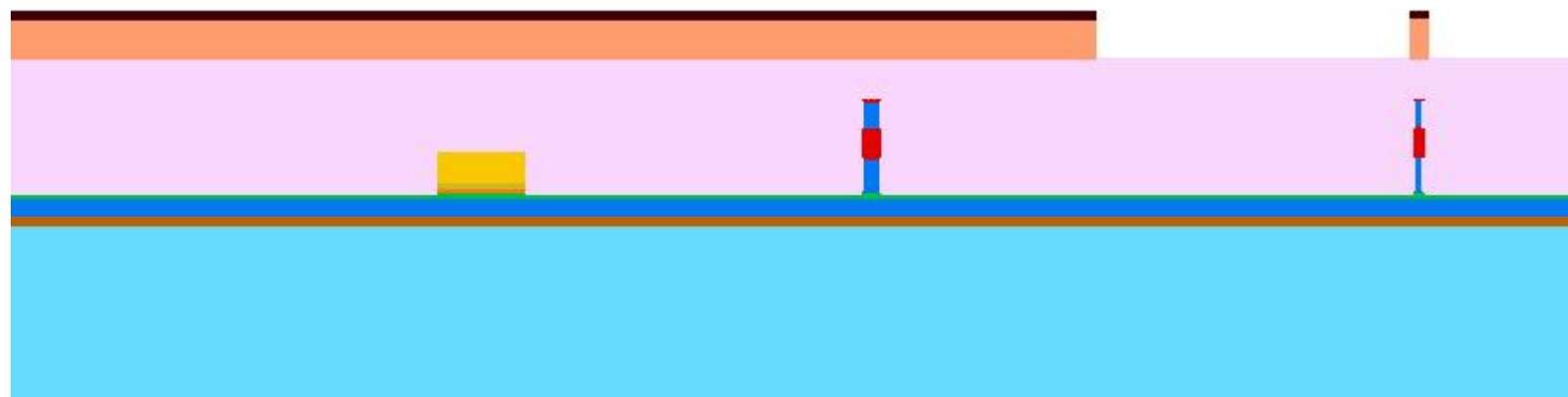
Gold etch - Manual (B3.1), 30s
Rinse - Manual, UPW

Develop HSQ



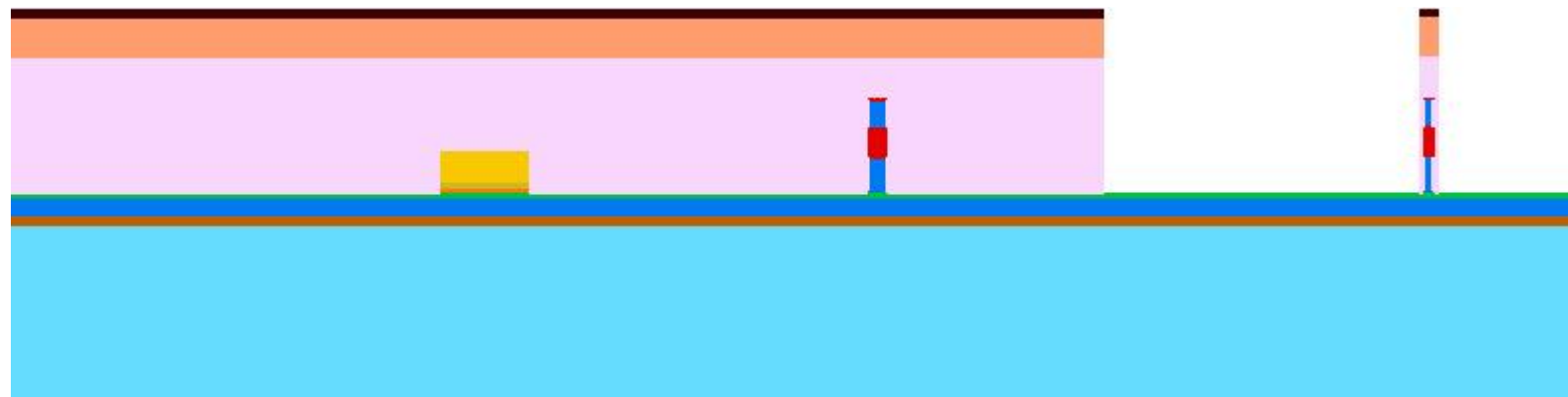
Develop HSQ - (B4.1), 2m
Rinse - Manual, UPW

Etch polymer (RIE)



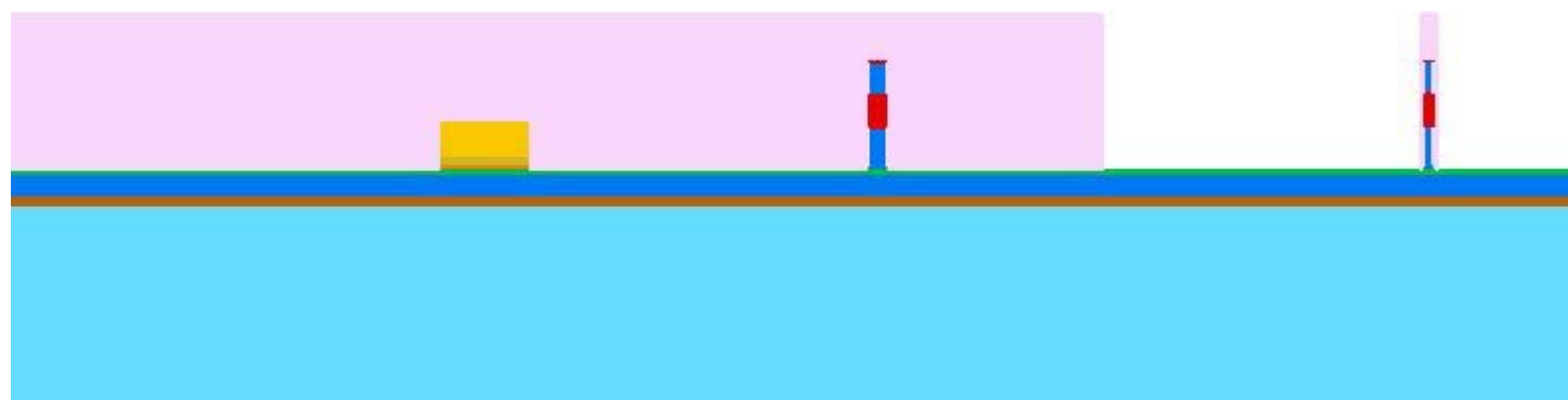
Etch polymer - Polymer RIE
(B5.3), 7m

Etch oxide (RIE)



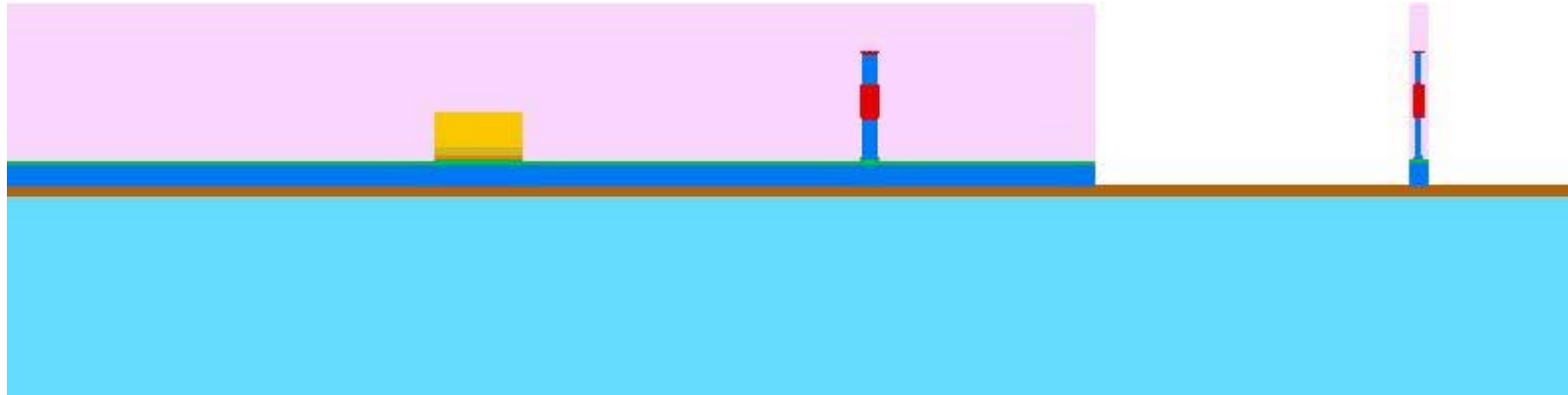
Nitride RIE - (B5.2)

Cleaning by stripping, rinsing and wet etching



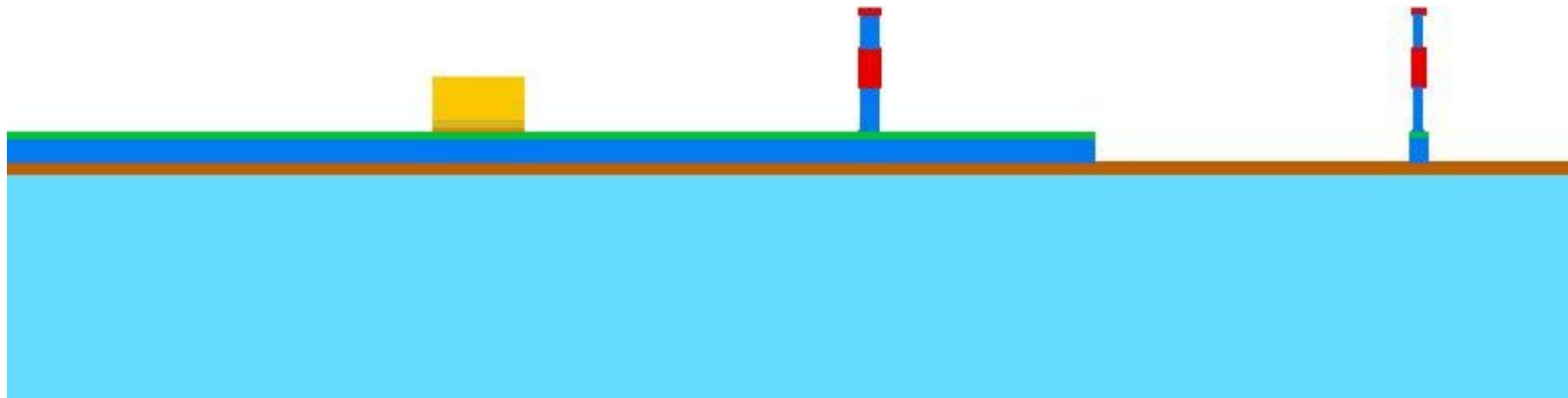
Dry clean - Stripper (B7.1)
 Acetone strip - Manual, acetone
 Dry clean - Stripper (B7.1)
 Wet clean - Manual (B1.3)
 Rinse - Manual (UPW)
 HP Dip - Manual (B2.1)
 Rinse - Manual, UPW

Etching of waveguide by ICP



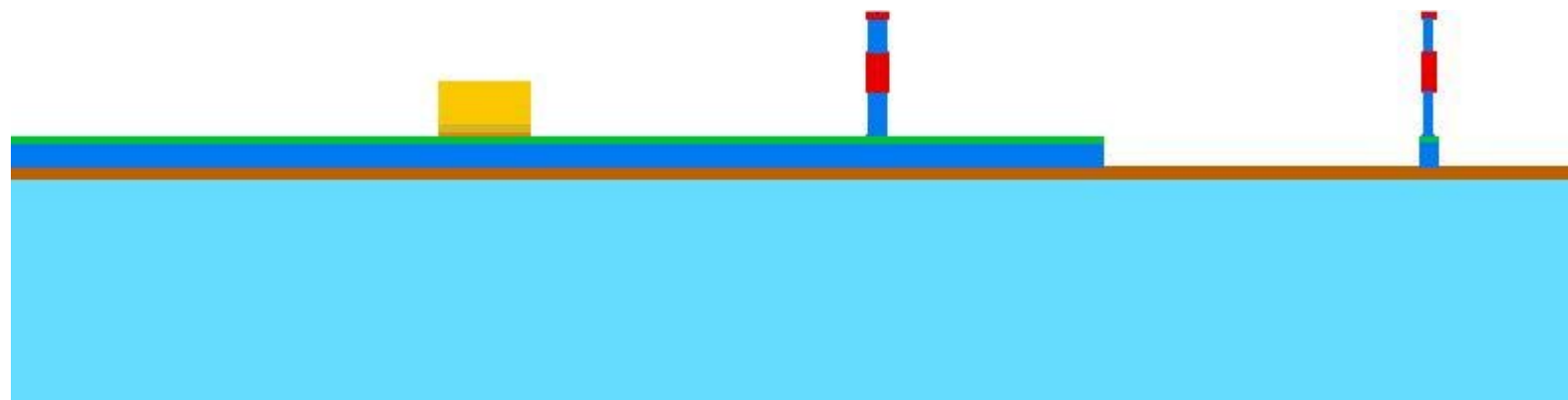
ICP etch - ICP RIE, Recipie?)

Remove hardmask



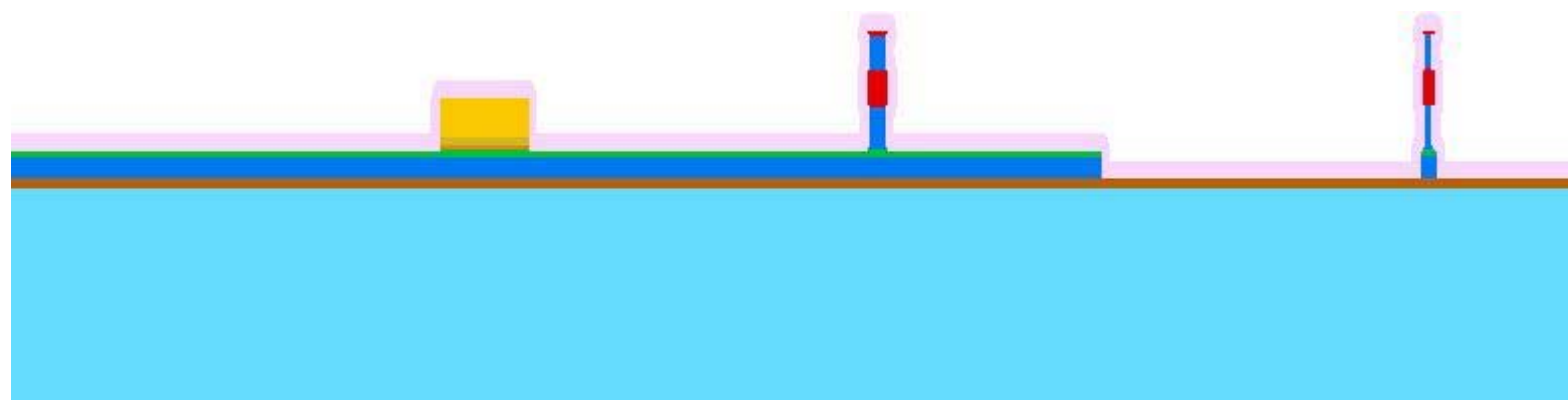
Wet etch - Manual (B2.2),
~(3*120)s
Rinse - Manual, UPW

Removal of sidewall damage (x4)



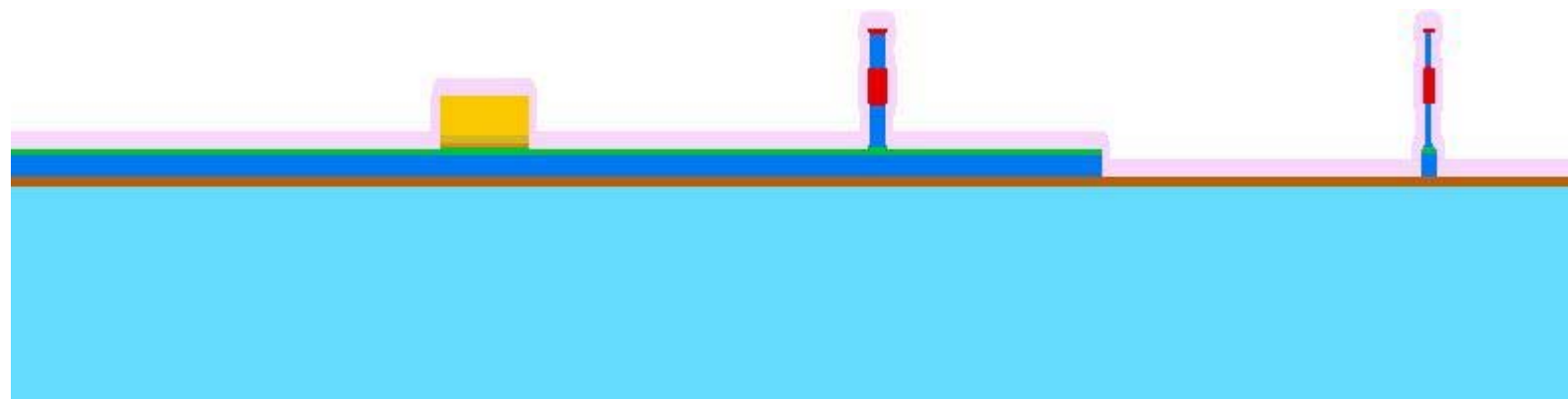
Dry clean - Stripper (B7.1)
Wet clean - Manual (B1.3)
Rinse - Manual, UPW

Deposition of insulation layer (SiO)



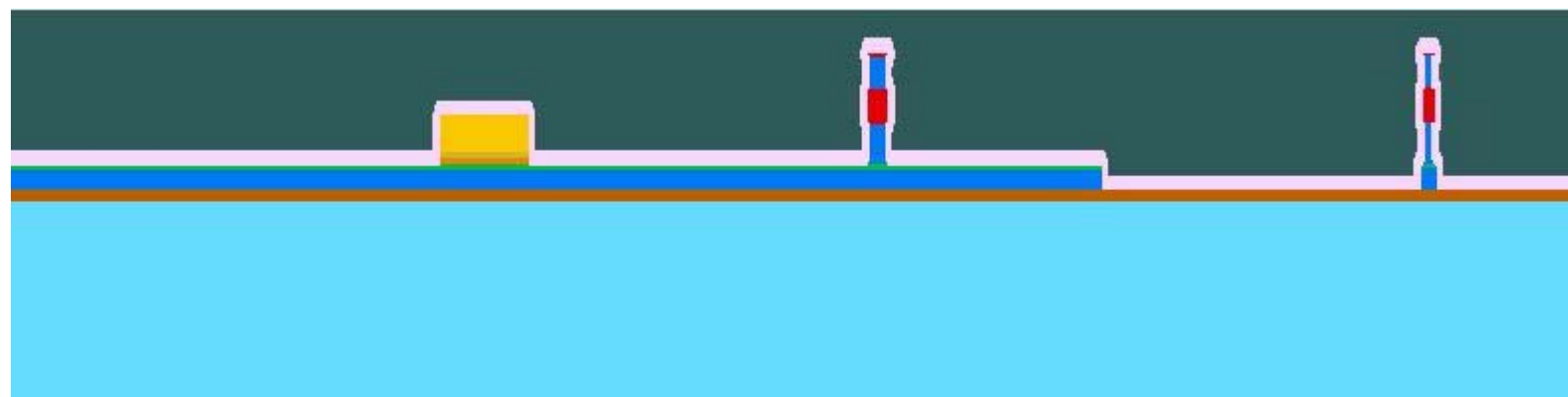
*Passivation layer to decrease
surface recombination
Thin oxide deposition - PECVD,
Recipe?
*Insulation layer
Thick oxide deposition - PECVD,
Recipe?

Preparation for adhesion pads lithography



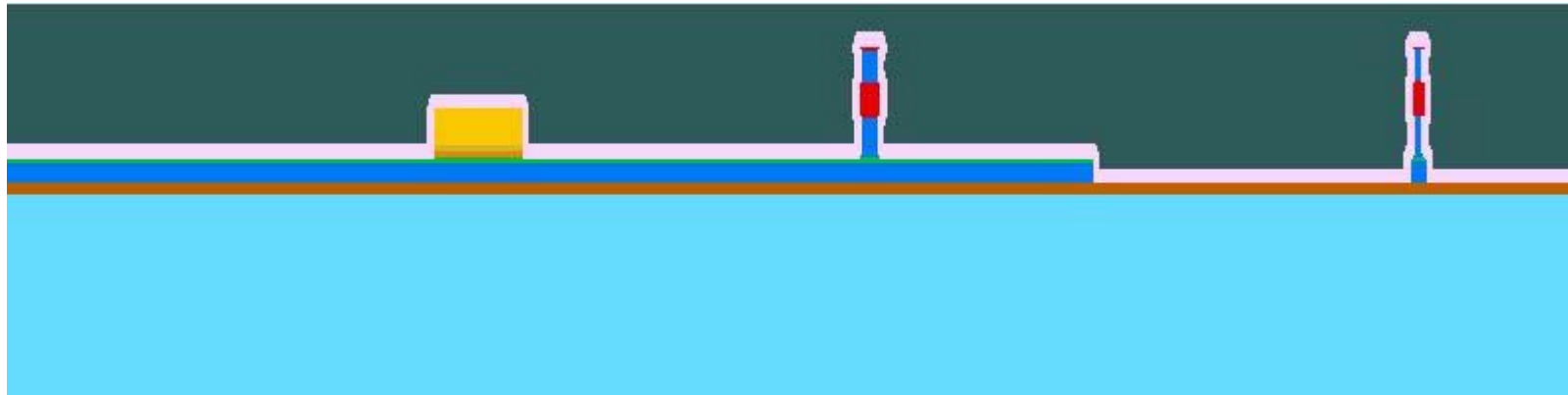
Surface oxidation
Dry clean - Stripper (B7.1)
Surface preparation for promotion
of resist adhesion (ideally, no H₂O
on surface)
HDMS Primer - Manual, old primer
oven

Deposition of MaN440 resist



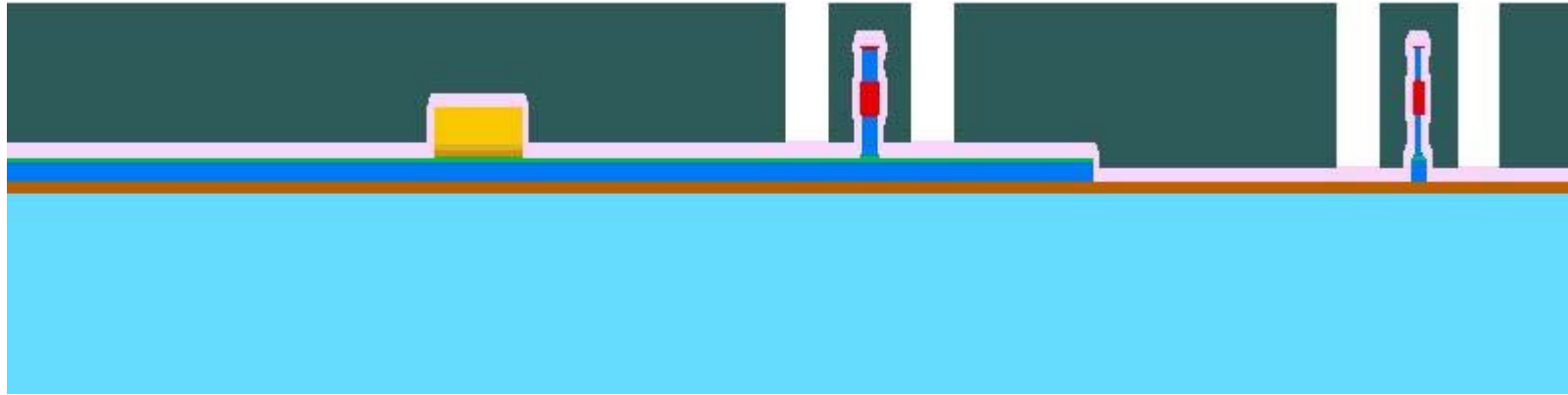
Spin resist - (B8.3), thickness:
pillar height + 400nm?
Softbake - (B9.8), 5m

Optical lithography to define adhesion pads



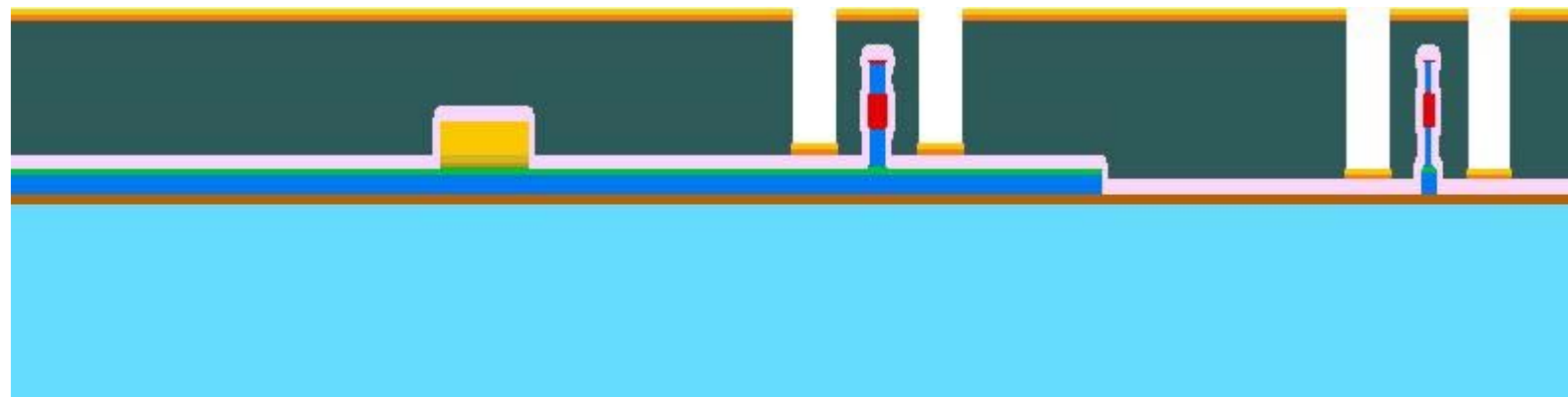
Optical lithography - MA6 (B10.1)?

Developing of MaN440



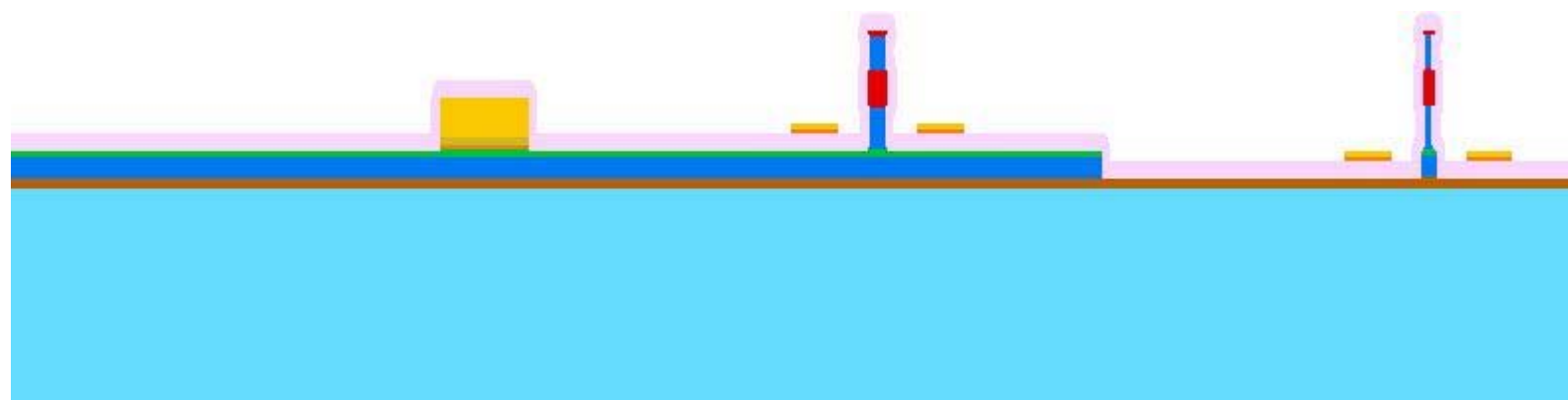
Develop MaN440 - (B4.2)
Rinse - Manual, UPW

Deposition of Ti/Au for adhesion pads



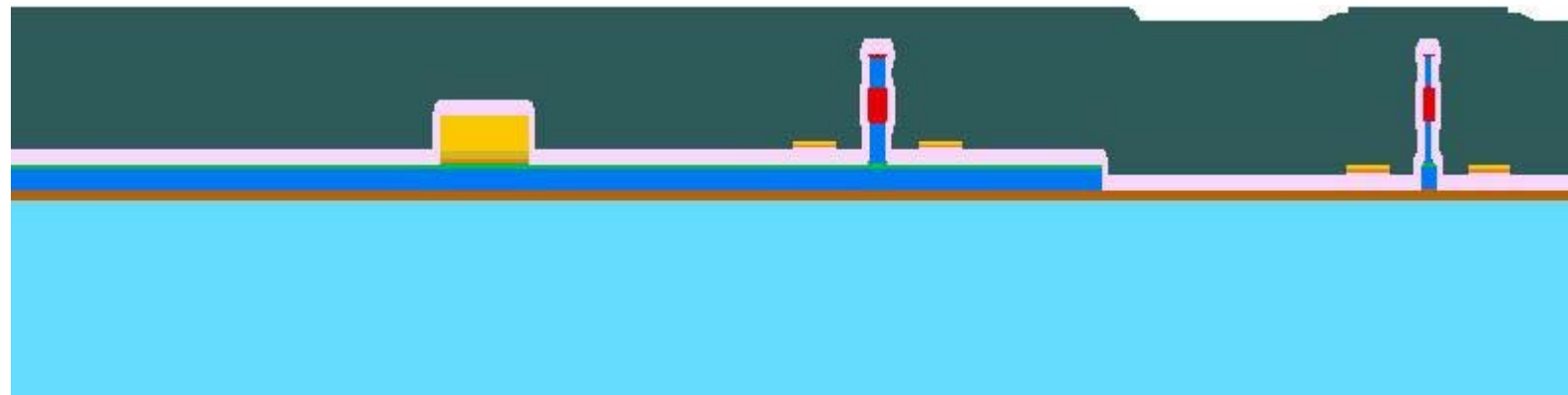
Evaporation of Ti/Au - FAC2000,
(B12.5), 50/40nm

Formation of pads by lift-off



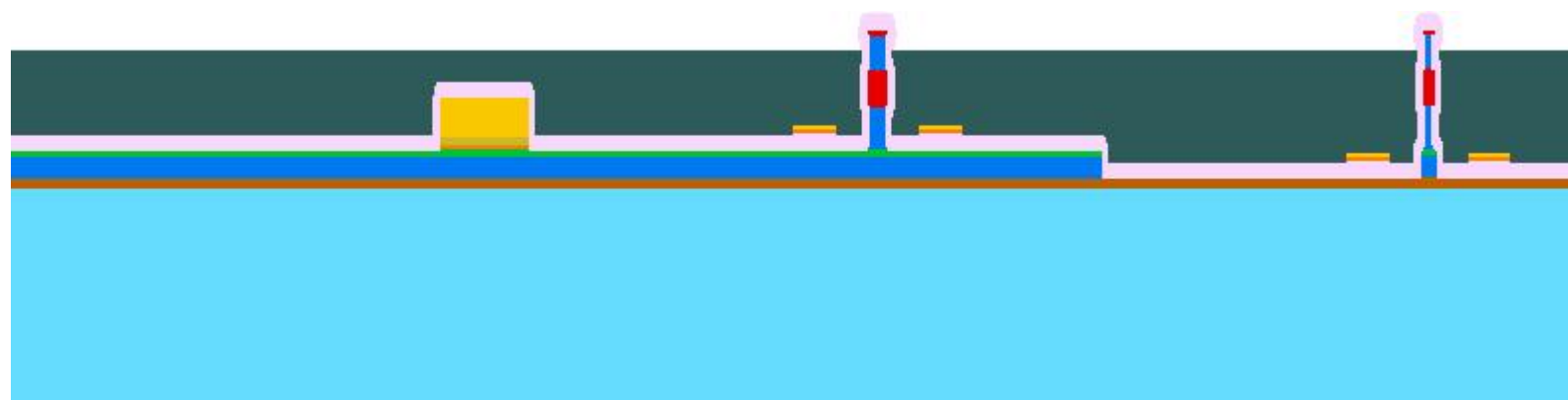
Acetone vapor - Manual, upside
down, 1 hour
Acetone soak - Manual, upside
down, 1 hour
IPA rinse - Manual, isopropanol

Prepare for planarization and MaN-415 resist deposition



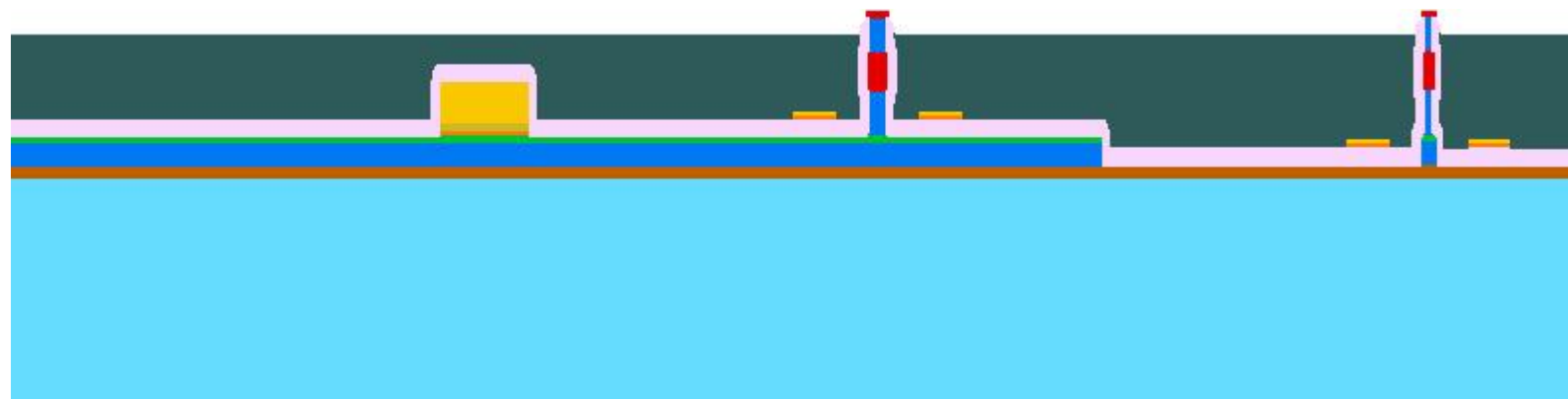
Dry clean - Stripper (B7.1)
Rinse - Manual, UPW
HMDS - Manual, old primer oven
Spin resist - (B8.4), thick enough
to cover pillar
Softbake - (B9.9)

Resist planarization until step of 200 nm is obtained



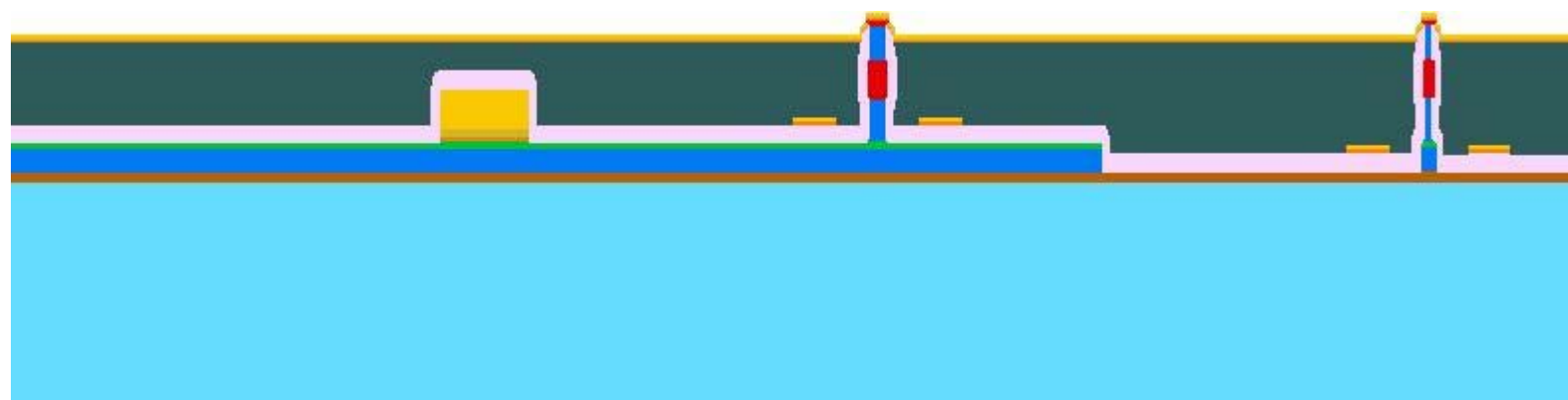
Planarize resist - Manual,
MaD-531S
Rinse - Manual UPW
Measure - Alpha stepper

Open oxide



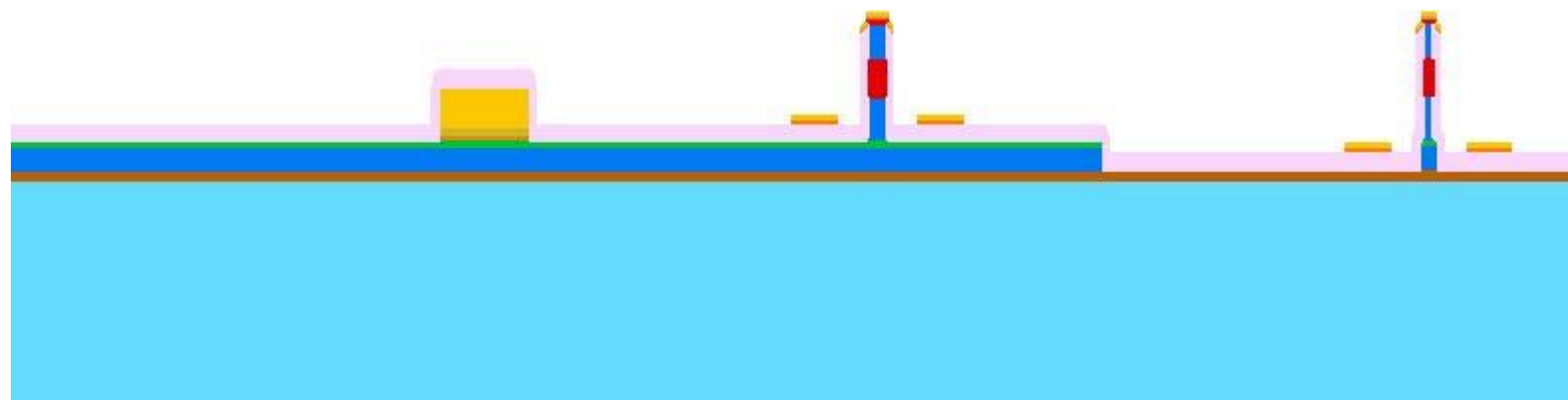
Etch nitride - Nitride RIE (B5.4)?
Acetone strip - Manual, acetone
IPA rinse - Manual, isopropanol

Deposit of Ti/Pt/Au to define top contact



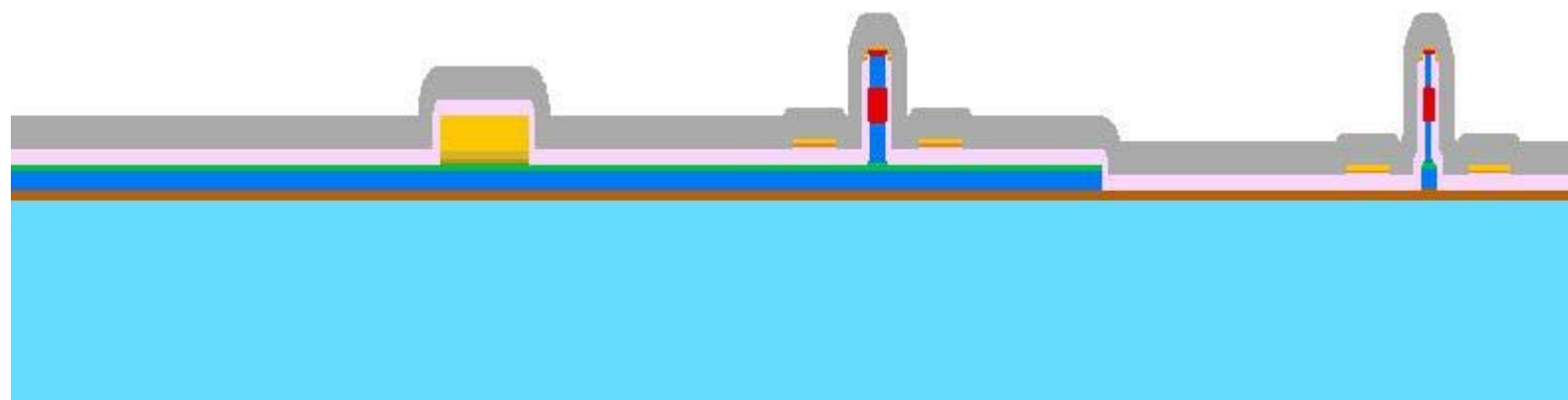
Wet clean - Manual (B1.3)
Rinse - Manual, UPW
Wet etch contact - Manual (B1.2)
Rinse - Manual, UPW
Evaporate Ti/Pt/Au - FC2000
(B12.6), 20/15/15nm

Formation of top-contact by lift-off



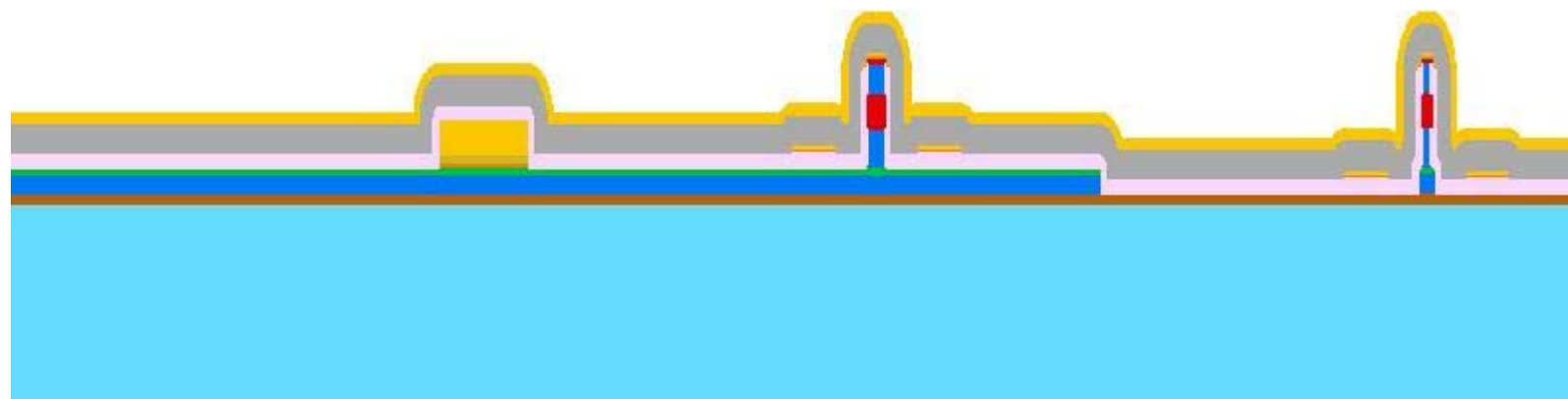
Acetone vapor - Manual, upside down, 1 hour
Acetone soak - Manual, upside down, 1 hour
IPA rinse - Manual, isopropanol

Deposit silver cladding



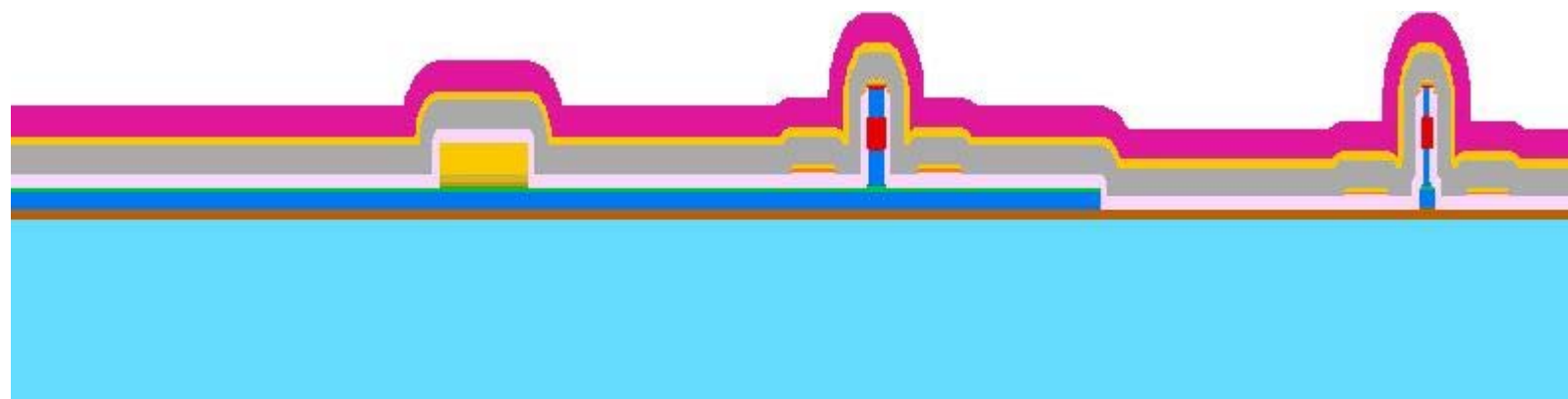
Dry clean - Stripper (B7.2)
Deposit silver - (B12.4), at different angles
Anneal - Jipilec, 400 C, 1 min
Deposit silver - (B12.4), at different angles

Anti-oxidation gold sputtering



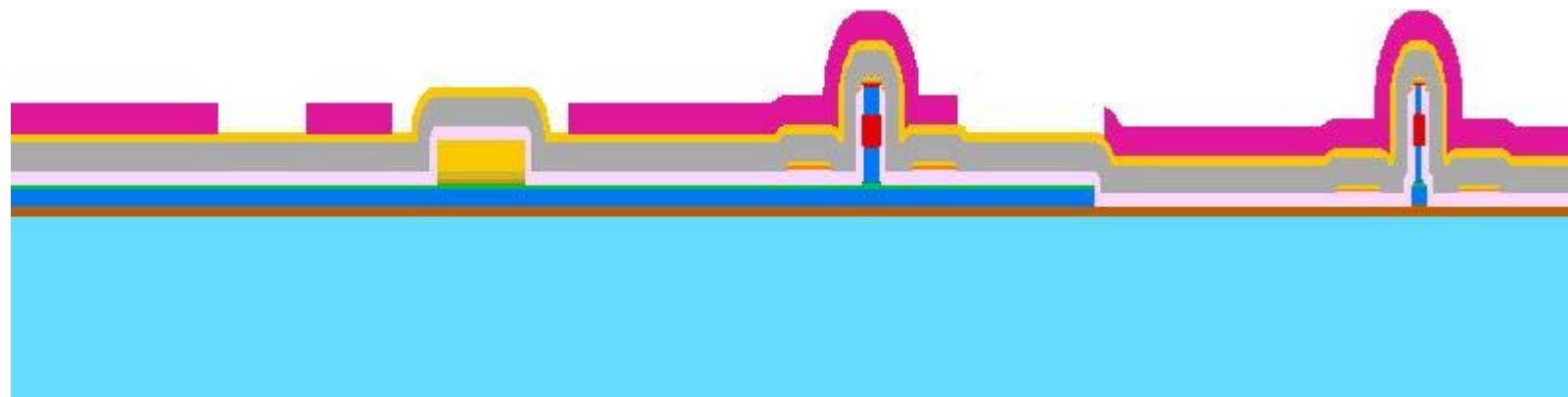
Sputter gold - AJA Sputtercoater
(B12.1), 14:31 min

Optical lithography to separate devices, remove silver from p-contact and waveguides



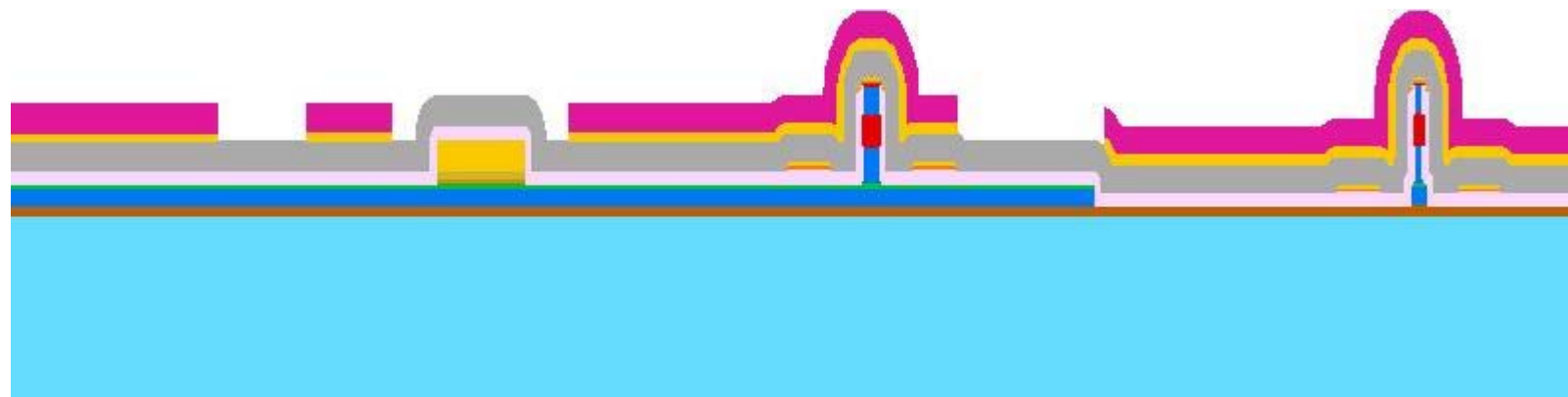
HMDS - Manual, old primer oven
Spin resist - (B8.5)
Softbake - (B9.10)
Lithography - MA6, (B10.2)

Develop AZ4533



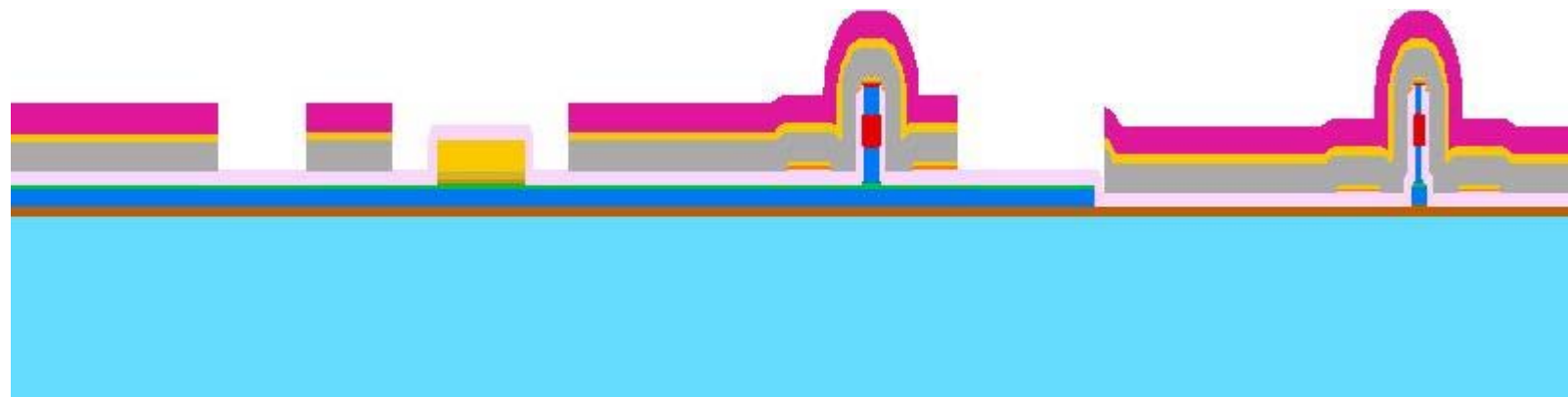
Develop AZ4533 - Manual, (B4.5)
Rinse - Manual, UPW
Post-exposure bake - (B9.11)

Wet etching of gold



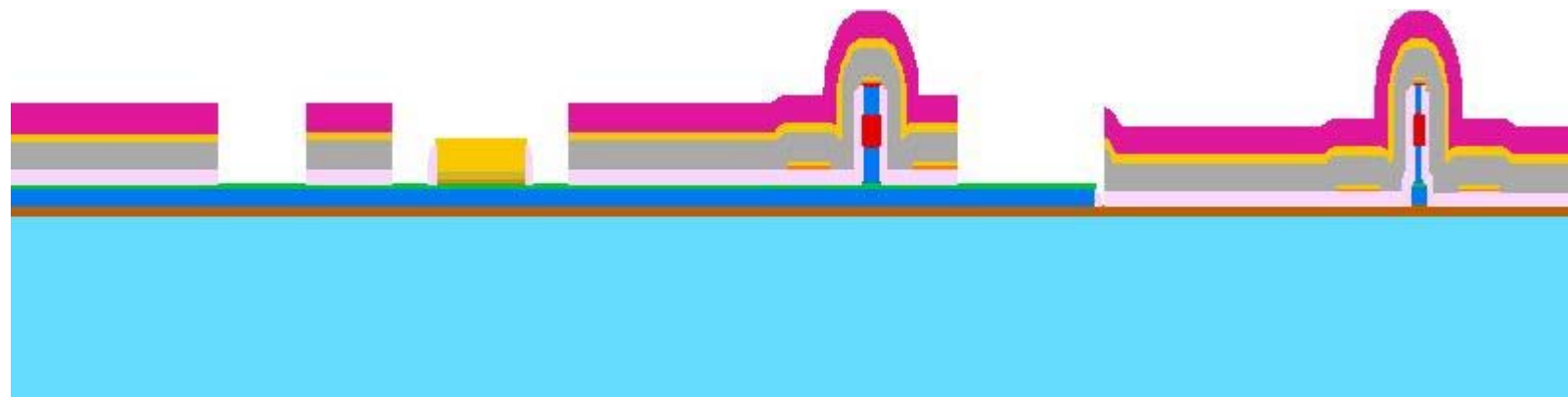
Wet etch gold - Manual,(B3.2),
2min

Wet etching of silver



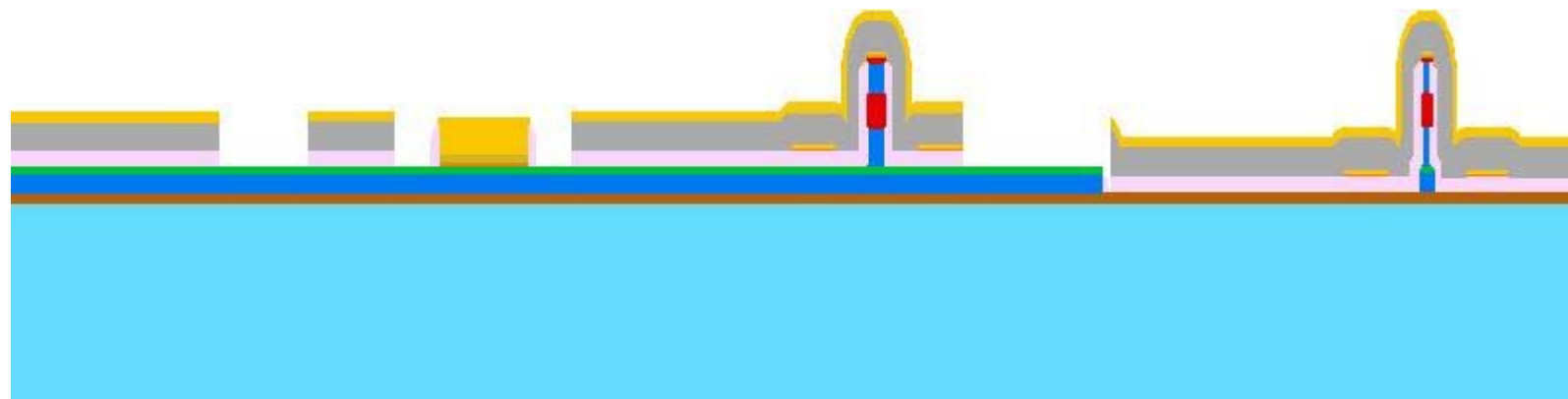
Wet etch silver - Manual, (B3.2 or B3.3?), 17min
Rinse - Manual, UPW

Etching of SiO



Etch nitride - Nitride RIE (B5.4)?

Removal of AZ4533 after etching metals



Acetone vapor - Manual, upside down, 1 hour
Acetone soak - Manual, upside down, 1 hour
IPA rinse - Manual, isopropanol